

Application Note 5274

Introduction

This document describes a list of standard surfaces that Avago Technologies recommends optical navigation manufacturers and designers for surface navigation testing. The selected surfaces include Paper, Wood, Dark, Glossy and Plastic materials; representing a broad spectrum of surfaces. It is intended to showcase Avago Technologies optical navigation sensor-solutions capability to navigate on virtually all surfaces.

Details on the surfaces

The table below describes the list of surfaces used to evaluate the LED-based and LaserStream™ mice. Avago Technologies recommends these surfaces for evaluating end products that use our LED-based and LaserStream optical navigation solutions. As a reference point, please refer to the respective optical mouse sensor datasheets for characterization example results based on some of these surfaces.

Category	Category Characteristics	Surfaces	LED Standard Surface	Laser Standard Surface	Supplier/Part number
Paper/ Cloth	Commonly available in offices and homes. This type of surface shows a random pattern and rough paper-like texture.	White Paper	•	•	Oce-Imaging Supplies / Ink Jet Bond 86-5000 Check Plot Bond 20#, Item #: 8650000042
		Manila	•	•	Smead / UPC# 10331, Stock no. 153L-1
Wood/ Office furniture	This type of surface shows the various inconsistent grains that appear multi-directional.	Spruce/ White Pine	•	•	1. Finnforest Timber-board 2. B&Q DIY Retailer
Dark	Dark colored surfaces with isolated textures	Black Formica	•	•	Material code: PN-909-58
Glossy	Surface that are reflective with repeated patterns and a smooth finishing.	Photo Paper		•	HP / Q5498A
		White Formica	•	•	Material code: 949-58
Plastics/ common surfaces	Include materials found in many stationeries and retail markets	White Delrin		•	Material type: Polyoxymethylene

Avago Technologies Standard Surfaces Selection

There are two factors Avago Technologies took into consideration for this selection of surfaces:

- Availability of the surfaces
- Surface commonly found in home and office areas, particularly where computer mice are used.

a. White Paper and Manila

These are the most common surfaces available today, making them necessary to evaluate surface tracking capability for both LED-based and LaserStream powered optical mice.

b. Spruce (also known as White Pine)

Wood is also another commonly found surface for furniture. This spruce wood, or well known as white pine, is available in almost any hardware shop worldwide.

c. Black and White Formica

Nowadays, there is a growing trend of laminating desks with Formica materials. As there are many kinds of semi-shiny Formica, Avago Technologies has chosen a black and a white surface for this kit. Manufacturers need to ensure that their optical navigation design can navigate successfully on both bright and dark Formica surfaces.

d. Photo Paper

Photo Paper is a special surface which can differentiate surface navigation performance between an LED-based and a LaserStream optical navigation solution. Due to its glossy and smooth texture, it serves as a good benchmark to evaluate the tracking capability of the optical navigation system.

e. White Delrin

White delrin is another unique surface which almost no LED-based navigation system can navigate on, but the surface enables excellent tracking for LaserStream navigation solution. This surface is commonly used as jigs and fixture for certain industries. It is commonly known as rugged polymer or Polyoxymethylene.

Testing an Optical Mouse

In the following section, we are recommending a few mouse bench testing methods that can be done using this surface kit. The main purpose of the test is to ensure the mice can navigate well or perform as per specifications on the standard surfaces. It is recommended that these are carried out only after the completion of mechanical/visual inspection and functionality tests.

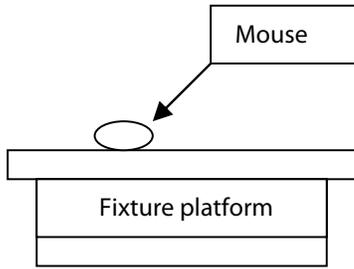
Mouse Bench Test

a. Motion Test

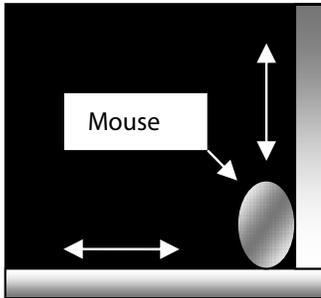
This test method is to evaluate the tracking smoothness and accuracy of the mouse. The motion test can be performed in a desktop drawing software environment, such as MS Paint. Optical mouse makers can also request for the "tester2.exe" file from Avago Technologies sales representatives. To conduct this test, please follow the steps below:

1. Place the mouse unit on one of the standard surfaces.
2. Wiggle the mouse on the test surface to ensure mouse unit is awake (LED shines brighter).
3. Conduct the Circle Test. Start with a small diameter and run the mouse in that given circumference. Do this motion a few times. Then, repeat the motion in a bigger diameter. You can do this at any speed provided it is within the optical mouse sensor's specifications
4. Compare the tracking output of the mouse against the actual mouse movement. Look out for unsmooth movements or cursor jumps.
5. Next, conduct the Straight Line Test at all possible angles and speeds. Lines at a diagonal angle are especially helpful in showing problems (see Figure 2).
6. Compare the tracking output of the mouse versus the actual mouse movement.
7. Rerun steps 1-6 for other remaining standard surfaces.

To ensure smooth and consistent motion, the standard surface and mouse can be put on a static fixture (for manual movement), or on motion fixture that can automate movement of either the standard surface or mouse in X and Y Axis. Circular and axis guide bars are recommended for static fixture setup (see Figures 1).

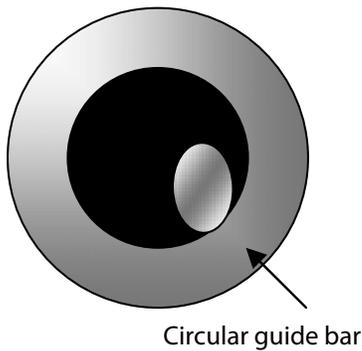


Horizontal view: Motion fixture or a static platform.



Horizontal Guide Bar

Top view: Surface pad with X and Y Axis bar for manual Line test.



Top view: Rounded surface pad with circular guide bar for manual circle test.

Figure 1. Motion Test – Static Fixture Setup Recommendation

Straight Line Test Setup Recommendation for Static (A) and Automated Fixture (B)

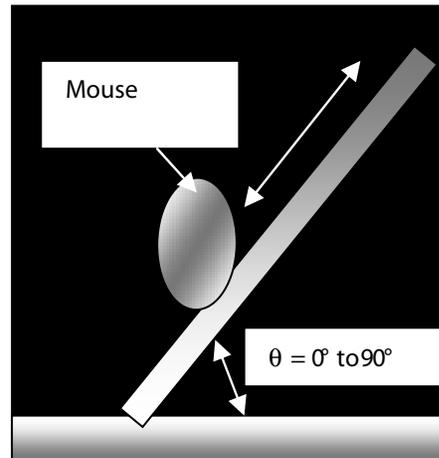


Figure 2A. (top view): Static Platform

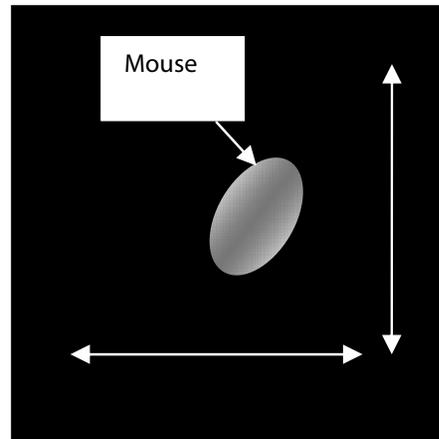


Figure 2B. (top view): Motion Fixture

Notes:

1. Figure A - Put the mouse unit 90° perpendicular with the bottom bar of the surface mounting plate, while touching the edge of the slanting bar at angle of choice, $\alpha = 0^\circ$ to 90° . A repetitive line drawing can be done as mouse slide against the angle slanting bar.
2. Figure B: Put the mouse unit static at an angle, $\alpha = 0^\circ$ to 90° as shown. Move the motion fixture in X and Y direction to enable diagonal drawing.

b. Resolution Test

This method is a quick test to re-confirm the resolution settings of an optical mouse. Again, optical mice makers should use the programme, "tester2.exe" for this test.

To conduct this test, follow these steps:

1. Throughout the resolution testing period, the control panel-mouse settings should be applied
 - a. Speed: in the centre of "slow" and "fast"
 - b. Acceleration: none
2. Next, place the mouse unit on one of the standard surfaces.
3. Clear the "tester2.exe" screen. The cursor can be seen re-set to the middle of the screen-page.
4. Move the mouse in straight line for a fixed distance, e.g. 0.5 inches. (Note: If a 400-cpi mouse moves 4 boxes in the screen, then an 800-cpi mouse will move 8 boxes).
5. Re-run steps 2-4 for the other remaining surfaces.

c. Position Jittering Test

Position jitter is an undesirable false movement of the cursor when an optical mouse is static. Such movements are usually small and can be seen on the screen as jittering or even quivering. This test should be performed by using "tester2.exe" as well. To conduct this test, please follow these steps:

1. Place the mouse unit on one of the standard surfaces.
2. Clear the "tester2.exe" and the cursor can be seen re-set in the middle of the screen.
3. Observe if there is any false movement when mouse unit is static on the surface.
4. Rerun steps 1-3 for other remaining standard surfaces.

d. Wakeup Test

This test is recommended for all wireless optical mice. This motion test can be performed on either MS Paint or "tester2.exe". Please follow these steps:

1. Place the mouse unit on one of the standard surfaces.
2. Wait for t seconds until the optical mouse enters the 1st rest mode.
3. Move the optical mouse and compare the response time of the cursor movement on screen. Check for any intolerable latency.
4. Repeat steps 2-3 for 2nd, 3rd or more rest modes if applicable.
5. Rerun steps 1-4 for other remaining standard surfaces.

Summary

These series of testings are aimed at providing our customers benchmarks to measure the optical navigation surface performance. It is also to demonstrate the performance difference between an LED-based and a Laser-Stream™ powered mouse. We hope this paper as well as the surface kit, will provide you a better comprehension of the mouse surface tracking quality that is using Avago Technologies' optical navigation solution.

If you have any queries on the testings please contact Avago Technologies technical support.

For product information and a complete list of distributors, please go to our web site:

www.avagotech.com

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