



# Universal Tilt Sensor (UTS) Technology

Stable Multi-Axis Control for Mobile Material Handling



ENGINEERING YOUR SUCCESS.

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## Stable Multi-Axis Control for Mobile Material Handling

The design and deployment of aerial lifts, truck-mounted cranes, telehandlers, scissor lifts, man lifts and other modes of vehicular material handling demands two requirements above all others:

- Safety for the operators
- Operational integrity for the vehicles

Achieving these dual goals requires constant monitoring of out-of-level conditions. For three quarters of a century following the Industrial Revolution, analog technologies addressed this challenge with visual indicators at each axis, which an operator then had to diligently monitor, making mechanical adjustments to ensure personal safety and the safety of the load—a task that required extreme vigilance and precise execution.

By the last decades of the 20th Century, electronic controllers powering audio signals and flashing lights had arrived on

the scene to help reduce a handling system's dependence on the operator's monitoring of individual gauges for each axis of control. Many of today's material handlers continue to rely on such electronically powered alert systems.

But with the advent of the Internet of Things (IoT) and the near-limitless interconnectivity possibilities it presents, a seismic shift has occurred in material handling control. Parker Universal Tilt Sensor (UTS) technology was specifically designed to optimize operator and load safety while facilitating interconnectivity.

### Open Protocol

Universal Tilt Sensors operate over a CAN bus using an industry-standard SAE J1939 communication protocol and an integral Deutsch DT four-pin connector. With UTS, OEM designers can deploy one product to achieve single,

dual or three-axis mobile control, while its plug-and-play connectivity with a full range of Parker hydraulics and electronic control components ensures system-compatible data collection, monitoring and alerts. The communication scheme also facilitates daisy-chain-style single-harness configurations that reduce exposure to accidental cutting and pinching and other operator- or environmentally induced damage.

### Compact and Versatile

UTS technology features a low-profile form and three slightly offset mounting holes around its diameter that make it easy to install and remove, even in challenging field conditions. This fool-proof mounting profile ensures the UTS is properly and consistently mounted across a vast array of machines, while enabling a full range of horizontal, vertical and angular mounting positions.



### Robust and Reliable

UTS technology features glass-filled hybrid-plastic construction with no moving components, and is designed to resist corrosion and vibration. Its robust sensor technology can withstand rugged material handling environments. With a spin weld design and a sealed

connector, environmental protection for outdoor as well as indoor applications is ensured. The UTS is rated IP68/IP69k in all orientations, and IP68 upside-down.

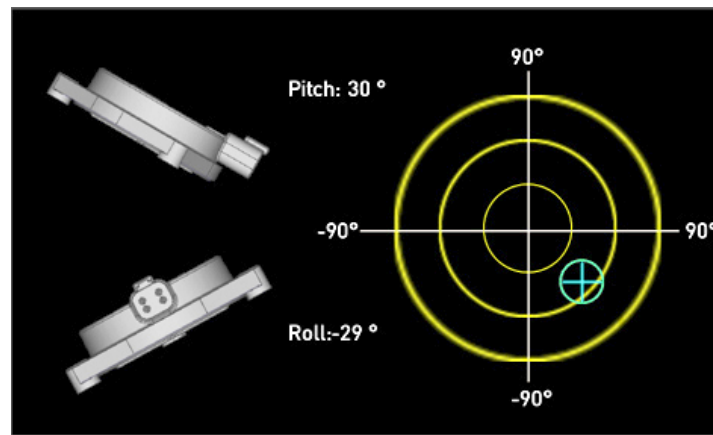
For lifts working around electric or magnetic fields, UTS provides effective insulation against electromagnetic and

electrostatic interference, meeting or exceeding EMI and ESD ISO environmental protection standards. In addition, customers who have field tested the UTS reported it providing predictable linearity over its specified operating temperature range (-40°C to 85°C) and without the deviations experienced with competitive products.

## UTS Technology in Action

As a multi-axis, MEMS (micro electro-mechanical system) technology, the UTS solution comes in three configurations to meet a variety of lift angles (from 10 to 90 degrees) and one, two or three axis operation. For OEMs and their customers, this means one single part can perform the many functions that formerly required a multitude of individual products, slashing inventory requirements, simplifying both installation and replacement, as well as reducing related labor.

Features	UTS	UTS	UTS
Mounting	Tripod	Tripod	Tripod
Angle range	±10°	±90°	±90°
Supply voltage	6.5-48V		
Number of Axes	2	2	3
Part number	162703ECD	160736ECD	159456ECD



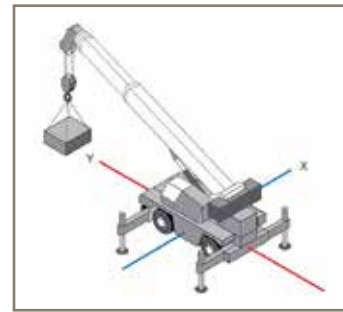
“ For OEMs and their customers, this means one single part can perform the many functions that formerly required a multitude of individual products, slashing inventory requirements, simplifying both installation and replacement, as well as reducing related labor. ”

## Auto Leveling

The stability of material handling and man-lift equipment depends first on the chassis platform being perfectly horizontal on both the x and the y axis prior to the commencement of lift or rotation. The UTS provides real-time feedback of out-of-level conditions while outriggers, jacks or other stabilizing actuators are being deployed. Whether used with Parker's IQAN or other Parker ECD electronics controllers, the UTS provides information regarding the platform's attitude to the control system, which then extends or retracts the equipment's stabilizing legs to ensure proper leveling throughout lift or rotation operations.



In applications where the chassis' wheel base front is over-extended, such as ladder engines or multi-axle crane trucks, two Universal Tilt Sensors may be deployed to monitor the roll and pitch conditions of the chassis in both the fore and aft zones, to limit platform frame twisting along its longitudinal axis.



## Boom Positioning

Once the base of the equipment is level and secure, lift and rotation operations can begin. Typically, the main boom arm assembly is located on the upper structure and a telescoping actuator is used to extend or retract the arm. In addition, a boom assembly can be raised or lowered from, or rotated around, the base axis. The work-performing implement (such as a fork, a winch or grapple), which is attached to the boom, then induces a load moment.

Every application will differ as to how far out, how high up or in what position an arm must be situated to prevent the load moment from falling outside safe operating parameters. Failure to observe the requisite safety limitations can result in tip-over and grave if not lethal consequences for the operator.

With a UTS positioned on the lifting arm, angular information on the lifting arm can be monitored in real time. The machine controller can then calculate the actual load moment being generated by the load at each point during the positioning process, compare it against the pre-set safe-handling parameter and then issue preemptive warnings and alarms to alert the operator to impending danger. Should an operator fail to heed the warnings, the control system can then prevent the arm from functioning in a direction that might critically compromise load and operator safety.

## Tilt Indication

With scissor lifts, the deployment of two Universal Tilt Sensors is required to maintain worker safety and the integrity of the equipment.

The first UTS is located at the base of the unit and is used to provide roll and pitch data in real time to the controller. The controller can initially generate warnings to the operator which, if unheeded, can be followed by operational disruptions such as limiting or blocking the steering, propulsion or elevation functions when the preset angle limit is dangerously close to being exceeded.

A second UTS is mounted on the lifting actuator. As the actuator extends or retracts, it will pivot at a point fixed to the base structure and will then be allowed to float with the first scissor stack at the opposite end. The angle information from the height UTS is continually monitored and communicated to the controller, which can then convert the data to determine and direct as necessary the safe operation of the interlocking functions it monitors and controls.



# IoT Connectivity

Perhaps most exciting of all are the infinite possibilities for connectivity possible using UTS technology. This closed-loop electro-hydraulic solution communicates over an open, industry-standard protocol, enabling plug-and-play IoT connectivity to controllers, hydraulic components, data collection and reporting software, as well as to the entire family of Parker hydraulic and electronic products and accessories.

## Imagine...

- Ladder engines using UTS for auto leveling and boom elevation transmitting operational behavior back to an OEM design team, which they can use to analyze safety-lapse trends and improve next-generation vehicles...
- Refuse trucks, dump trucks or forestry equipment operating on steep inclines transmitting individual route profiles back to the home office to identify problem areas and improve safety training...
- Material handlers transmitting information on operator behavior to spot and intervene when irresponsible handling repeatedly requires override intervention...
- Every mobile hydraulic vehicle's field performance being monitored by OEMs to facilitate warranty reviews and reduce liability...



**As more and more components and processes attempt to leverage the IoT, Parker UTS technology will become a drop-down configurable component within an increasingly complex, interconnected system that:**

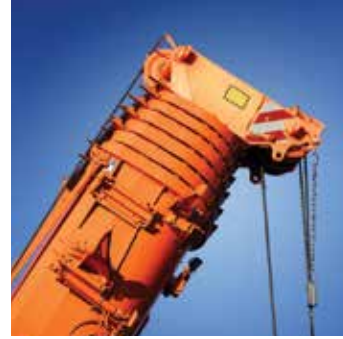
- **Promotes operator safety**
- **Optimizes equipment performance**
- **Provides comprehensive reporting for analysis and improvement**
- **Increases productivity through predictable maintenance and improved uptime**

- **Improves customer satisfaction and loyalty through proactive data-driven service engagement**

- **Selectively shares data across distribution and supply channels**

## Get Connected

UTS technology connects seamlessly with an extensive line of Parker electronic system products and solutions, including mobile master controllers, displays, mobile sensors, operator controls, IQAN master display modules, Vansco multiplexing module VMM and mobile software, accelerating the development and deployment cycles for industrial mobile vehicles.



## About Parker

As the leading global provider of fully integrated hydraulic systems and advanced hydromechanical and electromechanical subsystems and components, the Parker

Hydraulic Systems Division is ideally positioned to provide the engineering expertise, precision manufacturing and reliable

distribution network needed by material handling equipment OEMs and their customers to meet the challenges of the digital age.

## About the Authors

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