

# Perfectly Assembled

The assembly systems with parallel arms from Möve-Metall are equipped with Turck's inductive RI angle sensors to ensure that screws are inserted exactly to specifications

**P**oka Yoke is a Japanese concept that stands for "mistake-proofing" or "avoiding inadvertent errors". The term describes the ongoing production trend of excluding errors already in the production process, instead of looking for them after assembly through the implementation of complex quality controls. With the poka yoke principle, faults are prevented by making it as difficult as possible for the production worker to carry out their working steps incorrectly.

The US car parts supplier, Johnson Controls, a leading company worldwide in the supply of car seats, roof lining systems, door panels, dashboards and electronics for vehicle interiors, also follows this principle in its production processes. With car seat production, for example, this involves the following specific requirements: it must be ensured that each component is fitted to the

seat in the correct order, with the correct screw or rivet, the correct tool and with the correct amount of force.

This requirement is implemented using assembly devices with parallel arms or other so-called reaction arms supplied by Möve-Metall, in Mühlhausen. The company based in Thuringia, Germany, was formed out of the former VEB Möve Factory, has 50 employees and develops, designs and produces special machines, equipment, plants and, in particular, assembly and testing equipment for car parts suppliers. Möve-Metall developed a parallel arm with position detection for use in assembly processes. This enables the position measuring of the screw and rivet processes and reliably prevents incorrectly assembled parts.

"In order to screw in components, the car seat is fixed in positioning elements," Michael Zimmermann,

The contactless RI angle sensors from Turck supply a 4...20 mA signal to the controller from which it calculates the exact arm position



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**With a resolution of 0.09°, Turck's RI sensors provide more than sufficient accuracy**

technical manager of the company, explains the principle. "A screwdriver device is clamped on the parallel arm. The operation is based on the principle of the parallelogram and ensures the precise and repeatable positioning of the screwdriver." The position monitoring at the three joints of the parallel arm is provided by Turck inductive angle sensors. A beneficial spin-off of this is the fact that the forces involved with the assembly processes can be measured as well. This eliminates the effect of reaction torques on the user. If positions closely situated together have to be identified, the inductive RI angle sensors are located at all three joints of the arm. If positions far apart from each other have to be identified, a single angle sensor on the swing arm of the parallel arm is enough.

The parameters for each screw set are stored in the controller. If the operator wishes to screw in the first screw, he guides the arm to the appropriate position. The controller registers the correct position and releases the power or the compressed air for the screwdriver (first OK). The operator screws in the screw until the controller has registered the required number of screwdriver rotations (second OK) and the required torque has been reached (third OK), which guarantees that the screw is seated correctly. Only when these three OKs have been registered by the controller can the next screw be fitted: If the sequence was programmed beforehand, it is only possible to fit the screw that was stored in the controller as the second screw.

### Tolerant sensors

"The torque monitoring has been implemented here for a long time," Zimmermann explains, "but the position monitoring is relatively new. This offers an addi-

tional level of safety for the assembly process and is also easy to implement with the inductive angle sensor. A great benefit of the Turck sensor is its non-contact operation, thus requiring no mechanical connection to the positioning element. The four millimeter tolerance for the offset of the positioning element helps us considerably with the assembly process: we no longer have to fit so precisely and protect the sensor from contact, since slight impacts do not impair measuring."

Another benefit of the RI angle sensor is its immunity to magnetic fields and metal environments. The majority of other sensors on the market either have a mechanical connection between the rotary encoder and the sensor, or are susceptible to magnetic environments produced by large motors or welding equipment. The immunity of the sensor is based on its innovative resonant circuit measuring principle which eliminates the need for a magnetic positioning element. The resonator measuring principle from Turck uses instead an oscillation circuit that is formed by the sensor and the positioning element. The principle combines maximum precision with an excellent level of interference immunity and vibration resistance.

Another benefit of the sensors is their ease of adjustment and the setting of positions using a program developed by Möve. Zimmermann shows on the display of the Siemens controller how the mounting points are programmed. With the controller in Teach mode, he guides the parallel arm to the required mounting point and taps on the display. The controller defines the position and accepts the actual values of the three angle sensors as x, y and z coordinates of mounting point 1. Depending on how exact the position has to be defined, and the distance from the next mounting point, the user can define a tolerance window around the point.

### "Considerable benefit"

"Our assembly device is simple and reliable to use for today's customers. For us also, the use of Turck angle sensors is a considerable benefit. We previously designed the parallel arm with an optical length sensor between the two arms in order to also detect the arm position. However, the optical sensor was considerably heavier to fit and was more susceptible to faults during operation," Zimmermann summarizes. ■

#### Quick read

With their assembly and testing devices, Möve-Metall GmbH in Mühlhausen primarily supports the car parts suppliers in fault-free production. Wherever a manufacturing process requires manual interventions, the machines and devices from Thuringia in Germany ensure precise assembly conditions. This also includes the screwing in of car seats using various assembly devices with parallel arms, for which the arm positions are detected with Turck's inductive RI angle sensors.



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**Michael Zimmermann,  
Möve-Metall**