Introduction and Manual for Two-dimensional TOF Scanning Laser Scanner

Model: N301 Series

V1.5

LeiShen Intelligent System Co., Ltd.

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Introduction

N301 series laser scanner adopts TOF (time of flight) principle and can realize two-dimensional scanning and detection to the surrounding 360-degree environment. This series laser scanner transmits electric energy and laser scanner internal data in a wireless way. This series is classified into N301XXA, N301XXB, N301XXM, N301XXN, and other models according to the measuring range, the measuring frequency can reach 20 KHZ, and the laser scanner with higher frequency may be customized. The design detection accuracy is +/- 3cm, and the maximum measuring range ranges from 10 meters to 100 meters. As the low-cost solution, this series laser scanner is mainly used for indoor/outdoor service robots, AGV, Cleaning Robot, UAV, automobile ADAS systems and other applications.

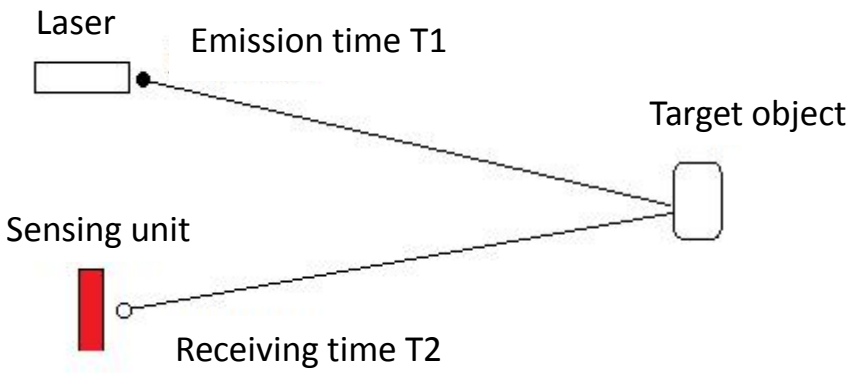
地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Principle

N301 series adopts TOF (time of flight) principle, and measures the relative distance between the object and the sensor by measuring the modulated laser emission and return time difference. The laser transmitter emits the modulated pulse laser, and the internal timer starts to count the time t1. When the laser irradiates the target object, part of energy returns. When the laser receives the returned laser signal, the internal timer t2 is stopped, and the distance from the laser scanner to the object is:

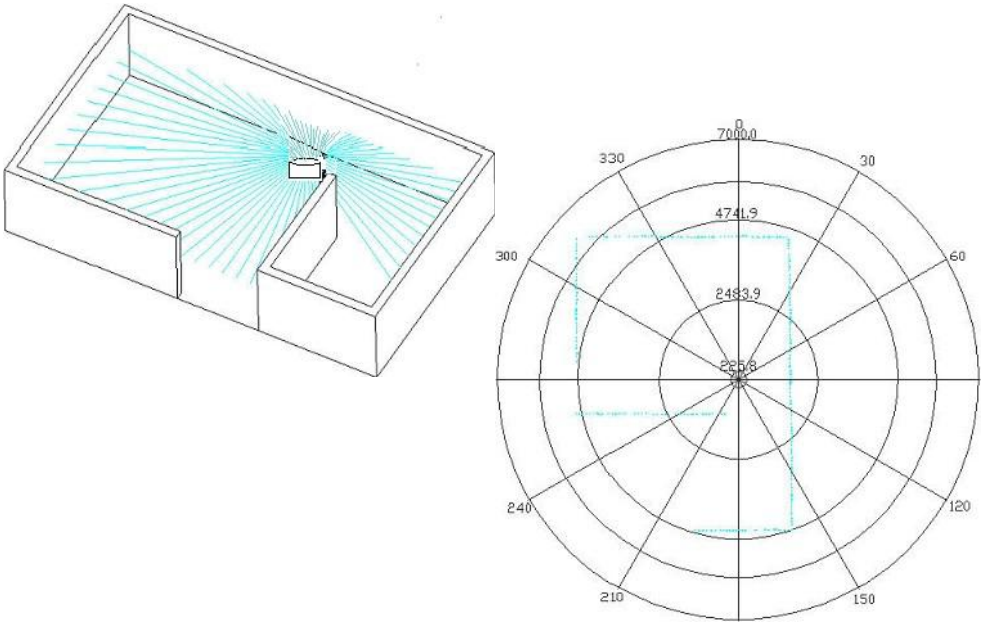
$$S=C(\text{speed of light})*(t2-t1)/2$$

$$S=C\ (\text{laser speed})*(t2-t1)/2$$



地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

According to the distance to the detected object calculated in real time by the signal processing unit embedded in N301 series laser scanner and in combination with the angle information outputted by the high precision adaptive angle measurement module, the two-dimensional plane information of the surrounding 360-degree environment can be obtained within the measuring range.



Effect Diagram for 360-degree Two-dimensional Plane Detected by N301 Laser Scanner

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Component Connection

N301 series laser scanner is mainly composed of a laser transceiver module, a TOF weak signal detection module, a signal processing module, a data/command transmission interface, etc. The laser scanners use 9-36V wide external power supply.

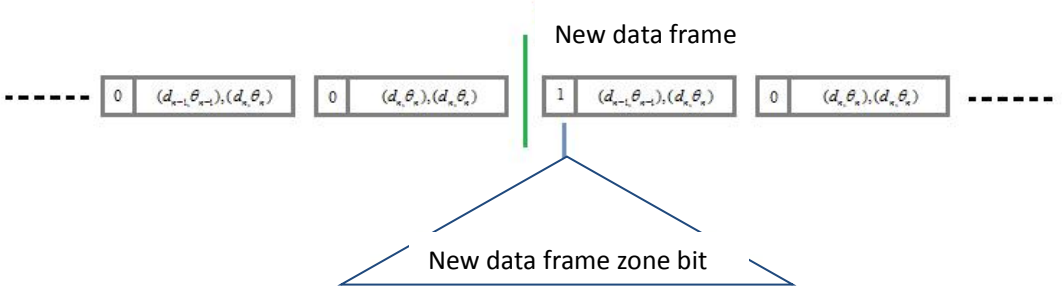
After the system is powered on correctly, users can obtain the scanned ranging data by calling the drive program of N301 series laser scanner.

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Data message format

When N301 series laser scanner works, each set of sampled data is outputted through the communication interface. The output data has a unified message format. If users demand detailed communication protocol and data message format, please contact LeiShen Intelligent System Co., Ltd.

Data Type	Unit	Description
Distance value	mm	Actual distance between N301 series laser scanner and current sampling point
Angle	Degree	Angle of current sampling point relative to N301 polar coordinates



The measurement data of N301 series laser scanner is outputted in a message format. The external system can control the laser scanner to output the data through request, stop and other commands or configure the format of output data. for detailed information, please Contact LeiShen Intelligent System.

Application Example

This system is suggested to be used in the following fields:

- Navigation and positioning of movable robot
- Navigation and obstacle avoidance of unmanned aerial vehicle
- Simultaneous localization and mapping (SLAM) platform
- AGV (Automatic Guided Vehicle)
- Driving system of unmanned vehicle
- Automobile driver assistance

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Safety and Product Protection

N301 series laser scanner uses 905nm pulse infrared laser as an emission light source, and is driven in a modulating pulse mode, and the laser power conforms to the safety level of CLASS Ⅰ. The laser emission unit of the laser scanner emits laser only when the system rotates at high speed. The actual laser power received within the unit time at the fixed point is far lower than CLASS Ⅰ laser safety standard, ensuring the safety of humans and pets.

In order to avoid the abrupt change of laser power caused by the external impact and abnormal work of the laser scanner and ensure that the laser power output is always within the safe output range of CLASS Ⅰ, we design the function of product protection module. When the following faults occur, the laser scanner will turn off the laser output and stop scanning the range to avoid the damage to itself and the outside.

- The transmitting power of the laser exceeds the threshold value;
- The laser cannot work;
- TOF ranging unit works abnormally;
- The scanning speed of the laser scanner is too low;

● The motor speed is not stable. The external system can inquire the working status of the device through the communication interface and can recover the normal working status through pause, restart and other commands.

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

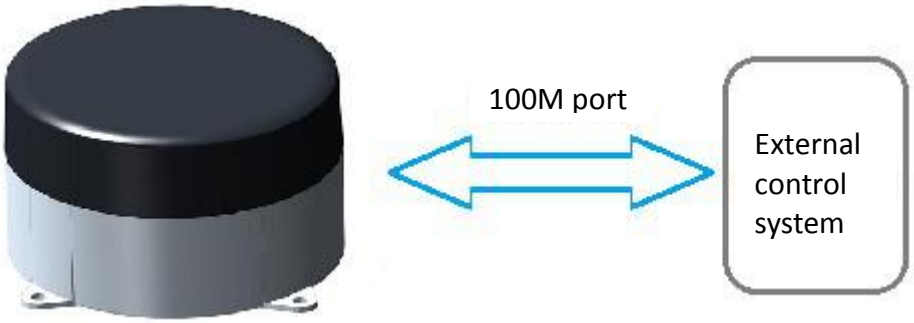
Performance Parameters

	Unit	Min	Standard	Max	Note
Laser wavelength	nm	895	905	915	infrared band
Laser Class			Class1- eye safe	-	
Pulse Duration	μs	-	7	10	
Detection range	m	-	10m	-	N30101A/B/M/N
			30m	-	N30103A/B/M/N
			50m	-	N30105A/B/M/N
			100m	-	N30110A/B/M/N
Absolutely measurement accuracy	cm	-	+/-3cm	-	
FOV	Deg		360°		
Angular resolution	Deg		0.18°	-	N301XXB、N301XXM
			0.36°	-	N301XXA、N301XXA
Every ranging time	ms		50	-	N301XXA、N301XXB N301XXM、N301XXN
Sampling Frequency	Hz		20,000	-	N301XXA、N301XXB
		-		-	N301XXM、N301XXN
Scan Frequency	Hz	3	10	11	N301XXM、N301XXB
		11	20	-	N301XXA、N301XXN
IP Level			IP67		
Ambient light	lx		100,000		
Operating Temperature	℃	-15	-	55	N301XXA、N301XXB
	℃	-35	-	55	N301XXM、N301XXN
Shock		500m/sec², lasting 11ms			
Vibration		5Hz-2000Hz，3G rms			

地址：深圳市宝安区沙井街道办蚝乡路运华时代大厦4楼
Address: F4, YunHua Times Building, Haoxiang Road, ShaJing Street, Bao'An District, Shenzhen, Guangdong, China

Communication and Interfaces

N301 series laser scanner products adopts Ethernet as communication interface. Ethernet interfaces of N301 series laser scanners uses a port with bandwidth of 100 MB as the communication interface, and can realize the real-time and high-speed transmission of mass data. The following table shows the specification information on ports. If users demand SDK, detailed communication protocols, parameter customization information, etc., please contact LeiShen Intelligent System.



Item	Unit	Minimum	Typical Value	Maximum	Remark
Bandwidth	bps	-	100M	-	Communication bandwidth
Working mode	-	-	Tcp-server	-	
IP address			192.168.1.1		IP address can be changed
Subnet mask			255.255.255.0		Set as required
Gateway address			192.168.1.1		Set as required

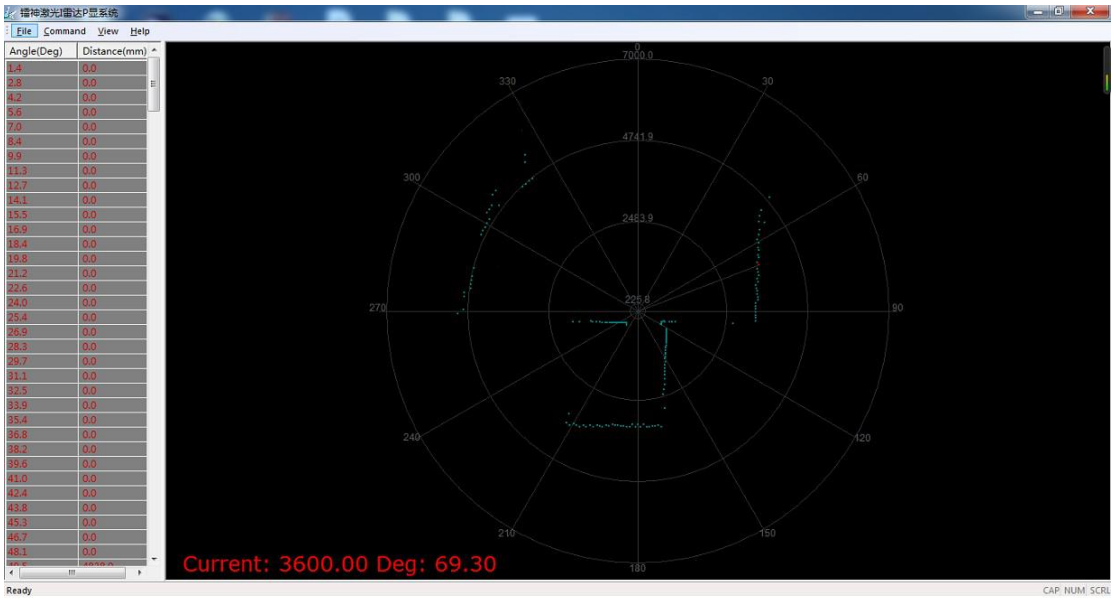
Power Supply Information

N301 series laser scanner uses 9-36V wide voltage power supply mode. The external power supply can normally work at 9-36V, but it is suggested to use the low ripple power supply to obtain a stable data output.

Item	Unit	Minimum	Typical Value	Maximum	Remark
System voltagea	Volt（v）	9	12	36	It is suggested to use the low ripple power supply.
Measuring module current	Milliampere (mA)	Pending	350 (12V power supply)	Pending	

Development Tool and Support

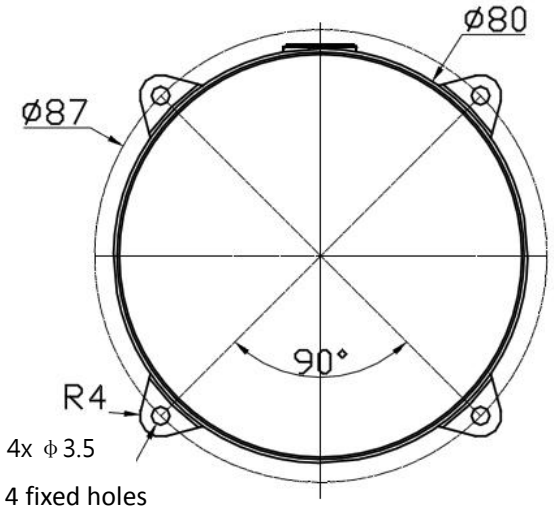
LeiShen provides SDK development kits supporting 301 series products for customers to process the scanned data in real time and display in the form of image. SDK development kits for N301 series products facilitate the users to be familiar with this product and help shorten the project development cycle. Currently, LeiShen Intelligent System only provides SDK kits based on Linux, ROS and Windows X86 platforms.

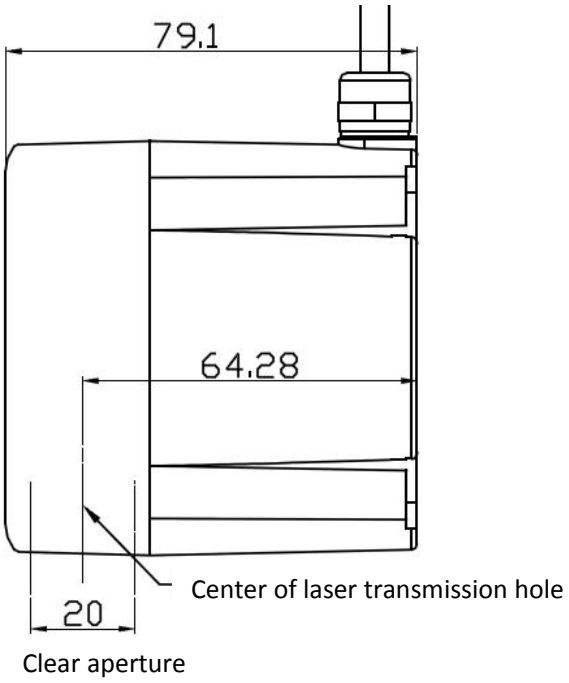


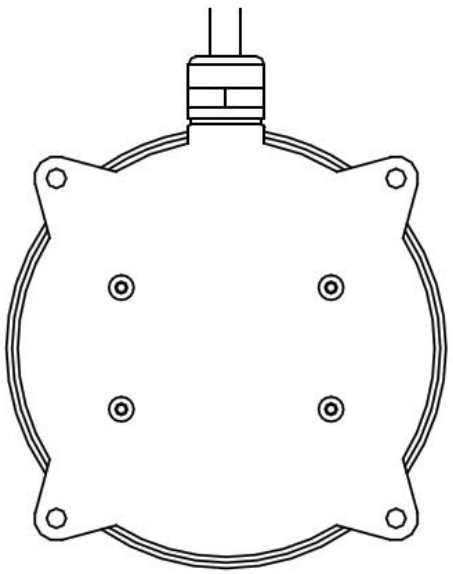
地址：深圳市光明新区玉律第七工业园 2 栋 8 楼 C 区镭神智能系统有限公司
Address: LeiShen Intelligent System Co., Ltd., Block C, F8, No.2 Building, Yulv Seventh Industrial Park, Guangming New District, Shenzhen City

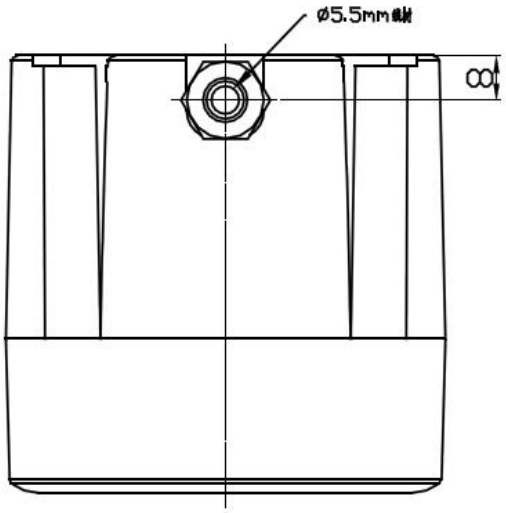
Structure Installation

The diagram for installation mechanism is shown below. If more detailed structure parameters needed, please contact LeiShen Intelligent System Team.









地址：深圳市光明新区玉律第七工业园 2 栋 8 楼 C 区镭神智能系统有限公司
Address: LeiShen Intelligent System Co., Ltd., Block C, F8, No.2 Building, Yulv Seventh Industrial Park, Guangming New District, Shenzhen City