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We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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DE LiDAR TF02



Benewake (Beijing) Co. Ltd.

Preface

Distinguished user:

We would like to express our gratitude to you for choosing our product.

This specification is aimed to help you use our product in a proper manner. Before you install and use the product, please make sure you have carefully read the documents attached, which will contribute to your better using of our product. If you have read this specification, it is suggested that you should keep it properly for future reference.

If you have any questions, please feel free to contact our technical support or aftersales customer service. We will try our best to solve any problem related with the product. If you have any advice or suggestion for us, please go to our official website(www.benewake.com) and give us feedback in the community module. We listen to every customer wholeheartedly.

Benewake aims to make the best robot eyes worldwide. We will adhere to the “customer experience centered” principle.

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1. Product Overview

This product is based upon TOF (Time of Flight), supplemented by particular optics, electricity, and design, so as to measure distance with stability, precision, high sensitivity, and high speed.

Key Features:

- high sensitivity, and the ability of measuring as far as 22 meters
- high speed measurement with a maximum sampling frequency of 100Hz
- excellent anti-ambient light usability (operable under 100kLux ambient light)
- outdoor long distance and light weight (with a module weight of less than 50g)
- high precision; its precision can reach centimeter level within measuring range

Major Applications:

- drone altitude holding and terrain following
- machine control and safe sensors
- distance measuring instrument

2. Optical Principle

TOF is short for Time of Flight. It refers that a sensor emits modulated near infrared light, which reflects when objects are in the way. TOF then convert the distance away from the filmed scenery by calculating the time difference or phase difference between emission and reflection, thereby generating in-depth information.

3. Electrical Properties

Project	Symbol	Minimum Value	Typical Value	Maximum Value	Unit
Input Voltage	DC	4.5	5	6	V
Power	P		0.6		W

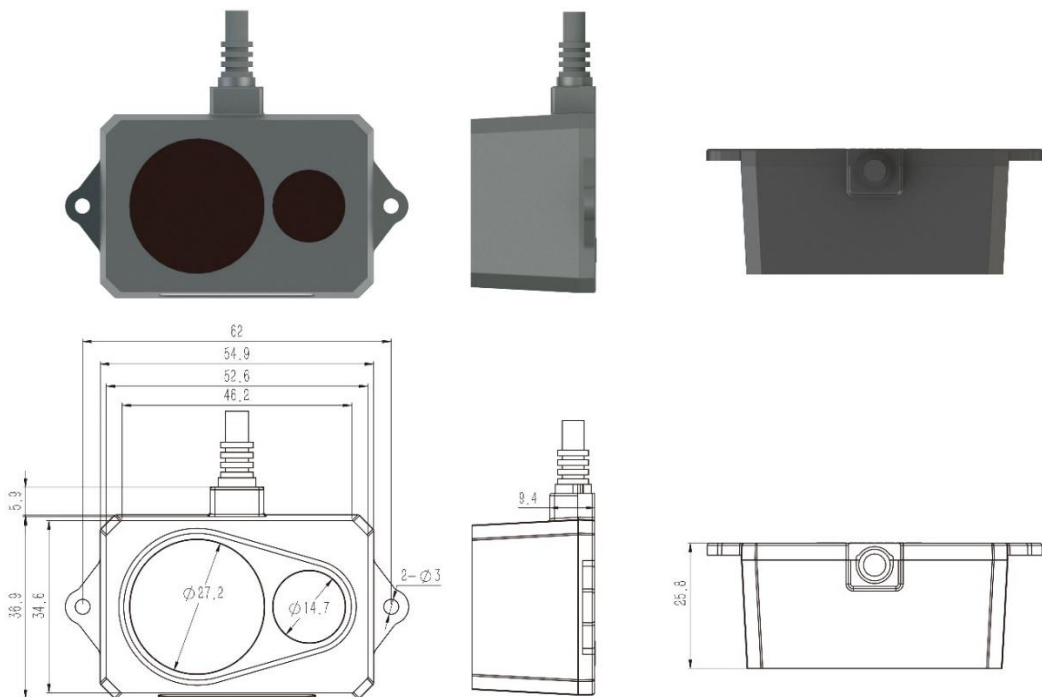
4. Optical Properties

Project	Symbol	Condition or Description	Typical Value	Unit
Working Distance	L	Indoor	0.4 - 10 (Reflectivity 10%) 0.4 - 22 (Reflectivity 90%)	m
		Outdoor illumination intensity of 100k Lux	0.4-10	

Emission Semi-angle of Signal Light	α		2	Degree
Reception Semi-angle of Signal Light	β		1.5	Degree
Detection Range	D	Object size detected from 5m away	26	cm
Distance Resolution Ratio	Re	Sensitivity to distance change	1	cm
Distance Precision	σ	Deviation between measuring distance and actual distance	1 - 5 (within 10m) 5 - 10 (10m - 22m)	cm
Working Temperature	T		-10 - 60	°C
Work Center Wave Length	λ		850	nm

5. Size and Specification

The module object figures and outline dimensional drawings below are reference designs and can be customized according to actual customer requirements and application scenarios.



DELiDAR TF02Outline Dimensional Drawing

Installation Requirements:

1. M2.5 round Philip's head screw is suggested when installing LiDAR and peripheral structures.
2. Optical windows of LiDAR front panel $\phi 27.2$ and $\phi 14.7$ cannot be blocked and shall be kept clean.

Line Sequence Description:

	Line Sequence of Serial Ports	Line Sequence of CAN
Red Line	+5V	+5V
Black Line	GND	GND
White Line	TTL-RXD	CAN-L
Green Line	TTL-TXD	CAN-H

6. Data Format

6.1 Communication Protocols of Serial Port Output

The following is an introduction to the method of DE-LiDAR TF02 connecting and communicating with peripheral equipment using serial ports, including coded format of sent data, and communication protocols of modules with peripheral equipment. The serial port output level is TTL.

Communication Protocol	UART	CAN
Baud Rate	115200	1M
Data Bit	8	--
Stop Bit	1	--
Parity Bit	None	--
ID	--	0x00480014

6.2 Standard Data Format of Serial Ports

The data output by TF02 is shown as follows. All the data are hexadecimal. Each frame of data totals 9 bytes. The data contains distance information (Dist), signal strength information (AMP), and reliability information (SIG). The frame tail is data parity bit.

Data Bit	Definition	Description
Byte0	Frame Header	0x59
Byte1	Frame Header	0x59
Byte2	DIST_L	DIST Low 8 Bits
Byte3	DIST_H	DIST High 8 Bits
Byte4	AMP_L	AMP Low 8 Bits
Byte5	AMP_H	AMP High 8 Bits
Byte6	SIG	Reliability is divided into 9 levels, respectively indicated by 0x01-0x09. When the reliability level is 7 or 8, it means data reliable. When the reliability level is other values, the frame of data is not recommended.
Byte7	Reserved Bit	Reserved Bit
Byte8	Check	Checksum parity bit low 8 bits, Checksum = Byte0 + Byte2 + ... + Byte7. Checksum is the low 8 bits of the checksum of the former 8 bytes

6.3 Data Format of Serial Port Pix

The output is in the form of a string with m as its unit. For example, if the measuring distance is 1.21m, then the output string is 1.21. Each distance value ends with line feed.

Note: if the output distance of TF02 is 22 (m), then it indicates outage or insufficient signal intensity. Hence, the distance is not reliable. It is suggested to eliminate the data.

6.4 CAN Standard Data Format

The data output by TF02 is shown as follows. All the data are hexadecimal. Each frame of data totals 8 bytes. The data contains distance information(Dist),signal strength information (AMP),and reliability information (SIG).

Remarks: CAN communication protocols can be customized according to customer requirements.

Data Bit	Definition	Description
Byte0	DIST_H	DISTHigh 8 Bits
Byte1	DIST_L	DISTLow 8 Bits
Byte2	AMP_H	AMPHigh 8 Bits

Byte3	AMP_L	AMPLow 8 Bits
Byte4	Reserved Bit	Reserved Bit
Byte5	SIG	Reliability is divided into 9 levels, respectively indicated by 0x01-0x09. When the reliability level is 7 or 8, it means data are reliable. When the reliability level is other values, the frame of data is not recommended.
Byte6	Reserved Bit	Reserved Bit
Byte7	Reserved Bit	Reserved Bit

Application Notice:

- This product is a custom-made precision optical instrument and must be maintained by engineers of our company.
- Working temperature: -10 - 60 °C
- Prevent foreign matters, such as dusts, from entering lens in case of bright dipping
- The product adopts moisture-sensitive components, therefore storage, transportation, as well as working under high moisture and high temperature should be avoided. Moreover, avoid using the product in acid or concentrated sulfur environment.