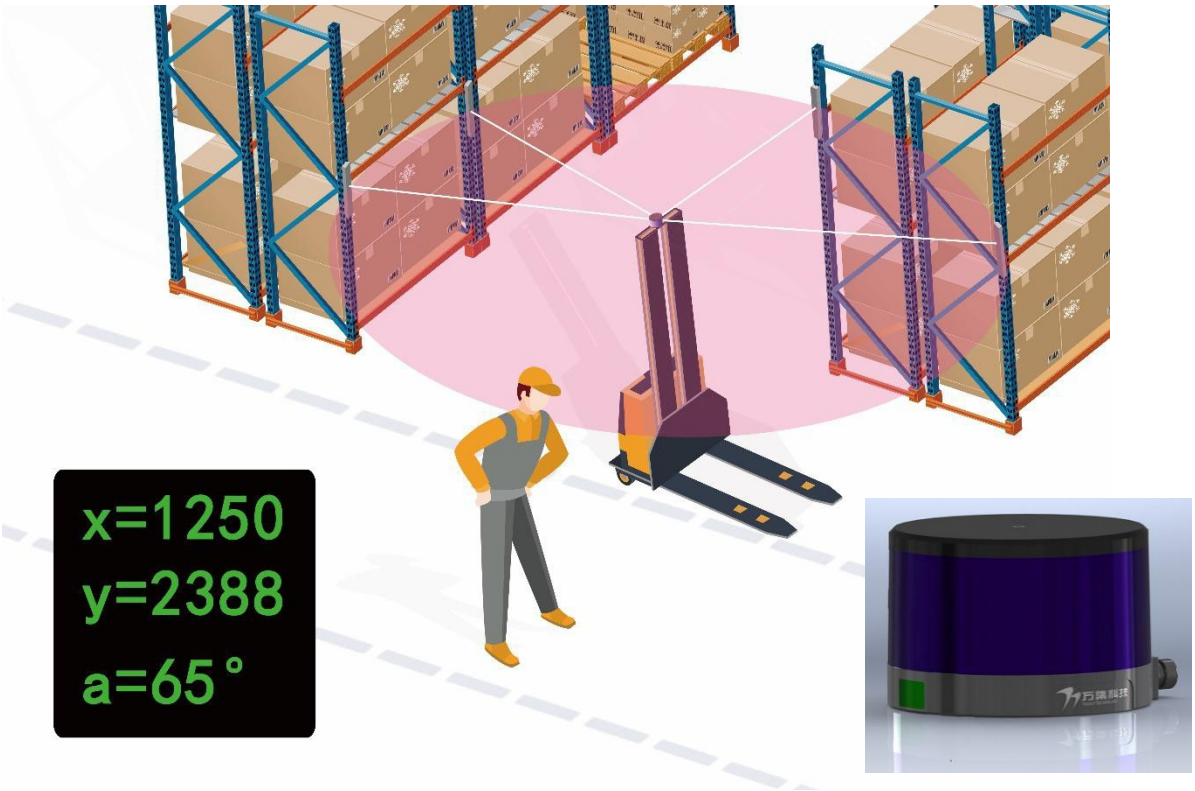


WLR-712 Laser Scanner
Product Manual V1. 3

VanJee Technology Co. , Ltd.

2022 February

1. Product introduction

WLR-712 is a navigation lidar independently developed by VanJee Technology Co., Ltd. It integrates the functions of ranging, navigation and positioning. The navigation lidar adopts the time-flight principle of laser, combined with high-frequency laser pulse generation technology, precise optical scanning system and stable navigation algorithm, so that it can achieve fast and accurate scanning and ranging within the range of 360°/50 meters (10% reflectivity diffuse reflection surface) , and can cooperate with the target to achieve accurate positioning within a range of 65 meters, suitable for AGV positioning, intelligent storage, autonomous driving, automatic ports, etc.

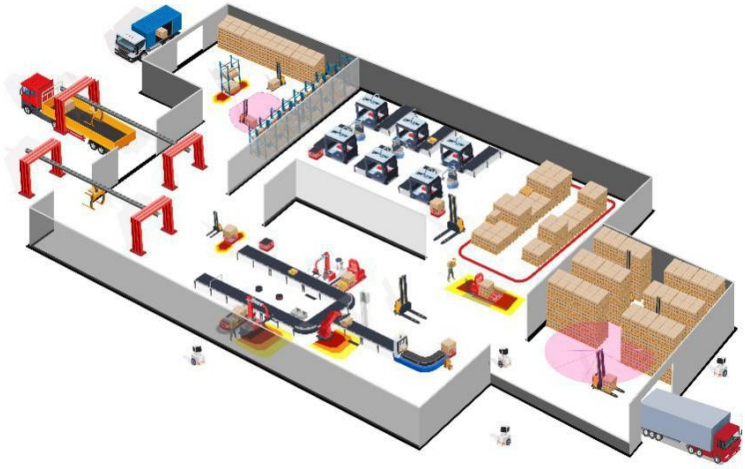


Figure 1.1 WLR-712 Application scene graph

1.1 Main Feature

- It adopts high-frequency laser pulse generation technology, precise optical scanning system, high-sensitivity receiving circuit, high-precision timing circuit, and stable positioning algorithm.
- 1 laser is used to ensure eye safety.
- The new parallel axis optical system can effectively resist the interference of dust and oil on the window mirror, and has a strong ability to resist the interference of ambient light.

- Using multi-pulse echo technology, it can filter out the interference of floating objects in the environment.
- Automatic heating, suitable for cold environment.
- IP67 protection grade.
- 360° scanning angle, 0.05°/0.1° resolution, 0.5~50m ranging range (10 % diffuse reflection surface) ±6cm error.
- Professional appearance and miniaturized, integrated structure design, stylish appearance.
- Suitable for different installation methods for easy vehicle integration.

1.2 Technical Specifications

Table 1.1 Technical Specification Sheet

VANJEE TECHNOLOGY

WLR-712

Parameters

Product Parameters 〉〉〉			
Model	WLR-712	Operating Temperature	-40°C (GB / T 2423.1-2008) ~ +70°C (GB / T 2423.2-2008)
Size	103mm X 103mm X 75mm		
Net Weight	0.8Kg	Storage Temperature	-40°C-80°C
Power Consumption	12W	Laser Wavelength	905nm
Operating Voltage	12~36V (>60W)		
Performance Parameters 〉〉〉			
Scanning Frequency	8Hz / 16Hz	Scan Angle	360°
Detection Distance	50m (10% diffuse reflectance)	Angular Resolution	0.05°/ 0.1°
Absolute Accuracy	Max: ±60mm (0.5m~50m @10% diffuse reflectance)	Interface Type	TCP (10-100M)、IO
Repeatability	Max:40mm	Positioning Error	±4mm (Related to Reflector Arrangement)
Relevant Certification 〉〉〉			
Protection Class	IP67	Electromagnetic Compatibility	EN 61000-6-1:2007; EN 61000-6-2:2005 / AC; EN 61000-6-3:2007+A1:2011; EN 61000-6-4:2007+A1:2011; EN 50293-2012
Security Level	Class I (eye safety)EN 60825-1:2014		
Resistance to mechanical loads	Passenger car regulations GB / T28046.3-2011		

Table 1.1 Technical Specification Sheet

1.3 Installation Size

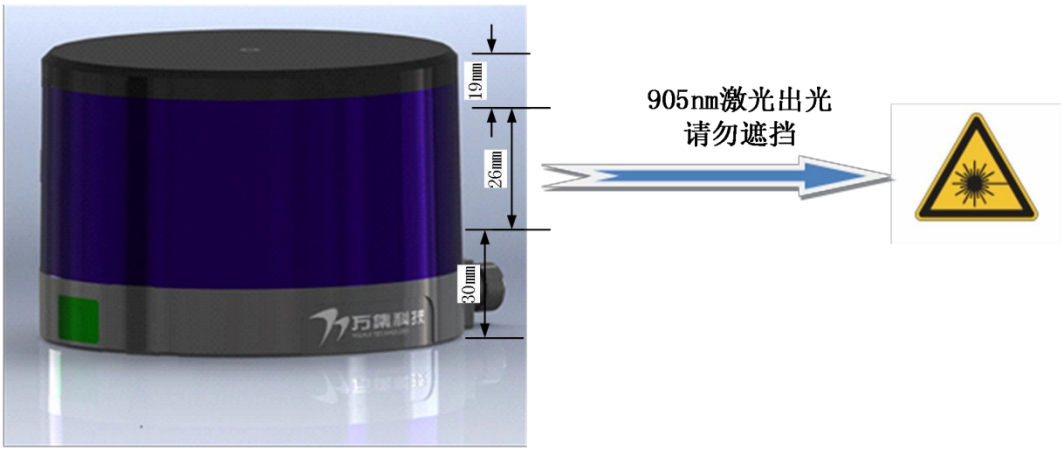


Figure 1.2 WLR-712 Lighting position map

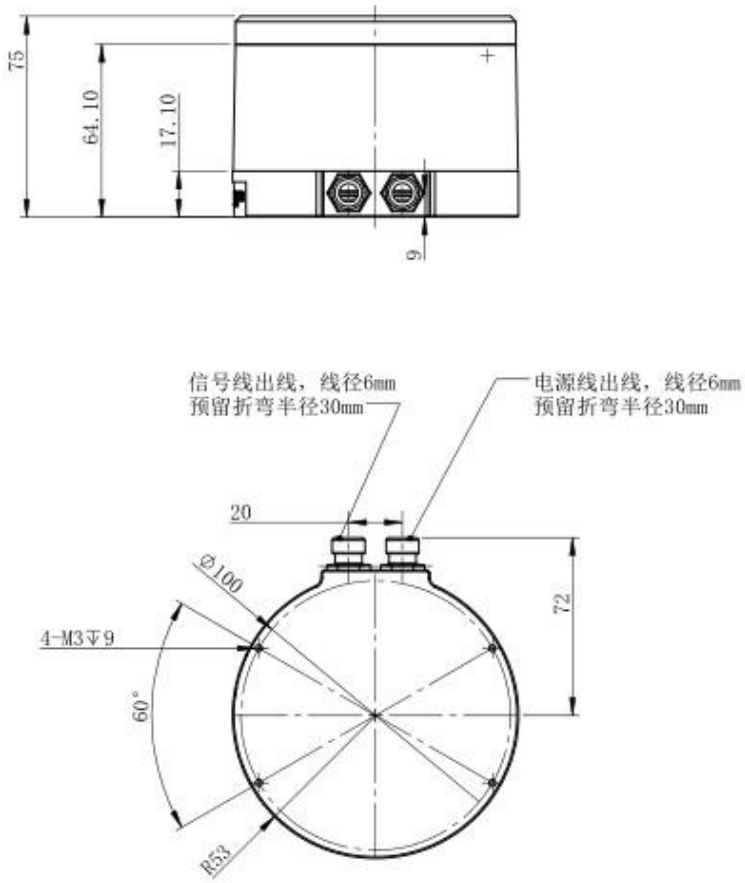


Figure 1.3 WLR-712 Dimensions

1.4 Interface Definition

Table 1.2 Interface definition

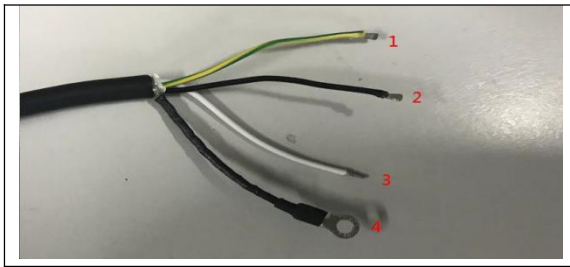
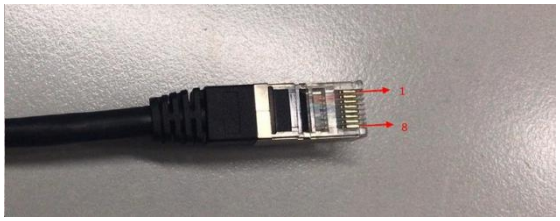
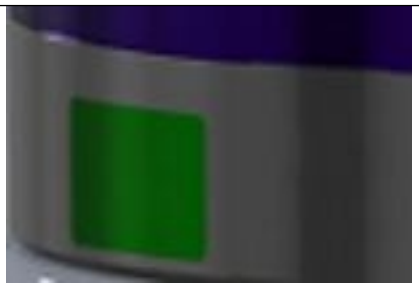
	1. Yellow-green: Power + 2. Black: Power- 3. White: sync signal 4. Black with grounding ring: shield
	1 TX+ 2 TX- 3 RX+ 4 232RX 5 232TX 6 RX- 7 GND 8 NC
	Red flashing: device power-on self-test Green: device working normally Yellow: The equipment is working abnormally, contact the after-sales service

Table 1.2 Interface Definition

1.5 Coordinate System

The outward direction of the middle position of the laser power cable and the network cable is the positive direction of the X-axis, and the direction of 90° counterclockwise rotation is the positive direction of the Y-axis.

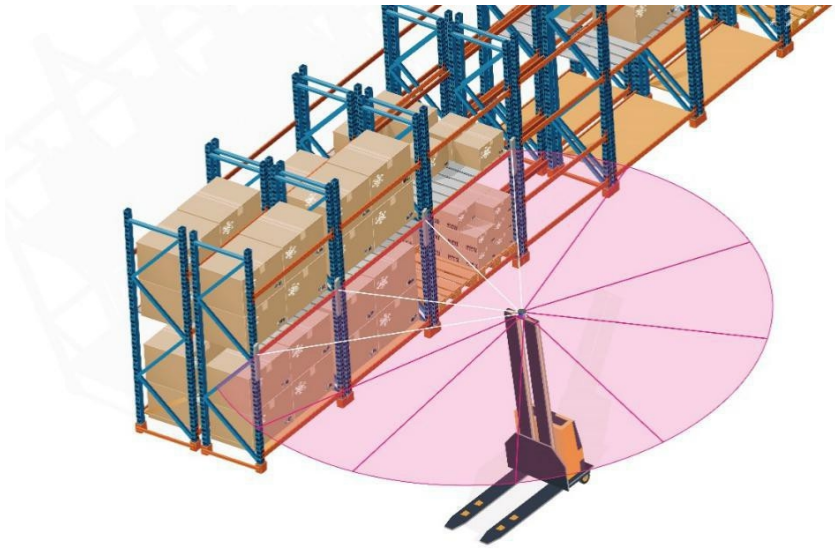
Using the distance data output by the WLR-712 , the scanned point number and the angular resolution information corresponding to the selected high speed and low speed , a relative coordinate system with the radar center as the coordinate origin can be established.

$$x = d * \cos(N * \partial)$$

$$y = d * \sin(N * \partial)$$

∂ is 0.05 ° in 8Hz mode and ∂ is 0.1 ° in 16Hz mode .

2. Working Mode



WLR-712 uses the principle of high frequency pulse laser ranging, and measures the distance, angle and reflectivity of the surrounding measured objects by scanning. Through configuration, the WLR-712 can work in 4 modes, distance detection mode, target detection mode, target acquisition mode, and navigation mode. High speed (16Hz , 0.1 °) and low speed (8Hz , 0.05 °) two working states.

2.1 Distance Detection Mode

In ranging mode, the maximum distance of a reflective surface with a reflectivity of not less than 10% is 50m , and the maximum distance of the detectable target is 65m;

In distance detection mode, the WLR-712 only outputs the point cloud data of the surrounding environment distance.

Under the working state of 8Hz/0.05 °, it outputs 7200 points of ranging data per scan (every 360 ° scan cycle) , and under the working state of 16Hz/0.1° , it outputs 3,600 points per scan (every 360 ° scan cycle). The maximum measurement distance on a 10% diffuse surface is 0.5m to 50m. Note: The software diagrams in this manual all have the "ruler" function turned on, which is turned off by default. This function can be used to easily view the distance information in the map. You can click the "ruler" button on the interface to turn it on / off. For the operation method of distance detection mode, please refer to Section 5.3 Mode Configuration.

Figure 2.2 WLR-712 point cloud

2.2 Target Detection Mode

In target detection mode, WLR-712 outputs the surrounding environment distance point cloud data, reflection intensity and target coordinate data. WLR-712 takes its own center point as the coordinate origin, the laser line head direction is the positive direction of the X - axis, and rotates 90° counterclockwise in the positive direction of the X- axis to establish a Cartesian coordinate system as the positive direction of the Y- axis, as shown in Figure2.3.

Picture2.3 WLR-712 Schematic diagram of target detection

For the operation method of target detection mode, please refer to Section 5.3 Mode Configuration.

2.3 Target Acquisition Mode

The target acquisition mode is used to establish the global coordinate system, and the subdivision has two working modes: normal mode and add mode.

Normal mode is to establish the zero point of the global coordinate system and add target information to initialize the coordinate system;

To add new target information without changing the global coordinate zero point. When it is used for a larger map, all target information cannot be obtained at one time in normal mode.

For method of the target acquisition mode , please refer to Section 5.4 to create a target map.

2.4 Navigation Mode

In navigation mode, WLR-712 uses target coordinates to locate its center position, and can continuously obtain its own position coordinates when WLR-712 moves. WLR-712 needs at least 3 targets to locate its position , and outputs its own global coordinates x, y and azimuth α, where x, y are the coordinates of the radar relative to the zero point of the global coordinate system , and azimuth α is WLR-712 The angle between the direction and the X axis of the global coordinate system .

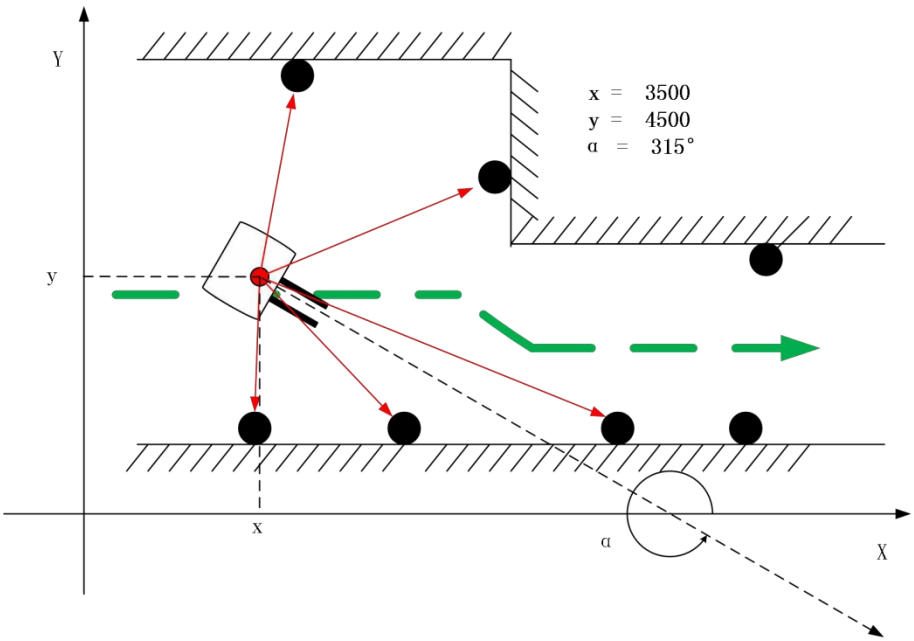


Figure 2.4 WLR-712 Navigation mode working diagram

For operation method of navigation mode please refer to 5.5.

3. Environmental Layout

3.1 Target size and shape

WLR-712 supports circular targets and flat targets. The height of the target is required to be greater than 80cm, and the scanning plane of the radar should be in the center of the target. According to the predetermined WLR-712 trajectory, the target diameter (width) meets the following conditions:

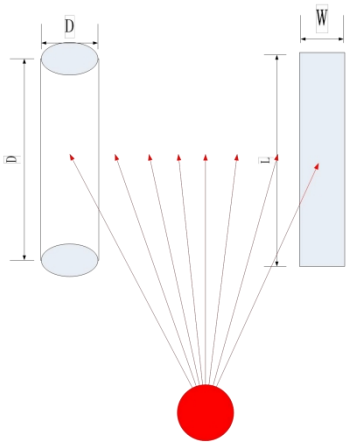


Figure 3.1 Circular target and flat target

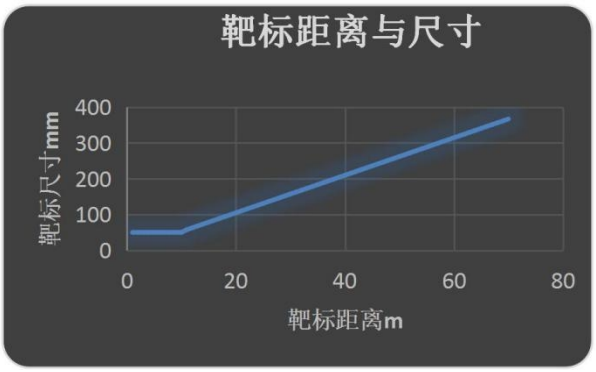


Figure 3.2 Relationship between target distance and size

3.2 Target placement requirements

The targets are required to be distributed on both sides of the driving path and must not be arranged at equal intervals, as shown in Figure 3.3.

3 targets need to be detected in the whole travel path , and the angle between the laser and the two targets is greater than 3° , as shown in Figure 3.4 . There should be no objects similar to the target or high reflectivity within the r range around the target. where r and the distance from the target to the laser satisfy the conditions shown in Figure 3.5 .

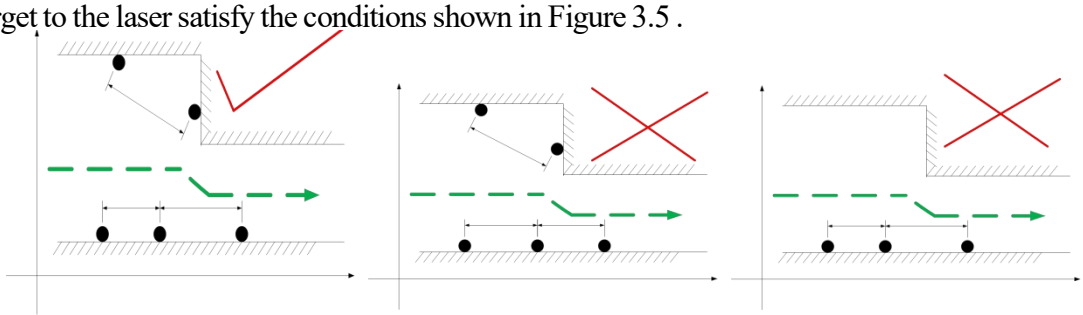


Figure 3.3 Schematic diagram of target arrangement

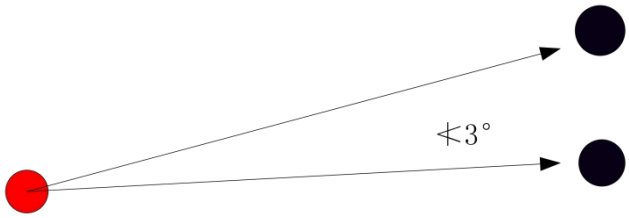


Figure 3.4 Schematic diagram of the angle between the two targets and the laser

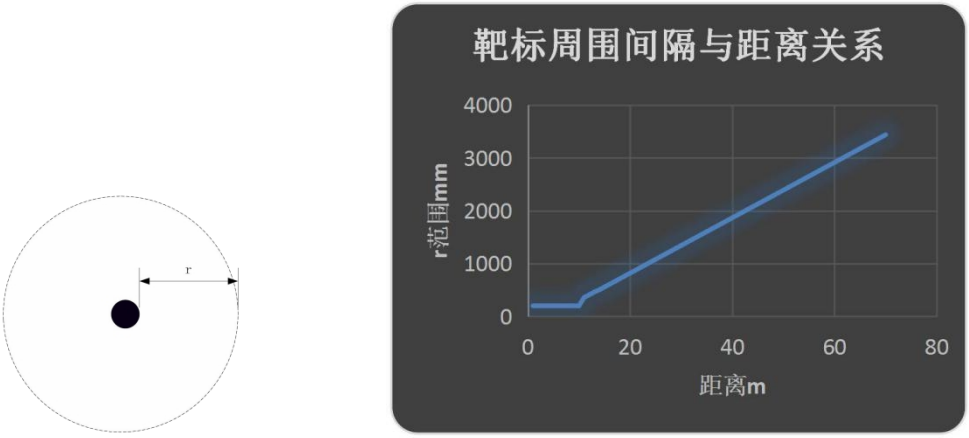


Figure 3.5 The relationship between the distance between the two targets and the distance to the laser

3.3 Recommended target placement conditions

To obtain higher positioning accuracy for WLR-712 , it is necessary to ensure that more than 5 targets that meet the conditions of 3.2 can be obtained within a range of 3 meters to 15 meters from the radar.

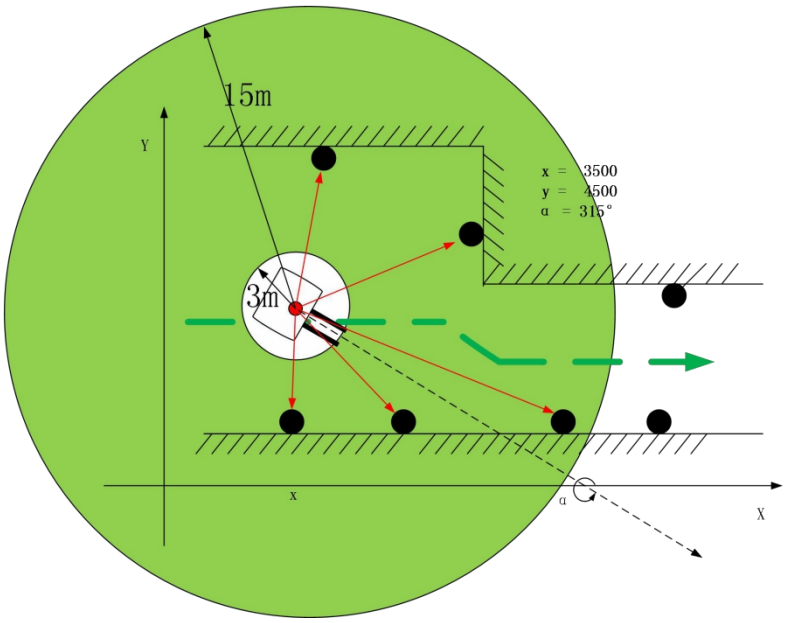


Figure 3.6 Schematic diagram of recommended target placement conditions

4. Configure WLR-712

4.1 Initialize WLR-712

Initialize the WLR-712 according to steps 1 , 2 , 3 , 4 , and 5 in Figure 4.1 to quickly arrange the environment and achieve positioning. When the coordinates of the target in the environment do not change, only 1 and 5 steps are required for each power-on.

When the coordinates of the target in the environment are known, the WLR-712 can configure the target in the environment through the configuration software. The label information is downloaded to the WLR-712 internal storage device. The coordinates of the target in the environment can be obtained through precise measurement equipment such as a total station . Similarly, when the target is set, the absolute position and attitude information of the radar can be obtained only through steps 1 and 5 each time it is powered on.

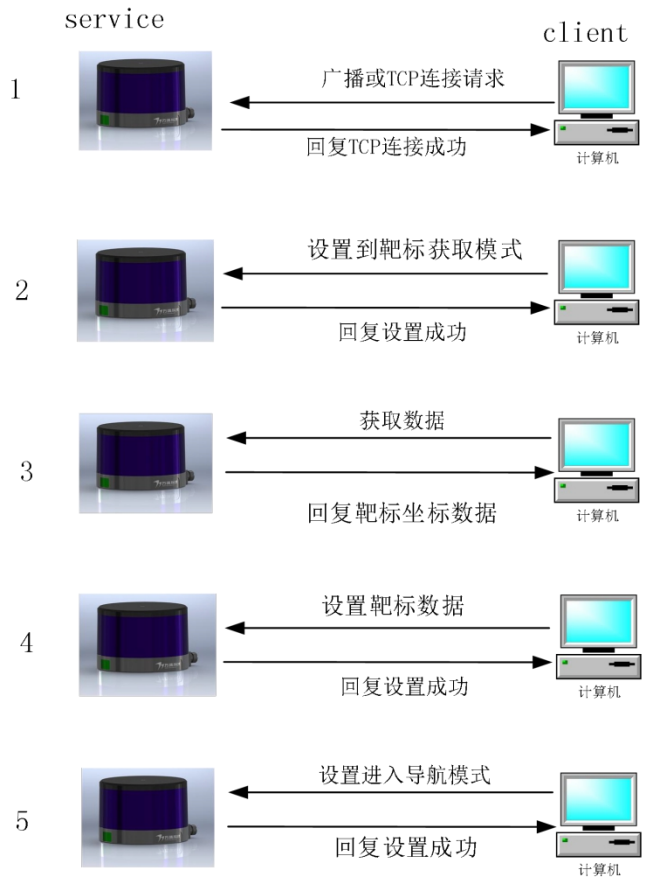


Figure 4.1 Get the data interaction diagram

4.2 Sync and Timestamp

WLR-712 supports 3 synchronization modes: IO, cycle trigger, and instruction trigger. After setting the synchronization mode, the time synchronization between the upper computer and the lower computer is completed by obtaining the timestamp command.

Time difference = (host computer time - 712 time) - transmission delay

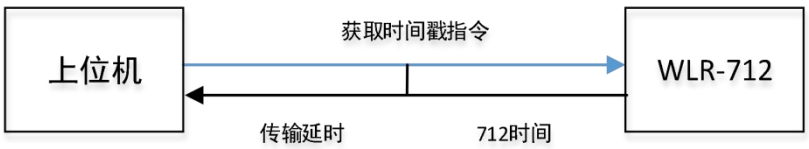


Figure 4.2 Synchronization and Timestamp

4.3 Positioning Timing

Data processing cycle of WLR-712 is 125ms. When positioning data needs to be obtained, the time interval for sending the command to obtain positioning data to the radar is generally set to be no less than 150ms.

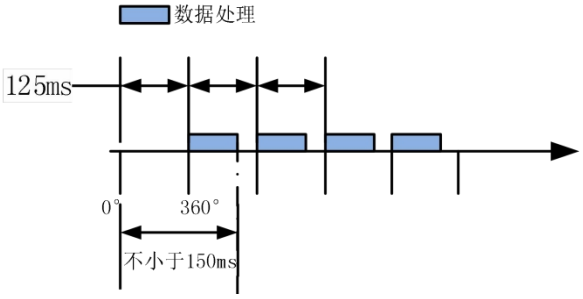


Figure 4.3 Positioning data timing

5. WLR-712 Configuration User Guide

WLR-712 configuration software is a configuration system independently developed by VanJee Technology. The information can be queried through the configuration software is as following: WLR-712 working status, setting target, displaying target information, monitoring WLR-712 positioning status, etc.

5.1 Connect WLR-712 and log in

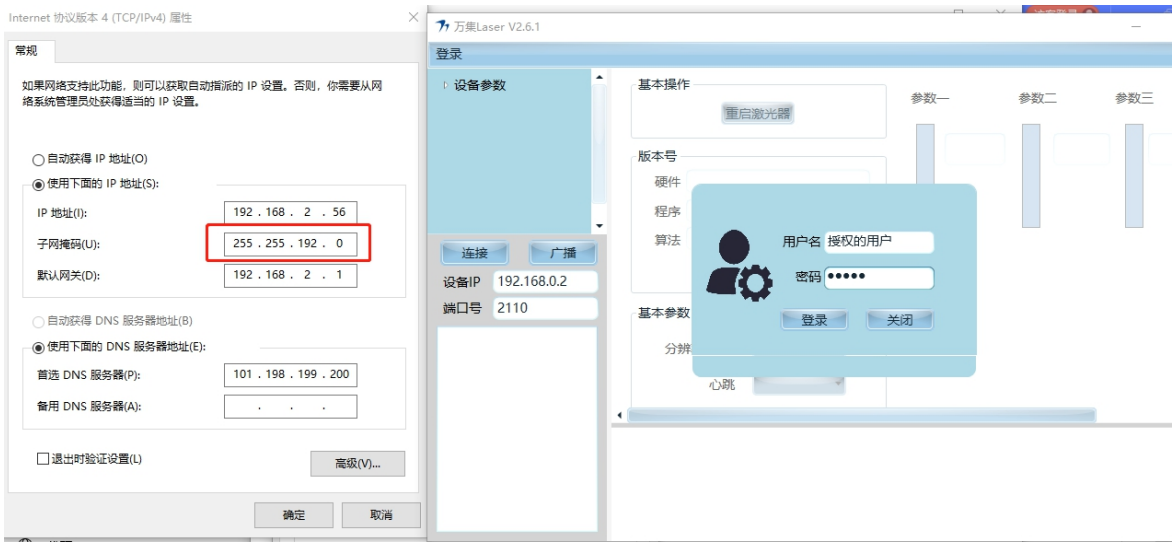


Figure 5.1 WLR-712 Software login diagram

1. Modify the local IP address to manual IP and the same network segment as WLR-712 or configure the subnet mask as 255.255.192.0, if the virtual machine software is installed, you need to exit the virtual machine and disable the virtual machine network.
2. Click to run WLR-712- V2.6.1.exe and subsequent updated versions, click broadcast, the IP address will jump to the actual IP of WLR-712 , click the connect button to connect the laser network.
3. Click "Login" in the upper left corner of the software, in the pop-up dialog box, the user name is "authorized user" and the password is "wanji", click the login in the dialog box.

5.2 Query parameters and configuration

Under the basic parameters, as shown in Figure 5.2, you can click "Query" in "Version Number" to query the program version currently used by WLR-712 . The basic parameter description is shown in Table 5.1.

Figure 5.2 WLR-712 Schematic diagram of basic parameters

Figure 5.3 is a schematic diagram of the factory parameters of WLR-712 , and the description of the factory parameters is shown in Table 5.1 .

Figure 5.3 WLR-712 Factory parameter diagram

Figure 5.4 is a schematic diagram of the functional parameters of WLR-712 , and the description of the functional parameters is shown in Table 5.1.

Figure 5.4 WLR-712 Schematic diagram of functional parameters

Click on the device parameters to have three pages: basic parameters, factory parameters, and functional parameters. The corresponding parameter information is as follows:

Parameter Type	Classification	Name	Description
Basic parameters (see Fig. 5.2)	Basic operation	Restart the laser	WLR-712 software reset
	version number	hardware	WLR-712 hardware version number (see Figure 5.2)
		program	WLR-712 internal program version number (see Figure 5.2)
		algorithm	WLR-712 internal algorithm version number (see Figure 5.2)
	Basic parameters	resolution	Configure the WLR-712 to work at 8Hz or 16Hz
		heartbeat	Configure WLR-712 to enable/disable sending heartbeat packets
Factory parameters (see Fig. 5.3)	Network parameters	MAC	WLR-712 Ethernet MAC Address
		IP	WLR-712IP address, the configuration can be modified
		local port	Corresponding network port number, which can be configured and modified
		subnet mask	Corresponding radar subnet mask
		gateway	Corresponding to the radar gateway, it needs to be in the same network segment as the IP address
	Factory reset	factory reset	All configuration parameters are restored to the factory state

Function parameter (see Fig. 5.4)	Target recognition threshold	point threshold	The ratio of the measurement points on the target, the default is 100%
		reflectivity threshold	Adjust the target reflectivity, the default is 100% , when the target If the reflectivity is low, the value can be lowered when it cannot be recognized.
	Special positioning function	Two target localization states	Default is off, enabling and disabling the function of positioning using two targets , when the last positioning value is valid for positioning (with 3 targets were identified) If only 2 targets were identified this time A target can still be effectively positioned after this function is turned on. The accuracy of the positioning value is poor. If it is turned off, it will be recognized. Cannot be positioned when there are less than 3 reflectors
	Target matching range	match radius	The fuzzy radius of target matching reflects the allowable deviation between the scanning target and the map target. The larger the value, the larger the deviation between the scan target and the map target is allowed. When the maximum value is equal to the minimum value, it has nothing to do with the target distance; when the maximum value and minimum value are not equal, the WLR-712 internally depends on the target distance Calculate the matching radius. The farther the target is, the larger the radius.
		Detection distance	temporarily useless
	target scanning range	Scan radius	Configure the target detection range of the WLR-712

Figure 5.1 Equipment parameter table

5.3 Mode configuration

Click Distance Detection → Get Continuous Waveform. At this time, WLR-712 enters distance detection mode, and the output data is the distance data of the surrounding environment.

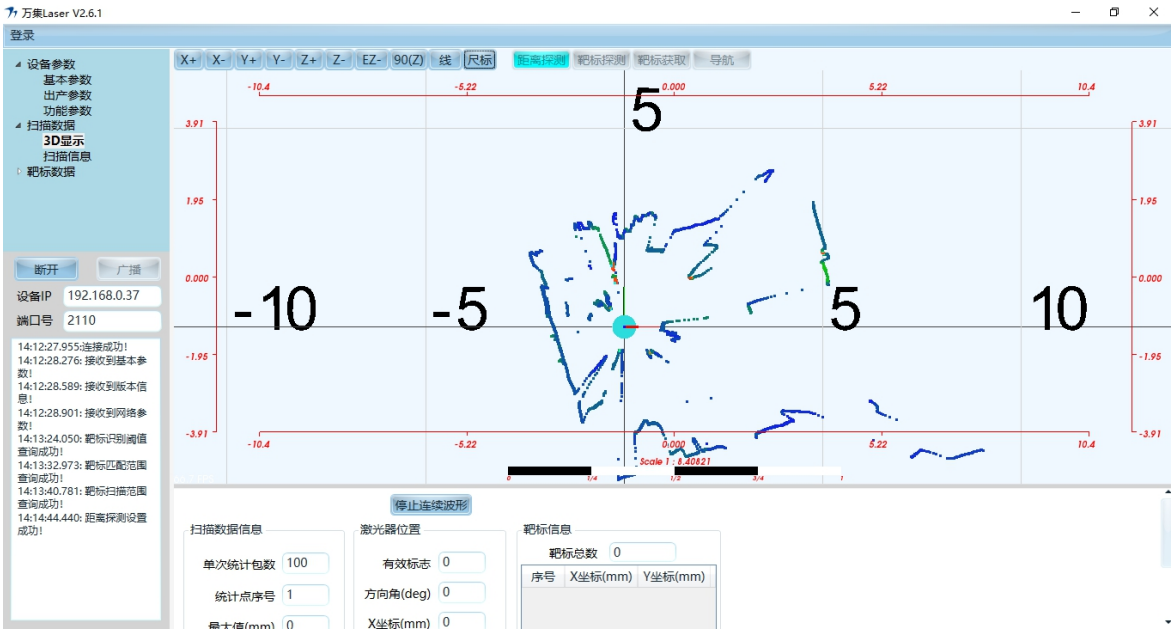


Figure 5.5 WLR-712 Schematic diagram of distance detection mode

Click target detection → configure target shape and size → click OK → acquire continuous waveform, at this time

WLR-712 Enter the target detection mode, the data includes the distance data, angle value , reflection intensity value and target coordinates of the surrounding environment. In the target information display column, the currently detected target number and relative coordinate information are displayed. The target is displayed as a green circle. Click the target in the target information column with the left mouse button , and the corresponding target in the drawing column is displayed in red.

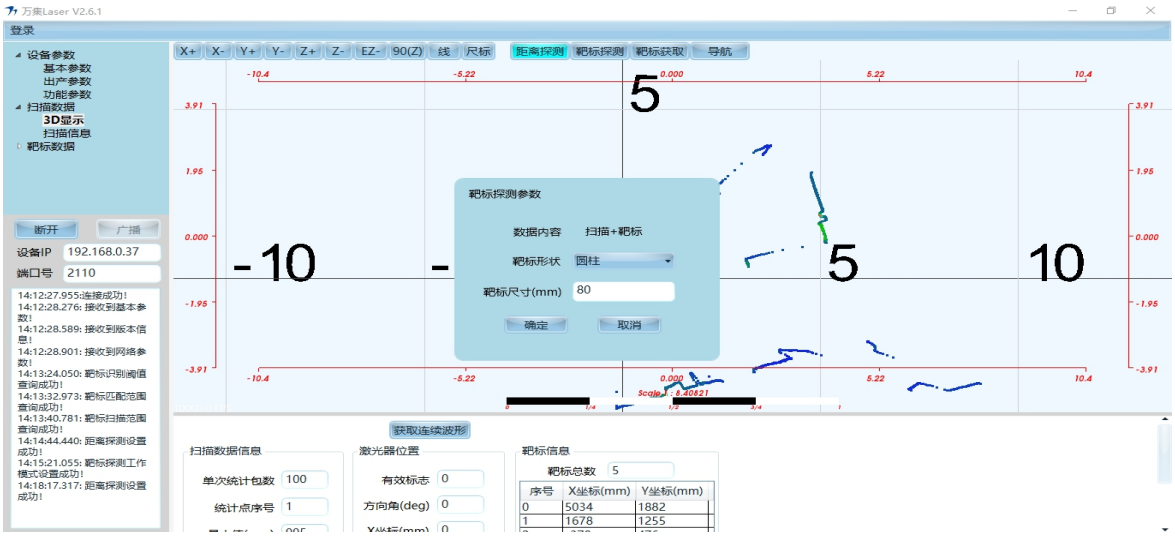


Figure 5.6 WLR-712 Schematic diagram of target detection mode

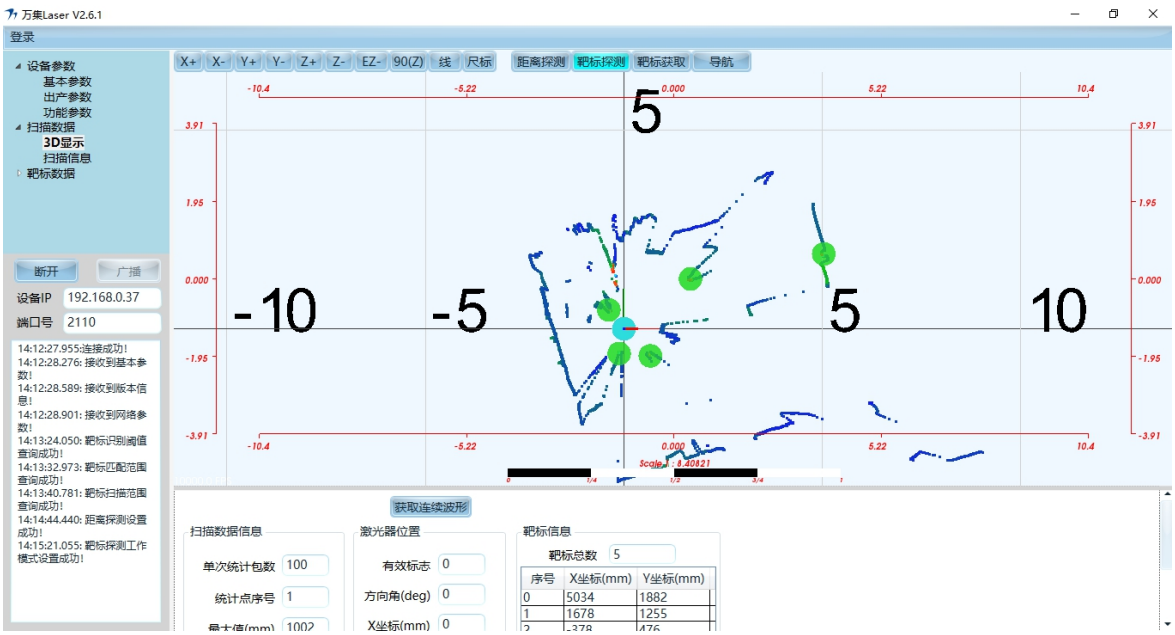


Figure 5.7 WLR-712 Schematic diagram of target detection mode

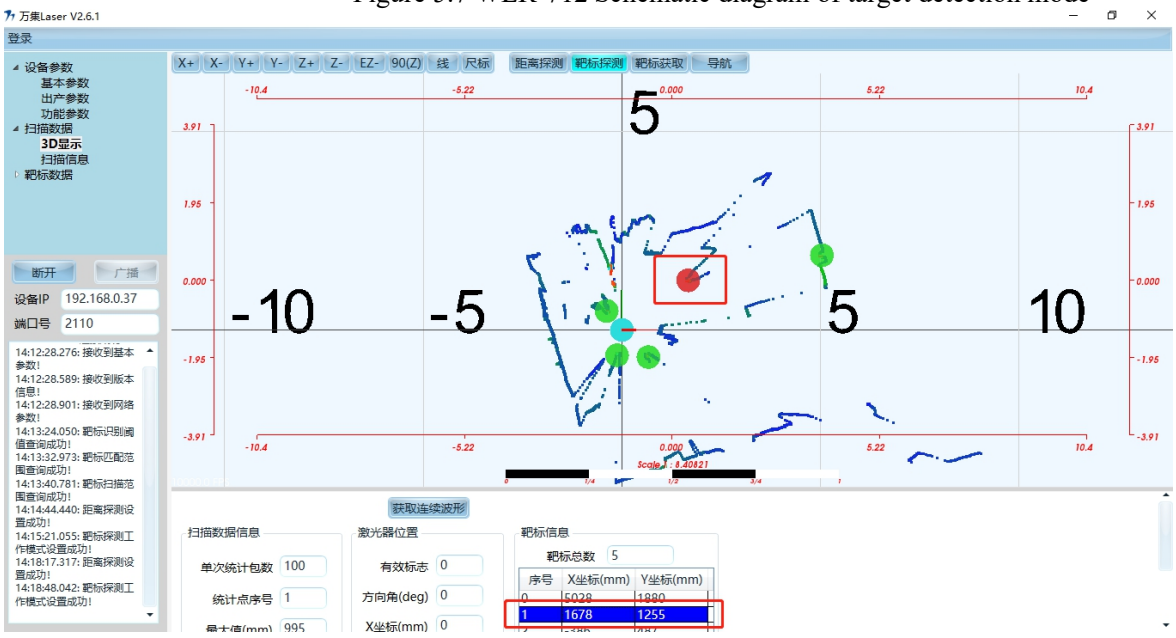


Figure 5.8 WLR-712 Schematic diagram of target detection mode

5.4 Build a target map

Figure 5.9 WLR-712 Schematic diagram of target acquisition mode

Figure 5.9 is a schematic diagram of the WLR-712 target acquisition mode, click the target acquisition → select normal mode / add mode (Note: due to the large map in actual use, only the normal mode is used for the first time, and the second time is based on the first time. After moving the WLR-712 lidar, use the add mode, and then use the add mode in turn until the map is built. After each target acquisition is completed, you need to use the "setting information" button to configure the built map to W L R - 712) , the detection target map configuration dialog box, the relevant parameters are shown in the following table:

Mode	Normal mode: The current radar position is the coordinate origin to establish environmental coordinates Add mode: The coordinate origin of the historical radar target map is the coordinate origin, and the new target is added to the original coordinate system
Current layer ID	Used to divide the target map in the environment into multiple areas, or to divide targets located in different environments The target is established under the same map, such as the target between two different floors
Current heading angle	Specifies the current bearing of the WLR-712 (Normal mode: specifies the radar azimuth; Additive mode: This value is used when WLR-712 cannot locate)

Current X coordinate	Specify the current X-coordinate value of the WLR-712 (Normal mode: specify radar position; Add mode: This value is used when WLR-712 cannot locate)
Current Y coordinate	Specify the current Y coordinate value of the WLR-712 (normal mode: specify the radar position; add mode: This value is used when WLR-712 cannot locate)
Target shape	Set the shape of the target in the current environment
Target size	Set the size information of the target in the current environment

Figure 5.2 Target acquisition parameter table

Click OK, WLR-712 starts to automatically calculate the target coordinate information of the current environment, and the calculation is completed.

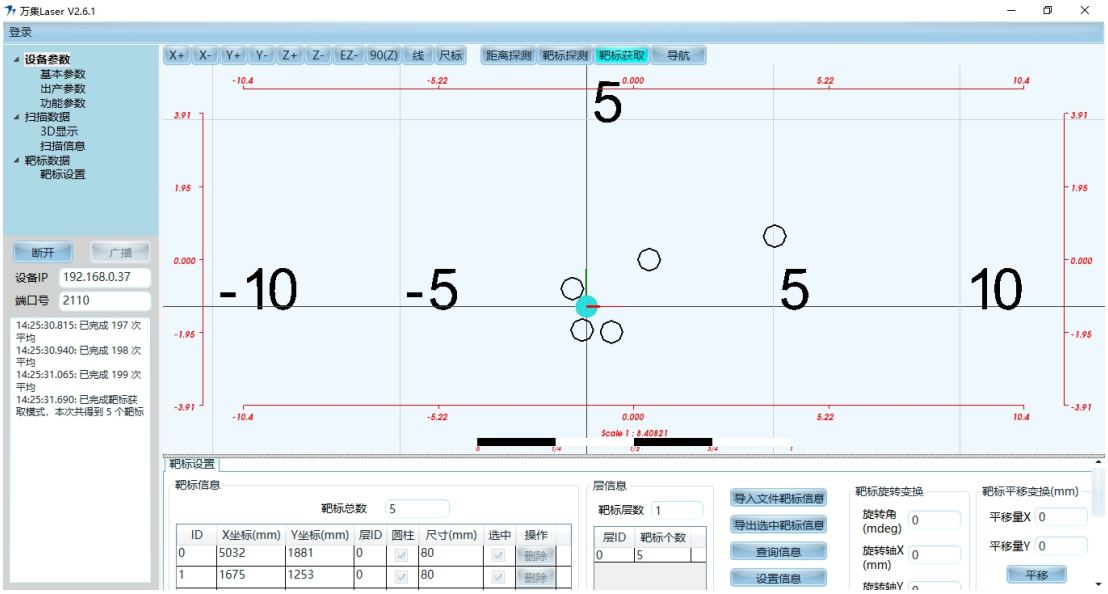


Figure 5.10 WLR-712 Schematic diagram of target acquisition mode

Figure 5.10 , the target information bar displays the number of targets currently obtained and the corresponding target information. The waveform display interface displays the target map. In the target information display column, the target can be deleted and the size, layer and coordinate information of a certain target can be modified.

How to quickly select a target: You can right-click on the target map display interface to select the corresponding target (The black cylinder turns red to be selected) , and at the same time, the information bar below jumps to the selected target information, and the information bar is filled with blue; you can also select the corresponding target with the left mouse button in the target information bar (after selection, the target information The target in the column will be filled with blue) , and the black cylinder of the target selected above will be displayed as a red cylinder. As shown in Figure 5.11 .

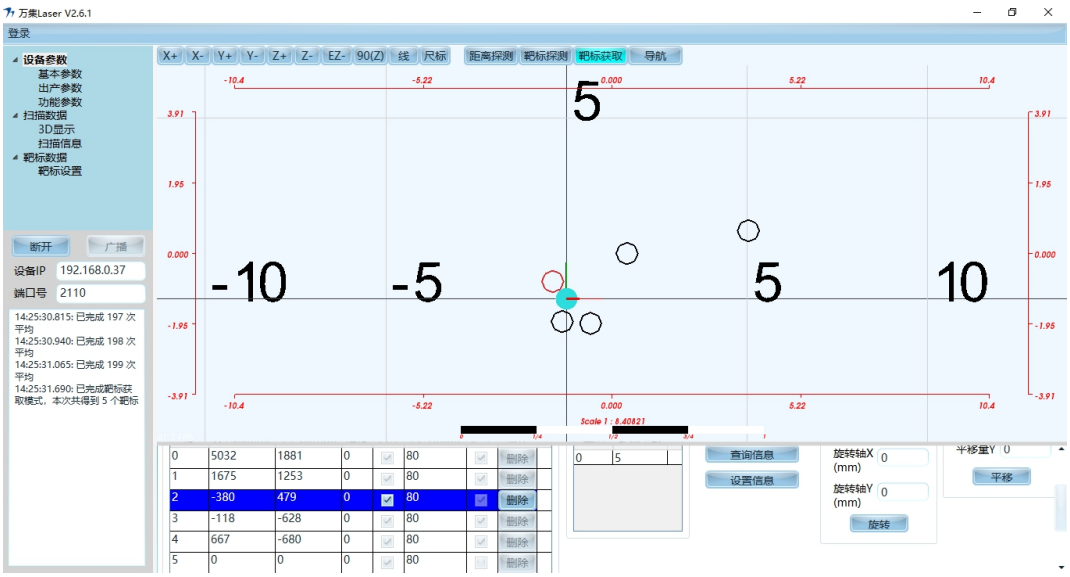


Figure 5.11 Quickly select the target in the map

Import file target information	For importing target map data files
Export selected target information	Used to generate the selected target in the target information column data files
search information	Used to query the internal target map data of WLR-712
setup information	Set the target data in the current target information bar to WLR-712

Figure 5.3 Target information setting menu

Target map transformation, using the target map transformation, the target data in the current target information column can be translated and rotated, and automatically added to the target information column for configuration in WLR-712.

Target rotation transformation:

rotation angle	The point corresponding to the X coordinate of the rotation axis and the Y coordinate of the rotation axis Rotate the map by the corresponding angle
Rotation axis X	X coordinate of the center of rotation
Rotation axis Y	Y coordinate of the center of rotation

Figure 5.4 Target rotation transformation function table

Target translation transformation:

Shift amount X	map along the X axis
Shift Y	map along the Y axis

Figure 5.5 Target translation transformation function table

5.5 Navigation

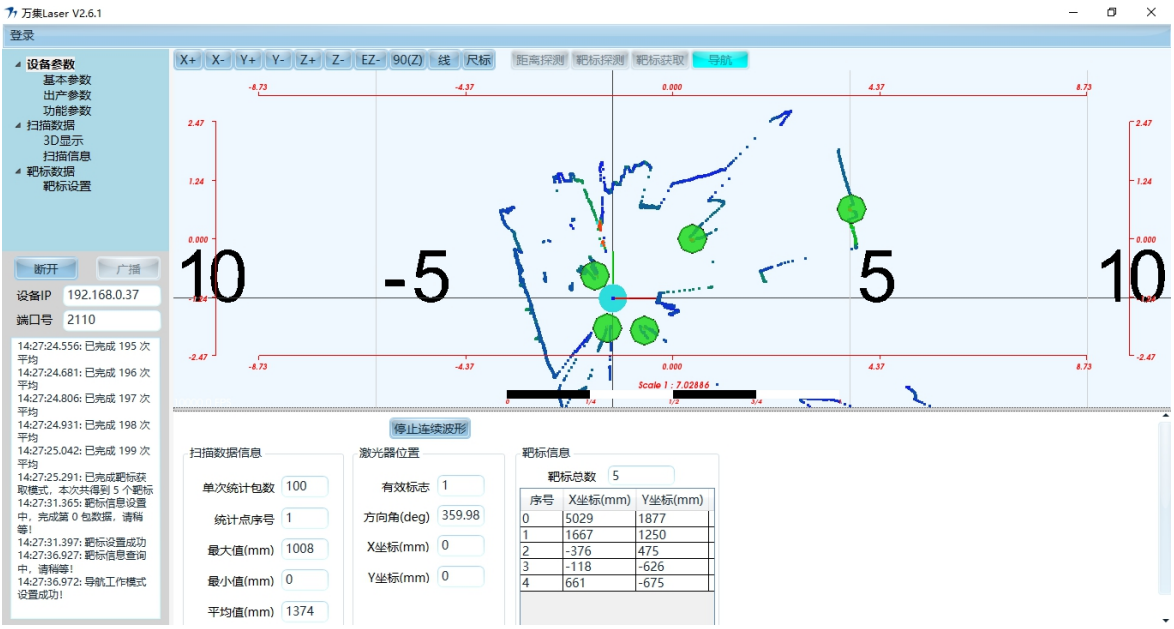


Figure 5.12 WLR-712 Navigation Mode Diagram

Configuring the target information to WLR-712 , click Navigation→Get Continuous Waveform, you can see the current position information of WLR-712 in the laser position column. The target information bar displays the currently detected target information.

6. Test report

6.1 High and low temperature, static electricity, pulse group experimental report

WJL TR 03 02 第 1 页共 6 页

中国认可
国际互认
检测
TESTING
CNAS L10306

检 测 报 告

报告编号：WJL-20181212-01

样品名称： WLR-712 导航激光雷达

委托单位： 激光产品事业部

检测类别： 送样检测

签发时间： 2018 年 12 月 12 日

北京万集科技股份有限公司检测中心

地址：北京市顺义区上宏西路 20 号院
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样品名称	WLR-712 导航激光雷达	规格型号	WLR-712
样品编号	WJL-SA-20181210-01 、WJL-SA-20181210-02 、WJL-SA-20181210-03 、WJL-SA-20181210-04		
委托单位	激光产品事业部	试验目的	研发
来样方式	送样检测	任务编号	JCWT-20181210-01
样品状态	功能正常	样品数量	4 台
到样日期	2018.12. 10	检测日期	2018.12.10-12.12
检测地点	北京万集科技股份有限公司检测中心环境实验室、EMC 实验室		
检测依据	GB/T 2423.1-2008；电工电子产品环境试验 第 2 部分：试验方法 试验 A：低温 GB/T 2423.2-2008；电工电子产品环境试验 第 2 部分：试验方法 试验 B：高温 GB/T 17626.2-2006；电磁兼容 试验和测量技术 静电放电抗扰度试验 GB/T 17626.4-2008；电磁兼容 试验和测量技术 电快速瞬变脉冲群抗扰度试验		
检测条件	高温试验：温度 70℃，工作运行保持 24h； 低温冷启动试验：设备在-40℃条件下不上电静置保持 1h 后设备上电运行； 低温工作试验：温度-40℃，工作运行保持 24h。 静电放电抗扰度试验：试验等级 3 级，接触 6kv，空气放电 8kv； 脉冲群抗扰度试验：试验等级 3 级。		
检测结论	高温试验：通过 低温冷启动试验：通过 低温工作试验：通过 静电放电抗扰度试验：通过 脉冲群抗扰度试验：通过		

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Figure 6.1 WLR-712 High and low temperature, static electricity, group pulse test report

6.2 Vibration test report

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检 测 报 告

报告编号：WJL-20181217-01

样品名称： WLR-712 导航激光雷达

委托单位： 激光产品事业部

检测类别： 送样检测

签发时间： 2018 年 12 月 17 日

北京万集科技股份有限公司检测中心

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样品名称	WLR-712 导航激光雷达	规格型号	WLR-712
样品编号	WJL-SA-20181212-01		
委托单位	激光产品事业部	试验目的	研发
来样方式	送样检测	任务编号	JCWT-20181212-01
样品状态	功能正常	样品数量	1 台
到样日期	2018.12.12	检测日期	2018.12.12-12.14
检测地点	北京万集科技股份有限公司检测中心振动实验室		
检测依据	GB/T 28046.3-2011 道路车辆 电气及电子设备的环境条件和试验 第 3 部分 机械负荷		
检测结论	随机振动试验：通过		
备 注	振动试验不是 CNAS 实验室测试项目		
报 告：	审 核：	批 准：	

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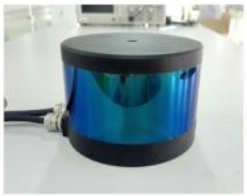
样品描述及说明	一、受试设备描述 安装形式：固定安装 一般描述：通过上位机检测扫描波形来判断受测设备工作是否正常 电源电压：24V 信号线：网线 二、振动测试 1、用于随机振动试验的样品编号为：WJL-SA-20181212-01。 2.受试设备的设置和工作状态 抗扰度试验过程中，EUT 通过网线与笔记本电脑连接，通过观察 EUT 与笔记本电脑的通信状态及显示扫描波形来判断 EUT 工作是否正常。 3.支持或辅助设备描述 设备名称：笔记本电脑 设备型号：L460 制造商：联想 连接方式：网线 工作状态：连续工作 三、样品照片：  样品编号：WJL-SA-20181212-01

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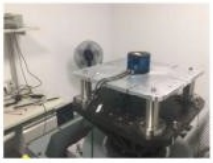
试验配置图片	 图 1 随机振动试验垂直方向试验（Z 轴）  图 2 随机振动试验水平方向试验（X 轴）  图 3 随机振动试验水平方向试验（Y 轴）

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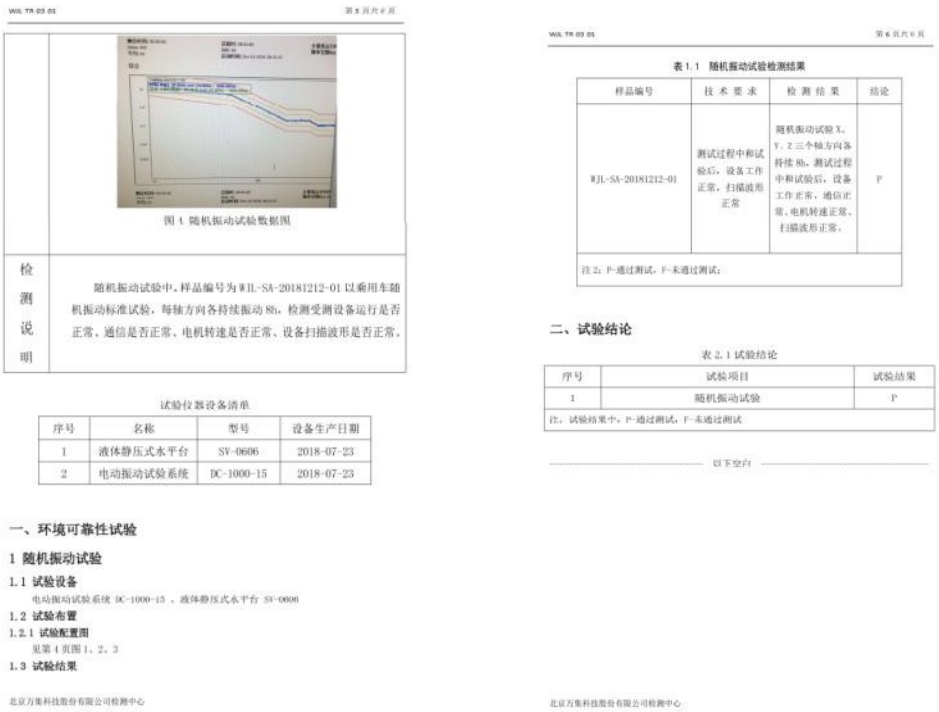

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图 4 随机振动试验数据图

检测说明	随机振动试验中，样品编号为 WJL-SA-20181212-01 以乘用车随机振动标准试验，每轴方向各持续振动 8h，检测受测设备运行是否正常、通信是否正常、电机转速是否正常、设备扫描波形是否正常。

试验仪器设备清单

序号	名称	型号	设备生产日期
1	液体静压式水平台	SY-0606	2018-07-23
2	电动振动试验系统	DC-1000-15	2018-07-23

一、环境可靠性试验

1 随机振动试验

1.1 试验设备

电动振动试验系统 DC-1000-15 、液体静压式水平台 SY-0606

1.2 试验布置

1.2.1 试验配置图

见第 4 页图 1、2、3

1.3 试验结果

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表 1.1 随机振动试验检测结果

样品编号	技术要求	检测结果	结论
WJL-SA-20181212-01	测试过程中和试验后，设备工作正常，扫描波形正常	随机振动试验 X、Y、Z 三个轴方向各持续 8h，测试过程中和试验后，设备工作正常、通信正常、电机转速正常、扫描波形正常。	P
注 2：P-通过测试，F-未通过测试；			

二、试验结论

表 2.1 试验结论

序号	试验项目	试验结果
1	随机振动试验	P
注：试验结果中，P-通过测试，F-未通过测试		

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Figure 6.2 WLR-712 Vibration Detection Report

7. After-sales service

- This product enjoys the stipulated free warranty service from the date of installation. During the warranty period , if the product is damaged or unusable due to non-human factors or product quality problems, please contact Wanji Technology or the local operator in time, and provide the purchase documents. The relevant service personnel will check your product. Do free repairs.
- No maintenance will be given to products that are disassembled by the user.
- After the expiration of the warranty period, the relevant service personnel of Wanji Technology will also be responsible for the maintenance of product failures, damages and other problems, but the material cost of maintenance and replacement of components will be charged.
- After the warranty period expires, the relevant service personnel of VanJee Technology will still provide users with free service to answer questions, including consulting services such as purchase guidance, usage methods, and installation.

Head Office Service Hotline: +86 (010) 51655012

8. User information

user name			
User address			
contact number		**contact**	
Device model		**device ID**	

9. Maintenance records

Maintenance times		**delivery date**	
Fault description			
Repair results			
Repair man		**Maintenance date**	

Address: Wanji Space, Building 12 , Zhongguancun Software Park, Haidian District, Beijing

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Postcode: 100193

Fax: +86 010-58858966

Website: www.vanjee.net