INDUSTRY GUIDE

Efficient solutions for material transport vehicles in factory and logistics automation

Move more with intelligent sensors.

SICK
Sensor Intelligence.

Knowing the direction to take.

Trailblazing solutions.

The optimization of processes in material transport is a continuous task. Because global competition and price pressures never stop. Which is why any detail can be of great importance at any time. SICK sensors help take advantage of efficiency potentials down to the last detail.

As an independent and leading developer and producer of intelligent sensor systems worldwide, SICK plays a major role in shaping process optimization throughout industry. SICK's sensor, safety and automatic identification solutions contribute towards making the entire production process safer, quicker and more transparent – whether overall or in detail. Risks and sources of error are systematically eliminated, individual production steps accelerated. Thus SICK, with its comprehensive sensor expertise, provides reliable solutions during all phases of the production process.

A wide range of solutions that enable you and your products to be among the leaders in global competition.

Global presence

Sensor solution supplier

SICK
Sensor Intelligence.

Innovation leader

International Service Solutions

e-business – the Partner Portal

Source: Bleichert, Osterburken.

SICK sensors:
benchmarks on all fronts

This brochure is intended to give you an insight into SICK's range of options and solutions for your applications. Let's simply take a look at the areas in which 'Sensor Intelligence' from SICK can make your material transport processes even more efficient.

Together we will discover the potential for optimization and develop, with you, individual solutions leading to greater competiveness.

STRONG PERFORMANCE

SAMPLE SOLUTIONS 10

Trailblazing in many markets.

Expertise that pays – for you.

Get double the benefit. Firstly, our personnel have insights into many different applications. So that you can transfer innovative sensor ideas from one market to another. Secondly, our market specialists are deeply rooted in their expertise.
This means that you communicate with specialists who immediately understand your task. This leads to quickly finding reliable solutions, capable of immediate practical implementation.

Mobile material transport systems are found in almost every industrial production area. Whether driverless or partially autonomous transport systems, transfer vehicles, automated storage and retrieval systems, Telpher systems, fork-lift trucks or narrow aisle vehicles – the most varied of sensors are employed for contour- or reflector-based navigation, for rough and fine positioning, for measurement and identification, as well as for optical data transmission. Above all, of course, humans must be protected, but goods in automated areas also require protection from collisions with these often rapid, and sometimes heavily loaded, vehicles.
In combination with the most varied of vehicle controllers, SICK's sensors and sensor systems provide efficient and reliable non-contact solutions for these challenges in your industry.

AUTOMOTIVE

PRINT & PAPER

ELECTRONICS

FOOD & BEVERAGES

CERAMICS

MACHINE TOOLS

WOOD & FURNITURE

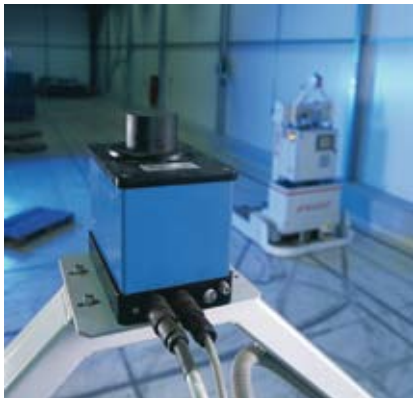
PHARMACEUTICALS & HOSPITALS

SICK sensor highlights: systemized mobility.

Optimizing key functions in overall factory automation.

Technology does not develop by itself. Progress only occurs when people repeatedly go beyond what is already known, develop new ideas and make them marketable. Like at SICK. SICK has always invested a significant amount in research and development. R&D is the engine of sensor development and our worldwide success. The results are impressive: sensor milestones that have repeatedly opened up new possibilities for optimizing processes in factory and logistics automation. These innovations have made a name for themselves and have been highly influential in the technological progress in your market.

Put us to the test. We would be pleased to convince you of our 'mobility'.



NAVIGATION

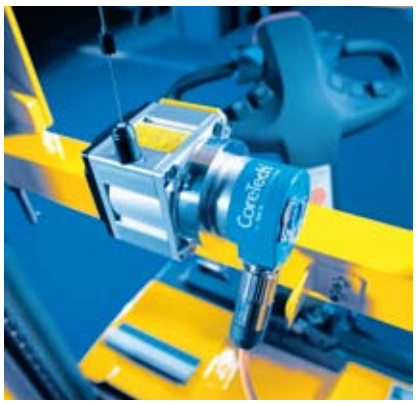
Laser Measurement Systems navigate automated guided vehicles and systems highly accurately with the help of reflector marks and/or landmarks – even under harsh operating conditions. They allow a freely programmable path management without the need to lay down guide wires or magnets.

PROTECTION

Safety photoelectric switches and laser scanners protect humans and prevent collisions with other vehicles or obstacles on the drive path. These solutions are highly flexible and adapt to the vehicle's speed.

IDENTIFICATION

A wide product range of 1D and 2D code readers and RFID read/write devices are used in almost all areas of factory automation. The reliable identification of objects greatly enhances smooth material flows.



POSITIONING

The highly precise positioning of storage and retrieval devices or other automated guided vehicles is easy with distance measurement devices and encoders. These products are available in a variety of designs and with standardized interfaces.

MEASUREMENT AND DETECTION

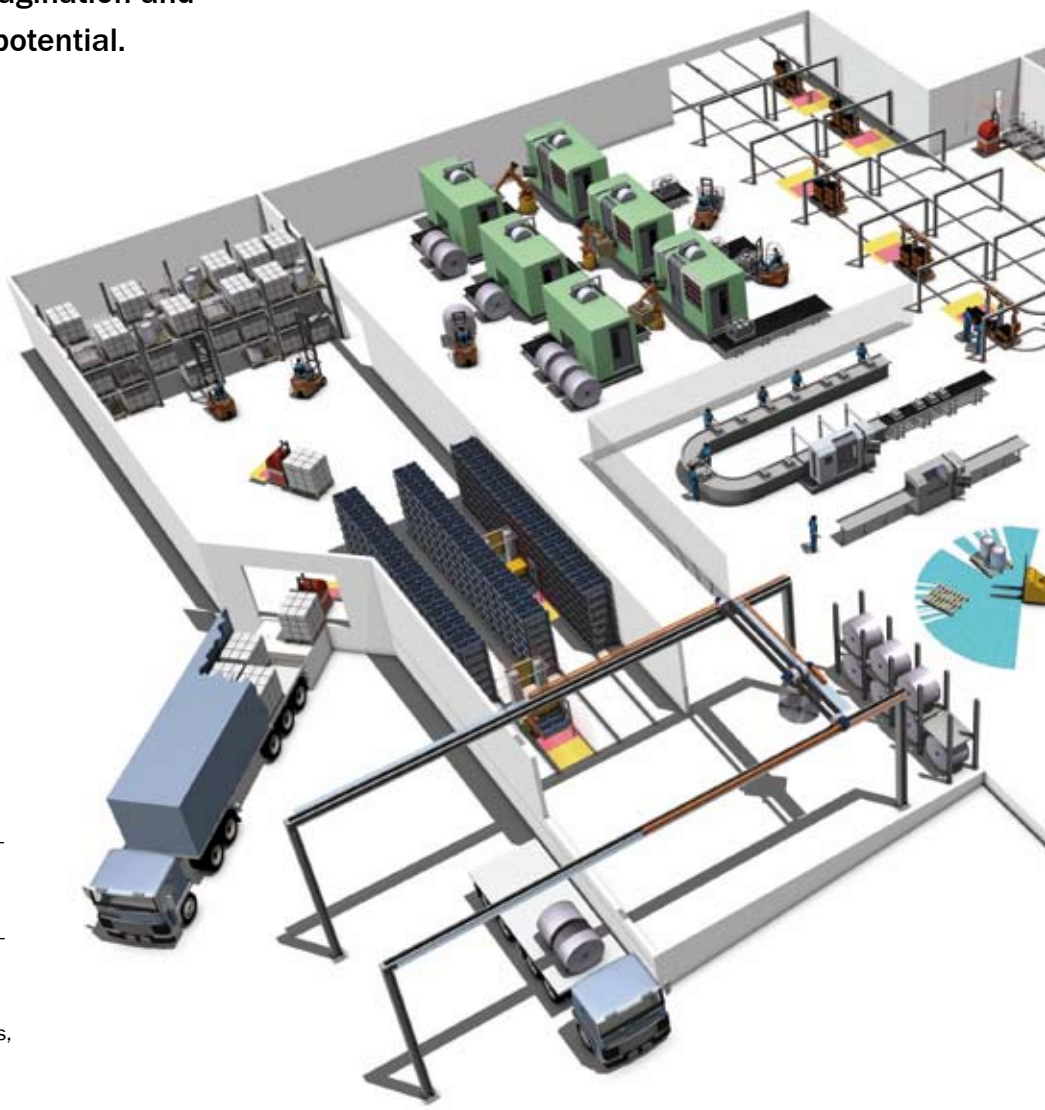
SICK sensors regulate production and logistical processes. They detect the presence of products or packaging elements; they measure distances, heights and the protrusion of goods on pallets and other transported objects – ensuring virtually error-free processes.

COMMUNICATION

With the I/O-Link sensor-actuator interface, as well as with system-open safety controller solutions and associated sensors, SICK is equipped for almost all automation tasks – and solves applications with innovative technologies.

Sample solutions for material transport vehicles in factory automation.

Discover, step-by-step, how SICK's 'Sensor Intelligence' makes your material transport vehicles quicker, more efficient and safer. We illustrate the numerous possibilities of intelligent solutions using selected application examples. Let them stimulate your imagination and discover your optimization potential. We can support you.



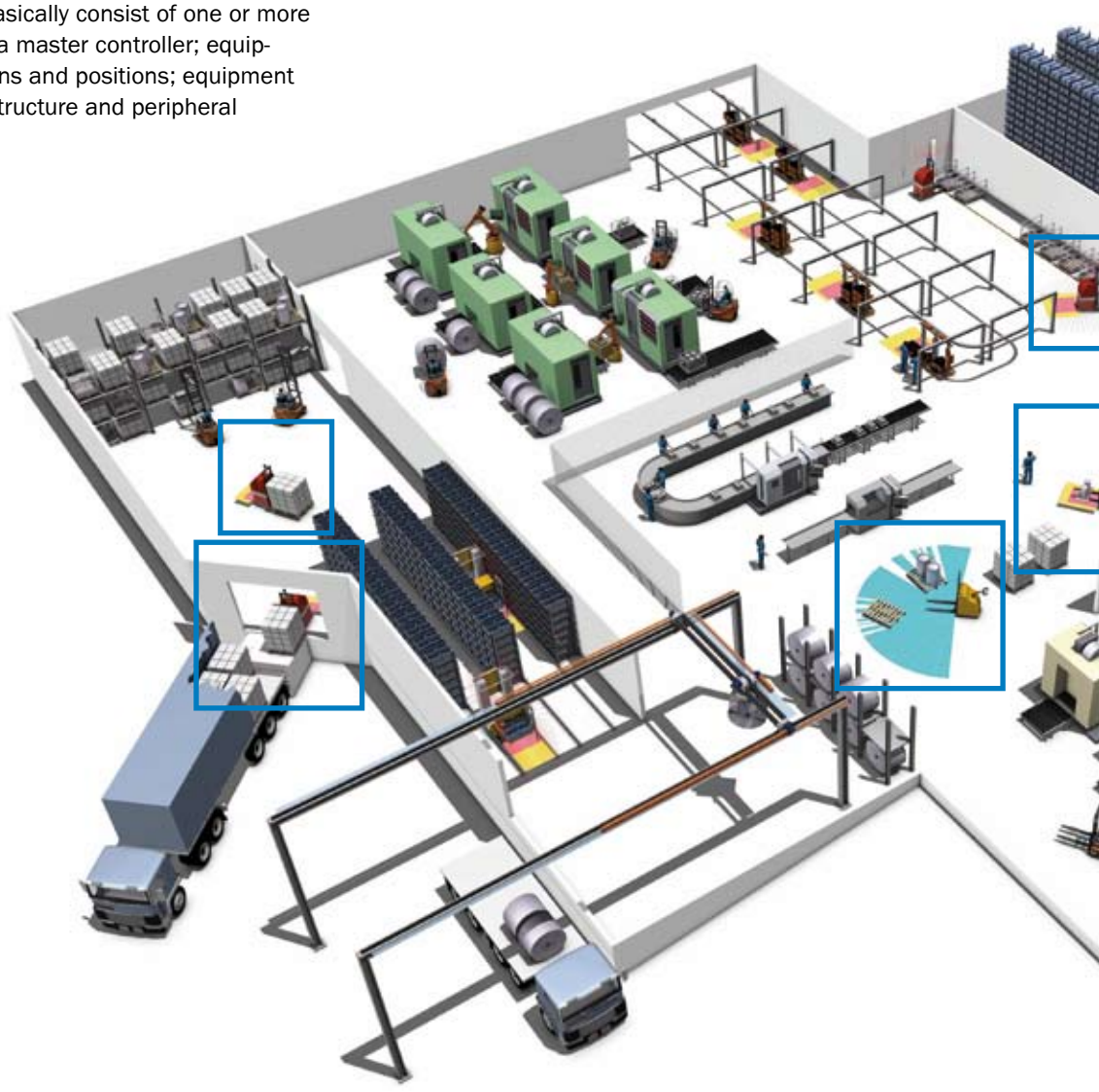
The layout of a typical production company shown here is in an abstract form. The necessary walls or protective measures (such as fences or light grids) have been omitted in order to retain an overview of the individual mobile applications. The applications described below only show the solutions schematically. Selection of the device types, their arrangement and mounting must be adapted to the task and the conditions of the operating environment, particularly in the case of safety technology. The illustrations of the applications, the product properties described, and the technical data are not binding, and represent no description of properties.

Automated guided vehicles and systems.

Navigation, positioning, protection, measurement, identification

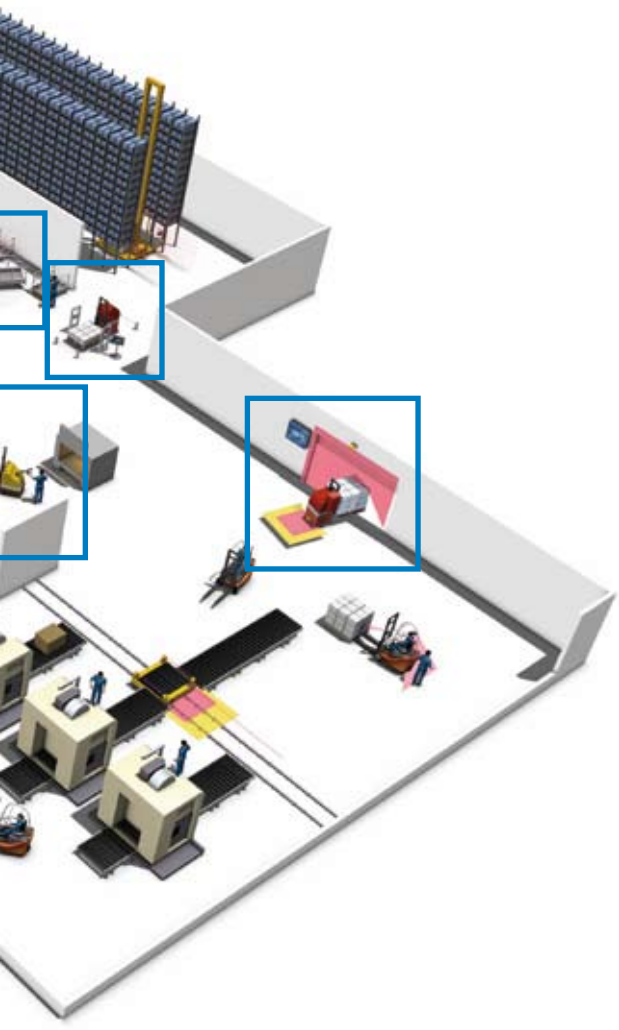
Automated guided vehicles (AGVs) are a floor-bound means of transport with their own drive, and are automatically controlled and guided without contact. They tow or carry transported goods and have active or passive load uptake equipment.
Automated guided vehicle systems (AGVSs) are in-house floor-bound transport systems with automatically controlled vehicles for material transport. They are used within and outside buildings and basically consist of one or more automated guided vehicles; a master controller; equipment for determining locations and positions; equipment for data transmission; infrastructure and peripheral equipment.

Semi-automated guided vehicles (Semi-AGVs) are guided by an operator or programmed for orders and then automatically travel along drive paths (like an AGV) in order to carry out, for example, automatic goods transport.

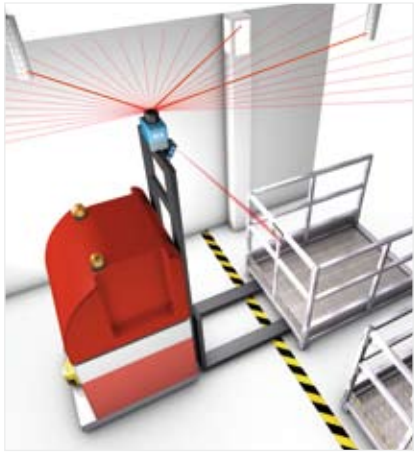


Sensors from SICK offer technically leading solutions for automated guided vehicles and their systems.

- **Navigation and position determination with laser scanners**
- **Human protection and collision prevention with safety laser scanners**
- **Determination of distances and positions with laser measurement systems**
- **Identification with bar code reading systems or RF identification systems**



Automated guided vehicles (AGVs) and systems
Focus 1:
Optimising navigation and the vehicle route

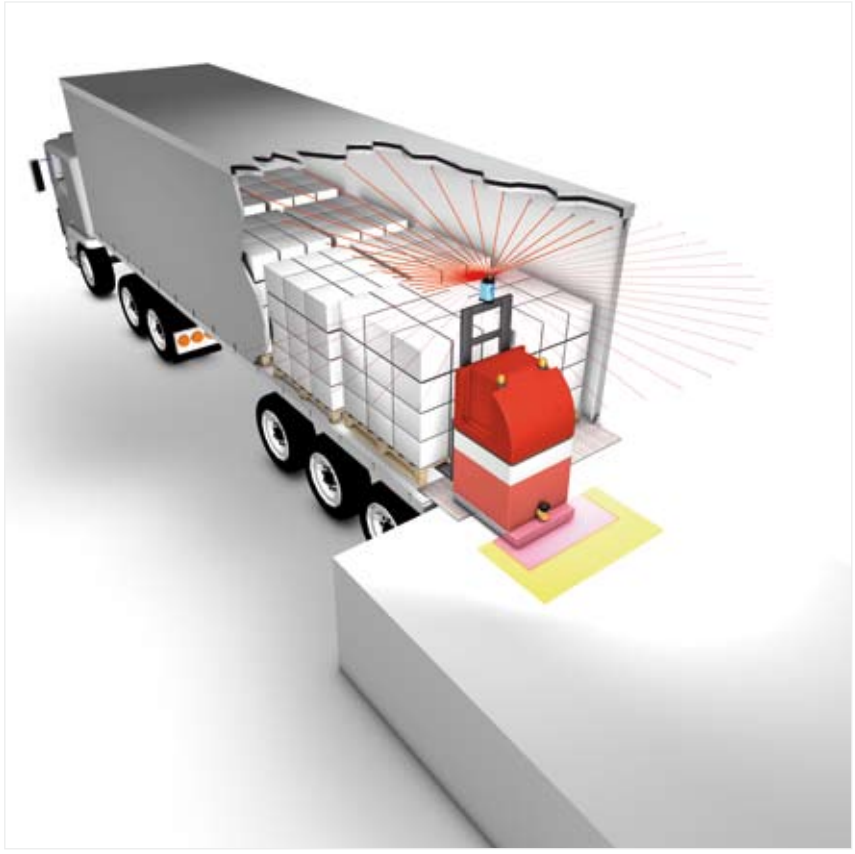


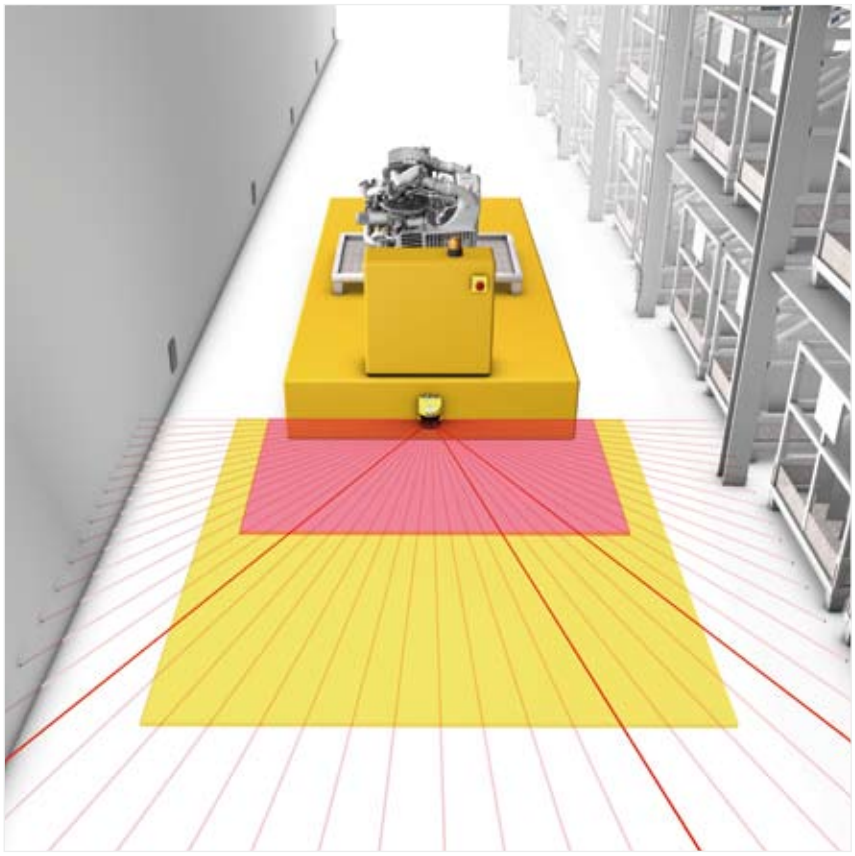
◂ **Orientation on reflectors**
Navigation of an AGV with a NAV200 laser-supported positioning system. With its comprehensive view it detects reflector marks within its operating environment, measures their distance very accurately, and provides the on-board computer with precise information for absolute vehicle positioning.

The CLV650 bar code reader with autofocus adjustment reads the bar code on the grid box and supplies the data to a central computer. This then assigns the AGV a new storage location and vehicle route.

Contour-based navigation ▸
The AGV loads and unloads a truck with palleted goods fully automatically. The LD-OEM laser measurement system provides space contour data (distance and angle) very quickly and accurately through its 360° range, without any reflector marks. The vehicle computer can use this information to calculate the vehicle's position even if the surroundings change.

Mixed-mode navigation
The NAV200 laser measurement system can be used as an alternative. It can process contour and reflector data. Thus vehicles guided by reflectors can also drive in areas where it is impossible to use reflector marks.





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Navigation with the safety laser scanner
Two-in-one: the S3000 Professional CMS (Contour Measurement and Safety) safety laser scanner combines safety technology with navigational support. For example, raw data from reflector marks (distance, angle, reflector) and speed are supplied to the on-board controller for odometry and position determination. Its use for evaluation in smaller vehicles is particularly economical. No mast is necessary for the navigation sensor. It also has strengths in mixed uses that complement each other excellently when differing application demands must be met simultaneously: driving in aisles (deep stacking) and area navigation, or when guided vehicles following defined routes have to switch to on-board navigation.

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Semi-automated guided vehicles
A semi-automated guided vehicle carries out production-based transport jobs autonomously. A worker takes over the stacker as soon as it reaches its destination, and feeds an annealing furnace as shown in the example. The vehicle's position determination and navigation is achieved with the NAV200 via reflector marks, while the route and load change is recorded using a teach-in process. After pressing the 'Automatic' button on the stacker it then automatically goes to collect the next load.

◂ **Automatic pallet pick-up**
S300 or S3000 safety laser scanners with supplementary advantages for the position-oriented retrieval of pallets or grid boxes. Measurement of the free storage space available. This is used for automatic palletizing: identification of the pallet geometry can be carried out with the help of the measurement data output from the S300/S3000 CMS safety laser scanner so that the hoisting fork can pick up the pallet accurately and reliably.

Automated guided vehicles (AGVs) and systems
Focus 2:
Measuring distances and determining positions

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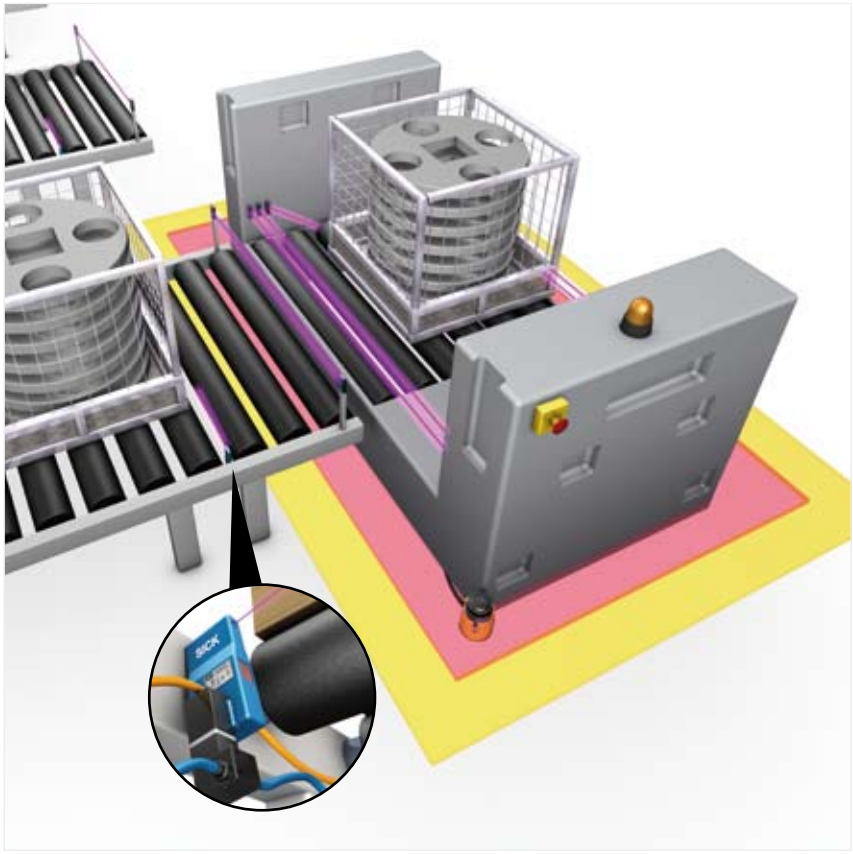
Odometry

The AGV's drive and steering axles are equipped with two DRS60 incremental encoders. They supply data on the steering angle and distance covered to the on-board computer or to the central computer for speed and position determination. Here, the maximum possible speed is calculated for the most effective use of the AGV, depending on the hoisting height and steering angle.



Measurement of fork height

The continuous position determination of the stacker's fork takes place precisely with a BKS09 wire-draw encoder. The highly flexible steel wire is fixed to the fork's 'shoulder'.

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Fork positioning

IME18 inductive proximity sensors provide stepwise signals to the controller for the lower position of the fork (load uptake from the floor), the drive position of the fork (the S3000 safety laser scanner has an unobstructed view), the positions for load uptake from the shelves or grid boxes stacked one upon another, and the upper maximum permissible fork position.

◄ **Automated load pick-up**

The AGV picks up goods at a transfer station (on pallets, in crates, boxes or small cartons). These are checked for position and projections. A WTR1 photoelectric proximity switch between the rollers of the feed conveyor starts or stops further transport of the goods. The following points are determined during transfer of the goods from the station to the vehicle using WL27-3 photoelectric switch(es):

1. aligned diagonally above the loading area, it checks whether the loading area is free,
2. positioned at each end of the roller section, and one on the AGV, they ensure the gap between the station and the vehicle is free and that the AGV can approach for alignment without damage,
3. one sensor placed on the right and one on the left side of the AGV check whether the goods have been placed on the AGV without obstruction.

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Automated guided vehicles (AGVs) and systems
Focus 3: Detecting free storage spaces
Focus 4: Identifying goods and storage spaces

▲
Identifying goods by means of bar codes
The CLV650 bar code reader with autofocus adjustment reads the bar code on the grid box and supplies the data to a central computer, which assigns the AGV the new storage space and thus the drive path.

▲
Storage bay availability
Single-beam sensors cannot reliably detect stored grid boxes during inspection of storage bay occupancy. The S100 or LMS100 laser scanner is used here. It scans the entire width of the storage bay with its fan-shaped light, and signals whether it is free for storage.

Goods identification using RFID
The AGV drives through an identification station that is equipped with an RFID system (Radio Frequency Identification). The goods, as well as their packaging and the pallet, are provided with so-called tags (transponders), in which the pallet number, pack type, type of goods, number of pack units or any special feature of the goods can be stored. The data is read by an RFI341 read/write device via antennae – without contact and without a direct view of the tag – and transferred to a computer.

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Automated guided vehicles (AGVs) and systems
Focus 5:
Protection and collision prevention

▲ **Preventing accidents**
The AGV is equipped for human protection and to prevent collisions with other vehicles or materials located on the floor – in both directions of movement – with an S3000 Professional safety laser scanner on the fork side and an S300 at the back. Using the DKS40 incremental encoder, the S3000 Professional detects the speed of the vehicle via its dynamic control inputs. Protection and warning fields are configured in the S3000 and S300 safety laser scanners for the different speeds. These are dynamically switched according to the speed of movement.

◂ The DT50 distance sensor continuously measures the distance between the AGV and the load to be picked up (grid box) in order to adapt the vehicle's speed. It supplies the signal for lifting when the load has been correctly positioned on the hoisting fork.

◂ **Non-contact comprehensive protection**
Four S3000 safety laser scanners provide the automated heavy load vehicle with all-around protection for humans and against collisions with materials in its path. Protective and warning fields do not need to be changed according to the speed because the AGV only moves very slowly.
In addition to protecting the typical directions of movement – forwards and backwards – safety laser scanners are also mounted on the sides in order to prevent additional risks or sudden stops during swivelling movements or while turning.

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Collision prevention in advance

In addition to the laser scanner's safety function for detecting persons or objects at floor height, another S100 laser scanner is used on this AGV to prevent collisions with objects in the vehicle's path. Hanging crane hooks or projecting materials are reliably detected by the S100's switching field (tilted upwards) before the vehicle or the load can be damaged.

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Overhang detection

An S100 laser scanner is mounted on the mast of this automated towing truck in order to reliably detect pallets or other objects jutting out of shelving, and to prevent any damage. An object detected by the switching field (tilted downwards), is reported to the controller: the truck is diverted away from the collision zone or stopped.

Safety in cold storage areas ▸

Navigation and safety are also possible even at extremely low temperatures, e.g. in unheated warehouses or in deep-freeze stores. Cold-store-enabled S3000 safety laser scanners or C2000 or C4000 safety light curtains permit the use of an AGV when a sensor's normal operating data reach their limits. Aisles are reliably monitored, and the entry of a vehicle prevented, until the operator has left the area again. The S3000 Cold Store safety laser scanner on the vehicle also handles human protection, and reliably helps prevent collisions with other vehicles or materials – even in this harsh environment.

Automated guided vehicles (AGVs) and systems
Focus 6:
Controlling, regulating and networking

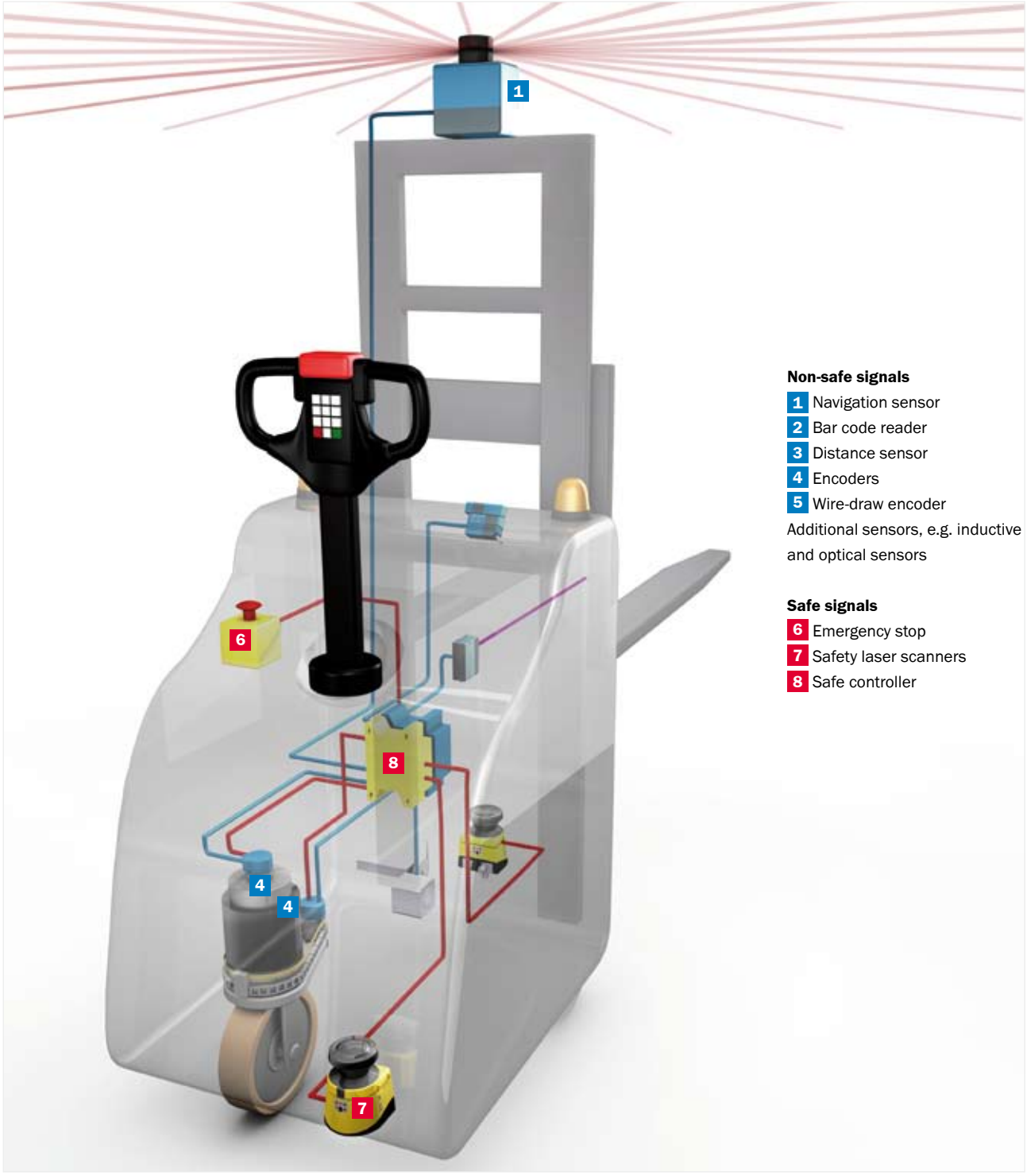
Control components combine the various sensors described on the previous pages to form a single solution:

- The **non-safe 'standard' controller** receives the navigation and direct distance data from a variety of possible scanner solutions with contour measurement, and thus precisely determines the correct route. The positioning of the fork takes place with continuously measuring wire-draw encoders or, optionally, stepwise with inductive sensors. Identification of the load is reported to the on-board controller by a code reader.

- The safety of the AGV is ensured by **compact safety controllers** and the sensors connected to them:
  1. collision prevention for humans and machines via a laser scanner in each direction of movement.
  2. data from encoders is used for adjusting the permissible speed on the basis of height-dependent values, and the steering angle is also evaluated here.

- The two controllers are connected to one another via an interface. Various fieldbus systems based on e.g. CANopen, AS-i, or PROFIBUS are possible.

- **I/O-Link** offers expanded functions regarding the sensors' diagnostic and parametrization capabilities, and thus more data on the vehicle and its load.



Non-safe signals

1 Navigation sensor
2 Bar code reader
3 Distance sensor
4 Encoders
5 Wire-draw encoder
Additional sensors, e.g. inductive and optical sensors

Safe signals

6 Emergency stop
7 Safety laser scanners
8 Safe controller

Forklift trucks.

Positioning, monitoring, protection, identification

Forklift trucks are one of the most important transport vehicles for goods of all types at almost all companies. Although most forklift trucks used today have a driver in the seat, automated functions are increasingly found in these vehicles. This is due to accidents that have led to injuries and material damage – and thus to productivity losses – as well as optimization of the production process.

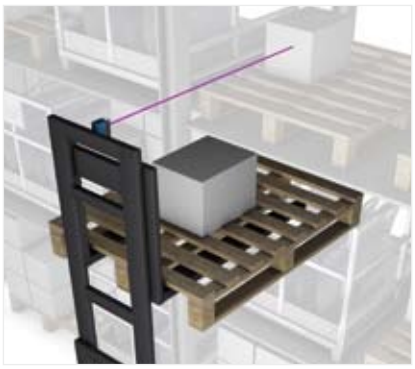
Sensors from SICK offer leading solutions for forklift trucks.

- **Human protection and collision prevention with safety laser scanners**
- **Tracking of the path with encoders**
- **Precise positioning with proximity sensors and photoelectric switches**
- **Checking storage bays with laser scanners and distance sensors**
- **Identification via bar code scanners and radio frequency identification**
- **Safe controllers and networks**

Forklift trucks
Focus 1: Measuring fork height
Focus 2: Measuring distances and determining positions

Measuring fork height and checking storage bay availability
Goods must still be safely removed or stored at heights at which the driver can no longer see from his or her position. A BKS09 wire-draw encoder continuously measures the fork height. Storage bay availibility is checked using an S100 or LMS100 laser scanner. Unlike single-beam sensors, they also reliably detect objects that are not flat and closed, such as grid boxes. In 'double' storage bays, the S100 can reliably detect goods in the front and in the back storage area by means of two differently programmed measurement fields. The driver receives support on a display in the forklift truck in the form of information on the fork height and whether the storage bay is free or occupied.

Correct load pick-up
Distance measurement between the spine of the fork and the load to be picked up, using a DT50 distance sensor, supports the driver during load pick-up in areas where he or she cannot see or when, during load pick-up, the fork cannot be inserted all the way into the pallet. A distance sensor mounted on the spine of the fork continuously determines the distance to the load, which the driver sees on the forklift's display.



Fork positioning
IME18 inductive proximity sensors provide the hoisting height or end position of the fork stepwise: lower fork position (load up-take from the floor), fork lifted in drive position, fork in position for load pick-up, transfer or in the shelving, and the upper maximum permissible fork hoisting height. The driver sees the heights on the display.

Forklift trucks
Focus 3: Protection and collision prevention
Focus 4: Identifying goods and vehicles

▲

Door control via RFID

While driving a forklift truck from one storage area to another, doors and gates that open fully automatically on approach save time. The driver must no longer step off the vehicle or look for keys. An RFID reader (Radio Frequency Interrogator) is connected to the gate control system and only opens for authorized vehicles that are carrying the appropriately coded transponder.

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Rear space monitoring

An S100 laser scanner, mounted on top of the electrically powered forklift truck, protects the space behind the vehicle. Persons are thus detected during reverse movement or maneuvering (the red protective field is interrupted), while the driver is concentrating on picking up the load, and the reverse movement of the forklift truck is stopped and a warning signal triggered.

Goods identification via RFID

The forklift truck drives past an identification station that is equipped with an RFID system (Radio Frequency Identification). The goods, their packaging and the pallet are provided with so-called tags (transponders), in which, for example, the pallet number, type of packaging, type of goods, number of packing units or other special features of the goods are stored. The data are read by the RFI341 read/write device, without contact and without any direct view, via antennae and transferred to a computer.

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Identification of goods via bar codes

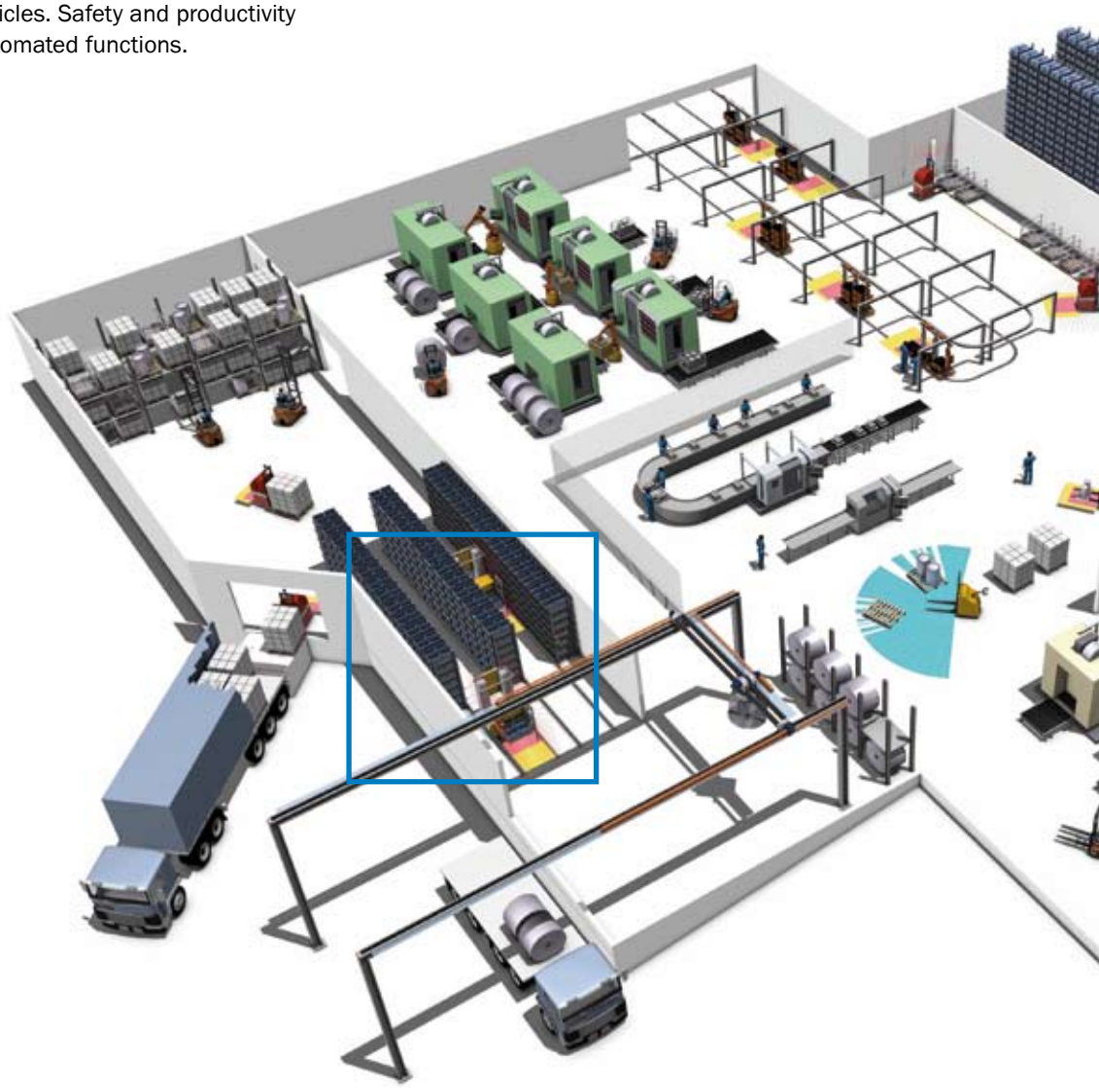
A CLV650 bar code reader identifies the goods on the pallet. The forklift driver receives information (for example the pallet number, type of goods, and units) on a display so that he or she can check that the order has been correctly filled.

▶

Narrow aisle vehicles.

Protection, positioning, controlling, monitoring

In high-bay warehouses, pallets are generally stored or retrieved using industrial trucks. Small parts are, on the other hand, removed manually or by order pickers. For cost-saving purposes, the aisles between the shelving are kept as narrow as possible. Aisles are described as narrow aisles when the necessary safety distance between the industrial truck and the shelving is less than 0.50 m (18 in). These narrow aisles pose particular risks when pedestrians meet narrow aisle vehicles. Safety and productivity are the main reasons for automated functions.



Sensors from SICK offer technically leading solutions for all types of narrow aisle vehicles with or without a driver.

- **Human protection and collision prevention with safety laser scanners**
- **Checking projections with laser scanners**
- **Proximity sensors and photoelectric switches**
- **Safe controllers and networks**

Narrow aisle vehicles
Focus 1: Measuring fork height
Focus 2: Measuring distance and determining positions

Positioning the fork and load

Using a BKS09 wire-draw encoder enables the narrow aisle vehicle to accurately determine the position of the fork. The highly flexible steel wire is fixed to the shoulder of the fork. The driver sees the position of the fork on a display. This provides support when the height of the fork cannot be seen (man-below system).

The WTB12-3 photoelectric proximity sensor, mounted between the fork prongs and aligned diagonally, signals when the load has been fully picked up. The driver receives this information on a display.

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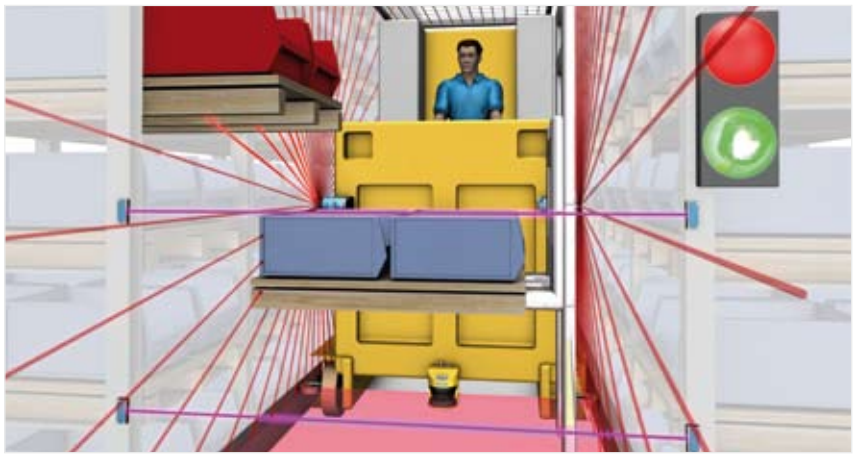
Narrow aisle vehicles
Focus 3:
Protection and collision prevention

Monitoring access

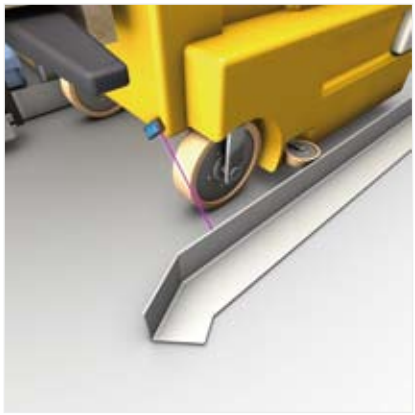
Two WS/WE27-3 through-beam photoelectric sensors at the entrance of the narrow aisle monitor access and activate an optical or acoustic warning signal when required.



Safety in narrow aisles

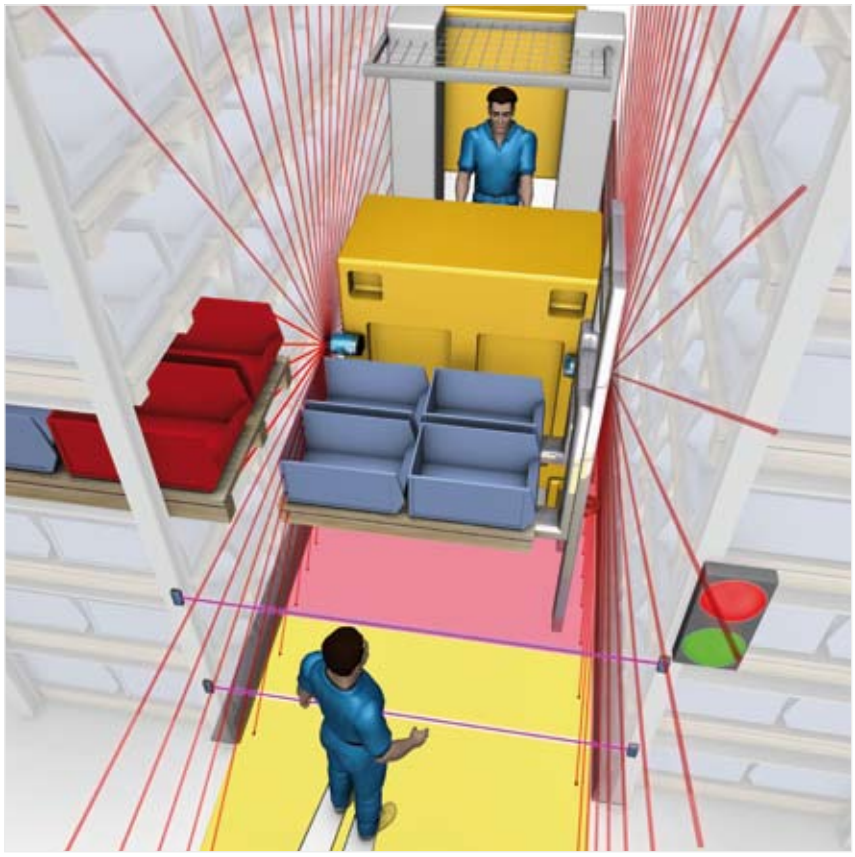
The order-picking storage and retrieval devices are guided by rails in the narrow aisles. WTB27-3 photoelectric proximity sensors detect the rails in the aisles on both sides of the vehicles: steering is switched off and the speed can be increased. An S3000 safety laser scanner is then activated and protects the area in front of the vehicle. Protective (red) and warning (yellow) fields are dynamically adapted according to the speed. The sensors are connected via a compact safety controller and stop the vehicle's movement when necessary.

While reversing, safety is ensured by automatically switching from the front S3000 safety laser scanner to a second S3000, with its protective and warning fields, mounted on the back of the narrow aisle vehicle. The protective and warning fields are shortened when the vehicle approaches a wall. Persons are then still reliably detected and the vehicle stopped.



Checking for projections

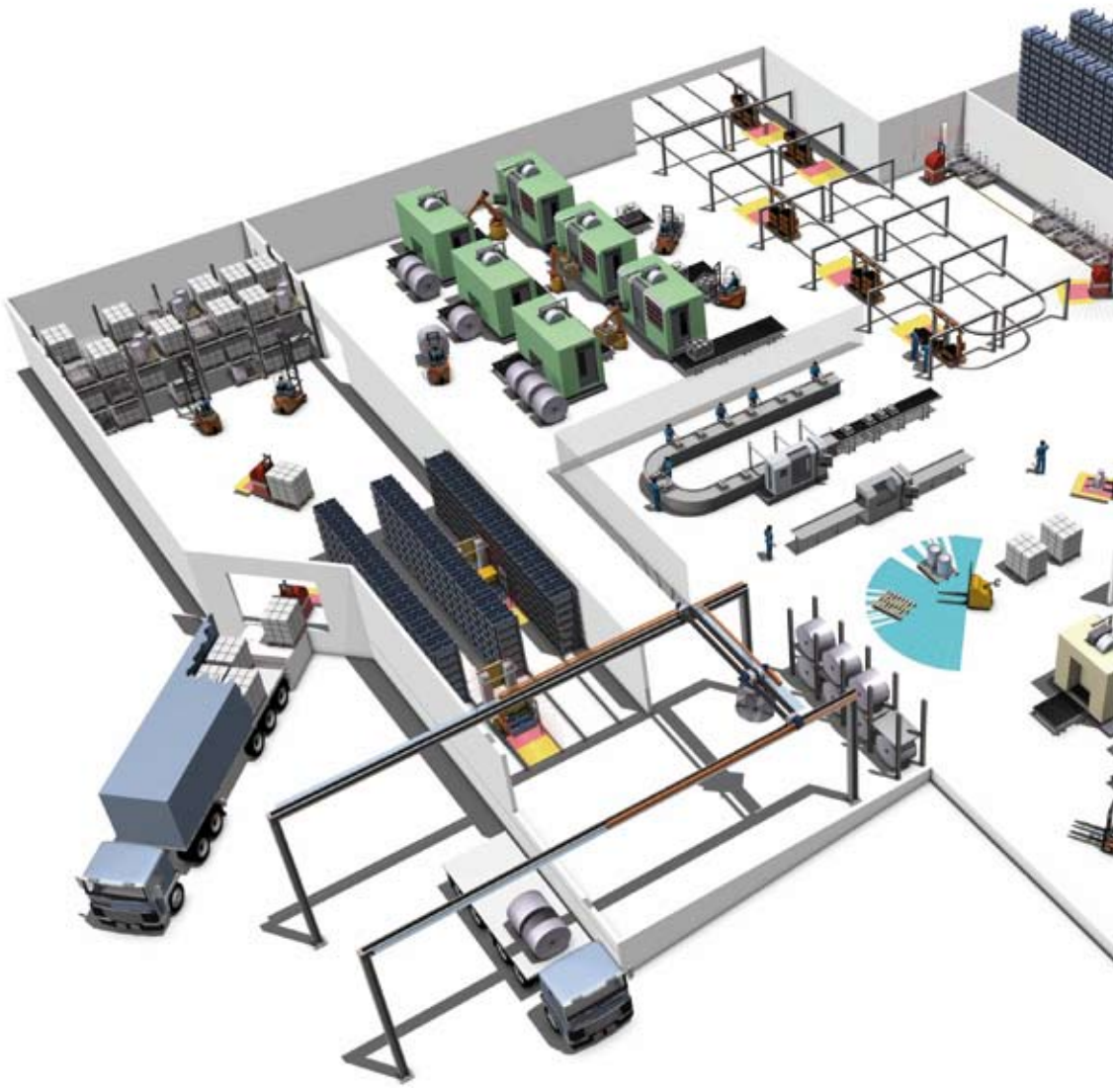
S100 units or LD-PDS units on both sides of the vehicle check whether pallets or individual boxes are projecting from the front of the shelving. When a projection is detected, the vehicle is automatically stopped early enough to prevent damage to the vehicle or goods.



Transfer vehicles.

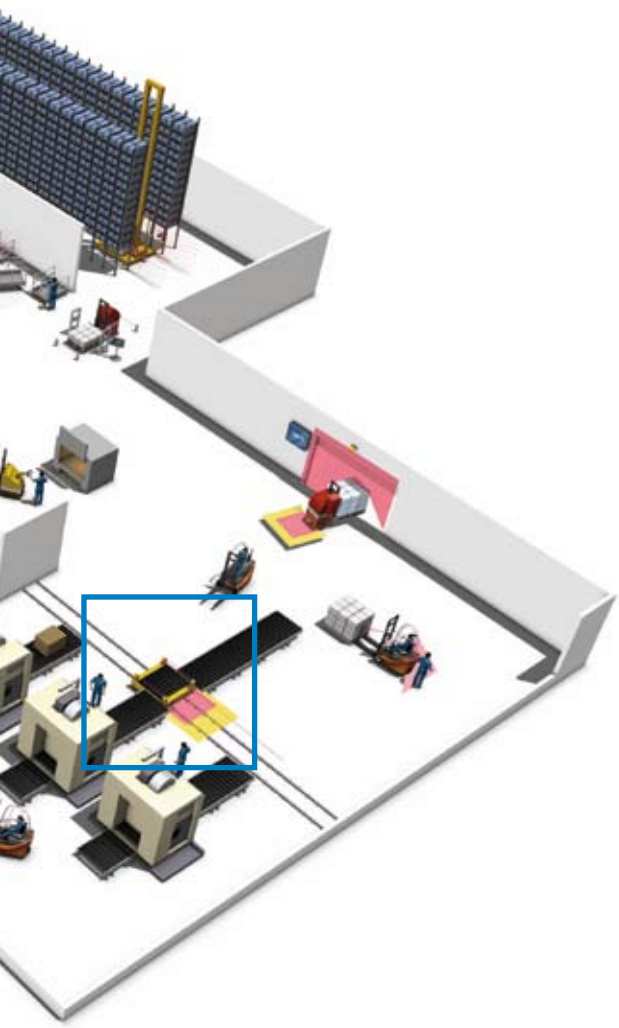
Protection, positioning, controlling, monitoring

Long distances can be rapidly and cost-effectively covered with **transfer vehicles,** even with heavy loads.
Despite transfer vehicles' simple level of automation and movement, this type of vehicle must nevertheless safely and reliably operate within its working environment. As transfer vehicles have the most varied of designs, the safety and automation solutions also vary greatly – to correspond to the costs and complexity of the particular vehicle.



Sensors from SICK offer technically leading solutions for all types of transfer vehicles.

- **Determining distances and positions with laser measurement systems**
- **Fine positioning with optoelectronic sensors**
- **Human protection and collision prevention with safety laser scanners**
- **Monitoring and positioning with proximity sensors and photoelectric switches**
- **Safe controllers and networks**



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Protection and collision prevention

FOCUS 2 33

Measuring distances and determining positions

Transfer vehicles
Focus 1:
Protection and collision prevention

Protecting obstacles in the vehicles' path
The transfer vehicle is protected in both directions of transport with S300 safety laser scanners. The sizes of the protection (red) and warning (yellow) fields are dynamically adapted to the approach speed. When the direction of movement changes, the protection and warning fields are sensors to the particular scanner in the direction to be protected. The DME5000 distance measurement device handles positioning of the transfer vehicles. Through-beam photoelectric sensors inspect correct transfer of goods: the vehicle can only be driven away when there are no obstacles. This prevents damage to both goods and equipment.

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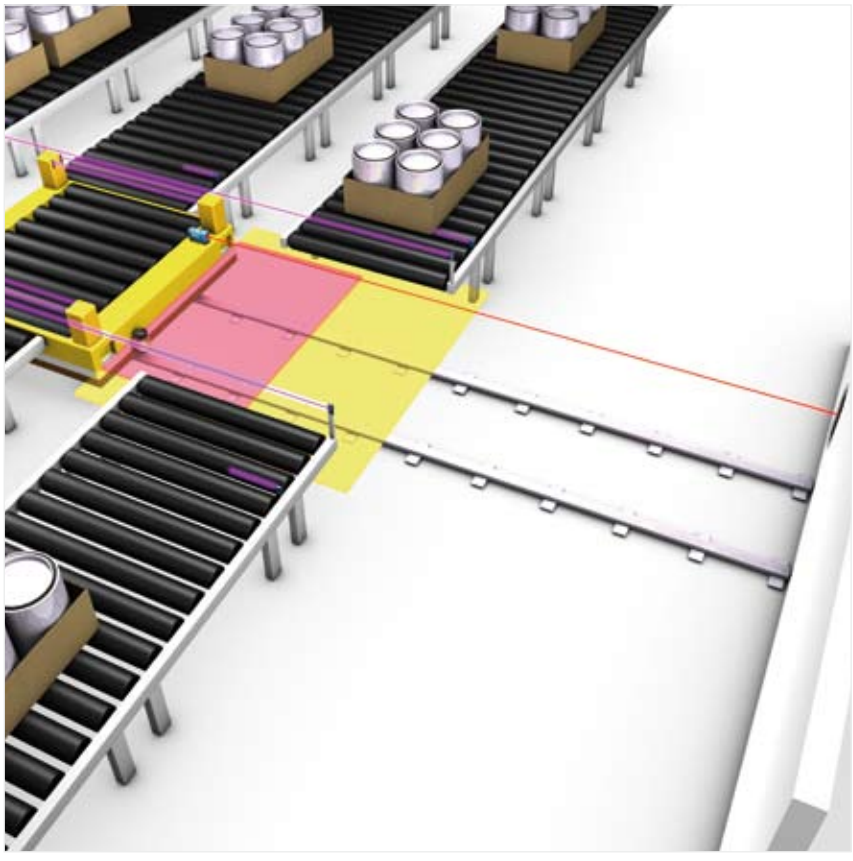
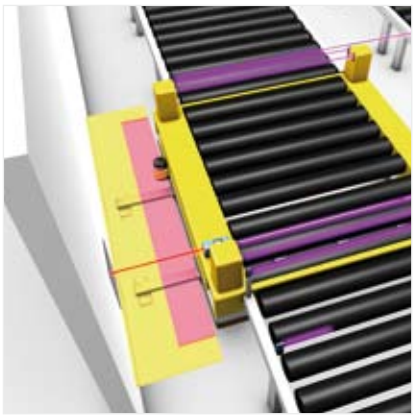
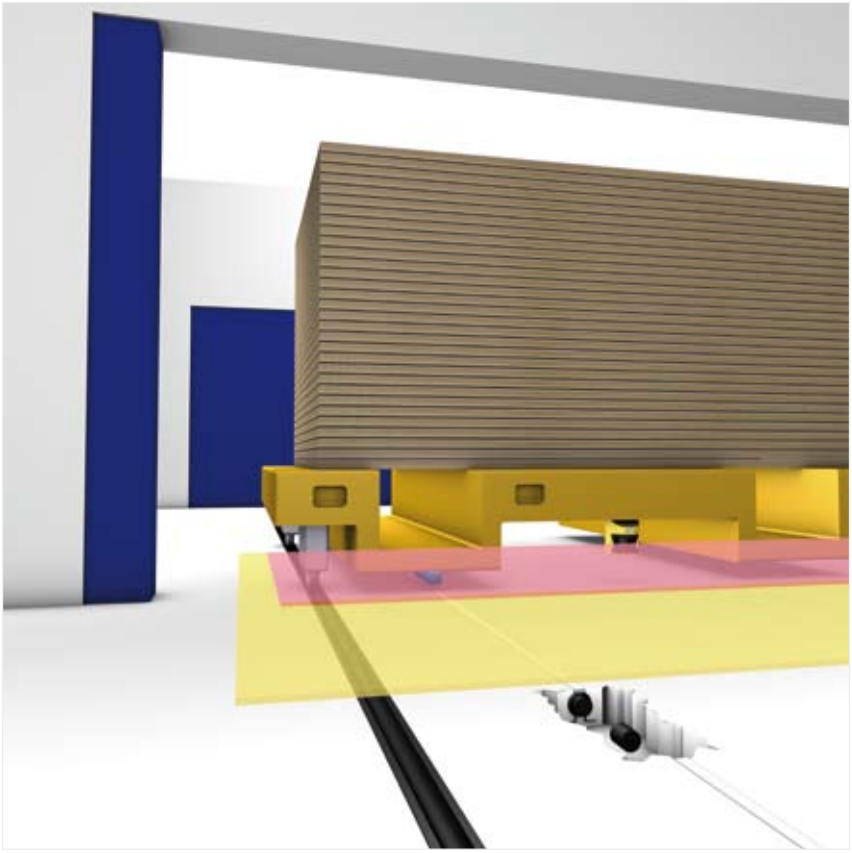




▲

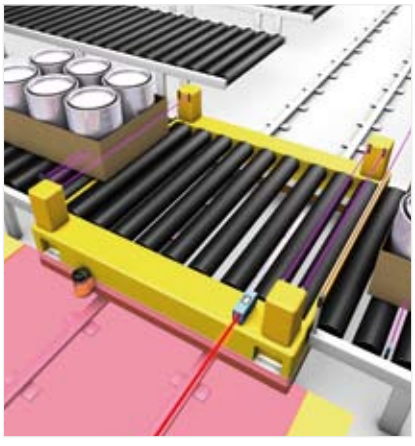
Safe approach to final position
The transfer vehicle's last transfer or storage station may be located directly in front of a wall. In order to permit the vehicle to accurately approach this station without being stopped by the laser scanner (because it detects the wall as an obstacle), the protective and warning fields of the S300 safety laser scanner are incrementally reduced in size according to the extent of approach. Persons who are present are still safely detected.

Transfer vehicles
Focus 2:
Measuring distances and determining positions



Magnetic path measurement and absolute position determination
The path of this heavy-load transport vehicle passes through several neighboring halls with fire protection gates. Thus an optoelectronic distance sensor would not be suitable for position determination. Instead, position detection takes place without contact or friction with the Pomux KH53 magnetic positioning system. For this purpose, reference marks are embedded in the floor (rails with permanent magnets). The distance between the magnets represents coding of the measurement path. The reading head is located on the transfer vehicle and thus passes over these reference marks.
S3000 safety laser scanners protect the transfer vehicle.

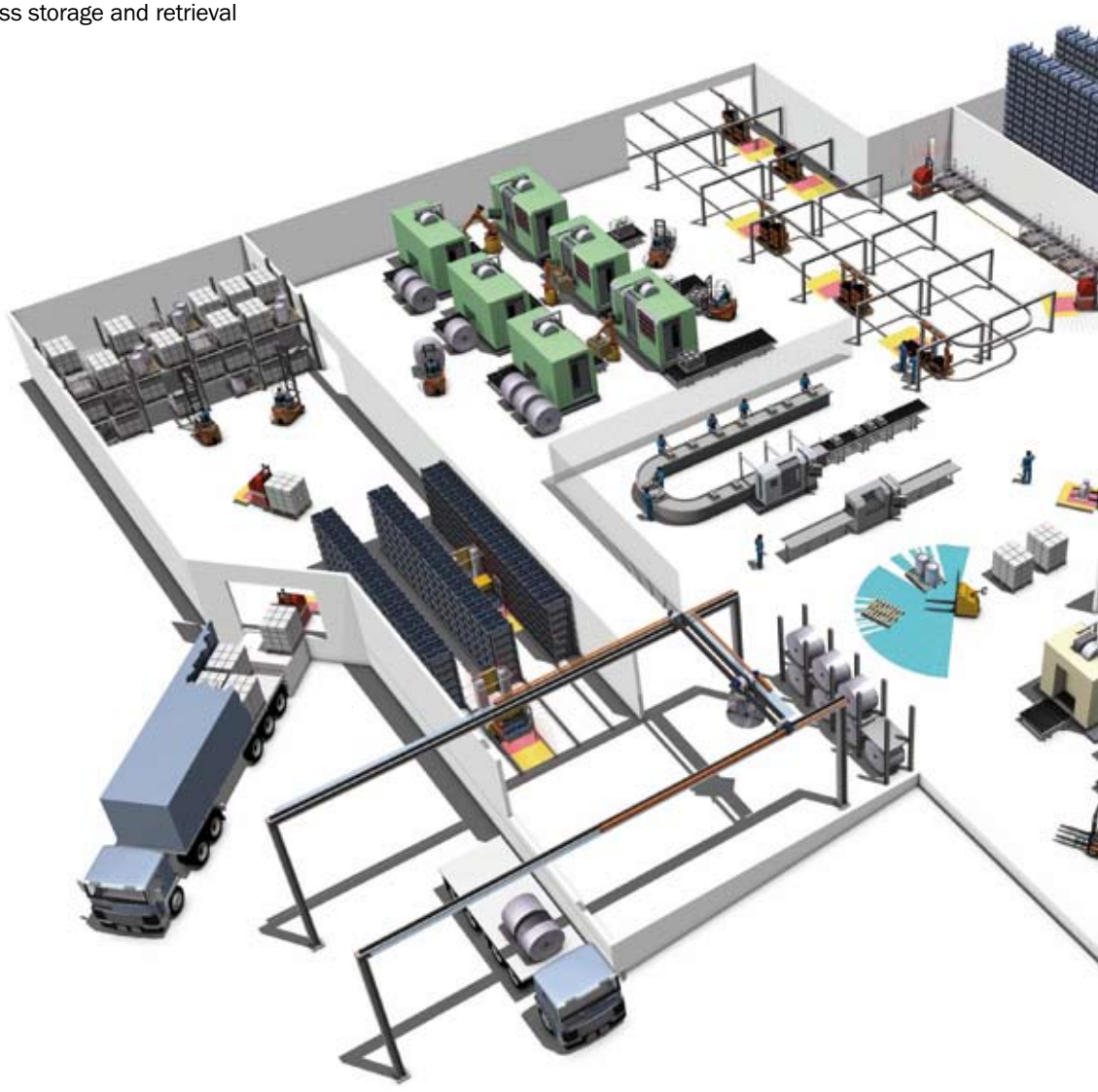
Vehicle positioning and load pick-up
The transfer vehicle accepts goods at a transfer station and passes them on at another station. WTR1 photoelectric proximity sensors between the rollers control the acceptance or transfer of the goods. These sensors are designed for so-called 'accumulation roller conveyors.' Their inner logic ensures a controlled flow of goods: they start or stop further movement of the goods.
The following are determined during acceptance transfer using WL27-3 photoelectric sensors:
1. aligned diagonally over the loading surface, it determines whether the loading surface is avaiable,
2. mounted at the start and the end of the roller conveyor, and two on the transfer vehicle, the sensors determine whether the gap between the station and the vehicle is open and there are no obstacles that could cause damage to goods or equipment,
3. mounted on the right and left side of the transfer vehicle, they determine whether the goods have been placed on the vehicle without overhang.



Automated storage and retrieval systems.

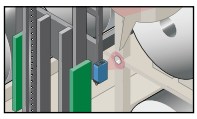
Protection, positioning, controlling, monitoring

Automated storage and retrieval systems (ASRS) are rail-guided, single-lane vehicles for the storage and retrieval of goods in high-bay warehouses. One distinguishes between ASRS that can be used throughout the entire warehouse via a points system (curve-negotiating ASRS for lower activities), and those that are only operated in a single aisle (aisle-bound ASRS for high activities).
Sensors are an important component of the automation system for controlling driverless storage and retrieval devices.



Sensors from SICK offer technically leading solutions for all types of automated storage and retrieval systems.

- **Distance and position determination with laser measurement systems**
- **Fine positioning with optoelectronic sensors**
- **Checking overhang with laser scanners**
- **Cable-free transfer of information with data transmission systems**
- **Access protection with safety light curtains and safety switches**
- **Human protection and collision prevention with safety laser scanners**

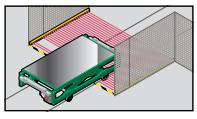


FOCUS 1 36

Positioning and checking storage bays

FOCUS 2 36

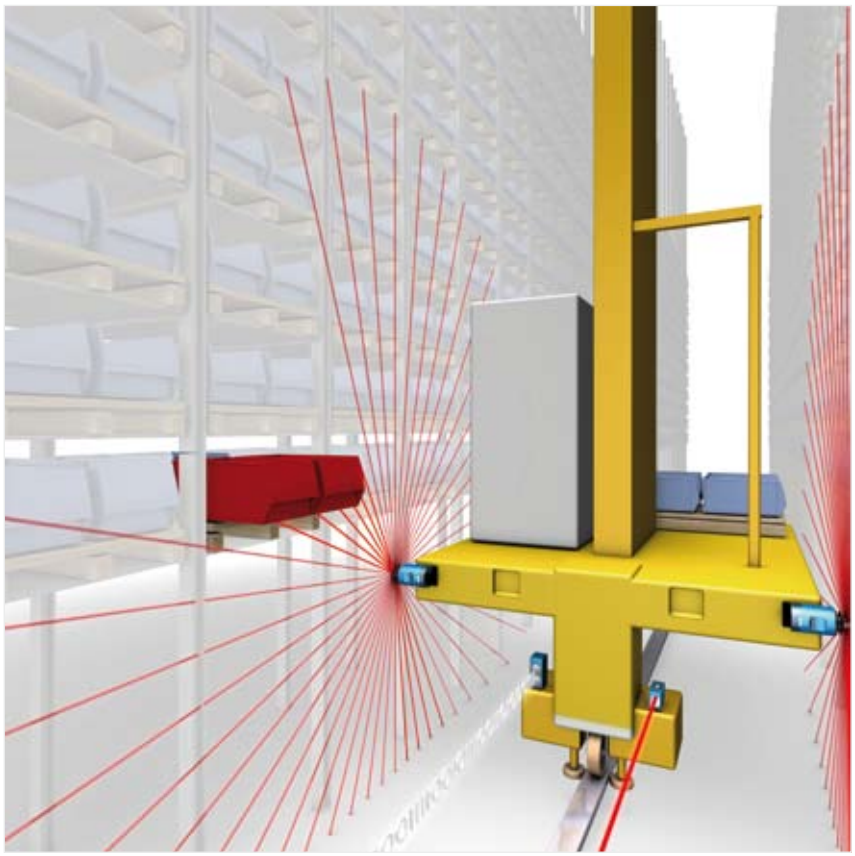
Wireless data transmission

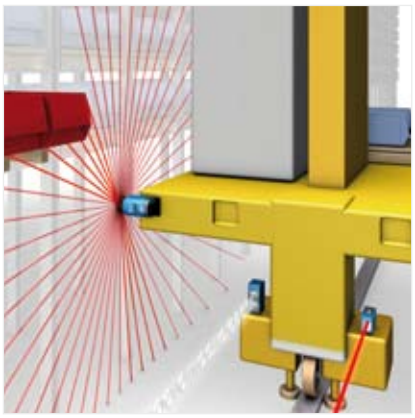


FOCUS 3 37

Protection and collision prevention

Automated storage and retrieval systems
Focus 1: Positioning and checking storage bays
Focus 2: Wireless data transmission



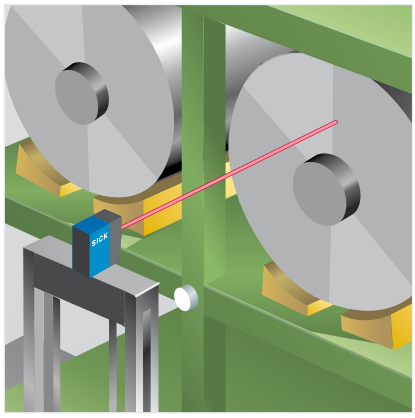


Positioning using laser and optical data transmission

The positioning of the storage and retrieval device in the x-axis is handled by the DME5000 distance measurement device. Fine positioning in the x- and y-axes is carried out with a DMP3 position finder. The ISD data transmission photoelectric switch handles the exchange of data between the SRD and the plant computer.

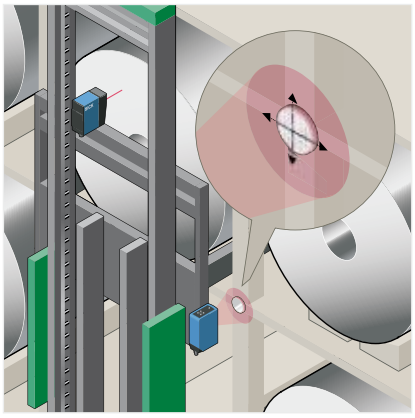
Fine positioning

The DMP2 position finder handles fine positioning of the ASRS. It allows the ASRS to drive until its receiver array is centrally illuminated by light reflected from a reflector.



Storage bay availbility

A DS30 or DS60 distance sensor signals that a storage bay is available. It is immune to reflections and is characterized by its particularly long range. It is used for checking occupancy where large-area goods (boxes, crates, sacks or trading units) are stored on pallets, etc. The S100 laser scanner is used in the case of the storage of grid boxes (see Page 24). It scans the entire width of the storage bay with its fan-shaped beam and signals whether the bay is empty.

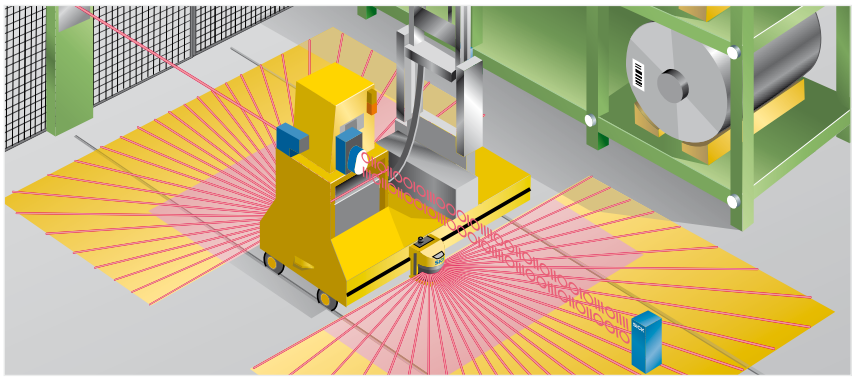


Automated storage and retrieval systems
Focus 3:
Protection and collision prevention

▲

Safe door locks

The i1001 safety switch with a safety key adapter locks the door to the work cell. The key must be turned and removed to open the door. This triggers a stop command for hazardous movements. The magnetic retention of the safety switch is maintained until all hazardous movements have stopped safely. Only then can the door be opened. In order to be able to carry out maintenance work, for example, the ASRS can operate in enabled mode, whereby the key must be inserted on the inside to ensure human protection. The operating area is reset to normal operation when the door has been locked again, the key has been returned to the adapter and the magnetic retention is activated.



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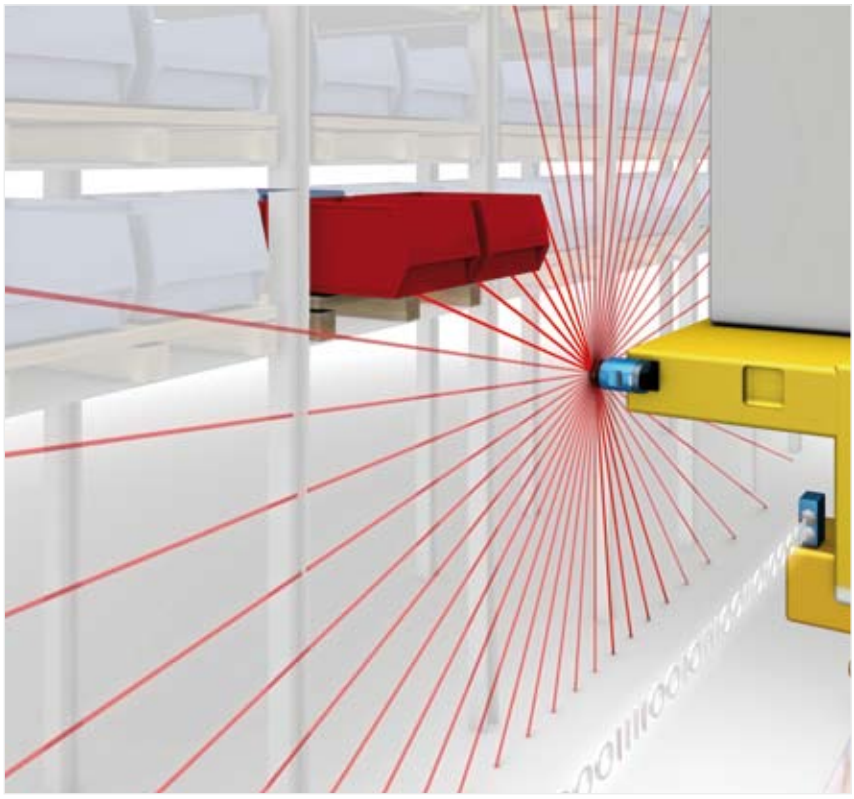
Accident prevention on a heavy-load ASRS

The ASRS is protected in both directions of movement with S3000 safety laser scanners. The sizes of the protective (red) and warning (yellow) fields are dynamically adapted to the speed of the ASRS. The protective and warning fields are switched when the direction of movement changes.

Checking projections

The LD-PDS laser scanner monitors objects projecting into the shelving aisle. The monitored area is tight on the shelving due to the construction of the transmission/receiver head.

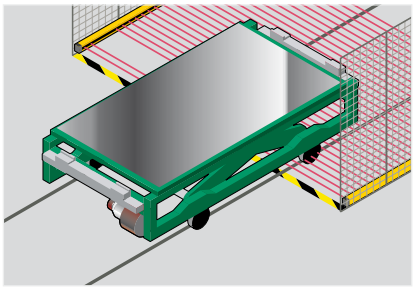
▼



Access protection

Locks to the warehouse (transfer stations) are protected with a C4000 Palletizer Advanced safety light curtain in such a way that the transport vehicles can drive in or out unhindered, but access by a person leads to a stop of the plant. Within its protective field, the light curtain detects the vehicle's two disc wheels, learns their shape autonomously and monitors them. Deviations from this shape lead to a stop command. The C4000 Palletizer Advanced requires no supplementary muting sensors.

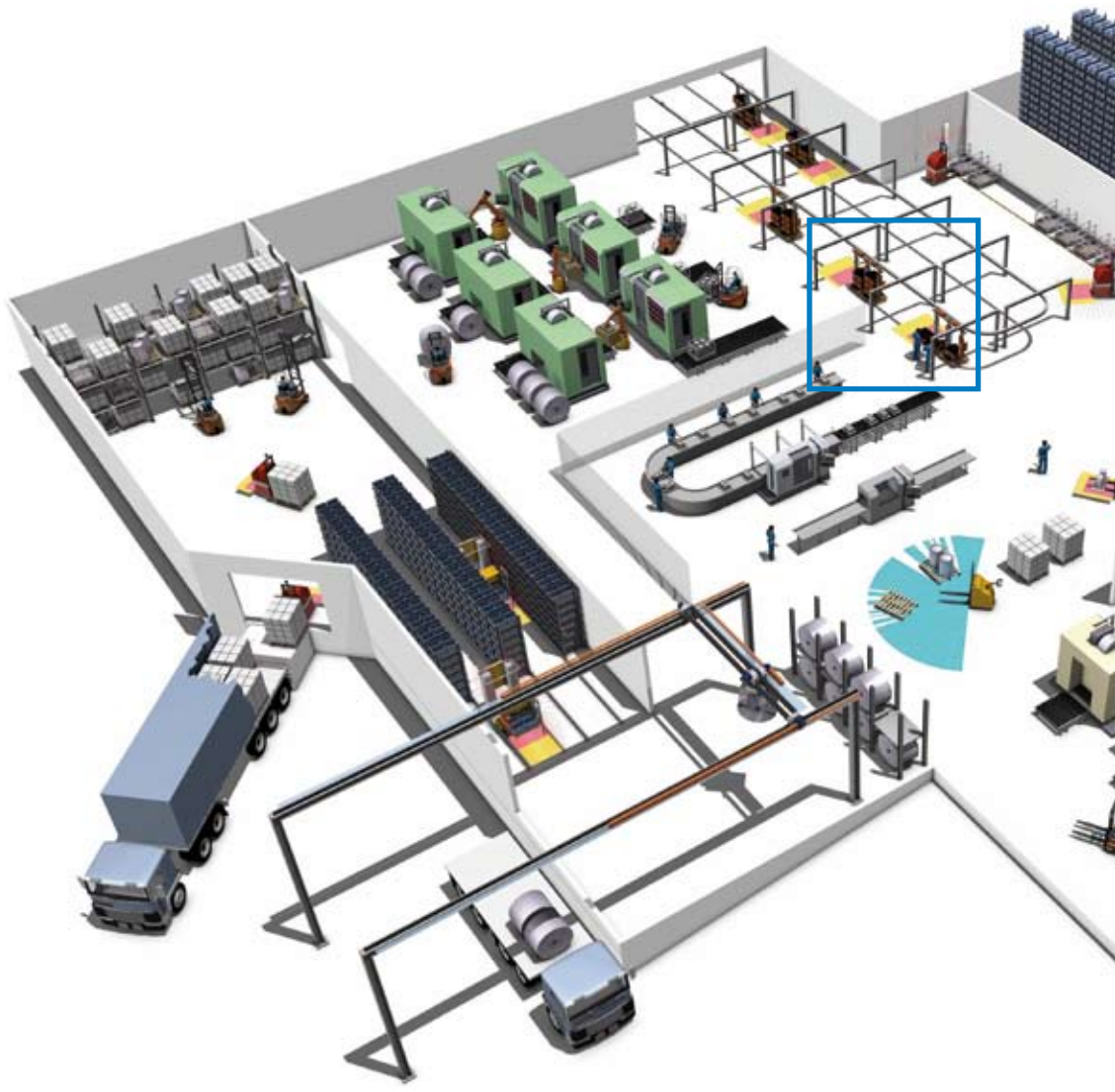
▼



Electric Telpher conveyors / Monorail.

Protection, positioning, controlling, monitoring

Electric Telpher conveyors (ETC) are monorail-bound means of transport with individually driven vehicles. The vehicles can move autonomously on the rail system. Junctions are achieved using points. The vehicles are supplied with power via contact conductors on the carrier rail. Sensors for stop functions and human protection, or to prevent vehicles approaching too closely to the vehicle in front, ensure a smooth, efficient flow of goods.



Sensors from SICK offer technically leading solutions for all types of electric Telpher conveyors.

- **Human protection and collision prevention with safety laser scanners**
- **Access protection with safety light curtains, safety photoelectric switches and safety switches**
- **Checking distance and positioning with laser scanners**
- **Proximity sensors and photoelectric switches**
- **Safe controllers and networks**

FOCUS 1 40

Monitoring distances, determining positions

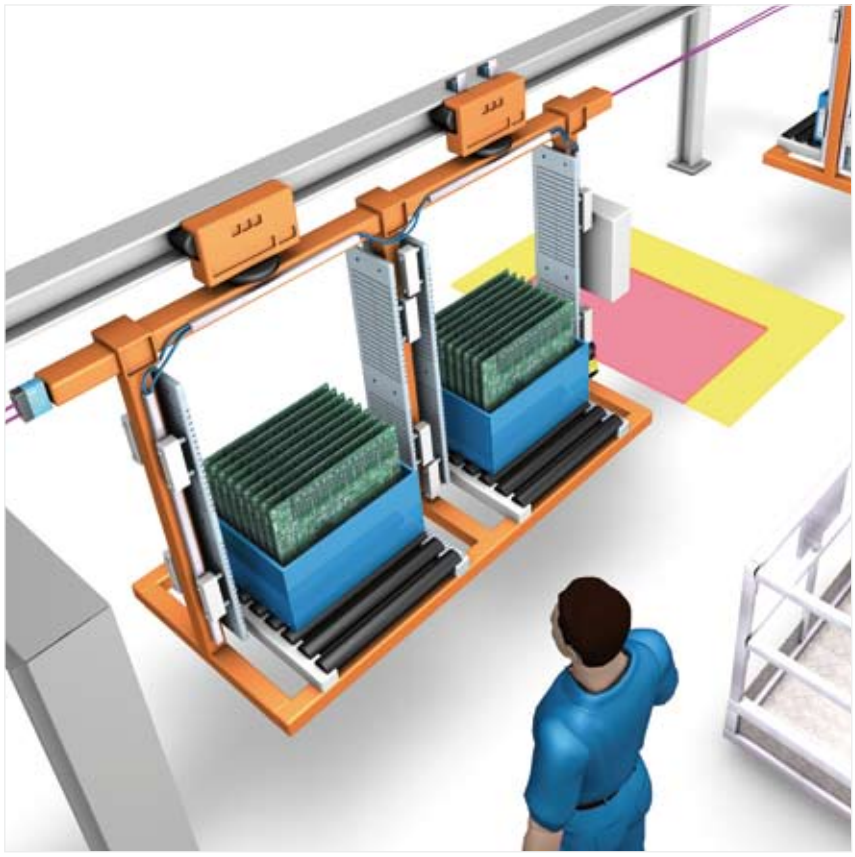
FOCUS 2 41

Protection and collision prevention

Electric Telpher conveyors
Focus 1:
Monitoring distances, determining positions

Monitoring distance and collision prevention ▸
DS30 or DS50 distance sensors ensure the correct separation between the suspended vehicles: collision prevention. The devices have two switching points that can be assigned particular distances. The suspension vehicle switches to low speed when Switching Point 1 is reached, and is stopped at Switching Point 2.

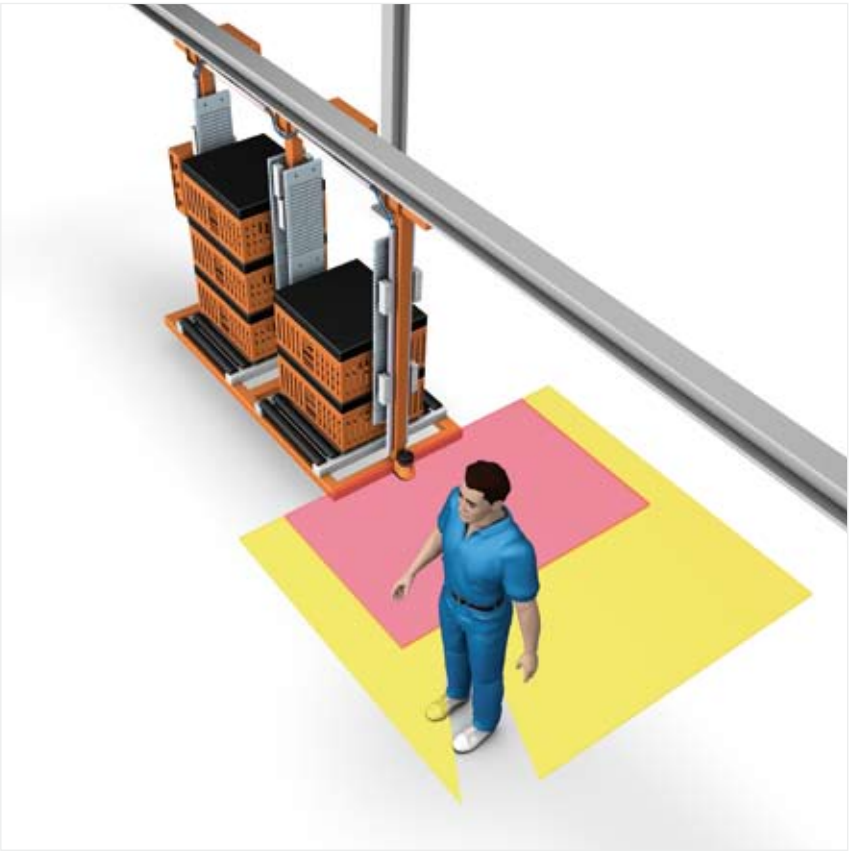
Positioning vehicles ▸
IQ40 inductive proximity sensors mounted above the rail on this electric Telpher conveyor serve to ensure correct positioning of the suspended vehicles at the loading and unloading stations.
The OLM100 optical linear measurement sensor provides a precise and reproducible positioning of Telpher conveyors. A barcode tape along the conveyor's path is used as a reference to determine the desired destination of each suspended vehicle.

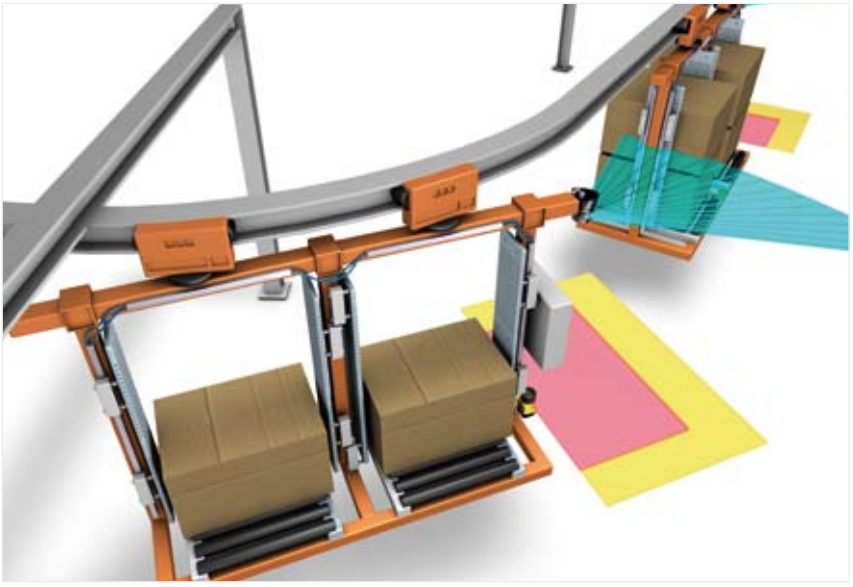


Electric Telpher conveyors
Focus 2:
Protection and collision prevention

Accident prevention ▸

The S300 safety laser scanner protects persons who cross the path of the Telpher line. It also determines the distance between the suspended vehicles in order to prevent collisions. Its scanning angle of 270° means that even curves of 180° pose no problem. If a person or object is in the hazardous area, the S300 ensures that the Telpher conveyor reduces speed and, if necessary, stops. Separation of the vehicles is also kept reliably under control via the warning field function, and the warning and protective fields are switched according to the speed and the course of the conveyor.





◂ **Collision prevention**

An S100 laser scanner monitors distance and prevents collisions. It now replaces the widely used mechanical anti-collision units and buffers. Measurement of the distance to the suspended vehicle in front, and the flexibly adjustable approach protection, offer the possibility of accumulating the vehicles in loading or unloading zones to save space. Compared to a solution involving a distance sensor, forward-facing measurement is also possible while turning due to its 270-degree scanning angle.

SICK sensor systems
Powerful, flexible and open for all system environments.

I/O LINK – THE NEW SENSOR/ ACTUATOR INTERFACE

Passive function elements become active process participants that communicate with the control level in order to autonomously signal their states and errors. This complete, central and continuous flow of information on all functions down to the sensor level allows more efficient operation of the plant as a whole.

IO-Link

FLEXIBLE CONTROL – WITH OR WITHOUT SAFE PLC

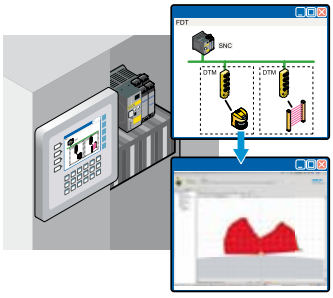
Safety controllers from SICK solve safety tasks flexibly and economically. Only as much control technology as the task requires is used. The system can easily be adapted and expanded – from simple solutions right up to more complex and interrelated safety functions. A considerable gain in efficiency!

Industrial Safety Systems.
Made by SICK.
safetyPLUS

Modular Safety Controller Flexi Soft

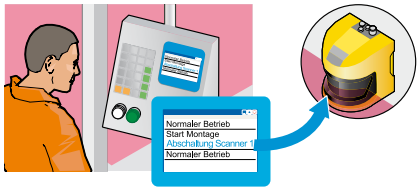
FDT/DTM TECHNOLOGY

- Standardized “Style Guide”: differing device tools can be operated with the same philosophy.
- Central data storage: the configuration data from differing device producers, the Device Type Managers (DTMs), are centrally stored in the Field Device Tool (FDT).
- Uniform access point: only the FDT constructs the connection to devices via the field level.



OPC SERVER

- Status and diagnosis direct to the Human Machine Interface (HMI) and via the company network
- Remote maintenance from anywhere, right down to the protective field
- Administration of information: configuration backup centrally stored
- Active-X allows illustration of protective fields in the OPC client via just a few mouse clicks.



Products from the Industrial Sensors, Industrial Safety Systems and Automatic Identification Divisions can be used on almost all system platforms. The potential for integration in the controller technology, based on standards valid worldwide, make every solution an investment with a secured future.

- **PROFIBUS, PROFIsafe**
- **DeviceNet, DeviceNet Safety**
- **AS-i, AS-i Safety at Work**
- **CANopen**
- **Ethernet**

I am PROFIsafe

DeviceNet Safety

Available gateways for these systems: PROFIBUS, Ethernet (TCP/IP), PROFIsafe and CANopen

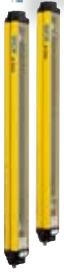
Safety network solutions, AS-i Safety at Work

Safety network solutions PROFIsafe

Safety network solutions DeviceNet Safety

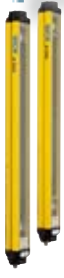
Safety laser scanner S3000

Safety light curtain C4000



Multiple light beam safety device M4000

Safety switch



Multiple light beam safety device M4000

Safety position switch

Complete system for effective accident prevention and human protection

The plus for greater safety and efficiency: safetyPLUS®. SICK has been developing safety innovations for 60 years. As a complete supplier with the world's most comprehensive safety portfolio, we set international standards in performance and functionality. This makes us the leading supplier of trailblazing products and services covering all aspects of industrial safety.

Experience and competence

safetyPLUS® forms the ideal wide-ranging safety concept from a unique range of performance, because the safety of persons and machines largely depends on the correct application of complex directives and standards. Another advantage: a comprehensive safety concept based on safetyPLUS® saves time and money.

State-of-the-art technology and system openness

We offer complete safety applications from a diverse product portfolio. Particularly important: SICK's typical openness provides smooth integration in all safety and system environments.

DeviceNet Safety

EtherNet

User-friendly and clever safety solutions

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All-embracing services

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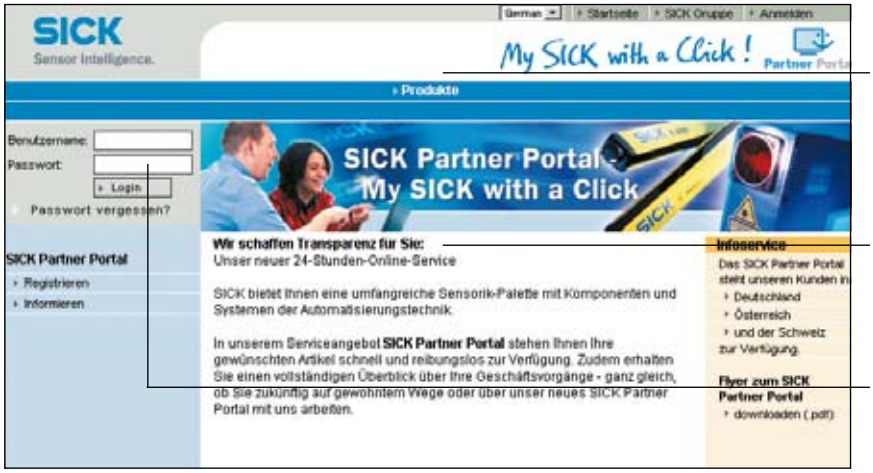

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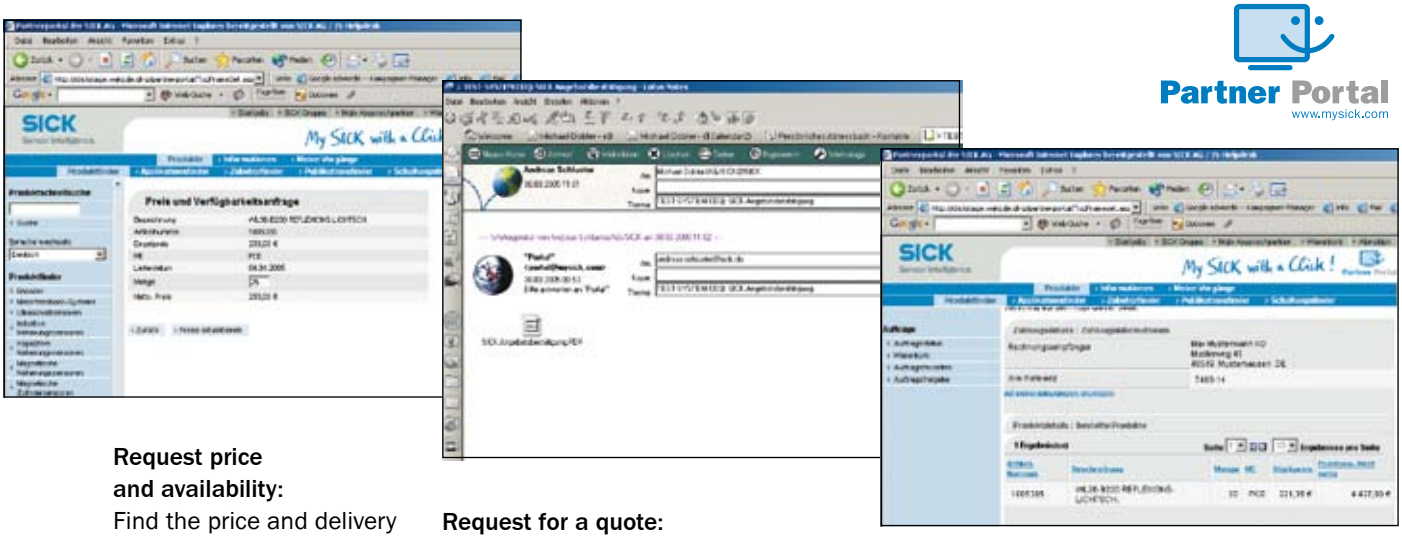

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Factory automation

With its intelligent sensors, safety systems, and automatic identification applications, SICK provides comprehensive solutions for factory automation.

- Non-contact detecting, counting, classifying, and positioning of any type of object
- Accident protection and personal safety using sensors, as well as safety software and services

Logistics automation

Sensors made by SICK form the basis for automating material flows and the optimization of sorting and warehousing processes.

- Automated identification with bar code and RFID reading devices for the purpose of sorting and target control in industrial material flow
- Detecting volume, position, and contours of objects and surroundings with laser measurement systems

Process automation

Optimized system solutions from SICK ensure efficient acquisition of environmental and process data in many industrial processes.

- Precise measurement of gases, liquids and dust concentrations for continuous monitoring of emissions and the acquisition of process data in production processes
- Gas flow measurements with maximum accuracy thanks to compact gas meters

SICK
Sensor Intelligence.