

Driving, Steering and Positioning: Sensor Technology for AGVs

Functioning safely without a driver

The automated guided vehicle systems from MLR System GmbH ensure an effective, economical flow of materials of all types in production, assembly areas and warehouses. A very wide range of goods can thus be picked up fully automatically from their staging areas, safely transported and delivered to their destination areas.

The task of establishing the speed, the vehicle steering angle and the exact position of the carrier vehicles is carried out by encoders and draw-wire systems from Kübler GmbH from Villingen-Schwenningen. Their accurate speed and position signals ensure the safe and reliable functioning of these AGVs.

The right transport system for every application

The main advantage of automated guided vehicle systems (AGVs) is their high degree of flexibility, allowing all types of materials to 'flow' efficiently and economically. They render transport processes transparent and facilitate the calculation of costs. They reduce logistical costs by shrinking personnel costs and inventory and by avoiding incorrect deliveries and shipping damage. In order to achieve the maximum here, each system (AGVs, guidance control system, power supply, equipment for position and location determination, equipment for data transmission as well as infrastructure and peripheral devices) must be customised to the task in question and to the environmental conditions. To address these requirements MLR System GmbH, based in Ludwigsburg, offers a range of suitable combinations of vehicles and navigation systems: The *motormouse* series boasts a high level of functionality and offers easy, low-cost installation of the route. The vehicle costs are far lower than the costs incurred with traditional systems. The extremely compact CAESAR series transports goods safely where space is at a premium. The powerful machines can act as load carriers or be used as tractor vehicles. If however goods need to be picked up or deposited in higher staging areas, then the PHOENIX or I-SIS series are the ideal AGV solution. They can pick up loads from floor level and hoist them without problems up to a height of 3 metres. The CASERO series has been designed for flexible use in public buildings, such as hospital, care homes, hotels or offices.

A lot of technology in a compact area

The AGVs move fully automatically and securely to their destination within the assembly hall or warehouse, from the storage location to the machine or production line and then back again. If necessary they are able to head independently to the docking station in order to charge their batteries. For navigation purposes, navigation technologies without guide wires are available, such as laser navigation with artificial or natural landmarks and magnetic navigation, or also classic guidance systems, such as active or passive inductive and optical guidance.

Unlike with guide wire systems, where sensors follow an optical or metallic wire strip or a guide wire embedded in the floor, in free navigation systems the routes are just stored virtually in the vehicle controller. All travel and handling movements are controlled via accurate sensors for distance and angle measurement. Their quality determines the accuracy of the navigation and the frequency of required course corrections. The vehicle corrects for discrepancies between the real route travelled and the virtual route in two ways: with magnetic navigation the vehicle detects reference magnets in the floor and with laser navigation it orientates itself either using artificial landmarks (reflectors) or by scanning the environment with a laser beam.

Automation technology is tightly squeezed into these freely navigating vehicles, as this compact construction is necessary in order to save as much space as possible when laying out the transport routes. Sensors, drives, control elements and also encoders for speed and position must all work together in perfect harmony in order to ensure faultless operation. When it comes to these demanding control tasks, the encoders and draw wire systems from Kübler GmbH prove themselves to the highest degree.

All motion sensors from one source

Robust miniature incremental encoders of type 2400 measure the speed of the vehicles. An encoder sits on both the right drive wheel and on the left one and supplies fast real-time signals to the controller. Moreover, compact absolute encoders of the Sendix M36 series measure the angle of the steering axle. The position value is transmitted to the controller via a CANopen interface, so that the vehicle can travel safely and dynamically along the driving route.

The load to be transported has to be picked up at various locations from bins situated at various heights and then unloaded and deposited at various other places.

The height of the carrier vehicle is measured via a Kübler draw-wire system, either B80 or C120, which covers a measuring range of up to 6 metres. Here the height of the carrier is converted into rotary motion by means of a wire and drum. The position value is then measured with an absolute multiturn encoder, which likewise sends it to the controller via the CANopen interface. Even if the vehicle has been completely switched off, the absolute position of the load carrier is immediately available when switching back on. As experts for length and angle measurement sensors in drive

and positioning systems Kübler is able to supply all the different types of components from one source. The respective requirements are discussed in advance with the customers and the best solutions are then put together on-site.

Compact and reliable

Kübler encoders of the Sendix M36 series have been specially designed for use in mobile automation. They have been thoroughly tested with shock loadings of 500 g and vibration loadings of 30 g. Additional benefits to the user include shaft seals that are protected against steam jets as well as the fully-encapsulated electronics. Thus the encoder, with a working temperature range of -40 °C up to +85 °C and a protection rating of IP69k, is ideal for mobile use both indoors as well as outdoors. Thanks to their compact design, with an outside diameter of just 24 mm, the miniature encoders of the 2400 series are perfect for use in confined spaces.

With a resolution of 1024 pulses per revolution they provide highly accurate speed information, allowing highly dynamic control of the drive. As with the draw-wire systems, they operate in an ambient temperature from -20 °C up to +85 °C.



Absolute encoders of the Sendix M36 series measure the angle of the steering axle.



PHOENIX R AGVs can pick up and deposit loads from higher staging areas.



The lift-height of the carrier vehicle is measured with the help of a B80 or C120 draw-wire system.

(Photos: MLR, Kübler 2)