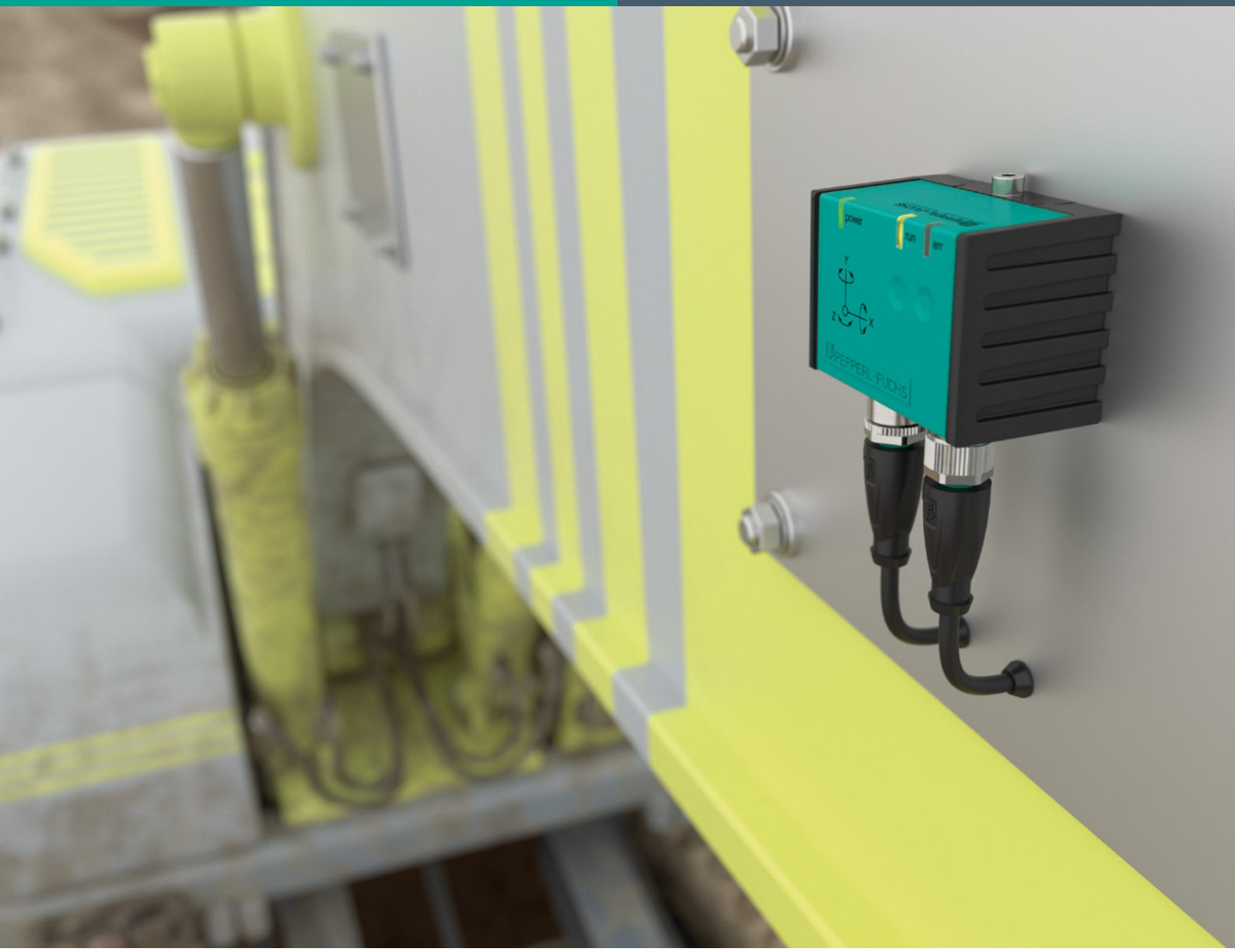
Precision through Fusion.

Error-free inclination detection for dynamic applications—in 360° and individually adaptable.

Inertial Measurement Unit F99



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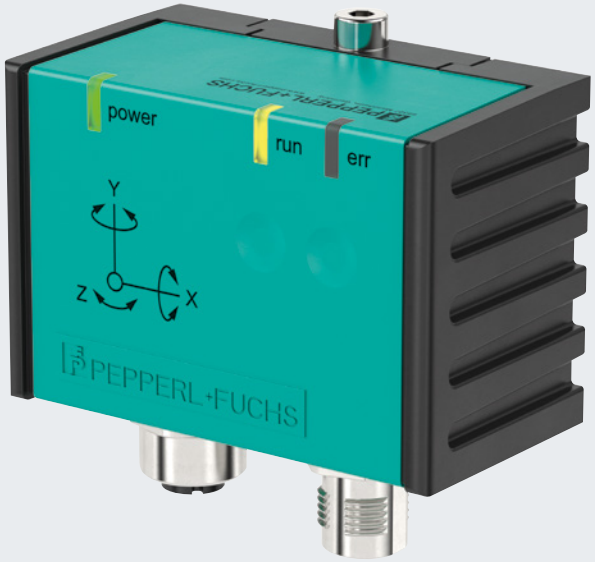
Inertial Measurement Unit F99

Maximum Precision for Dynamic Applications

The inertial measurement unit (IMU) F99 guarantees error-free inclination detection in dynamic applications. An intelligent combination of an acceleration sensor and a gyroscope compensates for external acceleration, increasing efficiency and opening up a range of new possibilities.



IP68 IP69K
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EMC
Increased EMC interference immunity: ISO 7637 and ISO 11452

+85 °C
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Extended temperature range

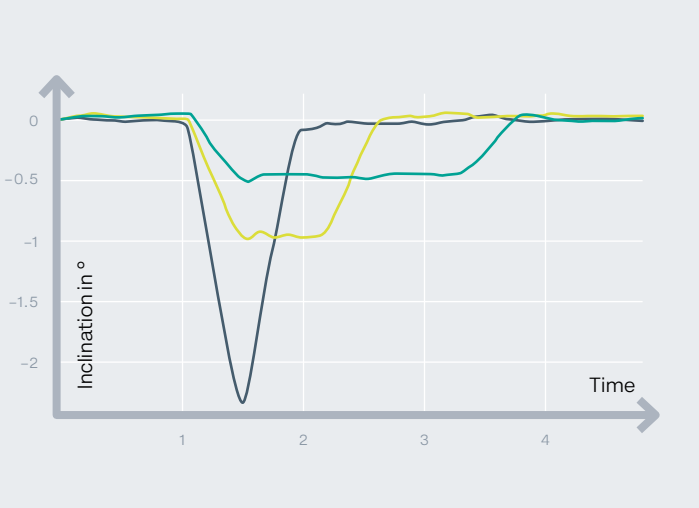
Increased resistance to mechanical shock and vibration up to 100 g

E1
E1 approval

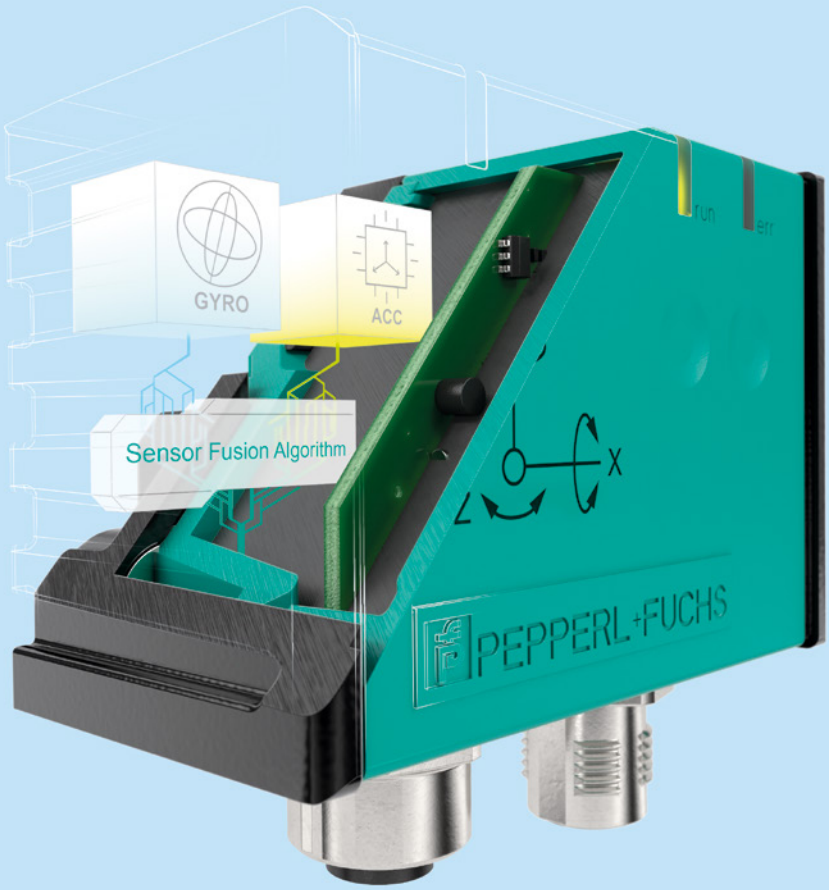
Compensation for External Acceleration

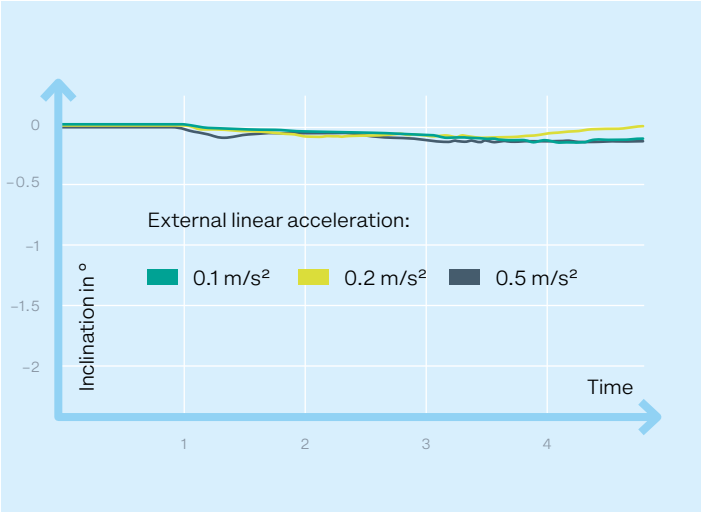
Static inclination sensors are based on the principle of gravitational acceleration measurement and provide information about the angular alignment of the sensor. This measuring principle is stretched beyond its limit as soon as forces other than gravity act on the sensor, such as acceleration, braking, or turns. This results in measurement errors, which can reduce accuracy and application performance.

The inertial measurement unit F99 has been specially engineered to compensate for external acceleration and to provide precise inclination measurement, even when there is multidirectional motion.



Static inclination sensor: measuring error caused by linear acceleration





Compensation for external acceleration by IMU F99

Acceleration Sensor and Gyroscope in One Device

The IMU F99 combines an acceleration sensor and a gyroscope into a single device. An intelligent Sensor Fusion Algorithm links the two sensor elements to optimize overall performance of the system. External acceleration is compensated for, and the user receives precise inclination data, even when the system moves, accelerates, or brakes.

Streamlined Information Flow

360° Measurement on Three Axes

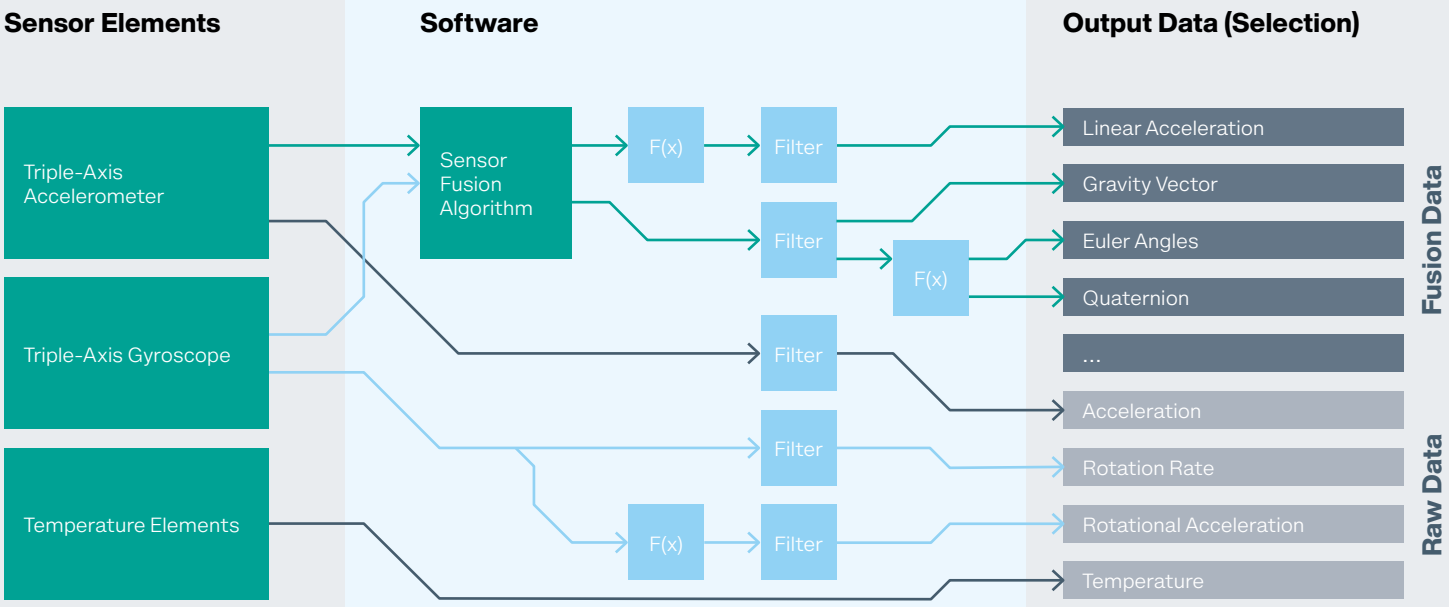
With two integrated three-axis sensor elements, all data can always be measured in the X, Y, and Z directions, and a 360° angular value can be calculated. As a result, applications that previously required multiple devices can now be solved with only one IMU F99 sensor. This saves time and money, both in selecting and in integrating the sensor.

Installation is also much easier than before: regardless of position and alignment, the sensor always delivers precise data under any mounting orientation.

Variety of Measurement Outputs

In addition to customer-configurable filters, the inertial measurement unit F99 also allows you to select the appropriate output to fit the requirements of your application.

Both the raw data from the individual sensor elements, as well as preconfigured output data are available to the user. Thanks to the intelligent Sensor Fusion Algorithm, data is calculated in real time and can be output immediately.



Inertial Measurement Unit F99

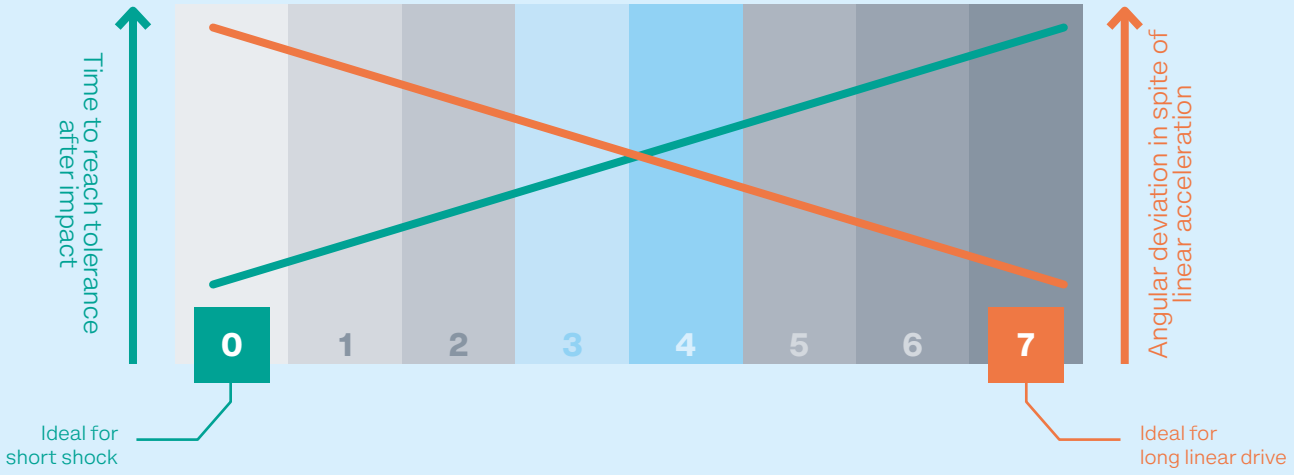
Freely Selectable Compensation Range

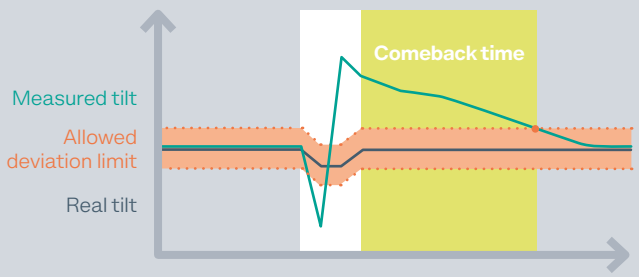
Suppress Interference

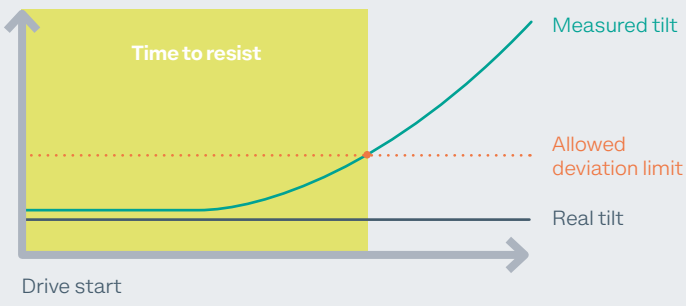
To ensure precise angle measurement, it is necessary to suppress the distorting effect of external acceleration. The sensor is equipped with eight compensation ranges for this purpose. Users can select the type of acceleration compensation best suited for their particular application.

For one-off events, such as hitting a pothole, the setting “0” should be selected. This minimizes the recurrence interval of the measured value within the permitted range.

For long-lasting acceleration on a level surface, the setting “7” is the most suitable. This setting maximizes the time until the measured value exceeds the tolerated level of deviation.

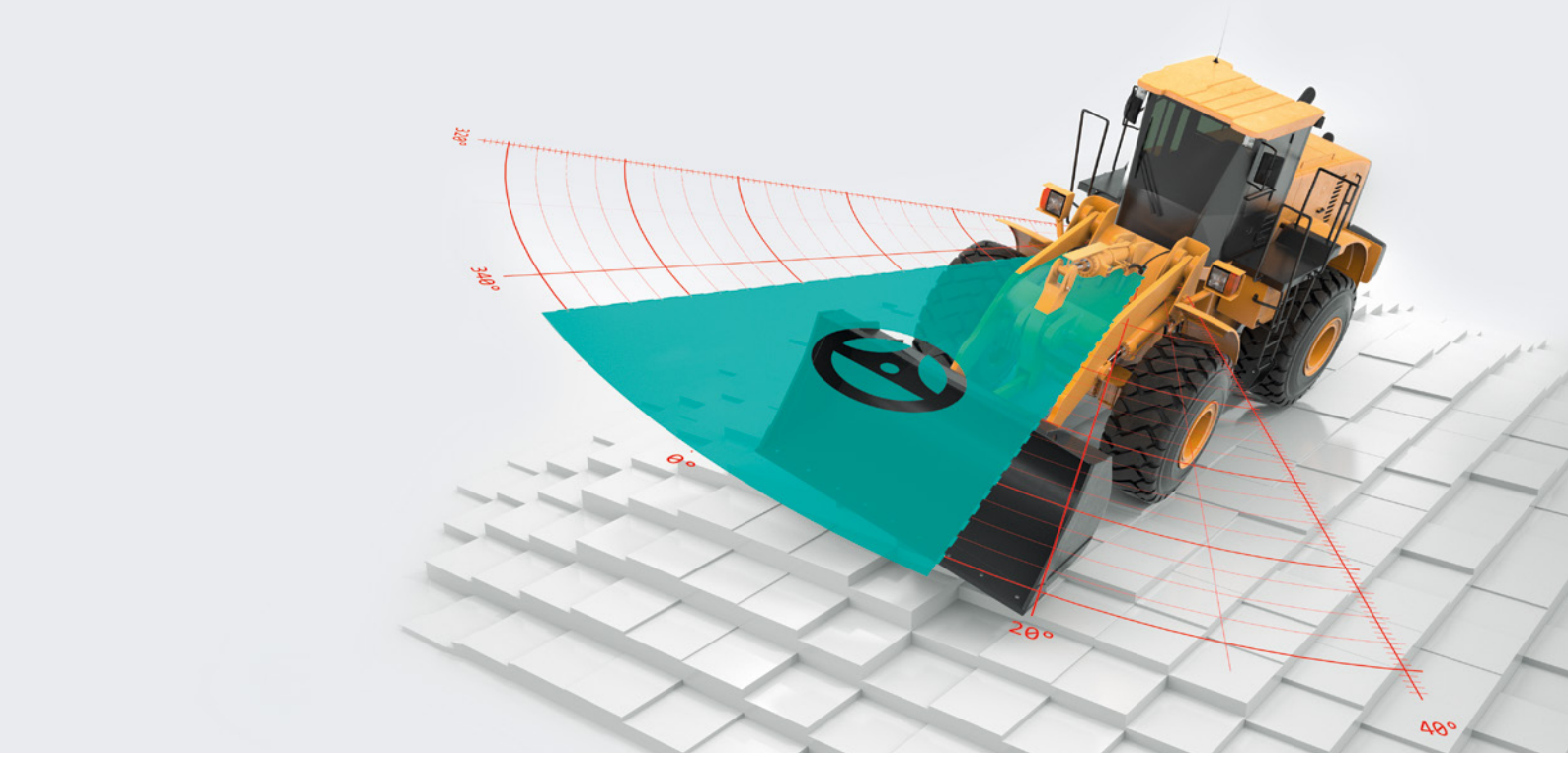






Improving Existing Applications and Creating New Ones

Inclination sensors are used in a range of industries. With IMU F99 technology, existing applications can be handled more efficiently, and completely new applications can become a reality.



Monitoring Steering-Angle Limit on Inclines

The ability to compensate for external acceleration opens up a host of new applications. One example is monitoring steering-angle limits on inclines. When heavy vehicles like wheel loaders or dump trucks take a turn too sharply on an incline, they can easily tip over. Forklifts have the same problem, especially when the forks are extended.

The IMU F99 provides 360° monitoring of the vehicle's inclination. Using the data provided by the sensor, the steering angle can be limited to prevent tilting. With this unique technology, the measurement is not affected by changes in speed or direction—making it applicable to a wider range of mobile equipment applications.

Making Onboard Scales More Efficient

In onboard scales on heavy equipment such as trucks, trailers, and forklifts, weight is often calculated directly on the vehicle. In these systems, external acceleration can cause measurement errors, which can only be corrected after the fact—if at all—with complex calculations.

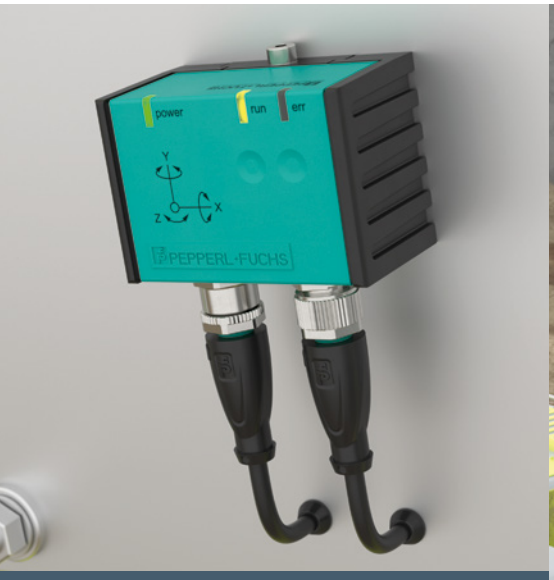
In modern wheel loaders, for example, the weight of the material being loaded is detected directly in the bucket. Existing solutions would require a delay in order to take exact measurements, and because any lost time is costly, measurement errors are often accepted.

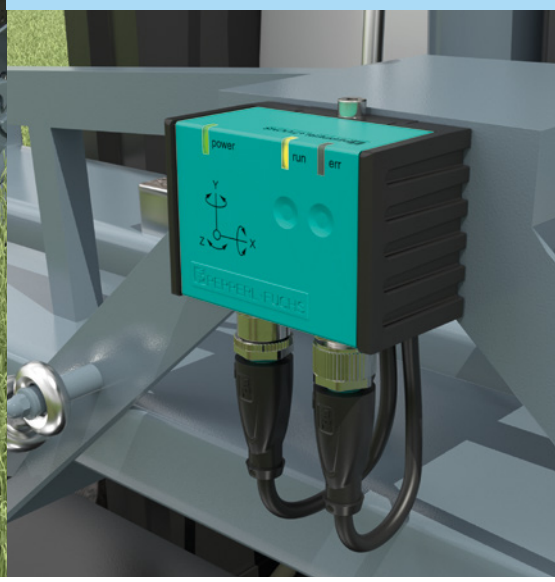
Weight calculation in port cranes is similar. In order to ensure an even weight distribution while large freighters are being loaded, the weight of each container is measured as it is being lifted. Delays are not an option in this environment, so conventional cranes often do not provide onboard weighing.

Because the inertial measurement unit F99 compensates for external acceleration, weight calculations can be made immediately during the loading or unloading process. With this feature, weight can also be calculated while a freighter is underway, dramatically increasing the efficiency of the overall process.

Shovel Positioning along Three Axes

The excavator's GPS-enabled software controller knows the location and dimensions of the hole that needs to be excavated. The display shows the relevant landscape points and the position of the shovel, which the operator can use to move the shovel as required. Sensor data from several IMUs F99 allows the operator to position the shovel along three axes with an accuracy of ±2 cm. The units are mounted on the moving parts of the articulated arm, the shovel, and the chassis. They continuously detect the angle of the moving components and the position of the shovel tip, even when it is moving. This means that a separate measuring device outside the excavator is no longer required.



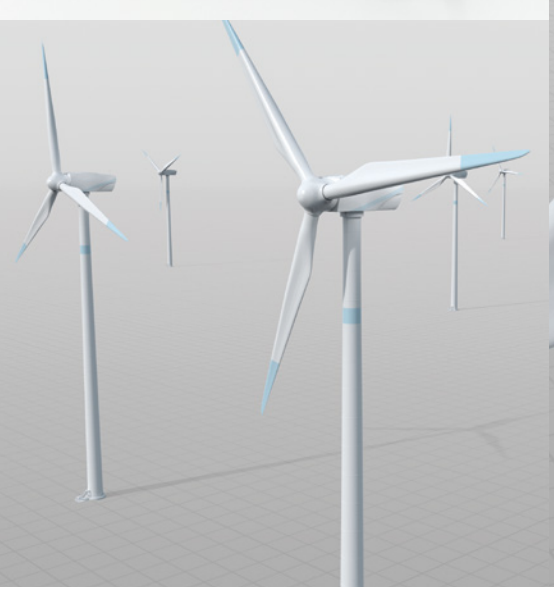


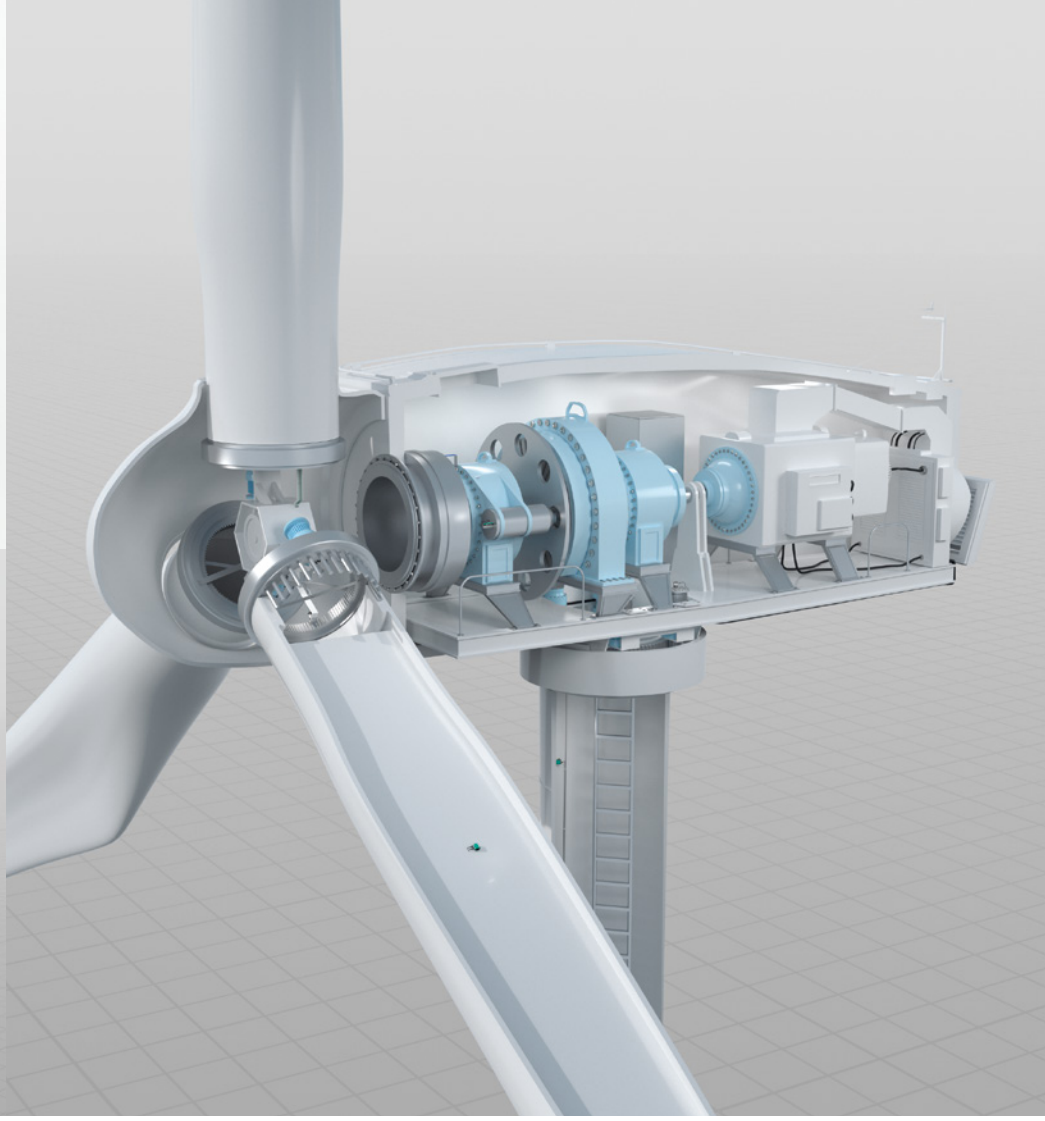
Ideal Height for Spray Nozzles

Liquid fertilizers and sprays are applied using agricultural machines with long booms. One of the aspects that affects the optimal distribution of these substances is the distance between the boom and the ground, which is measured using ultrasonic sensors. An IMU F99 continuously measures the inclination of the boom, while at the same time reading out the angle of the boom during travel. The inclination of the boom can be determined regardless of the position of the chassis. The controller uses the accumulated sensor data to calculate the ideal orientation for the boom.

Highlights

- Optimal measurement results: individual adaptation to ambient conditions by selecting the appropriate compensation range
- Reduced installation effort: measurement data in three axes for mounting in any orientation
- Certifications for mobile equipment allow a wide range of applications, including off-road





Protecting Wind Turbines and Maximizing Yields

To ensure that wind turbines can be operated safely and efficiently, it is vital to constantly monitor parameters such as tower vibration, the position and rotational speed of the hub, and blade torsion. When mounted on the various components, several inertial measurement units F99 can be used to monitor all of these different aspects. Tower vibration and blade vibration behavior are measured using acceleration values, while the hub rotation rate and angle indicate its speed and orientation. The hub and rotor blades can be optimally positioned to catch the perfect amount of wind or, if necessary, to protect the turbines from becoming overloaded.

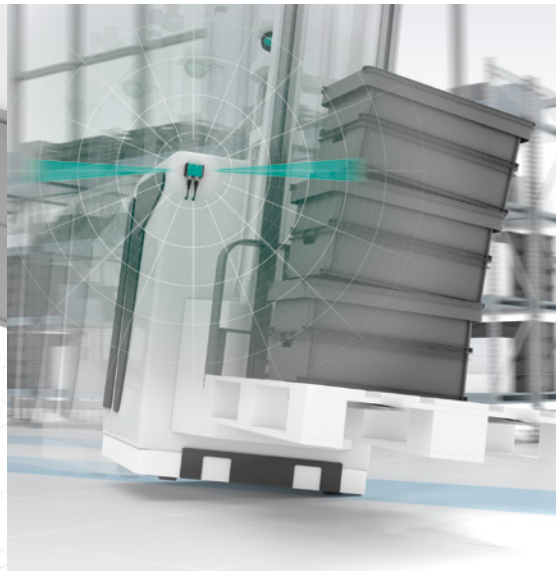
Movement Data for AGV Controllers

Automated guided vehicles (AGVs) typically use optical sensors to orient themselves within a space. Navigation also requires the vehicles to be able to precisely determine their own location using movement data. An IMU F99 detects any deviation from a straight-line movement by measuring the Coriolis force. The rotation rate values map the corners driven by the vehicle. The movement data allows exact and continuous position detection, which provides the basis for precise navigation when compared with the orientation information provided by the photoelectric sensors.

Highlights

- Compensation of multidirectional acceleration enables fast, precise, and dynamic inclination measurement
- Variety of outputs for complete application flexibility
- Versatile in use: detection of inclination, acceleration, and rotation rate in a single device

For more information, visit:
pepperl-fuchs.com/pf-IMU-F99



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