J1939-connectable radar scanner

Figure 1: The radar scanner at the top of the stacker also records the height of the roller conveyor (Source: Turck)

The MR15-Q80 radar scanner by Turck provides 3-dimensional (3D) data. It is suitable for mobile machines, enabling object detection and collision avoidance.

Some radar sensors for collision avoidance are limited to detecting the distance and thus only output one dimension as a measured value. The MR15-Q80 radar scanner delivers genuine 3D data, improving the mapping of objects and spaces. Due to its robust design, which can withstand shocks of up to 100 g, the product is suitable for mobile machinery, in particular forklifts and automated-guided vehicles (AGV).

Radar technology is usually associated with speed measuring. But since the 2000s, the technology has also been used in road vehicles themselves. Active adaptive cruise control (ACC) systems use radars to determine the distance to cars in front and their speed. Radar sensors have also become popular in industrial automation in recent years. Especially in level and conventional distance measurement, advantages over ultrasonic, optical sensor or media-contacting technologies pay off in many applications.

The J1939 interface uses parameter groups (PG) for data transmission. The MR15 uses a special proprietary PGN (PG number) to transmit not just one, but all process data as well as the radii and signaling zone information. The bit rate is 250 kbit/s. The device does not comply with the ISO 11783 series (also known as Isobus); it does not support CANopen, yet.

Resistant against shock and vibration

In 2020, Turck had presented its first radar sensors for level measurement with the LRS series, followed by the DR-M30 radar sensors for distance measurement in 2021. Both device series operate in the 120-GHz range. Now, the company has launched the MR15-Q80 radar sensor as the third member of its radar portfolio. The shape of the housing alone shows that a new device type has been added to the product range. Unlike the cylindrical devices for distances and levels, the MR15-Q80 has a flat, cuboid design. The technology is also different: A 60 GHz multi-antenna radar chip operates inside the IP69K-rated housing. Compared to the 120-GHz single-antenna chip, this offers the advantage that the actual object position is analyzed and not just the distance value. In addition, the antenna pattern and the 4-GHz bandwidth led to further properties such as a larger and fully adjustable field of view. The radar scanner detects objects with an opening angle of 120 degrees horizontally and 100 degrees vertically.

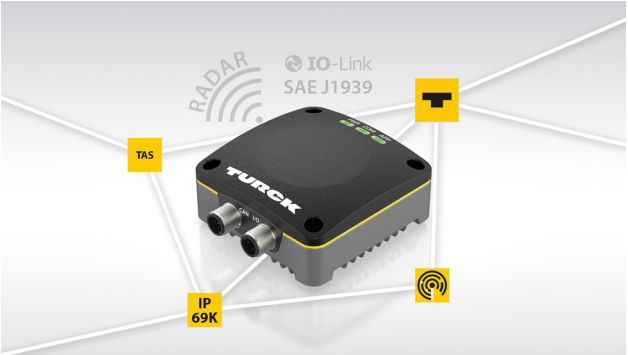

Figure 2: MR15-Q80 radar scanner is available with J1939 interface (Source: Turck)

The sensor achieves a range of up to 15 m, although this maximum value can also be reduced depending on the material, angle, and surface properties of the objects. However, users do not have to worry about a lack of range as the target applications are primarily object detection and collision avoidance. Foreign objects in the field can be detected better by radar than by alternative technologies. Lidar sensors, for example, require movable mirrors to direct the laser beams into every corner of the area to be scanned. This means, they cannot withstand shocks and impacts of up to 100 g. Additionally, radars are not sensitive to interference factors such as dust, fog, or light reflections. Besides its resistance to severe shocks, the radar scanner can also withstand supply voltages of 12 V or 24 V.

According to the supplier, the radar scanner is suitable for collision avoidance and object detection for non-safety related tasks. It detects objects in its surroundings and outputs measured values for three dimensions. A typical application is animal and object detection in harvesters and other mobile equipment applications. Due to the different reflective properties of animals or objects and grain stalks, the sensor can detect foreign objects that would either get damaged themselves or could damage the threshing unit.

In heavy-duty vehicle applications and on construction sites, mobile equipment requires to prevent collisions with other vehicles, buildings, animals, or objects. The MR15-Q80 provides distance and speed values for objects on all three spatial axes. This means that the surroundings and all the objects in them can be depicted. Mobile machines in particular with arms or booms at different heights receive valuable additional information about the surroundings. Due to the 3D information, the control system not only knows where an obstacle begins, but also where it ends and where the machine can operate with its arms. There are many other application areas where precise knowledge of the space in front of machines can be helpful, for example when recording topography and rocky outcrops in mining.

Another possible application on mobile equipment is blind-spot warning. Other application possibilities include intralogistics. Industrial trucks and AGVs could use the radar scanners to navigate and avoid collisions. Lidar scanners are normally used for safety-related environment monitoring. However, they are only suitable for the vertical monitoring of lift paths on autonomous forklift trucks to a limited extent, as they usually detect a small vertical opening angle. Special safety radars and scanners would also be oversized and therefore too expensive for the non-safety relevant function of height control. The 3D radar sensor can scan the height of obstacles and surroundings. This data can be used to control lifting movements, ensuring clearance heights and preventing damage to vehicles, goods, and plant elements. Camera systems are often used for these tasks, but they are more expensive and usually much more complex to set up.

Parametrization tool

The parameterization of radar scanners, which output more than just an analog signal or one or two switching signals, is often a challenge. The supplier supports customers with its TAS (Turck Automation Suite) configuration and IIoT (industrial Internet of things) software. The toolkit enables the optimization of setting signals and filters. The software visualizes raw data from the sensor in real-time in the web browser. Objects are displayed as points and point clouds on two graphs, one for the vertical data and one for the horizontal detection angles. ◀

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60-GHz radar sensor

D3 Embedded (U. S. A.) has developed the RS-6843AOPC radar sensor providing a CAN interface. It is equipped with an mmWave radar chip by Texas Instruments. The product comes in a 2,54-mm cube enclosure. The company offers development services to integrate the radar sensors into mobile machines and vehicles.

The radar sensor comes with an integrated CAN interface (Source: D3 Embedded)