



Benewake TF02-i 40m Lider Distance Sensor User Manual

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Benewake TF02-i 40m Lider Distance Sensor



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Specified Product

Product model: TF02-i

Product name: TF02-i LiDAR (Medium range sensor)

Manufacturer

Company name: Benewake (Beijing) Co., Ltd.

Address: NO.28 Xinxu Road, Haidian District, Beijing, PRC

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Foreword

Dear users:

Thanks for choosing Benewake products, and it's our pleasure to help you to solve any technical question.

For the purpose of offering a better operation experience to you, we hereby write this manual for an easier and simpler operation of our product, hoping to better solve the common problems you maybe meet.

This operation manual covers the product operation introduction and common problem solutions, but it is really hard to cover all the problems you maybe meet. So, if you have any further questions or problems, please feel free to consult our technical support service (support@benewake.com). We will do our best to solve any

problem related to the product. If you have any other good advice or suggestions, welcome to visit our official website and offer us your feedback there (<http://en.benewake.com/support>), and we are looking forwards to your participation.

We are Benewake who dedicated to making the best “Robotic Eyes” worldwide!

Attentions

About this Document

- This Manual provides information necessary for the use of this product.
- Please read this Manual carefully before using this product and make sure that you have fully understood its contents.

Installation and maintenance

- This product can only be maintained by qualified professionals and only the original spare parts can be used to ensure its performance and safety.
- The working temperature of the product is -20°C~60°C; please do not use it beyond this temperature range, so as to avoid risks.
- The storage temperature of the product is -30°C~80°C; please do not store it beyond this temperature range, so as to avoid risks.
- Do not open its enclosure for assembly or maintenance beyond this Manual; otherwise, it will affect the product performance.
- Do not twist the cable forcefully, so as to avoid damage to product.
- The product can't be aimed directly to the sun or another TF02-i, so as to avoid damage the detector by strong light. If there is such an application, please contact our technician.

Conditions with Potential Product Failure

- When the product transmitter and receiver lens are covered by dirt, there will be a risk of failures. Please keep the lens clean
- The product will have a risk of failure when immersed completely in water. Do not use it underwater.
- When detecting objects with high reflectivity, such as mirrors and smooth tiles, the product may have a high risk of failures.

Physical Interface

Wiring

Terminal model: MH1.25-7P-W/B, size of single wire is AWG26, diameter of single wire is 0.404mm, cross-sectional area is 0.129mm²

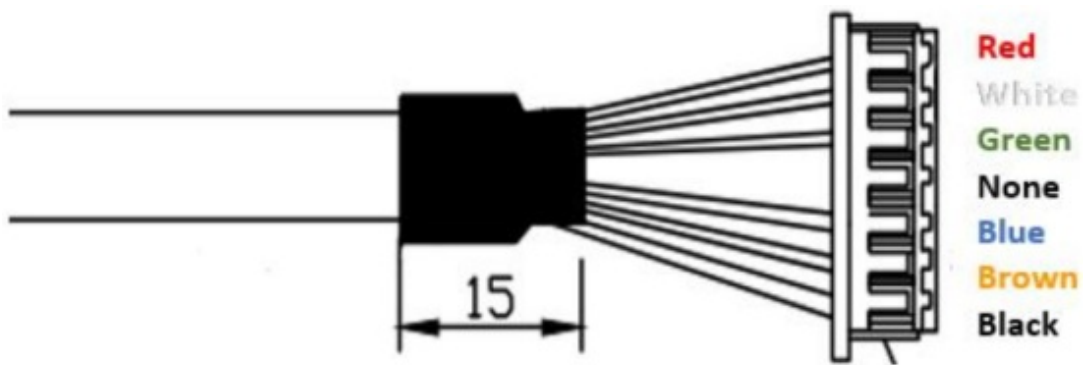


Figure 1 New Line Sequence of TF02-i

Table 1 Pin functions and connection instructions of TF02-i

| No. | Color | Pin | Function |
|-----|--------------|----------------|-----------------------|
| 1 | Red | VCC | Power supply |
| 2 | White/Yellow | RS485-B/ CAN_L | RS485-B/CAN bus |
| 3 | Green | RS485-A/ CAN_H | RS485-A/CAN bus |
| 4 | N/A | N/A | N/A |
| 5 | Blue/Orange | UART_RX | UART receive(debug) |
| 6 | Brown | UART_TX | UART transport(debug) |
| 7 | Black | GND | Ground |

Note: The hardware of RS485 and CAN is different; Do not mix UART cable with RS485 or CAN bus, otherwise it will cause damage of MCU.

Electrical Characteristics

TF02-i has overvoltage and polarity protection.

Table 2 Main electrical parameters

| Parameter | Typical value |
|-------------------------------------|---------------------|
| Supply voltage | 7V~30V |
| Peak current | 100mA |
| Average current | ≤70mA@12V |
| Average power consumption | ≤0.85W@12V |
| Overvoltage protection | 30V |
| Polarity protection | 40V |

Hardware and communication protocol

There are two communication interfaces available. The hardware of RS485 and CAN is different. The interface can not be switched by command.

Protocol of RS485

Modbus is the default setting. The parameters is shown as below. The default value of baudrate and slave ID is 115200 and 0x01.

Table 3 Communication protocol of TF02-i-485

| Item | Parameter |
|-------------------------|-----------|
| Communication interface | RS485 |
| Baud rate | 115200 |
| Data bit | 8 |
| Stop bit | 1 |
| Parity | None |

Parameter configuration and description of Modbus

Baudrate of TF02-i supports 9600 14400 19200 38400 43000 57600 76800 115200 128000 230400 256000. Based on reliability considerations, it is not recommended to use a baud rate above 115200 for communication

When Modbus protocol is enabled, the Modbus reading distance command format:

| Address field | Function code | Register address | | Number of registers | | CRC_low | CRC_high |
|---------------|---------------|------------------|----|---------------------|----|---------|----------|
| 01 default | 03 | 00 | 00 | 00 | 01 | xx | xx |

The data frame returned by TF02-i is as follows:

| Address field | Function code | Data length | Dist_high | Dist_low | CRC_low | CRC_high |
|-------------------|---------------|-------------|-----------|----------|---------|----------|
| 01 default | 03 | 02 | xx | xx | xx | xx |

Parameter configuration:

Note: Only RTU mode is supported for communication in UART link.

Function code of TF02-i Modbus

| Function code | Description |
|---------------|----------------|
| 03 | Read register |
| 06 | Write register |

Register address description

①All register addresses are hexadecimal and register values are 16bit;

②After setting parameter, save and restart to take effect;

Register address list using function code: 0x03(read only)

| Register address | Definition | Description |
|------------------|-------------------------------|--|
| 00 00 | Dist | Distance, unit: cm |
| 00 01 | Strength | Signal strength |
| 00 03 | High16bit of timestamp | 2 high-order bits of timestamp represent relative time of radar start up, unit: ms |
| 00 04 | Low16bit of timestamp | 2 low-order bits of timestamp represent relative time of radar start up, unit: ms |
| 00 06 | High16bit of software version | 00 + major version number |
| 00 07 | Low16bit of software version | Minor version number + revised version number |

Register address list using function code: 0x06(write only)

| Register address | Definition | Description |
|------------------|----------------------------|--|
| 00 80 | Save settings | Write any value to save settings |
| 00 81 | Power off/Restart | Register value 0-Power off unavailable currently 1-Restart |
| 00 82 | Disable Modbus | Register value 1-Disable Modbus Others-Error reply |
| 00 83 | Baud rate High | Set baud rate. Restart to take effect |
| 00 84 | Baud rate Low | Set baud rate. Restart to take effect |
| 00 85 | Slave ID | Set TF02-i's ID. Restart to take effect(default 0x01) |
| 00 86 | fps | Set fps. Restart to take effect(default 100hz) |
| 00 87 | Working mode | Set working mode. Restart to take effect after saving Register value: 0- Continuously detection mode(default) 1 Triggering mode Others-Error reply |
| 00 88 | Low-power consumption mode | Set low-power consumption mode Restart to take effect after saving Register value: 0-Disable(default) >0 and ≤10-Enable(the value is inside sampling frequent) |
| 00 89 | Restore default | Write any value. Restart to take effect after saving |

Examples:

1. Enable Modbus protocol

5A 05 15 01 75 // Enable Modbus

5A 04 11 6F // Save settings

Entry Modbus model and entry Modbus instructions after restarting

2. Disable Modbus protocol

01 06 00 82 00 01 E8 22 // Default address 01, disable Modbus

01 06 00 80 00 00 88 22 // Default address 01, save setting

Restart and exit Modbus.

Protocol of CAN

The data protocol of CAN is shown in

Table 4. Each data frame consists of 8 bytes and the data contains the distance(unit: cm), signal strength and timestamp(unit: ms) information.

Table 4 Data protocol of TF02-i-CAN

| Data byte | Definition | Description |
|-----------|------------|---------------------------------|
| Byte0 | DIST_L | DIST low 8-bits |
| Byte1 | DIST_H | DIST high 8-bits |
| Byte2 | Strength_L | Signal strength low 8-bits |
| Byte3 | Strength_H | Signal strength high 8-bits |
| Byte4 | Timestamp | Low8bit of timestamp |
| Byte5 | Timestamp | Secondary-low8bit of timestamp |
| Byte6 | Timestamp | Secondary-high8bit of timestamp |
| Byte7 | Timestamp | High8bit of timestamp |

Parameter configuration and description of CAN

The default baudrate is 250kbps, the default type is standard frame, default receive and send id is 0x00000003.

The format of instruction is shown as below:

| Byte | 0 | 1 | 2 | 3 | 4 | 5-8 | 9-12 | 13 |
|-------------|------|------|------|------|----------|------------|------------|-----------|
| Description | 0x5A | 0x0E | 0x51 | Type | Baudrate | Recv_id | Send_id | Check_sum |
| Default | | | | 0 | 8 | 0x00000003 | 0x00000003 | |

Type: 0(Standard Frame), 1(Extended Frame);

Recv_id: LiDAR receive ID, Little Endian; Send_id: LiDAR send ID, Little Endian

The relation between Baudrate(unit: kbps) and Byte4 is shown as below:

| Byte4 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|----------|------|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Baudrate | 1000 | 900 | 800 | 666 | 600 | 500 | 400 | 300 | 250 | 225 | 200 | 160 | 150 | 144 | 125 | 120 | 100 |

1. Examples of configuration

Example1: Standard frame, Baud rate 500kbps, receive ID=0x0010, send ID=0x0020

Command: 5A 0E 51 00 05 10 00 00 00 20 00 00 00 EE

Example2: Extended Frame, Baud rate 250kbps, receive ID=0x0000AABB, send ID=0x0000CCDD

Command: 5A 0E 51 01 08 BB AA 00 00 DD CC 00 00 D0

2. CAN Terminating Resistor Configuration Instructions

Enable 120Ω Terminating Resistor: 5A 05 60 01 C0

Disable(Default) 120Ω Terminating Resistor: 5A 05 60 00 BF

3. Others

- 1 Other configuration instructions are the same as UART instructions of standard products, such as saving

settings(5A 04 11 6F), resetting(5A 04 02 60) and so on. "Save setting" instruction must be sent after setting parameters, otherwise the parameter doesn't take effect after restarting.

2 When the command is longer than 8 bytes, it needs to be distributed into multiple CAN data frames. And interval between every data frame can't be longer than 20ms.

FAQ

Q1: Can the FOV (spot) of TF02-i be increased or decreased?

A1: Generally, this is a customized demand. You need to contact our sale colleague for further details. FOV is determined at the beginning of product design. Determination of FOV is also related to the optical system and the product structure. Therefore, it cannot be easily changed, and needs to be customized.

Q2: Can I change the frequency of data output?

A2: Yes, customization of parameter configuration is supported in TF02-i. You may consult our sales colleague or technical support for further details. Other common questions please refer to **SJ-PM-TF02-Pro A01 Product Manual** on our website

Headquarters:



400-880-9610



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Technical support:



support@benewake.com



Documents / Resources

| | |
|---|--|
|  | <p>Benewake TF02-i 40m Lidar Distance Sensor [pdf] User Manual TF02-i, 40m Lidar Distance Sensor</p> |
|---|--|

References

- support@benewake.com
- [| | | -](#)

Manuals+