

**Analyzing needs.  
Reinventing technology.  
Simplifying solutions.**

Light Section Sensors  
with SmartRunner Technology



Your automation, our passion.

 **PEPPERL+FUCHS**

# Specialized Sensors for Total Reliability

Exceptional features with unique technology: the SmartRunner family offers easy-to-install, high-precision light section sensors tailored to the needs of specific applications.

## SmartRunner Matcher: The Specialist for Profile Comparison

The SmartRunner Matcher uses the light section method to detect height profiles and compare them with a taught-in reference profile. With up to 32 profiles saved in the sensor, it is perfect for positioning, presence detection, and completeness checks of components on a conveyor.

More information on the SmartRunner Matcher can be found on page 6.

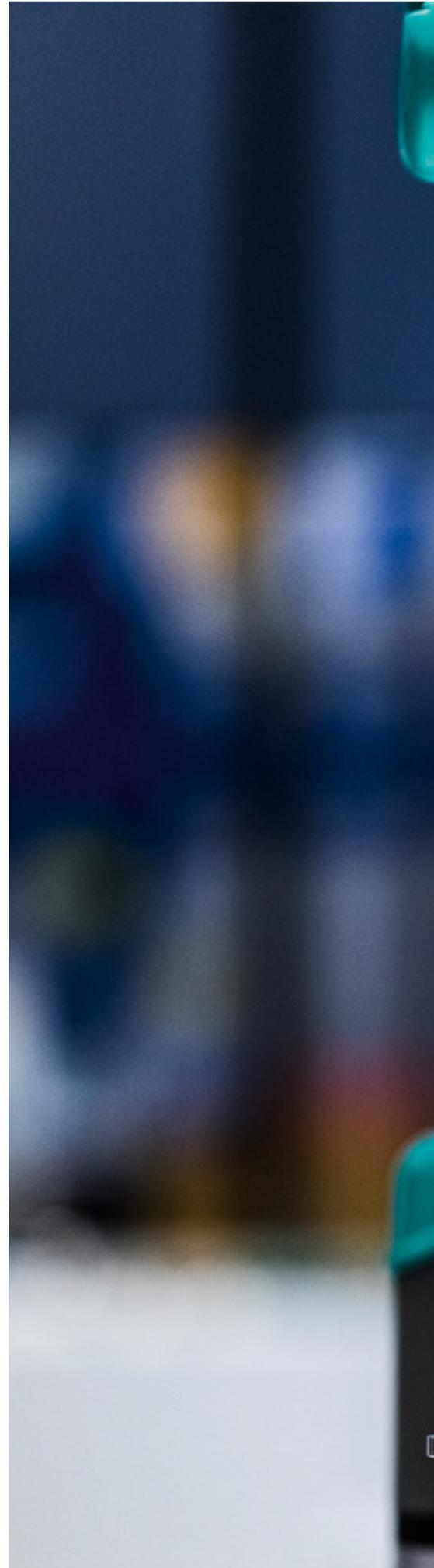
## SmartRunner Detector: The Specialist for Precise Monitoring

The SmartRunner Detector precisely monitors sensitive machine parts. Using the light section method, even the smallest faults are reliably detected and reported.

More information on the SmartRunner Detector can be found on page 14.

### Highlights

- Unique combination of light section technology and 2D vision sensor with integrated LEDs opens up a variety of new applications
- Application-specific sensors—preconfigured and calibrated based on the application
- Transformation of complex measuring data into simple digital signals for fast and easy integration
- Easy installation with parameterization via Data Matrix control codes or easy-to-use parameterization software
- Light section technology provides reliable measuring on any material regardless of surface contour or color





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# SmartRunner Technology

## Unique Engineering—Unique Opportunities

Based on an innovative combination of light section technology and 2D vision, SmartRunner from Pepperl+Fuchs is a family of high-precision sensors tailored to the needs of specific applications. These innovative sensors transform complex profile data into easy-to-process digital signals, making integration into the overall process incredibly simple.

### Light Section Technology—Precise and Reliable

Reliable, high-precision measurement independent of surface texture and color is the hallmark of light section sensors. As an integral part of the SmartRunner sensor family, laser light technology is ideally suited to detecting, monitoring, and protecting even the smallest of objects. Using triangulation, the height profile of a contour is recorded and supplied for evaluation.

### Application-Specific Sensors—Preconfigured and Ready to Use

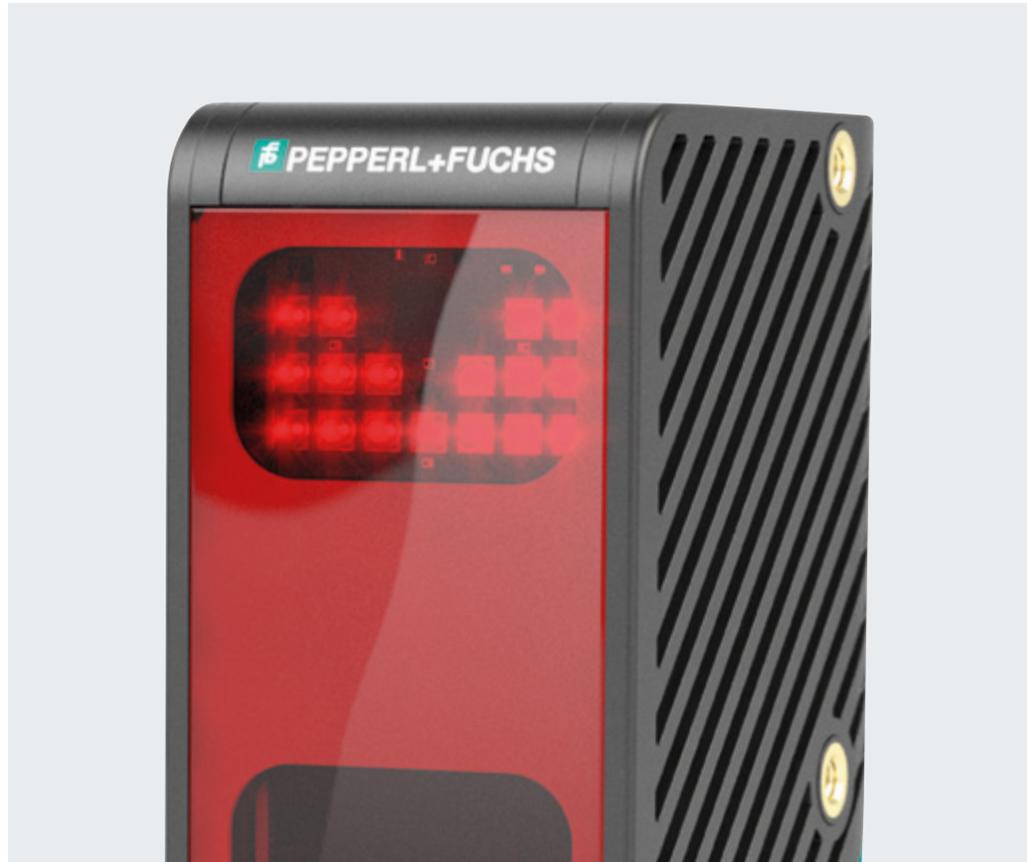
SmartRunner sensors are optimized and preconfigured to handle specific applications. The optics, camera, and evaluation logic are integrated into a compact housing and transform complex data into easy-to-process digital signals. Regardless of the task at hand, the user always receives a simple “good” or “bad” signal that can be taken directly to the control system.

The compact housing and a swiveling connection simplify integration, even in the tightest spaces. Using a deflection mirror to extend the base length allowed us to create an extremely compact housing without compromising performance.



### Advanced Diagnostics of 2D Vision Sensors

The integrated camera also makes it possible to record images in order to document the complete process and assure top quality control. The recorded error images can be uploaded remotely, preventing trips to the factory floor and allowing easy monitoring of difficult-to-access machine areas. The high-performance LEDs supply consistent, well-lit images. Parameterization through Data Matrix control codes is also possible.



### Easy Commissioning with Teach-In and Data Matrix Control Codes

Easy setup is a key feature when commissioning SmartRunner sensors. With teach-in, you can customize specific application requirements in a few seconds—without a PC or special expertise. A revolutionary method for initial or reparameterization is available through the use of control codes: All sensor parameters can be given in a Data Matrix code. Simply placed in front of the vision camera, it will be instantly detected and decoded, and the sensor will automatically save the parameters contained within. This allows a large number of sensors to be put into operation quickly and easily.

# SmartRunner Matcher

## The Specialist for Profile Comparisons



### Profile Comparison via Switching Signal

The SmartRunner Matcher's integrated evaluation unit is preconfigured to report deviations from a taught-in contour. The sensor uses profile comparison to verify the recorded contour of an object, its correct location, and spacing.

To do this, a specific height profile is programmed and a trigger executes a comparison between the reference and recorded contours. If they are identical, a "good" signal is issued. If the profiles differ, a "bad" signal is generated.

### Highlights

- Rugged and cost-effective presence, completeness, and position detection of components
- Precise profile comparison, even with differing surface textures, extraneous light, and varying operating distances
- Independently adjustable object and offset tolerances and separate data output

### Typical Applications

- Detection of small parts like screws, clamps, and studs
- Completeness checks for pens, pills, etc.
- Position testing and output for boxes, pallets, and other objects

Technical Data	VLM350-F280-2E2-1000	VLM350-F280-R4-1001	VLM350-F280-R4-1002	VLM350-F280-R4-1101	VLM700-F280-R4-1102
<b>Features</b>	Standard	Extended	Extended	Extended	Extended
<b>Detection range</b>	X 40 ... 160 mm Z 60 ... 350 mm	X 40 ... 160 mm Z 60 ... 350 mm	X 40 ... 160 mm Z 60 ... 350 mm	X 40 ... 160 mm Z 60 ... 350 mm	X 60 ... 300 mm Z 100 ... 700 mm
<b>Resolution*</b>	X 0.44 mm Z 0.4 mm	X 0.44 mm Z 0.4 mm	X 0.44 mm Z 0.4 mm	X 0.25 mm Z 0.2 mm	X 0.44 mm Z 0.4 mm
<b>Maximum scan rate</b>	10 Hz	10 Hz	30 Hz	30 Hz	15 Hz

\* at minimum distance



Profile comparison

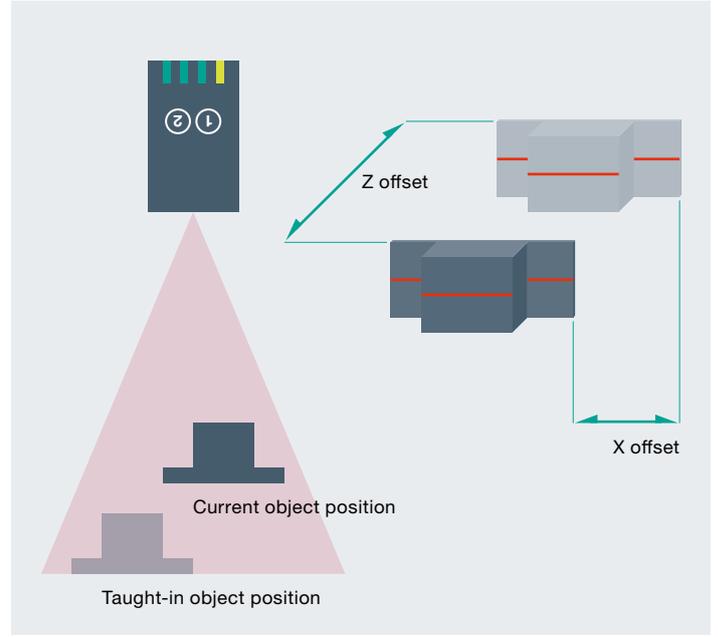
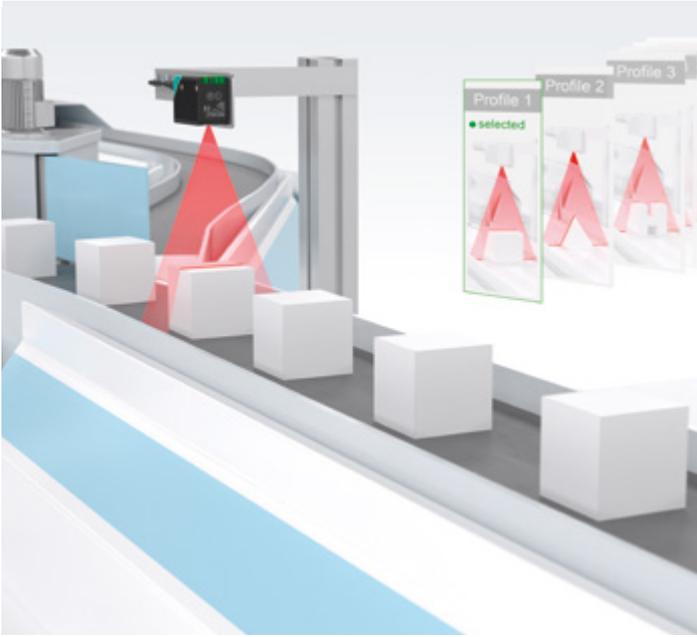


Eye-safe with Class 1 laser



Easy parameterization via Data Matrix code





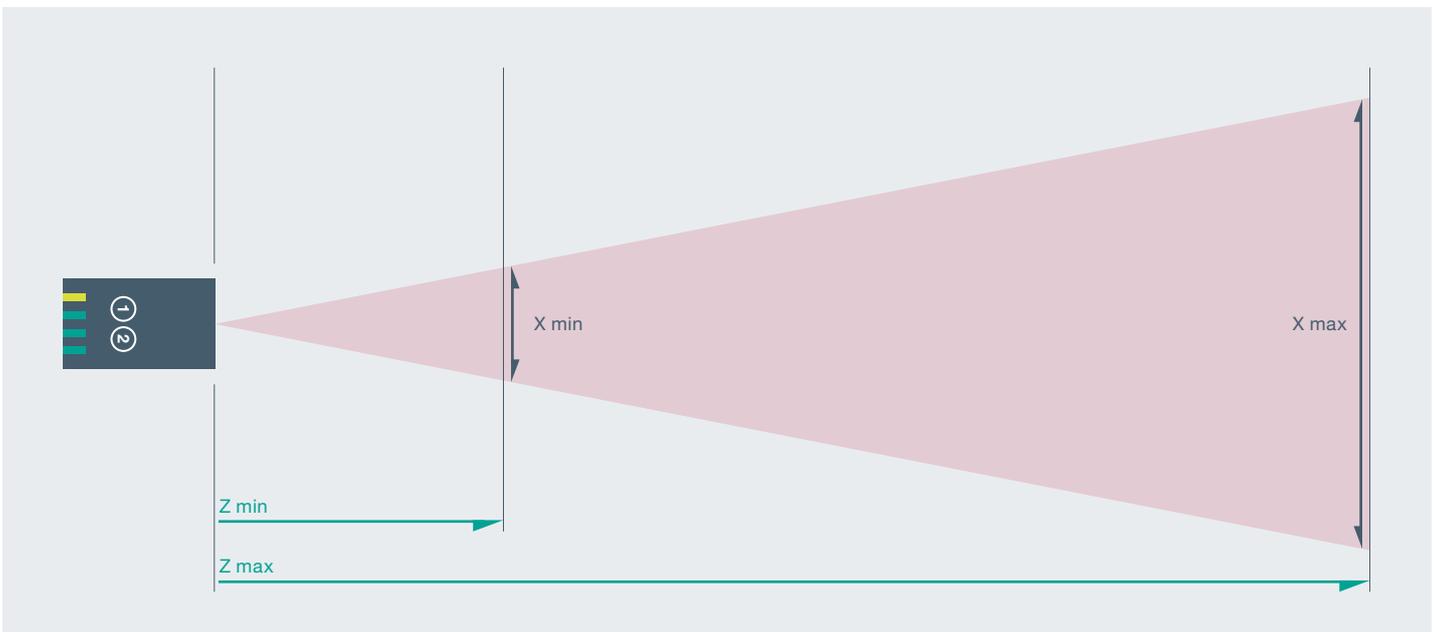
### Stores Up to 32 Profiles

The SmartRunner Matcher Extended stands out with a few additional features: multiprofile and output of X and Z offset data.

Up to 32 profiles can be stored directly in the sensor and activated as necessary via the multiprofile function. This simplifies recipe and production changes and eliminates the need for manual reconfiguration. Profiles are selected via an RS-485 interface or fieldbus using a gateway or Data Matrix codes.

### Precise X and Z Position Data

The X and Z offset data in millimeters is available to SmartRunner Matcher Extended users. Delivered separately, they indicate machine tolerances and enable precise positioning relative to the target.



Detection range of SmartRunner Matcher

# SmartRunner Matcher

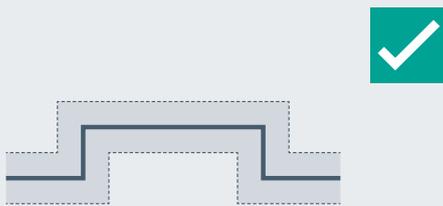
## Easy Configuration for the Perfect Solution

Adjustable detection sensitivity and step-by-step configuration. The SmartRunner Matcher can be optimized for every application via software wizard.

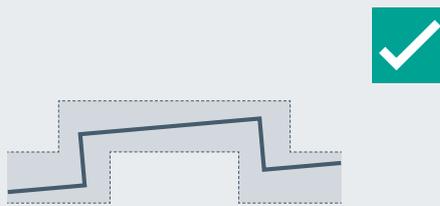
### More Flexibility with Separate Object and Offset Tolerances

Not all objects are the same. That is why an appropriate tolerance range must be identified. This starts with the definition of a curve around a taught-in profile. Depending on this, quality values are automatically determined. These can be used to define thresholds for differentiating good and bad parts. This allows the user to define the detection sensitivity of the sensor.

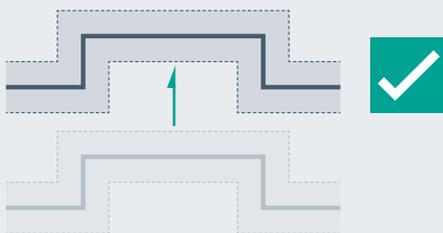
In addition to object tolerance, however, industrial manufacturing processes can also result in displacement tolerances, which are usually caused by trigger tolerances. With the SmartRunner Matcher, these can be set separately in millimeters in the X and Z directions and have no influence on the measurement result.



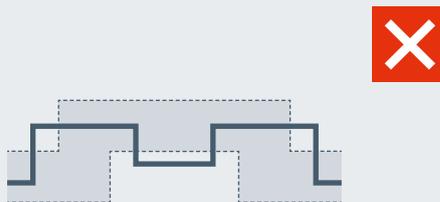
Detection sensitivity can be adjusted by setting the curve width and quality thresholds.



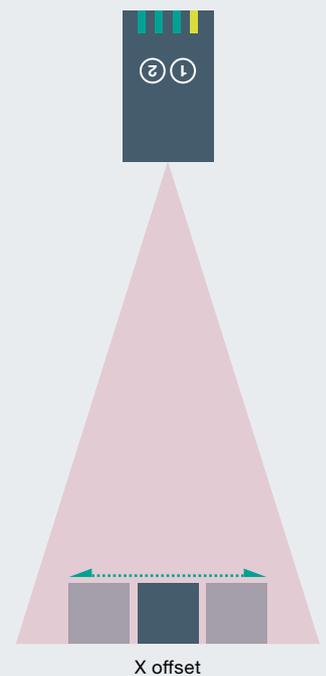
Slight rotations or offsets within the curve are recognized as "good."



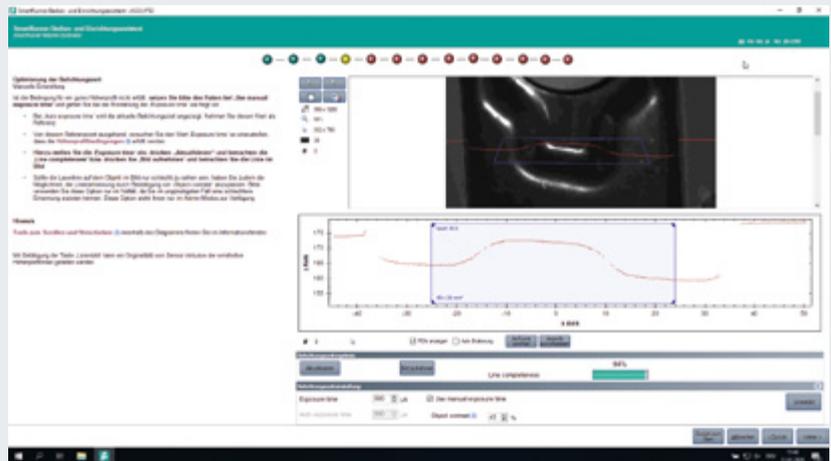
Offsets in the X and Z directions do not influence profile comparison. The object is reliably detected and the displacement is outputted in millimeters.



Any profiles that deviate are reliably detected as "bad."



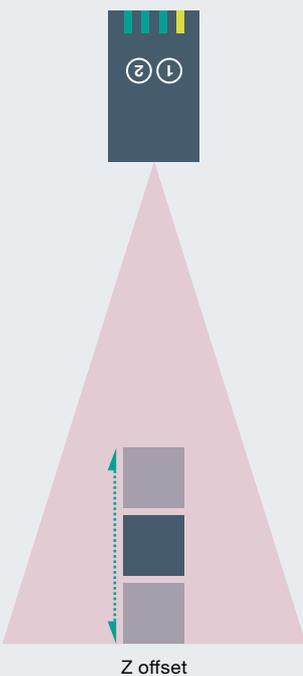
X offset



## Easy Commissioning with Software Wizard

There are several ways to commission the SmartRunner Matcher: via Vision Configurator—the uniform user interface for all vision sensors from Pepperl+Fuchs, via Data Matrix control code, or via guided operation and parameter setting with the software wizard.

The software wizard enables step-by-step configuration even without a manual. This makes it easy to define the sensing range. With the combination of the height profile and a 2D image of the object in one display, the relevant areas can be quickly identified and the sensing range defined.



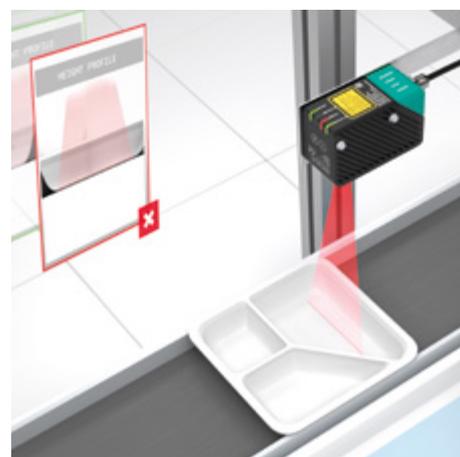
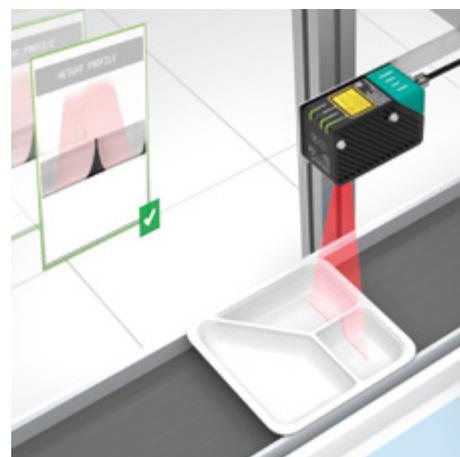
# SmartRunner Matcher

## Reliable Processes, Even When Contrast is Low

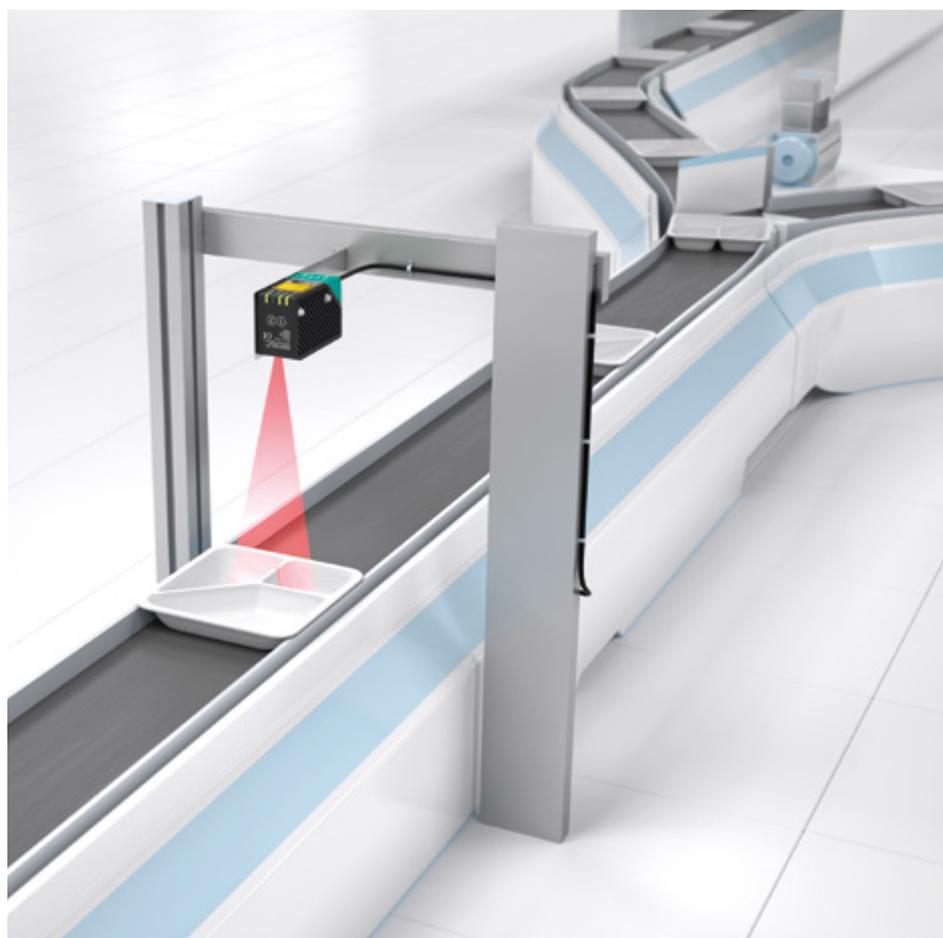
Low contrast, different surfaces, and ambient light are no problem for the SmartRunner Matcher. The light section method offers reliability where typical vision sensors fail.

### Profile Comparison—Even on Metal

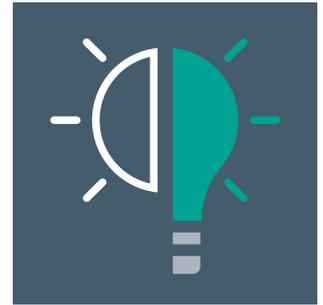
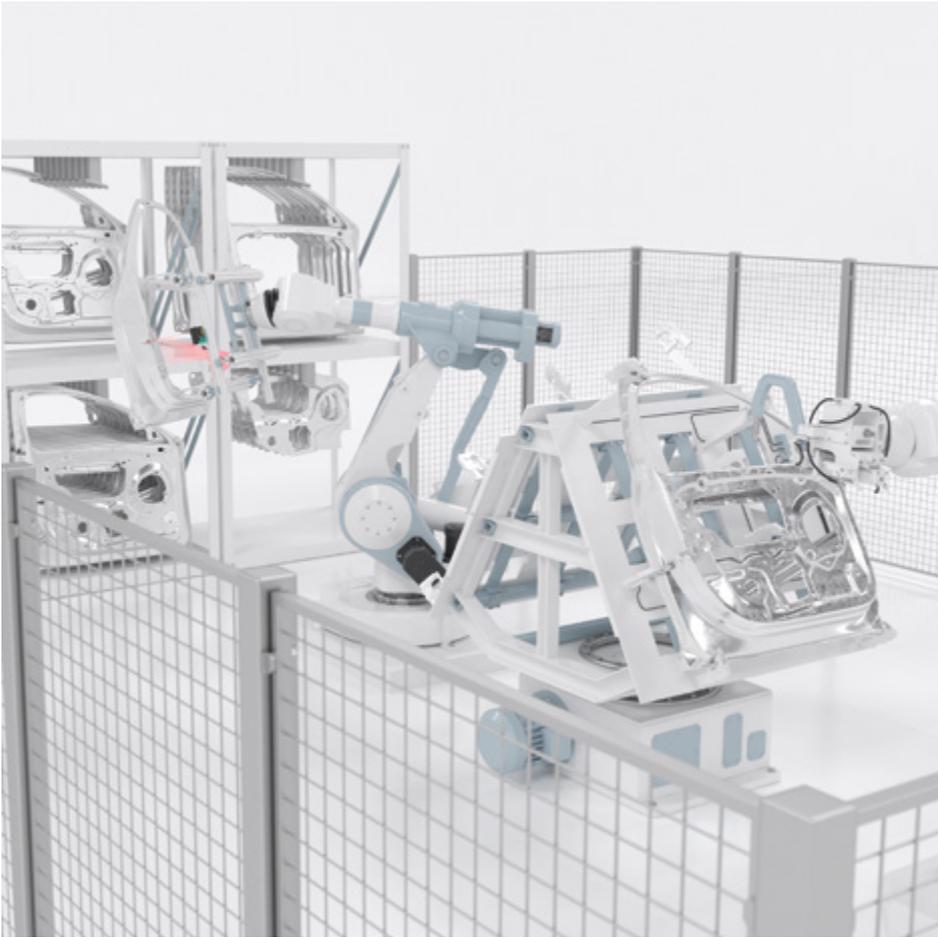
When conditions are tough, the light section method offers clear advantages over typical vision sensors. No external lighting is required, even with low-contrast objects such as metal on metal or single-colored plastics. Different surfaces, colors, and levels of contrast also have no influence on the measurement result.



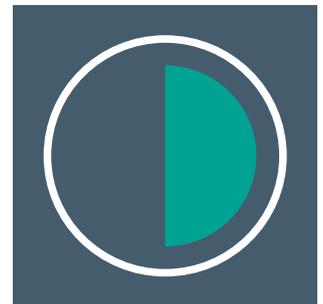
Precise contour detection even with low-contrast objects



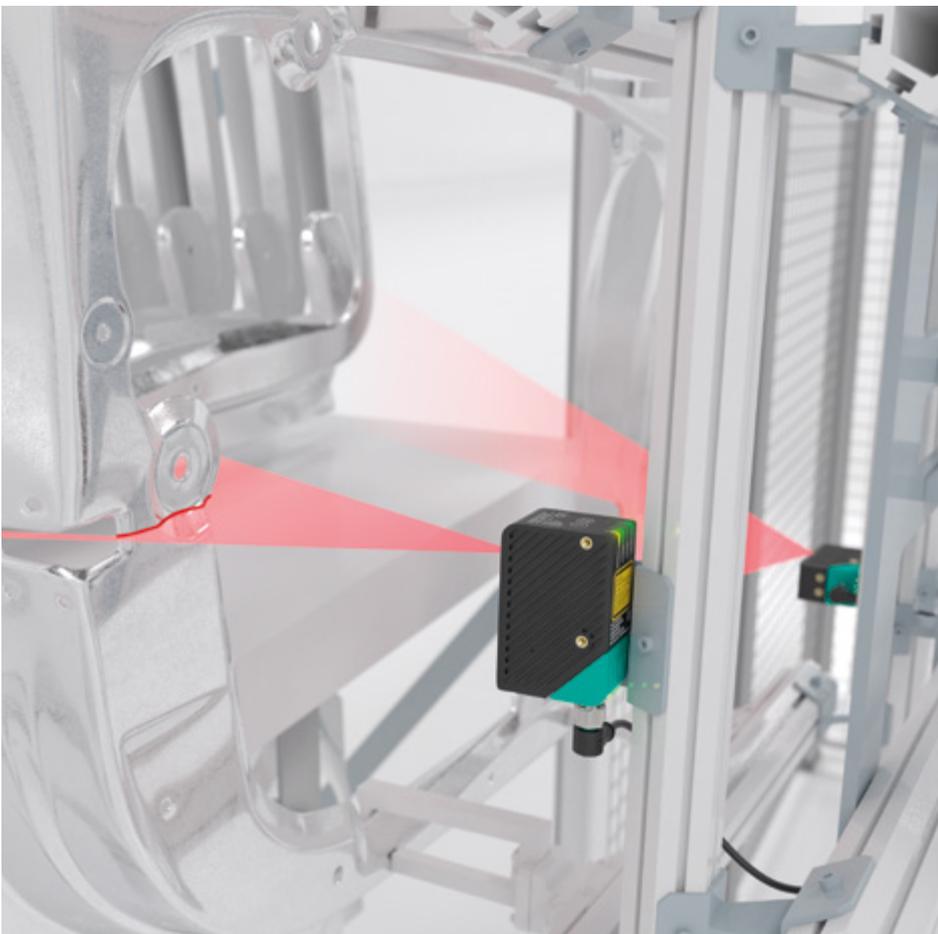
Positioning plastic trays in the production of ready-made meals



Insensitive to extraneous light



Insensitive to contrast



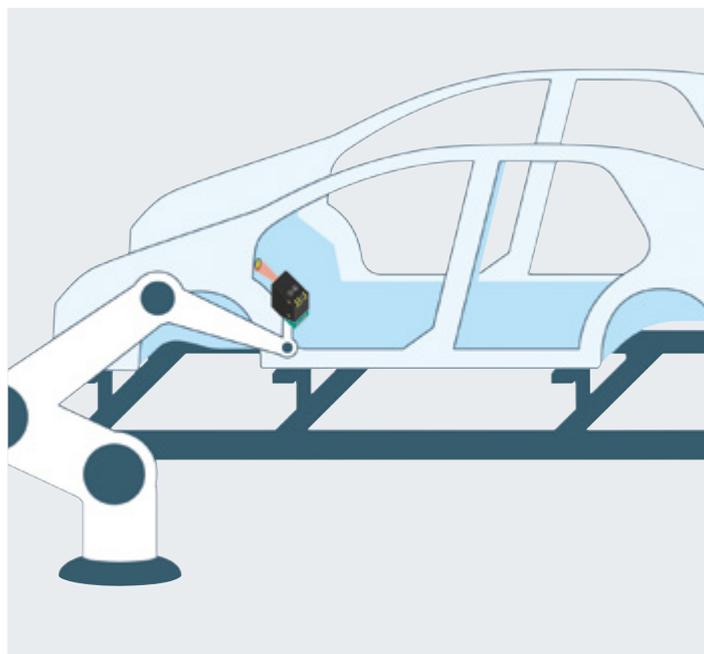
Insensitive to color and surface

Presence detection of metal parts  
in robotics applications

# SmartRunner Matcher Applications

## One Sensor for a Wide Range of Applications

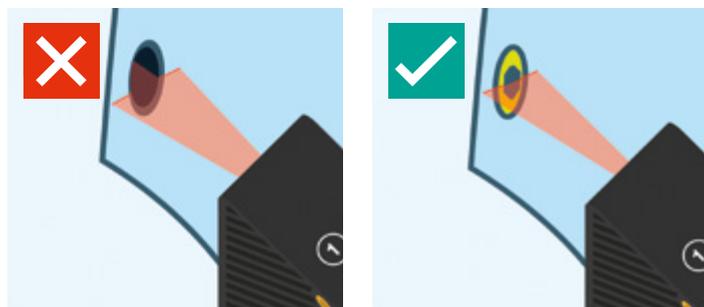
Optimized for profile comparison, the SmartRunner Matcher is incredibly versatile, mastering positioning, presence, and completeness detection of guided components.

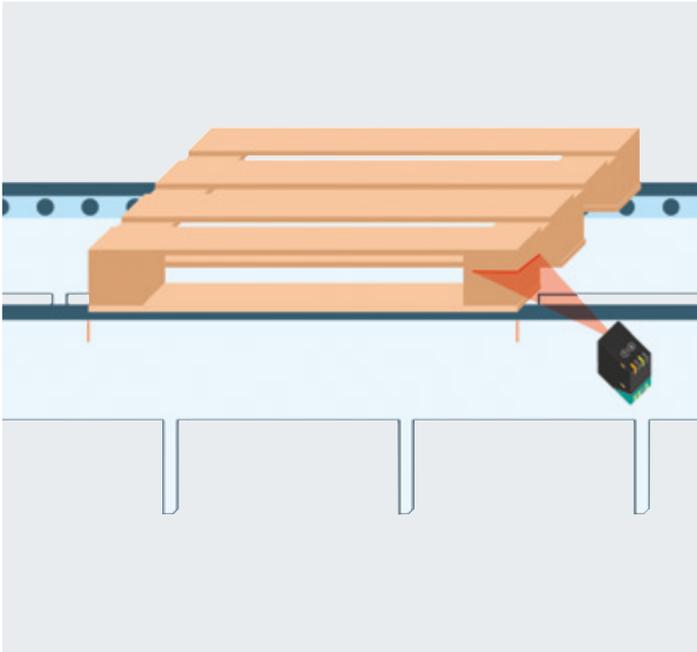


### Precise Presence Detection

The SmartRunner Matcher uses the laser light section method to quickly and easily check if a component has been installed correctly. Even small parts, such as plugs, can be reliably detected as part of quality assurance. For this purpose, the recorded height profile is compared with the previously taught-in profile. If the plug is missing, the height profile differs and a “bad” signal is sent.

- Presence detection of plugs, screws, and clips in automobile production
- Detection of metal parts and sheet metal, even on metal
- Quality assurance in production

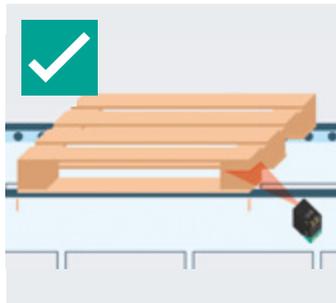
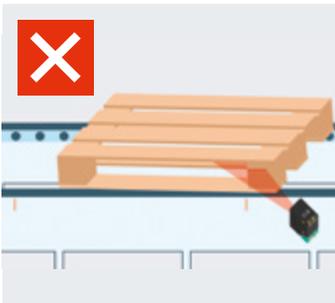




### Exact Positioning

The exact positioning of workpieces or workpiece carriers is essential in automated processes. In these applications, the profile of all or part of the object is used to teach a distinct contour in the desired end position, triggering subsequent processes. The output of the X and Z offsets also enables precise positioning.

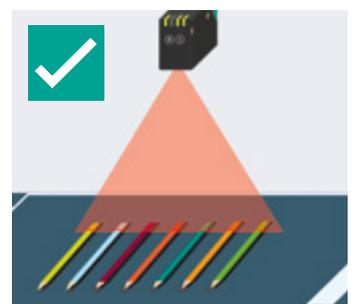
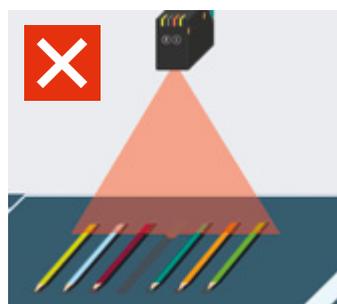
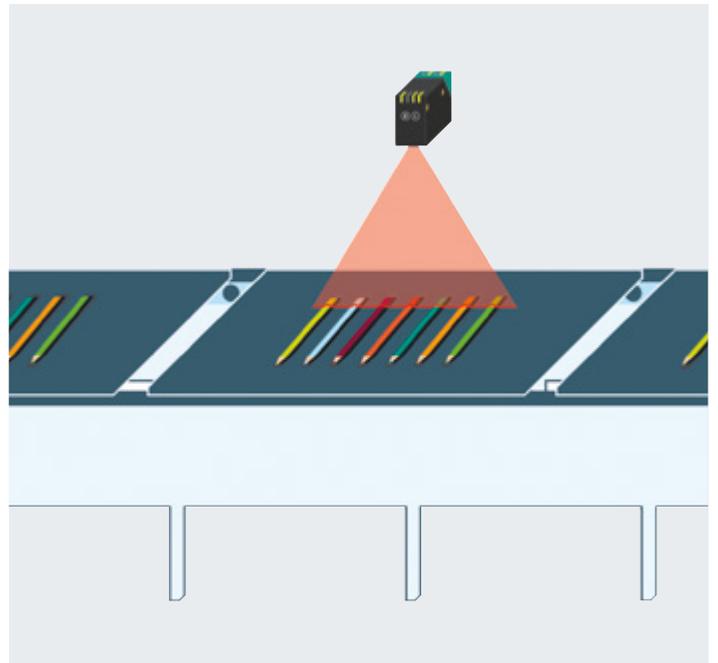
- Precise positioning of pallets in intralogistics
- Positioning of skid bolts in automobile production
- Torsion testing of plastic trays in food production



### Reliable Completeness Checks

Completeness checks are part of quality assurance in both production and packaging processes. In production, a height profile can be checked right before a process step, for example, to ensure all required components are in place. When packaging products, on the other hand, the sensor makes sure the correct products are packaged. This cuts unnecessary costs.

- Completeness check of workpieces
- Check for completeness of pens and other products



# SmartRunner Detector

## The Specialist for High-Precision Monitoring



### Easy Commissioning via Plug-and-Play

Factory optimization of the SmartRunner Detector makes commissioning extremely easy: the user projects the laser line onto a fixed background and teaches it in. No PC is required, and exposure times do not have to be adjusted manually. If an object enters the monitoring field, the sensor sends a digital signal and a stop is triggered, protecting sensitive machine parts.

### Highlights

- Easy parameterization using Data Matrix control codes or via parameterization software
- Background teach-in possible via sensor buttons or interface
- Object sizes and regions of interest (ROI) can be customized

### Typical Applications

- Area monitoring for the protection of sensitive machine parts
- Inspection of overlapping components for quality control
- Access monitoring

Technical Data	VLD700-F280-2E2-1000
Detection range	X 40 ... 310 mm Z 60 ... 700 mm
Object size*	≥ 0.25 mm
Maximum scan rate	30 Hz

\* at minimum distance

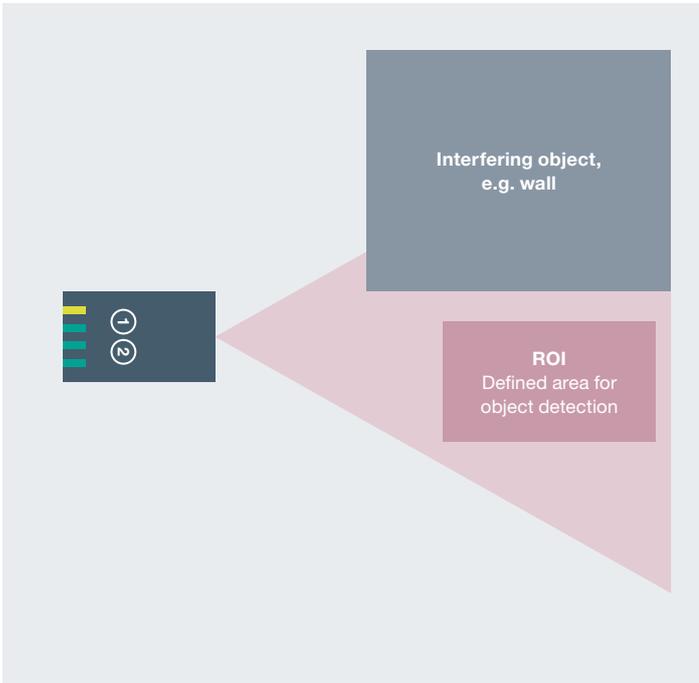


Monitoring



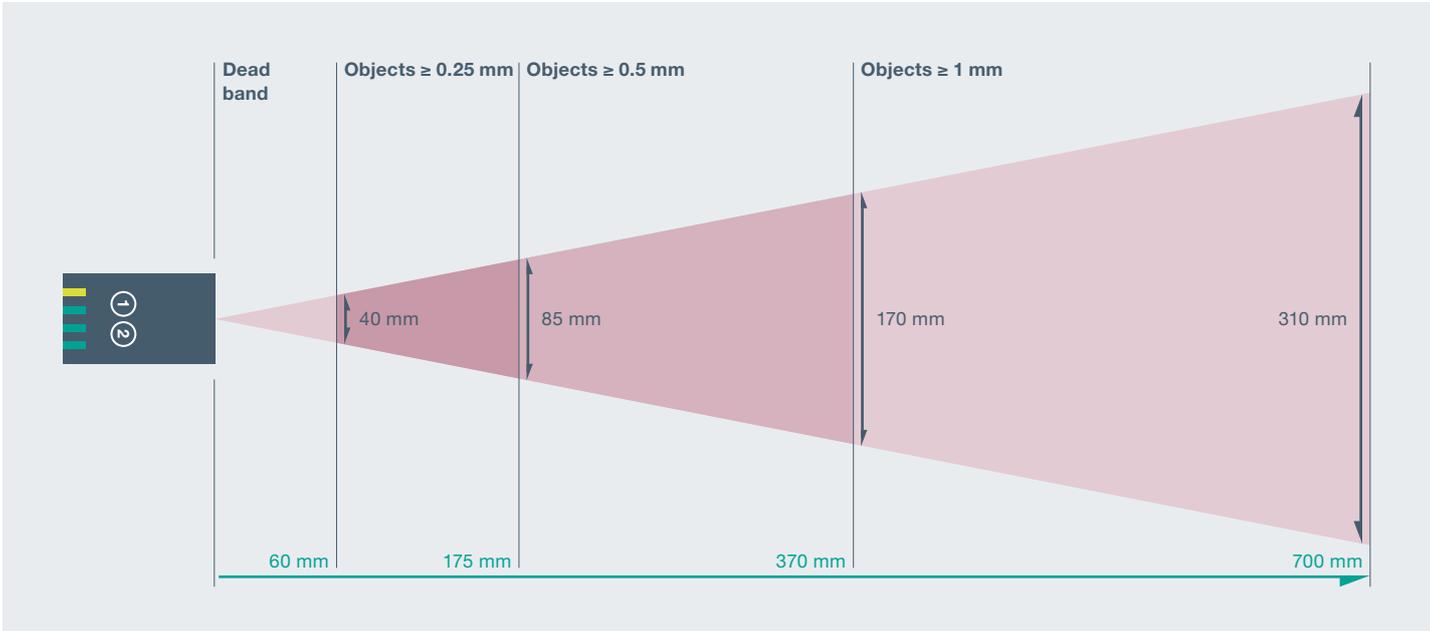
Eye-safe with  
Class 1 laser





**Freely Definable Detection Area for Maximum Flexibility**

If only specific application-related areas need to be monitored, the SmartRunner Detector offers the ability to freely define a region of interest (ROI). Objects that enter the detection zone outside of the ROI are detected, but they do not trigger a digital signal. The definition of minimum or maximum object sizes also prevents false alarms caused by targets outside the taught tolerance.



Detection range of the SmartRunner Detector

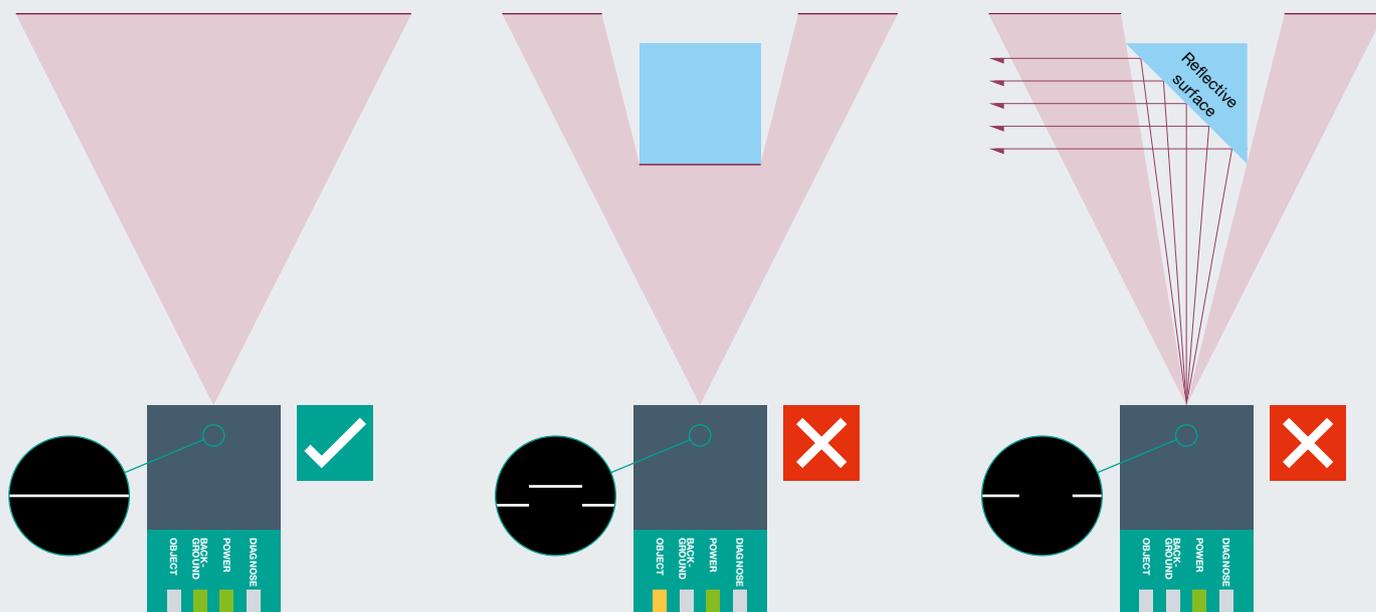
# SmartRunner Detector

## Reliable Protection with Simultaneous Evaluation

No matter if a surface is highly reflective, transparent, or absorbent: with additional background evaluation, the SmartRunner Detector detects every object with absolute reliability.

### Seamless Detection

The sensor also detects objects that are not visible to the camera—for instance, the surface of an object could be reflecting away the light such that the camera cannot see the object. Because the SmartRunner Detector evaluates both the laser line on the object as well as on the background, the sensor results are always reliable. Either a broken background line or an object in the detection zone will cause the target to be detected.



Simultaneous evaluation of the laser line: object and background

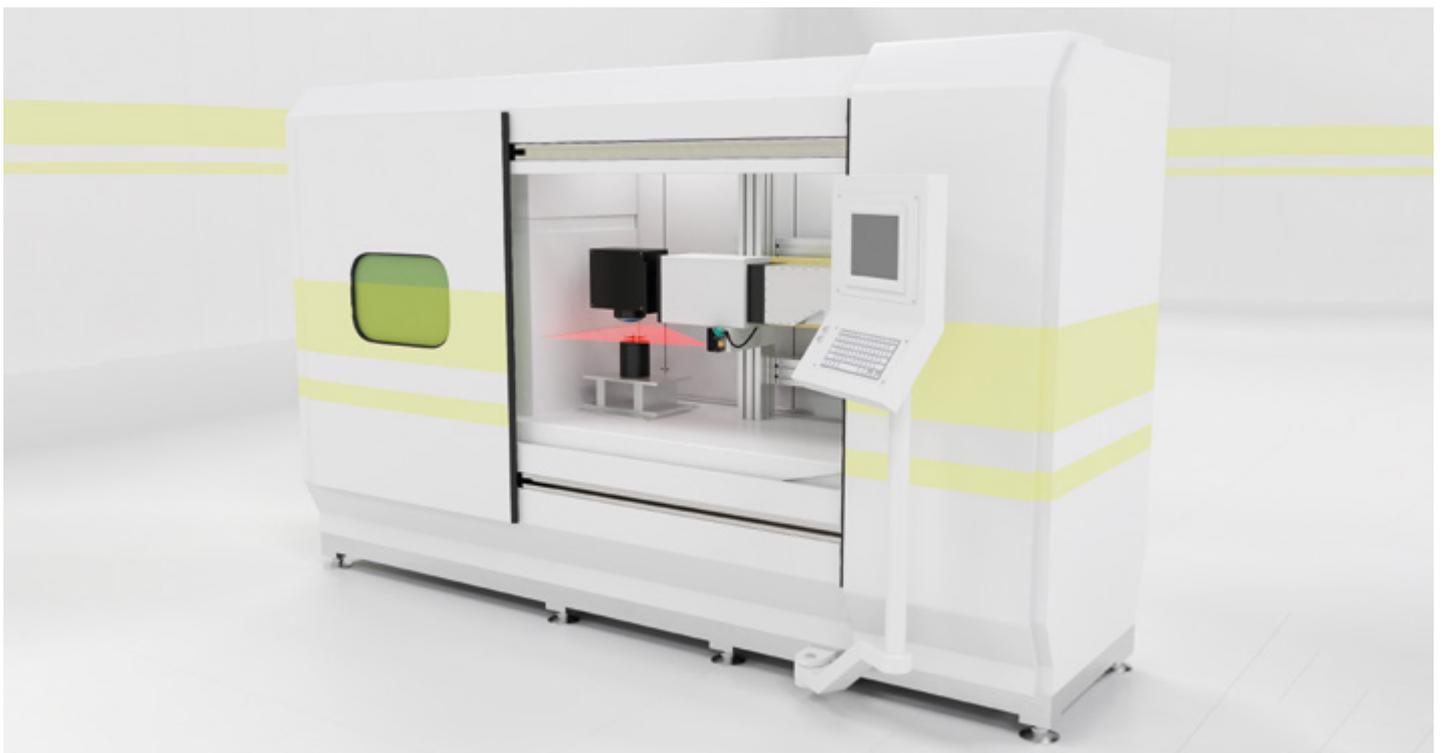
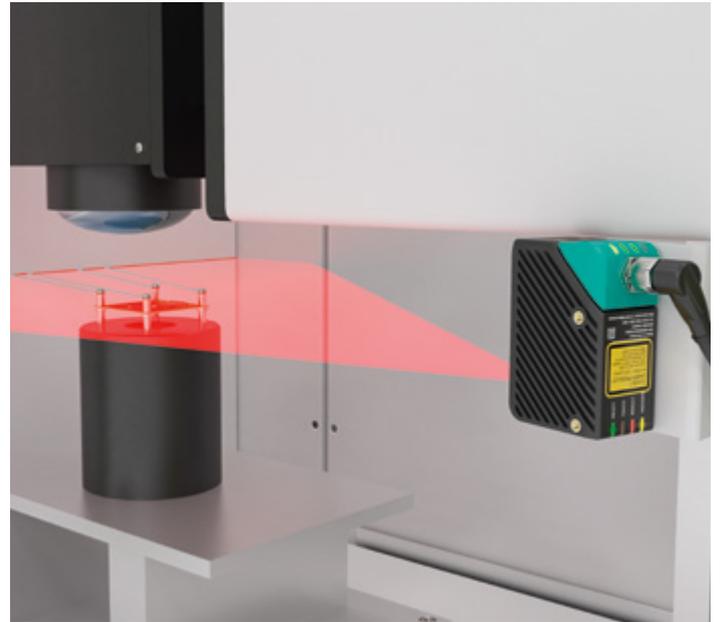
# SmartRunner Detector Applications

## Machine Monitoring with Light Section Technology

When it comes to protecting sensitive machine parts such as expensive optics or precision tools, the SmartRunner Detector is the product of choice. Optimized for high-precision monitoring, it detects even the smallest fault.

### Reliable Laser Cell Monitoring

The SmartRunner Detector monitors sensitive machine areas by detecting product overhang and shutting down the machine if necessary. It increases machine uptime and helps avoid expensive repairs and replacement parts. With high-precision light section technology, the sensor detects any deviation from the previously taught background. In a trapezoidal detection range with a width of 310 mm and a depth of 700 mm, the sensor detects objects as small as 1 mm. A “bad” signal on the digital output clearly indicates a bad part or obstruction.



# Accessories

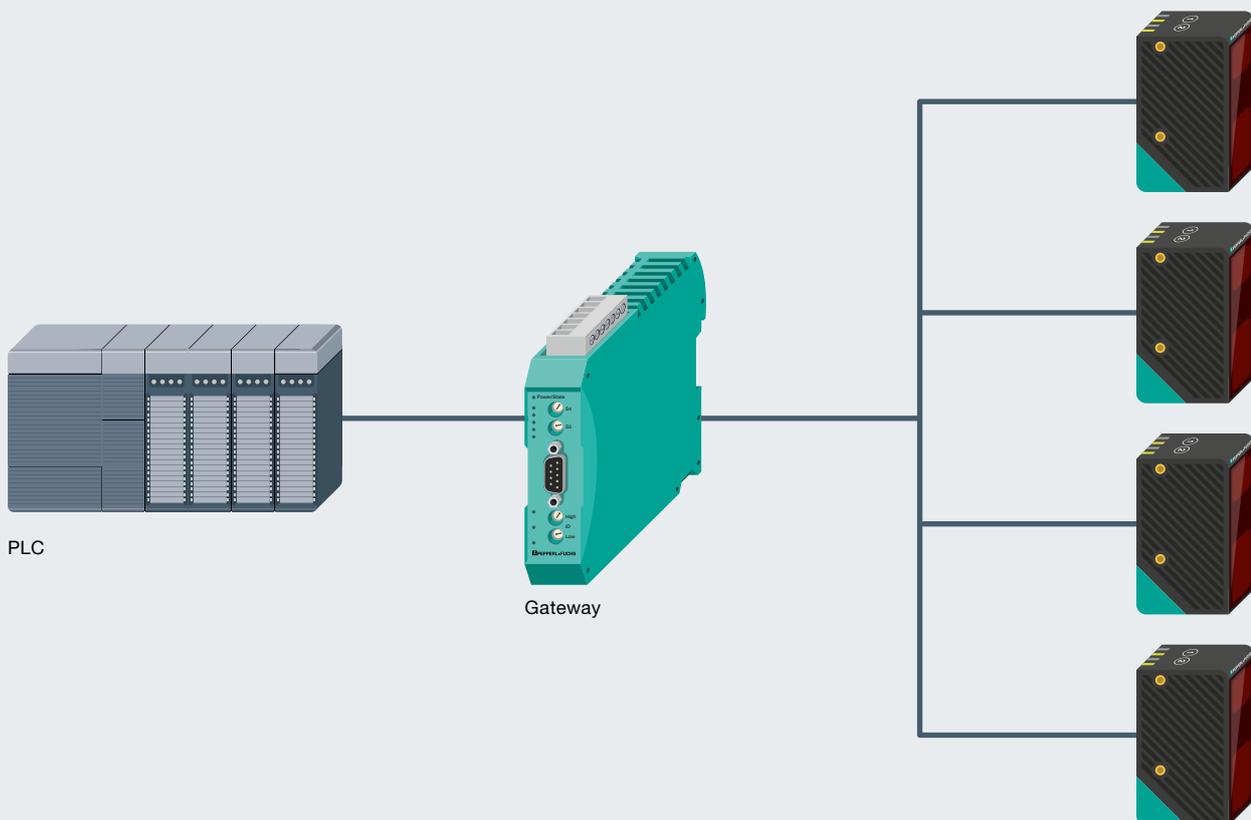
## The Perfect Supplement

Perfectly coordinated connection and mounting technology ensures optimal integration of the sensor. Pepperl+Fuchs' comprehensive range of accessories provides all necessary components for a ready-to-install solution that meets your specific requirements.

### Easily Connects to the Fieldbus

The SmartRunner transfers data using an RS-485 interface. If the sensor needs to be connected to a fieldbus, this is done quickly and easily via a gateway. These are available in the common fieldbus protocols and can be easily mounted on a DIN rail. Up to four SmartRunners can be connected with a single gateway.

Order Code	VLX-F231-B6	VLX-F231-B17	VLX-F231-B21	VLX-F231-B25
Interface	PROFIBUS	PROFINET	EtherCAT	EtherNet/IP



### Easy to Integrate with Custom Accessories

In addition to the interface modules for electrical integration, suitable accessories for mechanical integration are also available. Various brackets, interface converters, and the right connection technology are also available from a single source.



To find the right accessories, visit  
[www.pepperl-fuchs.com/pf-sr-accessories](http://www.pepperl-fuchs.com/pf-sr-accessories)



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## Explosion Protection

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- 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

### Pepperl+Fuchs Quality

Download our latest policy here:

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