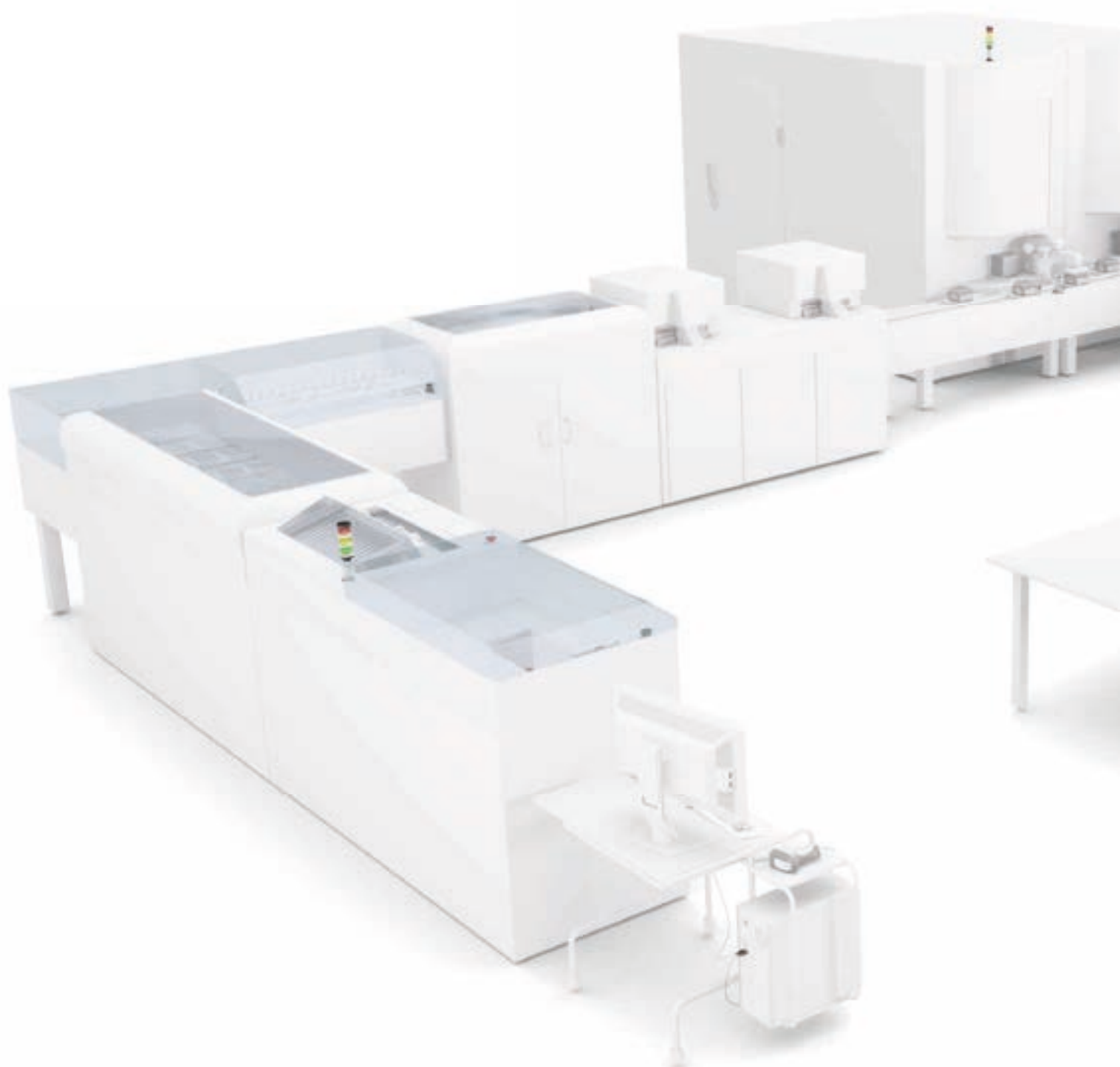


## Sensor solutions for **laboratory automation**







**Reliable solutions  
for laboratory automation**  
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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 60 years.  
The success of our customers is what drives us.  
Yesterday. Today. Tomorrow.







# Reliable solutions for laboratory automation

In the demanding world of laboratory automation, there are three essential properties of sensor solutions that are prerequisites: reliability, safety and user-friendliness.

The safety requirements for in vitro diagnostics are especially high, as here the focus of the laboratory work is on human samples. There are extremely strict requirements in this area, with no tolerance for errors.

This places high requirements on the used optical sensors, laser- or camera-based code readers and on the safety sensors. These products satisfy the highest demands thanks to their sophisticated design, their special optics as well as a user-friendliness that helps to pre-emptively minimize the risk of errors.





### **Many years of application experience**

We have many years of application experience in laboratory automation, making us the professional and reliable sensor supplier for the demanding tasks in medical technology. We also offer a broad range of products in the areas of optical sensors, identification technologies and safety sensors. This puts us in the position to be able to offer you the right product for your specific application.



### **Reliable change management**

For your safety, we will make no unannounced changes to either hardware or software. Our customer-specific model numbers make this possible. Our change management is always reliable and takes place only in close coordination with our customers.



### **Intercontinental networking**

Our experts for laboratory automation are represented as a team in six countries (China, Germany, France, Italy, Switzerland, USA) and, as a result, can directly address the local needs of our customers. Through production and distribution locations on three continents, fast and reliable delivery of sensors is guaranteed.

# Pre-analytical instruments

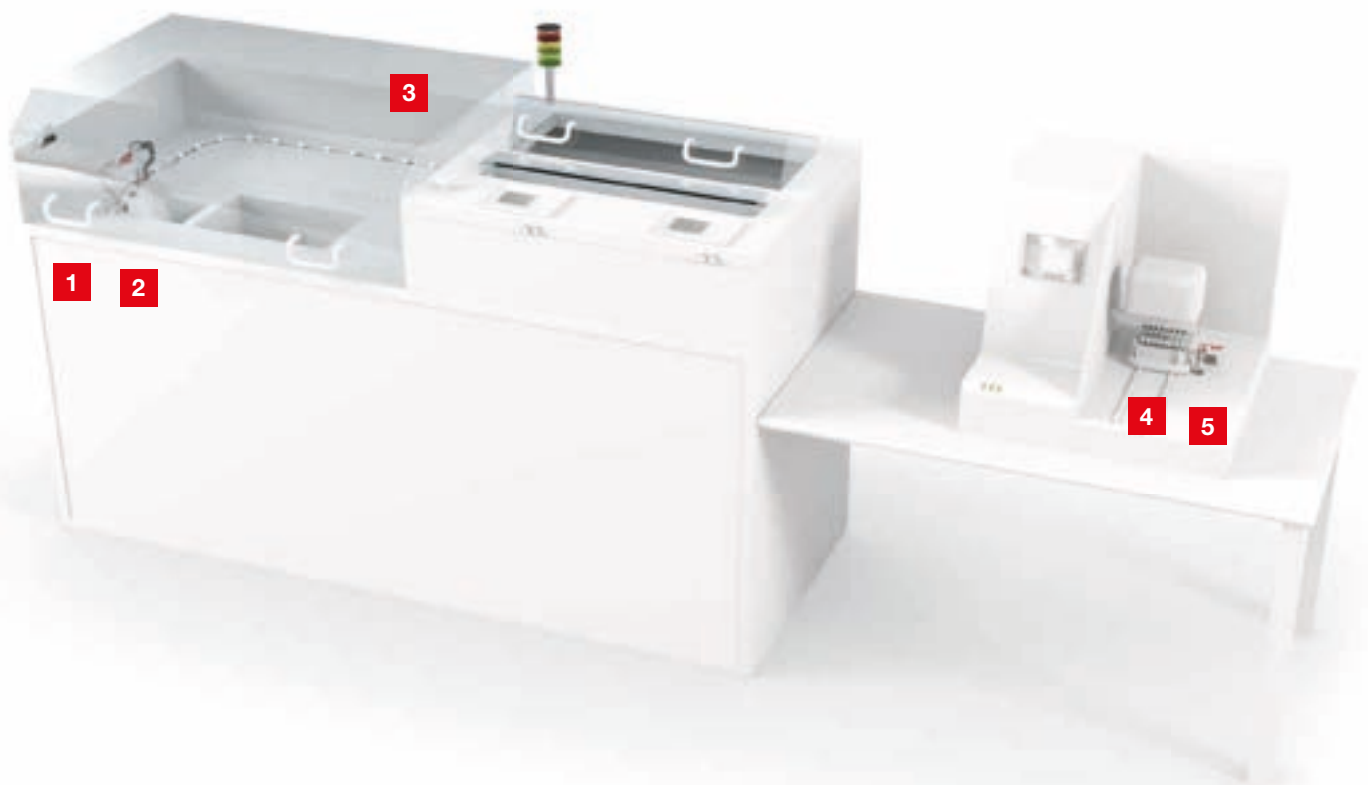
Our sensor solutions increase process reliability even during the automated delivery and during preparation and processing of the samples.

To ensure the sample integrity as well as for hygiene and safety reasons, automatic sample distributors are often used in the preparation of the analyses. These ensure reliable and fast preparation and assignment of the chaotically delivered samples independent of the number of samples and, above all, avoid cross contamination.

Thanks to high function reserves, our sensor solutions guarantee maximum system availability during analysis preparation. High-performance bar code readers, for example, are used to identify the information on the sample tubes and prepare it for the automatic analyzers. Or, we use optical sensors within the machines to ensure that the seals were properly removed and that the samples are reliably prepared for the next steps.







**1** Presence control of the sample  
in the sorter

**2** 1D-code reading in rotation

**3** Monitoring the closing state of the flap

**4** Cap detection

**5** Code reading on the sample holder

# Tube Sorters

## Presence control of the sample in the sorter

**Requirement:** For the reliable detection of the various samples, an easy-to-adjust and compact sensor is needed. Protection against manipulation that could result in undesired operation is also a prerequisite.



**Solution:** The compact diffuse sensors of the SR 2 and SR 3 series (HT 2/HT 3C) with teach function or potentiometer offer maximum process and functional reliability. In addition, they are lockable and therefore offer the required protection against manipulation.

## 1D-code reading in rotation

**Requirement:** The correct sample sorting and assignment in the laboratory is to be performed using bar codes. There are very high requirements on speed, uniqueness and reliability here.



**Solution:** With their laser technology, the bar code readers of the BCL 95 series can identify the bar codes on the samples quickly and reliably. Even poorly printed or partially destroyed bar codes can still be clearly decoded.

## Monitoring the closing state of the flap

**Requirement:** Monitoring of the closing state of the flaps is necessary for the desired process reliability and for safety at work.



**Solution:** The MC 300 (magnetically coded) and RD 800 (RFID coded) safety proximity sensors can be simply mounted on flap and frame. They operate free from wear and also have a long life expectancy, even with frequent operating cycles.

# De-Capper

## Cap detection

**Requirement:** For automatic opening, it is necessary to check for the presence of the caps. To do this, compact sensors with miniature design that can be easily and flexibly integrated are necessary.



**Solution:** The compact PRK 3C and PRK 2 retro-reflective photoelectric sensors are easy to integrate. With their precise light spot and matching reflector, they detect caps reliably – and independent of their color.

## Code reading on the sample holder

**Requirement:** The individually identified samples are linked to a sample holder ID. The sample holders may vary in size and design and must therefore be detected on every subsequent process step.



**Solution:** With the compact and easy-to-integrate code readers of the DCR 55 series, both 1D- as well as 2D-codes can be reliably identified on the sample holders.

# IVD instruments

Within automatic analyzers, sensors safeguard processes and reliably detect important process information. Modern analysis procedures for examining body fluids or tissue are highly automated, thereby allowing processes to be performed very efficiently and safely. Zero tolerance is essential here both during the handling as well as during the assignment of samples to the patient.

The sensors that are used must, therefore, reliably master high throughputs and be very compact so as to minimize space requirements in the systems. Our bar code readers, e.g., for tubes (sample holders or sample tubes), can have a reading field height of 80 mm to be able to reliably detect at just a short distance. Depending on where the automatic machine is used and the volume of sample that is to be analyzed, carousel, single- or multi-lane, or point-of-care solutions are used.





- |  |   |
|--|---|
| <b>1</b> 1D-code reading at automatic rack insertion                         | <b>10</b> 1D-code reading, single carousel                |
| <b>2</b> Stack-height monitoring   | <b>11</b> 1D-code reading, double carousel                |
| <b>3</b> Presence control of rack  | <b>12</b> 1D- and 2D-code reading                         |
| <b>4</b> Code reading on rows of racks with automatic insertion              | <b>13</b> Stationary 1D- and 2D-code reading              |
| <b>5</b> Manual code reading on up to 6 rows of racks with manual insertion  | <b>14</b> Stationary 1D- and 2D-code reading              |
| <b>6</b> Manual code reading on up to 15 rows of racks with manual insertion | <b>15</b> Mobile 1D- and 2D-code reading                  |
| <b>7</b> Safeguarding the process  | <b>16</b> Leak monitoring                                 |
| <b>8</b> Point of operation guarding (personnel protection)                  | <b>17</b> Fill level monitoring of liquid containers      |
| <b>9</b> Fill level monitoring of the samples                                | <b>18</b> Monitoring the closing state of doors and flaps |

# Single-lane

## 1D-code reading at automatic rack insertion

**Requirement:** For applications in laboratory environments, limited installation space and high throughput of samples pose challenges for a bar code reader. Bar codes usually need to be read fast and reliably at a reading distance < 50 mm.



**Solution:** The bar code readers of the CR 100 series convince in this application with their compact housing and their CCD line.

## Stack-height monitoring

**Requirement:** With single-lane transport, the stack height of empty trays in the storage chamber is to be detected by sensors with suitable resolution.



**Solution:** Because the various carriers often differ in material and color, diffuse sensors of the HT 3C.XL series with an expanded light spot are ideally used.

## Presence control of rack

**Requirement:** For the presence detection of the racks with multiple track systems, sensors with suitable operating range are necessary for activation of the code reading.



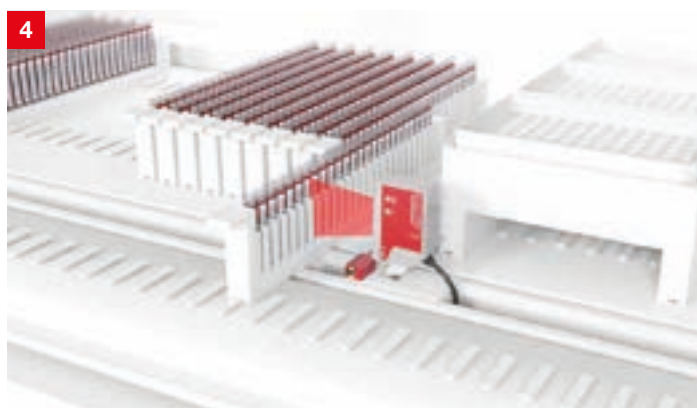
**Solution:** The miniature diffuse sensors of the HT 3C series with remote teach, small light spot and short response time offer reliable activation of code reading.



# Multi-lane

## Code reading on rows of racks with automatic insertion

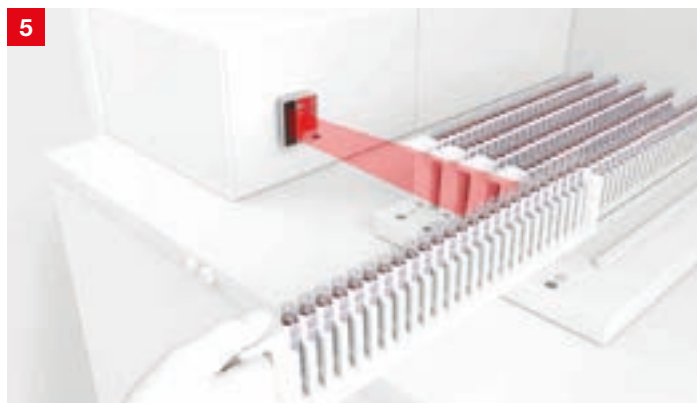
**Requirement:** With automatically fed-in sample codes in the rack, they must be clearly read, also if the various codes are just a few millimeters apart from one another. Even in the case of poorly printed codes and varying lighting conditions, the bar code reader must still supply reliable reading results.



**Solution:** The bar code readers of the BCL 95 series can also clearly identify densely packed codes. Even poorly printed or partially destroyed bar codes can still be clearly decoded. Varying lighting conditions do not affect the reading result.

## Manual code reading on up to 6 rows of racks with manual insertion

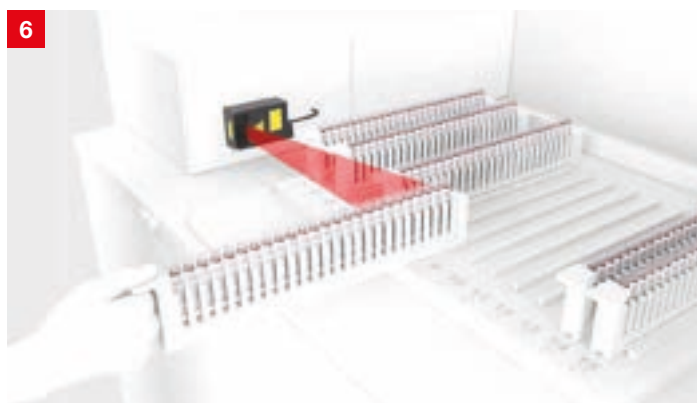
**Requirement:** There are extremely high requirements on speed for manual rack insertion, with speeds of up to 0.5 m/s. In addition, codes with a module width of up to 6 mil (0.15 mm) must be read at the same speed with a depth of field > 120 mm. Densely packed codes as well as varying lighting conditions must not affect the reading quality.



**Solution:** With their laser technology, the stationary bar code readers of the BCL 95 series can satisfy all requirements for speed and environmental conditions.

## Manual code reading on up to 15 rows of racks with manual insertion

**Requirement:** There are extremely high requirements on speed for manual rack insertion, with speeds of up to 0.5 m/s. In addition, codes with a module width of up to 6 mil (0.15 mm) must be read at the same speed with a depth of field > 300 mm. All sample codes must be read clearly, regardless of the lighting and space conditions.

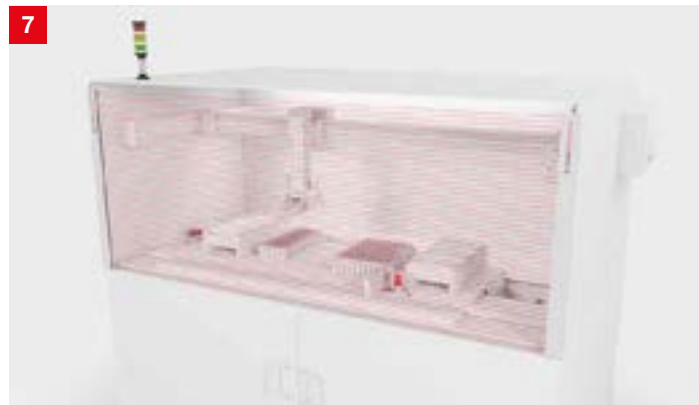


**Solution:** With their laser technology, the stationary bar code readers of the BCL 148 series can satisfy all requirements for speed and environmental conditions.

# Multi-lane

## Safeguarding the process

**Requirement:** For a smooth process in multiple track systems, the height and edges of the objects or object carriers must be complied with. Due to the various machines, different lengths and resolutions are advantageous.



**Solution:** Fast-switching light curtains in slim design of the CSL 505 series with various measurement field lengths and resolutions are a flexible solution for this task.

## Point of operation guarding (personnel protection)

**Requirement:** The point of operation accessible through a machine opening is to be safeguarded with a piece of electro-sensitive protective equipment. The safety sensor used here should ideally be easy to optimally integrate in the machine.



**Solution:** With their small dimensions and finely graduated protective field lengths, the especially compact MLC 520-S safety light curtains can be optimally integrated in machine openings. The protective field extends to the edge of the housing with the cost-optimized ELC 100 as well. Thus, both devices of both series can be mounted flush.

## Fill level monitoring of the samples

**Requirement:** The fill level monitoring of the containers in the rack must be attached to the gripper and have a very precise detection range within the samples.

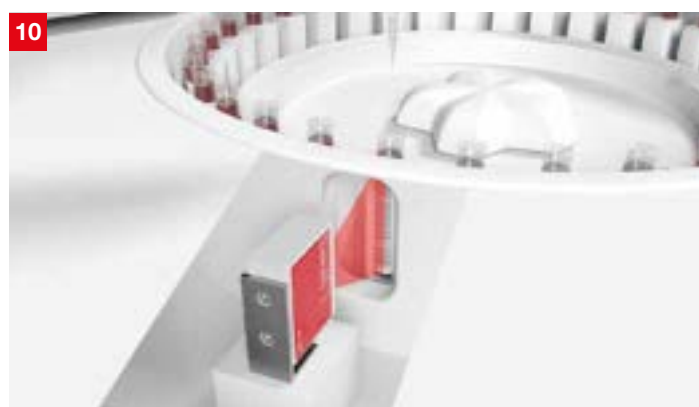


**Solution:** This application can be solved with fiber optics of the KF series with various beam exits, separate LV 46x amplifier with menu navigation, or with RKU 420 ultrasonic sensor and narrow sound cone.

# Carousels

## 1D-code reading, single carousel

**Requirement:** In a single carousel, bar codes are to be read through a glass pane. The installation space for the code reader is extremely limited here. Bar codes usually need to be read reliably at a reading distance < 50 mm.



**Solution:** The 1D-code readers of the CR 100 series can also identify the bar codes on the samples through glass panes error free. This also applies at a very short reading distance in a single carousel.

## 1D-code reading, double carousel

**Requirement:** In a double carousel, bar codes are to be read through a glass pane. The installation space for the code reader is extremely limited here. Bar codes usually need to be read reliably at a reading distance < 50 mm. In addition, there are just a few millimeters available for reading a bar code in multi-row carousel applications.



**Solution:** The 1D-code readers of the BCL 95 series can also identify the bar codes on the samples through glass panes error free. This is also true at a very short reading distance and with closely packed bar codes in a double carousel.

## 1D- and 2D-code reading

**Requirement:** 2D-codes are to be identified through a glass pane of the IVD instrument. The installation space for the 2D-code reader is extremely limited here.



**Solution:** With their small design and optimized reading field, the code readers of the DCR 55 series satisfy the requirement criteria of this application.

## Point-of-care instruments

### Stationary 1D- and 2D-code reading

**Requirement:** For use in small automatic analyzers, devices with modular construction are necessary that can reliably identify both 1D- as well as 2D-codes.

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**Solution:** The 1D-/2D-code readers of the DCR 50 series are available as a model without housing for especially tight installation spaces.

### Stationary 1D- and 2D-code reading

**Requirement:** 1D- or 2D-codes are to be manually read individually on glossy and uneven surfaces as well as on a wide range of containers and samples. In addition, the code reader must be integrated in the device in very constrained spaces.

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**Solution:** Thanks to their small size and open design, the dual-code readers of the DCR 50 series can be optimally integrated in constrained spaces in an IVD analyzer. Thanks to their flexible and powerful reading performance, they also deliver reliable results with various surfaces and sample containers.

### Mobile 1D- and 2D-code reading

**Requirement:** Individual samples that are provided with 1D- or 2D-codes are to be read manually. The surface (possibly glossy or uneven) as well as the type of container must not play a role here.

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**Solution:** The IT 1470 or IT 1950 hand-held scanners offer the flexibility and reading performance in the laboratory necessary to reliably read individual samples manually, regardless of the type of container or their surface.

# General monitoring functions

## Leak monitoring

**Requirement:** To avoid damage to machines caused by liquids that escape during the process, leak monitoring must be installed in the automatic machines.



**Solution:** With capacitive sensors of the LCS series – usually with a cubic design – escaping liquid can be detected through non-metallic walls.

## Fill level monitoring of liquid containers

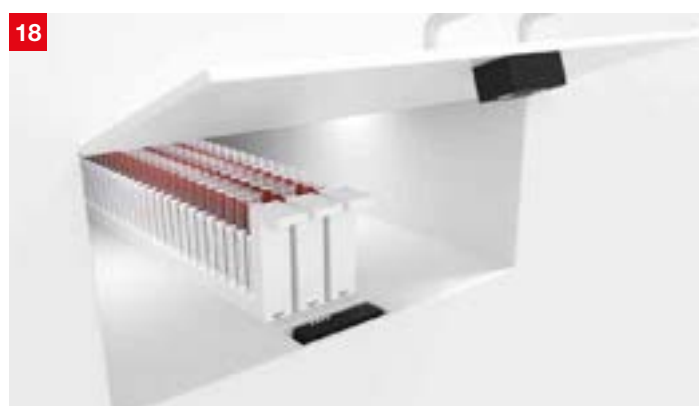
**Requirement:** For process optimization, the fill level monitoring in reservoir containers aids in either refilling in good time or avoiding overflows.



**Solution:** Minimum and maximum value logging can be performed from above with ultrasonic sensors of the HTU series or laterally with capacitive sensors of the LCS series.

## Monitoring the closing state of doors and flaps

**Requirement:** To avoid process errors and, if applicable, for personnel protection, the closing state of doors and flaps must be monitored in accordance with IEC 61010.



**Solution:** With their RFID coding, the RD 800 safety proximity sensors offer an especially high level of protection against manipulation. Alternatively, the MC 300 magnetically coded safety proximity sensors monitor the closing state.

# Sample automation

For complex analyses, samples need to be transported between various analyzers. This networking of the analyzers is often performed with compact, mini conveying belts and handling robots. The individual parts must be moved quickly, safely and reliably here and, prior to the subsequent analysis steps, also be detected and assigned without error. Furthermore, gapless traceability of the sampling path must be ensured.

Sensors make sample transport more reliable and minimize the risk of standstills in the analyzers which could, among other things, jeopardize the sample integrity.







**1** Sample fill level monitoring

**2** Petri dish fill level monitoring

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

**4** Presence control

**5** 1D- / 2D-code reading

# Sample automation

## Sample fill level monitoring

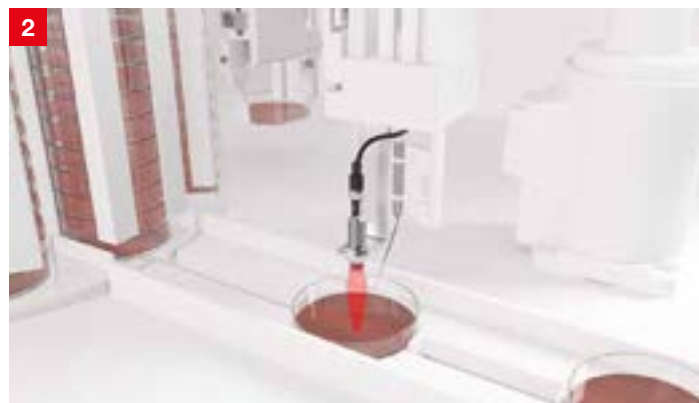
**Requirement:** A suitable sensor is necessary for monitoring a defined fill level in the sample.



**Solution:** For precise fill level detection, the LS 55 H2O throughbeam photoelectric sensors are especially well suited for water-based liquids.

## Petri dish fill level monitoring

**Requirement:** To ensure proper filling, the fill level must be detected from above for single- or multiple-track systems.



**Solution:** This task can be ideally solved using ultrasonic sensors in the switching (HTU) or measuring (DMU) version in various sizes and operating ranges.

## Monitoring the closing state of the protection hood

**Requirement:** Monitoring of the closing state of the protection hoods is necessary for the process reliability and safety at work in accordance with IEC 61010.



**Solution:** With their RFID coding, the RD 800 safety proximity sensors offer an especially high level of protection against manipulation. Alternatively, the MC 300 magnetically coded safety proximity sensors monitor the closing state.

## Presence control

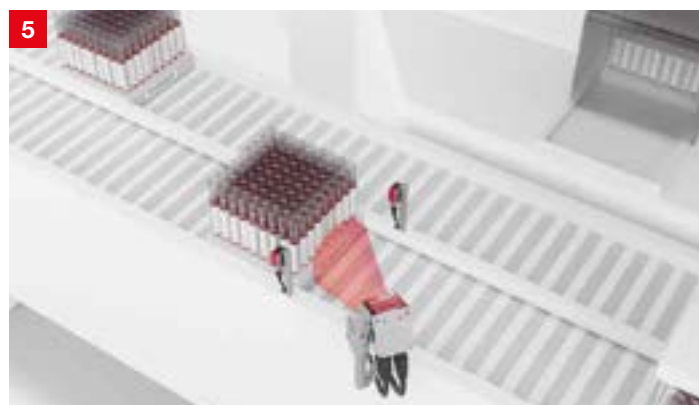
**Requirement:** Along the automated transport and distribution, the presence of the sample carriers must be detected at regular intervals on the conveyor for control purposes.



**Solution:** With an especially compact design for easy integration, the optical sensors of the SR 2 or SR 3 series with all operating principles are ideally suited for this environment. A PRK 2 with reflector is the preferred choice.

## 1D- / 2D-code reading

**Requirement:** With sample carriers on conveyor systems, the codes are not always in the same position. Thus, the field of view for a code reader must be designed so as to be sufficiently large.



**Solution:** With their reading field, the dual code readers of the DCR 200i series can detect a sufficiently large field of view for identifying codes at various positions on the sample carriers.

# Post-analytical instruments

Sensor technology simplifies and professionalizes the storage or disposal of samples after the analysis. Particularly when storing samples, dependable closure is extremely important for eliminating the possibility of subsequent contamination. In some cases, the storage is performed in deep-freeze conditions at temperatures at  $-80^{\circ}\text{C}$ , at which the sensors must continue to detect reliably. In addition, sensors ensure the traceability of the samples all the way to their storage location.

Even after the actual analysis, sensors continue to make the processes faster and more reliable. Sensors with high resolution, flexible fiber optics are used to check, e.g., the proper affixing of sealing films, ensuring that processes are completed professionally. During sample storage, optical sensors monitor for presence, even at extremely low temperatures.





- |   |   |
|---|---|
| 1 Projection monitoring                 | 4 Signaling of status information                 |
| 2 Presence control of sealing film      | 5 Monitoring the closing state of doors and flaps |
| 3 2D-code reading on the sample carrier | 6 Evaluation of safety sensors                    |

# Post-analytical instruments

## Projection monitoring

**Requirement:** To prevent interference in the process, it is necessary to check for projection prior to entry into the storage unit. The reagents may be highly transparent.



**Solution:** The compact PRK 3 or PRK 2 retro-reflective photoelectric sensors with precise light spot and suitable MTKS reflector for color-independent detection of protruding samples solve this task ideally, with autocollimation variants if necessary.

## Presence control of sealing film

**Requirement:** For storage and later use, the sample must be properly sealed.



**Solution:** The especially sophisticated KFX fiber optic sensors with easy-to-adjust LV 46x fiber optic amplifiers enable the reliable detection of the sealing film.

## 2D-code reading on the sample carrier

**Requirement:** With sample carriers on a transport system, the 2D codes are to be read multiple times from below.



**Solution:** With their reading field, the dual code readers of the DCR 200i series can detect a sufficiently large field of view from below for identifying multiple codes at various positions at once.



## Signaling of status information

**Requirement:** For all modules and machines, the status should be visualized for a better overview.



**Solution:** The preassembled D9 / TL305 lights or A7 modular tower lights as self-supporting column or as wall installation visualize the state with highly visible LEDs.

## Monitoring the closing state of doors and flaps

**Requirement:** The closing state of machine doors and flaps must be monitored for process reliability and personnel protection to avoid malfunctions and injuries.



**Solution:** The S 400 safety hinge switches unite the safety switch and door hinge functions in one component. The optional additional hinges (mechanical function only) provide an attractive, uniform design. Alternatively, the MC 300 magnetically coded safety proximity sensors monitor the closing state.

## Evaluation of safety sensors

**Requirement:** For the proper set-up of a safety function, the signals of the used safety sensors must be evaluated by safety relays or safety controls.



**Solution:** The MSI SR safety relays offer simple and cost-effective solutions for the integration of individual safety sensors. For more complex safety functions and multiple sensors, the configurable MSI 400 safety controls are used. They are modularly expandable and can be easily adapted to the application.

# Identification

Stationary bar code readers



**CR 50, CR 55**  
Miniature scanner



Technical data	Reading distance (dependent on version)	40 mm ... 250 mm
	Modulus size	0.1 mm ... 0.5 mm
	Scanning rate	330 scans/s
	Reading method	Line scanner
	Switching outputs	1x
	Switching inputs	
	Interface	RS 232   USB
	Configuration/parametization	Software
	Supply voltage U <sub>B</sub>	4.5 V DC ... 5.5 V DC
	Degree of protection	IP 54
	Ambient temperature, operation (< 0°C with heating possible)	0 ... 40 °C   0 ... 50 °C
	Housing	Plastic   Metal
Features	AutoConfig	
	Alignment mode	
	LED indicator	
	Reference code comparison	



**CR 100**  
Miniature scanner

CE UK CA CDRH



**BCL 92, BCL 95**  
Miniature scanner

CE UK CA CDRH



**BCL 148**  
Bar code readers for laboratory automation

CE UK CA CDRH

15 mm ... 72 mm	25 mm ... 275 mm	30 mm ... 310 mm
0.15 mm ... 0.5 mm	0.15 mm ... 0.5 mm	0.127 mm ... 0.5 mm
700 scans/s	600 scans/s	750 scans/s
Line scanner   Line scanner with deflecting mirror	Line scanner	Line scanner
1x	2x	
1x	2x	1x
RS 232	RS 232	RS 232   RS 485
4.9 V DC ... 5.4 V DC	4.75 V DC ... 30 V DC	18 V DC ... 30 V DC
IP 40	IP 54	IP 65
0 ... 45 °C	5 ... 40 °C	5 ... 40 °C
Metal	Metal	Metal
	X	
X	X	
X	X	
	X	

# Identification

## Stationary 2D-code readers



DCR 50, 55



DCR 200i



Technical data	Code types, readable	2D-codes   Bar codes	2D-codes   Bar codes   Stacked codes
	Reading distance (dependent on version)	30 mm ... 425 mm	40 mm ... 1,000 mm
	Modulus size	0.127 mm ... 0.528 mm	0.1 mm ... 1 mm
	Sensor	CMOS (Rolling Shutter)	CMOS (Global Shutter)
	Resolution (pixel)	1,280 px x 960 px	1,280 px x 960 px
	Light source		LED, infrared   LED, rot
	Switching outputs	1x	2x
	Switching inputs	1x	2x
	Selectable inputs/outputs		2x
	Interface	RS 232   USB	Ethernet   EtherNet IP   OPC-UA   PROFINET   RS 232   RS 422
	Configuration/parametization	Software	Configuration codes   Teach-in   via web browser
	Supply voltage $U_B$	4.75 V DC ... 5.25 V DC	18 V DC ... 30 V DC
	Degree of protection	IP 54	IP 65   IP 67   IP 69K
	Ambient temperature, operation	0 °C ... 50 °C	-30 °C ... 50 °C
	Dimensions without connector (W x H x D)	31.5 mm x 20 mm x 40.3 mm   31.6 mm x 12.7 mm x 27.5 mm	43 mm x 61 mm x 44 mm   46 mm x 61 mm x 46 mm
Accessories	Housing	Plastic   Metal	Stainless steel   Plastic   Metal
	Compatibility of materials		ECOLAB
	MA 200i connection unit		CANopen   DeviceNet   EtherCAT   EtherNet IP   EtherNet TCP/IP   PROFIBUS   UDP
Features	MA 150 connection unit		Point to Point
	Mounting devices		BT 320M   BTU 320M-D12
	Special version	Scan Engine Module	Heating   Optional with NPN switching inputs/outputs   Polarization filter

# Mobile code readers



IT 1470g, 1472g



IT 1950g, 1952g



Technical data	Reading distance	5 mm ... 400 mm	0 mm ... 822 mm
	Type of connection	Bluetooth   RJ41	Bluetooth   RJ41
	Modulus size	0.127 mm ... 0.508 mm	
	Code types, readable	2/5 Interleaved   Aztec   Codabar   Codablock   Code 39   Code 93   Code 128   Data Matrix Code   DotCode   EAN 8/13   EAN 128   EAN Addendum   GS1 Databar   GS1 Databar Expanded   GS1 Databar Limited   GS1 Databar Omnidirectional   GS1 Databar Stacked   GS1 Databar Truncated   Maxicode   Micro PDF   Micro QR   PDF417   QR code   UPC	2/5 Interleaved   Aztec   Codabar   Code 39   Code 93   Code 128   Composite Codes   Data Matrix Code   DotCode   EAN 8/13   EAN 128   EAN Addendum   GS1 Databar   GS1 Databar Expanded   GS1 Databar Limited   GS1 Databar Omnidirectional   GS1 Databar Stacked   GS1 Databar Truncated   Maxicode   Micro PDF   Micro QR   PDF417   QR-Code   UPC   Others on request
	Resolution (pixel)	1,040 px x 720 px	1,280 px x 800 px
	Interface	RS 232   USB	RS 232   USB
	Supply voltage U <sub>B</sub>	3.7 V DC   4 ... 5.5 V DC	4 ... 5.5 V DC   4.2 V DC
	Degree of protection	IP 40   IP 42	IP 41
	Drop height	1.8 m	1.8 m
	Ambient temperature, operation	0 ... 50 °C	0 ... 50 °C
Connectivity	Ambient temperature, storage	-40 ... 70 °C   -40 ... 60 °C	-40 ... 70 °C
	Dimensions without connector (W x H x D)	62 mm x 169 mm x 82 mm   173 mm x 82 mm x 62 mm	70 mm x 80 mm x 160 mm
Features	With MA 200i connection unit	CANopen   DeviceNet   EtherCAT   EtherNet TCP/IP   PROFIBUS   PROFINET RT   UDP	CANopen   DeviceNet   EtherCAT   EtherNet TCP/IP   PROFIBUS   PROFINET RT   UDP
	Areas of application	For dry and clean environments.	For dry and clean environments.

# Switching sensors

Photoel. sensors / diffuse sensors, cubic housing



**2 series**  
Universal, micro  
CE UK CA cULus



**3C series**  
Universal, mini  
CE UK CA cULus CDRH ECOLAB



**55C series**  
Stainless steel, Wash-Down design  
CE cULus ECOLAB CleanProof+

Technical data	Dimensions without connector (W x H x D)	8 mm x 23.1 mm x 12 mm	11.4 mm x 34.2 mm x 18.3 mm	14 mm x 35.4 mm x 25 mm
	Supply voltage $U_B$	10 ... 30 V, DC	10 ... 30 V, DC   12 ... 30 V, DC	10 ... 30 V, DC
	Interface		IO-Link	IO-Link
	Switching outputs	Transistor	Transistor	Transistor
	Connection type	Cable   Cable with connector, M8   Cable with connector, M12	Cable   Cable with connector, M8   Cable with connector, M12   Connector, M8	Cable   Cable with connector, M12   Connector, M8
	Degree of protection	IP 67	IP 67   IP 69K	IP 67   IP 68   IP 69K
	Housing material	Plastic	Plastic	Stainless steel
	Compatibility of materials		ECOLAB	CleanProof+   ECOLAB   Johnson Diversey
	Ambient temperature, operation	-30 °C ... 55 °C	-40 °C ... 60 °C	-40 °C ... 70 °C
Throughbeam photoelectric sensors	Min./max. operating range limit	0 m ... 2 m	0 m ... 10 m	0 m ... 80 m
	Light source	LED, red	Laser, red   LED, rot	LED, infrared   LED, rot
	Switching frequency	385 Hz	1,000 Hz ... 3,000 Hz	350 Hz ... 1,000 Hz
	Operational controls		270° potentiometer	
Retro-reflective photoelectric sensors	Min./max. operating range limit	0.07 m ... 4 m	0 m ... 7 m	0 m ... 6 m
	Light source	LED, red	Laser, red   LED, rot	Laser, red   LED, rot
	Switching frequency	700 Hz	1,500 Hz ... 3,000 Hz	1,500 Hz ... 3,000 Hz
	Operational controls		270° potentiometer   Teach button	Teach button
Diffuse sensors with background suppression	Min./max. operating range limit	0.001 m ... 0.06 m	0.005 m ... 0.6 m	0.005 m ... 0.6 m
	Light source	LED, red	Laser, red   LED, infrared   LED, red	Laser, red   LED, infrared   LED, red
	Switching frequency	700 Hz	250 Hz ... 3,000 Hz	750 Hz ... 3,000 Hz
	Operational controls		Multiturn potentiometer   Teach button	Multiturn potentiometer   Teach button
Functions	Activation input	X	X	X
	Suppression of HF illumination (LED)		X	X
	Autocollimation		X	X
	Extra long light spot (XL)		X	X
	Small light spot (S)	X	X	X
	Teach input		X	X
	Tracking function		X	
	Warning output		X	



Capacitive sensors



LCS-1



Technical data	Dimension (W x H x L)	40 mm x 40 mm x 10 mm   54 mm x 20.3 mm x 5.5 mm
	Type of installation	Embedded
	Supply voltage U <sub>B</sub>	10 V DC ... 30 V DC
	Typ. operating range limit S <sub>n</sub>	1 mm ... 20 mm
	Switching outputs	Push-pull   NPN   PNP
	Switching principle	NO (normally open)   NC (normally closed)   Normally closed contact (NC)/normally open contact (NO)
	Switching frequency	100 Hz
	Connection type	Cable   Connector, M8
	Degree of protection	IP 67
	Operational controls	Multiturn potentiometer (11 turns)   Multiturn potentiometer (20 turns)
	Housing	Plastic
	Features	Compact and flat design   Switching distances adjustable by means of potentiometer

# Switching sensors

## Fiber optic sensors



### LV46x

Fiber optic amplifiers



Technical data	Dimensions without connector (W x H x D)	10 mm x 31 mm x 62 mm   10 mm x 31.5 mm x 72 mm   10 mm x 33 mm x 79.4 mm
	Supply voltage U <sub>B</sub>	10 V DC ... 24 V DC
	Switching frequency	21 Hz ... 50,000 Hz
	Connection type	Cable   Cable with connector, M8   Cable with connector, M12   Connector, M8
	Degree of protection	IP 50   NEMA 1
	Interface	IO-Link
	Switching outputs	Push-pull   NPN   PNP
	Switching principle	Dark switching   Light/dark switchable   Light switching   IO-Link / light switching (PNP)/ dark switching (NPN)
	Analog outputs	Voltage   Current
	Selectable inputs/outputs	Activation input   Multiplex operation   Teach input
	Light source	LED, infrared   LED, red
	Operational controls	Control buttons   Multiturn potentiometer   Slide switch   Rocker pressure switch
	Housing	Plastic
	Special version	Large operating range   Short response time   Time function



### KF

Plastic fiber optics

Technical data	Operating principle	Throughbeam principle   Diffuse reflection principle
	Design	Cubic   Cylindrical
	Outer diameter	1 mm ... 4 mm
	Fiber length	500 mm ... 5,000 mm
	Fiber sheathing	PE   PTFE
	Fiber head	Stainless steel   Plastic   Metal
Features	Special version	Heat resistant

### Ultrasonic sensors, cylindrical



#### 400 series



Technical data	Thread size	M12   M18   M30
	Length	15 mm ... 104.3 mm
	Supply voltage $U_B$	12 V DC ... 30 V DC
	Switching outputs	Push-pull   NPN   PNP
	Interface	IO-Link
	Connection type	Connector, M8   Connector, M12
	Degree of protection	IP 67   IP 68
	Operational controls	Control buttons   Teach button
	Housing	Plastic   Metal
Diffuse reflection principle with background suppression	Operating range	0.01 m ... 6 m
	Switching frequency	1.6 Hz ... 50 Hz
	Switching principle	IO-Link / NC contact/NO contact   NO (normally open)   NC (normally closed)   NC contact/NO contact
	Inputs/outputs	1x
	Teach inputs	1x
Features	Ultrasonic frequency	75 kHz ... 380 kHz
	Special version	2 independent switching outputs   Multiplex operation   Synchronous operation   Teach input

### Light curtains



#### CSL 505

Throughbeam principle, narrow design



Technical data	Application	Precise object detection
	Profile cross section	10 mm x 27 mm   12 mm x 58 mm
	Measurement field length	35 mm ... 3,150 mm
	Beam spacing	5 mm   12.5 mm   25 mm   50 mm   100 mm
	Number of beams	8x ... 96x
	Minimum object diameter	7.5 mm ... 102.5 mm
	Operating range	0.3 m ... 6.5 m
	Supply voltage $U_B$	18 V DC ... 30 V DC
	Connection type	Connector, M8
	Degree of protection	IP 65
	Light source	LED, infrared
	Housing	Metal
	Cycle time	12 ms ... 100 ms
	Response time per beam	1,000 µs
Features	Type of configuration/ parameterization	Software   Via pin assignment
	Ambient temperature, operation	-30 ... 50 °C
	Type of display	LED
	Diagonal-beam scanning	X
	Crossed-beam scanning	X
	Parallel-beam scanning	X

# Measuring sensors

## Optical distance sensors



ODS 9

CE UK CDRH cULus

Technical data	Measurement range	50 ... 100 mm   50 ... 200 mm   50 ... 450 mm   50 ... 650 mm   50 ... 1,050 mm
	Response time	1 ... 8 ms
	Resolution (type-dependent)	0.01 mm
	Supply voltage U <sub>B</sub>	10 V DC ... 30 V DC
	Light source	Laser, red
	Degree of protection	IP 67
	Operational controls	Control buttons   LC display   PC software
	Display	LED   OLED display
	Housing	Plastic
	Dimensions without connector (W x H x D)	21 mm x 50 mm x 50 mm
	Outputs	Analog output, configurable, factory setting: current   Digital switching output, transistor, push-pull
	Interface	IO-Link   RS 232   RS 485
	Connection type	Connector, M12, turning, 90°
	Optical distance measurement principle	Triangulation
	Type of scanning system	Against object
Features	Special version	Activation input   Deactivation input   Teach input
	Display for measured value display and configuration	X
	Triangulation measurement	X
	Supports the IO-Link smart sensor profile	X

## Measuring ultrasonic sensors



300 series



400 series



Technical data	Thread size	M18   M30	M18   M30
	Length	60.3 mm ... 98.8 mm	90 mm ... 104.3 mm
	Measurement range	40 mm ... 6,000 mm	25 mm ... 6,000 mm
	Resolution	5 mm   6 mm   < 2 mm	0.1 ... 0.5 mm   1.0 mm
	Switching frequency	1 Hz ... 10 Hz	1.6 Hz ... 8 Hz
	Ultrasonic frequency	75 kHz ... 300 kHz	75 kHz ... 310 kHz
	Supply voltage $U_B$	10 V DC ... 30 V DC	15 V DC ... 30 V DC
	Switching outputs	Analog output, voltage   Analog output, current   Transistor, NPN   Transistor, PNP	Analog output, voltage   Analog output, current   Transistor, push-pull   Transistor, PNP
	Switching inputs	Teach input	Teach input
	Inputs/outputs selectable	1x	1x
	Interface		IO-Link
	Connection type	Connector, M12	Connector, M12
	Degree of protection	IP 67	IP 67   IP 68
	Operational controls	Control buttons	Control buttons
	Housing	Plastic	Metal
Features	Special version	Multiplex operation   Synchronous operation   Teach input	Multiplex operation   Synchronous operation

# Safety

## Safety light curtains



### ELC 100

Type 4 safety light curtains



Technical data	Type in accordance with EN IEC 61496	4
	SIL in accordance with IEC 61508 and EN IEC 62061 (SILCL)	3
	Performance Level (PL) in accordance with EN ISO 13849-1	e
	Resolution	17 mm   30 mm
	Operating range	0.5 ... 3 m   0,5 ... 6 m
	Protective field height	300 mm ... 1,500 mm
	Response time	4.7 ms ... 21.2 ms
	Profile cross section	34.7 mm x 39.3 mm
	Temperature range	0 ... 50 °C
	Degree of protection	IP 65
	Safety-related switching outputs (OSSDs)	2x, transistor, PNP
	Connection type	Cable with connector, M12, 4-pin
Functions	Display	LED
	Range reduction, transmission channel changeover	
	Automatic start/restart	X
	Start/restart interlock (RES)	
	Contact monitoring (EDM)	
	Configuration by means of wiring	
	AS-i Safety interface	
	Cascading (triple)	

**MLC 510**

Type 4 safety light curtains

**MLC 520**

Type 4 safety light curtains

**MLC 520-S Extra slim design**

Type 4 safety light curtains



4	4	4
3	3	3
e	e	e
14 mm   20 mm   30 mm   40 mm   90 mm	14 mm   20 mm   30 mm   40 mm   90 mm	14 mm   24 mm
0 ... 6 m   0 ... 10 m   0 ... 15 m   0 ... 20 m	0 ... 6 m   0 ... 10 m   0 ... 15 m   0 ... 20 m	0.2 ... 6 m
150 mm ... 3,000 mm	150 mm ... 3,000 mm	150 mm ... 1,200 mm
3 ms ... 108 ms	3 ms ... 64 ms	7 ms ... 17 ms
29 mm x 35.4 mm	29 mm x 35.4 mm	15.4 mm x 32.6 mm
-30 ... 55 °C   -15 ... 55 °C   0 ... 55 °C	-30 ... 55 °C   0 ... 55 °C	-10 ... 55 °C
IP 65	IP 65	IP 65
2x, transistor, PNP	2x, transistor, PNP	2x, transistor, PNP
Connector, M12, 5-pin	Connector, M12, 5-pin   Connector, M12, 8-pin	Cable with connector, M12, 5-pin
LED	7-segment display   LED	
X	X	
X		X
	X	X
	X	X
X		X
	X	X



# Safety

## Safety hinge switches



**S400, S410**  
Safety hinge switches



Technical data	Type	Locking device without guard interlocking, ISO 14119
	Safety	For safety applications up to performance level PL e / SIL 3
	Function	Safety switches and door hinge in one component
	Actuators	Encapsulated position switch inside hinge
	Housing material	Metal
	Degree of protection	IP 67   IP 69K
	Contact allocation	2NC + 1NO
	Connection type	Cable   Cable with connector, M12   Connector, M12
Functions	Functions	180° maximum opening angle of the protective device, adjustable switching point   Optional additional hinges (without contacts)   Positive-opening contacts for integration in a safety circuit
Features	Features	Elegant design for discreet and effective integration in the system   High protection against tampering through encapsulated position switch   Model S410 with wide fork dimension for attachment to special materials, e.g. glass   Hidden cable routing thanks to connection on rear side

## Safety proximity sensors, magnetically coded



**MC 300**  
Magnetically coded sensors



## Safety proximity sensors, RFID-coded



**RD 800**  
Safety transponders



Technical data	Switch type in accordance with EN ISO 14119	Type 4 interlock device, contactless actuation, low coding level	Type 4 interlock device, contactless actuation, high coding level
	Performance level / category in accordance with EN ISO 13849-1	PL e / cat. 4 in combination with a suitable evaluation unit	PL e / cat. 4
	Housing material	Plastic	Plastic
	Degree of protection	IP 67	IP 67   IP 69K
	Dimension (W x H x L)	25 mm x 13 mm x 88 mm   26.2 mm x 13 mm x 36 mm   M30 x 36 mm	25 mm x 18 mm x 72 mm
	Assured cut-in distance (Sao), max.	3 mm ... 9 mm	10 mm
	Assured cut-out distance (Sar), min.	11 mm ... 30 mm	16 mm
	Contact allocation / safety output	1NC + 1NO   2NO   2NO + 1NO (signaling)	Safety-related switching output OSSD
Features	Actuator coding	Actuator with low coding level in accordance with EN ISO 14119	Actuator with low or high coding level in accordance with EN ISO 14119
	Connection type	Cable with wire-end sleeves   Cable with connector, M12   Connector, M8	Cable   Connector, M12
Features	Features	Contactless actuation without mechanical contacts   Long life expectancy   LED status indicator   Magnetically coded (reed contacts)   Not sensitive to soiling	Contactless actuation without mechanical contacts   Long life expectancy   Connection in series with up to 32 devices possible   RFID coded, maximum protection against manipulation   Status and diagnostics display via 4 LEDs   Not sensitive to soiling   Models with programming input for teaching-in actuators

## Safety relays



MSI-SR4B



MSI-SR5B



## Technical data

Application	Solenoid switches (reed contacts, equivalent)   E-Stop circuits   Optoelectronic protective devices   Position switches (mechanical contacts)   Transponder switches (OSSD outputs)	Solenoid switches (reed contacts, equivalent)   E-Stop circuits   Optoelectronic protective devices   Position switches (mechanical contacts)   Transponder switches (OSSD outputs)
Functions	Start/restart interlock (RES)   Cross circuit monitoring   Contactor monitoring (EDM)	Start/restart interlock (RES)   Double sensor monitoring   Cross circuit monitoring   Contactor monitoring (EDM)
Restart	Automatic   Manual	Automatic   Manual
SIL in accordance with IEC 61508	3	3
Performance Level (PL) in accordance with EN ISO 13849-1	e	e
Category in accordance with EN ISO 13849-1	4	4
Continuous current per current path, max.	3 A	2 A
Supply voltage $U_B$	24 V, -20 ... 20 %, AC/DC	24 V, -20 ... 20 %, DC
Power consumption, max.	3 W, with 24 V plus output capability	4.8 W, with 24 V plus output capability
Number of outputs, safety-oriented, undelayed, contact-based	3x	2x
Number of outputs, signaling function, undelayed, contact-based	1x	0x
Response delay time	10 ms	10 ms
Type of terminal	Spring-cage terminal   Screw terminal	Spring-cage terminal   Screw terminal
Dimension (W x H x L)	22.5 mm x 99 mm x 114.1 mm   22.5 mm x 111 mm x 114.1 mm	22.5 mm x 99 mm x 114.1 mm   22.5 mm x 111 mm x 114.1 mm
Ambient temperature, operation	0 ... 55 °C	0 ... 55 °C

# Safety

## Safety control



## MSI 410



Technical data	Type of article	Safety control
	Category in accordance with EN ISO 13849-1	4
	Performance Level (PL) in accordance with EN ISO 13849-1	Up to and including e
	SIL in accordance with IEC 61508 and SILCL in accordance with EN IEC 62061	3
	Number of safe I/Os	20 IN, 4 OUT
	Maximum switching power per output	≤ 4 A
	Interface	USB
	Supply voltage U <sub>B</sub>	24 V, DC
	Ambient temperature, operation	-25 ... 65 °C
	Dimension (W x H x L)	45 mm x 96.5 mm x 121 mm   45 mm x 107 mm x 121 mm
Type of terminal	Spring-cage terminal   Screw terminal	
Functions	Expandable with up to 12 I/O modules	X
	Configuration via mini USB	X
	Transfer of diagnostic data via external fieldbus gateways	X
	Program memory in SD card format (512 MB)	X
	Freely configurable with MSI.designer (license-free)	X
	40 certified function modules	X
	Up to 300 function modules in a project	X
	Other functions	Integrated simulation with logic analyzer   Configurable report   Online diagnosis

# Accessories and supplementary products

## Signaling devices



TL 305 tower light



Tower light, type A



D9 tower light

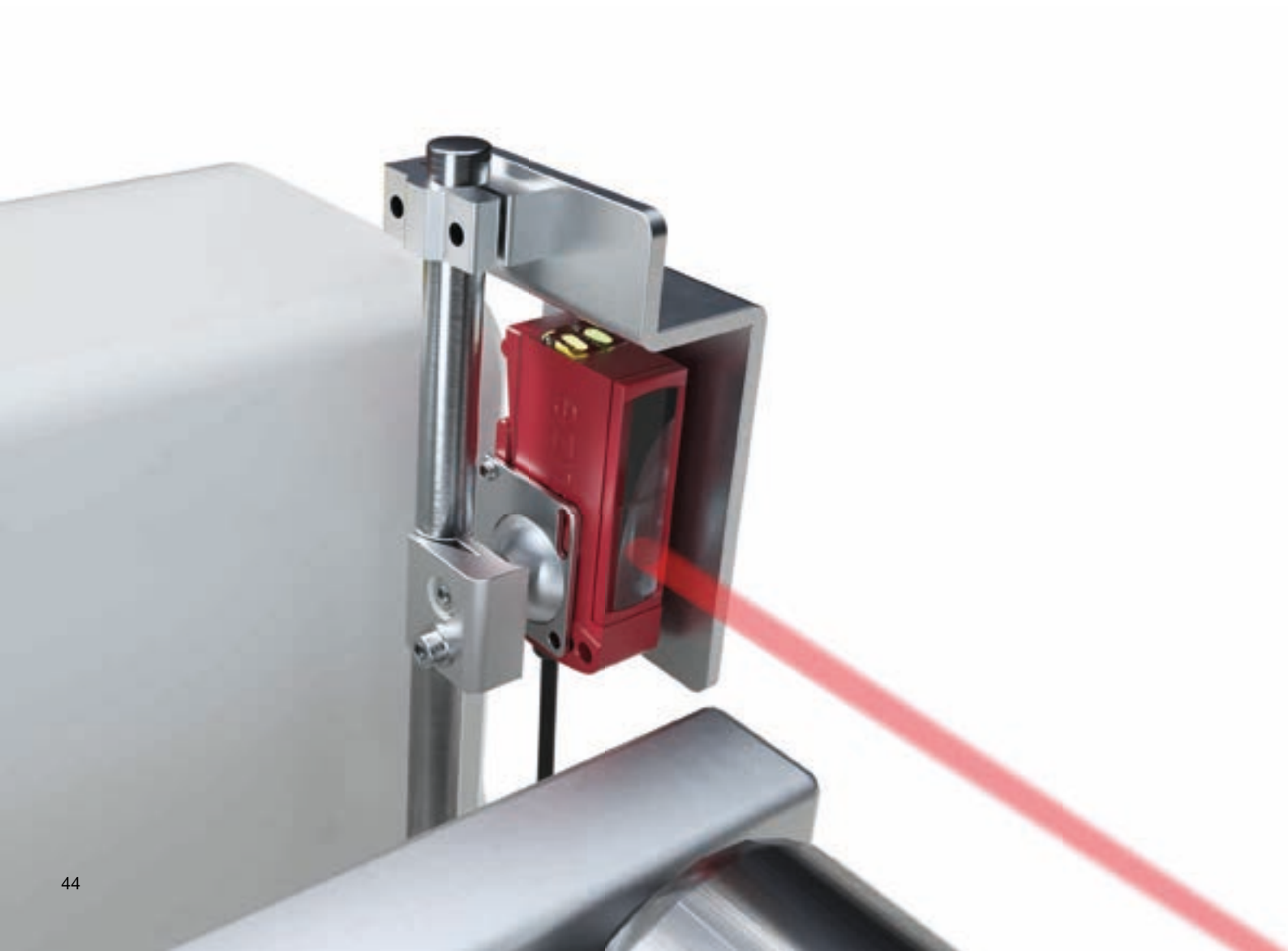


Technical data	Diameter	50.6 mm	70 mm	
	Interface	IO-Link		
	Supply voltage U <sub>B</sub>	18...30 V, DC   24 V, DC	24 V, DC, 10 %	24 V, AC/DC, 10 %
	Type of signaling	Optical   Optical and acoustic	Acoustic   Optical   Optical and acoustic	Optical and acoustic
	Signal image	Continuous, blinking, flashing light   Continuous light	Continuous or flashing light   Continuous or flashing light   Continuous light	Continuous light
	Colors of the modular tower light elements		blue   yellow   green   transparent   orange   red	
	Segments of the preassembled tower lights (ascending)	User defined via IO-Link: RGB color space, Factory settings: red, green, yellow, blue, white, orange, pink   Blue, green, orange, red   Green, orange, red   White, blue, green, orange, red	Green, orange, red   Green, orange, red, single sound buzzer	Green, orange, red
	Tone type	Continuous tone   Continuous tone, slow intermittent (1 Hz), rapid intermittent (2.5 Hz)	Continuous or pulse tone   Continuous tone   Pulse tone	Continuous or pulse tone
	Sound pressure	80 dB   95 dB	100 dB   105 dB	70 ... 90 dB
	Type of connection	Connector, M12	Cable   Cable, soldered to lens / open end   Connector, M12	Terminal
Features	Housing material	Aluminum	Plastic	Plastic
	Degree of protection	IP 20   IP 65	IP 66	IP 65
Features	Features	Aluminum housing with robust and high-quality design   IO-Link models with different oper- ating modes and extensive selection of colors   Models with predefined color assignment and models with IO-Link interface available   Preconfigured tower light with three, four or five segments, optionally with acoustic signaler	Flexible configuration: differently colored calottes (6 colors as well as the multicolor calotte), various stand and mounting options as well as different buzzer versions are available   Modular, freely configurable tower light elements and also preassem- bled models available   Transparent calottes/uniform clear glass optics	Simple wall mounting   Preassembled tower lights with three segments and acoustic signaler in semicircular form

## 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.



## 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.

## 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.



## 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 freestanding floor assembly and mirror columns for multi-sided safeguarding simplify the installations.

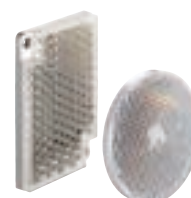


## Signaling devices

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.

## Reflectors

Just how reliably retro-reflective photoelectric sensors can detect depends upon the selected reflector, among other things. We offer reflectors with plastic or stainless steel housings as well as reflective tapes for different requirements.



# 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>Subsidiaries</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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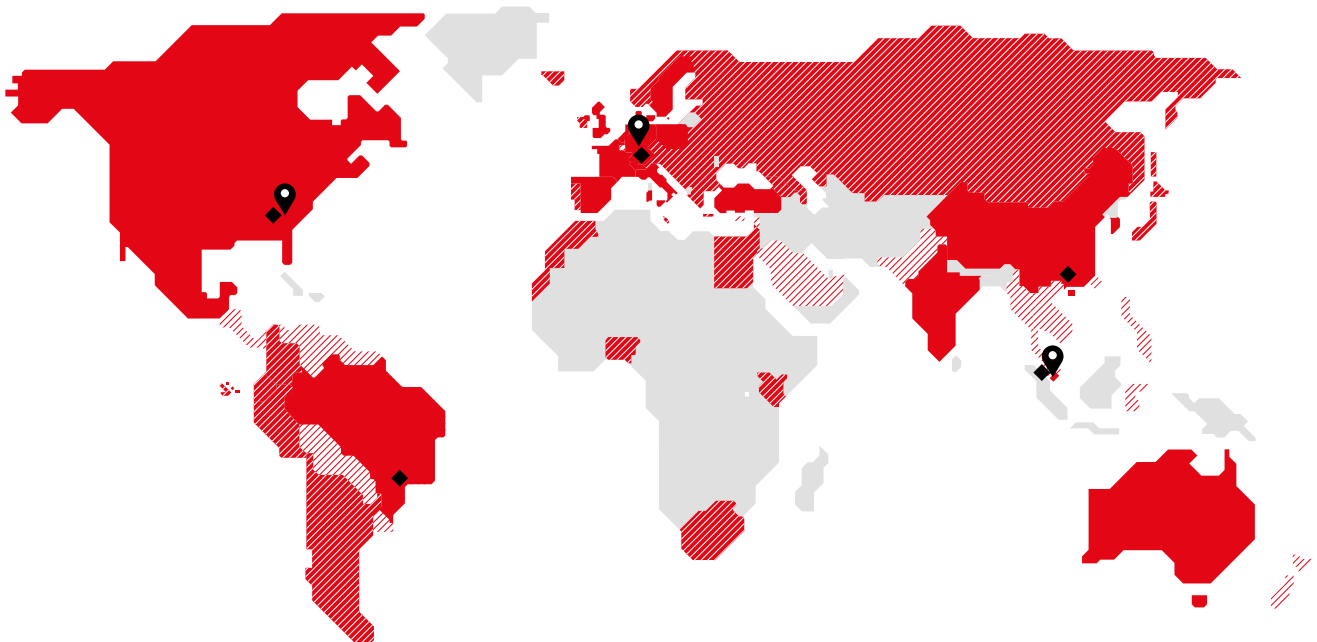




# Our Locations

## 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  
São Paulo, Brazil  
Malacca, Malaysia

### Subsidiaries

Australia / New Zealand	Italy
Belgium	Mexico
Brazil	Poland
China	Singapore
Denmark / Sweden	Spain
France	South Korea
Germany – headquarters	Switzerland
Germany – distribution company	The Netherlands
Great Britain	Turkey
Hong Kong	USA / Canada
India	

## 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 PLCs 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
- Vision Sensors

### Accessories and Supplementary Products

- Signaling Devices
- Mounting Systems
- Reflectors

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