DADISICK®

TECHNICAL DATA SHEET

Measurement-type Single-layer Scanning Lidar

DK-LD-100L series

Figure can vary

Contents

DADISICK TECHNOLOGY LIMITED

www.dadisick.com

DK-LD-100L High-Resolution Single-Layer Scanning LiDAR for Measurement and Shape Recognition Applications

Overview

The DK-LD-100L is a high-spatial-resolution measurement-type single-layer scanning LiDAR that supports both indoor and outdoor applications. It possesses all the features of the DK-LD-100L while offering higher angular resolution, making it particularly suitable for detecting small targets. It also provides better performance for shape recognition and volume measurement applications under static installation conditions.

Measurement capabilities

The DK-LD-100L boasts excellent measurement capabilities, with an effective range of 50 meters even for targets with 10% reflectivity. For applications such as security and protection, the DK-LD-100L can cover a monitoring area of approximately 6,000 square meters, significantly reducing the cost of monitoring and surveillance systems.

Measurement accuracy

The DK-LD-100L boasts excellent measurement accuracy. For most object surfaces with varying reflectivity, its measurement error is within 2 cm and measurement fluctuation is controlled within 3 cm within a range of 1 to 20 meters. Even beyond 20 meters, its measurement error remains within 4 cm and measurement fluctuation is controlled within 6 cm, meeting the needs of applications such as scene measurement and positioning guidance.

Scanning frequency and angular resolution

At a scanning frequency of 25Hz, the DK-LD-100L can achieve an angular resolution of 0.25°. Its 12mm base spot diameter and 6mrad spot divergence angle ensure that even fast-moving small targets can be detected and tracked within a certain distance range, ensuring the effectiveness of area monitoring and security applications, as well as the effectiveness of shape recognition and volume measurement applications under general conditions.

Built-in apps

The DK-LD-100L has built-in area monitoring software designed for security and protection applications. It can perform functions such as intrusion detection, contour monitoring, abandoned object detection, and target monitoring. It supports inputting disarming and forced alarm commands through the I/O port and can directly guide network cameras to perform video positioning and tracking of monitored targets through the Ethernet port, simplifying the complexity of system implementation and reducing system costs.

Equipment self-testing and intrinsic safety design

The DK-LD-100L has comprehensive self-testing capabilities, effectively detecting and alarming abnormal working environment factors that affect measurement performance and normal operation, such as dirty or obstructed light-transmitting covers, excessively low or high temperatures, and dense fog. It also provides flexible configuration options for the inherent safety design of application systems, ensuring that the application system can automatically enter a safety protection mode under abnormal and fault conditions to avoid safety accidents.

Work environment adaptability

The DK-LD-100L is designed to withstand outdoor working environments. In terms of measurement technology, even with a dirty lens cover reducing light transmittance to 50%, or in strong sunlight, the DK-LD-100L can still perform normal measurements. It also possesses a certain degree of penetration through rain, fog, and dust, enabling it to detect actual targets without interference from atmospheric impurities. Even in heavy rain or light to moderate haze/fog conditions, the DK-LD-100L's built-in area monitoring function remains effective, exhibiting good performance in terms of false alarm and missed alarm rates.

In terms of electrical and structural design, the DK-LD-100L supports a wide voltage input of DC10V-30V, while also supporting power-saving and life-extending controls, and is resistant to strong electromagnetic interference. Its enclosure has an IP67 protection rating, a built-in heating module, and an operating temperature range of -25℃ to 50℃. These technical features ensure its effective operation in general industrial environments.

Among similar products on the market with comparable measurement capabilities, built-in application functions, and environmental tolerance, the DK-LD-100L is the most comprehensive.

Measurement

The DK-LD-100L uses time-of-flight measurement to achieve laser ranging. The lidar emits a laser pulse and measures the time it takes for the pulse to return after being reflected from the surface of the target, then converts this time into distance data, as shown in Figure 1.

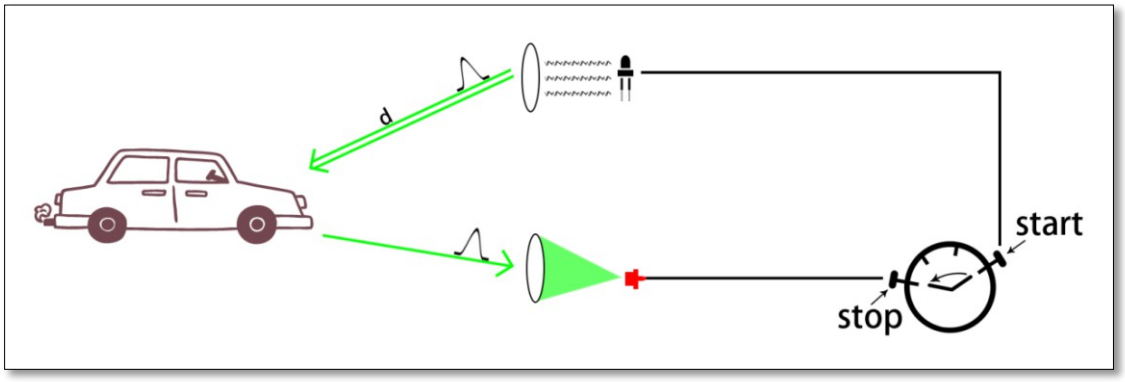


Figure 1. Time of Flight Measurement

The DK-LD-100L features multiple echo analysis capabilities. In rainy, foggy, or dusty environments, atmospheric impurities can reflect the ranging laser pulse, creating reflected echo pulses that arrive at the pulse receiving system along with the reflected echo pulse from the target being measured.

The DK-LD-100L analyzes all received reflected echo pulses, eliminates interfering pulses, and outputs the true distance data to the target being measured, as shown in Figure 2.

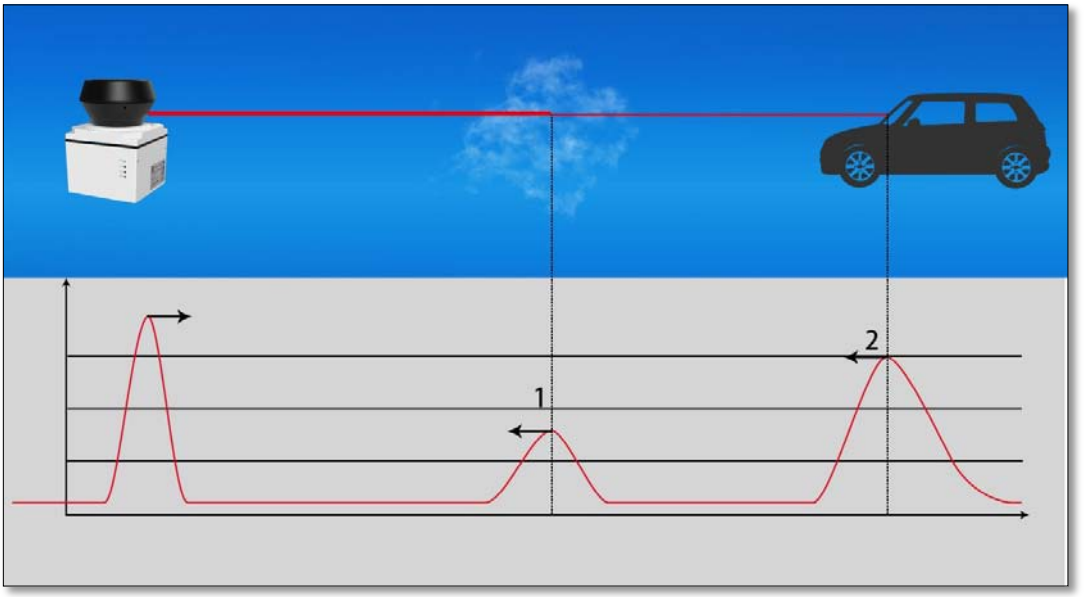


Figure 2. Multiple echo analysis

2D scanning

The DK-LD-100L deflects the ranging laser pulse by 90° using a mirror at a 45° angle to the original emitted optical path. This mirror is rotated by a motor, with its rotation axis parallel to the original emitted optical axis. This results in the actual ranging optical axis being distributed on a scanning plane perpendicular to the rotation axis, with the ranging azimuth angle matching the motor's rotation azimuth angle. This achieves two-dimensional optical scanning, enabling the measurement of distances to various points in the external environment on the cross-section of the ranging scanning plane, as shown in Figures 3 and 4. The DK-LD-100L uses specific network packets to provide users with two-dimensional measurement data at a fixed scanning frequency via an Ethernet port.

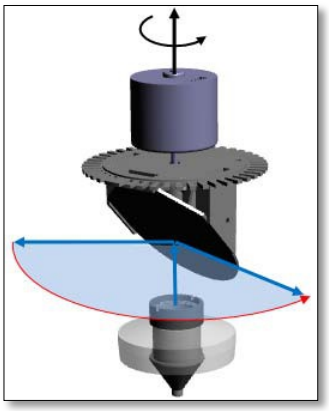


Figure 3.
Two-dimensional scanning mechanism

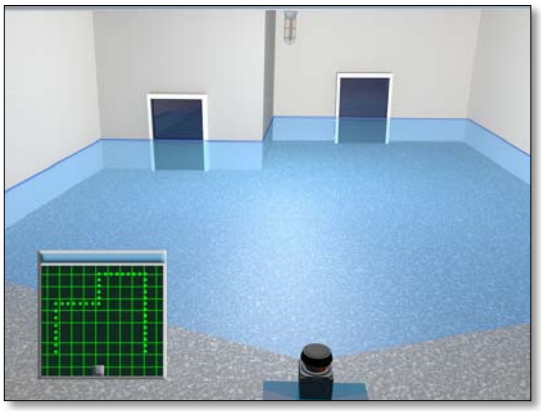


Figure 4.
Working principle of two-dimensional scanning

Scene measurement and area monitoring

By analyzing and processing distance data obtained from 2D scanning, the application system can measure and monitor the scene, detect and locate various targets within the scene, measure their shapes, and perform scene analysis through intelligent algorithms. It can also perform spatiotemporal tracking, type recognition, and behavior analysis of targets, and finally output analysis results according to application requirements, such as alarms, sorting, and guidance.

The DK-LD-100L has a built-in area monitoring function, designed for security and protection applications. It can perform perimeter protection, intrusion detection, contour monitoring, abandoned object detection, and target monitoring, and has background self-learning capabilities. For industrial security applications, such as production line conveyor belt security, the DK-LD-100L provides a normal target self-learning function, preventing alarms from being triggered for normally transported objects. The area monitoring function can be configured through the "LiDAR Diagnostic and Configuration Software (FILPS)" or the monitoring arming conditions can be set through the I/O input terminals. Monitoring results are output via TCP network packets and also in real time through the DK-LD-100L's I/O output terminals.

The DK-LD-100L has a built-in network camera (IPC) control module that supports the ONVIF protocol. It can directly guide the network camera through the Ethernet port to perform video positioning and tracking of alarm locations or monitored targets.

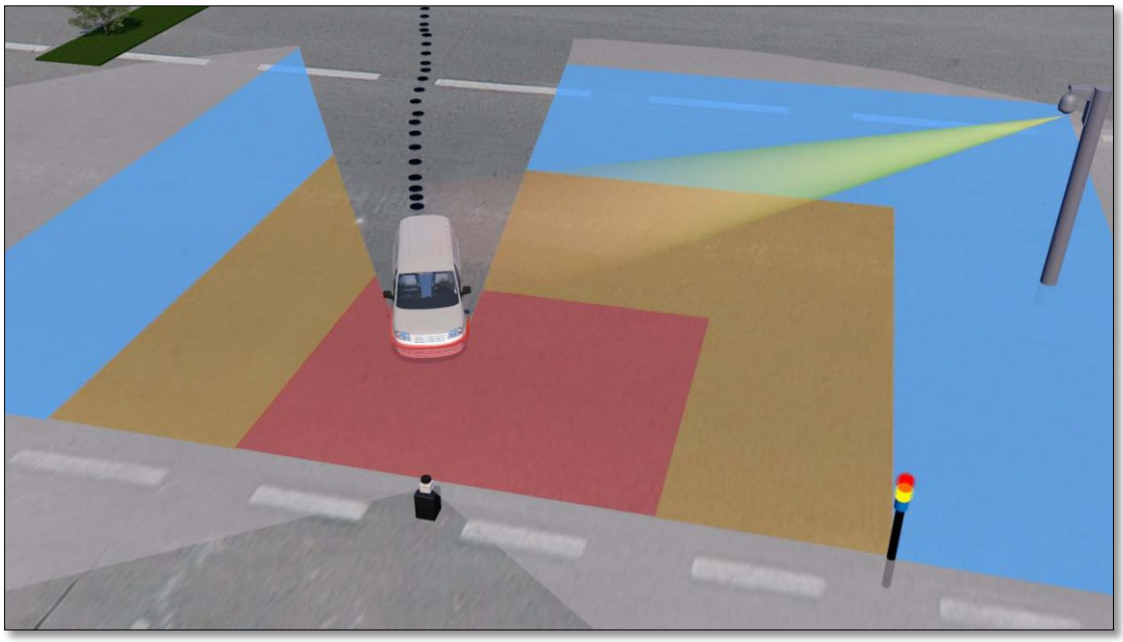
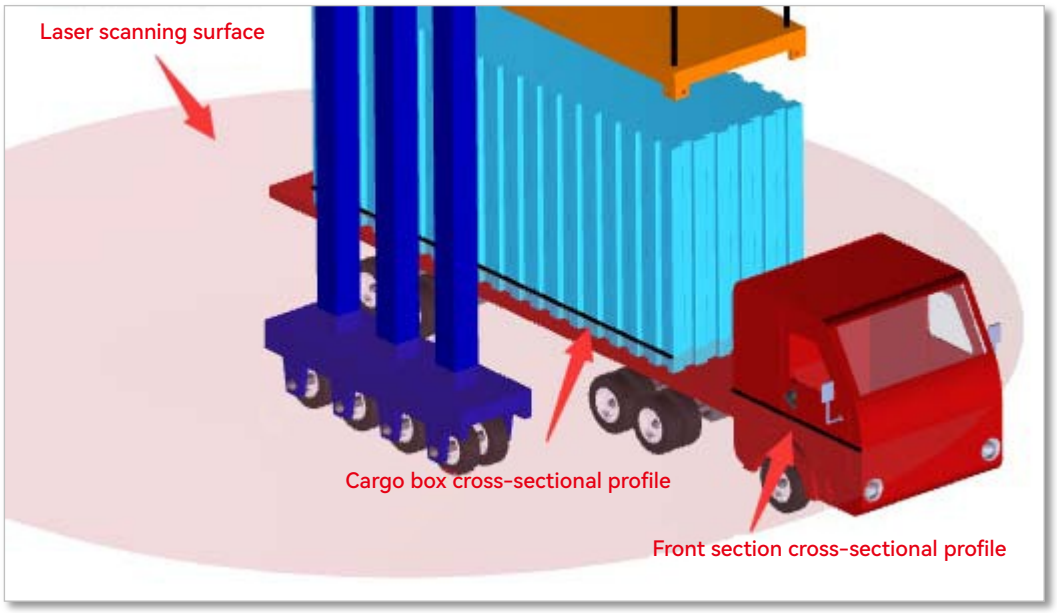


Figure 5. Regional monitoring function

Container truck anti-lifting and anti-smashing front monitoring



When port cranes unload containers from incoming trucks, truck drivers sometimes forget to unlock the locking pins, or the trucks are in poor condition and the pins don't fully open. Due to the crane operator's elevated position, it's difficult to accurately see the container locking status. Lifting the container and truck together, or only partially lifting it, before the locking pins are fully open can cause serious equipment damage and personal injury. Furthermore, if the crane operator misaligns the container during loading, there is a risk of it hitting and damaging the truck cab during lowering. The DK-LD-100L monitoring system can effectively prevent these accidents.

A DK-LD-100L laser scanner is installed on one side of the yard bridge lane, with its scanning surface parallel to the ground. During unloading operations, it detects the separation of the flatbed trailer's pallet and the container, ensuring that no suspended objects are scanned within the vertical projection range of the working container when the spreader is raised to the appropriate height. During loading operations, it detects the position of the truck cab, ensuring that the cab does not enter the vertical projection range of the working container. If either of these situations is detected, the monitoring system brakes the spreader to ensure the safety of the truck and driver.

The monitoring system requires only one DK-LD-100L unit installed on one side. It effectively monitors various locking pins that are not open during unloading operations and simultaneously prevents the truck cab from being struck during loading operations. It features fast response, high reliability, and the monitoring software is built into the DK-LD-100L, eliminating the need for an additional control unit. It is technically and economically efficient, easy to install and maintain, and comprehensively meets application requirements and field operating conditions. Furthermore, the DK-LD-100L's strong outdoor working capability ensures the system's all-weather operation.

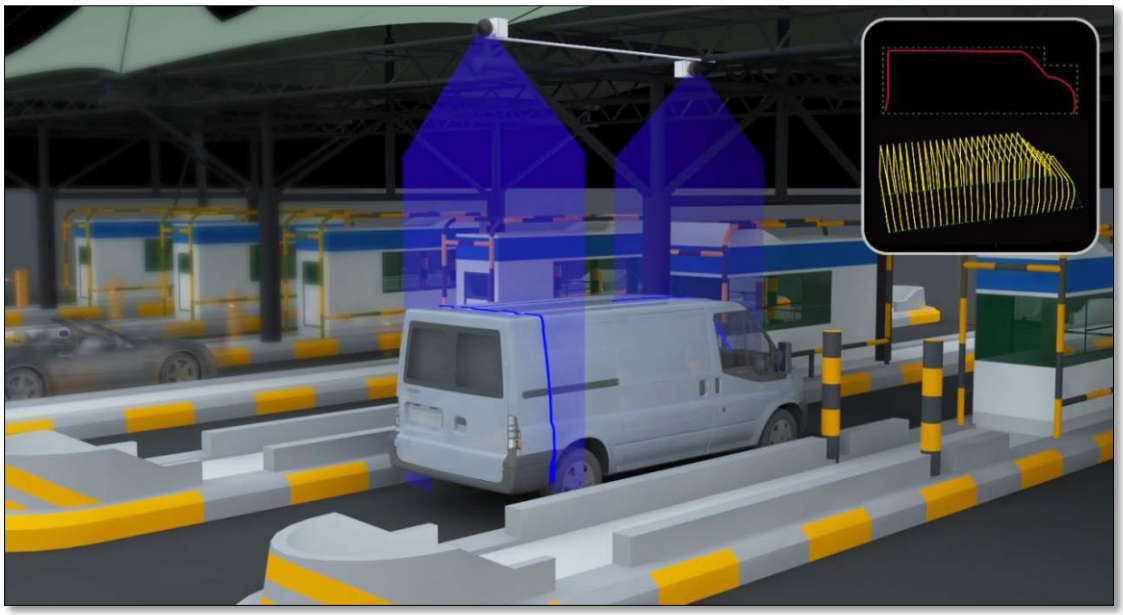
Container hoisting anti-collision box monitoring

In container terminal yards, collisions between containers and gantry cranes are frequent during operations due to insufficient lifting height of the spreader. These "bowling" accidents not only damage containers, cargo, and equipment, but also seriously endanger personnel safety. The DK-LD-100L monitoring system can effectively prevent such accidents.

Installing the DK-LD-100L on the gantry crane allows for real-time scanning of the container stacking profile below the spreader. It compares the height of the working surface below the spreader or the bottom surface of the lifted container with the stacking profile. If an impact point is found, the system calculates the distance between the impact point and the working surface in front of the spreader. Based on the impact distance, it interlocks the spreader's translational operation, such as slowing down to facilitate the driver's lifting of the spreader, or forcibly stopping the crane.

The monitoring software is built into the DK-LD-100L, outputting interlocking control commands via I/O output terminals. This avoids external data transmission and processing, resulting in fast response, high reliability, and a smaller installation footprint. Furthermore, the DK-LD-100L's strong outdoor working capability ensures all-weather operation of the system.

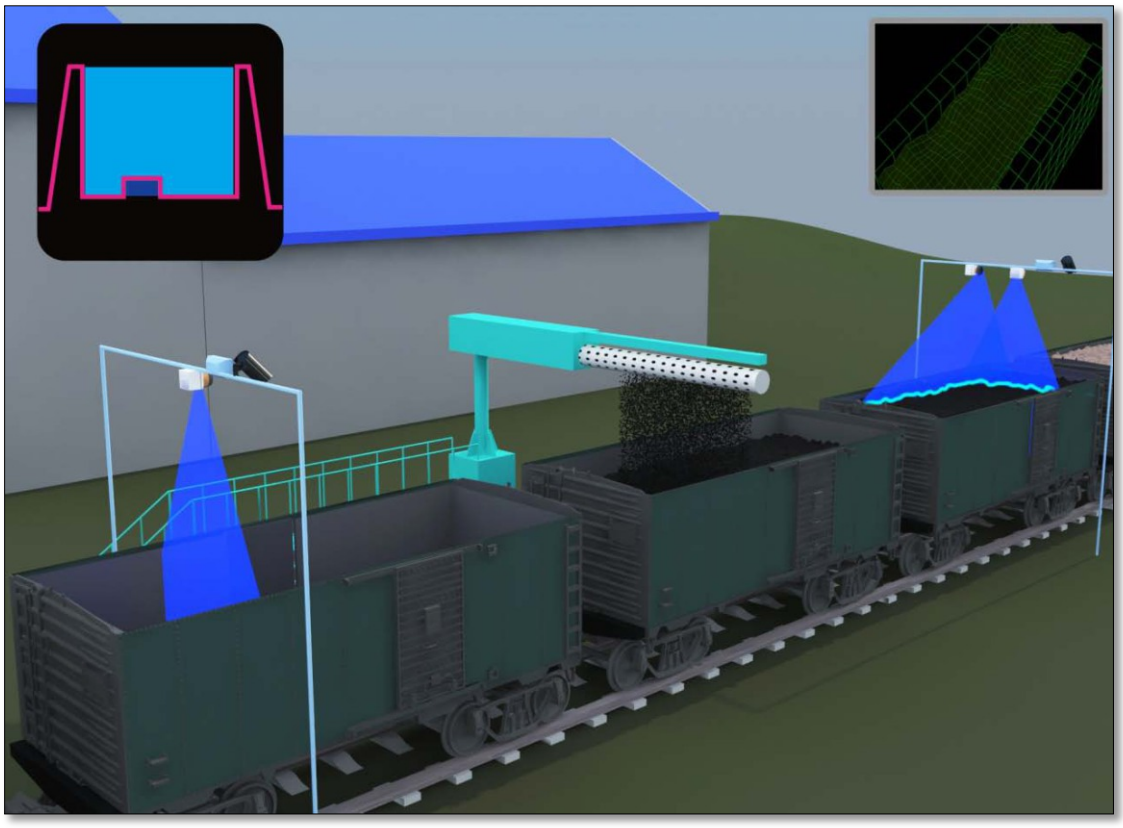
Highway toll booth vehicle recognition



Two DK-LD-100L scanners, each with a scanning surface perpendicular to the road surface, are installed on the top of the toll lane on a highway. These scanners measure and classify the shape of vehicles entering the toll lane, enabling automatic toll collection.

The DK-LD-100L scanner with its scanning surface parallel to the direction of travel obtains the vehicle's position by scanning its longitudinal profile and measures its instantaneous speed. The DK-LD-100L scanner with its scanning surface perpendicular to the direction of travel obtains the vehicle's cross-sectional shape. The results from both measurements are combined to generate a complete 3D "point cloud" image of the vehicle's shape, which is used to confirm the vehicle type and determine the toll rate.

Automatic loading control for trains and large transport vehicles

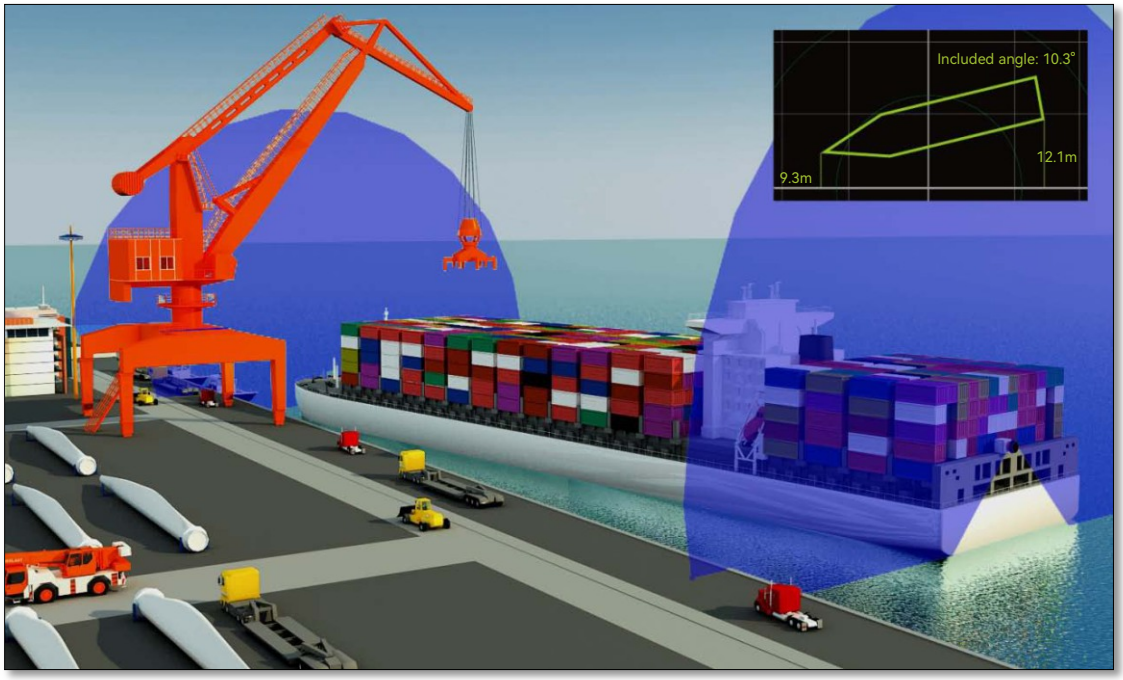


For automated loading systems on trains and large transport vehicles, it is essential to first ensure that the interior of the carriages is free of obstructions before the vehicles enter the station, thus avoiding lost transport capacity. After loading, the loading effect must be ensured, and anomalies such as overloading, underloading, and uneven loading must be detected. This requires two detection systems. The first system is deployed in the loading entry channel to acquire and classify the shape of empty carriages, while simultaneously detecting the presence of foreign objects. The second system is deployed in the loading exit channel to measure and analyze the shape of the loaded surface of the carriages after loading, determining the volume and upper surface shape of the cargo, and detecting any anomalies such as overloading, underloading, or uneven loading.

Each system comprises two DK-LD-100L scanners, their scanning surfaces perpendicular to each other and both perpendicular to the vehicle's travel plane. The DK-LD-100L with its scanning surface parallel to the travel direction acquires the vehicle's position by scanning its longitudinal profile and measures its instantaneous speed. The DK-LD-100L with its scanning surface perpendicular to the travel direction acquires the vehicle's cross-sectional profile. The two measurement results are combined to obtain a complete 3D "point cloud" image of the vehicle's shape. The speed-measuring radars of the two systems can be shared.

The DK-LD-100L's 0.5° scanning angle resolution ensures the accuracy of instantaneous speed and cross-sectional profile measurements. Furthermore, the DK-LD-100L's ability to penetrate rain, fog, and dust in automated loading stations ensures measurement accuracy, enabling the system to operate effectively and reliably with low maintenance frequency.

Ship berthing guidance

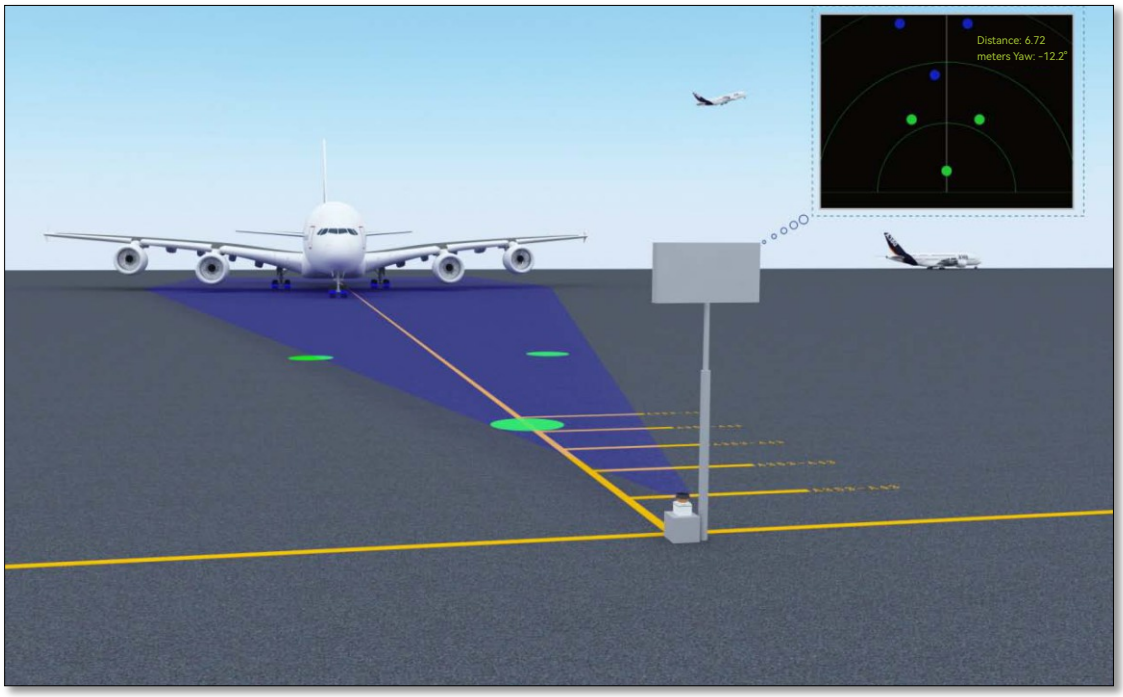


During berthing, the helmsman needs to understand the distance and angle between the vessel and the berth surface to ensure parallelism. Considering the limited field of vision on the bridge and the impact of rain and fog on visibility, berthing maneuvering poses a challenge to vessel handling skills. A berthing guidance system can effectively reduce the difficulty of berthing maneuvering and improve berthing efficiency.

The system consists of two DK-LD-100L units installed at the bow and stern. The DK-LD-100Ls are positioned along the vessel's longitudinal axis, with their laser scanning surfaces perpendicular to the axis. Both DK-LD-100Ls simultaneously measure the berth surface. By geometrically calculating the distance images of the berth surface sections acquired simultaneously from the bow and stern, and combining this with the vessel's length, the system can obtain the angle and vertical distance between the vessel and the berth surface. This data is then displayed graphically on the bridge's berthing guidance terminal to guide the helmsman's berthing operations.

The DK-LD-100L's strong measurement capabilities and outdoor working ability ensure the system's effectiveness and reliability, while its relatively low price also ensures its availability.

Aircraft parking guidance



Aircraft pilots must ensure accurate parking position during airport berthing operations, ideally achieving parking in one go. Considering the limited field of vision on the cockpit and reduced visibility at night, the berthing process presents a challenge to piloting skills. A berthing guidance system can effectively reduce the difficulty of berthing operations and improve berthing efficiency.

The system consists of a ground-mounted DK-LD-100L and a guidance display screen. The DK-LD-100L's scanning surface is parallel to the ground. As the aircraft approaches the berth, the DK-LD-100L locates the positions of the three landing gears, determines the approach distance and angle through geometric calculations, and displays the data on the guidance display screen. The pilot then controls the berthing process based on the information provided on the guidance display screen.

The DK-LD-100L's strong measurement capabilities and outdoor operating capabilities ensure the system's effectiveness and reliability, while its relatively low price ensures its availability.

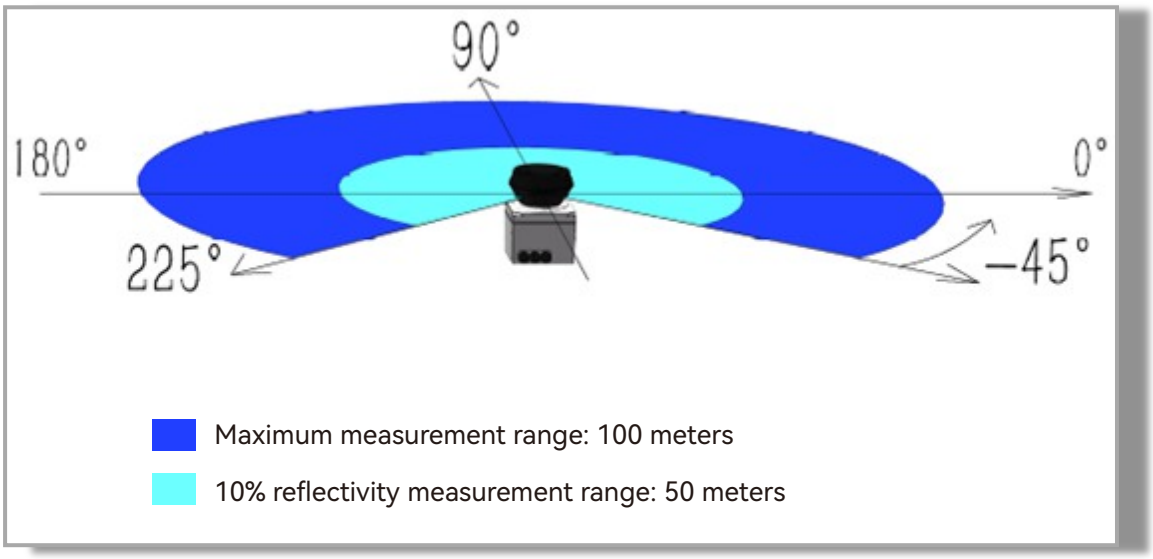
Model	DK-LD-100L	DK-LD-101L
Light Source	Infrared laser (905nm)	
Laser Safety Level	Class I (GB 7247.1-2012, eye-safe)	
Laser Spot Exit Diameter	12mm	
Laser Spot Divergence Angle	6mrad	
Scanning Angle Range	270°	
Scanning Frequency	25Hz	
Scanning Angle Resolution	0.5°	0.25°
Measurement Range	0.07m – 100m	
10% Reflectivity Range	50m	
Outdoor Performance	Resistant to dirt and sunlight	
Rain, Fog, and Dust Penetration	Support	
Technical Specifications		
Measurement Error (Typical)		
Systematic Error	2cm(1m~20m) / 4cm(20m~50m)	
Statistical Error (1σ)	1cm(1m~20m) / 2cm(20m~50m)	
Built-in Applications	Area Monitoring Monitoring Modes: Point Count Monitoring / Target Width Monitoring / Contour Monitoring Monitoring Signal Types: Attention / Warning / Alarm Number of Area Groups: 16 groups, supports self-learning background cropping Number of Concurrent Working Area Groups: 16 (max) Guides network cameras to perform video positioning and tracking of monitored targets.	
Device Self-Test	Content: Dirty/Obstructed light-transmitting cover/High temperature/Low temperature/Dense fog Output method: Indicator light + TCP message	
Device Interfaces		
Ethernet	Speed: 10/100 Mbps Network Protocol: TCP / UDP Functions: Device configuration / Measurement data output / Area monitoring signal output	
I/O Inputs	Quantity: 4 Type: Level Input High Level Range: DC 10V – 30V Low Level Range: DC 0V – 0.7V Preset Functions: Force Cancel/Force Enable Area Monitoring Signal, Valid Level: High Level Power Saving and Life Extension Control, Valid Level: High Level	
I/O Outputs	Quantity: 4 units Type: PNP/NPN switch output Maximum switching voltage: DC30V Power-on status: Off Preset function: Device ready/area monitoring signal output, valid status: configurable	
Indicator Lights	Quantity: 4 Definitions: PWR (Power Supply) LNK (Ethernet) ERR (Equipment Alarm: Dirty/Obstructed/Dense Fog, High/Low Temperature) HTR (Normal Measurement)	

Electrical/Mechanical Parameters	
Operating Voltage	DC 10V – 30V
Power Consumption	6W (measurement), 16W@DC12V / 32W@DC24V (heating)
Enclosure Protection Rating	IP67 (GB 4208-2008)
Safety Protection Rating	
Insulation Resistance	1MΩ (GB 16796-2009, 5.4.4)
Dielectric Strength	0.5KV (GB 16796-2009, 5.4.3)
Dimensions (L x W x H)	126 × 126 × 184 (mm)
Weight	1.76Kg
Operating Environment Standards	
Electromagnetic Compatibility (EMC)	
Electrostatic Discharge	6KV (GB/T17626.2-2006, Level 3)
Fast Burst Immunity	1KV (GB/T17626.4-2008, Level 2)
Electromagnetic Field Radiation Immunity	GB/T17626.3-2006, Level 2
Surge Immunity	GB/T17626.5-2008 Power Interface: 1.2/50us, 2KV/1KA (Level 3) Ethernet Interface: 10/700us, 1KV/25A (Level 2) I/O Interface: 1.5/50us, 0.5KV/0.25KA (Level 1)
Impact	GB/T 2423.5
Single Impact	15g，11ms
Continuous Impact	10g，16ms
Vibration	GB/T 2423.10
Frequency Range	10Hz – 150Hz
Amplitude	5g
Humidity	93%，+40℃，2h(GB/T 2423.3)
Operating Temperature Range	-25℃ – +50℃
Storage Temperature Range	-30℃ – +70℃
Ambient Illumination Range	0lux – 80,000lux
Rainfall Range [1]	≤20mm/h
Fog/Haze Visibility Range [2]	≥2Km

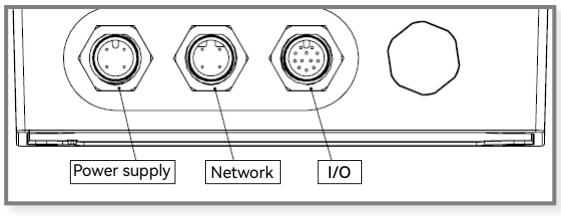
1. Normal operating conditions for regional monitoring functions: The typical rainfall reference value for heavy rain is 4 mm/h, and for torrential rain it is 10 mm/h;

2. Normal operating conditions for regional monitoring functions: The visibility reference value for moderate haze and light fog is 3 km, and for heavy haze it is 1 km.

Measurement coordinate system / Scan range / Measurement range

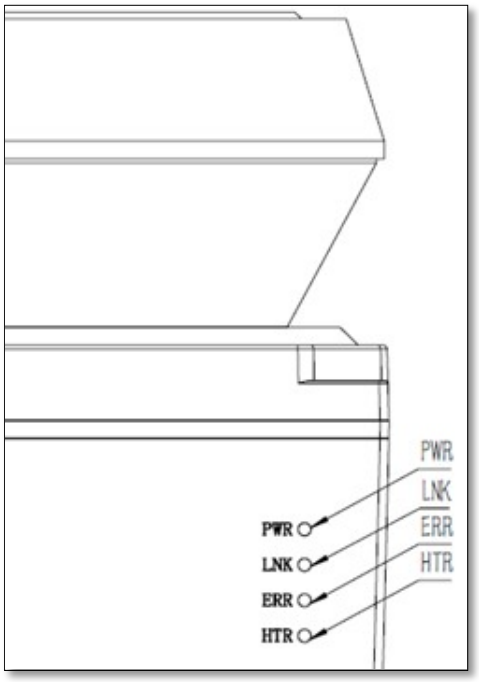


Device Interface



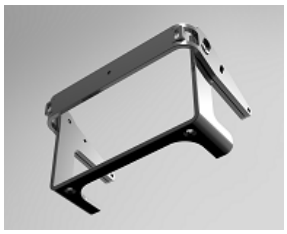
Outlet	Type	Description
Power Supply	M12 (Type A), Male	4-core
Ethernet	M12 (Type B), Male	4-core
I/O	M12 (Type A), Male	12-core

indicator lights



Name	Description
PWR	Power indicator light * Off: No power / Power invalid * On: Power on
LNK	Ethernet indicator light * Off: No network connection * On: Network connection available
ERR	Fault Indicator Light * Start-up Status: On (approx. 24 seconds) * Off: No fault * On: Internal fault / Measurement abnormality [1] * Long flash (0.5Hz): High temperature / Low temperature alarm * Short flash (1Hz): Dirty/obstructed light cover [2]
HTR	Normal Measurement Indicator * Start-up Status: Off * Constantly Off: Device has not started measuring * Constantly On: Device is measuring normally

1. Includes measurement stoppage and motor shutdown;
2. Includes obstruction by dense fog and obstruction of the monitoring area.

Accessories	Model Number	Description
Dust plug		
	DK11@M12	3, with random deliverables.
Connecting cable		
	DK11@M12AF5LD	Power cable, 1.5 meters long End A: M12 terminal (Type A) Female, 5 cores End B: Lead wire, 4 cores Deliverables
	DK21@M12BF5RJ45	RJ45 network cable, 1.5 meters long End A: M12 connector (Type B) Female, 5 pins End B: RJ45 plug Delivery
	DK31@M12AF12LD	I/O cable, 1.5 meters long End A: M12 terminal (Type A) Female, 12 cores End B: Lead wire, 12 cores Deliverables
Mounting bracket		
	DK21@DK-LD-100L	Side mount Stainless steel Adjustable tilt and tilt angle Requires separate order
	DK31@DK-LD-100L	Seat support frame Stainless steel Adjustable tilt and tilt angle Requires separate order
Protective cover		
	DK21@DK-LD-100L	Outdoor protective cover Made of stainless steel Features impact protection, sunshade, and dirt protection Requires separate order