

AGVs – Safety through smart sensors

In AGVs (automated guided vehicles), the implemented sensing, controlling, and actuating technology has to replace the driver. Wachendorff Automation provides encoders and according measurement systems used to ensure safety in AGV applications.

The logistics industry is currently experiencing a major upturn as a result of increasing automation and constant technical progress. Automated guided vehicles have long been standard in modern warehouses. Using AGVs is becoming more and more commonplace. Driverless transport vehicles are used when a driver can be removed. Applications include, for example, automated industrial trucks or transporting of different goods within a warehouse. This development will change the infrastructure and quality of life worldwide.

Automated guided vehicles (AGV) are self-propelled transport systems. They are guided without contact and are controlled automatically. The machine operation and control are performed by the machine itself and no person has a direct access to the inner life. Thus, accurate data acquisition by the vehicle and a quick response to a given situation is necessary. The vehicle must be able to stop immediately or reduce speed in a controlled way.

Using different sensor technologies ensures the safety of AGVs. One type of sensor used in such vehicles is the rotary encoder. Wachendorff Automation is a specialist in the development of encoders and measurement systems based on these. The medium-sized, owner-managed company is based in Rheingau near Frankfurt/Main (Germany). Rotary encoders are used in a variety of applications in AGVs. With different encoders optimally adapted to the requirements, many problems can be solved in a smart way.

Height position

Precise positioning of the system is required, for example, to determine the exact height of a forklift truck when filling the shelves in a warehouse. With a high-precision SZG165 draw-wire system and a WDGA 36A absolute encoder with a lateral cable outlet, the measurement can be integrated into the rail. Position and speed data are transmitted via a CANopen or a proprietary CAN-based network.

The exact position is determined by the implemented Quattromag single-turn technology. Using a patented calculation algorithm and four Hall sensors, the single-turn position of a magnetic absolute encoder can be calculated. The measured value is cross-correlated with the reference value to produce a more accurate value. A suitable calculation of the magnetic field generated by a diametrical magnet cancels out any interference from the Hall sensors. This allows the use of magnetic single-turn technology in dynamic and high-precision applications.

Absolute encoders are available in single-turn and multi-turn versions. Single-turn encoders can output an exact

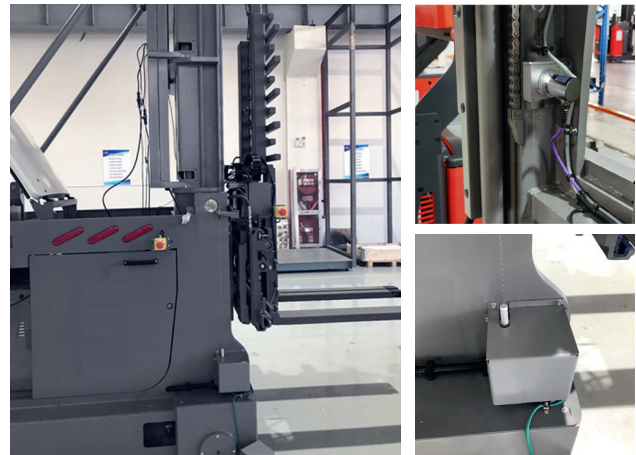


Figure 1: SZG165 draw-wire system and WDGA 36A absolute encoder used for precise positioning of a forklift truck (Source: Wachendorff Automation)

position within one rotation. Multi-turn encoders can also output an exact number of rotations. The patented Endra technology makes it possible to build encoders without a battery or gearbox that can detect and record rotations even in a de-energized state. This is achieved using the proven Wiegand effect.

Speed control

Reliable speed control is essential for an AGV. Depending on the speed, the protective fields of the AGV are also extended. As soon as the protective field is disturbed, the AGV must safely reduce its speed. A WDGI 58A incremental encoder can be used to determine a safe speed value. The encoder is mounted directly on the wheel and the values are verified with the controller. Wachendorff also offers redundant incremental encoders with integrated optical and magnetic independent sensor systems. ▶

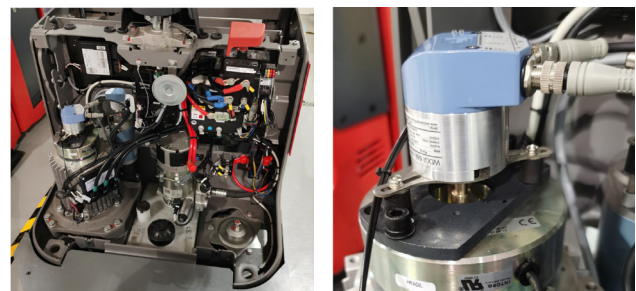


Figure 2: Redundant encoder WDGR 58B for speed detection (Source: Wachendorff Automation)

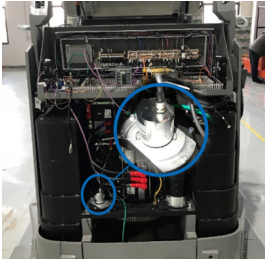


Figure 3: WDGA 58E for detecting the rotation angle of the steering motor (Source: Wachendorff Automation)

The WDGR 58B encoder provides two independent signals that are matched in the control system. The combination of the measuring principles of a magnetic and an optical encoder increases reliability. The encoder has a high immunity to the electromagnetic interference and can withstand high bearing loads. With the redundant encoder, signal generation, and power supply are completely independent. The redundancy gives the

encoder a multi-channel capability, which provides two values. This provides a hardware fault tolerance of one. The system is therefore safer than a standard encoder and less expensive than two standard encoders. The multiple redundancy protects against a common cause of failure (CCF). The advantage of redundant encoders is that the required level of safety for the entire application can be achieved with the appropriate vehicle concept and safety control.

Angle of rotation

The correct rotation angle of the steering system is important for precise steering of the autonomous vehicle. The space-saving WDGA 58E absolute hollow shaft encoder is mounted on the head of the steering motor to continuously measure the

angular position of the steering wheel. Depending on the concept, one signal (for example sent via CAN) is sufficient, which is synchronized with the distance sensors for the safety of the environment. The use of a redundant encoder is also possible.

The high bearing loads of Wachendorff encoders are particularly in demand when the user envisages connection to a gear wheel. The available encoder variants are very compact and easy to implement for precise adaptation even in small installation dimensions. By using a field programmable gate array (FPGA), company's Universal-IE encoder can activate an Industrial Ethernet protocol (e.g. Profinet, Ethercat, and Ethernet/IP) via a web server. By using a single hardware for all protocols, the user has a maximum of flexibility. Future updates can also be imported via the integrated web server.

The increasing level of automation is a challenge for many operators. Wachendorff's value promise is to provide high-precision, flexibly-mountable, reliable, and compact encoders. These features as well as their robustness and high-vibration resistance make them ideal sensors for use in driverless transport systems such as AGVs.

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