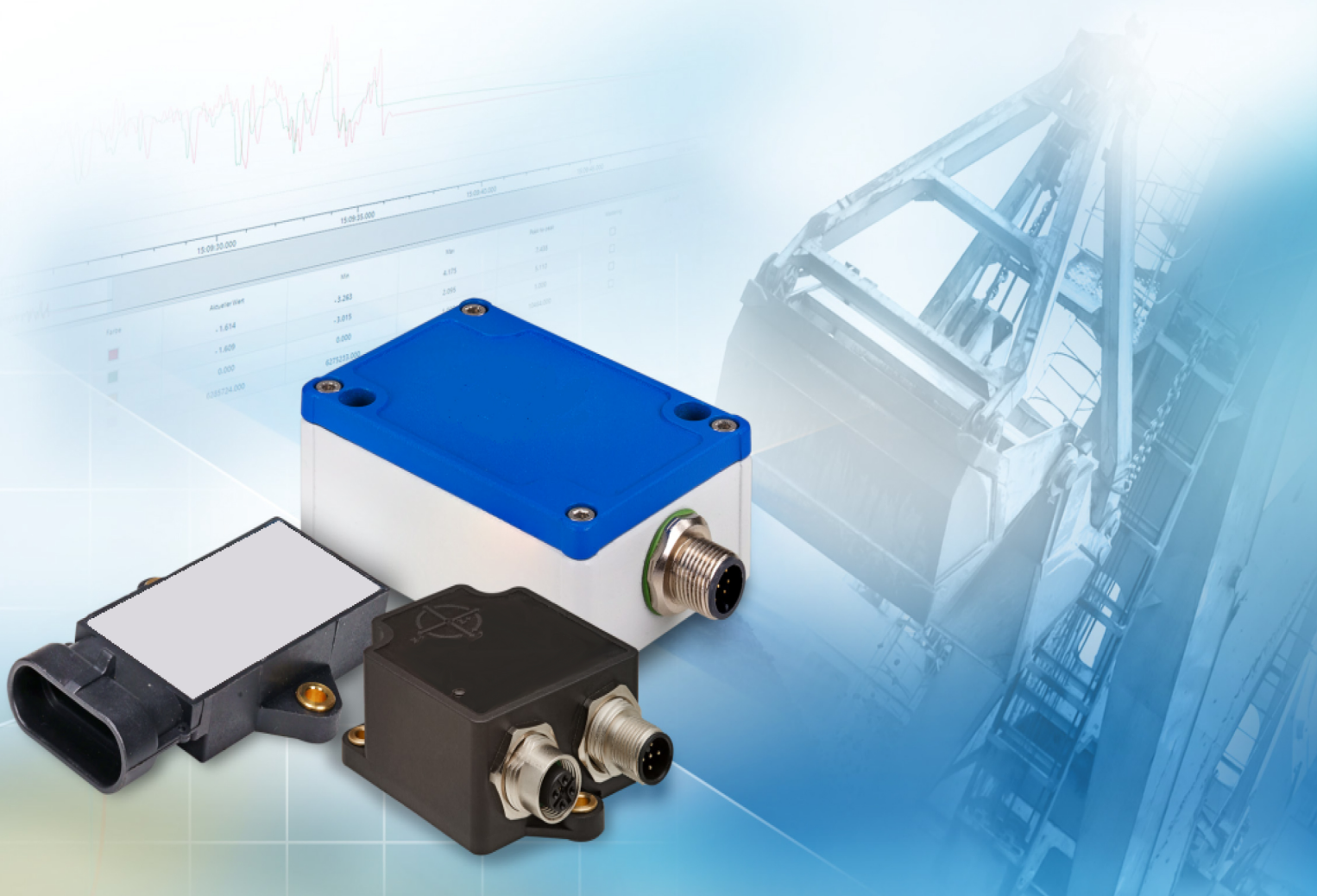




# More Precision

**inertialSENSOR** // Inclination and acceleration sensors



# Inclination and acceleration sensors

## inertial**SENSOR**

Multi-axis inclination and acceleration measurements

High static and dynamic accuracies

Precise measurements even with sudden movements, shocks and vibrations

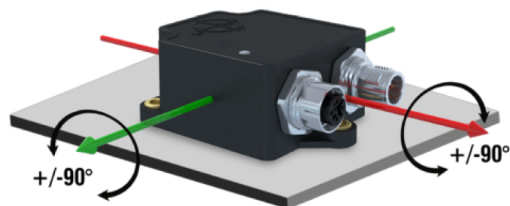
Stable measurement signal even with temperature fluctuations

Various analog and digital interfaces



### Precise inclination measurement

Industrial inclination measurement is a demanding measurement task in which the angle of inclination of an object relative to the earth's gravity is measured in one or two axes. Sensors from Micro-Hybrid are extremely precise and at the same time extremely robust against interference and fluctuating temperatures. Due to their outstanding angular accuracy and resolution, the inclination sensors can be used in a wide range of measurement tasks in both industry and the laboratory.



### Precise acceleration and oscillation measurements

Acceleration measurements are required where technical systems are exposed to stresses either caused by their own movement or by external impacts. Ideally suited to monitoring tasks or predictive system maintenance, the sensor reliably and precisely monitors the acceleration values of sensitive plant components. Standard models are available for all industrial and laboratory applications (ACC570x) and OEM systems for serial integration (ACC530x).



# Typical applications and measured values

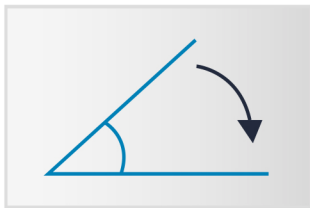
## inertial**SENSOR**

Micro-Hybrid offers an extensive portfolio of inclination and acceleration sensors. These compact sensors are often used in challenging environments (outdoor areas or integrated in a machine) and are therefore highly resistant to external influences of any kind. They measure angles and acceleration values reliably and precisely, e.g. of entire (mobile) machines or sensitive plant components.

Inertial sensors are particularly suitable for monitoring tasks or for predictive system maintenance.

Depending on the respective measurement task, inclination and acceleration measurements have different requirements. To give you a rough overview and enable you to preselect the right sensor, the most common types of application and measured variables are listed below, along with the appropriate sensor series:

### For inclination measurements



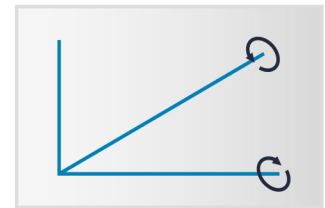
#### 1) High precision inclination measurement (1 axis)

For inclination measurements in only one axis, the focus is usually on very high resolution and accuracy. Changes in the angle or position of the object generally occur with little dynamism. INC5701D sensors are ideal for such applications.



#### 2) Dynamically compensated inclination measurement (1/2 axes)

The measurement of dynamic movements focuses on fast angular output. Typical disturbing influences such as centrifugal forces, vibrations or impacts on the sensor must often be optimally compensated for or reduced. The INC5502D has been developed for exactly this purpose.



#### 3) 1-axis or 2-axis static inclination measurement

If the position of a quasi-static object is to be monitored in one or two axes (also in parallel), the INC5502D is used. In this case, the dynamic compensation moves into the background and the signal is filtered using a low-pass filter.

### For acceleration measurements



#### 1) Acceleration

Acceleration values are usually measured in one axis and are used to monitor machines or machine parts, e.g. the approach speed of a press ram. An ACC5701 with analog output, for example, is suitable for this purpose.



#### 2) Oscillation

For example, the amplitude and frequency of the lateral vibrations caused by the lateral movements of a wind turbine are detected.

A 2-axis acceleration sensor such as the ACC5702 is often used.



#### 3) Vibration

Measurements of vibrations or oscillations are performed in different axes, intended to detect imbalances, bearing damage or other mechanical issues. The ACC5703 model with digital output is ideally suited for these measurement tasks.

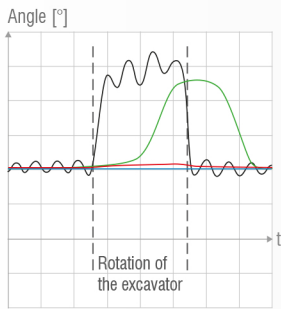
# Features

## inertial**SENSOR**

### Interference compensation

Selection of various types of filters and compensation

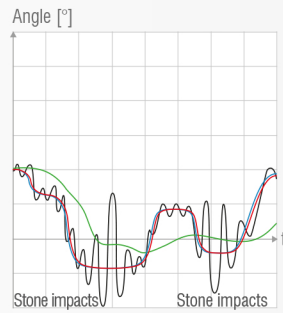
#### Centrifugal force compensation



#### Examples

Swinging an excavator arm  
Heavy braking on vehicles

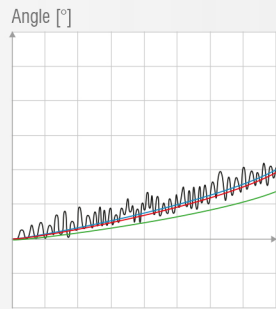
#### Shock compensation



#### Examples

Stone impacts on excavators,  
setbacks on milling machines

#### Vibration suppression



#### Examples

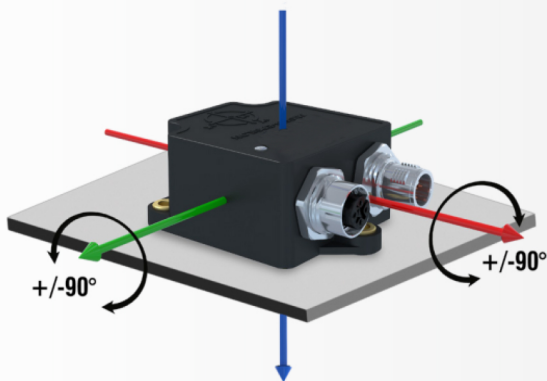
Compactors on inclines,  
engine vibration in mobile machinery

Reference curve  
Uncompensated  
Low-pass filter  
sensorFUSION technology

### Maximum integration flexibility

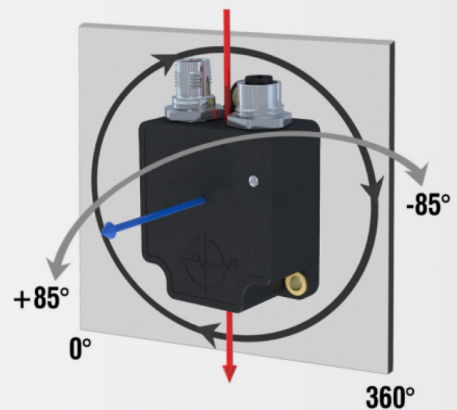
Various installation positions with regard to measuring axis, measuring range and mounting direction

#### Position angle



1 or 2 axes

#### Euler angle

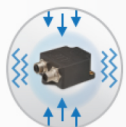


### Extremely wide field of use due to extraordinary robustness

#### Excellent signal stability:



Extremely robust against fluctuating temperatures ...



... and external interferences

#### Robust and long-life design:



High resistance to external magnetic fields(EMC) ...



... maximum protection against weather conditions & mechanical stress



### Inclination measurement on the boom

The INC5502D monitors the inclination of the boom and compensates for centrifugal forces caused by the movements.



### Position measurement of excavator bucket

The INC5502D precisely measures the inclination position of the bucket and compensates for impact and centrifugal forces that occur during excavation. In addition, a large measuring range of  $\pm 180^\circ / 360^\circ$  is required, as the bucket can be opened and closed completely.

### Leveling the driver's cab

The INC5502D is used to level the driver's cab in order to detect uneven surfaces during the drive, standstill and operation. The sensor is insensitive to disturbing accelerations such as vibrations, shocks or movements during braking and cornering, i.e. the output signal is not distorted.



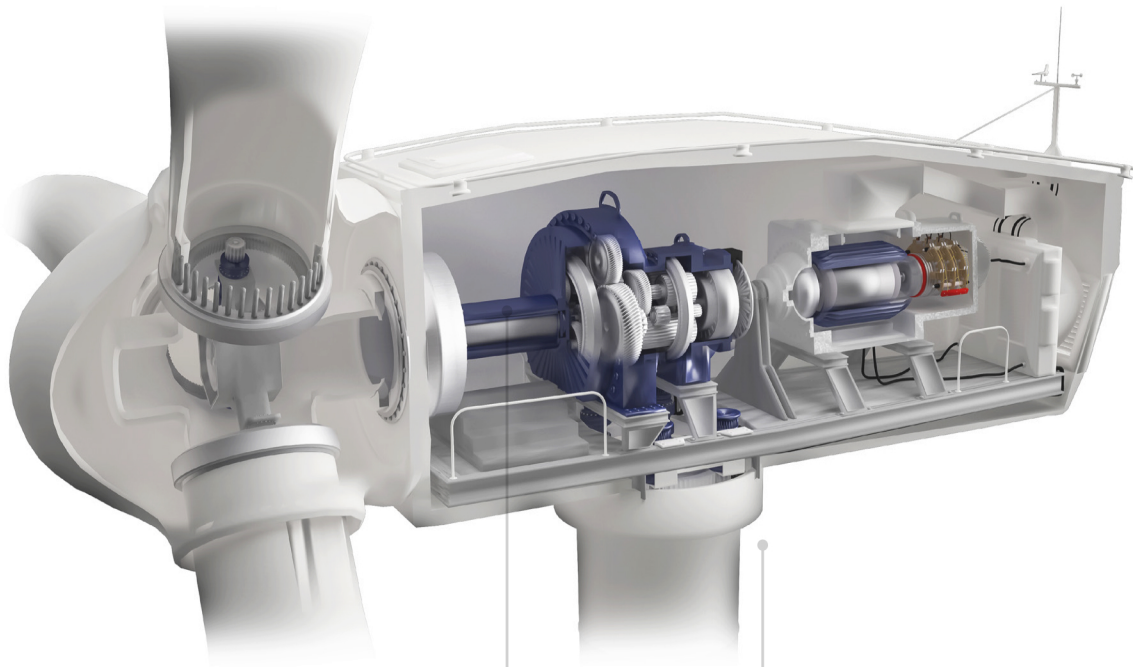
Reduced risk of tipping with loading wagons



Alignment of solar and photovoltaic panels

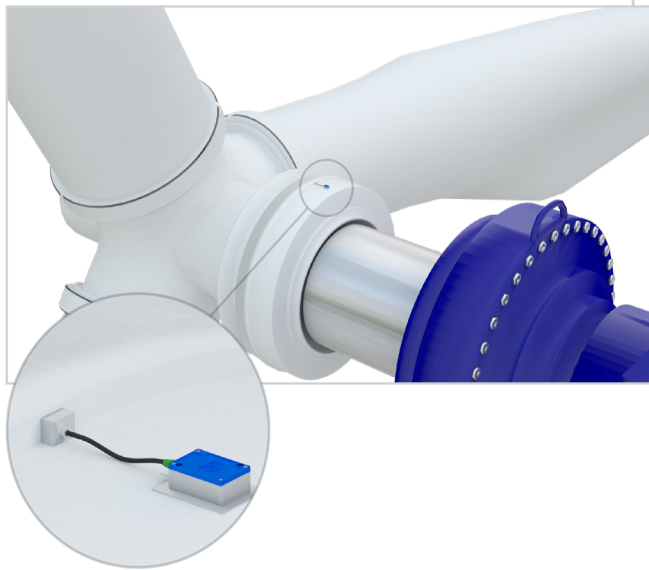
# Acceleration measurement in wind turbines

## inertial**SENSOR**



### Oscillation measurement of the drive train

Wind turbulence causes dynamic loads on the structure and the drive train. To measure these oscillations, high-precision and temperature-stable acceleration sensors from Micro-Hybrid are used.



### Monitoring the tower oscillation

Wind turbines are exposed to high stress caused by swaying. In order to avoid damage and downtimes, these tower oscillations are monitored. Inclination and acceleration sensors from Micro-Hybrid detect the tower oscillation with highest precision even with strongly fluctuating temperatures.



ACC5701-2

Stone chipping with harvesters



ACC5703

Monitoring of floor vibrations

# Dynamic and precise inclination sensor inertial**SENSOR** INC5502D

1-axis or 2-axis inclination measurement

High precision for dynamic measurement tasks up to  $\pm 0.3^\circ$

Angle measurement with disturbance compensation

Compact and robust plastic housing (IP67/IP69K)

Maximum signal stability thanks to application-specific parameter sets

Compact & robust - ideal for machine integration

Industrial-grade interfaces for mobile machines



**SAE J1939**  
**CANopen**<sup>®</sup>

## Precise inclination measurement in highly dynamic applications

The robust INC5502D inclination sensors are used for precise measurement of angles, alignment of machine parts and position detection of moving components. Thanks to the intelligent sensorFUSION algorithm, the measurement signal remains stable and free of overshoots even during sudden movements, e.g. due to shocks or start-up and braking processes. The high signal quality and a very short response time enable extremely accurate measurements during motion.

Depending on the measurement task, different types of angles (Euler or position angle) can be detected and output simultaneously in one or two axes. Other parameters such as accelerations or rotational speeds can also be displayed and output.

## Combination with sensorTOOL software

For a quick functional test and to check the measured values, the INC5502D can also be connected to the sensorTOOL software. The sensorTOOL enables you to adjust parameters and to display the measured values immediately.

## Compact design, great performance

A slim design and individual alignment options reduce installation effort and facilitate mounting on moving machinery and vehicles (construction machinery, agricultural machinery, forestry machinery), cranes and lifting platforms or ships. Integrated analog and digital interfaces allow direct output of measured values as well as easy setting of sensor parameters.

## Solution of special measurement tasks using customized parameter sets

Suitable, application-specific parameter sets for standard applications can be provided on request. These can be easily transferred to the sensor via the sensorTOOL software and optimize the sensor's measurement settings. As a result, the sensor immediately provides very accurate measurement values.

The presets are based on typical parameter combinations that have proven themselves in the specific application.

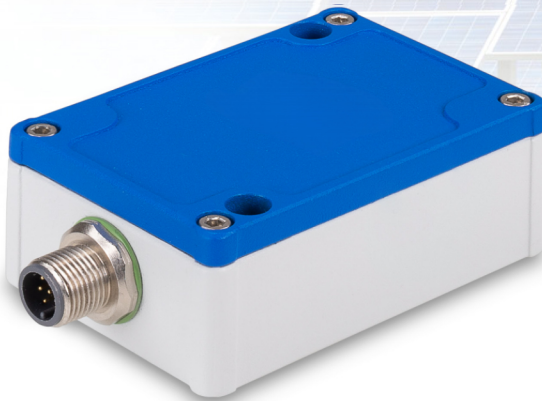
# High-precision inclination sensor inertial**SENSOR** INC5701D

Highest accuracy and resolution for precise measurements

Extremely stable measurement signal even with strongly fluctuating temperatures

High EMC resistance due to robust, die-cast aluminum housing

Digital RS485 interface and freely scalable analog outputs



## Ideal for high-precision inclination measurement

The INC5701D is a 1-axis inclination sensor that offers a measuring range up to 360°. The sensor stands out due to its excellent angular accuracy and resolution intended for very accurate and precise measurements. The industrial-grade aluminum die-cast housing enables applications in extremely harsh ambient conditions such as, e.g., in close proximity to electromagnetic fields. In addition, high temperature stability ensures reliable measurements in environments with strongly fluctuating temperatures which makes the sensor ideally suited to outdoor applications.

## Fields of application

Excellent angular accuracy and resolution make the inclination sensors ideal for precise measurements in laboratory and industry. In production monitoring, for example, machine components are precisely aligned using the INC5701.

## Easy commissioning and configuration

The free sensorTOOL configuration software supports quick and easy commissioning of the inclination sensor. The sensorTOOL enables you to adjust parameters and to display the measured values. In addition to outputs and filtering, the measuring range can also be infinitely adjusted between 0 and 360°, for example, so that the system sensitivity can be optimally adapted to the respective measurement task.

# High-precision acceleration sensor inertial**SENSOR** ACC570x

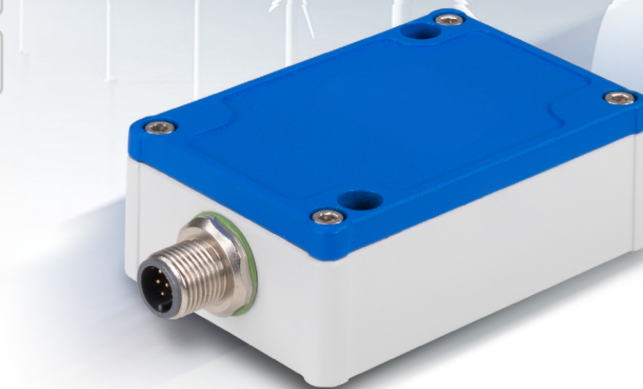
High accuracy and resolution for precise measurements

Extremely stable measurement signal even with strongly fluctuating temperatures

High interference immunity with increased EMC requirements

Ideal for integration into plant and machinery

Digital RS485 interface and freely scalable analog outputs



## Ideal for integration into plant and machinery

The analog ACC570x acceleration sensors are therefore ideal for static and dynamic acceleration measurements. They detect accelerations in one, two or three axes. These sensors are often used in applications requiring maximum precision in harsh ambient conditions.

The entire electronics is in a sealed aluminum die-cast housing and designed for ambient temperatures up to 125 °C. The high temperature stability enables the sensor to achieve high measurement accuracy even when surrounded by strongly fluctuating ambient temperatures. The housing offers excellent interference immunity for increased EMC requirements in close proximity to electromagnetic fields.

## Fields of application

The high signal-to-noise ratio enables the analog ACC570x sensors to measure even minor accelerations which occur, e.g., with tower oscillations of wind turbines, bearings and also measuring/calibration systems.

Its high EMC resistance makes the sensor ideally suitable for precise condition monitoring of electrical machines such as, e.g., generators. Combined with high temperature stability, the sensor is used in wind turbines to monitor the oscillations and vibrations of drive trains, rotor blades (ice detection) and generators (noise reduction).

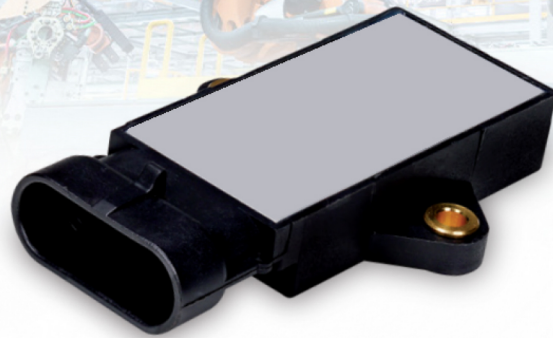
# Acceleration sensor for serial integration & OEM inertial**SENSOR** ACC530x

Customer-specific designs

Space-saving and robust plastic housing

Easy connection with AMP plug

High shock resistance



## **Ideal for serial integration**

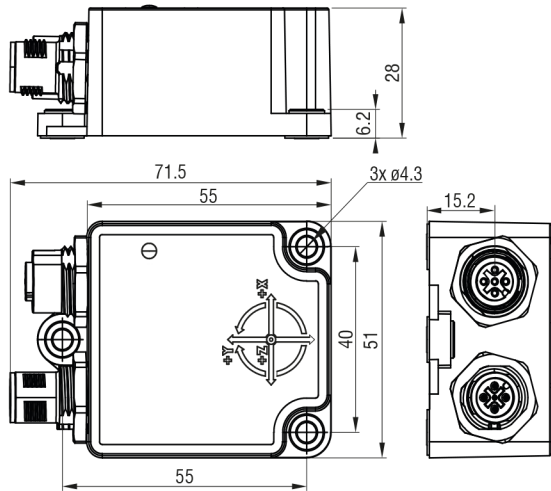
The ACC530x acceleration sensor is suitable for both static and dynamic acceleration measurements. The sensor detects accelerations in either one or two axes.

Combined with a compact design, its excellent price/performance ratio enables versatile fields of application in particular with serial applications involving large quantities.

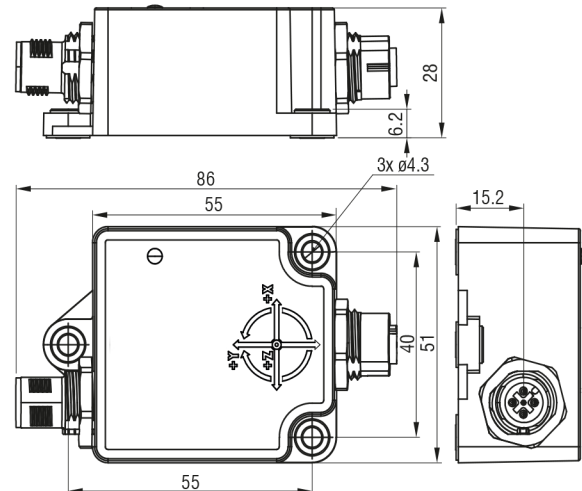
## **Fields of application**

The sensor is used to reliably detect accelerations and vibrations. High shock resistance and high protection class as well as simple and easy installation with an AMP plug make the ACC530x ideally suitable for serial applications, e.g., in mobile machines.

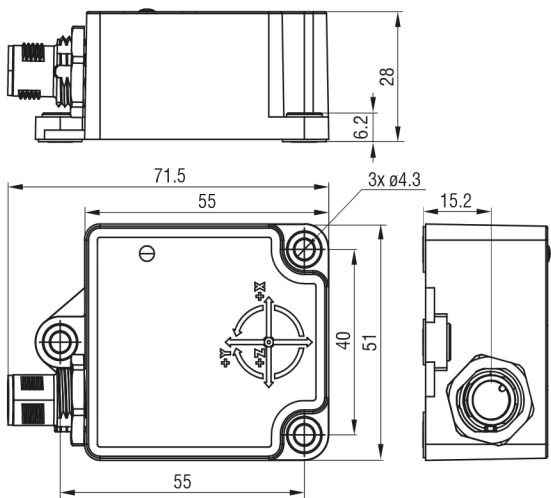
INC5502D-360/90-P-OS



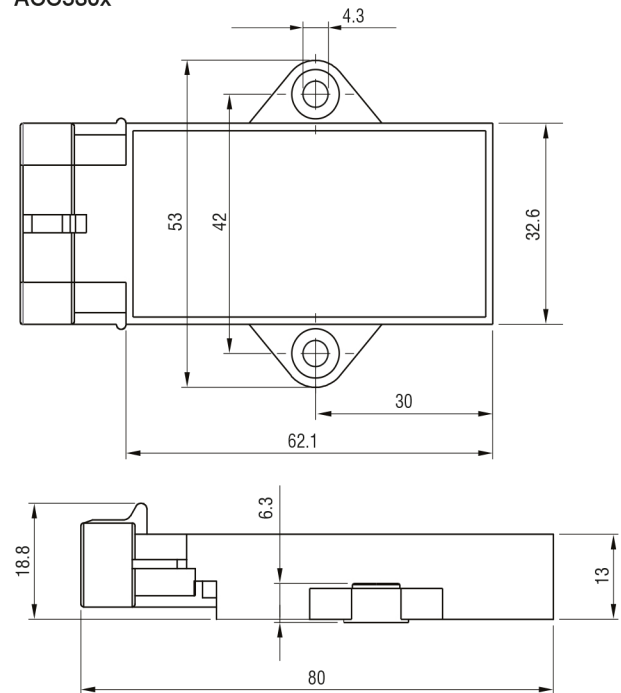
INC5502D-360/90-P-DS



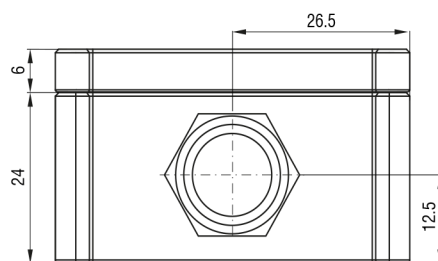
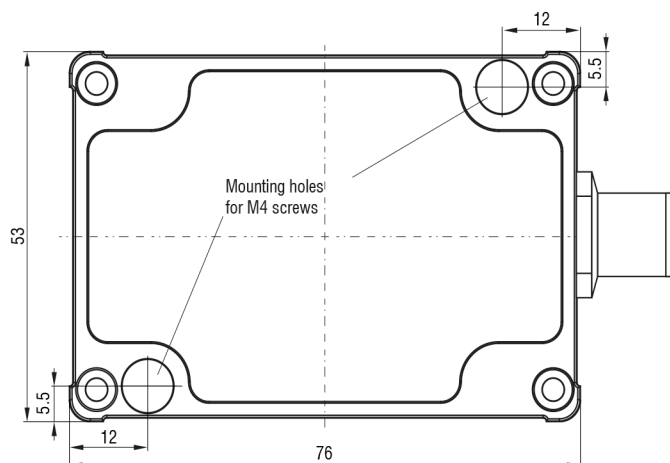
INC5502D-360/90-P-S



ACC530x



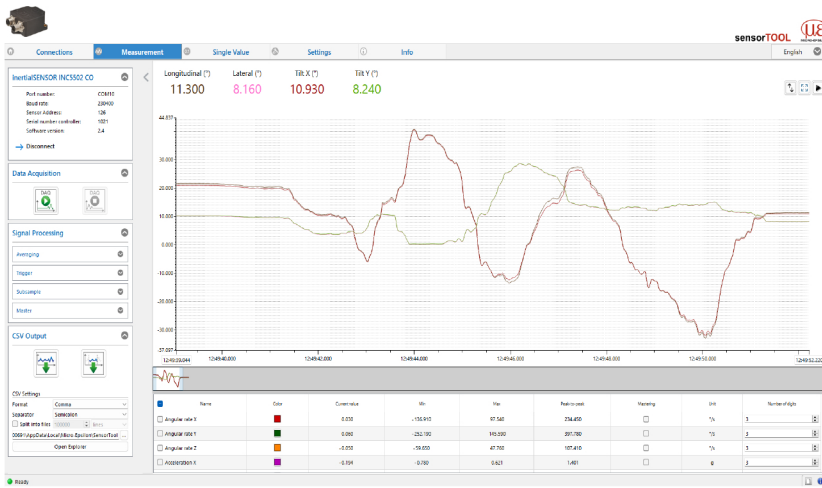
INC5701D / ACC570x



## Free configuration software

The configuration software from Micro-Epsilon offers simple commissioning of the sensors using a digital RS485 interface. The software enables access to many parameter set up and sensor configurations, e.g., measuring ranges and output parameters.

The software is available as a free download at [www.micro-epsilon.com/service/download](http://www.micro-epsilon.com/service/download).



Signal processing Euler/position angle

Static filter (0.1Hz pass)

Dynamic filter (SensorFDC/DC)

Low Pass: 0.00 [Hz] (1/30)

Zero Reset

Sensor orientation

Rotation rate X

Rotation rate Y

Rotation rate Z

Constant temperature

Longitudinal Euler angle

Lateral Euler angle

Test

Measurement configuration for Euler angle

Sensor orientation: y

Measuring range longitudinal Euler angle [°]: +/- 180°

Measuring range lateral Euler angle [°]: +/- 85°

Longitudinal Euler angle direction: Normal

Lateral Euler angle direction: Normal

Measurement configuration for position angle tilt

Sensor orientation: z

Measuring range Tilt x [°]: +/- 90°

Measuring range Tilt y [°]: +/- 90°

Tilt x direction: Normal

Tilt y direction: Normal

