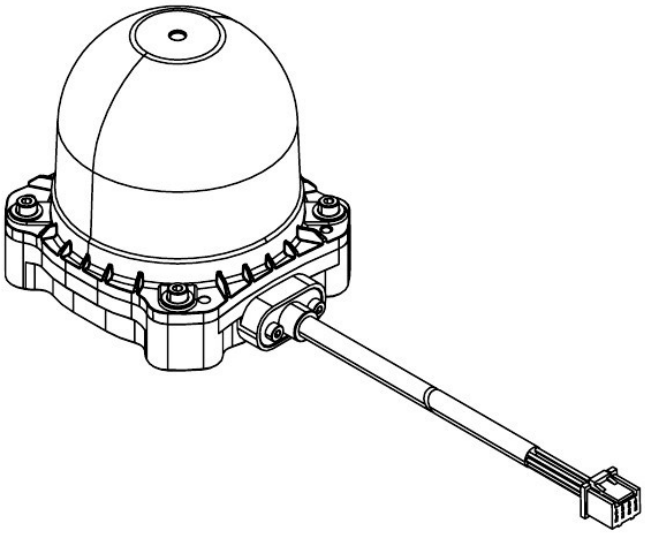
Benewake

SR18 LiDAR User Manual



Version V1.0

August 2026

Benewake (Beijing) Co., Ltd.

Application scenarios and software interfaces are shown for functional illustration only. Actual software functions and supporting materials are subject to the versions provided by Benewake.

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Preface

This user manual covers the product introduction, installation, connection, data formats, maintenance, and troubleshooting of the SR18 LiDAR. Read this manual carefully before operating the product and follow the installation and operating requirements to prevent product damage, property loss, or personal injury.

If you encounter a problem that cannot be resolved during use, contact Benewake Technical Support.

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Disclaimer

The SR18 product is under continuous improvement. Its appearance, functions, and specifications may change through product iterations. Refer to the latest information provided by Benewake.

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1 Safety Information

1.1 Safety Precautions

SR18 is a Class 1 laser product. Observe the following requirements during normal operation:

- Do not view the operating optical window through a microscope, head-mounted magnifier, or other magnifying device.
- The device may start automatically after power is applied. Do not remove the housing or touch internal moving parts while the device is operating.
- Do not apply film, wax, or other substances to the optical window.
- Do not touch the optical window directly. If it becomes contaminated, clean it as described in the maintenance section.
- Stop using the device and contact Benewake Technical Support if the housing, optical window, connector, or cable is damaged.
- Do not disassemble, repair, modify, or retrofit the device without written approval from Benewake.

1.2 Operating Environment

- Operating temperature: –20 ℃ to 65 ℃.
- Storage temperature: –40 ℃ to 85 ℃.
- Protection rating: IP66.
- Do not expose the device for extended periods to severe impact, crushing, fire, highly corrosive liquids, or unsuitable cleaning environments.

1.3 Power Supply and Installation

- Before applying power, confirm that the connector and cable are dry, clean, and undamaged.
- Use a power supply and cable that meet the specified requirements.
- Before operation, confirm that the device is securely mounted and that no installation structure or exterior trim blocks the LiDAR field of view.
- Power off the device before connecting or disconnecting the connector to avoid damage to the device or host.

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2 Product Overview

2.1 Product Description

SR18 is a 360° rotating LiDAR designed for robotics and industrial automation applications. It outputs point cloud, IMU, status, and fault information through RS485 and supports GPS and 1PPS time synchronization.

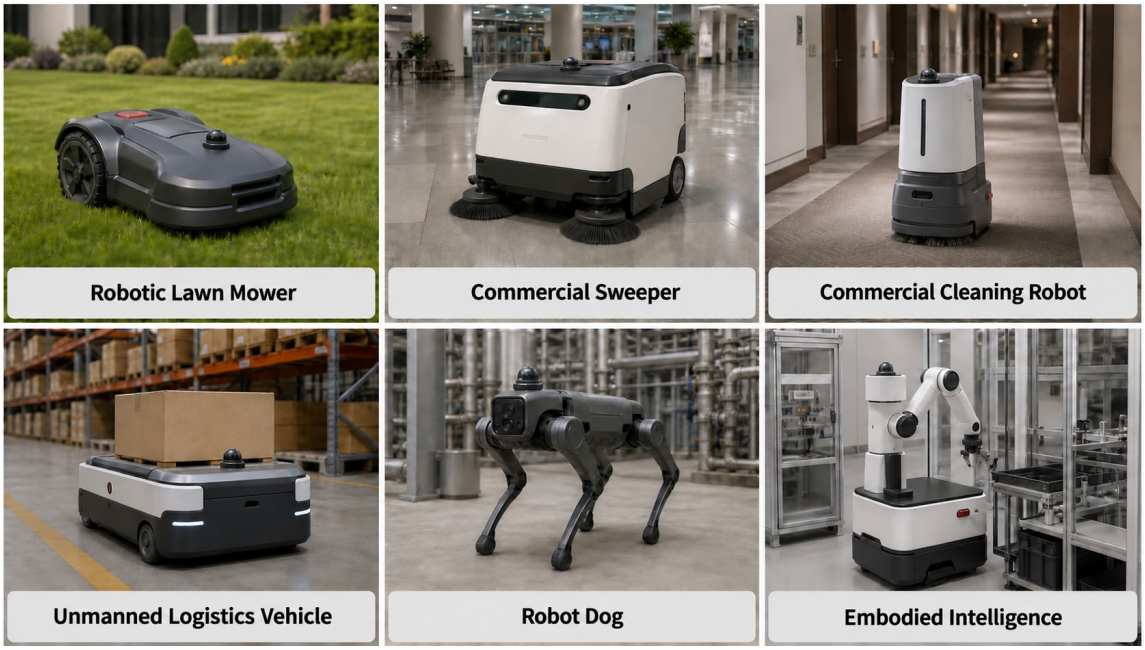


Figure 1 SR18 Typical Application Scenarios

Figure legend: Top row - robotic lawn mower, commercial sweeper, commercial cleaning robot. Bottom row - autonomous logistics vehicle, quadruped robot, and embodied-intelligence platform.

2.2 Operating Principle

The internal scanning mechanism performs a 360° horizontal scan. The SR18 measures target returns and calculates reflectivity or intensity. It also outputs timestamps, azimuth, channel data, IMU data, status information, and fault information.

2.3 Technical Specifications

Item	Specification
Performance	
Input voltage	12-16 V
Average power consumption	≤4.5 W
Peak power consumption	≤8 W
Operating temperature	–20 ℃ to 65 ℃
Storage temperature	–40 ℃ to 85 ℃

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Item	Specification
Protection rating	IP66
Horizontal / vertical field of view	360° × 48°
Vertical field-of-view range	−8° to +40°
Scan channels	18
Horizontal resolution	≤0.6° at 5 Hz
Detection range	≥30 m for a 10% reflectivity target
Maximum range	100 m
Blind zone	≤10 cm
Frame rate	5 Hz or 10 Hz, configurable; default 5 Hz
Ranging precision	≤3 cm at 1σ (≤30 m)
Ranging accuracy	±3 cm (≤30 m)
Time synchronization accuracy	≤1 μs (GPS + 1PPS)
Angular accuracy	≤0.05°
IMU output rate	200 Hz
Mechanical and Electrical	
Weight	≤190 g
Heat dissipation	Passive
Noise	≤30 dB at 0.5 m from the device

Note: This table lists only the product parameters required for this user manual. It does not include test reports, test conditions, or R&D validation procedures.

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3 Structure, Coordinate System, and Field of View

3.1 Structural Appearance

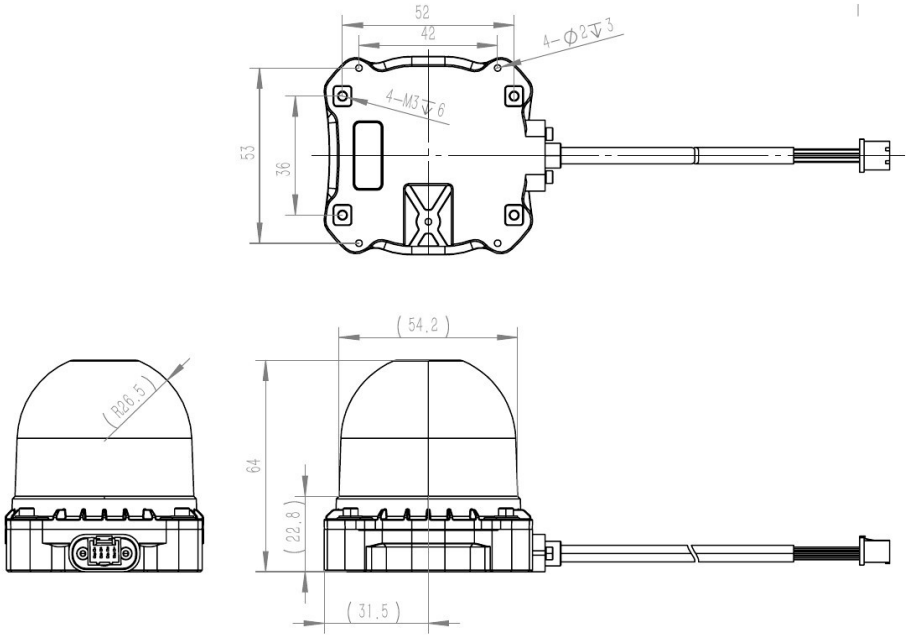


Figure 2 SR18 Structural Views and Appearance Dimensions

The SR18 uses a spherical optical window and base structure, with a pigtail cable exiting from the rear of the device. Protect the optical window from impact, compression, scratches, and contamination during installation and use.

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3.2 Coordinate System

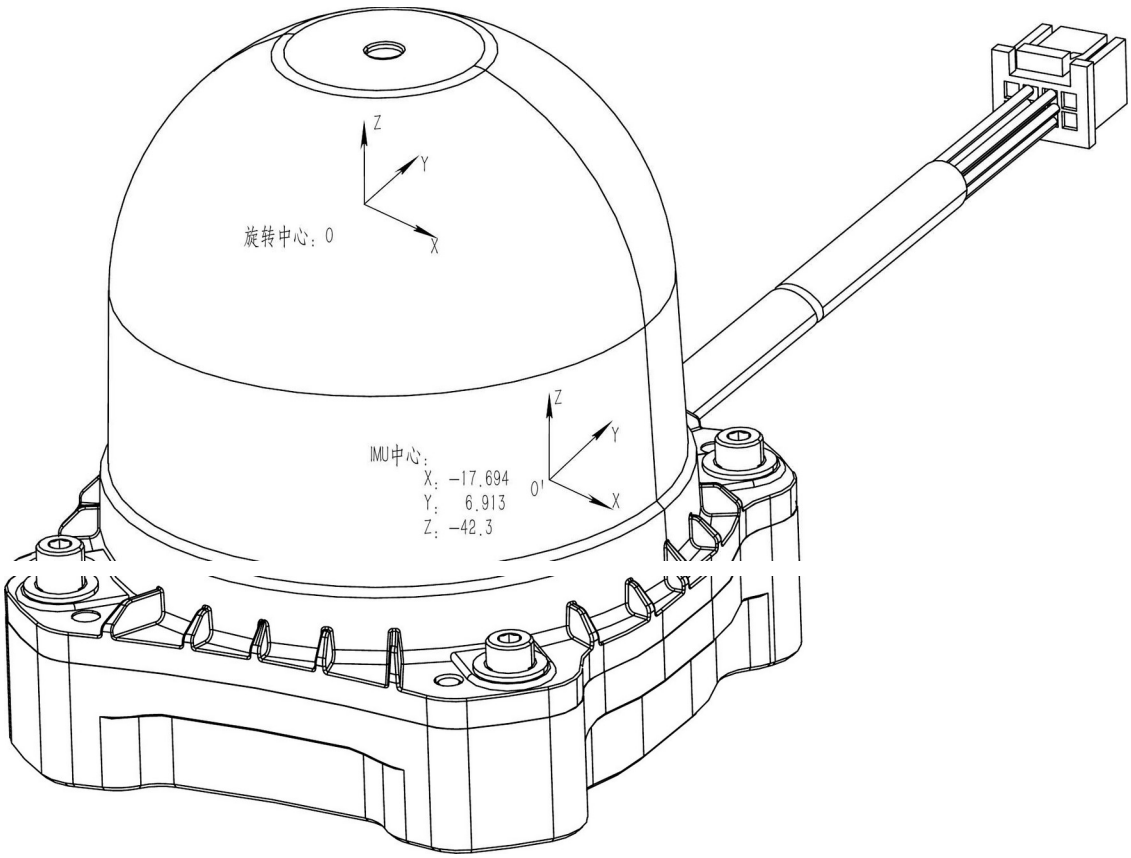


Figure 3 SR18 Point-Cloud Coordinate System and IMU Center

The SR18 uses a right-handed coordinate system. The rotation center O is the origin of the point-cloud coordinate system, and the Z-axis points upward along the rotation axis. The Y-axis points in the pigtail cable direction and defines the 0° horizontal azimuth. Positive horizontal azimuth is clockwise when viewed from above. The X-axis is determined by the right-hand rule. The IMU axes are aligned with the point-cloud coordinate system.

The drawing identifies the IMU center offset from rotation center O as X = −17.694 mm, Y = +6.913 mm, and Z = −42.3 mm. For point-cloud and IMU fusion or extrinsic compensation, use the supplied coordinate file as the final reference.

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3.3 Field-of-View Distribution

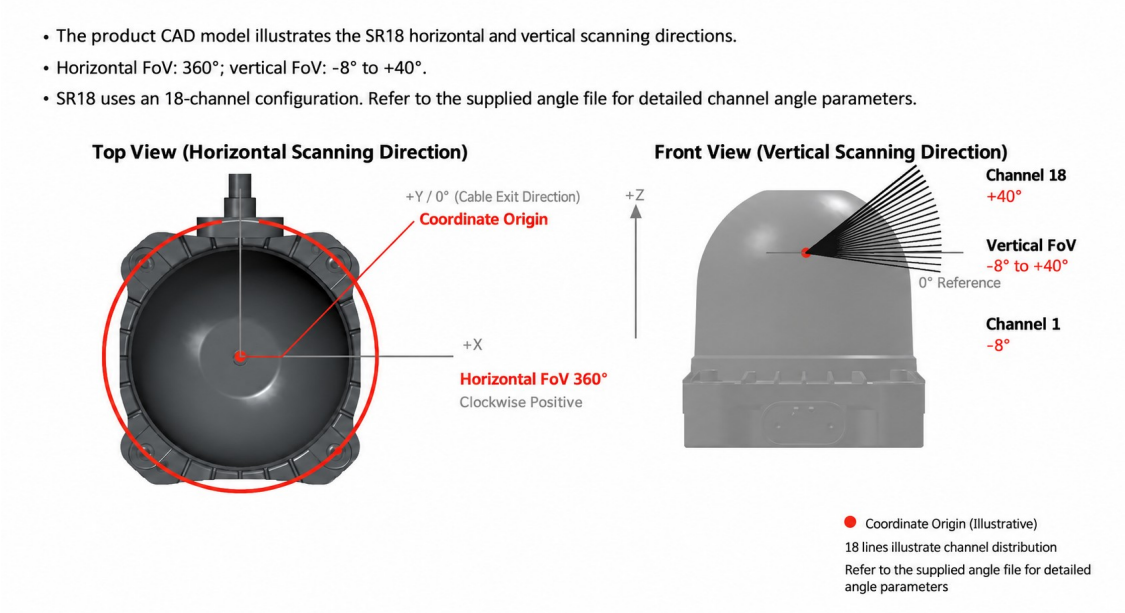


Figure 4 SR18 Field of View and Channel Distribution

The horizontal field of view is 360°, and the vertical field-of-view range is −8° to +40°. Use the supplied angle file for the exact angular parameters of the 18 channels.

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4 Mechanical Installation

4.1 Initial Inspection

1. Remove the protective material from the outside of the optical window.
2. Inspect the optical window, housing, pigtail cable, and connector for damage.
3. Confirm that the mounting surface is flat and clean and that the mounting structure will not block the LiDAR field of view.
4. Confirm that the installation position provides sufficient space for cable routing and maintenance.

4.2 Dimensions

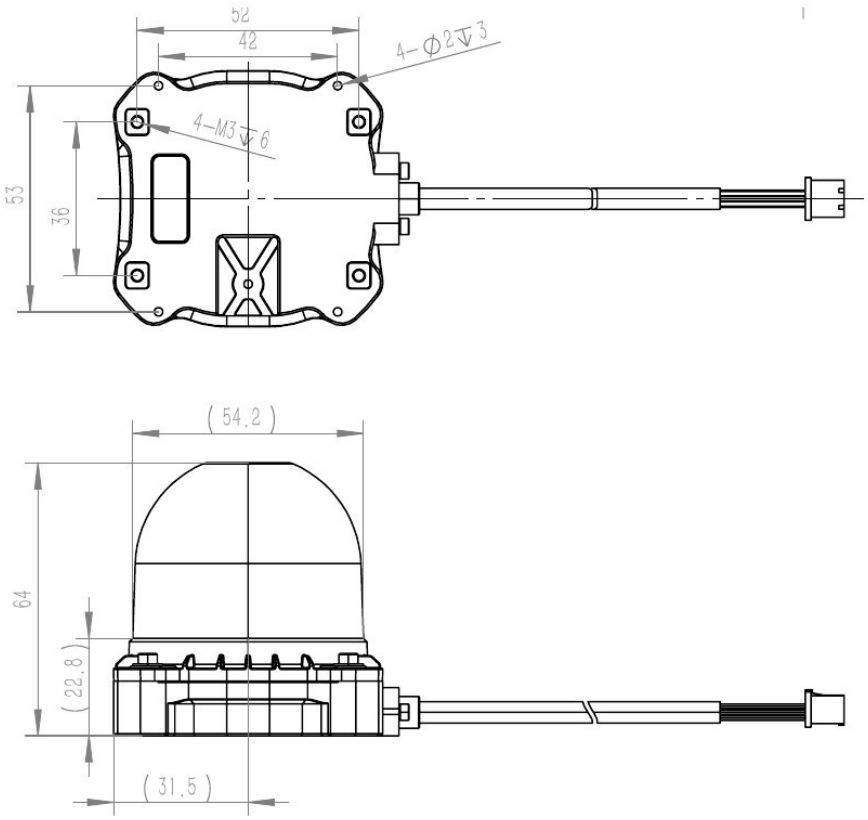


Figure 5 SR18 Dimensions and Mounting Holes (Unit: mm)

Use four M3 mounting holes to secure the SR18. Refer to the SR18 engineering drawing for exact hole positions, dimensions, and mounting orientation.

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4.3 Recommended Installation

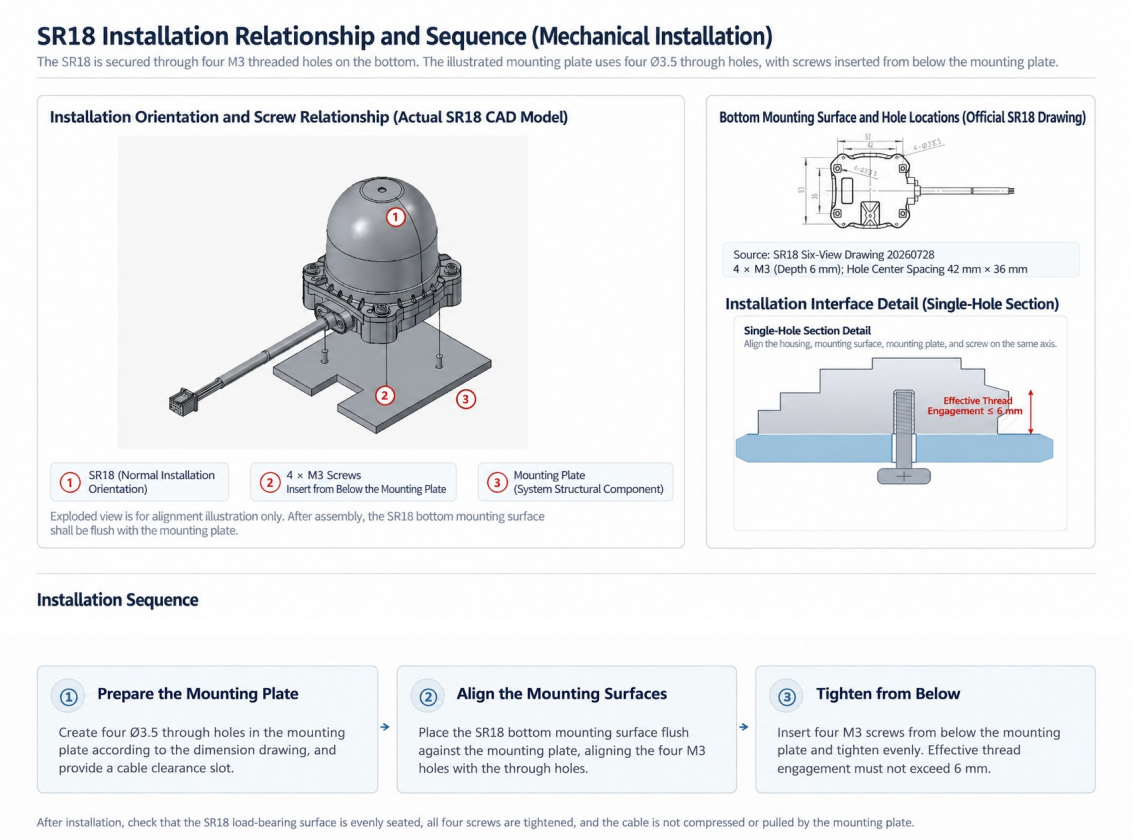


Figure 6 Recommended SR18 Installation

- Seat the bottom of the device fully against the mounting surface and secure it with four M3 screws.
- Bottom-hole center spacing: 42 mm × 36 mm.
- Maximum effective thread engagement: 6 mm.
- Do not allow the mounting structure or exterior trim to enter the effective LiDAR field of view.
- After installation, the device must not be loose, unstable, or mechanically obstructed.
- Protect the pigtail cable from tension, compression, and sharp bends.

4.4 Screw Installation

- Use combination screws with flat washers and spring washers. A strength grade of 4.8 or higher is recommended.
- The recommended torque for M3 screws is 0.5-0.6 N·m.
- Select the screw length according to the mounting-structure thickness. Screws that are too long may damage internal components.
- If threadlocker is used, clean the threaded holes before removal and reinstallation. Do not allow cleaning agents to contact the optical window.

Caution: Use the SR18 engineering drawing and the applicable engineering requirements as the final reference for exact hole depth and permitted thread engagement.

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5 Device Connection

5.1 Interface Overview

This manual covers only the RS485 external-interface version. The device uses a PUDP-08V-S external connector and connects to the host through power, RS485, RX_IN, and PPS_IN signals.



Figure 7 PUDP-08V-S Connector Pin Assignment

5.2 Pin Definitions

Pin	Direction	Signal	Level / Parameter	Description
1	Input	V+	9-32 V	Positive supply input; 12-16 V recommended
2	Input	GND	0 V	Power ground
3	Bidirectional, half-duplex	485_P	RS485; default 3,125,000 bit/s	Point cloud, IMU, status, and fault output; supports upgrade data transfer
4	Bidirectional, half-duplex	485_N	RS485; default 3,125,000 bit/s	Used together with 485_P
5	Input	PPS_IN	3.3 V CMOS	1PPS time-synchronization input
6	Input	RX_IN	3.3 V; 9600 bit/s	GPS NMEA input; may also carry control messages
7	-	Reserved / NC	-	Do not connect an external signal
8	-	Reserved / NC	-	Do not connect an external signal

Caution: Do not connect external signals to reserved or NC pins. Power off the device before connecting or disconnecting the connector.

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5.3 Cable Specification and Bend Radius

Item	Specification
Cable outer diameter	5 ± 0.20 mm
Minimum bend radius	5 × OD, approximately 25 mm
Wire 1 color	Red, V+
Wire 2 color	Black, GND
Wire 3 color	White, 485_P
Wire 4 color	Green, 485_N
Wire 5 color	Blue, PPS_IN
Wire 6 color	Yellow, RX_IN

- Route the cable so it is not compressed, stretched, cut by sharp edges, or held at a bend radius below the minimum for long periods.
- Secure the cable appropriately so device motion or vibration does not place the cable under tension.

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6 GPS and 1PPS Time Synchronization

6.1 Signal Connection

GPS NMEA messages are received through RX_IN, and the 1PPS signal is received through PPS_IN. RX_IN may also carry device control messages. This manual does not describe the control-command protocol.

Supported GPS NMEA message types include GPRMC, GPGGA, and GNRMC.

6.2 PPS and NMEA Timing

- PPS signal period: 1 s ± 50 µs, measured from rising edge to rising edge.
- PPS pulse width: ≥1 ms; 10-100 ms recommended.
- Send the NMEA message after the PPS rising edge for the corresponding second.
- Complete the NMEA message before the next PPS rising edge and leave an interval of at least 500 ms.

Tip: If the device does not receive a valid GPS or PPS signal, it may report a corresponding fault. Check the GPS source, PPS signal line, and grounding.

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7 Data Formats

This chapter describes point-cloud, IMU, status, and fault information only. It does not cover device control commands, register operations, or low-level OTA messages.

Unless otherwise specified, multi-byte fields are parsed in little-endian byte order.

7.1 Point-Cloud Data Frame

The point-cloud data frame is 87 bytes long and is transmitted from the LiDAR to the host. Each frame contains measurement data for 18 channels.

Offset	Field	Length	Type / Byte Order	Description
0	STX	2 B	Fixed bytes	EE FF
2	up_version	1 B	u8	Upper-board version
3	down_version	1 B	u8	Lower-board version
4	Reserved	1 B	u8	Reserved
5	D_TYPE	1 B	u8	0x00, point-cloud type
6	DateTime	6 B	u8[6]	Second, minute, hour, day, month, year - 1900
12	Microseconds	4 B	u32 LE	Microseconds within the current second, 0-999 999
16	Azimuth	2 B	u16 LE	Azimuth; 0.01°/LSB
18	Channel[0..17]	54 B	18 × 3 B	Measurement data for 18 channels
72	Contamination	5 B	18 × 2 bits + 4 reserved bits	Optical-window contamination level by channel
77	Lidar State	1 B	u8	LiDAR state
78	TDM_ID	1 B	u8	Low-rate information type identifier
79	TDM_Data	2 B	u16 LE	Low-rate information data
81	UDP_SEQ	2 B	u16 LE	Point-cloud packet sequence number
83	CRC	4 B	u32 LE	Covers offsets 0-82

7.1.1 Channel Data

In-Channel Offset	Field	Length	Type	Description
0	Distance	2 B	u16 LE	Distance = raw value × 4 mm
2	Intensity	1 B	u8	Raw reflectivity or intensity value

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The data for channel i starts at offset 18 + 3i. Use the supplied angle file for the exact angular parameters of the 18 channels.

7.2 IMU Data Frame

The IMU data frame is 34 bytes long, is transmitted from the LiDAR to the host, and has an output rate of 200 Hz.

Offset	Field	Length	Type / Byte Order	Description
0	STX	2 B	Fixed bytes	EE FF
2	up_version	1 B	u8	Upper-board version
3	down_version	1 B	u8	Lower-board version
4	CHK_ST	1 B	u8	Status field
5	D_TYPE	1 B	u8	0x01, IMU type
6	DateTime	6 B	u8[6]	Second, minute, hour, day, month, year - 1900
12	Microseconds	4 B	u32 LE	Microseconds within the current second
16 / 18 / 20	Acc X / Y / Z	6 B	s16 LE	1/8192 g/LSB
22 / 24 / 26	Gyro X / Y / Z	6 B	s16 LE	1/32.8 (°/s)/LSB
28	SEQ	2 B	u16 LE	IMU packet sequence number
30	CRC	4 B	u32 LE	Covers offsets 0-29, padded with two 0x00 bytes

The IMU center offset from point-cloud rotation center O is X = −17.694 mm, Y = +6.913 mm, and Z = −42.3 mm. Use the supplied coordinate file for the exact coordinate definition and final calibration data.

Convert IMU data to the point-cloud coordinate system before use. The default accelerometer range is ±4 g, and the default gyroscope range is ±1000°/s.

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7.3 Status and Fault Information Frame

The fault-information frame is 41 bytes long, is transmitted from the LiDAR to the host, and has a period of 1000 ms. This periodic status and fault frame can be used for online-status or heartbeat monitoring; this manual does not define a separate heartbeat frame.

Offset	Field	Length	Type / Byte Order	Description
0	STX	2 B	Fixed bytes	EE DD
2	FS_Version	1 B	u8	Fault-protocol version
3	DateTime	6 B	u8[6]	Second, minute, hour, day, month, year - 1900
9	Microseconds	4 B	u32 LE	Microseconds within the current second
13	LidarState / Counter	1 B	Bit field	bits [7:5] LiDAR state; bits [2:0] rolling counter
14	Total / Fault_ID	1 B	Bit field	Total fault count and current fault index
15	Fault_Code	2 B	u16 LE	Current fault code
17	Reserved	20 B	Reserved	Reserved field
37	CRC	4 B	u32 LE	Covers offsets 13-36

LiDAR state values are: 0 = normal operation, 1 = warning, 2 = shutdown, and 3 = standby. If multiple faults are present, handle the fault with the most severe state first.

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8 Visualization Tools, Maintenance, and Troubleshooting

8.1 Visualization Tools and Software Support

The SR18 provides a visualization and configuration tool, SDK, and ROS driver for real-time point-cloud viewing, point-cloud and raw-data recording, LiDAR parameter modification, and LiDAR status reading.

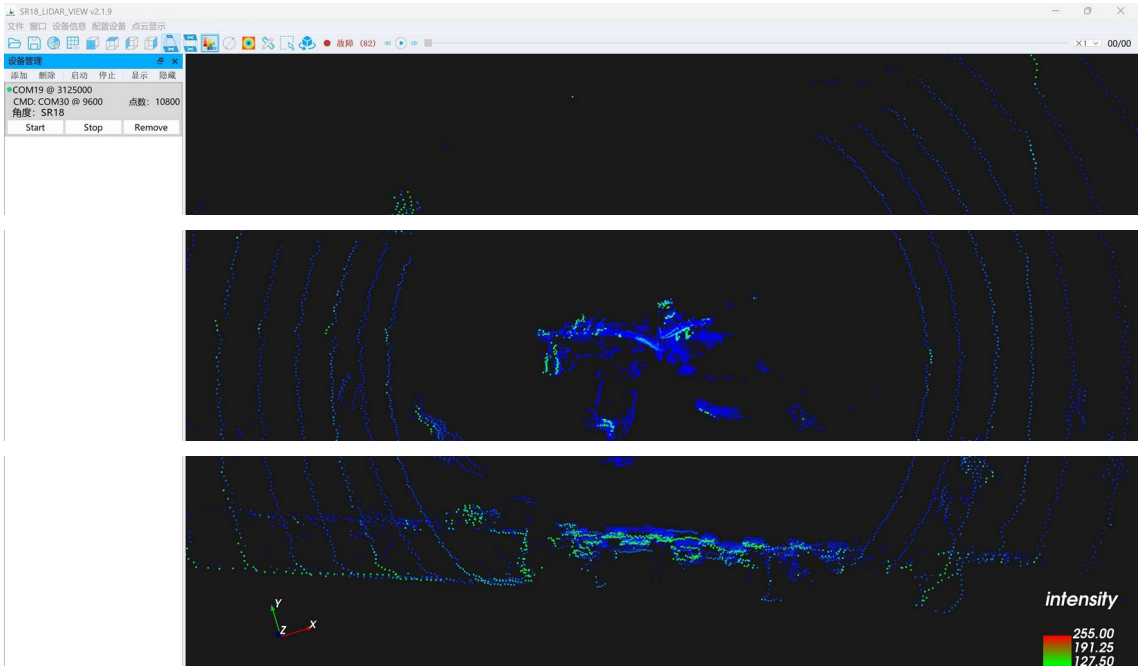


Figure 8 SR18 Visualization Tool Interface

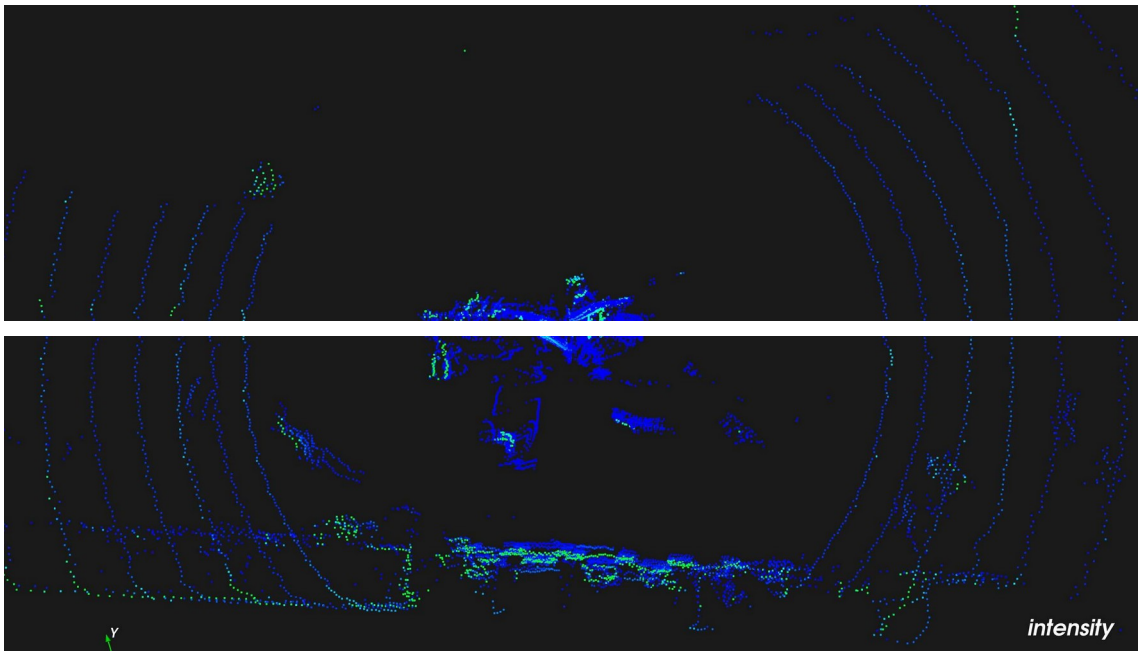


Figure 9 SR18 Point-Cloud Viewer

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Note: Contact Benewake Technical Support to obtain the software package, SDK, and ROS driver, or to request software upgrades.

8.2 Optical-Window Maintenance and Cleaning

The cleanliness of the optical window affects point-cloud quality. Inspect the optical window periodically according to usage frequency, storage environment, and climate conditions.

- Power off the device before cleaning.
- For light contamination, use clean water at room temperature and a soft cleaning cloth.
- For heavier contamination, use a mild neutral detergent, then wipe the surface with clean water.
- Do not use organic solvents, abrasive cleaners, or hard or sharp tools.
- Do not wax the optical window, apply film to it, or apply excessive force.
- Do not rinse the device immediately with cold water after high-temperature sun exposure.

8.3 Storage and Transportation

- Store the device in a dry, clean environment free of corrosive gases.
- Protect the device from drops, impacts, compression, and severe vibration during handling and transportation.
- For long-term storage, disconnect the external cable and protect the connector from dust and moisture.

8.4 Troubleshooting

Symptom	Recommended Check and Action
No data output	Check the power supply, RS485 cable, serial-port number, and baud rate. Confirm that RS485 uses 3,125,000 bit/s.
Motor does not rotate	Check the input voltage and cable connection, then power-cycle the device. If the problem persists, contact Benewake Technical Support.
Abnormal or flickering point cloud	Check optical-window cleanliness, packet loss, and the angle file. Recheck with another cable or host.
Abnormal packet count	Check whether the host is connected to multiple devices, verify the communication configuration, and power-cycle the device.
GPS / PPS synchronization fault	Check RX_IN, PPS_IN, the GPS source, and grounding. Confirm that the NMEA and PPS timing meets the requirements.
Device reports a fault code	Follow Appendix A. If the problem cannot be resolved, record the fault code and contact Benewake Technical Support.

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Appendix A Common Error Codes

Fault Code	Fault Name	Recommended Action
0x0104	Optical-window contamination	Clean the optical window.
0x0111 / 0x0112	LiDAR overtemperature	Check the ambient temperature.
0x0113	IMU fault	Wait 30 s. If the fault does not clear, restart the device.
0x0116	Input-voltage fault	Check the external voltage and restart the device after it returns to normal.
0x0117	LiDAR parameter fault	Restart the device.
0x0210	Motor-speed fault	Wait for automatic recovery. If the fault persists, restart the device.
0x0211	Motor stall	Wait for automatic recovery. If the fault persists, restart the device.
0x0212	Motor overcurrent	Wait for automatic recovery. If the fault persists, restart the device.
0x0213	Encoder-output fault	Restart the device.
0x0214	Encoder-disc contamination	Wait for automatic recovery. If the fault persists, restart the device.
0x0215	Startup failure	Restart the device.
0x0406	Low PPS synchronization accuracy	Check the PPS signal source.
0x0407	GNSS signal loss	Check the GNSS signal source.
0x0408	PPS signal loss	Check the PPS signal source.
0x0409	GNSS signal fault	Check the GNSS signal source.
0x0501	Eye-safety fault	Stop using the device and contact Benewake Technical Support.

Note: This table lists common fault codes for the current version. If the device reports a code not listed here, record the complete fault information and contact Benewake Technical Support.

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Appendix B Supporting Materials and Support

Contact Benewake Technical Support to obtain the latest communication protocol, OTA upgrade tool, SDK, ROS driver, angle file, compliance documentation, or complete fault-code definitions.

Contact Benewake Technical Support for the evidence and certification documents supporting IEC 60 825-1 Class 1, IP66, RoHS, and REACH compliance.

The accompanying materials include protective packaging and documentation. Refer to the actual shipping list for specific items, quantities, and versions.

Approval Information

Item	Information
Manual version	V1.0
Prepared by	
Reviewed by	
Approved by	

Contact Us

Official website: www.benewake.com

Technical support: support@benewake.com

Contact number: 400-880-9610

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