

# PERPETUAL INDUSTRIES INC.

Please direct all inquiries to:

#110, 5 - 8720 Macleod Trail South

Calgary, Alberta, Canada T2H 0M4

P: 403-214-4321

F: 403-770-8122

E: [info@perpetualindustries.com](mailto:info@perpetualindustries.com)

[www.perpetualindustries.com](http://www.perpetualindustries.com)

## CURRENT STATE AND OPPORTUNITY

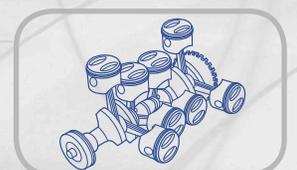
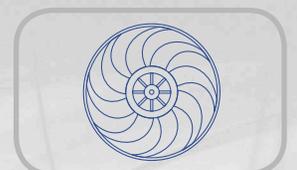
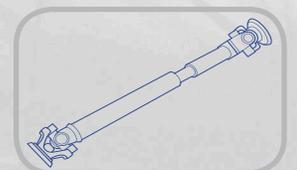
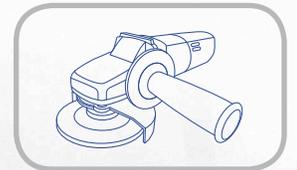
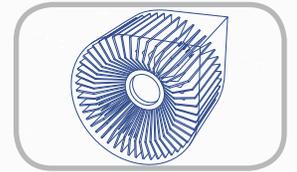
The XYO technology shows significant improvements in optical disk drive performance during independent studies. Perpetual Industries wants to work with innovative optical disk drive manufacturers to optimize and implement the XYO balancer in their products.

Contact us to see how your product can beat the competition using XYO



## XYO PROTOTYPE BALANCER AS APPLIED TO OPTICAL DISK DRIVES Summary Report

PROPRIETARY, PRIVILEGED, AND CONFIDENTIAL: the information contained herein ("the Contents") is the property of Perpetual Industries Inc. ("Perpetual"). Without Perpetual's written permission, any utilization, reproduction, or dissemination of the contents, in part or whole, for any purpose, is strictly prohibited. The contents relate to the XYO technology, and may include various kinds of intellectual property that are possessed or have been developed or acquired by perpetual, such as, but not limited to: proprietary know-how and patented information. The contents may be protected under contractual agreements such as, but not limited to: nondisclosure and non-circumvention agreements, agency agreements, employment agreements, application evaluation agreements, and licensing and optimization agreements. The contents may also be protected by trademarks or one or more of the approximately 60 patents, granted or pending, that perpetual directly or indirectly owns or controls in nearly 30 countries.





## RESULT HIGHLIGHTS

The XYO technology reduces vibration by compensating for variable mass imbalance during the operation of an optical disk drive (ODD). Tests show that the XYO system has a significant impact on the performance of an ODD. Vibration was reduced by **93%** with the XYO balancer (Figure 1). Additional benefits using XYO include:

- ▶ Higher disc spin speeds
- ▶ Greater data read rates
- ▶ Lower power draw
- ▶ Quieter operation

# Optical Disk Drive Vibration Decreased by 93%

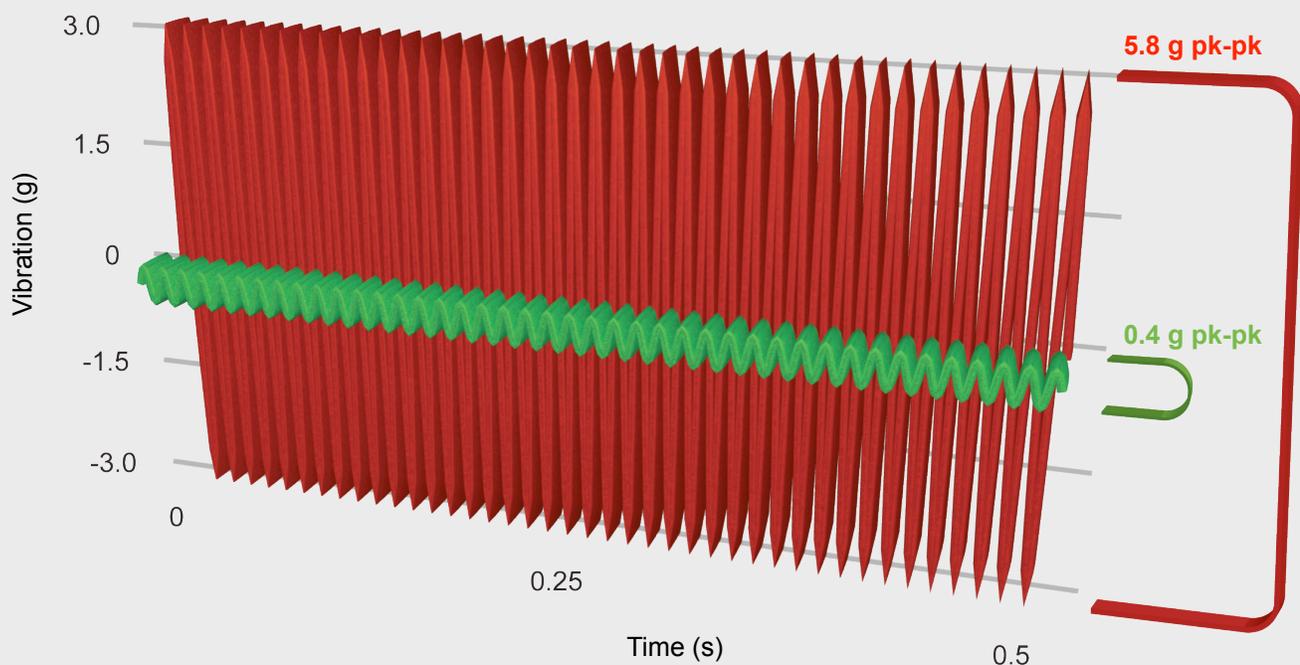


Figure 1. Impact of XYO on vibration of optical disk drives with a 6 g.mm imbalance at 10 000 RPM

■ WITHOUT XYO ■ WITH XYO

### Note:

- ▶ The results in this report are based on a prototype XYO balancer. While the results shown are significantly positive, it is possible to exceed and improve upon these results with further optimization.
- ▶ Mass imbalances of 2 to 10g.mm were imposed during testing; however, the XYO balancer can compensate for larger imbalances if desired.
- ▶ Perpetual Industries is looking for an innovative optical disk drive manufacturer to optimize and implement the XYO balancer and give their product a strong competitive advantage.



## INTRODUCTION

An optical disk drive (ODD) is a peripheral device in a computer. The mass imbalance of optical disks can lead to severe vibration. Since excessive vibration can have negative impacts (e.g., increased energy consumption, reduced acceleration and spin rates, and increased mechanical wear) manufacturers have tried several techniques to reduce or eliminate vibration. Some of these techniques include increasing the mass of the ODD case to reduce vibration amplitudes and using data buffering systems and counterweights. These options do not reduce vibration at its source and in some cases impose unacceptable levels of stress to the electrical drive.

## TEST OBJECTIVE

The objective of the test was to determine the impact that an XYO system would have on reducing the vibration of optical disk drives (Figure 2).

## TEST OVERVIEW

Our research indicated that greater than 90% of optical disks have a mass imbalance between 2 and 6g.mm. Mass imbalances of 2 to 10g.mm were used during testing.

An XYO balancer, designed to continuously and dynamically balance at a variety of rotational speeds, was built into an ODD mechanism with a capacity of 8g.mm (Figure 3).

**Note:** The XYO balancer can compensate for greater mass imbalances if desired.

To compare the vibration level with and without the XYO balancer, an accelerometer was mounted in the horizontal plane in line with the motor rotational axis at a distance of 40 mm (Figure 4).

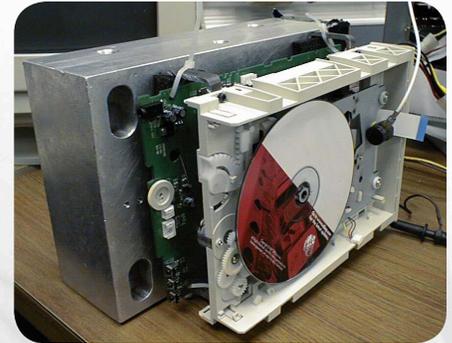


Figure 2. Left: horizontal mount drive, right: vertical mount drive

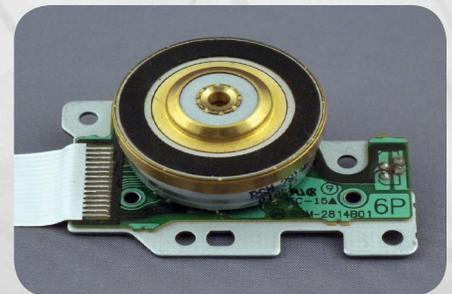


Figure 3. Left: unmodified turntable, right: XYO balancer implementation

### Accelerometer

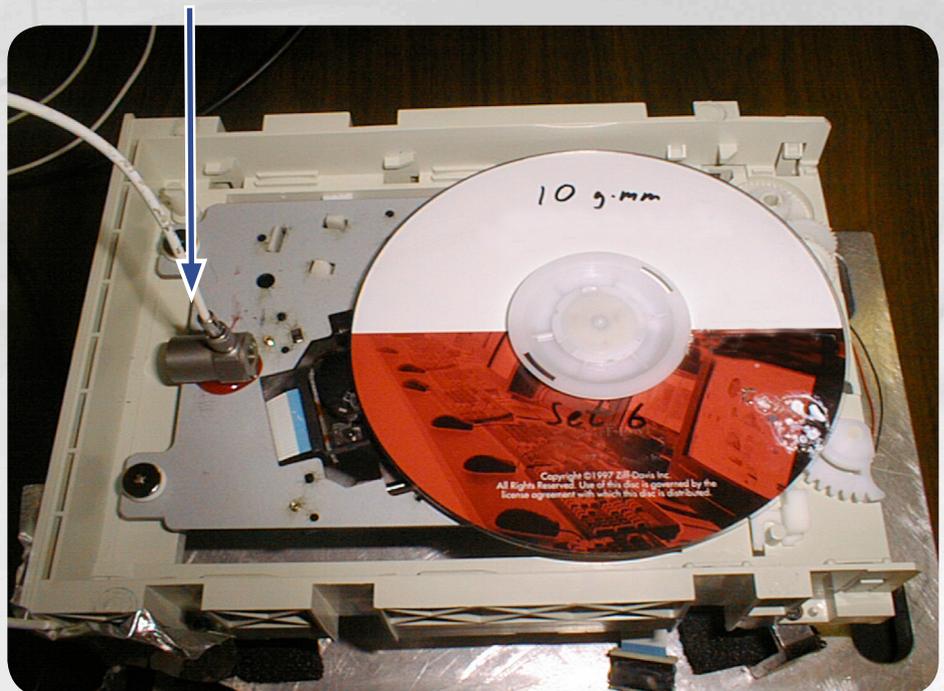
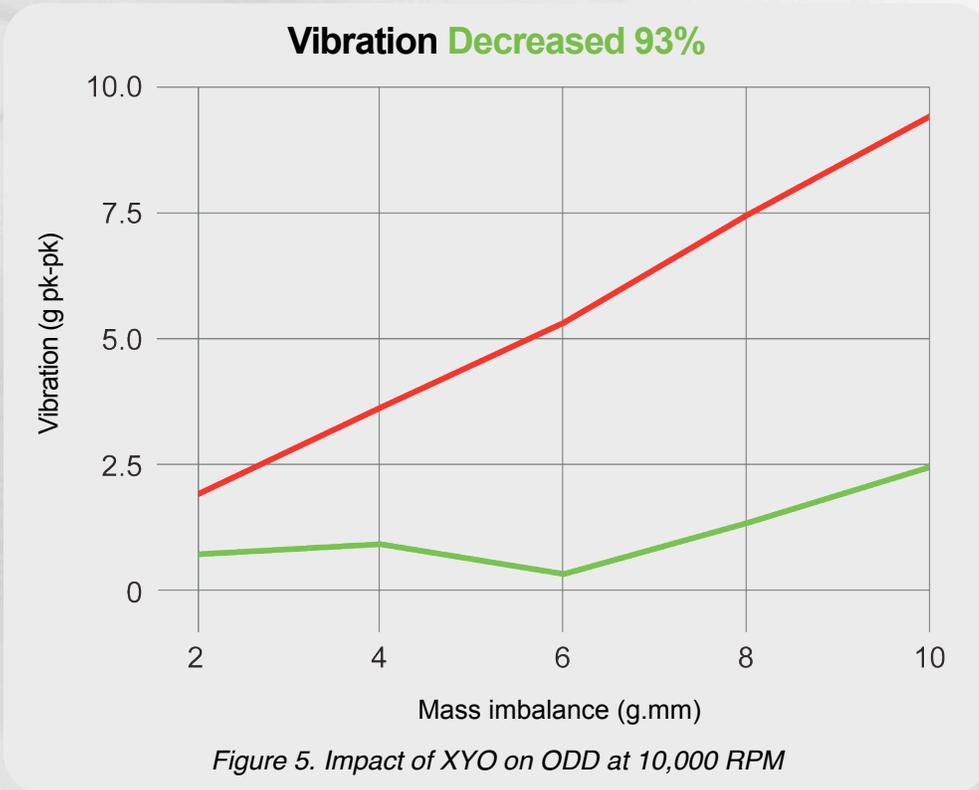


Figure 4. Probe location



## TEST RESULTS

Results were measured in the horizontal position and reported at 10,000 RPM. Figure 5 that the XYO balancer has a significant impact on the vibration of an optical disk drive. At 10,000 RPM, vibration is reduced by **93%** with the XYO balancer.



■ WITHOUT XYO    
 ■ WITH XYO

**Table 2.** Summary of vibration results for optical disk drive

MASS IMBALANCE (g.mm)	VIBRATION AT 10,000 RPM(g pk-pk)		IMPROVEMENT (g pk-pk)
	WITHOUT XYO	WITH XYO	
2	2.1	0.9	1.2 (57%)
4	4.1	1.2	2.9 (71%)
6	5.8	0.4	5.4 (93%)
8	8.1	1.4	6.7 (83%)
10	9.9	2.6	7.3 (74%)



## TEST RESULTS (Continued)

The XYO technology is effective at reducing vibration over a large range of operating speeds. XYO also remains effective with quick changes in speed during operation.

### 93% Vibration Reduction at 10,000 RPM

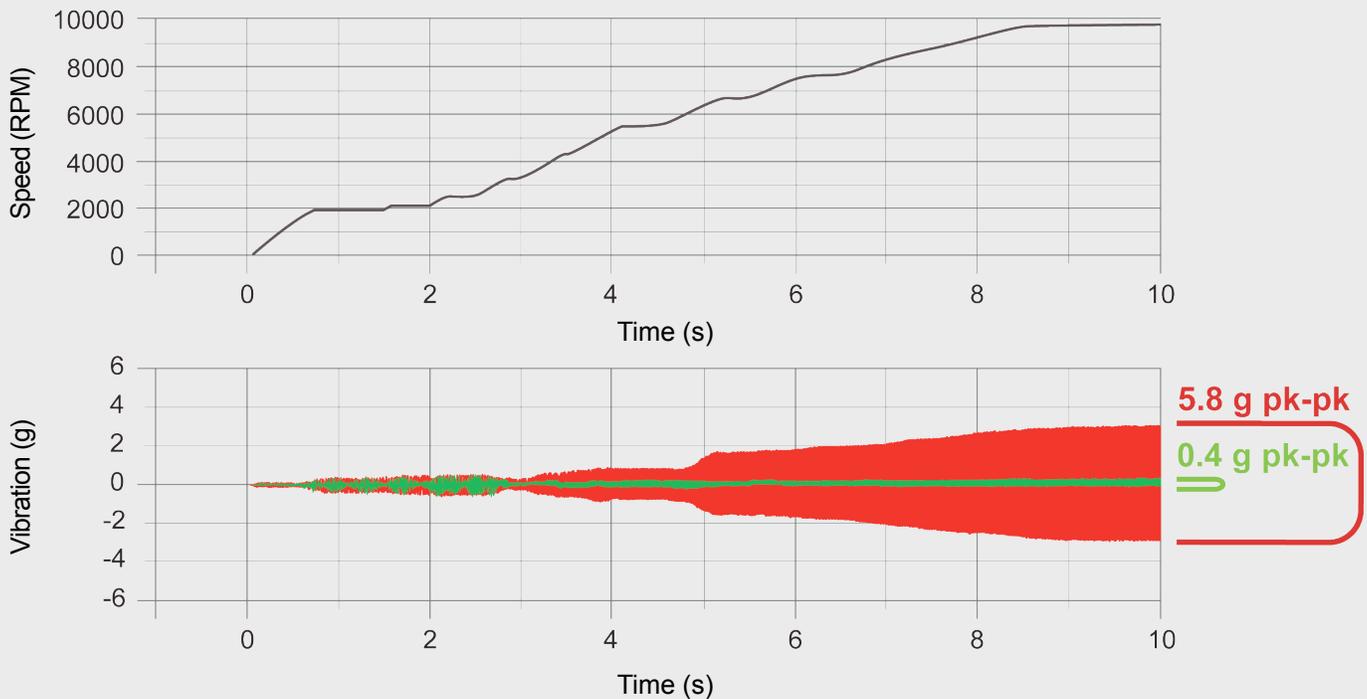


Figure 6. Optical Disk Drive run-up with and without XYO with an imbalance of 6g.mm

## FINDINGS AND CONCLUSIONS

The XYO technology was successfully applied to optical disc drives. Vibration was reduced significantly (**93%**) which should result in these additional benefits:

- ▶ The maximum spin speed of the drive will increase, allowing for better data read rates
- ▶ Data read rates will increase with a smoother spinning disk that prevents errors
- ▶ Power draw of the optical disk drive will be reduced
- ▶ Reduced noise levels due to less mechanical vibration

Perpetual Industries wants to work with a capable and innovative optical disk drive manufacturer to optimize and implement the XYO technology and provide a strong competitive advantage in the market.

### Impact of XYO:

- ▶ **Vibration reduced 93%**
- ▶ **Higher spin speeds**
- ▶ **Increased data read rates**
- ▶ **Decreased power draw**
- ▶ **Quieter operation of drive**

