

## TF-P64



Benewake (Beijing) Co. Ltd.

## Preface

Dear users,

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

This specification is aimed at helping 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, please keep it properly for future reference.

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

Benewake aims to make the best “Robotic Eyes” worldwide. We always adhere to the “customer experience centered” principle.

## Table of Contents

1.	Product Overview	4
2.	Optical Principle	4
3.	Electrical Properties	4
4.	Optical Properties	4
5.	Detection Angle	5
6.	Dimension and Product Specification	5
7.	Data Format	7
7.1	Communication Protocols	7
7.2	Standard Data Format of Serial Ports	7
8.	Interface Description of Serial Port Upper Computer	8

## 1. Product Overview

The TF-P64 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 able to measure as far as 100 meters
- Excellent anti-ambient light usability (operable under 100kLux ambient light)
- Protection grade reaches IP65
- Small in size and light

Major Applications

- Drone altitude holding and terrain following
- Machine control and safety sensors
- Distance measuring instrument

## 2. Optical Principle

TOF is short for Time of Flight. It refers to that a sensor emits modulated laser, which reflects when objects are in the way. TOF then converts 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

Item	Symbol	Minimum Value	Typical Value	Maximum Value	Unit
Input Voltage	DC	4.5	5	5.5	V
LED Peak Current	I <sub>led</sub>		110		mA
Serial Port TTL Electrical Level	LVTTL		0 ~ 3.3		V

## 4. Optical Properties

Item	Symbol	Condition or Description	Typical Value	Unit
Operating Distance	L	Indoor	0 - 100(reflectivity 90%) 0 - 30 (reflectivity 10%)	m
		Outdoor illumination intensity of 100Klux	0.1 - 70(reflectivity 90%) 0.1 -25(reflectivity 10%)	

Frequency	F	Adjustable;	100	Hz
FOV	$\alpha$	Divergence angle of light spot	0.6	Degree
Distance Resolution Ratio	Re	Sensitivity to distance change	1	cm
Distance Accuracy	$\Delta$	Deviation between measuring distance and actual distance	<3 ( within 30m ) $\phi$ <20 ( 30m~100m )	cm
Security Level	S	Laser security level	1 M	
Operating temperature	T		-20~50	$^{\circ}\text{C}$
Protection Grade	IP	Beta Version IP50	IP65	
Weight	W	Connection line included	60	g
Size	LWH	Length*Width*Height	40*39*22	mm

$\phi$  The reflectivity of black standard board is 10%. And the reflectivity of white standard board is 90%.

$\phi$  The testing environment is indoor white standard board.

## 5. Detection Angle

TF-P64 LiDAR's divergence angle is  $0.6^{\circ}$ , so detection angle is  $0.6^{\circ}$ . The side lengths of different distance detection ranges (the detection range takes on a rectangle) are shown as below in the table.

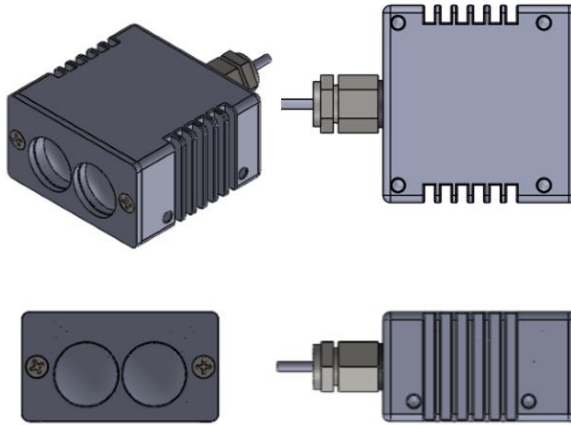
Distance/m	1	5	10	20	30	40	50	60	70	80	90	100
Detection Range Side Length ( cm )	1	5	10.	21	31	42	52	63	73	84	94	105

Note: the distance in the table stands for the vertical distance between LiDAR and the detected object, with meter as unit. The side length unit of detection range is cm. Generally, the side length of detected object should be greater than that of detection range. Only in this way the LiDAR output data can be reliable. When the side length of detected object is less than that of detection range, the LiDAR output data is not stable and the error increases. The etection range side length greater than 20m is theoretical estimate.

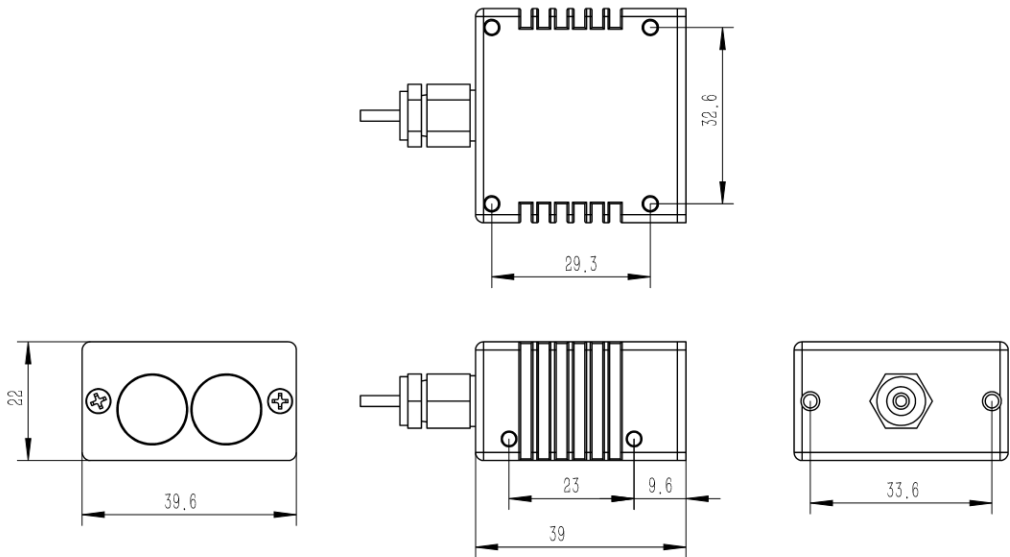
Note: the side length of detecting range is not equal to the object resolution at the corresponding distance.

## 6. Dimension and Product Specification

The following module object figures and outline dimensional drawings are all referece designs, and can be customized according to customers' requirements and actual application scenarios.



DELiDAR TF-P64 Outline Drawing



DELiDAR TF-P64 Outline Dimensional Drawing (unit: mm)

### 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 cannot be blocked and shall be kept clean.

### Line Sequence Description:

Divergence line	Line Sequence of Serial Ports
Red Line	+5V

Black Line	GND
White Line	TTL-RXD
Green Line	TTL-TXD

## 7. Data Format

### 7.1 Communication Protocols

The following is an introduction to the method of TF-P64 connecting and communicating with peripheral equipment, including coded format of sent data and communication protocols of modules with peripheral equipment. The serial port output level is LVTTTL (0-3.3V).

Communication	UART
Baud Rate	115200
Data Bit	8
Stop Bit	1
Parity Bit	None

### 7.2 Standard Data Format of Serial Ports

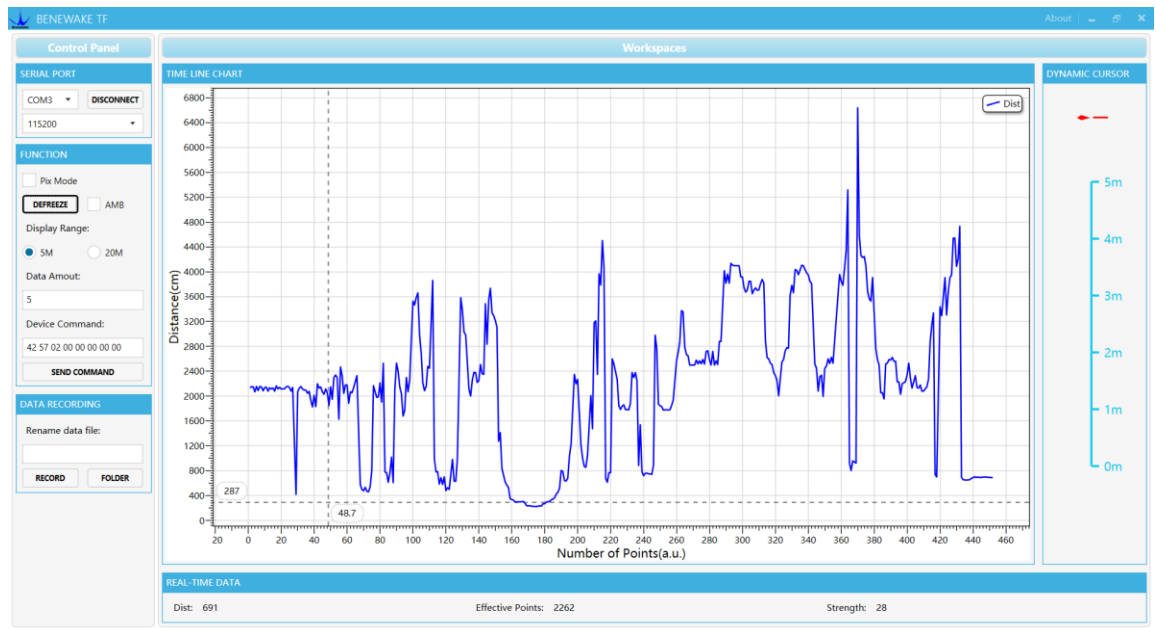
The data output by TF-P64 is shown as below. All the data are hexadecimal. Each frame of data totals 9 bytes. The data contains distance information, i.e. Dist; and reliability information, i.e. SIG. The frame end is data parity bit.

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	00	Reserved
Byte5	00	Reserved
Byte6	SIG	For signal quality detection, when 01 is output, it's reliable; when 00 is output, it's not reliable.
Byte7	00	Reserved
Byte8	Check	Low 8 bits of Checksum parity bit, Checksum = Byte0 + Byte2 + ... + Byte7, Checksum are the low 8 bits of the checksum of

former 8 bytes

## 8. Interface Description of Serial Port Upper Computer

Currently, the upper computer only supports Windows® operating systems, applicable to TF series products by Benewake (Beijing) Co. Ltd. In addition, it is limited to the product with serial communication protocols output. For detailed operations, please see the following description.



Client Interface of Distance Measurement Demonstration in Windows

TF series LiDAR connects with computer through TTL-USB adapter plate. Windows installs the driver by default. If the installation fails, please contact the technical support of our company.

- **Serial Port:** select the corresponding port number for LiDAR. Baud rate is 115200 by default. Click the **【CONNECT】** button to connect with LiDAR. If the LiDAR is standard serial port version, the **TIME LINE CHART** in the working area will display the data graph updated by LiDAR in real-time. The x axis is the quantity identification for received data and the y axis is the distance value output by LiDAR (unit: m);
- **FUNCTION:** if the product is Pixhawk, it is needed to click the box in front of pix mode. **FREEZE** can freeze the **TIME LINE CHART** in the working area for better observation. **Display Rang** can select the range of 5m or 20 m. Meanwhile, the scaleplate in the **Dynamic cursor** area can automatically change. **Data amount** is the data mean filtering and it is displayed by default after 5 groups of data averaging. After modifying the value, press the Enter key to modify the length of mean data value. **Device Command** can send hexadecimal port command to modify or set functions.
- **DATA RECORDING:** the name of the data file can be modified and saved in the text box. Click **【RECORD】** to start saving data, and click again to stop saving. Click the **【FOLDER】** button to open the folder of data files.
- **REAL-TIME DATA:** the real-time data area can display LiDAR data in real time. Among them, **Dist** stands for distance measurement value with cm as unit. **Effective Points** indicate the total quantity of



effective data output by LiDAR. Strength represents the intensity of signal. For the reason of no strength information, the Strength is 0 by default.

**Application Notice:**

- The product is not suitable in the condition of dense fog, snow and rain weather, due that the data would be wrong when the light is blocked.
- If your application requires the higher accuracy, Please turn on the machine and used after the 30mins, since that there is a certain temperature drift when starting
- The product is a custom-made precision optical instrument and must be maintained by engineers of our company.
- Storage temperature : 0 °C -60 °C
- This product adopts a special optical system. Please do not use the product against sunlight for a long time and keep it in dark place.