

# REDEFINING ROAD RAIL & RUGGED APPLICATIONS

Our sensors and switches  
move your business further.

LET'S DIG DEEPER

Honeywell

Honeywell Transportation Solutions ebook was designed for the curious reader. Using the navigation bar at the top, explore the various transportation solutions to learn more about Honeywell sensors, switches and controls.

Honeywell focus products are contained in a grey circle with red outline; there's a focused product overview on each. Supporting Honeywell products are contained in a grey circle; there's more information on them in the Product Quick Snaps section.

On these pages, the navigation icons will help the reader learn more about the products, as well as explore further on the product datasheet and web link.

PAGE NAVIGATION ICONS



What the product is.



What the product does.



Product innovation



Target applications



Product datasheet



Product web link

# WE'RE NOT AFRAID TO GET DOWN IN THE DIRT WHEN IT COMES TO HIGH-PERFORMING SOLUTIONS FOR RUGGED ENVIRONMENTS

Sensors and switches for transportation applications have to work hard. Front-end loaders, diggers and excavators, scissor lifts and aerial work lift platforms are used in temperatures from well below zero to scorching desert heat. Refuse trucks, cranes and timber harvesting equipment must often operate within tight performance control parameters. Smart suspension systems and leveling controls are needed to keep passengers and cargo safe in buses, RVs, emergency vehicles, material-handling equipment and last-mile delivery fleets. Tilt/trim position is important for boat engines, heavy-duty rail systems rely on accurate temperature sensing in their battery packs, and agricultural equipment relies on accurate articulation joints and many other critical sensor outputs that must meet strict safety requirements. And when folks working in these tough environments head out for off-hours fun, their snowmobiles, jet skis and off-road vehicles rely on sensors and switches for everything from handlebar controls to wheel speed direction and control.

Honeywell transportation sensors, switches, and controls meet the challenges of the most demanding environments, providing effectiveness and efficiency, improving safety, and enhancing operator interface. Our TARS-IMU (Transportation Attitude Reference System – Inertial Measurement Unit) packaged sensor array, for example, reports vehicle angular rate, acceleration, and attitude data for precise movement and guidance over severe terrain and grades. Our sealed Autonomous Sensing Suite Swing Angle Sensor, now available with analog output, is designed to be installed directly onto a swivel and tolerates high shock, vibration and tightening torque.

Add our comprehensive suites of linear position sensors, speed and pressure sensors, current sensors, rotary position sensors, sealed switches, toggle switches, and other manual controls and we've got you covered. It's a big rough world out there...and we're ready for it.

# TRANSPORTING INDUSTRY TO THE FUTURE.

**T**he transportation industry is poised to address a number of challenges in 2022 and beyond, and capitalizing on these will provide a competitive advantage for manufacturers of vehicles for this industry. The trends outlined here have implications for the selection of switches, sensors, and other vehicle components by these manufacturers.

Throughout the industry, the pandemic has had a substantial impact. Higher wages, combined with a shortage of skilled operators, is driving the need for equipment that maximizes operator efficiency through system automation and a reduced need for complex training, as well as ensuring that the equipment itself performs at peak efficiency to minimize downtime<sup>1</sup>.

The pandemic also shifted attitudes toward careers overall, allowing transportation vehicle companies to promote career growth potential with exciting new technology opportunities<sup>2</sup>.

For construction vehicles (excavators, cranes, backhoes, etc.), updated state safety regulations have increased emphasis on protective equipment, including smart machines and robots to perform hazardous tasks and augment human roles. Drones for both overhead viewing and actual construction tasks are just one new technology being utilized. Artificial intelligence (AI) and augmented reality (AR) are automating measurements, and providing speedy simulations and mobile access for real-time data gathering to digitally expand the construction world<sup>3</sup>, and a global focus on making new heavy equipment green and clean is leading to electric and hydrogen-fueled machinery<sup>4</sup>.

The growing construction industry is also driving the forklift/lift truck market, where these vehicles are also used extensively in warehouses, factories, and dockyards in the automotive, aerospace, transportation, retail, logistics, food and pharmaceuticals, and manufacturing industries. The pandemic expanded warehouse operations around the world, including in emerging economies, which has also increased forklift demand<sup>5</sup>.

# TRANSPORTING INDUSTRY TO THE FUTURE.



Innovations in electric- and hydrogen-powered lifts are being widely explored by lift manufacturers, in addition to the ability to customize other features for the broad variety of industries (above) in which they serve. Enhanced operator controls, without sacrificing safety, is another area where manufacturers are looking at their component options<sup>6</sup>.

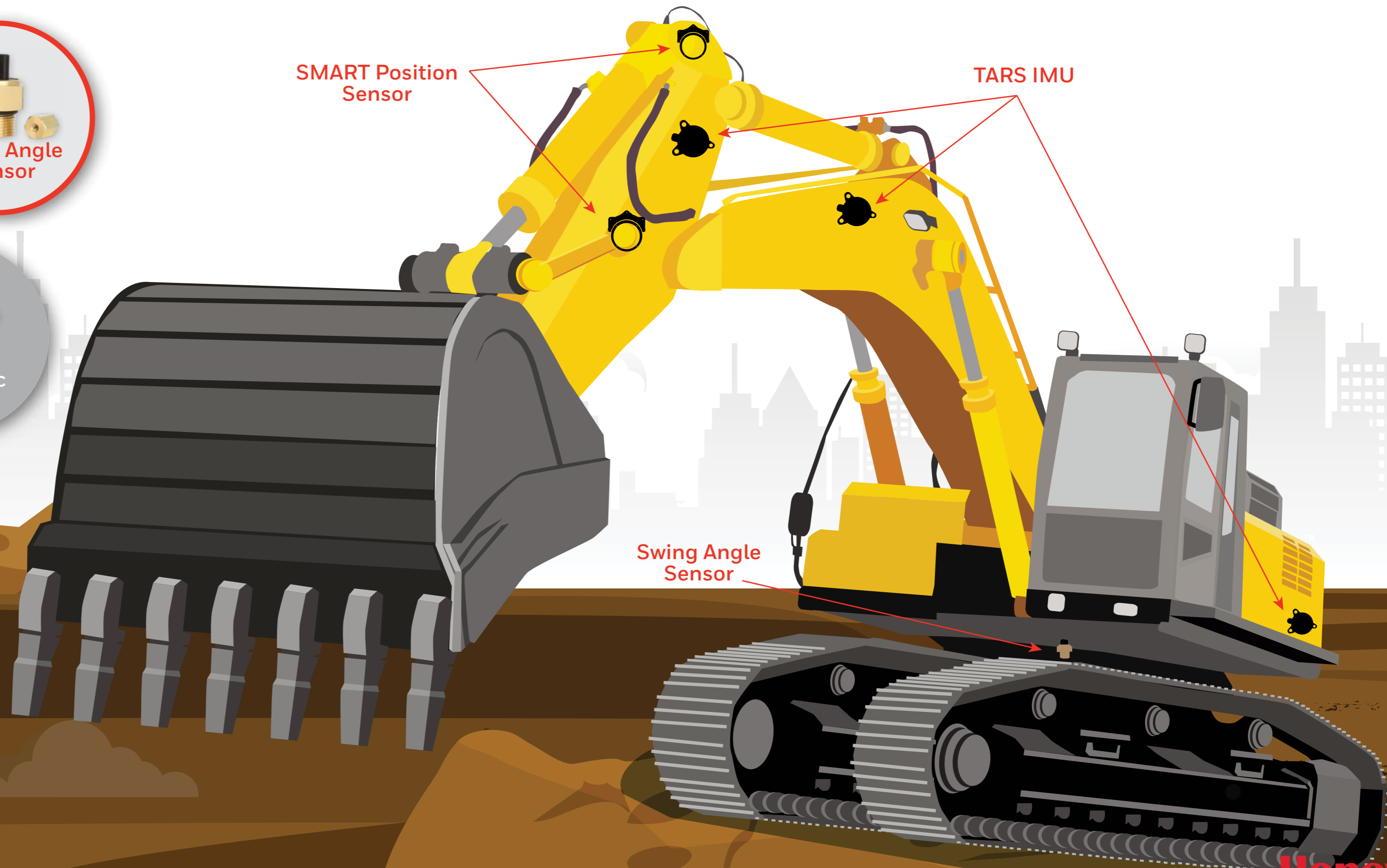
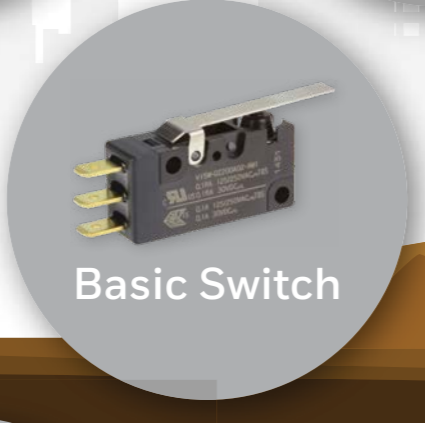
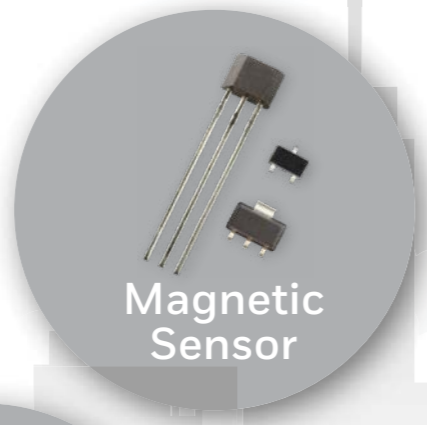
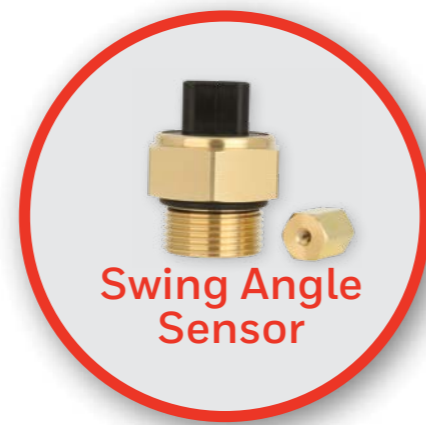
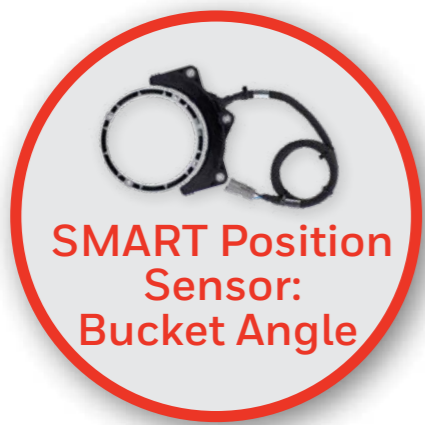
In the Utility Terrain Vehicles (UTV) segment, the US market is projected to grow at over 6 % CAGR (compound annual growth rate) through 2027, with applications in farming, forestry, and construction. New-model development is emphasizing overall weight reduction to improve the weight-to-power ratio and increase fuel efficiency. New regulations, safety features, and operator control optimization are also impacting designs, and combined with demand for electric models – with the battery management and engineering requirements they entail – will result in widespread transformation of this transportation segment<sup>7</sup>.

Tangentially, while the market for recreational vehicles (RVs) dropped substantially in the first months of the pandemic, scores of new options have expanded this segment of the transportation industry as people view RVs as a safer and more flexible travel option<sup>8</sup>.

With the rising popularity of outdoor sports activities, including off-road events and an explosion in adventure and trails parks, the All Terrain Vehicles (ATVs) market is forecasted to grow over 5 % (CAGR) through 2030. A major factor in this growth is a large increase in their use in agricultural and military applications as well as in manufacturing, construction, utilities, mining, game hunting, and search and rescue<sup>9</sup>. As with UTVs, ATV manufacturers are exploring electric models, as well as higher-performance braking systems and shocks, high-torque ability, optimized safety systems, and enhanced operator controls<sup>10</sup>.

# CONSTRUCTION SOLUTIONS

In this modern era of automation, earth moving firms are turning to operator assist technology to allow their operators work efficiently. Operator assist technology allows the automation of frequent job site operations such as dig, load, dump and grade. These automated operations are guided by software that is able to precisely control movements to dig where needed and grade at preset angles.

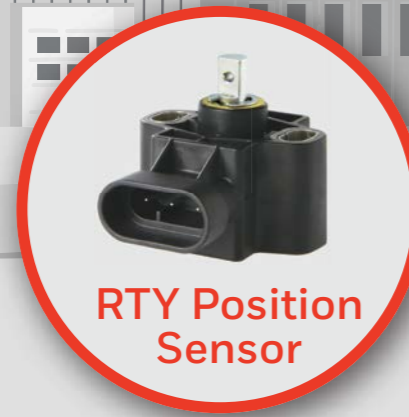


# AGRICULTURE SOLUTIONS

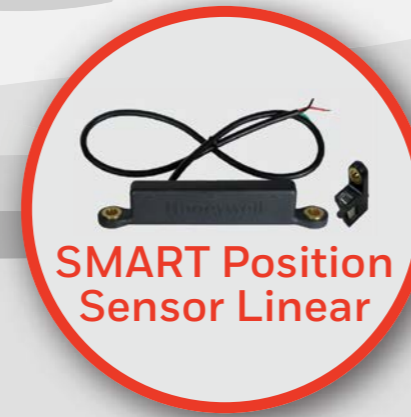
Agriculture vehicles inherently face a variety of design and safety challenges—including vehicular and biological hazards. Honeywell agriculture solutions offer highly accurate sensors, switches and controls that ensure better productivity and safety outcomes every season.



TARS IMU



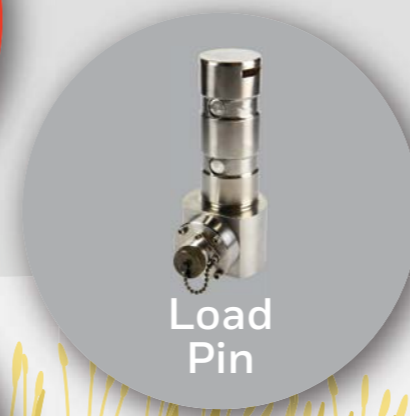
RTY Position  
Sensor



SMART Position  
Sensor Linear



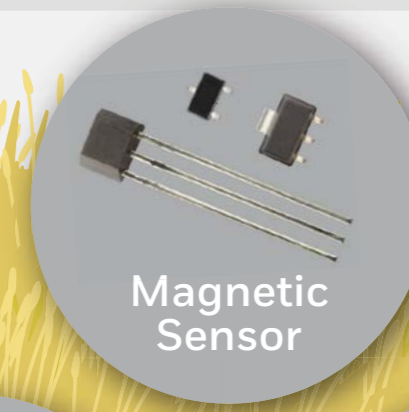
Speed Sensor



Load  
Pin



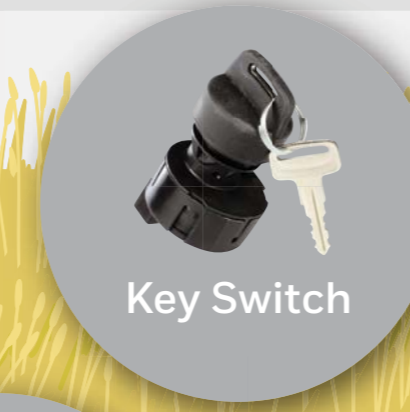
Basic Switch



Magnetic  
Sensor



Toggle  
Switch



Key Switch



Limit  
Switch



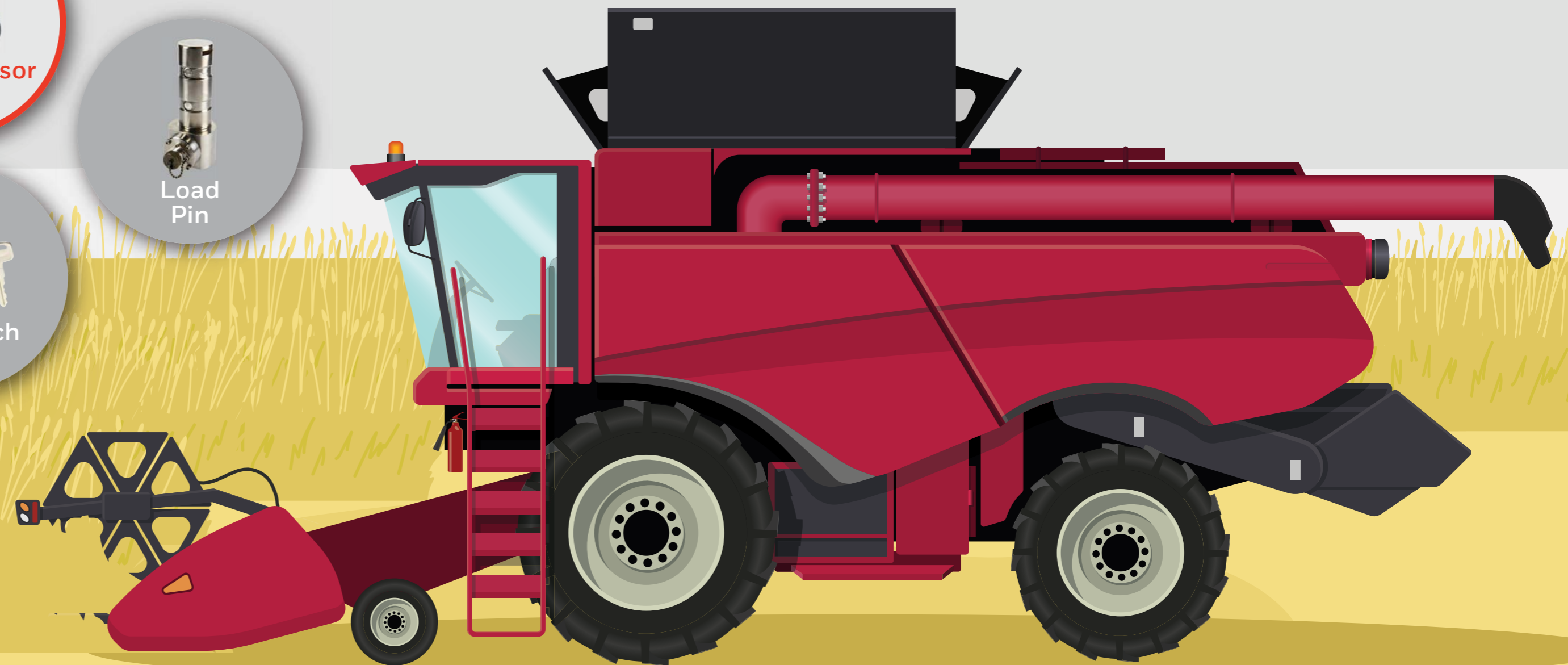
Pressure  
Sensor



Thermostat



Pressure  
Switch



# RECREATION SOLUTIONS

According to [Research & Markets](#), the all-terrain vehicle market, by value, is projected to grow to USD 4.4 billion by 2025 from USD 3.9 billion in 2020, at a CAGR of 2.4 % during the forecast period. Honeywell sensors and switches play an integral role in the design and engineering of ATV and UTV model development.



Speed  
Sensor



RTY Position  
Sensor



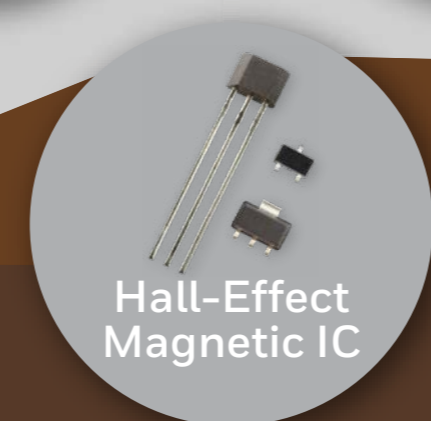
Pressure  
Sensor



Handlebar  
Controls



Key/Rotary  
Switch



Hall-Effect  
Magnetic IC



Pressure  
Switch



# MATERIAL HANDLING SOLUTIONS

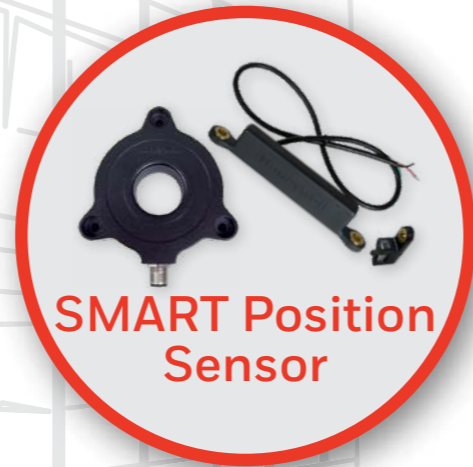
Throughout the supply chain, forklifts have transformed from material-handling vehicles into information-technology platforms that must leverage computers, barcode scanners, printers, RFID, voice and software to optimize complex workflows, in addition to keeping the driver and work area safe and hazard-free.



RTY Position  
Sensor



TARS IMU



SMART Position  
Sensor



Speed Sensor



Pressure  
Sensor



Key Switch



Toggle Rocker  
Switches



Limit  
Switch



Shifters/  
Stalk Controls

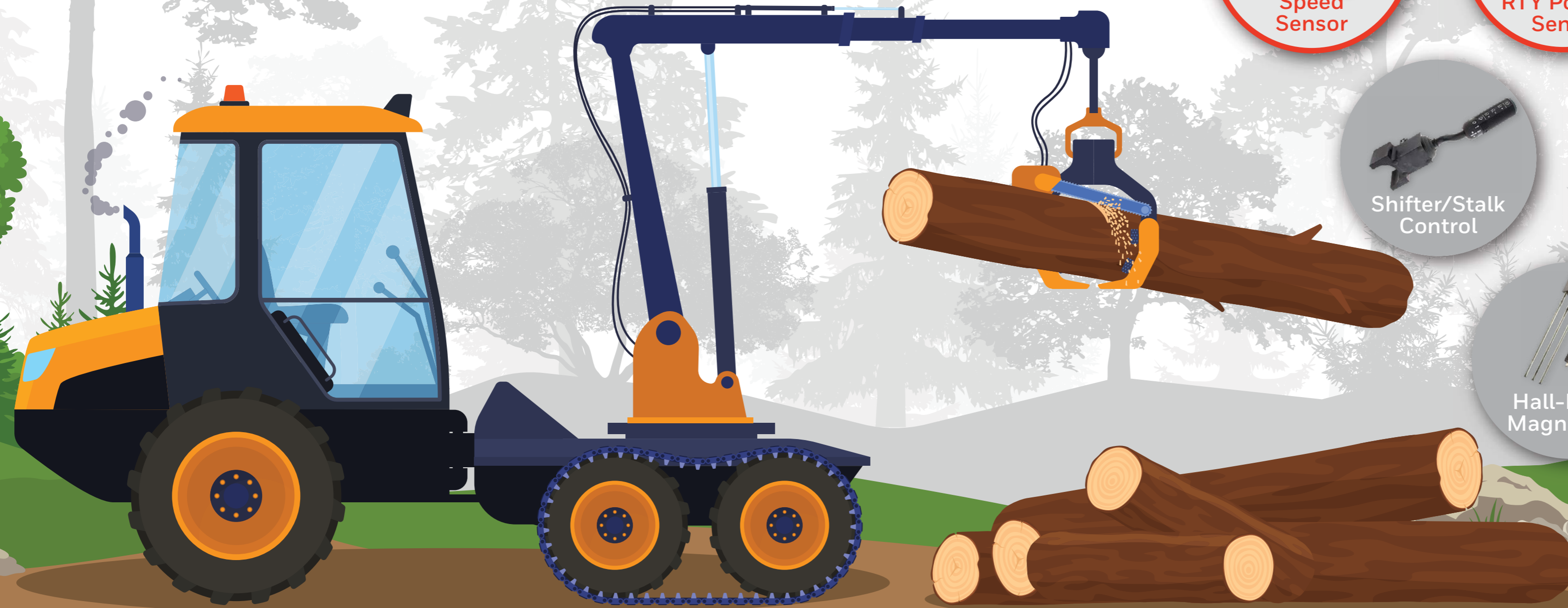


Pressure  
Switch



# FORESTRY SOLUTIONS

“Global Forestry Equipment Market, valued at USD 9,559.4 Million in 2018, is projected to reach USD 13,109.9 Million by the end of 2026, exhibiting a CAGR of 4.09 %.”<sup>11</sup> Most of the global growth in this industry surrounds an increasing emphasis in forestry management activities. For these vehicles to perform at optimal level, their components must be extremely rugged, excel in harsh condition, as well as be accurate and reliable.



TARS IMU



Speed Sensor



RTY Position Sensor



SMART Position Sensor



Swing Angle Sensor



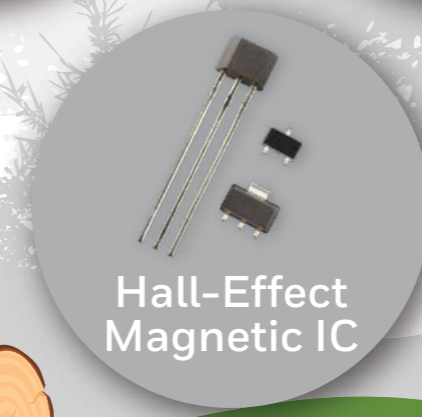
Shifter/Stalk Control



Key/Rotary Switch



Pressure Sensor



Hall-Effect Magnetic IC



Load Pin



Limit Switch

# RAIL SOLUTIONS

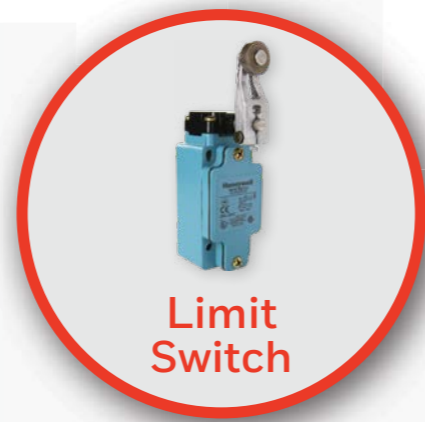
Sensor and switches in rail applications are designed to improve performance, maintenance and comfort. Rail systems need to ensure a safe passenger experience, so it's important to modernize infrastructure with high-quality, rugged products designed to thrive in harsh environments with minimal maintenance. Our sensors and switches provide repeatable and accurate sensing, lower failure rate and operational costs and increased engineering support.



Speed  
Sensor



RTY Position  
Sensor



Limit  
Switch



Pressure  
Transducer



Basic  
Switch



Hall-Effect  
Magnetic IC



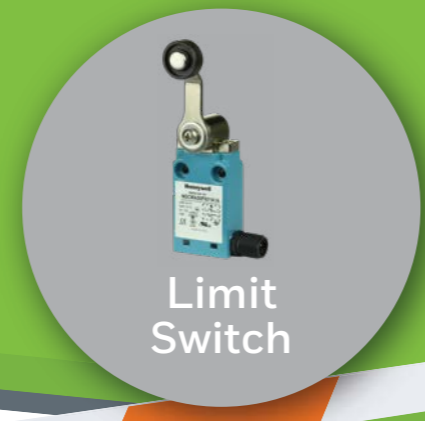
Key/Rotary  
Switch



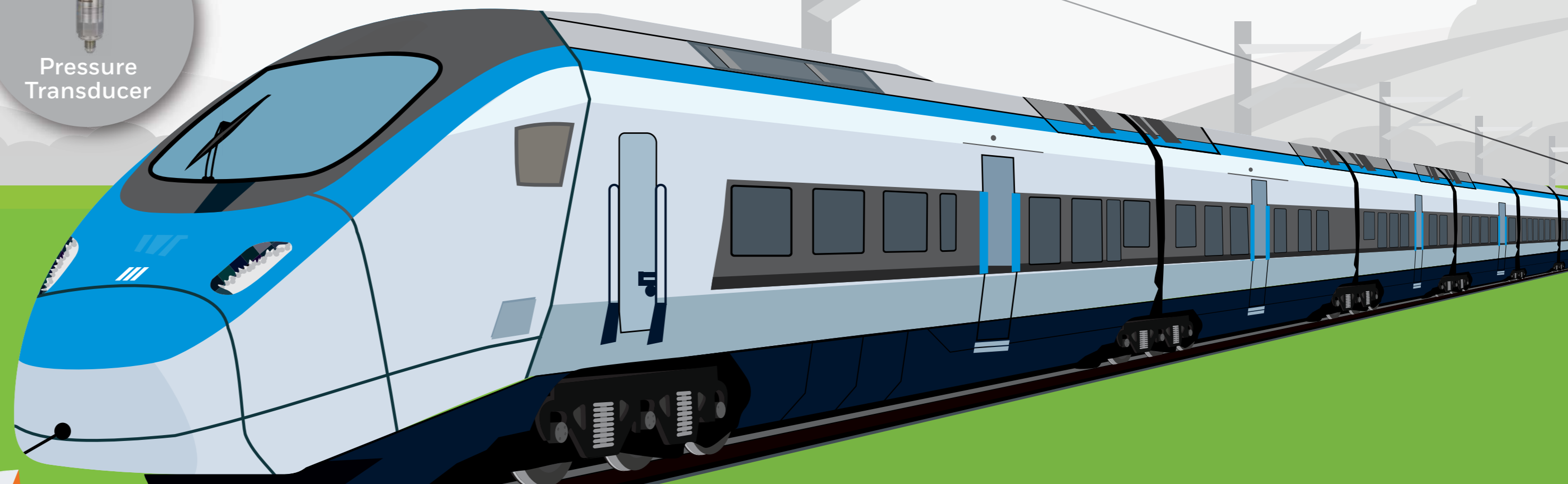
Pressure  
Sensor



Toggle &  
Rocker



Limit  
Switch



# ADVANCING & ACCELERATING TRANSPORTATION

To view more details on Honeywell Transportation focus products, please click on the product(s) below you wish to dig deeper on.

PAGE NAVIGATION ICONS



What the product is.



What the product does.



Product innovation



Target applications



Product datasheet



Product web link

Speed Sensors



Hall-effect Rotary Position Sensors



SMART Position Sensors



TARS IMU



SMART Arc CAN



Swing Angle Sensor



# TRANSPORTATION ATTITUDE REFERENCE SYSTEM TARS-IMU



A packaged sensor array designed to report vehicle angular rate, acceleration and attitude data



- Enables precise movement, actuation, and guidance over severe terrain and vehicle grades
- Enhances safety through monitoring and guidance capabilities to promote the productivity of operators



- The TARS-IMU is delivered with customizable firmware that allows manufacturers to use a single part number across vehicles and applications



- Equipment control
- Bucket control
- Vehicle stability control
- Performance and output control
- Linkage tracking
- Work monitoring
- Operator assisted control

Click to explore the 3D model.



EXPLORE MORE



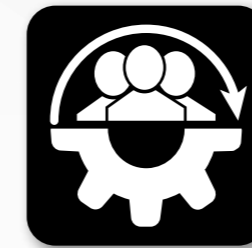
# SMART ARC CAN POSITION SENSOR



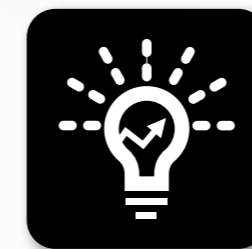
Click to explore the 3D model.



A durable, adaptable, lightweight and accurate position sensor for precise position sensing of rotating parts around a pinned joint



- Mounted directly on the pinned joint to provide precise position sensing of rotating parts around the pinned joint
- Reduces mechanical stack-up error & allows faster response time
- Enables greater position sensing and control



The adaptable, non-contact design allows the elimination of unnecessary linkages, reducing installation steps and cost. The sensor is installed on the pinned joint, allowing direct position measurement and reducing stack-up error impact to overall system operation



Specifically designed for construction machines like excavators, large backhoes, front-end loaders and other similar equipment

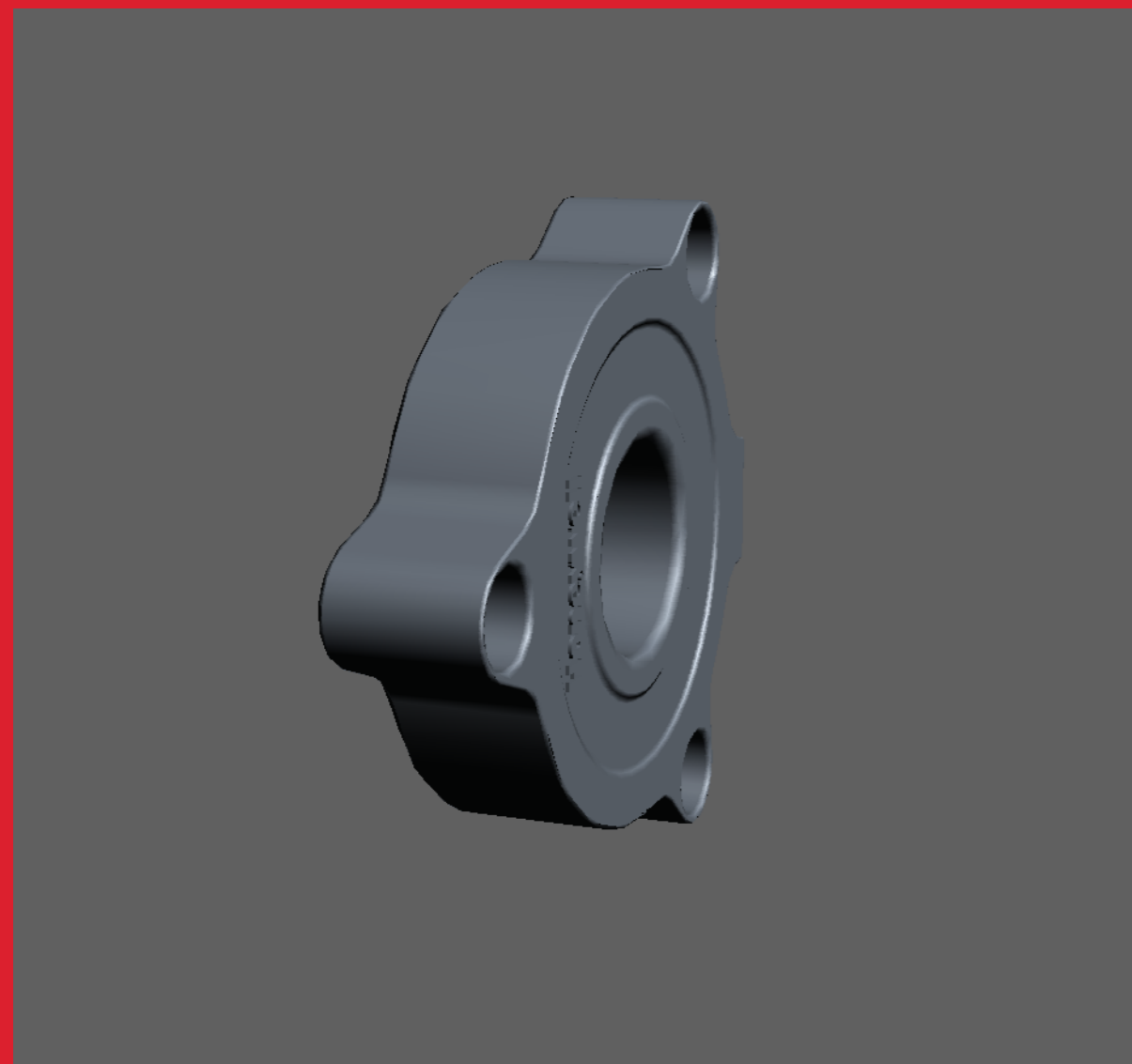
- Front end loader and digger/excavator boom position
- Refuse truck lift and automatic reach arm position
- Articulated vehicle steering position
- Timber harvester/processor equipment



# SMART POSITION SENSORS

## LINEAR, ARC & ROTARY

Click to explore the 3D model.



Non-contact sensing solutions (linear, rotary, and arc versions) for absolute position sensing with enhanced accuracy; senses the position of a magnet relative to the sensor



- A patented combination of an ASIC and an array of MR sensors to accurately and reliably determine the position of a magnet so that the object's position can be determined or controlled



- Non-contact design eliminates mechanical failure mechanisms, reducing wear and tear, improving reliability and durability, and minimizing downtime



- Industrial: valve position, material handling, plastic molding, cutting and slitting, wafer handling, CNC machines
- Transportation: engine transmissions, passenger bus level position, truck-mounted crane outrigger position, steering & articulation angle, boom arm detection, heavy equipment attachment identification, hydraulic cylinders, marine motors
- Aerospace: aircraft actuators, solar panel and satellite dish elevation and azimuth
- Military: remote weapon systems elevation, chassis suspension systems position height, vehicle door position

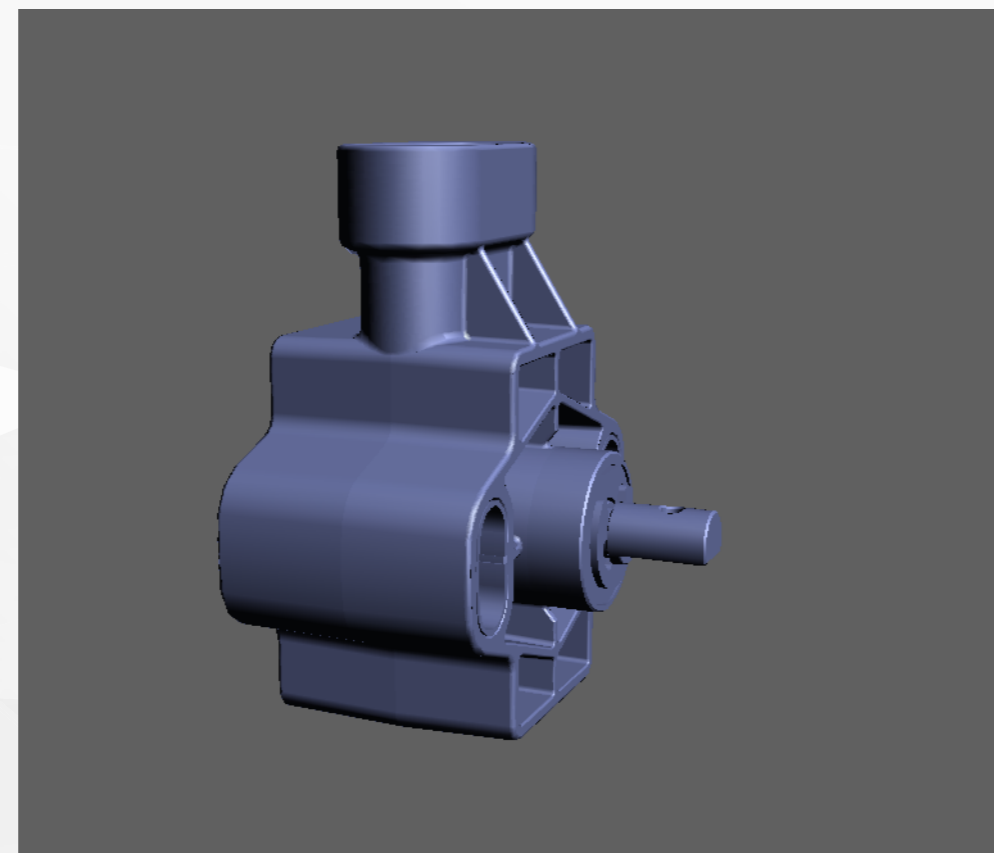
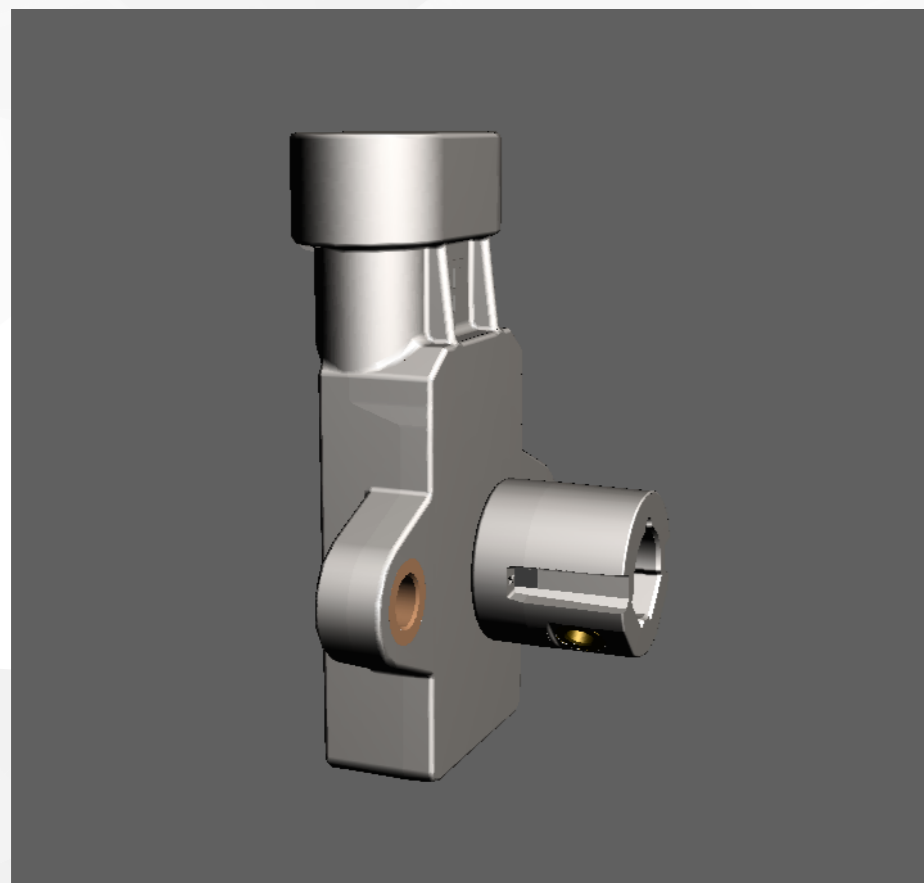
EXPLORE MORE



# HALL-EFFECT ROTARY POSITION SENSORS



Click to explore the 3D model.



Provide non-contact sensing in harsh transportation and industrial applications at a competitive cost



- Enhances fuel economy, equipment and engine performance, and safety.
- Accurate sensing validates the correct height for the application's system requirements, potentially aiding vehicle ingress/egress (liability), trailer height for warehouse docking (faster turns and liability), and suspension performance monitoring (diagnostic check)



These products use a magnetically biased, Hall-effect integrated circuit (IC) to sense rotary movement of the actuator over a set operating range. Rotation of the actuator changes the magnet's position relative to the IC. The resulting flux density change is converted to a linear output



- Position and movement detection (pedals, throttles, gear shift, levers, steering, linkages, and hitches)
- Suspension/kneeling position
- Valve control
- Irrigation equipment pivot
- Tilt/trim position
- HVAC damper control
- Ride height/suspension control





# SWING ANGLE SENSOR



Provides non-contact sensing. Two-piece construction where magnet and sensor are packaged in two separate housings. Both the sensor and magnet carriers are thread-mounted device



- Used to detect precise rotational angle between the upper body and lower body
- Provided dual analog output with 180° phase shift, and each one of them individually covers the sensing range of 270°. Can be used for sensing overall 360° applying simple logic

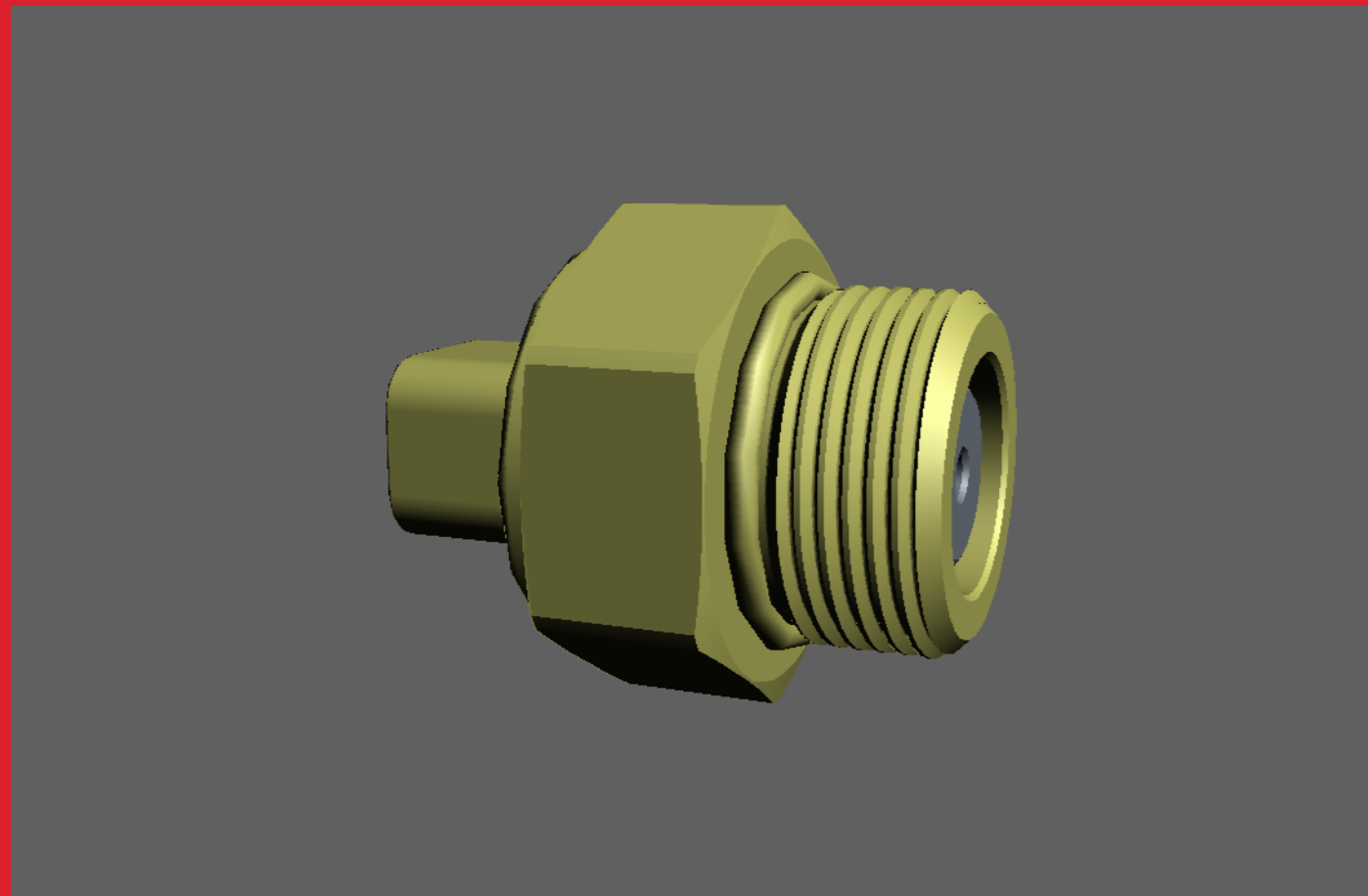


- Takes non-contact sensing to the next level by separating the magnet from the sensor body. The absence of the actuator shaft removes the wear and tear on the bearings caused by radial forces



- Transportation: Aerial work lift platform, front end loader and digger/excavator body position; refuse truck lift and automatic reach arm position; mobile crane steering; timber harvester/processor equipment cutter arm angle
- Industrial: Telescoping conveyor elevation; power generation contact angle; rail-road crossing arms position
- Military: Remote weapon systems elevation; chassis suspension systems position height

Click to explore the 3D model.



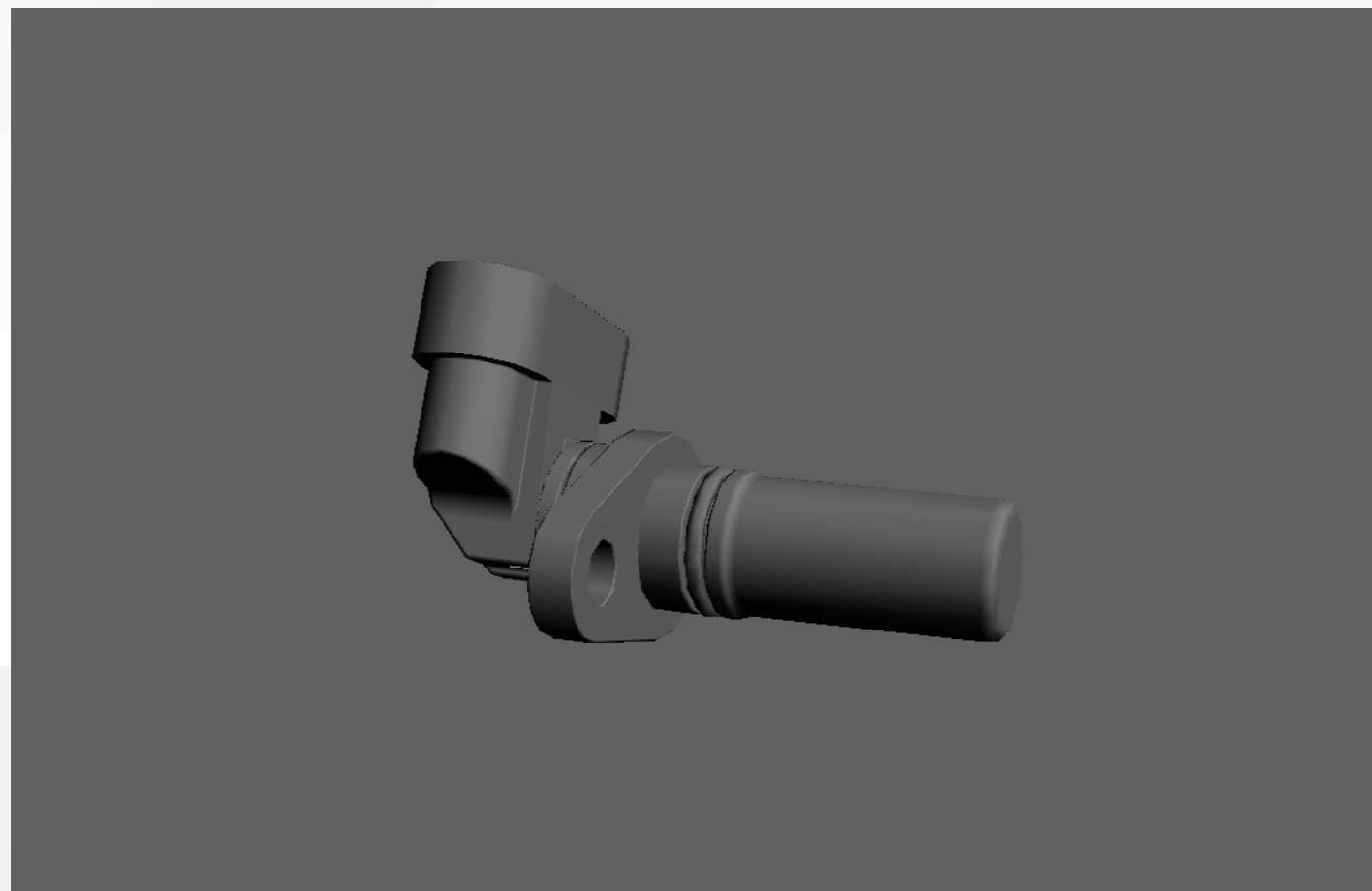
EXPLORE MORE



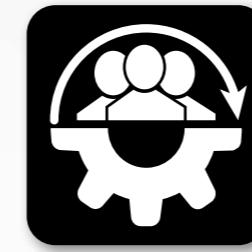
# HALL-EFFECT SPEED & DIRECTION SENSORS



Click to explore the 3D model.



Designed to provide both speed and direction information



- Speed information is provided using digital square wave outputs; direction is provided using a quadrature output with signals 90° phase shifted from each other. With the quadrature output, target direction is determined by output lead/lag phase shifting



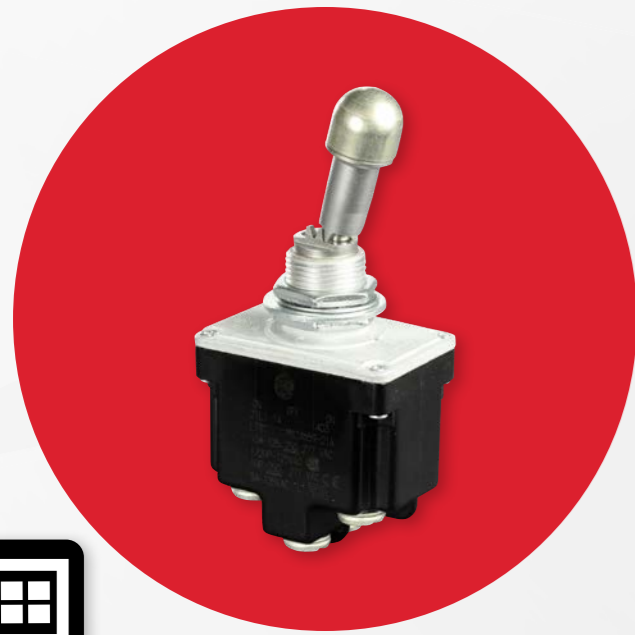
- Dual differential Hall-effect sensor IC technology allows an enhanced ability to detect small target features
- Wide operating temperature range, robust electrical noise immunity and enhanced environmental sealing capability allow flexibility of use in the application



- Hybrid electric transmissions in heavy duty trucks, buses, agriculture and construction machines
- Wheel speed detection in material handling, agriculture, and construction machines
- Hybrid engines in heavy duty trucks, buses, agriculture and construction machines



# SENSORS & SWITCHES



## TOGGLE SWITCHES

- Used in the control panel/board of wide variety of transportation equipment
- Operate movement of machinery and/or turn on lights, pumps, etc.
- Remote control of concrete pumping and drilling machines
- Control panel/board
- Movement of aerial platform lift
- Raise/loser, extend/retract, rotate platform
- Ignition switches, on-off switching



## ROCKER SWITCHES

- Flight decks for commercial and business jets
- Control panels for industrial machinery and equipment
- Operator interface controls for vehicles
- Main and auxiliary control panels for road construction equipment
- Agriculture equipment



## BASIC SWITCHES

- Designed for outdoor, wash down, and high-dust environments
- Operator presence detection
- Auxiliary controls and alarms



## LIMIT SWITCHES

- Used in a variety of applications including
- End-of-travel position
- Upper and lower stop for scissor lifts
- Truck bed position
- Truck stabilizer (outrigger) stow position
- Ag marker arms and air system on or off
- Oversize detection on balers
- Center pivot irrigation system position
- Door interlock and detections
- Brake wear detection
- Shunting and buffer position



## CONTROLS & SWITCHES

- Vehicle control, implements/accessories, lighting
- Ignition/starter switches, on-off switching, headlamp, flasher, and feature controls
- Throttle controls, indicator lights, engine shut-down, power-train, and custom switches



## KEY SWITCHES

- Used in a variety of applications ranging from run/start ignition to single-point control for lights and accessories
- All-terrain vehicles
- Snowmobiles
- Golf carts
- Aerial/scissor/boom lifts
- Telehandlers
- Construction equipment
- Skid loaders
- Forklifts
- Agricultural equipment
- Tractors

# SENSORS & SWITCHES



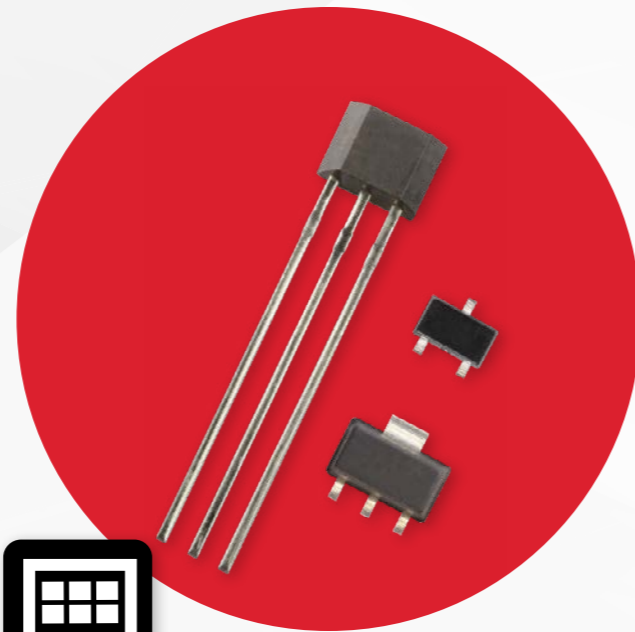
## PRESSURE SENSORS

- Multiple applications including braking and alternative fuels
- Hydraulic braking system and air brake pressure monitoring
- Fuel tank level sensing
- Dry air system monitoring; hydraulic, brake, and engine oil fluid pressure monitoring



## PRESSURE SWITCHES

- Various pressure applications in:
- Agricultural machinery
  - Heavy duty construction machinery and trucks
  - Lawn & garden machinery
  - Marine vessels
  - Material handling machinery
  - Railway



## HALL-EFFECT MAGNETIC ICs

- Speed and RPM sensing
- Tachometer
- Counter pickup
- Motor and fan control
- Electric window control
- Electric vehicle control



## SHIFTERS, TURN SIGNALS & STALK CONTROLS

- Electronic gear shifting and turn signals
- Gear shifting, turn signaling



## LOAD PINS

- Measures force within hydraulics and on actuators and hinges



## LOAD CELLS

- Measures the load on extended arms



## PRESSURE TRANSDUCERS

- Used in the braking system

<sup>1</sup> <https://www.reuters.com/business/cop/us-labor-costs-power-ahead-third-quarter-wage-surge-2021-10-29/>

<sup>2</sup> <https://www.alliedmarketresearch.com/atv-and-utv-market>

<sup>3</sup> <https://www.bigrentz.com/blog/construction-trends>

<sup>4</sup> <https://blog.rbauction.com/6-big-construction-industry-trends-for-2022/>

<sup>5</sup> <https://www.businesswire.com/news/home/20220131005440/en/Global-Forklift-Trucks-Market-2022-to-2027---Industry-Trends-Share-Size-Growth-Opportunity-and-Forecasts---ResearchAndMarkets.com>

<sup>6</sup> [https://www.theexpresswire.com/pressrelease/ForkLift-Trucks-Market-2022-Top-Manufacturers-Industry-Size-Share-and-COVID-19-Impact-on-Revenue-Growth\\_15546787](https://www.theexpresswire.com/pressrelease/ForkLift-Trucks-Market-2022-Top-Manufacturers-Industry-Size-Share-and-COVID-19-Impact-on-Revenue-Growth_15546787)

<sup>7</sup> <https://www.gminsights.com/industry-analysis/us-utility-terrain-vehicle-utv-market>

<sup>8</sup> <https://www.mordorintelligence.com/industry-reports/north-america-recreational-vehicle-market>

<sup>9</sup> <https://www.grandviewresearch.com/industry-analysis/all-terrain-vehicle-market>

<sup>10</sup> <https://linchpinseo.com/trends-shaping-the-all-terrain-vehicle-atv-industry/>

<sup>11</sup> <https://www.globenewswire.com/fr/news-release/2019/07/10/1880653/0/en/Forestry-Equipment-Market-to-Reach-US-13-109-9-Mn-by-2026-Caterpillar-s-Latest-Forest-Equipment-to-Boost-the-Market-says-Fortune-Business-Insights.html>

#### **WARRANTY/REMEDY**

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items that Honeywell, in its sole discretion, finds defective. The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages. While Honeywell may provide application assistance personally, through our literature and the Honeywell web site, it is buyer's sole responsibility to determine the suitability of the product in the application. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this writing. However, Honeywell assumes no responsibility for its use.

**For more information**  
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009634-1-EN | 1 | 06/22  
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