User Manual

Microwave Vehicle Detector

CLAIRWAV-U24

Version: 1.0

TraffiClair Technology Co., Ltd.

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1.Introduction

1.1 Description of the product

Tunnel Specialized Radar ClairWav-U24 is a radar specifically designed for tunnel scenarios, capable of multi-lane, high-accuracy detection, and collecting real-time, comprehensive, and accurate traffic information, including real-time vehicle positions, instantaneous speeds, lane positions, vehicle type classification, lane information, traffic flow, average speeds, time occupancy rates, headway distances, queue lengths, and regional vehicle counts, among other basic traffic statistics.

1.2 Functional features

The CLAIRWAV-U24 Microwave Tunnel Radar Detector has the following key functional features:

- Overcoming the pain point of inaccurate target identification caused by multipath reflections inside the tunnel, effectively reducing false targets, achieving a maximum longitudinal detection range of up to 400 meters.
- All-weather operation, adaptable to various complex tunnel environments including high temperatures, low temperatures, and dust, with an IP67 protection rating.
- Simple installation and configuration, low maintenance costs, suitable for various installation conditions, with the flexibility to choose between upright and inverted installation based on tunnel conditions.

1.3 Application Scenarios

Tunnel traffic information collection, suitable for different types of tunnels including circular, square, and tunnels with curved lanes, as well as two-lane and three-lane tunnels, applicable for observing both the front and rear of vehicles.

1.4 Basic specifications

Basic specifications

Model	CLAIRWAV-U24
Size	210mm×154mm×51.4mm
Weight	≤2Kg
Operating frequency	24GHz
Communication interface	Ethernet (RJ-45 100Mbps),RS-485
Power supply	DC 24V (equipment interface input voltage: DC 21.6V-32V)
Power consumption	≤25W
Working temperature	-40℃~+74℃
Storage temperature	-45℃~+85℃
Environmental humidity	0~95%
Protection level	IP 67
Service life	10 years, continuous uninterrupted operation for 7 * 24 hours

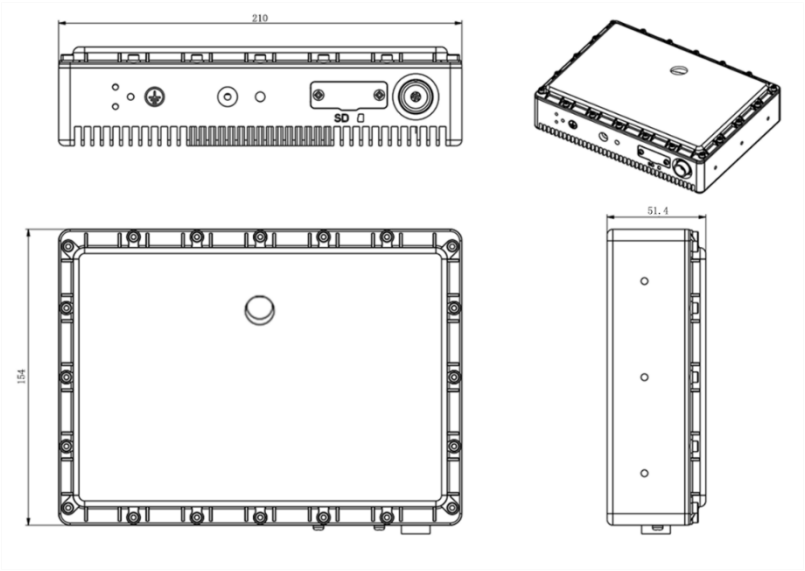
1.5 Technical indicators

Technical indicators	
Vehicle detection distance	400m
Target lane distance positioning	150m
Speed measuring range	±220Km/h
Maximum lanes	2 lanes
Maximum number of tracked targets	128
Vehicle flow detection accuracy	≥95%
Average speed detection accuracy	≥95%

Queue length detection accuracy	≥95%
Frame rate	20fps

1.6 Size

Appearance and size:210mm×154mm×51.4mm.



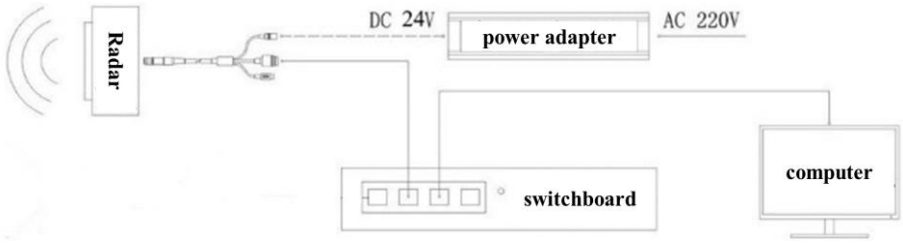
2. Instructions for Use

To ensure the normal use of this product, please refer to the installation manual and install it under the guidance of professional engineer. For ease of description, radar will be used as a synonym for microwave traffic flow detectors.

● During the installation and use of equipment, it is necessary to strictly comply with various electrical safety regulations of the country and the region of use.

● Please use a matching DC power adapter for power supply. The input voltage and power supply of the connector should meet the voltage and power consumption requirements and avoid using the same power adapter to power multiple devices.

● Ensure that the product is working properly, has been assigned and configured with a unique IP, and can communicate with the device through the IP normally. The brief connection diagram is shown in Figure 2. Before use, confirm that the device is working properly, and that the computer (PC) can communicate with the device on the network normally.



Attention: The working voltage of the microwave traffic flow detector is a stable power supply of DC 24V, 25W. If the voltage exceeds the range and causes damage to the microwave traffic flow detector, the loss shall be borne by oneself.

3. Installation Instructions

3.1 Installation Accessories

List of Items for Microwave Traffic Flow Detector:

- Microwave Traffic Flow Detector Main Body: 1 unit
- Microwave Traffic Flow Detector Mounting Bracket: 1 unit
- Mounting Screws: 5 pieces
- Connecting Cable: 1 piece
- Waterproof Cap (Set of Three): 1 unit
- Matching Power Adapter: 1 unit

Additional Fixing Accessories (self-provided):

- Clamps: 2 pieces
- Universal Joint: 1 piece
- Post Bracket: 1 piece
- Bracket Screws (with Flat Spring Washer): 6 sets

Note: The operating voltage of the microwave traffic flow detector is DC24V, with a stable power supply of 18W. Any damage caused by voltage exceeding the specified range will be the responsibility of the user.

3.2 Installation Instructions

Procedure and Explanation for Installing the Microwave Traffic Flow Detector:

1. Connect the Microwave Traffic Flow Detector bracket, universal joint, and post bracket.
2. Secure the post bracket to the pole using clamps.
3. Mount the Microwave Traffic Flow Detector onto the bracket, ensuring it is not installed upside down (the label on the back should be facing upwards for correct installation).
4. Connect the Microwave Traffic Flow Detector's connection cable.

5. Adjust the angle as necessary.

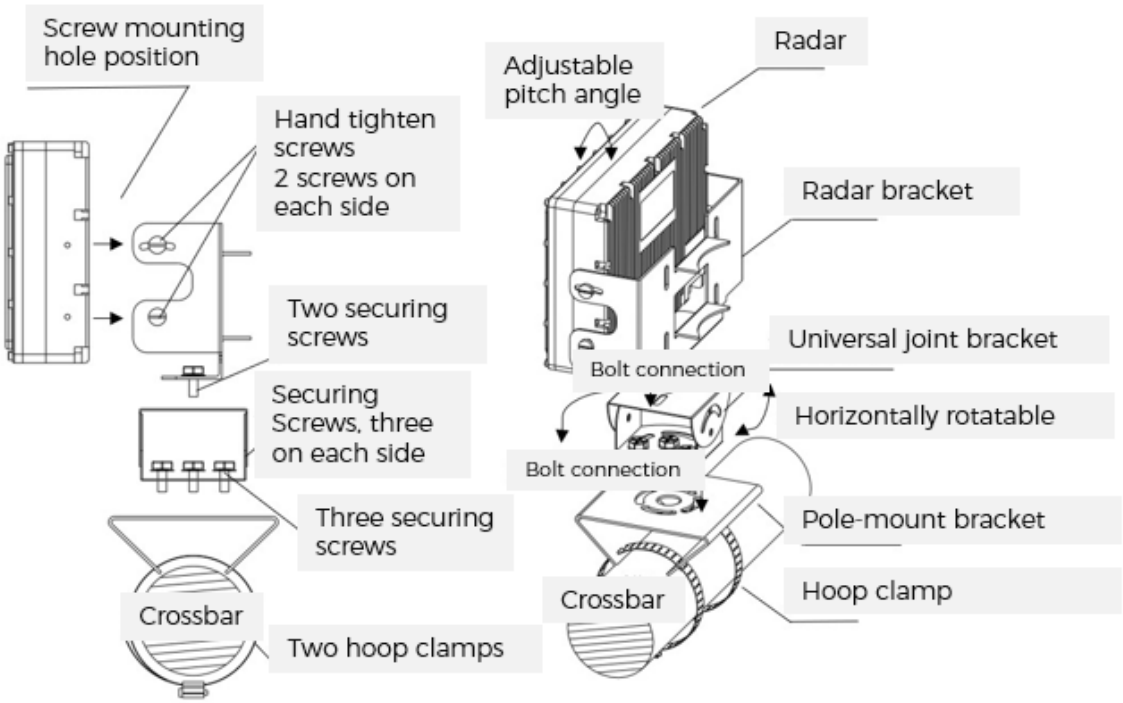


Figure 3.1: Installation Method for Microwave Traffic Flow Detector Crossbar

3.3 Microwave Traffic Flow Detector Connection Cable Instructions

When connecting the cable head to the Microwave Traffic Flow Detector, align the red dot on the aviation plug with the red dot on the connector of the Microwave Traffic Flow Detector. Insert it until you hear a slight click sound, indicating that it is properly installed. To remove, pinch the handle of the plug and pull downwards.

After insertion, tighten the waterproof sleeve around the Ethernet port. Once the power cable connection is complete, ensure waterproofing. Seal any unused connectors with tape for tight sealing.

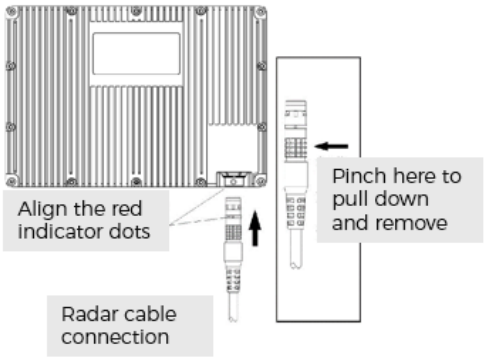


Figure 3.2: Connection of Cable Head

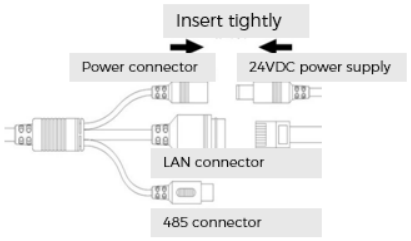


Figure 3.3: Connection of Cable Tail

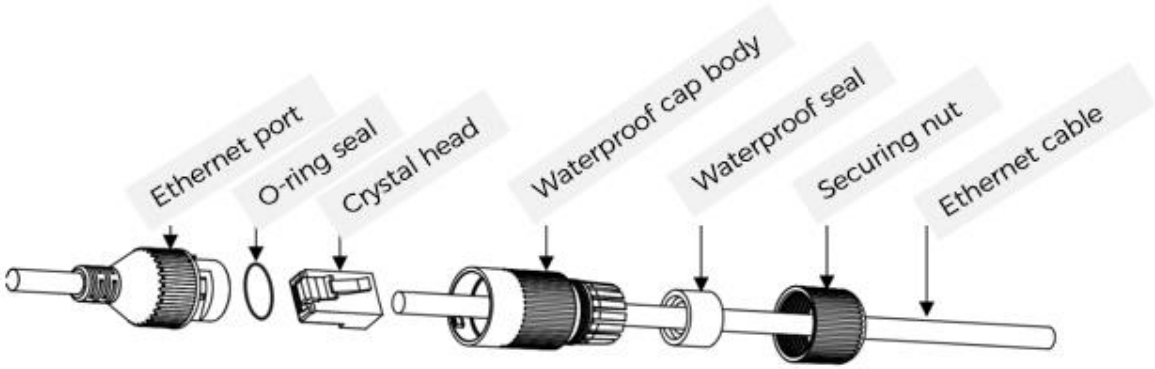


Figure 3.4: Waterproof Sleeve for Ethernet Port

3.4 Equipment Grounding Standards

The radar grounding structure is located at the middle screw holes on both sides of the radar. Grounding screws are provided to secure the grounding wire to the

radar housing.

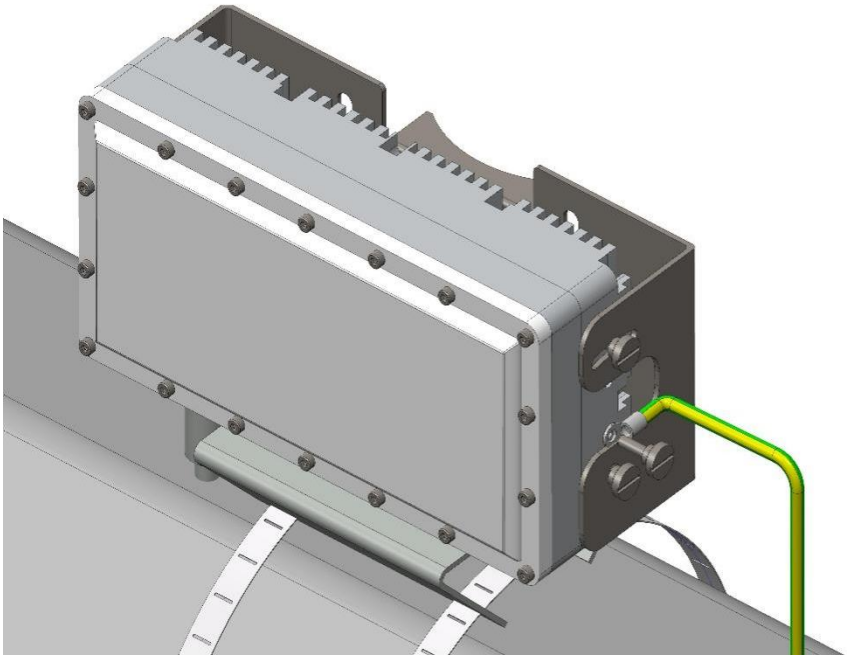


Figure 3.5 Grounding Terminal Diagram

3.5 Microwave Traffic Flow Detector Mounting Angle Instructions

The height of the Microwave Traffic Flow Detector should be consistent with that of the traffic light crossbar. The lateral tilt angle of the Microwave Traffic Flow Detector needs to be adjusted to horizontal, while the pitch angle also needs to be adjusted to horizontal, with the Microwave Traffic Flow Detector facing the target direction.

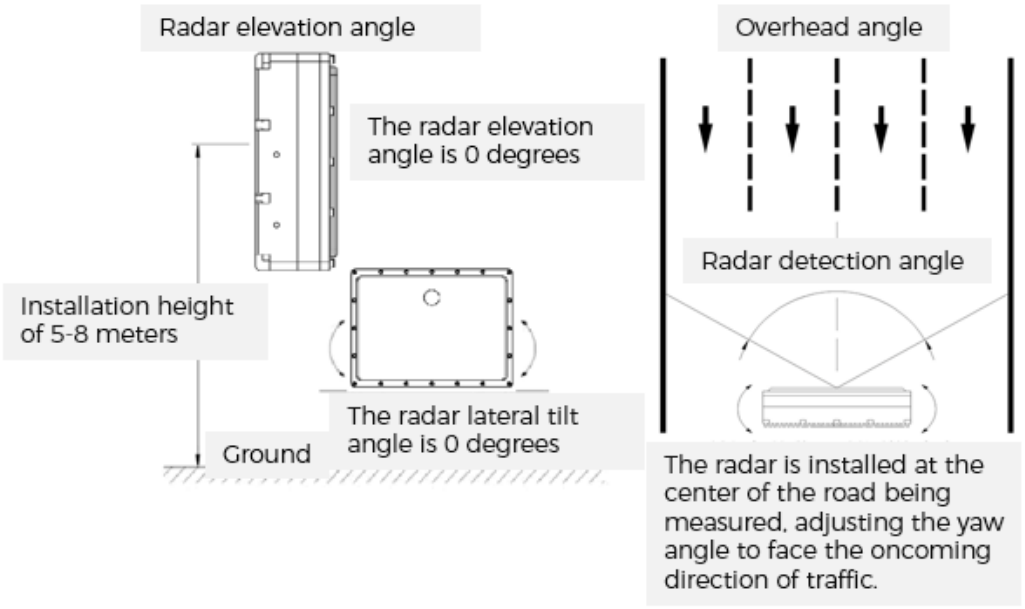


Figure 3.6: Adjustment of Microwave Traffic Flow Detector Mounting Angle

4. Radar setting

4.1 Preparation and inspection before setting

4.1.1 Preparation

1) Hardware: Laptop, network switch, Rj45 cable.

2) Software: “Device configuration Tool”

The setting software is provided by the product supplier to the customer.

Software initial password: admin

4.1.2 Inspection

1) Check whether the radar and switch are started normally

2) Check whether the network of radar, switch and laptop

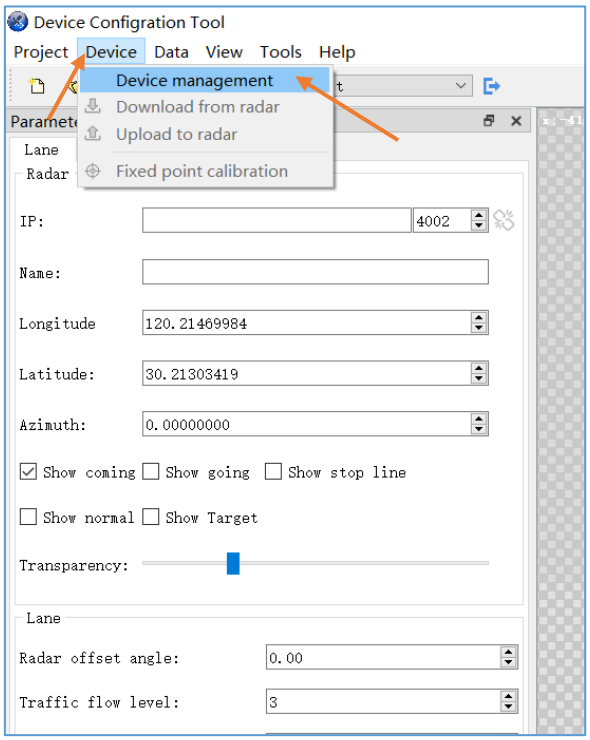
Note: The initial IP of the radar is 192.168.203.11. When setting the radar, the computer should be in the same IP segment as the radar.

According to the actual application scenario of radar, the user shall allocate the IP address of radar following to the steps of "3.2.1" first, then connect multiple radars to the same LAN.

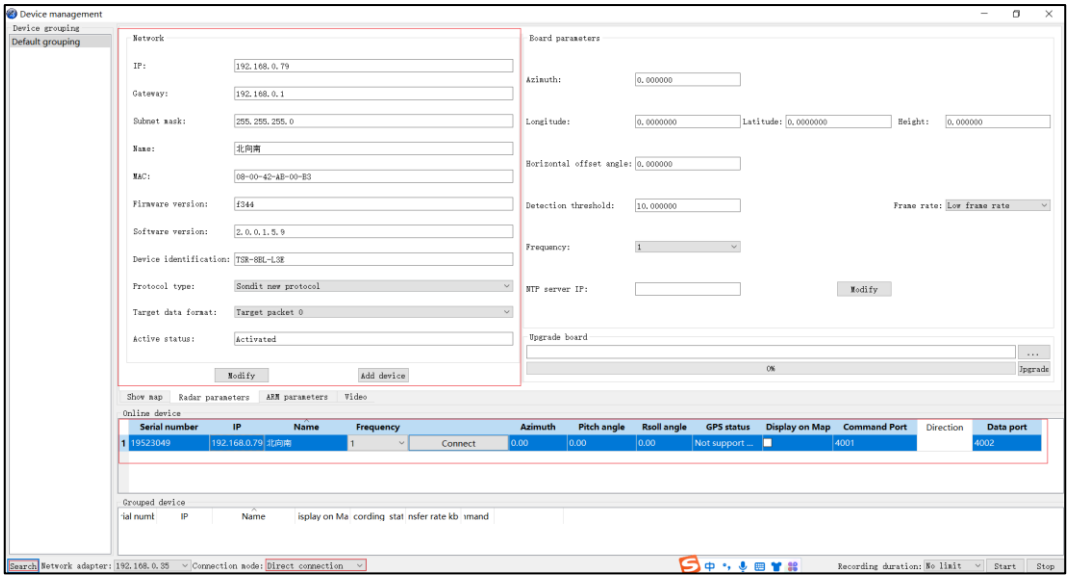
4.2 Radar setting description

4.2.1 Configure radar network parameters

Click “Device”→“Device management”, enter the device manage interface as follow:

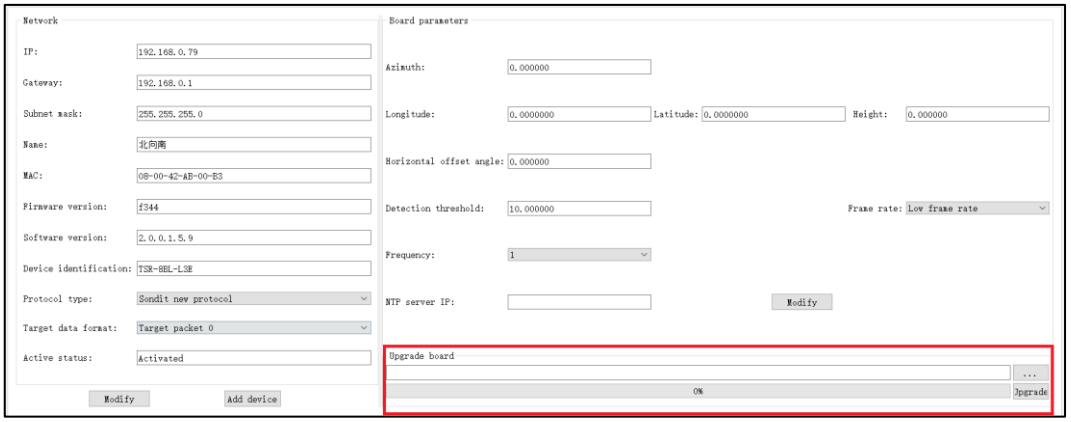


Select "Connect mode" as "Direct connection", click "Search" to search radar, select radar in the "Online device" interface, set radar network parameters in the "Network" interface, and click "Modify" to save the settings, and the radar will restart.



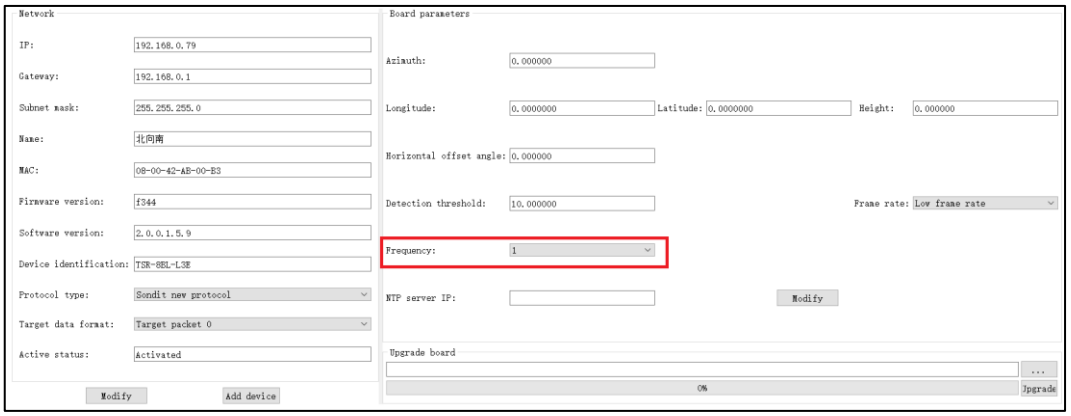
4.2.2 Radar firmware version upgrade

According to the project requirements or contact the technical support, select the corresponding radar firmware version for upgrading, as follow:



4.2.3 Radar frequency point configuration

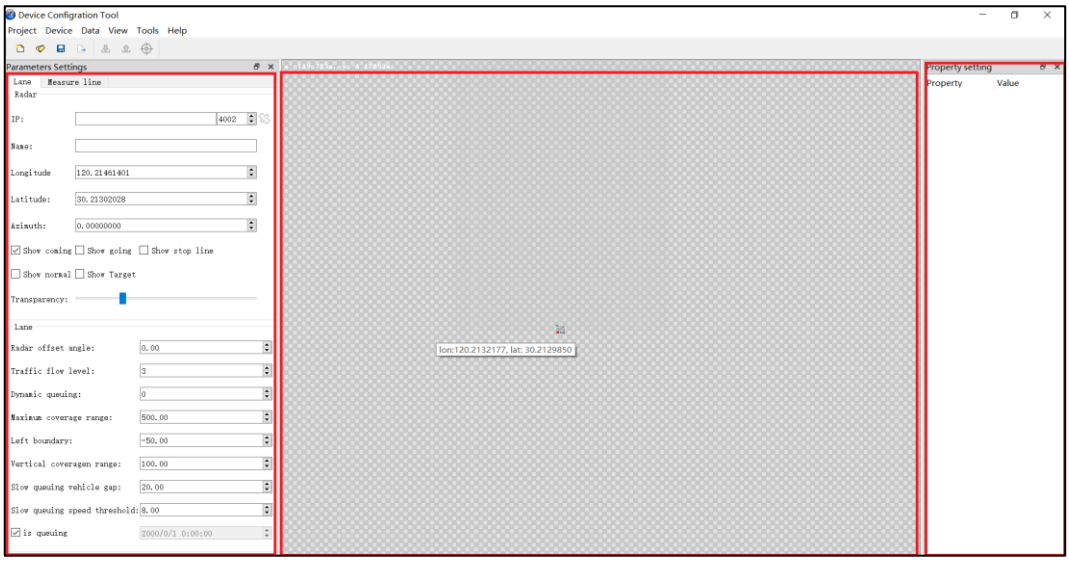
Radar can be configured with 6 frequency points. The factory default frequency point of the radar is 6. The frequency point configuration is shown as follow:



The frequency points of radar within 500m radius cannot be the same. In case of frequency point conflict, the output target data of the radar will be affected and the data will be abnormal. It is recommended to set the radar frequency point according to the direction, it can be planned as North 1, East 2, South 3 and West 4 to divide the radar frequency points.

4.2.4 Lane parameter configuration

4.2.4.1 Interface introduction



The main interface of lane drawing software is shown in the figure above. The software interface includes three areas: **Parameter configuration area, Drawing area and Property editing area.**

Parameter configuration area: radar connection parameter settings; Lane and Measure line parameter setting; Display and hide settings of layers and elements in the drawing area.

Drawing area: thermal diagram display area; Draw the display area of elements (lane, parking line, measure line, real-time vehicle, etc.). Satellite map and radar positioning can only be used by radar with GPS function.

Property editing area: edit the properties of elements.

4.2.4.2 Recording real-time thermal diagram

After installing the radar in the intersection and setting the network parameters and firmware version of the radar, recording real-time thermal diagram can be carried out.

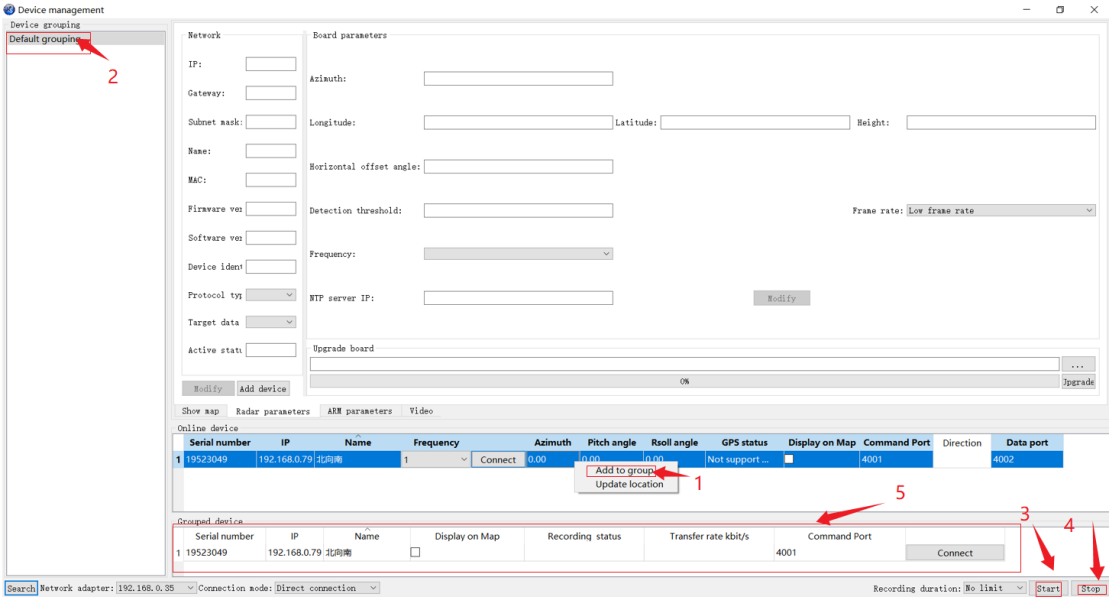
1) Enter the "Device management" interface (as 3.2.1), Right click the radar in the "Online device" column, right-click and select "Add to group", Radar will be added to the selected group, this operation does not affect any parameters of the radar, just groups the radar in the software and records the thermal diagram.

2) Click "group" then click the radar displayed in "Group device" to choice radar.

3) Click "Start", the radar will restart and start recording real-time thermal

diagram of traffic.

Note: This operation will clear the lane parameters of the radar. If the radar has drawn the lane, please save the drawn lane according to “3.2.4.10”.



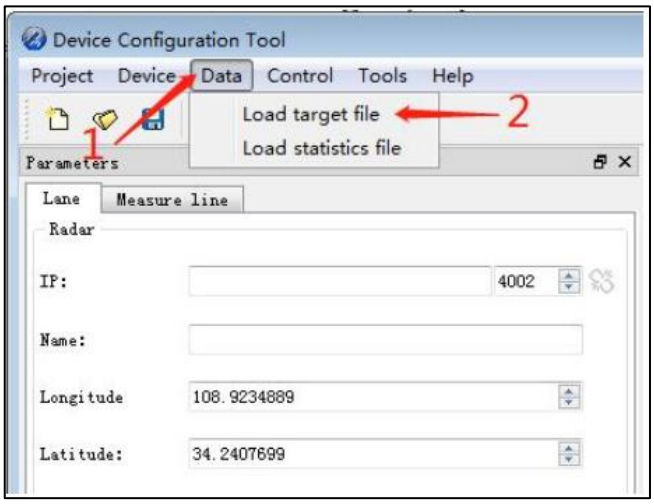
4) Click “Stop” to stop recording real-time thermal diagram of traffic.

The recorded data is saved in the "records" folder under the main directory of the software installation, with radar IP and radar name as the file name.

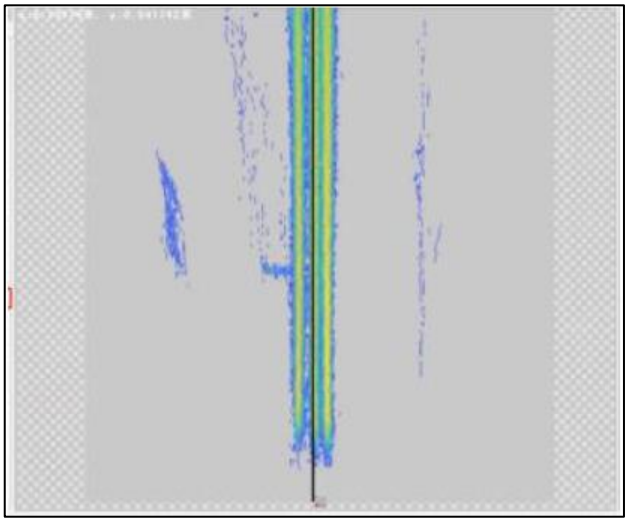
Generally, the intersection needs to be recorded for about half an hour to get a clear track thermal diagram. If the traffic flow at the intersection is large, the recording time can be appropriately reduced, vice versa.

4.2.4.3 Loading thermal diagram

Click “Data”→“Load target file”on the main interface as follow:



Select the recorded thermal diagram file (suffix: ". rd") . The data file will be loaded into the middle of the main interface to form a track thermal diagram as follow:

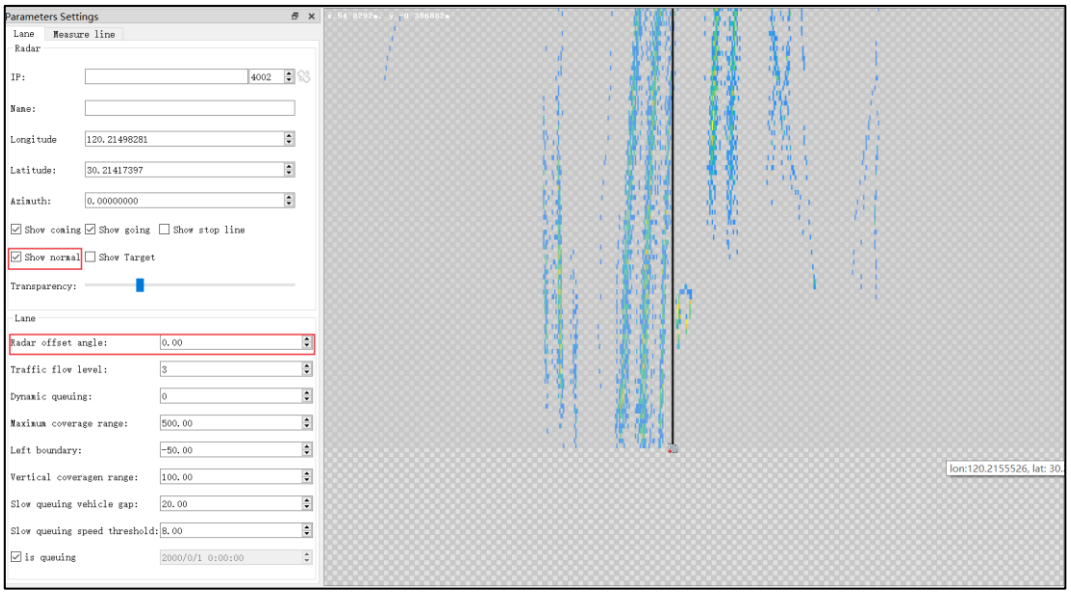


4.2.4.4 Lane drawing

1) Angle of radar configuration

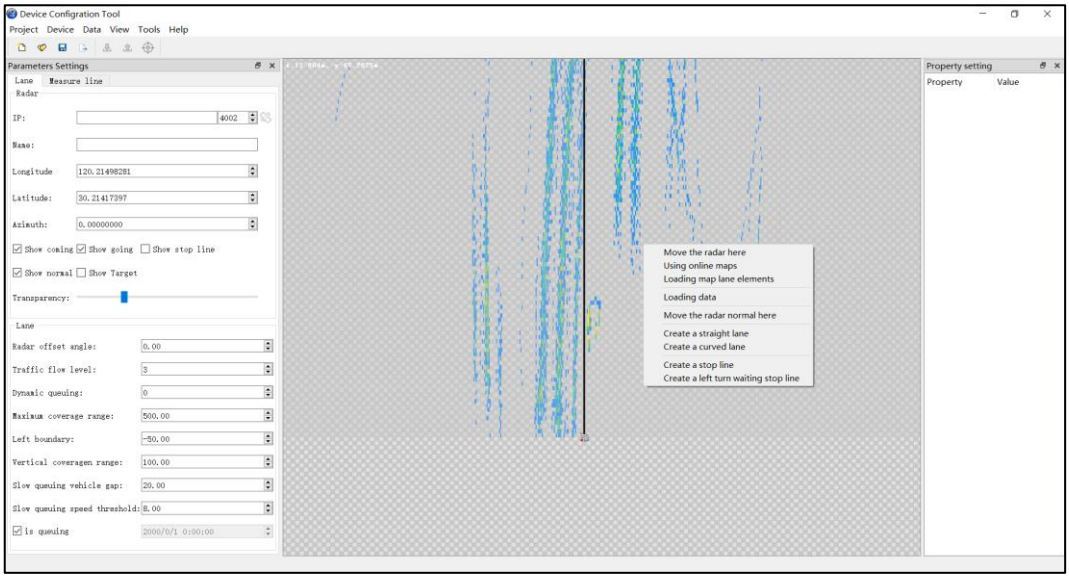
① After recording and loading thermal diagram, select the "Show normal" option;

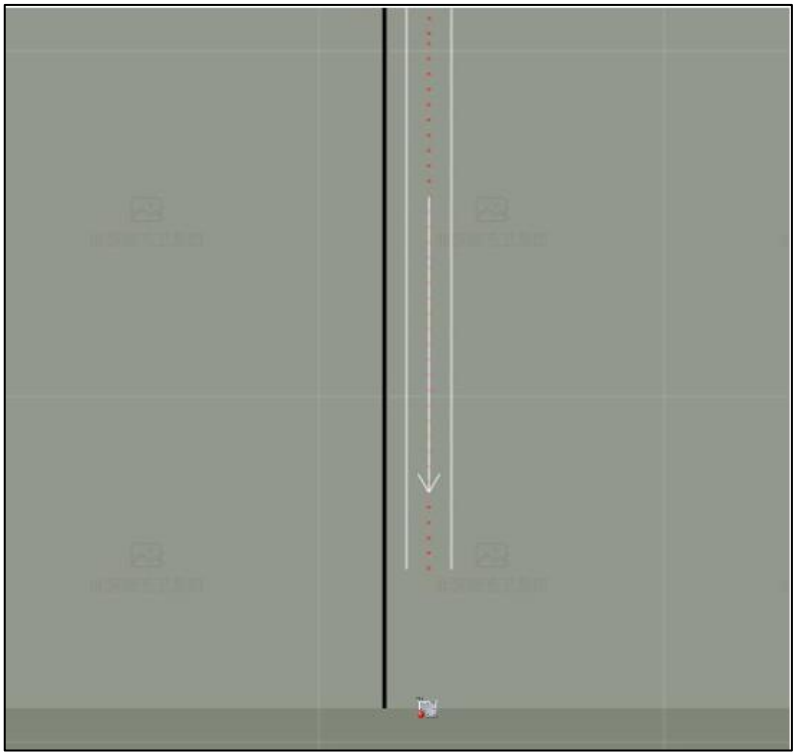
②Modify the "Radar offset angle" parameter and adjust it to keep the thermal diagram track close to the intersection parallel to the radar normal;



2) Draw straight lane

Right click in the drawing area and select "Create straight lane" , a straight lane is automatically drawn starting from the mouse position ;



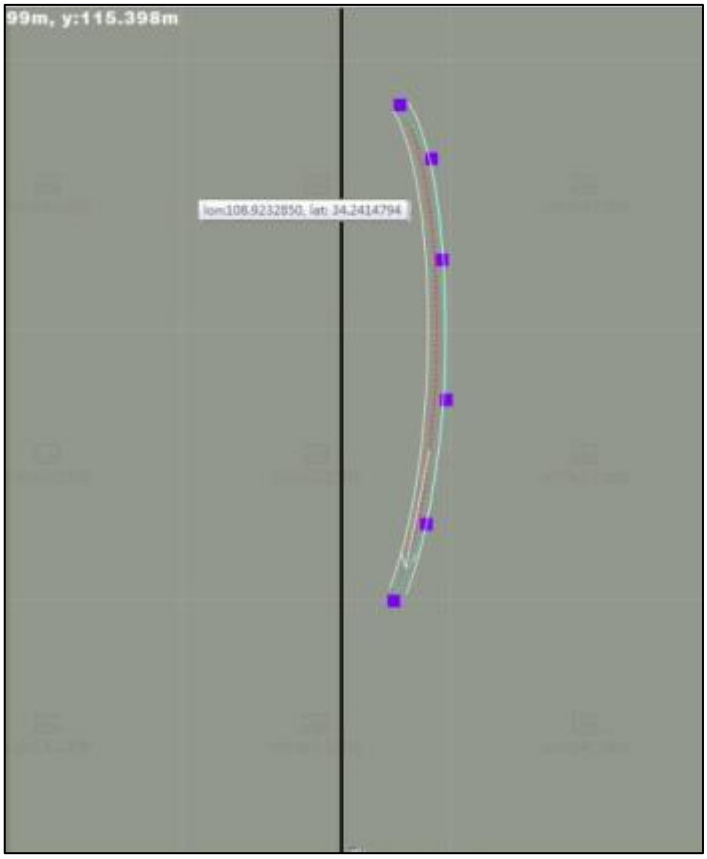


3) Draw curved lane

①Right click in the drawing area and select "Create curved lane";

②Right click the mouse one by one along the lane;

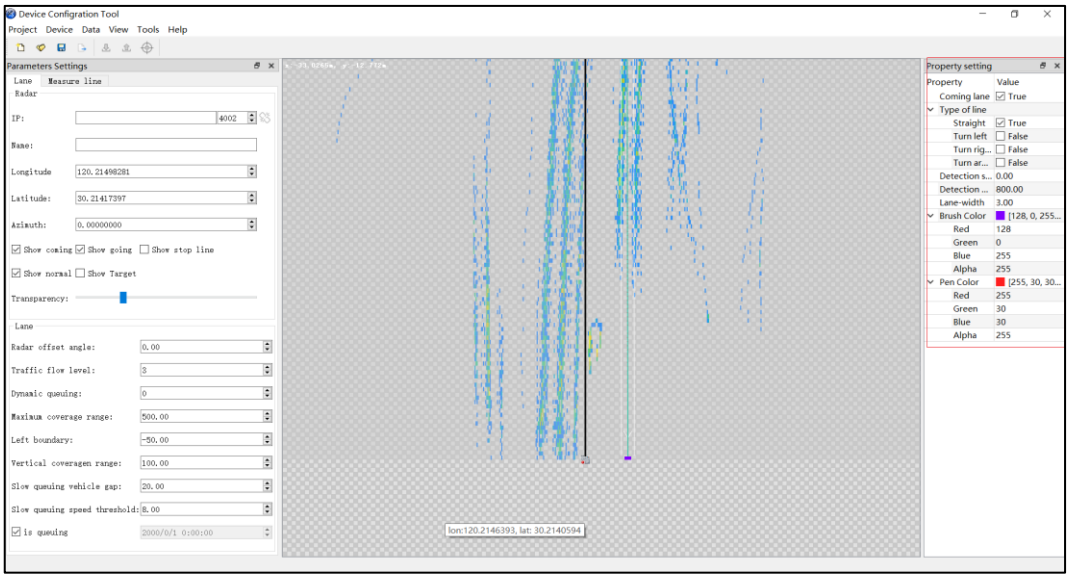
③Double left click to finish drawing the current lane.



4) Lane property editing

① Left click on the dotted line in the center of the lane to select the current lane;

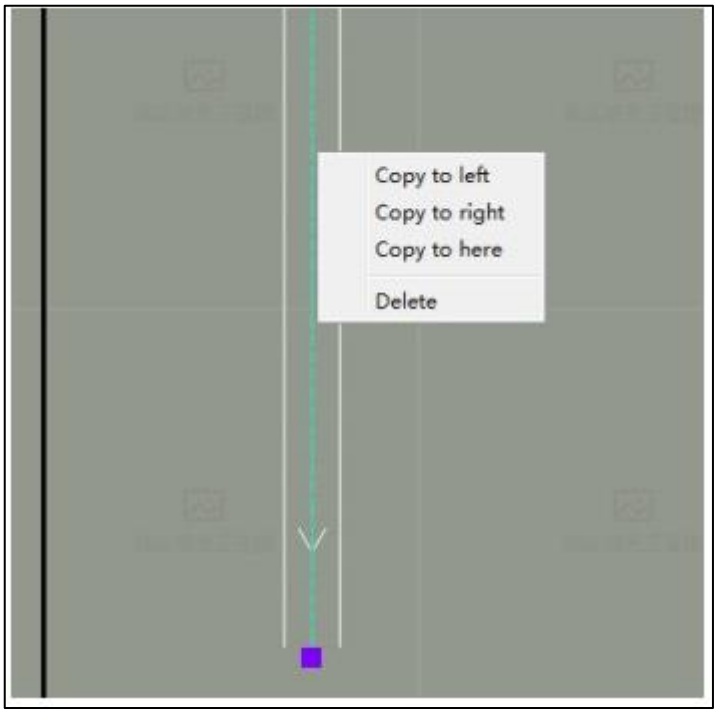
② In the property editing area on the right side of the interface, modify the parameters of the current lane according to the actual situation;



5) Copy and delete lane

Left click on the dotted line in the center of the lane to select the current lane,

then right click, select "Copy to left" ,"Copy to right", "Copy to here" or "Delete" from the right-click options, The user can draw lanes with the same property repeatedly, or delete the selected lane.



4.2.4.5 Stop line drawing

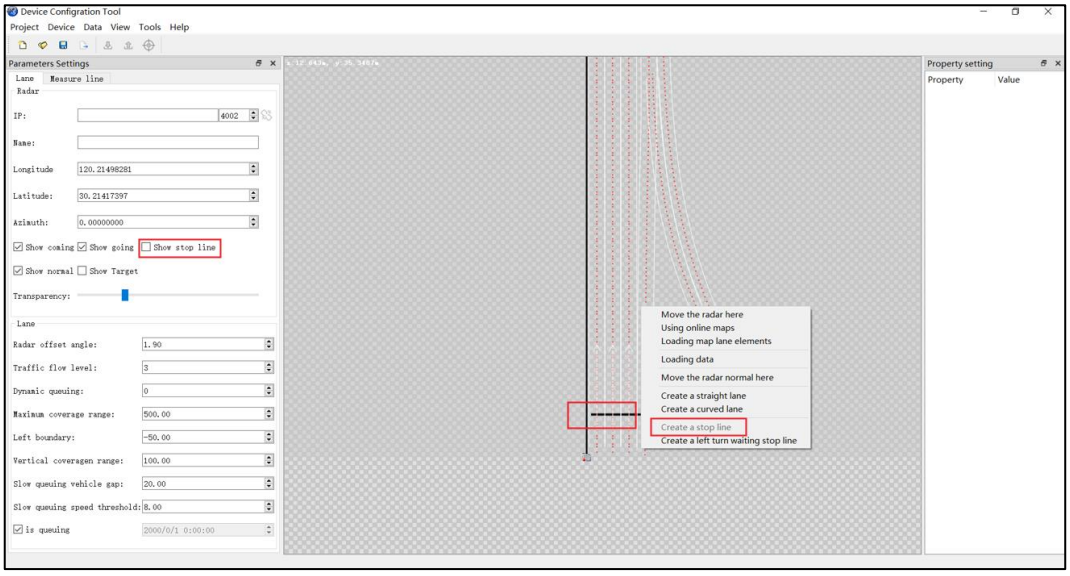
1) After lane drawing, select “Show stop line” :

① Right click in the drawing area and select "Create stop line" ;

② Right click at the left starting point of the stop line;

③ Right click at the right end point of the stop line;

④ Left double-click to complete the drawing of the stop line.

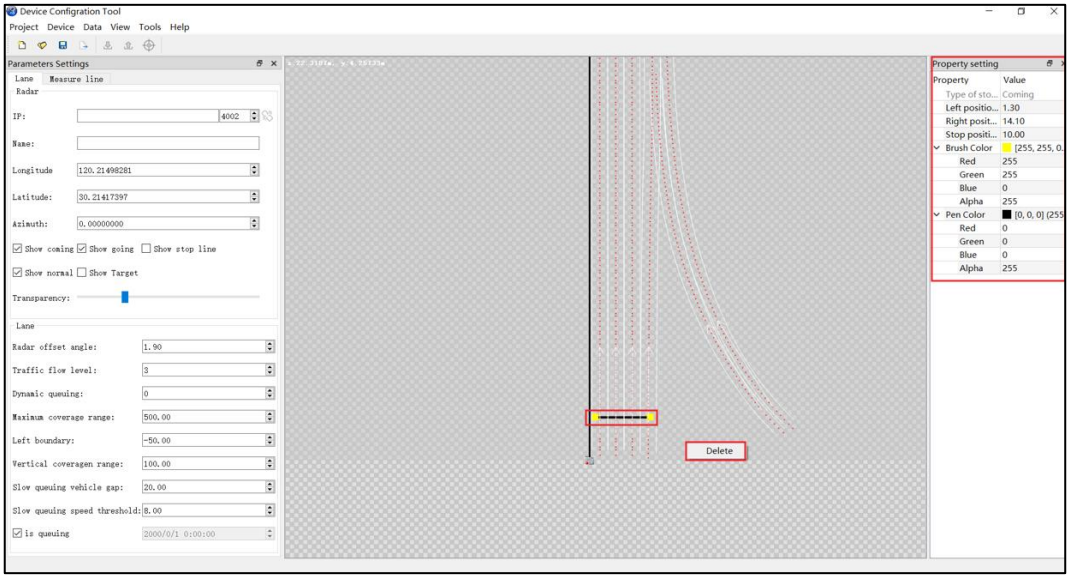


2) Stop line property editing:

① Left click on the stop line to select the stop line ;

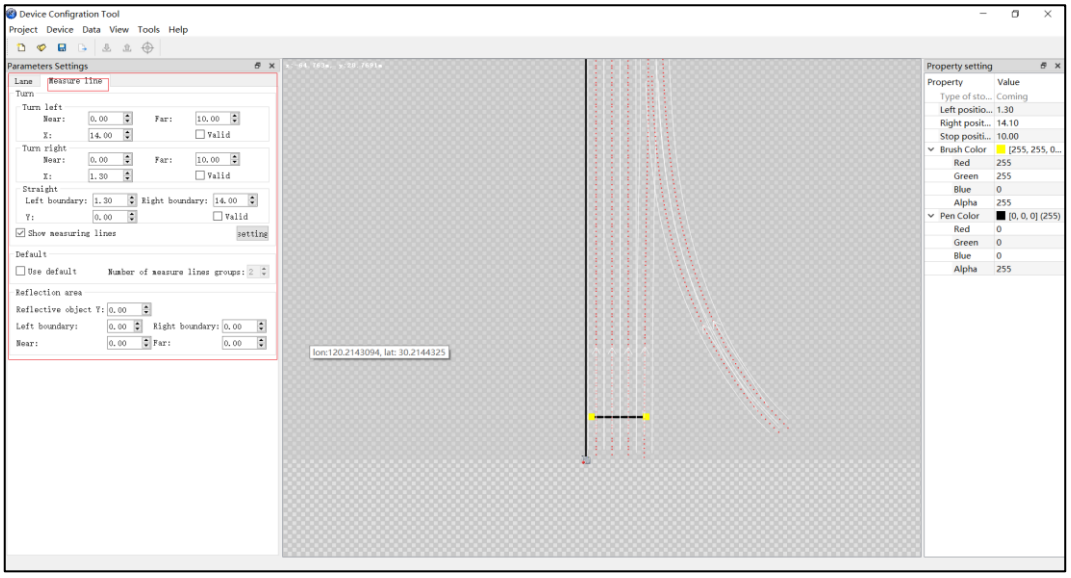
② In the property editing area on the right side of the interface, modify the parameters of the stop line according to the actual situation;

③ The user can select "Delete" from the right-click options to delete the stop line.



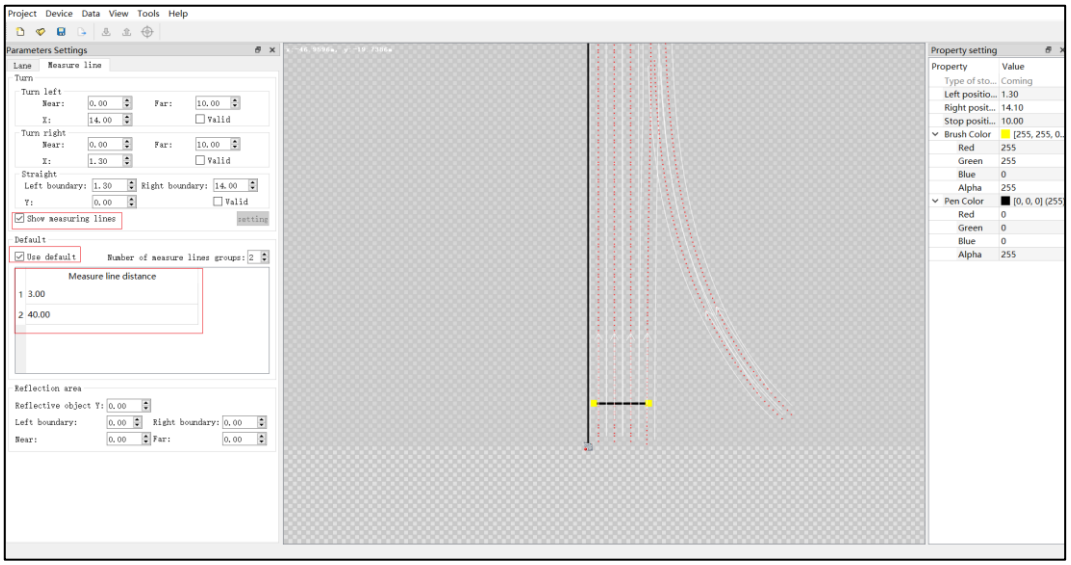
4.2.4.6 Measure line and virtual coil setting

After the lane and stop line are drawn, click "Measure line" on the main interface to enter the measure line setting:



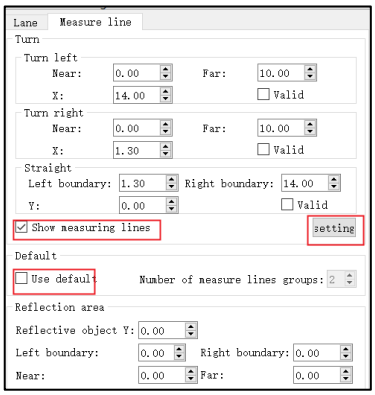
The virtual coil is automatically generated centered on the measure line. The software provides two ways to add measure lines: create default measure lines, and add measure lines manually.

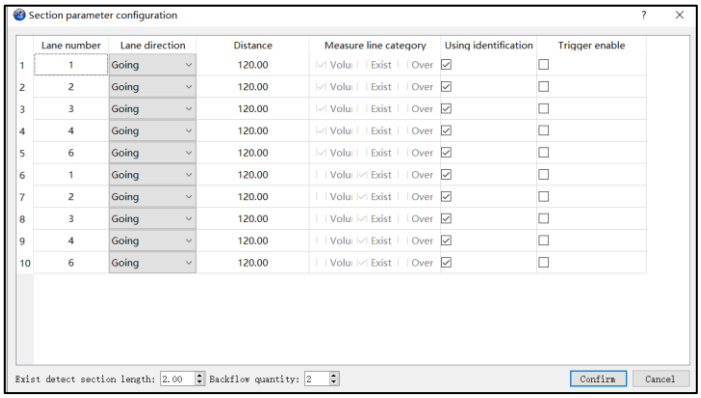
1) For creating default measure lines, select "Use default", adjust the value of "Measure line distance" as needed, select "Show measure line", the software will automatically set the existing and counting measure lines on each lane according to the value of "Measure line distance". If the value of "Measure line distance" is changed, the user need to cancel and reselect "Show measure line" to set new measure lines.



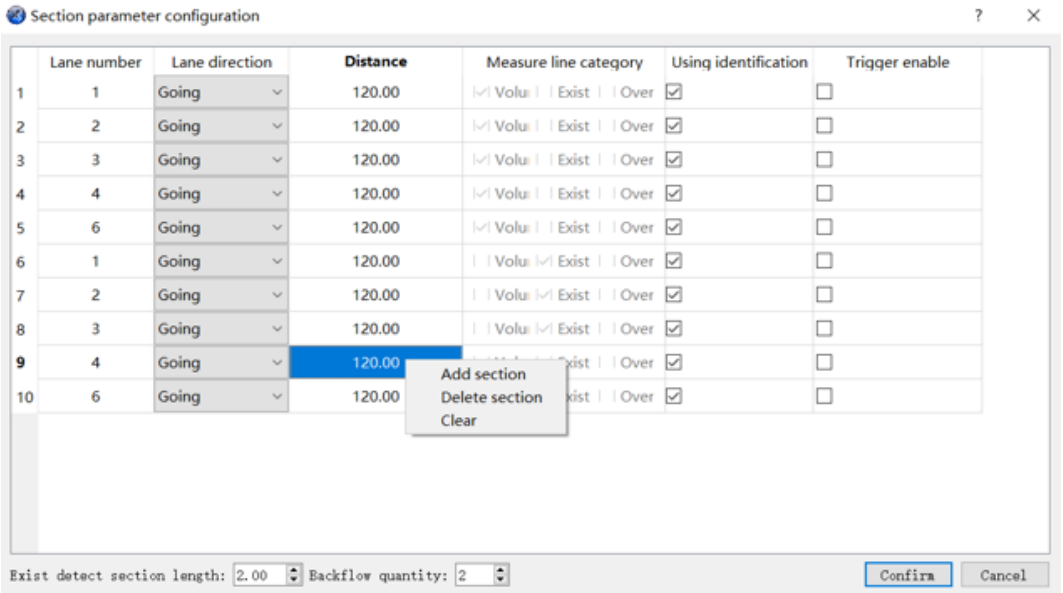
2) For creating measure lines manually, deselect "Use default", select "Show measure line", click "setting", the "Section parameter configuration" interface will

be displayed:



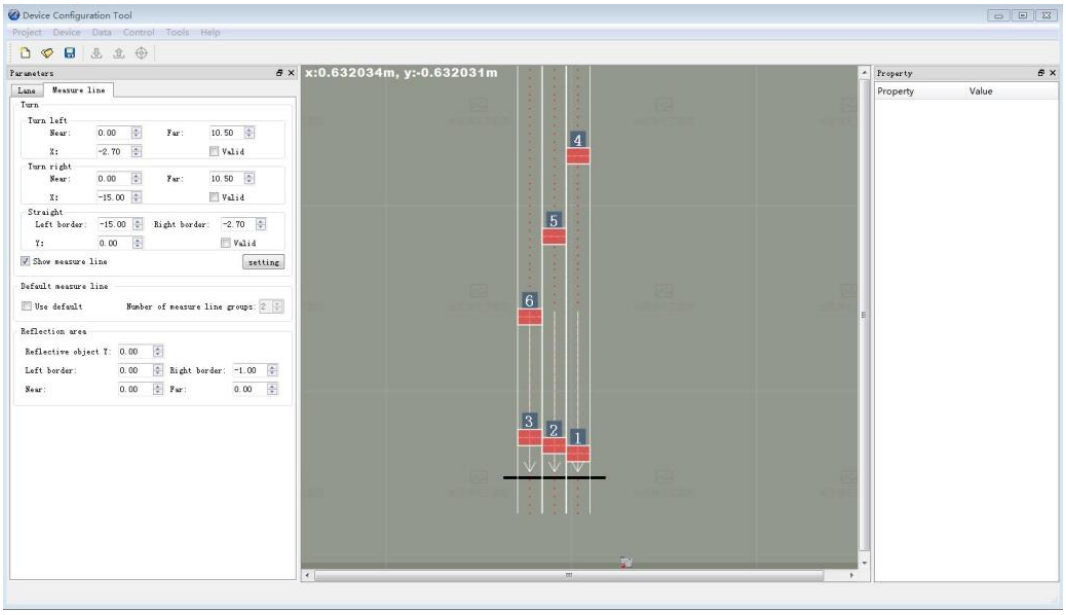


Left click to select measure lines, right click to add, delete or clear all measure lines, and left double click to modify parameters.



There are three types of measure lines: Volume of flow, Exist and Overflow. “Volume of flow,” is used to detect the traffic flow passing through the measure lines; “Exist” is use to detect the occupation of the vehicle on the virtual coil;

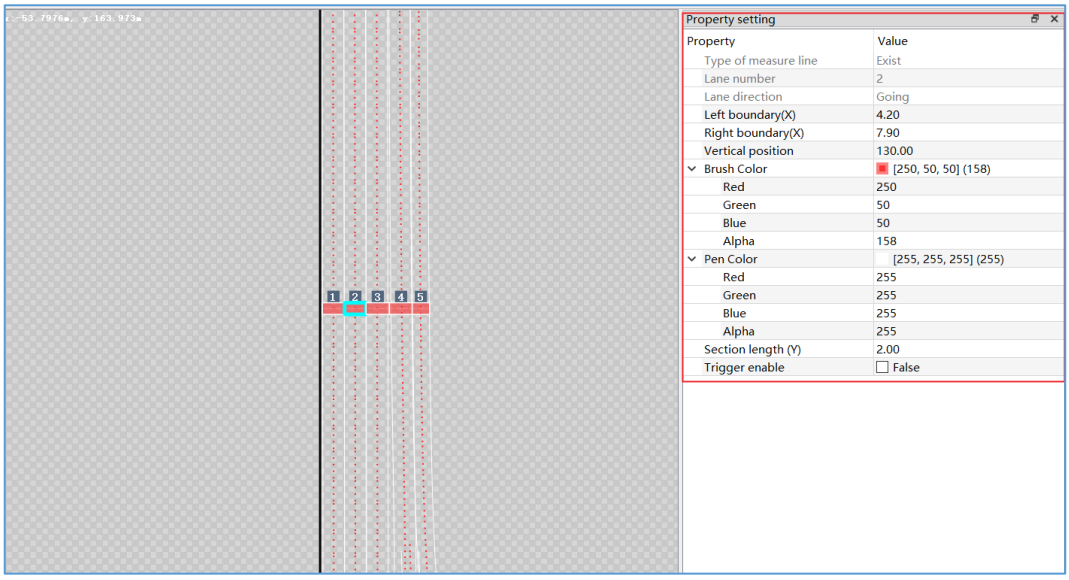
“Overflow” can only be used in the exit lane to detect reverse overflow. Generally, “Backflow quantity” under the interface is set to 3. Click “Confirm” after parameter setting, measure lines and virtual coils will be displayed in the main interface。



3) Measure line and virtual coil property editing

① Left click to select the measure line or virtual coil;

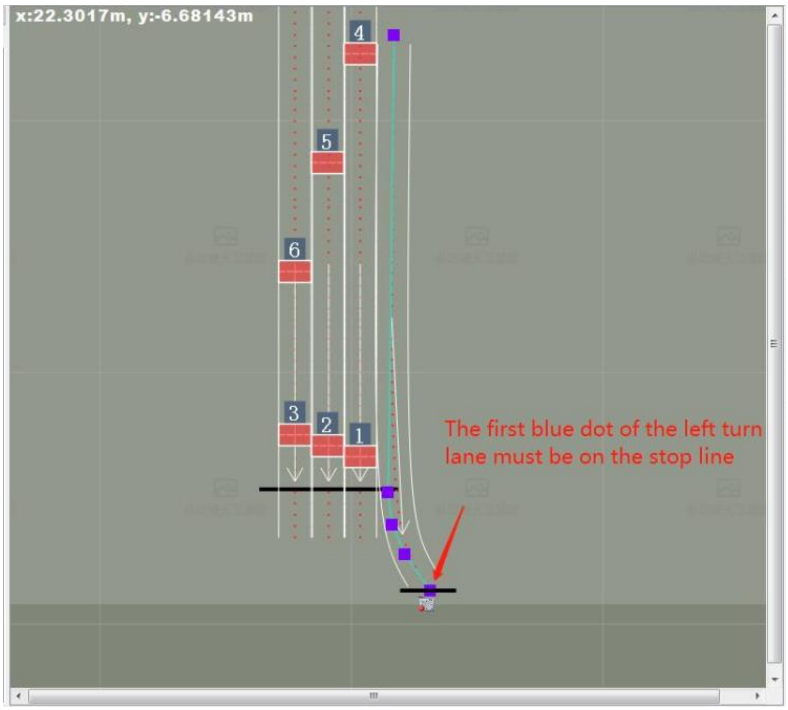
② In the property editing area on the right side of the interface, modify the parameters according to the actual situation;



4.2.4.7 Create left turn waiting area

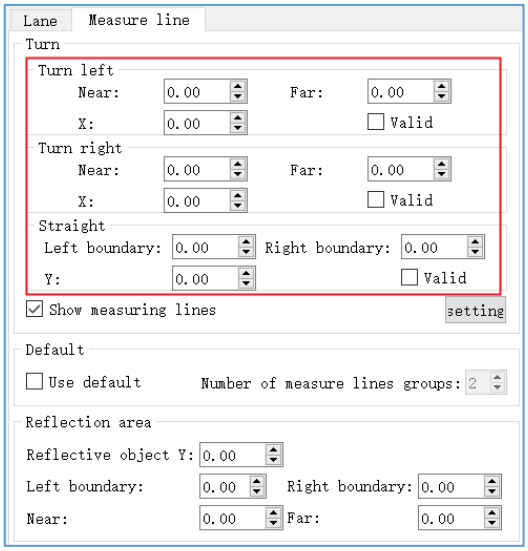
If there is a left turn waiting area at the intersection. A left turn stop line can be

set. The creation method is the same as that of ordinary stop lines. The first blue dot of the left turn lane must be on the stop line. The software will identify the range of the left turn area.



4.2.4.8 Other parameters setting

The parameters in the “Turn” option are used to detect which direction the vehicle leaves after passing through the stop line. When creating a parking line, the software will automatically generate these parameters, and user without special needs do not need to modify them.



The user needs to set or check some parameters in “Lane” interface.

“Traffic flow level”: Value 1-4, default 4, this parameter is used to adjust the accuracy of traffic flow detection;

“Dynamic queuing”: Value 0 or 1, default 1, this parameter is used to turn on or off dynamic queue detection;

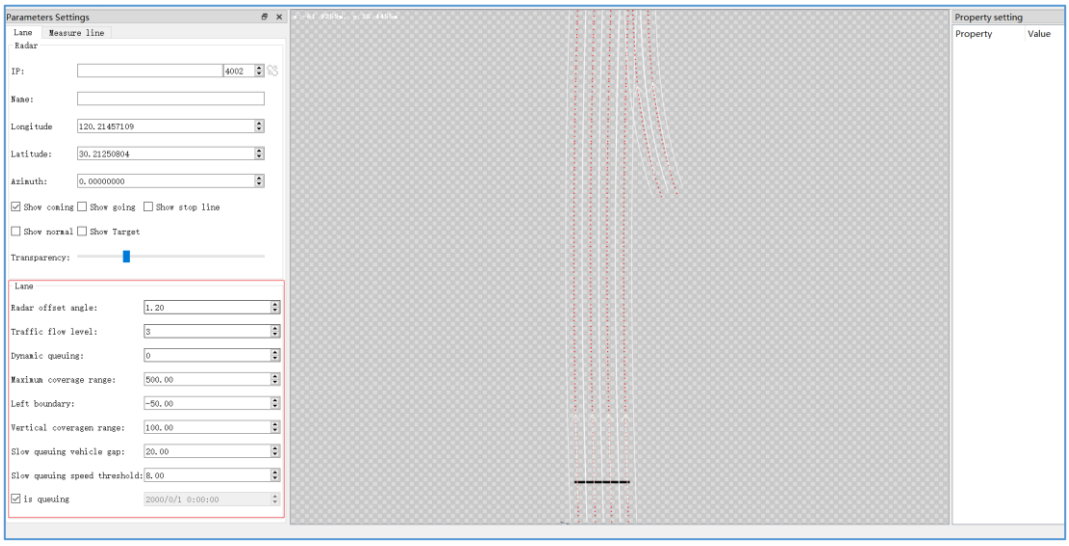
“Maximum coverage range”: Value 0-500, set according to the actual situation of the intersection. For example, if there is a strong reflection at 200m, resulting in a disordered track, the radial coverage range can be changed to 190m to avoid reflection.

“Left boundary”: Value -50-+50, default -50;

“Vertical coverage range”: Value 0-100, default 100;

“Left boundary” and “Vertical coverage range” determine the observation range of the radar in the X direction, these two parameters can be used to exclude area that do not need to be detected.

“Slow queue vehicle gap” and “Slow queueing speed threshold”: These two parameters are used for express way. They are used to set the detection threshold of slow queue, generally with the default values of 20 and 8.

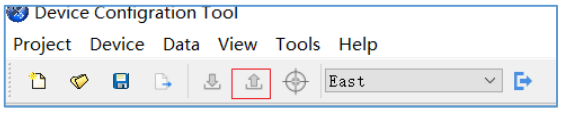


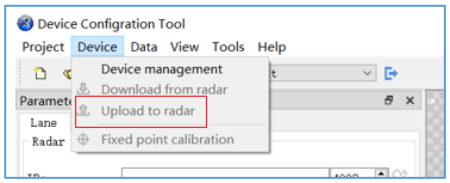
4.2.4.9 Upload parameters to radar and save project file

After all parameters are set, the lane configuration can be uploaded to radar. First check whether the radar IP is correct, then click the “Upload to radar” shortcut

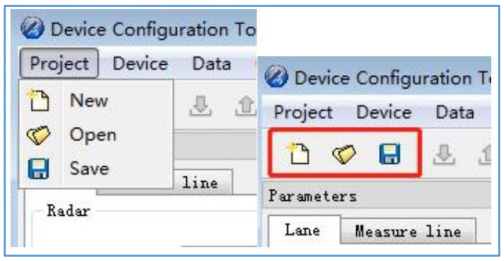
button, or click “Device”→“Upload to radar” in main interface, and the radar will restart.

Similarly, select the “Measure line” tab, confirm all settings are correct, then Upload parameters to radar.





All parameters set by the software can be saved as a project file for next use.

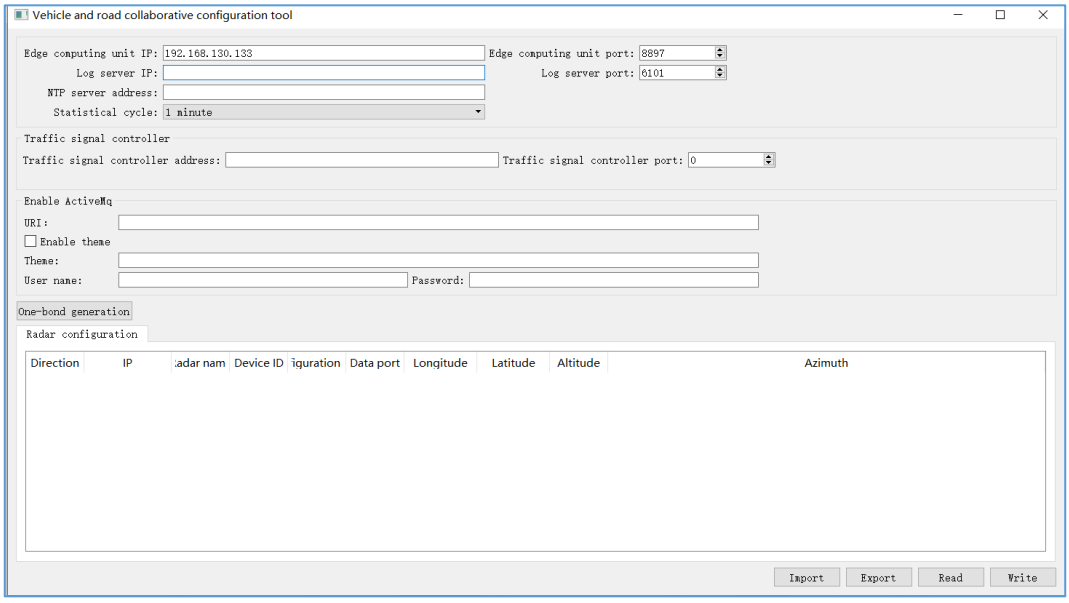


4.2.4.10 Data output settings

After setting all Lane parameters, the user can configurate the NTP server、Traffic signal controller server and ActiveMq address.

Edge computing unit IP is same as radar IP;

Edge computing unit port is 8897.



5. Intelligent vehicle detection system

After the lane parameters are successfully configured, the Intelligent vehicle detection system can display complete information such as vehicle status, traffic flow, average speed, headway, queue length, etc.

5.1 Adding Lanes

Open the intelligent vehicle detection system and click the Add Lane button in the bottom left corner.



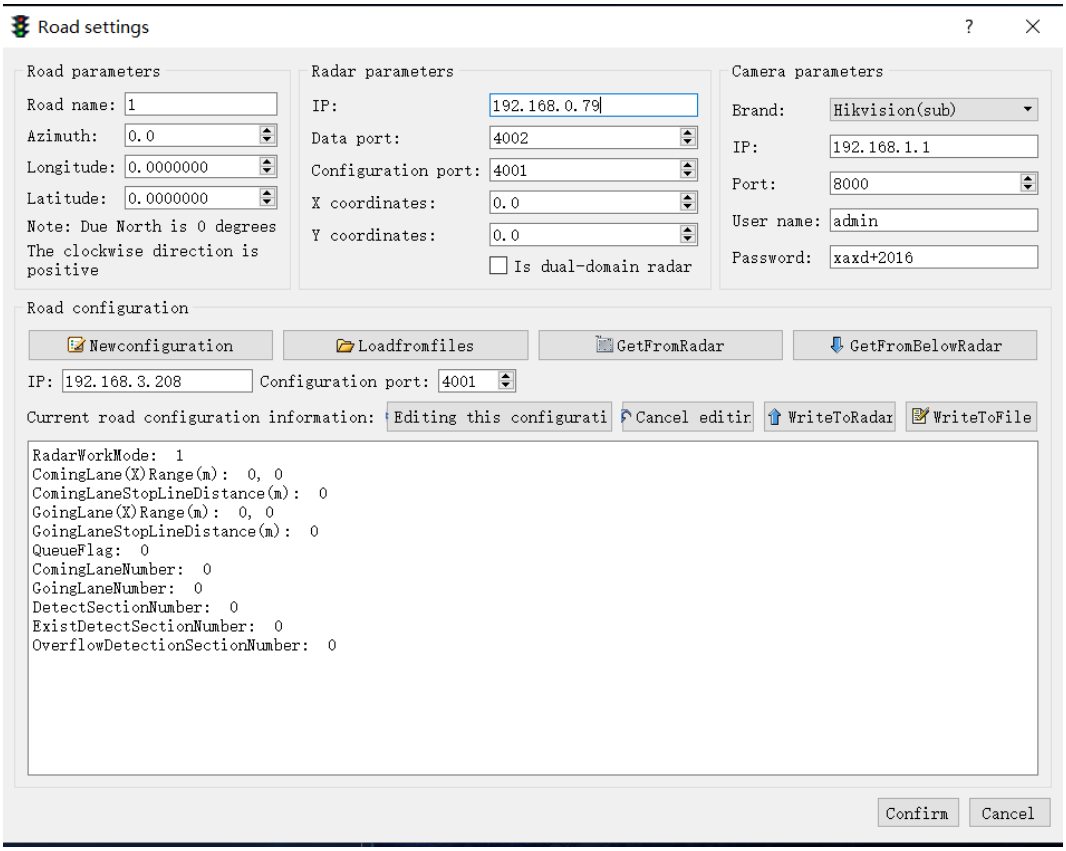
5.2 Editing Parameters

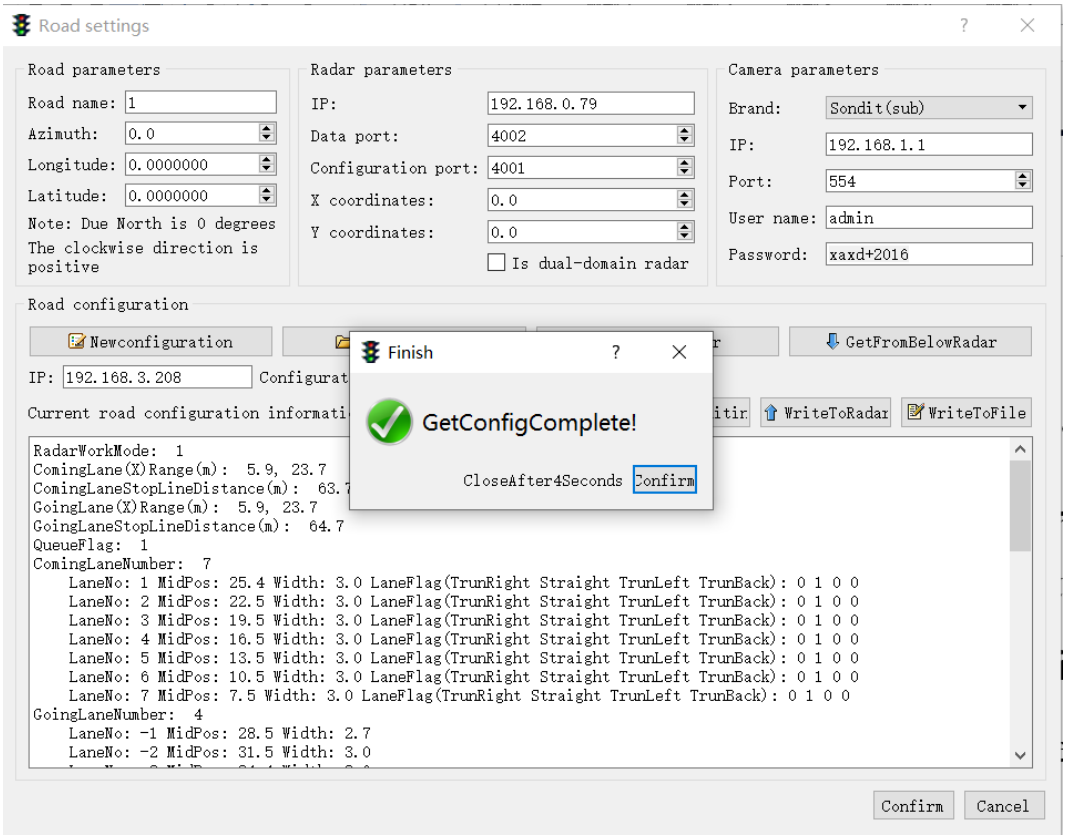
After opening the road editing interface, set the number of road orders and fill in the following information.

1.Road parameters

2.In the radar parameters, the "IP address", "data port number", and "configuration port number" can be checked according to Section 3.1 Arm Parameters - Online Devices - Command Port to find the corresponding command port of the radar. The configuration port is the command port, for example, 5001, and the data port is the command port +1, which would be 5002, and so on. After this, click the "Get

from Radar" button, and the lane information will be displayed. Then, click "OK".





5.3 Viewing Lanes

After successfully adding a lane, the lane will be displayed in the middle of the software. There is a "radar" button on the left side of the lane, with green indicating the device's open status and red indicating the device's closed status. Use the mouse to click on the icon to control the device's connection and disconnection; If you need to modify the lane parameters, click the [Edit] button on the right side of the lane.



6. Configuration and operational rules

6.1 Lane range

The observation range here refers to the observation start and end displayed in the right attribute bar after the lane is selected, which determines the observation range of the parking track, that is, if the track stops within the observation range, a parking point will be retained, and if the track stops outside the observation range, it will be deleted. Therefore, if an abnormal parking spot frequently occurs at a location (such as a vehicle turning around or crossing there), the observation range can be modified to exclude the abnormal parking spot.

6.2 Observation lane configuration

After the configuration is complete, observe the operating status of the radar to check whether the lane configuration is reasonable. Through the platform display software, after downloading the lane from the radar, it observes whether the vehicle is running in the lane, and whether the queue length of the vehicle is consistent with reality. For the use of the platform display software, see the relevant instruction manual.

7. Maintenance, repair and after sales

7.1 Maintenance instructions

There is no need for regular maintenance after radar installation. If you need to check whether there is a fault, please check:

1) Is the radar shell and mounting bracket secure?

2) Is the metal hoop firm?

3) Is the waterproof plug loose?

4) Is the DC voltage of the power adapter normal?

5) Are there any new shelters or adjacent new buildings in the detection area?

6) Is there any new equipment in the same frequency band in the detection area, and is there interference?

7) Does the radar horizontal angle and vertical depression angle maintain the original installation angle?

8) Use debugging control software and debugging program to check whether the output data is normal?

9) If you cannot confirm whether the radar is invalid or find any problems, please make detailed records.

The customer service will handle the follow-up technical support maintenance, return to the factory for maintenance or replace new products. Precautions: do not open the shell of the radar without authorization to attempt to repair or disassemble the radar. If the radar shell is opened without authorization, the warranty will be invalid.

7.2 Warranty and maintenance

The company guarantees that the product will be responsible for the quality assurance within two years from the delivery date, and the product will be replaced unconditionally in case of any problem. However, it does not include

faults caused by accidents, wrong maintenance, unauthorized modification or operation not in accordance with the instructions.

Opening the case cover, damaging the quality seal or tearing the device label without authorization will result in the invalidation of the warranty period. The company guarantees that the software and hardware can operate normally under the premise of correct installation, but it does not guarantee that they will not be disturbed or make mistakes under the extremely bad environment. The company carries out warranty or maintenance: the maintenance user pays one-way freight, and the company is responsible for repairing and returning the repaired equipment to the user.