SDKELI®

LS Series Laser Radar –
Obstacle Avoidance Type

OPERATION MANUAL

(June 2017)

Shandong Keli Opto-electronic Technology Co., Ltd.

■ Directives and standards

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

- European Union Directive EMC Directive 2004/108/EC
- International standard

  EMI: EN61326-1: 2013

  EN55011: 2009 + A1: 2010

  EMS: EN61326-1: 2013

  EN61000-4-2: 2009

  EN61000-4-3: 2006 + A1: 2008 + A2: 2010

  EN61000-4-4: 2012

  EN61000-4-6: 2009

  EN61000-4-8: 2010
- 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.

⚠ Caution

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.

⚠ Warning

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.

■ Safety precautions

⚠ Caution

- 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.
- To prevent the light from being projected to the ground, the installation height of LS should not be smaller than 100mm. Try to keep LS away from the vibration area during installation.
- When the USB interface is opened, water vapor and dust should be prevented from entering the LS. 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.

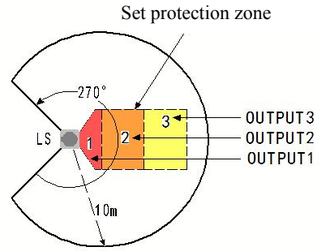
- Do not install LS in the following environments:

  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 10m through rotational scanning.

Users can configure the mode and shape of protection zone through the configuration software.

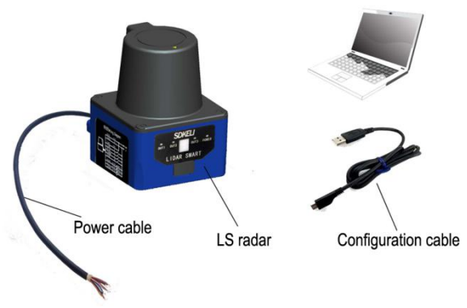


Introduction to the configuration of obstacle avoidance protection zone of mobile robot

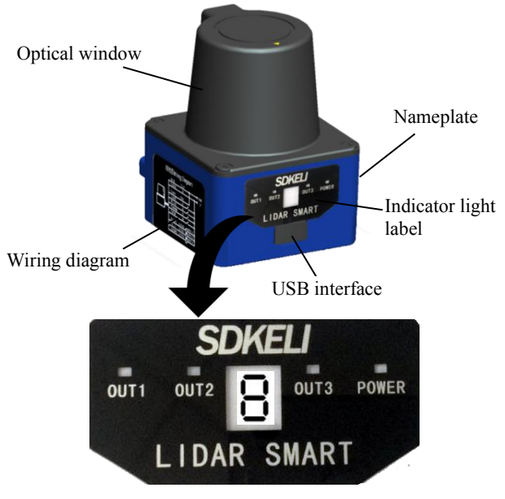
Identification	Meaning	Description
3	Protection zone 3 configured by user	OUTPUT3 will enter OFF state when any obstacle is detected
2	Protection zone 2 configured by user	OUTPUT2 will enter OFF state when any obstacle is detected
1	Protection zone 1 configured by user	OUTPUT1 will enter OFF state when any obstacle is detected
LS	LS obstacle avoidance laser radar	Scanning angle: 270 °, radius: 10m, reflectivity: @70%; radius: 4m, reflectivity: @10%

2. System composition

The LS system is composed of one laser radar, one power cord, one configuration line and configuration software. The user can use the configuration line to connect the laser radar with the computer, and set the relevant parameters such as the protection zone through the configuration software.



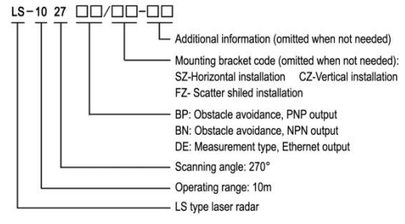
3. Appearance information and indication signs



Identification	Indicator light	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 the zone group 1
			2 : The current scanning zone is the zone group 2
			3 : The current scanning zone is the zone group 3
			4 : The current scanning zone is the zone group 4
			5 : The current scanning zone is the zone group 5
			6 : The current scanning zone is the zone group 6
			7 : The current scanning zone is the zone group 7
			8 : The current scanning zone is the zone group 8
			9 : The current scanning zone is the zone group 9
			A : The current scanning zone is the zone group 10
			B : The current scanning zone is the zone group 11
			C : The current scanning zone is the zone group 12
			D : The current scanning zone is the zone group 13
			E : The current scanning zone is the zone group 14
			F : The current scanning zone is the zone group 15
			G : The current scanning zone is the zone group 16
			H : Establish a communication connection with computer
			I : It is flashing during power-on initialization (with an interval of 1 second)
			J : LS configuraiton is successful
			K : LS system fails
			When multiple statuses coexist, multiple status words are displayed cyclically (with an interval of 1 second)

Note: For zone groups 5-16, and the definition principle of digital tube identification is: 7-segment digital tube consists of vertical 4 segments and horizontal 3 segments. We specify that each vertical segment represents value 4 and each horizontal segment represents value 1. For example, zone group 7 consists of 1 vertical segment and 3 horizontal segments (7), protection zone 11 consists of 2 vertical segments and 3 horizontal segments (B), and protection zone 16 consists of 4 vertical segments (G).

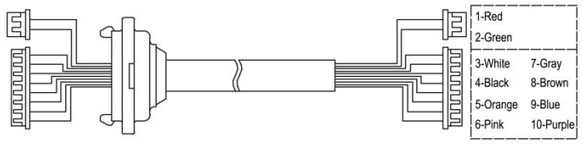
4. Specification



5. Transmission cable

The configuration line is a standard miro USB data cable, one end of which is miro USB interface and the other end of which is USB interface, and the length is 1.5m.

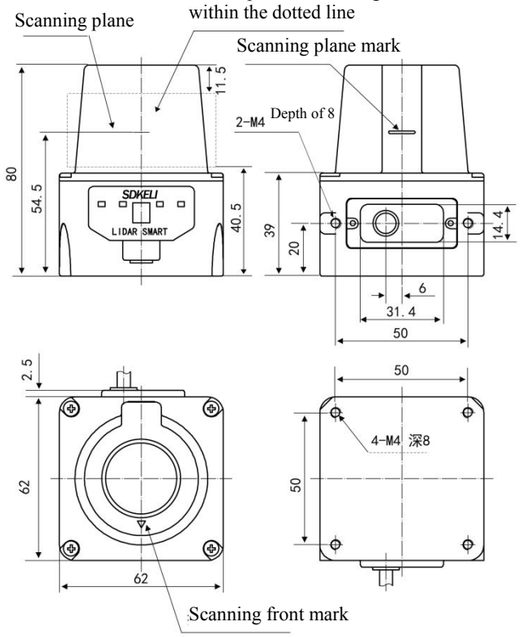
The power cable structure is shown below, and the standard length is 1m.



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 zone 2 will enter the OFF state when any obstacle is detected. OUTPUT3: Protection zone 3 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. Dimensions

The optical receiving area is within the dotted line



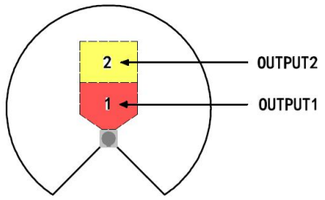
7. Technical Parameters

Optical properties			
Laser light source	Wavelength: 905nm; Class A laser product		
Maximum detection range	Radius: 10m; reflectivity: @ 70% (white object) Radius: 4m; reflectivity: @ 10% (black object)		
Scanning angle range	270°	Angular resolution	0.5°
Measurement error	±4cm		
Electrical / mechanical parameters			
Working voltage	DC9V～ DC30V/ DC18V～ DC30V		
Power-on time	Typical value 6s		
Power consumption	＜3W (No load on the output end)		
Output	OUTPUT1: Protection zone 1 will enter the OFF state when any obstacle is detected. OUTPUT2: Protection zone 2 will enter the OFF state when any obstacle is detected. OUTPUT3: Protection zone 3 will enter the OFF state when any obstacle / system failure is detected (alternative, it can be configured)		
Dimensions	62mm×62mm×80mm		
Cable length	≤30m		
Environmental properties			
Ambient temperature	Work: -10℃ ～50℃, Storage: -300℃～ 70℃, no frost or condensate fog		
Ambient humidity	Work: 35%RH ~ 85%RH, Storage: 35%RH ~ 95%RH		
Anti-light interference	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		
Protection grade	IP65		
Electromagnetic compatibility (EMC)	EMI	EN61326-1：2013 EN55011：2009 + A1：2010	
	EMS	EN61326-1：2013 EN61000-4-2：2009 EN61000-4-3：2006 +A1：2008 +A2：2010 EN61000-4-4：2012 EN61000-4-6：2009 EN61000-4-8：2010	
Configurable functions			
Protection zone configuration	The user can configure the protection zone of LS to the desired shape by configuring the software		
Response time	80ms (2 scanning cycles) ~ 640ms (16 scanning cycles), 80ms by default		
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		

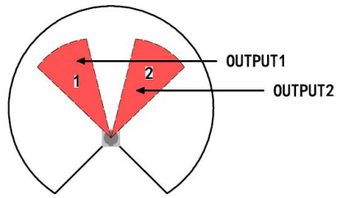
8. Working mode

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 Radar – Configuration Software”.

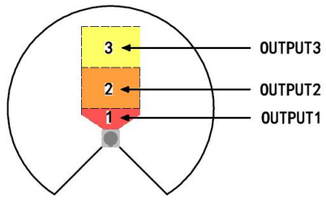
Mode 1: User can configure 2 protection zones from far and near corresponding to OUTPUT2 and OUTPUT1; meanwhile, provide system failure output OUTPUT3.



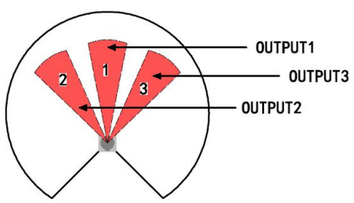
Mode 2: User can configure two independent protection zones corresponding to OUTPUT1 and OUTPUT2; meanwhile, provide system failure output OUTPUT3.



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

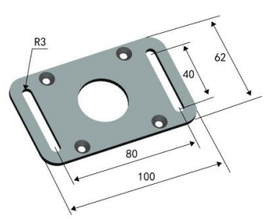


Mode 4: User can configure 3 independent protection zones corresponding to OUTPUT1, OUTPUT2 and OUTPUT3; not provide system failure output.

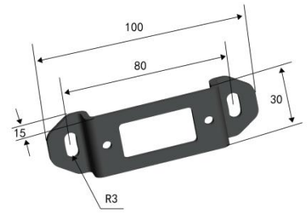


9. Installation

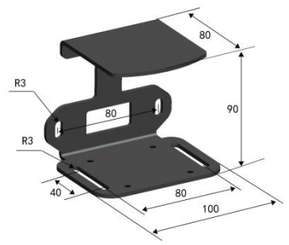
■ **Horizontal installation (SZ)**



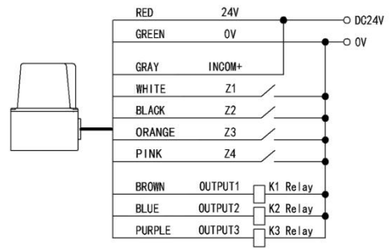
■ **Vertical installation (CZ)**



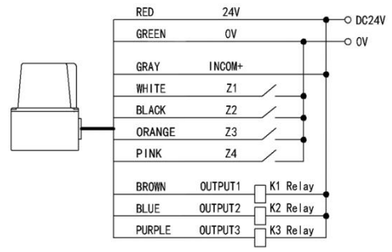
■ **Scatter shield installation (FZ)**



10. Wiring



PNP Output



NPN Output

⚠Warning

- Please read this manual carefully before wiring
- Wiring must be conducted when the power is cut off
- Double insulation or reinforced insulation must be used between all input and output interfaces and dangerous voltage. Otherwise, electric shock may be caused
- The cable of LS must be kept away from high-voltage wires and power lines
- It is strictly forbidden for users to replace the cable without permission
- Conduct correct wiring after defining the signal meanings of all terminals