Version 1.0

Change description

Version	Revision Date	Description
1.0	2025/04/11	Initial release

Reading Prompt

Symbolic instructions

⚠ Warning: The usage process should be strictly followed, otherwise it may lead to potential dangerous situations such as minor injuries or property damage.

! Important: The usage process should be observed, otherwise it may cause potential harmful situations such as product damage.

ⓘ Tip: The usage process should be valued sufficiently to achieve maximum value of the product efficiently and smoothly.

Resource Download

Please click the following link to download the latest product manual, RSview and other resources:

https://www.robosense.cn/resources

More Information

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Content

1 Safety Notices

1.1 Legal Statement

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1.2 User Guidelines

⚠ Please use this product in accordance with the following requirements:

1) Please strictly abide by relevant national laser safety laws and regulations;
2) Please read this product manual in detail before using the product;
3) Please use this product only in the relevant field of application;
4) Please avoid using this product in environments that are explosive, highly corrosive, or beyond the IP protection level of the equipment.

1.3 Illegal Operation

⚠ Please use this product in accordance with the regulations, otherwise it may cause product damage, property loss, and personal injury. Users are responsible for risk arising from unauthorized operations.

1) Do not disassemble or modify this product (including accessories);
2) Do not use power supplies and accessories that exceed specifications;

3) Please avoid abnormal operations such as dropping, colliding, burning, etc.;
4) If you notice any damage to the appearance of the device, please immediately stop using it;
5) If you notice any abnormal operation of the product, please immediately stop using it and contact RoboSense in a timely manner.

1.4 Requirements for Operating Personnel

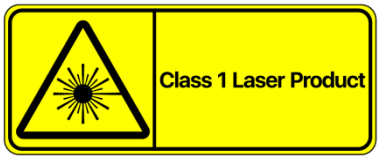
⚠ The use of this product requires certain basic professional knowledge and other related requirements for operating personnel. Unreasonable operations performed by personnel without basic knowledge or training do not constitute a fault of RoboSense and may cause damage to equipment and personal property.

1) Please read the product manual in detail before using the device;
2) Prohibit illegal operations;
3) Before working, personnel must undergo training and obtain relevant construction qualifications;
4) Have some basic knowledge of computer data connection, electrical, and so on.

1.5 Work Safety and Special Hazards

⚠ To avoid risks of accidents, damage to sensor or violating of your product warranty, please read and follow the instructions in this manual carefully before operating the product.

1) Laser Safety: This product meets the following standards for laser products: IEC 60825-1:2014;：



2) High temperature warning: Please pay attention to the overheating sign on the AC1 surface to avoid a hot AC1 surface that may lead to sensor failure or undesirable consequences.

3) Retain Instructions: The safety and operating instructions should be retained for future reference.
4) Heed Warnings: All warnings on the product and in the operating instructions should be adhered to.
5) Servicing: Except for what's described in this manual, the sensor has no field serviceable parts. For servicing, please contact RoboSense sales or the authorized distributors.

2 Product Description

2.1 Product Structure

The shape diagram of AC1 is shown in Figure 1 .

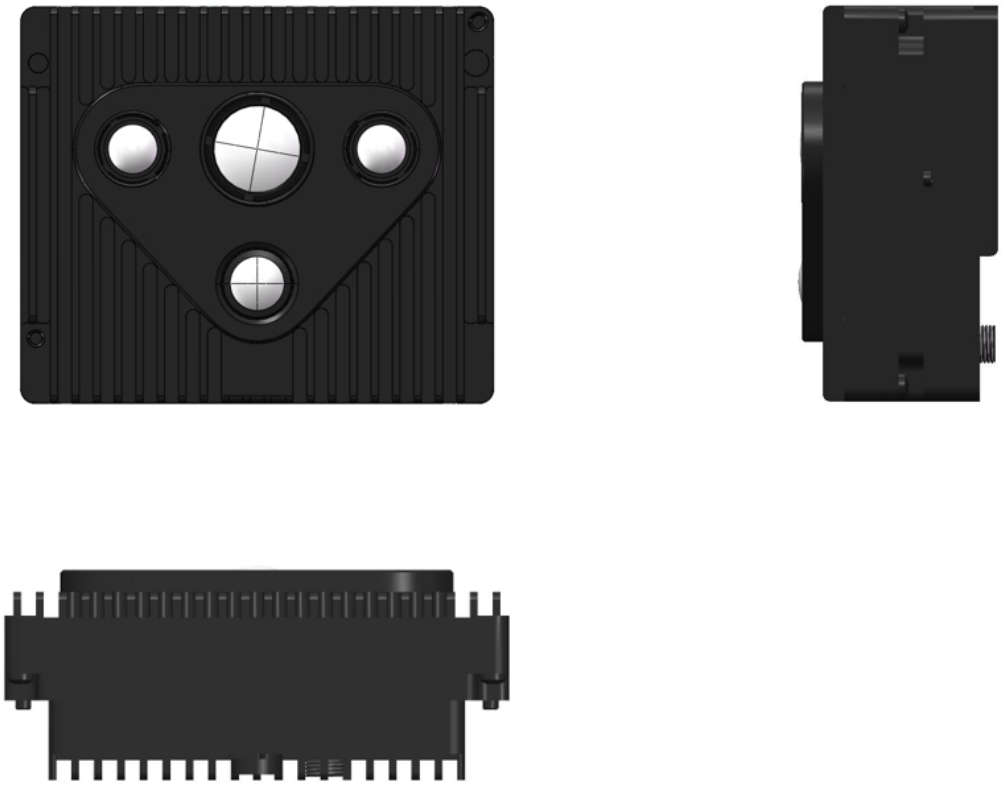


Figure 1 AC1 shape diagram

2.2 Optical Envelope FOV Definition

The optical envelope of the AC1 is shown in the figure below. After all limits are accumulated, the optical envelope of the AC1 cannot be blocked by external accessories, such as AC1 cover, forklift parts, and general mobile robot parts. After RoboSense is calibrated off the production line, there is a certain tolerance in the FOV Angle, which is subject to the final result of the manufacturer. Figure 2 shows partial FOV distribution of AC1 LiDAR. Figure 3 is a FOV diagram of the AC1 camera part.

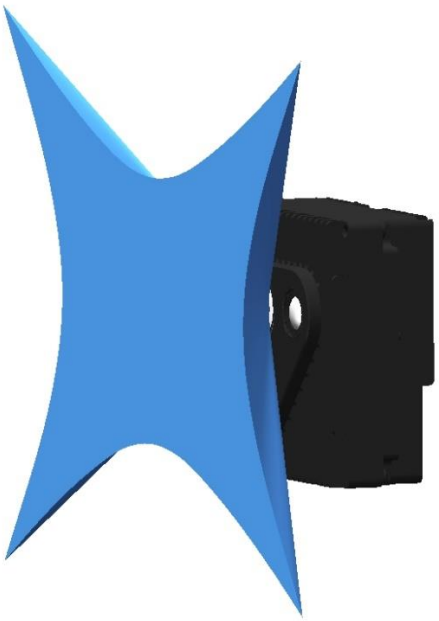


Figure 2 AC1 LiDAR FOV

Figure 3 AC1 Camera FOV

2.3 Product Specifications

AC1 (Active Camera 1) is a new type of active camera sensor developed by RoboSense, which combines the advantages of LiDAR and camera in sensing end and is mainly applied to robot environment perception. For specific parameters, refer to Table 1.

Table 1 AC1 Product Specifications

Product Specifications			
LiDAR Part			
Ranging principle	Time of Flight	FOV(horizontal)	120°
Wavelength	940 nm	FOV(vertical)	60°
safety class	Class1 eye safe	Angular resolution(horizontal)	average 0.625°[1]
Ranging distance [2]	20m @10%	Angular resolution(vertical)	
Blind area	0.1 m@90%	Ranging Precision[3]	±3cm@1 sigma (indoor) ±5cm@1 sigma (outdoor)
Count of the points	~173,333 points/second	Frame rate	10Hz
RGB camera Part			
Shutter type	Rolling shutter	FOV(horizontal)	144°
RAW output format	NV12，RGB24	FOV(vertical)	78°
Frame rate	30Hz	Resolution	1920*800
IMU			
Degree of freedom	6 axis data output	Gyroscope	±2000dps
Accelerometer	±16g	Data frequency	200Hz (adjustable)

[1] The vertical & horizontal angular resolution is not uniform in the entire FOV. The angular resolution is 0.625° in the center of the FOV and 0.7° at the edges of the FOV;

[2] The ranging capability of 30meters is measured with the 10% NIST diffuse reflector as the target, the test results may be affected by the environment conditions, including but not limited to factors such as ambient temperature and lights;

[3] The ranging precision is tested in the range of 10m~30m with 50% NIST diffuse reflector as the target. The test results may be affected by the environment conditions, including but not limited to factors such as ambient temperature and target distance. The precision value is applicable to most channels, but difference may exist between some channels.

General				
Form	Standard probe module	Power Consumption[4]	12.6 W (Typical)	
Operating Temperature [5]	- 20℃ ～+ 60℃	Storage Temperature:	- 20℃ ～+ 70℃	
Protection Rating	IP 54	Weight	400g±10%	
Data interface	USB 3.2 Gen1	Power interface	DC	
Size	Outer Contour	length（mm）	width（mm）	height（mm）
		95	42.6	80

[4] The test results of product power consumption will be affected by external environment, including but not limited to environmental temperature, distance of target object, reflection intensity of target object and other factors;

[5] The operating temperature of the product may be affected by the external environment, including but not limited to the lighting environment, air flow changes and other factors;

3 Product Installation

3.1 Product accessories

The list of AC1 standard shipped accessories is shown in Table 2.

Table 2 Connector scheme

No	Parts name	Specification	Quantity
1	Active Camera	AC1	1
2	Type-C data cable with screw lock	1m	1
3	DC power cord with screw lock	1m	1
4	DC adapter	12V⎓2A	1
5	Product specification		1

3.2 Interface specification

3.2.1 Interface and definition

Type-C with threaded lock pay, DC with threaded lock pay. As shown in .Figure 4

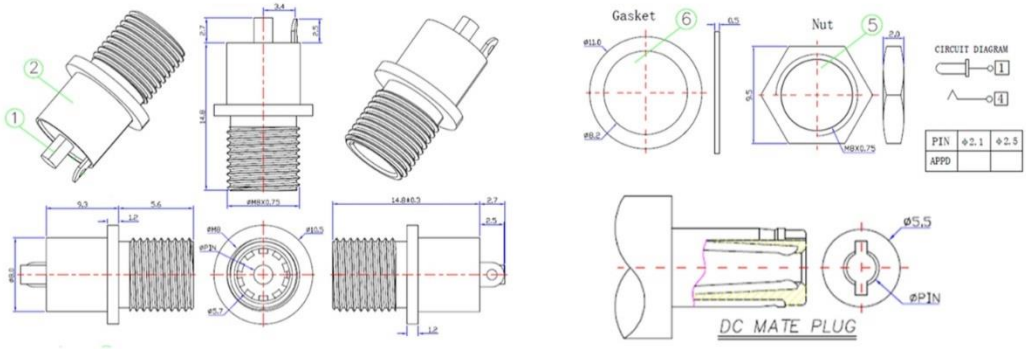


Figure 4 Direct Connection between LiDAR Equipment and Host Computer

DC interface pin definition:

1: VIN

2: GND

3.2.2 Power Interface

The AC1 power supply uses standard DC 5.5-2.5 and DC 5.5-2.1 interfaces.

3.2.3 Data Interface

AC1 data transmission uses the standard USB3.2 GEN1 interface.

4 Product Usage

4.1 Product Coordinate System

The AC1 coordinate system definition is shown in Figure 5 .

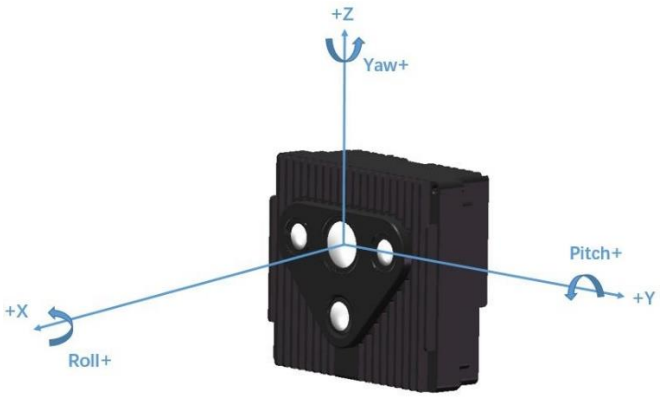


Figure 5 AC1 Coordinate System Definition

Please refer to wiki for how to obtain AC1 camera and IMU external parameters: https://robosense-wiki-en.readthedocs.io/en/latest/ac_studio/tools.html.

4.2 AC Viewer Useage

AC Viewer is a software designed for Active Camera and can be used to display all Active Camera data (including point clouds, images) connected to the computer in real time. With AC Viewer, users can easily view, record, and store sensor data for later use.

4.2.1 Install AC Viewer

AC Viewer can run on Windows 64-bit, Ubuntu 18.04 or higher operating systems. From RoboSense AC Viewer's official website (https://www.robosense.ai/en/resources) to download the latest version of the software package. After the software is downloaded, do not contain Chinese characters in the decompression path. You do not need to install the software. After the decompression, run the executable file to use the software. The configuration requirements of PC hardware are shown in.

Table 3 AC viewer requirements for PC configuration

	Minimum configuration	Recommended configuration
CPU	Seventh generation Intel Core i3 or equivalent	Intel 11500 or hugher, Mac M2 or higher
GPU	Integrated graphics	NVIDIA RTX 3060 or above specifications
RAM	8GB	16GB or higher
Connection	USB 3.0	USB 3.0

The physical connection of AC1 includes power cable connection and USB connection, and the USB connection is connected to the PC, as shown in Figure 6

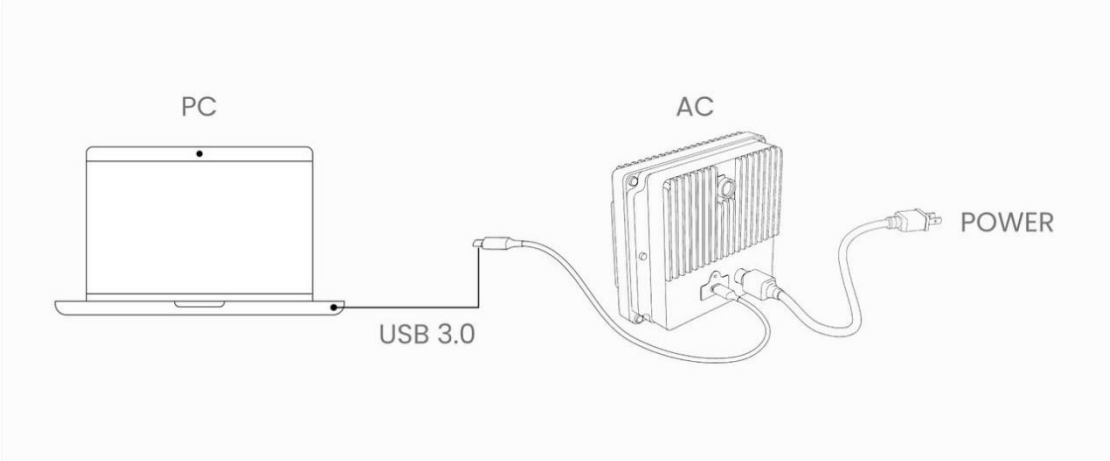


Figure 6 AC1 Physical connection mode

4.2.2 Use AC Viewer

The AC viewer instruction manual can be found at wiki. The address of wiki is https://robosense-wiki-en.readthedocs.io/en/latest/.

4.3 Communication Protocol

The communication between AC1 and computer adopts USB 3.0 to output the data of IMU, LiDAR and image sensor. The data fields are shown as the data types.

LiDAR output data structures include cloud_point_t and depth_frame_t.

1) cloud_point_t is relevant data for each point cloud, including x,y,z coordinates, reflection intensity, and timestamp information for the point cloud;
2) depth_frame_t is the data related to each frame point cloud, including the pixel

width, height, image data format, time stamp and other information of each frame image.

RGB output data structures is image_frame_t：

1) image_frame_t is the relevant data of each frame, including the pixel width, height, image data format, time stamp and other information of each frame.

IMU output data structures is motion_frame_t:

1) motion_frame_t is the relevant data output of each frame of the IMU, including the measured value of the accelerometer and gyroscope in x,y, and z directions, temperature, and time stamp.

Table 4 AC1 data structure

Sensor Type	Data field	Data type	Description
LiDAR	cloud_point_t		
	points.x	float	3D point cloud data x coordinates
	points.y	float	3D point cloud data y coordinates
	points.z	float	3D point cloud data z coordinates
	intensity	uint8_t	3D point cloud data reflection intensity
	depth_frame_t		
	data	void*	Pointer to depth data
	data_bytes	size_t	Number of bytes of the depth data buffer
	point_nums	uint16_t	Number of points in the depth data
RGB	image_frame_t		
	width	uint32_t	The width of the image in pixels

	height	uint32_t	The height of the image in pixels
	frame_format	frame_format_t	Format of image data
	step	size_t	The number of bytes per line
	sequence	uint32_t	Serial number of the image frame
	capture_time	struct timeval	Timestamp of image data acquisition
	data	void*	Pointer to image data
	data_bytes	size_t	number of bytes in the image data buffer
IMU	motion_frame_t		
	accel.x	float	Acceleration data of the accelerometer in the X-axis direction (unit m/s²)
	accel.y	float	Acceleration data of the accelerometer in the Y-axis direction (unit m/s²)
	accel.z	float	Acceleration data of the accelerometer in the Z-axis direction (unit m/s²)
	gyro.x	float	Angular velocity data of the gyroscope

			in the X-axis direction (unit: dps, degrees per second)
	gyro.y	float	Angular velocity data of the gyroscope in the Y-axis direction (unit: dps, degrees per second)
	gyro.z	float	Angular velocity data of the gyroscope in the Z-axis direction (unit: dps, degrees per second)
	temperature	float	Temperature data of IMU sensor (unit: degrees Celsius)
	capture_time	struct timeval	Timestamp of data collection

5 Product Maintenance

5.1 Transportation and Logistics

! Important

Improper transportation can cause damage to the equipment!

1) The products should be packaged with shock-proof and moisture-proof materials to avoid damage during transportation. It is recommended to use original packaging;
2) During transportation, please handle the products carefully to avoid dangerous behaviors such as bumping and dropping;
3) Upon receiving each shipment, please thoroughly check the delivery list and product packaging for any damage (including physical damage to the products);
4) If there is any transportation damage, please refuse to accept the goods and contact RoboSense in a timely manner.

5.2 Storage

! Important

Storage Inadequate can lead to equipment damage!

1) Please store the equipment in an indoor environment with normal temperature and dryness;
2) Handle the equipment carefully to avoid collisions, drops, and other dangerous behaviors;
3) The products should be stored in a safe environment to prevent corrosion, mechanical impact, and exposure to environments above the protective level;
4) Regularly check the status of all components and packaging. It is recommended to conduct inspections every 3 months.

5.3 Cleaning

In order to be able to accurately sense the surrounding environment, AC1 needs to be kept clean, especially the window.

5.3.1 Attention

! Please read the contents of this chapter carefully and completely before cleaning your AC1, otherwise improper operation may damage the sensor.

! When the AC1 is used in a harsh environment, it is necessary to clean up the dirt on the surface in time to keep the AC1 clean, otherwise it will affect the normal use of the AC1.

5.3.2 Required Materials

1) Clean, dust-free cloths
2) Neutral solution at moderate temperature (such as soap water, distilled water, 99% alcohol concentration, etc.)

5.3.3 Cleaning Method

1) If only some dust/dust particles have adhered to the surface of the LiDAR:
    a) First, use a clean, dust-free cloth to dip into a small amount of neutral solution;
    b) Then, gently wipe and clean the AC1 surface;
    c) Finally, use a dry, clean, dust-free cloth to wipe it dry.
2) If mud or other blocky foreign objects have adhered to the surface of the AC1:
    a) First, clean water should be sprayed on the surface of the dirty part of the AC1 to remove foreign objects such as mud (Note: the mud cannot be wiped off directly with a dust-free cloth, which may scratch the surface, especially the surface of the window)
    b) Then, spray warm soap water on the dirty area to accelerate the removal of the foreign objects. Gently wipe the AC1 surface with a

fiber cloth, but be careful not to scratch the surface;

c) Finally, rinse the AC1 surface with clean water to remove any soap residue (if there are still traces left, you can use 99% alcohol to clean it again), and dry it with a dry, clean, dust-free cloth.

6 After-sale service

If you encounter any problems that cannot be solved during use, please contact RoboSense company in time.

Official website: https://www.robosense.cn/contact

Email: support@robosense.cn

Telephone: 0755-86325830/15338772453

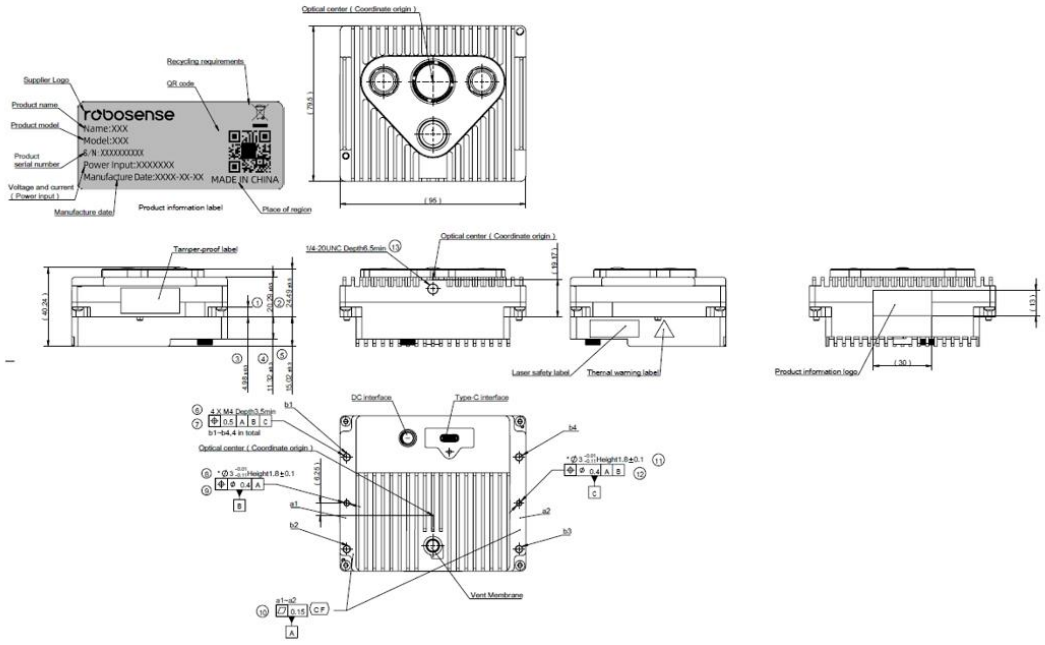
Note

1) Only after receiving confirmation of xx company's after-sales service, return the device;

2) The device can only be returned with the original packaging or equivalent moisture-proof packaging.

Appendix A structural drawings

The structural drawings of AC1 are as follows:



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