SK-A100

User Manual for

Laser Ranging

Sensor

Shanghai Shenji Optoelectronics
Technology Co., Ltd

Shanghai SenkyLaser Photoelectric Technology Co.
LTD

Version: V3.0 Date: September 21,

2024 Version: V3.0 Date: 2024.9.21

describe

This document is used to guide users in using the SK-A100 ranging LiDAR. The article introduces product performance, structural dimensions, communication protocols, and precautions for use.

The interpretation of this article belongs to Shanghai Shenji Optoelectronics Technology Co., Ltd. This document may differ from the latest product version sold, please refer to the explanation provided by the sales engineer for specific details.

If there are any unclear areas in the document, please contact the corresponding sales representative or email addresssales@shsenky.com.

VERSION	UPDATE	Update Date
V1.1	The first publishable version	2020-09-03
V1.2	Upper computer software update, adding trigger testing area Domain; New version of upper computer development	2020-09-25
V2.0	New protocol, new shell	2021.1.4
V3.0	New protocol, new shell	2024.9.21

Contact Us

Shanghai Shenji

Optoelectronics Technology

Co., Ltd. Shanghai

Headquarters:
Address: Room 607, Building 1, Wanda Plaza,
Qingpu District, Shanghai Phone:
15238312802

Zhengzhou Branch:
Address: Room 718-2, Building 1, Incubation Zone West, National University Science and Technology Park, No. 11 Changchun Road, High tech Zone, Zhengzhou City.
Phone: 15238312802

Tmall Taobao
shop: official
account:

catalogue

1. Product Overview 4
2. Performance parameters 5
3. Key Index 6
4. Mechanical parameters 7
5. Cable Definition Output Interface 7
6. RS485 Communication Protocol 8
6.1 Communication physical parameters 8
6.2 protocol format 8
6.3 Implementation of CRC Check in C Language 9
6.4 Register Description 10
6.5 Register usage details and examples 10
7. 4-20mA current loop 12
8. Matters need attention 13
8.1 Influence factors 13
8.2 Safety Precautions 14

1. Product Overview

The SK-A100 laser ranging sensor adopts the principle of laser phase method for ranging. It is possible to quickly and accurately measure the distance between natural targets in a non-contact manner through the emission and reception of lasers.

Fix the SK-A100 laser rangefinder sensor in one position, and once it starts working, it can quickly emit a visible red laser beam. After measuring the target object, the laser diffuse reflection signal is received by the sensor and the lens; Under the premise of a constant speed of light, the phase method accurately calculates the time difference between transmission and reception, and immediately and quickly obtains the distance value between the target object and the sensor.

SK-100 laser ranging sensor, with an effective detection distance of over 100m indoors and over 60m outdoors with a dedicated reflector; The accuracy error can reach ± 2mm across the entire range; The highest frequency is 20Hz, which can track real-time position information of dynamic targets within 1m/s; The most suitable position/deformation/distance detection for static targets.

SK-A100， Combined with dedicated reflective panels, it can measure over

60m outdoors. The measurement effect is the same as indoors. Product features:

- ✓ Can be used both indoors and outdoors
- ✓ High frequency 20Hz
- ✓ The measurement distance is far, up to 150m at most;
- ✓ High precision, up to 1mm;
- ✓ High and low temperature resistance -20~+60 ℃
- ✓ Easy to install, IP67 protection
- ✓ Supports RS485 Modbus RTU and current loop 4-20mA
- ✓ Visible red laser indication
- ✓ Industrial

level customer application:

- ❖ Pipeline inspection
- ❖ Tunnel deformation monitoring
- ❖ Elevator location
- ❖ Length, width, and height measurement
- ❖ Bridge deformation monitoring
- ❖ Material level and water level measurement
- ❖ Driving and crane positioning monitoring

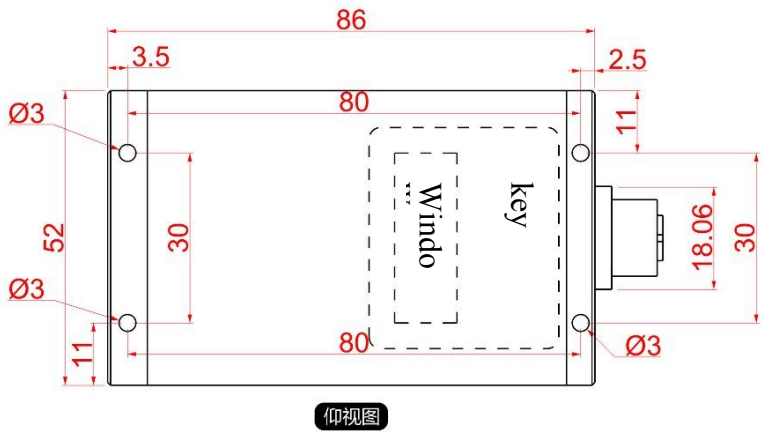
2. Performance parameters

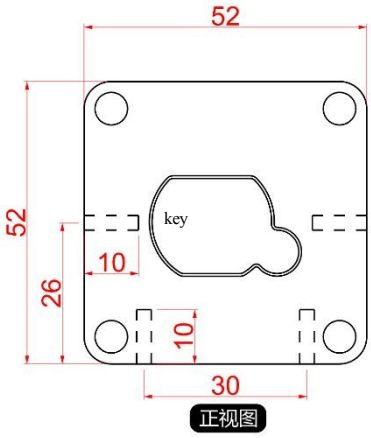
performance parameter				
model	SK-A100	SK-A100A	SK-A100B	SK-A100C
difference	Standard version	high frequency	The black effect is good for testing	large range
measuring range	100m	100m	100m	150m
frequency	3Hz	20hz	1-20hz	1-20hz
repeatability	2mm			
accuracy	±3mm			
Measure the target object	Natural surfaces or specialized reflectors for static or dynamic targets			
light source	Red visible laser with a wavelength of 635nm			
Laser safety level	2 (IEC 60825-1:2014, EN 60825-1:2014)			
Typical spot size (elliptical)	At 10m: 5x3mm At 25m: 10x6mm 50m away: 15x10mm At 100m: 30x20mm			
Laser lifespan	Over 10000 hours			
Mechanical and electronic parameters				
Supply Voltage	DC9~35V			
power consumption	＜1.5W			
Housing material	aluminium			
Dust proof lens material	High transparency quartz glass			
Specification size L * W * H	52*52*86mm			
degrees of protection provided by enclosure	IP67			
weight	230g			
operation temperature	-20~60℃			
Connector cable	M12 * 5 aviation plug, equipped with 1m cable			
install	Equipped with mounting bracket and reflective board			
data interface				
RS485 Modbus RTU/4-20mA/Digital/UART				

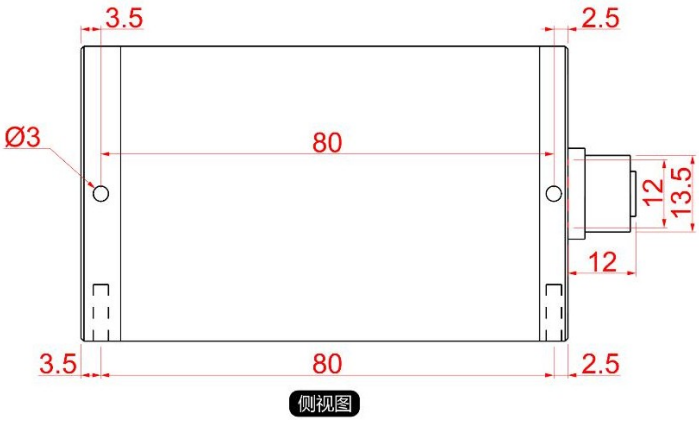
3. Key Index

- Laser wavelength: 635-645nm, within which the human eye can see a red spot;
- Laser safety level: Class II eye safety, do not stare directly at the laser emission for a long time to avoid damaging the retina;
- Laser lifespan: over 10000 hours, intermittent emission can extend laser lifespan;
- Light source power consumption:< 1mW；
- Power supply: DC voltage of 9-35V; Equipped with anti reverse protection;
- Power consumption: 12V,< 70mA； Power consumption<0.85W;
- Support single measurement and continuous measurement;
- Supports three modes: fast testing, precision testing, and automatic testing;
- The tested object is a natural target; The white plane has the best reflection effect, while the black plane has the worst reflection effect;
- Outdoor use requires the use of specialized reflective panels for optimal results;
- Indoor use, natural targets or specialized reflective panels can be used;
- Best applicable state, static deformation detection;
- Applicable environment, dynamic slow target positioning, tracking and measurement;
- Supports RS485 Modbus RTU
- Support 4-20mA output of current loop
- IP67 protection
- 4-digit digital display for real-time distance value

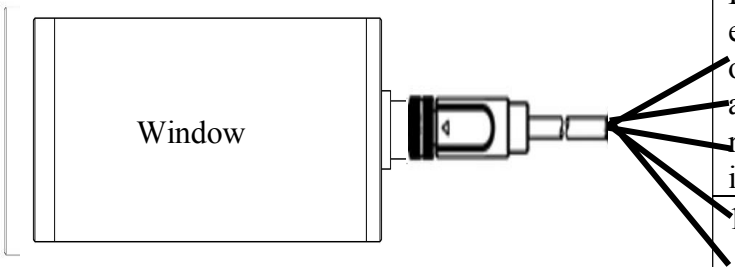
4. Mechanical parameters







5. Laser emission and reception



Laser emission and reception		
Laser emission and reception	Laser emission and reception	SK-A100
1	SK-A100	Cable Definition Output Interface
2	SK-A100	SK-A100
3	M12 5pin female shielded wire, 1m long	Hole position
4	Cable color	Default definition
5	Brown brown	VCC power supply+

6. White, white

6.1 RS485 B

- Blue Blue
  - RS485 A
  - Black yellow
  - GND power supply ground and I-

6.2 Grey Grey

I+current output+

RS485 Communication Protocol

(1) Communication physical parameters

Baud rate: 9600 (default); Can be modified to the following baud rate: 14400, 19200，38400，57600，76800， 115200；

Parity check: No check	Stop position: 1 position	Data bits: 8 bits	protocol format Adopting MODBUS-RTU method and CRC16 bit verification.	**Note: Adding H after the number indicates the hexadecimal data format, for example, 03H represents hexadecimal 03.** Function code 03H -- Query the contents of the device register
Table 1 Main Device Message Format	From device address	function code	Starting register address	Number of registers

(Calculated in 2 bytes)

CRC School	Inspection	1 byte	(03H) 1 byte	**2 bytes**
N bytes	2 bytes	Table 2: Format of Device Messages	From device address	function code

(2) Number of bytes in the data area

data area

crc check	1 byte	(03H) 1 byte	1 byte	**2 bytes**
Function code 06H -- Set the content of a single register from the	Table 3 Main Device Message Format From device address	function code	Register address	Write Data

device				

crc check

1 byte	(06H) 1 word	joint	2 bytes	**2 bytes**
2 bytes	Table 4: Format of Device Messages	From device address	function code	Register address

(3) Write Data

crc check

1 byte	(06H) 1 byte	2 bytes 2 bytes	2 bytes	Function code 10H - Set multiple register contents from the device Table 5 Main Device Message Format	From device address	function code Starting register
address	Number of registers	Write numerical section	number	Write data	CRC School	Inspecti on

1byte

(10H) 1 byte	2 bytes	2 bytes	N (1 byte)	Data (n bytes)
2 bytes	Table 6: Format of Device Messages	From device address	function code	Starting register address

Number of registers

- crc check
- 1 byte

(10H) 1 byte

- 2 bytes
- 2 bytes
- 2 bytes
- explain:

6.3 The entire packet of data must be sent continuously, and two packets must be sent with a pause time of 3.5 characters between them, otherwise both will be parsed incorrectly.

If using PLC equipment as the main device, the number of read registers sent is 2 bytes per register, so the

The number of registers is half of the byte length.

The effective range of slave device addresses is 0-255 (decimal), where device address 255 is a broadcast address that can be received by all slaves; 0 is the default address.

The valid range of function

codes is 1-255 (decimal). The

function codes used in this

protocol are 03 (read), 06

(write), and 10 (write)

If the address and data contain 16 or 32-bit data, the high byte will be sent first and the low byte will be sent last.

The CRC check data consists of two bytes, with the lower 8 bits at the beginning and the upper 8 bits at the end. The verification data is calculated from the device address, function code, and data using the CRC calculation formula in 1.2.1. The receiving device recalculates the CRC of the received message and compares it with the values in the received CRC field. If the two values are different, there is an error.

Implementation of CRC Check in C

Language

```
//Calculate CRC check value
   unsigned short CRC16 ( unsigned char *arrbuff ,int len)
   {
      unsigned short crc = 0xFFFF;  int i, j;
      for ( j=0; j<len;j++)
   {
   crc=(unsigned short)(crc ^arrbuff[j]);  for ( i=0; i<8; i++)
   {
      if ((crc & 1) > 0)
   {
 crc = (unsigned short)(crc >> 1);
crc = (unsigned short)(crc ^ 0xa001);
```

```
    }
    else
```

6.4 {

crc = (unsigned short)(crc >> 1);	}	}	}	return (crc);
}	Register Description	1	Register address	Register content
Number of registers	Register Status	1	describe	0000H
error status code	read only	2	100: No malfunction; 101: Over range	0001H running state
Reading and writing	0: Stop measuring; 1: Measuring/Starting measurement	1	0002H	Measure distance value read only
4-byte unsigned integer data, with high bits before low bits	Afterwards, the unit is 1mm,	2	0003H	From device address
Reading and writing	The effective range is 0-254 (0 is the default address, 255 is wide)	2	Broadcast address)	0004H
Baud rate	Reading and writing	1	Effective range 9600-115200	0005H

6.5 Distance offset

Reading and writing

6.5.1 Signed integer, unit 1mm

0006H	Program version number	read only
Current program version number	Register usage details and examples	The device is a distance measuring sensor, and the host is the control receiver. Taking device address=00H (decimal 0, default address) as an example, the data sent by the device is received by the host.
Read error status	direction	data
	meaning	Host ->Device

6.5.2 00 03 00 00 00 01 85 DB

Read error status	Equipment ->Host	00 03 02 00 64 84 6F
Normal, no errors	00 03 02 00 65 45 AF	Exceeding the range
Read the running status	direction	data
	meaning	Host ->Device

6.5.3 00 03 00 01 00 01 D4 1B

Read measurement status	Equipment ->Host	00 03 02 00 01 44 44
Measuring in progress	00 03 02 00 00 85 84	In the setting mode, stop measuring
	Set operating status	direction
data	meaning	Host ->Device
	00 06 00 01 00 00 D9 DB	Stop measuring

6.5.4 00 06 00 01 00 01 18 1B

Start measurement	Equipment ->Host	00 06 00 01 00 00 D9 DB
Measurement has been stopped	**00 06 00 01 00 01 18 1B**	Measurement has been initiated
Read the measured distance value	**direction**	data meaning
	Host ->Device	00 03 00 02 00 02 64 1A
	Read measurement distance	Equipment ->Host

6.5.5 00 03 04 00 00 03 E8 EA 4D

Measurement result 00 00 03 E8, converted to decimal structure	The fruit is 1000mm, with a unit of 1mmm	00 03 04 00 00 00 00 62 32
The measurement result is 0, and the distance is invalid	00 03 04 00 00 FF FF EB 43	Exceeding the maximum range, display the maximum value
	Read device address	direction
data	meaning	Host ->Device

6.5.6 00 03 00 03 00 01 75 DB

Read device address	FF 03 00 03 00 01 61 D4	If you don't know the device address, you can use the broadcast address 255
Equipment ->Host	00 03 02 00 00 85 84	The default address is 00
Set device address	direction	data

6.5.7 meaning

Host ->Device	00 06 00 03 00 01 B9 DB	Set device 00 address to 01 address
Equipment ->Host	01 06 00 03 00 01 B8 0A	
Setting successful	Read baud rate	direction

data

meaning	9600	14400	19200	38400	57600	76800	115200
Host ->Device	00 03 00 04 00 02 84 1B	Equipment ->Host	00 03 04 00 00 25 80 F1 C3	Return 2580H=baud rate 9600	Instructions for use: When modifying the baud rate, it is necessary to know the current baud	Baud rate decimal	hexadecimal

					rate, otherwise the instruction will not be correctly recognized by the device.		

6.5.8 00 00 25 80

00 00 38 40	00 00 4B 00	00 00 96 00
00 00 E1 00	00 01 2C 00	00 01 C2 00
set baud rate	direction	data

6.5.9 meaning

Host ->Device	00 10 00 04 00 02 04 00 01 C2 00 F6 00	Set the baud rate to 115200
Equipment ->Host	00 10 00 04 00 02 01 D8	complete
Read distance offset	direction	

6.5.10 data

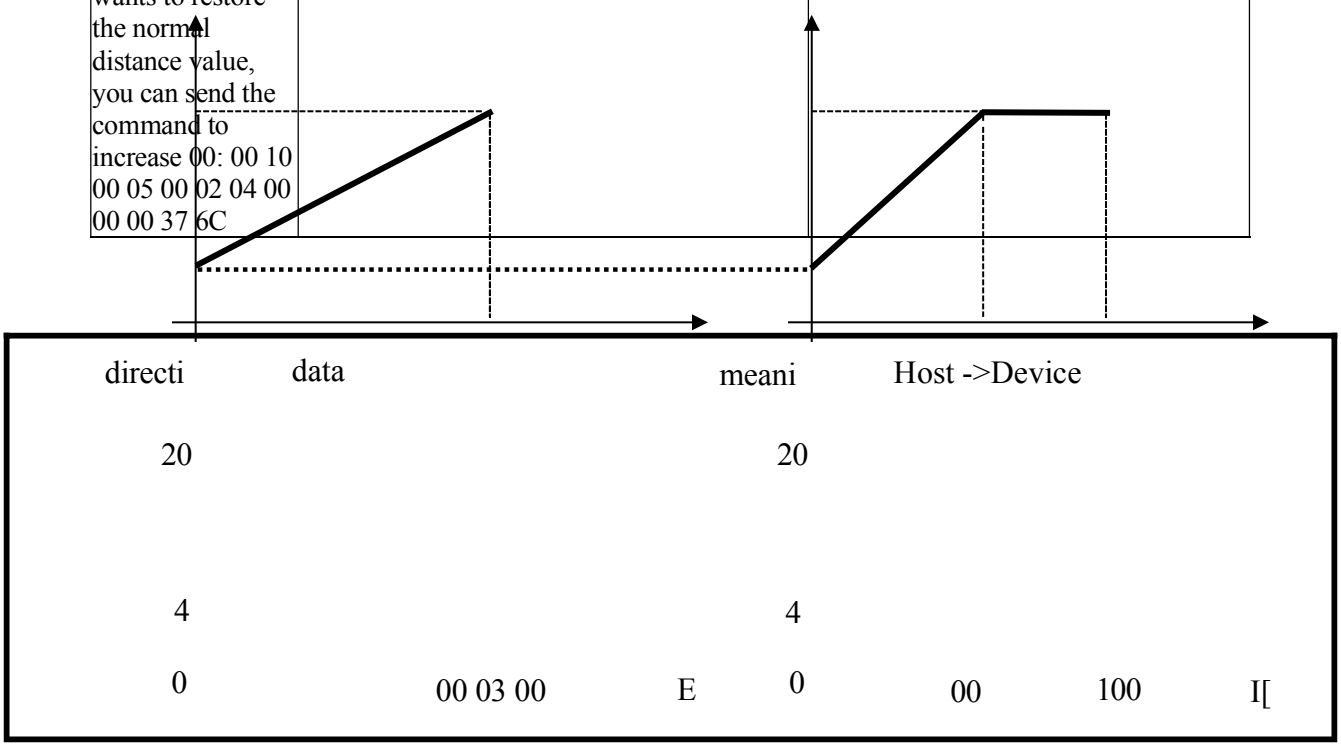
meaning	Host ->Device	00 03 00 05 00 02 D5 DB
Read the distance offset of the device	Equipment ->Host	00 03 04 00 00 27 10 F0 CF
	Set distance offset	direction
data	meaning	Host ->Device

00 10 00 05 00 02 04 00 00 27 10 2D 50

Increase offset 2710H=1000.0mm

6.5.11 00 10 00 05 00 02 04 FF FF D8 F0 6D 0C

Reduce offset by 1000.0mm	Equipment ->Host	00 10 00 05 00 02 50 18
Setting successful	Note: Assuming the offset is reduced to x (decimal). Converting (4294967296-x) to hexadecimal is equivalent to writing 4 bytes.	
If the device has set the offset and wants to restore the normal distance value, you can send the command to increase 00: 00 10 00 05 00 02 04 00 00 00 37 6C	Read program version number	



7. 4... 20mA factory settings

I[mA]

4... 20mA calibration measurement range
100(AEP)

8. m

AEP

8.1 m

8.1.1 I[mA]

4... 20mA factory settings	I[mA]	4... 20mA calibration measurement range
100(AEP)	m	AEP
m	I[mA]	4... 20mA factory settings
I[mA]	4... 20mA calibration measurement range	100(AEP)

8.1.2 m

（1） AEP

m

（2） 4-20mA current loop

notes:

1. The factory setting corresponds to a range of 0-100m for 4-20mA; You can adjust the corresponding range by pressing the button yourself;

（3） 2

Matters need attention

（4） SK-A100 is an optical instrument, and its operation is affected by environmental conditions. Therefore, the achievable range during application varies, while the ranging accuracy is not affected by such factors. The following conditions may have an impact on the measurement process:

（5） Influence factors

Factors affecting the measurement range

8.2 essential factor

Factors for extending the measurement range

Factors that shorten the measurement range

8.2.1 target surface

（1） Specialized reflector plate, reflector film

Dim and dull surfaces, green and blue

（2） Air particles

clean air

Dust, fog, rainstorm, snowstorm

Intensity of sunlight

Dark environment

The target is illuminated brightly

Reasons affecting measurement accuracy

Rough surface

When measuring rough surfaces such as plaster walls, align with the center of the shiny area. To avoid measuring deep into the plaster joints, please use target boards or wooden boards.

Transparent surface

To avoid measurement errors, please do not measure against the surface of transparent objects, such as colorless liquids

For unfamiliar materials or liquids such as water or glass (dust-free), they can be tested first. When aiming at a target through a glass window or when there are several target objects in the line of sight, measurement errors may occur.