Benewake
TFA170-L LiDAR
Sensors

Benewake TFA170-L LiDAR Sensors User Manual

Contents

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Preface

This user manual contains the introduction, use, and maintenance of TFA170-L LiDAR. Please read this manual carefully before formal use, and strictly follow the steps described in the manual during use to avoid product damage, property loss, personal injury, or/and violation of product warranty terms. If you encounter problems that cannot be solved during use, please contact Benewake staff for assistance.

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Disclaimer
The TFA170-L product is constantly being improved, and its specifications and parameters will undergo iterative changes. Please refer to the official website for the latest version.

Product Overview

This chapter mainly introduces the measuring principle, technical specifications, structural description, equipment coordinates field view distribution of the TFA170-L LiDAR.

Measuring principle
TFA170-L is a typical Pulse Time of Flight (PToF) sensor. TFA170-L emits an arrow pulse laser, which is collimated by the transmitting lens, which enters the receiving system after being reflected by the measured target

and is focused on the APD detector by the receiving lens. The time between the transmitted signal and the received signal is calculated through the circuit amplification and filtering, and the distance between TFA170-L and the measured target can be calculated through the speed of light.
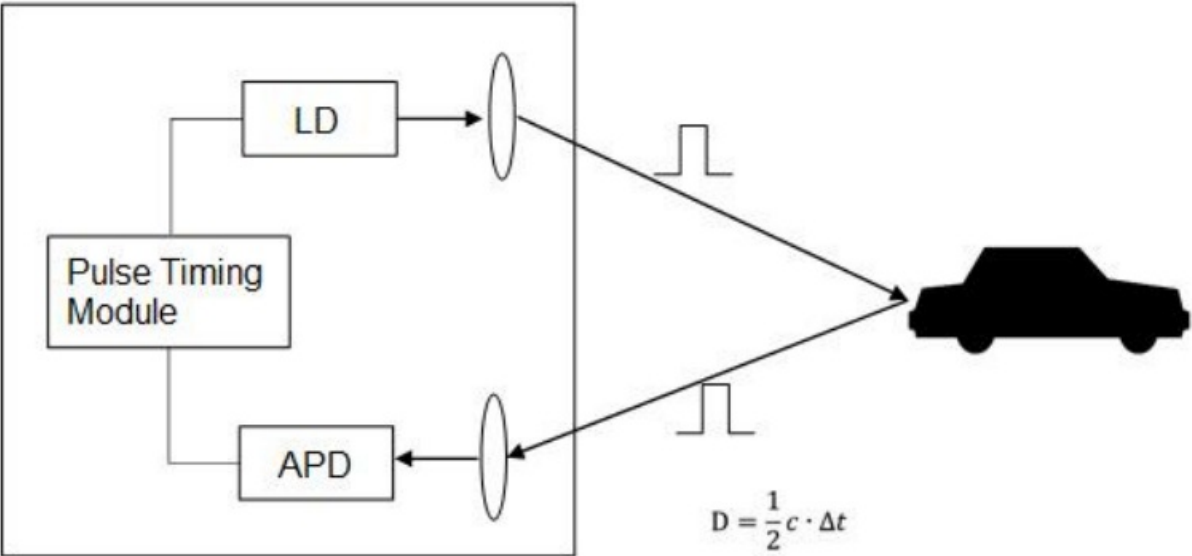

Figure. 1: Pulsed time of flight

Technical Specifications

Table. 1: Technical specifications

Performance Parameter	
Detection Range①	0.1-170m@90% reflectivity 0.1-70m@10% reflectivity
Accuracy②	±10cm(<10m), 1%(≥10m)
Distance resolution	1cm
Default frame rate③	50Hz
Ambient light resistance	100KLux
Laser Parameters	
Light source	EEL
Central wavelength	905nm

FoV	<0.5°
Eye safety	Class 1 Eye-safe [EN60825]
Mechanical/Electrical	
Average power consumption	≤1W
Peak current④	120mA@12V
Power supply	DC 12±10%V
Operating temperature	-20℃ ~ +60℃
Storage temperature	-20℃ ~ +80℃
Dimensions	TYP. 31.0 x 30.2 x 19.2mm³
Weight	~10g
Connector	1.25mm-4P
Protection Level	N/A
Communication Protocol	
Communication Interface	RS-232

NOTICE

1. The range is based on 25℃, 85KLux conditions, and any changes in environmental conditions may cause changes in the measurement results.
2. The accuracy is based on 25℃ indoors and 90% reflectivity condition and any changes in environmental conditions may cause changes in the measurement results.
3. The frame rate will be between 1Hz and 1000Hz. 50Hz is the default frame rate. The default frame rate can be customized within the range.
4. The peak current is measured at room temperature.

Structural Appearance
The overall appearance of the LiDAR is as shown in the figure below:

Figure. 2: TFA170-L Appearance

FoV
The FoV (field of view) is the angle covered by the LiDAR sensor. The horizontal FoV is 0.4° and the vertical FoV is 0.04°.
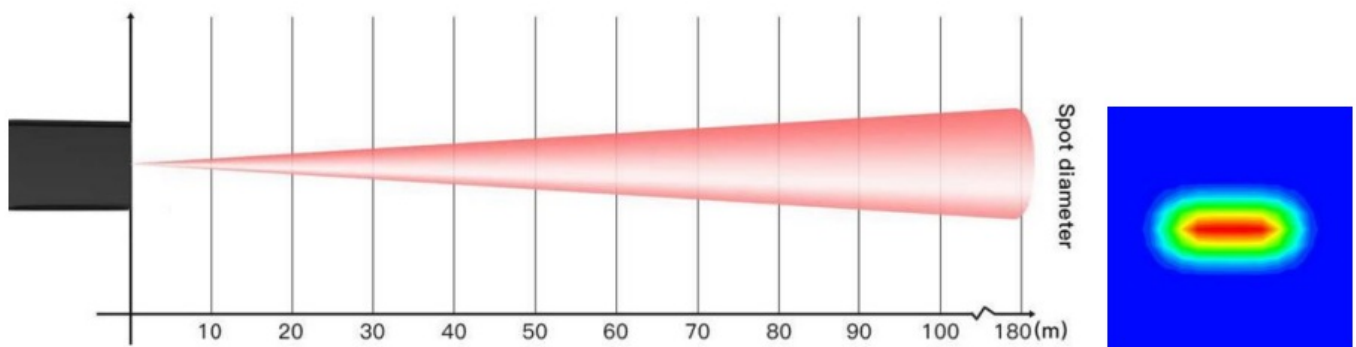

Figure. 3: FoV of TFA170-L

NOTICE
0.4° and 0.04° are theoretic values. Because the manufacturing error and the installing error exist, there is a divergence between actual and theoretic values.

Device Installation
This section introduces the mechanical installation and connection information of TFA170-L LiDAR.

Mechanical installation
As shown in the following figure. The model of the installation screwis M2.
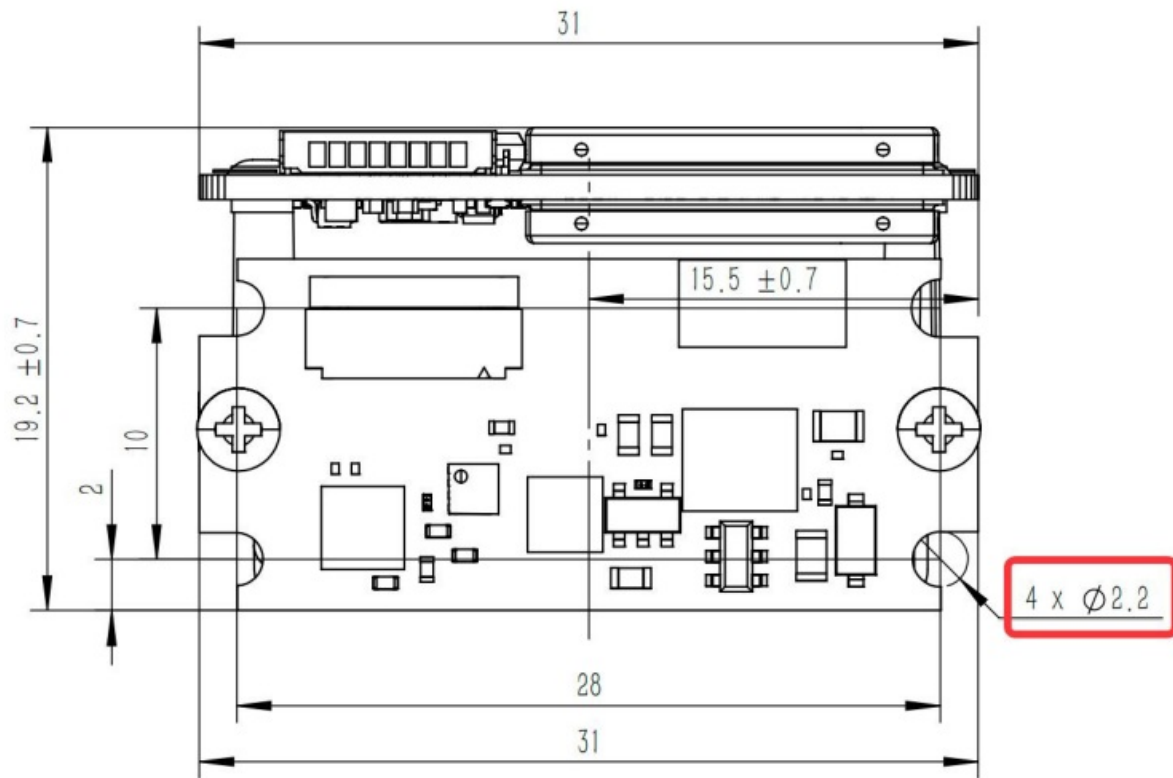
Figure. 4: Diagram of TFA170-L installation hole

Connector

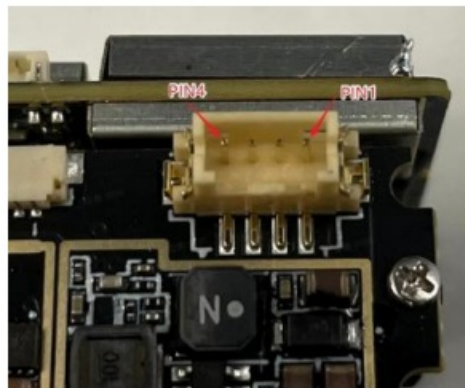The connector is 1.25mm-4P, appearance and definition are shown:

Figure. 5: LiDAR connector appearance

Table. 2: Interface connector pin definitions.

PIN	Definition
1	VCC
2	GND
3	RS232_TX
4	RS232_RX

Communication Protocols

By definition, RS-232 is a hardware communication protocol that uses synchronous serial communication with configurable speed. Asynchronous means there is no clock signal to synchronize the output bits from the transmitting device going to the receiving end.
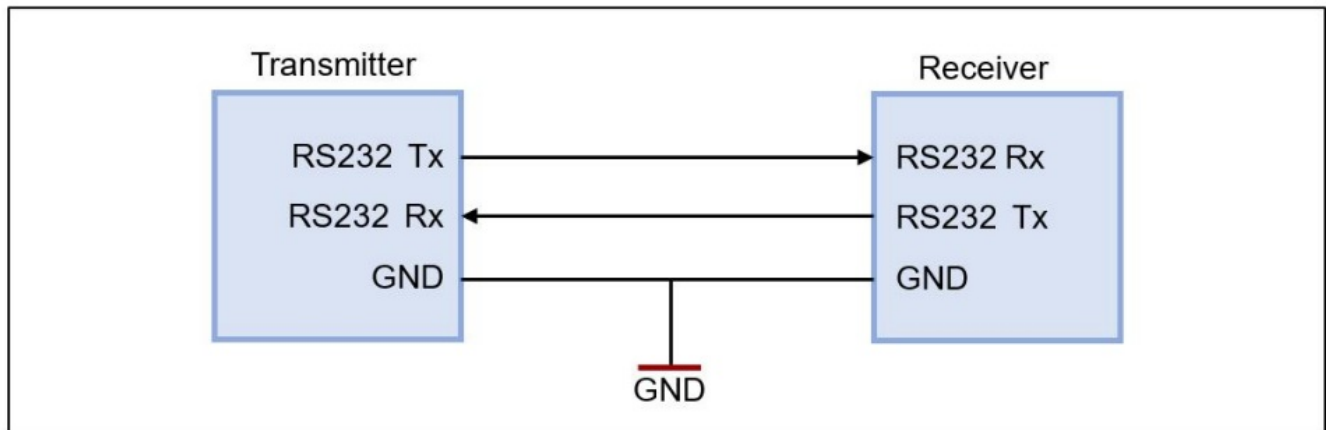

Figure. 6: RS-232 Connection Diagram

Communication protocol

The device does not contain any power switch. Data can be transmitted after the power adapter is connected and connected to the computer via a network cable.

Table. 3: Characteristics of RS-232 Interface

Character	Value	Configurability
Baud rate	115200	Configurable
Data bit	8	Non-configurable
Stop bit	1	Non-configurable
Parity	None	Non-configurable

NOTE

The baud rate can be set to 9600, 14400, 19200, 38400, 56000, 57600, 115200, 128000, 230400, 256000, 460800, 500000, 512000, 600000, 750000, and 921600. If other the value was set, TFA170-L will set it to 115200.

Data protocol

A standard data frame consists of 30 bytes of hexadecimal numbers. The details are shown as follows:

Table. 4: Data transfer Protocol.

No. byte	Definition	Remark	Default
0	Frame Header	Fixed value: 0x59	0x59
1	Frame Header	Fixed value: 0x59	0x59
2	Frame Length	Length of this data transfer frame. Number of bytes. Frame header and CRC checksum are included.	0x1E
3	Frame ID	0x00: Data transfer frame 0x20: Self-test frame	0x00
4	RefDist_L	Distance, uint16_t	cm
5	RefDist_H		
6	ConLvl	Confidence level of reference distance.	%
7	Status	Status of LiDAR, e.g., Overtemperature warning, etc.	/
8	Temp_L	Temperature	Raw data
9	Temp_H		
10	OrgDist1_L	Original Distance #1	Raw data
11	OrgDist1_H		
12-13	PulseWidth1_L	The pulse width of the echo pulse of original distance #1	/
	PulseWidth1_H		
14-15	OrgDist2_L	Original Distance #2	Raw data
	OrgDist2_H		
16-17	PulseWidth2_L	The pulse width of the echo pulse of original distance #2	/
	PulseWidth2_H		
18-19	OrgDist3_L	Original Distance #3	Raw data
	OrgDist3_H		
20	PulseWidth3_L	The pulse width of the echo pulse of the original	/

21	PulseWidth3_H	distance #3	
22-23	APDV_L	APD voltage, a basic value used to evaluate the status of LiDAR	/
	APDV_H		
24	Reserved1	Reserved byte #1	0x00
25	Reserved2	Reserved byte #2	0x00
26	Reserved3	Reserved byte #3	0x00
27	Reserved4	Reserved byte #4	0x00
28	CRC_L	Lower byte of Checksum	/
29	CRC_H	Higher byte of Checksum	/

Custom configuration

TFA170-L realized several configuration parameters. These parameters, such as data format, and frame rate, could be modified by certain commands. All the parameters will be stored in Flash after configured successfully and customers don't need to configure again when restarting. Please change the parameter according to certain requirements and do not frequently try irrelevant instructions. Please configure the product according to the requirements of the datasheet and don't sendunstatedcommand.

Table. 5: Description of TFA170-L Command

21	PulseWidth3_H	distance #3	
22-23	APDV_L	APD voltage, a basic value used to evaluate the status of LiDAR	/
	APDV_H		
24	Reserved1	Reserved byte #1	0x00
25	Reserved2	Reserved byte #2	0x00
26	Reserved3	Reserved byte #3	0x00
27	Reserved4	Reserved byte #4	0x00
28	CRC_L	Lower byte of Checksum	/
29	CRC_H	Higher byte of Checksum	/

Table. 6: General Parameter Configuration and Description

Obtain firmware e version.	5A 04 01 5F	5A 07 01 VA VB VC SU	The version number r VC.B.A	/
System reset	5A 04 02 60	5A 05 02 00 61	/	/
Change frame rate	5A 06 03 LL HH SU	Same as command	/	50 FPS
Output control	On: 5A 05 07 01 67 Off: 5A 05 07 00 66	Same as command	/	Enabl ed
Modify baud rate	5A 08 06 H1 H2 H3 H4 SU	Same as command	/	115200
Enable checks um	On: 5A 05 08 01 68 Off: 5A 05 08 00 67	Same as command	/	Enabl ed
Restore default settings	5A 04 10 6E	5A 05 10 00 6F 5A 05 10 01 70	Success Failed	/
Save setting	5A 04 11 6F	5A 05 11 00 70	Same as	/

CAUTION
Do not send the command that is not in the list above.

NOTE
To send certain commands to TFA170-L, these steps should be followed:

- Change the value of a parameter to HEX
- Put the HEX value in a certain command
- Calculate the checksum, put low 8-bits into the command
- For example, changing the baud rate to 460800, first, changing 460800 to HEX, we can get 0x00 07 08 00, then we can get this command-5A 08 06 0008070077.

Documents / Resources

Benewake TFA170-L LiDAR Sensors [pdf] User Manual
TFA170-L LiDAR Sensors, TFA170-L, LiDAR Sensors, Sensors

References

- **User Manual**