



KLM Type Safety Lidar

Configuration Software Operation Manual

(V2.0)



Jining Keli Photoelectronic Industrial Co., Ltd

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Introduction

KLM Safety Lidar is for short named KLM.

KLM configuration software operation manual is applicable to guide the configuration and diagnosis of KLM Lidar.

This manual mainly introduces the installation and uninstallation, software user interface, relevant application examples, common problems and solutions of KLM configuration software.

Before configuring KLM, Users must carefully read this manual and correctly use KLM configuration software.

KLM configuration software is not applicable to other types of products of our company and products with similar functions that produced by other manufacturers.

Jining Keli photoelectric industrial Co., Ltd. will assume no responsibility for the damages and losses caused by incorrect use of KLM configuration software.

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1 Software installation

1.1 Computer system environment

The computer needs to meet the following system requirements before using KLM configuration software, as shown in Table 1.

Table 1 Minimum system requirements

Item	Description	
Communication interface	USB2.0/3.0	
Computer hardware	CPU	Dual core or higher processor
	Memory	512M or more
	Free hard disk space	400M or more
	Mouse, Keyboard	Available
	Multimedia driver	CD-ROM
Compatible operating system	Microsoft Windows XP 32-bit (SP3 or above)	
	Microsoft Windows 7 32/64 bit	
	Microsoft Windows 8 32/64 bit	
	Microsoft Windows 8.1 32/64 bit	
	Microsoft Windows 10 32/64 bit	
Computer display	16-bit color or above, the resolution is 800*600 or above	

In the following system environments, KLM configuration software cannot be properly installed and used:

- Operating systems not listed in Table 1.
- Multi monitoring environment.
- Multi operating system environment.
- Personal assembly computer.

Note:

- .NET Framework 4.0 will be installed automatically when installing KLMs configuration software, if it does not exist on the computer.
- Even if all the system requirements in Table1 are met, the situation also may happen that KLMs configuration software cannot be installed and used on some computers.
- When the KLMs lidar is working, cover the USB connector to prevent dust from entering the inside of the device.
- Use the USB cable of KLMs lidar.
- Please read this manual carefully before configuring KLMs lidar.

1.2 Installation and uninstallation

1.2.1 Installing the software

a) Start the computer, find the folder “KLM configuration software installation package”, and double-click “setup.exe” in the folder.

b) Follow the prompts to complete the installation of KLM configuration software.

Note:

- Please select allowing installation if you encounter anti-virus software blocking during installation.
 - If the installation fails, it is recommended to temporarily close the anti-virus software and then reinstall it.
 - The default installation path of KLMs configuration software is C:\Program Files (x86)\JNKELI\ KLMs\.
- If you want to install it to other folders, select the location that you want when installing.

1.2.2 Uninstalling the software

Method 1: uninstalling from start menu.

- a) Click  “Start” menu button, and then select “All programs”.
- b) Find the folder “JNKELI”, and then select “uninstall KLM”.
- c) When the dialog box is popped up, click “Yes” to uninstall KLM configuration software from the computer.

Method 2: uninstalling from Control Panel.

- a) Click  “Start” menu button, and then select “Control Panel”.
- b) Click “Uninstall programs”.
- c) Find “KLM lidar configuration software” and select it, then click “uninstall”. KLM configuration software will be uninstalled from computer.

1.3 Start and exit

1.3.1 Start

The following steps can be used to start KLM configuration software:

- a) Connect the USB cable of KLM lidar to the USB interface of the computer.
- b) Click  “Start” → “All programs” → “JNKELI” → “KLM”.
- c) Or double-click the Shortcuts of KLM configuration software  on Desktop.

d) KLM configuration software will start and pop up the dialog box as shown in Fig.1.3.1. You need to select the model of the device in the drop-down menu, and then click “OK” button. After that, enter the main interface (Fig.1.3.2).After the initialization is complete, the software startup is complete.

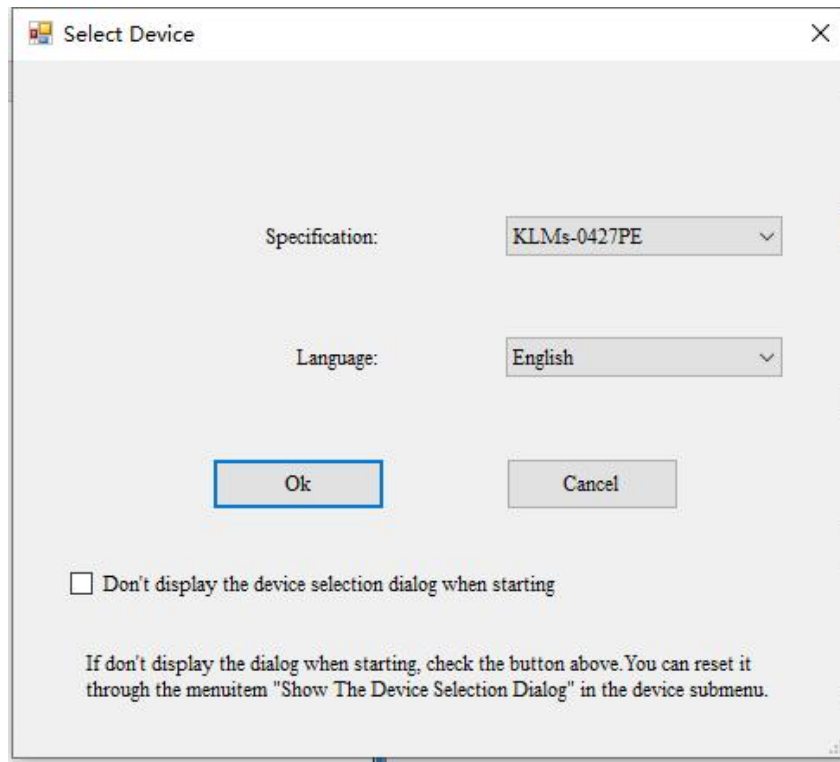


Fig.1.3.1 Device selection window

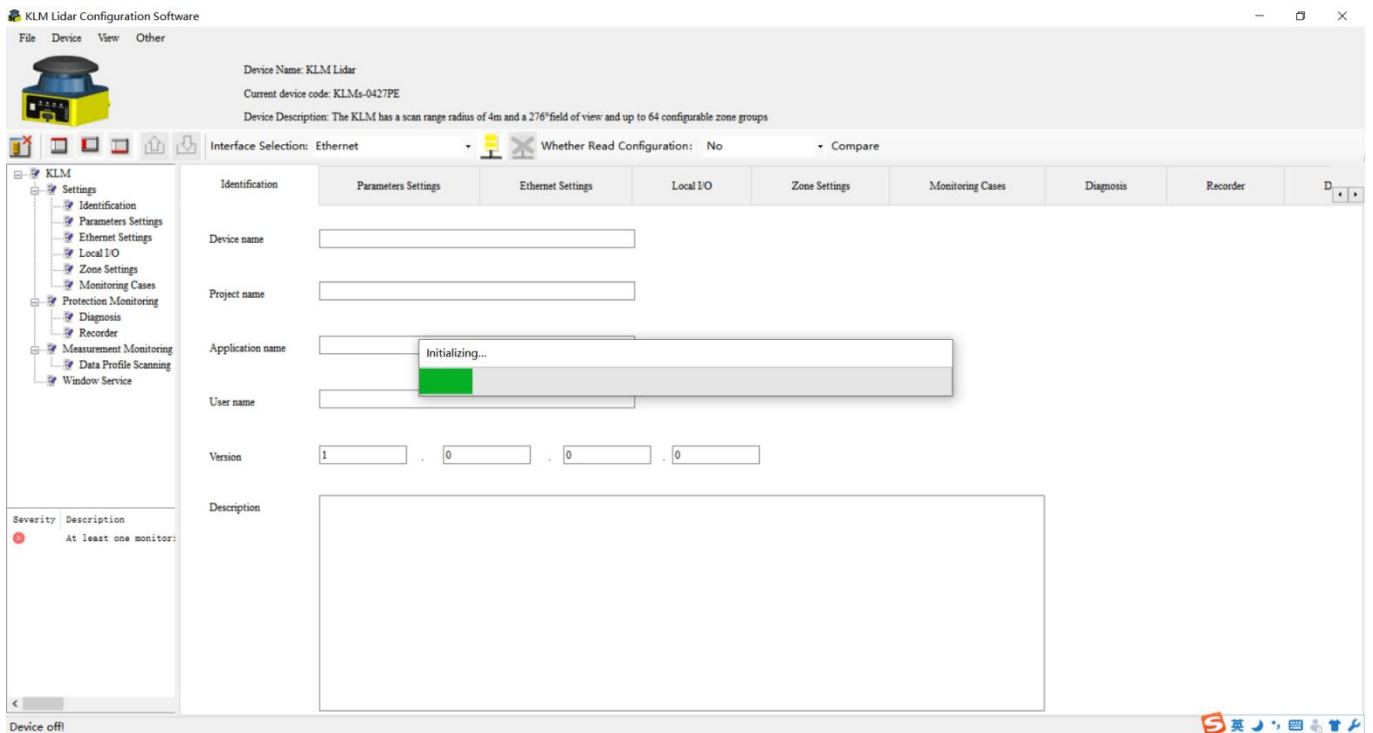


Figure1.3.2 Main interface of KLM configuration software

1.3.2 Exit

If you want to exit KLM configuration software, please click “Close” button in the upper right corner of the soft-ware interface. Or select “Exit” from “File” menu.

1.4 Establish connection

There are two ways to establish connection between KLM and the software: Ethernet connection and serial connection. The obstacle avoidance Lidar (BP) is connected through the serial port, the measurement type (DE) and the dual output type (PE) are both support these two connection ways. After selecting the model, the system will

automatically jump to the operation interface of the corresponding model of lidar.

For the lidar of the obstacle avoidance type or the dual-output type using serial port connection, you can connect it to the computer USB port through the configuration cable, and then click the button  on the toolbar, the serial port selection window (Fig.1.3.3) will pop up automatically. Select the serial port corresponding to the lidar, click “OK”, and then the connection is being established. If the connection succeeds, the window will pop up showing successful connection.

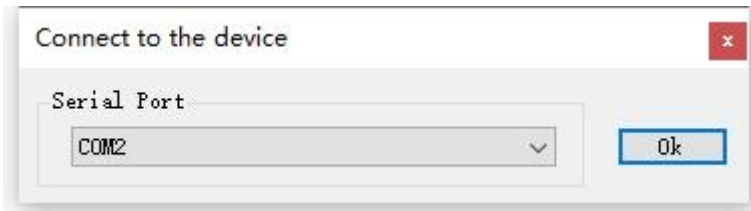


Figure1.3.3 Serial port selection window

For the lidar of the measurement type or the dual-output type using Ethernet connection, you can click the button  on the toolbar, the window will pop up which shows the lidar IP address and the computer IP address, as shown in Fig.1.3.4. If the two IP addresses are not in the same network segment, here are two methods to change the lidar IP address as follows:

Method 1: Type the values what you want in the same network segment with the computer in the textboxes of De-vice IP address, Subnet Mask, Gateway, click “Modify”, and then click “connect”.

Method 2: click “Match”, the system will automatically assign an IP address for device and establish a connection.

After the connection established, the new IP address of the device will display on the status bar. If "Whether to read the Configuration" is selected as “Yes”, the system will automatically read the radar configuration.

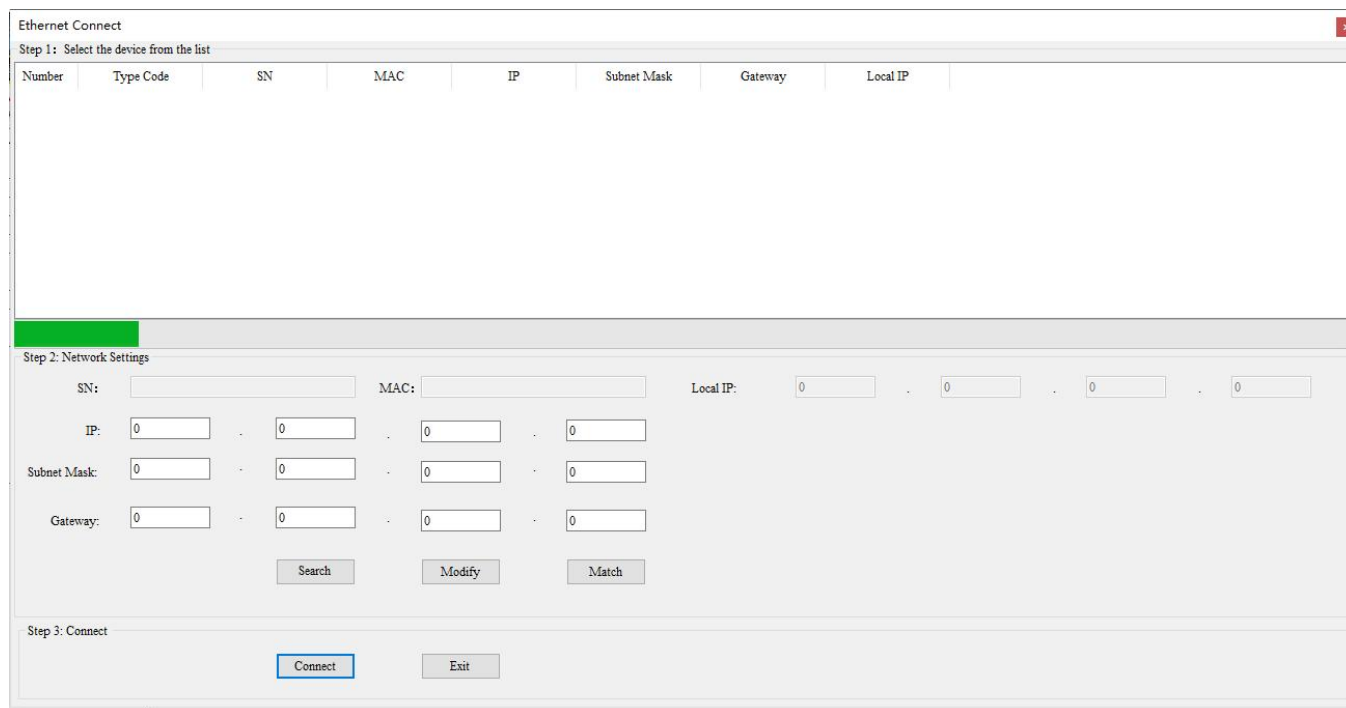


Figure1.3.4 Ethernet connect window

2 Software user interface

Design of the user interface has been compatible with Microsoft operation system as much as possible. The user interface consists of ①- Menu, ②-Device information bar, ③-Tool bar, ④-Tree view, ⑤-Error message prompt bar, ⑥-Configuring zone and ⑦-Status bar.

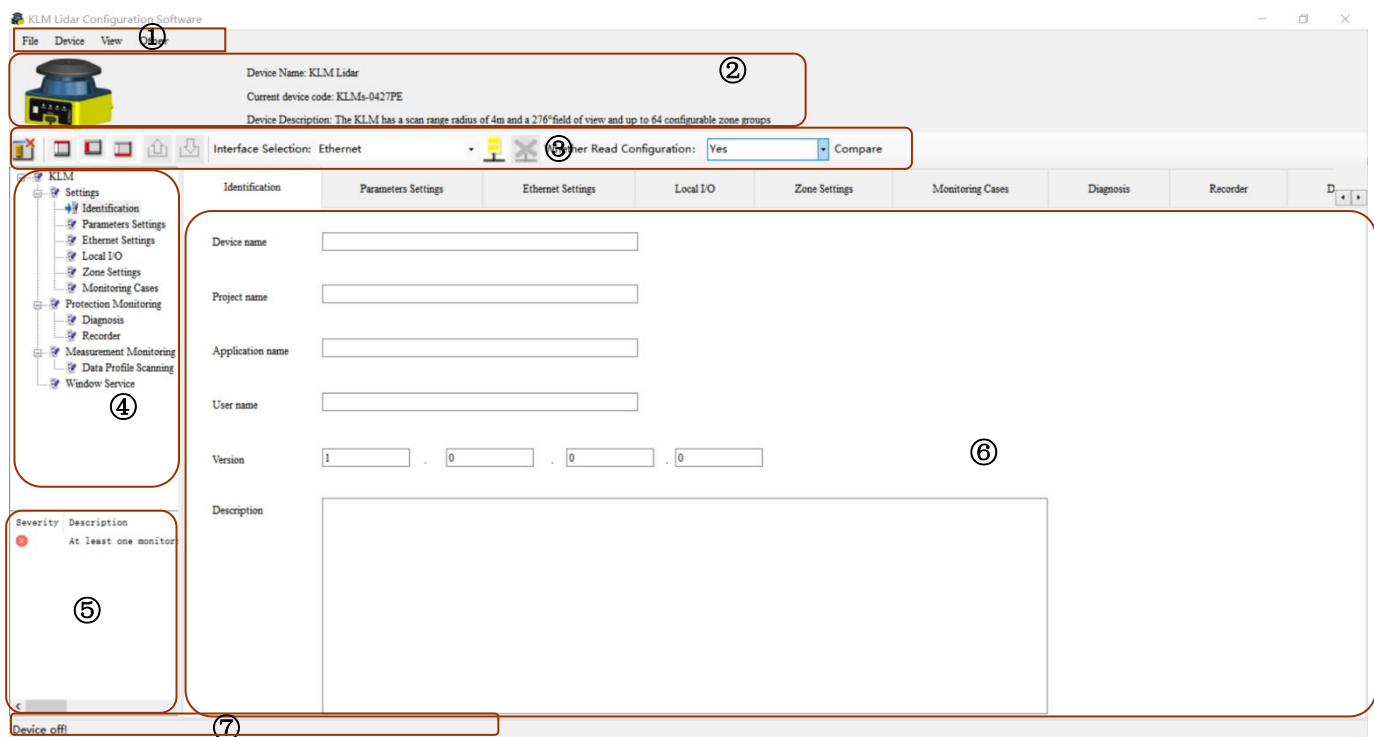


Fig.2 User interface

2.1 Menu

This part introduces functions of all menu items in the main menu. The function of a menu item can be carried out by clicking the menu item directly or by using the menu item shortcut key. If KLM configuration software is not connected with KLM lidar, some menu items will be unavailable and displayed in gray.

The menu structure consists of 4 sub-menus: File, Device, View and Other, as shown in Fig.2.1.



Fig.2.1 Menu interface

2.1.1 File

File menu is used to create, open, save a configuration project, preview current configuration, and exit the con-figuration software. Click “File” menu, you can see all the submenus of “File” menu shown as Fig.2.1.1, and each submenu’s function is listed in Table 2.

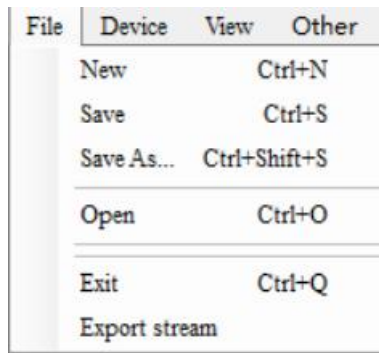


Fig.2.1.1 Submenus of “File” Menu

Table 2 Functions of “File” submenu item

Menu item	Shortcut key	Function
New	Ctrl+N	Create a new configuration project
Save	Ctrl+S	Save current configuration project
Save as	Ctrl+Shift+S	Rename and save the current configuration file
Open	Ctrl+O	Open a saved configuration project
Exit	Ctrl+Q	Exit the application
Export stream		Export the current configuration in the form of TXT file

2.1.2 Device

The device menu is used to transmit the current configuration to the KLM lidar, read the lidar configuration information, change the device type and so on. Click “Device” menu, you can see all the submenus of “Device” menu shown as Fig.2.1.2, and each submenu’s function is listed in Table 3. Submenus here are all unavailable and displayed in gray, when the software is not connected with KLM lidar.

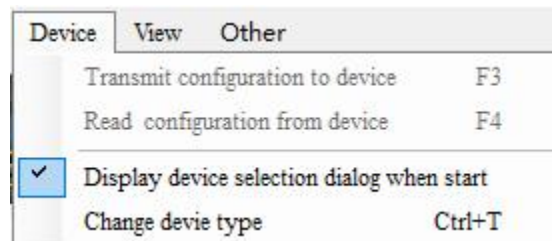


Fig.2.1.2 “Device” menu

Table 3 Functions of “Device” submenu item

Menu item	Shortcut	Function
Transmit configuration to device	F3	Transfer the current configuration to KLM
Read configuration from device	F4	Read configuration information from KLM
Display device selection dialogue when starting		If this option is checked, the device selection dialog box will pop up after the software starts.
Change device type	Ctrl+T	After disconnecting the device, this function can be used to select the device type

Attention:

There are no options of “Transmit configuration to device” and “Read configuration from device” for the measurement lidar device menu.

2.1.3 View

The view menu is used to display and hide the device information bar, tree view, and status bar in the user interface. Click “View” menu, you can see all the submenus of “View” menu shown as Fig.2.1.3, and each submenu’s function is listed in Table 4.

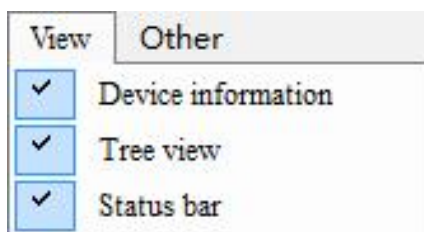


Fig.2.1.3 “View” menu

Table 4 Functions of “View” submenu item

Menu item	Function
Device information	Show or hide the device information bar
Tree view	Show or hide the tree view
Status Bar	Show or hide the status bar

2.1.4 Other

“Other” menu (Fig.2.1.4) can switch languages. Chinese and English are the two languages supported currently. In addition, you can view some information of the software here, such as developer, software version and website, as shown in Fig.2.1.5.

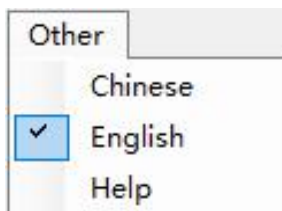


Fig.2.1.4 “Other” view

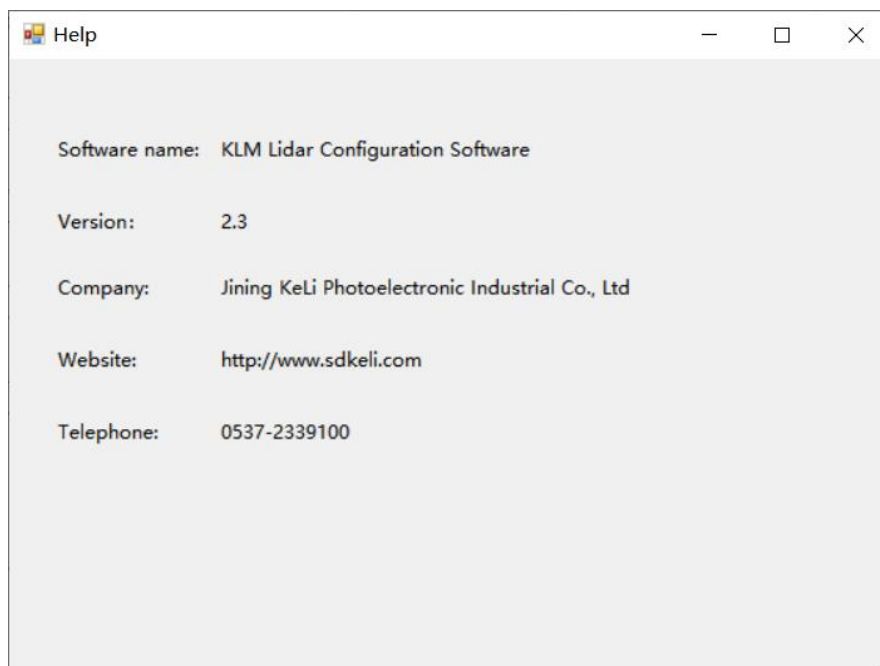


Fig.2.1.5 Software information

2.2 Device information bar

This bar displays device's picture, name, type and description, as shown in Fig.2.2.

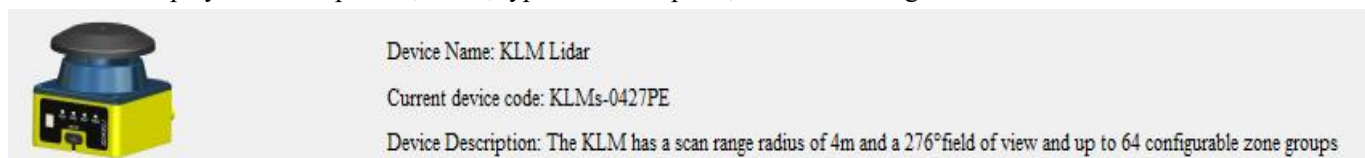


Fig.2.2 Device information bar

2.3 Toolbar

The structure of main toolbar is shown in Fig.2.3 and the function of each command is shown in Table 5.



Fig.2.3 Main toolbar

Table 5 Toolbar Command

No.	Icon	Tip	Function
1		Exit	Exit KLM lidar configuration software
2		Show or hide device information bar	Show or hide device information bar
3		Show or hide tree view	Show or hide tree view
4		Show or hide status bar	Show or hide status bar
5		Transmit configuration to device	Transfer current configuration to lidar, and be available after connection is established
6		Read configuration from device	Read the configuration information from the KLMs lidar, and be available after the connection is established
7		Interface Selection: Ethernet	The connection mode between KLMs lidar and PC software is selected
8		Connect	Connect with KLMs lidar
9		Disconnect	Disconnect with KLMs lidar
10		Whether Read Configuration : Yes	The connection mode between KLMs lidar and PC software is selected
11		Compare	Compare the current configuration with the read radar inner0 configuration, and display the difference item in the pop-up window (see Fig. 2.3.2)

Different Items	Current Configuration	Inner Configuration
Device Name	test1	
Project Name	test2	
Apply Name	test3	
User Name	test4	
Description	test5	
Version	3.0.1.9	1.0.0.0
Scan Times	3	2
OSSD Delay	1	0
Contour recognition function	25 percent	80
Pin9	Encoder 1	Static control input C
Pin10	Encoder 1	Static control input C
Pin11	Encoder 2	Unassigned
Pin12	Encoder 2	Unassigned
Pin13	Unassigned	Encoder 3

Fig. 2.3.2 Compare Window

2.4 Tree view

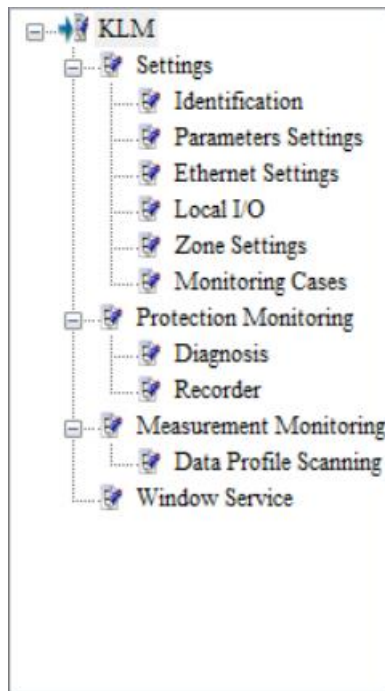


Fig.2.4.1 Tree view

The main function of the tree is to show and quickly switch to the corresponding tab of the node. Its structure is shown in Fig.2.4.1.

For example, when you click tree node “Zone Settings”, the current tab will be switched to tab “Zone Settings”, as shown in Fig.2.4.2. This is convenient for user to check and change configurations.

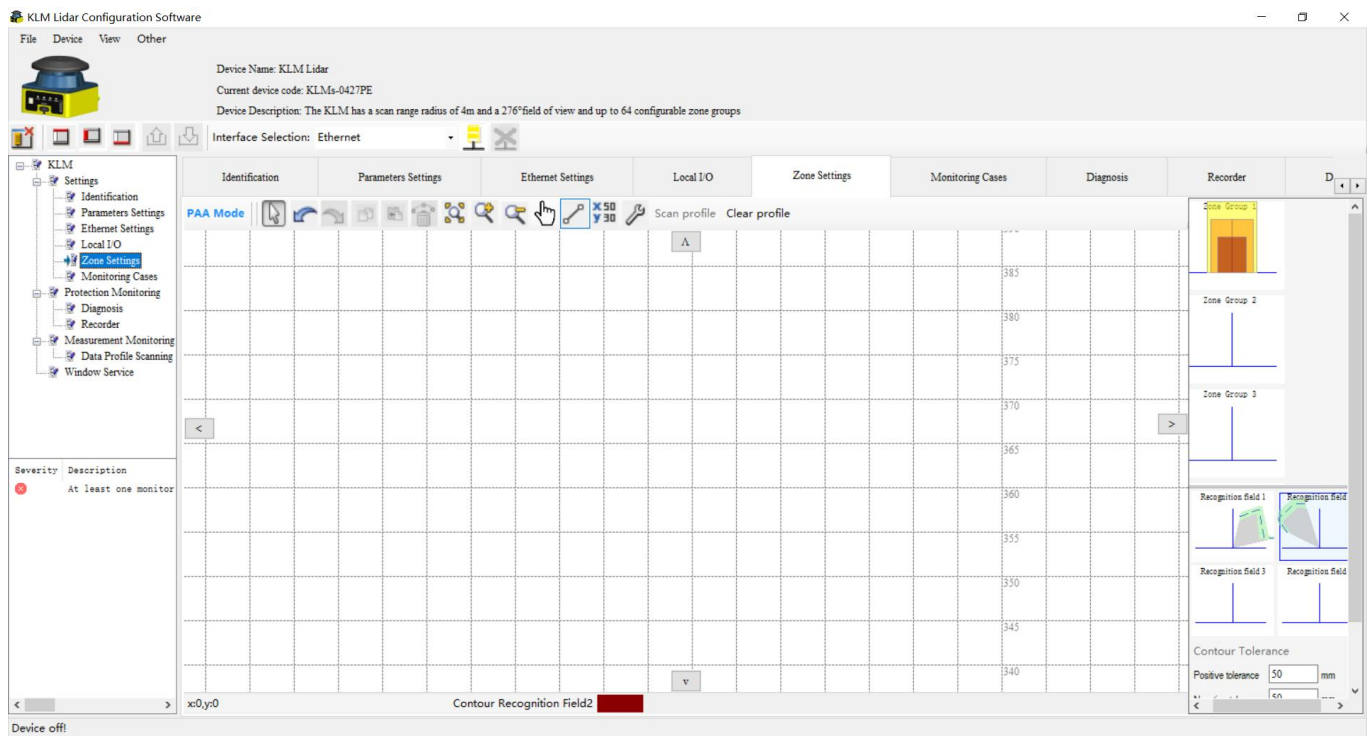


Fig.2.4.2 Tree view and Tabs associated with tree nodes

2.5 Error message prompt bar

The error message prompt bar is at the bottom of the tree view, as shown in Fig.2.5 below. In the process of configuring parameters, the program will detect the correctness of the configuration and prompt. The prompt information includes two types:

- Error(Represented by ): If an error exists, the parameters configured are not allowed to send to the device until there is no error.
- Warning(Represented by ): Warning is only used to prompt the user and does not affect the parameter distribution.

By dragging the scroll bar or placing the mouse over an item, you can view the complete prompt information.

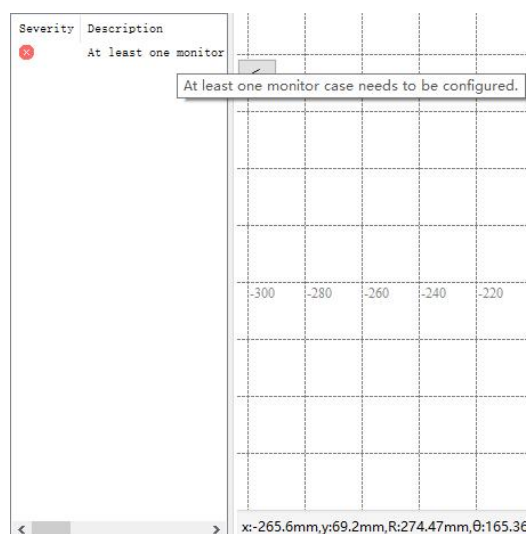


Fig.2.5 Error message prompt

2.6 Configuring zone

The configuring zone includes 10 tabs: Identification,Parameters Settings, Ethernet Settings, Local I/O, Zone Settings, Monitoring cases, Diagnosis, Recorder, Data Profile Scanning and Data Service, as shown in Fig.2.6. It is mainly used for configuration and diagnosis of KLMs lidar.

Identification	Parameters Settings	Ethernet Settings	Local I/O	Zone Settings	Monitoring Cases	Diagnosis	Recorder	D
----------------	---------------------	-------------------	-----------	---------------	------------------	-----------	----------	---

Device name

Project name

Application name

User name

Version

1

.

0

.

0

.

0

Description

Fig.2.6 Tabs

2.6.1 Identification

[Identification] TAB is used to set the identifier of the radar by the user, so that the radar can be classified and managed, including device name, project name, application name, user name, version, description, etc. Users can set each item by themselves.

The modification takes effect only after the configuration is transmitted to the device. After the radar is reconnected and the device configuration is read, the identification of the radar will be displayed on this page.

Device name

Project name

Application name

User name

Version

1

.

0

.

0

.

0

Description

Fig.2.6.1 Identification

2.6.2 Parameters Settings

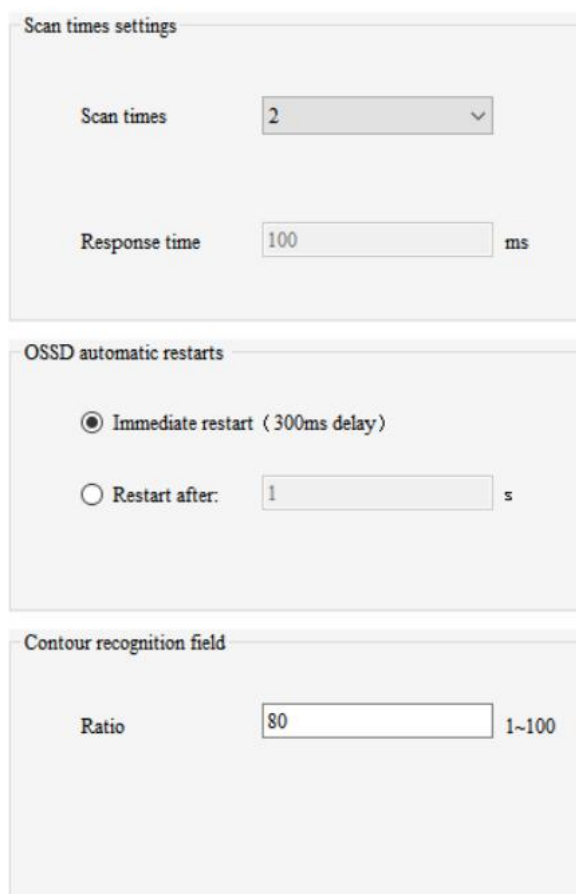
The tab “Parameters Settings” is used to set the scan times and response time for KLMs, as shown in Fig.2.6.2.

Scan times: The range is 2-16 times.

Response time: This value cannot be set. The response time cannot be set. It will display the corresponding value according to different scan times and motor speed for the dual output lidar, and for the obstacle avoidance lidar, according to different scan times.

OSSD automatic restarts: This parameter is used to set the interval from shutdown to restart of the OSSD, that is, the time from the time when the obstacle is removed from the protected area to the time when the OSSD recovers the on-off.

Contour recognition field: This parameter is used to set how high the matching degree between the actual scene and the drawn contour identification area reaches to switch to the corresponding contour identification area. The closer the value is to 100, the higher the matching degree between the actual scene and the contour identification area is required. When the software determines that the contour does not match and there is no other monitoring example to switch, the radar displays fault status.



The screenshot displays the 'Parameters Settings' window with three distinct sections. The first section, 'Scan times settings', contains a 'Scan times' dropdown menu set to '2' and a 'Response time' input field set to '100' with a 'ms' unit label. The second section, 'OSSD automatic restarts', features two radio button options: 'Immediate restart (300ms delay)' which is selected, and 'Restart after:' with an input field set to '1' and a 's' unit label. The third section, 'Contour recognition field', includes a 'Ratio' input field set to '80' with a range indicator '1~100' to its right.

Fig.2.6.2 Parameters settings

2.6.3 Ethernet settings

On the tab “Ethernet settings”, you can configure and read the network parameters of KLM. See Fig.2.6.3.

Configurable network parameters here include IP address, subnet mask, gateway.

Click “Read”, and the lidar’s network parameters read is displayed on the interface.

Click “Write”, and the network parameters configured on the interface can be sent to KLM.

IP

192

168

0

10

Subnet mask

255

255

255

0

Gateway

192

168

0

1

Read

Write

Fig.2.6.3 Ethernet Settings

2.6.4 Local I/O

On the tab “Local I/O”, users can configure the input and output interface of KLM, as shown in Fig.2.6.4 below. Pins 1-4 are not configurable, which are the fixed functions.

Pin No.	Identification	Optional signals	Signal type	Assigned signal	More configuration
3	OSSD 1.A	OSSD 1.A	Output	OSSD pair 1	
4	OSSD 1.B	OSSD 1.B	Output	OSSD pair 1	/
6	General-I/O 02	OSSD 2.A A1 Alarm Fault	Output	Alarm output 1 Unassigned Alarm output 1 Fault output	/
7	General-I/O 03	OSSD 2.B A2 Alarm Fault	Output		/
5	General-I/O 01	B1 Alarm Fault	Input	Static control input B	/
8	General-I/O 04	B2 Alarm Fault	Input	Static control input B	/
9	Input 01	C1 Encoder1(0°)	Input	Encoder 1	Speed Incremental encoder 1(pin 9) pulse 100 per 10 mm route
10	Input 02	C2 Encoder1(90°)	Input	Encoder 1	Incremental encoder 2(pin 11) pulse 10 per 10 mm route
11	Input 03	D1 Encoder2(0°)	Input	Encoder 2	Tolerance between the measured values 25 %

Fig.2.6.4 Local I/O

- ①Pin identification and optional signals
②Available signals
- ③Signal assigned
④ Encoder configuration panel

2.6.4.1 Pin identification and optional signals

The base color in the column of the Pin No. indicates the color of the cable corresponding to the pin. The pin identification indicates the role that the pin can play; The pin marked as General-I/O can be allocated as input signal or output signal; pins identified as Input can be only assigned output signals. The column “Optional signals” indicates all

signals that can be assigned to this pin. The functions that can be assigned to each pin are shown in Table 6.

Table 6 Functions that can be assigned to pin

Pin	Identification	Configurable functions	Pin	Identification	Configurable functions
1	24V	Working voltage (+24V DC)	2	0V	Working voltage (0V DC)
3	OSSD1.A	OSSD pair 1	4	OSSD1.B	OSSD pair 1
5	General I/O 1	Static control input: B1 General Output: Alarm output 1/Alarm output 2	6	General I/O 2	Static control input: A1 General Output: Alarm output 1/Alarm output 2/OSSD pair 2
7	General I/O 3	Static control input: A2 General Output: Alarm output 1/Alarm output 2/OSSD pair 2	8	General I/O 4	Static control input: B2 General Output: Alarm output 1/Alarm output 2
9	Input 01	Static control input: C1 Dynamic control input: Encoder 1a (0°)	10	Input 02	Static control input: C2 Dynamic control input: Encoder 1b (90°)
11	Input 03	Static control input: D1 Dynamic control input: Encoder 2a (0°)	12	Input 04	Static control input: D2 Dynamic control input: Encoder 2b (90°)
13	Input 05	Static control input: E1 Dynamic control input: Encoder 3a (0°)	14	Input 06	Static control input: E2 Dynamic control input: Encoder 3b (90°) Input: EDM1 (External device monitoring)
15	Input 07	Static control input: F1 Dynamic control input: Encoder 4a (0°)	16	Input 08	Static control input: F2 Dynamic control input: Encoder 4b (90°) Input: EDM2(External device monitoring)
17	NC		Shield	PE	

2.6.4.2 Assigning signal for pin

The user can assign signals to pins by selecting from the drop-down list.

■ Note:

According to the actual signal configuration, the drop-down list lists all currently available signals, and unavailable signals are automatically excluded and not displayed. Only one of pins 5/6/7/8 can be assigned as fault output. Static input signals must be allocated in pairs, for example, pin 9 and 10 can be allocated as static control input C1 and C2 in pairs; As each encoder occupies two pins, Dynamic control input signals are configured with at least two encoders (4 dynamic control inputs) at one time, and at most four encoders (8 dynamic control inputs) are allocated. For example, pin 9, 10, 11 and 12 are allocated to encoder 1a, encoder 1b, encoder 2a and encoder 2b at the same time.

2.6.4.3 Output signals

OSSD pair output signal

Inform whether the corresponding protected zone has been invaded. When the protected zone is invaded, the OSSD will disconnect from the output signal, and its signal light will turn red. Each OSSD pair, as output signal, occupies two pins. When signal OSSD pair 2 is configured, the mode of protection zone group is changed from PAA to PP. In mode PP, the alarm output signal is not required (see the section 2.6.4.6 for details).

Alarm output signal

Notify whether the corresponding warning zone is invaded. When the warning zone is invaded, the alarm output signal will be off, and its Alarm signal light will turn red.

Fault output signal

Notify radar if there is a malfunction. When the radar fails, the fault output is turned off.

2.6.4.4 Input signal

Static control input

Static control input is a dual channel control input. The input state of each channel is 0 or 1, occupying two pins. After static control input is assigned to some pins, its state can be used to configure in monitoring cases. The logic state of each static input signal is determined by the input signals of its two pins; Take static control input A (its two pin input signals are A1 and A2 respectively) as an example to illustrate its logic state, as shown in Table 7 below (in section 2.6.6.3).

Dynamic control input

The pins configured as dynamic control input (encoder) can be used to connect the incremental encoder to switch the monitoring cases according to the speed.

In order to ensure the accuracy of speed, each encoder occupies the two pins corresponding 0° and 90° at the same time; Encoders are used in pairs: Encoder 1 and Encoder 2 are the first group, and Encoder 3 and Encoder 4 are the second group.

When any one of pins 9~12 (Input 01~04) is assigned encoder, the other three are automatically configured as encoder (not selectable); When any one of pins 13~16 (input 05~08) is assigned as encoder, the other three are automatically configured as encoder input (not selectable), (see the section 2.6.6.4 for details).

External Device Monitoring (EDM)

The external device monitoring (EDM) monitors the status of downstream contactors.

If the auxiliary contacts of the positively guided contactors are connected to the external device monitoring, the external device monitoring checks whether the contactors switch correctly when the OSSDs are switched off.

2.6.4.5 Configuration of encoder parameter

After the encoder signal has been assigned to the pin, configure the encoder in the "More Configurations" column to control the speed range and tolerance value assigned by the dynamic input condition. Tolerance value configuration range is [0%, 50%].

Speed

Incremental encoder 1(pin 9)

pulse per mm route

Incremental encoder 2(pin 11)

pulse per mm route

Tolerance between the measured values

%

Incremental encoder 3(pin 13)

pulse per mm route

Incremental encoder 4(pin 15)

pulse per mm route

Tolerance between the measured values

%

Speed Range (Unit: mm/s)

Fig.2.6.4.1 Encoder parameters configuration panel

■ **Note:**

- If two groups of encoders are configured at the same time, the extreme value of the speed range is the minimum one of the four values.
- If one group of encoders is configured, the extreme value of speed range is the minimum one of the two values.
- The speed measured by two encoders in the same group may be different. When the difference between the two speeds is within the tolerance range of their measured values, it is considered that the speed is correct, otherwise it is wrong.
- The extreme value of speed for Encoder i, $V_i = \text{Maximum pulse frequency} / (\text{pulse/route})$, among the parameters, Maximum pulse frequency is 200 kHz. Therefore, the minimum value of V_i is taken as the extreme value of speed range.

As shown in Fig.2.6.4.1, the speed extreme value of the encoder is calculated as follows:

Encoder 1: $200 * 1000 / (500 / 10) = 4000$,

Encoder 2: $200 * 1000 / (200 / 10) = 10000$,

Encoder 3: $200 * 1000 / (333 / 10) = 6006$,

Encoder 4: $200 * 1000 / (666 / 10) = 3003$,

The minimum value is 3003, which is taken as the extreme value of the speed range, so the speed interval is [-3003, 3003]. When the speed range configured by the user exceeds this range, the software will report an error warning.

2.6.4.6 Work mode

The default defense zone group of the system is PAA mode, that is, each zone group is composed of one protection zone (Protection Zone) and two warning zones (Warning Zone 1 and Warning Zone 2). Now, the user can allocate any two of the General-I/O pins 01 ~ 04 as Alarm output 1 and Alarm output 2 through the configuration software.

When two protection zones (PP mode) need to be configured, the pins General I/O 02 and General I/O 03 can be allocated as OSSD pair 2. At this time, the mode of defense zone group switch from PAA to PP, that is, each zone group is composed of two protection zones (Protection Zone 1 and Protection Zone 2).

■ **Note:**

- When the work mode is about to switch from PAA to PP, a window as shown in Fig.2.6.4.2 will pop up. Click "Yes" to switch the work mode, and the following changes will occur:
 - ① Clear the graphics drawn in warning zone of all defense zone groups.
 - ② The mode of the zone group in the monitoring case cut-off path is also switched from PAA to PP, and the thumbnail of each zone is simultaneously updated.

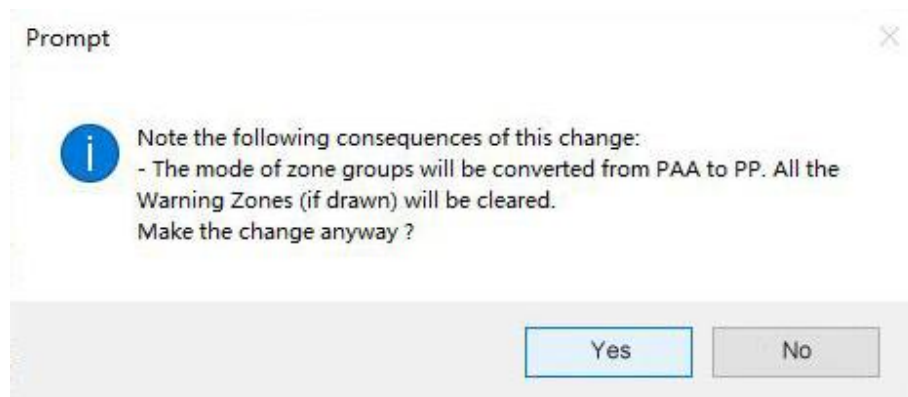


Fig.2.6.4.2 Work mode switching from PAA to PP

- When the work mode is about to switch from PP to PAA, a window as shown in Fig.2.6.4.3 will pop up. Click "Yes" to switch the work mode, and the following changes will occur:

- ① Clear the graphics drawn in Protection Zone 2 of all defense zone groups.
- ② The mode of the zone group in the monitoring case cut-off path is also switched to PP, and the thumbnail of each zone is simultaneously updated.

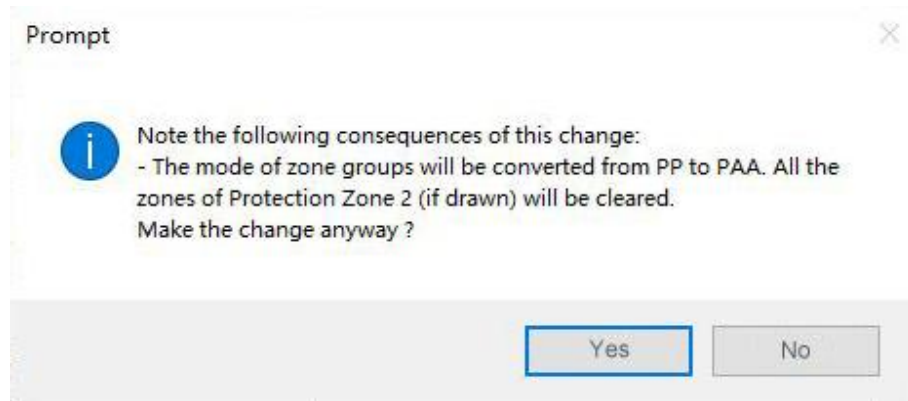


Fig.2.6.4.3 Work mode switching from PP to PAA

2.6.5 Zone Settings

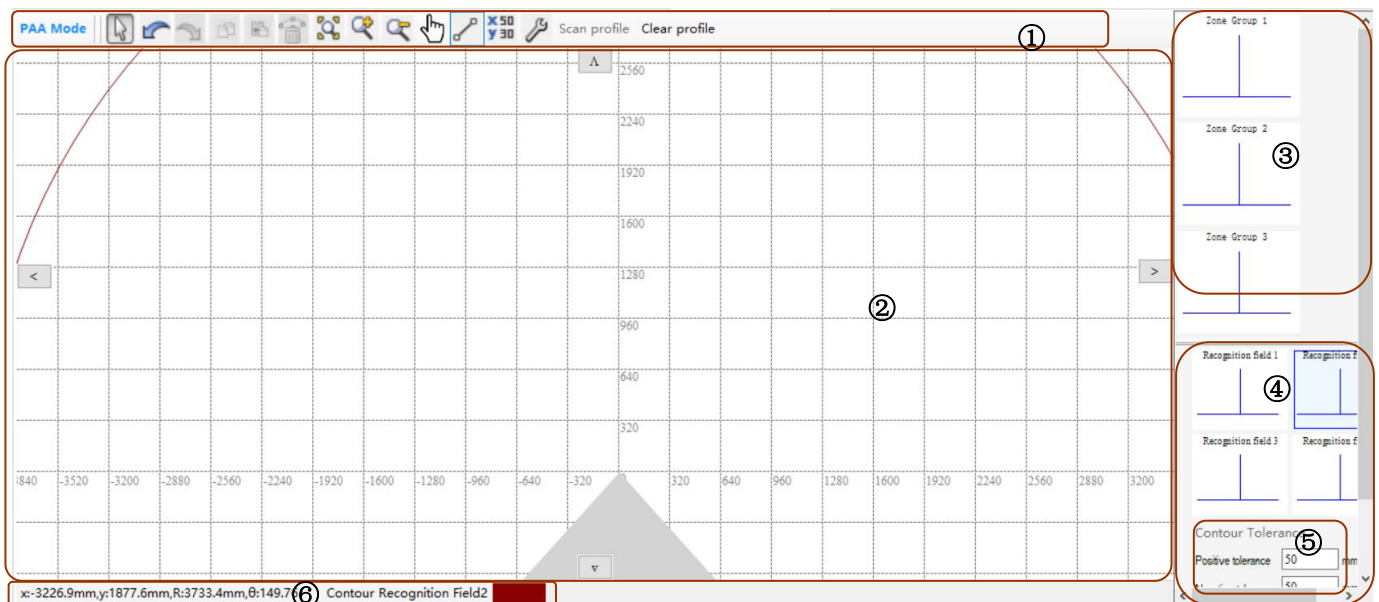


Figure2.6.5.1 Zone settings tab

The tab “Zone Settings” includes: ①-Zone edit toolbar, ②- Drawing area, ③-Zone group list, ④- Contour recognition area, ⑤- Contour tolerance, ⑥- Status bar, as shown in Fig. 2.6.5.1.

2.6.5.1 Zone editing toolbar

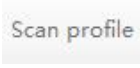
In the zone editing toolbar (in PAA mode), you can select Protection Zone, Warning Zone 1, or Warning Zone 2, and edit it respectively. See Table 8 for the functions of each command in the toolbar.



Table 8 Function description of each command in the toolbar

No.	Icon	Prompt information	Description
1		Work mode	Show current working mode (see the introduction of 2.6.4.6 for details)

2		Protection Zone	Click to edit Protection Zone
3		Warning Zone 1	Click to edit Warning Zone 1
4		Warning Zone 2	Click to edit Warning Zone 2
5		Switch Zone	Switch between different type zones
6		Select	Select one or a group of boundary points in the current drawing Zone
7		Undo	Undo the previous operation, and can undo continuously
8		Redo	Back to the previous step, and can be redo continuously
9		Copy	Copy boundary point that currently selected
10		Paste	Paste boundary points that have copied to other areas
11		Delete	Delete boundary point that currently selected
12		Show All	Click to show the whole protection zone that currently drawn
13		Zoom in	Zoom in the boundary outline. Scrolling the mouse wheel can also make it.
14		Zoom out	Zoom out the boundary outline. Scrolling the mouse wheel can also make it.
15		Move	After clicking, you can drag the canvas freely.
16		Free drawing	Dot drawing tool, detailed in below.
17		Straight line	Line drawing tool, detailed in below.
18		Sector	Sector drawing tool, detailed in below.
19		Rectangle wizard	Rectangle drawing tool, detailed in below.
20		Show all points	Click to display all boundary points in the current editing zone.
21		Show user-defined points	Click to display all boundary points in the current editing zone defined by user.

22		Do not Show points	Click to not show any boundary points.
23		Modify boundary points	Click to modify boundary points in the pop-up dialog, detailed in below.
24		Canvas Settings	Users can rotate the canvas according to the actual scanning area. See the following for details.
25		Scan profile	Scan the environment contour in real time, be available after establishing a connection. See 3.2 of this manual for specific functions.
26		Clear profile	Click to clear the contour scanned.

2.6.5.1.1 Free drawing tool

Click , and then you can draw a single or a series of boundary points in the drawing area. For example, click at the coordinate point (0, 200) in the drawing area, a boundary point will generate, as shown in Fig.2.6.5.2.

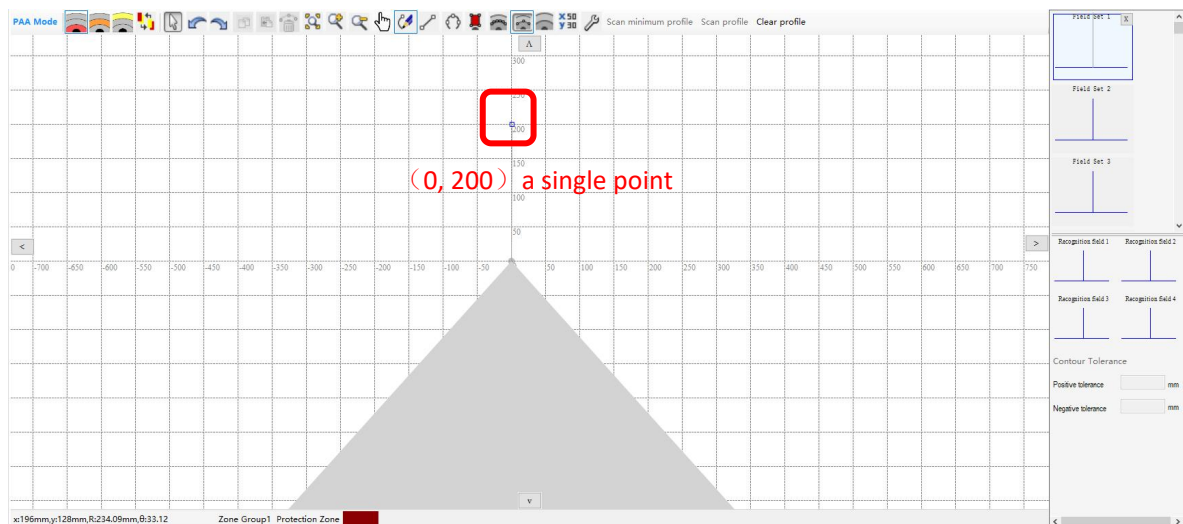


Fig.2.6.5.2 Draw a single point

In the drawing area, hold down the left mouse button and drag, a series of boundary points will generate, as shown in Fig.2.6.5.3.

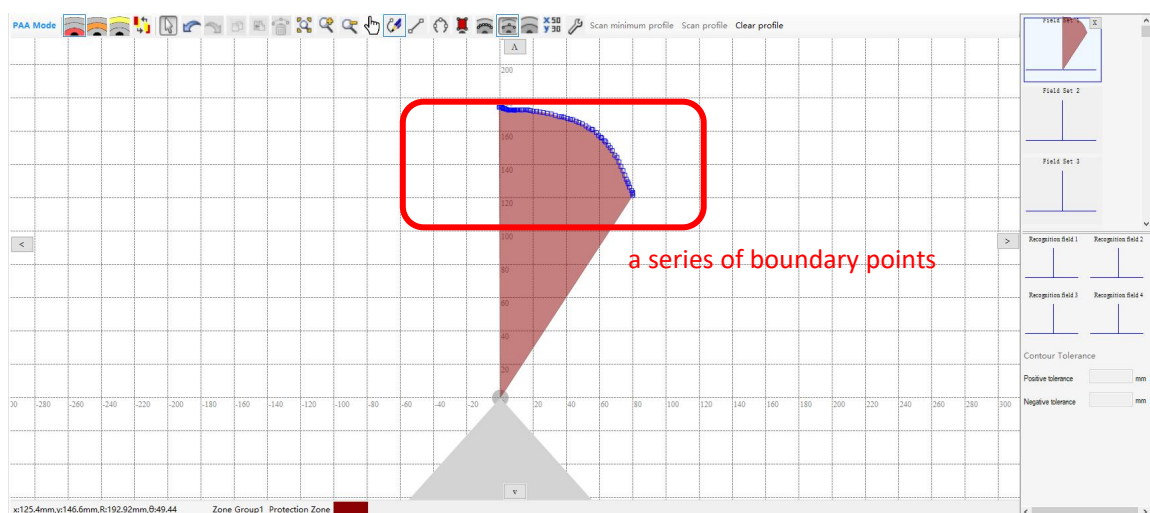


Fig.2.6.5.3 Draw a series of boundary points

2.6.5.1.2 Straight line tool

Click  and then you can draw straight line in the drawing area.

For example, in the drawing area, click the left mouse button at (0, 2400) as the starting point of the straight line, and click at (1200, 1200) as the end point. Protection Zone generated is shown in Fig.2.6.5.4 below.

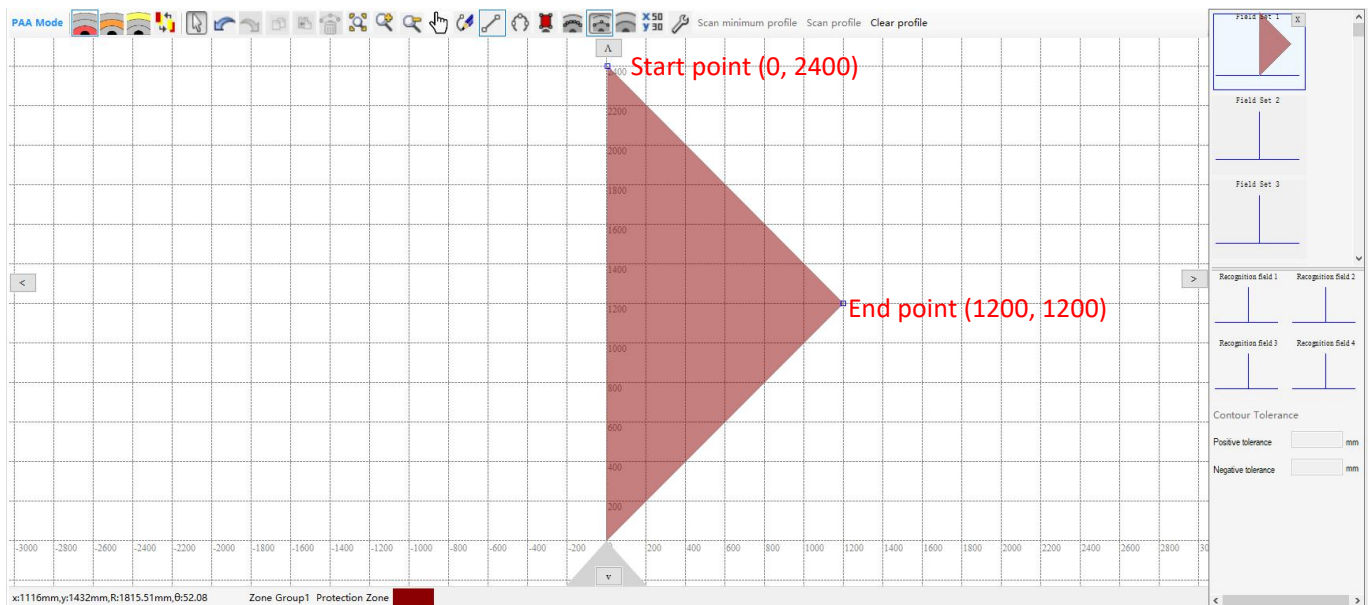


Fig.2.6.5.4 Draw straight line

2.6.5.1.3 Sector tool

Click  and then you can draw sector boundary in the drawing area.

For example, press the left mouse button at (0, 180) as the start angle (90°) of the sector, drag the mouse to (-160, 80) as the end angle (153°), and then release the left mouse button. The sector with a radius 180 mm will generate as Protection Zone, as shown in Fig.2.6.5.5.

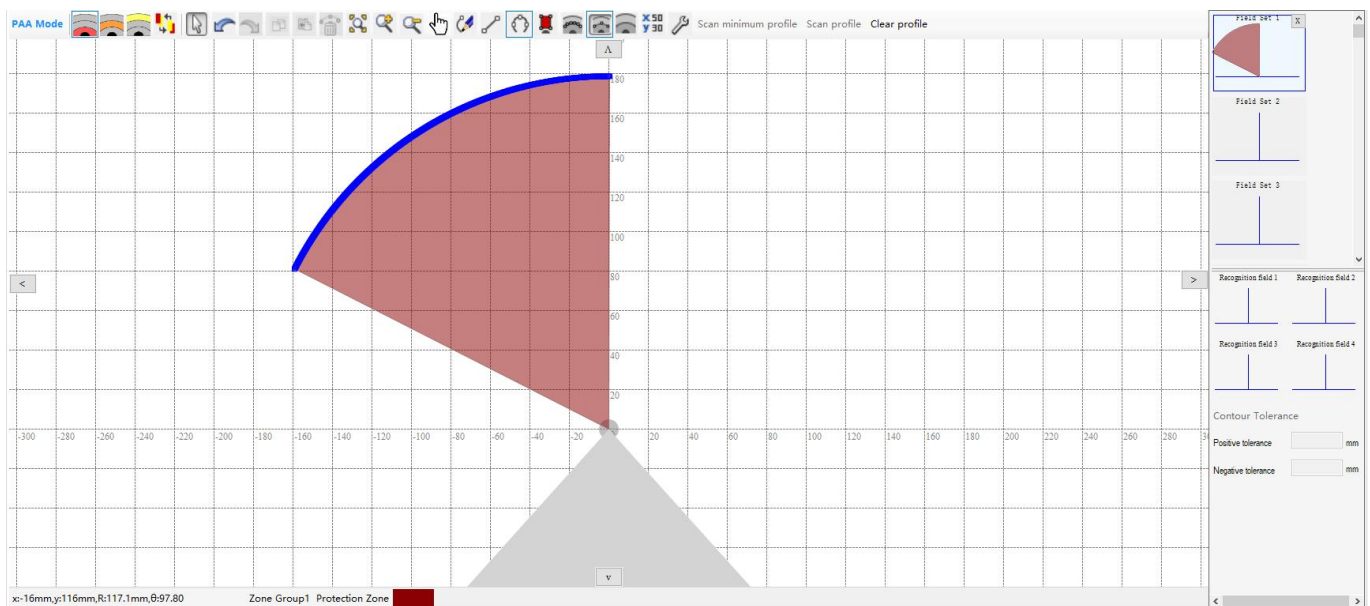


Fig.2.6.5.5 Draw sector

2.6.5.1.4 Rectangle tool

Click , the setting dialog pops up, which is shown in Fig.2.6.5.6.

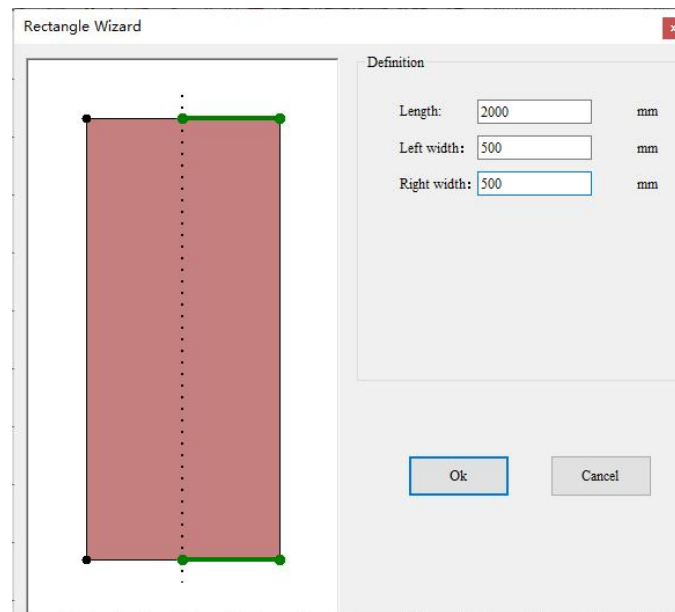


Fig.2.6.5.6 Dialog for editing rectangle

Here, you can input the length and width of the rectangle as required. As shown in Fig.2.6.5.7, Set the length to 2000 mm, and the left and right length both to 500 mm. Then click “OK”, the Protection Zone will generate.

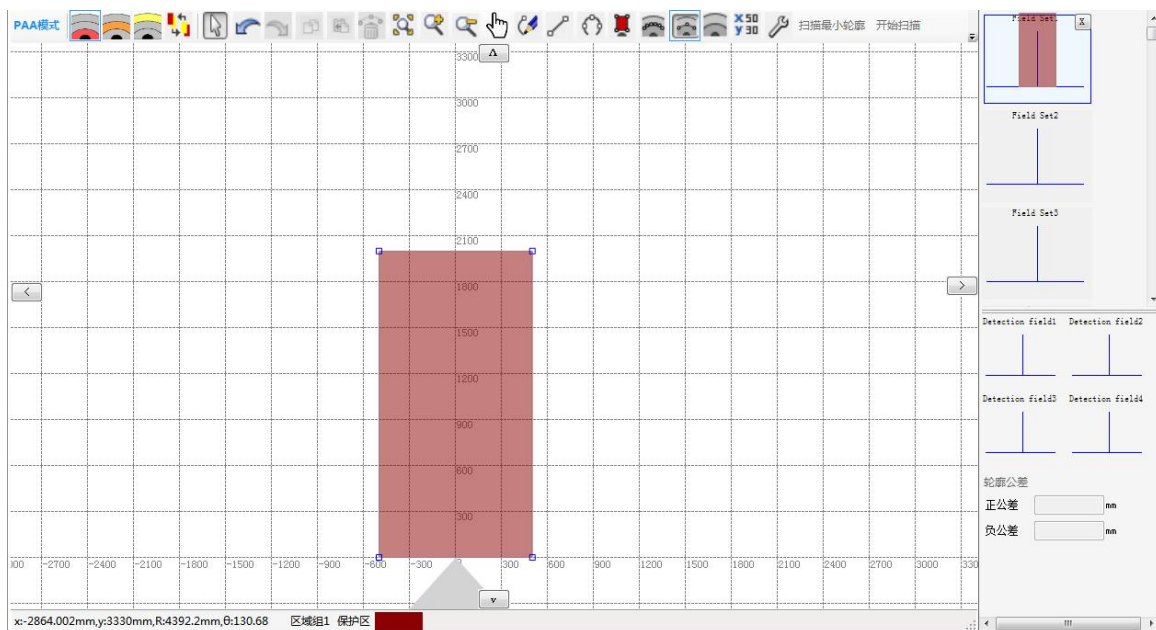


Fig.2.6.5.7 Draw rectangle

2.6.5.1.5 Canvas setting

Click , the dialog for setting canvas will pop up as shown in Fig.2.6.5.8.

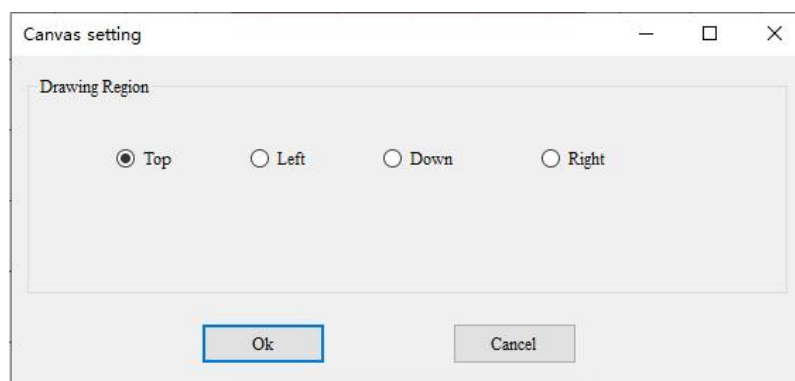


Fig.2.6.5.8 Canvas settings

The user can rotate the canvas according to the actual scanning area. For example, select “Down” and click “OK”, then the canvas of the drawing area shown in Fig.2.6.5.7 will be rotated, as shown in Fig.2.6.5.9 below.

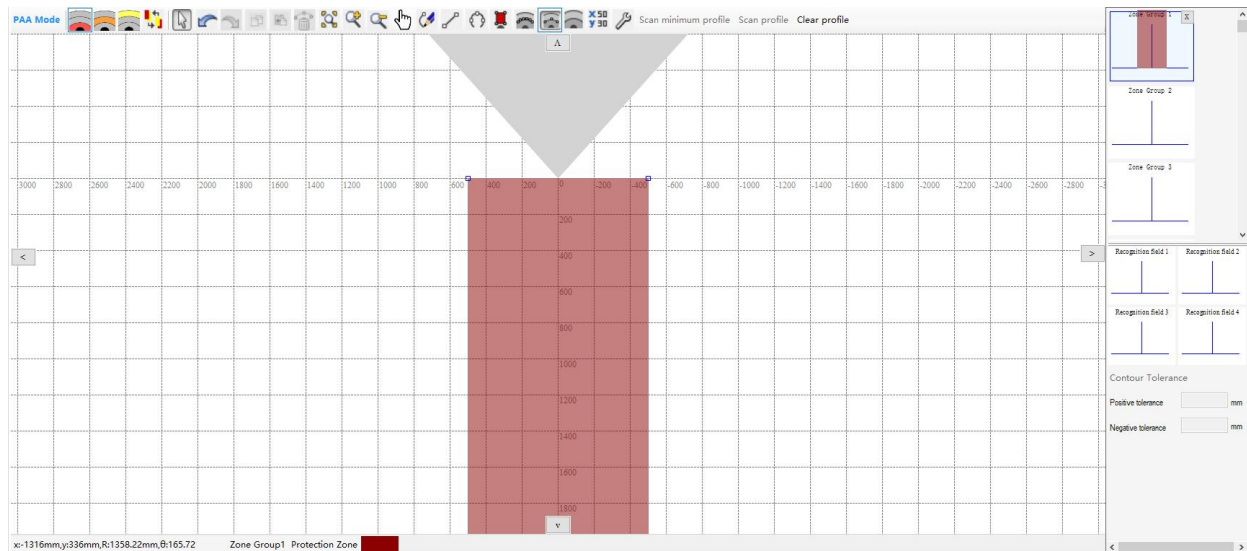


Fig.2.6.5.9 Canvas after rotated

2.6.5.1.6 Modify boundary points

Click , then you can make precise modifications to the current editing area. For example, when editing the area shown in Fig.2.6.5.7, click the button, the window will pop up, just as Fig.2.6.5.10.

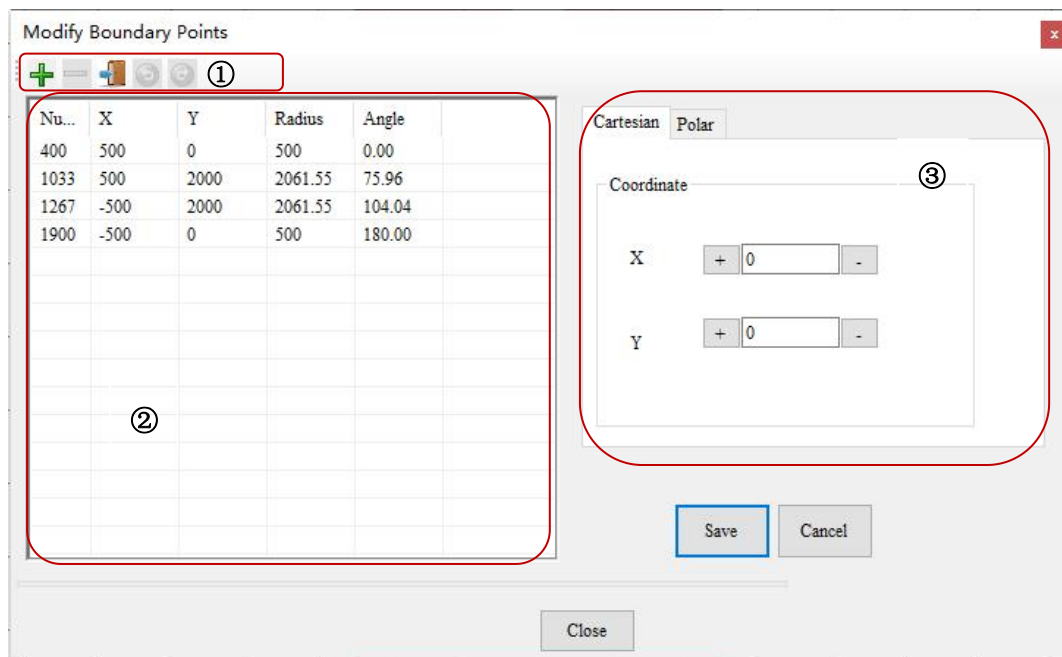


Fig.2.6.5.10 Modify points window

- ① - toolbar: it includes buttons: Add , Delete , Exit , Undo , Redo .
- ② - boundary point list view: displays all coordinate data of user-defined boundary point in list form.
- ③ - coordinate input: modify the coordinate data of user-defined boundary points. Here provides two input methods, XY coordinate and polar coordinate.

Operation example: assuming that the protection zone is defined as the one shown in Fig.2.6.5.7 (a rectangle), we will introduce the functions below, including  Add,  Delete,  Undo,  Redo.

(1) Modify the boundary points of the rectangular area shown in Fig.2.6.5.7. Click , select (500, 0) in the boundary point list in the left of this window, and then adjust the XY coordinate to (500, 500) in the right of this window, then click “Save” to finish the modification. See Fig.2.6.5.11 below for detail:

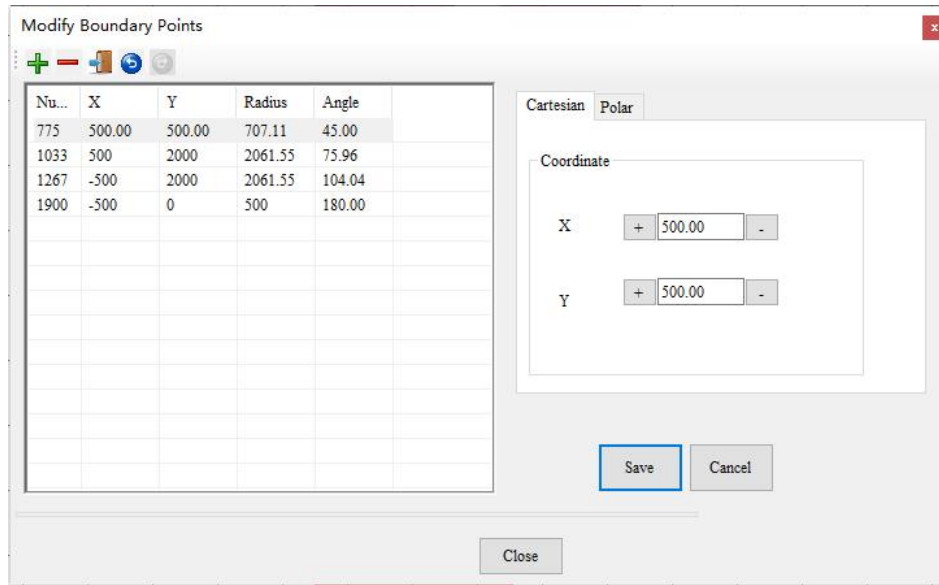


Fig.2.6.5.11 Modify coordinate

Close the pop-up window, then you can the protection area after modifying as shown in Fig.2.6.5.12.

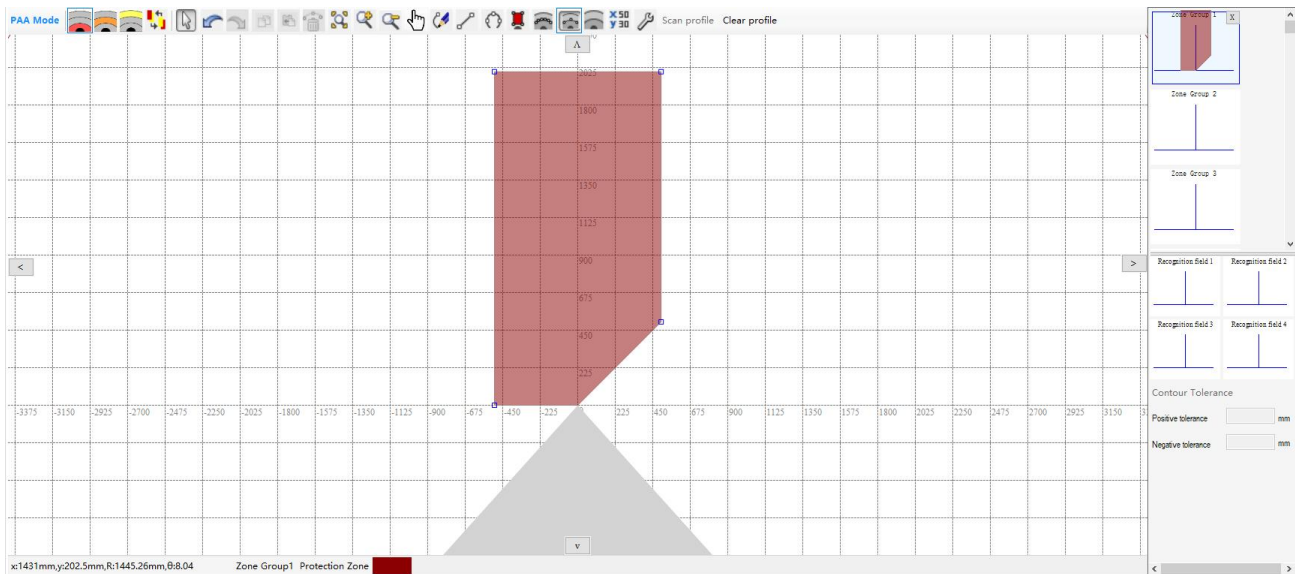


Fig.2.6.5.12 Drawing area after modifying

(2) Add an point to the protection area shown in Fig.2.6.5.7. Click , then click “Add”  in the toolbar on the pop-up dialog. Input XY coordinate (-1000, 1000) or polar coordinate data in the right of the interface, as shown in Fig.2.6.5.13 below.

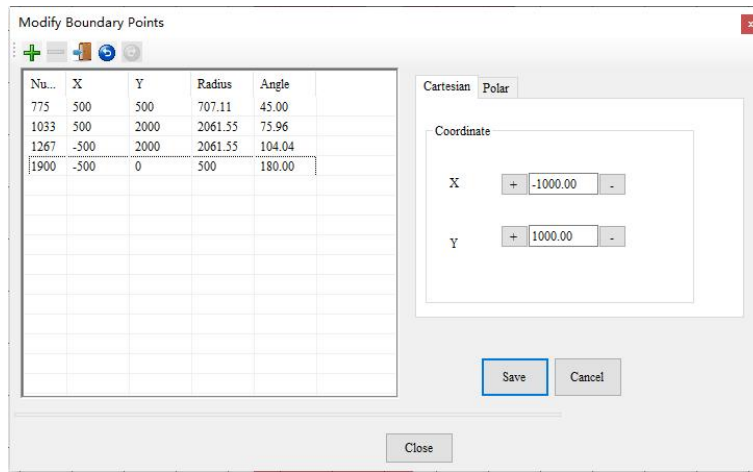


Fig.2.6.5.13 Add a point

Click “Save”, the point is added successfully, you can find this point (-1000, 1000) in the left list view of boundary points, as shown in Fig.2.6.5.14 below:

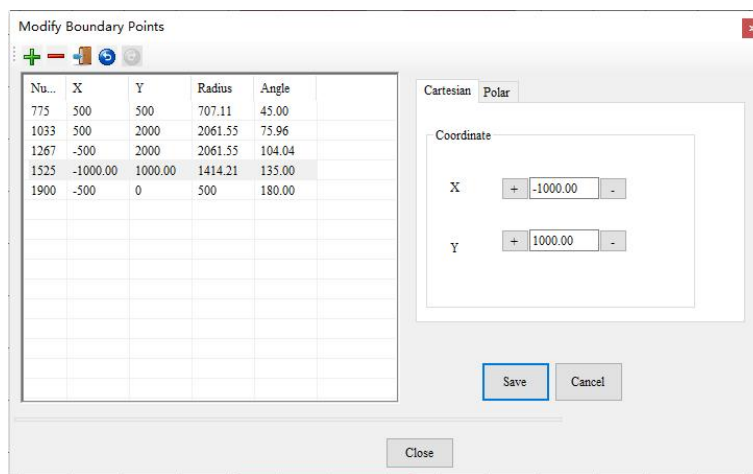


Fig.2.6.5.14 The point added

Close the pop-up window, then you can the protection area after modifying as shown in Figure2.6.5.15.

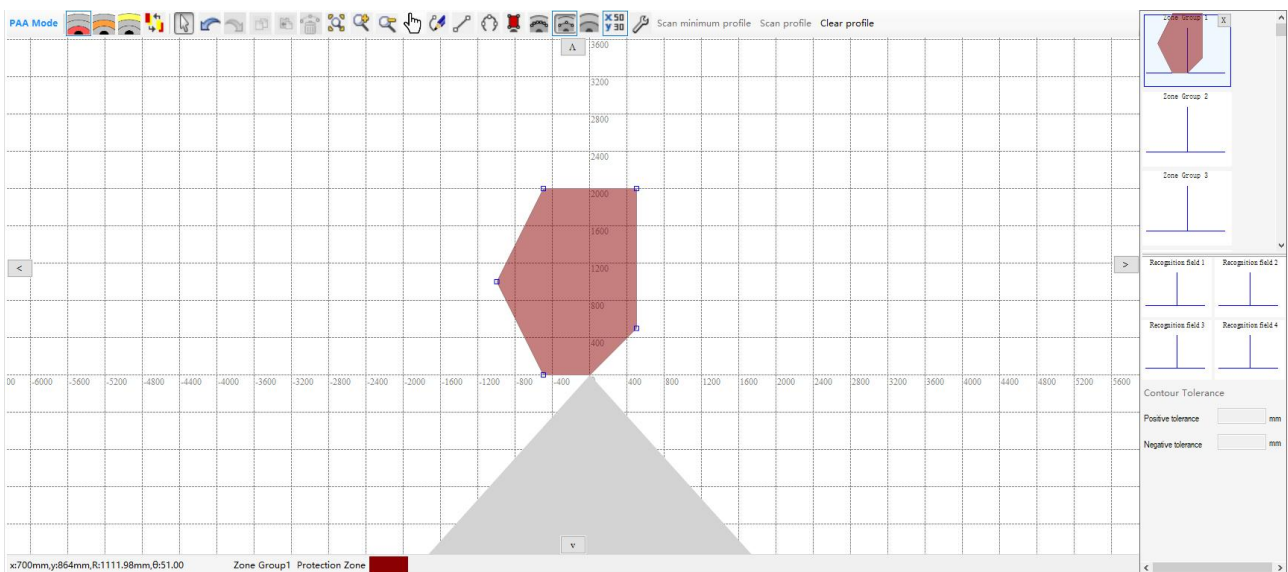


Fig.2.6.5.15 Drawing area after adding a point

(3) Delete the boundary points of the protection area shown in Fig.2.6.5.15 above. Click  and select the point (500, 500) in the left list view of the pop-up window to delete, as shown in Fig.2.6.5.16 below:

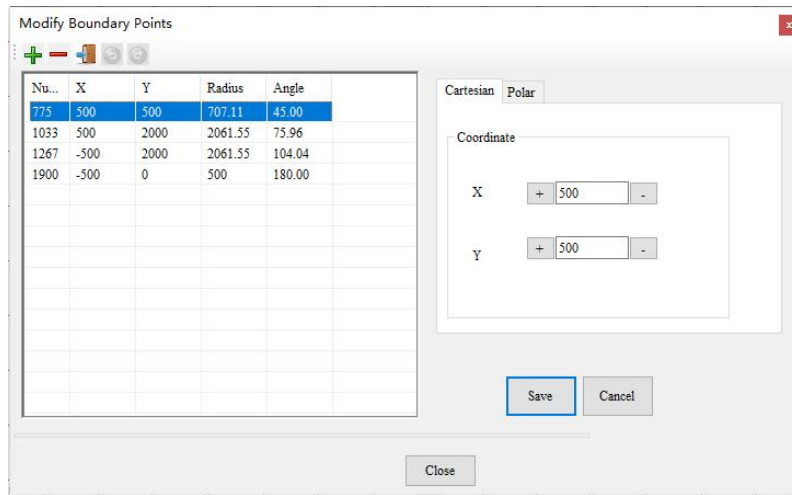


Fig.2.6.5.16 select point to delete

Click “Delete” , and the point (500, 500) in the left list view is delete, as shown in Fig.2.6.5.17 below:

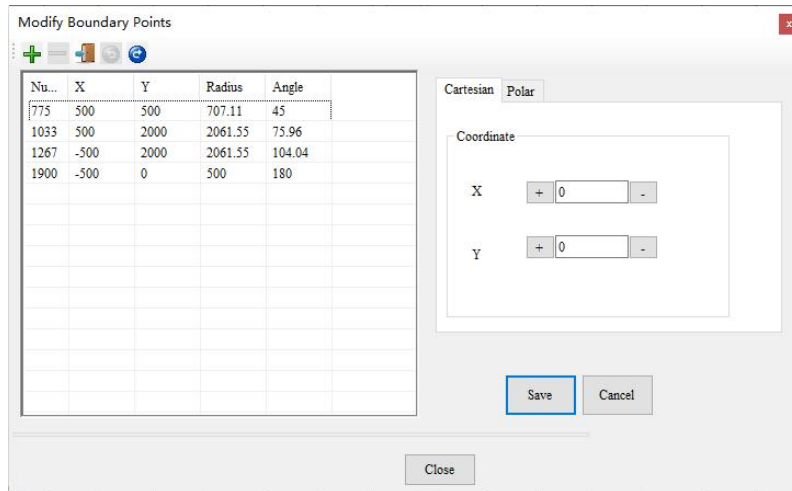


Fig.2.6.5.17 Delete the point selected

Close the pop-up window, then you can the protection area after modifying as shown in Fig.2.6.5.18.

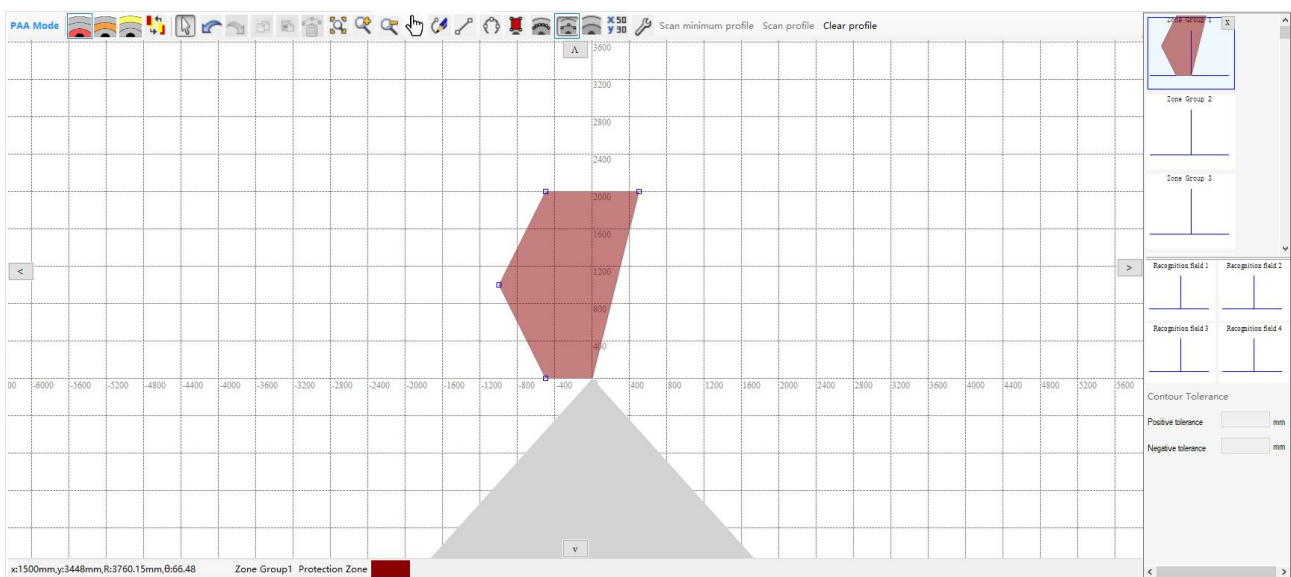


Fig.2.6.5.18 Drawing area after deleting a point

(4) Cancel modifying the boundary points of the rectangular area shown in Fig.2.6.5.7. Click , select (500, 0) in the left list view, then modify XY coordinate to (500, 500) in the right of this interface, and click “Save”, as shown in Fig.2.6.5.11. If you click , the previous operation will be cancelled, and the result is shown in Fig.2.6.5.10. Now, if

you click , the previous operation can be resumed, and the result is shown in Fig.2.6.5.11.

2.6.5.2 Drawing area

The drawing area is for users to draw and display graphics.

- The coordinate unit is millimeter (mm).
- The minimum scale of the coordinate system is 5mm, and the maximum range is 150m.
- The coordinate origin corresponds to the lidar position.
- You can use the four direction buttons (, , , ) to pan the graph, or click  and then hold the left mouse button and drag it to pan the graph.
- You can zoom the graphics by zoom commands (, , ) or the mouse wheel.
- Each type of zone corresponds to a color, as shown in Table 9.

Table 9 Color assignment of Zone

Zone	Color
Protection Zone	Red 
Warning Zone 1	Orange 
Warning Zone 2	Yellow 
Contour Recognition Field	Gray 
Contour Tolerance	Green 

2.6.5.3 Zone group list

In the zone group list on the right of the main window, click the view box of the specific zone group, then you can edit the graphics of each zone of this group. The count of zone groups supported here is up to sixty-four.

When a zone group is selected, its view box will be highlighted in blue. As shown in Fig.2.6.5.20 below, Zone Group 2 is selected now. According to the selection of buttons on the toolbar, the current drawing area is used for editing Protection Zone of Zone Group 2.

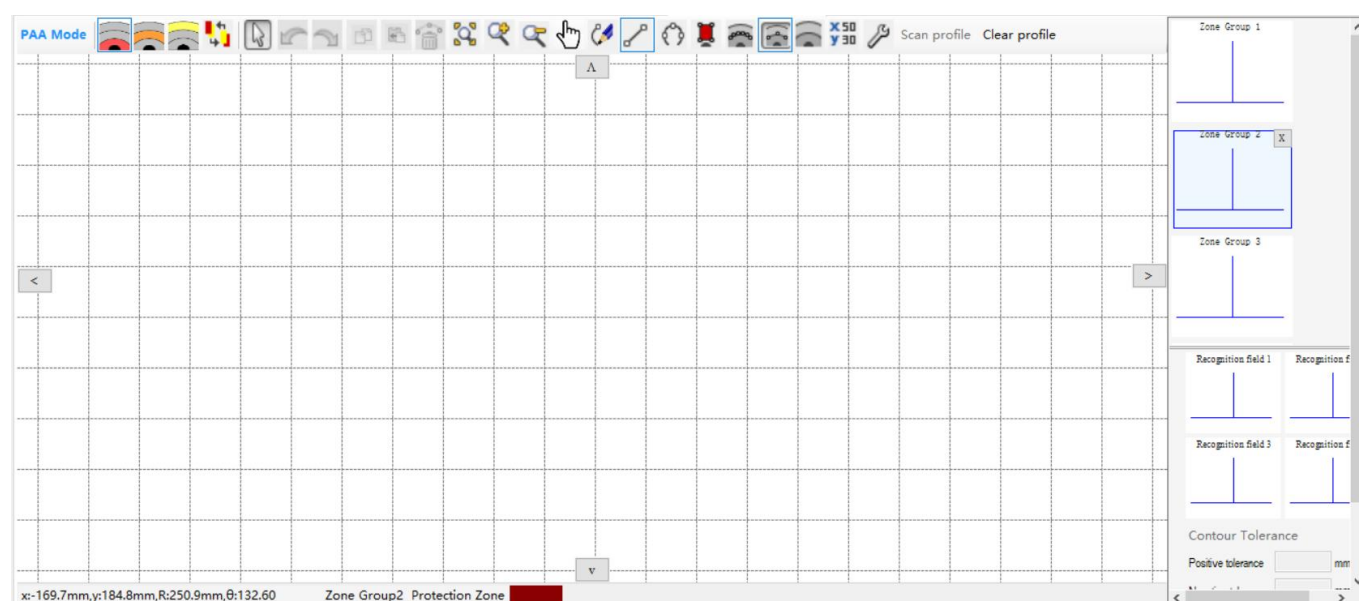


Fig.2.6.5.20 View that Zone Group 2 is selected

- Click the delete button in the upper right corner of the view box to empty the graphics in the drawing area, as shown in Fig.2.6.5.21 below.

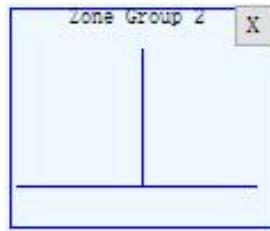


Fig.2.6.5.21 Small view of zone group

2.6.5.4 Contour recognition field

This area is designed to draw and edit the shape of the recognition area for user, and the tolerance of the contour recognition field can also be set here. The count of contour recognition field supported here is up to four.

Click the small view of the specific contour recognition on the list, the drawing area and toolbar buttons will switch to the drawing and editing of the contour recognition field, and the contour tolerance panel will display the positive and negative tolerance values of the recognition field.

When a recognition field is selected, its view box is highlighted in blue. As shown in Fig.2.6.5.22 below, Contour Recognition Field 1 is selected, so this contour recognition field can be edited.

 is the tool to draw contour recognition field in the toolbar, and the default values of positive and negative contour tolerance are both 50 mm.

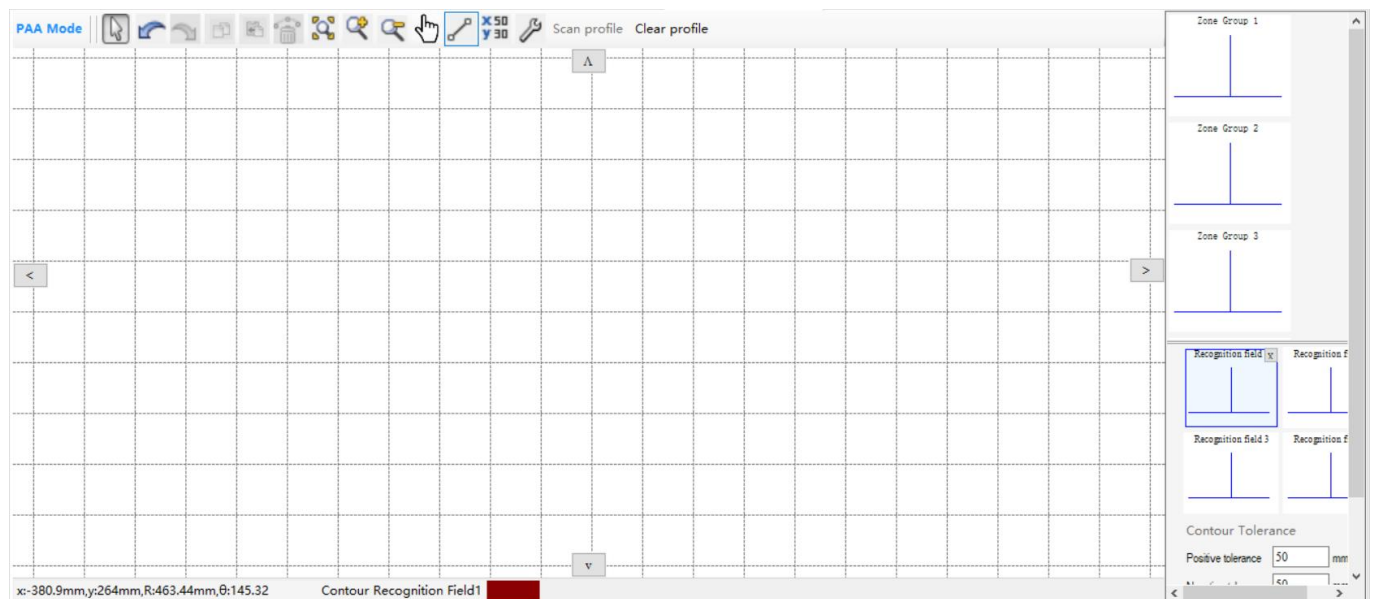


Fig.2.6.5.22 View that Contour Recognition Field 1 is selected

- Click the delete button in the upper right corner to empty the graphics in the drawing area, as shown in Fig.2.6.5.23 below.

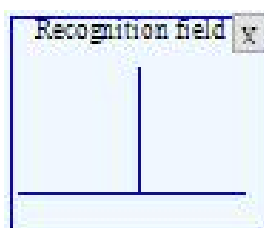


Fig.2.6.5.23 Small view of contour recognition field

2.6.5.5 Contour tolerance setting

The contour recognition field has a positive and a negative tolerance zone. By setting positive and negative tolerances, contours with tolerance bands are generated.

Positive tolerance: tolerance away from lidar.

Negative tolerance: tolerance close to lidar.

As shown in Fig.2.6.5.24 below, the positive and negative tolerances for the contour recognition field are 50 mm, respectively. When the contour recognition field is used as the input condition for the monitoring case, The contour detected by KLM is within the tolerance zone of the recognition field, and the static and dynamic input conditions for the case are all satisfied before the monitoring case can be activated.

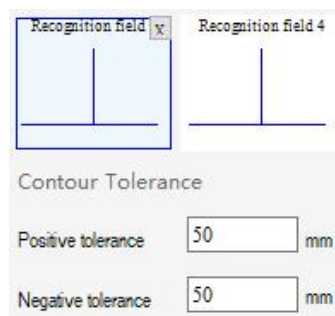


Fig.2.6.5.24 Contour tolerance setting

■ Note:

➤ When drawing the recognition field, the lidar can be in a scanning state, which helps to draw the contour recognition field. After the location and shape of the recognition field is determined, you can use the tool  to draw its outline. In the drawing area, click the left mouse button at the point that determined as outline point in turn, double-click the left mouse button to end the drawing, and automatically generate the contour recognition field and tolerance zone. Fig.2.6.5.25 shows an area of the contour recognition field that has been drawn. Contour tolerances can be set before or after drawing the contour. When the contour recognition field is selected, you can drag a single point or all points on the outline of the recognition field, or precisely modify the points on the outline of the recognition field with the tool , when the modification completes, the contour recognition field and the tolerance zone will regenerate.

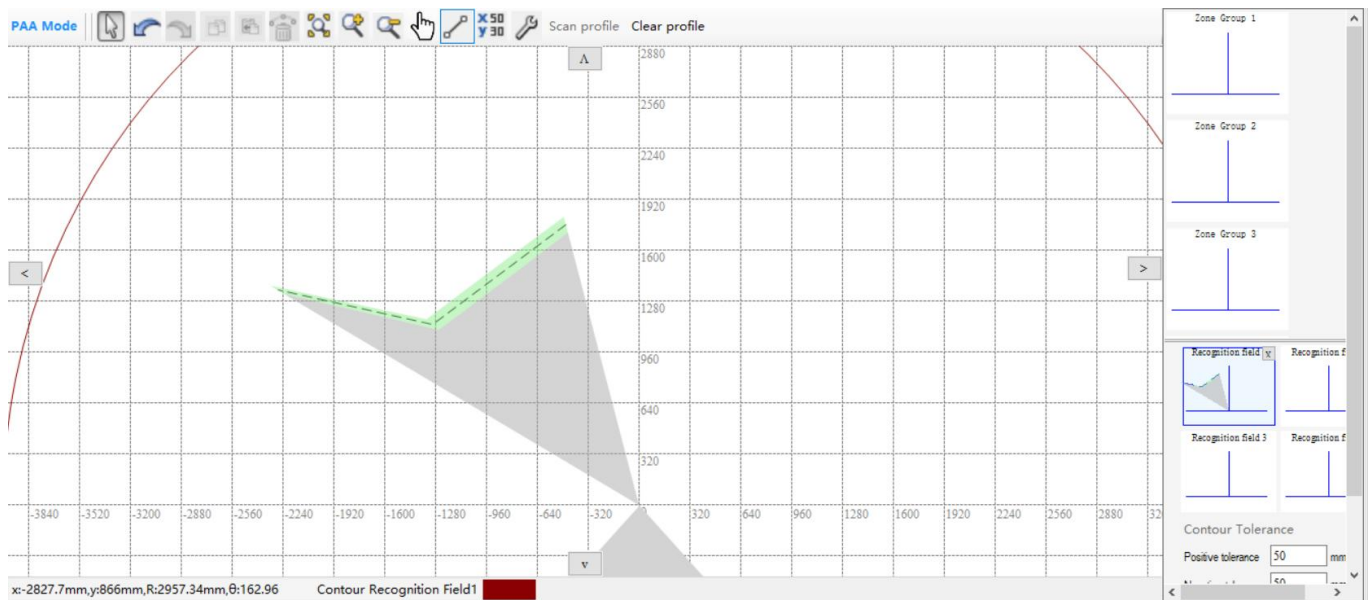


Fig.2.6.5.25 Example for contour recognition field

2.6.5.6 Status bar

The status bar includes the coordinate information (both Cartesian and Polar coordinates) of the cursor in the drawing area, the current editable zone information, and zone color.

- As the cursor moves in the drawing area, the coordinate information of the status bar is updated in real time.
- When you click  to edit Protection Zone, the status bar displays as shown in Fig.2.6.5.26 (for example, Zone Group 1).

x:-1228mm,y:792mm,R:1461.25mm,θ:147.12 Zone Group1 Protection Zone 

Status bar showing Protection Zone in PAA mode

x:3132mm,y:1344mm,R:3408.19mm,θ:23.28 Zone Group1 Protection Zone 1 

Status bar showing Protection Zone 1 in PP mode

x:-2396mm,y:-288mm,R:2413.25mm,θ:186.84 Zone Group1 Protection Zone 2 

Status bar showing Protection Zone 2 in PP mode

Fig.2.6.5.26 Status bar showing protection zone

- When you click  to edit the Warning Zone 1, the status bar displays as shown in Fig.2.6.5.27 (for example, Zone Group 1).

x:3828mm,y:-1920mm,R:4282.52mm,θ:-26.64 Zone Group1 Warning Zone 1 

Fig.2.6.5.27 Status bar showing Warning Zone 1

- When you click  to edit the Warning Zone 2, the status bar displays as shown in Fig.2.6.5.28 (for example,

Zone Group 1).

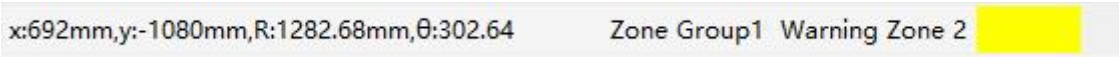


Fig.2.6.5.28 Status bar showing Warning Zone 2

➤ When you select the contour recognition field to edit, the status bar displays as shown in Fig.2.6.5.29 (for example, Contour Recognition Field 1).

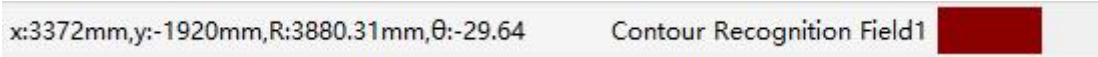


Fig.2.6.5.29 Status bar showing contour recognition field

2.6.6 Monitoring cases

On the interface of the tab “Monitoring Cases”, the user can determine the monitoring case, its input conditions and assign zone group to cut-off path.

Users can manage the monitoring case, and set the name, activation conditions and its zone groups under cut-off path. As shown in Fig.2.6.6.1. Up to 256 monitoring cases can be added to KLM, corresponding to 64 different zone groups.

+Add -Delete ①

Monitoring case		Input condition						Cut-off path			
Number	Name	A	B	C	D	E	F	Speed 1 (mm/s)	Speed 2 (mm/s)	Contour Recognition Field	Zone Group
1	monitor case 1	1			0		/	Not used	Not used	Not used	Zone Group 1
								Recognition field		Protection Zone Warning Zone 1 Warning Zone 2	
2	monitor case 2	0			1		1	Not used	Not used	Not used	Zone Group 2
								Recognition field		Protection Zone Warning Zone 1 Warning Zone 2	
3	monitor case 3	1					1	Not used	Not used	Not used	Unselected
								Recognition field		Protection Zone Warning Zone 1 Warning Zone 2	
4	monitor case 4	0			1		0	Not used	Not used	Not used	Unselected
								Recognition field		Protection Zone Warning Zone 1 Warning Zone 2	

⬇ ⬇ ⬇

☒ OSSD pair 1 ☒ Alarm 1 ☒ Alarm 2

Fig.2.6.6.1 Monitoring cases

- ①- Add / Delete case
- ② - Monitoring case number and name
- ③ - Static control input condition configuration
- ④ - Dynamic control input condition configuration
- ⑤ - Contour recognition field allocation
- ⑥ - Zone group allocation of monitoring cases and cut-off paths

2.6.6.1 Add/delete case

Click “+Add”, and a new monitoring case will be generated in sequence by number in the case list. The default name is "monitor case X", and "X" is the number of the case. In the case list, click the line where the case that you want to delete. The background of this line is blue, that is, the line is selected, and then click “-Delete” to delete this case. When a monitoring case is added or deleted, all current monitoring cases are automatically rearranged in numbered order.

2.6.6.2 Monitoring case naming

As shown in Fig.2.6.6.2, click in the name input field, and the input cursor flashes, indicating that the name can be editable. At present, the name is only allowed to be in English.

+Add
-Delete

Monitoring case							
Number	Name	A	B	C	D	E	F
1	monitoring case 1						

Fig.2.6.6.2 Name of monitoring case

2.6.6.3 Static control input condition

On The configuration area of static control input conditions, the static input signals A ~ F are arranged from left to right. After the static input signal is assigned to the pin in tab Local I/O, the corresponding static input signal here can be changed as the static activation condition for monitoring case switching. The static input button in gray indicates that the static input is not allocated and unavailable.

On the tab “Local I/O”, you can first assign the static control input terminals A ~D to the corresponding pins. And then you can switch the tab to “Monitoring cases” to change the status of static input conditions A ~ E of each monitoring case, whose values can be “0”, “1”, “1”, “1”, as shown in Fig.2.6.6.3.

Monitoring case							
No.	Name	A	B	C	D	E	F
1	monitoring case 1	0	1	1	1		

Fig.2.6.6.3 Configuration of static control input condition

■ **Note:**

The static control input adopts the redundant complementary mode and switches the state of the static input through the inversion of the channel. The following table takes static control input A (pin 6/7 is assigned as static input A, where pin 6 signal is A1 and pin 7 signal is A2) as an example to illustrate the logic state of static input signal A; The logic state of static input signals B ~ F is the same as that of A.

Table 7 Logic state analysis of input signal A

A1	A2	Logical state of A	Description
0	1	0	When input level states of pin 6 and pin 7 are 0 and 1, input signal A is 0
1	0	1	When input level states of pin 6 and pin 7 are 1 and 0 respectively, input signal A is 1
0	0	fault	When input level states of pins 6 and 7 are both 0, the status of input signal A is faulty
1	1	fault	When input level states of pins 6 and 7 are both 1, the status of input signal A is faulty

2.6.6.4 Dynamic control input condition

You can assign the encoder as dynamic control input and configure the parameters for encoder, then configure the speed range of the monitoring case as a necessary condition for the activation of the monitoring case. The speed range of the monitoring cases should be within the speed range of the encoder and be configured according to the actual speed of use. The specific application is detailed in Section 3.2.

First, you can assign Four encoder inputs in tab “Local I/O”, the speed range of the encoder is to [-10000, 10000] (unit: mm/s). Then, you can do the configuration for the dynamic input condition in tab “Monitoring cases” as shown in Fig.2.6.6.4. When case 1 is monitored, the speed of encoders 1 and 2 is between -1000mm/s-1000mm/s and that of encoders 3 and 4 is between 2000mm/s-10000mm/s. When case 2 is monitored, the speed of encoders 1 and 2 is between -5000mm/s and -2000mm/s, and the speed of encoders 3 and 4 is between 5000 and 10000mm/s.

Monitoring case		Input condition					
Number	Name	A	B	C	D	E	F
1	monitoring case 1	0	1				
		Speed 1 (mm/s)		Speed 2 (mm/s)			
		Range		Range			
		-1000 1000		2000 10000			
2	monitoring case 2	0	1				
		Speed 1 (mm/s)		Speed 2 (mm/s)			
		Range		Range			
		-5000 -2000		5000 10000			

Figure2.6.5.4 Dynamic control input conditions

■ Note:

- The speed range of the dynamic control input condition is not allowed to exceed the encoder speed range configured in tab “Local I/O”.
- The speed range of dynamic control input conditions should include stop section (-100, 100) (unit: mm/s).
- When monitoring the case switching only by the state of dynamic control input, at least one speed range in Speed 1 or Speed 2 does not overlap to effectively switch.

2.6.6.5 Contour recognition input condition

When the contour recognition field is used as the input condition, there are six choices: Not used, Recognition field 1, Recognition field 2, Recognition field 3, Recognition field 4 and No recognition fields matches. "Not used", that is, recognition field is not used as the input condition.

When using the contour recognition field as a condition for field zones switching, the user can select the corresponding option from the drop-down list of the contour recognition field in column “Input condition”, as shown in Fig.2.6.6.5.

When the outline scanned by the lidar is within the tolerance area of the contour recognition field of the monitoring case (see 2.6.4.4 and 2.6.4.5 for related concepts), so the contour recognition field condition of the corresponding monitoring case is satisfied, and if other input conditions of the case are all met at the same time, the monitoring case is activated, and the cut-off path of the case is used for zone protection.

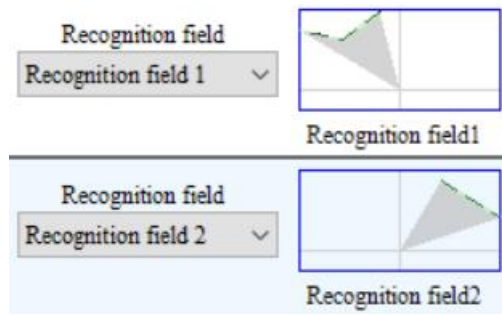


Fig.2.6.6.5 Input condition of contour recognition field

■ **Note:**

The contour recognition field drawn does not need to be identical to the outside contour, as long as it can be completely covered by the contour tolerance zone.

2.6.6.6 Composite input conditions

Firstly, the user allocates the static control input and encoder input signals in tab “Local I/O”, and then, a variety of input conditions can be used to jointly control the switching of monitoring cases, which is named composite input conditions. When multiple input conditions are configured for a monitoring case at the same time, all input conditions must be met at the same time before switching to the case.

As shown in Fig.2.6.6.6 below, when the state of static control input A is 0, the state of F is 1; And the speed of encoder 1 is between -2000mm/s and 1000mm/s; And the external contour conforms to Recognition field 1, Then monitoring case 1 will be enabled.

+Add -Delete		* The range of speed 1 is : [-10000,10000]									
Monitoring case		Input condition									
No.	Name	A	B	C	D	E	F	speed1 mm/s	speed2 mm/s	Recognition field	Zone Group
1	monitoring case 1	0					1	Range -2000 1000	Not used	Recognition field 1	Zone Group 1
										Recognition field1	Protection Zone
											Warning Zone 1
											Warning Zone
2	monitoring case 2	1					0	Range 1500 4000	Not used	Recognition field 2	Zone Group 2
										Recognition field2	Protection Zone
											Warning Zone 1
											Warning Zone

Fig.2.6.6.6 Monitoring cases with composite input conditions

2.6.6.7 Zone group allocation

If you want to assign the corresponding zone group to the cut-off path of each monitoring case, you can select the zone group from the drop-down list, with a total of 1 to 64 optional, as shown in Fig.2.6.6.7.



Fig.2.6.6.7 Zone group allocation

2.6.7 Diagnosis

The tab “Diagnosis” monitors the lidar online and displays the status information of the lidar indicator window, the contour boundary of the current zone group and the contour of the surrounding environment, as shown in Fig.2.6.7.

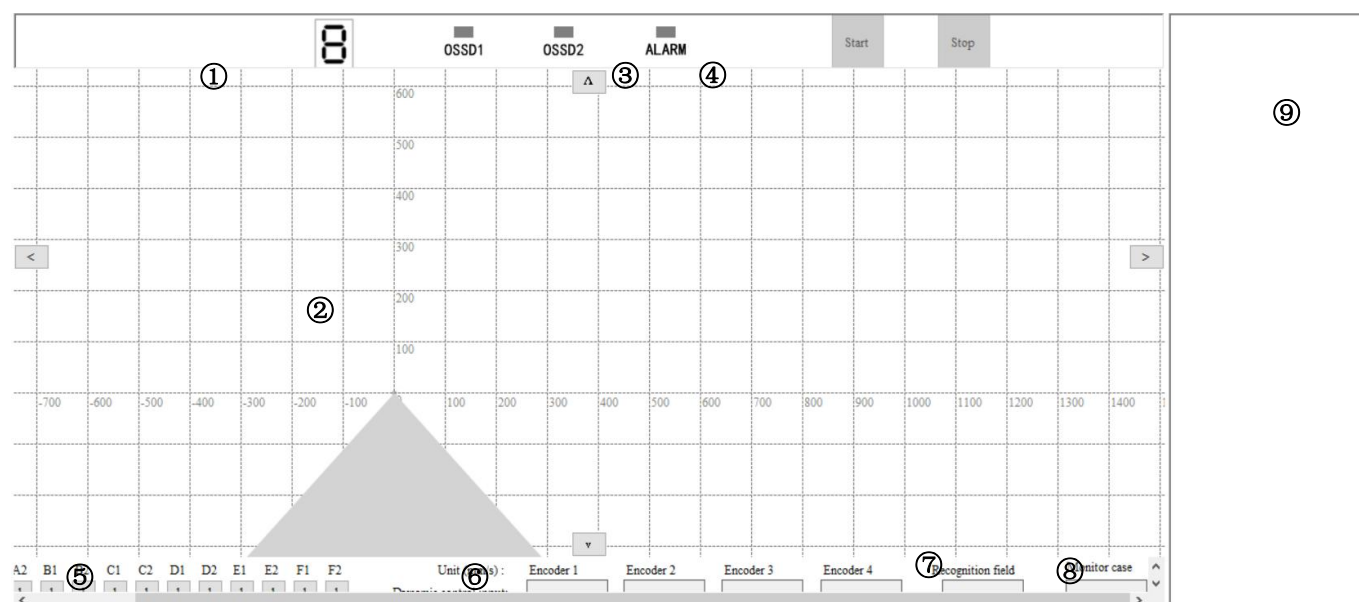


Fig.2.6.7 Tab “Diagnosis”

① - indicator status bar: the number of the current zone group is displayed in real time through numbers on the left side of the status bar. For example, if zone group 6 is activated, it is displayed on the left side of the status bar **06**. See Table 10 for the detailed meaning of other indications.

② - canvas area: displays the boundary outline and surrounding environment outline of the current protection area.

③ - button “Start”: start the diagnostic function, which can be used after establishing a connection. Click it to read the online lidar configuration information and display it in the canvas and indicator status bar.

④ - button “Stop”: “Stop” is available after clicking button “Start”. Click it to pause the real-time update of the environment outline, and the indicator status bar will return to the initial state. To restart the diagnosis, click the button “Start” again.

⑤ - static input signal: display the signal status of the static control input (“0” or “1”) in real time.

⑥ - dynamic input signal: display the speed of the autonomous guided vehicle that is input by the incremental encoder in real time.

⑦ - recognition field number: the number of the contour identification area corresponding to the current radar scanning profile is displayed in real time; 0 is displayed if the current environment does not match any of the contour recognition field.

⑧ - Monitoring case number: the number of enabled monitoring cases in real time. If no monitoring case is enabled, the number is 0.

⑨ - Error message bar: display the fault of the radar in the current state in real time, and it is empty if there is no fault.

Table 10 Meanings of indications on the tab “Diagnosis”

Meaning	Indication	Lidar state description
Indicating power status	 POWER	Lidar is powered on.
	 POWER	The lidar's power supply is disconnected, and there is no power supply.
Indicating protection zone status	 OSSD1	Indicates in PAA mode of defense zone, no object is detected in the protection zone, and OSSD outputs ON status.
	 OSSD1	Indicates in PP mode of defense zone, no object is detected in the protection zone 1, and OSSD outputs ON status.
	 OSSD1	Indicates in PAA mode of defense zone, objects are detected in the protection zone, and OSSD outputs OFF status.
	 OSSD1	Indicates in PP mode of defense zone, objects are detected in the protection zone 1, and OSSD outputs OFF status.
	 OSSD1	Lidar's power disconnected, no power supply.
Indicating protection zone status	 OSSD2	Indicates in PP mode of defense Zone, no object is detected in the protection zone 2, and OSSD outputs ON status.
	 OSSD2	Indicates in PP mode of defense Zone, objects are detected in the protection zone 2, and OSSD outputs OFF status.
	 OSSD2	PAA mode
	 OSSD2	Lidar's power supply is disconnected, and there is no power supply.
Indicating warning zone status	 ALARM	In PAA mode, the configured warning zone detects objects: If two warning zones are configured, one of them can meet the requirements.
	 ALARM	PP mode
	 ALARM	In PAA mode, no warning zone is configured.
indicating the value of digital tube		Protection zones are not configured, or zone group input signal failure.
		A valid zone group is being monitored
		Establish a communication connection with a computer.
		KLMs is configured successfully.
		KLMs system failure
		Display window dirty, activated when the window is dirty seriously.

Note:

When the digital tube indicates the coexistence of multiple states, multiple status words are displayed circularly.

2.6.8 Recorder

This tab is used to display the boundary data information of current zone group outline and the surrounding environment outline during diagnosis, as shown in Fig.2.6.8.

Ethernet Settings		Local I/O	Zone Settings		Monitoring Cases		Diagnosis	Recorder	Data Profile Scanni
Serial Number	Angle	Status	Protection Zone	Warning Zone 1	Warning Zone 2	Distance			
1	-48.00	Scanning	0.0	0.0	0.0	958.0			
2	-47.88	Scanning	0.0	0.0	0.0	948.0			
3	-47.76	Scanning	0.0	0.0	0.0	962.0			
4	-47.64	Scanning	0.0	0.0	0.0	964.0			
5	-47.52	Scanning	0.0	0.0	0.0	956.0			
6	-47.40	Scanning	0.0	0.0	0.0	968.0			
7	-47.28	Scanning	0.0	0.0	0.0	970.0			
8	-47.16	Scanning	0.0	0.0	0.0	970.0			
9	-47.04	Scanning	0.0	0.0	0.0	968.0			
10	-46.92	Scanning	0.0	0.0	0.0	984.0			
11	-46.80	Scanning	0.0	0.0	0.0	992.0			
12	-46.68	Scanning	0.0	0.0	0.0	994.0			
13	-46.56	Scanning	0.0	0.0	0.0	1000.0			
14	-46.44	Scanning	0.0	0.0	0.0	1008.0			
15	-46.32	Scanning	0.0	0.0	0.0	1014.0			
16	-46.20	Scanning	0.0	0.0	0.0	1038.0			
17	-46.08	Scanning	0.0	0.0	0.0	1044.0			
18	-45.96	Scanning	0.0	0.0	0.0	1054.0			
19	-45.84	Scanning	0.0	0.0	0.0	1058.0			
20	-45.72	Scanning	0.0	0.0	0.0	1064.0			
21	-45.60	Scanning	0.0	0.0	0.0	1056.0			
22	-45.48	Scanning	0.0	0.0	0.0	1062.0			

Fig.2.6.8 Tab "Recorder"

2.6.9 Data Contour Scan

This tab is used to display the contours of the surrounding objects detected by the lidar in real time, as shown in Fig.2.6.9.

Scan profile: After clicking, the contours of the surrounding objects detected by the lidar are displayed in the canvas area.

Stop Scanning: In the same position as the button "Scan profile", when the lidar starts scanning, it shows "Stop Scanning". After clicking, the outline of the canvas area stops updating.

Clear profile: It is used to clear the outline displayed in the canvas area for rescan after stopping scanning.

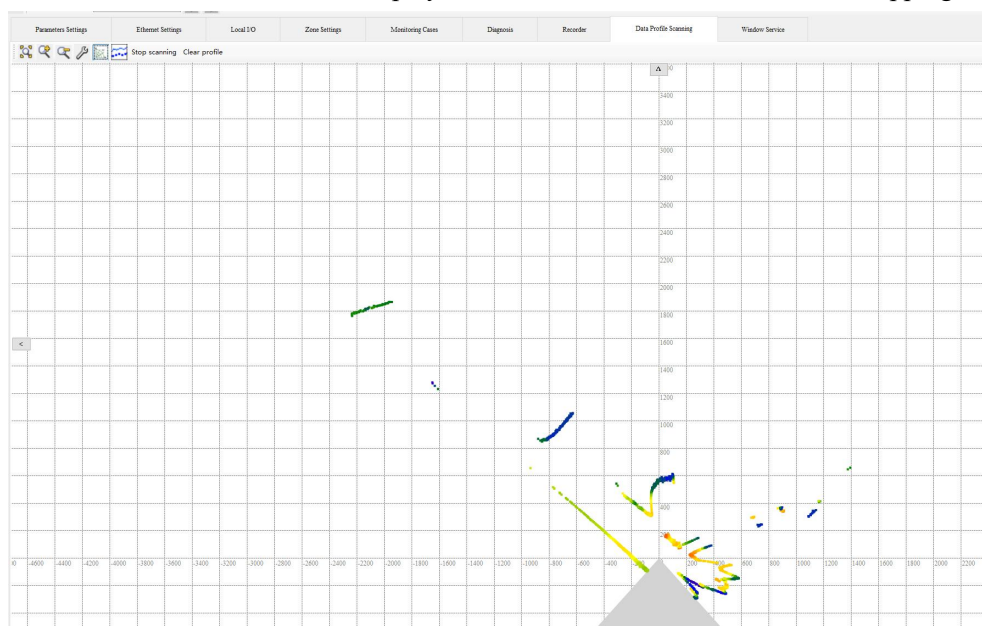


Fig.2.6.9 Data Contour Scan

Note:

Only PE lidar connected through Ethernet can use data contour scanning function.

2.6.10 Window Service

This TAB is used to detect the dirty state of the radar window, so that users can carry out targeted cleaning of the window, as shown in Fig.2.6.10.

Read status: After clicking, the dirty position of the window will be displayed in real time through the red area.

Calibrate: You need to click "Calibrate" only after replacing a new window, and you should ensure that the window is clean before clicking "Calibrate". After clicking, the radar will automatically calibrate the pollution detection parameters.

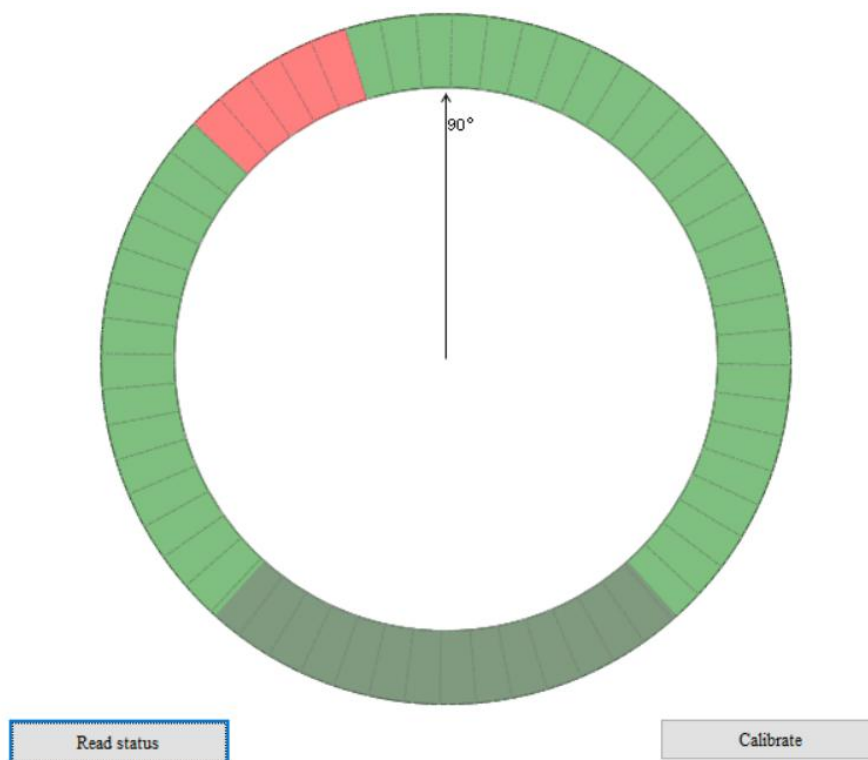


Fig.2.6.10 Window Service

Note:

The window stain detection function only detects the Angle from which the region group and contour recognition area are drawn. If a specific contour recognition area and region group are currently activated, the Angle corresponding to the currently activated region is detected. Otherwise, the angles corresponding to all drawn area groups and contour recognition areas are detected.

2.7 Status bar

This is used to display the KLM configuration software's connection status to lidar, as shown in Fig.2.7.



Fig.2.7 Status bar

Device offline: Software and lidar are not connected.

Device Online: The software is connected to the lidar and displays the IP address of lidar.

3 Application Examples of KLM Lidar Configuration Software

3.1 Configuration Preparation

3.1.1 Software, hardware and cable preparation

Before configuring the KLM lidar, in addition to lidar, you need to prepare the power/control interface cable, the network interface, and a computer with the configuration software.

3.1.2 USB driver installation

Driver installation is only required when connecting for the first time. Connect the two ends of the configuration cable to the computer and the KLM lidar respectively. The operating system above Win7 will automatically complete the identification of KLM and driver installation under the condition of networking. For Windows XP system, a pop-up window will prompt to find new hardware wizard, please follow the steps below to complete the driver installation:

- (1) Select "Yes, only this time (Y)" and click "Next". As shown in Fig.3.1.2.1 below.



Fig.3.1.2 Found new hardware wizard

- (2) Select "Install from a list or specified location" and click "Next". As shown in Fig.3.1.3.



Fig.3.1.3 Found new hardware wizard

- (3) Select "Don't search, I want to choose the driver to install by myself", click Next, as shown in Fig.3.1.4.

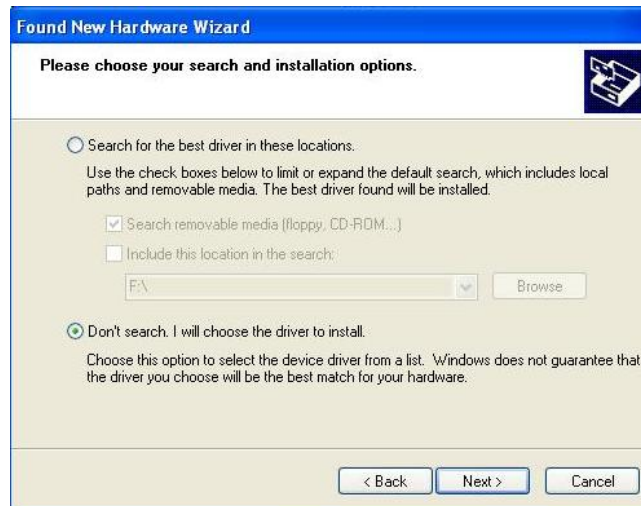


Fig.3.1.4 Driver installation wizard

- (4) Select the "USB Serial Converter" version in the device model list: 2.12.6.0 (2015-7-10), click "Next", as shown in Fig.3.1.5.



Fig.3.1.5 USB Serial Converter selection

- (5) The following window will pop up, showing that the driver is being installed, as shown in Fig.3.1.6.



Fig.3.1.6 USB driver installation

(6) If the operation is correct, the following window will pop up, click “Finish”, as shown in Fig.3.1.7.



Fig.3.1.7 Completing the new hardware wizard

Note: After completing the installation, the following window will pop up again for most systems:



Follow the previous steps and repeat the operation again to complete the USB driver installation.

(7) After the USB driver is installed correctly, the user can view the COM port used after the lidar is connected to the computer. The specific steps are as follows:

■ Right-click "My Computer" and click the "Management" menu item in the pop-up menu, as shown in Fig. 3.1.8 below.



Fig.3.1.8 Right-click “My Computer”

- In the open window, click "Device Manager", as shown in Fig.3.1.9 below.

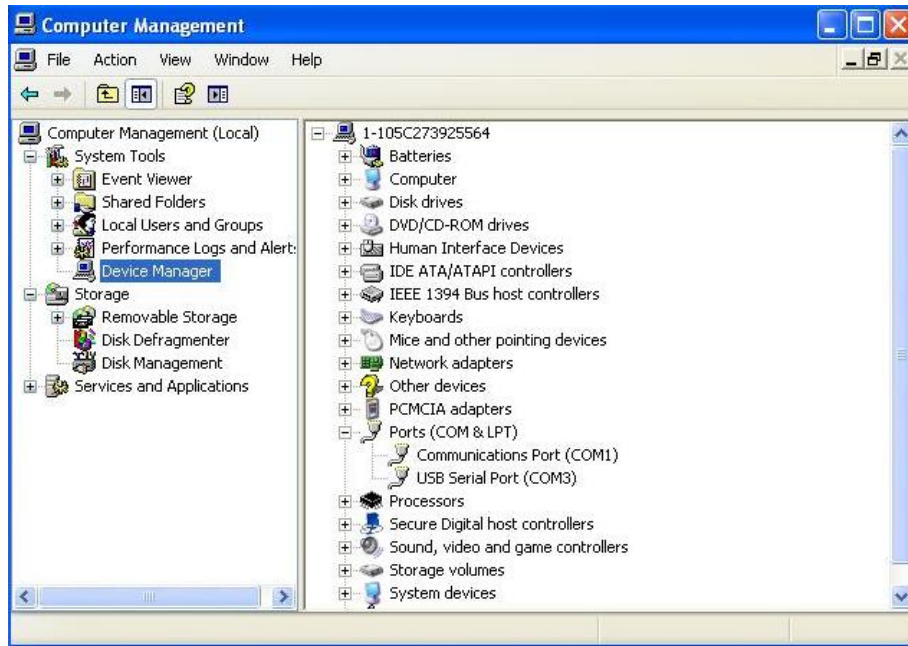


Fig.3.1.9 Device Manager

- In the window of Fig.3.1.9, expand the branch item "Port", in which "USB Serial Port (Com 13)" is the COM port connected to the KLM lidar, as shown in Fig.3.1.10 below.

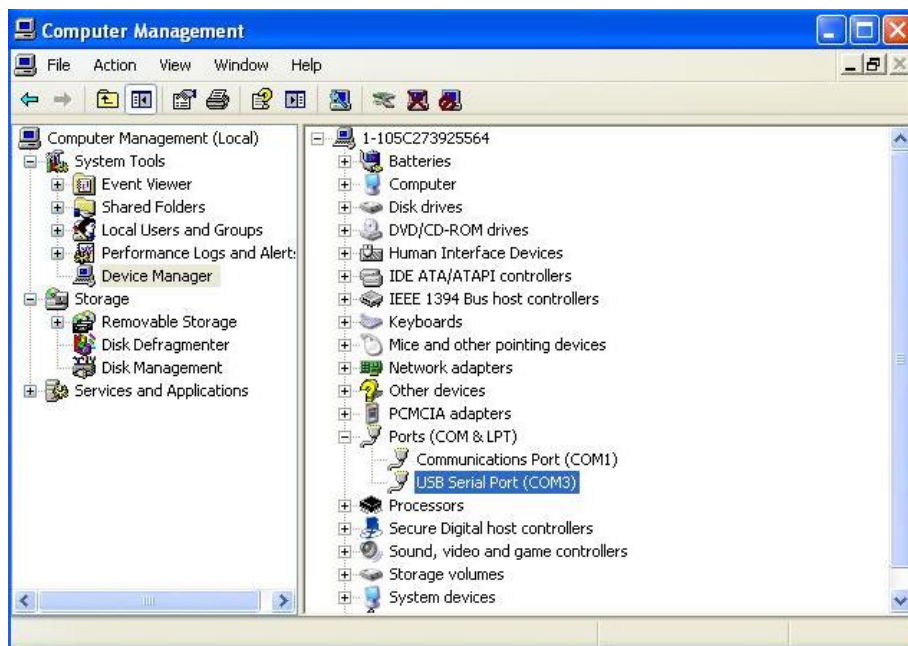


Fig.3.1.10 USB Serial Port

3.1.3 Power on and start

Connect one end for the transmission line to the lidar power control interface and connect the other end for the power connection line to the DC 24V power supply. The lidar is powered on and the digital tube starts to flash (with an interval of 1 second). After 10 seconds, the digital tube stops flashing, and the lidar Startup is complete.

3.1.4 Configuration software startup



Double-click the shortcut icon of the KLM configuration software on the desktop to start the software, select the model of the device in the pop-up dialog box, and then click the "OK" button to enter the relevant main interface (Fig.3.1.11).

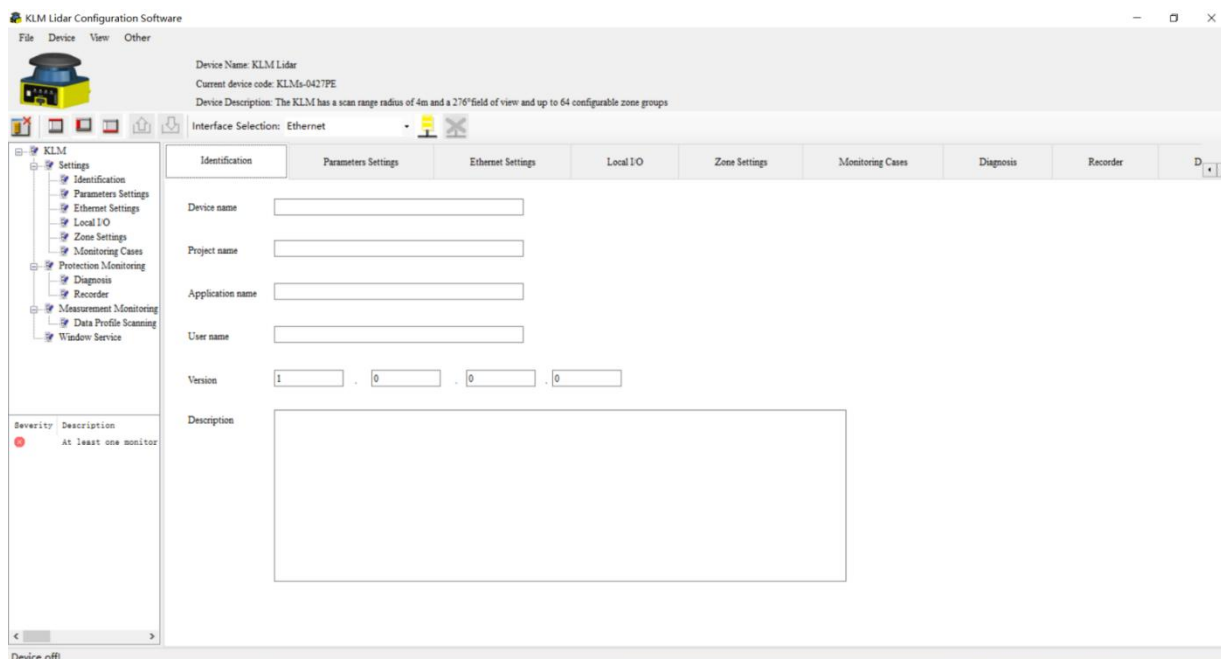


Fig.3.1.11 User interface

3.1.5 Establish a connection

The connection method that the user can choose varies according to the radar. The BP radar can only be connected by serial port, and the PE radar can be connected by serial port or Ethernet.

3.1.5.1 Serial connection establishment

(1) The default mode of configuration interface is serial communication. You can directly click the establish connection button , and the window as shown in Fig.3.1.12 will pop up. Click the drop-down menu to select the corresponding serial port.

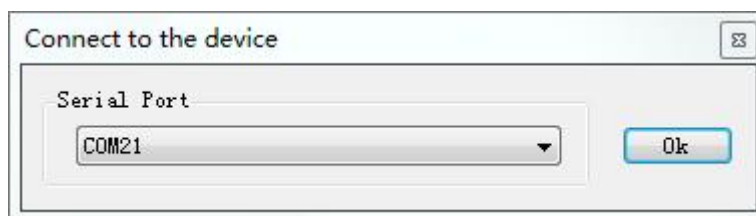


Fig.3.1.12 Serial port selection

(2) After clicking “OK”, if the connection between the software and the lidar is successful, a pop-up box will prompt that the connection is successful, as shown in Fig.3.1.13, the digital tube displays **6**; if the connection fails, a pop-up window will prompt the user that the device connection is abnormal, as shown in Fig.3.1.14.



Fig.3.1.13 Connection success prompt



Fig.3.1.14 Connection failure prompt

- (3) Click “OK” or close the pop-up window to complete the configuration preparation.

3.1.5.2 Establishing connection via Ethernet—customizing the IP address

- (1) Click the drop-down box of configuration interface selection and select Ethernet, as shown in Fig.3.1.15.



Fig.3.1.15 Communication mode selection

- (2) Click the establish connection button , the computer automatically searches for devices in the entire network segment, and displays the searched devices in the device list, as shown in the pop-up window in Fig.3.1.6.

Number	Type Code	SN	MAC	IP	Subnet Mask	Gateway	Local IP
1	KLM-1227PE	20220415-000005	0250C2280035	192.168.0.10	255.255.255.0	192.168.0.1	192.168.10.241
2	KLM-1227PE	20220415-000001	0250C228002F	192.168.0.10	255.255.255.0	192.168.10.1	192.168.10.241

Step 2: Network Settings

SN: MAC: Local IP: . . .

IP: . . .

Subnet Mask: . . .

Gateway: . . .

Step 3: Connect

Fig.3.1.16 KLMs connection setup 1

- (3) Select the one with the same SN number as the connected device in the device list, the device and local IP address will be displayed in the network modification, as shown in Fig.3.1.17.

Number	Type Code	SN	MAC	IP	Subnet Mask	Gateway	Local IP
1	KLM-1227PE	20220415-000005	0250C2280035	192.168.0.10	255.255.255.0	192.168.0.1	192.168.10.241
2	KLM-1227PE	20220415-000001	0250C228002F	192.168.0.10	255.255.255.0	192.168.10.1	192.168.10.241

Step 2: Network Settings

SN: MAC: Local IP: . . .

IP: . . .

Subnet Mask: . . .

Gateway: . . .

Step 3: Connect

Fig.3.1.17 KLMs connection setup 2

(4) Compare the first three network segments of the device IP address and the local IP address. Only when the first three network segment addresses have the same value and the fourth digit address has different values, the connection between the device and the computer can be established. The IP address shown in Fig.3.1.17 cannot complete the connection, and the IP address of the device should be modified first.

(5) In the third edit column of the IP address of the device, change the original number 0 to 10 as the IP address of the machine, and then click button “Modify”, the software will set the lidar’s IP to the changed address, and prompt the IP modification success.

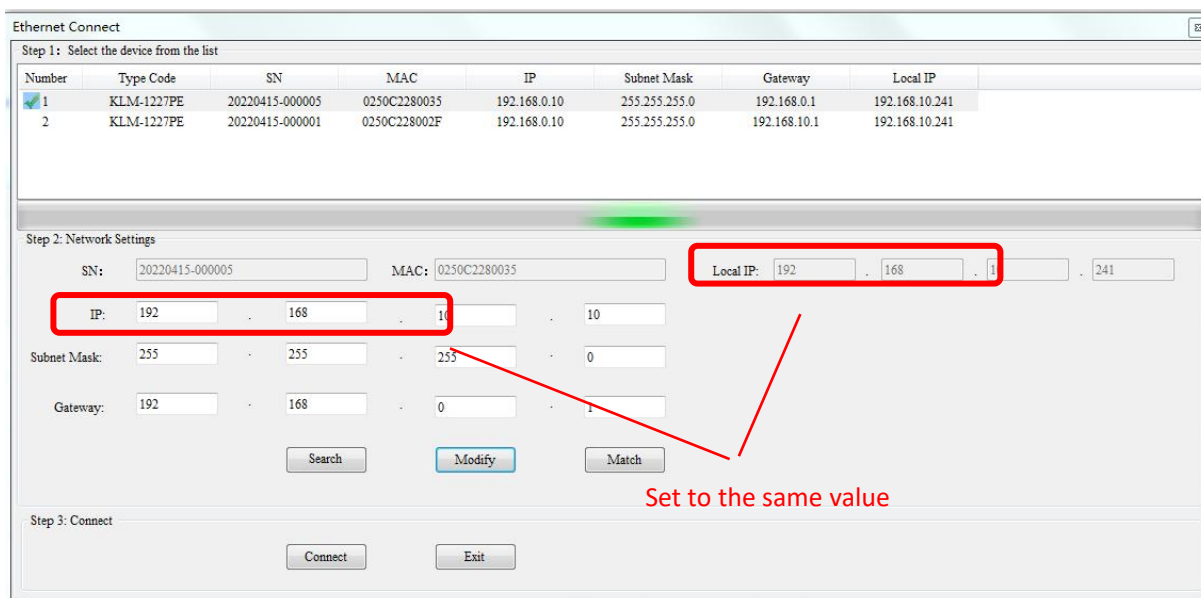


Fig.3.1.18 KLMs connection setup 3

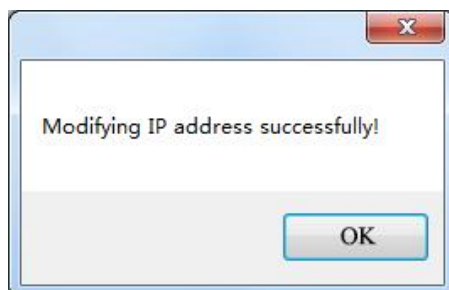


Fig.3.1.19 IP modified successfully

(6) Click “OK” to complete the IP modification.

(7) Click “Connect”, if the software is successfully connected to the lidar, a pop-up box will prompt that the connection is successful, as shown in Fig.3.1.20, the digital tube will display 6.



Fig.3.1.20 The device is connected successfully

(8) Click “OK” to complete the connection between the device and the computer.

3.1.5.3 Establishing connection via Ethernet - automatically matching the IP address

After completing steps (1) to (4) of 3.1.5.2, you can choose to automatically match the device IP address, the steps are as follows:

(1) Click “Match”, the software will automatically assign an IP address to the lidar according to the computer IP, as shown in the Fig.3.1.21 below.

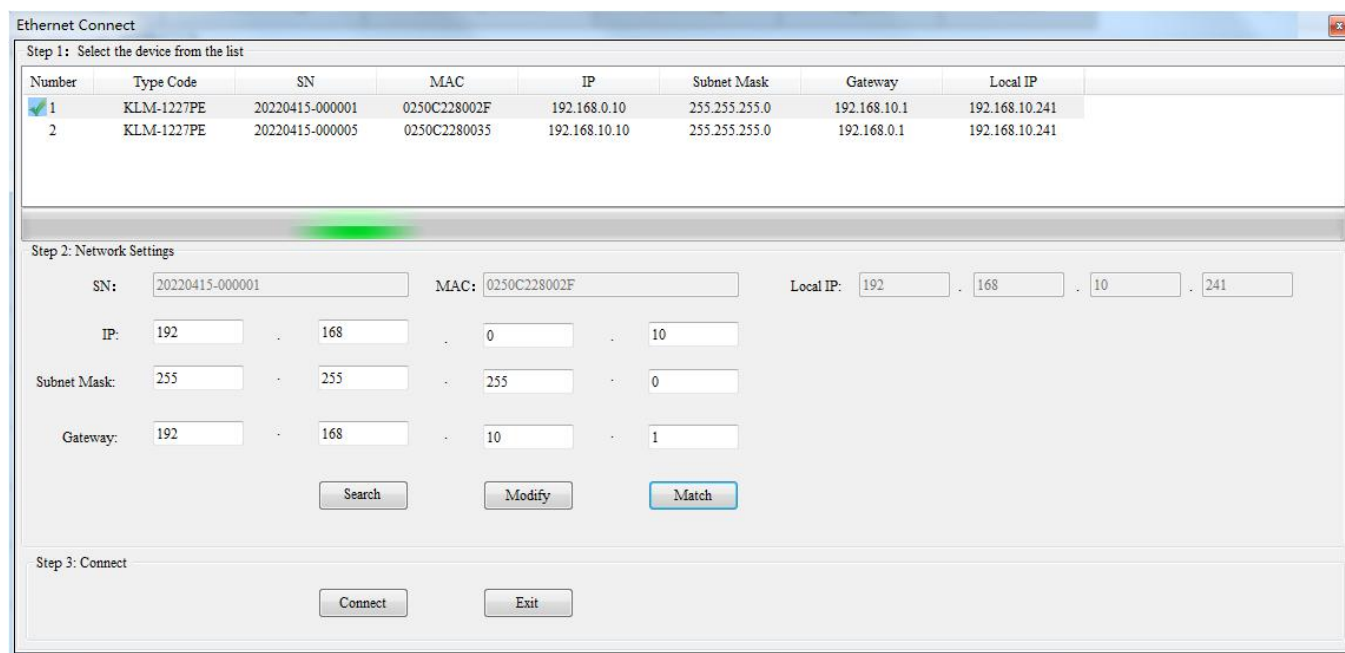


Fig.3.1.21 Automatically match IP address

(2) After the matching is completed, a pop-up window prompts that the IP modification is successful, as shown in Fig.3.1.19.

(3) Click “OK” to complete the IP modification.

(4) Click “Connect”, if the software is successfully connected to the lidar, a pop-up box will prompt that the connection is successful, as shown in Fig.3.1.13, the digital tube displays 6 , as shown in Fig.3.1.20.

(5) Click “OK” to complete the connection between the device and the computer.

3.1.6 Disconnection

After the software establishes a connection with the lidar, click  to disconnect the lidar. If the connection is successful, a pop-up window indicates that the device has been disconnected, as shown in Fig.3.1.22. Click “OK” to complete this operation.

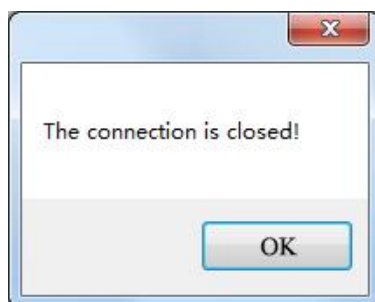


Fig.3.1.22 Disconnect

3.2 KLM lidar configuration example 1

User requirements: two monitoring cases, the zone group in the cut-off path is including one protection zone and

two warning zones, use alarm output 1 and alarm output 2, two static control inputs and one dynamic control input. Each monitoring case uses a different contour recognition field, and the response time is 100ms.

- Start the software and enter the software user interface.
- A new project is created automatically after the software is opened. The default number of scans is 2 and the corresponding response time is 100ms.
- For the user needs in this example, parameters on tabs “Parameters Settings”, “Local I/O”, “Zone Settings”, “Monitoring cases” need to be configured.

Detailed configuration steps are described below.

3.2.1 Establish a connection between KLM lidar and software

If the configuration preparation described in 3.1 is Completed, now you can establish the connection between lidar and software. The USB driver only needs to be installed on the first connection, and later connections can be automatically identified.

3.2.2 Configuration on “Parameters Settings”

You can switch to the corresponding setting area by using the tree chart or the tab “Parameters Settings”, setting the number of scans to 2 and the corresponding response time to 100 ms, as shown in Fig.3.2.1 below.

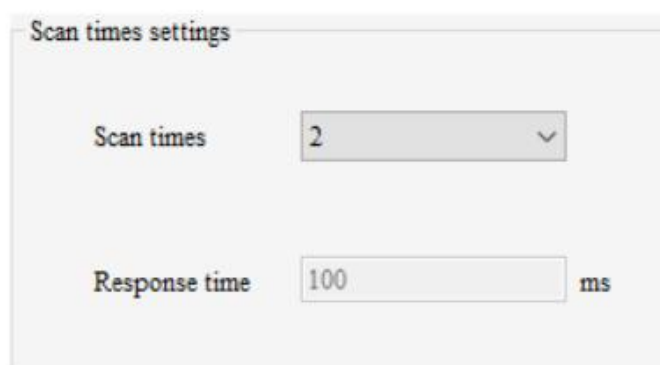


Fig.3.2.1 Parameters Settings

3.2.3 Configuration on “Local I/O”

Switch to the corresponding setup interface through the tree view or the tab “Local I/O”. In the column “Assigned signal”, select the corresponding function signal from the drop-down list corresponding to the different pins to configure the pin, as shown in Fig.3.2.2 below.

Pin No.	Identification	Optional signals	Signal type	Assigned signal	More configuration
3	OSSD 1.A	OSSD 1.A	Output	OSSD pair 1	/
4	OSSD 1.B	OSSD 1.B	Output	OSSD pair 1	/
6	General-I/O 02	OSSD 2.A A1 Alarm	Output	Alarm output 1	/
7	General-I/O 03	OSSD 2.B A2 Alarm	Output	Alarm output 2	/
5	General-I/O 01	B1 Alarm	Input	Static control input B	/
8	General-I/O 04	B2 Alarm	Input	Static control input B	/
9	Input 01	C1 Encoder1(0°)	Input	Static control input C	/
10	Input 02	C2 Encoder1(90°)	Input	Static control input C	/
11	Input 03	D1 Encoder2(0°)	Input	Unassigned	/
12	Input 04	D2 Encoder2(90°)	Input	Unassigned	/
13	Input 05	E1 Encoder3(0°)	Input	Encoder 3	Speed Incremental encoder 3(pin 13) pulse 100 per 10 mm route Incremental encoder 4(pin 15) pulse 100 per 10 mm route Speed Range (unit: mm/s) MIN Value: -10000 MAX Value: 10000
14	Input 06	E2 Encoder3(90°) EDM1	Input	Encoder 3	
15	Input 07	F1 Encoder4(0°)	Input	Encoder 4	
16	Input 08	F2 Encoder4(90°) EDM2	Input	Encoder 4	

Fig.3.2.2 Configuration for pin functions

3.2.4 Configuration for defense zone

3.2.4.1 Switch to tab “Zone Settings”

Switch to the corresponding setup interface through the tree view or the tab “Zone Settings”, as shown in Fig.3.2.3.

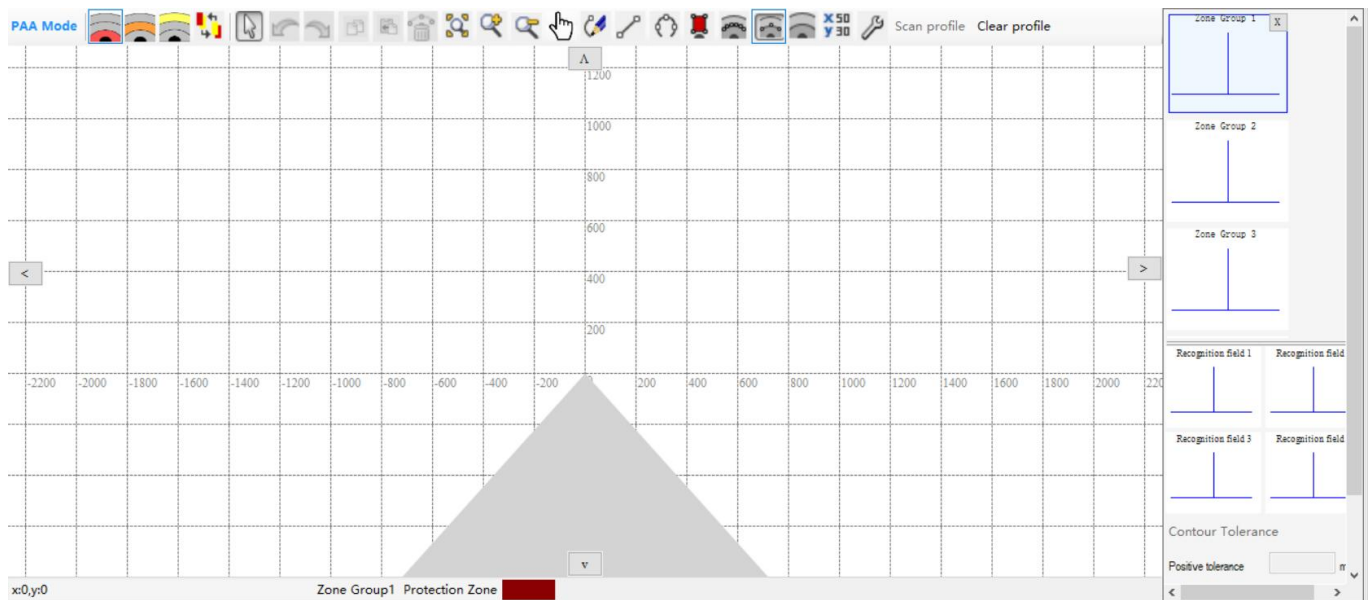


Fig.3.2.3 Zone settings

3.2.4.2 Configure Protection Zone of Zone Group 1

Use a ruler and an angle ruler to collect the boundary data of the protected area in the field, and then draw the boundary of the protection zone in the configuration software according to the actual measurement data.

The tools to draw include free drawing , straight line , sector , rectangle , and modify boundary .

points . See 2.6.4.1 for a detailed description of drawing commands. Fig.3.2.4 below shows user-defined protection zone boundaries.

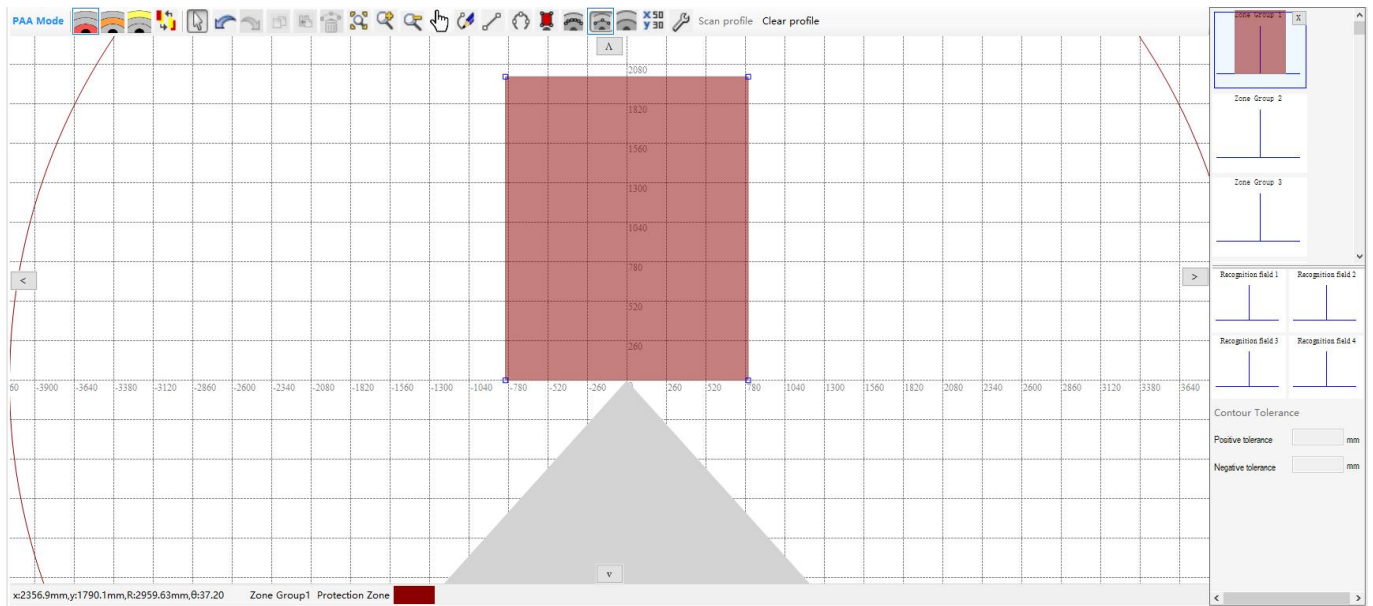


Fig.3.2.4 Drawing Protection Zone

3.2.4.3 Configure Warning Zone 1 of Zone Group 1

Click on the icon  or , switch to Warning Zone 1, and draw the border of Warning Zone 1. For example, the user-defined Warning Zone 1 boundary is shown in Fig.3.2.5 below.

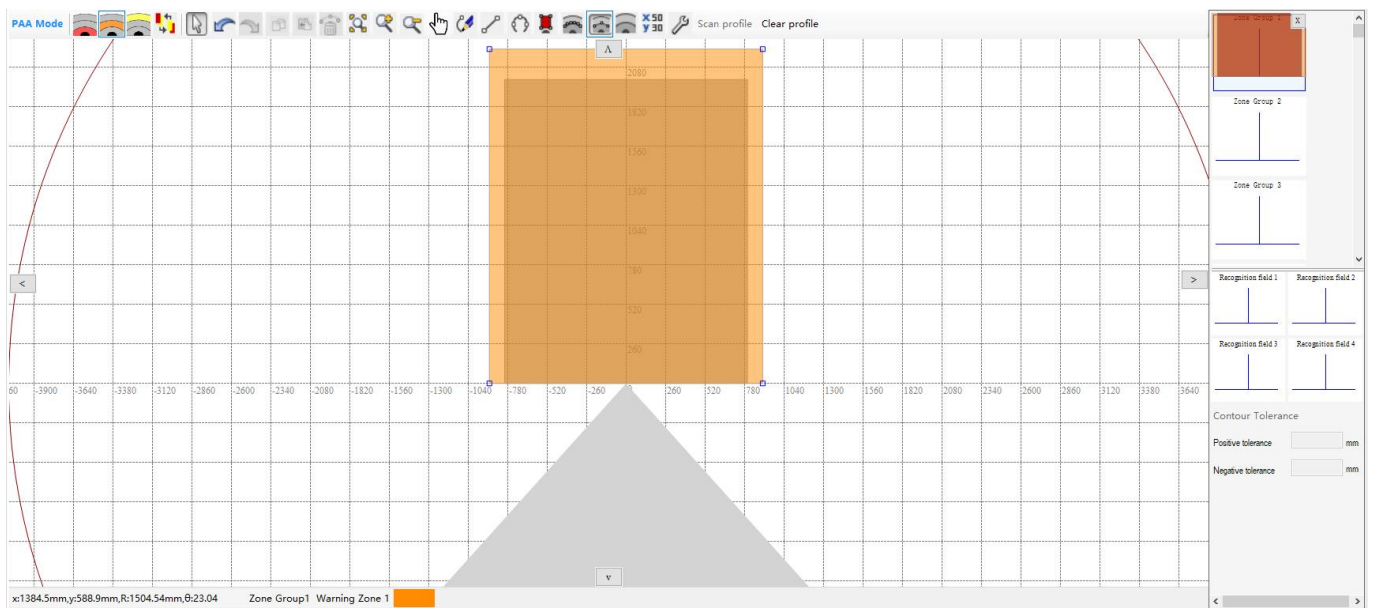


Fig.3.2.5 Drawing Warning Zone 1

3.2.4.4 Configure Warning Zone 2 of Zone Group 2

Click on the icon  or , switch to Warning Zone 2, and then draw the border of Warning Zone 2. For example, the user-defined Warning Zone 2 boundary is shown in Fig.3.2.6 below.

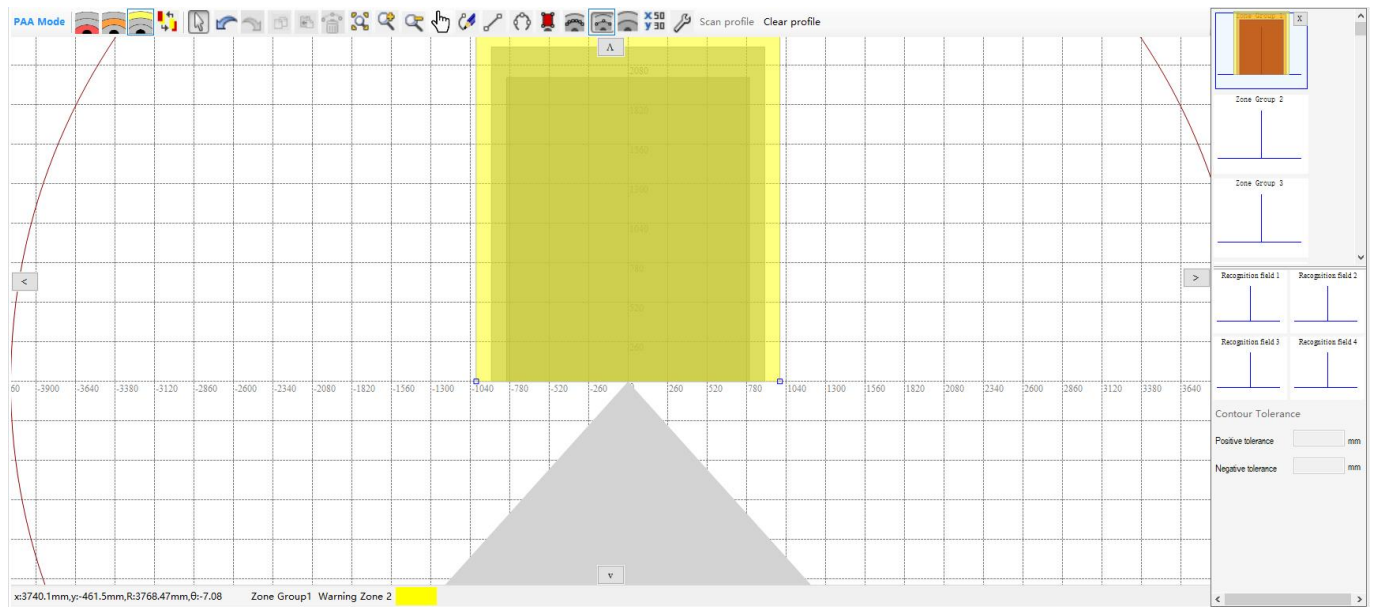


Fig.3.2.6 Drawing Warning Zone 2

3.2.4.5 Configure Zone Group 2

Step 1: Click to select Field Set 2 as shown in Fig.3.2.7 below:

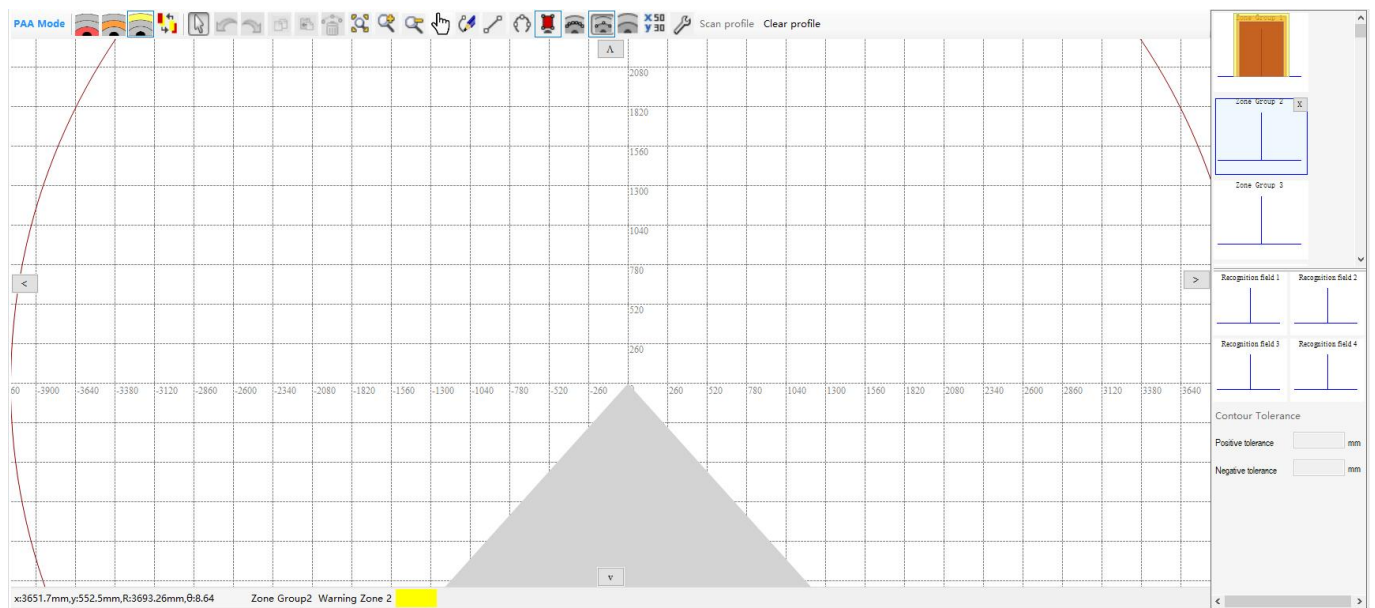


Fig.3.2.7 Zone group 2 is activated

Step 2: Configure Zone Group 2, referring to the configuration of Zone Group 1.

3.2.5 Configuration for contour recognition field

3.2.5.1 Configure Recognition field 1

According to the position and shape of the object in the contour recognition area, use the tool  to draw the contour recognition field, and set the tolerance of the recognition field, as shown in figure 3.2.8.

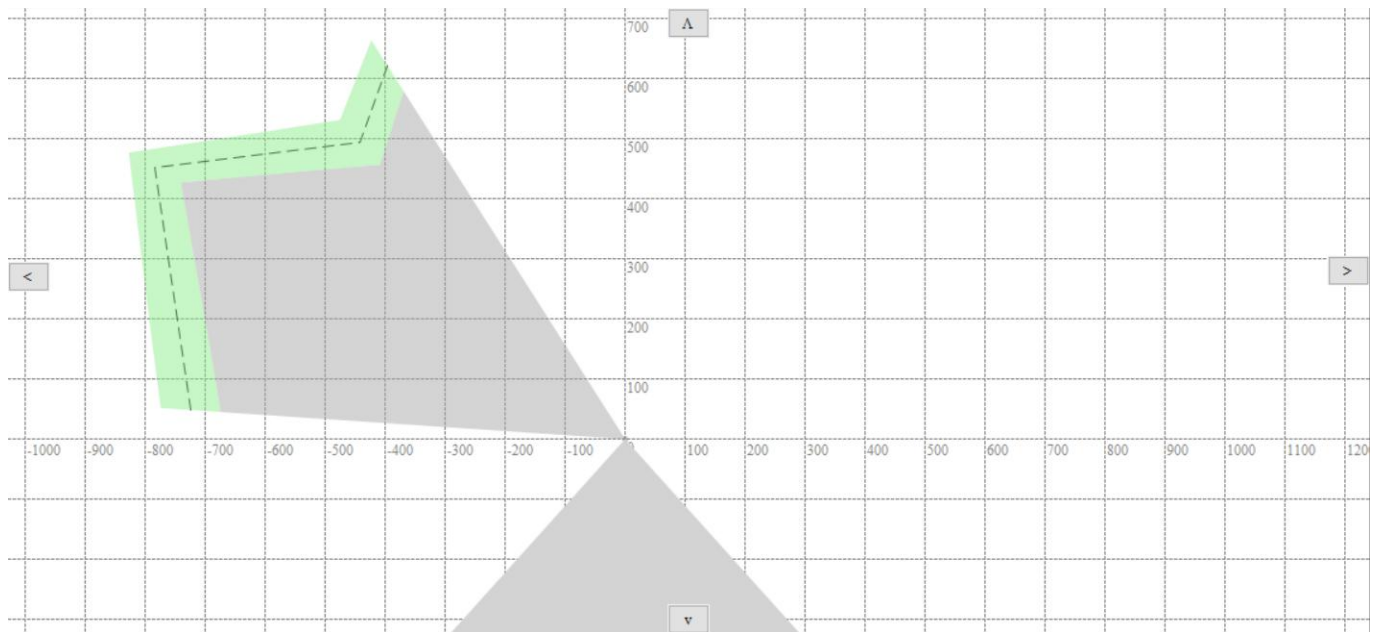


Fig.3.2.8 Recognition field 1

■ **Note:**

- Drawing the contour recognition field can enable the scanning contour function to determine the position and shape of the object in the recognition area.
- After the contour recognition field is drawn, you can select it, translate one point or all points in the contour line of the recognition field to change the recognition field; You can also select the recognition field and use tools  to accurately control the position of points on the contour line in the recognition field.

3.2.5.2 Configure Recognition field 2

Referring to the configuration of Recognition field 1 in section 3.2.5.1, select the small view of Recognition field 2 on the right, and then draw it in the drawing area, as shown in Fig.3.2.9.

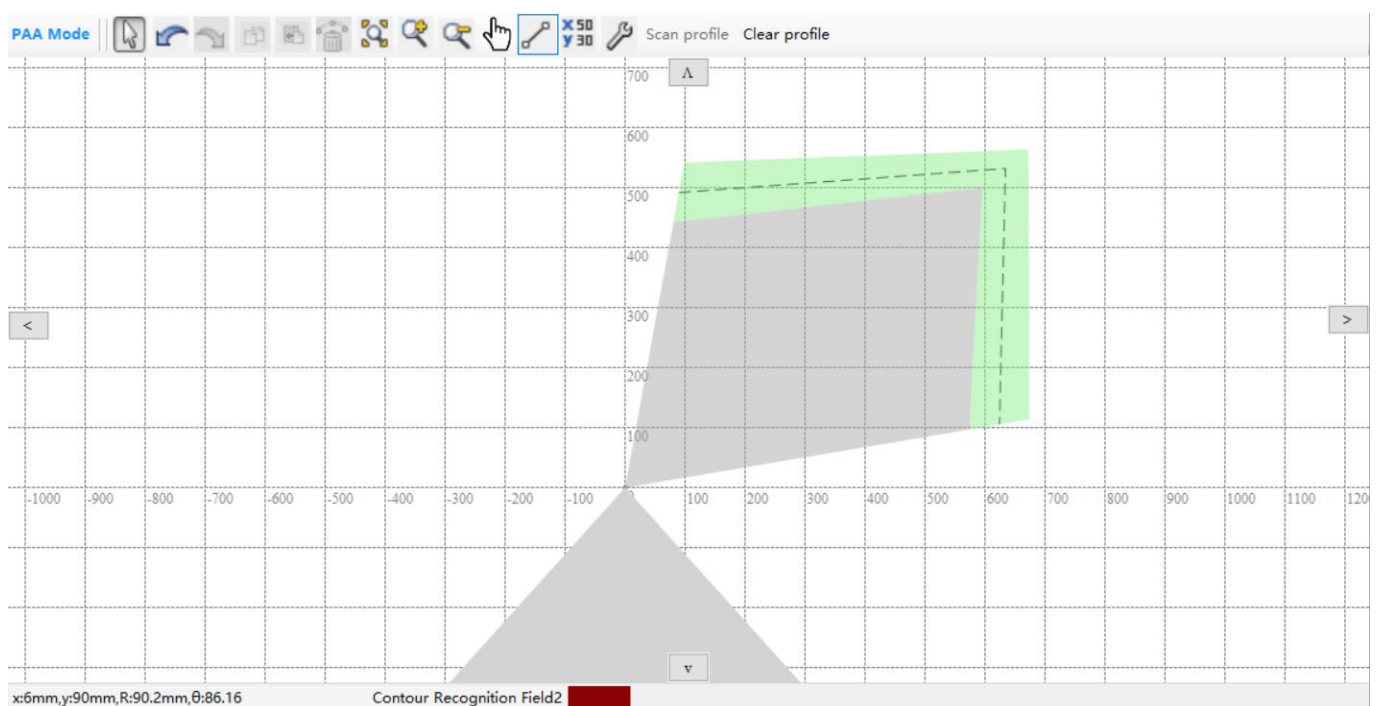


Fig.3.2.9 Contour recognition field 2

3.2.6 Configuration for monitoring cases

3.2.6.1 Switch to tab “Monitoring cases”

Switch to the corresponding setup interface through the tree view or the tab “Monitoring cases”, as shown in Fig.3.2.10.

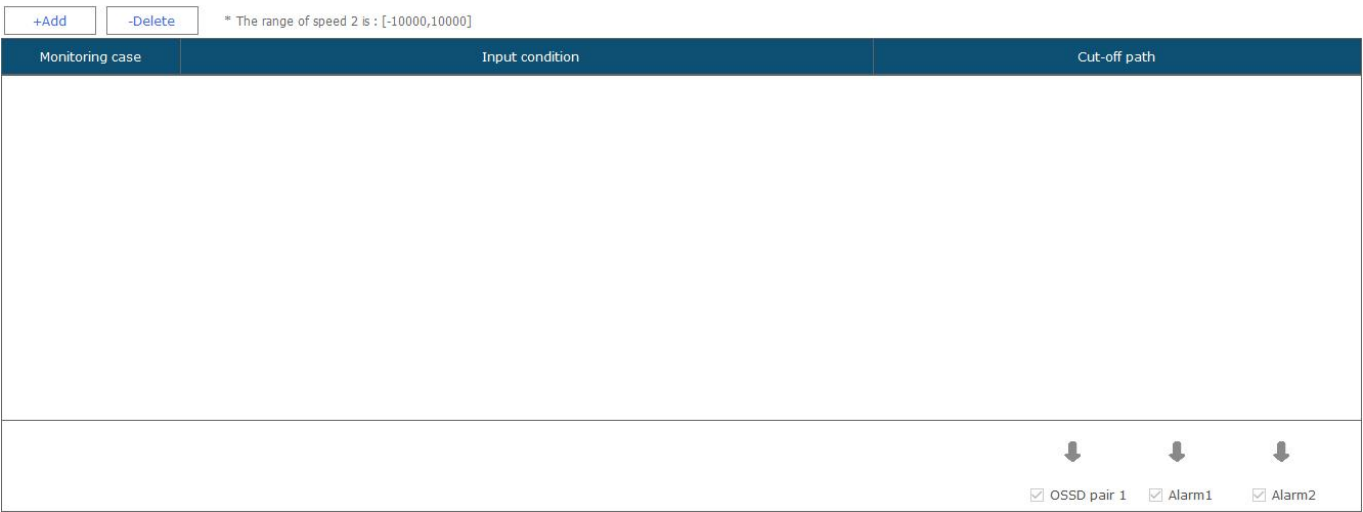


Fig.3.2.10 Monitoring cases interface

3.2.6.2 Add a monitoring case

Click the button  twice to add two monitoring cases. Parameters just like the name of the case, the input condition, and the zone group used for the cut-off path are shown in Fig.3.2.11 below.

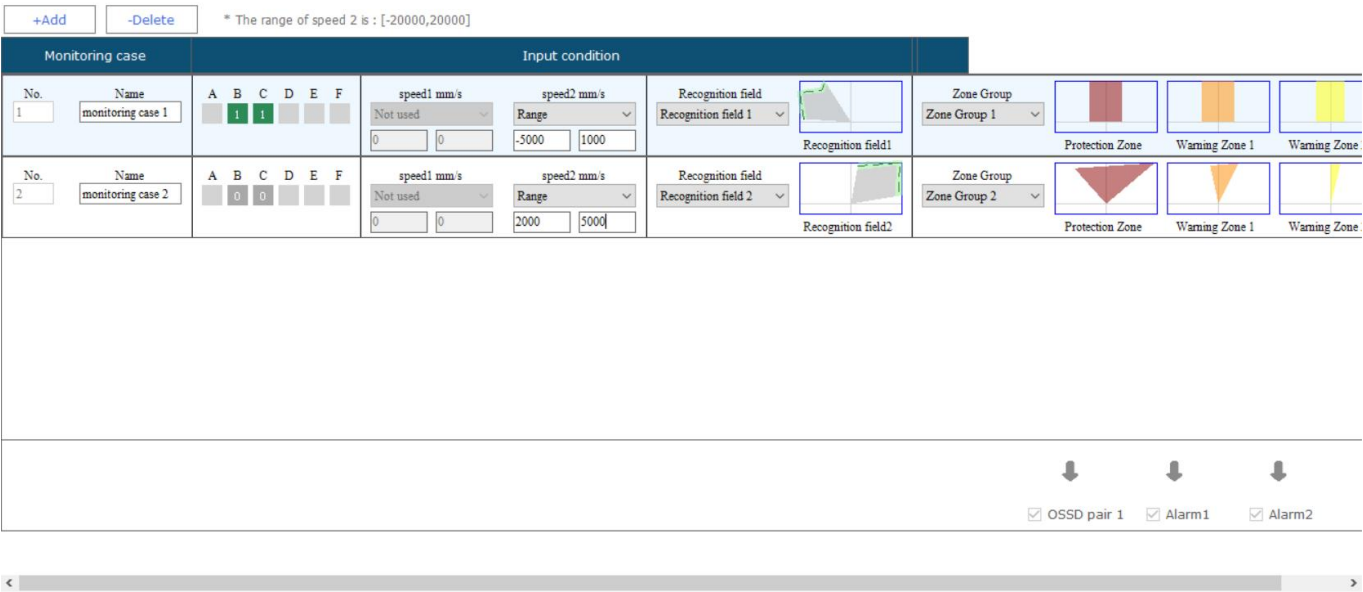


Fig.3.2.11 Monitoring cases configuration

3.2.7 Transmission of the configuration to lidar

(1)Click the toolbar (transfer configuration to device) to transfer the configuration to lidar. The pop-up window is shown in Fig.3.2.12. During transmission, the digital tube of the lidar indicator window displays.

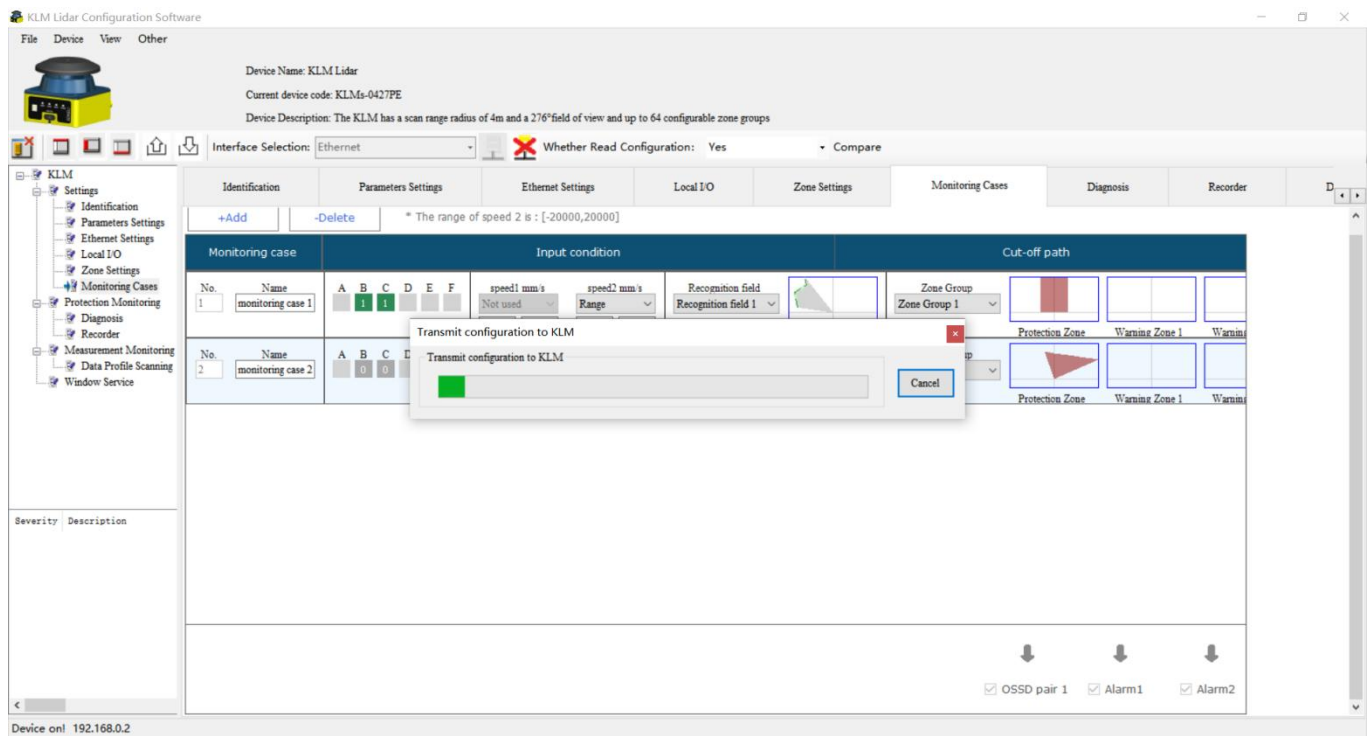


Fig.3.2.12 Transfer the configuration to lidar

(2) After transmission, the pop-up window closes automatically, and then the pop-up box indicates that the configuration is successful. The digital tube in the lidar indicator window displays **9**, indicating that the configuration is successful.

(3) After the configuration is successful, you can click  to disconnect. A pop-up window will prompt that the disconnection is successful, and **6** and **9** displayed on the digital tube in the lidar indicator window will be off.

After this configuration, close the KLM configuration software and unplug the configuration line.

Tips: After the configuration, it is recommended that the user clicks “File” – “Save as” in the menu bar to save the existing configuration information as a project file with the suffix of “.bin”, which is convenient to open and call directly next time.

If the transmitted configuration is the same as the radar configuration read by the software, it will not be configured.

3.3 KLM lidar configuration example 2

User requirements: two monitoring cases. Each zone group in the cut-off path includes two protection zone to monitor two controlled devices respectively. Only static control input conditions are used, and the scanning time is 80ms.

The steps of lidar connection, zone settings and transmission of configuration to lidar are similar to those in example 1, which will not be repeated here, we only introduce the configuration on the tabs “Local I/O” and “Monitoring cases”.

3.3.1 Configuration on “Local I/O”

Switch to the tab “Local I/O” interface and configure as shown in Fig.3.3.1.

7	General-I/O 03	OSSD 2.B A2 Alarm Fault	Output	OSSD pair 2	/
5	General-I/O 01	B1 Alarm Fault	Input	Static control input B	/
8	General-I/O 04	B2 Alarm Fault	Input	Static control input B	/
9	Input 01	C1 Encoder1(0°)	Input	Static control input C	/
10	Input 02	C2 Encoder1(90°)	Input	Static control input C	/
11	Input 03	D1 Encoder2(0°)	Input	Static control input D	/
12	Input 04	D2 Encoder2(90°)	Input	Static control input D	/
13	Input 05	E1 Encoder3(0°)	Input	Static control input E	/
14	Input 06	E2 Encoder3(90°) EDM1	Input	Static control input E	/
15	Input 07	F1 Encoder4(0°)	Input	Static control input F	/

Fig.3.3.1 Configure pin functions

3.3.2 Configuration on “Monitoring cases”

Switch to the “Monitoring Cases” interface and configure it as shown in Fig.3.3.2.

+Add
-Delete

Monitoring case		Input condition													
No.	Name	A	B	C	D	E	F	speed1 mm/s	speed2 mm/s	Recognition field		Zone Group			
1	monitoring case 1	1	1	1	1	0		Not used	Not used	Recognition field 1		Zone Group 1			
2	monitoring case 2	0	1	1	0	1		Not used	Not used	Recognition field 2		Zone Group 2			

↓
↓

☒ OSSD pair 1
☒ OSSD pair 2

Fig.3.3.2 Create Monitoring cases

4 Software problems and solutions

4.1 The lidar is not recognized or the connection fails to be established

If the number of COM ports displayed in the pop-up window is less than 2 when the user establishes a connection, it means that the lidar is not recognized.

Solution:

- (1) Close the configuration software, power off the lidar, re-plug the configuration cable, and power on the lidar.
- (2) Please click  to establish a connection after the lidar is powered on and started (typically 10 seconds).
- (3) After clicking to establish a connection, please select the correct COM port. For the viewing method of the COM port corresponding to the lidar, see step (8) in 3.1.2.
- (4) If the Lidar USB Serial Port (Com×) can be found but there is no response when the connection is established, it is recommended that the user uninstall the USB driver and reinstall it.
- (5) Reinstall the USB driver: find “KLM software installation package” – “USB driver” – “CDM v2.12.06 WHQL Certified” in the USB disk, double-click to run and follow the prompts to complete the installation.
- (6) Re-execute 3.1 configuration preparations and establish a connection with the lidar.

4.1.1 Method of uninstalling USB driver

- (1) Use the configuration cable to connect the computer and the lidar.
- (2) Open the device manager (see step (8) in 3.1.2 for the method), right-click the port “USB Serial Port”, and select Uninstall, as shown in Fig.4.1.1 below.



Fig.4.1.1 USB Serial Port uninstall

- (3) Click OK in the pop-up window, as shown in Fig.4.1.2 below.



Fig.4.1.2 USB Serial Port confirm uninstall

- (4) Right-click on "Device Manager" - "Universal Serial Bus Controller" - "USB Serial Converter" and select Uninstall, as shown in Fig.4.1.3 below.



Fig.4.1.3 USB Serial Converter uninstall

- (5) Click “OK” in the pop-up window, as shown in Fig.4.1.4 below.



图 4.1.4 USB Serial Converter confirm to uninstall

- (6) Unplug the configuration line after uninstalling.

4.2 Other issues

If an abnormality occurs during the use of the software, it can generally be solved by closing the configuration software, re-plugging and unplugging the configuration cable, re-powering the lidar, and re-opening the configuration software. If the customer has other abnormal operations during the use of the software, please contact our technical staff, and we will provide comprehensive technical support services to meet customer needs. The typical problems and solutions that may occur are listed below for reference.

4.2.1 The software cannot be started

Problem Description:

Double-click the software shortcut icon , the software cannot be started.

Solution:

- (1) Move the cursor to the software shortcut icon, click the right mouse button, and select the “Properties” item in

the pop-up menu bar, and the pop-up window shown in Fig.4.2.1 will pop up.

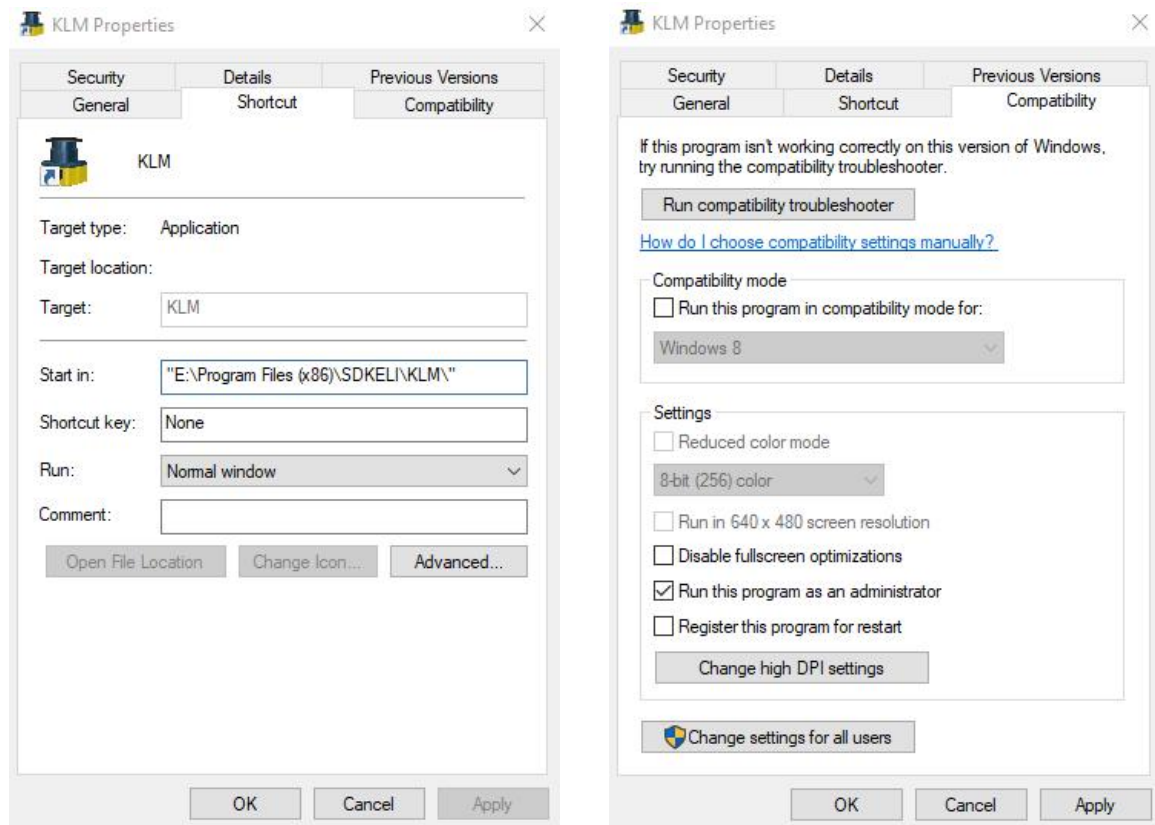


Fig.4.2.1.1 Properties displayed in a pop-up window

- (2) Select the “Compatibility” item, check the option to run this program as an administrator under the privilege level under this option page, and click “OK” to complete the modification.