TF03-C LiDAR (Long-range distance sensor)

1. Product Overview

TF03-C is a industrial high-speed LiDAR with a range of up to 180m. With active dust removal function, the lens can be cleaned by wiper. Thus, it can be used in the harsh environment with a lot of dust, without manual cleaning. TF03-C includes compensation algorithms for outdoor glare and other interference, so it works normally under strong light environment. Different built-in operating modes let customers change parameters and configuration to meet their needs.

Main Features:
- High measurement frequency (up to 10KHz[1])
- Automatic dust removal
- Small in volume
- Multiple interfaces supported (UART, CAN, IO, RS485, RS232, 4-20mA)

Primary Usage Scenarios:
- Vehicle collision avoidance and safety forewarning
- Traffic statistics
- Trigger of camera capture
- Assistance of UAV lifting
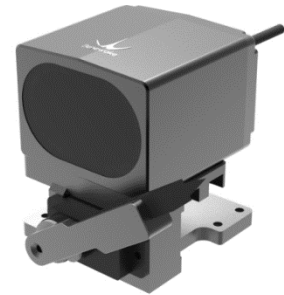
2. Technical Specification

TF03-C adopts separate design. The wiper needs separate 5V power supply and drive. There are 3 versions provided, and customers can choose according to the interface and power supply. Three versions below are specifically offered for TF03 itself.

1) Standard version: Support TTL serial port and CAN interface with 5V power supply. (If 6-24V power supply is needed, please contact sales).

2) RS485/RS232 version：Support RS485 and RS232 interface with 6-24V power supply.

3) 4-20mA version：Support 4-20mA analog output with 12-24V supply.

Please Check the parametric table below for detailed information:

Table 1 Main parameters of TF03-C

Parameters		Standard version	RS485/RS 232 version	4-20mA version
Performance	Operating range	0.1-180m@90% reflectivity, 0.1-70m@10% reflectivity, 0.1-130m@90% reflectivity&100Klux，0.1-50m@10% reflectivity&100Klux		
	Accuracy[2]	±10cm (within 10m), 1% (10m and further)		

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[1] A high frame rate mode, contact us for detailed information about this mode. In normal working mode, the frame rate is from 1Hz to 1000Hz.

[2] Measuring range, accuracy and repeatability are measured in white board (90% reflectivity) at room temperature 25 ℃ and will be somewhat different in the case of different reflectivity or light sensitivity conditions.

	Distance resolution	1cm		
	Frame rate[3]	1Hz-1000Hz adjusted (default 100Hz)		
	Repeatability	1σ：<3cm		
	Ambient light immunity	100Klux		
	Operation temperatures	-10~60°C		
	Enclosure level	IP5X[4]		
Optical parameters	Light source	LD		
	Center wave length	905nm		
	Photobiological safety	CLASS 1（EN 60825）		
	FOV[5]	0.5°		
Electrical parameters	Supply voltage of wiper	5V±0.5V		
	Supply current of wiper	≤200mA		
	Communication mode of dust removal brush	PWM		
	Supply voltage of TF03	5V±0.5V	6V-24V	12V-24V
	Average current of TF03	≤180mA	≤200mA @ 6V ≤100mA @ 12V ≤50mA @ 24V	≤140mA @ 12V ≤80mA @ 24V
	Power consumption of TF03	≤0.9W	≤1.2W	≤2W
	Peak current of TF03	≤180mA	≤200mA @ 6V ≤100mA @ 12V ≤50mA @ 24V	≤140mA @ 12V ≤80mA @ 24V

[3] TF03-C has a high frame rate mode, in this mode the frame rate can be set to 10KHz, please contact us for more detailed information about this mode. In normal working mode, the frame rate is from 1Hz to 1000Hz.

[4] The enclosure rating of LiDAR without wiper is IP67 which has strong protection against harmful dust and immersion in water with a depth of up to 1 meter for up to 30 minutes but as the wiper is also attached to it which has no protection against water so it cannot be used in rainy or snowy weathers.

[5] Detection angle means FOV of light spot, horizontal is different with vertical, the detection angle in the parameters table means the maximum one, which means the horizontal one. Note: Lidar's horizontal axis and light spot's axis are same when logo face up.

	Communication interface level	LVTTL （3.3V）	RS485 （RS485） RS232 （RS232）	/
	Communication interface	UART/CAN/IO	RS485/RS232	4 mA ... 20 mA (<300Ω)
Others	Dimension	44mm*43mm*32mm （L*W*H）		
	Enclosure material	Aluminum alloy		
	Storage temperature	-40~85°C		
	Weight	77g±3g	80g±3g	80g±3g
	Cable length	70cm for TF03-180/15cm for steering gear		

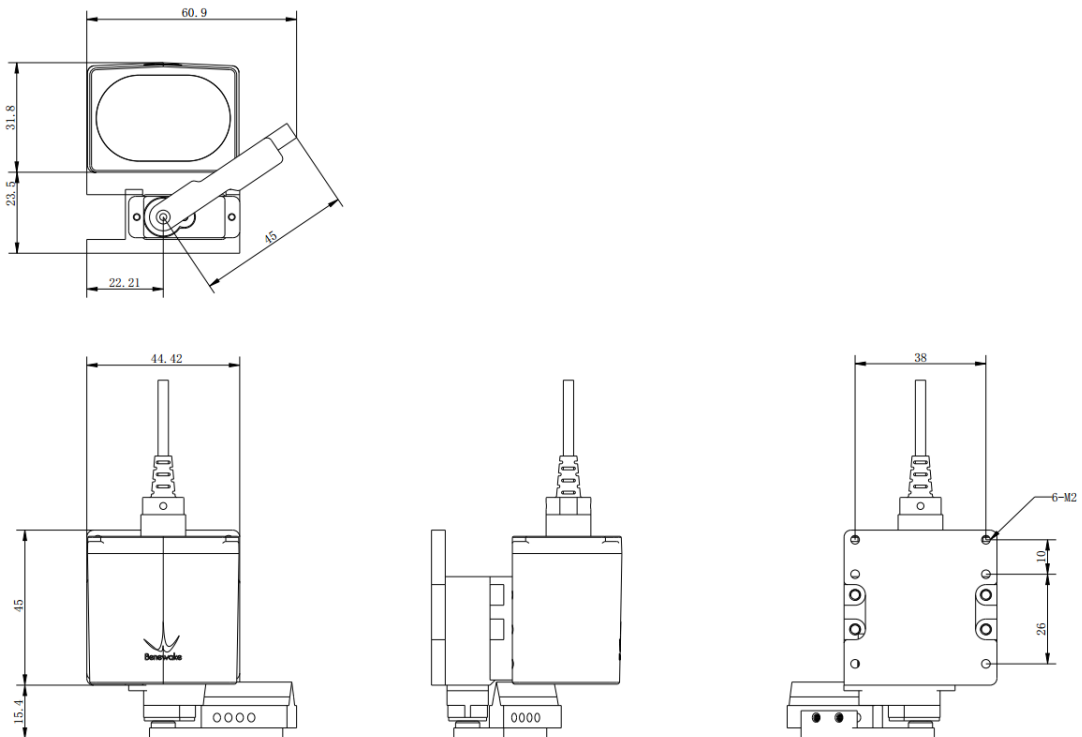## 3. Product Dimensions

Figure 1 Dimensions of TF03-C (Unit: mm)

4. Wiper

To make LiDAR usable in dusty environment, a wiper has been integrated into TF03-C. The wiper is driven by PWM signal, and the action range of the dust brush is up to 115°. More details can be found in sample code. In sample code, the dust removal brush shall be operated every 4 hours, and it shall swing back and forth twice in each operation. Besides, customers can set the above parameters by themselves to achieve the purpose of personalized drive.

Note: When the wiper is working, the output data of TF03-C is not credible because the wiper will cover the lens. In addition, the steering gear is recommended to dust more than 30 minutes in the case of high temperature.

5. Communication Protocol

TF03-C standard version supports TTL serial ports as default, and CAN communication mode is also available to use if needed. Commands are provided for modifying to CAN mode, but only one of two modes are working, two of them cannot output at the same time.

TF03-C RS485/RS232 version supports RS485 and RS232 communication modes at the same time. By default, both interfaces can communicate, and different interface line can be used.

TF03 4-20mA version supports analog current output, and debugging port is TTL serial port.

Table 2 Serial port communication protocol of TF03-C

Communication Protocol	UART/RS485/RS232
Baud rate	115200
Data bit	8
Stop bit	1
Checksum bit	N/A

Table 3 CAN communication protocol of TF03-C

Communication Protocol	CAN
Baud rate	1000K
Receiving ID	0x3003
Sending ID	0x3
Frame format	Default sending frame is standard frame, receiving frame support standard frame and extended frame

6. Line sequence description

TF03-C is composed of a TF03-180 and a steering gear, these two components have their own cables. Please refer to TF03-180 UART's datasheet for detailed information of its cable. Figure 2 below and Table 4 below show the basic information of steering gear's cable.
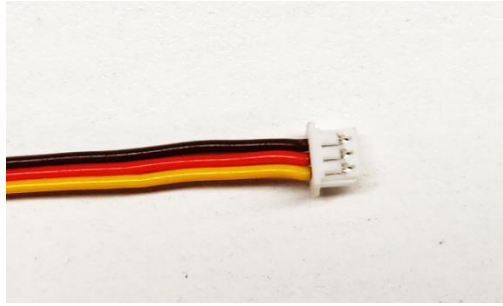
Figure 2 Cable of steering gear

Table 4 Specification of steering gear's cable

No.	Color	Function	Note
1	Red	+5V±0.5V[6]	Positive terminal of steering gear motor
2	Brown	GND	Negative terminal of steering gear motor
3	Yellow	PWM	Signal line of steering gear motor

7. Configurable Parameters

Table 4 Configurable parameters example

Configurable parameters	Description	Default configuration
Fame rate	Detection frame rate could be configured by related command, range 1~1000Hz	100Hz
Over range output	This value will be pushed output when measuring value more than this value	180m
Output format	UART/Pixhawk/IO/CAN	UART
Baud rate	● Serial port baud rate could be customized ● CAN port baud rate could be customized，CAN ID could be changed	/

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[6] This steering gear motor has no overvoltage protection and overcurrent protection. Please check the voltage and current before power it on.

Reset	Restore all the settings to default. Reset could be done with TF03_setup GUI software	/
Parameter saving	If configuration is not saved and power is switched off then all the configurations will be lost, so before removing the power source configuration must be saved.	/

Note: More configuration parameters and command could be found in the production manual.