

Beyond Vision.

Laser Profile Sensors
with SmartRunner Technology

Unique combination of laser light
section method and 2-D vision
technology in a single device.



Your automation, our passion.

 **PEPPERL+FUCHS**



SmartRunner

Unique Laser Profile Sensors for Any Application

Exceptional features due to unique technology: application-specific laser profile sensors or raw data device for maximum flexibility.

SmartRunner Explorer: The Specialist for Height Profile Output

SmartRunner Explorer captures precise height profiles and makes these available as raw data for further external processing. In addition, 2-D surface images can be output and used for diagnosis or documentation purposes. More information on the SmartRunner Explorer can be found on page 8.

SmartRunner Matcher: The Specialist for Profile Comparison

The SmartRunner Matcher uses the laser light section technology 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 12.

SmartRunner Detector: The Specialist for Precise Monitoring

The SmartRunner Detector precisely monitors sensitive machine parts. Using laser light section technology, even the smallest faults are reliably detected and reported. More information on the SmartRunner Detector can be found on page 18.

Innovation in Combination

High-precision height profiles and true 2-D surface images for diagnosis and documentation. The unique SmartRunner technology combines both in one compact device.

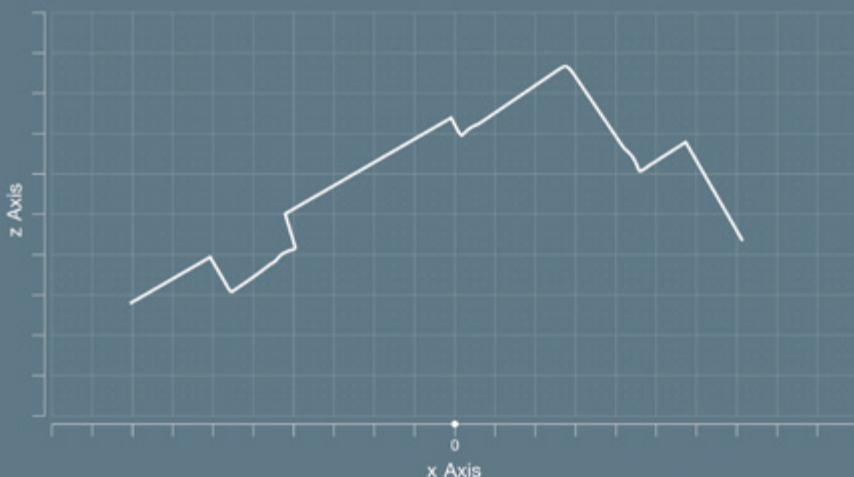
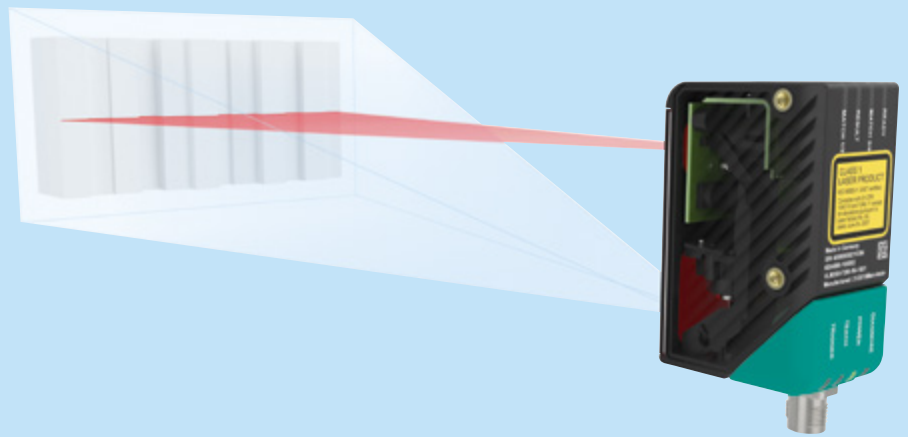
Laser Light Section Technology: Precise and Reliable

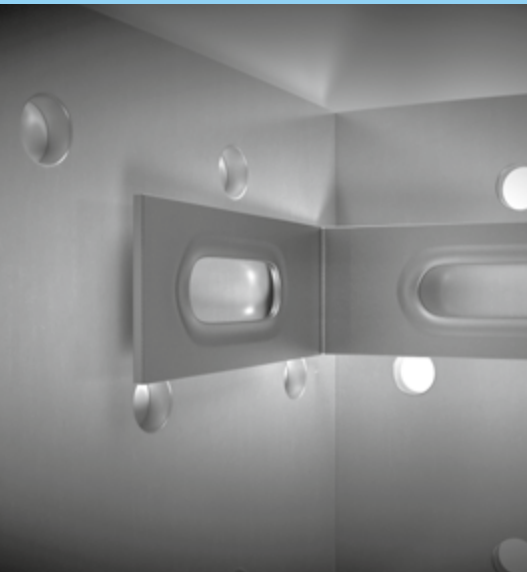
Regardless of color and surface condition, the established laser light section technology is characterized by maximum precision and reliability.

It is based on a projected laser line that is recorded with a camera that only detects the wavelength of the laser. Therefore, the height profile of the object is imaged in the

camera. Due to the downward offset position of the camera, the exact height profile can then be calculated using the triangulation principle and output in world coordinates.

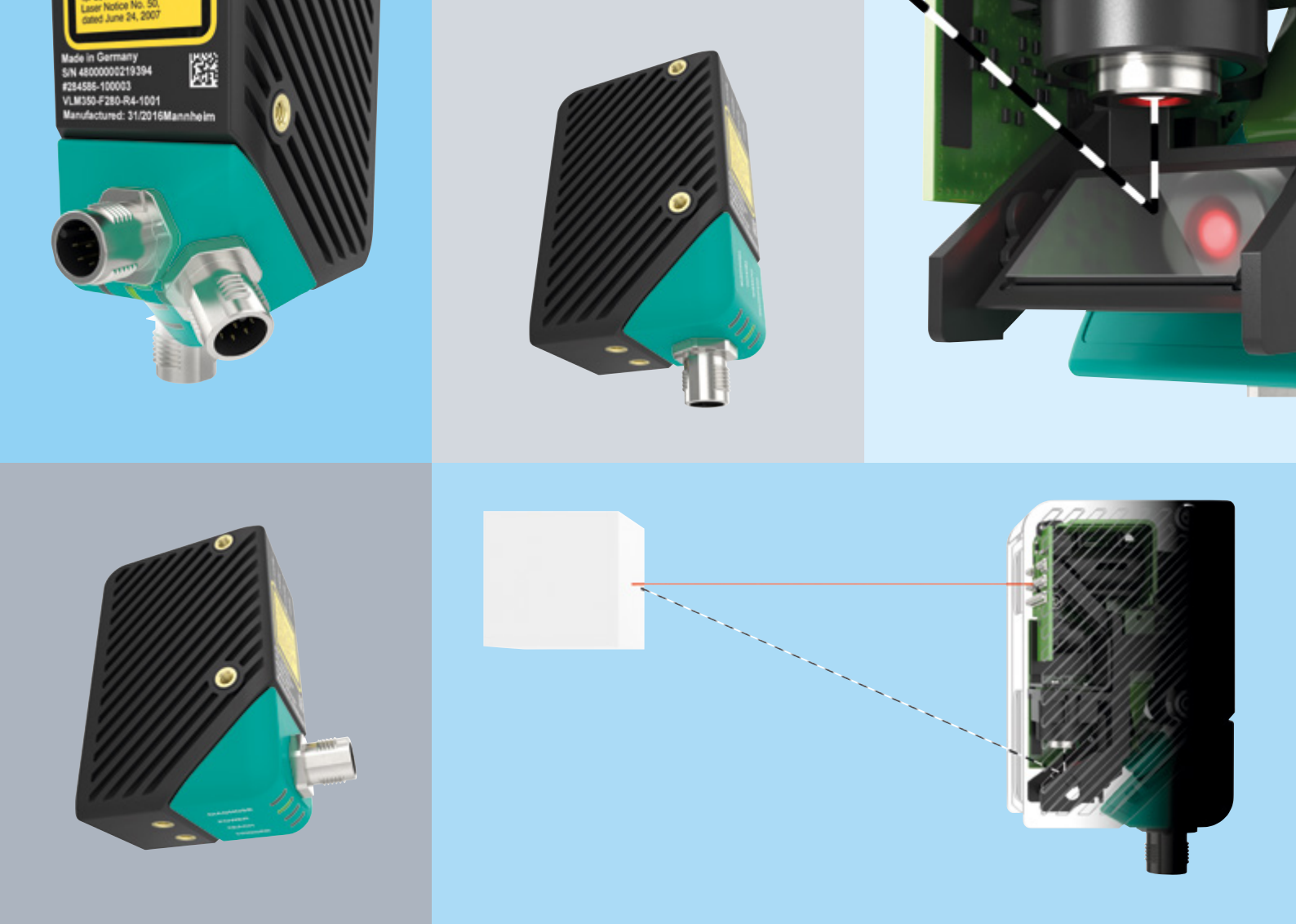
As an integral part of the SmartRunner technology, this method is ideal for detecting, monitoring, and measuring even the smallest objects.





Integrated 2-D Vision Sensor

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.



Compact Design with Maximum Performance

The small housing of 55 × 38 × 85 mm (L × W × H) enables easy mechanical integration, even in confined installation conditions. By using a deflection mirror, it has been possible to realize a virtual base length extension, which additionally makes the laser profile sensor very compact with impressive performance. In addition, the swiveling connection simplifies installation.

Profile Detection Even on Metal

Especially in difficult environmental conditions, the advantages of the laser light section technology compared to typical vision sensors become clear. Therefore, even with low-contrast objects, such as metal on metal or single-color plastics, no external light sources are required. Even different surfaces, colors, and ambient light do not have any influence on the measurement result.



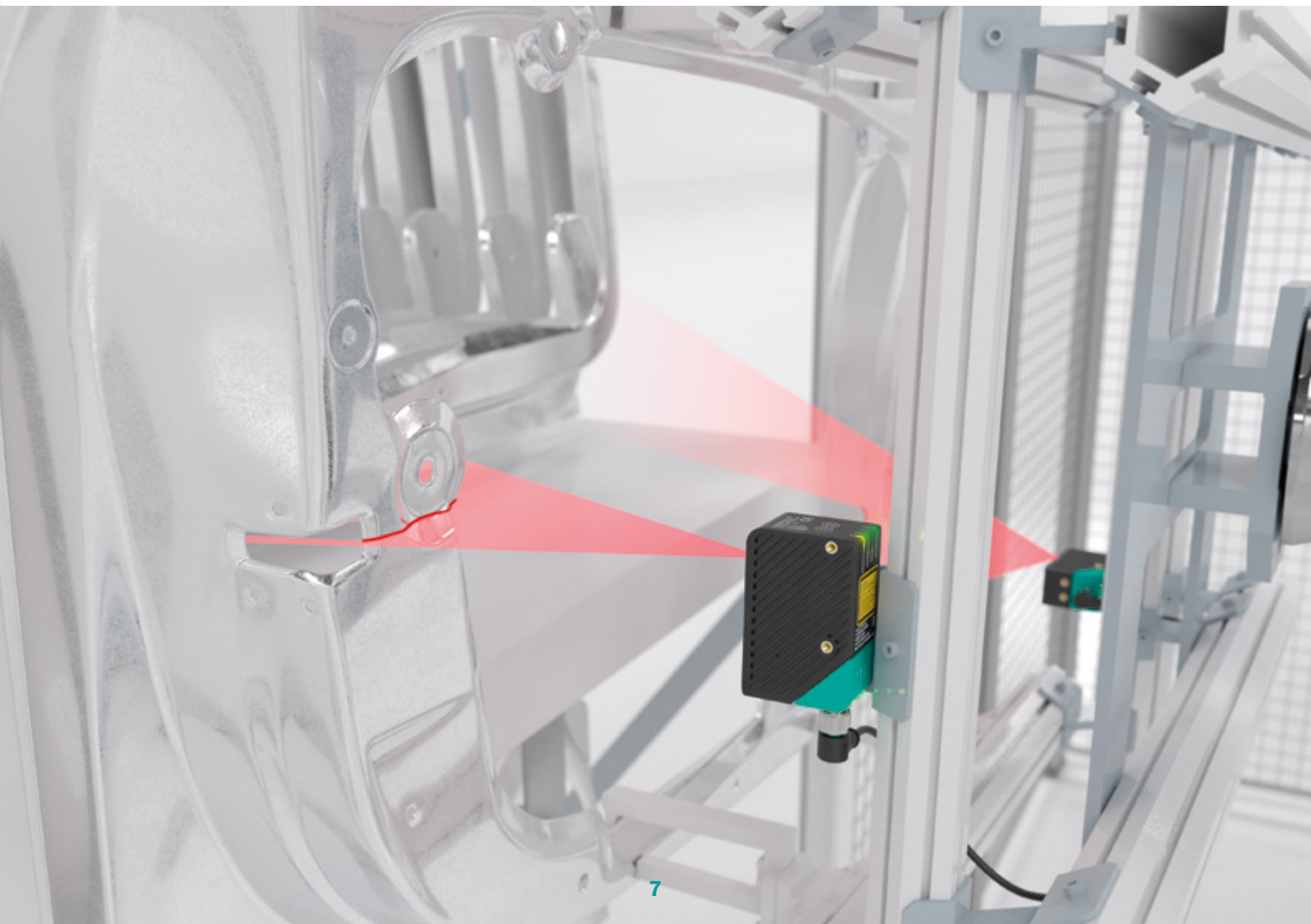
Insensitive to
ambient light



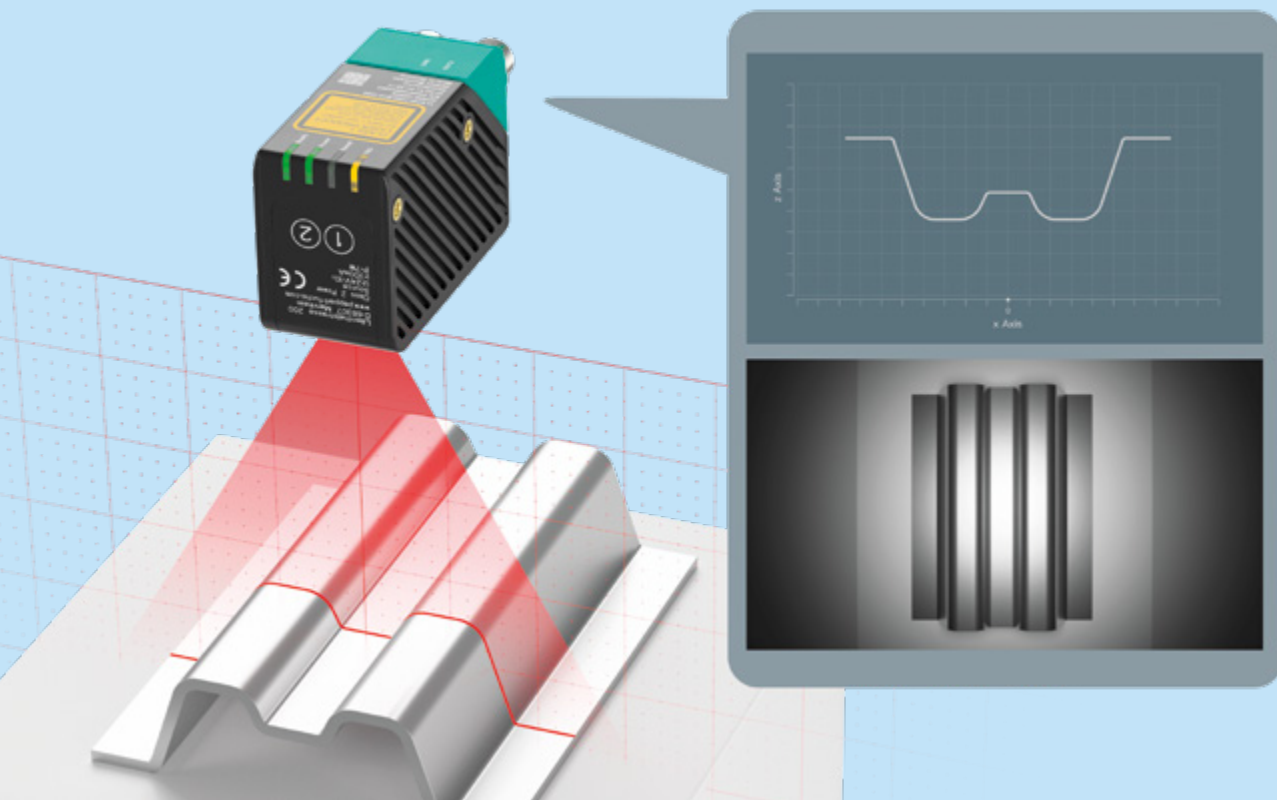
Insensitive to
contrast



Insensitive to
color and surface



The Specialist for Height Profile Output



Maximum Flexibility Using Raw Data

The SmartRunner Explorer offers the unique combination of height profile and 2-D image output in one compact sensor. It can be easily integrated into PC programs via Ethernet TCP/IP and the supplied DLL. This enables the individual implementation of applications such as the measurement or quality control of components.

Universal interfaces for simple application implementation

The output of raw data opens up endless possibilities for implementing individual applications. For the quick and easy use of this data, the SmartRunner Explorer offers the GenICam and ROS interfaces. They enable universal access to data and parameters as well as an almost infinite variety of available programming modules.

Typical Applications

- Measurement and volume detection
- Quality control
- Individual applications by using raw data

Highlights

- Unique combination of height profile and 2-D image output in one sensor
- Raw data output for flexible application implementation
- Easy integration via Ethernet TCP/IP and included DLL

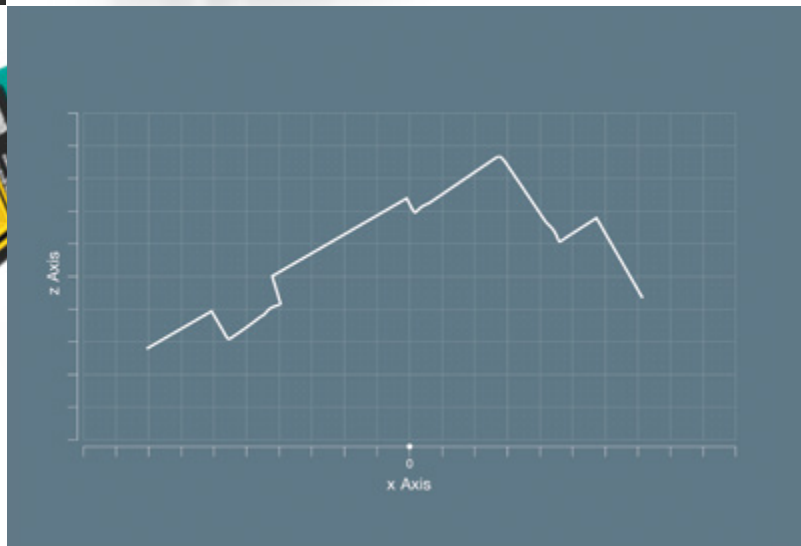
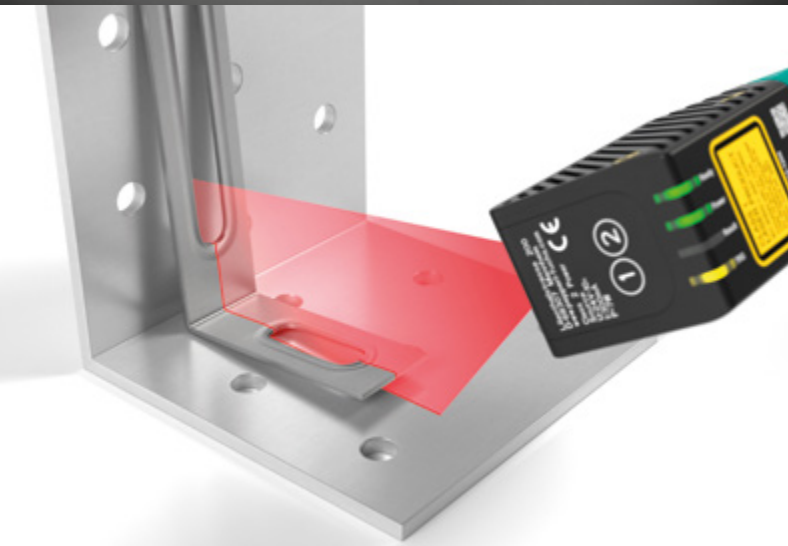
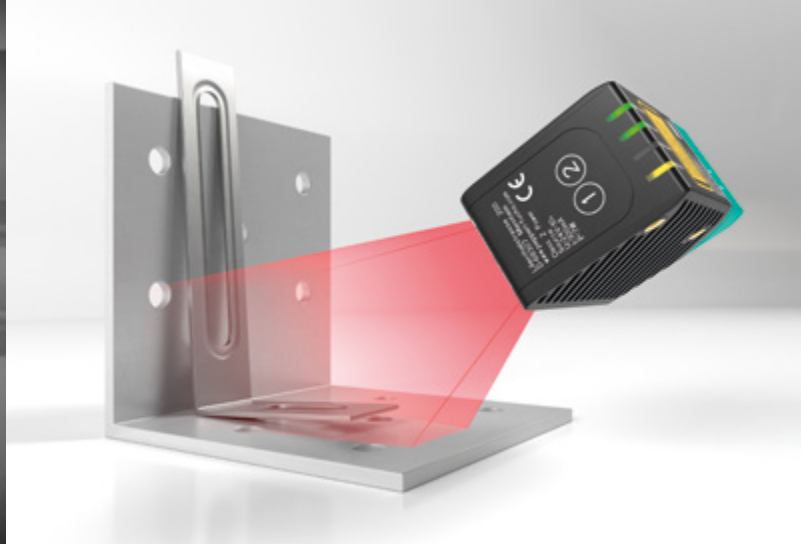
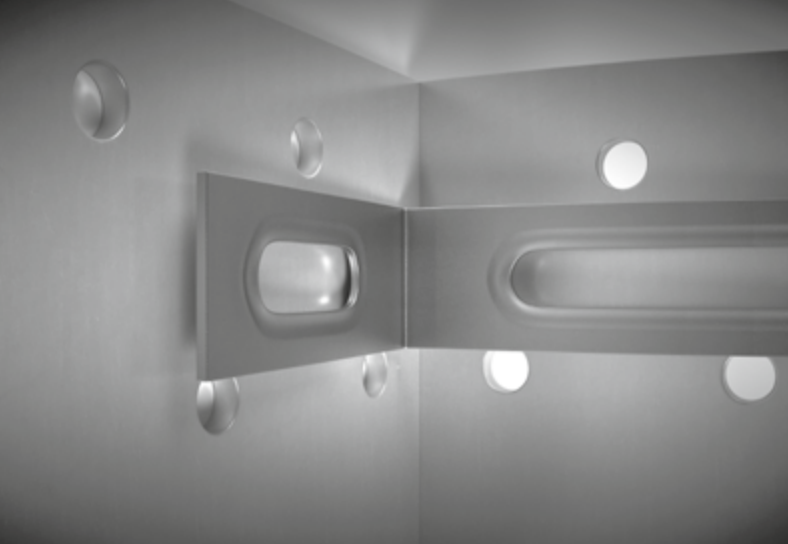


Raw data
output



Eye-safe with
Class 1 laser





Technical Data

VLE350-F280-B12-1100

VLE700-F280-B12-1200

Detection range

X: 40 ... 160 mm
Z: 60 ... 350 mm

X: 60 ... 345 mm
Z: 100 ... 700 mm

Line data

960 value pairs (world coordinates in 0.01 mm steps)

Image data

1280 × 960 px

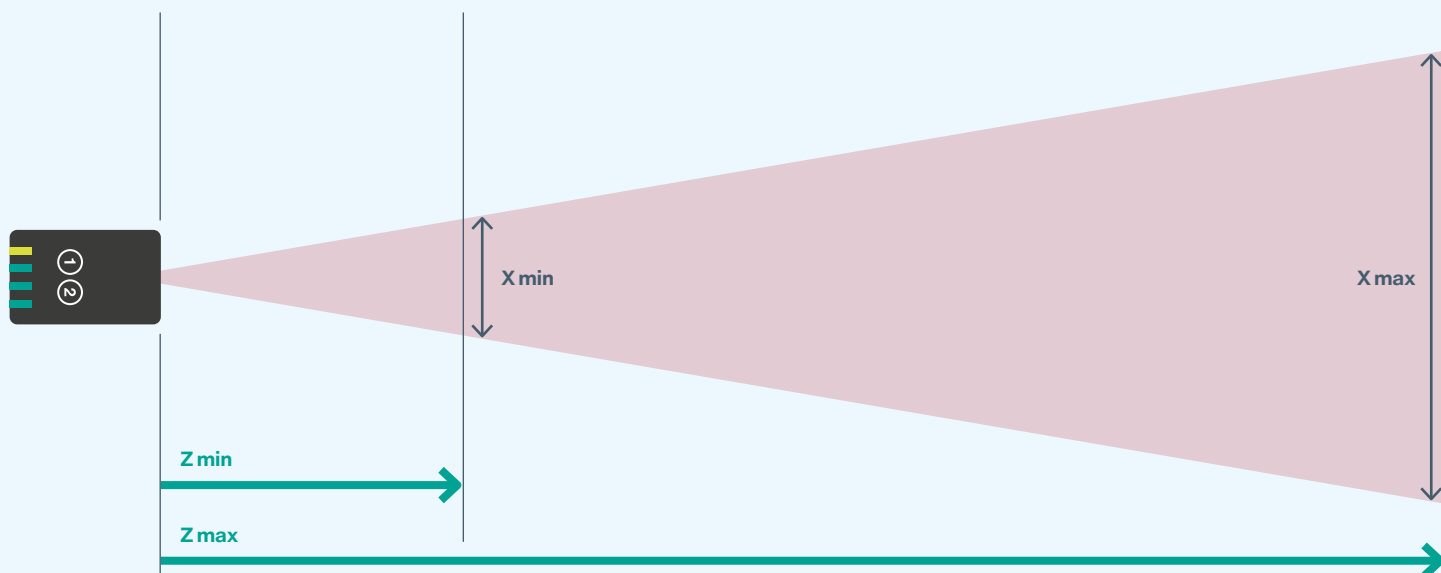
1280 × 960 px

Maximum scan rate

30 Hz

30 Hz

GEN*i*CAM



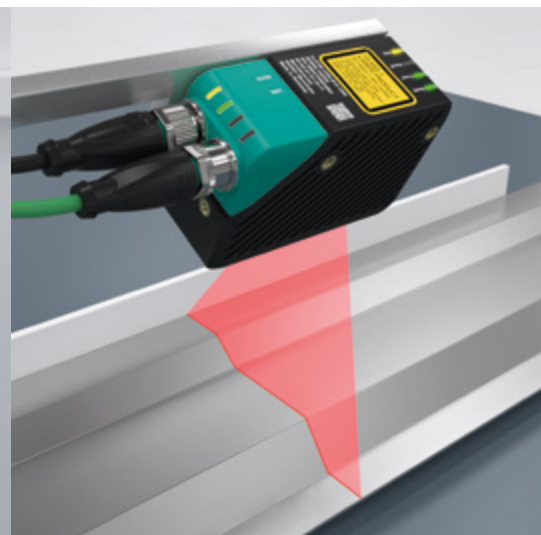
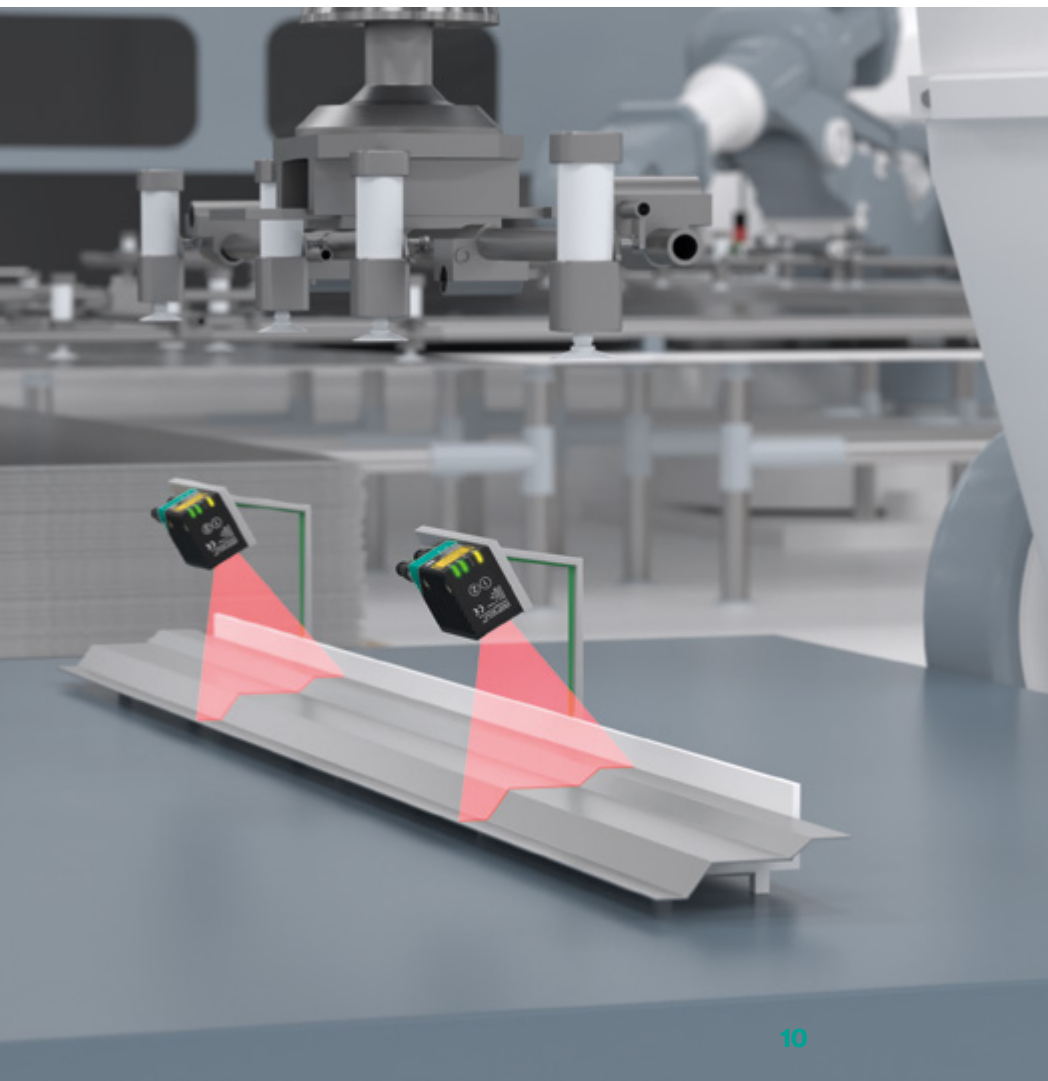
Detection range of SmartRunner Explorer

Flexible Use with Raw Data Output

Volume detection, measurement, or quality control—the profile output of the SmartRunner Explorer enables the individual solution of your application. Furthermore, the additional output of 2-D images can be used to automate documentation tasks.

Quality Control of Bent Metal Sheets

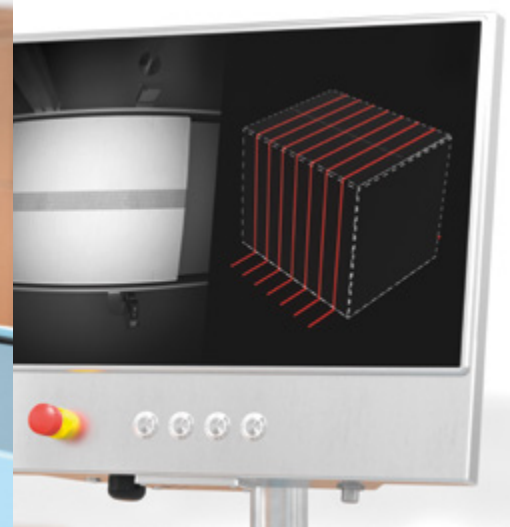
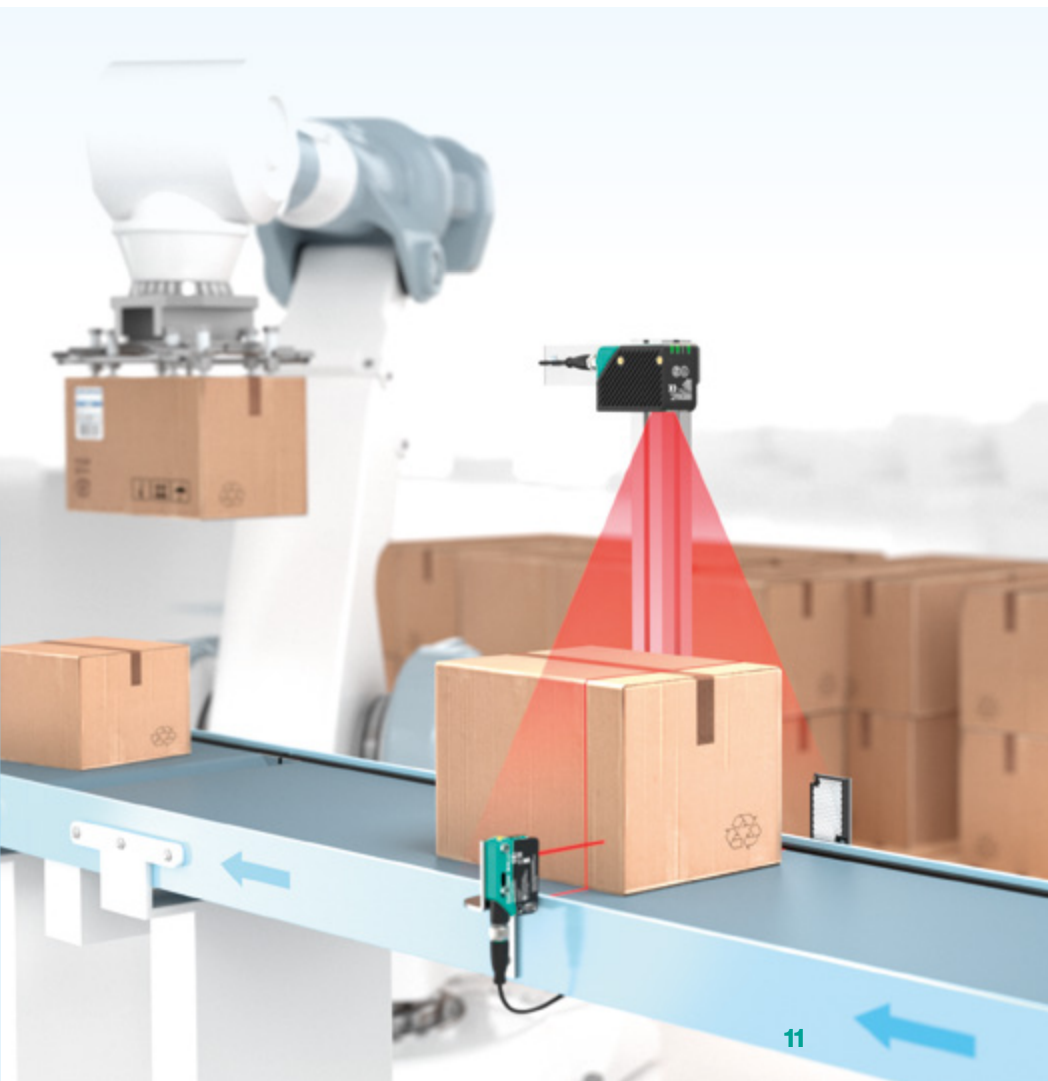
When automating metal bending processes, it is necessary to ensure that the metal has been formed correctly. For this purpose, the sheets are individually removed from the press by a robot and transported to an inspection station. The SmartRunner Explorer performs the inspection at one or several positions. The height profile of the sheet metal is recorded with high precision and transmitted in world coordinates via Ethernet TCP/IP to an industrial PC. There, the shape is then checked for correctness or any deviations.



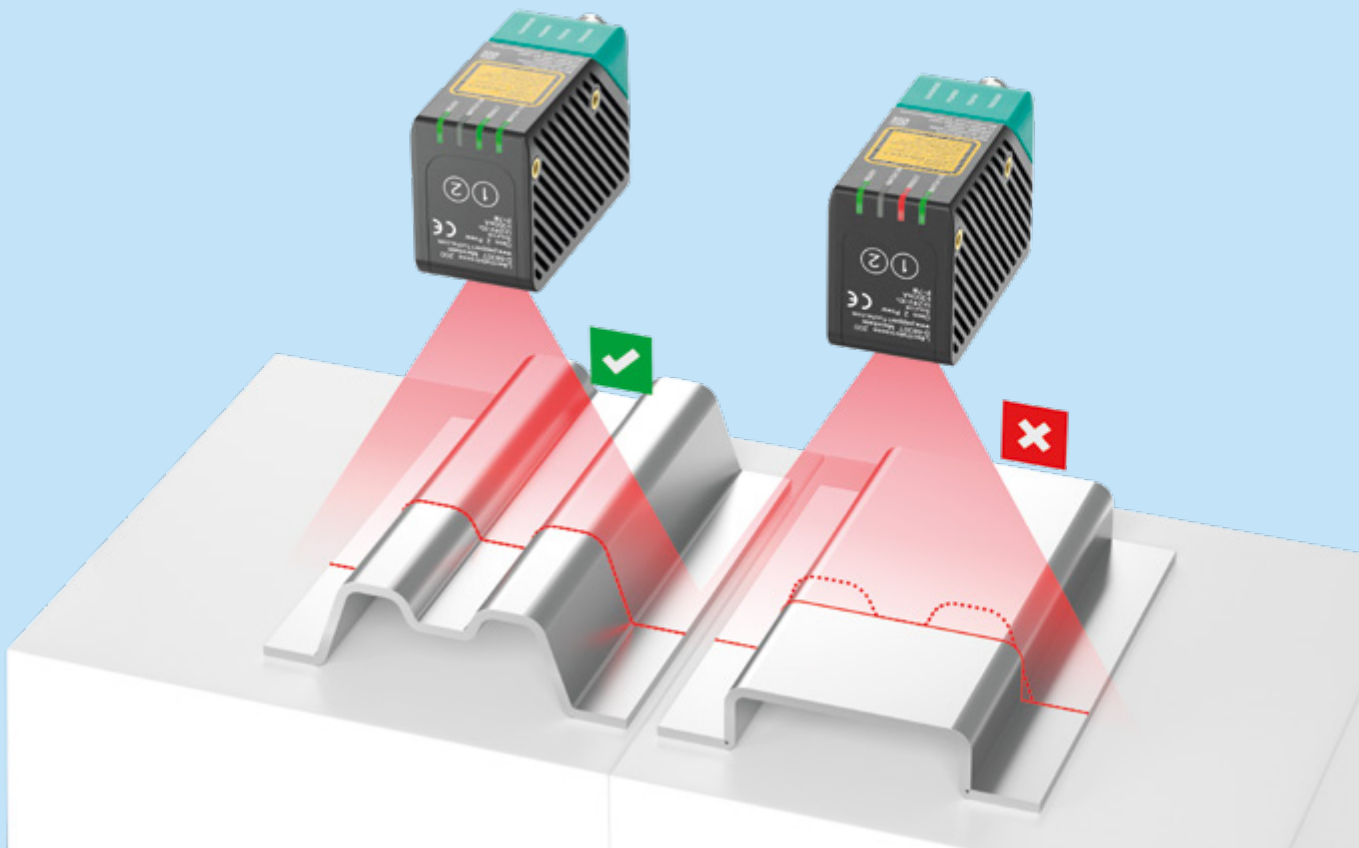
Package Measurement with Automatic Documentation

The SmartRunner Explorer can also be used to determine the volume of packages in logistics processes. The measurement process is initiated by a trigger sensor on a conveyor belt. The laser profile sensor transmits the height profile data to a downstream PC in a fixed cycle. There, the dimensions or volume can be easily determined with the help of the height profiles and path data of the conveyor belt. If the analysis program detects a deviation in the shape, a 2-D image can be captured and documented for later verification.

For the implementation of such applications, the commands for line and image data are available simply in the form of a DLL. The graphical user interface of the own parameterization and visualization software, a programming example, and the comprehensive manual simplify the implementation.



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.

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

Highlights

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



Profile comparison



Eye-safe with Class 1 laser



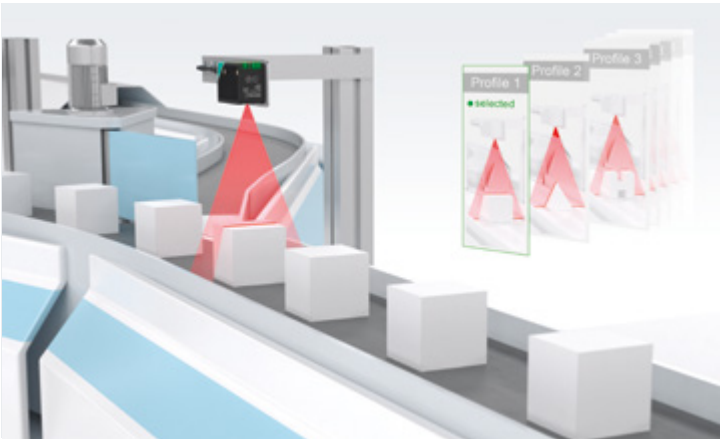
Easy parameterization via Data Matrix code



Stores Up to 32 Profiles

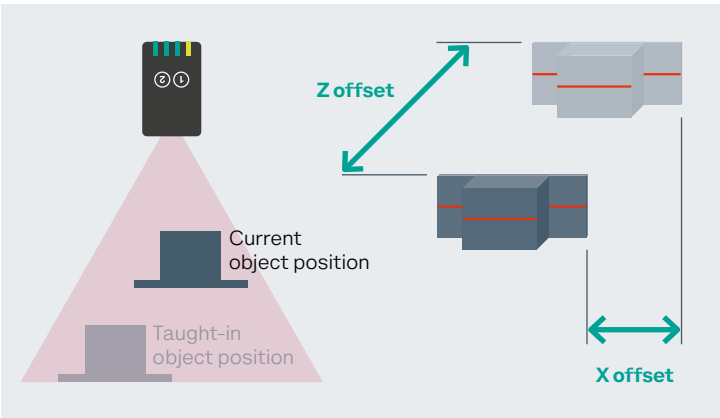
The SmartRunner Matcher Extended stands out with a few additional features: multiprofile and output of X and Z offset data.

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.



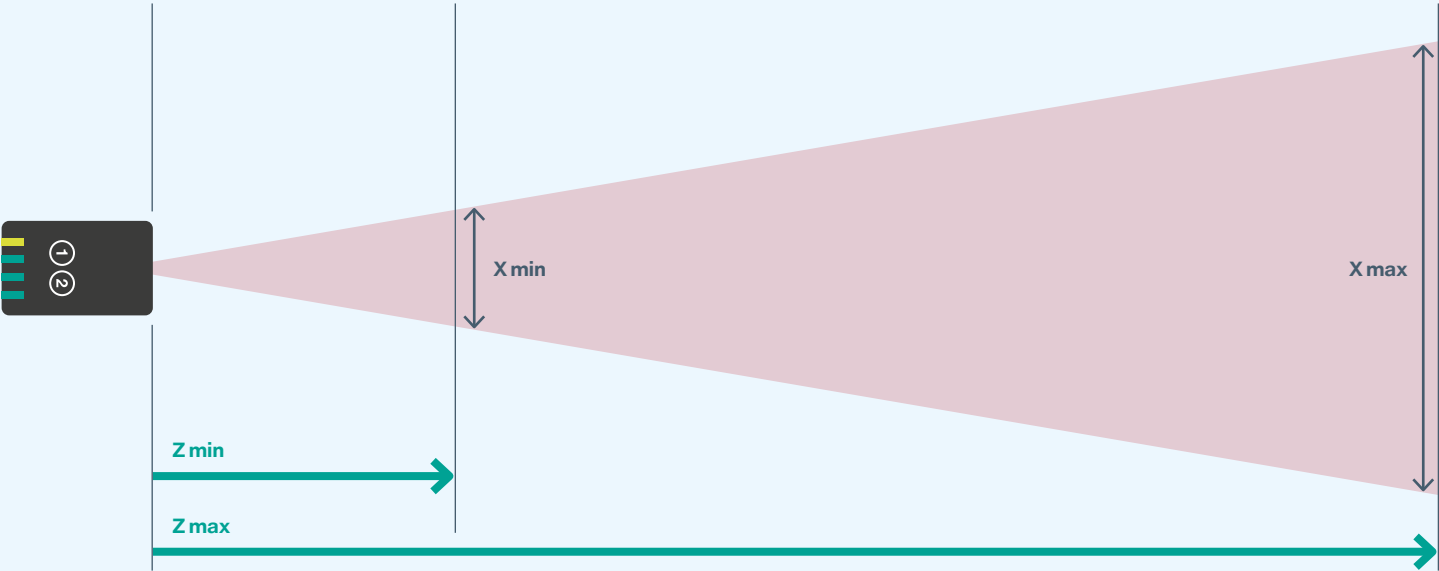
Precise X and Z Position Data

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.



Technical Data	VLM350-F280-2E2-1000	VLM350-F280-R4-1001	VLM350-F280-R4-1002	VLM350-F280-R4-1101	VLM700-F280-R4-1102
Features	Standard	Extended	Extended	Extended	Extended
Detection range	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
Resolution*	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
Maximum scan rate	10 Hz	10 Hz	30 Hz	30 Hz	15 Hz

* at minimum distance



Detection range of SmartRunner Matcher

tion via software wizard.

If several SmartRunner Matchers are used in a plant, the parameterization can be duplicated quickly and easily via Data Matrix control code. Simply placed in front of the vision camera, it is immediately captured and then decoded. The sensor automatically activates the parameters it contains. The Data Matrix control codes can be easily generated using the Vision Configurator parameterization interface provided. This allows a wide range of sensors to be put into operation quickly and easily.

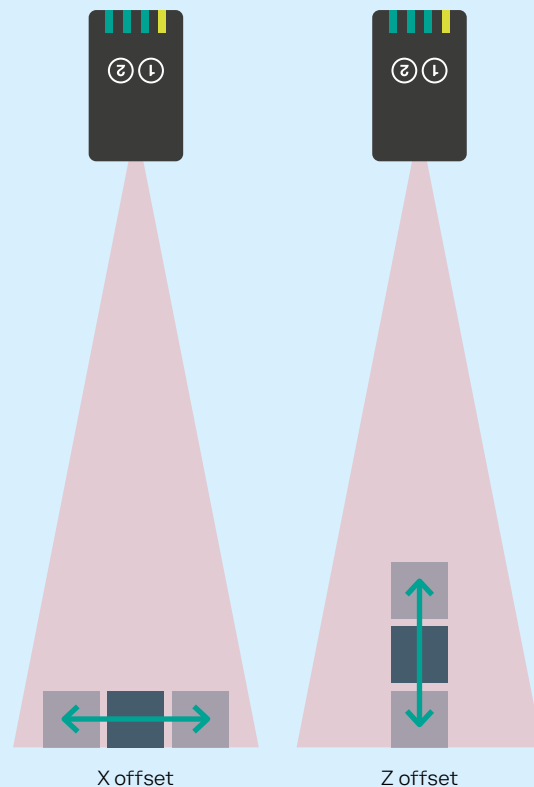
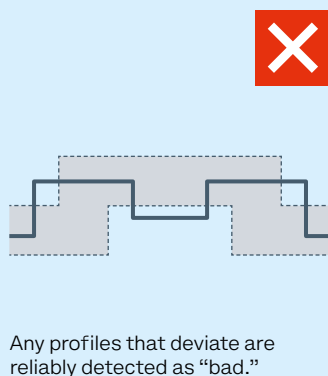
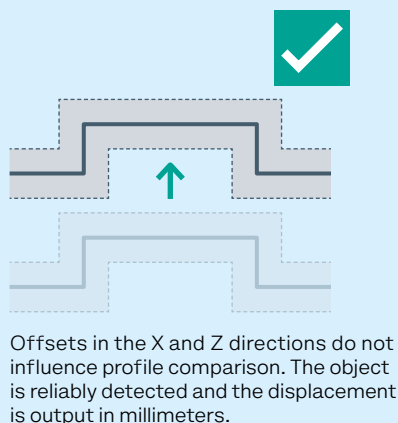
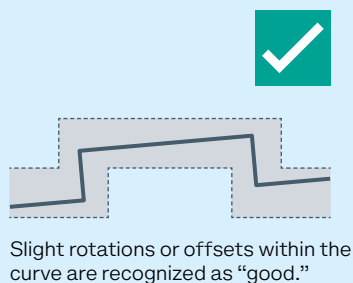
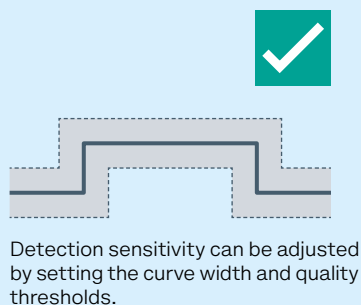
Not all objects are the same. That is why an appropriate tolerance range must be identified. This starts with the definition of a curve around a taught-in profile. Depending on this, quality values are automatically determined. These can be used to define thresholds for differentiating good and bad parts.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

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 2-D image of the object in one display, the relevant areas can be quickly identified and the sensing range defined.



Reliable detection of object profile, positioning, and distance

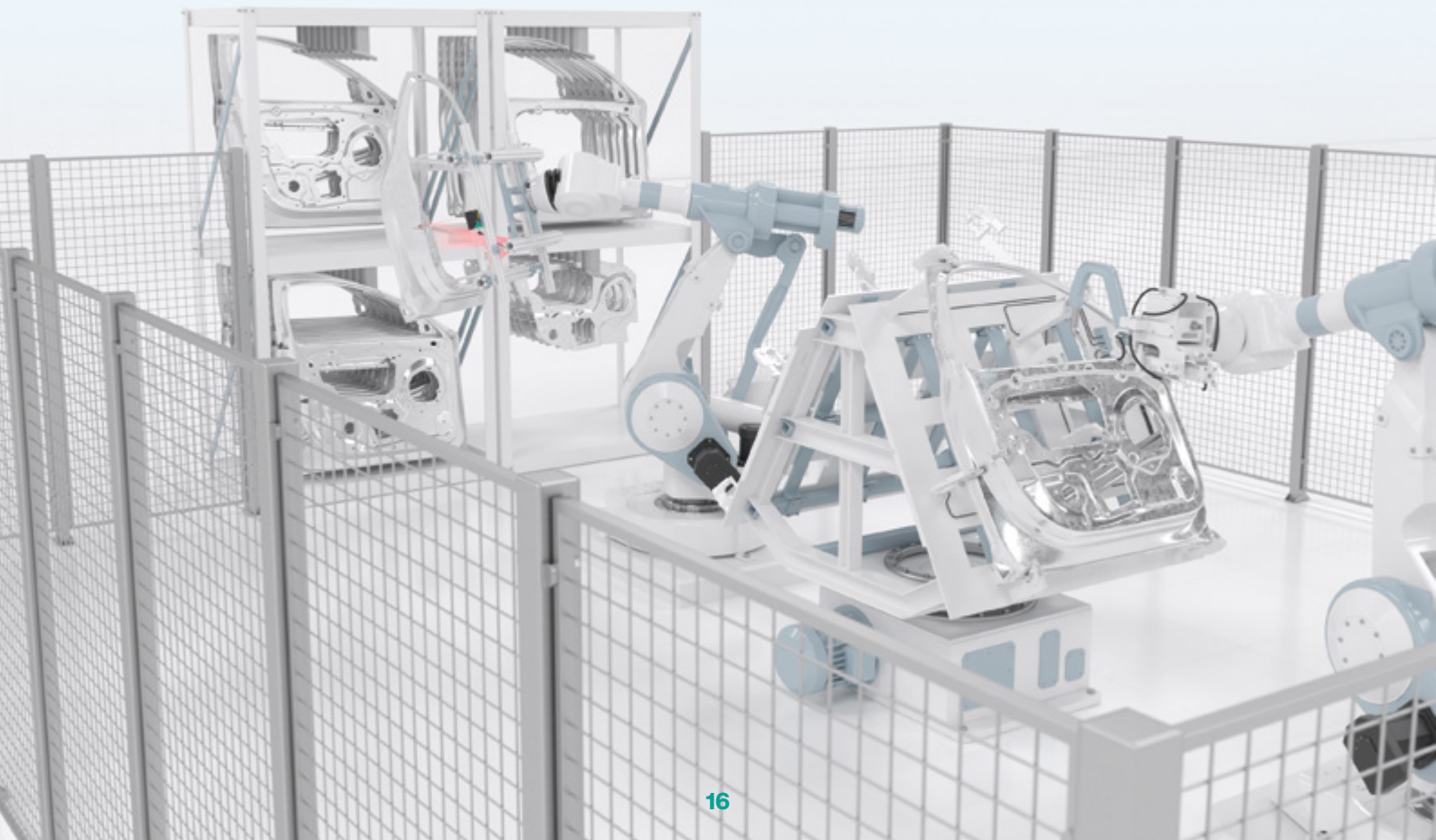
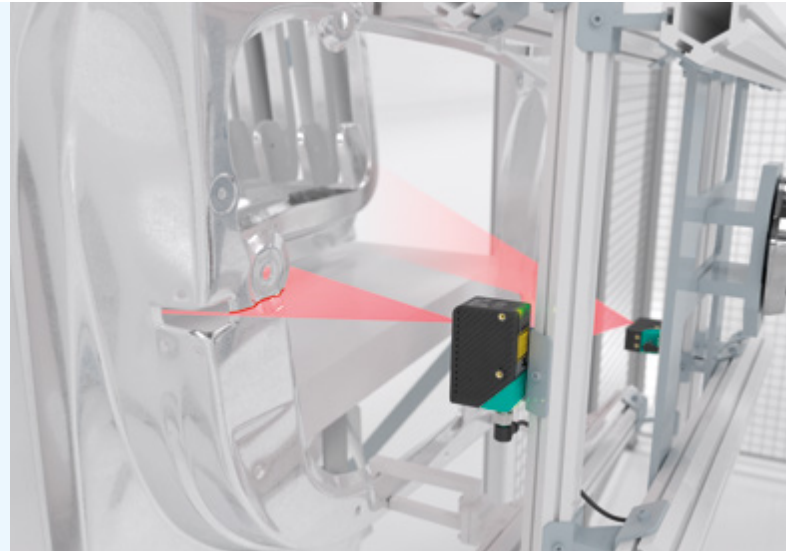
One Sensor for a Wide Range of Applications

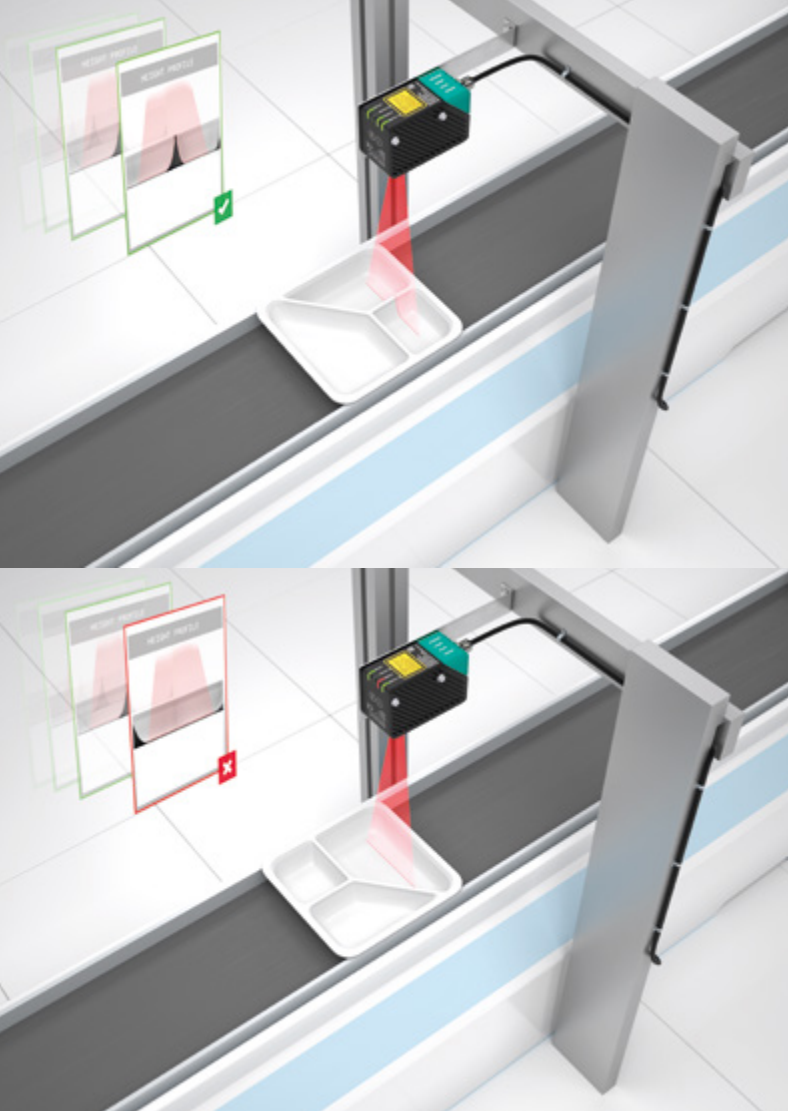
Optimized for profile comparison, the SmartRunner Matcher is incredibly versatile, mastering positioning, presence, and completeness detection of guided components.

Precise Presence Detection

The SmartRunner Matcher uses laser light section technology to quickly and easily verify that 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 deviates 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

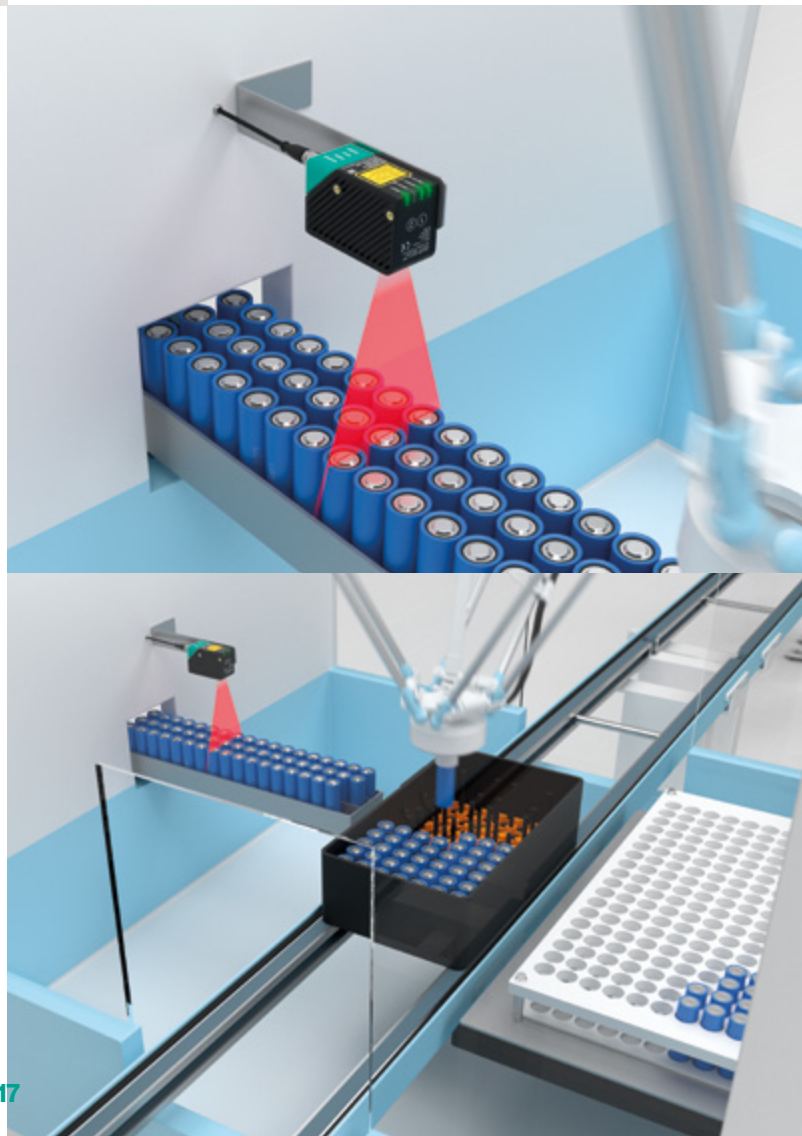
The exact positioning of workpieces or workpiece carriers is essential in automated processes. In these applications, the profile of all or part of the object is used to teach a distinct profile in the desired end position, triggering subsequent processes. The output of the X and Z offsets also enables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

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

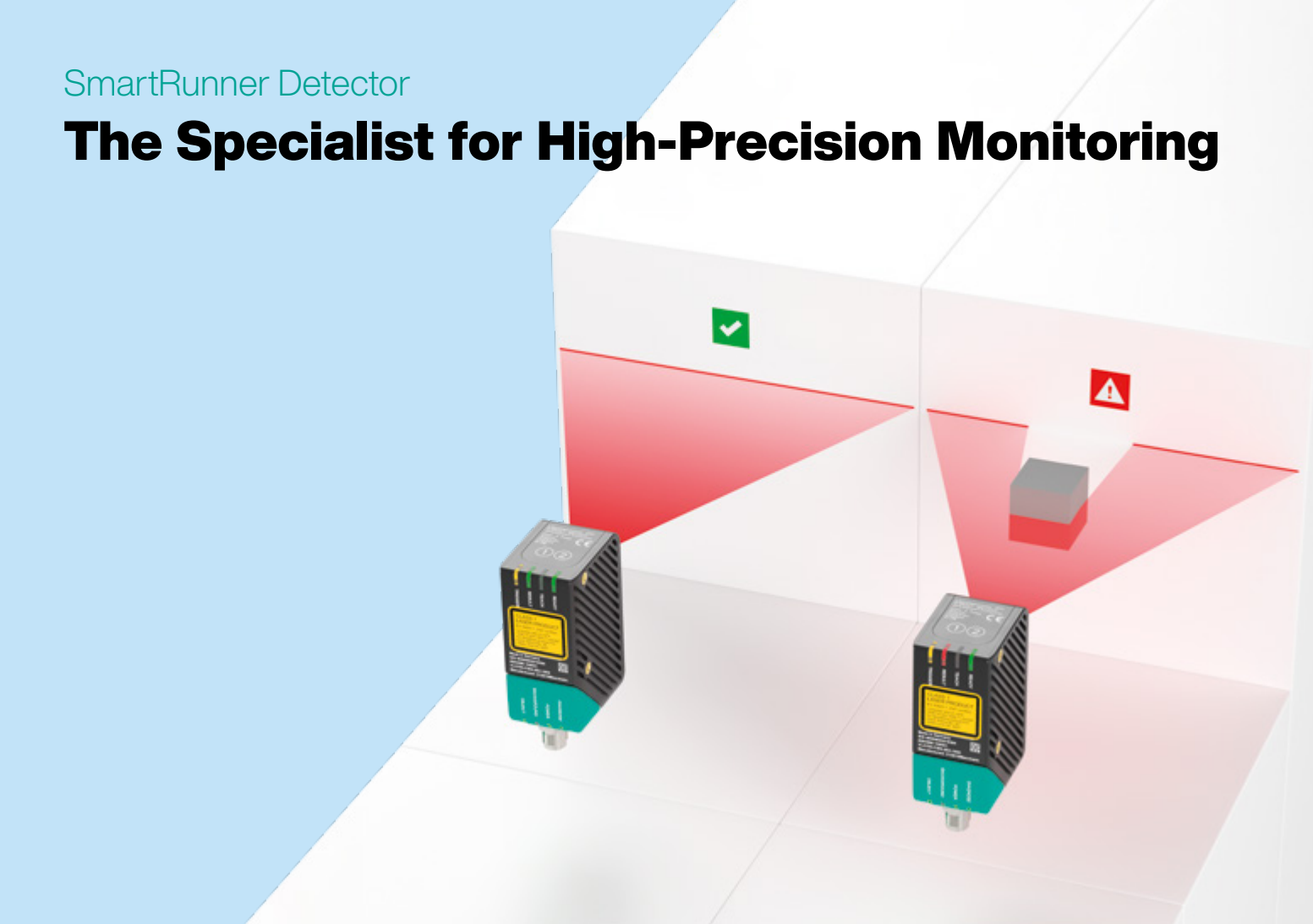
Reliable Completeness Checks

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 battery cells, pens, and other products



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. If there is no fixed background, the Teach-in can also be performed in an empty room. 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.

Typical Applications

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

Highlights

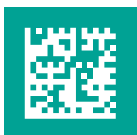
- Easy parameterization using Data Matrix control codes or via parameterization software
- Background Teach-in possible via sensor buttons or interface
- Object sizes and regions of interest (ROI) can be customized



Monitoring



Eye-safe with
Class 1 laser

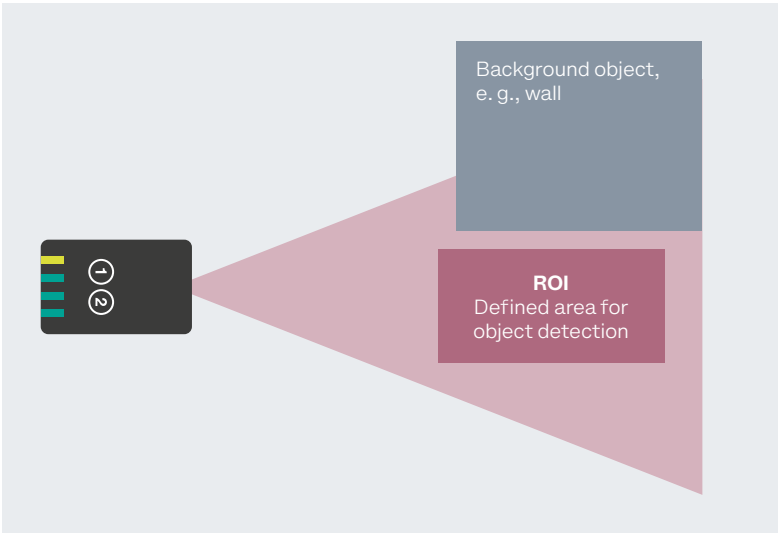


Easy parameterization
via Data Matrix code



Adjustable 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-in tolerance.

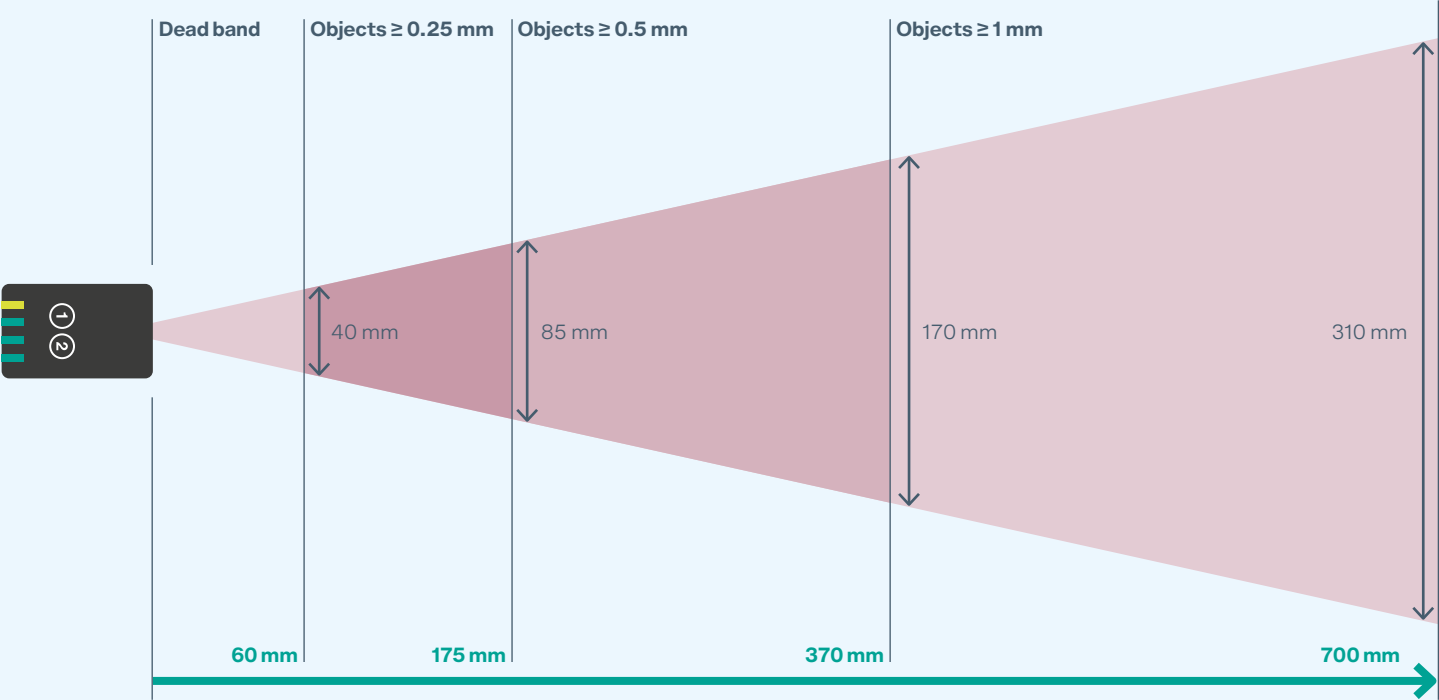


Technical Data

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



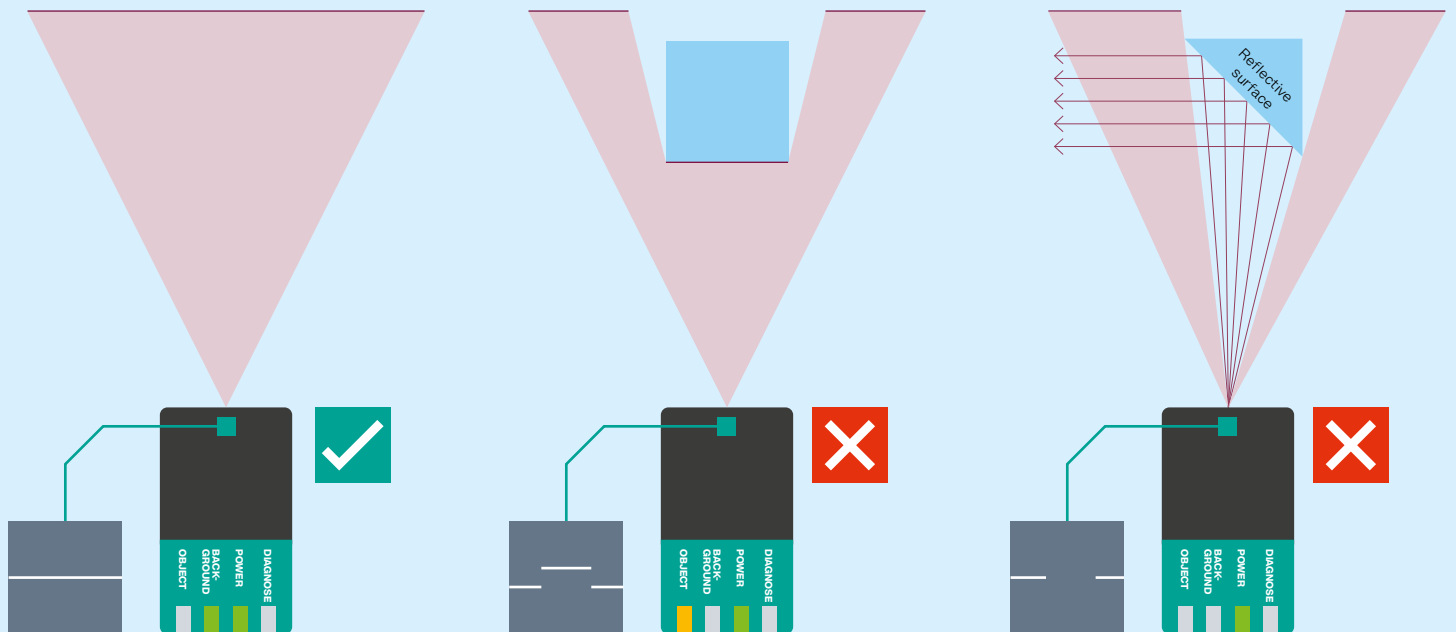
Detection range of SmartRunner Detector

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.

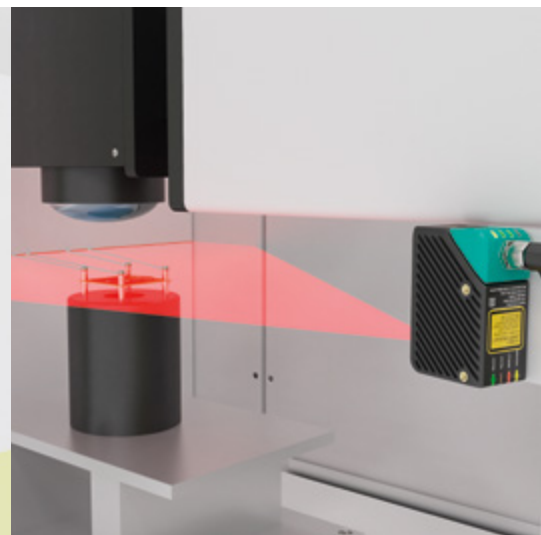
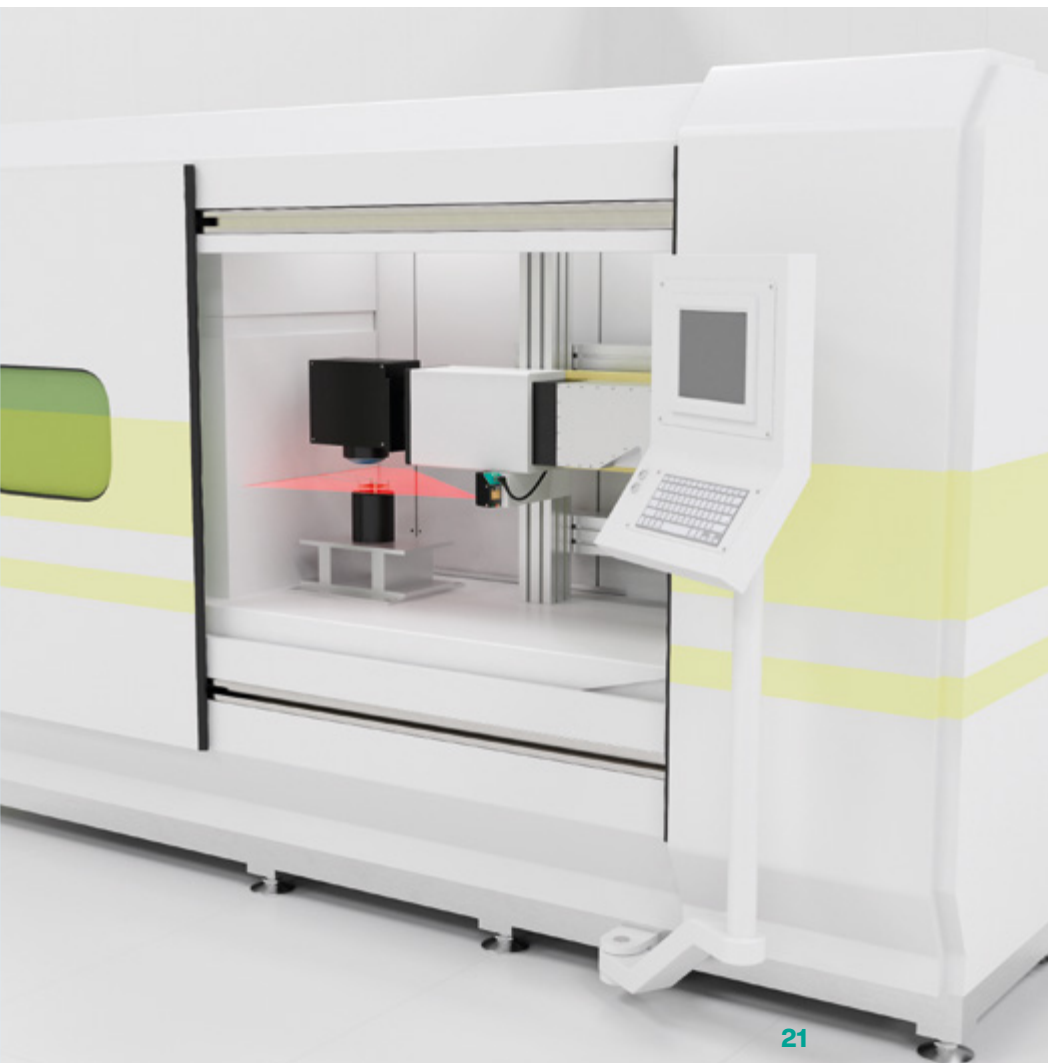


Machine Monitoring with Laser Light Section Technology

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 laser light section technology, the sensor detects any deviation from the previously taught-in 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.



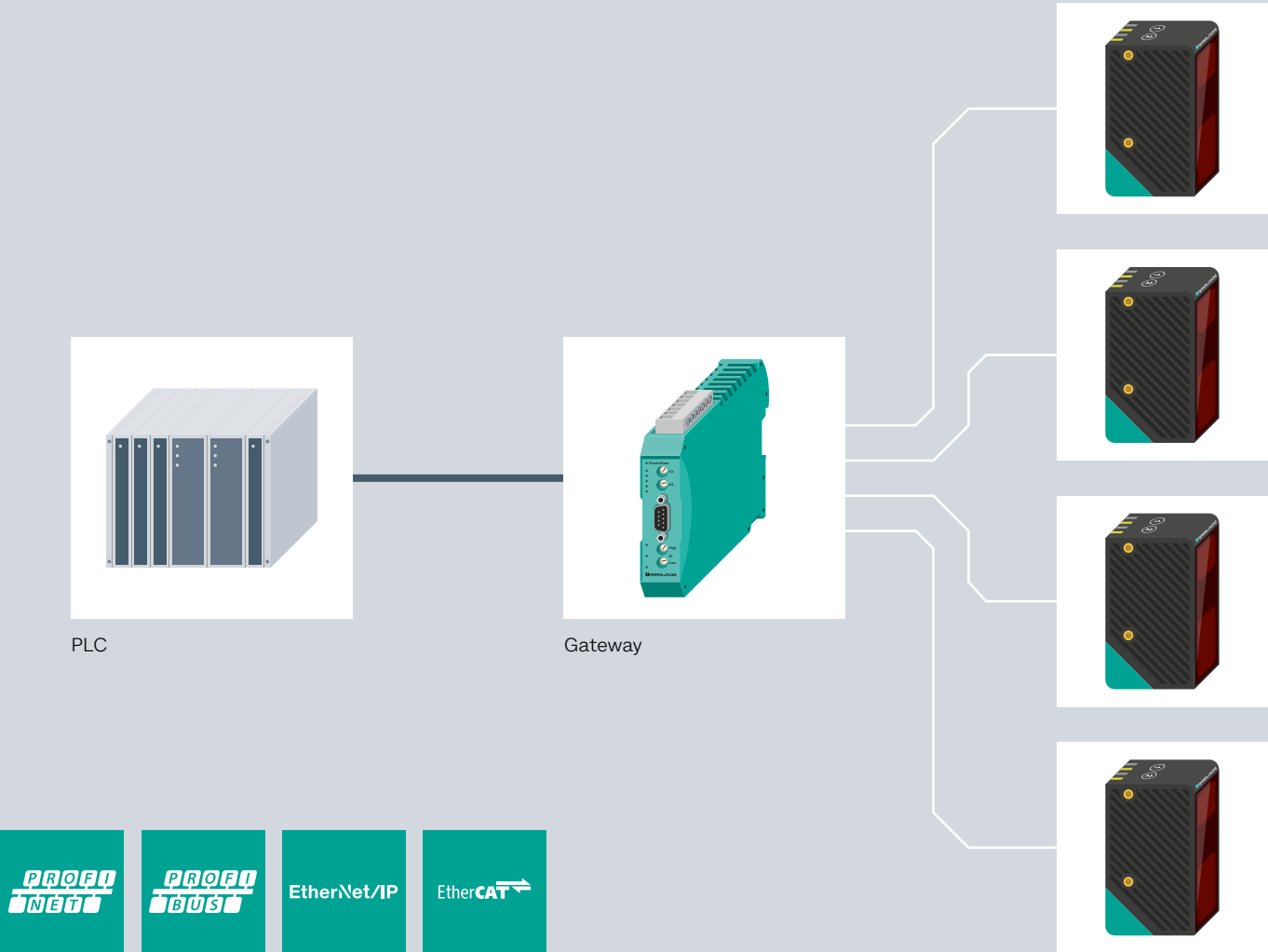
The Perfect Supplement

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 Matcher and Detector use an RS485 interface for data transmission. If the sensor should 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 conveniently mounted on a DIN rail. Up to four SmartRunners can be connected with just one 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 available from a single source.

Order Code	VLX-F280-C	VLX-F280-C-GLASS	VLX-MB1	VLX-MB2	V19-*	V1SD-*	PCV-USB-RS485-Converter Set
Accessory	Protective enclosure	Replacement glass	Mounting aid	Mounting aid	Power supply cable	Ethernet cable	Interface converter
Description	Weld slag cover model	Replacement glass for SmartRunner protective housing	Mounting bracket	Mounting bracket	Available in different lengths and versions	Available in different lengths and versions	Converter USB to RS485



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