Safer Fun Rides

Turck's uprox+ sensors reliably detect copper and aluminum targets on the latest roller coasters at the Europa Park

Anyone wishing to be a major player in the leisure park world unavoidably has to continuously extend their offering and make new attractions available. This also applies to the Europa Park, one of the key operators in the sector, which was able to welcome over 4.5 million visitors last year. 2012 was also the year in which the family-owned enterprise made the largest investment in its history. This included the new major attraction, the wooden roller coaster – the Wodan Timbur Coaster – which is aiming to set new benchmarks.

The safety provision for the wooden roller coaster includes sensor technology from Turck, which was already implemented on the Blue Fire Megacoaster powered by Gazprom, which was opened in 2009. The Megacoaster is the only roller coaster in the Europa Park that is started with a catapult launch system. Roller coasters are normally pulled up to the highest point of the ride in a lift phase and then race down to the station at the bottom driven only by the gravitational potential energy. With the Blue Fire roller coaster, on the other hand, the train is launched along the track from stand-

The Wodan Timbur Coaster is the first wooden roller coaster in the Europa Park

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still within 2.5 seconds at a speed of 100 km/h. A linear induction motor is used to produce the acceleration. An elongated electric motor provides the non-contact acceleration of a static magnetic field generated on the train using a wandering magnetic field – similar to the operating principle of a maglev train.

Sound system triggered by wheels

A sound arrangement composed for the ride accompanies the passengers and is started regardless of the position of the train. The video camera that films the passengers during the ride is not started until a particular section of the track is reached. These functions are combined in the Oracs onboard system supplied by Emis Electrics GmbH in Waldkirch. The system integrator also develops and produces the electronics and the control system for the roller coasters of the Europa Park. The system requires the position information of the train along the entire length of the ride. Instead of using trigger points on the track, the controller uses the revolutions of the train's wheels to determine its position. An inductive proximity switch is mounted on an aluminum wheel of each train, and detects the revolutions of the wheel by means of the holes in the alloy wheel.

Turck delivered uprox+ sensors in a watertight housing for the shipping fleet of the Europa park. They detect under water the entry into harbor in order to switch off the water canons in time

"Initially we used a different proximity switch. Although this functioned reliably, it had a very short switching distance. During maintenance when the wheels were taken off, even if the mechanic hit the sensor lightly, this would cause the bracket to bend so that we had to readjust it," Oliver Gebhardt, responsible project manager at Emis Electrics, describes the situation. "For a long time we looked for a sensor with a longer switching distance. Although most other sensors had the switching distance we required, they needed more space for resetting than the Turck switch." The metal-free space on the wheel is narrow. The Turck NI10U uprox+ sensor stood out on of accounts of its clean switching performance with a precise switch point. "The Turck sensor has a very good detection beam. This therefore provides us with considerably more availability for the installation," Gebhardt adds. Turck uprox+ sensors also detect the correct closing of the bar restraints on the Blue Fire roller coaster.

The manufacturers of this mega coaster are Mack Rides, who originally founded the Europa Park as an exhibition park for its fairground machinery. The park

Quick read

Even if inductive proximity switches are the bread and butter business in the automation sector, there are still a great deal of differences between sensor suppliers. The latest roller coasters in the Europa Park therefore rely on the sensors of Turck – the larger switching distance, a precise switch point and the clean switch response of the uprox+ sensors were the key factors in the selection.

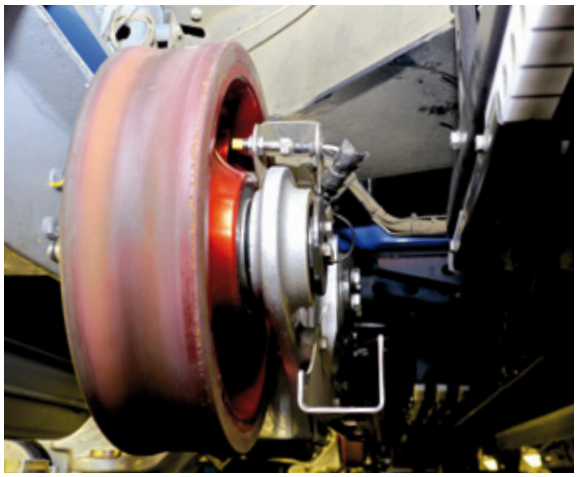
Safe enjoyment: The wheels of the Blue Fire Megacoasters powered by Gazprom grip the rails on all sides

has developed greatly from the original concept of a small amusement park for day visitors. With a total of five 4-star theme hotels of its own, Germany's largest amusement park also attracts several multi-day visitors and short-stay holiday travelers. A major part of the Europa Park's fairground machinery still comes from Mack Rides. The Wodan wooden roller coaster is an exception. The ride is based on Norse mythology for which wood is a much better material than steel. As Mack Rides are specialists in steel fairground machinery, this roller coaster comes from the US manufacturers Great Coasters International (GCI).

Emis Electrics also planned the control system and the electronics concept of the roller coaster. However, the Europa Park operators set the requirements for the controller and the electrical and electronic components used. These specify the use of only two sensor technology manufacturers – one of which is Turck. This enables the amusement park to keep its inventory manageable and the maintenance times short.

Block system secures the wooden roller coaster

The safety requirements placed on passenger rides are extremely high – the standards are even more demanding than for elevators. Roller coasters are normally equipped with a block safety system. A block is a section of the track between two brake points of the ride. The core principle of the system is to enable a section



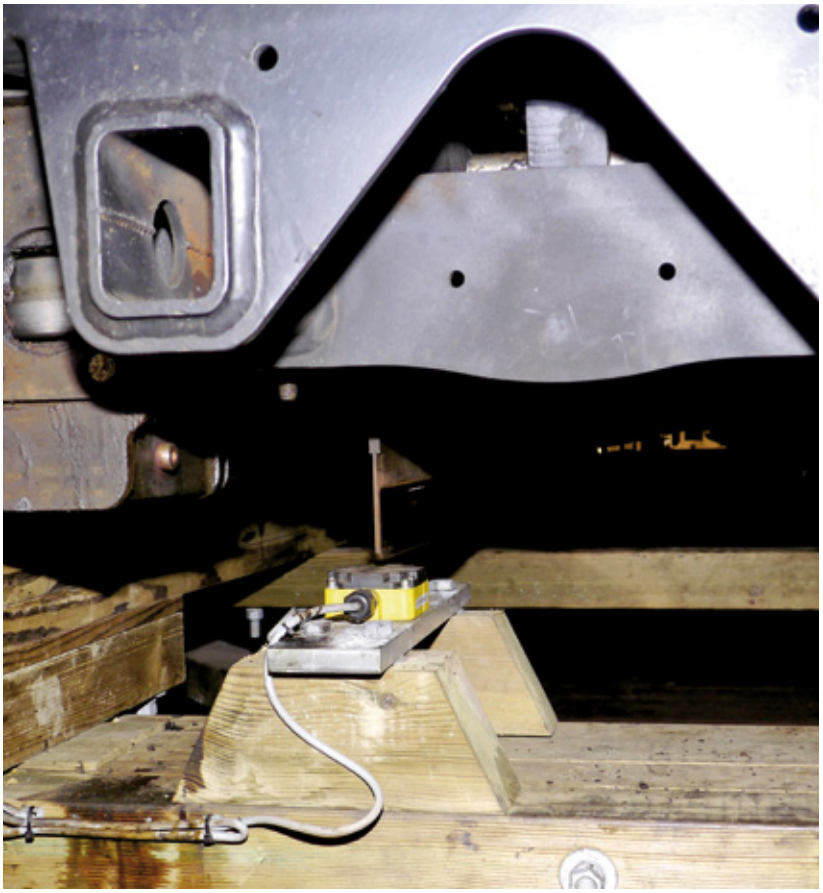
The hole in the alloy wheel of the Megacoaster is detected by the uprox+ with its precise switch point

for the train, i.e. to open the brakes only if the previous train has left the next block. The block system is also used to determine the speed of the train by recording the travel time between the blocks.

Factor-1 sensors detect copper brake fins

The system is normally monitored and controlled with proximity switches. The switches detect the so-called copper brake fins which are fastened to the bottom of

The train is detected by the uprox+ sensors over the entire lift phase



The view below the train shows the copper brake fin of the Wodan Timbur Coaster carriage above the robust uprox+ sensor

the train 70 cm apart along its entire length. "Copper is a nonmagnetic metal. This is important in order to respond to the magnetic brakes which slow down the ride when required," explains Markus Spoth, electrical engineering manager at the Europa Park. The advantage gained here is a disadvantage for the detection with inductive sensors. Inductive switches with ferrite core technology have the worst response to copper. A factor 1 sensor which guarantees the same switching distance with all metals therefore had to be used at this point. The Turck NI75 was able to stand out from the factor 1 sensors of its competitors. No other comparable switch offers such a highly reliable switching distance of around 6 centimeters. The train can have an offset of up to 2.5 centimeters to the right or left of the rails. "The sensors detect the 12 millimeter thick brake fin on the train from below and from the side. In both cases we need a clean switching performance. The Turck switches made this non-standard design possible. They supply a clean switch point in both mounting positions," explains Gebhardt.

Silent lift hill

The section of the ride in which the train is pulled up to its descent point is known as the lift. An anti-rollback rail in the track bed ensures that the train does not uncontrollably roll back to the station if the pulling chain or another component breaks. Normally a safety anchor clatters over the anti-rollback dogs in the track bed – making a clearly audible sound in the process. In order to prevent this noise, GCI lifts the anchor with an electromagnet. GCI calls this noise-free system a silent lift hill. The train is detected by sensors and its speed monitored by the controller. As soon as the train goes below a defined speed of 1.5 m/s, this indicates that there must be a fault in the chain drive. In this case, the controller reliably switches off the electromagnets, and the anchor falls onto the ratcheted track and engages. In this way, the system also functions in the event of power failure.

The use of Turck sensors used in Germany's largest amusement park will be continued. The use of an NI50U uprox+ sensor in the Whale Adventures Splash Tours water ride shows that it is also sometimes minor details that make the difference. The rectangular Turck switch impressed Emis because it could be ordered directly with a matching protective housing for underwater mounting.

Outlook

Further applications for Turck sensors in the amusement park are everywhere. For example, inclinometers are going to be used in future for the Windjammer swing ride. A new carousel ride that is partly lowered into water and is controlled and raised by three motors is to be fitted in future with inductive linear position sensors from Turck in order to ensure the concentric running of the ride. ■

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Oliver Gebhardt, Emis Electrics