PIHER sensing systems
an Amphenol® company

Tilt Sensors Contribute to Safer Motorcycle Riding

Bank Angle Tilt sensors are integral to the functionality and safety of modern motorcycles and two-wheelers. Their ability to provide precise inclination measurements enhances driving dynamics and various systems, from ABS and TCS to navigation and crash detection. As technology advances, the role of tilt sensors will continue to expand, contributing to safer, more efficient, and more pleasurable riding experiences.

MEMS (Micro-Electro-Mechanical Systems) tilt sensors offer several advantages over other sensors types, such as, durability and reliability, simplicity of integration, lower power consumption:

Safety and Stability Control:

■ Anti-lock Braking System (ABS): Tilt sensors play a crucial role in the functioning of ABS by detecting the angle of the bike during braking. This information helps in modulating the brake force to prevent wheel lock-up and maintain stability. This is mandatory from 2022 on as per Regulation (EU) No 168/2013, motorcycles in the L3e-A1 subcategory

■ Traction Control System (TCS): By monitoring the bank angle, TCS can adjust the power delivery to the wheels, preventing slippage and ensuring better grip, especially on slippery surfaces.

Cornering and Lean Angle Measurement:

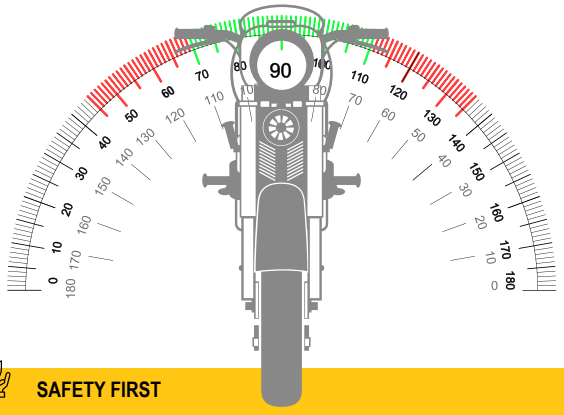
■ Enhanced Riding Experience: Tilt sensors provide real-time data on the lean angle of the bike during cornering. This information can be displayed to the rider, helping them understand their riding dynamics and improve their technique.

■ Electronic Stability Control (ESC): ESC systems use tilt sensor data to ensure the bike remains stable during sharp turns, reducing the risk of skidding or losing control. To prevent accidents, some motorcycles are equipped with safety features like bank angle sensors. If the bike tilts more than 60 degrees, the engine automatically shuts off to minimize the risk of falling over. Additionally, the fuel supply is cut off to avoid fuel leaks in case of a crash.

Navigation and Telemetry

■ Advanced Navigation Systems: Modern motorbikes equipped with navigation systems utilize tilt sensors to provide more accurate and context-aware directions. This includes adjusting the map orientation based on the bike's tilt. Tilt transducers equiped with gyros and odometry can be used to augment GPS when GPS reception is un-available thanks to Heuristic drift elimination (HDE) algorithms.

■ Data Logging and Analysis: For professional riders and enthusiasts, tilt sensors offer valuable data for performance analysis. The tilt angle, combined with other telemetry data, helps in assessing and improving riding performance.



SAFETY FIRST

For everyday riding on regular roads, a lean angle of about 10-20 degrees is typically comfortable and sufficient for most turns. This angle provides a balance between maintaining control and comfort. More experienced riders can comfortably handle lean angles of up to 30 degrees or more, especially on sport bikes designed for aggressive cornering.

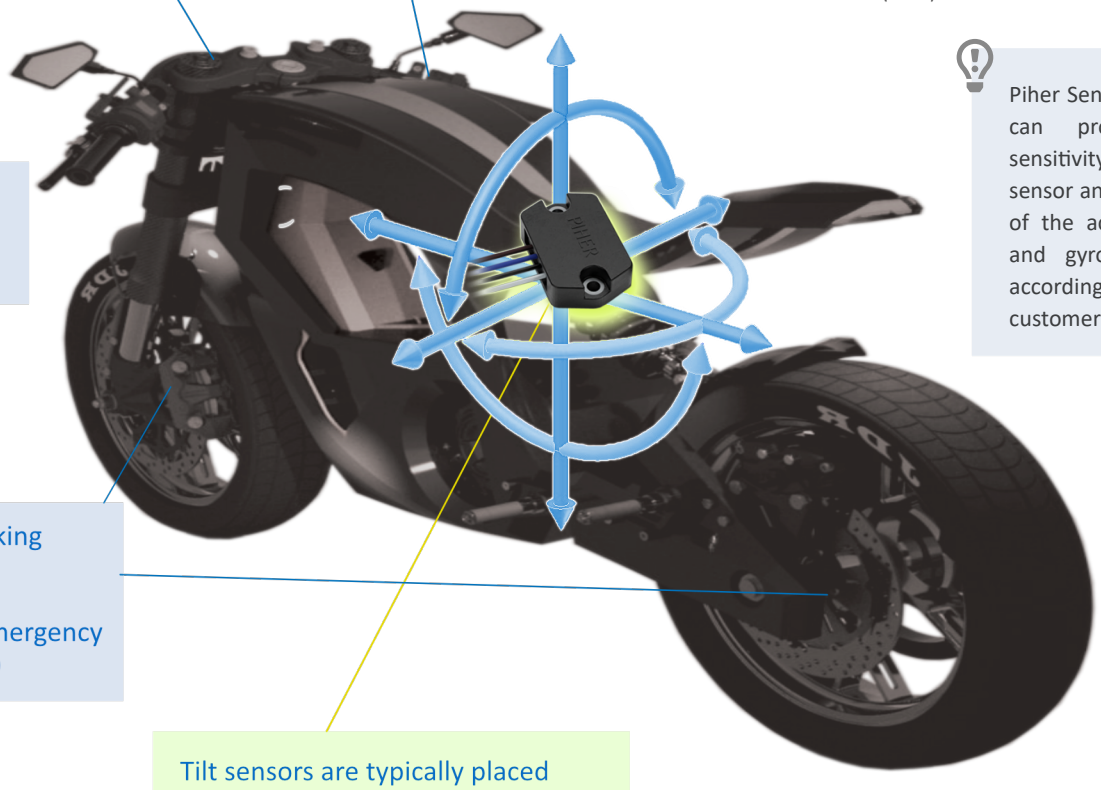
Safety Features

■ Automatic Turn Signal Cancellation: Tilt sensors can detect when the bike returns to an upright position after a turn, automatically cancelling the turn signals.

■ Automatic Emergency Braking (AEB): By detecting an abrupt tilt or lean, tilt sensors can trigger AEB systems, significantly reducing the severity of accidents.

■ Crash Detection: In the event of an accident, tilt sensors can detect abnormal tilt angles, triggering emergency alerts or safety protocols.

An Enhanced Riding Experience



Tilt sensors are typically placed near the center of the bike to provide accurate reading of the bike's overall tilt angle.

Inclinometer based on MEMS Technology

The tilt sensors of the TS family are reliable and precise sensors and ideal for applications where fast response and high accuracy is needed. Based on mechanics-free MEMS technology these inclinometers accurately measure inclination, tilt and angle in harsh environmental conditions. With its ability to measure angles up to 360° with an accuracy of <0.5° over the full temperature range, it is perfect for use in heavy-duty applications such as load monitoring, leveling and boom angle monitoring.

TSDA
Dual Axis Inclinometer
based on MEMS Technology

Different outputs options and measurement ranges are configurable. Custom packaging is available on request.

The tilt sensor features reliable and wear-free MEMS technology, providing a range of inclination options from ±25° to ±180°. It utilizes digital signal processing with advanced filter algorithms and offers analog, CAN J1939 and CAN Open outputs. Additionally, it combines a gyroscope and accelerometer to enhance its functionality.

With an accuracy of less than 0.5° across the full operating temperature range, this sensor is fully sealed to IP69K standards, making it suitable for use in harsh environments. These features can be extended to 3-axis feedback and 4-pin integrated connector and ISO 26262 (ASIL).

Piher Sensing Systems can program the sensitivity of the sensor and the weight of the accelerometer and gyroscope data according to customer's needs.

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