# Accepting challenges.
# Experiencing reliability.
# Reinterpreting innovation.

Product Overview
LiDAR Sensors




Your automation, our passion.

PEPPERL+FUCHS

LiDAR Sensors

# Innovative Sensor Solutions for Maximum Performance

Pepperl+Fuchs draws on decades of experience and in-depth technical know-how to consistently drive forward innovative ideas. LiDAR sensors with Pulse Ranging Technology (PRT) follow this tradition—they stand out with highly precise and reliable measurement results. The company's systematic approach to developing these sensors ensures that new and even more powerful sensor solutions will be available in the future.

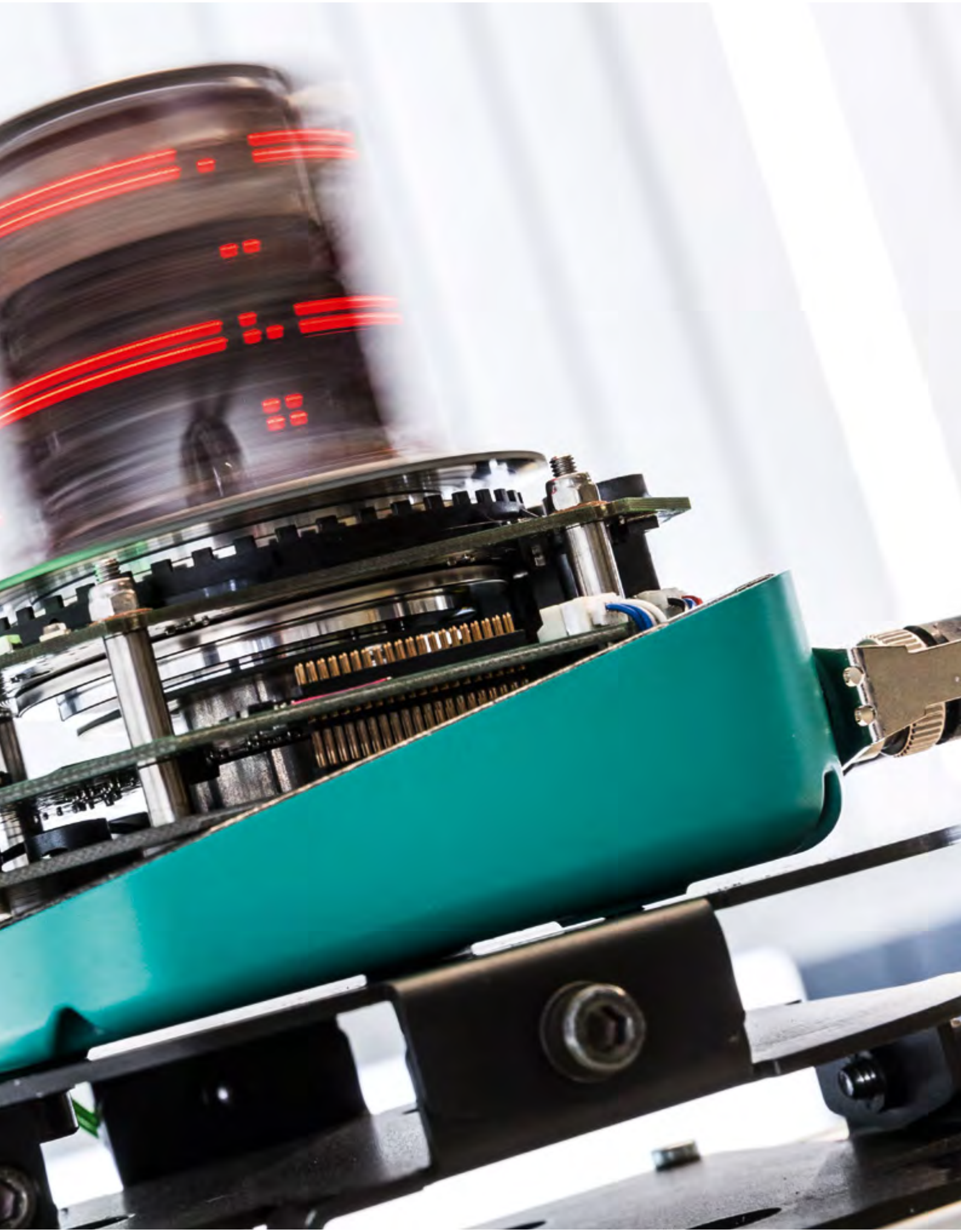


### One Critical Step Ahead

The portfolio of LiDAR sensors from Pepperl+Fuchs offers exactly the right solution for every application, from basic requirements to high-end applications. The R2000 is a 2-D laser scanner that impresses with 360° performance and unmatched precision. The R2300 is a 3-D laser scanner that combines four scanning layers in a single sensor, delivering more information and more reliable measurement results. The R2100 is a durable multi-ray LED scanner that is extremely cost-effective, making it the perfect choice for straightforward and reliable object detection.

### Superior Technology: PRT for Precise and Reliable Measurement Results

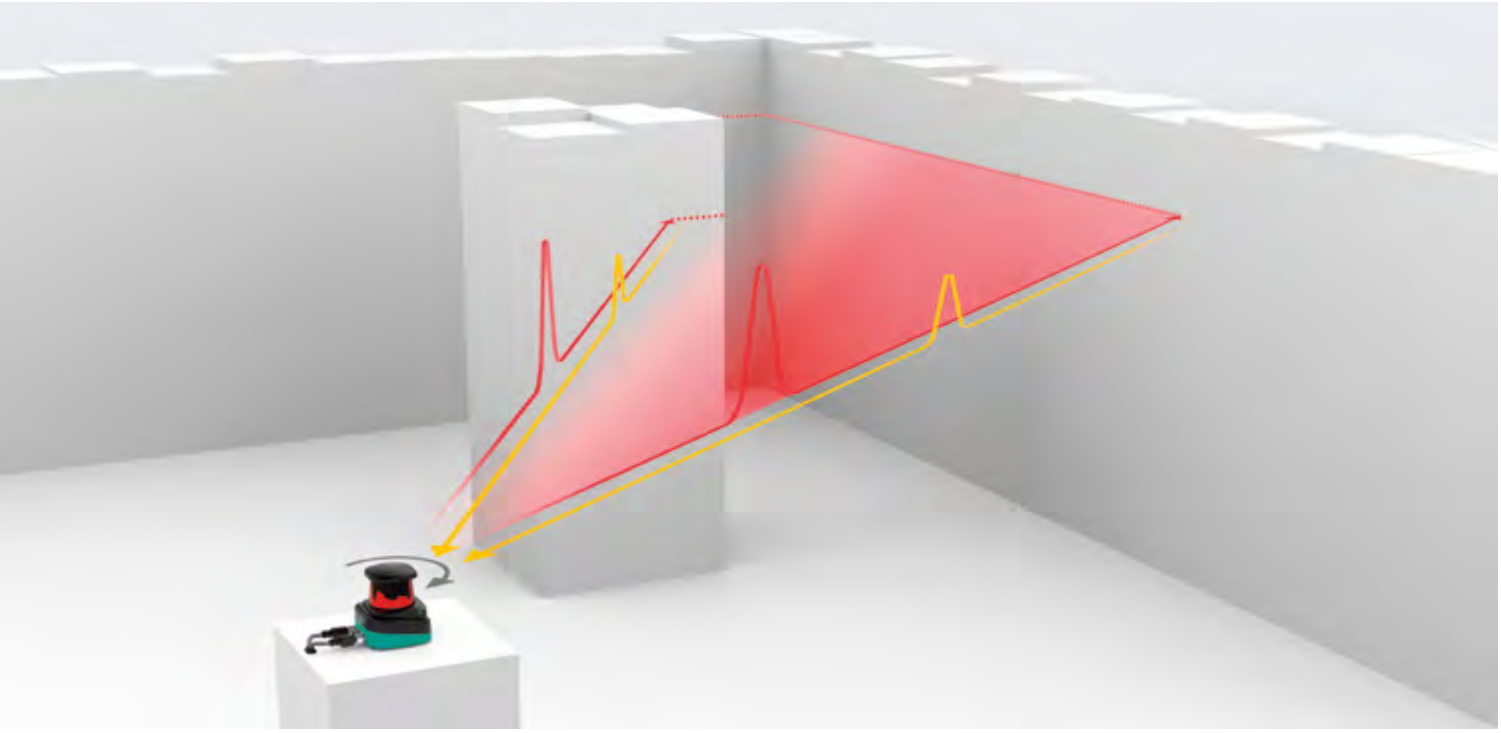
By developing Pulse Ranging Technology (PRT), Pepperl+Fuchs has incorporated direct time-of-flight measurement technology into products that are available for commercial and industrial use. This means that the precise and highly reliable technology can be scaled to meet a wide range of requirements. PRT makes it possible to measure distances ranging from a few centimeters to several hundred meters with absolute precision and reliability, even in challenging conditions.



Pulse Ranging Technology

# Intelligent Technology for a High Level of Precision

Pulse Ranging Technology (PRT) was specially developed by Pepperl+Fuchs for highly precise distance measurement. It can measure distances ranging from a few centimeters to several hundred meters with the utmost precision.



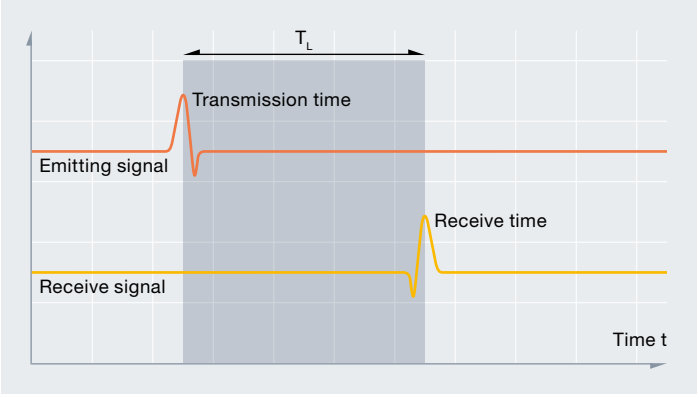
## High-Energy Pulses Instead of a Continuous Beam of Light

Pulse Ranging Technology uses a powerful light source to emit short pulses of light. These pulses are reflected off the target object and detected with a high level of accuracy by a light-sensitive receiver. The exact distance to the target object is then calculated on the basis of the recorded values and the speed of light.

The energy content of a light pulse is considerably higher than that of sensors using indirect measuring methods and constant light sources. In contrast to triangulation, the measuring range of PRT is not limited by the geometrical layout of the optics. Even in relatively small housings, PRT sensors can still provide significantly larger measuring ranges and meet high requirements in terms of the quality of measured values.

## Pinpoint Precision, Even over Long Distances

One of the reasons why Pulse Ranging Technology has been so successful is the extremely high energy density of the light pulses. This not only makes it possible to achieve higher detection ranges, but also effectively suppresses interference from extraneous light and different object properties. By directly measuring the transit time of these light pulses, PRT sensors deliver highly precise and reliable measurement results.



### All-Round Visibility: The R2000

The scanner's 360° measuring angle allows for all-round visibility. The 2-D laser scanner offers best-in-class angular resolution and an interactive display for easy-to-see status information. The basic settings can be configured directly on the device. Operating and diagnostic information can also be viewed during operation.

### Precision on Four Levels: The R2300

The R2300 multi-layer scanner combines four scanning layers into a single 3-D LiDAR sensor, providing significantly more measurement information about the sensing range. It reliably detects even the smallest object structures and contours. The integrated pilot laser can be switched on for simple alignment and commissioning. Solid-state electronics make the device especially durable.

### An Economical and Durable Solution: The R2100

The R2100 has a solid-state design, which provides extra durability. This multi-ray LED scanner from Pepperl+Fuchs is also cost-effective. The device carries out 2-D measurements over 11 single beams for absolutely reliable measurement results. Multiple wide-beam emitters ensure reliable object detection regardless of surface texture.

**Typical PRT Applications**

- Medium to very large detection ranges, fluctuating ambient conditions
- Parallel operation of several neighboring sensors
- Precise object detection and positioning
- Reliable navigation support and collision avoidance




Multi-ray LED scanner R2100, 2-D laser scanner R2000 and multi-layer scanner R2300.

# R2000 UHD/HD

# High Level of Precision for Demanding Applications




## Accurate Detection of Even the Smallest Objects

The combination of unique features is what makes the R2000 really stand out. A precise light spot combined with high angular resolution makes it possible to detect objects with a length as small as one millimeter. This guarantees absolutely reliable object detection and clear measurement results, even under extremely challenging ambient conditions. The 360° measuring angle ensures all-round visibility at all times.

## Highlights

- R2000 HD/UHD: Output of highly precise measurement data
- Sharp light spot for small-object detection and precise edge detection
- All-round visibility with 360° measuring angle
- Compact design for simple mechanical integration
- Interactive, wraparound LED display provides easy-to-see status information

| Technical data | R2000 UHD (Ultra High Density) | R2000 HD (High Density) |
|---|---|---|
| **Order code** | OMD10M-R2000-B23-V1V1D<br>OMD30M-R2000-B23-V1V1D-1L<br>OMD60M-R2000-B23-V1V1D-1L | OMD30M-R2000-B23-V1V1D-HD-1L |
| **Measuring range** | 10 m to object/60 m to reflector (OMD10M)<br>30 m to object/200 m to reflector (OMD30M)<br>60 m to object/200 m to reflector (OMD60M) | 30 m to object/<br>30 m to reflector |
| **Scanning angle** | 360° | |
| **Repeatability** | < 12 mm | |
| **Resolution** | 1 mm | |
| **Light type** | Red light, laser infrared light | Laser infrared light |
| **Angle resolution** | ≥ 0.014° | ≥ 0.043° |
| **Measuring rate** | Up to 250,000 measurements/s | Up to 84,000 measurements/s |
| **Interface** | Ethernet TCP/IP, UDP, 100 Mbit/s | |
| **Data output** | Distance/angle/echo/time stamp | |
| **Laser class** | 1 | |



Measuring range
60 m




Scanning angle

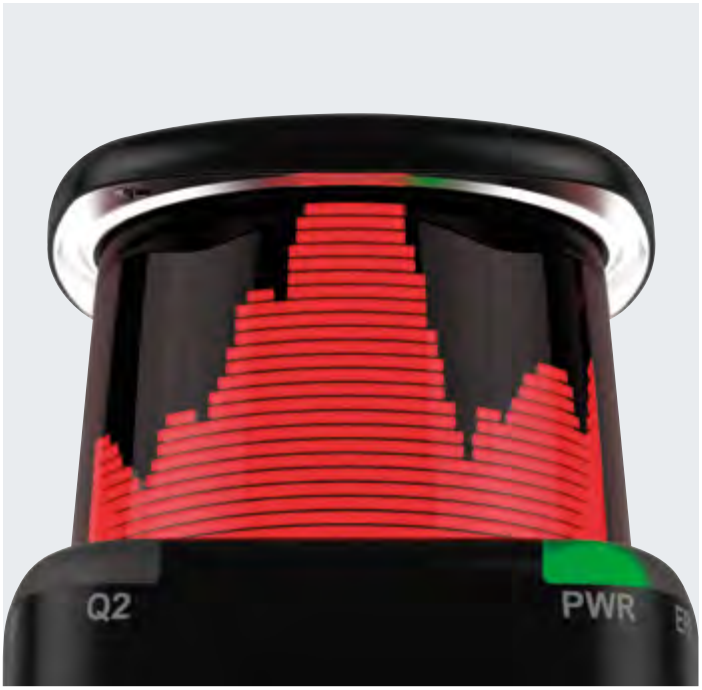


Interactive,
all-around display



Detection of very
small objects

For more information, visit:
**www.pepperl-fuchs.com/pf-r2000**




R2000 HD and UHD display




Easy-access controls

## Precise Object Detection with a 360° Measuring Angle

The R2000 features a 360° measuring angle for all-round visibility. The interactive all-round display provides text and graphical information. Basic settings can be configured directly on the device via easy-to-access controls. These controls also make it possible to view diagnostic information during operation. This includes messages about the pollution degree of the lens, so the user can intervene before a fault occurs.

## Extremely High Sampling Rate, High Degree of Angular Resolution, Large Detection Range

The R2000 combines extreme speed with a market-leading angular resolution of 0.014°. The high sampling rates of 3,000 revolutions per minute and 250,000 individual measurements per second guarantee the highest possible performance. Switchable filters can be used to adjust the measured value output easily and quickly to the relevant application. In addition to providing precise distance and angle measurements, the R2000 can differentiate between natural objects and reflectors. An accurate time stamp in the measurement data allows precise integration into dynamic measurement tasks.

# R2000 UHD/HD

# Intelligent Solution for Highly Complex Tasks

The strengths of the R2000 UHD/HD come into play whenever peak performance is required. In robotics applications, for example, the combination of a precise light spot and a high measuring rate makes it possible to detect even the finest contours and structures in real time.

### Perfect Navigation with No Collisions

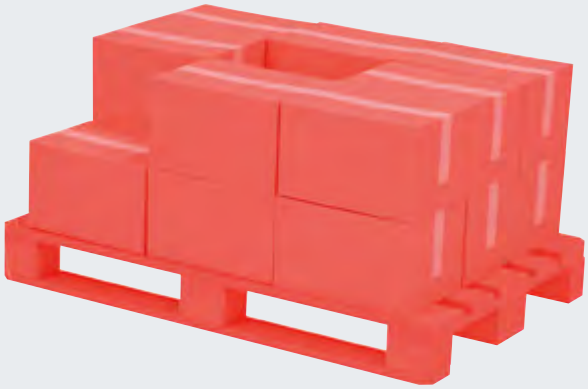
Logistics companies use driverless transport vehicles to make their processes as efficient as possible. These vehicles drive up to continuous conveyors autonomously and receive pallets, for example. The 360° measuring angle of the R2000 means that it meets one of the key requirements for navigation applications of this kind. The precise light spot and angle resolution of 0.014° guarantee reliable localization of other vehicles and objects.

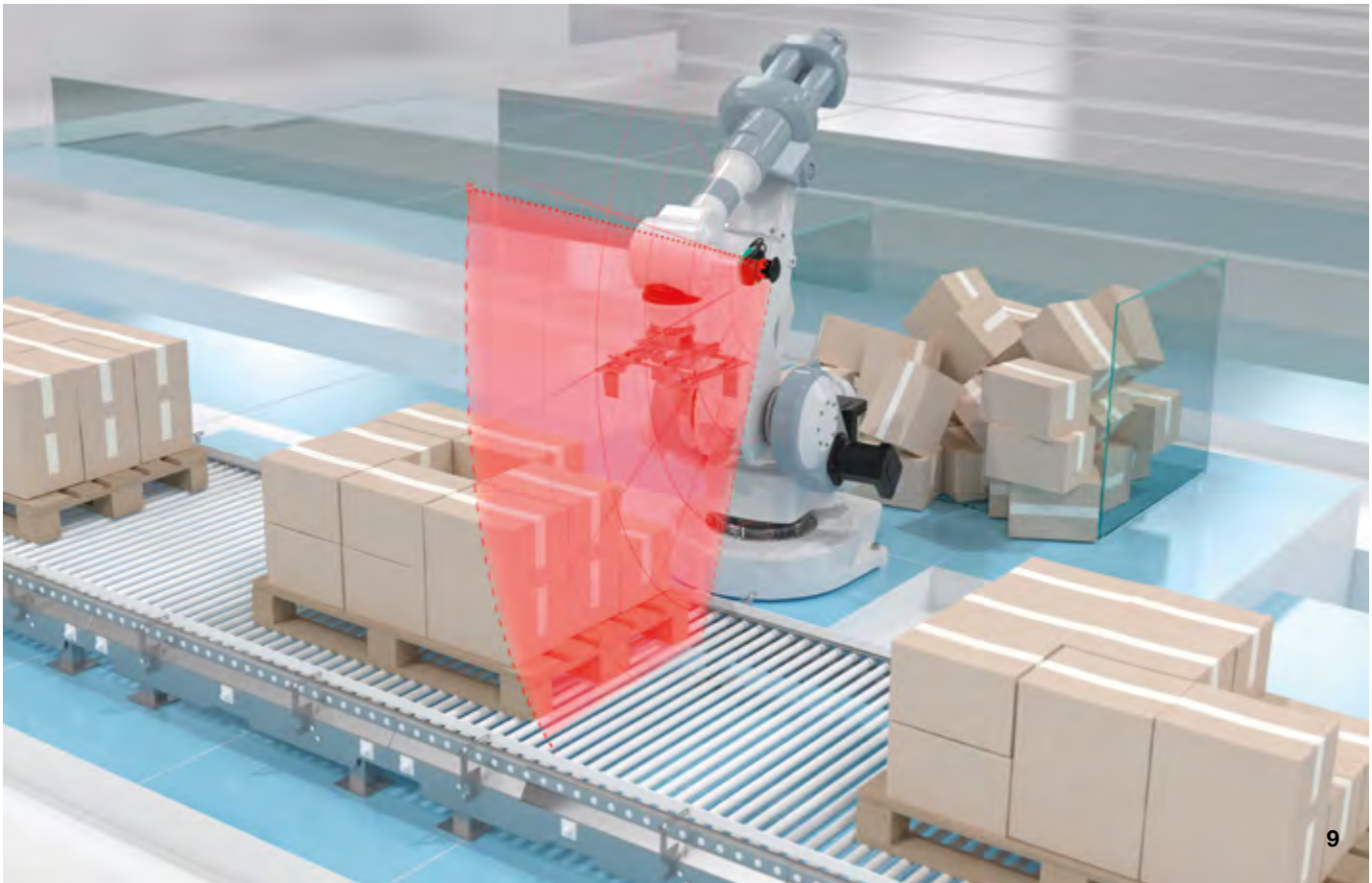
The precise measuring spot ensures that even the smallest objects are detected so that collisions can be avoided. A range of different evaluation modes also offers maximum flexibility, allowing optimal adjustment to individual application requirements.



## Accurate Contour Measurements for Robotic Applications

In the field of warehousing and material handling, robots are used with horizontal conveyors to accurately place packages in gaps on passing pallets. When attached to a robot's arm, the R2000 can provide the data required for precise position calculations. This makes it possible to detect empty spaces into which boxes can be inserted. The precise light spot and high measuring rate ensure that even the finest contours and structures are detected in real time.





# R2000 Detection

# The All-Rounder for Demanding Monitoring and Detection Tasks




## Ideal for the Smallest Objects and Dynamic Applications

The R2000 Detection boasts a simple operating concept, a highly stable scanning axis, and best-in-class angular resolution. It is ideal for tasks such as gap control and empty storage-bay detection. The devices have four freely configurable detection fields and are available in infrared light (OBD30M) or red light (OBD10M) versions upon request. Both versions allow reliable natural-object monitoring at a range of up to 30 meters.

## Highlights

- R2000 Detection: Switching sensor for field monitoring
- A stable, wobble-free scanning axis guarantees precise monitoring of the scan surface
- Highest degree of angular resolution of any digital I/O scanner on the market—0.071°—ensuring detection of extremely small objects
- Easy to operate with four freely configurable detection fields
- Available with a visible red laser or infrared laser

| Technical data | R2000 Detection |
|---|---|
| **Order code** | OBD10M-R2000-4EP-V1V17<br>OBD30M-R2000-4EP-V1V17-1L |
| **Measuring range** | 10 m to object/30 m to reflector (OBD10M)<br>30 m to object/30 m to reflector (OBD30M) |
| **Scanning angle** | 360° |
| **Min. object width** | < 12 mm |
| **Angle resolution** | ≥ 1 mm |
| **Repeatability** | ≥ 0.071° |
| **Number of switch fields** | 4 freely programmable fields |
| **Signal output** | 4 switching inputs/outputs (selectable) |
| **Parameterization** | R2000 DTM for integration into PACTware |
| **Laser class** | 1 |



Measuring range
30 m




Scanning angle



Interactive,
all-around display



Configurable
detection fields

For more information, visit:
www.pepperl-fuchs.com/pf-r2000d




R2000 Detection display



Configuration of up to four detection fields

## Highly Flexible and Adjustable Monitoring Fields

The stable, wobble-free scanning axis of the R2000 Detection guarantees precise and reliable monitoring of the scan surface. The device has four detection fields that can be configured easily and intuitively via DTM. This makes the scanner the ideal choice for detecting gaps and protruding parts. Fields and inputs are linked logically to the outputs and make configuration very simple and user-friendly. Parameterization of field evaluation guarantees rugged object detection, even under the most challenging ambient conditions and in the event of eavy pollution. The R2000's field evaluation feature also ensures that large and small objects can be reliably distinguished.

## All-Round Visibility

The R2000 Detection is a 2-D laser scanner that stands out because it pairs a high level of performance with an extra compact design. The device offers 360° all-round visibility and best-in-class angular resolution. The R2000 Detection features not only a short reaction time, but also an extremely high degree of resolution of 0.071 degrees. When combined with the precise light spot, this resolution allows even the smallest of objects to be detected.

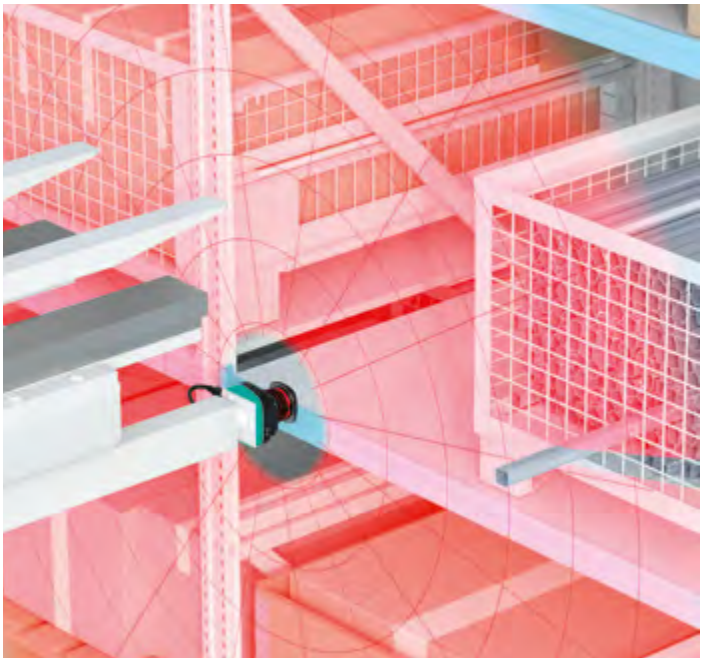
R2000 Detection

# Zero Collisions, Even at Top Speed

Sensors are used to prevent collisions in many areas from automotive manufacturing to warehousing and logistics. The R2000 Detection LiDAR sensor is the ideal choice for precisely these tasks. Its four detection fields can be precisely defined so that they can detect even the smallest objects at any time and with absolute reliability.

### Reliable Gap Control in High-Bay Warehouses

Automated storage and retrieval systems are used to transport goods at high speeds in modern high-bay warehouses. Even a minor collision can bring the whole plant to a stop, significantly increasing process costs. R2000 Detection LiDAR sensors can be attached to an automated storage and retrieval system or even to the rack itself, making it possible to detect even the smallest objects due to a high degree of angular resolution of up to 0.071 degrees. Potential hazards can be detected early on, thus allowing collisions to be reliably avoided.





## Accurate Small-Parts Detection in Automotive Production

A typical vehicle assembly process involves car bodies moving along a production line. It is vital to ensure that they can pass through each assembly step without errors to avoid faults or downtime in the course of the production process. Every part that finds its way onto the travel path, no matter how small, must therefore be detected reliably. R2000 LiDAR sensors monitor the underside of the vehicle so the production line can be stopped as soon as an object is detected below the body.



## Other Typical Applications

- Overhang monitoring
- Empty storage-bay detection
- Collision avoidance for AGVs and self-navigating platforms



R2300

# Reliable and Highly Efficient with Multiple Layers



## Robust Construction and Precise Measurements

The R2300 multi-layer scanner provides the user with significantly more scanning information than single-layer devices, thus ensuring a far more reliable detection result for the sensing range. Solid-state electronics make the sensor especially durable. The use of PRT technology guarantees highly precise and reliable measurements, regardless of the ambient and object conditions. Using only one multi-layer scanner instead of several sensors reduces acquisition, wiring, and integration costs.

## Highlights

- Cost-effective and versatile multi-layer LiDAR sensor for object perception in 3-D space
- High sampling rate and measurement density—ideal for positioning, object classification, and navigation-support tasks
- Simplified installation and commissioning with integrated pilot laser
- Solid-state electronics increase durability, efficiency, and longevity

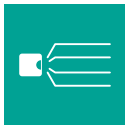
| Technical data | R2300 |
|---|---|
| **Order code** | OMD10M-R2300-B23-V1V1D-4S |
| **Measuring range** | 10 m to white (90 %)<br>4 m to black (10 %) |
| **Scanning angle** | 100° |
| **Repeatability** | 12 mm |
| **Resolution** | 1 mm |
| **Light type** | Measuring laser: infrared (laser class 1)<br>Alignment laser: red (laser class 1) |
| **Angle resolution** | 0.1° |
| **Measuring rate** | Up to 4,000 pixels per scan |
| **Interface** | Ethernet UDP 100 Mbit/s |



Measuring range 10 m




Scanning angle



4 scanning layers



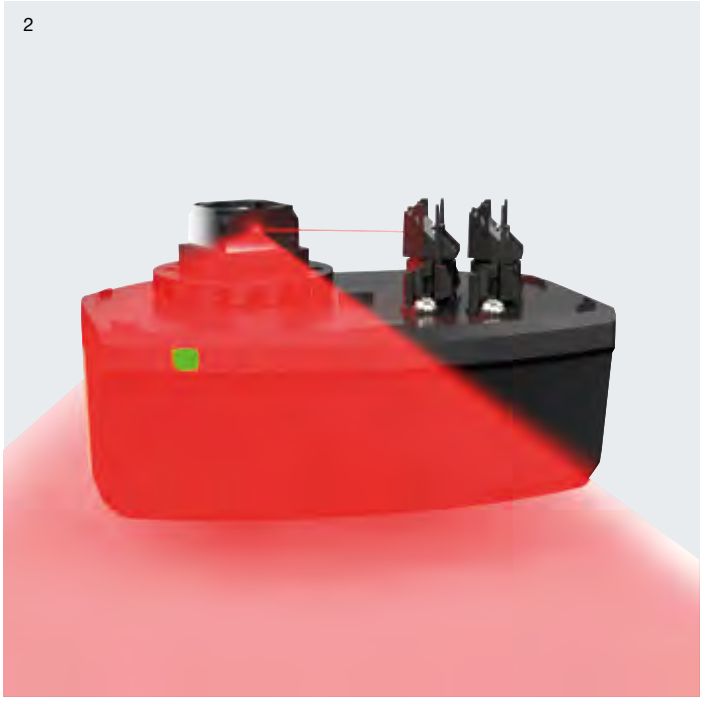
Pilot laser

For more information, visit:
www.pepperl-fuchs.com/pf-r2300

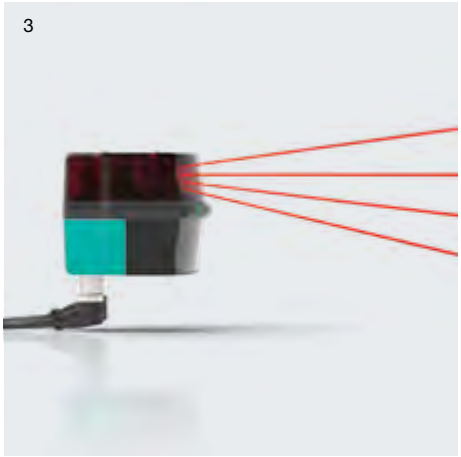
1



2



3



1: separation of emitter and receiver
2: rotating mirror
3: measurements on four scanning layers

## Easy Commissioning and Low Level of Interference

With the exception of the rotating mirror, the R2300 has entirely solid-state electronics. This makes the sensor resistant to impact and vibration and reduces its susceptibility to interference. An integrated pilot laser can be switched on to allow users to simply align and commission the R2300 without additional tools.

## Large Field of View and Sophisticated Mechanical Concept

The R2300 multi-layer scanner combines a very high degree of angular resolution of 0.1°, a high sampling rate, and a precise light spot. This ensures precise and reliable detection of the smallest object structures and contours. The scanner delivers both flexibility and a high level of accuracy when it is used in the field. Mechanical separation of the emitter and the receiver prevents optical short circuits. This results in cleaning intervals that are much longer than for other devices in this class, and significantly reduced downtimes. The extremely compact design of the R2300 means that it can be used in the smallest spaces, for example in automated transport systems.

R2300

# A Perfect View of Every Layer

Many applications require different layers to be detected simultaneously. This is where the R2300 from Pepperl+Fuchs really comes into its own. This 3-D LiDAR sensor can be trusted to keep an eye on everything, including the end of a conveyor belt, the location of a pallet, and the position of a load.

### Reliable Navigation of AGVs

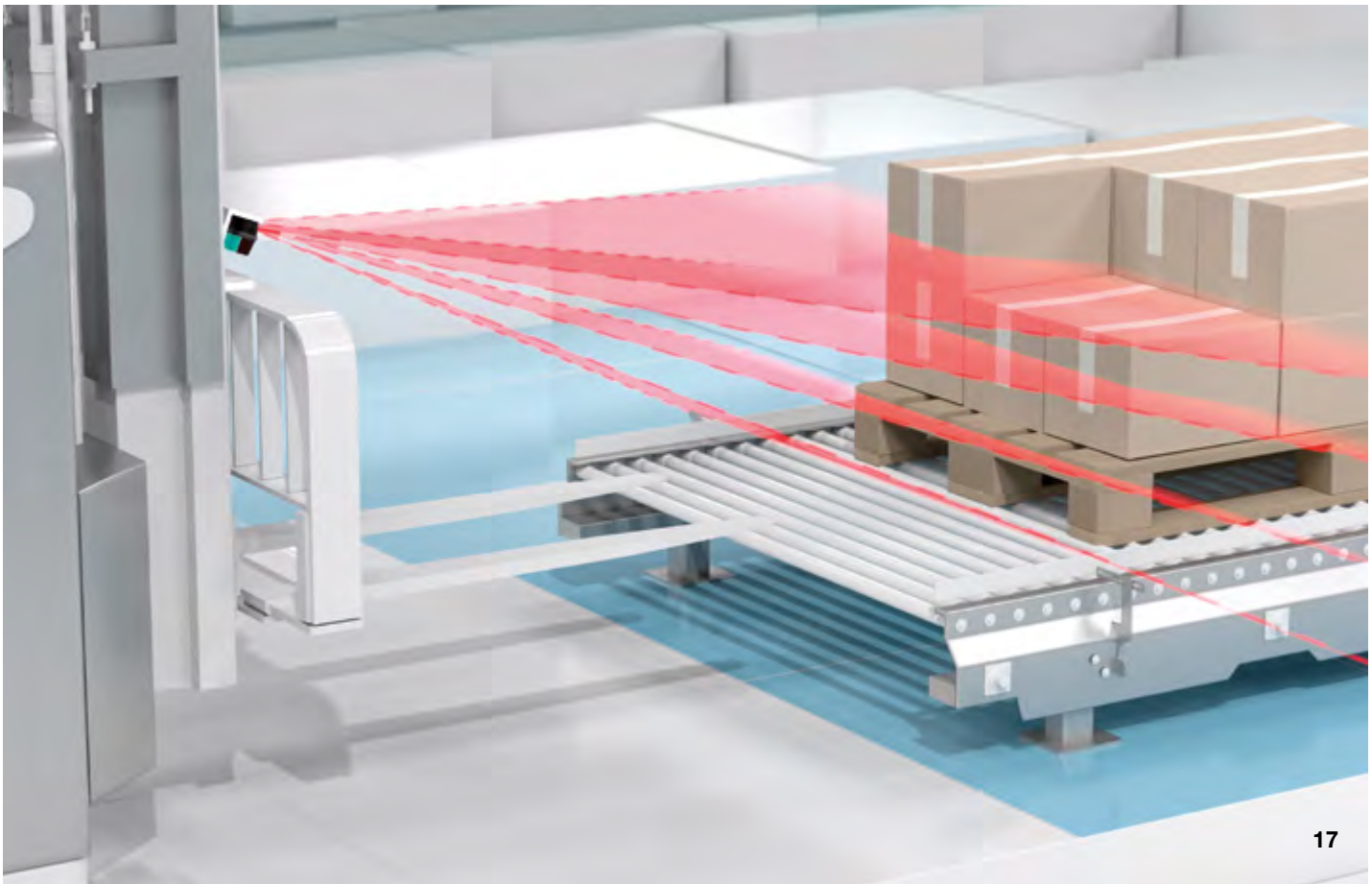
The warehousing and logistics sector often uses automated guided vehicles (AGVs), which drive under racks and lift them up before transporting them (and their contents) to the specified destination. The R2300 3-D LiDAR sensor can be used in such cases to supply the data needed to avoid collisions and navigate the AGVs reliably. Outstanding measurement accuracy and area detection guarantee absolutely reliable transport. The compact design of the housing makes the scanner the ideal choice given the small amount of space available in these vehicles.





## Precise Positioning at Transfer Stations

Many systems in the warehousing and logistics sector use transfer stations. AGVs might collect pallets at the end of a belt, for example. Mounted on the vehicle, the R2300 supplies accurate information on the location and position of the load and ensures optimal positioning of the vehicle. The use of four scanning layers guarantees reliability and significantly increases process reliability at transfer stations.



R2100

# Top Performance with the Highest Level of Efficiency



## Innovative Technologies for Reliable Measurement Results

The R2100 two-dimensional multi-ray LED scanner is the perfect combination of Pulse Ranging Technology (PRT) and multi-channel measurement. Multiple LED emitters that are arranged side by side evaluate a 2-D area within an 88-degree zone. This ensures that the scanner supplies absolutely reliable and stable measurement results, regardless of the ambient conditions. As a result, the R2100 is the perfect choice for applications in the fields of mobile equipment, intralogistics, and machine and plant engineering.

## Highlights

- Ultra-IR LEDs guarantee powerful performance and a long lifetime
- No moving parts for added durability
- 2-D measurement with multi-ray scan
- Not harmful to the eyes thanks to LEDs
- Multiple wide-beam emitters ensure reliable object detection regardless of surface texture

| Technical data | R2100 |
|---|---|
| **Order code** (Interface/Protocol) | OMD8000-R2100-R2-2V15 (RS232/serial)<br>OMD8000-R2100-B16-2V15 (CAN/CANopen) |
| **Measuring range** | 0.2 ... 8 m |
| **Light type** | 88° |
| **Scan rate** | 1 mm |
| **Scanning angle** | Infrared LEDs, modulated light, 850 nm |
| **Resolution** | 50 s–1 (1 scan = 11 measurements) |
| **Operating voltage** | 10 ... 30 V DC |
| **No-load current** | ≤ 120 mA/24 V DC |
| **Protection type** | IP67 |
| **Ambient temperature** | –30 ... 50 °C (–22 ... 122 °F) |
| **Dimensions (L x W x H)** | 157 × 81 × 45 mm |



Measuring range
8 m




Scanning angle







For more information, visit:
www.pepperl-fuchs.com/pf-r2100









1: ultraflat housing
2: separation of emitter and receiver
3: multi-channel measurement

## Extremely Robust and Highly Efficient

The R2100's emitter elements are arranged side by side to evaluate a 2-D area within an 88-degree zone, enabling multi-channel measurement. Unlike other 2-D laser scanners, the device features a solid-state design. This makes the R2100 extremely robust and an ideal choice for mechanically demanding applications. The scanner's energy consumption is also extremely low, making it a particularly economical solution.

## Minimum Response Times for Quick Processes

The intelligent sensor electronics of the R2100 provide fast response times, ensuring precise detection and quick processing speeds. The LED measuring system is not harmful to the eyes, provides optimal protection for operating personnel, and can be used in all work areas without posing a hazard. The device also features optical channel separation, which significantly increases its pollution tolerance. This delays cleaning intervals, which in turn significantly reduces downtime.

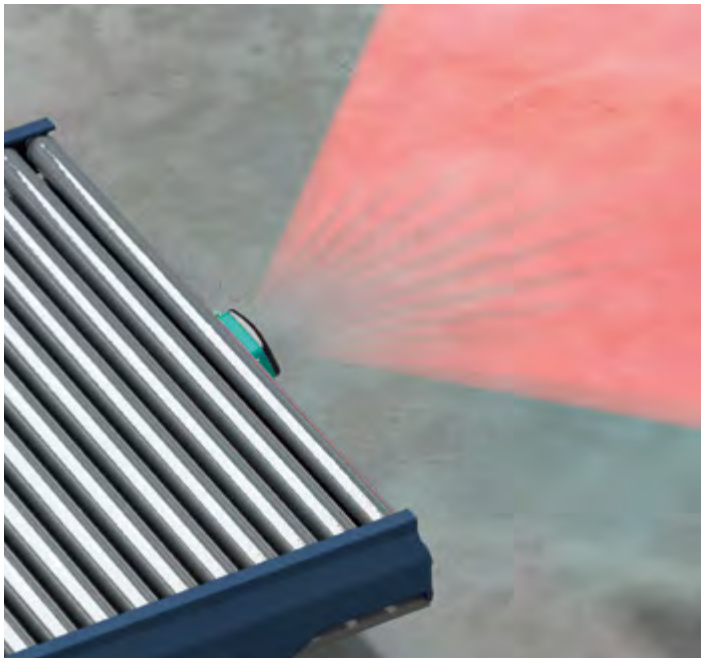
R2100

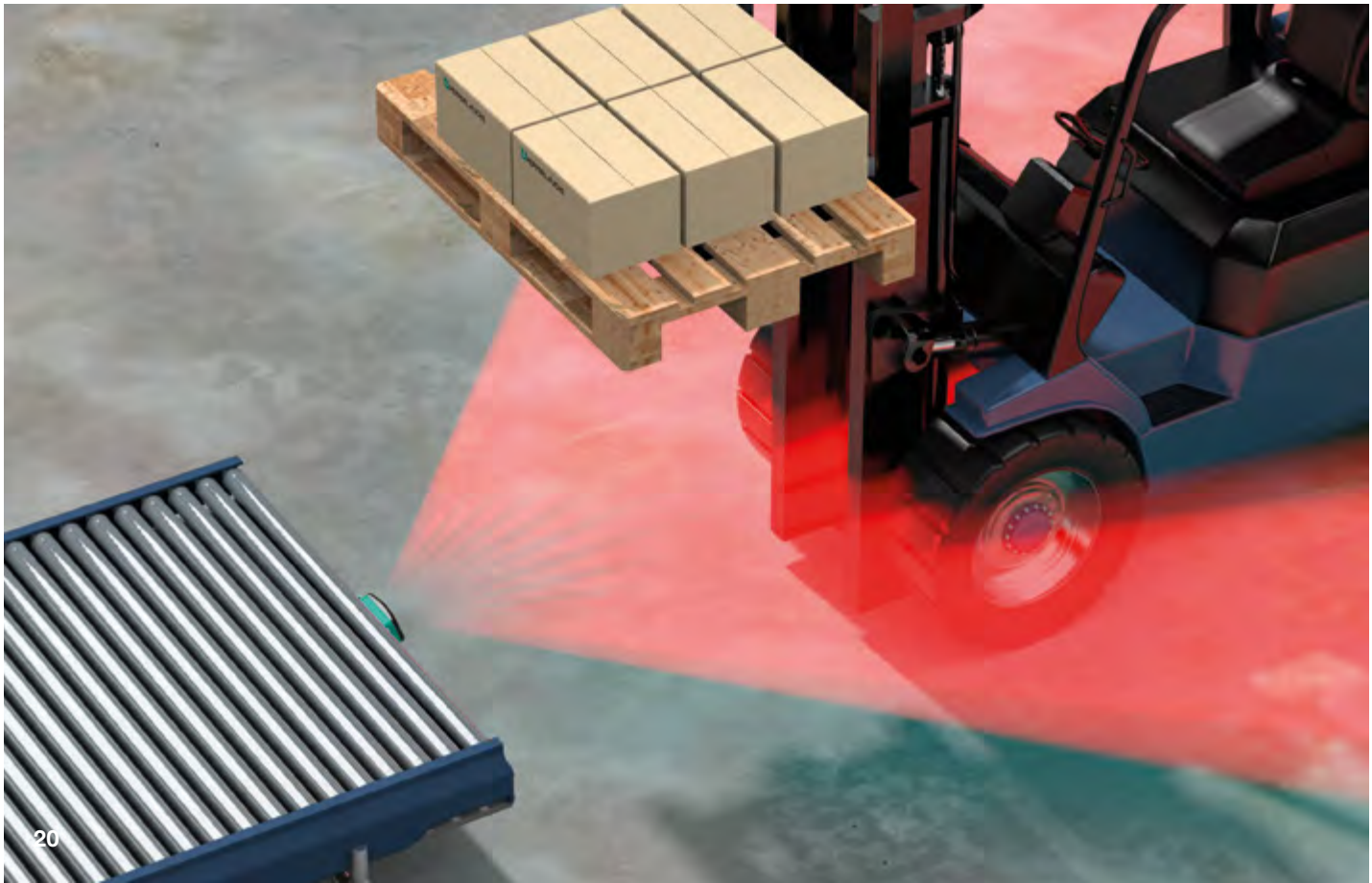
# Focusing on What Matters

Robust, quick, and cost-effective—the R2100 is the perfect sensor solution for mechanically demanding tasks. This multi-ray LED scanner is a particularly good choice when it comes to simple and reliable object detection.

### Reliable Object Detection

One of the ways in which the R2100 2-D laser scanner can be used in the warehousing sector is to detect forklift trucks reliably at transfer stations. When used for this purpose, the device is mounted on the station in the direction which the vehicles navigate. From this position, the sensor can detect an approaching vehicle, such as a forklift; the 2-D technology means that the direction of approach is irrelevant. The device uses PRT to determine the exact distance to the forklift, and can then react according to the operating situation, for example stopping the belt. The multiple wide-beam emitters ensure that only relevant events are evaluated, and disturbances involving small objects do not affect plant availability.





## Safe Collision Avoidance

In warehouses where driverless AGVs move racks, the R2100 is used for object detection to prevent collisions with objects or other vehicles in the path of travel. The sensor provides reliable information on the distance and location of any obstacle to the control panel. Since the device features no moving parts, the level of mechanical stress during use is low, making it extremely robust. The R2100 is also the ideal solution for tasks like these due to its price-performance ratio. The scanner also features LEDs with an infrared transmitter light. These are invisible to the user, eliminating any possibility of irritation.



## Other Typical Applications

- Object detection and classification
- Detection of simple height profiles
- Vehicle detection
- Occupied-compartment check



# Software for Simple Handling: PACTware

PACTware is all about straightforward and user-friendly operation. The convenient user interface, coupled with the matching Device Type Manager (DTM), guarantees perfect visualization and allows easy configuration and parameterization of sensors.

### Perfect Communication with a Modern Design

The PACTware operating software is an FDT frame application for optimal communication with field devices. The FDT technology underpinning PACTware makes it possible to overcome the hierarchical levels of the automation pyramid. The latest version of the software, PACTware DC, has been optimized for point-to-point communication with field devices and has a particularly effective modern design. Since the project setup runs independently in the background, the user can concentrate fully on the device interface.

### PACTware for the R2000 Series

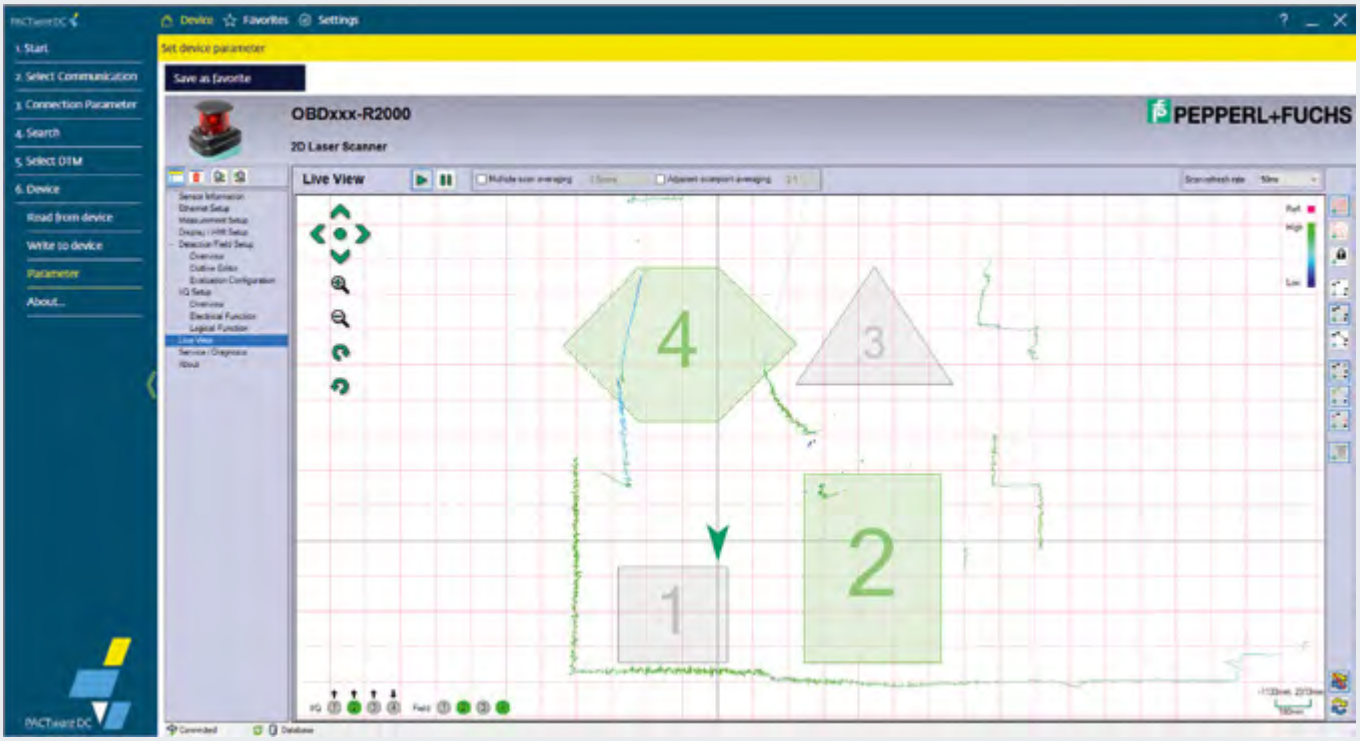
Pepperl+Fuchs offers a DTM for both the R2000 HD/UHD and the R2000 Detection. In addition to device identification and diagnostics, the DTM offers many other options, including extensive parameterization of device tags, direction of rotation, and scanning frequency. It allows quick and easy programming of the display and the configuration of parameters for Ethernet communication.

The DTM for the R2000 Detection makes it possible to set up monitoring fields quickly and flexibly using the intuitive editor. Simple logic functions can be implemented directly in the DTM on the basis of logical links between field states and inputs.

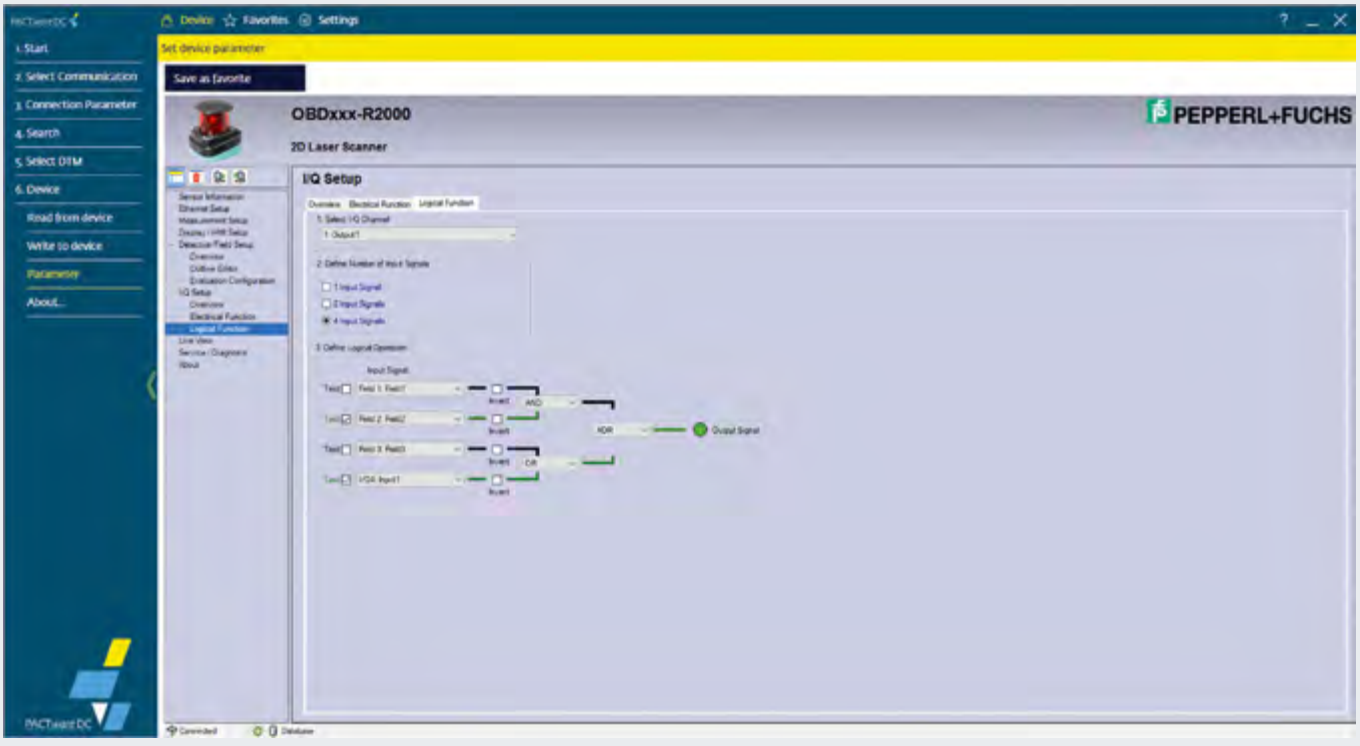
**Highlights**

- Simplifies identification, parameterization and diagnosis of the devices
- Very user-friendly and intuitive to use
- Manufacturer- and network-independent operating software for field devices
- Visual support of the operation and documentation of the device settings

Device type manager and PACTware are free to download at:
**www.pepperl-fuchs.com/dtm-r2000**




Adjustable monitoring fields in the live view.




Logic function for logical links between field states and inputs.

# Your automation, our passion.

## Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

## Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

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