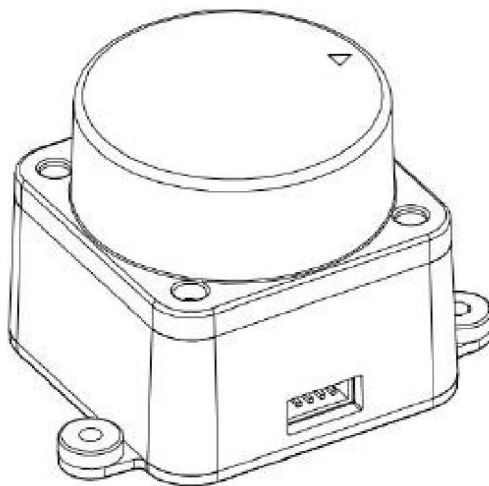


LIDAR Sensor LD19

Datasheet



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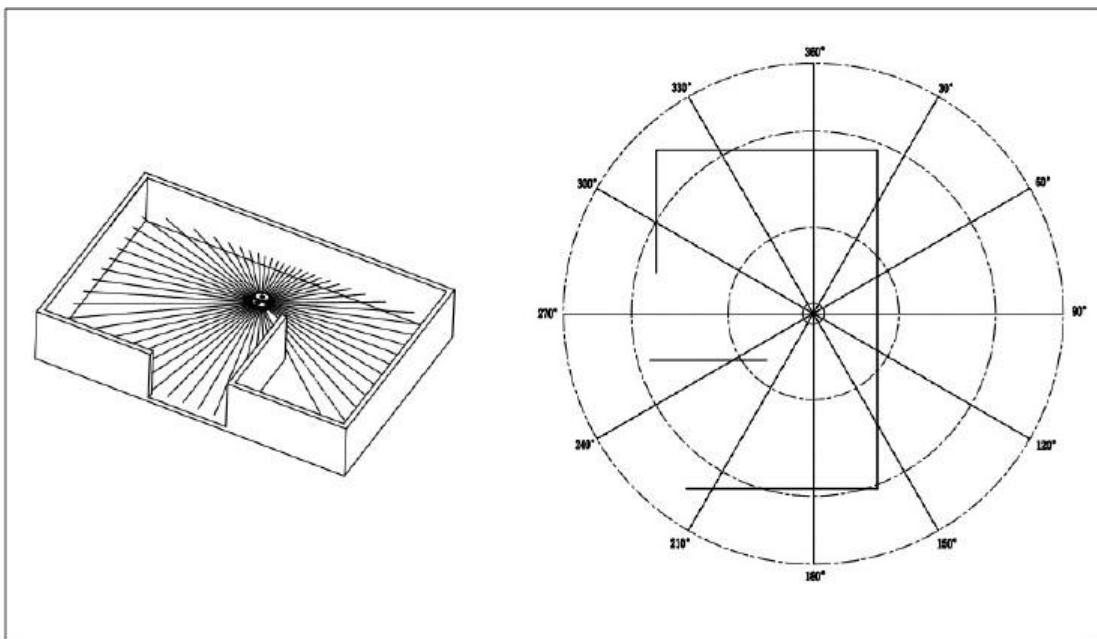
1. Introduction to the Principle and System

The LD19 consists mainly of a laser ranging core, a wireless power transmission unit, a wireless communication unit, an angle measuring unit, a motor drive unit and a mechanical housing.

With DTOF technology, LD19 ranging core is able to perform 4,500 measurements per second. For each ranging, the LD19 emits an infrared laser in a forward direction, which is reflected back to the single photon receiving unit when it encounters the target object. From this, we obtain the time at which the laser is emitted and that at which it is received by the single photon receiving unit. The time difference between them is the time of flight of the light, which can be combined with the speed of light to solve for the distance.

Once the distance data have been obtained, the LD19 integrates the angle values measured by the angle measuring unit to form the point cloud data and then sends the point cloud data to an external interface via wireless communication. Meanwhile the external interface provides PWM to enable the motor drive unit to drive the motor. The external control unit obtains the speed and controls it to the specified speed by means of a PID algorithm in closed-loop control, thus allowing the LD19 to work stably.

A diagram of the environmental scan formed by the LD19 point cloud data is shown below:



2. Specifications

2.1. Electrical and mechanical parameters

Parameter name	Unit	Minimum value	Typical value	Maximum value	Remarks
Input voltage	V	4.5V	5V	5.5V	

Parameter name	Unit	Minimum value	Typical value	Maximum value	Remarks
PWM control frequency	KHz	20	30	50	Square signal
PWM high level	V	3.0	3.3	3.5	
PWM low level	V	0	0	0.5	
PWM duty ratio	%	0	40	100	40% duty ratio, scan frequency of 10Hz
Starting current	mA	-	300	-	
Working current	mA	-	180	-	
Machine dimension	mm	38.59*38.59*33.50 (L*W*H)			
Machine weight *	g	-	47	-	Without connecting line
Communication interface	-	UART@230400			
UART high level	V	2.9	3.3	3.5	
UART low level	V	-0.3	0	0.4	
Driving motor	-	BLDC			Brushless motor
Working temperature	°C	-10	25	40	
Storage temperature	°C	-30	25	70	

Remarks: Actual weight may vary depending on configuration, manufacturing process, and measurement methods.

2.2. Optical parameters

Parameter name	Unit	Minimum value	Typical value	Maximum value	Remarks
Optical maser wavelength	nm	895	905	915	Infrared band
Laser power	W	-	25	-	Peak laser diode power; actual power used is much lower than this value
Laser pulse width	ns	-	1	-	
Laser safety level	-	IEC-60825 Class I			
Pitch angle	°	0	0.5	2	

2.3. Performance parameters

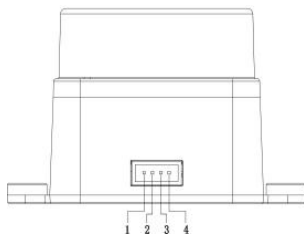
Parameter name	Unit	Minimum value	Typical value	Maximum value	Remarks
Ranging scope	m	0.02	-	12	70% target reflectivity
Scanning frequency	Hz	5	10	13	PWM speed control provided externally
Ranging frequency	Hz	-	4500	-	Fixed frequency

Parameter name	Unit	Minimum value	Typical value	Maximum value	Remarks
Average ranging accuracy	mm	-	-	-	When the ranging is lower than 0.3m, some data are output. The trend in ranging data is consistent with the trend in actual distance
	mm	-45	-	+45	The average of 100 measurements over a ranging scope from 300mm to 12,000mm (70% diffuse reflective surface)
Ranging standard deviation	mm	-	10	-	Ranging scope from 300mm to 12,000mm
Measurement resolution	mm	-	15	-	
Angle error	°	-	-	2	
Angular resolution	°	-	0.8	-	At 10Hz scan frequency by default
Anti-background light	KLux	-	-	30	
LiDAR noise	dB	≤45dB@30cm			The LiDAR is placed horizontally in a positive direction and tested at a distance of 30 cm through a noise meter (model AZ8922);
Machine life	h	10000	-	-	

3. Data Interface

3.1. Communication and interface

LD19 is connected to external systems via a ZH1.5T-4P1.5mm connector for power supply and data reception, with the interface definitions and parameter requirements shown in the following diagram/table:



S/N	Signal name	Type	Description	Minimum value	Typical value	Maximum value
1	Tx	Output	LiDAR data output	0V	3.3V	3.5V
2	PWM	Input	Motor control signal	0V	3.3V	3.5V
3	GND	Power supply	Negative pole	-	0V	-
4	P5V	Power supply	Positive pole	4.5V	5V	5.5V

LD19 is furnished with a stepless speed regulation motor drive and supports both internal and external speed control. When the PWM pin is grounded, the internal speed regulation is available by default, at the speed of 10Hz by default. External speed control requires a square signal to be connected to the PWM pin, which can be used to control the start, stop and speed of the motor via the PWM signal duty ratio. Conditions for triggering external speed control: a. Input PWM frequency of 20-50K, 30K recommended; b. Duty ratio within the (45%, 55%) interval (excluding 45% and 55%) and a minimum continuous input time of 100ms. Once the external speed control is triggered, it remains in the external speed control state and does not revert to internal speed control unless it is restarted after a power failure; It is also possible to control the speed by adjusting the PWM duty ratio. Due to individual differences in each product motor, the actual speed may vary when the duty ratio is set to typical values. For precise control of the motor speed, closed-loop control is required based on the speed information in the received data.

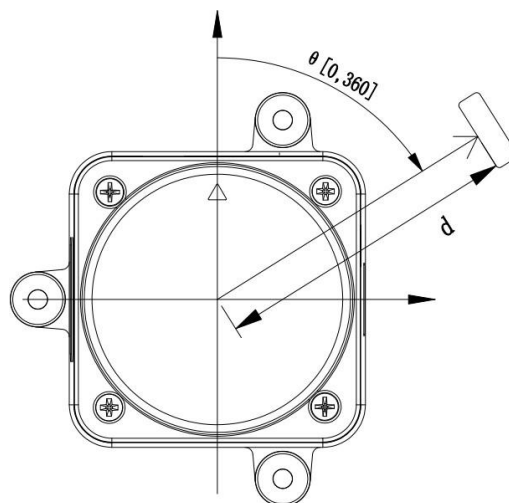
Notes: When external speed control is not used, the PWM pin must be grounded. The data communication of the LD19 is sent in one direction using a Universal Asynchronous Receiver Transmitter (UART) with the transmission parameters shown in the following table:

Baud rate	Data length	Stop bit	Parity check bit	Flow control
230400	8Bits	1	N/A	N/A

With one-way communication, LD19 starts sending measurement data as soon as the rotation is stabilized, without sending any commands.

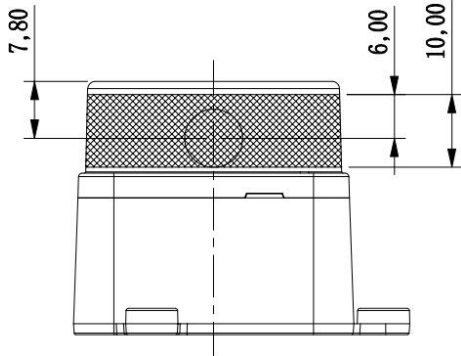
3.2. Coordinate system definition

The LD19 commonly follows a left-hand rule coordinate system where the front of the sensor is defined as the X-axis of the coordinate system (i.e. the 0-angle position), the origin of the coordinate system is the center of rotation of the ranging unit, and the angle of rotation increases along the clockwise direction, as shown in the following diagram:

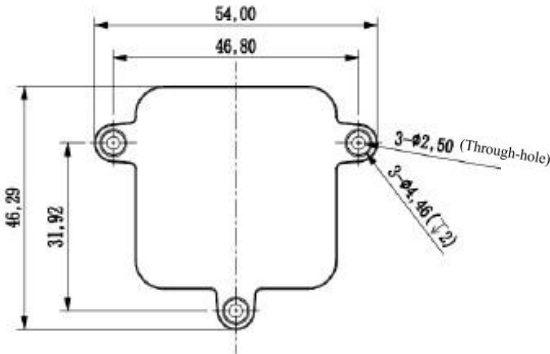
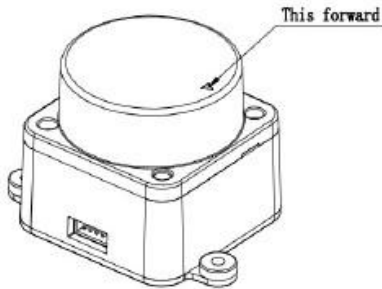
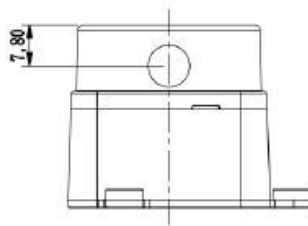
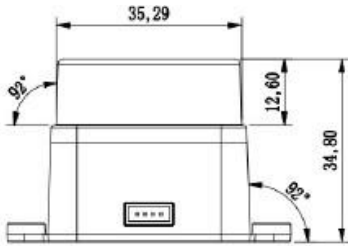


4. Optical Windows and Mechanical Dimensions

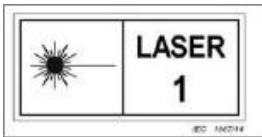
The laser emission and reception in the ranging unit of the LD19 requires an optical window, which needs to be exposed in the structure. The partial occlusion of this window by external systems will affect the ranging performance of the LD19 to some extent. The diagram below shows the optical window dimensions (in mm).



Other mounting dimensions are shown in the following diagram with a tolerance of ± 0.2 (in mm):



5. Safety and Scope of Application



LD19 is provided with a low-powered infrared laser as the emitting light source to ensure safety for humans and pets. It is qualified in the tests of Class I laser safety standards. The LD19 complies with 21 CFR 1040.10 and 1040.11 with the exception of deviations from Laser Notice No. 50 dated June 24, 2007.

Attention: Self-adjustment or modification of this product may result in dangerous radiation exposure.

6. Revision Records

Version	Revision date	Revision contents
1.0	2021-4-02	Initial creation
1.1	2021-05-21	Updated remarks on ranging accuracy
1.2	2021-11-16	1. Speed control constraint: When external speed control is not used, the PWM pin is grounded. 2. Increased product noise standards
2.3	2021-12-30	1. For emitter board software versions V1.2.9 and above, see the description of PWM external speed control in the text; For versions V1.2.8 and below, the conditions for triggering external speed control: Input PWM frequency of 10-50K; 2. Updated the maximal PWM high level and minimal PWM low level;
2.4	2022-3-4	Updated product pictures and coordinate system description pictures on the home page
2.5	2022-04-21	1. Updated newest Visual Identity 2. Added remarks about weight information