

## Function description

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### **【ID】**

- ID is one variable set up for distinguishing the different sensors, which is used to identify each sensor during the cascade connection.

### **【Interface & Baudrate】**

TOFSense supports two communication modes with configurations are UART and CAN.

- UARTThe communication baud rate setting range is as follows :

<b>UART Baud Rate</b>	<b>Note</b>
115200,230400,460800,921600,1000000,1200000,2000000,3000000	Baud Rate is 115200 in default

- Under CAN output mode, the setting range of Baud rate shall be shown as :

<b>CAN Baud Rate</b>	<b>Note</b>
100000,250000,500000,1000000,2000000,3000000	Baud Rate is 1000000 in default

Interface data output mode setting :

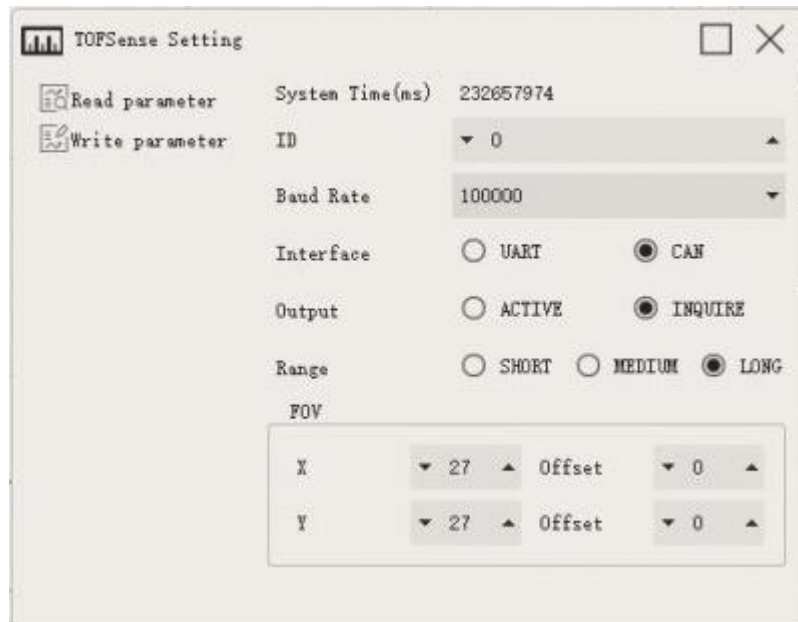
- Active Output :
  - The active output mode can only be used with a single module. In this mode, the module actively outputs measurement information at a frequency of 10 Hz.

- The active output mode configuration is as shown below :



- Query Output :
  - The query output mode can be used in single module and cascade connection. In this mode, the controller sends a query command containing the module ID to the desired query module, and the module can output one frame of measurement information.

- Query output mode configuration as shown below :



## 【Distance Status】

The module can output the current distance status, the user can perform the data processing with the combination of distance status, The meaning of distance status is as follows :

Value	Note
0	Measuring distance is valid

1	Standard deviation is more than 15mm
2	Signal strength is lower than 1Mcps
4	Phase exceeds boundary
5	HW or VCSEL has fault
7	Phase is not matched
8	Internal algorithm underflow
14	Measuring distance is invalid

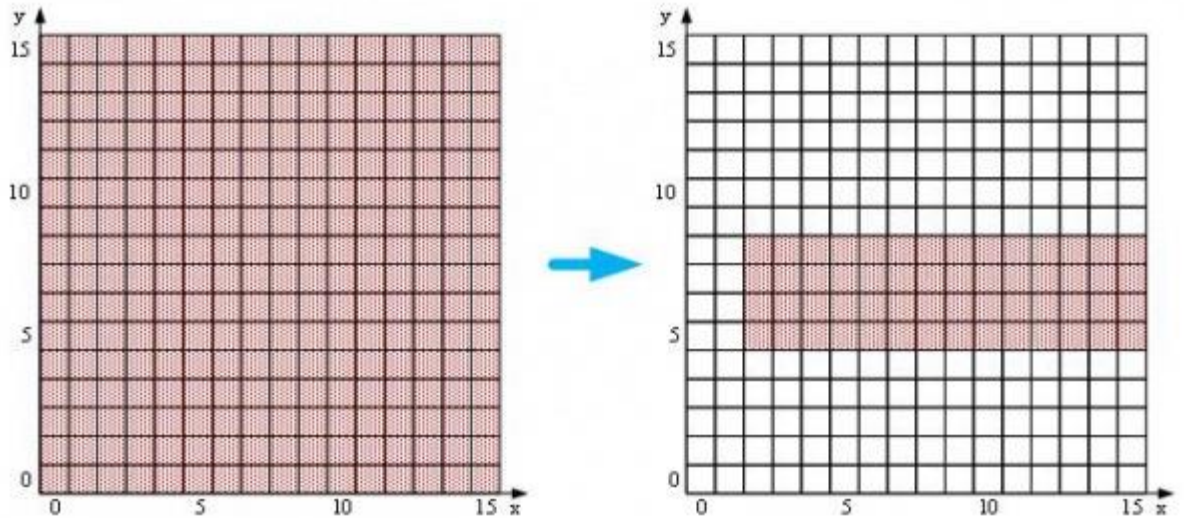
### **【Signal Strength】**

Indicate the strength of current return signal, and the larger this value indicates the stronger the return signal.

### **【FOV】**

- The field angle FOV determines the vision scope of TOFSense. The module can change the field angle at X direction fov.x, field angle at Y direction fov.y, offset at X direction fov.x\_offset and offset at Y direction fov.y\_offset. The setting scope for field angle at X, Y directions is 15°~27°. The setting scope of offset for field angle at X, Y directions is -6°~6°.
- Module initial field of view parameters:fov.x=27°、fov.y=27°、fov.x\_offset=0°、fov.y\_offset=0°.  
By setting the X-direction field of view angle of 25°, Y-direction field of view angle of 15°, X-direction offset 1°, Y-direction offset -1°.

The area of interest of the module can be changed as shown in the figure below :



*Note: A smaller FOV can improve the detection performance of the module in a small space and small objects, but the change of the FOV field of view will also affect the module's farthest ranging distance. The smaller the field of view, the smaller the farthest ranging distance.*

### **【Indicator Light】**

- The indicator includes two flashing status in total, including the fast flash once per 0.1S and slow flash once per 1S. LED status and meaning are as follows :

Status	Note
Fast Flash (interval 0.1S)	Module starting stage
Fast Flash (interval 0.1S)	Module firmware update
Slow Flash (interval 1S)	Module normal working

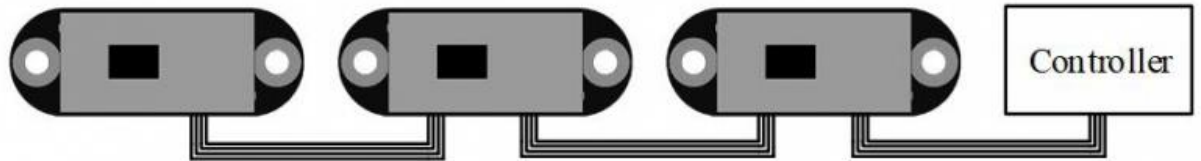
### **【Function Key】**

- It is used for the parameter setup under CAN communication mode. Press the power-on key until the indicator has the slow flash, and then compulsively enters UART configuration mode. This operation will not change the module setting parameter. If changing the module setup, it is required to rewrite the parameter.

## 【CascadeRanging】

- Multiple sensors are configured with different IDs and connected in series, and the ranging information of all sensors can be read through one communication interface.

The connection diagram is as follows:



*Note: Under cascade ranging, it is suitable for UART query, CAN query, and CAN active output.*

## Protocol analysis

- The protocol is composed of Frame Header, Function Mark, Data, and Sum Check.
  - The Frame Header and Function Mark are fixed values;
  - Data is the content of the transmitted data;
  - Sum Check is the lowest byte after the addition of Frame Header, Function Mark, and Data (that is, the addition of all the previous bytes).
- Agreement composition:

```
Frame Header + Function Mark + Data + Sum Check
```

*Note: Protocol packets follow the principle of little-endian mode, that is, the low byte is first and the high byte is last.*

- TOFSense\_UART\_Frame:
  - **Data Sources** : Connect the module to the host computer and configure the UART as active output mode.
  - **Raw data** :

```
57 00 ff 00 9e 8f 00 00 ad 08 00 00 03 00 ff 3a
```

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- **Analysis table** :

Data	Type	Length (Bytes)	Hex	Result
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Frame Header	uint8	1	57	0x57
Function Mark	uint8	1	00	0x00
reserved	uint8	1	ff	*
id	uint8	1	00	0
System_time	uint32	4	9e 8f 00 00	36766ms
dis*1000	uint24	3	ad 08 00	2.221m
dis_status	uint8	1	00	0
signal_strength	uint16	2	03 00	3
reserved	*	1	...	*
Sum Check	uint8	1	3a	0x3a

- TOFSense\_UART\_Read\_Frame:
  - **Data Sources** : Connect the module to the host computer, configure it as UART query output mode, id is 0, send the following data through the host computer to achieve data query.
  - **Raw data** :

```
57 10 FF FF 00 FF FF 63
```

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- **Analysis table** :

Data	Type	Length (Bytes)	Hex	Result
Frame Header	uint8	1	57	0x57
Function Mark	uint8	1	00	0x00
reserved	uint8	2	ff	*
id	uint8	1	00	0
reserved	uint8	2	ff	*
Sum Check	uint8	1	3a	0x3a

- TOFSense\_CAN\_Frame:
  - **Data Sources** : The module is configured as CAN active output mode, id is 1, connect to CAN receiving device.
  - **Raw data** :

```
AD 08 00 00 03 00 FF FF
```

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- **Analysis table** :

Field name	Part	Level	Type	Length(bits)	Hex	Result
Start Of Frame	SOF		*	1	*	*
Arbitration Field	ID		*	11	0x200+id	0x201



Arbitration Field	RTR		*	1	*	*
Control Field	IDE		*	1	*	*
Control Field	r0		*	1	*	*
Control Field	DLC		*	4	*	*
Data Field	dis*1000		uint24	24	ad 08 00	2.221m
Data Field	dis_status		uint8	8	00	0
Data Field	signal_strength		uint16	16	03 00	3
Data Field	reserved		*	16	*	*
CRC Field	CRC		*	15	*	*
CRC Field	CRC_delimiter		*	1	*	*
ACK Field	ACK Slot		*	1	*	*
ACK Field	ACK_delimiter		*	1	*	*
End Of Frame	EOF		*	7	*	*

- TOFSense\_CAN\_Read\_Frame:
  - **Data source:** The module is configured in CAN query output mode, id is 1, connected to CAN query device, and id\_s is configured as 2.

- **Date Sources :**

FF FF FF 01 FF FF FF FF

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- **Analysis table :**

Field name	Part	Level	Type	Length(bits)	Hex	Result
Start Of Frame	SOF		*	1	*	*
Arbitration Field	ID		*	11	0x400+id_s	0x402
Arbitration Field	RTR		*	1	*	*
Control Field	IDE		*	1	*	*
Control Field	r0		*	1	*	*
Control Field	DLC		*	4	*	*
Data Field	reserved		uint24	*	*	*
Data Field	id		uint8	8	01	id = 1
Data Field	reserved		uint16	*	*	*
CRC Field	CRC		*	15	*	*
CRC Field	CRC_delimiter		*	1	*	*

ACK Field	ACK Slot		*	1	*	*
ACK Field	ACK_delimiter		*	1	*	*
End Of Frame	EOF		*	7	*	*

## Software

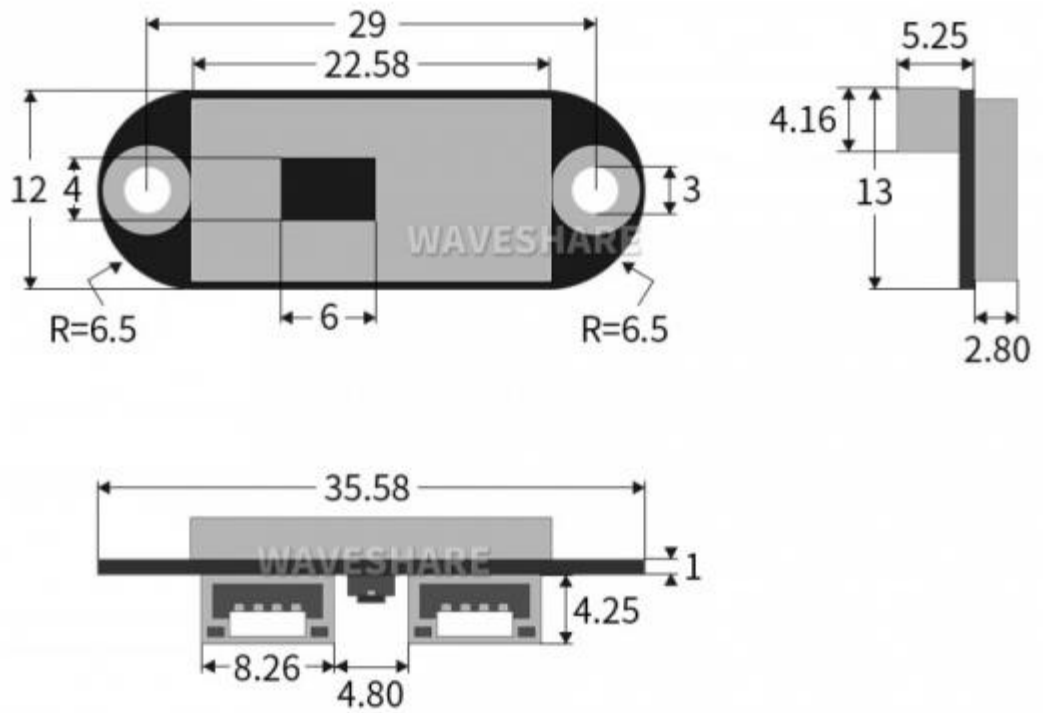
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NAssistant is the accessory debug software for TOFSense with the main functions are: Debug configuration, Status display, Function application, Firmware upgrade:

- Debug configuration: Used for configuring the relevant parameters of nodes, e.g. ID, working mode, Baud rate etc.
- Function application: Used for the application development, e.g. data import and export, motion trail storage, historical trial replay etc.
- Firmware upgrade: Used for carrying out the wired firmware upgrade for product.

## Dimensions

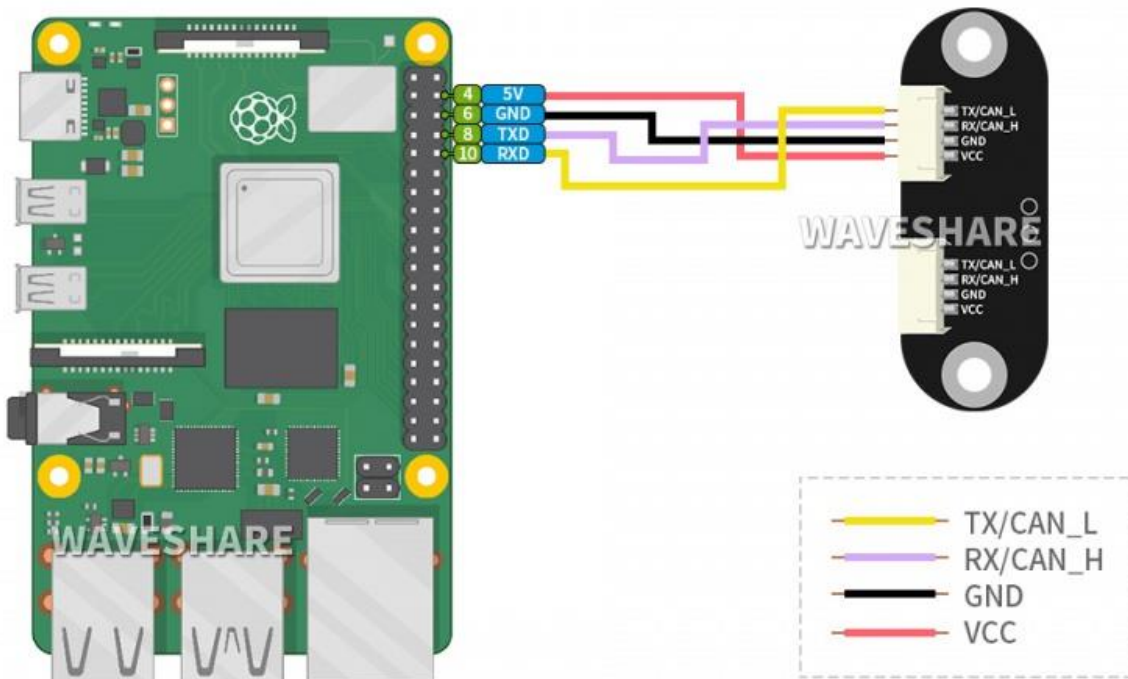
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## Working with Raspberry Pi

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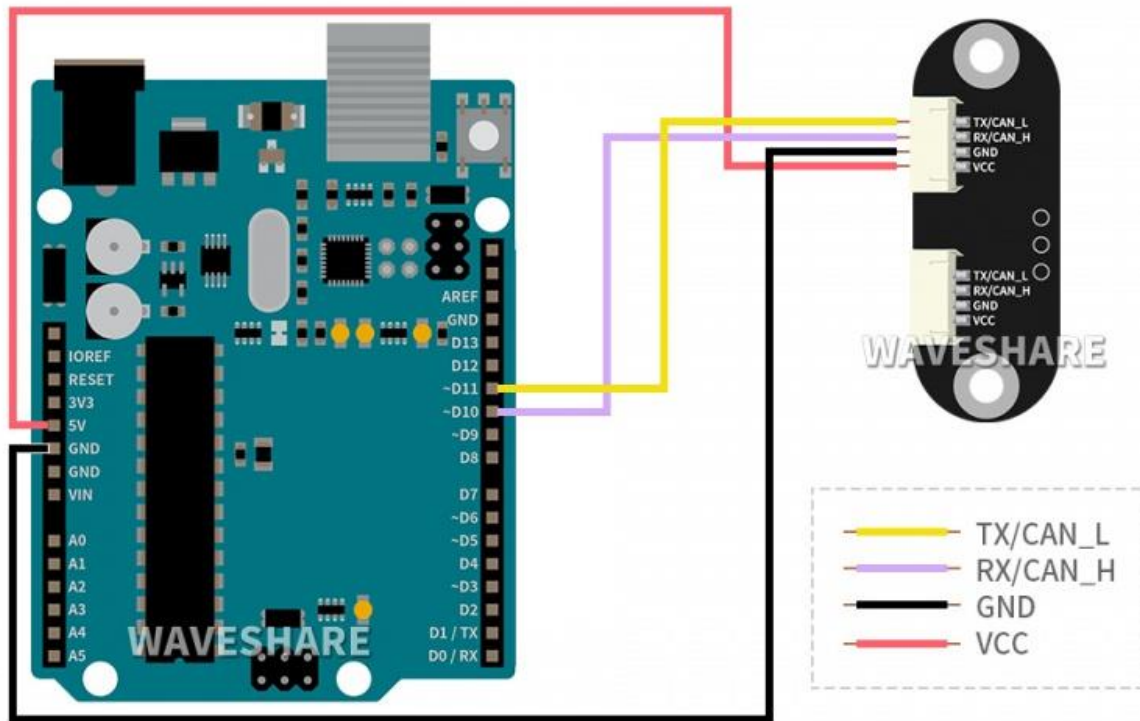
### Hardware connection



## Working with Arduino

### Hardware connection

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## Resources

### Demo code

- [File:TOF-Laser-Range-Sensor-Demo.7z](#)

### Software

- [TOF Assistant PC Assistant \(Windows 7/10 64-bit machine\)](#)
- [TOF AssistantPC Assistant \(Windows 7/10 32-bit machine\)](#)