With an operating height of 27 m and an outreach of 14.8 m the performance of the TB 270 is impressive

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Angle Indicator

Turck angle sensors are used in the aerial platforms of Ruthmann to measure the rotation angle of the working cage

In the Ruhr district (Germany) people would be surprised to know that the term "Steiger" is protected by trademark. In the German coal mining industry, the "Steiger" is the term given to a mine overseer or supervisor. However, when the municipal parks commission gets a STEIGER® they usually mean an aerial platform from Ruthmann, a company that defined the features of this type of product in the fifties. It all began when the Duisburg municipal works started looking for a solution that was safer than ladders for maintaining street lights. At that time Ruthmann had already been in existence for around 50 years. The company, headquartered in Gescher-Hochmoor in the Münsterland region of Germany, had already been producing transport solutions since 1901. However, it wasn't until the invention of the aerial platform for the Duisburg municipal works that the Westphalian company became a global player and gained sector leadership.

The compact Ri360-QR14 is reliably protected from mechanical damage by the steel cover

Higher, more compact, further

The challenge in the sector is to develop mobile aerial platforms that can be extended out from a truck chassis with a defined permissible total weight, that are flexible and which also allow a large lateral outreach. The entire vehicle in its retracted state must be compact in design and easy to maneuver. The weight of the truck chassis and its structure play an important role in the further development of aerial platforms. Manufacturers of aerial platforms benefit from the progress made in material science and the latest shaping and joining technologies such as laser welding. Ten years ago, Ruthmann was able to build the TTS 1000, an aerial platform with a maximum working height of 100 meters. While the lead employees at the Gescher-Hochmoor company admit that the market for these kinds of extreme devices is limited, they appreciate the positive advertising gained from these mammoth plants.

As the aerial platforms carry people, they must meet special safety requirements. The safety-related sensors and the controller in particular must have a redundant design. This is the case with all models from the small K 110 on a 3.5 ton base up to the TTS 1000. Sensors are used to measure the position of the telescopic arm on which the working cage is located. Many STEIGER® machines also feature a jib between the telescopic arm and the working cage. This jib – called the RÜSSEL® at Ruthmann – allows flexible maneuvering over obstacles.

The swiveling of the working cage, whether it is located on the jib or the telescopic arm, is also monitored by a sensor underneath the cage. "Only if the jib is in the correct position can the working cage itself be swiveled fully. If it is too steep, the cage with the control console may hit the jib," Dr.-Ing. Klemens Post, head of electrical control technology at Ruthmann, explains the task of the sensor. "To prevent this, the controller continuously monitors the swivel angle of the jib and ensures that it is only moved as far as the actual posi-

Quick read

The aerial platforms built by Ruthmann are based on quality and innovative technology. To guarantee at any time the safety of the STEIGER® aerial platform with a maximum working height of 100 meters, sensors detect each position change – right through to the swivel angle of the working cage. This task is mastered by Turck's Ri360-Q14 inductive angle sensor, which made a big impression with its compact design, simple teach function for the sensing range and intelligent response at the measuring range end points.

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>
> **Dr.-Ing. Klemens Post, Ruthmann GmbH & Co. KG**

tion allows." On aerial platforms without a jib, the cage can not be fully swiveled to any position.

Behavior in the limit range

"There had been problems with the angle sensor that we had previously used," Post explains. The sensor was taught with a sensing range of 180 degrees." It outputs a 0.5 volt signal at the starting point of the measuring range at -90 degrees, and the maximum value of 4.5 volts at the end point at +90 degrees. If the stop at 4.5 volt was slightly overshot, the sensor signal jumped to 0.5 volt. This immediately caused the controller to lock the movement of the working cage in the direction of the 0.5 V signal. We had to go on the safe side and teach the old sensor within a safer range, i.e. from -85 to +85 degrees," Post describes how they dealt with the previously used angle sensor.

Turck's Ri360-QR14 inductive angle sensor is better adapted to this. If a position is reached that is outside of the taught start or end point, the 0.5 volt signal is still output at positions before the start point and the 4.5 volt signal at positions after the end point. The signal does not jump until the intended limit point has moved between the two end points. If therefore – as with Ruthmann – the sensor is taught from the start point at 9 o'clock to the end point at 3 o'clock, and the sensor is at 4 o'clock, it continues to output the maximum signal of 4.5 volts until the limit has been reached at 6 o'clock. Only then does the signal jump to the start value of 0.5 volts.

Straightforward sensor offset

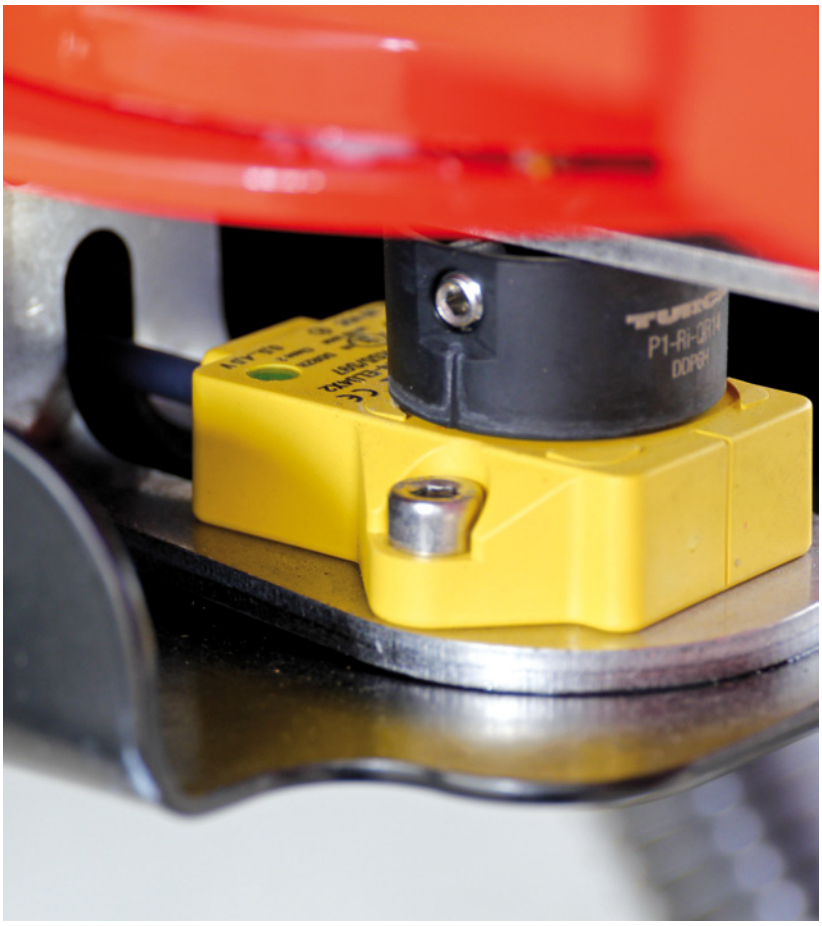
This behavior was not the only reason for using the Turck sensor. "A major benefit for us is the tolerance provided when the positioning element is offset. Vertically and horizontally, the sensor can be offset by three millimeters. This is very helpful because a few millimeters of offset frequently occur when the sensor is fitted. The teach functionality is also really child's play," Post describes the benefits of the sensor. "We move to the first position, press the teach adapter button for two seconds, move to the end position, press once more for two seconds and that's it."

The design of the angle sensor also made an impression: With dimensions of 54 x 50 x 14 millimeters, it is considerably more compact than similar products. The magnetic field immunity of the Ri360-QR-14 was not however a decisive factor in selection. The product previously fitted was an inductive system and was also magnetic field immune.

Ruthmann put the sensor through its paces for over four months in a demonstration model of a TBR 200. With a working temperature range of -40 to +70 degrees Celsius the angle sensor also operated perfectly in winter. After all the tests were successful, Post and his team decided to use the sensor in the series

The angle sensor underneath the working cage measures the swivel angle of the cage

The Bi20-Q20 detects the folded ladder on the outer wall of the working cage



Turck's angle sensor also tolerates a positioning element offset that is not always avoidable

production of the TBR 200 and gradually introduce it as the standard in five other series: The Turck angle sensors now detect the swivel angle of the working cage in the TB 220, TB 270, the T 285, T 300.1 and the T 330. The number in the product name stands for the maximum working height of the particular STEIGER®. The TB 220 therefore allows a working height of 22 meters.

Automatic setup and retraction

Ruthmann provides an automatic system for setting up the aerial platforms. The operator can press a button to bring the device to a safe position. All four side jacks are automatically extended and brought with the necessary movement into a position that secures the entire vehicle in the horizontal position – the controller allowing a five degree tolerance. The automatic retraction of the aerial platform simplifies operation once more. At the push of a button the STEIGER® moves all telescopic booms and the jib from the working position back to the ground or transport position. The working cage is kept vertical during the entire operation.

In order to reduce the risk of accidents, the controller checks whether the ladder for entering the cage is retracted before the working cage can be maneuvered. An inductive proximity switch from Turck is used to detect the retracted ladder. Ruthmann selected Bi20-Q20 primarily due to its small height. At 20 millimeters it fits exactly between the outer wall of the working cage and the ladder. The sensor also has e1 certification for mobile machines.

Klemens Post regards the collaboration with Turck as positive. "We received excellent support from Turck sales. Furthermore, all the Turck sensors that we use are operating to our complete satisfaction. We are gradually fitting the angle sensor in all our machines in which the swivel angle of the working cage has to be measured." ■

▸ Sensors for mobile machinery

Sensors for mobile machinery must be particularly robust and come with a high degree of protection. Manufacturers often require extended temperature ranges, especially when the sensors are to be installed close to an engine or motor. The standard output signal range in the sector is also 0.5 to 4.5 volt. The special signal range became established when the onboard voltage of the machinery fluctuated far more than it does today. The output signals were therefore previously measured ratiometrically. The signal output by the sensor was not absolute but interpreted in relation to the actual onboard voltage present. In this time 0.5 to 4.5 volts developed into the industry standard for mobile machinery and is therefore still frequently used in the sector.