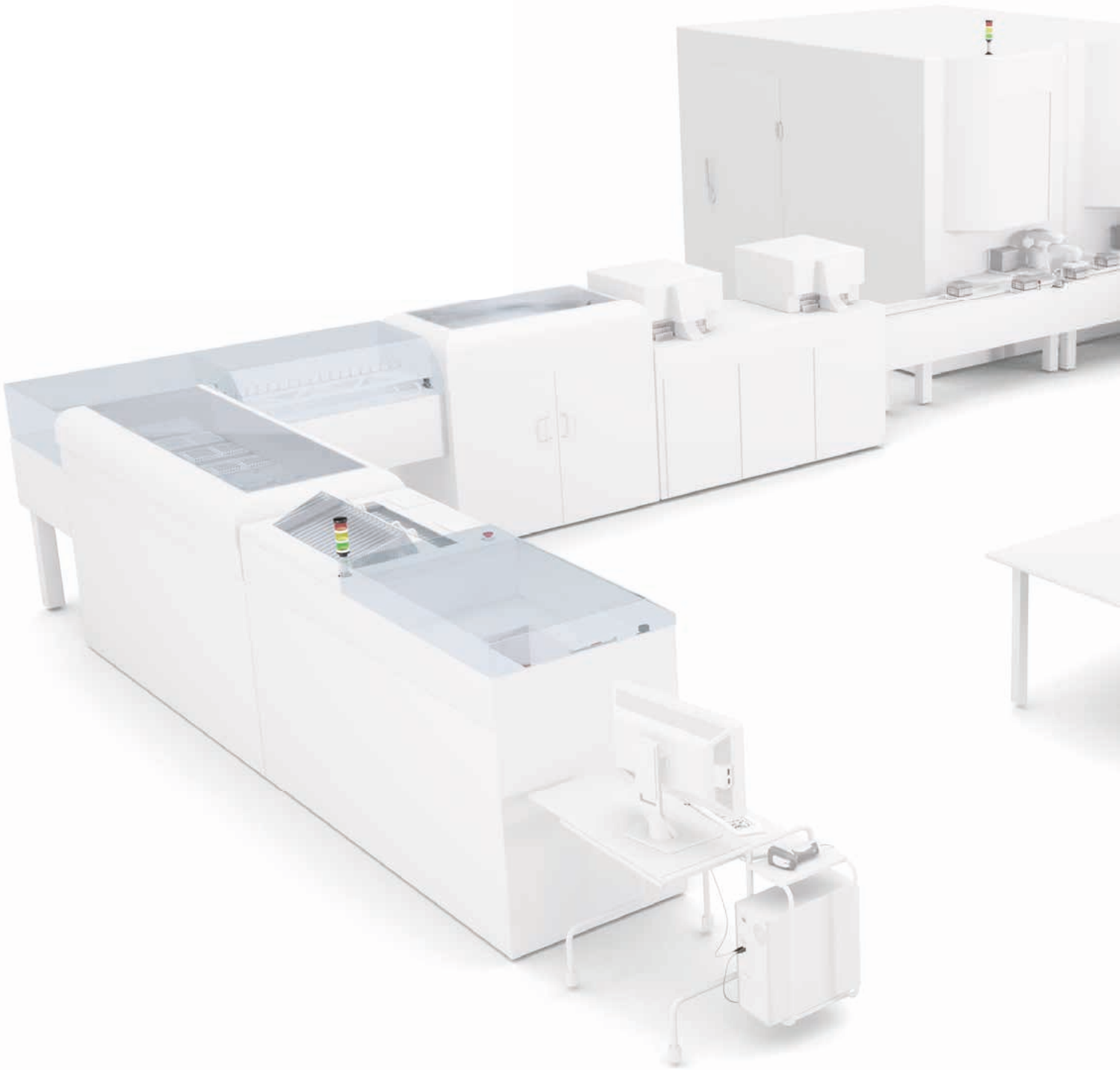
Leuze

Sensor solutions for **laboratory automation**

The Sensor People



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.

1

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.

2

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.

3

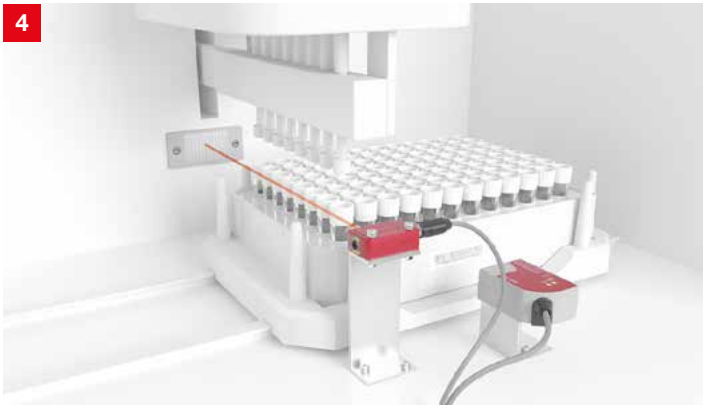
Solution: The MC 300 (magnetically coded) and RD 800 (RFID coded) safety proximity sensors can be simply mounted on flap and frame. They operate free from wear and also have a long life expectancy, even with frequent operating cycles.

De-Capper

Cap detection

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

4



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.

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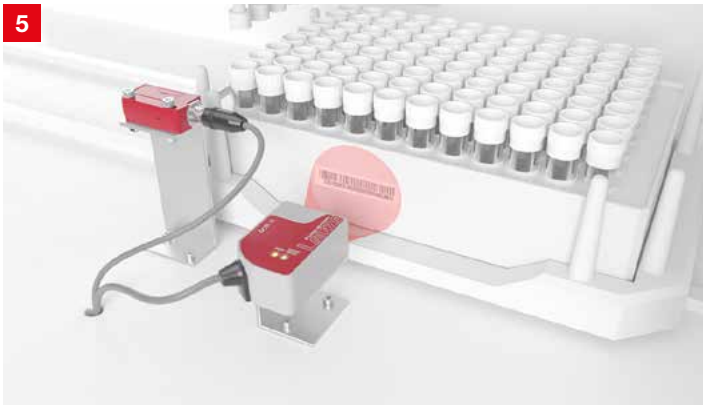


Solution: With the compact and easy-to-integrate code readers of the DCR 55 series, both 1D- as well as 2D-codes can be reliably identified on the sample holders.

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.

1 1D-code reading at automatic rack insertion

2 Stack-height monitoring

3 Presence control of rack

4 Code reading on rows of racks with automatic insertion

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

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

7 Safeguarding the process

8 Point of operation guarding (personnel protection)

9 Fill level monitoring of the samples

10 1D-code reading, single carousel

11 1D-code reading, double carousel

12 1D- and 2D-code reading

13 Stationary 1D- and 2D-code reading

14 Stationary 1D- and 2D-code reading

15 Mobile 1D- and 2D-code reading

16 Leak monitoring

17 Fill level monitoring of liquid containers

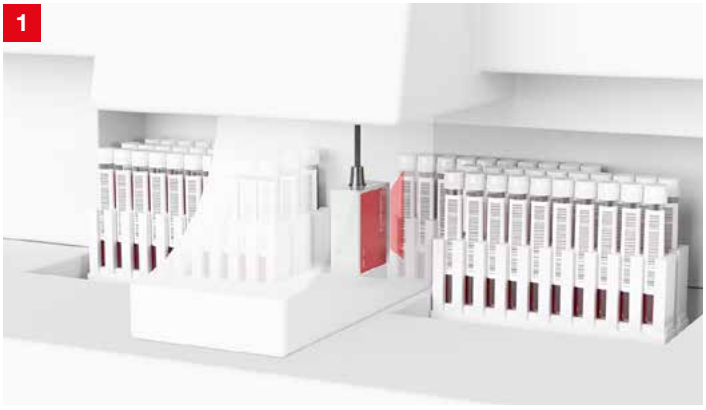
18 Monitoring the closing state of doors and flaps

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.

1

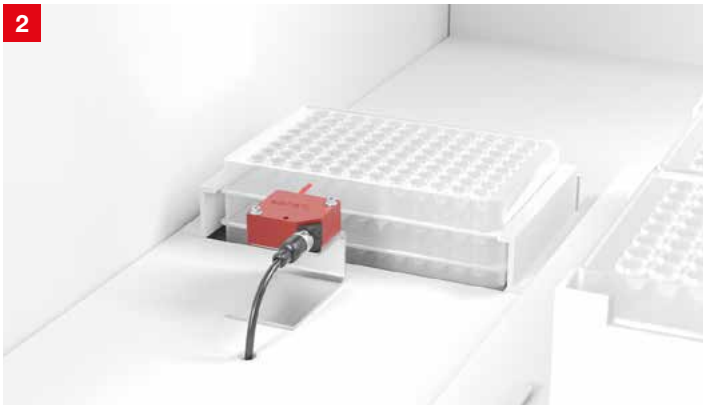


Solution: The bar code readers of the CR 100 series convince in this application with their compact housing and their CCD line.

Stack-height monitoring

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

2

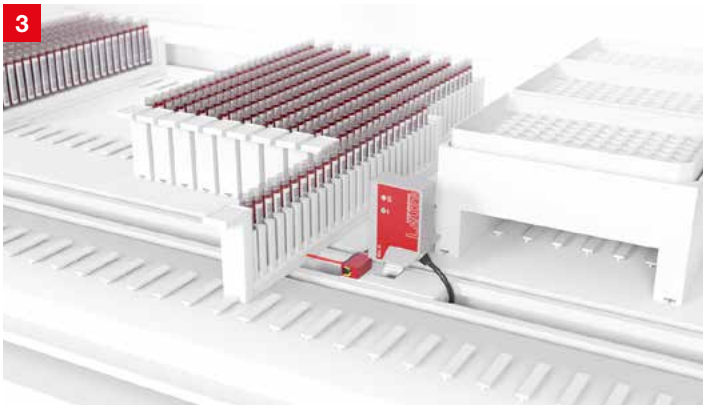


Solution: Because the various carriers often differ in material and color, diffuse sensors of the HT 3C.XL series with an expanded light spot are ideally used.

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.

3



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.

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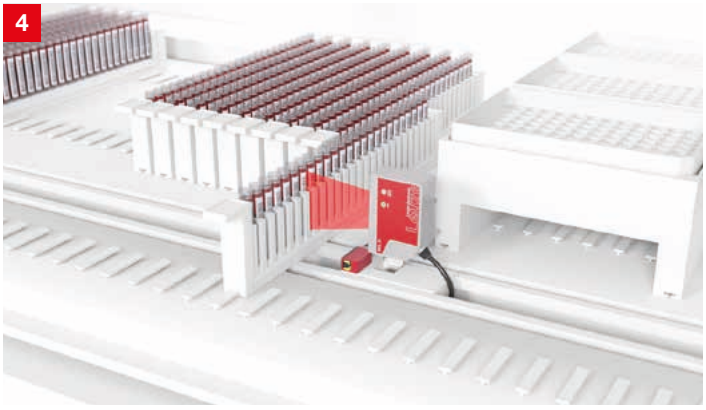

Solution: The bar code readers of the BCL 95 series can also clearly identify densely packed codes. Even poorly printed or partially destroyed bar codes can still be clearly decoded. Varying lighting conditions do not affect the reading result.

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.

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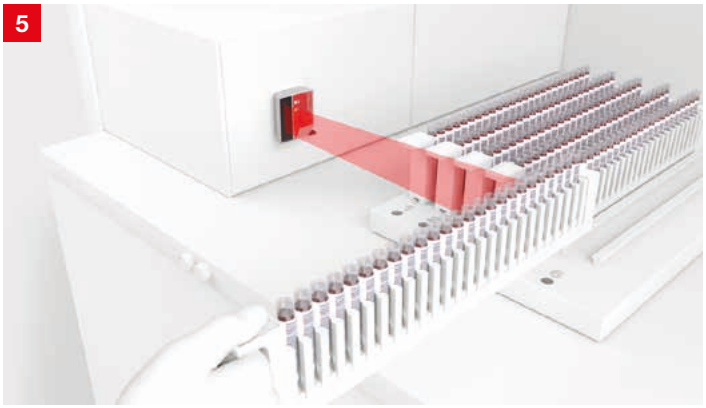
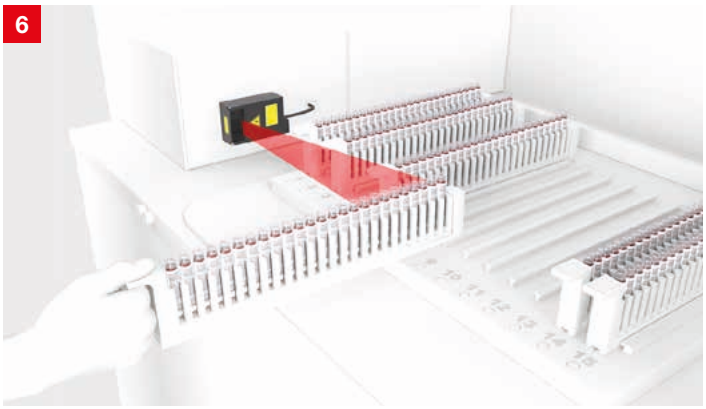


Solution: With their laser technology, the stationary bar code readers of the BCL 95 series can satisfy all requirements for speed and environmental conditions.

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.

6



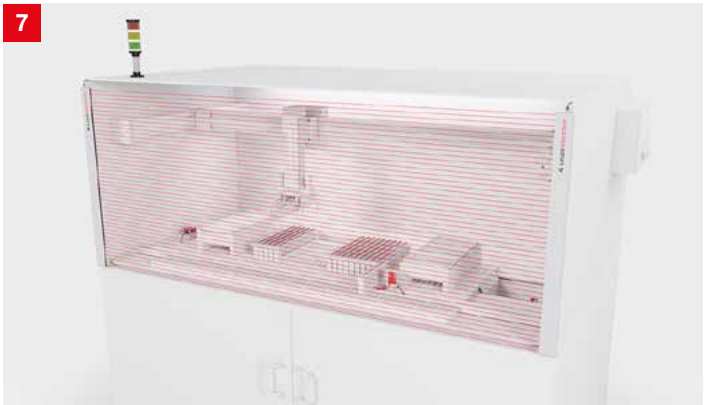
Solution: With their laser technology, the stationary bar code readers of the BCL 148 series can satisfy all requirements for speed and environmental conditions.

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.

7



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.

8

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.

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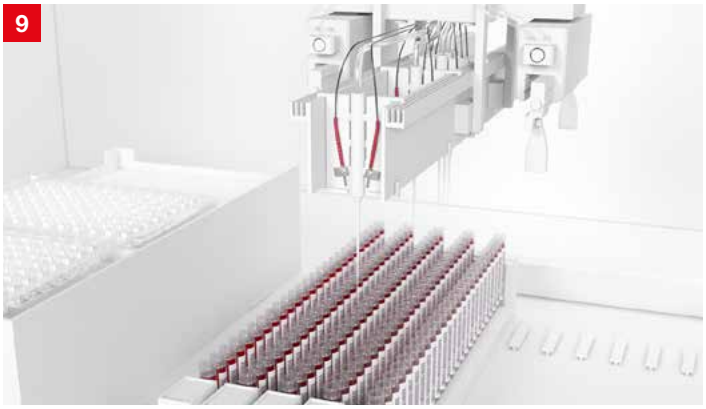
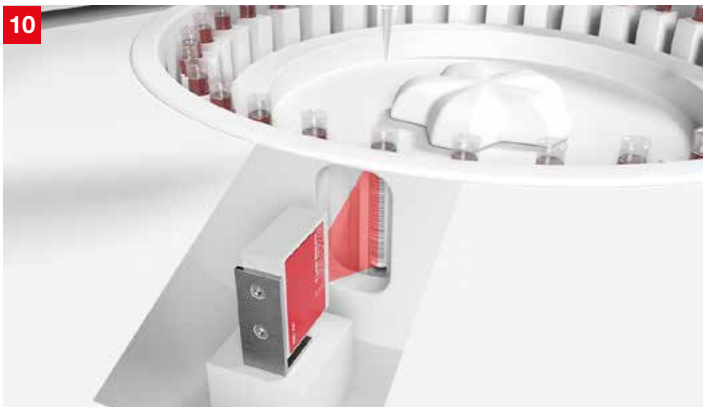


Solution: This application can be solved with fiber optics of the KF series with various beam exits, separate LV 46x amplifier with menu navigation, or with RKU 420 ultrasonic sensor and narrow sound cone.

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.

13

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.

14

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.

15

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.

16

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.

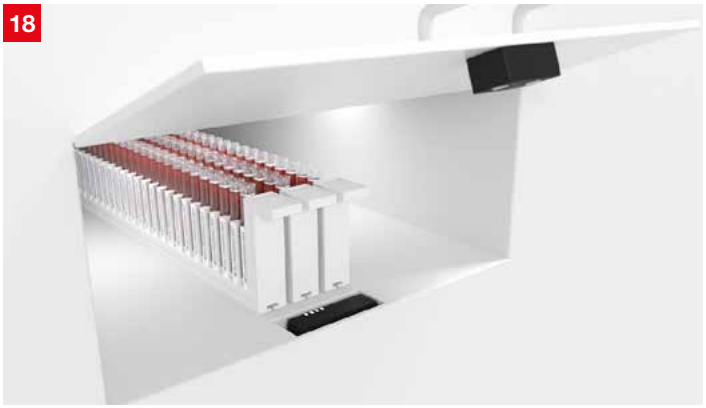
17

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.

18



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

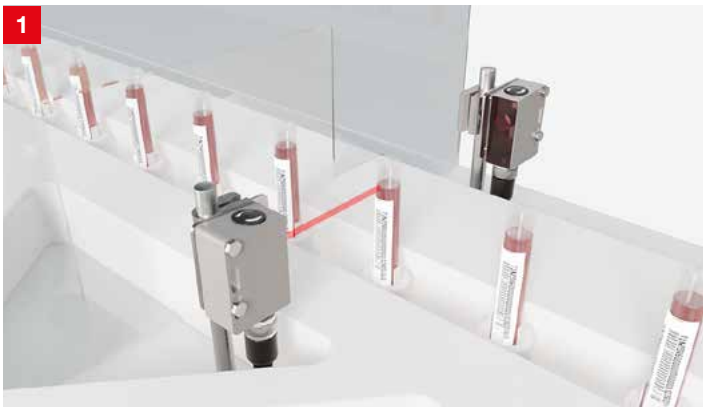
4 Presence control

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

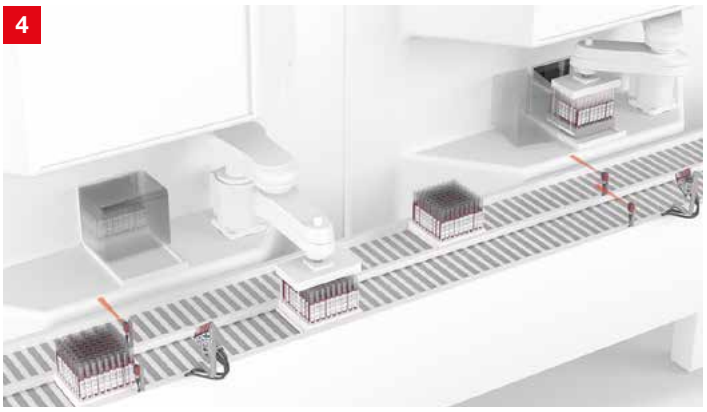
Requirement: Monitoring of the closing state of the protection hoods is necessary for the process reliability and safety at work in accordance with IEC 61010.

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.

4

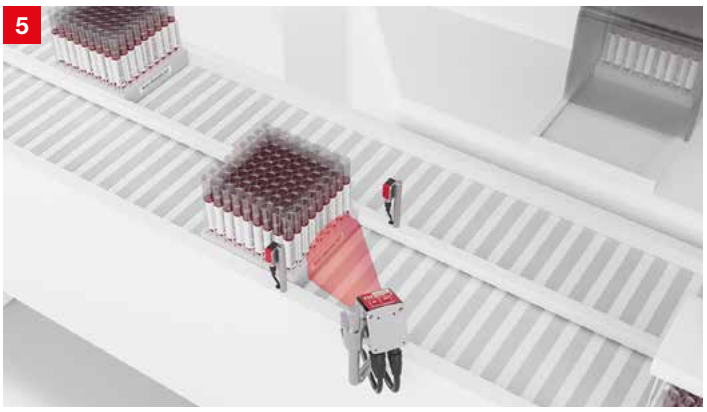


Solution: With an especially compact design for easy integration, the optical sensors of the SR 2 or SR 3 series with all operating principles are ideally suited for this environment. A PRK 2 with reflector is the preferred choice.

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.

5



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°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

2 Presence control of sealing film

3 2D-code reading on the sample carrier

4 Signaling of status information

5 Monitoring the closing state of doors and flaps

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.

1

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.

2

Solution: The especially sophisticated KFX fiber optic sensors with 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.

3

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.

4

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.

5

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.

6

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_B	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

BCL 92, BCL 95
Miniature scanner

BCL 148
Bar code readers for laboratory automation

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**
		CE UKCA cULus	CE UKCA cULus ECOLAB
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
	Housing	Plastic | Metal	Stainless steel | Plastic | Metal
	Compatibility of materials		ECOLAB
Accesories	MA 200i connection unit		CANopen | DeviceNet | EtherCAT | EtherNet IP | EtherNet TCP/IP | PROFIBUS | UDP
	MA 150 connection unit		Point to Point
	Mounting devices		BT 320M | BTU 320M-D12
Features	Special version	Scan Engine Module	Heating | Optional with NPN switching inputs/outputs | Polarization filter

		Mobile code readers	
			
		IT 1470g, 1472g	**IT 1950g, 1952g**
		CE	CE
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_B	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
	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
Connectivity	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
Features	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	**3C series** Universal, mini	**55C series** Stainless steel, Wash-Down design
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_B	10 V DC ... 30 V DC
	Typ. operating range limit S_n	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_B	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, rot
	Operational controls	Control buttons | Multiturn potentiometer | Slide switch | Rocker pressure switch
	Housing	Plastic
Features	Special version	Large operating range | Short response time | Time function

KF
Plastic fiber optics

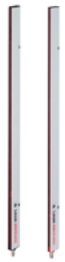
Technical data	Operating principle	Throughbeam principle | Diffuse reflection principle
	Design	Cubic | Cylindrical
	Outer diameter	1 mm ... 4 mm
	Fiber length	500 mm ... 5,000 mm
	Fiber sheathing	PE | PTFE
	Fiber head	Stainless steel | Plastic | Metal
Features	Special version	Heat resistant

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
	Ultrasonic frequency	75 kHz ... 380 kHz
Features	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
	Type of configuration/ parameterization	Software | Via pin assignment
	Ambient temperature, operation	–30 ... 50 °C
	Type of display	LED
Features	Diagonal-beam scanning	X
	Crossed-beam scanning	X
	Parallel-beam scanning	X

Measuring sensors

		Optical distance sensors
		
		ODS 9
		CE UKCA 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_B	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**
		CE UKCA cULus	CE UKCA cULus
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)	
	Contactor 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	X

Safety

		Safety hinge switches	Safety proximity sensors, magnetically coded	Safety proximity sensors, RFID-coded
				
		S400, S410 Safety hinge switches	**MC 300** Magnetically coded sensors	**RD 800** Safety transponders
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	Plastic	Plastic
	Degree of protection	IP 67 | IP 69K	IP 67	IP 67 | IP 69K
	Contact allocation	2NC + 1NO		
	Connection type	Cable | Cable with connector, M12 | Connector, M12		
	Dimension (W x H x L)	49 mm x 22.5 mm x 100.6 mm | 79 mm x 22.5 mm x 100.6 mm	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
	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
	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
	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
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	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
		CE cULus FS
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_B	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

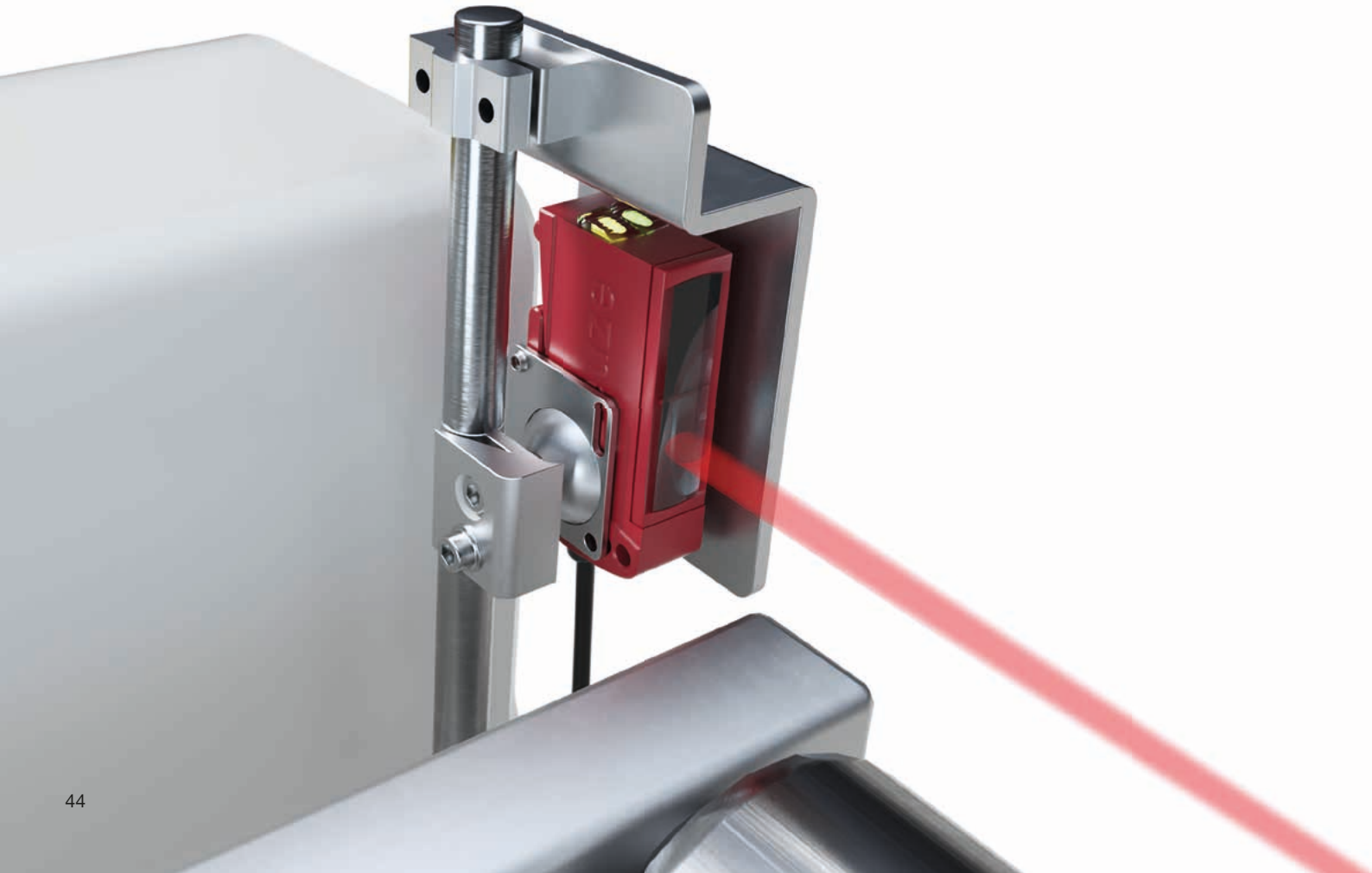
Accessories and supplementary products

		Signaling devices		
				
		TL 305 tower light	**Tower light, type A**	**D9 tower light**
		CE UKCA	cULus UKCA CE	CE cULus
Technical data	Diameter	50.6 mm	70 mm	
	Interface	IO-Link		
	Supply voltage U_B	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
	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 operating 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 preassembled 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.



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.

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 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

Foundation	1963
Company structure	GmbH + Co. KG, wholly family-owned
Executive management	Salvatore Buccheri, Dr. Henning Grönzin, Helge Held
Headquarters	Owen, Germany
Subsidiaries	21
Production locations	6
Technological competence centers	3
Distributors	40
Employees	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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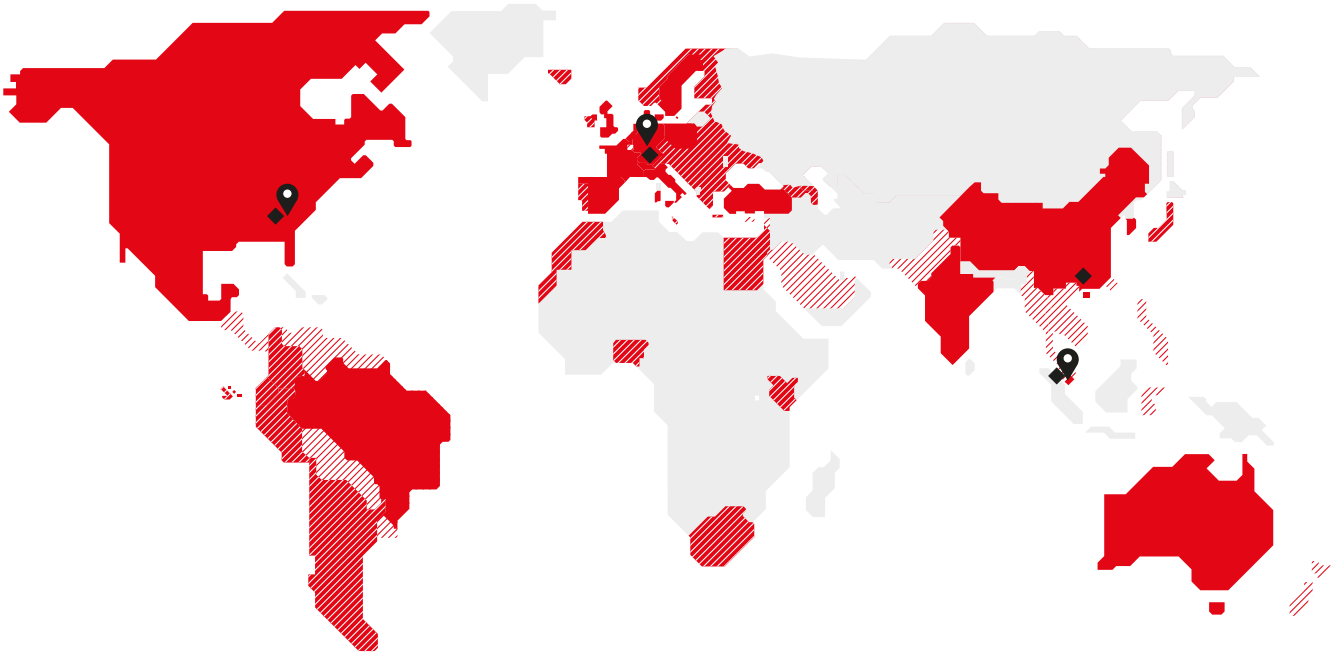
Our Locations
At work for you around the world

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
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 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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en 01-2024/01 1383
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