

DE1.1 LiDAR TF01

Release level: Public

Confidential level: Public

Product series: DELiDAR-TF01

Overview

Dear users :

Congratulations! You have chosen the device DE LiDAR-TF01 manufactured by Benewake.

Please read this manual carefully before you install this device and put it into operation. Instructions and hints included in this manual provides better use of the product . Keep the instruction for reference of later work on the equipment.

Benewake (Beijing) Co. Ltd (www.benewake.com), is a high-tech company focusing on “Robotic eyes”. IDG capital has granted Benewake A round investment. In 2016, we were awarded “Demo China EXPO” champion. We aim to turn the expensive LiDAR into core compartments for consumer use, and seek for intelligent robots to be owned by normal families.

The core R&D team members of Benewake come from Wake Forest University, Washington University, Humboldt University, Ecole Centrale Marseille, and Beijing Jiaotong University. 18% of our employee has a Doctor degree , and 42% with a Master degree.

Benewake, make the best Robotic Eyes.

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1. Product overview

Based on ToF (Time of Flight) principle, with unique characteristic of optics , electronics, and design, the product can achieve stable, accurate, high – sensitivity and high – speed distance measurement.

Features	Sensitivity	High
	Detection range	10m max (@90% Reflection)
	Detection frequency	500Hz
	Anti – ambient light	Function under 100k Lux ambient light
	Shape	Exquisite size , light weight (module < 50 g)
	Accuracy	Cm level @ detection range
Applications	UAV(drones) floating at fix height	
	Terrain Following	
	Machine control, security sensor	
	Distance measurement	

Table 1 Features & applications

2. Working principle

Time of Flight (ToF) is a distance measurement method. The modulated near-infrared light emitted from sensor is reflected by the object. By calculating the time difference or phase difference between emission and reflection, the distance from the object can be deduced and so does the depth information.



Fig.1 DE1.0 Simulated light path

3. Electrical characteristics

Parameter	Symbol	Typ.	Unit
Supply voltage	DC	7.4-12 ($\pm 5\%$)	V
Power Consumption	P	≤ 1	W
LED peak current	I_{\max}	200	mA
TTL	V_{TTL}	0 ~ 3.3	V

(a) TF01-L Electrical characteristics

Parameter	Symbol	Typ.	Unit
Supply voltage	DC	5 ($\pm 5\%$)	V
Power Consumption	P	≤ 1	W
LED peak current	I_{\max}	200	mA
TTL	V_{TTL}	0 ~ 3.3	V

(b) TF01-U Electrical characteristics

Table 2 TF01 Electrical characteristics

(Ta=20 °C)

4. Optical characteristics

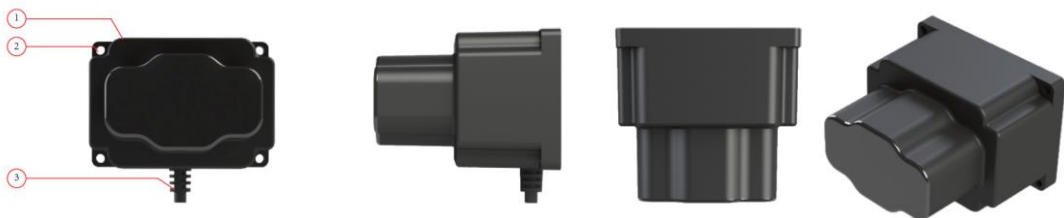
Parameter	Symbol	Conditions/Comments	Typ.	Unit
Operating range	L	100Klux ambient light @90% Reflection	30-1000	cm
Emitting half-angle	α	Customizable	1	Degree
Receiving half-angle	β	Customizable	1	Degree
Detection	De	Minimum detectable object size @ 5m	4 - 6	cm
Resolution	Re	Sensitivity to distance change	0.5	cm
Operating temperature	T		-10~60	°C
Peak Wavelength	λ		850	nm

Table 3 Optical characteristics

Test conditions: stable working for 8 hours.

5. Dimension and specification

Picture below is reference design , the shape and size can be highly customized.



1: Shell

2 : Assembly hole

3 : Wire

Fig.2 DELiDAR TF01 Mechanical Dimensions (reference design)

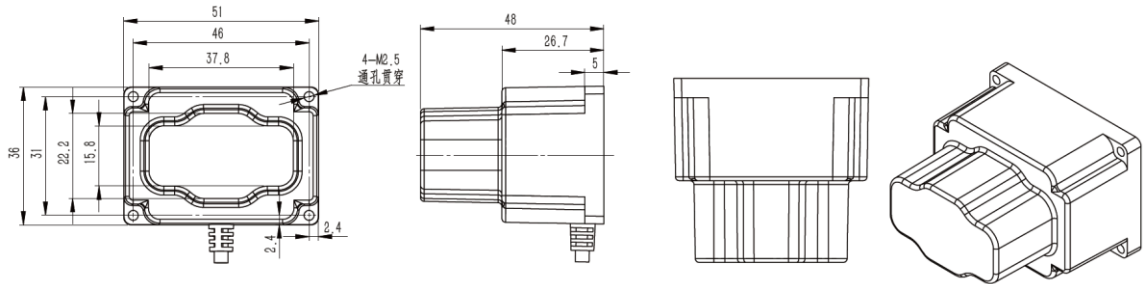


Fig.3 DELiDAR TF01 contour dimension (unit : mm)

6. Data output and protocol

Table below is protocol for DELiDAR TF01

Protocol	UART
Baud rate	115200
Data bit	8
Checksum bit	1

Table 4 Communication Protocol

Data is output in hexadecimal format, 9 bytes per frame , including one distant info , called "Dist" ; Every "Dist" has a serial number info to it , called Sequence ; Frame end bit is checksum bit.

7. Noise Model

Strength	Correction Dist standard deviation/cm
> 110	< 0.7
80 – 100	0.7 – 1.1
50 – 80	1.1 – 2
20 – 50	2 – 5
< 20	> 5

Table 6 500Hz TF01 noise model

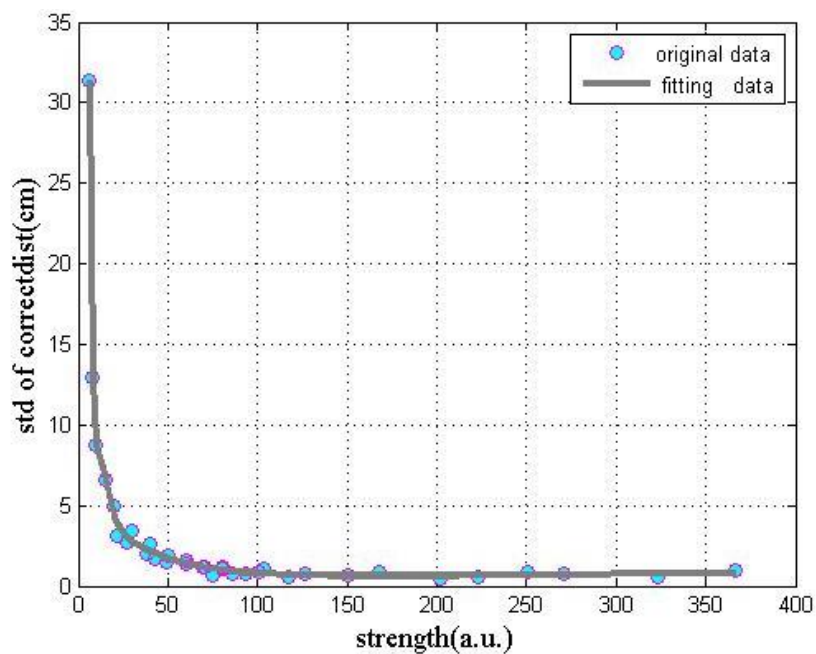
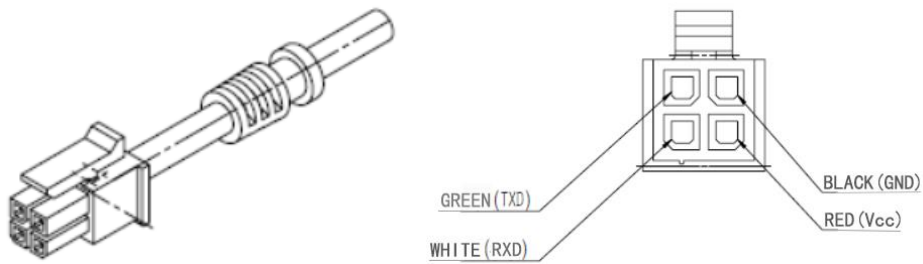


Fig.4 correction dist standard deviation-strength curve

8. Line sequence



Technical requirement :

- 1、 Connect model Molex 43025-0400
- 2、 Cable should be 4 core shielded RVV wire, inner core diameter 0.2

Fig.5 TF01 line sequence

9. GUI

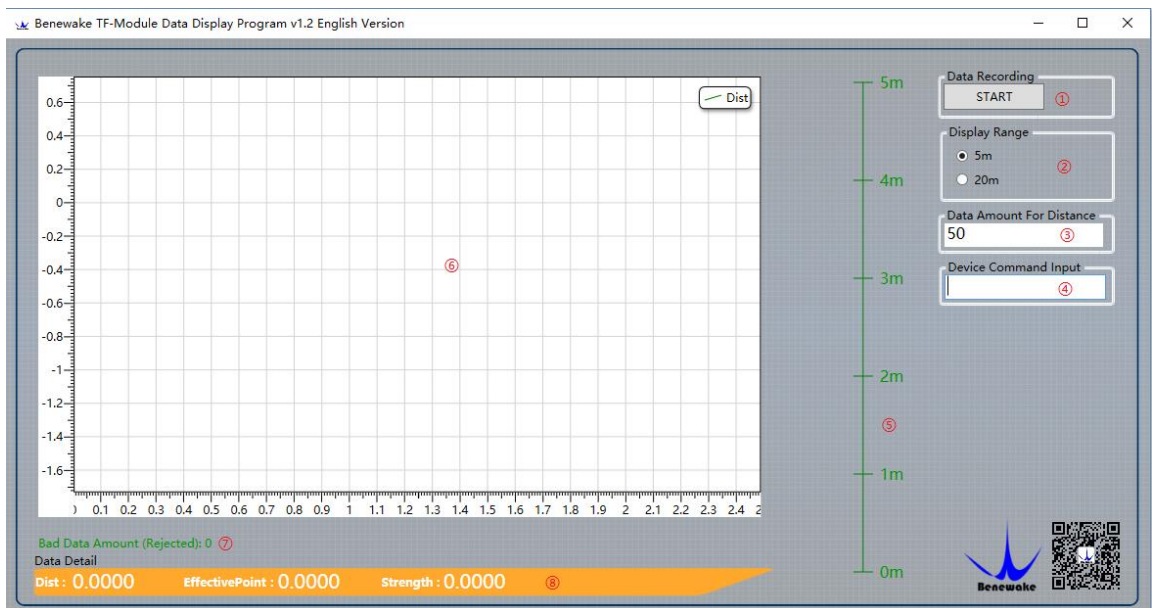


Fig.6 Windows TF-Module Data Display Program UI

- ① "Start" button, press the button to record TF-01 HEX data, the data will be saved in the same directory with the GUI;

- ② "Display Range", click 5m or 20m to switch display scale between 5m and 20m;
- ③ "Data Amount for Distance", Data amount to get an average distance(DAGAD)
- ④ Device command input area, input HEX command in this window and press Enter to send, to change functions or setting;
- ⑤ Scale to display the real-time measurement;
- ⑥ Area to display average distance-number of measurements;
- ⑦ the amount of the data rejected.
- ⑧ Data Detail area : Dist stands for distance , unit cm ; Effective Point stands for data quantity of TF-01 output ; Strength stands for signal strength.

Cautions :

- The product must be maintained by our engineers since it is customized optical instrument with high precision.
- Operating temperature : -10-60°C , storage temperature : 0-70°C
- The operating environment must be kept clean. Prevent dust or other stuff from getting into the lens.
- Keep away from high temperature and high humidity environment for storage, transportation or operation.
- Keep away from acid or strong sulfur environment.