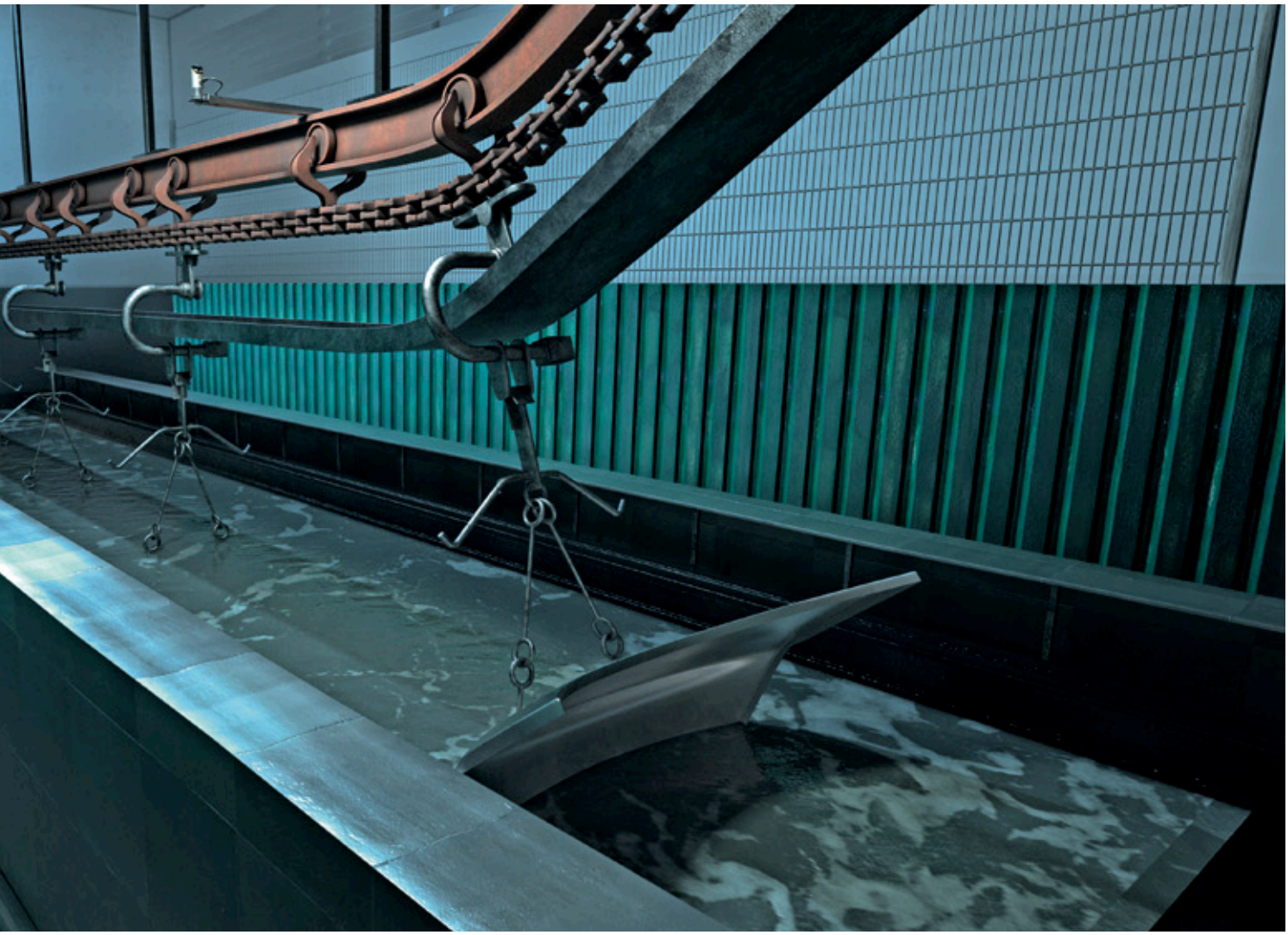
The Perfect Wave

Turck radar sensors for level and distance measurement bring the benefits of the technology to factory and logistics automation – including visualization with the Turck Radar Monitor

Most people associate radar technology with speed radar traps on the road. In the past decade, the technology has increasingly found use in the car itself. Adaptive cruise control systems, so-called ACC systems, use radars to determine the distance to vehicles in front and their speed.

For a long time, radars have been rather exotic devices in industrial automation. The process industry, on the other hand, has been using this technology for level measurement for some time. Since radars reliably detect levels even over long distances without media contact, they have clear advantages over ultrasonic, optical sensor or media-contacting technologies in many applications. In manufacturing automation,

The LRS+ radar level sensor shares many of its positive features with the other members of the Fluid+ sensor series. The alphanumeric bicolor display with capacitive buttons simplifies operation and commissioning of the sensors



Radar sensors are ideal for wear-free, non-contact level measurement in dip coating baths, interference signals such as from hooks and linkages can be suppressed

radars were for a long time mostly reserved for safety sensors to detect protective fields, for example on AGVs.

With the LRS+ level radar from the Fluid+ series, Turck launched its first in-house radar sensor on the market in 2021. The IO-Link-capable radar sensors were developed for level measurement in the range from 0.35 to 10 meters. The devices with IP67/69K protection are therefore suitable for longer ranges and offer more detailed options for suppressing interference signals than the LUS+ ultrasonic level sensor, which is also based on the Fluid+ sensor platform.

QUICK READ

Whether for dip coating basins or container ports – radar technology offers clear benefits over alternative solutions using ultrasonic or optical sensor technology in many application fields. However, radar sensors have rarely been used to date for distance or level measurements in production and logistics. With its LRS+ and DR-M30 radar sensors, Turck now offers efficient solutions for demanding applications in these areas as well. The browser-based Turck Radar Monitor visualizes the signal curve for the precise adjustment of measuring ranges and sets new standards here.

Additional data simplifies condition monitoring

A characteristic feature of the Fluid+ platform is the operating unit with capacitive touchpads and translucent front cap, via which the LRS+ displays distance, level and volume values. The absence of a metal guide probe enables the sensor to be used easily in hygiene applications and simplifies commissioning. LRS sensors are available either with two switching outputs or with one switching output and one analog output. Thanks to their additional IO-Link interface and intelligent, decentralized signal processing, all variants also offer a large quantity of additional information for processing in condition monitoring applications in IIoT: besides signal strength, this includes temperature values, operating hours or switching cycles.

Radar Monitor visualizes the signal curve

The Turck Radar Monitor is a browser-based configuration tool which displays the signal curve of the radar

The browser-based Turck Radar Monitor enables the user to intuitively adjust the radar sensors and specifically mask out sources of interference

and provides plain text access to all relevant parameters as well as offering many other functions. These kinds of detailed analysis functions were previously reserved for high-end radar sensors used in the process industry. With the Radar Monitor and in particular the visualized signal curve, Turck also makes it easier for its customers to set up in factory automation. This makes it possible for example to mask out the interference signal of an agitator or grid, or to perfectly align with the real-time feedback of the sensor in order to maximize the reliability of level measurement in challenging applications.

Application: level measurement in the dip coating line

One application in which the advantages of radar-based level measurement come into their own is the measurement of the level in dip coating lines. This is used for coating car body parts by means of cathodic dip painting (KTL) – also called cataphoresis. This uses an electric field to help even workpieces with complex structures to achieve a uniform, durable surface coating.

In order to completely and safely immerse the workpiece attached to a conveyor belt in the coating medium, users need several items of information. On the one hand, it must be ensured that the conveyor belt is mounted at the correct height. At the same time, the correct level of the coating medium in the basin must be ensured. The high electric currents used in the coating process present another challenge. Since immersion sensors can only be used to a limited extent in the cataphoresis process due to the high currents, users usually measure the levels without contact. However, the conveyor linkage and other structures between the level sensor and the immersion bath can cause undesired signals and incorrect measurements of the immersion bath level.

The Turck Radar Monitor helps the user to suppress interference signals from metal carriers or the car body itself. The graph of the signal curve clearly shows a large peak emitted by the main target, the immersion bath, as well as smaller peaks caused, for example, by the transport hooks on which the body parts are pulled through the immersion bath. These interference pulses can easily be masked out by defining the specific measuring window.

The easiest way to access the Turck Radar Monitor is via Turck's IO-Link master. This allows the Radar Monitor to be accessed via the IODD Configurator without the need for additional software. The IODD of the radar sensors is downloaded automatically by the Turck IO-Link masters.

The alphanumeric bicolor display, which the sensor shares with the other Fluid+ series members, is another helpful feature of the LRS+ radar level sensors. A color change of the display from green to red can be parameterized to improve the visibility of critical levels. This means that every employee in the field can see directly, even from a distance, when critical levels are reached.

DR radar sensor for distance measurements in outdoor areas

After the development of the level radar sensor, the obvious next step was to adapt the technology for applications where a display and an operating menu on the sensor are not required, i.e. for distance measurements. Turck has thus now introduced the DR-M30-IOL distance radar sensor. With ranges from 0.35 to 15 meters, a stainless steel housing and shock resistance up to 100 g, it is also designed for use in extreme environmental conditions. The 122 GHz radio frequency of the FMCW radar as well as the IO-Link interface and IP67/IP69K protection type are features the sensor has in common with the LRS, its technology counterpart for level measurement.

The properties not only allow use in harsh applications in factory automation, but also in mobile or outdoor applications. This makes the sensors ideal for distance measurement in port logistics, for example, where optical or ultrasonic sensors are often ruled out due to their limited range or interference from dust, wind or light.

As with the level radar, the Turck Radar Monitor also simplifies the setup of the distance radar devices by means of the real-time display of the signal curve – especially when setting filters to suppress interfering signals or in complicated mounting situations. The IO-Link device parameters can also alternatively be set via an IODD interpreter such as Pactware. When mounted in direct proximity to each other, the FMCW measuring principle of the devices prevents any mutual interference between the signals. In addition to IO-Link, all DR-M30-IOL sensors have one analog and one switching output, and the analog output can also be configured as a second switching output.

Application: distance measurement on container gantry cranes in port logistics

This can be useful in industries such as port logistics, for example. In this sector, the sensors are ideal for distance measurement on container gantry cranes. The grippers used to transfer ISO containers from ships to

trucks or rail wagons are picked up by so-called spreaders. The distance between the spreader and the container must be continuously measured to prevent collisions and to control the speed. The DR-M30-IOL can withstand harsh, salty coastal air thanks to its stainless steel housing. And since things often get rough in port logistics, the 100 g shock resistance is particularly worthwhile in the application.

The spreaders target the container at close range with so-called flippers. These mechanical feeding guides ensure that the container can be docked precisely to the last few centimeters so that the spreader can reliably grip the lifting eyes. The dimensions of the container, however, are widened by the opened flippers. The plant controller must calculate this information with the distance signal of the sensors in order to also prevent collisions in narrow container bays. The distance sensor is also ideal for measuring the distance between the individual container gantries.

Variants with alternative lens configurations for longer distances

In addition to the DR-M30 now presented with a standard lens, Turck will add variants with alternative lens configurations in the coming months:
A sensor version with a long and narrow detection field is ideal for greater distances of up to 20 meters, as is also required in port facilities. Another lens configuration enables a wide field with a short range, as used for example for object detection in collision protection.

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IIoT ready: Turck's innovative radar distance sensors such as the DR-M30-IOL collect large amounts of data, but process it directly and only pass on the relevant data