

LS Series Laser Lidar - Obstacle Avoidance Type
OPERATION MANUAL
(August 2022)



(The picture is for reference only, the actual item may be different from the picture shown.)

Shandong Keli Opto-electronic Technology Co., Ltd.

Directives and standards

LS series laser lidar (referred to as LS) meets the following standards:

- **European Union Directive**
EMC Directive 2014/108/EC
- **International standard**
EMI: EN61326-1: 2013
EN55011: 2009 + A1: 2010
EMS: EN 61326-1: 2013
EN 61000-4-2: 2009
EN 61000-4-3: 2006 + A1: 2009 + A2: 2010
EN 61000-4-4: 2004 + A1: 2010
EN 61000-4-6: 2009
EN 61000-4-8: 2010
EN 61000-4-11: 2004
- **GB standard** GB 4028

Safety precautions

The following safety warning signs are used to warn potential personal injury hazards, please follow all safety information with this symbol to avoid possible injury.

<p>This is a key information prompting sign. Sign contents are very important. Operators must understand content requirements and implement the operations in strict accordance with the requirements, so as to avoid possible accidents.</p>

<p>This is a safety warning sign. Sign contents are very important. Operators must strictly enforce the safety information prompted on the sign, so as to avoid possible accidents.</p>

Safety precautions for use

<ul style="list-style-type: none"> ➢ Before using LS, please carefully read this manual carefully to understand the procedures and requirements of installation, operation and setting. ➢ LS should be selected, installed, overhauled and maintained by professionals. Professionals refer to the people who have been professionally trained and accredited, or people who have a wealth of knowledge, training and experience and the ability to solve such problems. ➢ Measures should be taken to prevent water vapor, dust and other substances from entering LS when USB interface is open. In order to achieve the IP65 protection grade in use, please close the black seal cover on the USB interface. ➢ Do not drop LS. ➢ LS should be used in accordance with local relevant standards and laws and regulations. ➢ Users should establish rules and regulations for safe operation and management and implement them effectively.

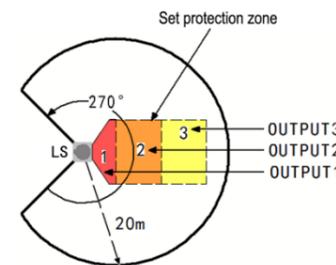
Applications

Obstacle avoidance type LS is suitable for collision prevention of mobile robots. The typical application is automated guided vehicle (AGV) and rail guided vehicle (RGV).

- The protection object of LS must meet the following conditions:
 - 1) Only protect the objects that go into the protection zone.
 - 2) LS cannot detect transparent and translucent objects.
The size of objects that go into the protection zone must be greater than or equal to the detection capability of LS.
- Do not install LS in the following environments:
 - 1) Places outside the range of environment specified in the Operation Instructions (temperature, humidity, interference light, impact and vibration).
 - 2) Places with flammable or explosive gas.
 - 3) Places with smoke, particles, corrosive chemicals and other substances.
 - 4) Places that may generate strong light interference (such as direct light) on the LS.

1. Working principles and protection zone configuration

LS is designed based on pulsed laser ranging principles to realize the two dimensional zone detection with an angle of 270° and radius of 20m through rotational scanning.
Users can configure the mode and shape of protection zone through the configuration software.



Introduction to the configuration of protection zone for mobile robot

Identification	Meaning	Description
3	Protection zone 3 configured by user	OUTPUT3 will enter OFF state when any obstacle is detected
2	Protection zone 2 configured by user	OUTPUT2 will enter OFF state when any obstacle is detected
1	Protection zone 1 configured by user	OUTPUT1 will enter OFF state when any obstacle is detected
LS	LS obstacle avoidance laser lidar	Scanning angle: 270°, Radius: 20m @70% reflectance, 8m @10% reflectance

2. System description

LS supplies power to its system and monitors the external equipment through the power cable. Users can use the USB configuration cable to connect the lidar with the computer, and set the relevant parameters such as the protection area through the configuration software.



3. Appearance information



<p>Be sure to press the black sealing cover on the USB interface tightly to prevent moisture, dust, etc. from entering the LS, so as not to affect the use and life of the lidar.</p>

Mark	Indicator	Color	Description
OUT1	Output 1	Red	It is the status indicator light in protection zone 1, and the light is on when any obstacle is detected
OUT2	Output 2	Red	It is the status indicator light in protection zone 2, and the light is on when any obstacle is detected
OUT3	Output 3	Red	It is the status / system fault indicator (optional, configured through working mode) in protection zone 3, and the light is on when any obstacle is detected in protection zone 3
POWER	Power supply	Red	It will turns on after turning on the power
8	Digital tube	Red	0 : Protection zone is not configured or there is input signal failure
			1 : The current scanning zone is Zone group 1
			2 : The current scanning zone is Zone group 2
			3 : The current scanning zone is Zone group 3
			4 : The current scanning zone is Zone group 4
			5 : The current scanning zone is Zone group 5
			6 : The current scanning zone is Zone group 6
			7 : The current scanning zone is Zone group 7
			8 : The current scanning zone is Zone group 8
			9 : The current scanning zone is Zone group 9
			0 : The current scanning zone is Zone group 10
			1 : The current scanning zone is Zone group 11
			2 : The current scanning zone is Zone group 12
			3 : The current scanning zone is Zone group 13
			4 : The current scanning zone is Zone group 14
			5 : The current scanning zone is Zone group 15
6 : Establish a communication connection with computer			
8 : It is flashing during power-on initialization (with an interval of 1 second)			
9 : LS configuration is successful			
F : LS system fails			
			When multiple statuses coexist, multiple status words are displayed cyclically (with an interval of 1 second)

4. Specification

Series	Maximum scan radius	Scan angle	Output form	Maximum measurement error	Angle resolution	Installation code
LS(2)	□□	27	□□ / □	□	□□ / □□	□□

Specification	Maximum scan radius	Output form	Maximum measurement error	Angle resolution
LS-0627BP/M05	6m@70%reflectance	PNP	±4cm@1sigma	0.5°
LS-0627BPH/M05		PNP		
LS-0627BN/M05	2m@10%reflectance	NPN		
LS-1027BP/M05	10m@70%reflectance	PNP	±4cm@1sigma	0.5°
LS-1027BPH/M05		PNP		
LS-1027BN/M05	4m@10%reflectance	NPN		
LS-2027BP/M05	20m@70%reflectance	PNP	±4cm@1sigma	0.5°
LS-2027BPH/M05		PNP		
LS-2027BN/M05	8m@10%reflectance	NPN		
LS2-0627BP/M05	6m@70%reflectance	PNP	±4cm@1sigma	0.5°
LS2-0627BPH/M05		PNP		
LS2-0627BN/M05	2m@10%reflectance	NPN		

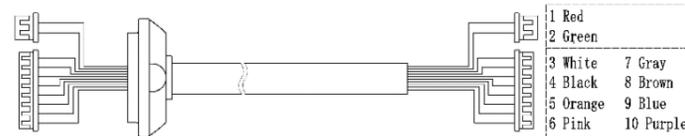
LS2-1027BP/M05	10m@70%reflectance 4m@10%reflectance	PNP	±4cm@1sigma	0.5°
LS2-1027BPH/M05		PNP		
LS2-1027BN/M05	20m@70%reflectance 8m@10%reflectance	NPN	±4cm@1sigma	0.5°
LS2-2027BP/M05		PNP		
LS2-2027BPH/M05	8m@10%reflectance	PNP	±4cm@1sigma	0.5°
LS2-2027BN/M05		NPN		

Scanning angle: 270°

Installation code: SZ: Horizontal installation
CZ: Vertical installation
FZ: Scatter shield installation

5. Power cable

The power cable structure is shown below, and the standard length is 1m.



No.	Wire core color	Signal definition	Signal description
1	Red	24V	Working power supply
2	Green	0V	
3	White	Z1	Zone group is used to select signals, and thus realize the switching among multiple protection zones through the changes in Z1, Z2, Z3 and Z4 input signals
4	Black	Z2	
5	Orange	Z3	
6	Pink	Z4	
7	Gray	INCOM+	Zone group is used to switch signal input shared terminal (connected to the positive pole of DC power)
8	Brown	OUTPUT1	Output signal, OUTPUT1: Protection zone 1 will enter the OFF state when any obstacle is detected. OUTPUT2: Protection zone2 will enter the OFF state when any obstacle is detected. OUTPUT3: Protection zone3 will enter the OFF state when any obstacle / system failure is detected (alternative, it can be configured by user)
9	Blue	OUTPUT2	
10	Purple	OUTPUT3	

6. Technical parameters

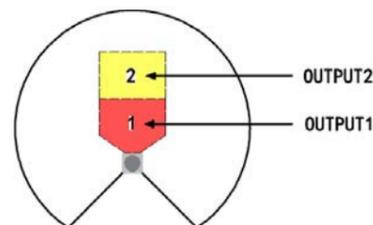
Optical properties	
Laser light source	905nm wavelength, Class A laser product
Max. scan radius	20m@ 70% reflectance 8m@ 10% reflectance
Scan angle	270°
Angle resolution	0.5°
Measurement error	±4cm
Electrical / mechanical parameters	
Supply voltage	DC9V to DC30V
Power-on time	Typical 6s
Power consumption	Typical 3W

Output	OUTPUT1: Protection zone 1 will enter the OFF state when any obstacle is detected. OUTPUT2: Protection zone2 will enter the OFF state when any obstacle is detected. OUTPUT3: Protection zone3 will enter the OFF state when any obstacle / system failure is detected (alternative, it can be configured)
Dimensions	62×64×84.2mm
Cable length	≤30m
Environmental properties	
Ambient temperature	Work: -10℃ to 50℃(no frost or condensate fog) Storage: -30℃ to 70℃,
Ambient humidity	Work: 35%RH to 85%RH Storage: 35%RH to 95%RH
Ambient light immunity	15000Lux
Shock resistance	Acceleration: 10g; pulse duration: 16ms; Number of collision times: three axes, 1000 ± 10 times per axis
Vibration resistance	Frequency 10Hz ~ 55Hz; amplitude: 0.35 ± 0.05mm; Number of scans: three axes, 20 times per axis
Enclosure rating	IP65
Electromagnetic compatibility (EMC)	EMI EN61326-1: 2013 EN55011: 2009 + A1: 2010
	EMS EN 61326-1: 2013 EN 61000-4-2: 2009 EN 61000-4-3: 2006+A1: 2009+A2: 2010 EN 61000-4-4: 2004 + A1: 2010 EN 61000-4-6: 2009 EN 61000-4-8: 2010 EN 61000-4-11: 2004
Configurable functions	
Protection zone configuration	The user can configure the protection zone of LS to the desired shape by configuring the software
Response time	Adjustable (40ms/r)
Zone group switching	4 groups of external input signal (Z1, Z2, Z3, Z4) to achieve the switching among 16 zone groups; when Z1, Z2, Z3 and Z4 are not received, zone group 1 will work by default
Working mode	LS provides 4 kinds of working modes, and the default is working mode 1

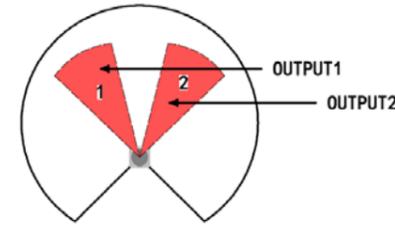
7. Working mode

LS provides 4 kinds of working modes, and the default is working mode 1, and user may modify the working mode by configuring software. See "Operation Instructions of LS Type Laser Lidar – Configuration Software".

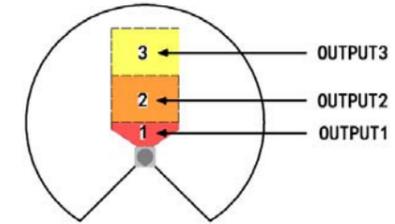
Mode 1: User can configure 2 protection zones from far and near corresponding to OUTPUT2 and OUTPUT1; meanwhile, provide system failure output OUTPUT3.



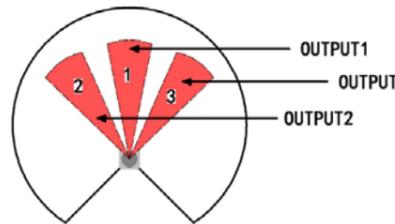
Mode 2: User can configure two independent protection zones corresponding to OUTPUT1 and OUTPUT2; meanwhile, provide system failure output OUTPUT3.



Mode 3: User can configure 3 protection zones from far and near corresponding to OUTPUT3, OUTPUT2 and OUTPUT1; not provide system failure output.



Mode 4: User can configure 3 independent protection zones corresponding to OUTPUT1, OUTPUT2 and OUTPUT3; not provide system failure output.



8. Installation

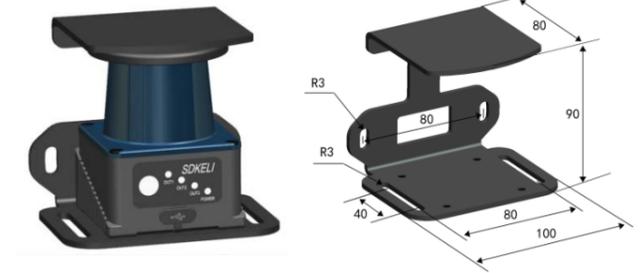
Horizontal installation (SZ)



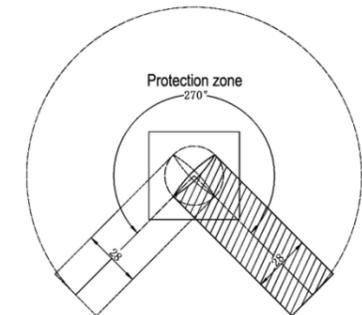
Vertical installation (CZ)



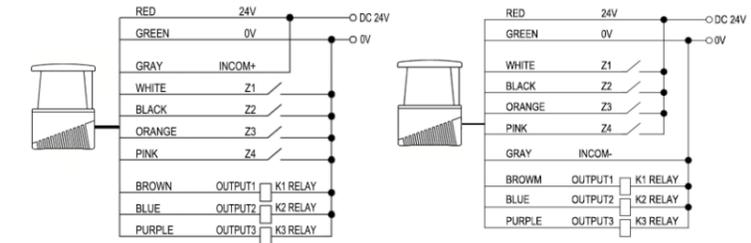
Scatter shield installation (FZ)



- To prevent the light from being projected to the ground, the installation height of LS should not be smaller than 200mm.
- Try to keep LS away from the vibration area during installation.
- During installation, there should be no obstacles in the optical receiving area shown in the figure below.

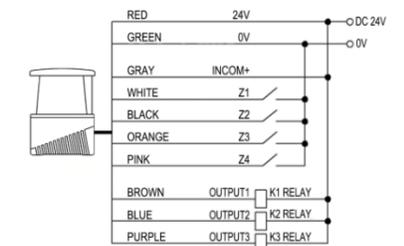


10. Wiring



PNP Output - BP type

PNP Output - BPH type



NPN Output

WARNING

- Please read this manual carefully before wiring.
- Wiring must be conducted after the power is cut off.
- Double insulation or reinforced insulation must be used between all input and output interfaces and dangerous voltages.
- LS cables must be kept away from high-voltage wires and power lines.
- Users should not replace the cable without permission.
- Conduct correct wiring after defining the signal meaning of all terminals.