Backlights in the spotlight

Why led backlit displays are being used in more and more industrial applications. By **Gunter Wagschal.**

One of the main benefits of using LEDs for backlighting is their high mechanical robustness when compared to conventional cold cathode fluorescent lamps (CCFL).

In conjunction with a suitable touchscreen, LED backlit LCDs provide an excellent basis for creating resilient man-machine interfaces. As a first model of the industrial display series with LED backlight, Sharp has equipped a 5.7in LCD with a resistive touchscreen integrated directly into the frame of the LCD module and bonded to the LCD panel without any air gap.

The advantages are excellent optical characteristics: the module has a brightness of 320cd/m^2 and displays images with a contrast ratio of 500:1. At the same time, the dimensions of the TFT LCD will appeal to those designing products into limited spaces. With an installation depth of 13.8mm, the touchscreen display is only 1.4mm thicker than the standard display. The screen offers high mechanical resilience and, above all, a broad operating temperature range which spans -30 to 70°C. This is important as conventional touchscreen displays are generally specified only for an operating temperature ranging from zero to approximately 50°C.

Wagschal: "LED backlit screens offer particular advantages in low ambient temperatures, because of their prompt response characteristics."

Resistive technology allows users to interface with the display in a range of ways

Resistive technology also broadens the ways in which users can interface with the display; not only can the touchscreen be operated with bare hands, but also with gloves and pens. This is a decisive advantage for low temperature applications. Additional target applications include, control units for construction, agricultural and forestry machinery, industrial facilities as well as diagnostic and monitoring systems in the medical sector and rescue services.

LED backlit screens offer particular advantages in low ambient temperatures, because of their prompt response characteristics. CCFLs only provide the full light output when they have reached their normal operating temperature and, even at room temperature, this can take a few minutes. LEDs, in contrast, achieve their full light output almost as soon as the operating voltage is connected. The brightness can also be regulated over the range from 0V to the maximum operating voltage without decreasing the lifetime of the backlight. Cold environments have no effect on this – in fact, it's quite the opposite. Ambient temperatures that are significantly less than the standard temperature of 25°C mean the lifetime of LEDs can increase to more than 50,000 hours.

The challenge with LED backlit industry displays is when they will be used in higher ambient temperatures. Compared to CCFL backlights, LEDs have an increased power dissipation and produce more heat. At elevated t emperatures, it is harder to get rid of this excess heat and this can affect the LCD and the backlight.

Many display manufacturers will only replace

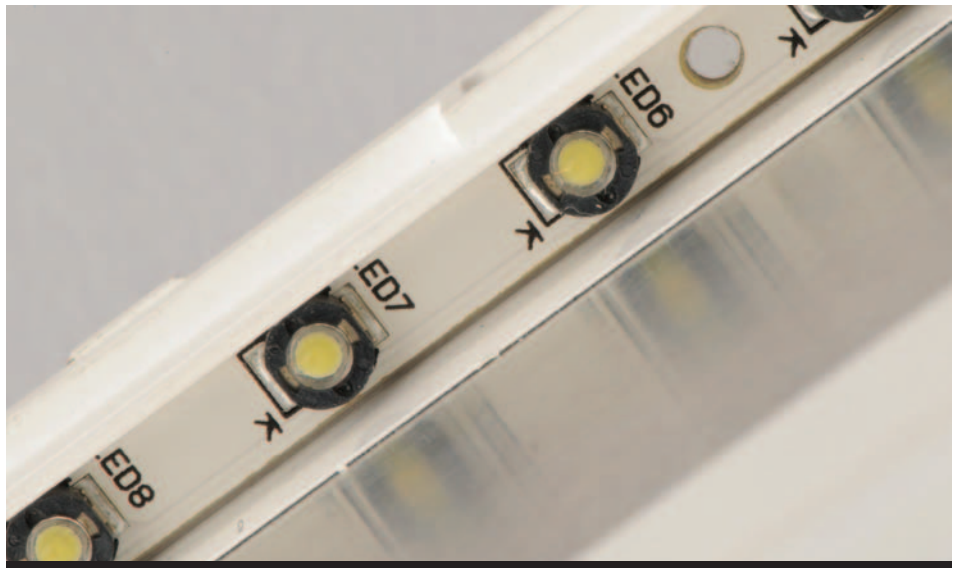
the CCFL cartridge with an insert fitted with LEDs. As there is no direct link to the external panel housing, it is hard for the heat to escape. This can cause heat to accumulate in the backlighting area, damaging the liquid crystals, the colour filter and – not least – the LEDs. Conventional LCDs with LED backlights are therefore only designed for a comparatively low maximum temperature and have a shortened life cycle compared to the CCFL variant.

Sharp's offerings have been developed for LED backlighting. There is a direct thermal coupling between the backlight and the mechanical parts of the LCD module, allowing the waste heat from the LEDs to be transported to the rear outer side of the panel.

This principle can be applied to LCDs of all sizes for industrial applications. After the successful introduction of a 10.4in display with an LED backlight in the spring of 2008, Sharp has expanded the range to include nine displays in sizes ranging from 2.5 to 23in. For Strong2 modules (see box), the operating temperature ranges from -30 to 80°C as standard.

In addition to high mechanical resilience and fast response at low temperatures, LED backlighting offers further advantages. For example, LEDs do not contain mercury and are therefore RoHS compliant, in contrast to CCFLs. And because LEDs can be driven from a 30V supply or lower, the high voltage inverter needed for CCFL lamps is no longer necessary. In turn, this means LED backlit displays have better emi characteristics. Further, eliminating the need for voltage inverters reduces system complexity.

LED backlit displays supplement the existing portfolio of LCDs with CCFL backlights by providing important model variants. Both cover different application areas: LED backlights have the advantage over conventional CCFLs, particularly where aspects such as great mechanical robustness, a broad brightness range, the avoidance of mercury and explosion protection are important. But, thanks to their proven features and excellent cost effectiveness, displays with CCFLs continue to be a good choice for a large number of applications in the industry sector as backlighting. CCFLs are particularly ideal for use as luminants for backlighting in cases where LCDs are exposed to high ambient temperatures for a longer period of time.



A chassis specially developed for LED backlit industrial LCDs conducts heat away from the display

Improving all the time

LED backlights are intended for use in industrial displays and they are improving all the times. Even so, there is room for further improvement; for example, CCFL backlit LCDs are more cost effective alternative. But the two technologies should reach similar price points in the next three to four years.

Those, however, who have already chosen displays with the new backlight technology today for specific applications, such as explosion protection, must ensure that the chassis of the LCD modules is specially designed to accommodate LED backlit displays and it should have a direct thermal connection between the backlight and the housing to avoid overheating.

As is the case with the models from Sharp, LED backlit LCDs can only meet the long life cycle required by the industry if the increased waste heat of the LEDs can be released via the housing to the environment.

In the long term, LEDs will develop into a real backlight alternative to industry displays. Through their use in an increasing number of mass market applications (such as LCD TVs, general lighting applications and lighting for vehicle lamps), the cost of manufacturing LEDs is falling. It should also be expected that the light output from the diodes will increase still further and the power requirements of LED backlit displays will decrease, with correspondingly less heat needing to be discharged from the display.

LCDs for extreme conditions

Sharp's Strong2 series of lcds is specified for use in temperatures ranging of -30 to 80°C and has been designed for particularly high mechanical loads.

New materials, and an optimised design of the display, ensure that shocks and vibrations can be cushioned. The electronics are not fixed to the frame, instead they 'float' freely within the casing. In addition, the glass is protected by plastic buffers on either side.

The backlight casing has also been optimised in order to secure the light elements better – irrespective of whether they are LEDs or CCFLs.

These special displays can withstand accelerations of up to 19.6m/s^2 and frequencies ranging from 57 to 500kHz.

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