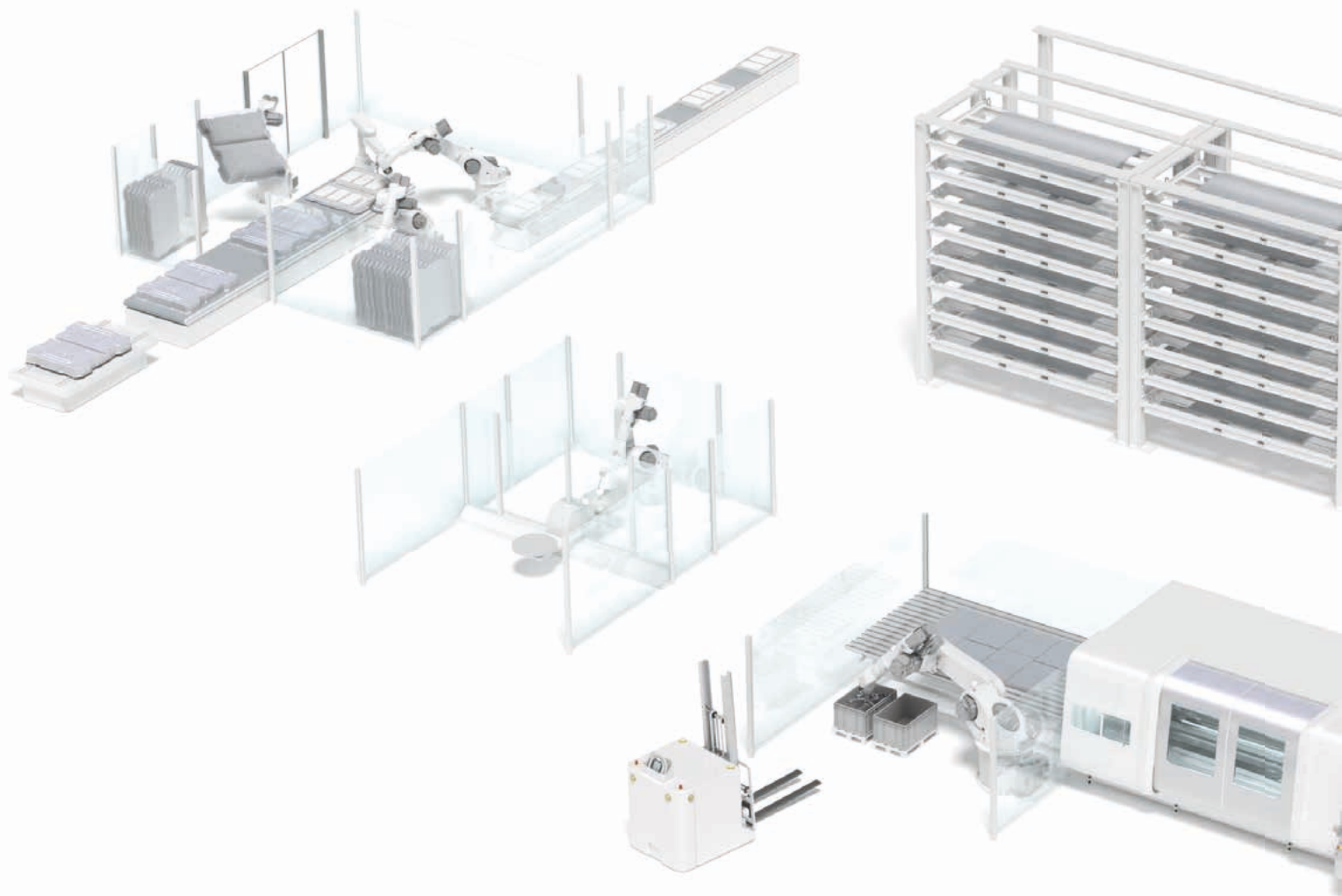
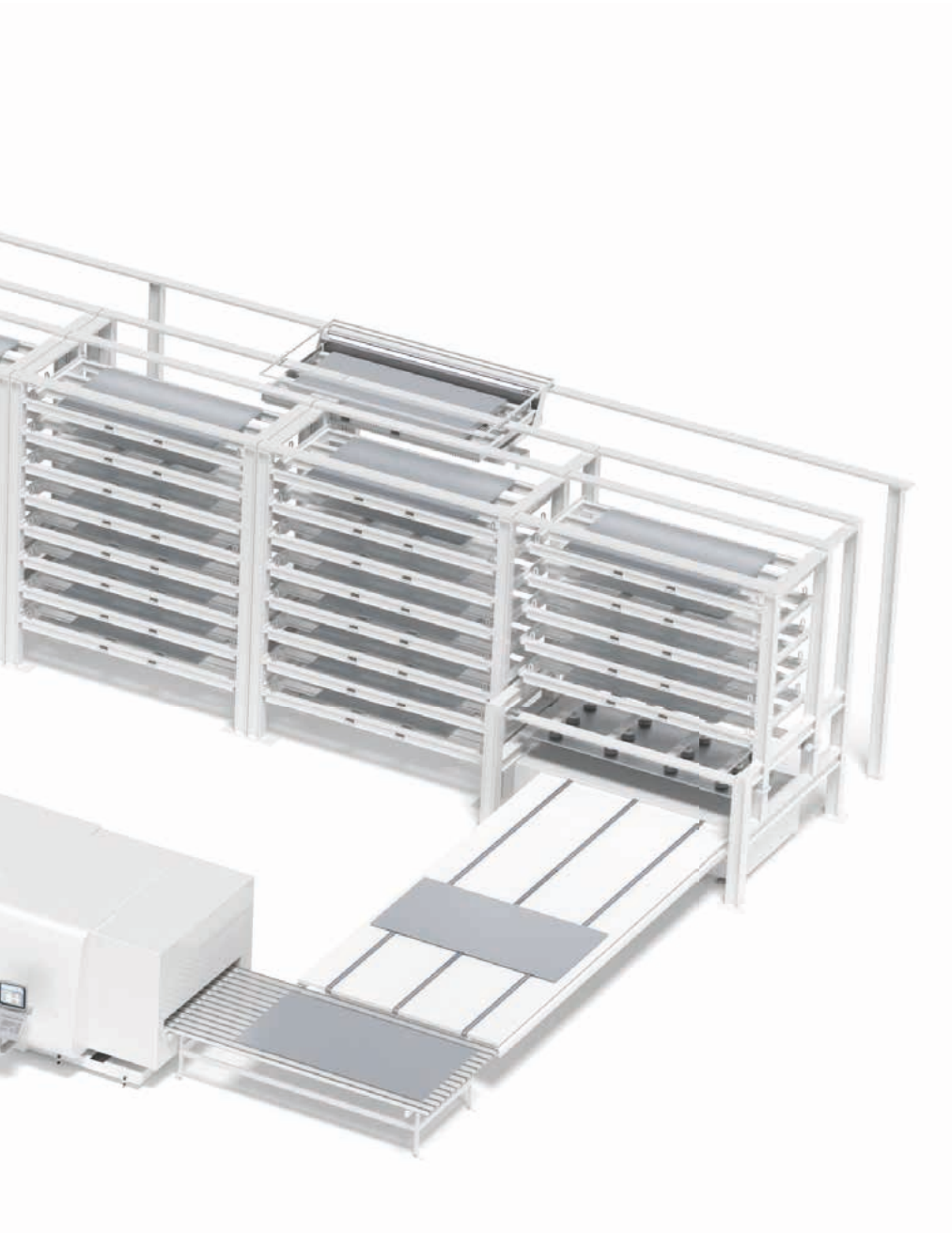


## Sensor solutions for machine tools and automation systems







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# **Creating transformation. Yesterday. Today. Tomorrow.**

With curiosity and determination, we – the Sensor People – have been partners for technological milestones in industrial automation for more than 50 years. The success of our customers is what drives us. Yesterday. Today. Tomorrow.







# For safely automated machine tools

Machine builders are facing new challenges due to increasing automation and the vision of the smart factory:

From individual machine tools to fully networked production systems, flexibility and networking are becoming increasingly important – with the highest safety and quality standards.

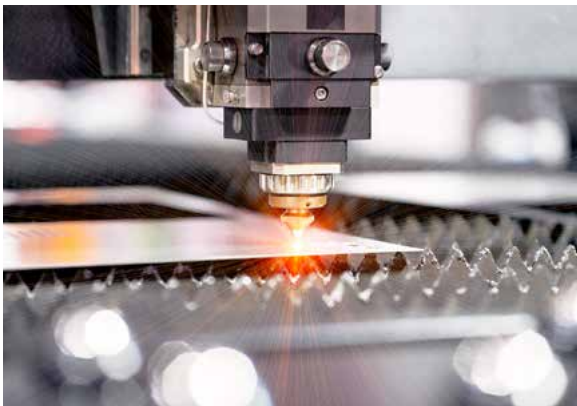
As a sensor manufacturer, our goal is to make your production even more flexible, efficient, and safer through the use of our innovative products and solutions. This is how we ensure your success in an industry that is ever evolving.





### **Machine tools and automation systems**

Production of the future is characterized by flexible structures. From the individual machine tools to a production cell or a fully networked production system of a smart factory. What all have in common are the automated and linked processes in and between the cells. This improves productivity, allows for a more efficient use of materials and enables higher product quality. For a while now, sensors are, thus, not only a matter of process control – today they are above all needed for linking processes together.



### **Maximum system availability and certified quality standards**

Our sensors support you in all areas of automation, quality assurance, traceability and machine safety. They are characterized by easy handling during commissioning and exchange. With sophisticated functions, intelligent devices ensure smooth production and material provision. The long-term quality as well as the availability of the sensors are guaranteed. Our products thereby help to ensure and maintain the high availability of the system.



### **Safety without compromise**

The advance of automation gives rise to new requirements with regard to the safety of persons and machines. Through our specific application know-how and more than 30 years of experience in the area of machine safety, we offer unique insight into safety-related applications. With our safety product range consisting of high-quality products, intelligent systems as well as competent technical services, we provide you with targeted answers.

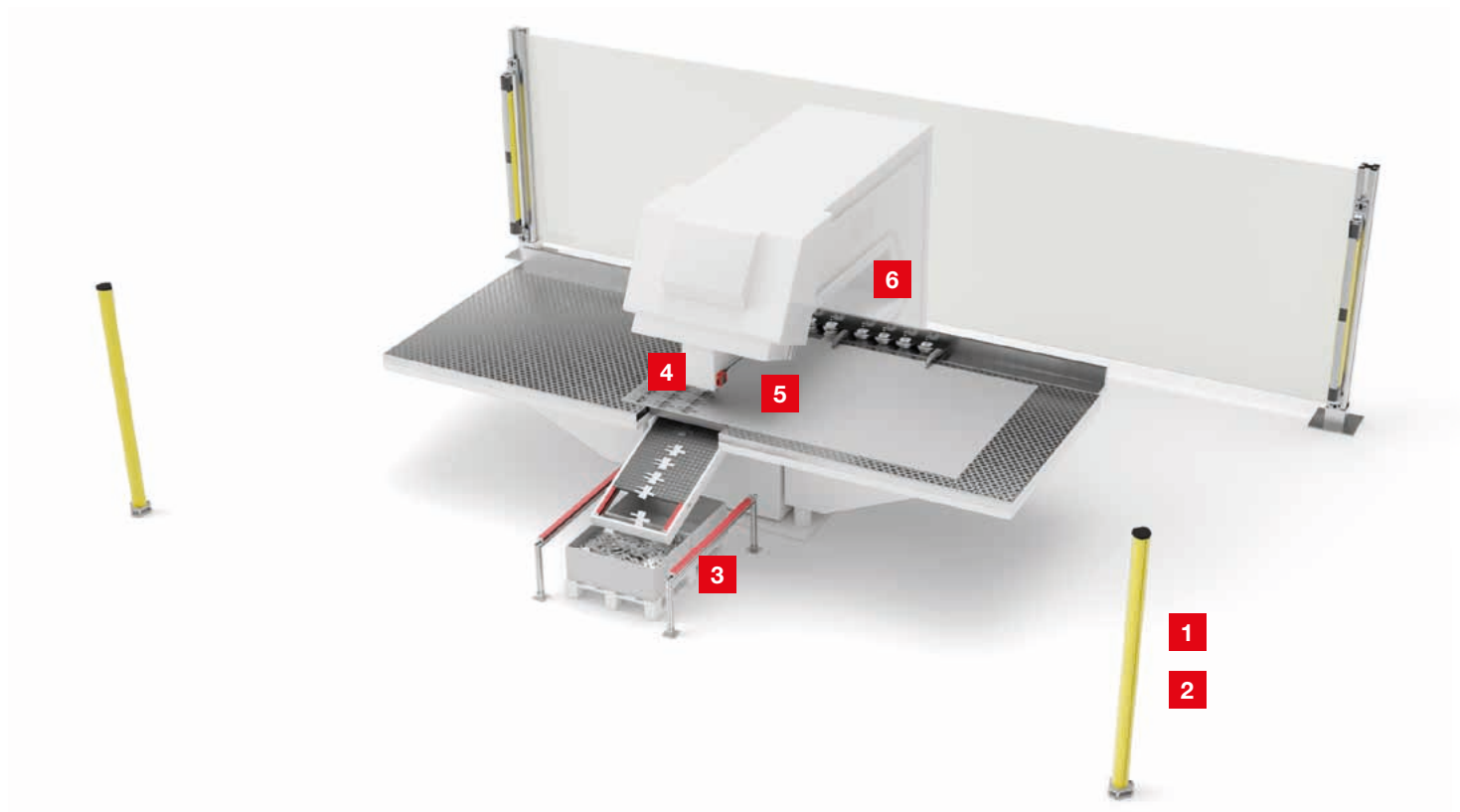
# Punching machine and laser-cutting machine

Punching machines and laser-cutting machines separate very quickly and precisely smaller parts from large sheet metal plates. When processing sheet metal plates with punch presses or with laser cutting, safety at work plays an important role, as work is performed with high pressure and high-energy laser beams. In addition, the sensor system used must be able to detect very small stamping parts to ensure a fault-free production process.

Our sensor solutions reliably and flexibly safeguard hazardous areas. And do so with maximum protection for people and with minimal influence on the workflows. Moreover, sensors check for tool availability, prevent collisions and monitor the ejection of the sheet metal parts being processed.







1 Access guarding, one side

2 Access guarding, multiple sides

3 Monitoring of container filling levels

4 Presence control of the tool in the punching head

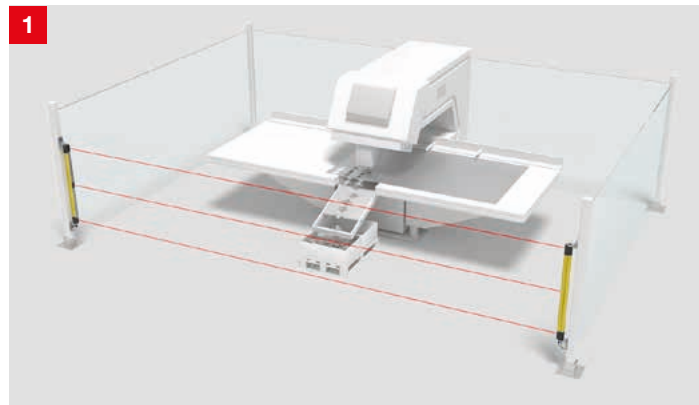
5 Collision avoidance of metal sheet with machine

6 Tool identification

# Punching machines and laser-cutting machines

## Access guarding, one side

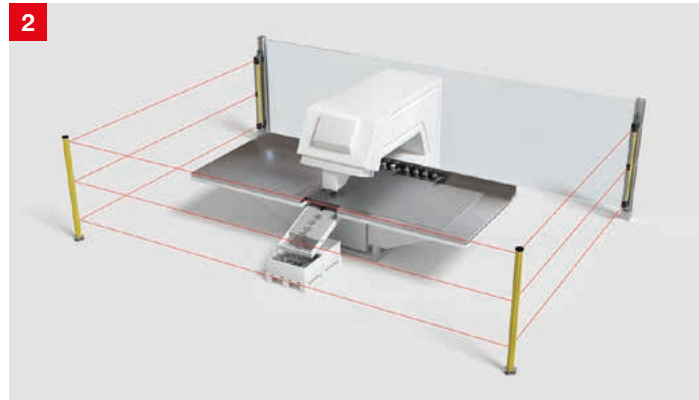
**Requirement:** Access to a dangerous area at a machine or system is to be guarded. To enable material entry and exit, the machine must be easily accessible from one side.



**Solution:** The MLD 300/500 multiple light beam safety devices provide cost-effective access guarding solutions. The transceiver models with an operating range of up to 8 m are especially easy to install. For wide-area guarding, transmitter/receiver models are available with a larger operating range.

## Access guarding, multiple sides

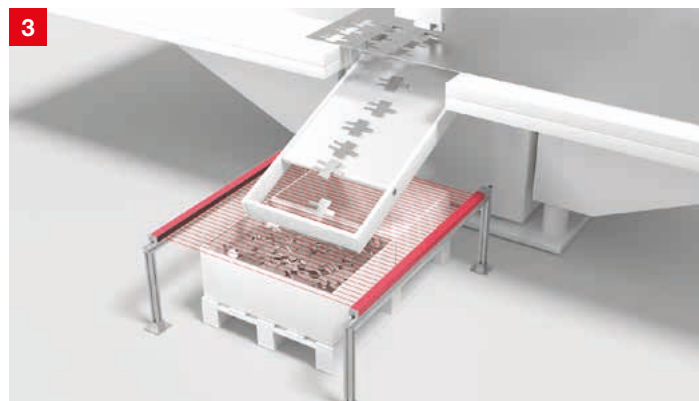
**Requirement:** Access to the working range is to be guarded while the machine is in operation. To enable material entry and exit, the machine must be easily accessible from multiple sides.



**Solution:** The MLD 300/500 multiple light beam safety devices in combination with the UMC mirror columns safeguard access to the machine on multiple sides and over lengths of up to 70 m. The integrated laser alignment aid makes installation quick and easy.

## Monitoring of container filling levels

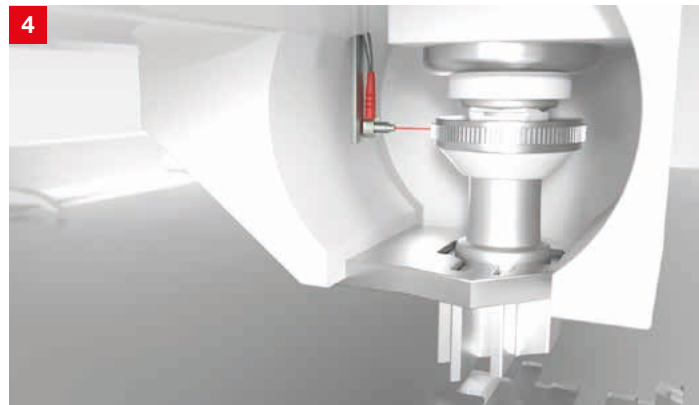
**Requirement:** After the punching or laser process, the produced parts are guided to a collection container via a chute. The reaching of the maximum permissible fill level of the container is to be monitored. Monitoring must function reliably with oily and glossy surfaces on the parts as well.



**Solution:** The CSL 710 switching light curtains convince with their ease of configuration and large function reserves – even with extremely small parts. Various fastening materials enable optimum mechanical integration in the machine. For applications with IO-Link interface, the CML 700 measuring light curtains are available.

### Presence control of the tool in the punching head

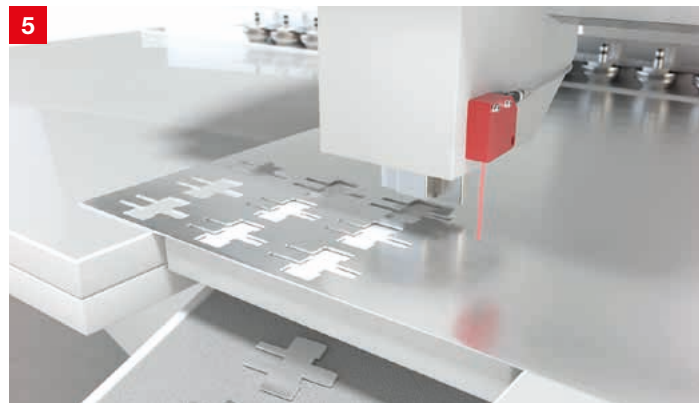
**Requirement:** On a punching machine, the presence of the punching head in the tool holder is to be checked following the tool change. The check is performed before the actual punching process is started. This serves to avoid down-time and ensures an optimum punching process.



**Solution:** The fiber optic sensors of the LV/KF series are particularly well suited for use in constrained spaces thanks to their flexible fiber optics. Depending on the contour of the punching head, various beam exits are available. The parallel display of signal and switching threshold on the amplifier ensures fast commissioning.

### Collision avoidance of metal sheet with machine

**Requirement:** To ensure an optimum punching process, the material thickness must be checked. This is performed by measuring the distance to the material with high resolution.



**Solution:** The ODSL 8 and ODS 9 sensors measure the distance with resolutions of up to 0.01 mm and thereby supply the basis for a high quality of this process step.

### Tool identification

**Requirement:** To ensure clear identification for a reliable tool change, a 2D-code is applied to the work piece, i.e. the punching head.



**Solution:** The DCR 200i code readers and the LSIS 400i smart cameras read 2D-codes. The DCR 200i are characterized by their compact design and simple commissioning. Their optics models enable different reading ranges. With the motor-driven focus adjustment, the LSIS 400i offer a large and flexibly adjustable reading field.

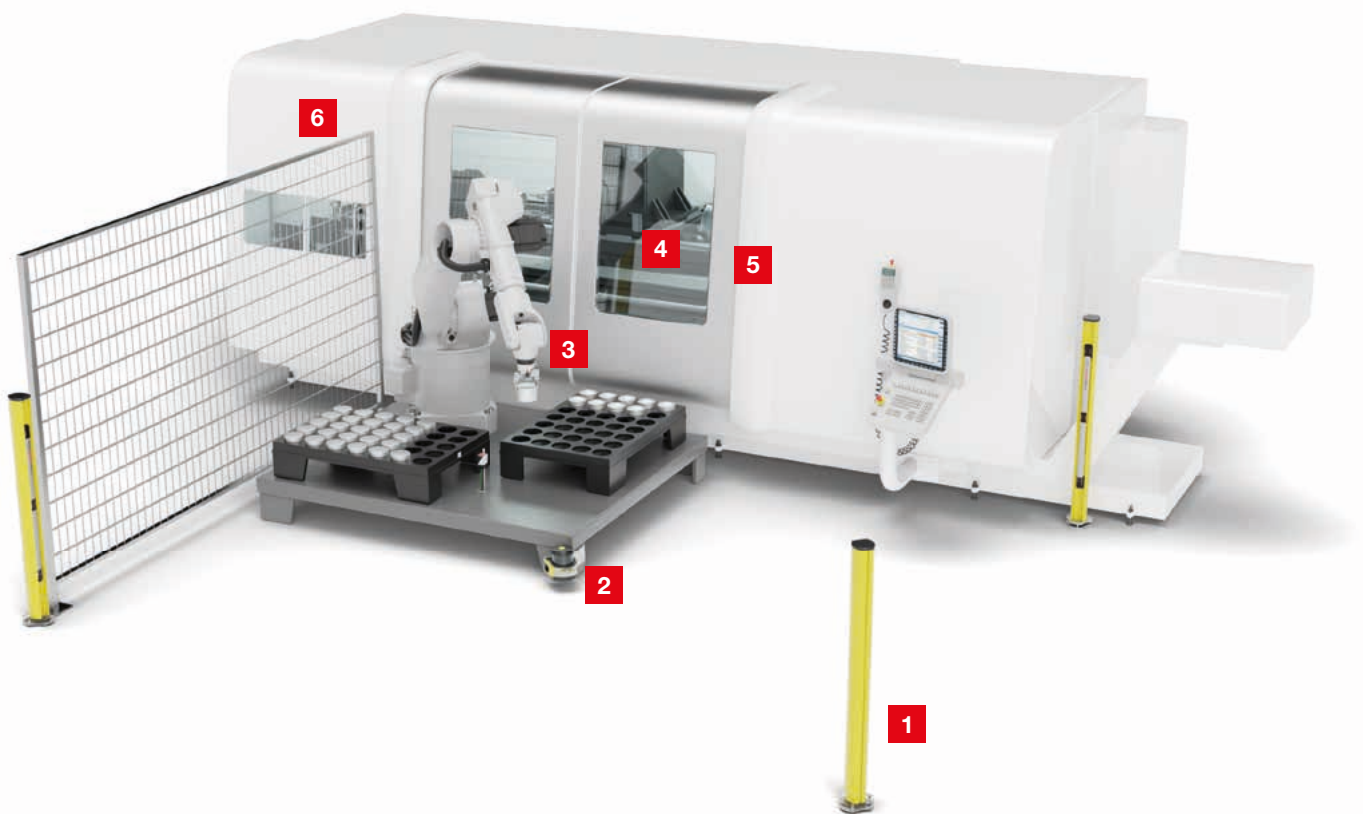
# Machining center

In machining centers, objects of various materials are machined, turned, and drilled. The prerequisite for processing work pieces in complex machining centers with a high degree of precision is having the right tool available for each work step. Industrial robots are often used for the automated loading and unloading of processing centers. Before the robot picks up a part, the part must be uniquely identified to ensure that the correct processing step is carried out. The robots perform numerous swivel and gripping movements in a very short period of time. The working ranges of the robots must be reliably safeguarded in terms of access by and the presence of persons.

Our inductive and optical sensors check and monitor the presence and position of work pieces and parts. Our identification systems record data for the traceability of those work pieces and parts and for the next work step. And our safety sensors reliably monitor danger zones and safeguard points of operation.







1 Access guarding, multiple sides

2 Area guarding

3 Presence control

4 Visual monitoring of the machine compartment

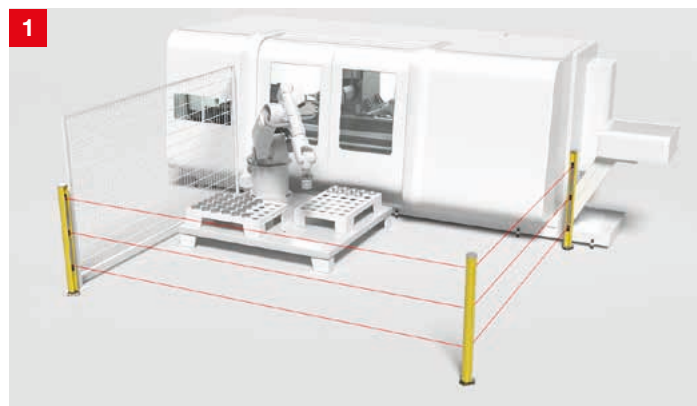
5 Point of operation guarding

6 Machine interior monitoring

# Machining center

## Access guarding, multiple sides

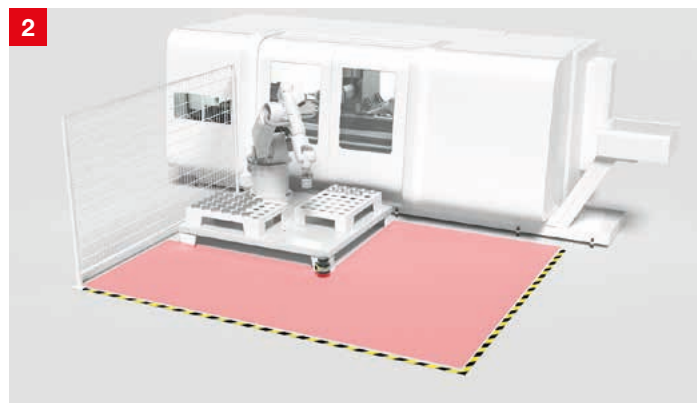
**Requirement:** Access to the working range is to be guarded while the machine is in operation. To enable material entry and exit, the machine must be easily accessible from multiple sides.



**Solution:** The MLD 300/500 multiple light beam safety devices in combination with the UMC mirror columns safeguard access to the machine on multiple sides and over lengths of up to 70 m. The integrated laser alignment aid makes installation quick and easy.

## Area guarding

**Requirement:** The hazardous working range of the robot is to be guarded against entry by and the presence of persons. The interaction of man and machine requires efficient structuring of the processes.



**Solution:** The RSL 400 safety laser scanners monitor the working range of the robot and enable simple access to the machine. Because the presence of persons is also monitored, an automatic start-up of the robot can be integrated in the processes.

## Presence control

**Requirement:** During the automatic loading of the processing center, an industrial robot performs numerous swivel and gripping movements in a very short period of time. During the gripping movement, inductive and optical sensors check and monitor the presence and position of work pieces and parts.



**Solution:** Due to the constrained space, the fiber optic sensors such as the LV / KF series are ideally suited for this application. Depending on the contour of the part/work piece, various beam exits are available. The fiber-optic product range is rounded out by the dual display of the amplifier for convenient commissioning.

### Visual monitoring of the machine compartment

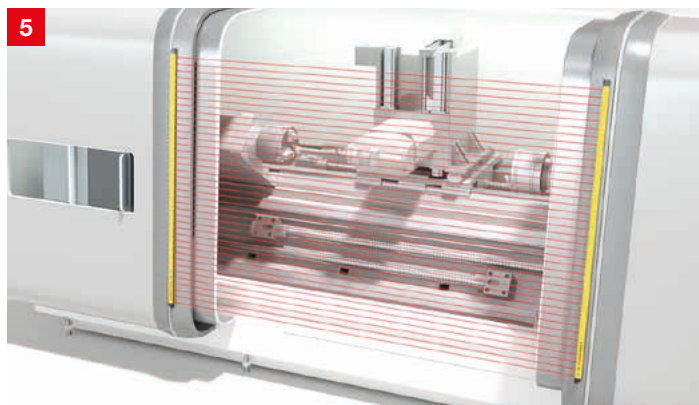
**Requirement:** The machine room is to be visually monitored. This also applies for areas that cannot be viewed from the outside. Due to the special environmental conditions, an industrial camera with high degree of protection is required.



**Solution:** The LCAM 408i color camera is optimized for use in harsh, industrial environments. 5-megapixel image resolution and Giga-bit Ethernet interface ensure high image quality and fast, live-image transfer. The metal housing with degree of protection IP 67 and models with compressed air connection guarantee reliable operation.

### Point of operation guarding

**Requirement:** The point of operation that arises from opening the safety doors must be safeguarded. Ideally, the optical protective device can easily be integrated in the machine in a space-saving manner.



**Solution:** The MLC 520-S safety light curtains have an especially narrow design. Together with the finely graduated length selection in increments of 30 mm and the design without dead zones, the devices can be perfectly integrated in the machine assembly.

### Machine interior monitoring

**Requirement:** During the fully automatic loading of processing centers by means of AGVs, it must be ensured that no persons are located in the interior before the process is allowed to restart. This also applies for areas of large processing centers that are difficult to see.



**Solution:** The LBK 3D safety radar system detects persons in the monitored area and operates reliably even under harsh ambient conditions. Furthermore, the radar technology allows the presence of static objects in the monitored area.

# Wire- and pipe-bending machine

Tube and wire bending machines bend and cut round material. Because these machines process materials of various lengths, the area guarding at the bending head of the machines must be adaptable to different dimensions. Also important is reliable presence control of the material – regardless of its surface characteristics.

Our easy-to-configure safety laser scanners facilitate fast configuration of different-sized protective fields for this purpose. In addition, they are very resistant to particles that may separate from the material during the machining process. Our optical sensors function largely reflection-independent and therefore reliably detect a wide range of surfaces.







**1** Safeguarding the bending area

**4** Presence control

**2** Monitoring the closing state of the protection hood

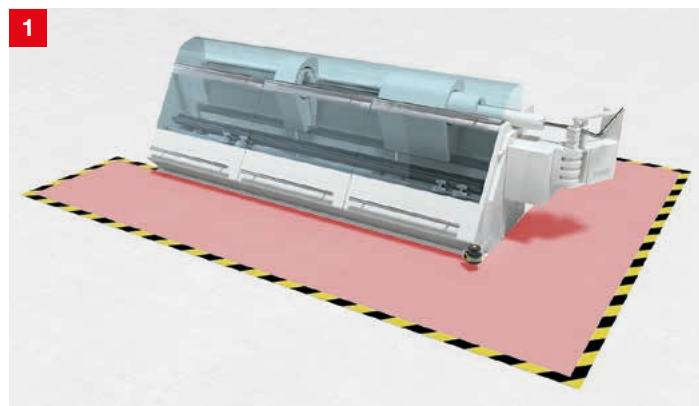
**5** Presence control

**3** Integration of safety sensors

# Wire- and pipe-bending machine

## Safeguarding the bending area

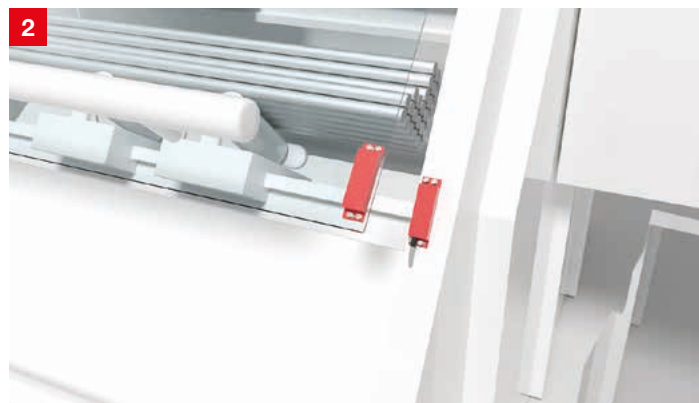
**Requirement:** The hazardous working range of the machine is to be guarded against entry by and the presence of persons. The contour of the monitored area is to be adapted to the contour of the machine.



**Solution:** The RSL 400 safety laser scanners use configurable protective fields for area monitoring. Thanks to the 8.25 m operating range and 270° scanning range, large areas can be guarded with just one device.

## Monitoring the closing state of the protection hood

**Requirement:** The closed state of safety guards such as doors or flaps must be monitored. EN ISO 14119 stipulates that measures to protect against manipulation must also be provided. If this is not possible through constructive measures, the sensor must have a high level of protection against manipulation.



**Solution:** Thanks to diverse installation options, the S20/200 safety switches can be used universally. The contactless, magnetically coded switches of the MC series are ideal for use in harsh environments. The RD 800 safety transponders with RFID coding also offer maximum protection against tampering.

## Integration of safety sensors

**Requirement:** Multiple safety sensors must be integrated into the machine or system control. Functions such as a time delay for releasing a locking device or signal connections are also to be configured.



**Solution:** The basic module of the MSI 400 expandable safety control already has 24 safe inputs/outputs as well as an Ethernet interface with Industrial Ethernet protocols. The safety control can be configured quickly and efficiently using the license-free configuration software MSI.designer.

### Presence control

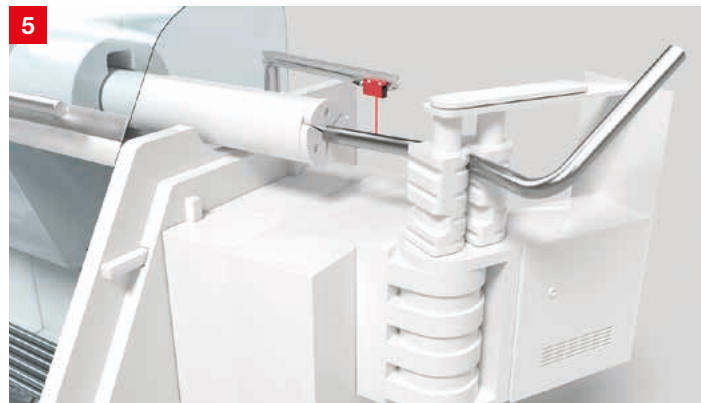
**Requirement:** The bending process should be performed with consistent accuracy for both simple as well as complex shapes. To do this, the presence control of the wire is to be checked to ensure that the subsequent machining process can begin reliably.



**Solution:** The IS series of inductive switches offers operating ranges of up to 40 mm and a wide range of cylindrical and cubic designs. Furthermore, the models in robust full-metal construction are resistant against aggressive lubricants.

### Presence control

**Requirement:** The bending process should be performed with consistent accuracy for both simple as well as complex shapes. To do this, the presence control for the correct position of the pipe is to be checked to ensure that the subsequent machining process can begin reliably.



**Solution:** The HT 3 diffuse reflection sensors for shorter operating ranges and HT 25C for longer operating ranges ensure reliable presence control. Models with various light-spot geometries offer reliable detection of different materials. The version with IO-Link interface makes commissioning quick and easy.

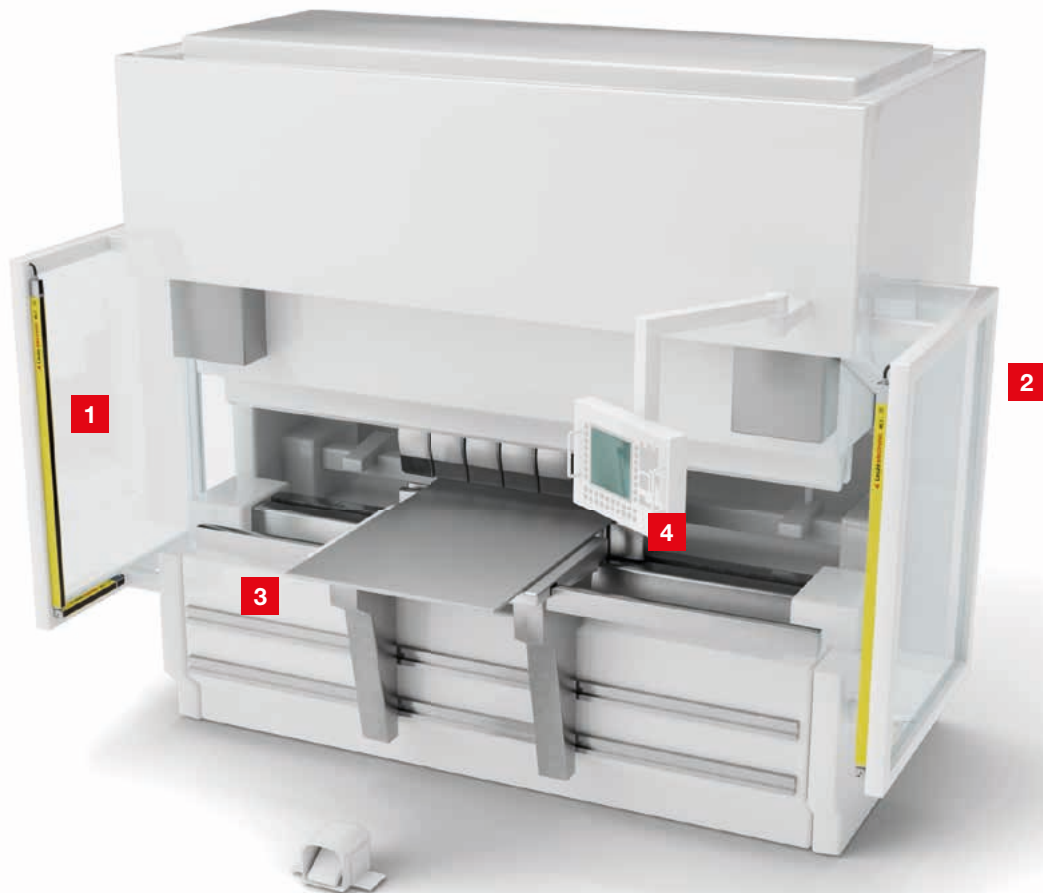
# Hydraulic press brake

In hydraulic press brakes, bending presses or bending machines, a wide range of sheet metal parts are produced through bending. Extreme forces are at play here in some cases. These as well as the large dimensions of the manufactured parts require various safety measures.

Our robust safety light curtains safeguard points of operation as needed. The series includes many different models. It thus offers a perfect solution for nearly every requirement. Flexible blanking functions also make it possible to adapt to different work pieces and make them safe, yet efficient to use.







**1** Guarding the point of operation with protection against reaching under

**2** Access guarding at rear of machine

**3** Integration of safety sensors

**4** Detection of order data

# Hydraulic press brake

## Guarding the point of operation with protection against reaching under

**Requirement:** Guarding of the point of operation must detect violation of the protective field. Fixed or moving machine parts or work pieces inside the protective field, however, are to be permitted and must not cause a shutdown.



**Solution:** The MLC 530 safety light curtains have the following functions: fixed blanking, floating blanking and reduced resolution. These functions can be configured so that certain objects are permitted inside the protective field.

## Access guarding at rear of machine

**Requirement:** Access to the rear of a machine is to be guarded by an electro-sensitive protective device. The necessary distance between the protective device and point of operation is to be as small as possible.



**Solution:** With their high resolution, the safety light curtains of the ELC and MLC series offer reliable finger and hand detection. Short safety distances can thereby be realized. A multiple light beam safety device of the MLD series is available as an alternative solution for larger safety distances.

## Integration of safety sensors

**Requirement:** Multiple safety sensors must be integrated into the machine or system control. Functions such as a time delay for releasing a locking device or signal connections are also to be configured.



**Solution:** The basic module of the MSI 400 expandable safety control already has 24 safe inputs/outputs as well as an Ethernet interface with Industrial Ethernet protocols. The safety control can be configured quickly and efficiently using the license-free configuration software MSI.designer.

### Detection of order data

**Requirement:** During the processing of customer and production orders, 1D- or 2D-codes must be read on the corresponding order papers for each order to record and assign individual orders.



**Solution:** The IT147xg mobile code readers detect all commonly printed 1D- and 2D-codes. The especially ergonomic housing design is gentle on the user during continuous use. The robust devices also withstand impacts or falling onto the floor. The IT199xi are especially resistant to contamination such as oils or cleaning agents.

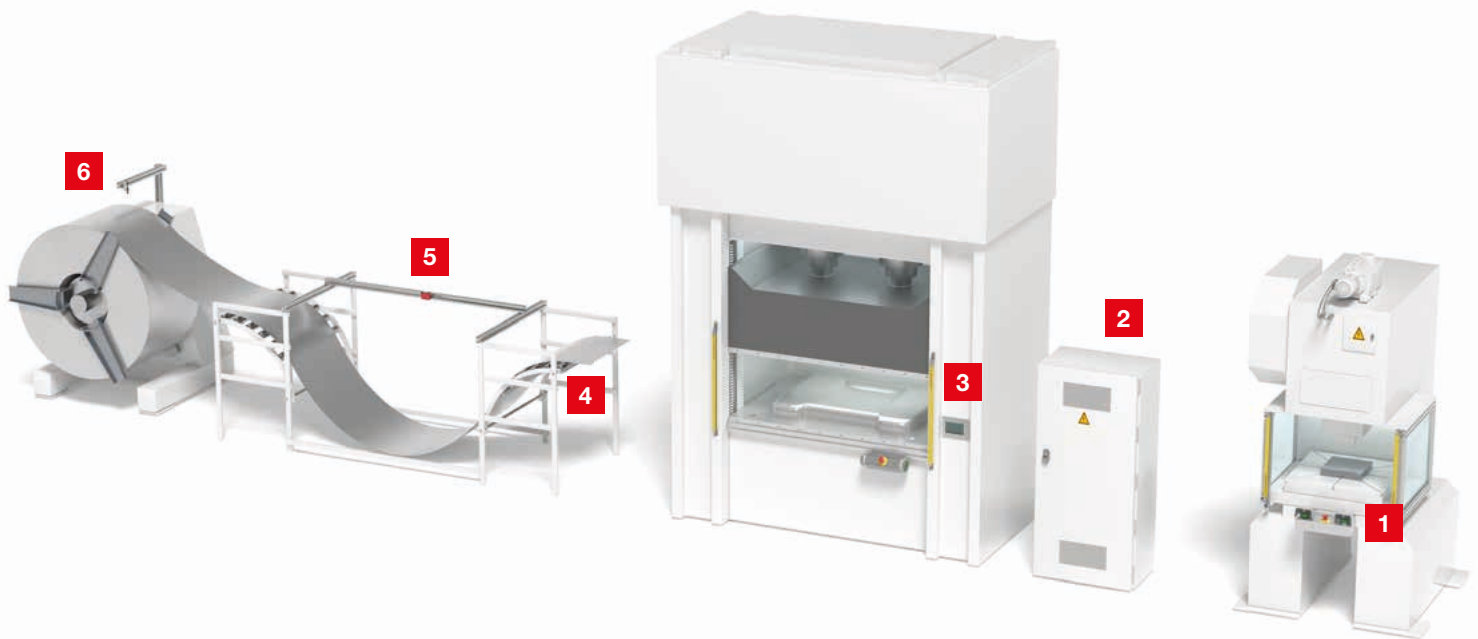
# Hydraulic, servo and eccentric presses

Hydraulic, servo and eccentric presses are used for the entire spectrum of metal forming applications. During the forming of sheet metal plates, the operator must be reliably protected from injury in the case of manual operation. Cutting machines or presses can be automated through the use of optional sheet feeders. In this case, the sheet metal plate is unwound from the coil automatically and fed to a cutting machine or press. At the start of the unrolling process, the material must be quickly and unambiguously identified. During the unrolling process, the sheet metal must be inspected for uniform unrolling to ensure precise processing during the subsequent cutting phase.

The safety sensors and controls from Leuze can easily be incorporated in machine processes and process flows, reliably safeguard these processes, and render them tamperproof. Our measuring sensors for loop control and edge control enable smooth process flows when feeding in sheet metal. Our switching sensors reliably detect the end of the coil.







**1** Guarding the point of operation with protection against reaching under

**2** Monitoring of the press procedure

**3** Point of operation guarding

**4** Edge control

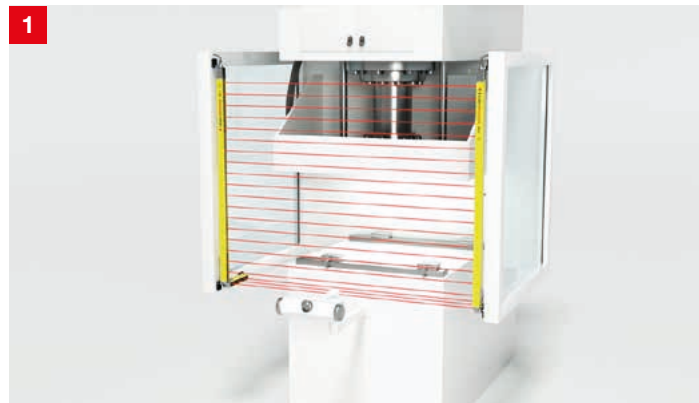
**5** Loop control

**6** Detection of roll diameter

# Hydraulic, servo and eccentric presses

## Guarding the point of operation with protection against reaching under

**Requirement:** Access to the point of operation is to be guarded by means of a safety light curtain. If the sensor can be reached under or stepped behind, then a further safety light curtain is required in order to detect these situations.



**Solution:** The cascable MLC 520 and MLC 520-S safety light curtains allow up to 3 segments to be linked together. They are integrated in the control via a common connection. This makes installation easy and cost-effective.

## Monitoring of the press procedure

**Requirement:** The specific requirements on the safety of mechanical and hydraulic presses are described in standard EN ISO 16092. To meet these requirements, the sequence of press movements must be monitored by a safety control.



**Solution:** Even the base model of the MSI 400 safety controls feature 24 safe inputs/outputs and can be expanded if necessary. The special function library with tailored function blocks for the control and protection of presses make configuration quick and easy.

## Point of operation guarding

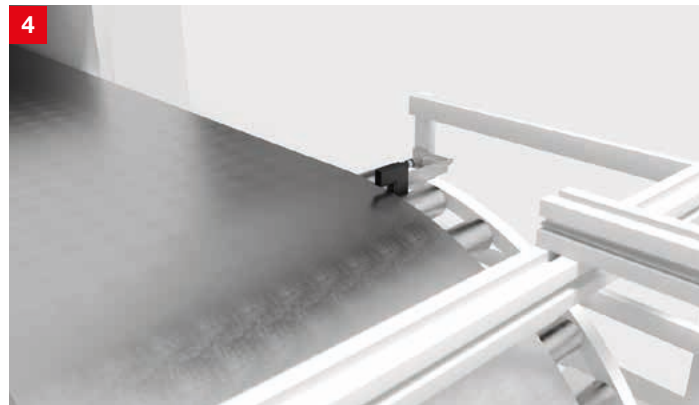
**Requirement:** The point of operation at a press is to be guarded by an electro-sensitive protective device. The necessary distance between the protective device and point of operation is to be as small as possible.



**Solution:** With various resolutions from 14 mm, the safety light curtains of the ELC 100 and MLC 500 series offer reliable finger and hand detection and thereby facilitate short safety distances. Through the optimized design, the ELC 100 and MLC 500 in the V-version are especially resistant to shock and vibration.

## Edge control

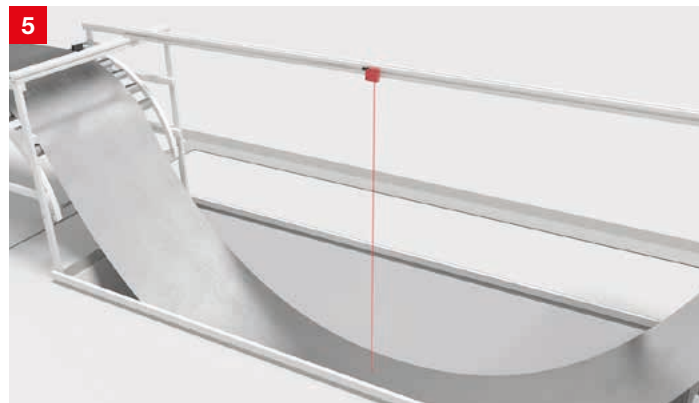
**Requirement:** The blank cutting system cuts the material that is unwound from the endless band into so-called plates or blanks. To ensure that they are identical in shape and dimensions and within tolerance, the edge must be precisely controlled.



**Solution:** With their high level of reproducibility of  $\pm 0.03$  mm, the GS 754B CCD fork photoelectric sensors ensure precise determination of the web edge. The devices can be flexibly integrated via analog output or serial interface.

## Loop control

**Requirement:** In the cutting system, the cutting process must be decoupled from the belt transport. The sag of the loop is to be determined contact-free to communicate the necessary measurement values to the control for determining the haul-off speed.



**Solution:** The sensors of the ODS10 / 110 and ODSL 96 series, which operate according to the time-of-flight measurement principle (TOF), offer measurement ranges of several meters. They feature a high resolution and a high level of reproducibility. The devices can be flexibly integrated via analog output, serial interface and IO-Link.

## Detection of roll diameter

**Requirement:** To enable an automatic coil change before the material runs out, the diameter of the coil must be constantly monitored. Cost-intensive downtime can thereby be minimized.



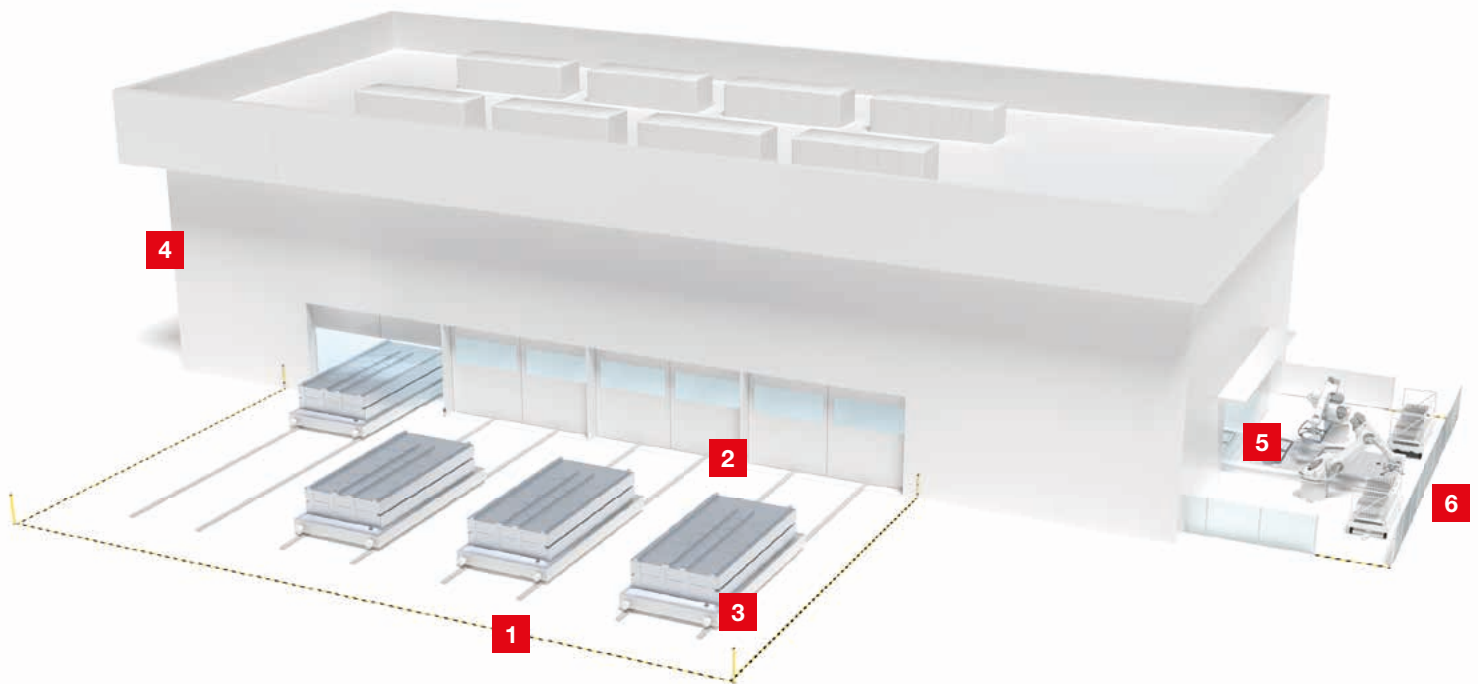
**Solution:** The measuring ultrasonic sensors of the DMU 300 / 400 series offer an especially large measurement range of up to 6,000 mm. The robust devices in plastic and full-metal versions are characterized by short response times and high resolutions. They are available with analog current or voltage output and IO-Link interface.

# Press line

Made from massive steel rolls – known as coils – molded parts, such as car body parts, are produced in various work steps. Whether for cutting the coils or punching, pressing and shaping the blanks: our sensors accompany and safeguard all manufacturing steps, even under harsh environmental conditions.

The applications are as diverse as our product range, which is tailored to these applications. Our inductive and optical sensors check and monitor the presence and position of parts. Our identification systems record data to ensure the traceability of those parts. And at the cutting systems, our sensors supply measurement values for loop control and edge control.





1 Access guarding on press lines

2 Anteroom guarding on press lines

3 Presence control of the tool

4 Monitoring of the stack height

5 Presence control for controlling the gripper robot

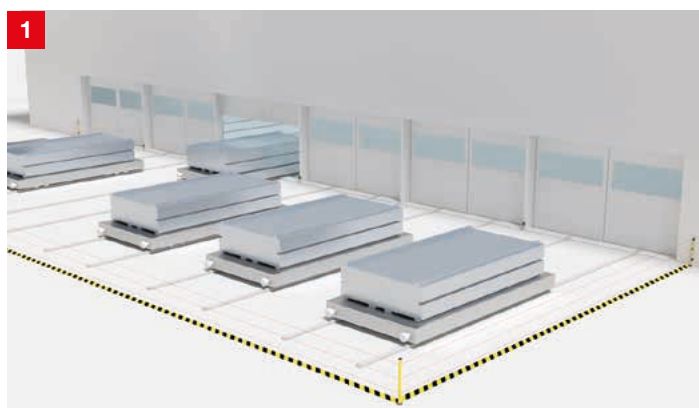
6 Code reading on the rack



# Press line

## Access guarding on press lines

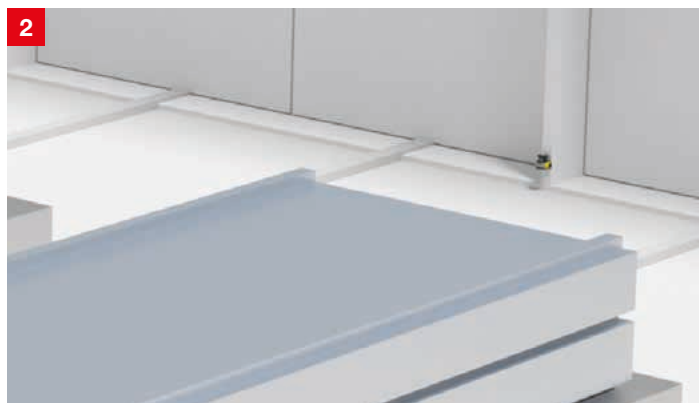
**Requirement:** The press tools are brought to the press anteroom with gantry cranes and positioned in the press during a tool change. During this process, the entire anteroom is a safety-critical area. The access of persons must be monitored.



**Solution:** The multiple light beam safety devices of the MLD 500 series offer economical access guarding for large areas. As transmitter-receiver systems with operating ranges of 70 m, they are used together with mirror columns and thereby safeguard the entire press anteroom.

## Anteroom guarding on press lines

**Requirement:** Before the carriages move into the press, a check must be performed to ensure that no persons are in front of the gates. During entry, the area to the side of the carriages is to be secured to prevent persons from entering the press line alongside a carriage.



**Solution:** With its configurable and switchable protective fields, the RSL 400 safety laser scanner secures the area in front of the respective door. With its large operating range of 8.25 m and two parallel protective functions, two entrance areas can be simultaneously monitored independent of one another with just one device.

## Presence control of the tool

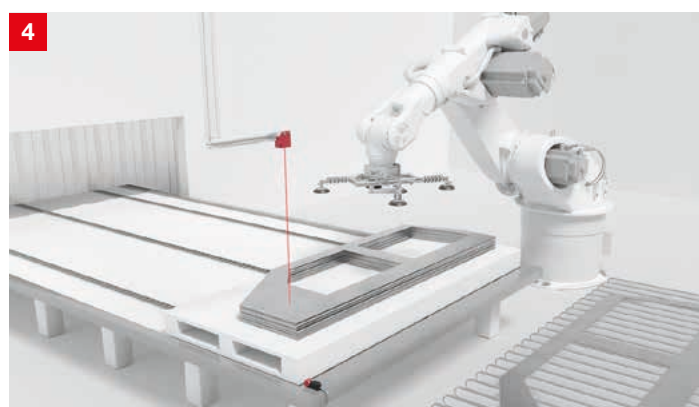
**Requirement:** The fitting tool is positioned on the shuttle carriage by means of a crane. In doing so, the proper seating is to be checked so that automatic locking can occur.



**Solution:** The IS/ISS 244 models with cubic design are the best suited from our wide range of inductive switches. The compact sensors can be installed quickly and in a space-saving manner. Status indicators that are easily visible from the side simplify commissioning and visualize states.

## Monitoring of the stack height

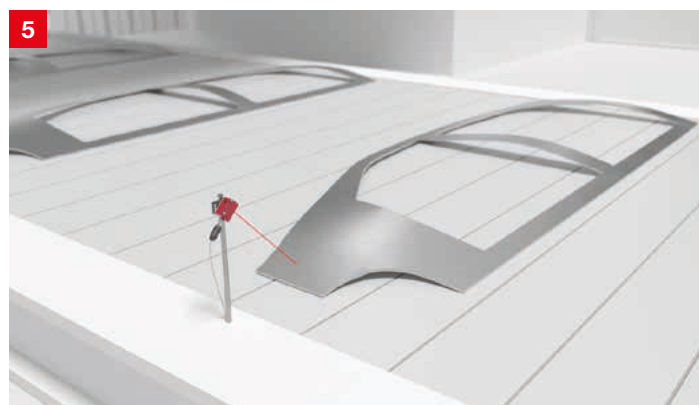
**Requirement:** During operation, a continuous material infeed must be ensured. If the last blank is gripped by the robot or the filling level of the blank stack drops below a defined level, resupply is to be triggered automatically. To do this, the stack height of the blanks is to be monitored.



**Solution:** Devices with time-of-flight measurement (TOF) from our wide range of switching and measuring distance sensors are especially well suited for larger operating ranges. These include the HT 10 switching sensors, which monitor a defined stack height to ensure that it does not drop below a defined level, and the ODS 10 measuring sensors, which determine the height of the stack.

## Presence control for controlling the gripper robot

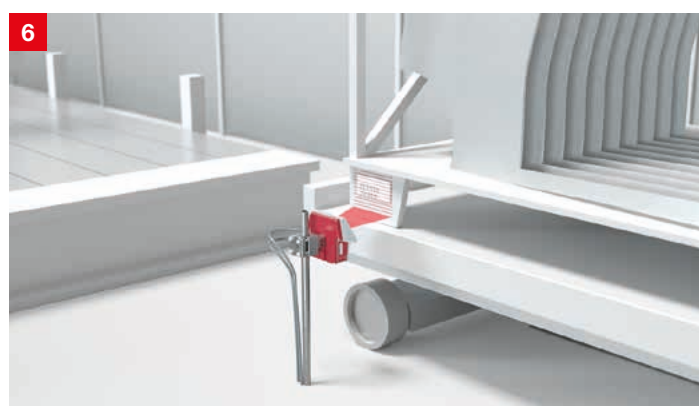
**Requirement:** At the end of the press line, the finished molded sheet metal parts are automatically removed and loaded on transport vehicles for further processing. To control the gripper robot, the presence of the parts on the belt conveyor must be checked.



**Solution:** From our wide product range of switching sensors, the HT 25C series combines above-average function reserve with compact size. Parts with glossy and even dark or structured surface are reliably detected. The devices are available as red light and infrared versions.

## Code reading on the rack

**Requirement:** The finished sheet metal parts are stored on movable racks that can be transported, e.g., by automatic tugger trains or AGVs, to the further processing in the body shop. To ensure that the rack is used correctly, the identification code attached to the rack that is to be read.



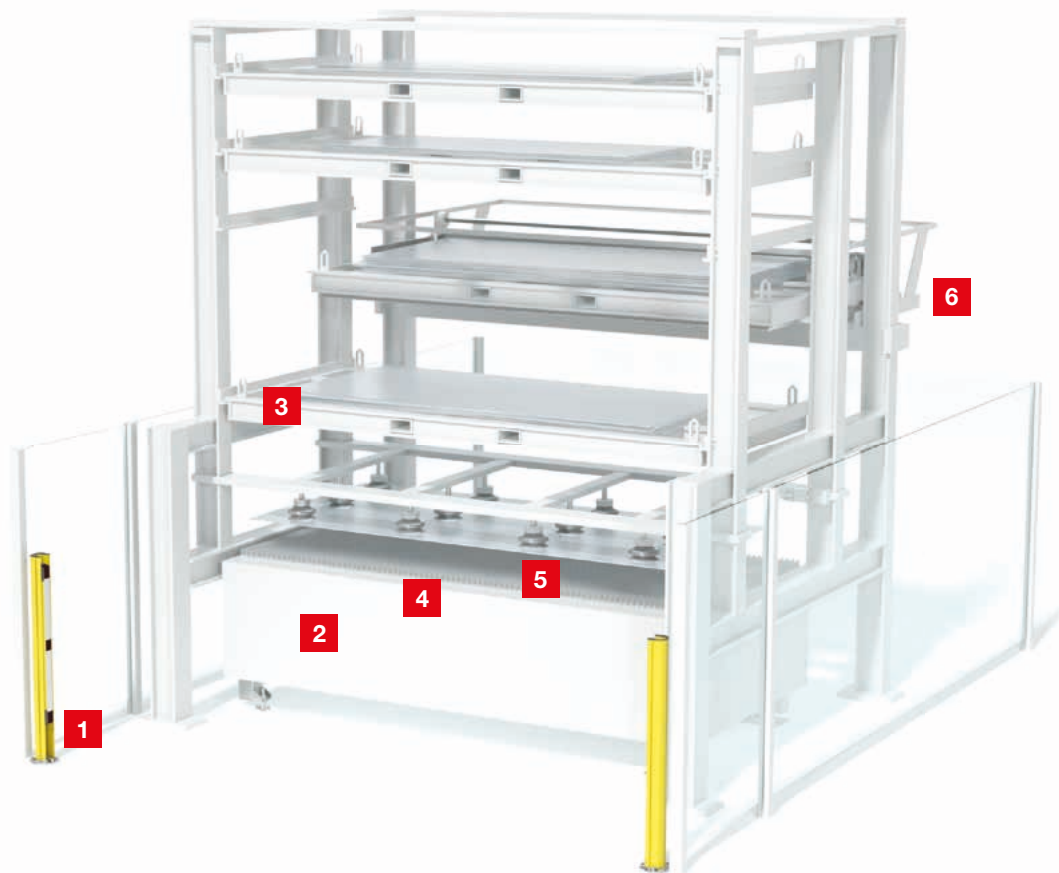
**Solution:** Depending on the attachment of the code and the reading distance, a BCL 300i decodes the code as a raster scanner and transfers the data to the PLC or to the material flow computer. If the label has large position tolerances, device models with integrated oscillating mirror are used.

# Tower storage system

Intelligent solutions for the storage of sheet metal plates and long goods optimize material flow, improve machine utilization and improve work safety and process reliability. Through the compact design of a tower storage system, it is thereby possible, for example, to optimally utilize valuable production space as an intermediate warehouse, buffer storage or for material stockage.

Our components guarantee smooth processes and ensure safety. Typical areas of use are access guarding at dangerous areas of machines and systems. Our inductive and optical sensors check and monitor the presence and position of sheet metal plates or stacks. And they optimize the process flow, thereby ensuring high availability of the machine or system.





1 Access guarding, one side

2 Integration of safety sensors

3 Projection monitoring

4 Presence control for sheet metal

5 Presence control for sheet metal

6 Positioning

# Tower storage system

## Access guarding, one side

**Requirement:** Access to a dangerous area at a machine or system is to be guarded. To enable simple entry and exit of material, optoelectronic safety sensors are to be used.



**Solution:** The MLD 300/500 multiple light beam safety devices provide cost-effective access guarding solutions. The transceiver models with an operating range of up to 8 m are especially easy to install. For wide-area guarding, transmitter/receiver models are available with a range of up to 70 m.

## Integration of safety sensors

**Requirement:** Multiple safety sensors must be integrated into the machine or system control. Functions such as a time delay for releasing a locking device or signal connections are also to be configured.



**Solution:** The basic module of the MSI 400 expandable safety control already has 24 safe inputs/outputs as well as an Ethernet interface with Industrial Ethernet protocols. The safety control can be configured quickly and efficiently using the license-free configuration software MSI.designer.

## Projection monitoring

**Requirement:** To avoid collisions with the load handling device during the storage and retrieval process, a check is to be performed to determine whether sheet metal plates protrude at the loading area. To reliably detect even slightly rotated sheet metal plates, the check is to be performed at multiple points.

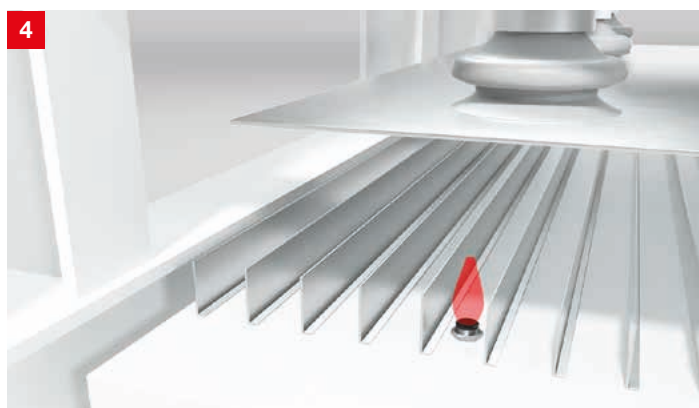


**Solution:** The HT 25C diffuse reflection sensors with background suppression ensure reliable presence control. With their degrees of protection IP 67 and IP 69K as well as the active ambient light suppression, the extremely compact sensors offer a very high level of flexibility and reliability.



### Presence control for sheet metal

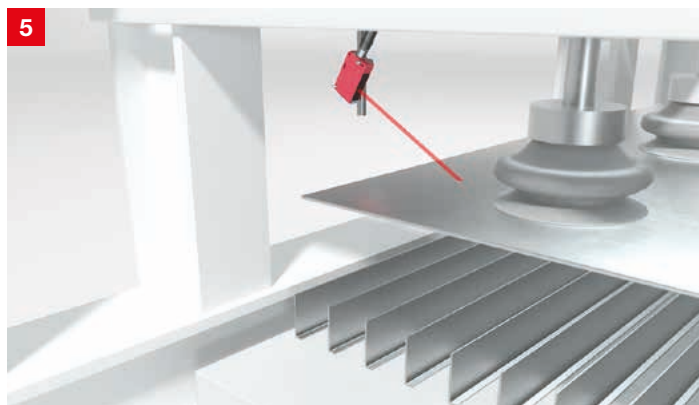
**Requirement:** After the pick & place unit deposits the sheet metal plate, the presence of the sheet metal plate is to be checked at the storage location to allow the subsequent process step to start, e.g., infeed of the material to the machine.



**Solution:** The FT 328i energetic diffuse sensors in the sturdy plastic housing with metal thread facilitate robust material detection. The simple adaptation to the material using the teach button enables fast and simple commissioning. Available as an economical alternative are the inductive switches of the IS 200 series.

### Presence control for sheet metal

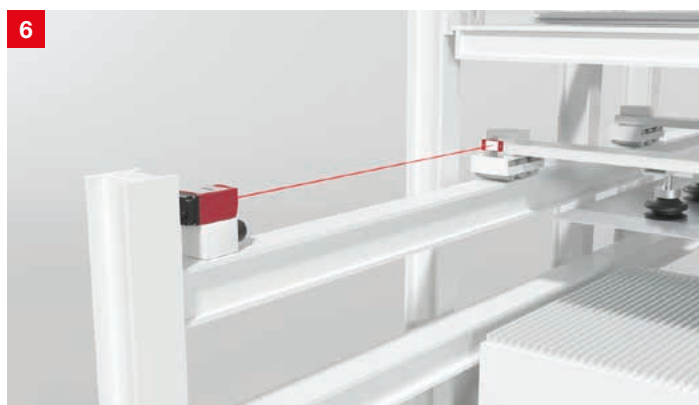
**Requirement:** After the sheet metal plate is picked up by the pick & place unit, the presence of the sheet metal plate in the unit is to be constantly monitored to ensure a smooth process flow.



**Solution:** The HT 46C and 25C diffuse reflection sensors with background suppression ensure reliable presence control. Models with various light-spot geometries offer optimum adaptation to the application. Flexible mounting brackets, cables and IO-Link models are also available.

### Positioning

**Requirement:** To position the load handling device in the tower rack, the distance to a specified reference point is to be determined.



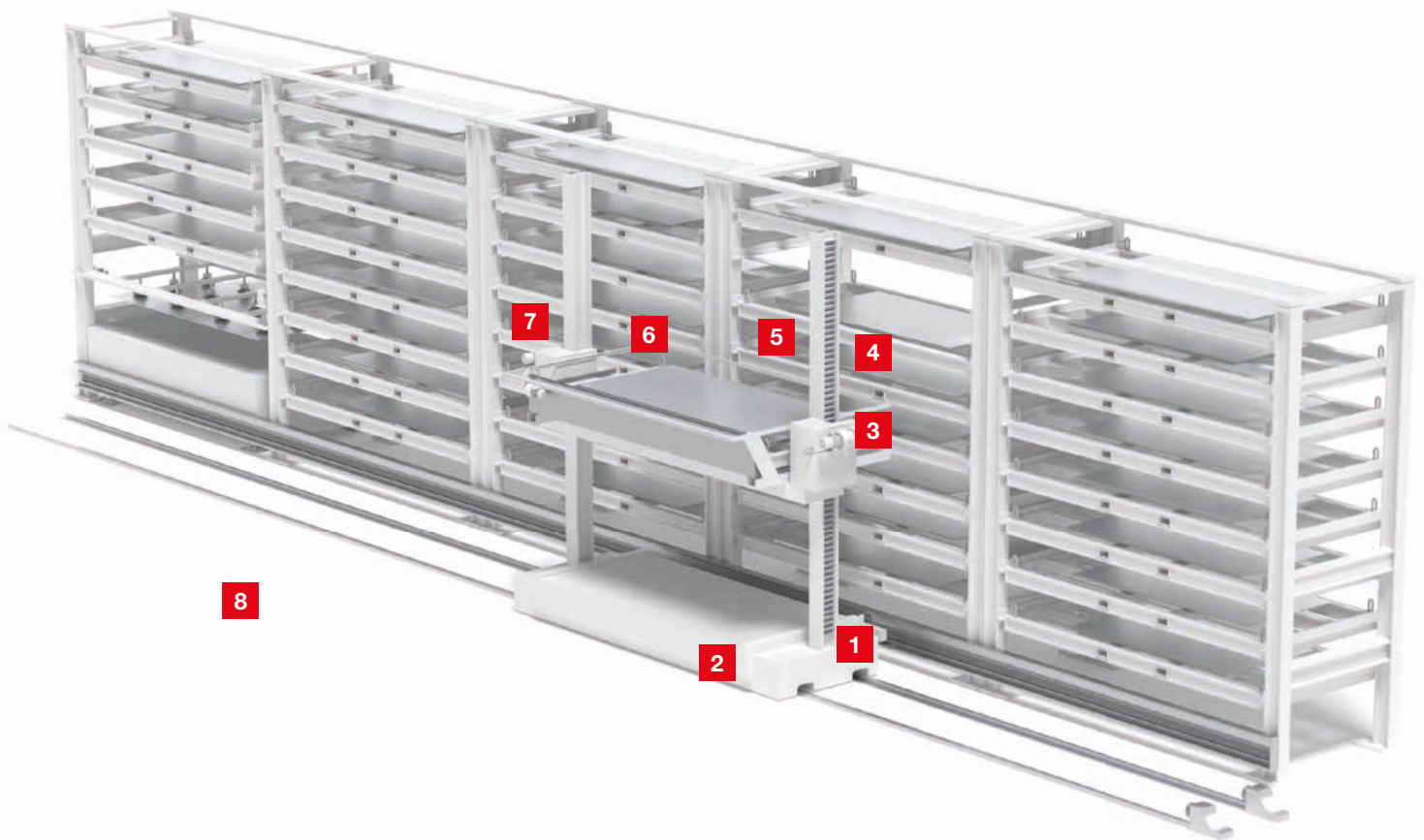
**Solution:** With the focused laser, the ODSL 30 optical distance sensors offer operating ranges of up to 65 meters and, with an absolute measurement accuracy of  $\pm 2$  mm, are ideal for precise positioning.

# Storage system with high-bay storage device

Flexible storage systems make a significant contribution to the automation of production processes. In high-bay warehouses, the performance of the high-bay storage devices is especially important. They perform the automatic storage and retrieval of materials such as sheet metal plates and long goods. Their speed and reliability are, thus, decisive for the overall performance and availability of the systems.

Our sensor solutions enable optimum operation of the high-bay storage devices. They capture position data in the travel/lifting area and optically transmit travel commands and position data to the control. In addition, our sensors perform the compartment occupation check and prevent material from being pushed through. Reliable operation and high availability of the system are thereby ensured.



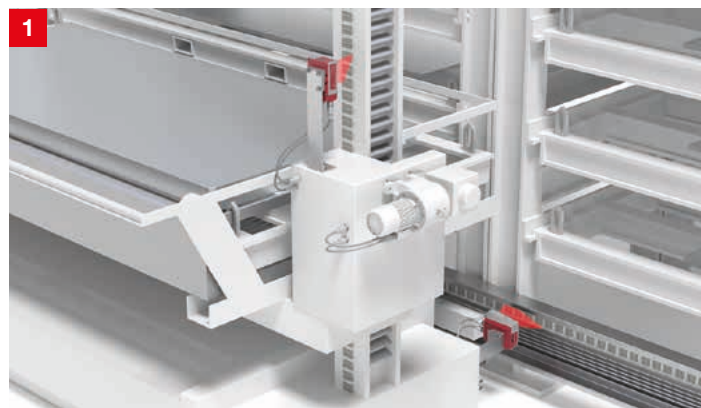


- |   |   |
|---|---|
| 1 Positioning (linear)                          | 5 Compartment occupation check /<br>push-through protection |
| 2 Positioning (linear) / data transmission      | 6 Presence control  |
| 3 Compartment fine positioning in x- and y-axis | 7 Projection monitoring                                     |
| 4 Compartment fine positioning in x-axis        | 8 Access guarding on conveyor lines                         |

# Storage system with high-bay storage device

## Positioning (linear)

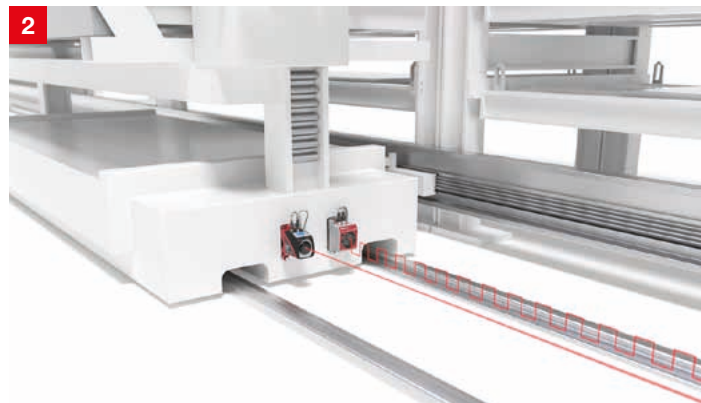
**Requirement:** The high-bay storage device or load handling device must be positioned in the X-direction (travel axis) and Y-direction (lifting axis) accordingly for the pallet to be approached.



**Solution:** The BPS 300i compact bar code positioning systems enable exact positioning. Interfaces for fieldbuses, industrial Ethernet as well as SSI or serial connections make integration in the control simple and flexible. The configuration and diagnosis of the devices are just as easy.

## Positioning (linear) / data transmission

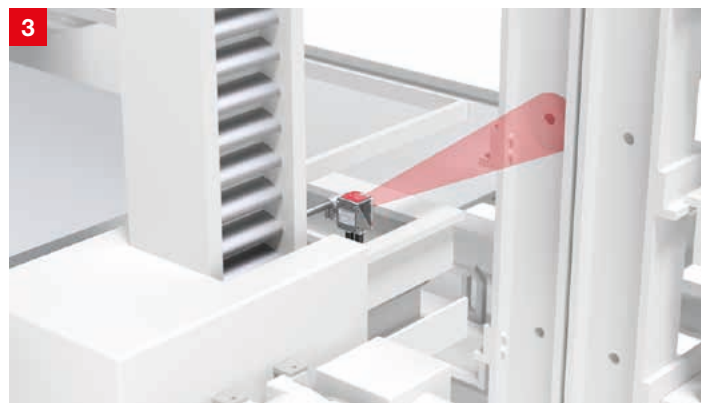
**Requirement:** The high-bay storage device or load handling device must be appropriately positioned in the X-direction (travel axis) and Y-direction (lifting axis). Travel commands and positioning data are to be optically transferred to the control to ensure high availability of the system.



**Solution:** The AMS 300i laser distance measurement devices are used for exact positioning. The DDLS 500i data transmission photoelectric sensors function fault-free without offset directly next to the AMS 300i devices. Selectable operating ranges, interfaces and protocols ensure optimum solutions.

## Compartment fine positioning in x- and y-axis

**Requirement:** Following rough positioning, additional optical sensors are used for the compartment fine positioning of a high-bay storage device in the horizontal (X) and vertical (Y) direction.

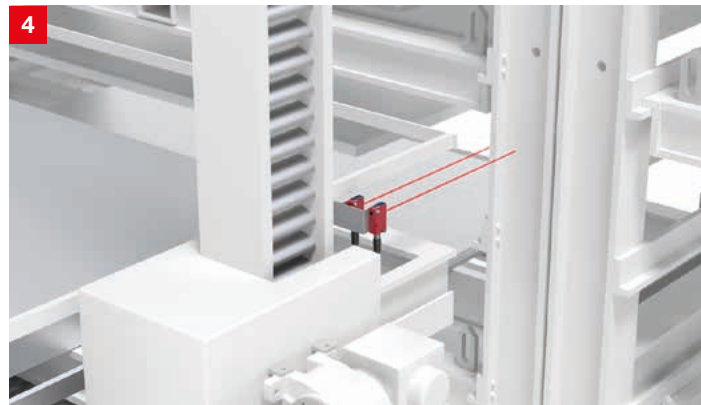


**Solution:** The camera-based IPS 200i are predestined for compartment fine positioning. Extremely small size, simple operation and configuration via the integrated web server are a few of the highlights of the series. The data is transferred to the control via the integrated Ethernet TCP/IP or PROFINET interface.



### Compartment fine positioning in x-axis

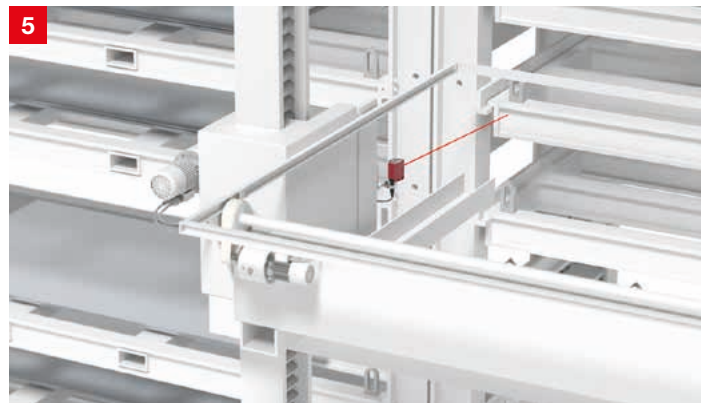
**Requirement:** Before the material is transferred, the correct position of the load handling device in front of the storage location is to be checked in the horizontal and vertical direction (compartment fine positioning). This is to be performed by optically sensing the column or the bar edge.



**Solution:** The HT 46C diffuse reflection sensors with background suppression are used for positioning the load handling device. A wide range of profile types as well as color or glossy surfaces are reliably detected. Thanks to the optimized beam path, the sensors function reliably even in the case of columns with holes.

### Compartment occupation check / push-through protection

**Requirement:** Before a pallet or a cassette can be stored in a rack, a check must be performed to determine whether the rack is empty. When retrieving, on the other hand, it is necessary to monitor the entry of the telescopic arm or fork to ensure that the stored material is not pushed in the wrong direction.



**Solution:** Thanks to their focused laser, sensors ODS 9, ODS/HT 10 and HT 110 detect the cassette at an operating range of up to eight meters. With switching product models, the movement of the cassette can be detected with the help of the window function.

### Presence control

**Requirement:** During a material movement, the cassette with the sheet metal plates, for example, is checked for presence. Especially after retrieval, a check must be performed to ensure that the load handling device has completely pulled in the material in order to avoid collisions and downtime.



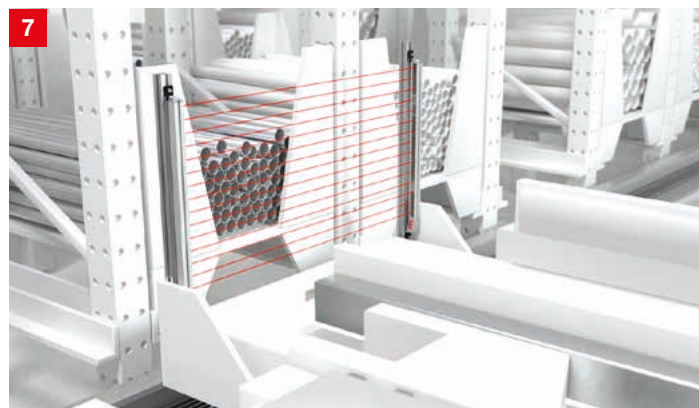
**Solution:** In addition to large operating ranges and increased function reserves, series 3 is also characterized by simple handling. Thus, the devices stand for reliable object detection even with thin sheet metal plates. The optional IO-Link interface provides additional benefits, such as fast commissioning and diagnostics functions.



## Storage system with high-bay storage device

### Projection monitoring

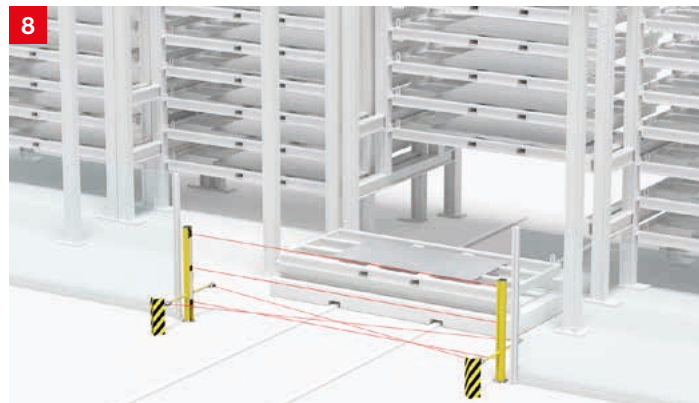
**Requirement:** After loading, e.g., a cassette on the load receptacle, a check is to be performed to determine whether the cassette or material is protruding and thereby posing a risk of collision. An optical sensor is to monitor a large surface on the load handling device here and ensure reliable operation.



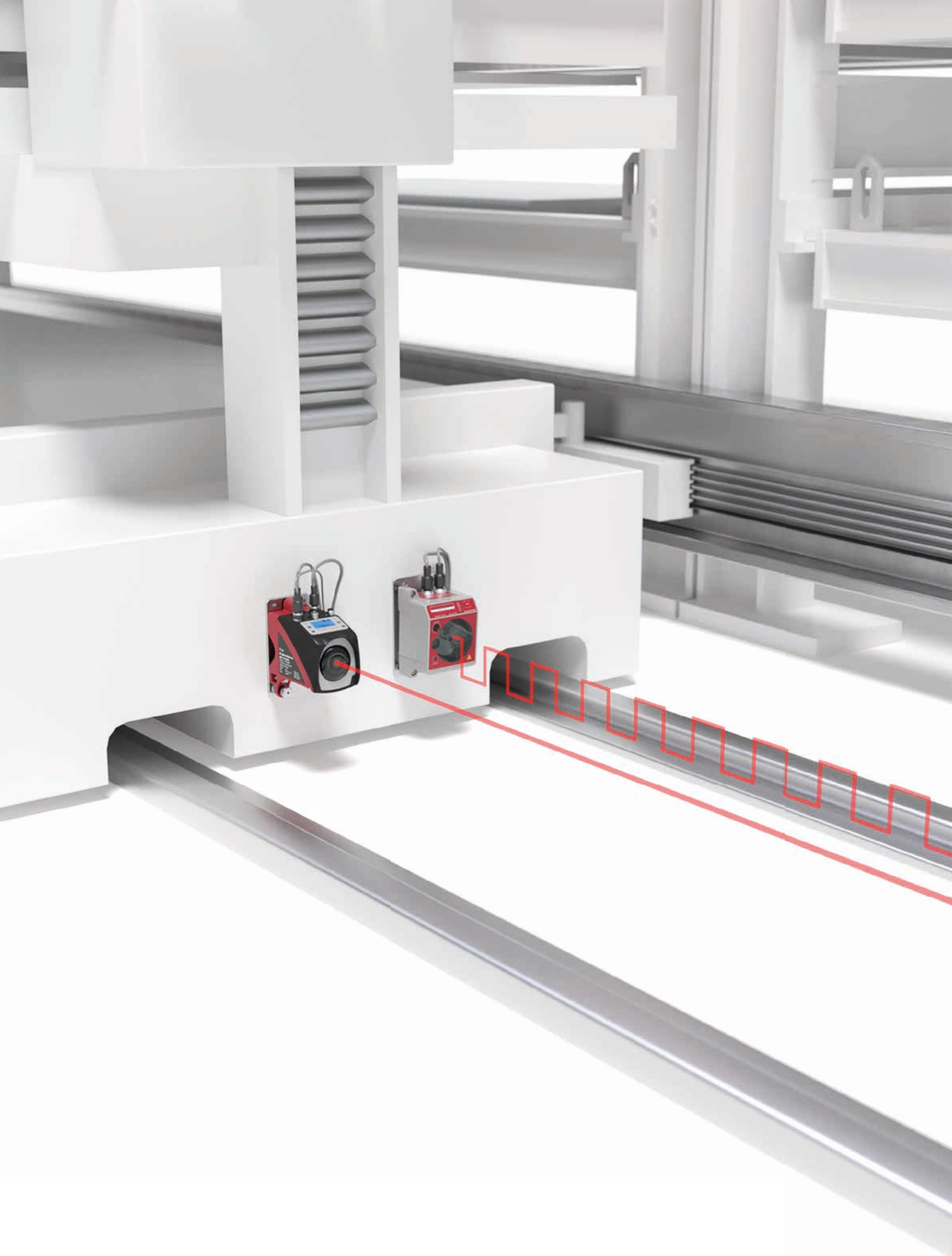
**Solution:** The CSL 710 switching light curtains monitor large areas and convince with their ease of configuration and large function reserves. Various fastening materials enable optimum integration. Alternatively, the CML 700i measuring light curtains with integrated PROFINET or PROFIBUS interface are available.

### Access guarding on conveyor lines

**Requirement:** Access guarding on conveyor lines is to prevent persons from accessing the danger zone, while at the same time allowing the transported goods to pass through.



**Solution:** The muting function bridges the safety sensor in a controlled manner to allow the transported goods to pass through. This function is already integrated in the MLD 500 multiple light beam safety devices and the MLC 500 safety light curtains. The MSI-MD-FB muting interface and MSI 400 safety control provide an external muting control.

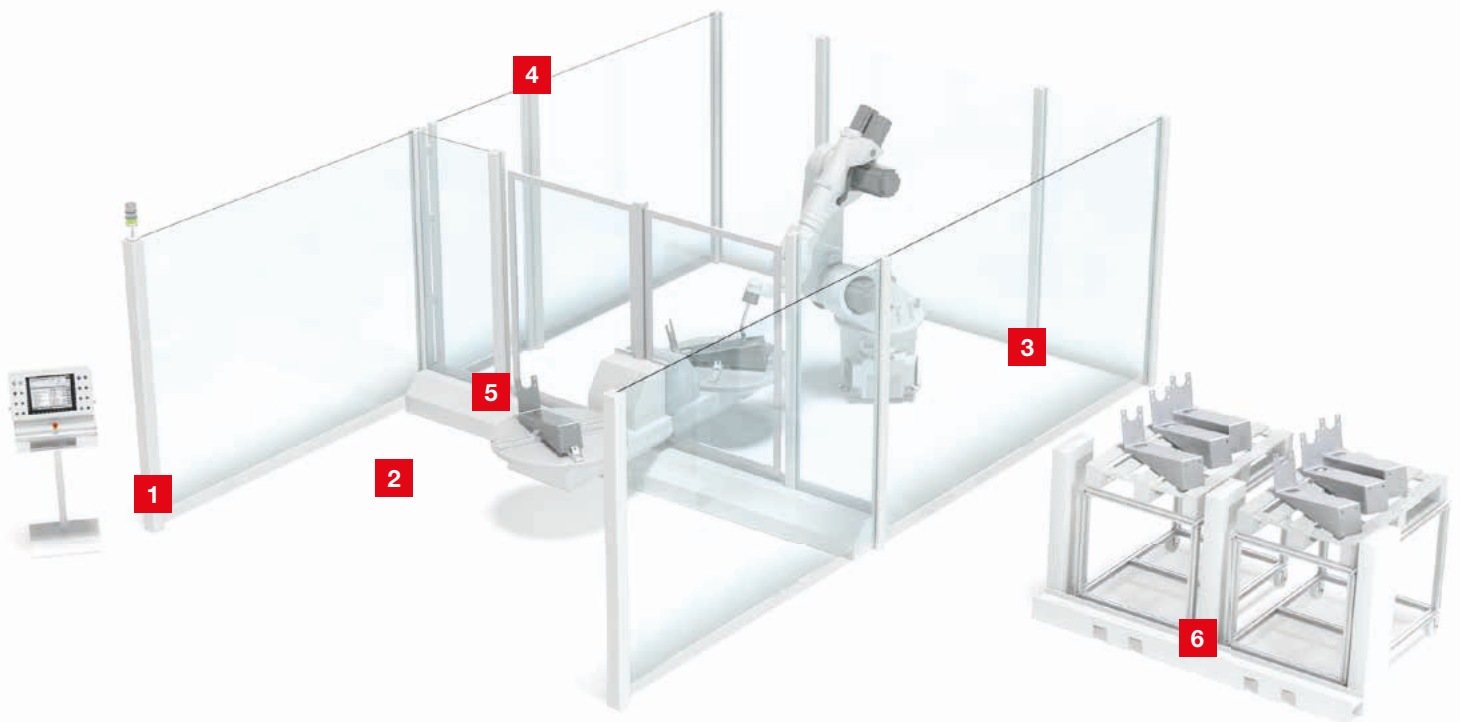


# Production cell

The factory of the future is characterized by flexible production cells. From individual production cells to a fully networked production system of a smart factory. What all have in common are the automated and linked processes in and between the cells. This improves productivity, allows for a more efficient use of materials and enables higher product quality.

With our sensor solutions, processes run efficiently: from material flow, in which the presence of work pieces or parts is detected, to information flow via intelligent sensors, whose data is captured and analyzed with the help of new communication technologies across all levels of a production system. The applications and possibilities here are as diverse as our product range tailored to them. Our inductive and optical sensors check and monitor the presence and position of work pieces and parts. Our identification systems record data for the traceability of those work pieces and parts and for the next work step. Our safety solutions reliably and flexibly safeguard hazardous areas.





1 Access guarding, one side

2 Area safeguarding

3 Restart protection and monitoring of hidden areas

4 Monitoring of doors, with locking device

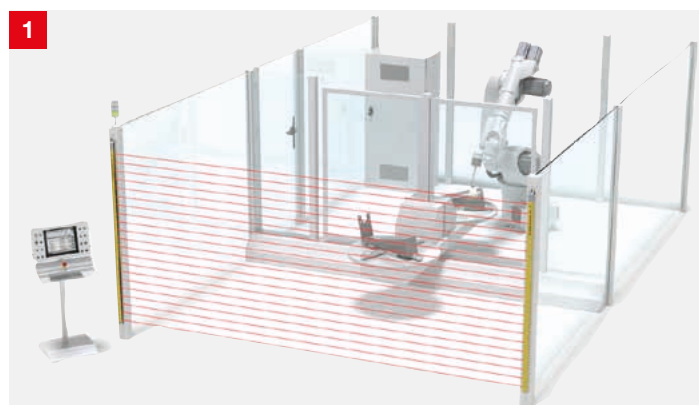
5 Presence control of the work piece

6 Presence control and pallet identification

# Production cell

## Access guarding, one side

**Requirement:** Access to the dangerous area of the robot cell is to be guarded.  
To enable simple entry and exit of material, optoelectronic safety sensors are to be used.  
The compact layout of the cell means that the necessary distance between protective device and danger zone must be as small as possible.



**Solution:** The ELC 100 and MLC 500 safety light curtains offer high resolutions for short safety distances and a compact system design. If there is sufficient space, the MLD 500 multiple light beam safety devices are used. These are optionally available with integrated muting functions.

## Area safeguarding

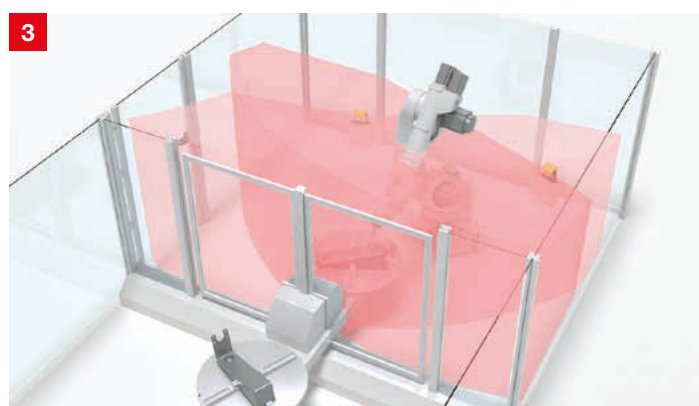
**Requirement:** Access to the dangerous area of the robot cell is to be guarded.  
To enable an automatic start/restart, this area must be constantly monitored for the presence of persons.



**Solution:** The RSL 400 safety laser scanners use configurable protective fields for area monitoring. Thanks to the 8.25 m operating range and 270° scanning range, large areas can be guarded with just one device. The models with PROFIsafe / PROFINET interface can easily be integrated into industrial networks.

## Restart protection and monitoring of hidden areas

**Requirement:** To prevent danger, the process is not permitted to restart until it has been ensured that no persons are in the work area or in the hidden area. Safe operation and high availability must also be guaranteed under harsh ambient conditions – such as dirt or welding sparks.



**Solution:** With its protected area, the LBK 3D safety radar system monitors for the presence of persons – even under harsh ambient conditions. Furthermore, the radar technology allows the presence of static objects in the monitored area.



## Monitoring of doors, with locking device

**Requirement:** Areas with hazardous movements can be entered via safety doors to allow maintenance. If the movement does not stop immediately after the door is opened, the door is to be guarded by a safety switch with locking device. Work and safety conditions are to be signaled.



**Solution:** The robust safety switches with locking device of the L series lock safety doors until they are released by means of an electrical signal. In addition to the standard models, there are devices with integrated control buttons and emergency stop as well as devices with RFID-coded actuator. Optical and acoustic signalers of the A7 series complement the integrated LED status displays.

## Presence control of the work piece

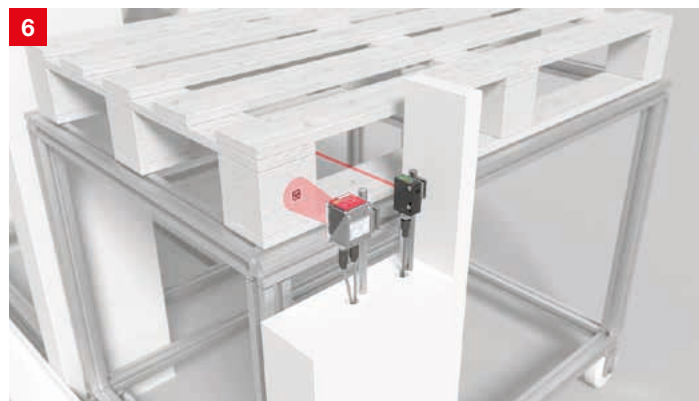
**Requirement:** The presence of components as well as shapes, holes and openings or other special features is to be detected prior to the next processing step.



**Solution:** The HT 25C diffuse reflection sensors with background suppression for longer operating ranges and HT 3 for shorter operating ranges ensure reliable presence control. Models with various light-spot geometries offer optimum adaptation to the application. Flexible mounting brackets, cables and IO-Link models are available.

## Presence control and pallet identification

**Requirement:** In addition to the traceability of individual processing steps, the “track & trace” concept also includes determination of the current location. Depending on the used system, the 1D-/2D-code affixed to the pallet is to be captured. To start the read process of a code reader, the presence of the pallet in the work station is to be detected.



**Solution:** The DCR 200i decode the 2D-codes on the pallet. They combine a compact design with large reading range and high depth of field, making them easy to integrate. The compact HT 15 diffuse reflection sensors with background suppression ensure reliable presence control.

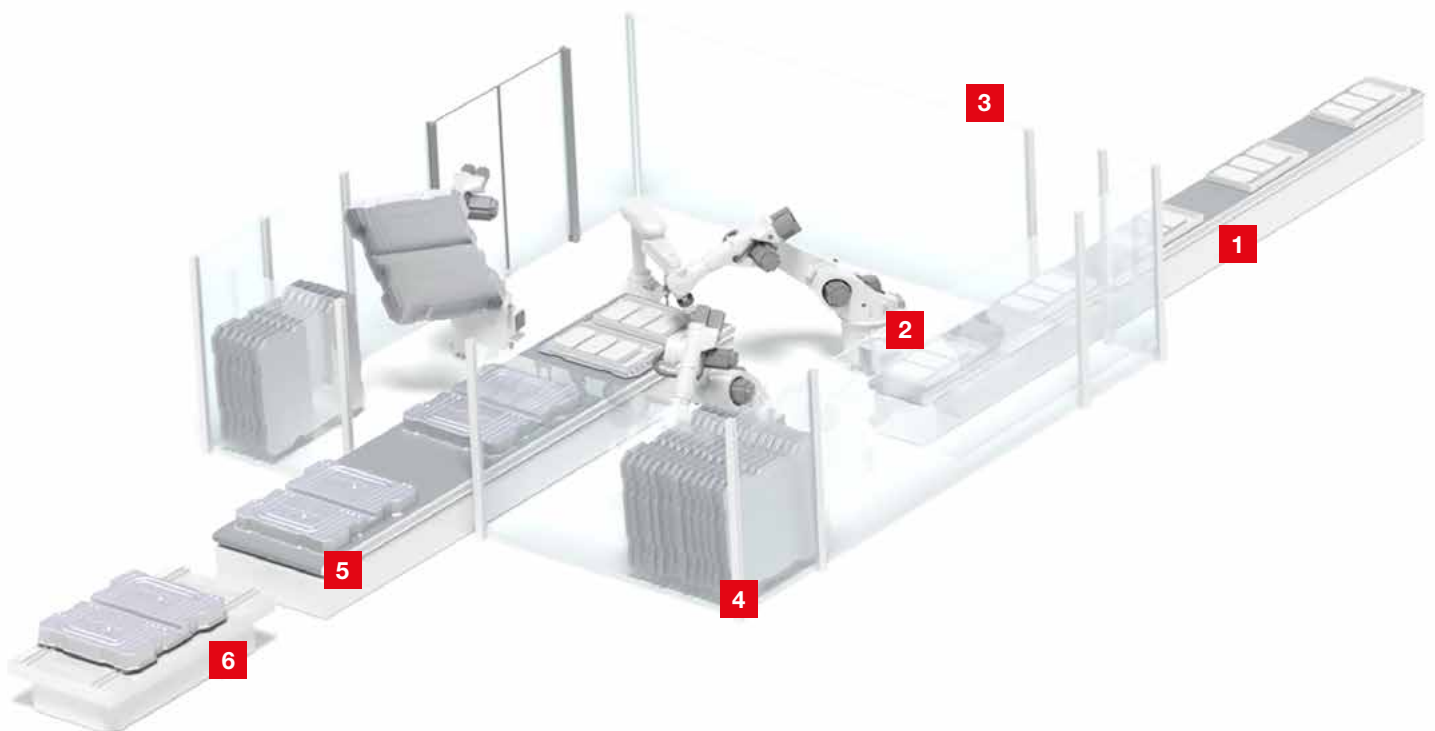


# Assembly line using e-mobility as an example

On assembly lines, components and products are manufactured through successive assembly processes. Depending on requirements, everything from small, partially automated lines to fully automated lines are used. In the area of e-mobility, the installation of battery cells, modules and packs is usually fully automated. The “tracking & tracing” of the components, transport- and logistics solutions for material supply of the assembly cells and the safety of the work stations determine the requirements on the sensors.

Our components guarantee smooth processes and ensure machine safety. Typical areas of use are code reading and identification for the traceability, object detection for automation as well as access guarding at the assembly cells.





**1** Code reading for the traceability of the batch

**2** Code reading for the traceability of the cells

**3** Access guarding of the work systems

**4** Access guarding with short safety distances

**5** Transport control of the conveyor line

**6** Guarding and navigation of automated guided vehicles (AGVs)

# Assembly line using e-mobility as an example

## Code reading for the traceability of the batch

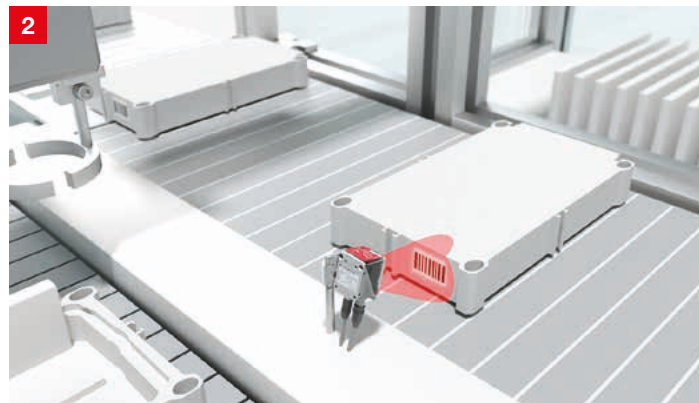
**Requirement:** The order and the batch are to be detected at the start of battery production and stored for the further course of action. To do this, the processing steps and all relevant components are to be identified using a bar code.



**Solution:** Mobile code readers are well suited for detecting the orders and the batches. Wireless models like the IT 1991i make operation easy and comfortable. Depending on the control concept, they are connected directly to a PC or – for integration via common fieldbus and Ethernet interfaces – to the MA 200i modular connection unit.

## Code reading for the traceability of the cells

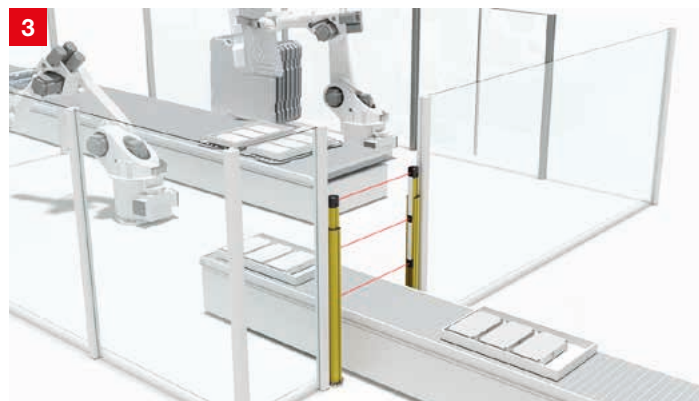
**Requirement:** The “track & trace” concept also includes the traceability of each individual battery cell that is in the work system for processing. Depending on the used system, the 1D- or 2D-code affixed to the cell is to be captured.



**Solution:** The DCR 200i code readers and the LSIS 400i smart cameras reliably identify 1D- and 2D-codes. The DCR 200i are characterized by their compact design and simple commissioning. The LSIS 400i operate especially flexibly. If, for example, the reading distance changes, the focus and the field of view can be adapted online using a browser.

## Access guarding of the work systems

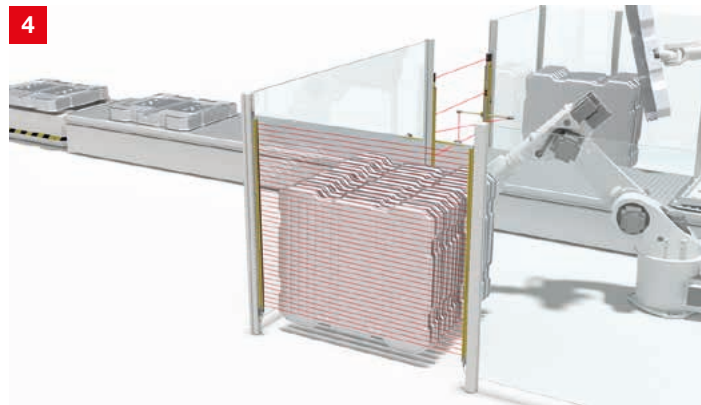
**Requirement:** The battery components are moved from one robot assembly cell to the next via the conveyor system. The entrances and exits to the robot cells must be secured against access.



**Solution:** The MLD 500 multiple light beam safety devices safeguard the access point to the conveyor lines. Depending on requirements, e.g., installation situation and size of the transport material, models are available with and without muting function. Configuration is easily performed via the pin assignment. With the integrated muting function, no additional devices are necessary.

### Access guarding with short safety distances

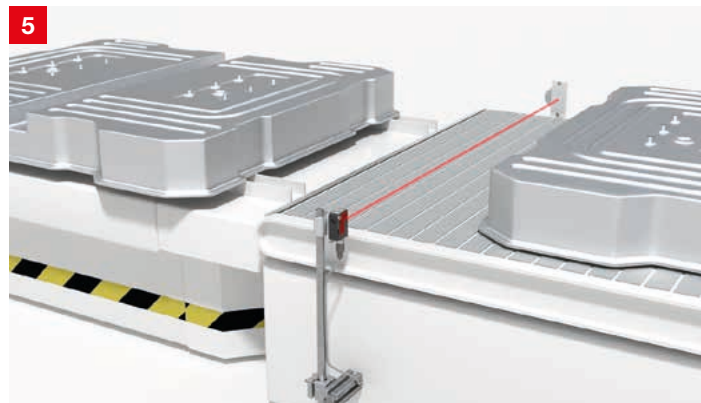
**Requirement:** Even on automatic operating systems, it can be necessary for the operating personnel to intervene. Because easy access is required in these cases, optical safety sensors are to be used. To keep the designs of the system as compact as possible, the sensors should enable short safety distances.



**Solution:** With their resolution of 14 mm, the MLC 510 safety light curtains offer the shortest possible safety distances. Various mounting options and protective field lengths of up to 3,000 mm ensure simple and tailored integration of the devices. For European requirements, the devices feature AIDA-compliant pin assignment.

### Transport control of the conveyor line

**Requirement:** The production systems for battery production are linked by means of conveyor systems. The products are fed to the next process step either directly on these or in trays. To allow the products to be removed by the gripper robot or transferred to an AGV, the conveyor line must be controlled through detection of the products.



**Solution:** The universally usable PRK 15 and PRK 25C retro-reflective photoelectric sensors offer high function reserves for high system availability. With their bright light spot, they can be adjusted quickly and easily. Additional functions, such as warning output and activation input, increase process reliability.

### Guarding and navigation of automated guided vehicles (AGVs)

**Requirement:** The transportation path of the AGV must be guarded by means of safety sensors. The protective fields are to be flexibly adapted to the movement and loading situation. If the principle of natural navigation is used, the device is at the same time to provide the measurement data for the navigation software.



**Solution:** The RSL 400 safety laser scanners merge safety technology and high-quality measurement value output in a single device. They have a scanning range of 270° and 100 reversible field pairs. Two scanners therefore provide optimum guarding of the AGV. The measurement data has a high angular resolution of 0.1° and a low measurement error.

# Switching sensors

Photoel. sensors / diffuse sensors,  
cubic housing



**3C series**  
Universal, mini

**15 series**  
Standard

**25C series**  
Universal

Technical data	Dimensions excl. connector, W × D × H	11 × 32 × 17 mm	15 × 43 × 30 mm	15 × 43 × 30 mm
	Operating voltage	10–30 V DC	10–30 V DC	10–30 V DC
	Switching outputs	Push-pull, PNP, NPN, IO-Link	PNP, NPN	PNP, NPN, push-pull, IO-Link
	Connection type	M8, cable, cable+M8 / M12	M12, cable, cable+M12	M8 / M8+snap / M12, cable, cable+M8 / M12
	Degree of protection	IP 67, IP 69K	IP 66, IP 67	IP 67, IP 69K
	Certifications	CE CDRH cULus	CE cULus	CE CDRH cULus
	Housing	Plastic	Plastic	Plastic
Throughbeam photoelectric sensors	Operating range*	0–10 m	0–30 m	0–30 m
	Light source	Red light / laser (class 1)	Red light	Red light
	Switching	Light, dark, antivalent	Light, dark	Light, dark
	Switching frequency	1,000 / 3,000 Hz	500 Hz	1,500 Hz
Retro-reflective photoelectric sensors	Operating range*	0–7 / 0.02–5.5 / 0–3 m	0–8 / 0–10 m	0–10 / 0–12 / 0–25 m
	Light source	Red light / infrared / laser (class 1)	Red light	Red light / laser (class 1 and 2)
	Switching	Light, dark, antivalent	Light, dark	Light, dark, antivalent
	Switching frequency	1,000 / 1,500 / 3,000 Hz	500 Hz	1,500 / 2,500 Hz
Energetic diffuse sensor	Operating range*			
	Light source			
	Switching			
	Switching frequency			
Diffuse sensors with background suppression	Operating range*	5–600 mm	0–1,000 mm	0–1,200 mm / 0–1,300 mm
	Light source	Red light / laser (class 1)	Red light / infrared	Red light / infrared / laser (class 1 and 2)
	Switching	Light, dark, antivalent	Light, dark	Light, dark, antivalent
	Switching frequency	1,000 / 3,000 Hz	500 Hz	1,000 Hz / 2,500 Hz
Additional functions	Transparent media	X		X
	Protective sensors category 2/4			X (type 2)
	Warning output	X		X
	Activation input	X	X	X
	Deactivation input			
	Active ambient light suppression A <sup>2</sup> LS	X	X	X
Features		ECOLAB   Two housing through holes with metal sleeves or threaded sleeves   Sensor with different light-spot geometry and V-configuration   Laser variants   Teach-in   Bottle detection   Contrast sensors   Detection of labels on bottles   Devices with IO-Link communication interface   Teach button with remote function	Mechanically adjustable operating range   Sensitivity adjustment   Retro-reflective sensor with large function reserve / for stretch-wrapped containers	ECOLAB   M4 metal threaded sleeves   Sensors with small and long light spot   Sensor for bay positioning / for the detection of broken containers   Focused light spot   Foreground suppression   High function reserve   For stretch-wrapped packages   Bottle detection   Laser variants   Teach-in   Dynamic reference diffuse sensor   Long-range sensor   IO-Link interface   Safety-vest sensor

**Photoel. sensors / diffuse sensors, cubic housing**

**46C series**

Universal, long range

20.5 × 76.3 × 44 mm

10–30V DC

PNP, NPN, push-pull

M12, cable, cable+M12

IP 67, IP 69K



Plastic

0–150 m

Red light / infrared

Light, dark, antivalent

100 / 500 Hz

0.05–30 m

Red light

Light, dark, antivalent

25 / 150 / 500 Hz

5–3,000 mm

 Red light / infrared /  
red light laser (class 1 and 2)

Light, dark, antivalent

20 / 100 / 200 / 250 / 500 Hz

X

X

X

X

Retro-reflective photoelectric sensors with light-band for objects with openings / irregular contour | Detection of tubular bags on a conveyor belt | Can be used as muting sensor | Roller conveyor sensor | Models for dusty environments | Optimized for parallel operation | Extreme background suppression | Devices with IO-Link interface

**Photoel. sensors / diffuse sensors, cylindrical housing**

**318(B) series, 328 series**

M18, cylindrical

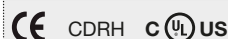
M18 × 46 mm, M18 × 60 mm

10–30V DC

PNP, NPN, push-pull

M12, cable

IP 67


 Full metal, stainless steel,  
plastic

0–15 / 0–23 / 0–120 m

Red light / infrared / laser (class 1)

Light, dark, antivalent

500 / 1,000 / 5,000 Hz

0–7 / 0.02–6 / 0.1–15 m

Red light / laser (class 1)

Light, dark, antivalent

500 / 5,000 Hz

 0–140 / 0–1,000 / 0–300 /  
0–280 mm

Red light / infrared / laser

Light, dark, antivalent

500 / 1,000 / 5,000 Hz

1–140 mm

Red light

Antivalent

1,000 Hz

X

X

X

X

X

Bracket versions | Simple alignment with omni-mount | Embedded mounting option | Models with M18 stainless steel sleeve and full-metal version | Variant available with preset range and as label sensor

**Fiber optic sensors**

**LV46x**

Fiber optic amplifiers

10–30V DC

PNP, NPN, IO-Link

 M8, cable, cable+M8,  
cable+M12

IP 65



Plastic

0–1,700 mm

Red light, infrared

Light, dark

250 Hz ... 50 kHz

Red light, infrared

Light, dark

250 Hz ... 50 kHz

For glass and plastic fiber optics | High-speed or long-range amplifier | Teach-in | Sensitivity adjustment | Time functions | Multifunction input | IO-Link interface


**KF**

Plastic fiber optics

Ø 2.2 × 500 / 2,055 mm

Ø 2.2 plugged

 Plastic, models with bending  
protection

0–1,700 mm

Red light, infrared (with LV46x)

0–270 mm

Red light, infrared (with LV46x)

Straight or lateral optical outlet | Various ancillary lenses | Arrays, V-arrangement | Various types of fiber structure, e.g., highly flexible, coax | Highly precise or heat resistant, models with bending protection



# Long-range sensors



**25 LR series**  
TOF, long range

**110 series**  
TOF, long range laser

**10 series**  
TOF, long range laser

Technical data	Dimensions excl. connector, W × D × H	15 × 38.9 × 28.7 mm	50 × 23 × 50 mm	25 × 65 × 55 mm
	Operating voltage	10–30 V DC	18–30 V DC	18–30 V DC
	Switching outputs	PNP, NPN, push-pull, IO-Link	Push-pull, IO-Link	Push-pull, IO-Link
	Connection type	Cable+M12	Turnable M12 connector	Cable+M12, cable, turnable M12 connector
	Degree of protection	IP 67	IP 67, IP 69K	IP 67
	Certifications	CDRH  US	CDRH  US	CDRH  US
	Housing	Plastic	Plastic	Plastic
Diffuse sensors with background suppression	Operating range*	50–3,000 mm	100–5,000 mm (WH) / 3,000 mm (BK)	50–8,000 mm / 25,000 mm
	Light source	Infrared TOF (light propagation time measurement)	Laser, red, 655 nm (class 1)	Red light laser (class 1)
	Switching	Light, dark	Light	Light
	Switching frequency	30 / 40 Hz	250 Hz	40 Hz
Additional functions	Transparent media			
	Protective sensors category 2 / 4			
	Warning output	X		X
	Activation input	X	X	X
	Active ambient light suppression A <sup>2</sup> LS			X
Features		Detection of objects with low diffuse reflection > 4%   2 teachable switching points (TOF)   Line teach and deactivation   All devices with IO-Link interface for configuration (including adaptation to the application) and process data transfer   Very good fading   Operating range adjustment via IO-Link	All devices with IO-Link interface   Turnable M12 connector   2 switching points   Small black-white error   High repeatability   Adjustment via teach buttons   Propagation time of the radiated light (TOF)	Turnable M12 connector   All devices with IO-Link interface   Light/dark switching via teach button   Window function   Adaptation to the application by means of configurable filters and gain values   Propagation time of the radiated light (TOF)

## Inductive switches



**IS 203, 204, 205, 206**  
Miniature sensors,  
cylindrical housing

**IS 208, 212, 218, 230**  
Standard, cylindrical

**IS 240, 244 / ISS 244**  
Standard, cubic

Technical data	Dimensions incl. connector, W × D × H	Ø 3.0: 22 mm Ø 4.0: 25 mm M5: 25–38 mm Ø 6.5: 35–65 mm	M8: 22–45 mm M12: 35–60 mm M18: 35–64 mm M30: 40.6–73.5 mm	12 × 40 × 26 mm 40 × 40 × 67 mm 40 × 40 × 118 mm
	Type of installation	Embedded / non-embedded	Embedded / non-embedded	Embedded / non-embedded
	Operating voltage	10–30 V DC	10–30 V DC	10–30 V DC
	Operating range	1–3 mm	2–40 mm	4–40 mm
	Switching outputs	PNP	PNP, NPN	PNP, NPN
	Switching principle	NO, NC	NO, NC, NO + NC (antivalent)	NO + NC (antivalent)
	Switching frequency	Up to 5,000 Hz	Up to 5,000 Hz	Up to 1,400 Hz
	Connection type	M8, cable + M8, cable	M12, cable + M12, cable	M8, M12, terminal, cable
	Degree of protection	IP 67	IP 67	IP 67, IP 68, IP 69 K
	Certifications	CE cULus	CE cULus	CE cULus
Features	Housing	Stainless steel (V2A)	Metal	Plastic
		Cylindrical miniature housing   Versions with increased operating range	Different versions available:   Short housing design   Increased range   AC/DC device versions   Antivalent switching output	Bright status display   Antivalent switching outputs (NO+NC)   Increased ranges   M12 plug, turnable 270° and thus suitable even for angled connection cables   360° visibility through 4-way LED indicator on the sensor head

# Measuring sensors

## Distance sensors



### ODS 9

Optical distance sensors

### ODS 10

Optical distance sensors

### ODS 110

Optical distance sensors

Technical data	Function	Distance measurement, optical	Distance measurement, optical	Distance measurement, optical
	Dimensions excl. connector, W × D × H	21 × 50 × 50 mm	25 × 65 × 55 mm	50 × 23 × 50 mm
	Operating voltage	18–30 V DC	18–30 V DC	18–30 V DC
	Outputs	4–20 mA 1–10 V, 0–10 V RS 232 / RS 485 Push-pull IO-Link	4–20 mA 1–10 V, 0–10 V Push-pull IO-Link	4–20 mA 1–10 V 1x push-pull IO-Link
	Connection type	M12	M12	M12
	Degree of protection	IP 67	IP 67	IP 67
	Certifications	CE CDRH cULus	CE CDRH cULus	CE cULus
	Measurement range	50–650 mm	50–3,500 mm 50–8,000 mm (90 % diffuse reflection) 100–25,000 mm on reflective tape	100–3,000 mm 100–5,000 mm (90 % diffuse reflection)
	Measurement principle	Optical / laser (class 1 and 2)	Optical / laser (class 1)	Optical / laser (class 1)
	Measurement time	1 ms	3,4–1,020 ms (adjustable)	4–20 ms
	Measurement field width / Scanning angle			
	Ultrasonic frequency			
	Resolution	0.01–0.5 mm	1 mm	1 mm
	Mouth width			
	Mouth depth			
	Number of inspection tasks			
	Operation	Teach-in Control buttons on foil display or Sensor Studio	Control buttons on foil display or Sensor Studio	Teach-in or Sensor Studio
Features		Display for measured value display and configuration   Turnable M12 connector   Triangulation measurement   Supports the IO-Link smart sensor profile	Display for measured value display and configuration   Turnable M12 connector   All devices with IO-Link interface   Propagation time measurement (TOF)	All devices with IO-Link interface   Turnable M12 connector   Adjustment via teach button   Propagation time measurement (TOF)



## Ultrasonic sensors



## Fork sensors


**ODSL 30**

Optical distance sensors

**ODSL 96B**

Optical distance sensors

**300, 400 series**

Measuring ultrasonic sensors

**GS 754B**

CCD fork sensors

Distance measurement, optical	Distance measurement, optical	Distance measurement, ultrasonics	Edge/diameter measurement, optical
79 × 69 × 149 mm	30 × 90 × 70 mm	M18 × 46.3 / 51.8 / 74.3 / 75 / 77.6 / 82.8 mm M30 × 75 / 88.8 / 142.5 mm	19.4 × 81.5 × 91 mm 20 × 155 × 91.5 mm
10–30 V DC 18–30 V DC (analog)	10–30 V DC 18–30 V DC (analog, IO-Link)	10–30 V DC 12–30 V DC	10–30 V DC (digital) 18–30 V DC (analog)
4–20 mA 1–10 V RS 232 / RS 485 1 × PNP, 2 × PNP, 3 × PNP	4–20 mA 1–10 V, 0–10 V RS 232 / RS 485 Push-pull IO-Link	PNP (NPN)	2 × 4–20 mA 2 × 0–10 V RS 232 / RS 422 / RS 485 1 × PNP, 2 × PNP
M12	M12, cable	M12	M12
IP 67	IP 67, IP 69K	IP 67	IP 67
<b>CE</b>	<b>CE</b> CDRH <b>cUL</b> US <b>ECOLAB</b>	<b>CE</b> <b>cUL</b> US	<b>CE</b> <b>cUL</b> US
200–30,000 mm 200–65,000 mm (50 % ... 90 % diffuse reflection)	150–2,000 mm 300–10,000 mm 300–25,000 mm on reflective tape	25–400 / 50–400 / 80–1,200 / 150–1,300 / 250–3,500 / 300–3,000 / 350–6,000 / 600–6,000 mm	
Optical / laser (class 2)	Optical / LED / laser (class 1 and 2)	Ultrasonics	Optical / LED
30–100 ms	1–100 ms	0.1–1 s	Min. 2.5 ms
		200 kHz / 310 kHz	25 mm
1 mm	0.1–3 mm	1 mm	14 µm
			27 / 98 mm
			42 mm
			5
Teach-in Display	Teach-in Configuration software Display	Teach-In IO-Link	Terminal program via RS232 interface
Metal housing   Display for measured value display and configuration   M12 connector Ex devices are also available Phase measurement	Robust metal housing   Display for measured value display and configuration   M12 connector Ex devices are also available Triangulation measurement Propagation time measurement (TOF)   Phase measurement	3/5 operating modes   Temperature-compensated   Metal/plastic housing Small dead zone	Detection of transparent media Foil detection > 0.1 mm Turnable M12 connector Wide-ranging evaluation functions Perfect for thread and fiber measurement

## Positioning



### AMS 300i

### BPS 300i

Technical data	Function	Distance measurement, optical	Position detection, optical
	Operating range	40 / 120 / 200 / 300 m	10,000 m
	Reading distance		50 ... 170 mm
	Interfaces	<b>Integrated:</b> PROFIBUS and SSI PROFINET PROFINET and SSI DeviceNet EtherCAT EtherNet/IP CANopen Ethernet TCP/IP, UDP Interbus-S RS 232, RS 422, RS 485 SSI	<b>Integrated:</b> PROFINET EtherCAT PROFIBUS SSI RS 422 RS 232 RS 485
	Connectivity	Via the interfaces mentioned above	
	Position calculation through	Reflector	Bar code tape
	Measurement value output	1.7 ms	1 ms
	Reproducibility	±0.9 / 1.5 / 2.1 / 3 mm (3 sigma)	±0.15 mm (3 sigma)
	Accuracy	±2 / 2 / 3 / 5 mm	
	Degree of protection	IP 65	IP 65
	Light source	Red light laser (class 2)	Red light laser (class 1)
	Supply voltage	18–30 V DC	18–30 V DC
	Operating temperature	–5 ... +50 °C (–30 ... +50 °C with heating)	–5 ... +50 °C (–35 ... +50 °C with heating)
	Additional functions	Speed measurement and monitoring	Speed measurement and monitoring
	Certifications	CDRH  US	CDRH  US
Features		Absolute measurement system with very high accuracy, tested by the Physikalisch-Technische Bundesanstalt (German Metrology Institute)   Simultaneous use of the PROFIBUS and SSI; alternatively, PROFINET and SSI interface   Easy programming via extensive configuration file   Optionally with heating   Multiple language menu-driven display   Heatable reflectors available as accessories	Positioning on curves, gradients and track switches   Curve-going, horizontally and vertically   Metal housing   3 selectable connection systems   Fast, secure and position-neutral installation using special mounting device   Extensive diagnostic options   Comfortable programming via GSDML/GSD or ESI files   Optionally with heating or display

## Sensors for compartment fine positioning



**IPS 200i**  
Sensors  
for positioning



**IPS 400i**  
Sensors  
for positioning

Typical applications	Compartment fine positioning	Single compartment depth	Double compartment depth
	Sensor / cameras	CMOS (Global Shutter)	CMOS (Global Shutter)
	Resolution (pixel)	1,280 × 960	1,280 × 960
	Focal point	Reading distance 100 ... 600 mm Marker dependent	Reading distance 250–2,400 mm Marker-dependent
	Interface	<b>Integrated:</b> Ethernet TCP/IP, UDP PROFINET IO/RT	<b>Integrated:</b> Ethernet TCP/IP, UDP PROFINET IO/RT
	Digital inputs/outputs	3x IN; 5x OUT	3x IN; 5x OUT
	Optional	Cables, mounting devices, reflectors, heating model to –30°C	Cables, mounting devices, reflectors, heating model to –30°C, external illumination
	Number of test routines	8	8
	Configuration /Operating system	Web-based configuration tool (webConfig tool) XML commands; 2x operational controls	Web-based configuration tool (webConfig tool) XML commands; 2x operational controls
	Additional functions	Configuration on the device via configuration codes	Configuration on the device via configuration codes
	Dimensions, W × H × D	43 × 61 × 44 mm	43 × 61 × 44 mm
Features	Certifications	CE cULus	CE cULus
		Time savings through fast commis- sioning via web-based configura- tion tool or printed configuration codes   Innovative alignment system via feedback LEDs simpli- fies alignment   One device for the entire region of interest from 100– 600 mm   Quality score enables the early detection of a deterioration in reading performance   Can be used flexibly thanks to high-perfor- mance, infrared LED illumination that is independent of ambient light   Model with integrated heating for use to –30°C	Time savings through fast commis- sioning via web-based configura- tion tool or printed configuration codes   Innovative alignment system via feedback LEDs simplifies alignment   Quality score enables the early detection of a deterioration in reading performance   One device for double-depth working range from 250–2,400 mm   Can be used flexibly thanks to high-performance, infrared LED illumination that is independent of ambient light   Model with integrated heating for use to –30°C



# Measuring and switching light curtains



**CML 700i**  
Measuring



**CSL 505**  
Switching



**CSL 710**  
Switching

Technical data	Function	Size / contour detection, optical	Throughbeam principle	Throughbeam principle
	Dimensions excl. connector, W x D x H	29 x 35 x 168 ... 2,968 mm	10 x 27 x 150 ... 3,180 mm 12 x 58 x 120 ... 480 mm	29 x 35 x 168 ... 2,968 mm
	Operating voltage	18–30 V DC	24 V DC	18–30 V DC
	Outputs	Analog, CANopen, IO-Link, PROFIBUS, PROFINET, RS 485 (MODBUS)	2x outputs / push-pull	4 I/Os (configurable) + IO-Link
	Connection type	M12	M8	M12
	Degree of protection	IP 65	IP 65	IP 65
	Certifications	CE cSP US	CE cSP US	CE cSP US
	Operating range*	4.5 ... 9.5 m	Up to 5 m	Up to 3.5 ... 7 m
	Light source / Measurement principle	Infrared	Infrared	Infrared
	Cycle time / measurement time	10–30 µs per beam + 0,4 ms	1 ms per beam	30 µs per beam
	Measurement field length / scanning angle	160–2,960 mm	35–3,100 mm	160–2,960 mm
	Resolution	5, 10, 20, 40 mm	5**, 12.5, 25, 50, 100 mm	5, 10, 20, 40 mm
	Number of beams	Max. 592	Max. 160	Max. 592
	Operation	Control buttons on foil display, 5 languages, configuration software	Autocalibration, configuration software, configuration by means of pin assignment	Control buttons on foil display, 5 languages, configuration software
Features	CML 730: 10 µs x number of beams + 0.4 ms   Cycle time CML 720: 30 µs x number of beams + 0.4 ms   Detection of transparent media   Display for diagnosis and alignment   Standard profile for simple mounting   Robust metal housing   Suitable for low-temperature applications down to –30 °C		2 switching ranges   Narrow profile   Through holes   Suitable for low-temperature applications down to –30 °C	8 switching ranges   Simple area splitting   4 switching outputs + 1 IO-Link   Robust metal housing   Extremely fast cycle time   Display for diagnosis and alignment   Suitable for low-temperature applications down to –30 °C

\* Guaranteed operating range

\*\* 5 mm resolution only with 58 mm housing depth

# Data transmission



## DDLS 500

Technical data	Operating range	40, 120, 200 m
	Light source	Infrared laser (laser class 1M)
	Transmission rate	100 Mbit/s
	Interfaces	PROFINET EtherNet IP EtherNet TCP/IP EtherCAT UDP
	Degree of protection	IP 65
	Supply voltage	18–30 V DC
	Operating temperature	–5 °C ... +50 °C (–35 °C ... +50 °C with heating)
	Certifications	<b>CE</b> CDRH <b>c</b> <b>UL</b> <b>US</b>
Features	<p>Transparent, real-time transmission of all TCP/IP- and UDP-based protocols   Very simple diagnosis of the transmission technology   Pre-mounted and complete delivery of all mounting and alignment elements   Integrated laser pointer for fast installation (available optionally)   Simple remote diagnosis via web browser-based user interface (available optionally)   Device models as PROFINET network participants</p>	

# Identification

## 2D-code reader



### DCR 200i

Typical applications	Code reading	Data Matrix, bar code, QR-Code, Pharmacode, Aztec, GS1 Databar
	Sensor / cameras	CMOS (Global Shutter)
	Resolution (pixel)	1,280 × 960
	Focal point	U optics: 50 mm N optics: 70 mm M optics: 105 mm F optics: 185 mm L optics: 285 mm
	Interfaces	<b>Integrated:</b> Ethernet TCP/IP, UDP PROFINET IO/RT RS 232 RS 422
	Connectivity	<b>With MA 200i connection unit</b> PROFIBUS Ethernet TCP/IP, UDP, IP EtherCAT DeviceNet CANopen
	Digital inputs/outputs	2 / 2
	Number of test routines	Memory capacity for 1 parameter set in the camera
	Configuration / Operating system	Configuration via configuration codes or via PC using standard web browser without software to be installed additionally (webConfig tool)
	Options	Optional: connection cables   Optical filters   Housing hoods   External illumination   Mounting devices: BTU 320M-D12, BT 320M   MA 150 modular connection unit
Features	Dimensions, W × H × D	43 × 61 × 44 mm
	Certifications	<b>CE cULus</b>
		Camera system for omnidirectional reading of bar codes, stacked codes and 2D-codes   Integrated illumination (type-dependent: red or IR)   High object speed of up to 7 m/s   Integrated teach functions for simple adjustments via buttons   Optional robust stainless steel housing   Optional with NPN switching inputs/outputs   Optionally with integrated heating for use to -30 °C

## Stationary bar code readers



### BCL 300i

Technical data	Reading distance (dependent on version)	20 – 700 mm
	Smallest resolution	0.127 mm
	Scanning rate	1,000 scans/s
	Optics models	N, M, F, L, J
	Reading method	Single line scanner Raster scanner Deflecting mirror Oscillating mirror Code reconstruction technology
	Inputs/outputs	1 / 1
	Interfaces	<b>Integrated:</b> RS 232 / 485 / 422 multiNet PROFIBUS PROFINET IO/RT Ethernet TCP/IP, UDP Ethernet IP EtherCAT
	Connectivity	<b>With MA 200i connection unit</b> DeviceNet, CANopen
	Supply voltage	18 – 30 V DC
	Degree of protection	IP 65
Accessories	Network master	MA 31
	Certifications	<b>CE CDRH cULus</b>
Features	Optional	
	Mounting devices	BT 56, BT 59, BT 300 W, BT 300
		Integrated fieldbus connectivity   Code reconstruction technology (CRT)   Available as a front scanner, deflecting mirror and oscillating mirror model   Simple configuration without additional software via USB interface or GSD/GSDML file   Modular connection type via M12 hood with integrated connectors, terminal hood or cable hood   Optional with display and as heating model

# Industrial image processing

Smart cameras



LSIS 412i, 462i

Industrial IP cameras



LCAM 408i

Typical applications			
	Presence control / completeness monitoring	X	
	Dimension / position monitoring	X	
	Position and type detection	X	
	Code reading	Data Matrix, bar code, Pharmacode (LSIS 462i)	
	Measurement	(LSIS 462i)	
	Monitoring camera		X
	Sensor / cameras	CMOS (Global Shutter)	Color CMOS
	Resolution (pixel)	752 × 480	2,592 × 1,944
	Focal point	50 mm ... ∞ (focal length 8 mm) 75 mm ... ∞ (focal length 16 mm) Depends on lens with C-mount models	500 mm ... ∞
	Interface	<b>Integrated:</b> Ethernet, RS 232	<b>Integrated:</b> Ethernet
	Connectivity	<b>With MA 200i connection unit</b> PROFINET IO/RT PROFIBUS EtherCAT DeviceNet CANopen	
	Digital inputs/outputs	8, configurable	
	Fast EtherNet	Yes	Gigabit
	Optional	Cables, mounting devices, external illumination	Cables, mounting devices, air blower
Features	Number of test routines	Typically 10 to 60, depending on scope of test	
	Configuration / Operating system	Configuration via PC using standard Web browser (webConfig tool)	Configuration via PC using standard Web browser (webConfig tool)
	Dimensions, W × H × D	75 × 113 × 55 mm	75 × 113 × 55 mm / 76.5 × 66 × 126 mm
	Certifications	<b>CE cULus</b>	<b>CE</b>

Very well suited for industrial use through glass or plastic window  
 | Metal housing and homogeneous integrated illumination (depends on type: white, IR or RGBW)  
 | Degree of protection IP 65 / IP 67  
 | Flexible use through motor-driven focus adjustment

Very well suited for industrial use through glass window and metal housing  
 | Degree of protection IP 65 / IP 67  
 | 5 megapixel color camera chip for live transmission in MJPEG format

# Safety

## Safety laser scanners



RSL 410, 420, 425

RSL 430, 440, 445

RSL 420P, 450P, 455P

General	Protective field range	3,0 / 4,5 / 6,25 / 8,25 m	3,0 / 4,5 / 6,25 / 8,25 m	3,0 / 4,5 / 6,25 / 8,25 m
	Scanning angle	270°	270°	270°
	Angular resolution	0.1°	0.1°	0.1°
	Warning field range (at 10% diffuse reflection)	20 m	20 m	20 m
	Resolution, selectable	30 / 40 / 50 / 60 / 70 / 150 mm	30 / 40 / 50 / 60 / 70 / 150 mm	30 / 40 / 50 / 60 / 70 / 150 mm
	Response time	≥ 80 ms	≥ 80 ms	≥ 120 ms
	Safety	Type 2, SIL 3, PL d	Type 2, SIL 3, PL d	Type 2, SIL 3, PL d
	Dimensions, incl. connection unit (W × H × D)	140 × 149 × 140 mm	140 × 149 × 140 mm	140 × 170 × 142 mm
	Temperature range	0 ... +50°	0 ... +50°	0 ... +50°
	Certifications	CE cULUS TÜV	CE cULUS TÜV	CE cULUS TÜV
Functions	Safety-related switching outputs	1	2	RSL 420P: PROFI-safe, 1 protective field RSL 450P, 455P: PROFI-safe, 4 simultaneous protective fields
	Number of field pairs (1 protective field + 1 warning field)	RSL 410: 1 RSL 420: 10	RSL 430: 10+10 RSL 440, 445: 100	RSL 420P: 10 RSL 450P, 455P: 100
	Number of 4-field sets (1 protective field + 3 warning fields)	RSL 410: 1 RSL 420: 10	10	RSL 420P: 10
	Number of 4-field sets (2 protective fields + 2 warning fields)	–	RSL 440, 445: 50	RSL 450P, 455P: 50 (Warning fields can be evaluated as protective fields)
	Number of independent sensor configurations	1	RSL 430: 2 RSL 440, 445: 10	RSL 420P: 1 RSL 450P, 455P: 10
	Plain-text display, integrated electronic spirit level	X	X	X
	Configurable signal outputs	RSL 410: 3 RSL 420: 4	9	All status information can be called up
	UDP data output optimized for AGV navigation, configurable, 50 m operating range	RSL 425 Distance and signal strength, angular resolution 0.1°	RSL 445 Distance and signal strength, angular resolution 0.1°	RSL 455P Distance and signal strength, angular resolution 0.1°
Interfaces / connection	Connection unit (removable, with integrated configuration memory)	RSL 410: M12 connector, RSL 420, 425: cable or connector, 16-pin	Cable or connector, 29-pin	3x M12 connector for 2-port switch and voltage supply or 4x M12 connector with additional voltage output   AIDA variant with push-pull connectors, communication via copper or fiber-optic cable
	Interfaces for configuration and diagnosis	Ethernet TCP/IP, Bluetooth RSL 420, 425: USB	Ethernet TCP/IP, USB, Bluetooth	Ethernet TCP/IP, USB, Bluetooth
	PROFINET	–	–	Conformance class C   Network load class III   PROFINET device acc. to Specification V2.3.4   GSDML acc. to Specification V2.3.2
	Further features	Technology for robust operation   Contactor monitoring (EDM), start/restart interlock (RES)   Vertical access guarding with reference boundary monitoring   Parking function (protective field switchover, RSL 420 and RSL 425)	Technology for robust operation   Contactor monitoring (EDM), start/restart interlock (RES)   Vertical access guarding with reference boundary monitoring   Parking function (protective field switch-off)	Technology for robust operation   Start/restart interlock (RES)   Vertical access guarding with reference boundary monitoring   Parking function (protective field switch-off)

## Safety radar systems







LBK with I/O controller  
(LBK-C22-LZ)LBK with PROFI-safe controller  
(ISC-Bus-PS)

General	SIL in accordance with EN IEC 62061 (SILCL)	SIL 2	SIL 2
	Performance Level (PL) in accordance with EN ISO 13849-1	PL d	PL d
	Category in accordance with EN ISO 13849-1	Category 2	Category 2
	Operating principle	FMCW (frequency modulated continuous wave) for movement detection	FMCW (frequency modulated continuous wave) for movement detection
	Response time	100 ms	100 ms
	Temperature range	-30 °C ... +60 °C	-30 °C ... +60 °C
	Certifications	<b>IMQ</b> <b>CE</b>	<b>TUV</b> <b>CE</b>
Sensor	Operating range	0 ... 4 m	0 ... 4 m
	Adjustable protective field and warning field size	1 ... 4 m	1 ... 4 m
	Angle of radiation	Wide: 110° (horizontal plane) 30° (vertical plane) Narrow: 50° (horizontal plane) 15° (vertical plane)	Wide: 110° (horizontal plane) 30° (vertical plane) Narrow: 50° (horizontal plane) 15° (vertical plane)
	Frequency range	24.0 ... 24.5 GHz	24.0 ... 24.5 GHz
	Emitted power	≤ 13 dBm	≤ 13 dBm
	Dimensions (W × H × D)	85 × 85 × 53 mm	85 × 85 × 53 mm
	Connection	M12, 5-pin	M12, 5-pin
	Supply voltage	Via controller	Via controller
	Degree of protection	IP 67	IP 67
Controller	Safety-related switching outputs	Relay output, 2-channel	PROFI-safe, 2 PNP transistor outputs (OSSDs)
	Signal outputs	2 relay outputs	Via PROFINET
	Inputs	3 (2-channel)	2 (2-channel)
	Number of sensors in a system	6	6
	Number of configurable groups (1 to 6 sensors)	3	2
	Deactivation of individual groups	X	X
	Switchable configurations	–	32
	Start / restart interlock (RES)	X	X
	Dimensions (W × H × D)	166.25 × 92.6 × 46.5 mm	90 × 60 × 110 mm
	Degree of protection	IP 20	IP 20
	Interfaces for configuration and diagnosis	USB 2.0 Micro USB	Ethernet TCP/IP USB 2.0



















## Safety light curtains

**ELC 100****MLC 310  
MLC 510**

General	Type in accordance with EN IEC 61496	Type 4	MLC 300: type 2 MLC 500: type 4
	SIL in accordance with IEC 61508 and EN IEC 62061 (SILCL)	SIL 3	MLC 300: SIL 1 MLC 500: SIL 3
	Performance Level (PL) in accordance with EN ISO 13849-1	PL e	MLC 300: PL c MLC 500: PL e
	Resolution	17 / 30 mm	14 / 20 / 30 / 40 / 90 mm
	Operating range	3 / 6 m	6 / 15 / 10 / 20 / 20 m
	Protective field height	300 ... 1,500 mm	150 ... 3,000 mm
	Response time	4.5 – 21 ms	MLC 300: 3 – 51 ms MLC 500: 3 – 64 ms
	Profile cross section	34.7 mm × 39.3 mm	29 × 35 mm
	Temperature range	0 ... +50°C	MLC 300: 0 ... +55°C MLC 500: –30 ... +55°C
	Safety-related switching outputs (OSSDs)	2 PNP transistor outputs	2 PNP transistor outputs
	Connection type	300 mm cable with M12 connector	M12 connector
	Certifications	 	   
Functions	Range reduction on the transmitter		X
	Switchable transmission channels		X
	LED indicator	X (additional alignment indicator)	X
	7-segment display		
	Configuration by means of wiring		X
	Automatic start / restart	X	X
	Start / restart interlock (RES)		
	Contact monitoring (EDM)		
	Beam blanking, fixed or movable		
	Muting function, integrated		
	Linkage of safety output, multiscan		
Versions for special applications	Extremely slim design		
	Cascadable (triple)		
	AIDA version		X
	AS-i Safety interface		X
	Ex marking acc. to EN 60079		
	Degrees of protection IP 67 / IP 69K, mounted in protective tube		X
	Extra shock / vibration resistant	X (standard for all devices)	X


**MLC 320**  
**MLC 520**
**MLC 520-S**
**MLC 530**
**MLC 530-SPG**

MLC 300: type 2 MLC 500: type 4	Type 4	Type 4	Type 4
MLC 300: SIL 1 MLC 500: SIL 3	SIL 3	SIL 3	SIL 3
MLC 300: PL c MLC 500: PL e	PL e	PL e	PL e
14 / 20 / 30 / 40 / 90 mm	14 / 24 mm	14 / 20 / 30 / 40 / 90 mm	30 / 40 / 90 mm
6 / 15 / 10 / 20 / 20 m	6 m	6 / 15 / 10 / 20 / 20 m	10 / 20 / 20 m
150 ... 3,000 mm	150 ... 1,200 mm	150 ... 3,000 mm	150 ... 3,000 mm
MLC 300: 3–51 ms MLC 500: 3–64 ms	7–17 ms	3–64 ms	3–64 ms
29 × 35 mm	15.4 × 32.6 mm	29 × 35 mm	29 × 35 mm
MLC 300: 0 ... +55°C MLC 500: –30 ... +55°C	–10 ... +55°C	–30 ... +55°C	–30 ... +55°C
2 PNP transistor outputs	2 PNP transistor outputs	2 PNP transistor outputs	2 PNP transistor outputs
M12 connector	160 mm cable with M12 connector	M12 connector	M12 connector
   	   	   	   
X		X	X
X		X	X
X	X	X	X
X		X	X
X	X	X	X
X	X	X	
X	X	X	X
X	X		
		X	X
		X (2-sensor timing controlled)	X (Smart Process Gating)
		X	
	X		
X	X		
(group II, cat 3D and 3G)			
X		X	

## Safety light curtains



**MLD 310, MLD 320  
MLD 510, MLD 520**



**MLD 330, MLD 335  
MLD 530, MLD 535**

## Single light beam safety devices



**MLD 510, MLD 520,  
MLD 530**



**SLS 46C type 4  
SLS 46C type 2**

General	Type in accordance with EN IEC 61496	MLD 300: type 2 MLD 500: type 4	MLD 300: type 2 MLD 500: type 4	Type 4 (self-monitoring)	Type 4, in combination with an MSI-TRM safety relay Type 2, in combination with a safety monitoring device
	SIL in accordance with IEC 61508 and EN IEC 62061 (SILCL)	MLD 300: SIL 1 MLD 500: SIL 3	MLD 300: SIL 1 MLD 500: SIL 3	SIL 3	SIL 3 (SLS 46C type 4 with MSI-TRM safety relay) SIL 1 (SLS 46C type 2 in combination with safety monitoring device)
	Performance Level (PL) in accordance with EN ISO 13849-1	MLD 300: PL c MLD 500: PL e	MLD 300: PL c MLD 500: PL e	PL e	PL e (SLS 46C type 4 with MSI-TRM safety relay) PL c (SLS 46C type 2 in combination with safety monitoring device)
	Number of beams / beam distance	2 / 500 mm 3 / 400 mm 4 / 300 mm	2 / 500 mm 3 / 400 mm 4 / 300 mm	1	1
	Operating range	0.5 ... 50 m or 20 ... 70 m (transmitter-receiver systems) 0.5 ... 6/8 m (transceiver systems)	0.5 ... 50 m or 20 ... 70 m (transmitter-receiver systems) 0.5 ... 6/8 m (transceiver systems)	0.5 ... 70 m 20 ... 100 m	0.25 ... 40 m 5 ... 70 m
	Dimensions	Profile cross section 52 x 65 mm	Profile cross section 52 x 65 mm	52 x 65 x 193 mm	20.5 x 77 x 44 mm
	Temperature range	-30 ... +55 °C	-30 ... +55 °C	-30 ... +55 °C	-30 ... +60 °C
	Safety-related switching outputs	2 PNP transistor outputs (OSSDs)	2 PNP transistor outputs (OSSDs)	2 PNP transistor outputs (OSSDs)	2 push-pull transistor outputs
	Connection type	M12 connector	M12 connector	M12 connector	2 m cable, M12 connector
Functions	Certifications				
	LED indicator	X	X	X	X
	7-segment display	MLD 320, 520	X	MLD 520, 530	
	Start / restart interlock (RES)	MLD 320, 520	X	MLD 520, 530	
	Contact monitoring (EDM)	MLD 320, 520	X	MLD 520, 530	
	Configuration by means of wiring	MLD 320, 520	X	MLD 520, 530	
	Laser alignment aid (optional for transmitter/receiver systems)	X	X	X	
	2-sensor muting (timing and sequence controlled)		MLD 330, 530 MLD 335, 535	MLD 530	
	4-sensor muting (timing controlled)		MLD 335, 535		
	Muting-timeout extension to up to 100 hours		X	MLD 530	
	Integrated status indicator (optional)	X	X		
	AS-i Safety interface	MLD 510		MLD 510	

## Safety switches



S20, S200

## Safety position switches



S300

## Safety proximity sensors, magnetically coded



MC 300

## Safety proximity sensors, RFID coded



RD 800

General	Type in accordance with EN ISO 14119	Type 2 interlock device without guard interlocking	Type 1 interlock device without guard interlocking
	Safety	For safety applications with performance level up to PL e/SIL 3	For safety applications with performance level up to PL e/SIL 3
	Housing / Degree of protection	Technopolymer (S20) or metal (S200) / both IP 67	Technopolymer or metal, both IP 67
	Actuator	Mechanical tongue, with low coding level in accordance with EN ISO 14119	Actuated by unencoded cam in accordance with EN ISO 14119
	Locking type, locking force acc. to ISO 14119		
	Connection type	Cable entry M20 × 1.5 (S20: optional 3-way), M12 connector	Cable entry M20 × 1.5 (1- or 3-way), M12 connector
Functions	Certifications	CE (M) cULUS	CE (M) cULUS
	Function	Safety switches with separate actuator	Safety switches with plunger and roll actuator
	Integration in safety circuit	Positive-opening contacts for integration in a safety circuit	Positive-opening contacts for integration in a safety circuit
	Actuator	Up to 8 different actuators	6 different plunger and roll actuators
Features	Special functions		Switching direction selectable
		Universal use with 5 actuator approach directions	Universal use with individually set actuator approach directions and angles in 10° grid
		Easy mounting with standard construction	Extremely durable / robust
		High-quality silver contacts for long life expectancy	Various contact blocks
Features		Various contact blocks	

General	Type in accordance with EN ISO 14119	Type 4 interlock device without guard interlocking	Type 4 interlock device without guard interlocking
	Category in accordance with EN ISO 13849-1	Up to 4 (depending on the number of sensors)	4
	Performance Level (PL) in accordance with EN ISO 13849-1	Up to PL e (depending on the number of sensors)	PL e with a single device
	Dimensions (housing)	M30 × 36 mm (MC 330) 36 × 26 × 13 mm (MC 336) 88 × 25 × 13 mm (MC 388)	87.5 × 25 × 18 mm (sensor) 45 × 25 × 18 mm (actuator)
	Assured operating distances (Seo, Sar)	< 6 mm, > 14 mm (MC 330) < 3 mm, > 11 mm (MC 336) < 6 mm, > 30 mm (MC 388)	12 mm, 10 mm
	Switching tolerance	± 1 mm	
Functions	Contact type	2 NC or 1 NC + 1 NO	
	Code type	Actuator with low coding level in accordance with EN ISO 14119	
	Connection type	M8, M12, cable, cable+M12	
	Min. approach speed of actuator towards sensor	50 mm/s	
	Response time	3 ms	3 ms
	Degree of protection	IP 67	IP 67 / IP 69K
Features	Certifications	CE cULUS TUV	CE cULUS TUV
	Encoding	Magnetically coded	RFID coded, for maximum protection against manipulation
	Status indicator	LED	4 LEDs
	Signal contact	X	X
	Programming input		For teaching-in actuators
Features		Contactless actuation without mechanical contacts   Long life expectancy   Not sensitive to soiling	Contactless actuation without mechanical contacts   Long life expectancy   Not sensitive to soiling   Series connection possible

## Safety locking devices









L100, L200



L250















L300

General	Type in accordance with EN ISO 14119	Type 2 interlock device with guard interlocking	Type 4 interlock device with guard interlocking	Type 4 interlock device with guard interlocking
	Safety	For safety applications with performance level up to PL e / SIL 3	Performance Level PL e / SIL 3 with a single device	Performance Level PL e / SIL 3 with a single device
	Housing / Degree of protection	Technopolymer or metal, both IP67	Technopolymer IP 67 / IP 69K	Metal, IP 67 / IP 69K, IP 65 for integrated operational controls
	Actuator	Mechanical tongue, with low coding level in accordance with EN ISO 14119	Mechanical tongue with RFID-encoded actuator in accordance with EN ISO 14119; AC-L250-SCA: low AC-L250-UCA: high	Mechanical tongue with RFID-encoded actuator in accordance with EN ISO 14119; AC-L300-SCA: low AC-L300-UCA: high
	Locking type, locking force acc. to ISO 14119	With either quiescent current principle or open circuit current principle L100: $F_{1max}$ 1,100 N L200: $F_{1max}$ 2,800 N	With either quiescent current principle or open circuit current principle, $F_{1max}$ 2,100 N	With either quiescent current principle or open circuit current principle, $F_{1max}$ 9,750 N
	Connection type	Cable entry M20 × 1.5 (3-way)	M12 connector, various outgoing lines	Cable entry M20 × 1.5 (3-way), M12 (8- or 12-pin), M23 (19-pin)
	Certifications	CE  c  US	CE c  US  ECOLAB	CE c  US  ECOLAB
Functions	Function	Safety switches with locking device	Safety switches with locking device	Safety switches with locking device
	Integration in safety circuit	Positive-opening contacts for integration in the safety circuit	OSSD safety-related switching outputs	OSSD safety-related switching outputs
	Actuator	Multiple heavy-duty actuators	Contactless actuation through RFID technology	Contactless actuation through RFID technology
	Status indicator	LED status display (L200)	LED status display	LED status display
	Escape release	Models with escape unlocking (L200)	Models with escape unlocking	Models with escape unlocking
	Special functions			Models with up to three integrated operational controls
Features		Universal use with 5 actuator approach directions  Robust design for big machinery and systems in harsh ambient conditions (L200)	Large center opening for actuator shaft  Flexibly mounted actuator enables secure closing even with warped doors  Variable installation options: Front and side mounting with just two screws   Flexible and independent alignment of connection unit and escape unlocking	Large center opening for actuator shaft  Flexibly mounted actuator enables secure closing even with warped doors  Variable installation options: Flexible and independent alignment of device head and escape unlocking  Lock-out/tag-out functionality  Door handle for simple mounting of switches and actuators

## Programmable safety controls

**MSI 410****MSI 420  
MSI 430****MSI-EM-I8  
MSI-EM-I084**

Technical data	Device type/function	Safety control base module	Safety control base module	Safe extension module
	Category / Performance Level (PL) in accordance with EN ISO 13849-1	4 / PL e	4 / PL e	4 / PL e
	SIL in accordance with IEC 61508 or EN IEC 62061 (SILCL)	3	3	3
	Inputs/outputs / Inputs or outputs, configurable	20 / 4 / –	16 / 4 / 4	8 / – / – 8 / 4 / –
	Maximum switching power per output	4 A	4 A	4 A
	Test outputs / signal generators	4 / 4	4 / 4	8 / 2 (EM-I8) 2 / 2 (EM-I084)
	Interfaces	USB mini	USB mini, Ethernet TCP/IP	
	Fieldbus protocols		MSI 430: PROFINET IO, EtherNet/IP and Modbus TCP integrated	
	Supply voltage	16.8 ... 30 V DC	16.8 ... 30 V DC	16.8 ... 30 V DC
	Ambient temperature, operation			
	Dimensions	45 × 96 × 115 mm	45 × 96 × 115 mm	22.5 × 93.7 × 120.8 mm
Functions	Certifications	   	   	   
		40 certified function blocks   Expandable to up to 116 safe inputs / 56 safe outputs and 2 gateway modules   Special function blocks for press control	40 certified function blocks   Expandable to up to 116 safe inputs / 56 safe outputs and 2 gateway modules   Special function blocks for press control	Safe extension modules   Each base module can be expanded by up to 12 freely selectable extension modules
Features		Configuration via MSI.designer configuration software (license-free): supports up to 300 function blocks in one project, integrated simulation with logic analyzer, configurable report, online diagnosis   Removable program memory in SD card format, 512 MB   Designs with screw or spring-cage terminals	Configuration via MSI.designer configuration software (license-free): supports up to 300 function blocks in one project, integrated simulation with logic analyzer, configurable report, online diagnosis   Removable program memory in SD card format, 512 MB   Designs with screw or spring-cage terminals	Designs with screw or spring-cage terminals



# Network and connection technology

## Connection units









**MD 700i**  
IO-Link master



**MD 798i**  
IO-Link master



**MD 742**  
IO-Link hub

Technical data	Connection type	2x M12, 4-pin, D-coded, Ethernet fieldbus connection 2x M12, 5-pin, L-coded, voltage supply 8x M12, 5-pin, A-coded	2x M12, 4-pin, D-coded, Ethernet fieldbus connection 2x M12, 5-pin, L-coded, voltage supply 8x M12, 5-pin, A-coded, IO-Link	1x M12, 5-pin, A-coded, IO-Link / voltage supply 8x M12, 5-pin, A-coded, 8x M8, 3-pin, digital input
	Interfaces	PROFINET EtherNet/IP IO-Link 1.1	PROFINET EtherNet/IP IO-Link 1.1	IO-Link 1.1
	Features	Integrated switch Voltage IN/OUT 8x IO-Link Class A 8 IO-Link + 8 DI 16 DI / 8 DI/8DO	Integrated switch Voltage IN/OUT 8x IO-Link Class A+B, pin 4 in IOL mode 4x DIO + 8 SIO mode 4x DO	16 (M12) / 8 (M8) digital PNP inputs COM 2 / 38.4 kbit/s
	Shield	Shielded	Shielded	Shielded
	Degree of protection (only in the screwed-down state with the corresponding mating parts)	IP 65 / 67 / 69K*	IP 65 / 67 / 69K*	IP 65 / 67 / 69K*
	Dimensions, L x W x H	65 x 210.4 x 30 mm	60 x 230 x 39 mm	54 x 150 x 27 mm 32 x 144 x 32 mm
	Certifications	  US	  US	  US
Functions		Cloud connection via OPC UA   Integrated web server   Can be operated as stand-alone device	Integrated web server	Economical connection of digital signals
Features		Robust design for harsh conditions   For the connection of up to 8 IO-Link devices   Parallel data exchange with control and the IT world   Models with OPC UA as standardized model for transferring data from the field level to the cloud   Stand-alone system with fully integrated web server   No further software necessary   Module cloning for device exchange and extension to new devices	Robust design for harsh conditions   Resistant to welding sparks   For the connection of up to 8 IO-Link devices   Stand-alone system with fully integrated web server   No further software necessary   Module cloning for device exchange and extension to new devices	Robust design for harsh conditions   Resistant to welding sparks   Standardized mounting holes in the middle enable flexible mounting on all standard profiles and mounting plates   For bundling up to 16 digital signals per hub   No further software necessary, description via IODD

# Accessories and Supplementary Products



**MD 200i**  
IO-Link master

2x RJ45 Ethernet fieldbus connections, 2x screw terminals for the voltage supply, 8 x IO-Link master ports

PROFINET  
EtherNet/IP  
IO-Link 1.1

Integrated switch  
Voltage IN/OUT  
8x IO-Link Class A  
8 IO-Link + 8 DI  
16 DI / 8 DI/8DO

Shielded

IP 20

114 x 45 x 108 mm

CE cULus

Cloud connection via OPC UA  
| Integrated web server | Can be operated as stand-alone device

Robust design for harsh conditions  
| Mounting holes in the middle and additional fixing holes on the side enable flexible mounting on all standard profiles and mounting plates | For the connection of up to 8 IO-Link devices | Parallel data exchange with control and the IT world | Models with OPC UA as standardized model for transferring data from the field level to the cloud | Stand-alone system with fully integrated web server | No further software necessary | Module cloning for device exchange and extension to new devices

## Signaling devices



### Signaling column, type A

### Signaling column, type E

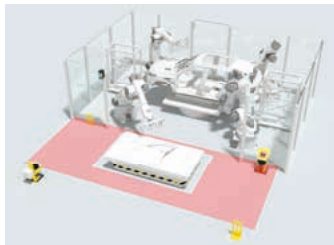
Technical data	Operating voltage	24 V DC $\pm 10\%$	24 V AC/DC, $\pm 10\%$
	Degree of protection	IP 66	IP 66
	Diameter	70 mm	70 mm, 40 mm
	Certifications	CE cULus	CE cULus
Func-tions	Housing	Plastic, PC-ABS	Plastic, PC
		Optical & acoustic signaling for displaying machine states	Optical & acoustic signaling for displaying machine states
Features		Flexible configuration: 6 different colors (red, orange, yellow, green, blue, white)   Simple mounting: base mounting: 3 stand heights with plastic foot, flat mounting variant, hinged mounting variant   Models with and without M12 connector   Module connection via bayonet lock   Position-independent – protection against interchanging   Transparent calottes/uniform clear glass optics   Single-sound & multi-sound buzzer modules (up to 105 dB)   Preassembled models & freely configurable elements   Signal image: continuous light & flashing light   Multicolor with 7 different colors	6 different colors (red, orange, green, blue, white, yellow)   Base mounting, bracket mounting, horizontal mounting   Single-sound buzzer module   Freely configurable elements   Signal image: continuous light & flashing light

# Safety solutions

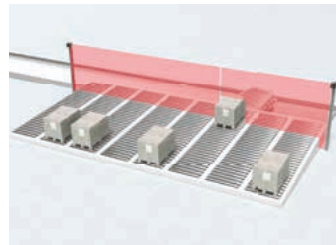
## Efficient material flow and maximum safety

The increasing automation of processes places growing demands on safety concepts. Classic concepts such as muting are often pushed to their limits here, e.g. at transfer stations and material locks. Our innovative safety solutions guarantee gapless safety, efficient material flow and high availability of your system, even with automatic processes.

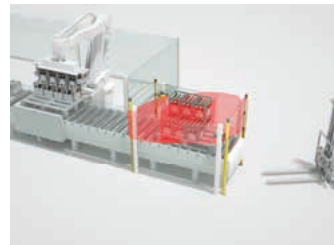
### Safeguarding of robot/AGV transfer stations



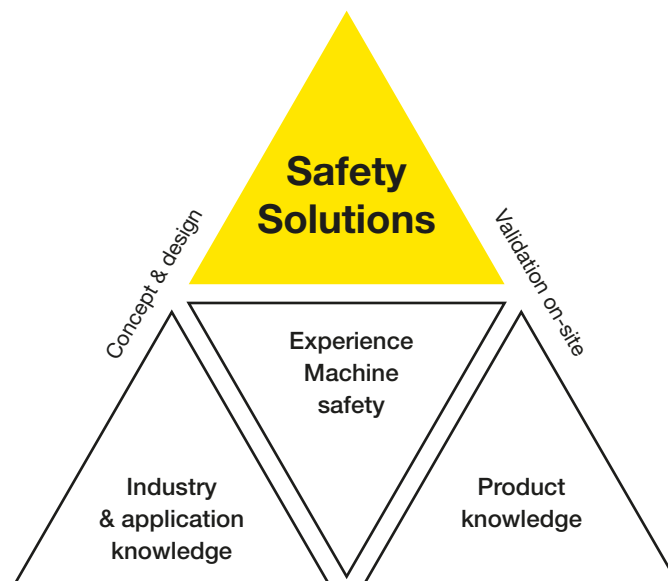
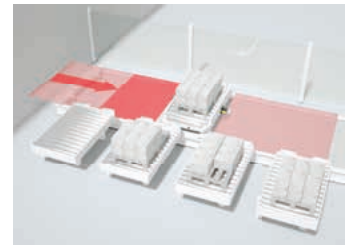
### Access guarding on multi-track transport systems



### Access monitoring at material transfer station



### Area guarding at transverse side-tracking skate



### Use our experience and our know-how

Innovative ideas are based on experience and know-how. For more than 30 years, we have been supporting safety-related applications in different industries by offering a broad range of products. Our safety experts have comprehensive knowledge of the latest norms and standards and extensive experience in designing safety concepts. This allows us to develop efficient safety solutions for use in automated environments.

- Global network of certified experts for the creation of safety concepts and the validation of the solutions on-site
- In-house Solutions Engineering Center
- Development and design according to the V-model in accordance with EN ISO 13849-1
- Extensive selection of in-house safety products

## Your partner for efficient safety solutions

From the gathering of the requirements to the safety acceptance, you are accompanied by our professional project teams.

They make sure that the safety solution meets your requirements and ensure that the project runs smoothly.



## Tailored to your needs

Our solutions are based on qualified safety concepts which, if necessary, can also be extended or created new. Every solution is individually tailored to your system layout and includes

- All necessary hardware and software components
- Engineering services, such as configuration according to project requirements
- Start-up support
- Validation of the safety function
- Full documentation



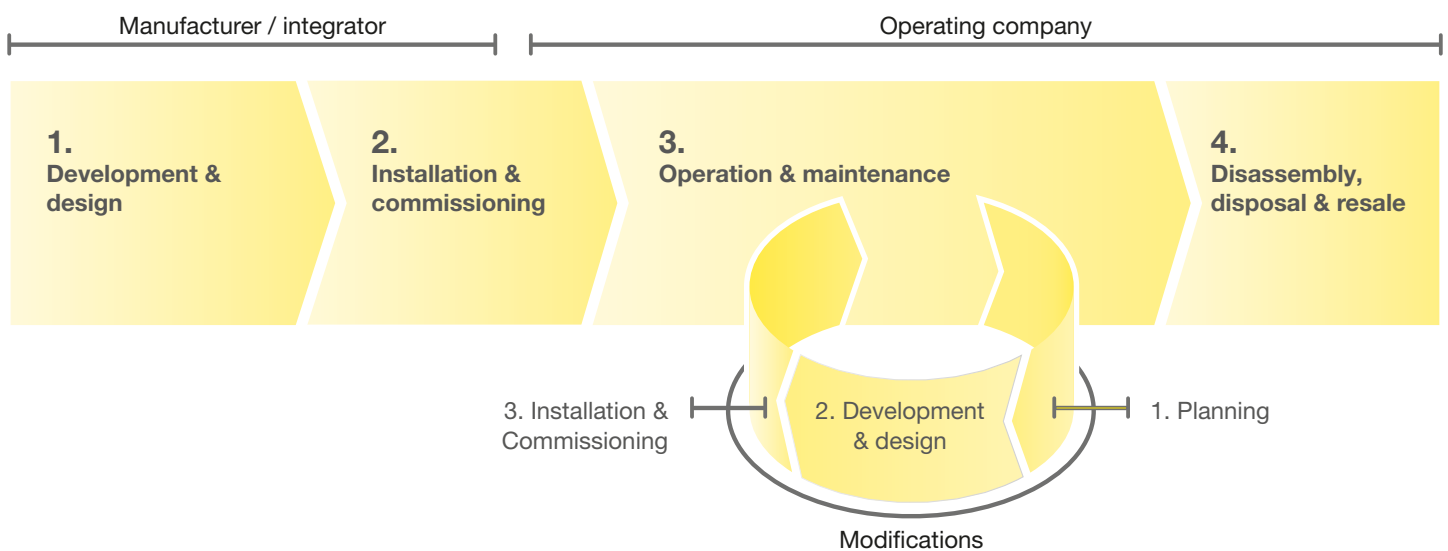
## The path to your solution



# Machine Safety Services

Sustainable machine safety begins with professional planning of the safety systems and spans the entire lifecycle of a machine. Our teams of experienced and certified experts offer the appropriate support here.

## Stages of a machine life cycle



When designing and constructing machines, we create the safety-related concept together with you and support you in its realization. During operation, we regularly perform tests to ensure the permanent function of the safety systems. If changes are made to existing machines, we provide you with support on everything from the safety-related planning to renewed commissioning.

Through our services, you benefit from our many years of experience in the area of machine safety and our extensive industry and application knowledge. Efficient safety-related solutions for every phase of a machine's life cycle are thereby created together.

## Our service offerings



### Status check: safety technology on machines and systems

- Our experts analyze the safety-related condition of your machinery and check whether the current safety-related requirements are satisfied in accordance with the current state of the art.
- In the event of deviations, we provide recommendations on what corrections can be performed so as to comply with legal requirements.



### Risk assessment and hazard assessment

In accordance with applicable directives, the manufacturer of a machine is required to perform a risk assessment. This also applies in the case of significant modifications or extensions of machines.

The national regulations for the operation of machines require employers to conduct a hazard assessment before using work equipment and to update this assessment at regular intervals according to the current state of the art.

- Our experts support you in identifying the dangers, in assessing and evaluating the risks as well as in defining the risk-reducing measures.



### Inspection of protective devices

- Within the scope of the initial or regular inspection, we check the condition, mounting and correct function of the protective device as well as the correct integration in the safe part of the machine control
- We summarize the results of the tests in a detailed report. If necessary, this includes practically oriented suggestions on how deviations can be corrected.



### Stopping time measurement

For the correct placement of the protective device, the required minimum distance between protective device and dangerous movements is to be calculated. To do this, the stopping time of the machine must be known. With the stopping time measurement, we determine this value reliably.

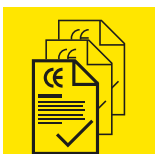
- By measuring the stopping time within the scope of regular inspections, any wear, such as in brake components, can be detected in good time.



### Status check: CE marking of machines

During the development of machines, the specifications from the machinery directive must be adhered to and documented by the manufacturer. This is confirmed with the Declaration of Conformity and the CE marking.

- We check the documentation for completeness and give recommendations of how any deviations can be corrected.



### Conformity assessment in accordance with the European machinery directive

The machinery directive defines the procedure for the design and construction of machines for satisfying the applicable safety and health protection requirements. This is a prerequisite for the Declaration of Conformity and the CE marking.

- We help you comply with and implement the legal requirements of the machinery directive.



### Safety concept and safety design

The measures necessary for risk minimization are known from the risk analysis. The safety concept and the safety functions are developed on the basis of these requirements.

- With our extensive industry knowledge and our many years of safety-related experience, we create practically oriented concept proposals for you and support you during their implementation.



### Verification and validation

To avoid errors during the implementation of safety functions, both the hardware as well as the software must be checked to determine whether the requirements of the functional specification were met completely and correctly. The function test of all safety functions is to be performed according to the validation plan.

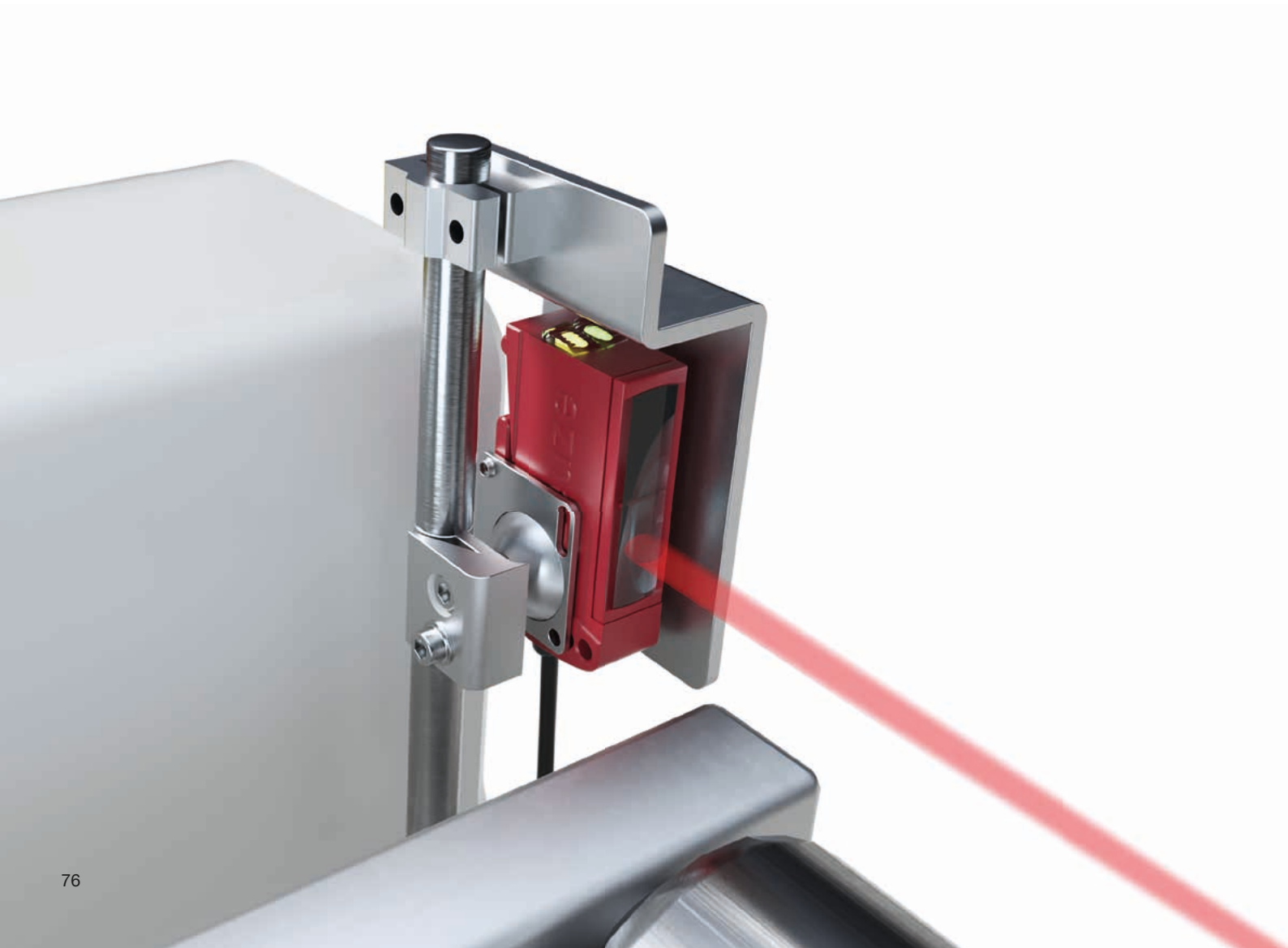
- We support you during the planning, development and execution of the function tests as well as with the creation of the required documentation.



# Accessories and Supplementary Products

Efficient work requires more than just a sensor. Almost as important are the appropriate accessories, which allow the sensor to utilize its full functionality. No matter if you need easy mounting, uncomplicated connection or reliable signaling, you can easily find the right accessories for your application in our extensive product range.

You can find our complete accessories range on our website at [www.leuze.com](http://www.leuze.com).





### Mounting systems

We place great emphasis on our products being easy to mount and simple to align. For this reason, you will find specially-attuned mounting systems in our product range such as mounting brackets, rod holders or device columns.

### Reflectors

Just how reliably retro-reflective photoelectric sensors can detect depends upon the selected reflector, among other things. That is why we offer various matching solutions made of plastic, film, and glass for all conceivable conditions.



### Cables

To facilitate the integration of our sensors, we offer a large variety of connection and interconnection cables with M8, M12, and M23 connectors – straight or angled, and with or without LED.

### Connection units

Today, sensors, safety switches and cameras are linked together via active or passive sensor distribution boxes with fieldbus interfaces from our product range to ensure more flexibility and transparency during installation.



### Mounting brackets and device and mirror columns

The mounting brackets designed for our safety sensors ensure simple mounting and alignment of the devices. Device columns for free-standing floor assembly and mirror columns for multi-sided safeguarding simplify the installations.

### Signaling devices

For signaling in automated systems, we offer an extensive product range of single- and multi-colored as well as acoustic transducers in order to ensure productivity and efficiency.



# Our company

## Everything at a glance

In a constantly changing industrial world, we work together with our customers to find the best solution for their sensor applications: innovatively, precisely and efficiently.

### Key figures

<b>Foundation</b>	1963
<b>Company structure</b>	GmbH + Co. KG, wholly family-owned
<b>Executive management</b>	Salvatore Buccheri, Dr. Henning Grönzin, Helge Held
<b>Headquarters</b>	Owen, Germany
<b>Distribution companies</b>	21
<b>Production locations</b>	6
<b>Technological competence centers</b>	3
<b>Distributors</b>	40
<b>Employees</b>	> 1,600

### Product range

- Switching sensors
- Measuring sensors
- Safety
- Identification
- Data transmission
- Network and connection technology
- Industrial image processing
- Accessories and supplementary products

### Focus industries

- Intralogistics
- Packaging industry
- Machine tools
- Automotive industry
- Laboratory automation



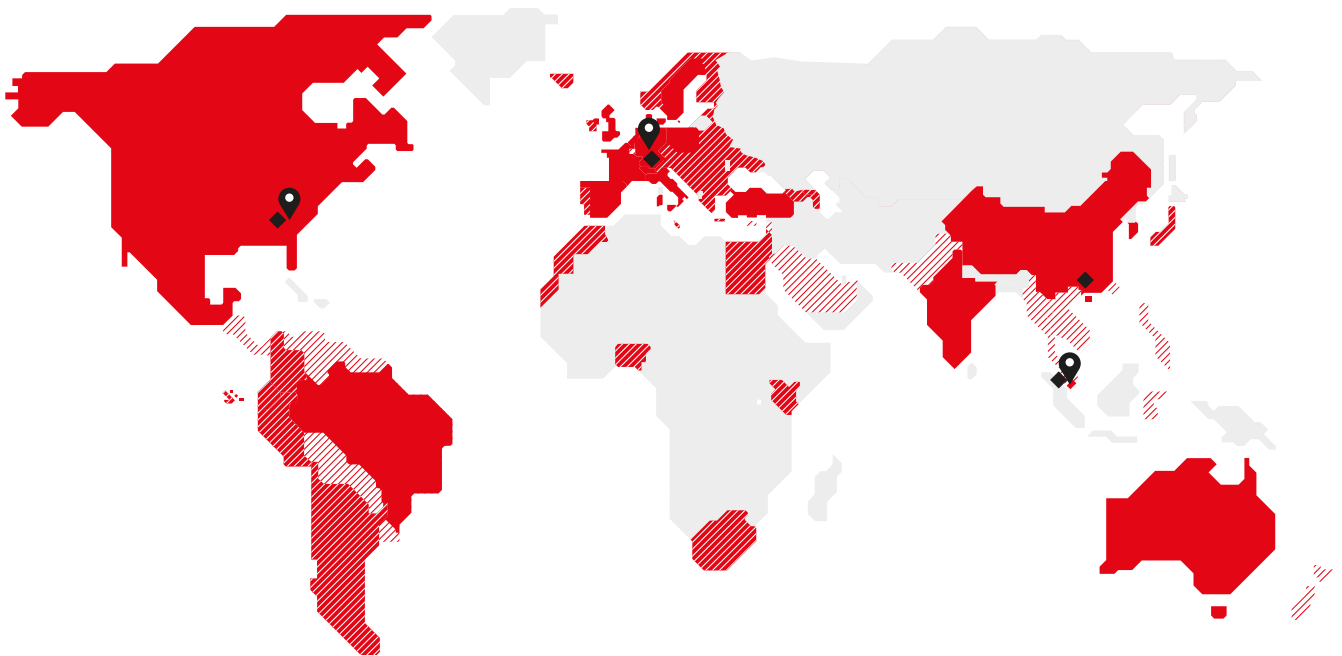
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[www.leuze.com](http://www.leuze.com)

# Our Locations

## At work for you around the world

Your success is our motivation. We therefore place great value on always being personally, quickly, and easily accessible to you. We produce on four continents, allowing us to offer you reliable product availability.



- 📍 Technological competence centers
- ◆ Production locations
- Subsidiaries
- ▨ Distributors
- ▨ Distribution through neighboring country

### Technological competence centers

Owen, Germany  
Duluth/Georgia, USA  
Singapore

### Production locations

Owen, Germany  
Unterstadion, Germany  
Duluth/Georgia, USA  
Shenzhen, China  
Malacca, Malaysia

### Subsidiaries

Australia/New Zealand  
Belgium  
Brazil  
China  
Denmark/Sweden  
Germany – headquarters  
Germany – distribution company  
France  
Great Britain  
Hong Kong  
India

Italy  
Mexico  
Poland  
Singapore  
South Korea  
Spain  
Switzerland  
The Netherlands  
Turkey  
USA/Canada

## Our product range at a glance

### Switching sensors

- Optical Sensors
- Inductive Switches
- Capacitive Sensors
- Ultrasonic Sensors
- Fiber Optic Sensors
- Fork Sensors
- Light Curtains
- Special Sensors

### Measuring sensors

- Distance Sensors
- Sensors for Positioning
- 3D Sensors
- Light Curtains
- Bar Code Positioning Systems
- Fork Sensors

### Safety

- Safety Solutions
- Safety Laser Scanners
- Safety Light Curtains
- Single and Multiple Light Beam Safety Devices
- Safety Radar Sensors
- Safe Locking Devices, Switches and Proximity Sensors
- Safety Controls and Relays
- Machine Safety Services

### Identification

- Bar Code Identification
- 2D-Code Identification
- RF Identification

### Data transmission

- Optical Data Transmission Systems

### Network and Connection Technology

- Connection Technology
- Modular Connection Units

### Industrial image processing

- Light Section Sensors
- Smart Camera

### Accessories and Supplementary Products

- Signaling Devices
- Mounting Systems
- Reflectors

## Your contact with us

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