



# Standard Test Method for Determining Color of a Membrane Switch Backlit with Diffuse Light Source<sup>1</sup>

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## 1. Scope

1.1 This test method covers procedures for determining the luminous color of a backlit membrane switch. As written, it applies to a fully assembled switch. For specific purposes, it can be applied to partially assembled switches, with the understanding that the results pertain only to the partial assembly and will be modified as the further assembly proceeds.

## 2. Terminology

### 2.1 Definitions:

2.1.1 *graphic overlay*—a graphically illustrated layer, often attached to the top side of the switch assembly for protection, cosmetic purposes, or to indicate the location and function of the switch keys.

2.1.2 *illumination layer*—a layer in the construction of a membrane switch, which may or may not be a physically distinct layer which contains or supports the source of illumination for the switch. Examples are a flexible layer containing light emitting diodes (LEDs), often either the top or bottom layer of the switch, or a flexible layer of electroluminescent (EL) material, often a distinct and separate layer added at assembly.

2.1.3 *membrane switch*—a momentary switching device, in which at least one contact is on, or made of, a flexible substrate.

2.1.4 *UUT*—unit under test.

## 3. Significance and Use

3.1 Illumination of a switch or of certain features of a switch often has a functional purpose and must meet specification to satisfy the functional requirements of the switch.

3.2 Illumination of the switch can be affected by variations in the quality and design of the overlay and its application.

3.3 This test method addresses only the optical and visual appearance of the switch and not its electrical function.

3.4 This test method is non-destructive.

3.5 If this test method is applied to the entire switch assembly, the results can be applied to the whole device. However, it may be sufficient and practical to apply the test either to a subassembly only, or to the illumination only, in which case the results apply to that layer only and the net effect on the fully assembled device must be extrapolated.

## 4. Interferences

4.1 Tests on incomplete assemblies give results appropriately to that state of assembly. Specifically, later application of a graphic overlay may alter the results.

4.2 Failure to fill the sampling aperture of the colorimeter will bias the results in a way which is not necessarily predictable and for which compensation cannot be made.

4.3 Since every light source changes characteristics as it ages, it must be recognized that the results apply to a particular interval in the lifetime of the system. Characterization of the aging properties may be addressed in a separate test method.

4.4 *Perpendicularity*—Since the angular distribution of emitted light can be altered by any material through which it passes, it is important that photometer be held perpendicular to the area to be sampled.

4.5 *Temperature*—Since the performance of many light sources can vary with temperature, it is important to allow the UUT to thermally stabilize, if necessary, and then record the ambient temperature at which the measurements are made.

4.6 *Ambient Light*—Stray light sources will be detected by the photometer and will affect UUT color measurement. It is important to measure the ambient light before illuminating the UUT. This ambient light reading should be zero or as close to zero as possible.

## 5. Apparatus

5.1 A working or mounting surface to hold and support the UUT assembly, providing electrical access to the termination region from which the illumination is to be powered and visible access to the regions at which the luminous color is to be measured.

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5.2 A power supply providing appropriate and adequate power to drive the illumination device(s) with appropriate connector(s). This should be specified as dc or ac, with voltage and power level given, and ideally should be switched.

5.3 A calibrated device to measure the color of the luminance. This is typically a spot colorimeter or similar equipment, with a fairly compact sampling aperture (<1-cm diameter at the minimum working distance). Output should be in one of the CIE Tristimulus descriptions, such as the 1931 values ( $x$ ,  $y$ ) or the 1976 values ( $u'$ ,  $v'$ ).<sup>2</sup>

5.4 A means to support the color measuring instrument at a fixed distance and orientation to the UUT.

5.5 A means to control stray light and prevent it from entering the aperture of the photometer.

## 6. Procedure

6.1 Mount UUT on the working surface with the luminous surface visible.

6.2 Attach a switched power source as appropriate to the luminous device set to the design operating point.

6.3 Mount the colorimeter so that the axis of its field of view is perpendicular to the area of the UUT to be measured. Ensure that the sampling aperture is filled by the area to be measured on the UUT.

6.4 Measure the stray light level by taking a colorimeter reading while the UUT luminous source is not powered. If this step yields a significant measurement, do not proceed, but take steps to reduce the stray light present. Unlike luminance or radiance (integrated spectrum) measurements, color measurements may not easily be compensated for the effects of stray light.

6.5 Switch on the luminous source in the UUT assembly.

6.6 Measure the color values of the UUT.

## 7. Report

7.1 Report the following information:

7.1.1 State of UUT (assembled or not),

7.1.2 Stray light level,

7.1.3 Color coordinates,

7.1.4 Power conditions for the luminous device,

7.1.5 Location and size of the sample area or areas,

7.1.6 Colorimeter used, sample settings, calibration status, and the size of the sampling aperture,

7.1.7 Ambient temperature, and

7.1.8 Date of test.

## 8. Keywords

8.1 backlit; CIE; color coordinates; colorimeter; diffuse light; electroluminescent material; light emitting diodes; luminance; luminous color; membrane switch; photometer; radiometer; video photometer

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<sup>2</sup> For example, CIE Publication No.15.2, Colorimetry 2d ed., Central Bureau of CIE, Vienna, 1986.

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