

**Honeywell**

THE POWER OF **CONNECTED**

# TRANSPORTATION ATTITUDE REFERENCE SENSOR IN A WHEEL LOADER/EXCAVATOR

An Application Note





**Background** Wheel loaders/front loaders/excavators are used in construction sites, waste handling facilities, and agricultural areas such as farms and nurseries. They can move a large amount of material: construction debris, dirt, feed, and just about anything else the operator can fit into the bucket. Their efficiency and quality of work depends on the skill and expertise of the operator. A skilled operator can treat the machine like an extension of his/her body moving it from place to place with ease, quickly, and in a safe manner. An unskilled operator, or an operator unfamiliar with the vehicle or the surrounding terrain, may need extra help to ensure the quality of work and safety is maintained.

This help often comes from vehicle stability control electronic and software systems. Similar to the units and designs found on passenger cars and performance vehicles, the systems found on construction vehicles can keep the engine's power output to a certain level to limit traction loss. Some systems can warn of potential tipping and overloading situations. While others can monitor vehicle's position relative to the ground, and alert the operator when traction is lost or the vehicle's footing has become unstable. When equipped with these systems, an operator can perform more efficiently in a safer environment.



**TARS-IMU:** Transportation Attitude Reference Sensor (TARS) Ruggedized Inertial Measurement Unit (IMU)

### TARS Key Features

- High performance IMU, reports vehicle angular rate, acceleration, and inclination (6 degrees of freedom)
- Ruggedized design for most demanding applications and environments (IP67 & IP69K certified)
- Advanced fusion filtering to minimize unwanted noise and vibrations, improves positioning accuracy
- Optional metal guard for added protection
- Supports 5 V and 9 V to 36 V vehicle power systems
- Operating temperature of -40 °C to 85 °C [-40 °F to 185 °F]
- Reduced power consumption
- Small form-factor

### The Solution

When designing systems for off-highway vehicles, engineers need to know how the vehicle reacts in a given loading and movement situation. Honeywell TARS-IMU can do that as it's a packaged sensor array that reports angular rate, acceleration, and inclination. When installed on a vehicle, the TARS-IMU can tell if a vehicle is turning, moving uphill, tilting about its lateral axis, accelerating, and more. This information is a key input to systems monitoring traction and vehicle output. For example, an operator has applied power to move the vehicle. This signal is controlled and relayed by the vehicle's electronic control unit (ECU) to the engine to provide power to the drivetrain and move the wheels. Meanwhile, the TARS-IMU is sensing the vehicle's movement. If the signal from TARS-IMU does not match how the ECU expects the vehicle to move, it could be interpreted as a traction loss or wheel slippage event. If programmed to automatically reduce power to the wheels in such an event, the system could limit the incidents of wheel slippage. In some cases, wheel slippage on previously worked surfaces and ground can quickly require costly rework.

## Other Potential Applications

### Construction equipment

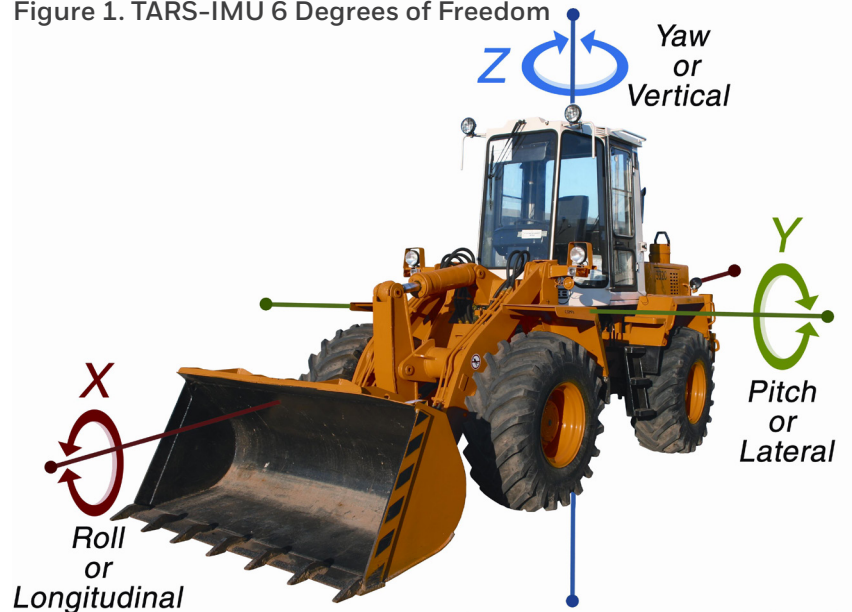
- Excavators, mining trucks, forestry equipment, telescopic handlers, loaders, cranes, graders
  - Improves operator awareness relative to equipment loading/extension arms in cranes, material/telescopic handlers
  - Provides real-time stability control in most rugged/steep terrain (Inclination outputs to prevent vehicle roll over)
  - Provides active control of graders/bulldozers (depth/angle)

### Agricultural equipment

- Combines, harvesters, tractors, balers
  - Provides motion control feedback (attitude/acceleration) for stability and the leveling cutting blades, planters, tillers, and other equipment when on slopes/hills
  - Inclination outputs to prevent vehicle roll over
  - Improves automated steering capabilities by providing rotational rate change data to vehicle controls

**Any application where inclination or position is needed.**

Figure 1. TARS-IMU 6 Degrees of Freedom



## Value to OEM Customers

### Durability for the environment

- Corrosion-resistant housing/case minimizes the susceptibility to deterioration often experienced in salt-water environments
- UV-resistant plastic housing
- IP67 and IP69K ratings provide resistance to weather, harsh conditions and cleaning environments, reducing risk and cost associated with lower-rated products
- Wide operating temperature range withstands most thermal extremes, preventing package breakage
- Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) rating ensures device compatibility with the radio frequency environment

### Ease of integration

- One high voltage (9 V to 36 V) model is designed for operation from heavy-duty vehicle battery power with immunity to load dump and electrical transients
- The second low voltage (5 V) model is designed for operation from a regulated 5 V power source
- SAE J1939 CAN output – allows more data to be transmitted than a RS-485 output
- AMPSEAL 16 connector, common in transportation applications, simplifies the customer's supply chain and reduces design complexity
- The TARS-IMU employs a boot-loader feature to facilitate program updates and integration with new functional requirements. New features can thereby be upgraded without opening the unit, keeping the calibration parameters and sensor performance intact

### Performance in a wide variety of environmental conditions

- Calibration with 2-axis rate table with verification over temp. range
- Tested to mechanical shock, thermal shock, and random vibration

## Warranty/Remedy

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## **WARNING** **PERSONAL INJURY**

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**Failure to comply with these instructions could result in death or serious injury.**

## **WARNING** **MISUSE OF DOCUMENTATION**

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

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