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Shenzhen Hi-link Electronics Co., Ltd.

HLK-LD6001A-60G

Human body trajectory radar module

# User Manual

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## 1.Product Features

Compared with traditional visual, infrared, laser and other sensing methods, millimeter wave radar is not affected by light, can realize non-sensing active sensing and monitoring of indoor personnel all day long, and has personal privacy protection function, which is currently the best sensor for home scene application. This product uses domestically produced chips, which are autonomous and controllable, and can accurately track and locate multiple people indoors. At the same time, it can detect people in static states such as reading and sleeping, and can suppress interference from curtains, green plants, etc. This product has the advantages of low cost, domestic production, high reliability, and high performance.

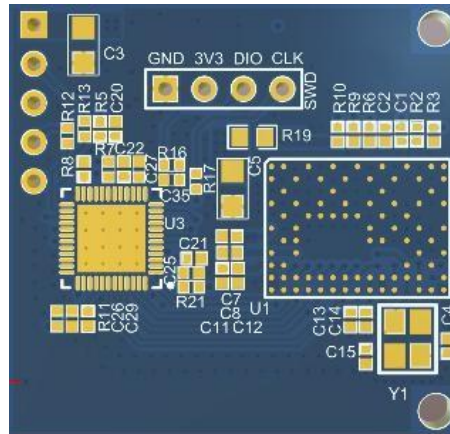
No.	Function	Detail description
1	Multi target tracking	1) It can achieve target tracking function for up to 10 people, including target motion trajectory and real-time target position; 2) Strong ability to suppress false targets (curtains, green plants, multi path, etc.); 3) High sensitivity for detecting micro motion targets (stationary, shaking, waving, etc.).
2	Area division	Users can flexibly configure the detection area

## 2.Product Parameter Introduction

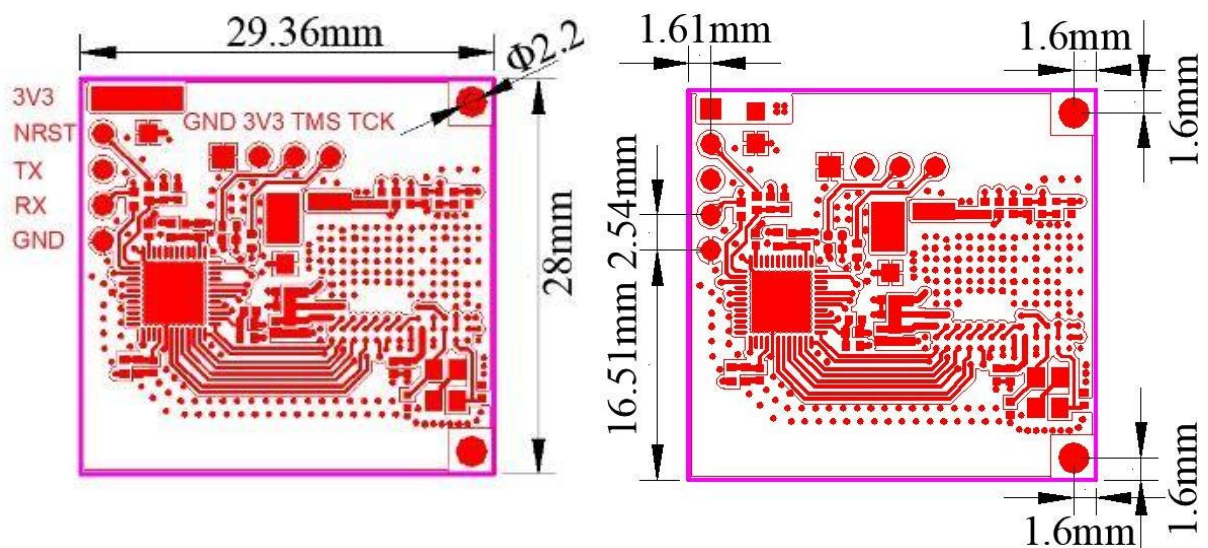
Serial number	parameter	Serial number	parameter
1	Installation method:ceiling installation	6	Peak power consumption: 1.7w
2	Detection distance: 0.5~8m ( The effective projection ground has a radius of 3.5m Circle, installation height 2.7m)	7	Communication method: TTL Serial Port
3	Azimuth and elevation coverage: $\pm 60^{\circ}$	8	Operating frequency: 60-64GHz

4	Power supply: 3.3V	9	Processing cycle: $\leq 30\text{ms}$
5	Average power consumption: 0.3w	10	Size: 29.36*28mm

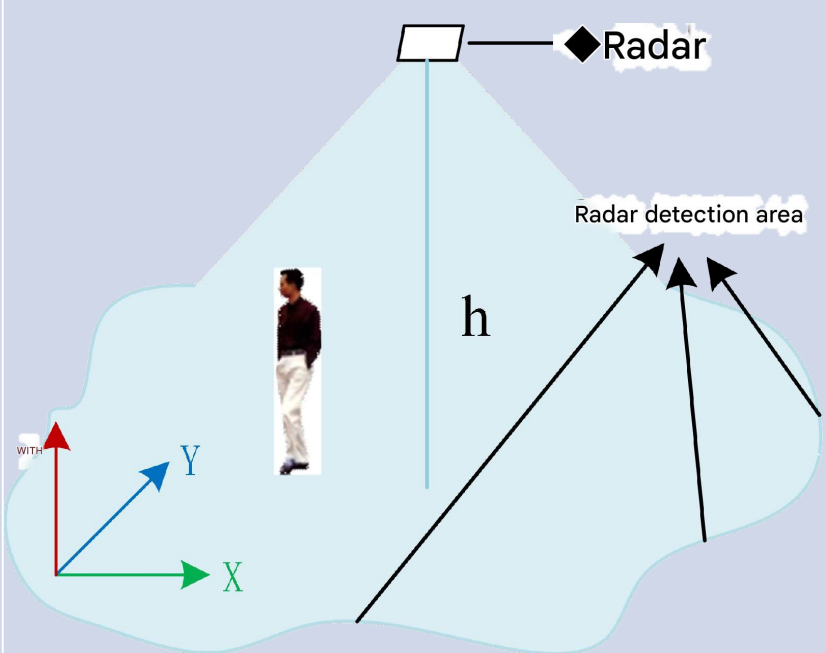
## 2.1.Product appearance



## 2.2.Product size



### 3.Product Features

Serial No.	characteristic	Detailed Introduction
1	Installation Scenario	 <p>Detection distance: 0.5~8m</p> <p>Note: The detection distance is related to factors such as the installation environment, human body volume, relative angle and movement range. The above parameters are the test results of our company. Under different test conditions, the actual test results shall prevail.</p>
2	Not affected by the environment	Not affected by temperature, humidity, dust, light, noise, etc.
3	Flexible parameter configuration	The detection range, function mode, etc. can be configured through the serial port.

## 4. Electrical Characteristics

### 4.1. Pin Description

Pin	Description
3V3	Module power input
NRST	Module reset
TX	Serial port sending
RX	Serial port receiving
GND	land

### 4.2. Limit Rating Parameters

Pin	Min	Max	Unit
3V3	- 0.5	3.6	V
I/O (TX/RX/NRST)	- 0.5	3.6	V

### 4.3. Typical operating parameters

Pin	Typical Value	unit
3V3	3.0 ~ 3.3	V
I/O (TX/RX/NRST)	-0.5 ~ VDD+0.3	V




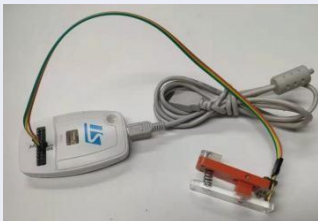
Note: VDD in the above table refers to power input

### 4.4. Module power consumption

The radar module contains RF devices. When the RF transceiver is turned on, the current is about 530mA , and when the RF transceiver is turned off , the current is about 80mA . The average power consumption of the module is related to the frame period of the radar detection process. If the radar working frame period is 100ms , the average current is about 110mA . For the power input of the module, a power supply with large driving capability is required, and the output current Need to be no less than 1A .

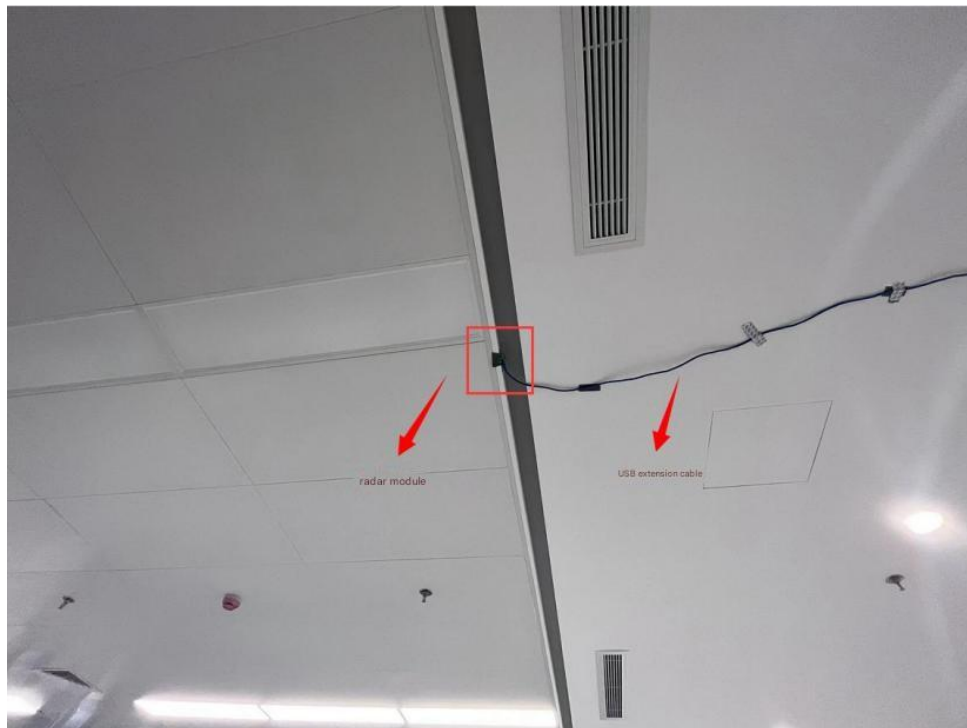
## 5.Environment Construction

### 5.1.Hardware Composition

No.	Name	Picture	Describe
1	Radar module		Model: HLK-LD6001A- 60G
2	USB Convert to TTL Modules		USB to TTL module, can realize serial port command configuration, antenna calibration and other functions.
3	USB Extension cord		USB Extension cable for connecting to PC With USB Convert to TTL Module cables.
4	ST-LINK Downloader		ST-LINK Downloader, used for radar module firmware upgrade, secondary development simulation debugging.

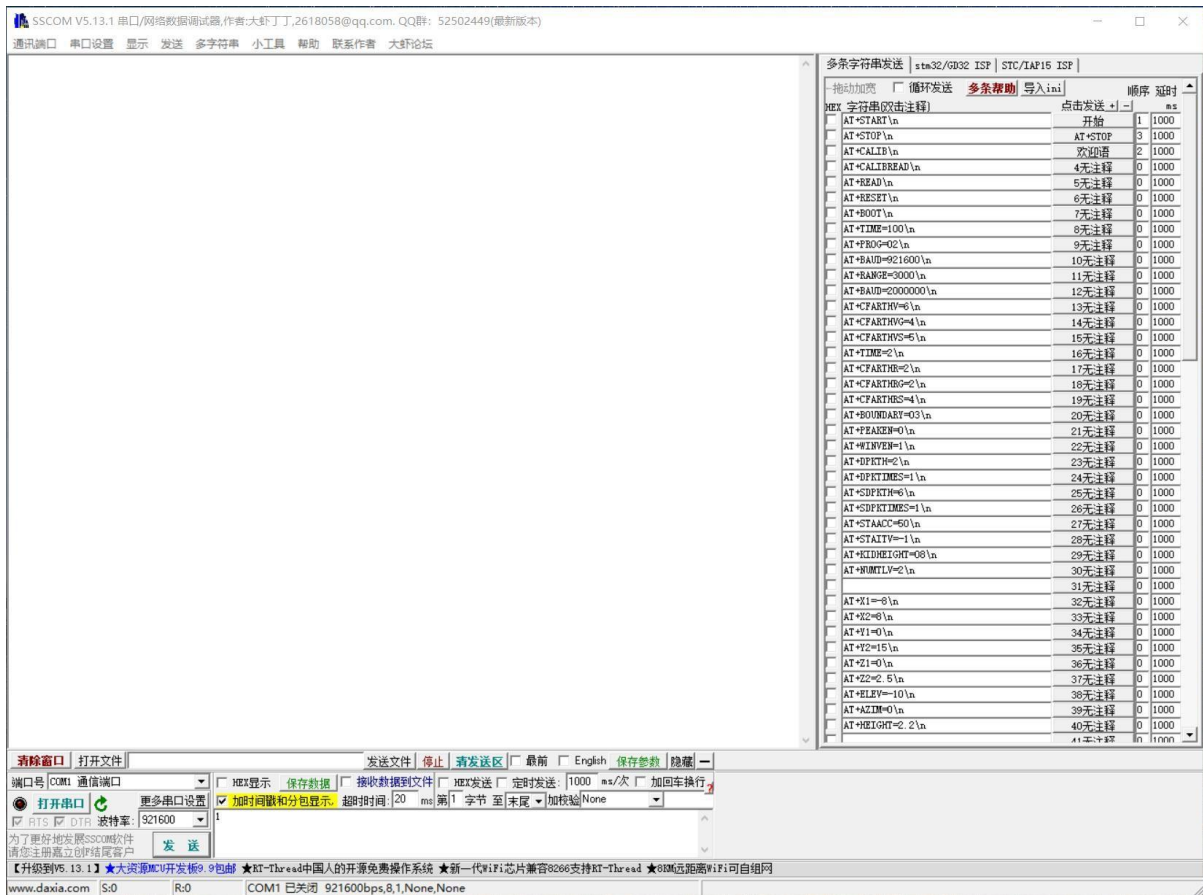
## 5.2. Installation location

The module is installed on the ceiling with the antenna facing downwards, at a height of 2.5-3.0m . When installing the module, try to keep it fixed to avoid module shaking. The surrounding environment should be as open as possible. The USB extension cable should be fixed as much as possible to avoid interference caused by the cable.





## 6.Parameter configuration



Adjust the corresponding parameters as needed. Note: After modifying the parameters, click the button behind the parameters to complete the parameter modification.

Common parameter settings are as follows:

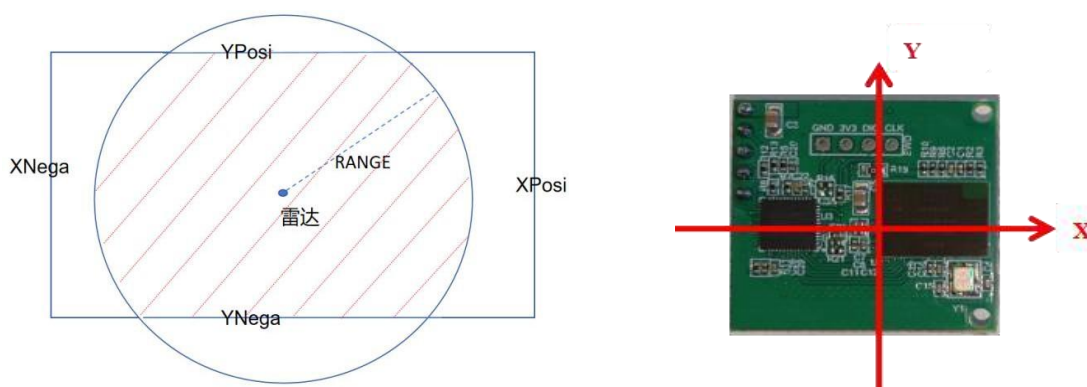
Order	Meaning
AT+START\n	Start working
AT+STOP\n	Stop working
AT+RESET\n	Reset module
AT+READ\n	Reading parameters
AT+RESTORE\n	Restore Default Settings
AT+DPKTH=X\n	Long-distance detection sensitivity ( default is 4 , range 1~9 , the larger the value, the lower the sensitivity )
AT+BAUD=XX\n	Configure the serial port baud rate ( <b>default value is 115200</b> )
AT+HEATIME=XX\n	Configure the protocol output heartbeat interval ( units , range 10-999 , default value 60 )

AT+RANGE=XX\n	Configure the radius of the radar detection circle projected onto the ground ( unit: cm , range: 100-500 , default value: 450 )
AT+HEIGHTD=XXX\n	Set vertical distance ( unit: cm , setting range: 50~500 , default value: 300)
AT+DEBUG=X\n	0 : Protocol mode (default, simple protocol ) 1 : Output string 2 : Debug mode (used by host computer ) 3 : Protocol mode (detailed protocol )
AT+XPosi=XXX\n	Configure X Forward range ( unit: cm , range: 20 ~ 500 , default value 450 )
AT+XNega=-XXX \n	Configure X Negative range ( unit: cm , range: -500 ~ - 20 , default - 450 )
AT+YPosi=XXX\n	Configuration Y Forward range ( unit: cm , range: 20 ~ 500 , default value 450 )
AT+YNega=-XXX \n	Configuration Y Negative range ( unit: cm , range: -500 ~ - 20 , default - 450 )
AT+Moving=XXX\n	Configure the moving target disappearance time ( unit 100ms, range 5~1000, default value is 110 )
AT+Static=XXX\n	Configure static target disappearance time ( unit 100ms, range 5~1000, default value is 100 )
AT+Exit=XXX\n	Configure target exit boundary time ( unit 100ms, range 2~1000, default value is 5 )

Note: If the configuration is successful, AT+OK will be returned ; if the configuration fails, Save will be returned. Para Fail , you need to resend the command.

Boundary configuration instructions:

AT+ RANGE=XXX\n , AT+XNega=XXX\n , AT+XPosi=XXX\n , AT+YNega=XXX\n , AT+YPosi=XXX\n are all configuration boundary instructions. It indicates the radius of the radar detection circle projected from the radar to the ground, that is, the distance from the target to the radar should be less than the distance configured by AT+RANGE . The area enclosed by these boundaries is the radar detection area. The schematic diagram is as follows :



## 7. Protocol Description

### 7.1. Simple protocol mode ( **AT+DEBUG=0** )

Example of a complete data package:

55 AA 0A 04 00 00 00 00 0E

55 AA : Frame header

0A : Byte number 04 :

type=0x04 People

counting 00 00 :

Reserved

00 00 : Reserved

00 : Number of people counted

0E : XOR check ( 0A 04 00 00 00 00 00 XOR calculation )

### 7.2. In detailed protocol mode ( **AT+DEBUG=3** )

#### 7.2.1. Data upload format

Fields		Number of bytes	Description
HEAD		8	Frame header, fixed as \x01\x02\x03\x04\x05\x06\x07\x08
LENGTH		4	The length of the entire frame data ( uint32 )
FRAME		4	Frame number ( uint32 )
TLVs		4	TLVs = 1 ( uint32 )
POINTLENGTH		4	The length of the point cloud is always 0 ( uint32 )
TLVs		4	TLVs = 2 ( uint32 )
TRACKLENGTH		4	Personnel information length ( uint32 ) (number of people = TRACKLENGTH/32 )
Person 1	F	4	reserve
	ID	4	Personnel ID ( uint32 )
	X	4	Personnel's X/Y/Z Coordinates and speed ( X left, Y front and back, Z is height ) ( float )
	Y	4	
	Z	4	
	Vx	4	
	Vy	4	
	V	4	

...		...	...
Personnel	F	4	reserve
	ID	4	Personnel ID ( uint32 )
	X	4	Personnel's X/Y/Z Coordinates and speed ( X left, Y front and back, Z is height ) ( float )
	Y	4	
	Z	4	
	Vx	4	
	Vy	4	
	V	4	
Check		1	XOR check of frame number and personnel information content

### 7.2.2. Example of a complete data package

01 02 03 04 05 06 07 08 40 00 00 00 A3 01 00 00 01 00 00 00 00 00 00 00 02 00 00 00 20 00 00 00 00 00 00 00  
 00 00 00 00 21 28 96 BF CB 85 20 40 9A AB A3 3E 8A BD C1 3D 50 98 99 BD 40 52 C3 3A CC

01 02 03 04 05 06 07 08: frame header

40 00 00 00: The total length of the entire frame is 64 bytes

A3 01 00 00: The current frame rate is 419 frames

01 00 00 00: TLV=1

00 00 00 00: Constant at 0

02 00 00 00: TLV=2

20 00 00 00: The length of personnel data is 32, which means that the number of personnel  
 00 00 00 00 is 32/32=1 person

00 00 00 00: reserved

00 00 00 00: people ID is 0

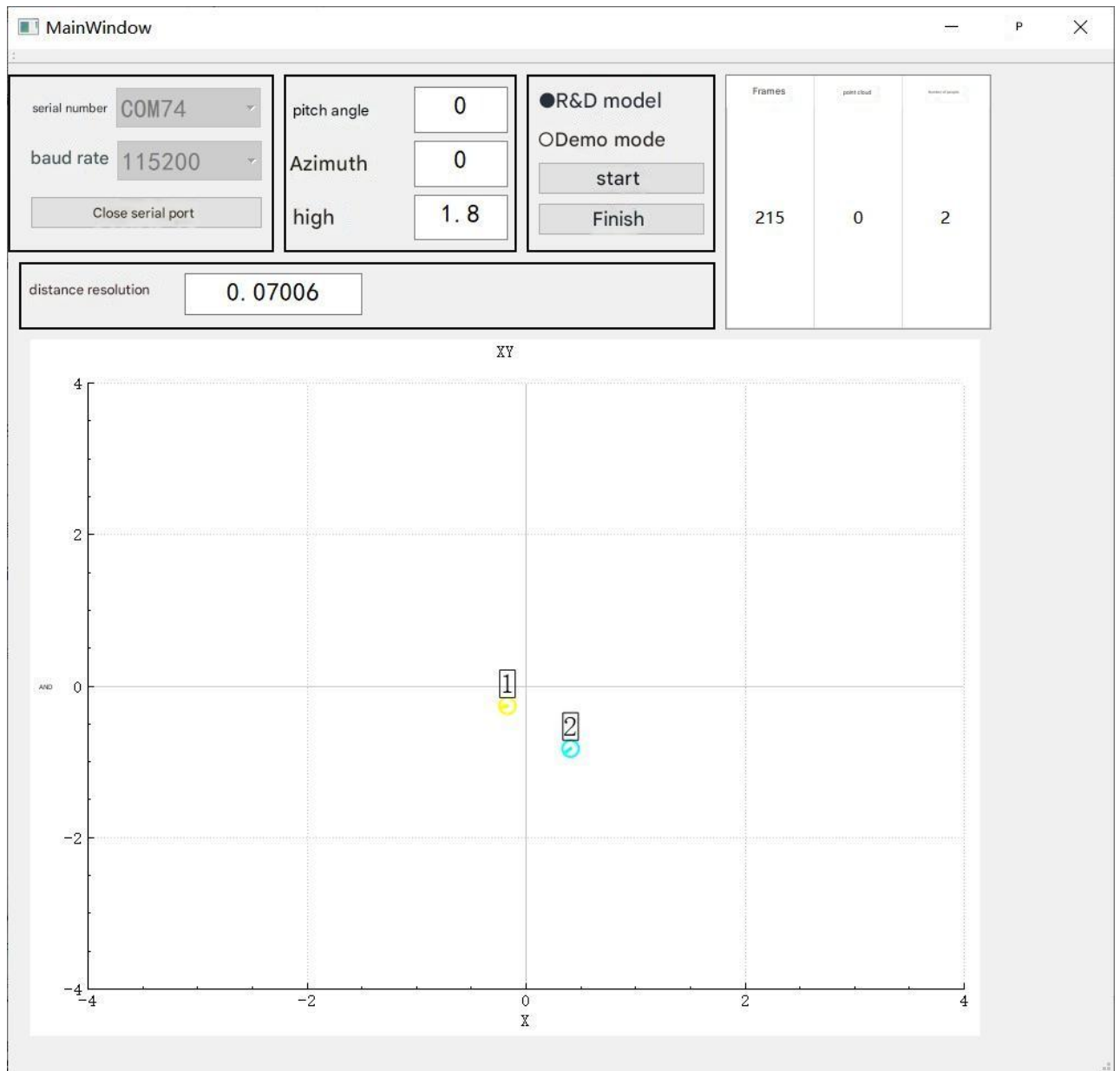
21 28 96 BF 72 6F 81 BF CB 85 20 40:

8A BD C1 3D 50 98 99 BD 40 52 C3 3A

CC: A3 01 00 00 and personnel information 00 00 00 00 00 00 00 00 21 28 96 BF CB 85  
 20 40 9A AB A3 3E 8A BD C1 3D 50  
 XOR verification of 98 99 BD 40 52 C3 3A

### 7.3.Used by host computer ( AT+DEBUG=2\n )

Select the serial port number. The serial port number in the figure below is COM74 , and the baud rate is 115200. Click "Open Serial Port" and then click "Start" to run normally:



## Appendix A Document Revision History

Version Number	Scope of Revision	Date
V1.0	Initial release.	Oct 17 <sup>th</sup> ,2023
V1.1	Modify instructions	Sep 11 <sup>th</sup> , 2024
V1.2	The default baud rate is 921600 Modified to 115200	Nov 29 <sup>th</sup> ,2024

