All About LiDAR Technology

A brief history of LiDAR, its advantages, and when you should use 2D or 3D LiDAR

SICK
Sensor Intelligence.

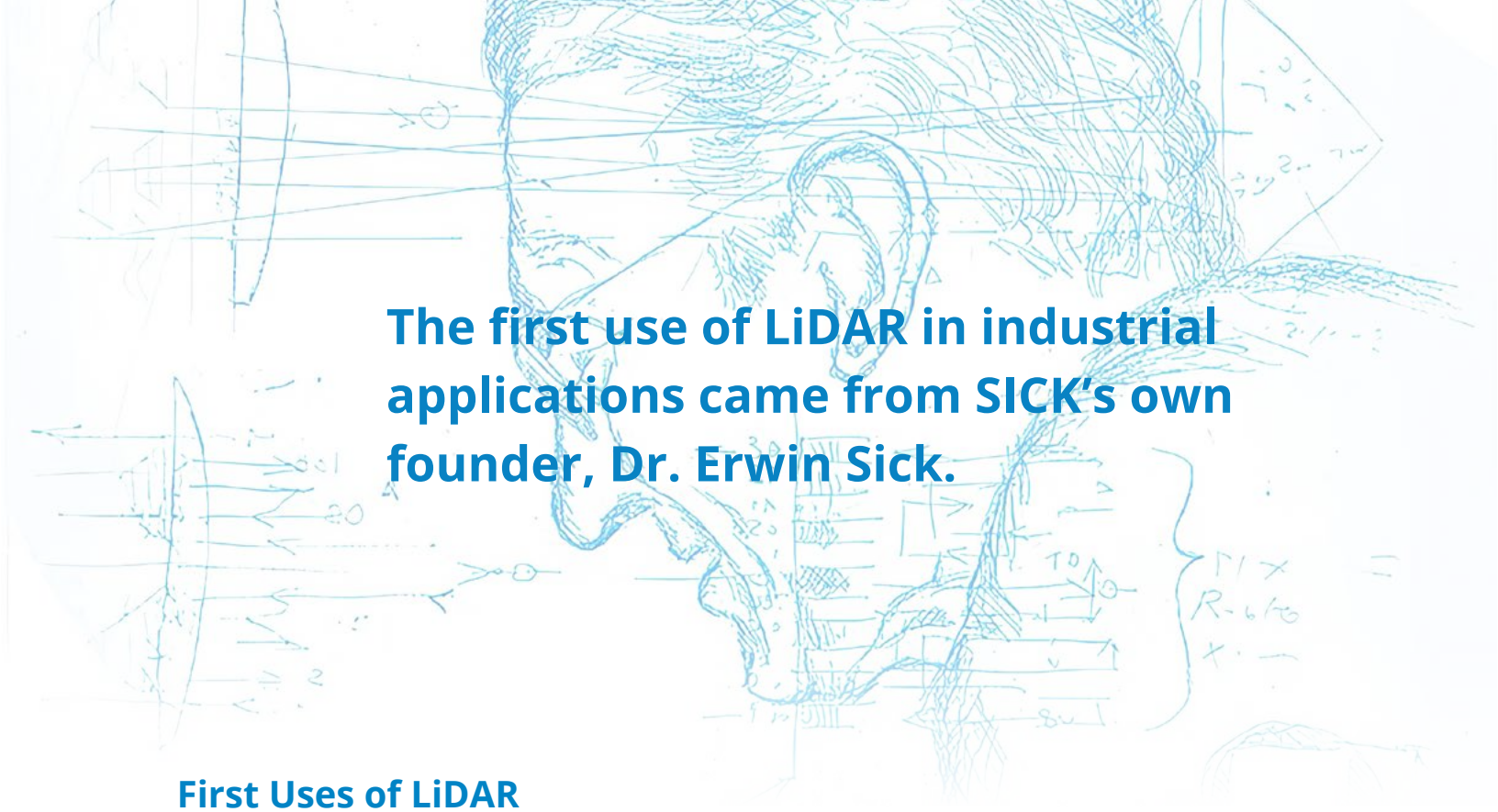
What is LiDAR technology

For decades, LiDAR technology has been used as an effective means of detection and ranging in various settings and industries. But what exactly is it and where did it come from?

LiDAR is an acronym , standing for LIght Detection And Ranging. It operates on the time of flight concept, which is a very well tested concept in industry. We know the speed of light through our atmosphere so that means we can send a pulse of light, bounce it off a target, and measure the amount of time it takes to come back. By halving the total time and multiplying by the speed of light, we know the distance to the target. This is the core of how LiDAR works.

To capture more data about the surrounding contours, you take the pulse of light and bounce it off a rotating mirror. As the laser rotates around, you get all these measurements in a fan around the LiDAR, which forms a flat plane of measurement. This plane of measurement can be stacked with subsequent planes (like a loaf of sliced bread) to create a three-dimensional map, called a point cloud.

LiDAR technology has a number of advantages, including a high degree of accuracy, high resolution, and a long-detecting distance. This makes it beneficial to use in numerous applications.



The first use of LiDAR in industrial applications came from SICK's own founder, Dr. Erwin Sick.

First Uses of LiDAR

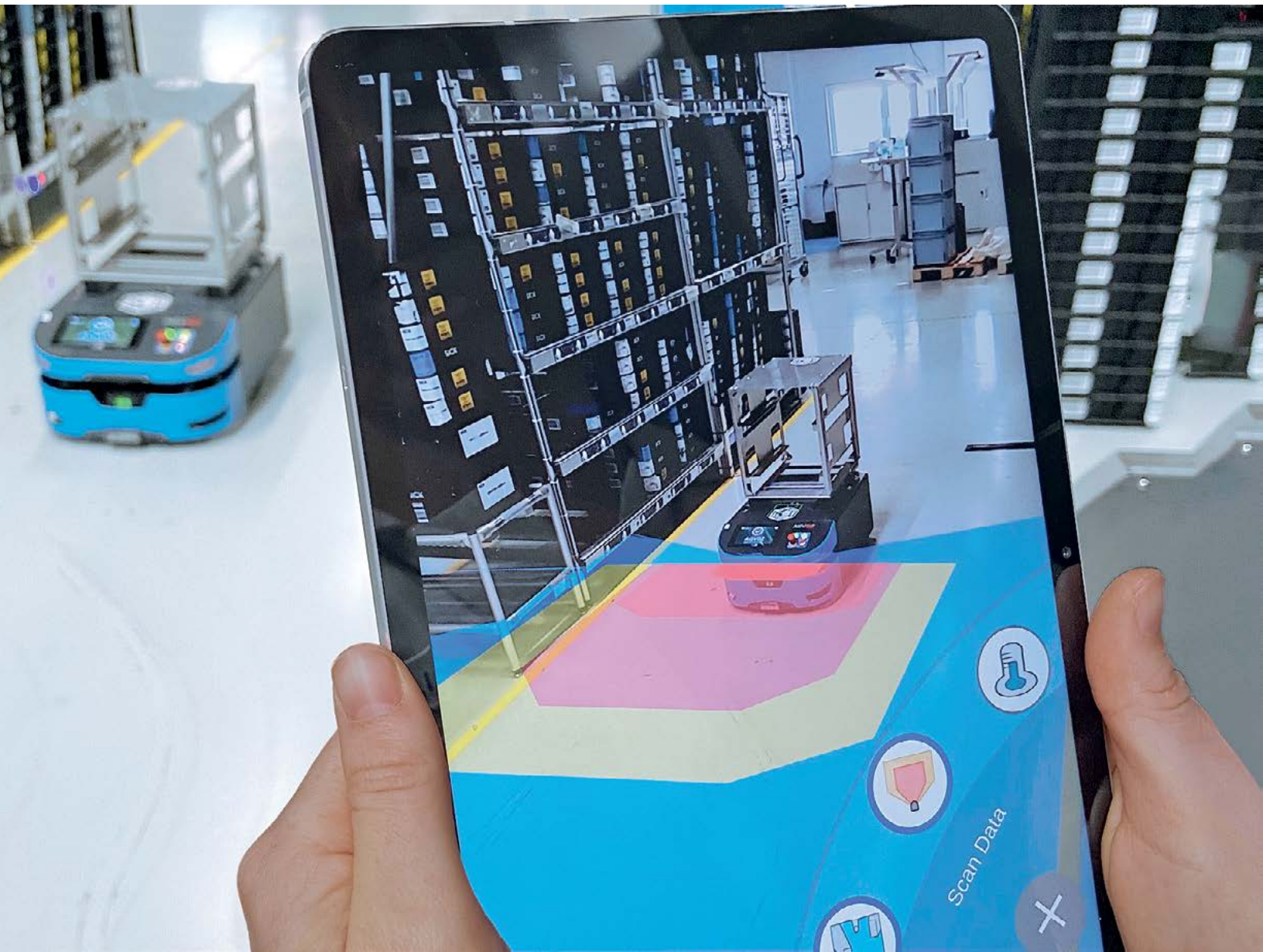
The concept of LiDAR was first discovered in 1930 to estimate the distance and density of clouds using searchlights, photographic paper, and a telescopic lens. Building upon that concept, the first prototype for LiDAR technology came shortly after the invention of the laser in 1961 from Hughes Aircraft Company. The original intention was to use it to track satellites and measure clouds and pollution in the air. The technology gained popularity when the United States' space program used the technology to map the surface of the moon during the 1971 Apollo 15 mission.

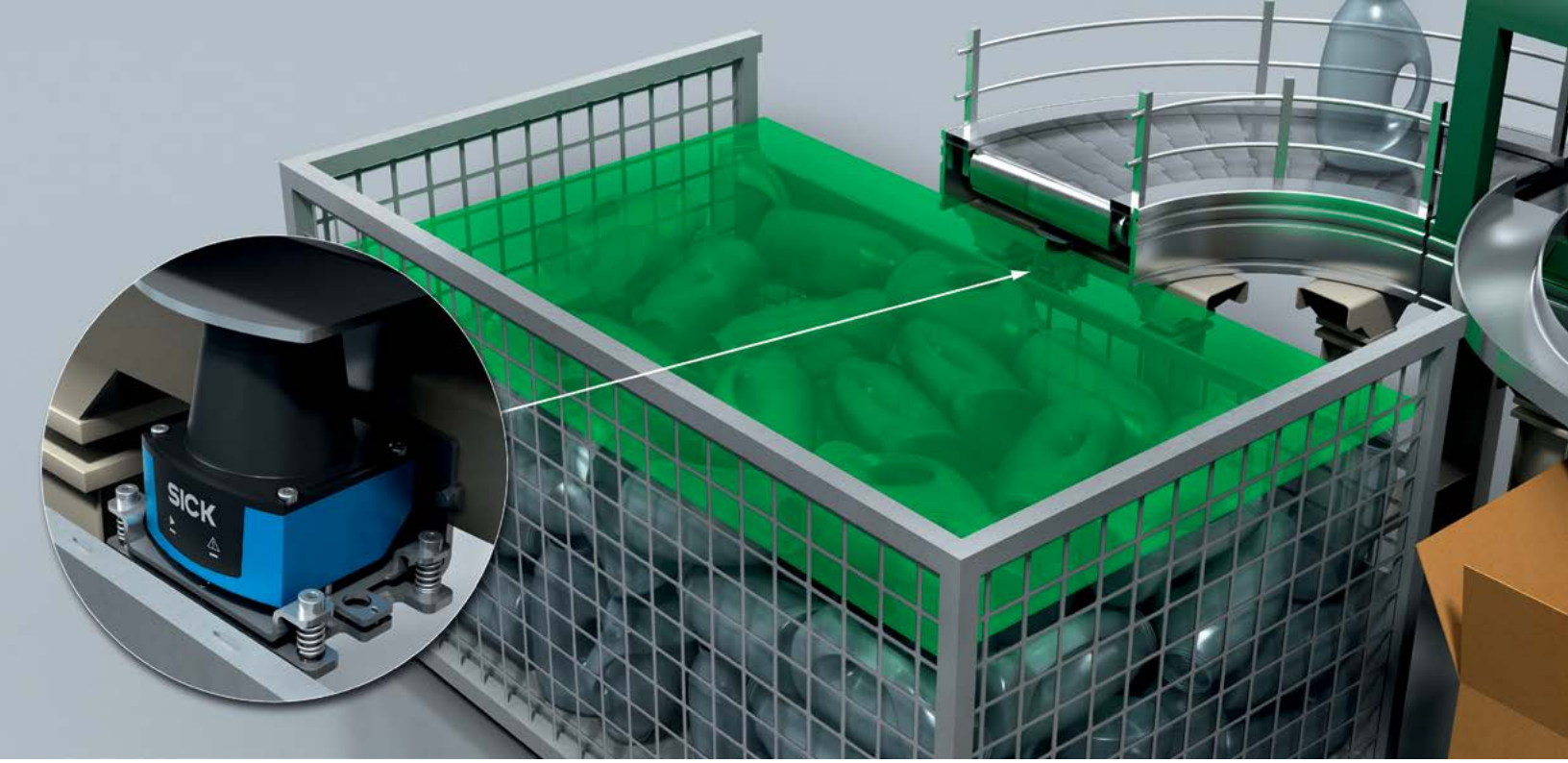
Since then, it has been used in numerous applications across several industries. NASA continues to use LiDAR for topographic mapping of Earth and to study climate change. Geologists use it to create shoreline maps or make digital elevation models. Archaeologists use it to create high-resolution maps for surveying. It's even been used in the entertainment industry to create scans of buildings and cities in 3D for production. You may even have LiDAR in your pocket. The latest iPhones have a tiny LiDAR sensor for augmented reality apps.

The first use in industrial applications came from SICK's own founder, Dr. Erwin Sick, who used light or light-based ranging to make machinery safe. His goal was to find ways to use technology to make people's jobs safer and make world a better place. Since then, the technology is used in a number of manufacturing and industrial settings, including machine safety and robotics.

Evolution of Data Processing with LiDAR Technology

In the past, much of the data was sent to a controller, which would parse through the information and use that information to take action. This was a complex process and many didn't have the resources or see the value in undertaking such a project. Over the years, though, we've added more tools and functionality to LiDAR to make the technology easier to work with and this has given the ability to obtain highly valuable data from manufacturing processes. Today, many of our LiDAR products come with built-in configuration utilities that make setup simple and intuitive.





Sensorized LiDAR

This type of LiDAR comes in the form of a compact and lightweight laser scanner. These are considered entry-level technology as they are typically used for simple area monitoring tasks. Sensorized LiDAR products function well even in high ambient light thanks to the High-Definition Distance Measurement (HDDM) technology from SICK. This reduces cost and complexity in LiDAR detection.

This type of LiDAR is used in some autonomous vehicle applications, but it is also increasingly used for basic applications on the factory floor. The LiDAR sensor creates an invisible plane of detection and can be oriented to detect the presence of objects that should not be there – perhaps an overfilled bin or a tote with objects hanging out of it. This is especially useful in a packaging and production environment.

In bin-picking and pass-through detection applications, sensorized LiDAR can also be used. This allows manufacturers to monitor the production of products and ensure quality control. If an operator reaches into the incorrect bin, the system will signal the operator. Historically, this was often done with multiple light curtains, but a single LiDAR device is much simpler to install and wire.

Multi-Layer LiDAR

Some people call it 3D LiDAR and others refer to it as multi-layer or multi-channel. This type of LiDAR provides not just a single plane like 2D LiDAR, but three more planes that provide additional detection. This can be used to detect objects at a long distance.

Additional planes add an extra layer of detection that 2D LiDAR lacks. For example, if an object isn't correctly aligned with the plane, another plane may pick it up instead. This allows more flexibility so that if things aren't perfectly aligned or 100% always in the exact same position, a multi-layer sensor can adapt to it.

A common reason to use multi-layer LiDAR is to detect pallet overhang in a packaging environment. It can be used to scan pallets to look for any objects that aren't supposed to be there. It can also ensure that the pallet is in order and that no objects are hanging out that might get caught up on equipment, puncture stretch wrap, or anything that will mess up the line. It can also account for pallets that aren't completely vertical because it's multi-layer.

Solid-State LiDAR

Still another type of LiDAR is solid state. Instead of a single plane or multiple planes like the previous two, this type of LiDAR provides a camera view of everything it looks at. With this technology, a 3D snapshot is taken of the surrounding area that goes beyond just an image. It also provides the depth or distance associated with each “pixel” of that image.

This type of LiDAR can be used in many AMR applications, but also works well in other applications. For example, in bin picking applications, the LiDAR can provide a 3D image of whatever is in the bin, allowing the robot to know when and what it should pick up.

One final application is in package dimensioning for pallet loading. In pallet loading, it’s common to use a robot’s suction gripper to collect several cartons and stack them on a pallet. By adding LiDAR to the end effector, the robot can now determine the position and dimensions of the carton so that it can adapt its grip dynamically to improve efficiency and reduce errors. The camera is quick to install, ready for operation immediately, and provides reliable high-quality 3D data in just one shot.

HDDM+ Technology with LiDAR

You may have seen the term HDDM+ mentioned when talking about SICK sensors, but what exactly does it mean? Well, we're here to shed some light on this patented technology, including what it is, how it works, key applications, and the advantages it can add to your operations.

To start, HDDM+ stands for High Definition Distance Measurement Plus. It is a high-resolution time-of-flight process for non-contact distance measurement that is used in distance sensors and LiDAR sensors. Suitable for indoor and outdoor use, the technology is used to measure the distance to diffusely reflecting objects and to retro-reflective reflectors.

The sensing range of distance sensors equipped with HDDM+ is up to 1.5 km on retro-reflective tape. In contrast to single pulse or phase correlation technologies, HDDM+ is a statistical measurement process. This means that the sensor statistically evaluates the echoes of multiple laser pulses to calculate a distance value. Furthermore, thanks to HDDM+, sensors can also be equipped with multi-echo capability. This enables distance measurements with high measurement certainty, even under difficult ambient conditions.

How does it work?

HDDM+ technology is primarily used on optical distance and LiDAR sensors. These sensors are applied in a large spectrum of applications from distance measurement in quality control for the electronics production industry, multi-dimensional object detection and position determination with LiDAR sensors in mechanical and plant engineering, and even determining the position of industrial cranes or vehicles.

Depending on the distance range, measurement accuracy requirements, data repeatability, and ambient conditions, different measurement principles can be used to suit the respective application.

Time-of-flight measurement and HDDM+

HDDM+ utilizes time-of-flight (TOF) measurement for non-contact distance measurement. TOF measurement is an indirect process used to determine the distance to a target object. Essentially, the sensor emits a light beam in the direction of the target object. This light beam is usually laser light with wavelengths in the visible or near infrared range. The sensor receives the light that is reflected by the target object. Using the speed of light, the distance between the sensor and the target object is calculated based on the time of flight of the light.

The distance measurement is practically independent of the target object's surface properties. Time-of-flight measurement is suitable for one-dimensional distance measurement as well as for multi-dimensional measurement with LiDAR sensors that detect areas or solid angles.

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Multi-Echo Technology and HDDM+

HDDM+ sensors can have multi-echo capability. Multi-echo measurement can provide information about object contours and semi-transparent surfaces to better identify and locate objects. In some applications, the sensor receives multiple echoes due to multiple reflections of the light beam. Such (false) echoes can be caused by measuring through protective screens, rain, snow, fog, or dust.

As a rule, only one of the received echoes represents the real distance between the sensor and the target object. The other echoes can lead to inaccurate measurements. The multi-echo capability of the HDDM+ technology enables the Dx1000 distance sensor, multiScan100 3D LiDAR sensor, and MRS1000 3D LiDAR sensor to identify the relevant echo among multiple echoes, to evaluate only this echo, and to transmit it to the connected control. The unwanted echoes can be blanked.

In the case of conventional distance sensors with time-of-flight technology, the simultaneous detection of two echoes usually leads to inaccurate measurements or even faults. On the other hand, HDDM+ multi-echo technology identifies and blanks the false echo by setting the ROI accordingly. This enables you to measure the distance to the reflective surface with high measurement certainty.

Taking HDDM+ Sensors Outdoors

Distance and LiDAR sensors equipped with HDDM+ are particularly suitable for outdoor use. This is because they have a high degree of resistance to ambient light, precipitation, fog, or dust in the measurement path. This resistance to ambient light results from the statistical evaluation of the echoes. False echoes due to a high photodiode current induced by ambient light, which can lead to inaccurate measurements in single-pulse measurement processes, are effectively filtered out.

For trouble-free measurements in rain or snow, the multi-echo capability also enables you to effectively filter out short-term reflections of the measuring laser. In addition, the HDDM+ technology can suppress unwanted reflections caused by fog or dust in the measuring range.

For example, collisions between rubber-tired gantry cranes in ports can be prevented by permanently monitoring the movement range with an MRS1000 3D LiDAR sensor. The multi-echo technology enables a reliable distinction to be drawn between false echoes due to rain or fog and the echoes of containers and other obstacles in the movement range. In this way, collisions can be reliably avoided, and high availability is achieved at the same time.

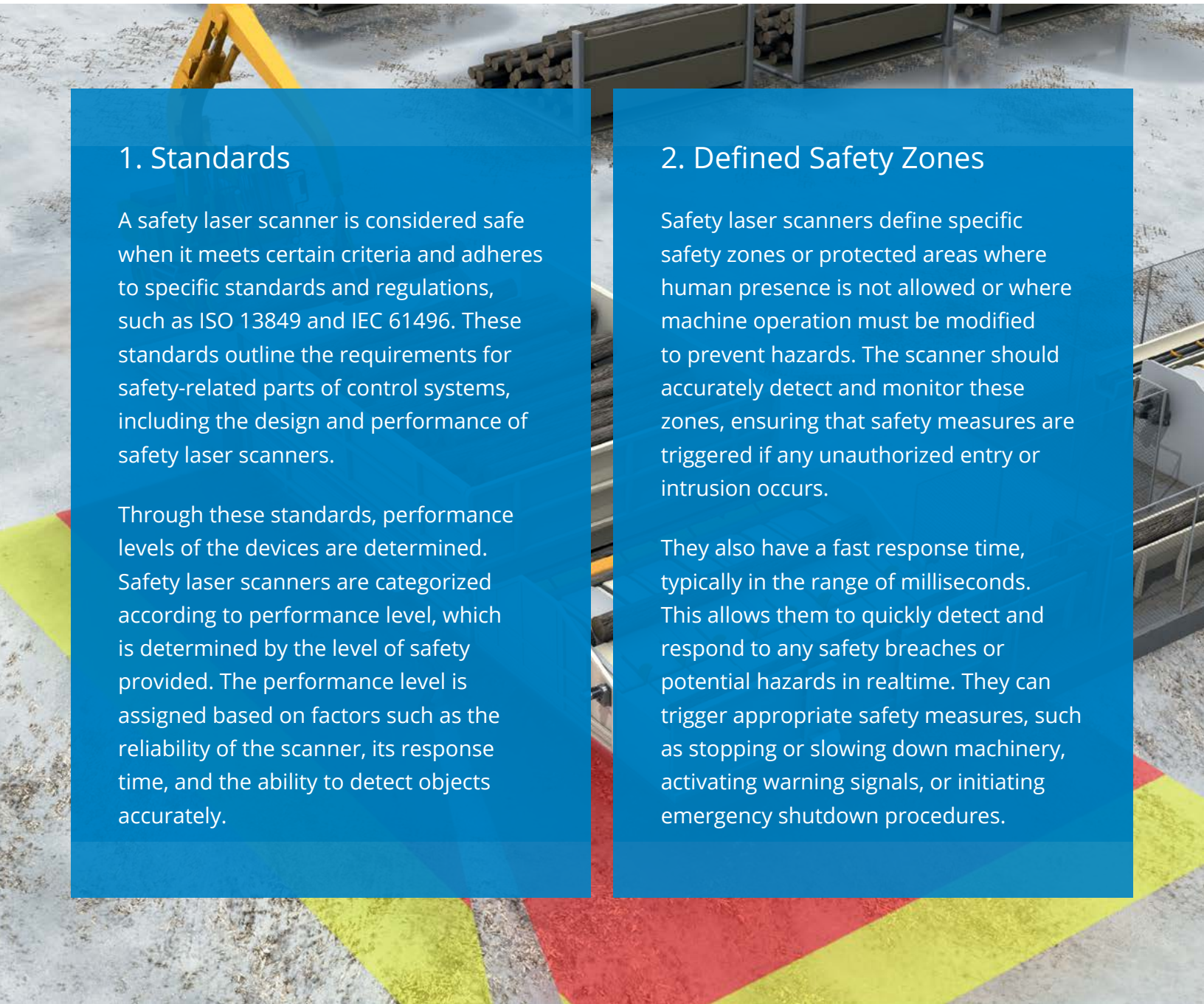
Safe LiDAR vs LiDAR

As LiDAR becomes one of the leading technologies in the industry, it is important to understand all that goes into it. Between determining what type is right for your application and the numerous options available, it can feel overwhelming to make a choice.

But one of the key elements to consider when selecting LiDAR technology is whether you need safe LiDAR or LiDAR. But what makes LiDAR safe? And when do you need a safety-rated device? Well, look no further, we've got the answers for you right here!

What makes LiDAR safe?

But what makes these devices safe? Well, safety laser scanners are specifically designed with safety in mind. There are three elements that make LiDAR safe.



1. Standards

A safety laser scanner is considered safe when it meets certain criteria and adheres to specific standards and regulations, such as ISO 13849 and IEC 61496. These standards outline the requirements for safety-related parts of control systems, including the design and performance of safety laser scanners.

Through these standards, performance levels of the devices are determined. Safety laser scanners are categorized according to performance level, which is determined by the level of safety provided. The performance level is assigned based on factors such as the reliability of the scanner, its response time, and the ability to detect objects accurately.

2. Defined Safety Zones

Safety laser scanners define specific safety zones or protected areas where human presence is not allowed or where machine operation must be modified to prevent hazards. The scanner should accurately detect and monitor these zones, ensuring that safety measures are triggered if any unauthorized entry or intrusion occurs.

They also have a fast response time, typically in the range of milliseconds. This allows them to quickly detect and respond to any safety breaches or potential hazards in realtime. They can trigger appropriate safety measures, such as stopping or slowing down machinery, activating warning signals, or initiating emergency shutdown procedures.

3. Testing and Validation

Safety laser scanners undergo rigorous testing and validation to ensure safety and performance. This includes tests for factors like fault tolerance, resilience to environmental conditions, and adherence to safety standards.

Certified safety laser scanners should have documentation, such as a Declaration of Conformity, indicating that they have undergone the necessary testing and meet the specified safety requirements.

Safety LiDAR vs LiDAR- Which Type of LiDAR is Right for Your Application

When selecting LiDAR sensors, it is important to consider safety ratings, especially for applications involving potential risks to humans. Both safe and non-safe LiDAR are valuable for the manufacturing industry, but you may not always need to use safety-rated sensors. And sometimes certain applications may require safety-rated LiDAR that you may not expect. It's important to stay informed and understand when you should use either type. This is almost always done through risk assessments. SICK offers safety services to conduct comprehensive risk assessments.

Safety-Rated LiDAR

Safety-rated sensors are used indoors and outdoors in manufacturing. Safe LiDAR is often used in mobile and stationary settings, such as applications where there may be significant human interaction with the machine, device, or robot.

Safety-rated sensors comply with norms and standards set by organizations such as the International Electrotechnical Commission (IEC) and The American National Standard Institute (ANSI). The IEC 61496 standard establishes criteria for Electro-Sensitive Protective Equipment (ESPE) construction and testing. ESPE levels are determined based on the associated machinery or process risk within the industry. Similarly, the Safety Integrity Level 2 (SIL2), or ISO 13849-1 standard, specifies the functional safety of LiDAR sensors. SICK offers numerous safety laser scanner options, but two of them are the microScan3 and the nanoScan3.

The microScan3 is built for the protection of stationary and mobile applications, from simple to complex. With its innovative safeHDDM™ scanning technology, it is highly resistant to dirt, dust, and ambient light. In addition, it is highly practical as it is not affected by additional laser scanners or other infrared sources. With the ability to simultaneously monitor up to 8 protective fields, it also performs well in applications requiring simultaneous protection of several hazardous areas.

The nanoScan3 is one of the smallest profile safety laser scanner on the market. Its space-saving design works perfectly in mobile robotics applications, but also in stationary applications where space is limited. It delivers high-precision measurement data and is extremely resistant to light, dust, or dirt. It also has the highest level of flexibility with up to 128 freely configurable fields and monitoring cases.

What is 2D Safe LiDAR?

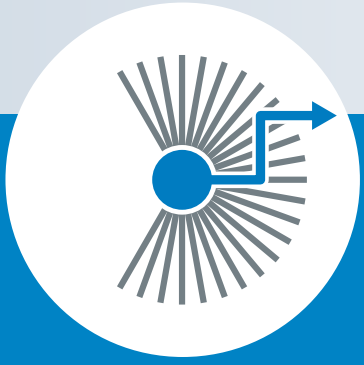
This technology is often used in safety applications that require coverage of large areas or complex contours. It uses lasers to detect objects in a two-dimensional plane, providing detailed information about the environment. These sensors can be used to detect people and objects, measure distances, identify moving objects, and more. It can also be used to detect obstacles and prevent collisions in automated manufacturing processes.

2D LiDAR first began to be used in manufacturing in the early 2000s. Initially, it was used primarily in the automotive industry for collision avoidance systems. Since then, 2D LiDAR has been adopted in a variety of manufacturing industries, including robotics, logistics, and other production sites. It has become increasingly popular in recent years as the cost of the technology has decreased and its accuracy has improved.

Additionally, 2D LiDAR can be used to monitor and detect changes in the environment. This can help ensure that the manufacturing process is safe and efficient. 2D LiDAR can be used in stationary or mobile applications. A typical stationary application may be horizontal area monitoring or vertical access protection. In a mobile application, simultaneous field protection for mobile robots or AGVs is available. This allows for gradual slow downs and stops, depending on what field an object or person enters.

Main Features of 2D LiDARs:

- Obstacle detection: 2D LiDARs can detect obstacles and people in a space, which is essential for safety applications in manufacturing.
- High resolution scanning: The high-resolution scanning capabilities of 2D LiDARs allow for localization and navigation aided by highly accurate and precise measurement data.
- Fast reaction time: 2D LiDARs can detect objects quickly and accurately, which can be used to reduce response times in safety-critical applications.
- Safety-rated protective fields: 2D LiDARs can be used to map out protective fields in a manufacturing environment, allowing for the safe movement of people and machines.
- Real-time monitoring: 2D LiDARs provide real-time feedback and data, which can be used for safety checks and monitoring.



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What is Safe 3D Time of Flight (ToF)?

3D Time of Flight (ToF) is a type of optical-based sensing technology that uses light to detect objects. This technology works by emitting a light pulse and detecting the time it takes for the pulse to reflect off objects in the environment.

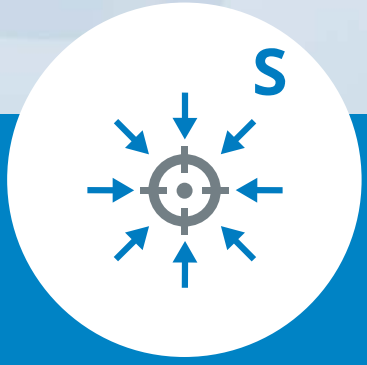
3D ToF is often used in safety applications that require detailed information about the environment. Using a light pulse, 3D ToF can create an accurate 3D map of the area being monitored. This map can then be used to detect objects and whether they are moving.

3D Time of Flight (ToF) technology was first used in manufacturing in the early 2000s. It was initially used for 3D imaging and scanning, but since then its use has grown to include a variety of applications. These applications include collision protection for mobile robots, 3D protection for collaborative robots, and object detection on conveying solutions.

Main Features of 3D ToF:

Accurate distance measurement: 3D time of flight sensors can measure the distance from the object to the sensor with very high accuracy, making it ideal for safety applications such as robot collision avoidance.

- Safe three-dimensional environment perception: Increases the safety and efficiency of your applications.
- Compact and lightweight: Small and lightweight, making them suitable for use in confined spaces.
- Precise measurement data: Reliably solves automation tasks, eliminating the need for to purchase additional hardware components.
- Rugged Design: The safeVisionary2 from SICK offers a compact shock- and vibration-resistant design with enclosure rating IP65 and IP67.



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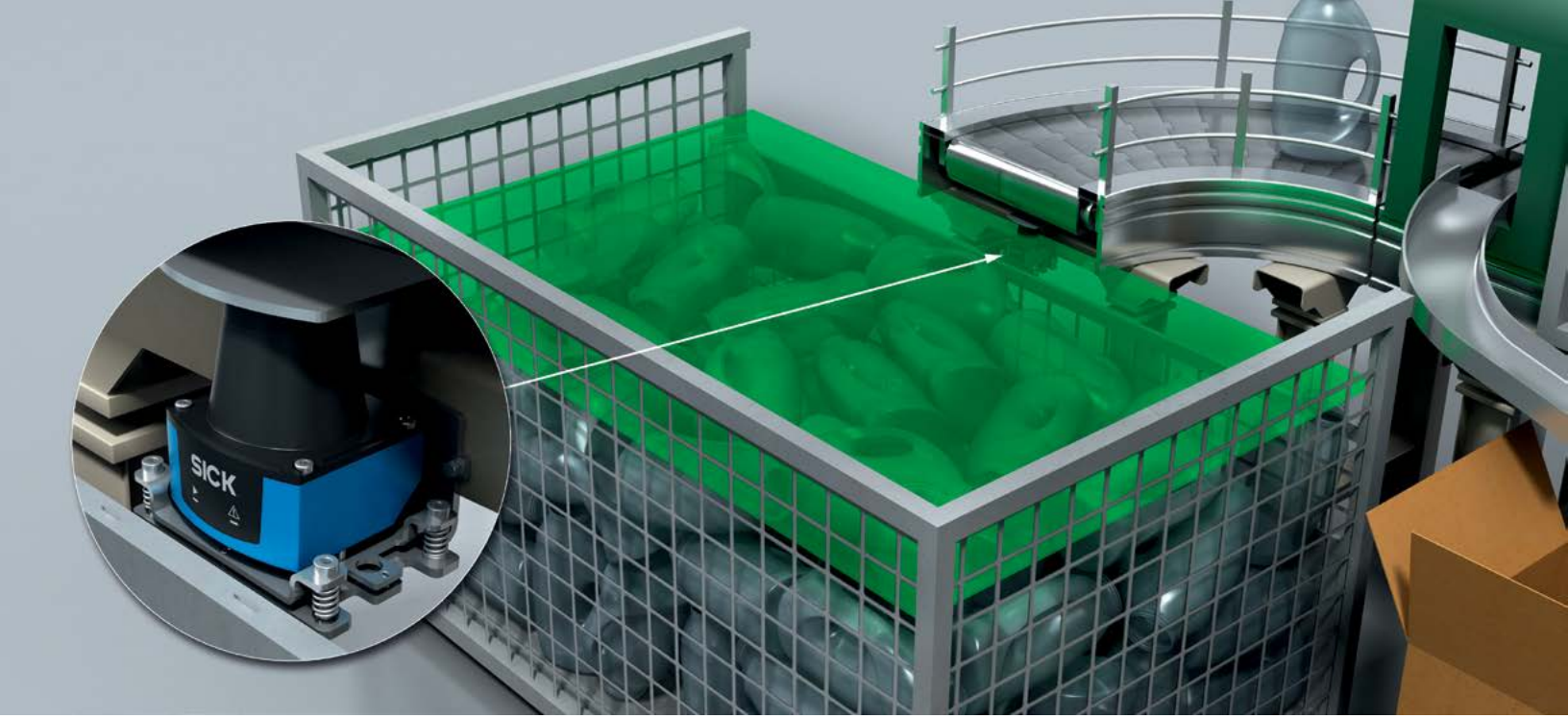


LiDAR

In applications with reduced human involvement, non-safety-rated sensors can be considered. These are also used indoors and outdoors in manufacturing, and although these sensors possess similar capabilities to safety-rated devices, they do not meet safety standards to qualify them as a safety laser scanner. While not considered safety-rated, that does not make these devices unnecessary or dangerous to use.

LiDAR sensors are commonly employed in conventional industrial control systems. These sensors provide the advantage of non-contact detection of actual values at the output of the work process, utilizing the measurement element. Non-safe LiDAR measures in 1D, 2D, and 3D.

1D LiDAR

Linear measurement sensors are 1D distance sensors, such as the Dx1000. They scan in a linear, one-dimensional direction toward the measuring object. This enables them to detect distances and changes in distance to defined targets (with up to 100% remission) or reflectors. Linear measurement sensors can be used to position objects such as large cranes at an accurate distance, enabling them to perform gripping and unloading processes.

2D LiDAR

To maintain the excellent measurement capabilities provided by laser systems and apply them to surface measurements, 2D LiDAR was developed. These sensors utilize a method involving a laser beam being directed across a rotating mirror, which may seem simple at first glance but requires attention to detail.

Many scanning sensors are designed as coaxial measuring systems, with the emitted beam at the center of the received beam. In this setup, a rotating mirror is used to deflect the beam. All the exceptional properties of laser measurements, including the ability to scan over a wide range and measure even dark objects, still apply in this scenario.

When to Use 2D LiDAR

To use 2D LiDAR or 3D LiDAR: that is the question. LiDAR is used throughout the manufacturing industry in numerous applications. However, some believe that 2D LiDAR is not a beneficial technology and 3D should be the preferred choice.

While 3D LiDAR has advanced capabilities and is often preferred for applications that require a more comprehensive understanding of the environment, 2D LiDAR remains valuable for several reasons.

Cost Effective and Simple

2D LiDAR systems are generally more affordable than 3D counterparts. This cost advantage makes it a practical choice for applications with budget constraints, where the full capabilities of 3D LiDAR may not be necessary.

The technology typically uses a single laser to scan the environment in a 2D plane, making the hardware less complex and more affordable. Analyzing and processing 2D data is computationally less demanding than processing 3D data. This simplicity in data processing contributes to lower costs in terms of both hardware and software requirements.

2D LiDAR is suitable for certain applications and industries where a full 3D representation is not necessary. For example, in robotics, factory automation, and certain navigation scenarios, a 2D view of the environment may be sufficient, leading to cost savings.

Real-Time Processing

As mentioned previously, the analysis and processing of 2D data is less demanding than 3D data. This makes it the ideal choice in applications requiring real-time and fast data processing. This can be crucial in scenarios where rapid decision making is essential.

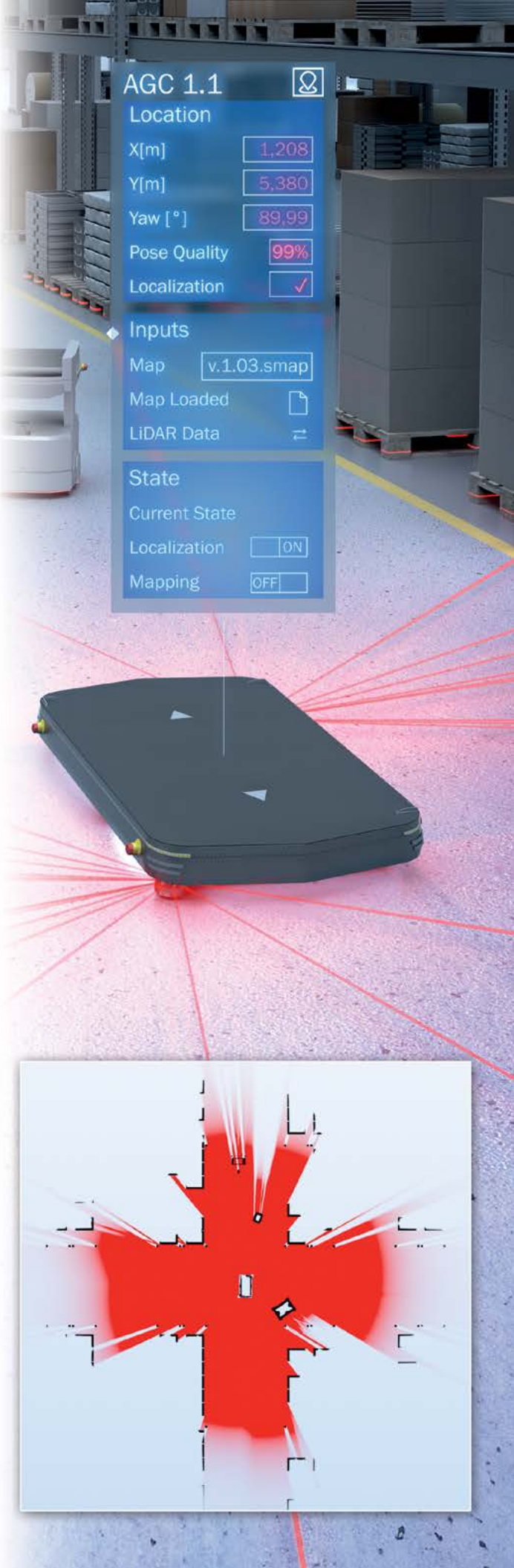
Since these systems are simpler in design and operation, that also tends to make it more robust and reliable in certain scenarios. The simplicity can be an advantage in applications where the environment is less dynamic, and a straightforward obstacle detection is sufficient.

Proven Technology for the Industry

2D LiDAR technology has been in use for a longer period, and its reliability and performance are well-established. For certain applications, particularly those with a long history of using 2D LiDAR, there may be little incentive to transition to 3D LiDAR if the existing technology meets their needs.

SICK has been developing LiDAR technology for decades and continues to innovate it to meet manufacturer's changing needs. For example, SICK's most recent 2D LiDAR product is the picoScan100.

With a large scanning range, fine angular resolution, and high sensitivity, the picoScan100 2D LiDAR sensor, successor of the TiM series, is setting new standards. It also reliably detects small and dark objects. The sensor delivers exact measurement data and features integrated processing of data that is transmitted through various communication interfaces.



The compact picoScan100 equipped with multi-echo technology has a rugged housing and ensures reliable measurement results even under harsh ambient conditions. It can be used in demanding industrial applications both in- and outdoors. The picoScan100, available in three variants (Core, Prime and Pro), can also be adapted with other features to meet individualized requirements.

Ideal Applications for 2D LiDAR

Some applications do not demand the full three-dimensional mapping capabilities of 3D LiDAR. For instance, in certain industrial settings, where the primary concern is detecting obstacles or monitoring specific areas, 2D LiDAR can provide the necessary information without unnecessary complexity.

Robotics – 2D LiDAR is extensively used in robotics for navigation, obstacle detection, and mapping. Mobile robots and autonomous vehicles often incorporate 2D LiDAR sensors to perceive their surroundings.

Manufacturing and Factory Automation – Industrial robots and automated machinery in manufacturing facilities utilize 2D LiDAR for tasks such as material handling, quality control, and ensuring the safety of workers by detecting obstacles.

Agriculture – In precision agriculture, 2D LiDAR sensors are employed for tasks like crop monitoring, autonomous tractors, and the navigation of agricultural vehicles. They assist in mapping the terrain and detecting obstacles in the field.

Logistics and Warehousing – 2D LiDAR is used in logistics and warehouse environments for inventory management, automated guided vehicles (AGVs), and optimizing the movement of goods within a facility.

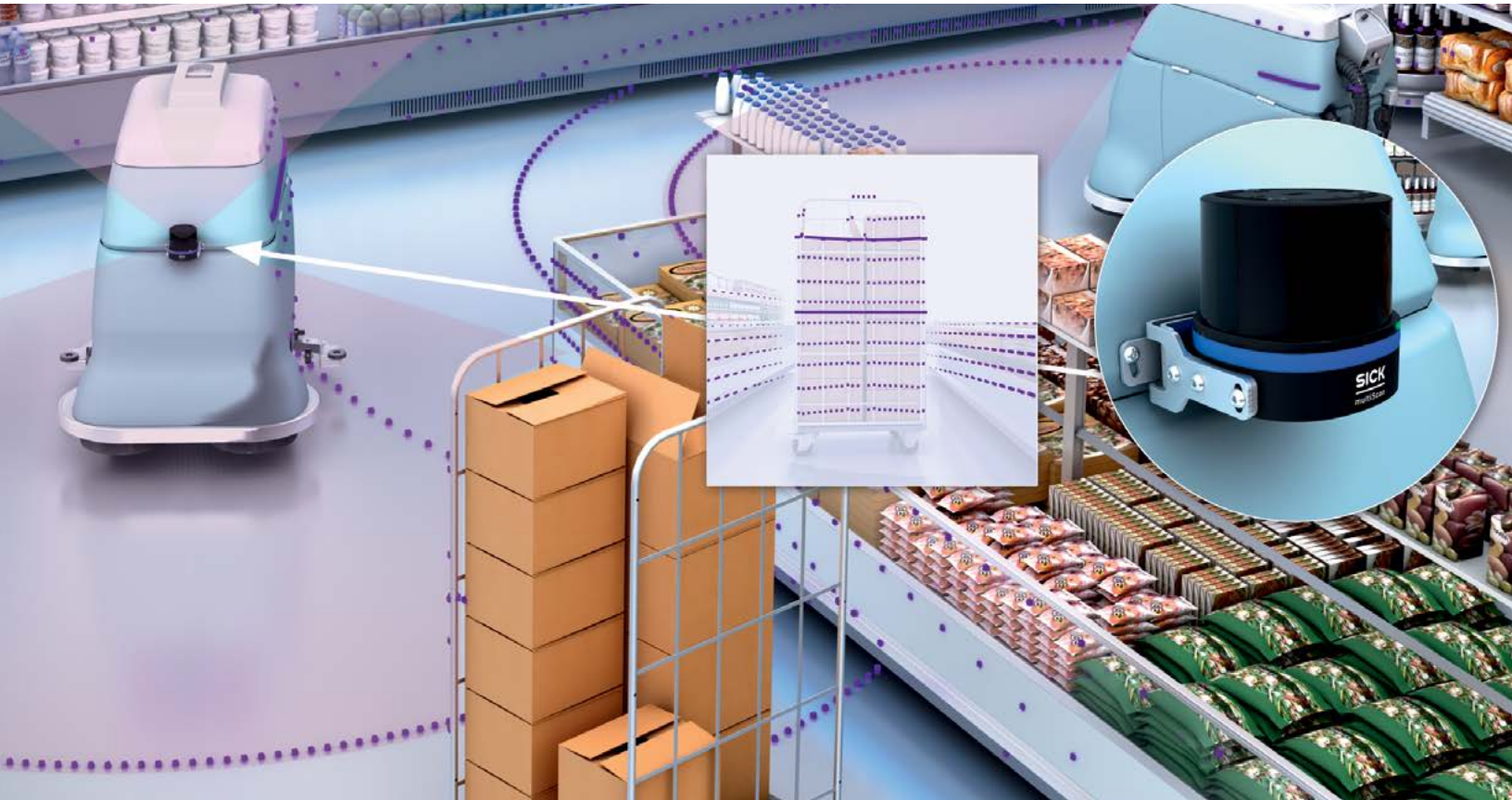
Traffic Management – 2D LiDAR plays a role in traffic monitoring and management systems. It helps in vehicle and pedestrian detection, as well as in controlling traffic signals and optimizing traffic flow.

2D LiDAR remains relevant and valuable in specific contexts where its cost-effectiveness, simplicity, and proven performance make it a practical choice. The choice between 2D and 3D LiDAR depends on the specific requirements of the application and the trade-offs between cost, complexity, and performance.

3D LiDAR

To measure space, 3D LiDAR is utilized. When translating the measurement data from a 2D LiDAR sensor into a 3D image, it is necessary to accompany the standard outgoing telegram with the mechanical application point of the sensor in the customer's chosen coordinate system. The scans are provided with time stamps and indexing to enable the customer to logically create an image of the output scans with accurate times and locations.

The multiScan100 3D LiDAR sensor is a great example of this technology, and of multi-layer LiDAR. The sensor generates a 3D point cloud that can be used to detect people and objects. It effortlessly detects cliffs and overhanging obstacles. This is how it reliably protects mobile robots from accidents and failures. The multiScan100 reliably detects objects, no matter whether they are standing on the ground or projecting into its field of view. This helps it avoid collisions. The sensor always "knows" exactly where a vehicle is.



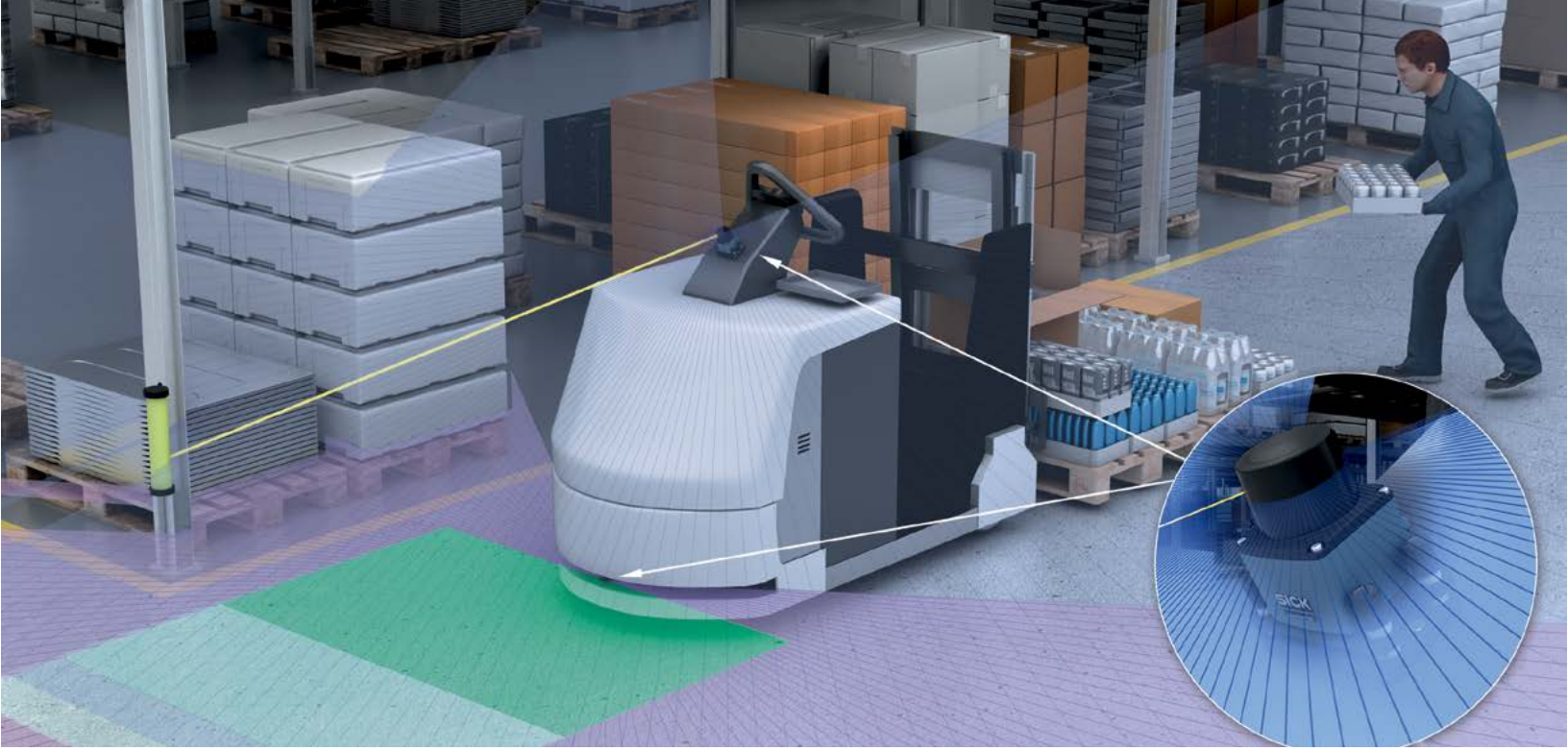
picoScan100: The Compact Powerhouse of Precision LiDAR Technology

Compact 2D LiDAR Sensor: Economical, High-Performance Sensing Solution

As the advanced successor of the TiM series, the picoScan100 breaks new ground with its expansive scanning range, precise angular resolution, and heightened sensitivity. Engineered to detect even the smallest and darkest of objects, this sensor provides exact measurement data, bolstered by integrated data processing transmitted via multiple communication interfaces.

With SICK's picoScan100, you gain access to a fusion of high-tech hardware and versatile software solutions, all housed within a durable and compact design, delivering unparalleled cost-effectiveness for a myriad of applications.

The picoScan is four things: it is compact and efficient; it is powerful; it is accurate; and it is easy to use.



Compact and Efficient

The picoScan100 stands out for its compactness and efficiency, a true marvel of SICK's engineering. The sensor's diminutive stature, being four millimeters shorter than its predecessor, makes it a breeze to integrate into tight spaces—ideal for applications like mobile robotics. Beyond its size, the picoScan100 is a model of energy efficiency, with a modest power consumption of only 4.5W, ensuring that battery-operated devices won't be drained by its operation.

Weighing in at a mere 220g, the picoScan100 is not just lightweight but also boasts a robust design. The underside of the sensor reveals three sturdy screw holes, allowing for secure mounting on various materials. This thoughtful design extends beyond mere aesthetics; it's a testament to the sensor's resilience and capability. In essence, the picoScan100 is not only compact and energy-efficient but also a powerhouse in a small package.

Big Power, Compact Size

The picoScan100 is a testament to SICK's innovation, packing immense power into its compact frame. This sensor achieves what was once only possible with much larger and costlier equipment. It boasts an impressive range, capable of detecting white targets up to 75m and reflectors up to 120m away, while maintaining a high frequency of 40 to 50Hz depending on the configuration. Even black targets, known for their low reflectivity, can be detected at distances up to 40m.

The picoScan100's high resolution is particularly noteworthy. For instance, when examining a dark foam corrugated target, the difference in resolution is stark. At a standard setting, the target is visible but details are indistinct. However, when the sensor is set to a fine 0.1-degree angular resolution, the clarity is remarkable, revealing a dense array of points that define the target with precision. This level of detail is crucial for applications requiring nuanced detection and is a clear demonstration of the picoScan100's superior capabilities.

Accuracy in a Tiny Package

The picoScan100 is a paragon of precision, offering remarkable stability and accuracy in its measurements. It boasts a statistical error of five millimeters or less, which is exceptionally precise for a wide range of applications. This level of accuracy is largely attributed to the sensor's laser, which produces a finely focused circular beam with a divergence of only 0.27 degrees.

This sensor's capabilities were once exclusive to high-end LiDAR systems, but now, the picoScan100 brings these advanced specifications to a more accessible platform. Enhancements like multi-echo, fog, and particle filters have been integrated to maintain accuracy even in outdoor environments with challenging conditions such as rain, dust, or snow.

Demonstrating the multi-echo feature, for instance, allows users to discern between different reflections. In an example application, a window screen is identified by the first echo and appears in blue, while subsequent echoes, representing objects behind the screen, appear in green. By activating the echo filter and switching to the last echo, the screen becomes invisible, allowing clear visibility of the objects behind it—much like seeing through rain or snow. This feature ensures that the picoScan100 provides reliable data, regardless of environmental interferences, making it an invaluable tool for precise outdoor applications.

Effortless Operation with the picoScan100

The picoScan100 is designed with user-friendliness in mind, streamlining the process of accurate data collection and sensor operation. A key feature enhancing its usability is the sensor's ability to identify reflectors, which simplifies localization tasks. By switching to reflector mode, non-essential data points are grayed out, leaving only the red-highlighted reflectors visible. This allows for precise localization within a facility without the clutter of extraneous ranging data.

Ease of maintenance is another aspect that makes the picoScan100 user-friendly. The sensor is equipped with a system plug at its base, held in place by two screws. This plug not only stores all configuration settings but can also be detached and attached to a new housing if necessary, ensuring a quick return to operation. The plug's design also allows for rotation, providing flexibility in cable management, and can be customized to accommodate different connector types.

To further facilitate ease of use, SICK has developed a product configurator on their website, enabling customers to create custom part numbers or choose from three predefined options: Core, Prime, and Pro, each offering varying levels of functionality. Additionally, the picoScan100 outputs data in compact and MSGPACK formats, which are user-friendly standards that simplify data parsing and integration. These thoughtful design choices underscore the picoScan100's commitment to providing a seamless and efficient user experience.

With a large scanning range, fine angular resolution and high sensitivity, the picoScan100 2D LiDAR sensor, successor of the TiM series, is setting new standards.

Harness the Power of Precision: SICK's multiScan100 Revolutionizes 3D Sensing

Compact 3D LiDAR sensor with high detection reliability even in the toughest conditions

The multiScan100 3D LiDAR sensor by SICK is a versatile powerhouse, adept at detecting a vast array of objects across diverse environments. From ground level to the ceiling, this sensor excels in both indoor and outdoor spaces.

The multiScan100 is a gamechanger in the industry, but there are four main points that we feel make it the ideal sensor for precise 3D LiDAR applications. What makes it unique is that it is powerful, accurate, reliable, and super easy to use. So let's dive into those topics further.

Powerful Performance in a Compact Design

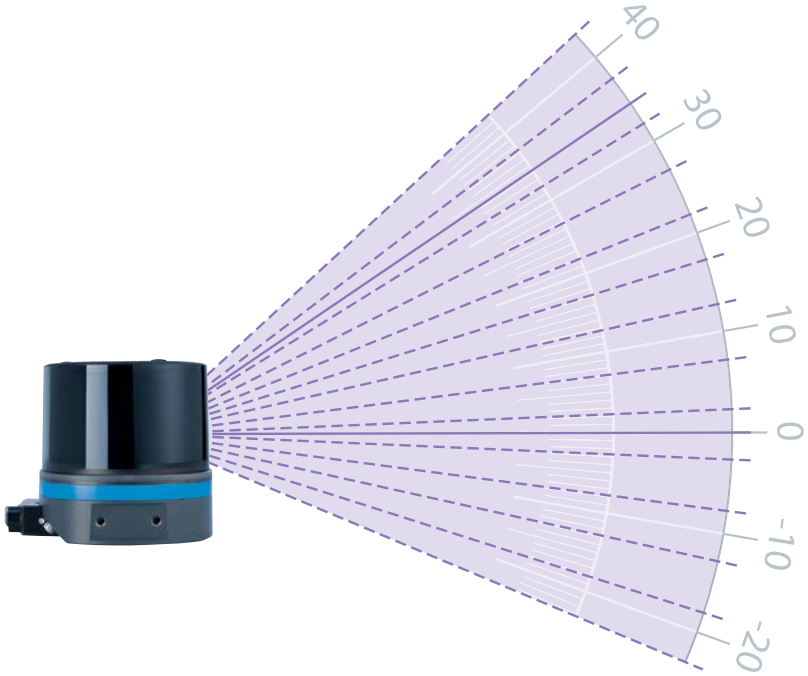
Despite its small housing, the multiScan packs a powerful punch. It boasts a full 360-degree horizontal field of view and a 65-degree vertical opening angle, ensuring comprehensive coverage. The device's impressive range is complemented by its ability to output approximately 648,000 data points per second, making it an ideal solution for precise localization tasks, especially in mobile robotics.

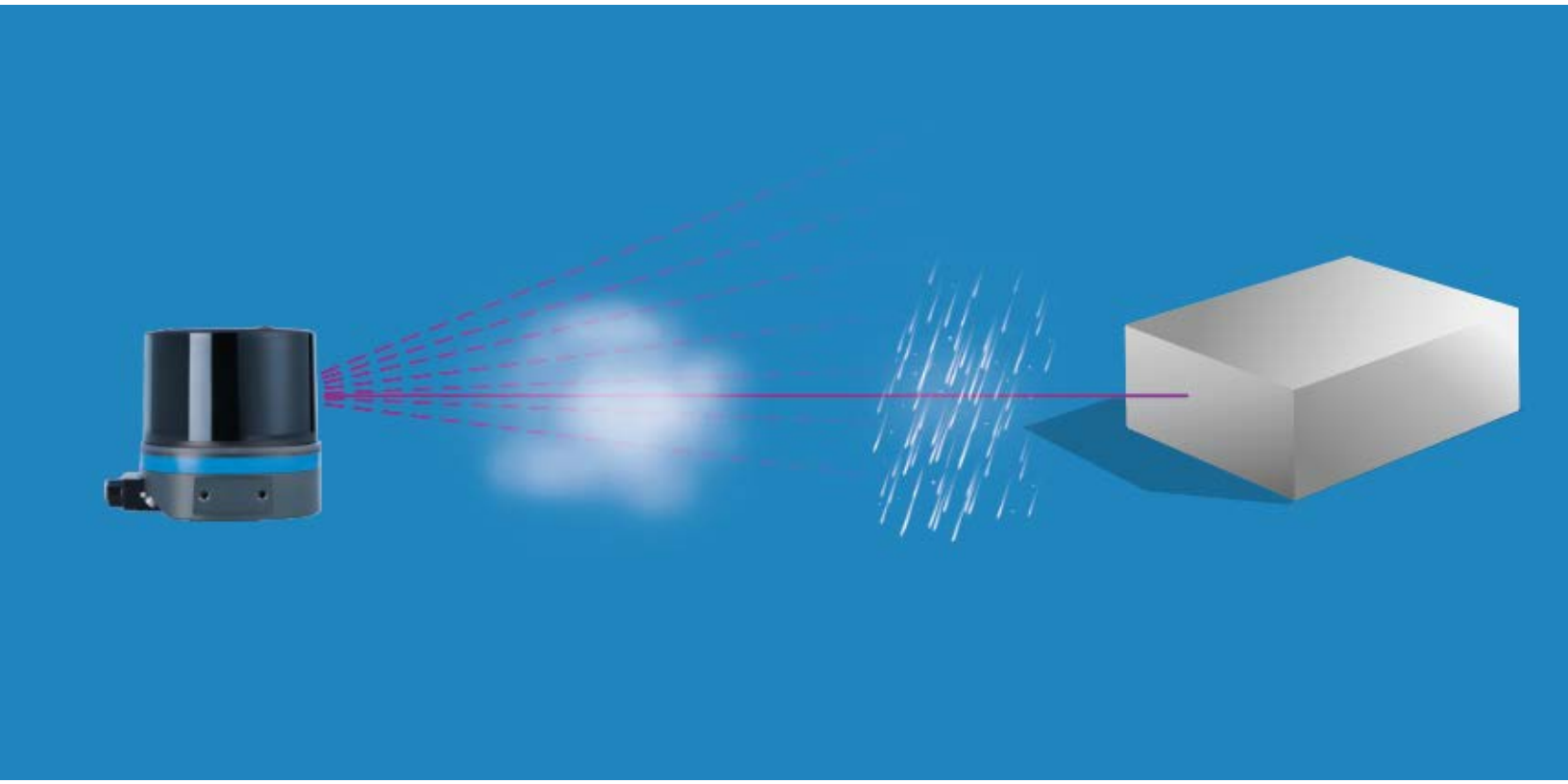
Equipped with 16 scan layers, the multiScan100 offers an expansive three-dimensional field of view, enabling it to perceive its surroundings in full 3D—both vertically and horizontally. This makes it particularly effective for 2D localization, thanks to certain variants featuring a high-resolution 0° scan layer. For mobile platforms requiring 3D environmental perception, such as collision avoidance systems, the multiScan100 stands out as the optimal choice.

And with all of this data being output by the sensor, it's important to note that the data is also highly accurate.

Precision and Accuracy

The multiScan100 is equipped with an array of features designed to enhance its precision, chief among them being the multi-echo technology. This feature is particularly beneficial for outdoor operations where environmental factors such as dust, rain, and snow are present. It significantly reduces noise interference, ensuring cleaner data output. Additionally, the software-enabled fog and particle filters contribute to maintaining data clarity by mitigating the impact of airborne particulates, ensuring a statistical error margin of less than 20mm.





This level of accuracy is crucial for precise positioning, providing stable and reliable measurements. The sensor also offers real-time reflector detection, which is essential for reflector-based navigation systems.

In practice, when the reflector mode is activated within the software, non-reflector points are displayed in gray, while actual reflectors are highlighted in red. This visual distinction simplifies the process by focusing only on the reflector points, reducing the need to process the full spectrum of 648,000 points per second. This capability underscores a significant advantage of the multiScan100 over other sensors, emphasizing its ruggedness as a SICK sensor, ready to withstand the rigors of any operational environment.

Generating a comprehensive 3D point cloud, the multiScan100 is capable of detecting people and objects with precision, making it ideal for monitoring large areas and machinery. Its flexibility extends to both mobile and stationary applications, where it consistently identifies drop-off edges and potential obstacles. Customization is at the core of the multiScan100's design, allowing for tailored configurations that include high-resolution scan layers or extended scanning ranges.

Reliable in Any Environment

The multiScan100 has been meticulously engineered to thrive in the most demanding outdoor conditions. It boasts an IP69K rating, signifying its high resistance to dust and high-pressure water jets, and can operate within a broad temperature range from -30°C to +50°C. A specialized pressure equalization vent ensures that sudden temperature drops won't result in water condensation within the device, safeguarding it against moisture-related complications.

This resilience is further enhanced by the sensor's ability to withstand significant shock and vibration, enduring up to 15G of single shock or 10G of continuous vibration. This robustness can be augmented with rubber isolators for even greater durability. The multiScan100's design also includes a screen contamination function, which actively monitors the lens's cleanliness and alerts users to any dirt accumulation that could affect performance, allowing for timely maintenance.

In terms of usability, the multiScan100 excels with its user-friendly design. One of its standout features is the field evaluation capability, which enables the creation of virtual zones within the software to detect object presence. This simplifies integration by focusing on specific areas of interest rather than processing extensive ranging data.

For those who prefer working with ranging data, the sensor supports compact and MSGPACK formats, offering a more standardized and accessible approach to data handling. Additionally, for users of the Robot Operating System (ROS) or Python, SICK provides convenient code snippets and drivers to facilitate seamless integration. These features collectively make the multiScan100 not only robust and reliable but also exceptionally easy to integrate and use in a variety of applications.

Ease of Use and Maintenance

The multiScan100's design prioritizes user convenience, featuring a system plug located at the base, secured by two screws for easy access. This innovative plug can be swiftly detached and transferred to another sensor in the event of damage, preserving all stored configurations and IP address details.

The plug's versatility extends further, allowing for a 180-degree rotation to adjust the orientation of the connectors. It also offers the flexibility to accommodate custom system plugs, enabling users to incorporate alternative connectors seamlessly. This ensures that the multiScan100 remains operational with minimal downtime, retaining all settings for a hassle-free replacement or customization.

The multiScan100 is a robust, accurate, and user-friendly sensor that stands out in the market. Its design and features make it an excellent choice for both indoor and outdoor applications, particularly in mobile robotics.

Want to learn more about LiDAR?

LEARN MORE

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