Circuit safety

- Installation and use shall be in accordance with local electrical safety codes.
- The power supply shall comply with the safety [extra low] voltage (SELV) standard and the 12 V DC power supply shall comply with IEC60950-1. Please note the power supply requirements on the equipment label.
- Please ensure the safety of electricity before operating the equipment.
- There shall be easily removable disconnecting devices in the building installation wiring.
- Be careful not to crush or step on the power cord, especially the plug, power socket and the connector from the equipment.
- Proper installation and use of this product will not cause any fire or electric shock.

Environment

- Ensure that there are no obstructions such as vegetation, trees, buildings, or vehicles that prevent detection.
- Make sure that there is no electromagnetic interference in the radar installation area and the radar detection area, including the external unit of the air conditioner, the high-voltage transformer, etc.
- Please transport, use and store the equipment within the allowable humidity and temperature range.
- Do not store the equipment in a humid or dirty environment, especially an environment with too high or too low temperature, an environment with strong electromagnetic interference, or an environment with strong light.
- Packages of standard or equivalent materials shall be used when transporting the equipment.

Protective measures

- Ensure that the radar detection surface is clean.
- Please do not disassemble the machine without permission, otherwise it may cause water leakage or affect the product performance.
- Use a dry, soft cloth to clean the device. If the stain on the equipment is difficult to remove, wipe it with a damp cloth dampened with a mild detergent and then clean it with a dry cloth. To avoid damage to the equipment surface coating or deterioration of the equipment performance, do not use solvents such as alcohol, benzene, thinner, or corrosive cleaning agents.

Warning

- Please use the standard components supplied by the manufacturer to ensure that the equipment is installed and fixed by professional engineers.
- To avoid damage to the equipment, do not use two or more components.

Disclaimer

- This instruction manual is for reference only. For more information, please refer to the instruction manual of the specific equipment.
- The supporting software and user manual of this equipment will be updated synchronously on the official website. Please download without notice.
- In the event of damage or injury caused by misuse, the Company shall not be liable for any loss or liability.
- If you have any objections or questions, please refer to our final explanation.

Table of contents

I. Summary

TSC224 multi-lane speed radar is a very cost-effective short-range K-band millimeter-wave radar sensor. With a set of vehicle capture equipment, it can monitor multiple lanes (1 to 4 lanes) at the same time, and obtain the distance and speed information of vehicles in each lane. Detect 20 ~ 50 meters, capture rate is more than 99%, support top and side top installation, greatly increase the adaptability of radar to the scene.

1.1 Technical parameters

Classification	Description	Indicators	Remarks
Performance	Modulation mode	FMCW	
	Operating frequency	24～24.25GHz	
	Center frequency deviation error	≤±45MHz	
	Transmit Power (EIRP)	10dBm	Adjustable power
	Response time	50ms	
	Trigger consistency	≤±0.5m	
	Capture rate	>99%	
	Capture distance	1-50m	
	Speed measurement range	5～250km/h	
	Speed measurement accuracy	（-2~0）km/h	
	Cover the lane	Four lanes	
	Beamwidth (Azimuth/Tx)	64°	
	Beamwidth (Elevation/Tx)	16°	
Power source	Power source	9～32V DC	
	Electric current		
Material	Antenna panel material	ABS+PC	
	Bottom shell material	ABS+PC	
External interface	Interface	RS485/Wi-Fi/network port	
	Indicator light	Three (red for power light, green for status light, blue for Wi-Fi working status light)	
Environmental adaptability	Degree of protection	IP67	
	Corrosion protection grade	IEC 60068-2-11	
	Operating temperature	-40℃～85℃	
	Operating humidity	5%RH～95%RH	
Certification	Certification	CE/ROHS/FCC	

	Certification	OINLR91	
Installation	Installation method	Top mounting, side top mounting	
	Mounting height	Standard 6m (4-10 m)	

二、Installation

2.1 Schematic diagram of installation

The radar is fastened to a special bracket through four M5 screw holes on the back of its housing (as shown in Figure 1). The bracket is fastened to the universal joint mounting bracket through screws, and then connected to the mounting rod through the mounting bracket. Customers can customize and purchase standard two-dimensional universal joint brackets or three-dimensional universal joint brackets.

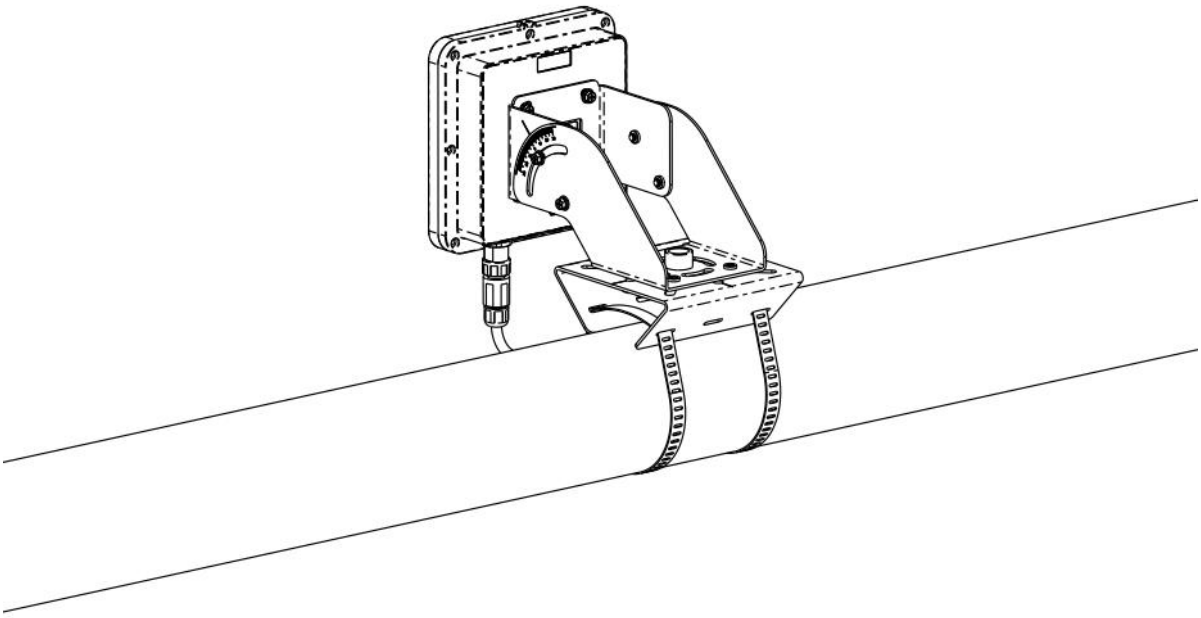


Fig. 1 Schematic Diagram of Crossbar Installation

The dedicated bracket is shown in Figure 2.

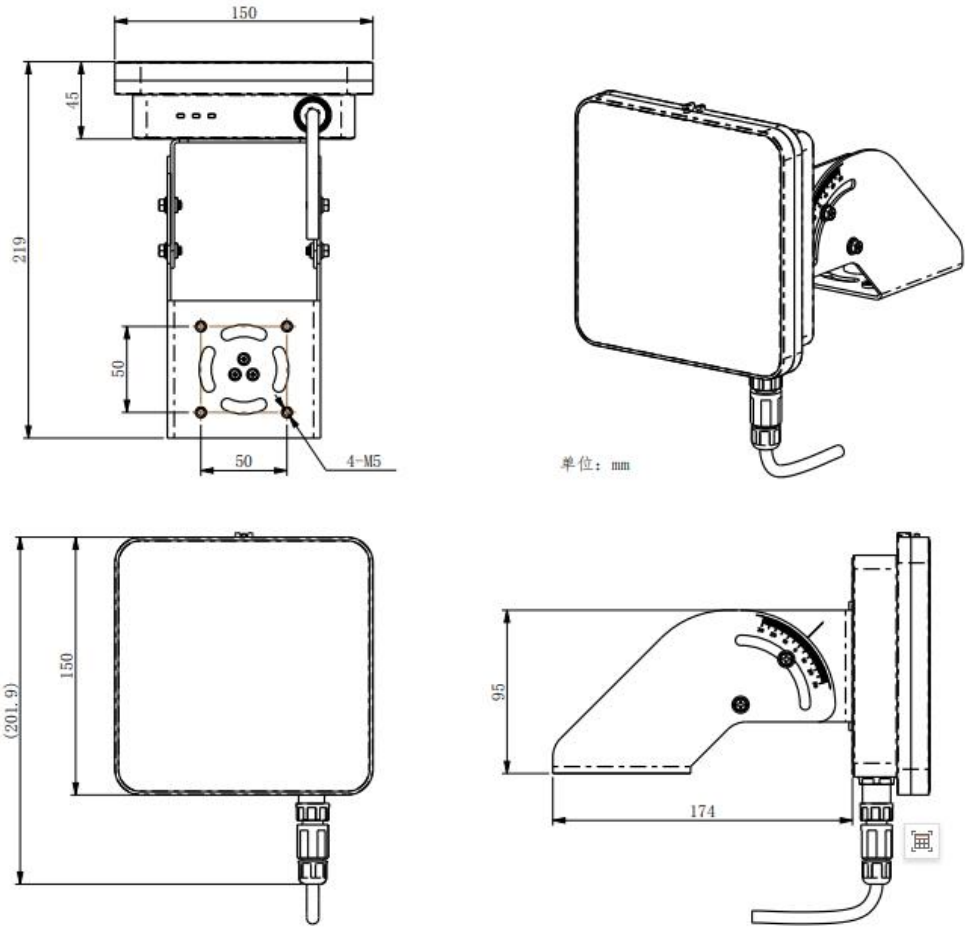


Fig. 2 Schematic Diagram of Overall Dimension

2.2 Connecting cables

Interface description	Remarks	Radar light status	Remark
DC12V	Power supply 5.5mm interface	Red	The red light is always on after the power supply is connected
RS485+/-	Positive/negative terminal (+-) for receiving and transmitting differential signals	Blue	After the network cable is connected and the communication is successful, the green light is always on.
RJ45	Radar TCP communication connection network cable	Green	A green light indicates that a target is detected

	interface		

Table 1 Definition of line sequence

2.3 Installation method

The radar is usually installed on a gantry or a "Γ" type cross bar in a positive way.

On-site radar installation requires that the left and right sides of the radar are more than 30 cm free of obstacles (such as cameras, fill lights, etc.). If the distance is less than 30 cm, the radar performance will be affected, resulting in unstable radar speed measurement.

As shown in fig. 4.

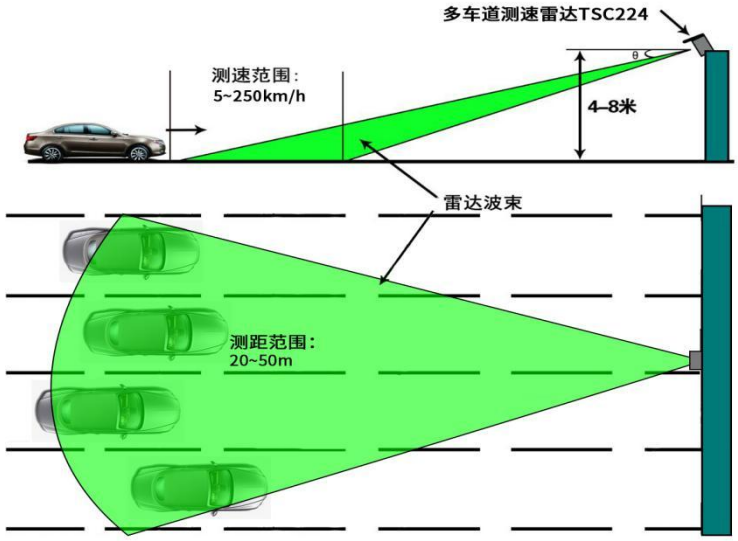


Fig. 4 Schematic Diagram of Radar Installation Elevation Angle

Typical radar installation elevation angle and radar beam center illumination distance at different heights and capture distances are shown in Table 2.

Radar installation height (above the ground)	Recommended installation elevation angle α of radar	Theoretical detection area
4m	6°	15-75M
5m	10°	15-75M
6m	13°	15-75M
7m	16°	15-57M
8m	19°	15-45M
9m	22°	15-39M
10m	25°	12-35M

Table 2 Typical Values of Mounting Pitching Angles of Radar in Coming Direction

Note: The radar elevation angle α shall be adjusted according to the actual installation height. If the base is not level, it is recommended to use a tool such as a mobile phone level to confirm the pitch angle. This parameter

is more important. If the depression angle is too different from the radar installation requirements, it needs to be adjusted again.

III. Parameter Configuration

3.1 Connecting the radar

3.1.1 TCP Connection

Select the TCP network port, the default IP of which is 192.168.10.123 and the port number is 50000. Click "Connect", and the × on the radar upper computer becomes √, as shown in the following figure (after successful connection, the firmware/algorithm version is displayed in the lower left corner, and the frame rate display of 21 Hz indicates that all functions are enabled).

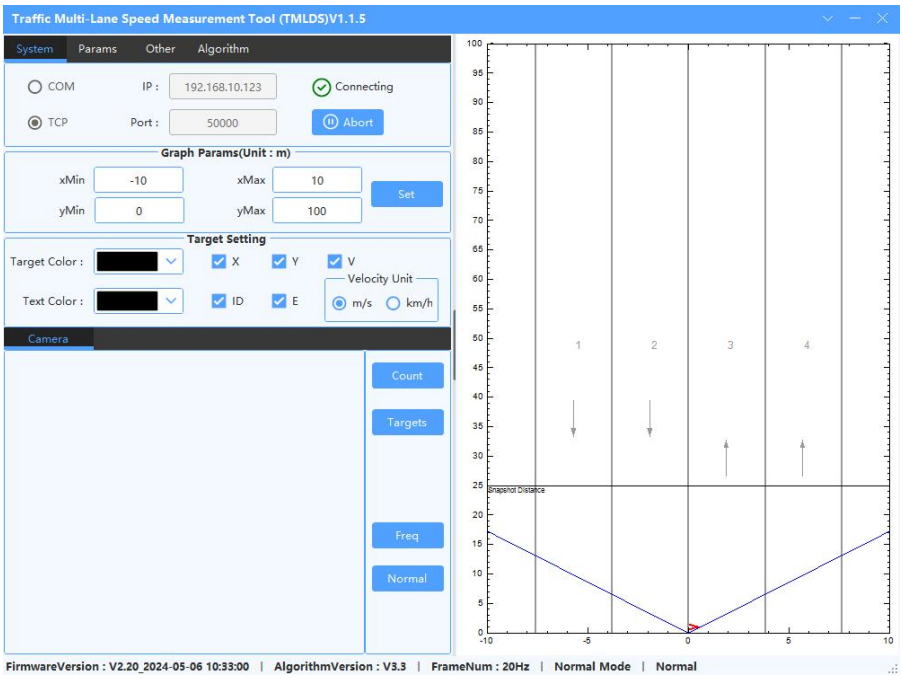


Figure 5 TCP Connection

3.1.2 Setting the radar mode

In the radar mode, set the mode to "Continuous Mode" and click "Set" to pop up the "Saved successfully" reminder box

3.1.3 lane parameters

Observe the abscissa d (left negative and right positive) of the left edge of lane 1 relative to the radar (origin). For single lane, only the width of lane 1 needs to be set. For multiple lanes, the width of multiple lanes needs to be set according to the site conditions. Click "Set" to pop up the "Set successfully" reminder box (the standard lane is 3.8 M).

3.1.4 Installation parameters

Set the actual installation height corresponding to the radar. If the radar is normally installed, the installation angle is set as 0 °; If the radar is side-mounted, change the horizontal angle of the radar to the corresponding angle (left negative and right positive), and then click "Set" to pop up the "Saved successfully" prompt box

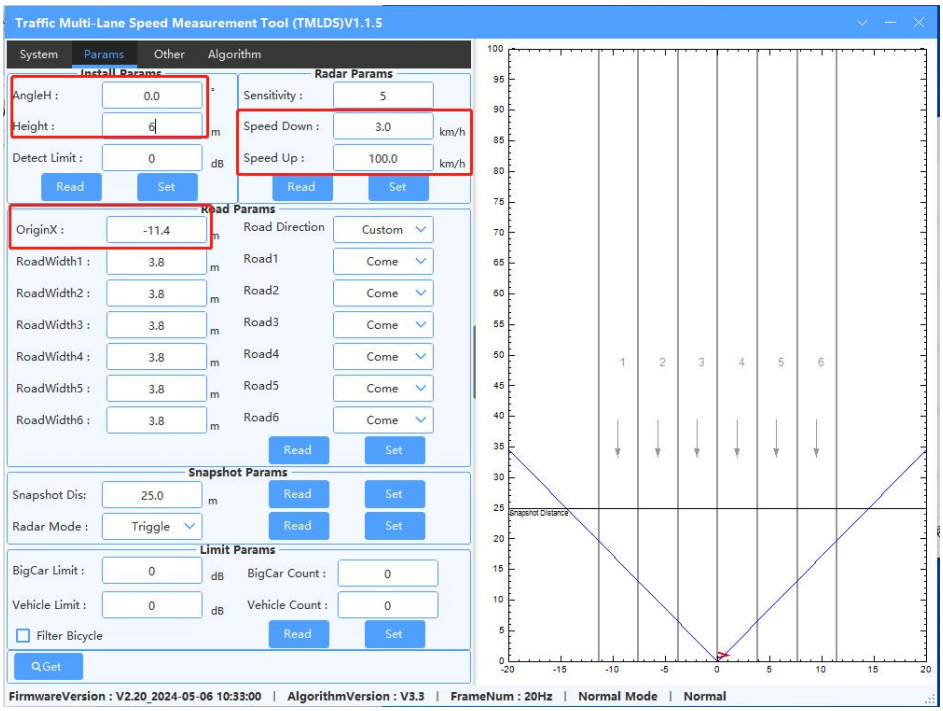
3.1.5 Radar parameters

Sensitivity: radar detection sensitivity

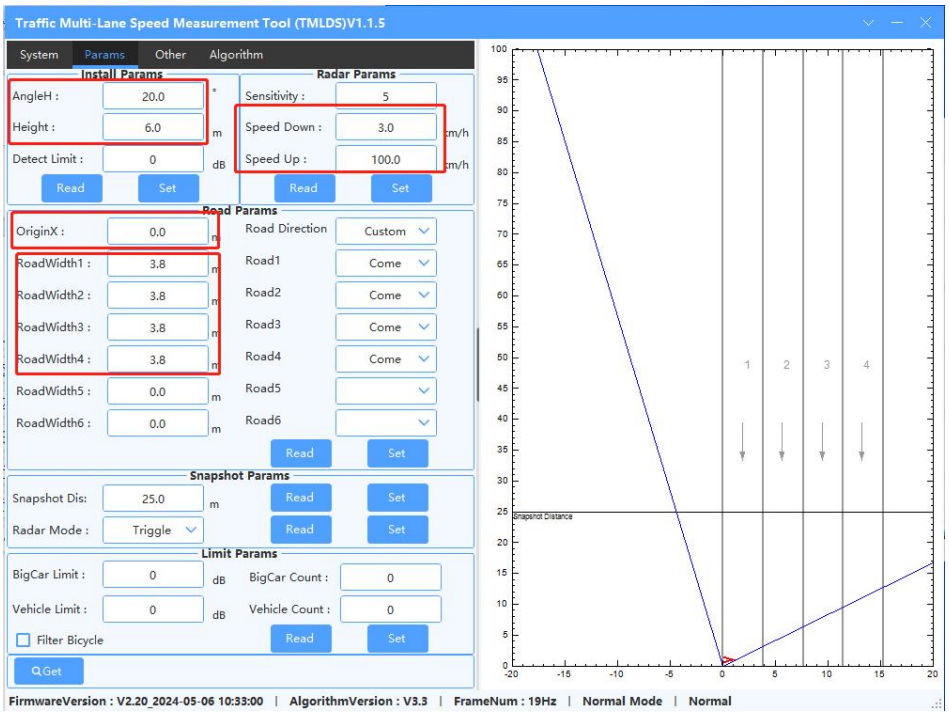
Lower limit of speed measurement: no output below the speed (unit: km/H)

Upper limit of speed measurement: no output above the speed (unit: km/H)

Parameter Setting of Forward-mounted 0-degree Six-lane Directional Continuous Mode

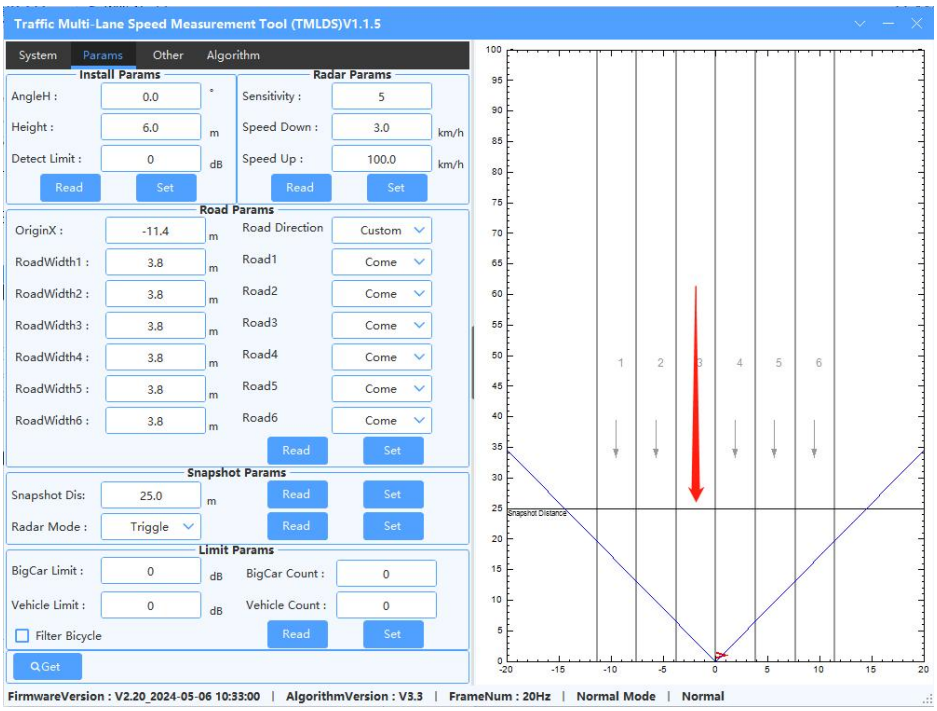


Parameter setting of 20 ° four-lane on-coming continuous mode on the left side



3.1.6 Observe the vehicle track

In the track display interface of the upper computer for debugging, observe whether the track of the vehicle is straight (start tracking from the farthest, and the tracking track is within the set lane), as shown in the following figure. If the tracking trajectory is too short, the elevation angle of the radar is too large, and the radar needs to be tilted up. If the tracking trajectory is not straight, there is an error in the radar horizontal angle in the previous step, which needs to be modified.



3.1.7 Set the snapshot mode

Radar mode:

Continuous mode: all vehicle tracks within the radar output detection range

Trigger mode: radar output only outputs vehicle data at the position of the capture line.

Change the radar operation mode to "trigger mode".

Capture direction:

Coming direction-detecting the direction of the front of the vehicle-detecting the direction of the rear of the vehicle-coming direction

Select the appropriate snapshot direction in the drop-down list according to the usage scenario

Capture distance: select the appropriate capture distance according to the best detection area tested in the continuous mode and the best focus of the multi-lane capture camera (ensure that the radar is installed at the recommended angle, and the detection range is not much different from the theoretical range)

If the best detection rate of radar is required, multiple data for each lane detected must be analyzed

For example, the detection range trajectory data (target appearance and disappearance distance) of two vehicles in each lane in the forward continuous mode

1 Lane 15-70M 18-70M 2 Lane 20-60M 21-59M 3 Lane 20-60M 19-60M

4 lanes 20-60M 21-58M 5 lanes 20-60M 21-57M 6 lanes 20-60M 19-57M

According to the data

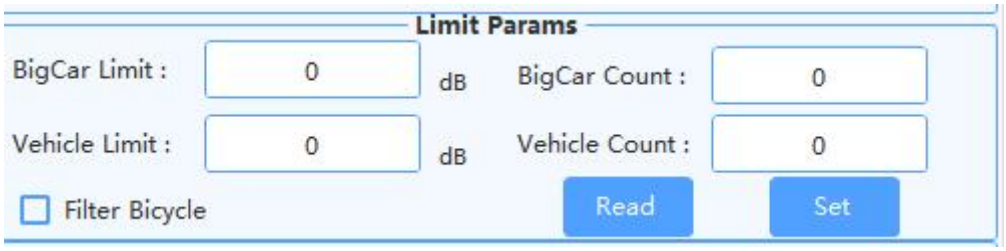
The maximum close range is 21 M (some vehicles can only be detected at 21 M)

The minimum distance is 57 M (some vehicles can not be detected outside 57 M).

Then the appropriate capture range is selected from 21 M to 57 M, and the best focus range of the camera is selected (for example, the best focus range of the camera is 18-30 M). Then, in combination with the radar data, the radar capture range can be set to any distance within 21-30 M.

5.2.8 View the snapshot effect

Capture information will appear in the target information statistics box every time a vehicle passes. If there are more shots of large vehicles, adjust the vehicle type identification settings to reduce the door limit of large vehicles, as shown in the following figure.



IV. Troubleshooting

4.1 Radar TCP connection cannot be connected

Radar Default IP 192.168.10.123 Port 50000 Ethernet Settings-Properties-IPV4 Settings 10 Segment IP/Subnet Mask/Gateway.

Check that the blue light of the radar is always on. If the blue light is not on, check the network cable and network environment.

4.2 Radar WIFI is normal, but the upper computer cannot be connected

1) WIFI WLAN Settings-Properties-IPV4 Select Auto Obtain

2) Operate the radar upper computer as an administrator

4.3 The vehicle tracking track is too short and the tracking track is not straight

1) If the tracking trajectory is too short and the elevation angle of the radar is too large, it is necessary to tilt the radar upward.

2) If the distance is from far to near, the track displayed by the upper computer deviates from left to right, adjust the horizontal angle; if the distance is from far to near, the track displayed by the upper computer deviates from right to left, adjust the installation angle.

4.4 Missing shooting and excessive shooting of large vehicles

1) If the phenomenon of excessive shooting of large vehicles is serious, adjust the threshold parameters, filter non-motor vehicles, and reduce the threshold of large vehicles.

2) If the car misses a lot of shots, lower the target detection threshold a little and increase the door limit of the big car a little (it is necessary to test the balance between multiple shots and missed shots)

3） In case of the side lane, in the continuous mode, the vehicle coming from the side lane has no tracking track, and the width of the side lane needs to be increased)

4.5 The camera does not capture, but the radar captures normally.

1) Check whether the version protocol is consistent with the camera protocol

2) Check whether the camera baud rate is consistent with the radar output baud rate.

4）Check the 485 wiring, and use the serial port assistant to check whether the vehicle has data output.

Appendix: Function Description of Upper Computer

（1）Chart range (m): xmin xmax Radar horizontal canvas left and right nodes ymin ymax Radar vertical canvas upper and lower nodes

（2）Target color: you can set the color of the target.

（3）Text Color: Sets the text data color

（4）Target speed: X: Lateral distance of target from radar Y: Longitudinal distance of target from radar V: Target speed ID: Target ID number E: Target energy

（5）Statistics: It can be used to count the number of vehicles passing each lane, and manual review is required for vehicle lane change and non-straight track.

（6）Target information: all output protocol information of the detected vehicle

（7）Dot frequency mode: This function needs to be enabled for indoor simulator test or certification test.

（8）Normal mode: Only when the dot frequency mode is turned on, it will take effect. Click it to switch from the electric frequency mode to the normal mode

（9）Horizontal angle: radar side-mounted angle compensation (left negative and right positive)

（10）Installation height: actual installation height of radar

（11）Detection threshold: output when the target is greater than the value, and filter when the target is less than the value

（12）Lane parameter: set the starting horizontal coordinate and lane width

（13）Radar parameters: adjust radar sensitivity and upper and lower limits of speed measurement

（14）Capture parameter: adjust radar capture direction/capture distance/radar mode

（15）Threshold parameter: non-motor vehicles can be filtered by adjusting the door limit of motor

vehicles/large doors.

（16）Other-TCP: TCP network parameters can be set

（17）Other-WIFI: WIFI network parameters can be set

（18）Other-output interface: TCP/485/WIFI designated port output can be set

（19）Others-Radar Cancellation: enable or disable radar cancellation

（20）Others-wrong frequency number: stagger the radar frequency, which is used for the same frequency jamming of radar opposite radiation.