

## TIRE BALANCING EQUIPMENT

### Introduction

Tire balancing equipment is used to help eliminate imperfect wheel and tire weights or shapes and ensure the tire is operating properly. This application note discusses the uses of a series 285 and 286 rotary position sensors versus the common market sensor to measure the diameter and distance of the

### Background

A wheel is a rigid rotor that is constrained to rotate about its axle. If the principal axis of the wheel's moment of inertia is not aligned with the axle due to an asymmetric mass distribution, then an external torque perpendicular to the axle is necessary to force the wheel to rotate about the axle. Asymmetric mass distribution is typical of mass produced automobile tires and rims. The reaction to this asymmetric mass and external torque, by Newton's Third law, is applied to the axle transferring it to the suspension of a vehicle, resulting in vibration.

Tire balancing is essential in all types of road vehicles to eliminate the effects of imperfect tire or wheel shapes, and to minimize effects of brake pulsation, worn or loose drivelines, suspension or other steering components.

Wheel balancing equipment is used to identify imperfection of tires and rims. Counter balances are applied to the wheel to minimize the effects of external torque, allowing the wheel to rotate perfectly about the axle. Wheel balancing equipment is used multiple times a day causing excessive wear to its components. The rotary position sensor used to measure the diameter and distance of the tire rotates at a specific mechanical angle repeatedly during one balancing operation. Multiple balancing operations are required to re-evaluate the tire for proper balancing.

A typical single-turn, Hall-effect rotary position sensor such as CTS Series 285 is good for 10 million rotational cycles but is only able to track a certain number of positions of the wheel over a 360-degree turn of its shaft. In comparison, and thanks to a rugged internal reduction gear set, a multi-turn rotary position sensor such as Series 286 can provide up to 10 turns for every single turn of the shaft, for a mechanical angle of 3600 degrees. This translates into 10 times the resolution versus a single-turn device.



## VIABLE TECH SOLUTIONS

### Non-contact Hall Effect

Non-contacting magnetic, also known as “Hall Effect,” technology offers a reliable and high-quality solution where contacting technology falls short. Discovered by Edwin Hall in 1879, Hall Effect refers to the potential difference on opposite sides of a bar-shaped conducting or semiconducting material (Hall element). This potential difference (voltage) is produced by a magnetic field applied perpendicular to the Hall element through which electric current flows. Figure 1 is provided to illustrate this concept.

Hall Effect technology produces an analog output similar to that of contact-type potentiometers, without the aid of a physical wiper contact. There are no internal contacting parts subject to mechanical wear or failure, making this technology ideal for use in harsh environments where extreme levels of shock, vibration, temperature changes, moisture and dust particles are present. Figure 2 demonstrates the typical configuration for the Hall Effect sensor where a magnet is rotated over a pre-programmed integrated circuit (IC) thereby producing an analog signal output.

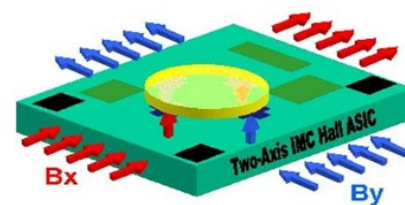


Figure 1: Hall Concept

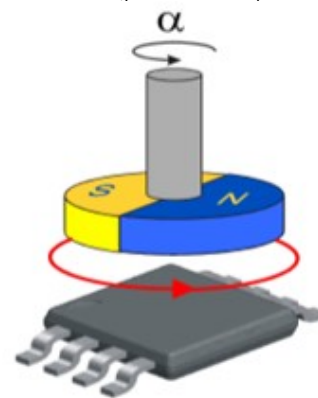


Figure 2: Typical Hall Configuration

### CTS Solutions

Our Series 286 non-contacting multi-turn rotary position sensor is the solution of choice for this application. The multi-turn capability can perform 3, 5, or 10 turns per shaft revolution, extending the mechanical angle range to 3600 degrees.

The 286 also incorporates Hall Effect technology and thus has no internal contacting parts to wear. The working life of the Series 286 is 10 million cycles, greatly reducing service replacement cost and equipment down time. In addition, the linearity of the Series 286 is  $\pm 0.5\%$ , providing a higher accuracy output for better wheel imbalance detection. By transitioning from contacting technology to non-contacting technology, the needs for periodic calibration, maintenance and service checks are virtually eliminated. Additional benefits from this upgraded technology include cost savings from reduced maintenance and reduced equipment down time. The Series 286 also offers IP rating options for equipment that is exposed to harsh environments. Standard flying leads offered on this model eliminate the need for soldering wires to the unit, making installation a quick procedure.

Custom connection configurations are also available on request. Contact an authorized CTS Sales Representative for additional details. Contact us with any questions at <https://www.ctscorp.com/>

