Testing LCD Display Panels with the TEGAM Model 1750

INTRODUCTION

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and videos. Their main uses include computer monitors, televisions, and instrument panels. Other applications range from aircraft cockpit displays to everyday devices such as video players, gaming devices, clocks, calculators and telephones.

The use of LCDs in the electronics industry has increased significantly over the past decade because of the attractive form factor, reduced power consumption and lower cost. In 2007 the LCD televisions surpassed CRT units in worldwide sales. Today, with companies competing to stay alive in the harsh consumer market, LCD testing has become very important to ensure the product quality. Various testing methods are utilized to minimize problems, detect poor product quality and to increase customer satisfaction and company profitability.

The purpose of this Application Note is to describe how the unique features of TEGAM's Model 1750 High-Speed, Precise, Programmable Micro-Ohmmeter assist in testing large LCD panels.

Application Background

A typical LCD assembly consists of multiple layers of polycrystalline silicon interconnected with Indium Tin Oxide (ITO) conductors. ITO is used because it is a good conductor and optically transparent. The consistency and integrity of the ITO layer is important to the performance of the display and can be verified by measuring the conductance of individual ITO traces. A process goal is to minimize the use of ITO because it is expensive, but it must be deposited in sufficient thickness to be a good conductor.

Figure 1 - 8th Generation LCD Panel Tester

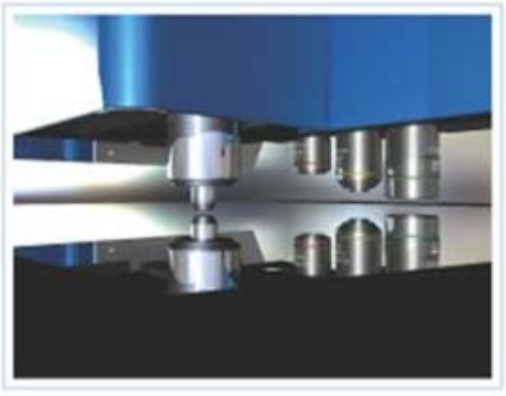

Figure 2 - Actual Resistance Test System

As the size of the LCD panel grows, more test points are required to cover the whole active area. For example: An 8th generation LCD is 2.2m X 2.5m in size and the 11th generation is 3.2m x 3.6m which is more than twice the surface area of the 8th generation.

The Solution – TEGAM Model 1750

A typical production line can produce 3000 8th generation LCD panels per day which is more than 1 panel every 30 seconds. To properly verify the conductance of ITO traces requires an instrument that can measure milli-ohm values accurately at very high speed. To accomplish this requires specialized techniques and an instrument optimized for these types of measurements.

TEGAM offers the Model 1750 High-Speed, Precise, Programmable Micro-Ohmmeter which is more accurate than most ohmmeters and DMMs without compromising measurement speed.

Accurate milli-Ohm measurements require the detection of voltages in the milli- to nano-volt range. Because lead resistances create significant errors at these levels, a four-wire Kelvin lead configuration is required. The 1750's four-wire Kelvin configuration minimizes lead resistance errors by using a regulated current source for the test signal. Voltage sense leads are connected across the sample terminals to measure the voltage across the sample and a final resistance value is calculated. Figure 3 below illustrates the 4-wire measurement technique.

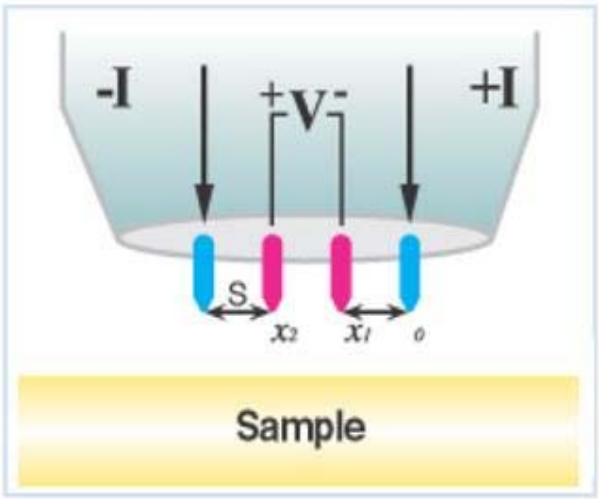

Figure 3 - Resistance Testing on an LCD Panel

The 1750 is capable of measuring 1 mΩ with an accuracy of better than 1 μΩ in less than 36 msec. It does this while simultaneously monitoring the integrity of the 4-wire measurement circuit. This allows for rapid trace thickness measurement on multiple locations of the LCD panel.

The 1750 also alternates the polarity of a precision reference current source several times during this 36 msec period to cancel the thermoelectric junction effects. A thermoelectric junction is formed at the interface of the test probes and the LCD panel. This junction creates a voltage offset in the measurement signal that is cancelled out by alternating the reference current.

The 1750 is also designed to interface with either a PLC through discrete I/O points or a PC with GPIB and RS-232 communications. This makes it compatible with vast majority of automated systems.

This same combination of features is also beneficial to manufacturers of solar panels, conductive coatings, bulk material resistivity and electroplating where measuring the thickness of a conductive material applied to a surface is important to the performance of the end product.

Figure 4 - TEGAM Model 1750

If you have any comments or would like to discuss your application, please email Amit Sabnis or call at 440-466-6100.