



Standard Practice for Measuring Sheet Resistance of Thin Film Conductors for Flat Panel Display Manufacturing Using a Four-Point Probe Method¹

This standard is issued under the fixed designation F1711; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes methods for measuring the sheet electrical resistance of sputtered thin conductive films deposited on large insulating substrates, used in making flat panel information displays. It is assumed that the thickness of the conductive thin film is much thinner than the spacing of the contact probes used to measure the sheet resistance.

1.2 This standard is intended to be used with Test Method **F390**.

1.3 Sheet resistivity in the range 0.5 to 5000 ohms per square may be measured by this practice. The sheet resistance is assumed uniform in the area being probed.

1.4 This practice is applicable to flat surfaces only.

1.5 Probe pin spacings of 1.5 mm to 5.0 mm, inclusive (0.059 to 0.197 in inclusive) are covered by this practice.

1.6 The method in this practice is potentially destructive to the thin film in the immediate area in which the measurement is made. Areas tested should thus be characteristic of the functional part of the substrate, but should be remote from critical active regions. The method is suitable for characterizing dummy test substrates processed at the same time as substrates of interest.

1.7 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

F390 Test Method for Sheet Resistance of Thin Metallic Films With a Collinear Four-Probe Array

3. Terminology

3.1 *Definitions*:

3.1.1 For definitions of terms used in this practice see Test Method **F390**.

4. Summary of Practice

4.1 This practice describes the preferred means of applying Test Method **F390** to measure the electrical sheet resistance of thin films on very large flat substrates. An array of four pointed probes is placed in contact with the film of interest. A measured electrical current is passed between two of the probes, and the electrical potential difference between the remaining two probes is determined. The sheet resistance is calculated from the measured current and potential values using correction factors associated with the probe geometry and the probe's distance from the test specimen's boundaries.

4.2 The method of **F390** is extended to cover staggered in-line and square probe arrays. In all the designs, however, the probe spacings are nominally equal.

4.3 This practice includes a special electrical test for verifying the proper functioning of the potential measuring instrument (voltmeter), directions for making and using sheet resistance reference films, an estimation of measurement error caused by probe wobble in the probe supporting fixture, and a protocol for reporting film uniformity.

4.4 Two appendices indicate the computation methods employed in deriving numerical relationships and correction factors employed in this practice, and in Test Method **F390**.

¹ This practice is under the jurisdiction of ASTM Committee **F01** on Electronics and is the direct responsibility of Subcommittee **F01.17** on Sputter Metallization.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.