

# Functional Safety in Direction Detection for AGV Control Systems

Compact Inductive Sensors Meet  
PL d and SIL 2 Standards

## At a Glance

- Reliable detection with no dead band
- Not affected by dust or dirt
- High characteristic safety values allow easy integration into a safety loop and minimize testing effort
- Can be used in extreme temperatures and harsh conditions
- Compact design for easy mechanical integration even in confined spaces

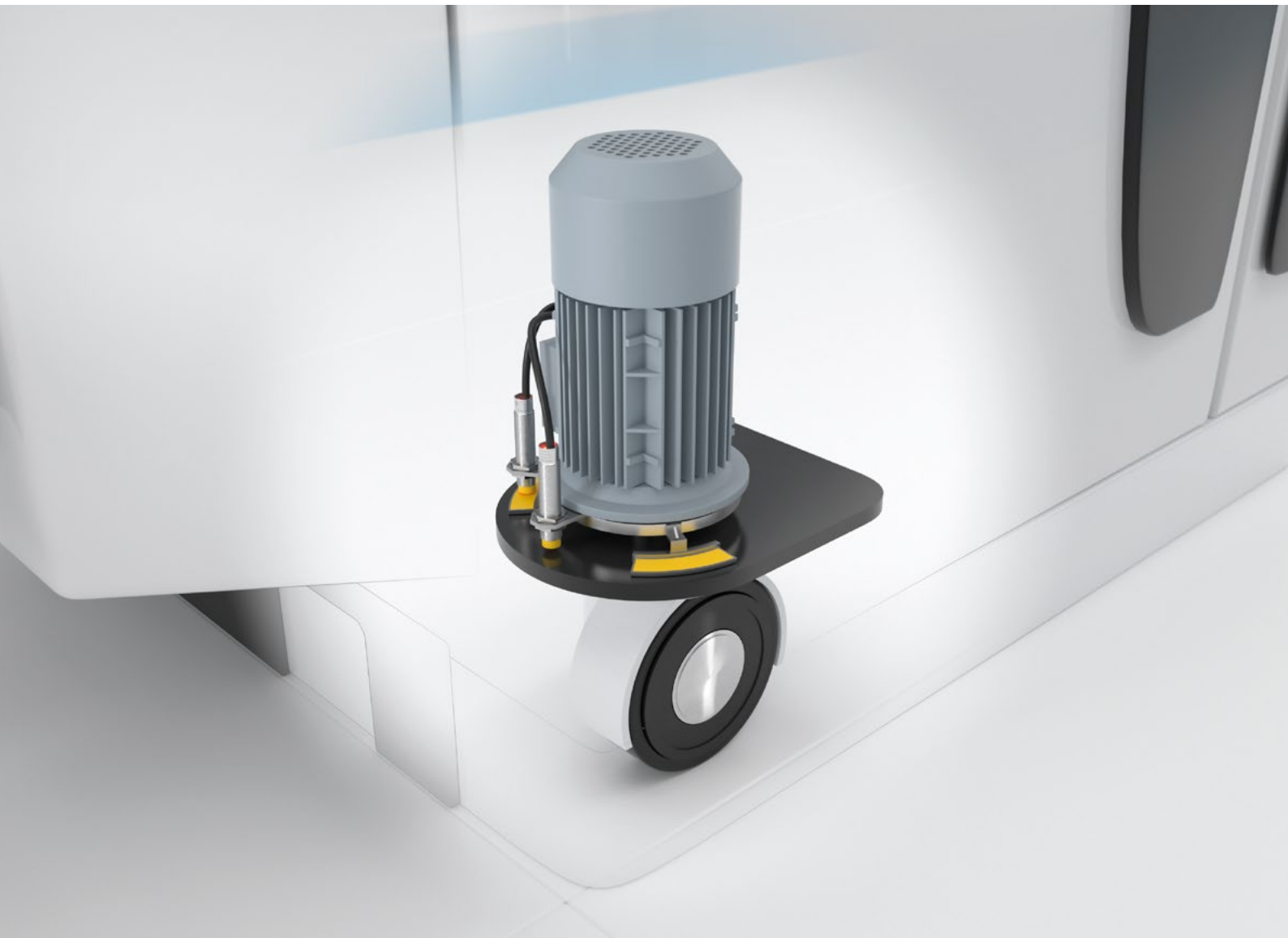


## The Application

Automated guided vehicles (AGVs) require reliable navigation and safe movement control. The vehicle's individual phases of movement can be recorded using a range of sensors. This data serves as a source of information for the vehicle control system. In general, sensors that meet functional safety requirements are used to detect the direction of movement. AGVs are used in a wide range of locations, from conventional plants to cold rooms at very low temperatures and outdoor areas with harsh weather conditions.

## The Goal

The direction detection system ensures that the vehicle is oriented in the correct direction of travel once started up. It needs to provide the vehicle control system with essential information for the vehicle to be steered safely and maintain a stable course, regardless of the weight and size of the load. The direction detection must be reliable and safe, while remaining unaffected by environmental influences. This is especially important after vehicle initialization or during reference runs used to verify the direction of travel.



## The Solution

Inductive safety sensors from the NSB and NSN series provide reliable data for direction detection. This data is generated using safe position monitoring of the switching cams on each steering axle on the AGV. The sensor detects the metal target—the switching cam—and sends the corresponding switching signal to the control system. This prevents excessive steering angles when transporting heavy loads, for example. The sensors are able to detect the target with no dead band, meaning no minimum distance is required. Detection is not affected by dust or dirt.

## The Benefits

The devices are very compact and can be easily fitted to the AGV drive system. A standardized OSSD interface and comprehensive safety documentation ensure quick and easy integration. At the same time, the sensors comply with the functional safety requirements of the PL d (EN ISO 13849-1) and SIL 2 (IEC EN 61508) standards. Models with an extended temperature range (–40 to +85 °C) and high degree of protection (IP68/69) are available. Standard metal targets are sufficient—no special coding is required. The high characteristic safety values enable easy integration into the safety loop and limit the number of required proof tests to one per year.

### Technical Features

#### Example for NSN4-12GH45-2E2-V1-M1-S2D2:

- No dead band
- Can be used with standard metal activators
- Approvals: Category 2, PL d/SIL 2, E1
- LED for switch states and fault indicator
- OSSD interface
- TÜV certification
- Temperature range: –40 to +85 °C
- Housing material: brass, stainless steel (V4A)

The sensors are available in a wide range of designs and with various equipment options, such as:

- M12, M18, and M30 cylindrical sensors, flush and nonflush, with cable or M12 plug in brass or stainless-steel housing
- Rectangular Varikont L2 sensor, flush and nonflush, with M12 plug

