# Optical Glide / Optical Certification Discrimination

## Purpose:

To provide the reader with an understanding of the defect detection method and capability of the THôT Model 42000 disk inspection system including baseline references and test thresholds.

## Background:

The THôT Technologies Model 42000 Optical Glide/Optical Certification defect detection card incorporates a discrimination circuit which is responsible for determining whether a defect is above the disk surface (an asperity) or below the surface (a pit). The same Optical Glide/Optical Certification card also controls the peak detectors used for storing the largest value for each defect type (asperity and/or pit) within each test sector.

The laser Doppler Vibrometer (LDV) output signal is a direct velocity measurement. For a velocity signal the baseline is zero, by definition, in the absence of motion along the measurement axis. Therefore the return signal is the instantaneous velocity of the disk surface plus laser and electronics noise which may be present.

The broadband noise for the defect/roughness is equivalent to ≈ 0.01 -0.02Å. As such the laser and electronics noise signatures are currently below the morphology signals created by defects and surface roughness.

DC offsets produced by the amplifiers and other active components are removed as part of the OG/OC card's calibration procedure. Offset drift has been measured in the range of low ppm over a several month period. Calibration is automated, requires approximately 10 minutes and is recommended on a quarterly interval.

## Detection / Discrimination Circuits:

The defect discriminator consists of the following functional blocks;

First, a baseline correction function which accepts the velocity signal from the laser system and removes any lower frequency components contributed by disk runout and waviness. This functional block passes only information corresponding to high frequency roughness and defects.

Then, a specialized envelope tracking circuit, which follows the disk roughness (background) levels while ignoring any defect greater than 5% above the background envelope. This approach prevents the defect from affecting the average baseline envelope value. The tracking envelope value is summed with a customer controlled (programmable) D.C. value to determine a test threshold for the comparators. There are two channels for defects, pit and asperity and the thresholds can be independently programmed.

This is similar to the TAA circuits used in old traditional certifiers with a fast attack time and a slow decay time, but adds the ability to be unaffected by the peaks (impulses) created by any defect encountered during a test.

High speed voltage comparators and discriminator control logic are used to determine the slope of the leading edge of the defect above, or below, the test threshold. The test threshold is the sum of the baseline tracking envelope detector and a customer supplied (programmed) D.C. threshold value. These test thresholds are compared with the velocity signal to determine the polarity of the event. If the leading edge is positive going above the test threshold, the event is an asperity and if the leading edge is negative going below the test threshold, the event is a pit.

Finally, the highest value in each sector is stored in a high speed peak capture circuit and recovered by the data acquisition system at the end of each sector. At the same time, the lowest value in each sector is stored in the pits channel for transfer to the data acquisition. In this manner, the data for the full surface, both pits and asperities, is captured.

**Conclusion:**

The tool functions in a manner very similar to the older, more traditional head based certifiers except that we are using a laser Doppler vibrometer. The advantage of the vibrometer is that it is unaffected by fly height modulation and can easily discriminate between pits and asperities due to the Doppler shift.

An up-Doppler will always be an asperity and a down-Doppler will always be a pit. In addition, at a 632.8nm wavelength and the ability to discriminate the phase shift down to one part in ten to the minus sixth, the accuracy can be guaranteed to be sub-Angstrom.

Couple this with deconvolution techniques and micro-stepping and the tool can resolve and measure very small features on the disk surface.