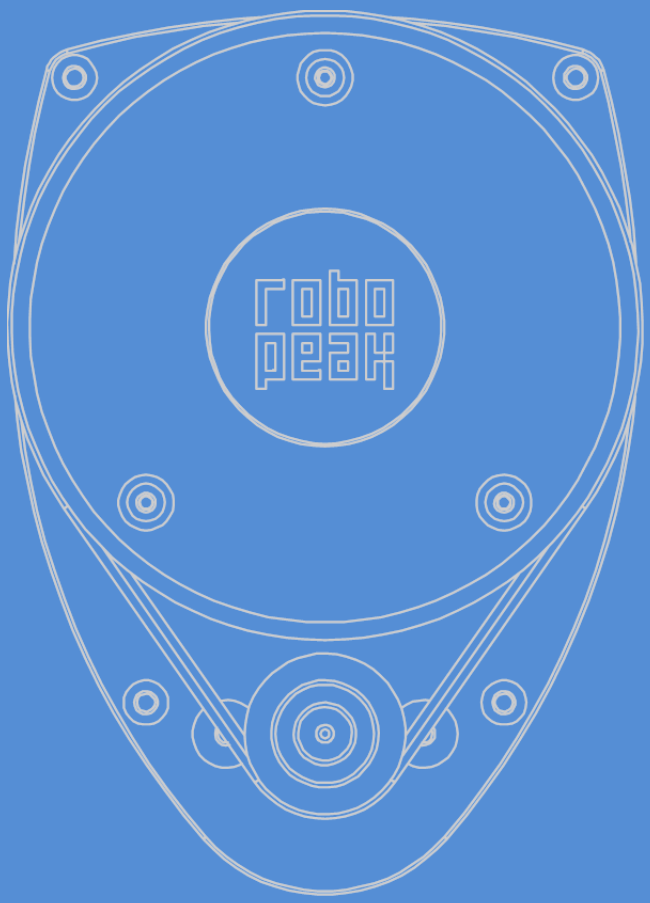
RPLIDAR

Low Cost 360 degree 2D Laser Scanner (LIDAR) System

Introduction and Datasheet

2014-4-17
rev.6

For Model: A1M1



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1. Introduction

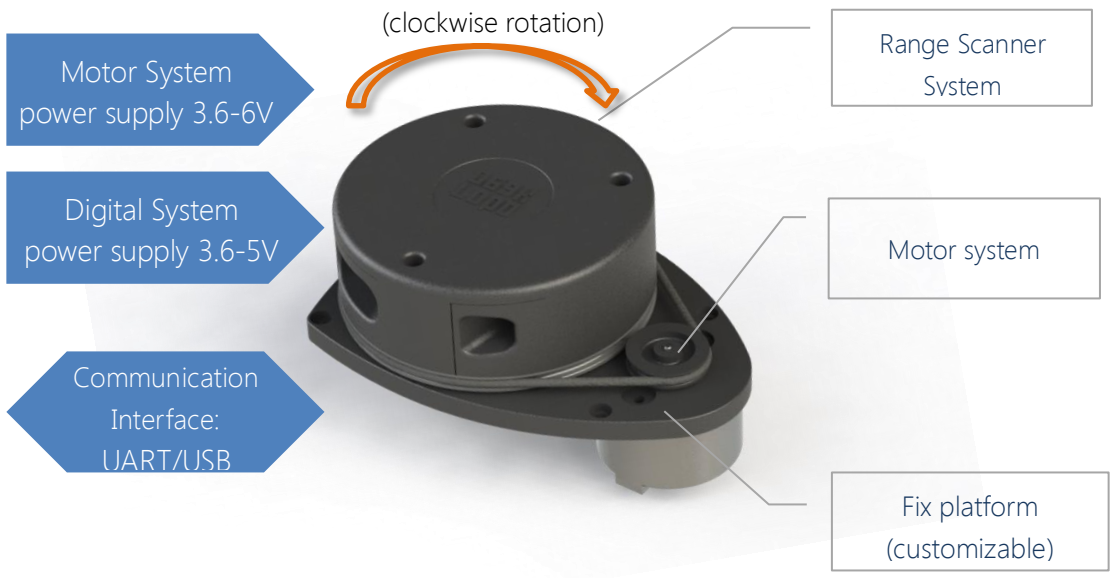
RPLIDAR is a low cost 360 degree 2D laser scanner (LIDAR) solution developed by RoboPeak. The system can perform 360 degree scan within 6 meter range. The produced 2D point cloud data can be used in mapping, localization and object/environment modeling.

RPLIDAR's scanning frequency reached 5.5 hz when sampling 360 points each round. And it can be configured up to 10 hz maximum.

RPLIDAR is basically a laser triangulation measurement system. It can work excellent in all kinds of indoor environment and outdoor environment without sunlight.

System Connection

RPLIDAR contains a range scanner system and a motor system. After power on each sub-system, RPLIDAR start rotating and scaning clockwisely. User can get range scan data through the communication interface (Serial port/USB).



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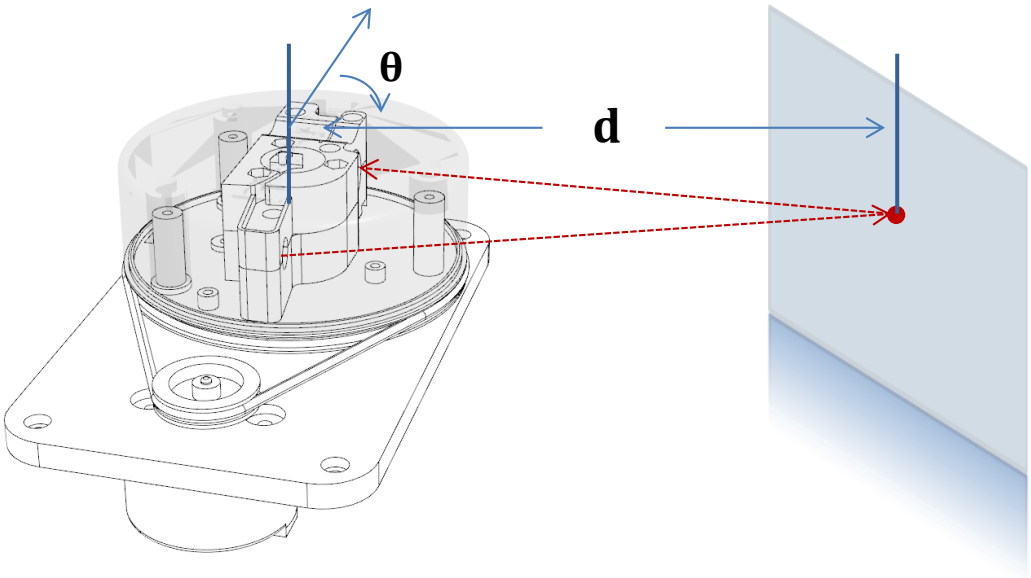
RPLIDAR comes with a speed detection and adaptive system. The system will adjust frequency of laser scanner automatically according to motor speed. And host system can get RPLIDAR's real speed through communication interface.

The simple power supply schema saves LIDAR system's BOM cost and makes RPLIDAR much easier to use. Detailed specification about power and communication interface can be found in the following sections.

Mechanism

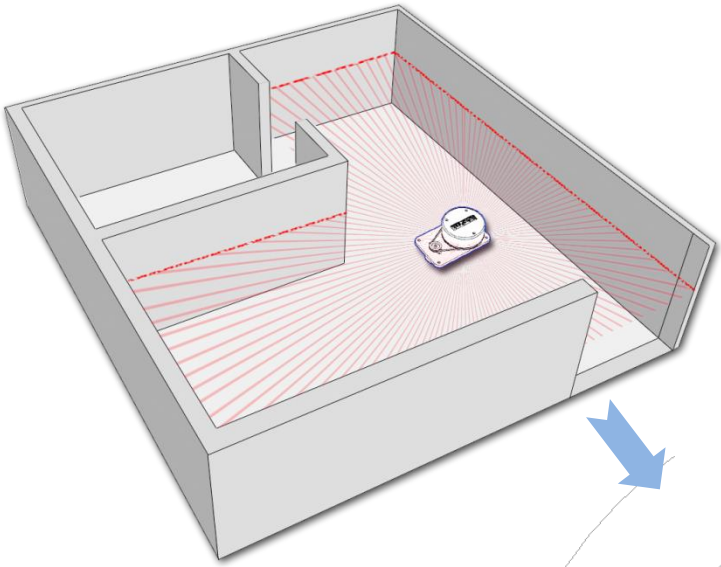
RPLIDAR is based on laser triangulation ranging principle and uses high-speed vision acquisition and processing hardware developed by RoboPeak. The system measures distance data in more than 2000 times' per second and with high resolution distance output (<1% of the distance).

RPLIDAR emits modulated infrared laser signal and the laser signal is then reflected by the object to be detected. The returning signal is sampled by vision acquisition system in RPLIDAR and the DSP embedded in RPLIDAR start processing the sample data and output distance value and angle value between object and RPLIDAR through communication interface.

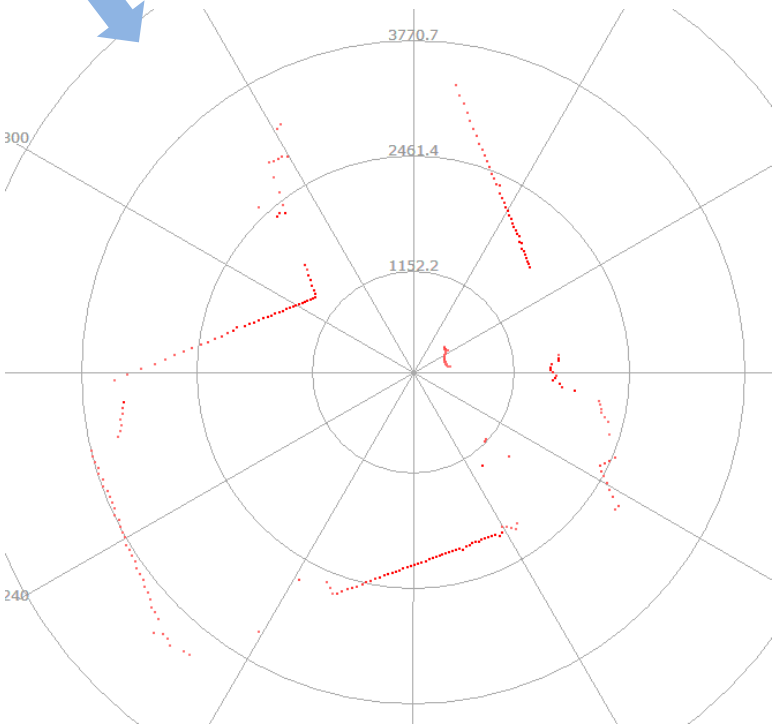


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The high-speed ranging scanner system is mounted on a spinning rotator with a build-in angular encoding system. During rotating, a 360 degree scan of the current environment will be performed.



*Note：The LIDAR scan image is not directly relative to the environment showed here. Illustrative purpose only.



Safety and Scope



Class I

RPLIDAR system use a low power (<5mW) infrared laser as its light source, and drives it using modulated pulse. The laser emits in a very short time frame which can make sure its safety to human and pet and reach Class I laser safety standard.

The modulated laser can effectively prevent ambient light and sunlight during ranging

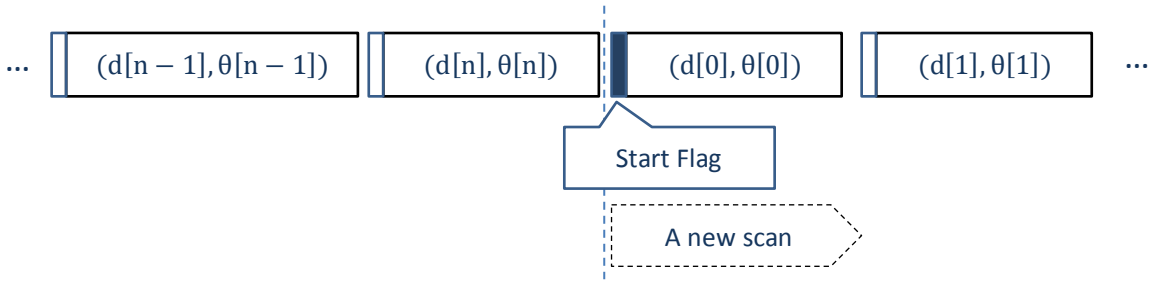
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scanning process. This make RPLIDAR work excellent in all kinds of indoor environment and outdoor environment without sunlight.

Data Output

When RPLIDAR is working, sampling data will output to communication interface. Each sample point contains below information. RPLIDAR outputs sampling data continuously. Host systems can configure output format and stop RPLIDAR by sending stop command. If you need detailed data format and communication protocol, please contact with RoboPeak.

Data Type	Unit	Description
Distance	mm	Current measured distance value
Heading	degree	Current heading angle of the measurement
Quality	level	Quality of the measurement
Start Flag	(Boolean)	Flag of a new scan



Application Scenarios

RPLIDAR can be used in below application area:

- General robot navigation and localization (Home service robot/cleaning robot)
- Smart toy's obstacle avoidance
- Environment scanning and 3D re-modeling
- General simultaneous localization and mapping (SLAM)

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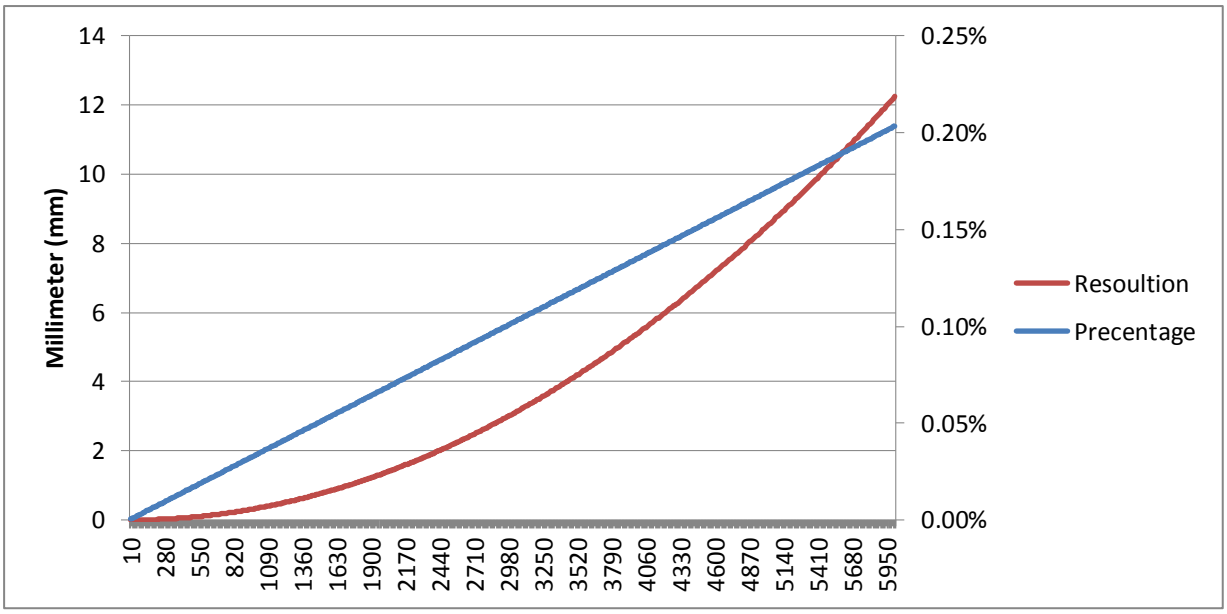
2. Specification

Measurement Performance

- For Model A1M1 only

Item	Unit	Min	Typical	Max	Comments
Distance Range	Meter(m)	TBD	0.2 - 6	TBD	White objects
Angular Range	Degree	n/a	0-360	n/a	
Distance Resolution	mm	n/a	<0.5 <1% of the distance	n/a	<1.5 meters All distance range*
Angular Resolution	Degree	n/a	≤1	n/a	5.5Hz scan rate
Sample Duration	Millisecond(ms)	n/a	0.5	n/a	
Sample Frequency	Hz	n/a	≥2000	2010	
Scan Rate	Hz	1	5.5	10	Typical value is measured when RPLIDAR takes 360 samples per scan

*Note：triangulation range system resolution changes along with distance change, the below chart showed the theoretical resolution change of RPLIDAR：



Optical Specification

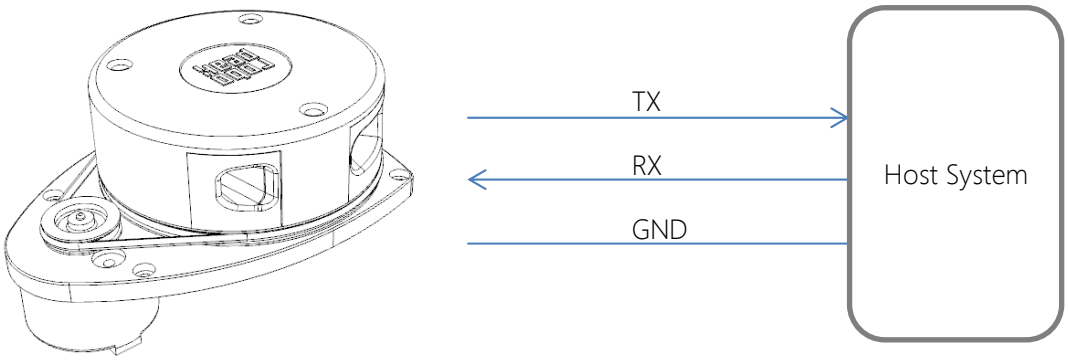
- For Model A1M1 only

Item	Unit	Min	Typical	Max	Comments
Laser wavelength	Nanometer(nm)	775	785	795	Infrared Light Band
Laser power	Milliwatt (mW)	TBD	3	5	Peak power
Pulse length	Microsecond(us)	TBD	110	300	

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Communication interface

RPLIDAR uses 3.3V-TTL serial port (UART) as the communication interface. Other communication interface such as USB can be customized according to customer's requirement. The table below described specification for serial port interface. Please contact RoboPeak if you want detailed communication protocol and SDK.

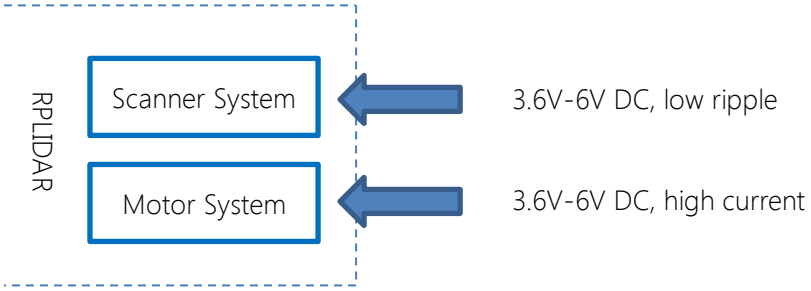


Item	Unit	Min	Typical	Max	Comments
Band rate	bps	-	115200	-	
Working mode	-	-	8N1	-	8n1
Output high voltage	Volt (V)	2.9	-	3.3	Logic High
Output low voltage	Volt (V)	-	-	0.4	Logic Low
Input high voltage	Volt (V)	1.6	-	5.2	Logic High
Input low voltage	Volt (V)	-0.3	-	1.17	Logic Low

Power supply and consumption

Ranging scanner system and motor system are powered separately in RPLIDAR. External system should provide power supply for them separately in order to ensure data accuracy. Below chart showed a recommended power mode. More specification is provided in the following table.

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- For Model A1M1 only

Item	Unit	Min	Typical	Max	Comments
Scanner system voltage	Volt (V)	3.6	5	6	Low ripple recommend
Scanner system current	Milliampere (mA)	TBD	40	70	Sleep mode, 5V input
		TBD	130	200	Work mode, 5V input
Motor system voltage	Volt (V)	3.6	5	6	Adjust voltage according to speed
Motor system current	Milliampere (mA)	TBD	100	TBD	5V input

MISC

Item	Unit	Min	Typical	Max	Comments
Weight	Gram (g)	-	170	-	core module only
Temperature range	degree Celsius (°C)	-	0-45	-	

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3. Self-protection and Status Detection

To make sure RPLIDAR's laser always working in the safety range (<5mW) and avoid any other damage caused by device, RPLIDAR comes with laser power detection and sensor healthy check feature. RPLIDAR will shut down the laser and stop working when any of below errors has been detected.

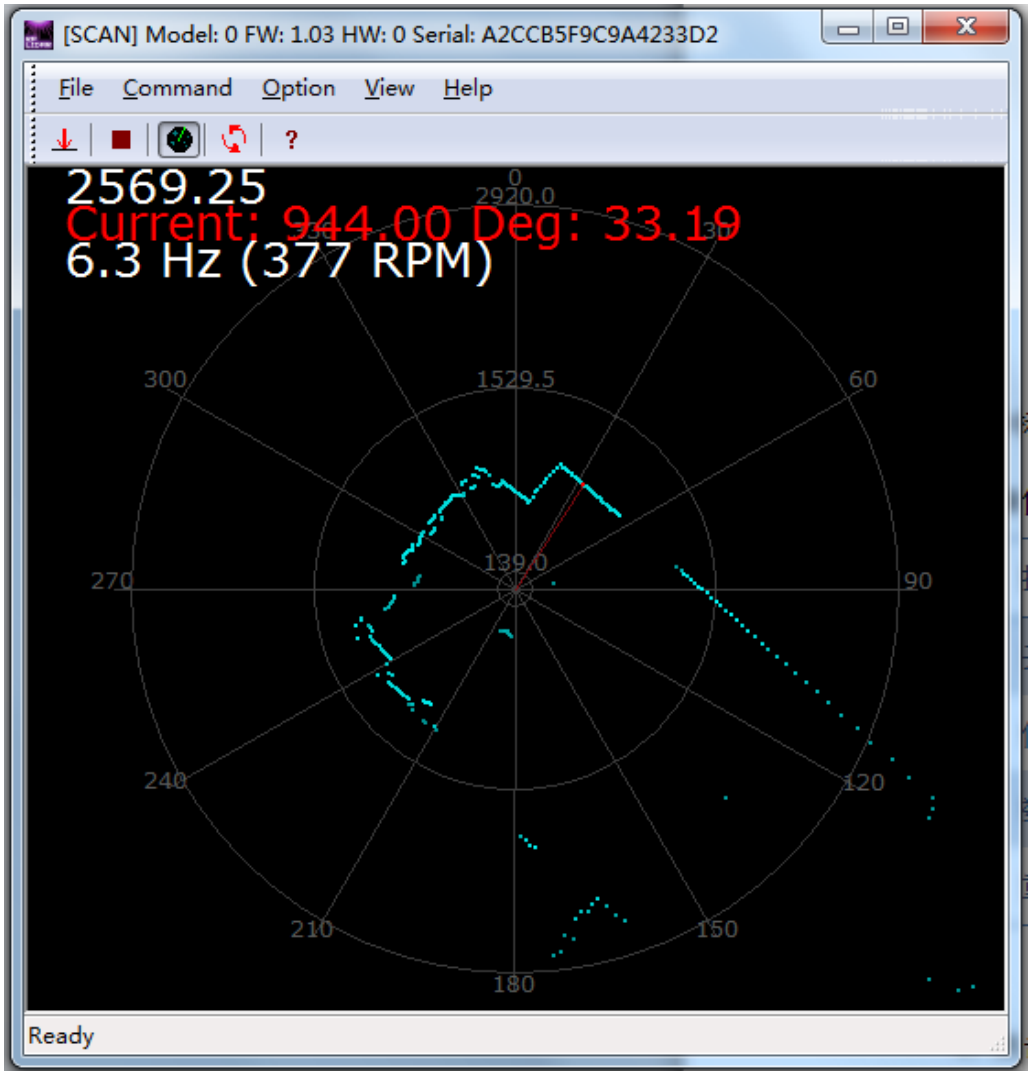
- Laser transmit power exceed limited value
- Laser cannot power on normally
- Scan speed of Laser scanner system is unstable
- Scan speed of Laser scanner system is too slow
- Laser signal sensor works abnormally

Host systems can inquiry the RPLIDAR's status through communication interface and restart RPLIDAR to try to recovery from error.

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4. Development SDK and Support

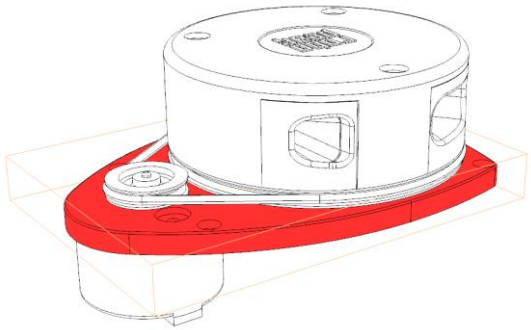
RoboPeak provides debug GUI tool and SDK (available for Windows, x86 Linux and Arm Linux) to speed up product development. Please contact us for detail information.



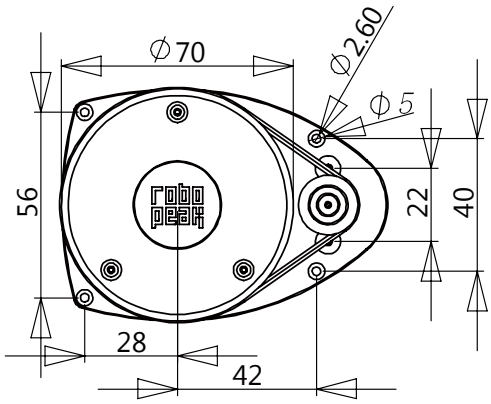
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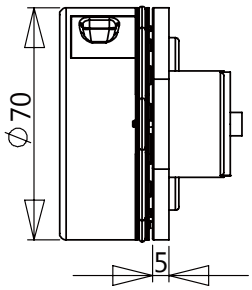
5. Mechanical and Customization Options

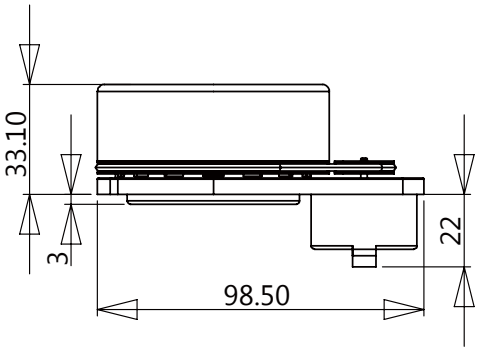
To facility customer's integration, RPLIDAR's structure is designed to decouple the core ranging system and fixed platform which can be customized. The part marked red in the below figure is the fixed platform that can be customized according to customer requirement.



The RPLIDAR-A1M1 assemble size showed below:







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6. Revision History

Date	Content
2013-3-13	Initial draft
2013-5-16	1. Updated the laser class information 2. Updated motor voltage range 3. Updated size chart according to Rev1.5 sample design
2013-8-9	Updated power consumption
2013-11-23	Updated product specification
2013-12-29	Updated product specification
2014-2-9	Added model name: A1M1
2014-4-17	Added weight and temperature range description

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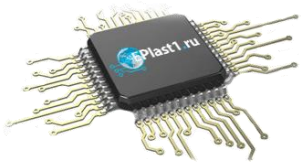
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