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# **Engineering Application Note**

## **Optical Navigation Trackball Technology**

## Introduction

This document has been released by Cursor Controls Ltd to describe the principles of operation behind their latest Optical Navigation Technology.

It is primarily intended for OEM customers considering the integration of this technology into their designs.

## What is an Optical Trackball?

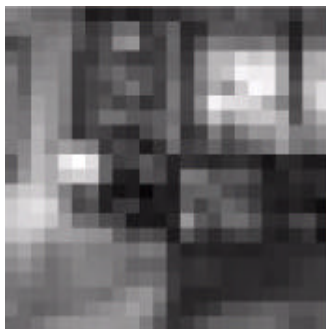
An optical trackball uses solid state Optical Navigation Technology in place of the traditional mechanical assembly of conventional trackballs. The only moving part in the entire assembly is the ball, whose movement is sensed directly without the need for shafts, separate encoders and opto-couplers.

The optical navigation sensors employed are well-established architecture and are being utilised by other leading manufacturers (such as Microsoft) in the latest generation of computer mice.

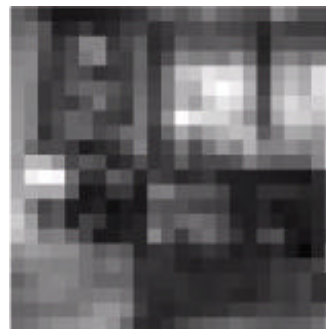
## How do the optical sensors work?

The optical sensors measure changes in position on a surface by optically acquiring sequential images of the surface and mathematically determining the direction and magnitude of movement between these sequential images (figure 1).

*Figure 1*



*Sequential Image A  
at  $t = 0.0$  ms*



*Sequential Image B  
at  $t = 0.67$ ms*

*Common features can be identified in the two images above. The sensors register that these features have moved a distance down and to the left in 0.67ms.*

### **How are the optical sensors integrated into trackball technology?**

An optical beam of a specific wavelength is focused precisely onto the finely patterned area of the ball to be read and the resultant reflections are directed through lenses onto the optical sensors for the capture of the sequential images.

Rotation of the ball thus results in electronic outputs from the optical sensors which are further processed to produce mainstream protocol interfaces such as USB, PS/2 and Quadrature. On board processors allow the further integration of special features (e.g. VX3 and ½ speed) and the implementation of specific customer requirements such as custom resolutions.

### **What are the main advantages of this new technology?**

- The integration of Optical Navigation Technology into Cursor Controls industrial Trackerball products has allowed the development of totally waterproof industrial trackballs for the OEM market.
- The solid state design ensures that they are extremely robust, and will actually work with the ball wholly immersed or submersed in fluids such as water, beer and coffee.
- The integration of an impenetrable barrier between the user interface and electronics circuitry ensures that these are totally ESD protected devices.
- The devices will work with the ball covered in most industrial/medical contaminants (including ultrasound gel). Models have been designed for complete wash-down, decontamination and sterilisation processes.
- Self-draining and back-flushable features have been integrated for operating environments where these may be of benefit.

Cursor Controls Ltd has several Patent Claims lodged in association to the integration of Optical Navigation Technology into industrial trackball designs.