LGA60 Safety LiDAR

1. Technical Parameter

Sensing distance	0.1m-10m (Reflectivity 10%)
	0.1m -30m (reflectivity 90%)
	0.1m-30m (reflective board)
Detection range	320°
Light source	Laser diode
Laser level	Level 1(IEC60825-1:2014,EN60825-1:2014)
Wavelength	905nm
Sampling rate	144K,288K,576K (3 types of scanning frequency for option)
Scanning frequency	10HZ, 20Hz can be set
Angular resolution	Minimum 0.025°
Absolute accuracy	±20mm
Repeat accuracy	±20mm(unfiltered)
Detection resolution	1mm
Power supply	DC10V~30V
Operating current (DC24V)	90mA (144k)
Rated power	<3w
Contact resistance	Below 25mΩ
Output	3*NPN Output Terminal (output signal of red area, orange area and fault
	Ethernet TCP/UDP output of 320° original detection data;
Communication interface	M8-4 female cable, Ethernet port
	M8-8 female cable, power and digital port
Operating status indicator	Green
Output status indicator	Red, yellow, orange
LED screen	128*64 pixel with OLED screen
Operating temperature	-10°C-55℃, for indoor use
Operating humidity	Below 80%RH
Storage temperature	Storage temperature (-20°C-70°C)
Protection rate	IP65
Ambient light limitation	Resistant to sunlight (<100000 Lux)
Weight	250g
Dimension (max)	60mm x 60mm x 83.5mm
Sine vibration frequency	10Hz to 1000 Hz, with an acceleration of 58, in three axes, and 10 cycles for each axis.
Random vibration frequency	5Hz to 250H, Gr.m.s =4.248, three axes, 5 hours per axis.
Shock resistance	Acceleration 50g, pulse time 3ms, 5000 impacts on each axis, totaling 30,000 impacts

2. Preparation

2.1 Configuration List

<table>
<tr><td>Things list for configuration (Cable should be purchased separately)</td><td>Please check label on products and confirm if it is same as you purchased;
Please confirm if all things included in parcel, otherwise, please contact supplier in time.
<table>
<tr><th>Item</th><th>QTY</th><th>Description</th></tr>
<tr><td>Laser LiDAR</td><td>1pc</td><td>Scanner</td></tr>
<tr><td>Power & IO cable</td><td>1pc</td><td>1.5m cable with M8 female connector, 8pin, integrator power and I/O</td></tr>
<tr><td>Ethernet cable</td><td>1pc</td><td>2m cable with M8 female connector, 4pin, other side with RJ45</td></tr>
</table>
</td></tr>
</table>

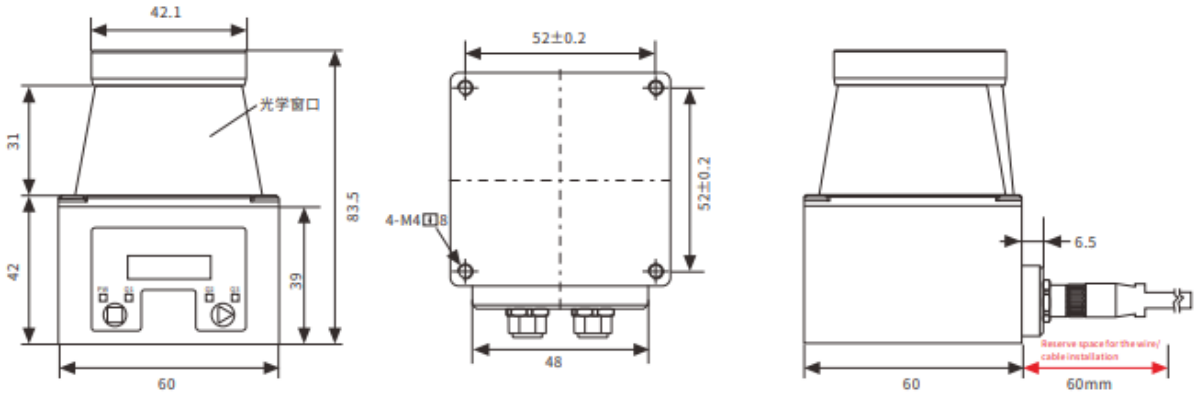
2.2 Configuration tool

Auxiliary debugging requires the following software and hardware

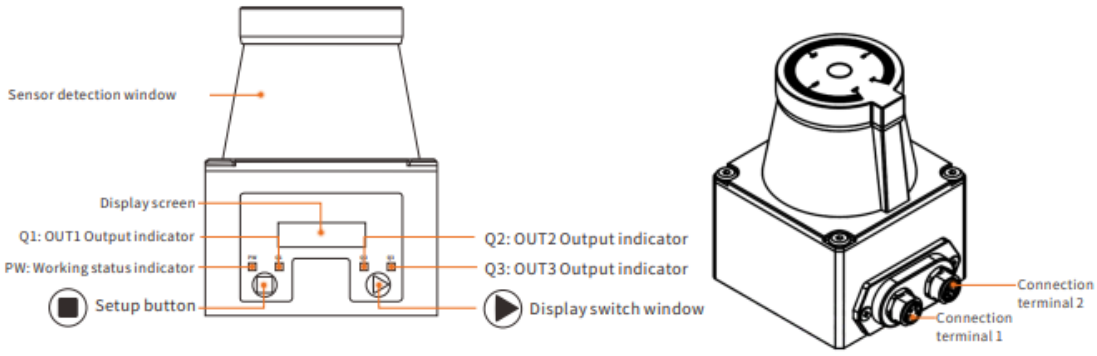
Software	Software Tool
Power	DC24V power
Tool	Computer configuration with RJ45 port (get through transmitting

3. Physical parameter

3.1 3.1 Product size



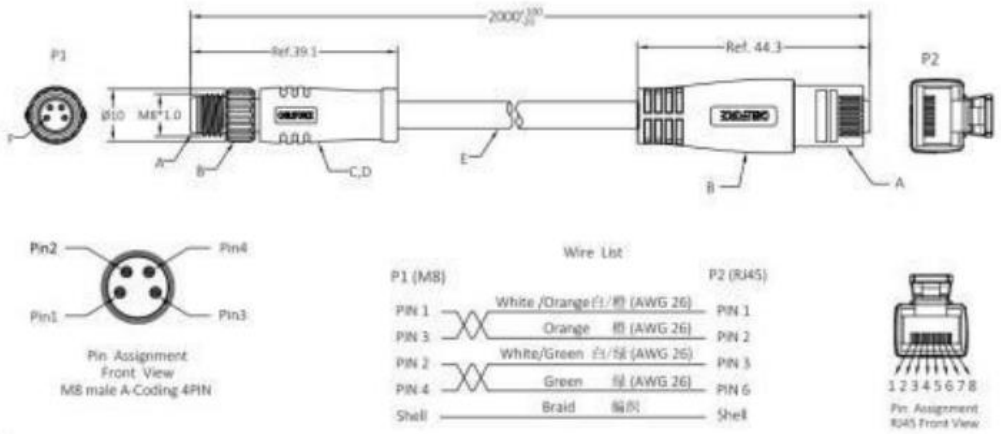
3.2 Component specification



NO.	Symbol	Function	Remark
1	-	Sensor detection window	Sensor detection window
2		Screen	State showing
3	PW	Indicator light	Green indicator Light OFF: no power or abnormal work Steady: Normal work Flash: Sensor detect inside fault, stop to work
	Q1	OUT1 output indicator	Yellow indicator Light OFF: no power or no detected objects Steady ON: Detect objects Flash: Sensor detection trigger
	Q2	OUT2 output indicator	Orange indicator Light OFF: no power or no detected objects Steady ON: Detect objects Flash: Sensor detection trigger
	Q3	OUT 3 output indicator	Red indicator Light OFF: no power or detected objects Steady ON: Detect objects Flash: Sensor detection trigger
4		Setting button	
5		Display switch on window	
6		Port 1	For ethernet connection
7		Port2	For power and IO signal cable connection

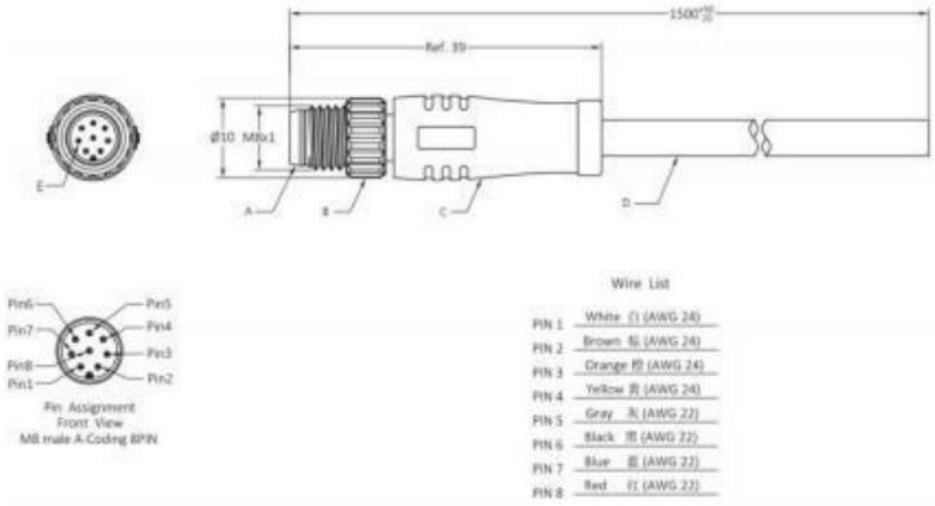
3.3 Cable definition

Ethernet port



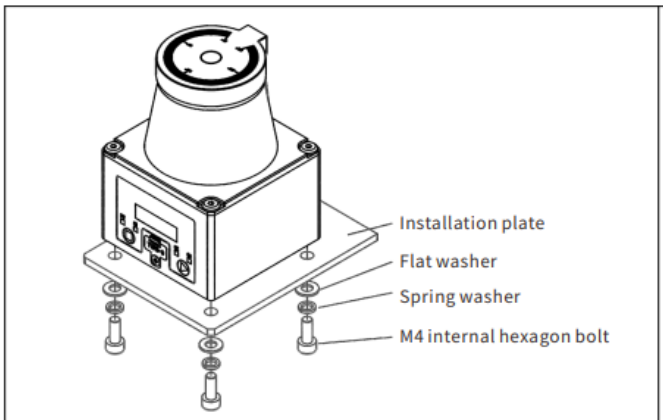
Cable	Line	Color	Symbol	Function	RG45
Ethernet connection cable	Pin 1	White & Red	Tx+	Ethernet TX+	1
	Pin 2	Red	Tx-	Ethernet TX-	2
	Pin 3	White & green	Rx+	Ethernet RX+	3
	Pin 4	Green	Rx-	Ethernet RX-	6

Port of power & switch quantity

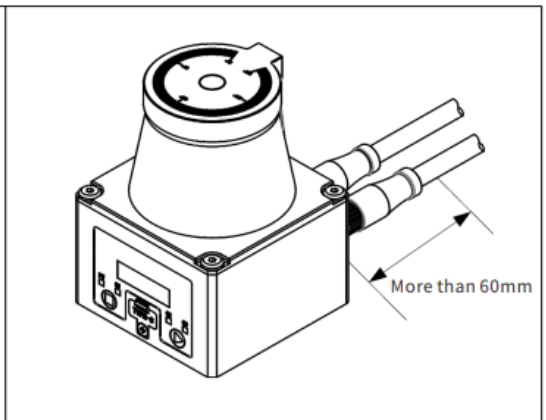


Cable	Line	Color	Symbol	Function
Power and IO cable	Pin 1	White	OUT1	Output 1
	Pin 2	Brown	VCC+	Power positive pole
	Pin 3	Orange	C-H	CAN-BUS
	Pin 4	Yellow	C-L	CAN-BUS
	Pin 5	Gray	OUT3	Output 3
	Pin 6	Black	OUT-COM	Output common terminal
	Pin 7	Blue	VCC-	Power negative pole
	Pin 8	Red	OUT4	OUTPUT 4

3.4 Installation Requirement



Spring washer is necessary to prevent screw loosing.



A 60mm space is reserved at the rear end for cable installation;

3.5 Output Signal Connection

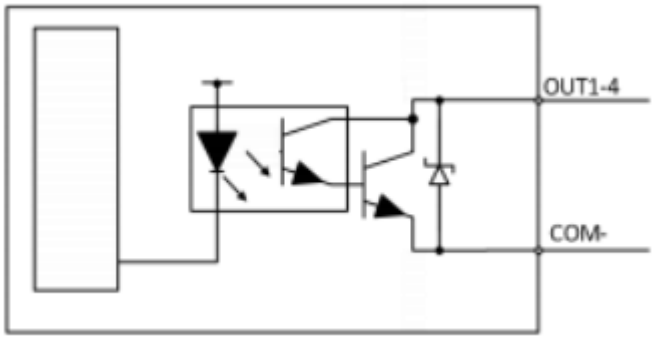
IO can output detection data when choose area detection function.

Function

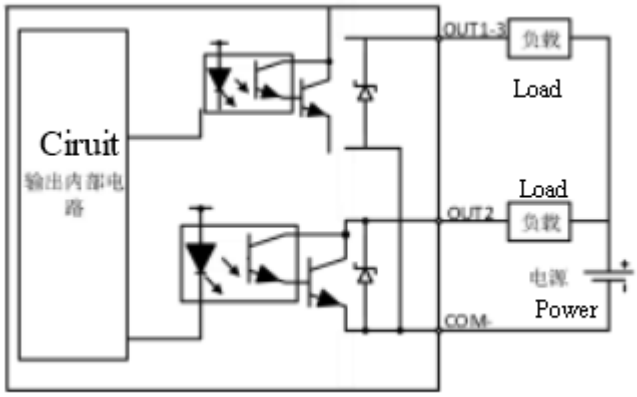
Port	Function	Output logic
OUT1	For long distance warning or deceleration	Default: Normally close, can change to normally open through software
OUT3	For close distance to stop	Default: Normally close, can change to normally open through software
OUT4	For output state when lidar fault	Default: Normally close, can change to normally open through software
OUT-COM	Output common port	

The output is an open collector (NPN) signal, which is isolated by an optocoupler. When there is a signal on the output, the voltage is 0V-.

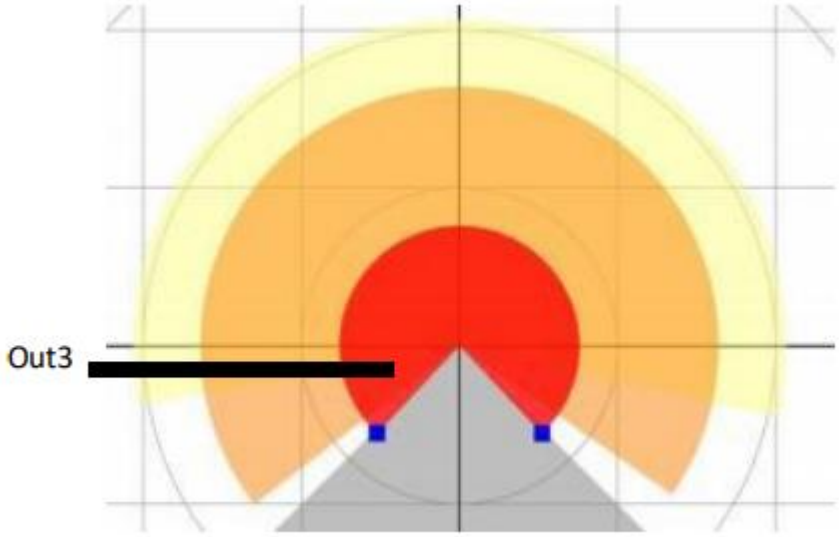
The maximum load capacity of output port is 100mA.



All output port is NPN. Output principle please refer below:



The sensor output port corresponds to the graph drawn in the configuration software.



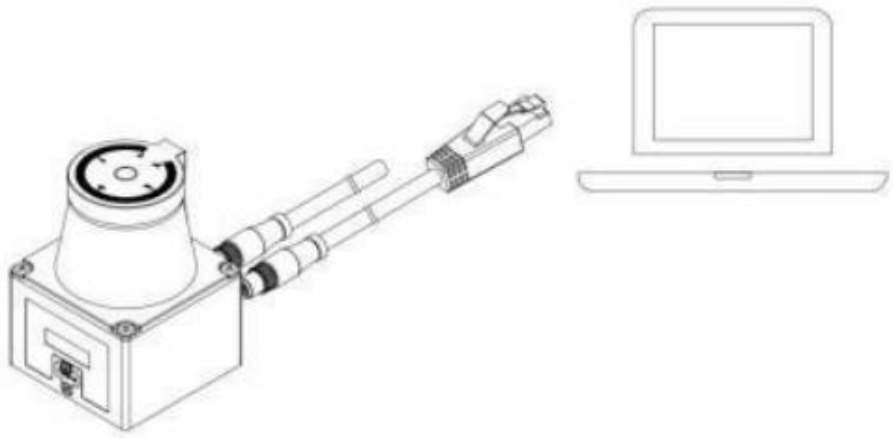
Remark: There will be detection output only when the corresponding output has graphics drawn;

4. Function configuration

4.1 Preparation

Power and switch quantity port cable	Length	1.5m
Ethernet port cable	Length	2m
DC power supply	Voltage	DC10V-DC30V
	Current	Over 1A
Computer	System	Advanced than Windows 7
	Port	With RJ45 connector or equipped with USD for transmitting RJ45
	Resolution	Over 1280*720

4.2 Connection between sensor and software



4.3 Software

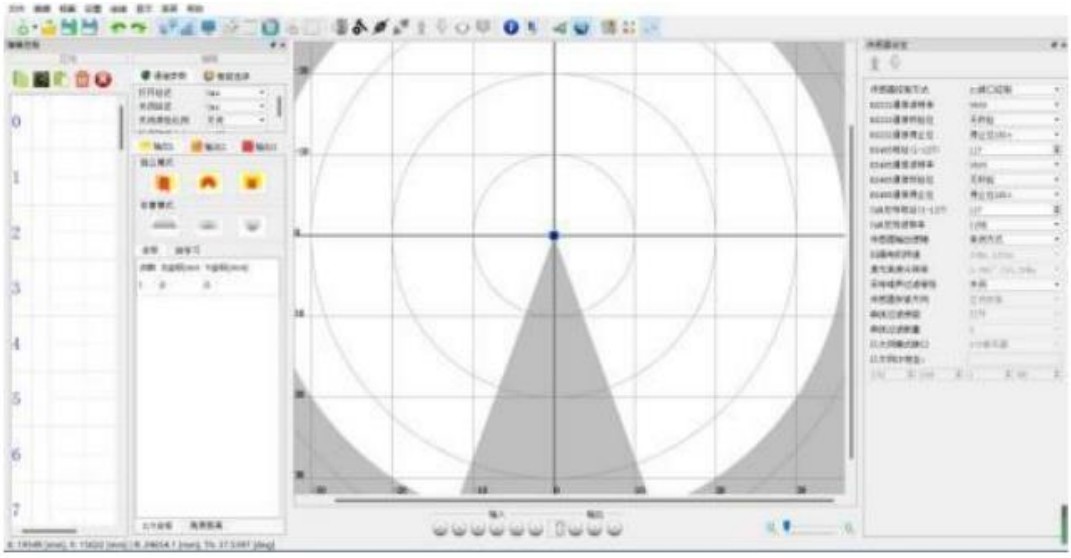
Getting software	
Consult with sales you contact	
Software operating environment	
System request	Advanced than Window 7
Resolution	1280*720 (MIN.)
Ethernet connection	Local network, configured to 192.168.1.3URL

Open software

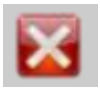
Compressed configuration software, double click to enter LGA60V1.0

Enter following interface: follow steps 1,2, 3 and 4 to connect lidar with software as below.

After successfully connecting, the interface will be like below.



Part 1: Menu

A menu	B menu	C menu	Corresponding label	Remark
File	Create new folder	-		Open a folder
	Open a folder	-		Open existing folder
	Save folder	-		Save edited folder
	Save as	-		Save the edited file as
	Exist	-		Exit current configuration software interface
Edit	Undo	-		Undo previous operation
	Redo	-		Redo previous operation
	Copy	-		Copy detection pattern of a certain detection channel
	Cut	-		Cut some detection pattern of a certain channel
	Paste	-		Paste the detection pattern of a detection channel to another channel

	Delete	-		Delete currently selected detection channel graphic
	Delete All	-		Delete all detection channel graphics
	Setting	-		-
Windo w	Window	Edit		Click the icon to configure the software to display the editing function box
		Monitor		Click the icon to configure the software to display monitoring status
		Sensor setting		Click the icon to configure the software to display the sensor parameter setting function box.
		Input and output simulation		Click the icon to display the sensor input and output simulation function box
		Self-checking		Click the icon to display sensor self-test status
	Distance	-		Click to close or display the current 320° scan profile of the sensor
	Reflectivity ability	-		Click to close or display the reflective intensity of obstacles
	Data list	-		The configuration software does not support the output of distance data of all current detection points. Item is not available
Setting	Interface			The sensor does not support serial port connection configuration software, this item is unavailable
	Ethernet			Click to select Ethernet connection configuration software
	Interface setting			The sensor does not support serial port connection configuration software, this item is unavailable
	Ethernet setting			Click to view the current sensor Ethernet address

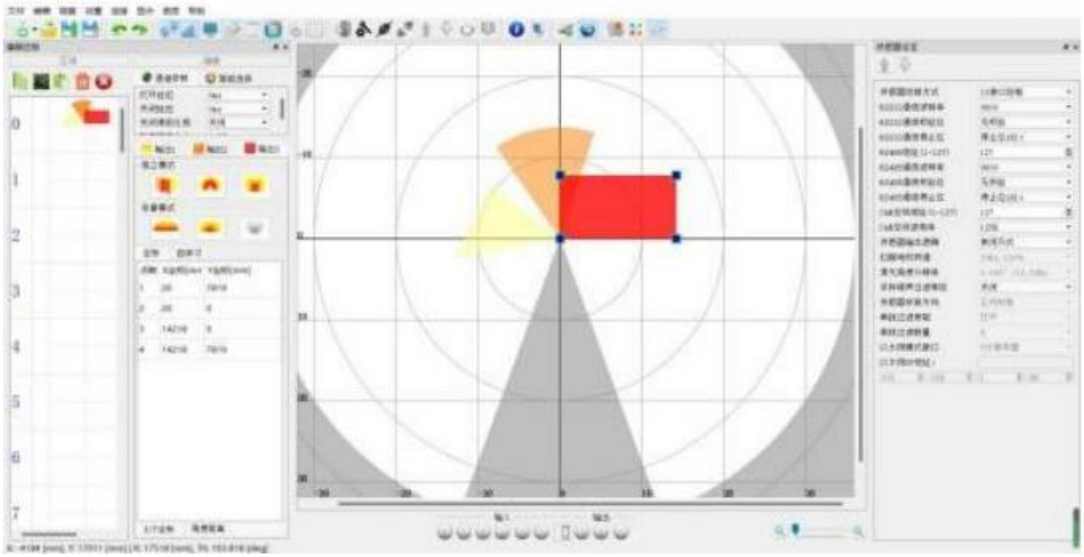
Connection	Connector	Interface		The sensor does not support serial port connection configuration software, this item is unavailable
		Ethernet		-
	Connect Device	-		Click to connect lidar with configuration software
	Disconnect device	-		Click to disconnect lidar from configuration software
	Upload data	-		Click to upload set detection channel graphics and various parameters.
	Download data	-		Click to download each detection channel and all data
	Reboot device	-		After setting the detection channel pattern and all data, click it to reboot device, then setting successfully
	Lidar information	-		-
Display	Pattern display	-		Click it to display detection contour with 2D file
	Point cloud display	-		Click it to display detection contour in point cloud
	Line display	-		Click it to display detection contour in line
Language	Simplified Chinese	-		Click here to change language in Chinese
	English	-		Click it to change language in English
Help	About	-		Click here to show the version of software
	Instruction	-		-

Part 2: Shortcuts

All shortcuts with explanation in part 1.

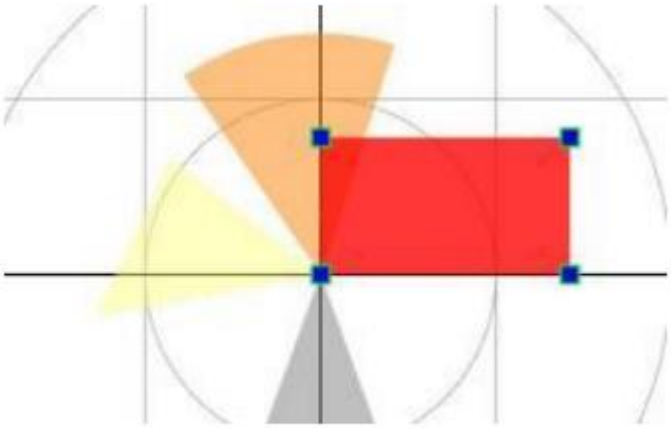
Part 3: Edit pattern in detection channel

Lidar support 0-63 detection channel, each detection channel support 3 detection area detect pattern output, lidar can choose channel through ethernet and output 3 detection area of channel to detect if obstacles intruding.

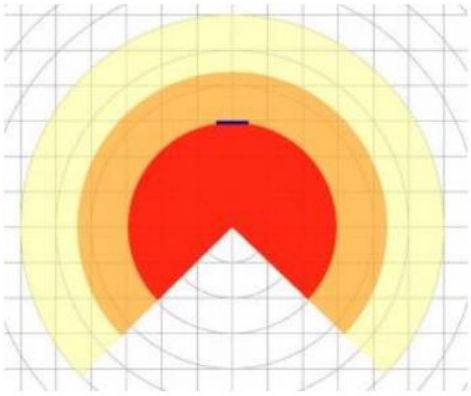


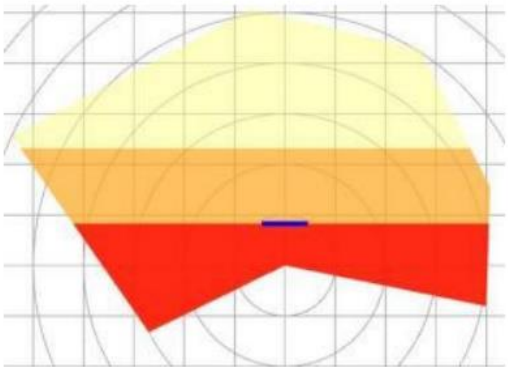
Part 4: Channel detection graphics output 1, output 2, output 3 editing mode.

Independent mode: under independent mode, irregular shapes, sectors and rectangles can be set separately. The irregular shapes are composed of up to 100 points of connected lines.



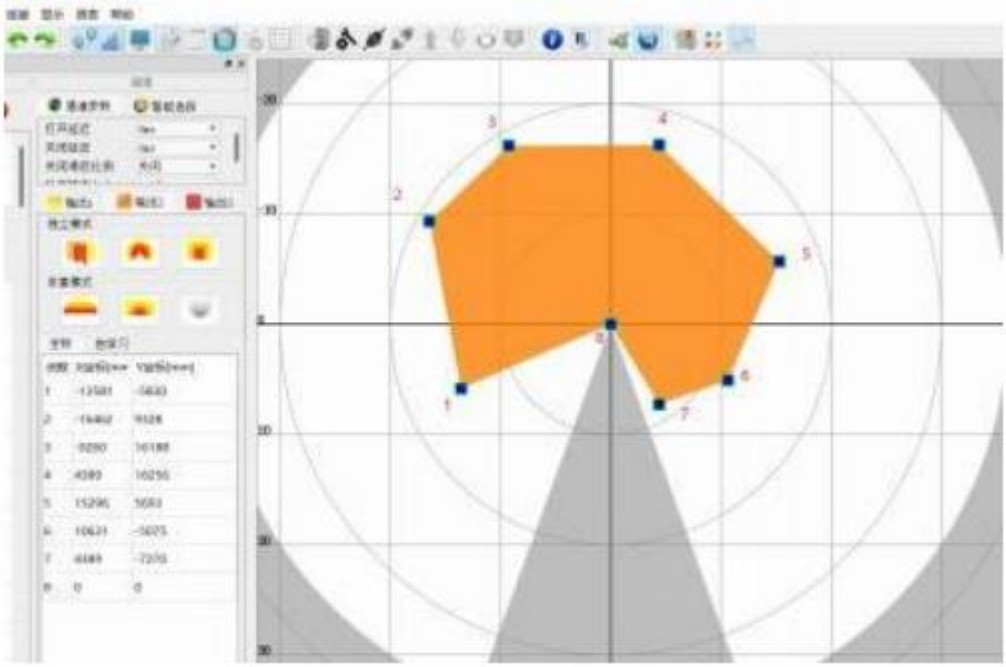
Rely on mode: After setting the graphic of output 1, you can choose to reply on mode to copy the graphics of output 1 according to different proportions.





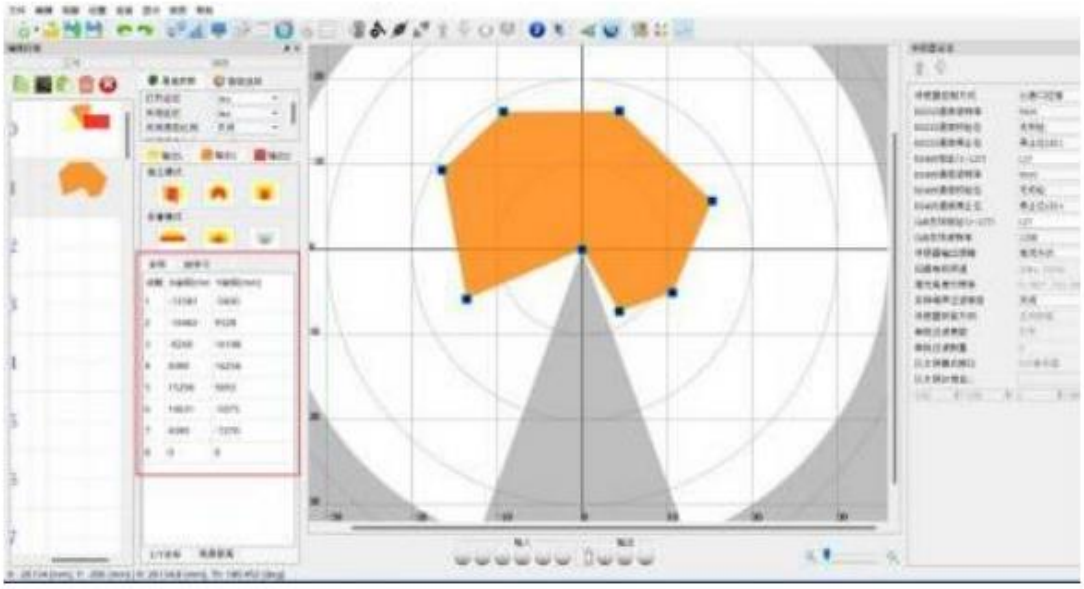
Part 5: Coordinates and their angle values

Coordinates of each points irregular graphics in independent mode. (X, Y)



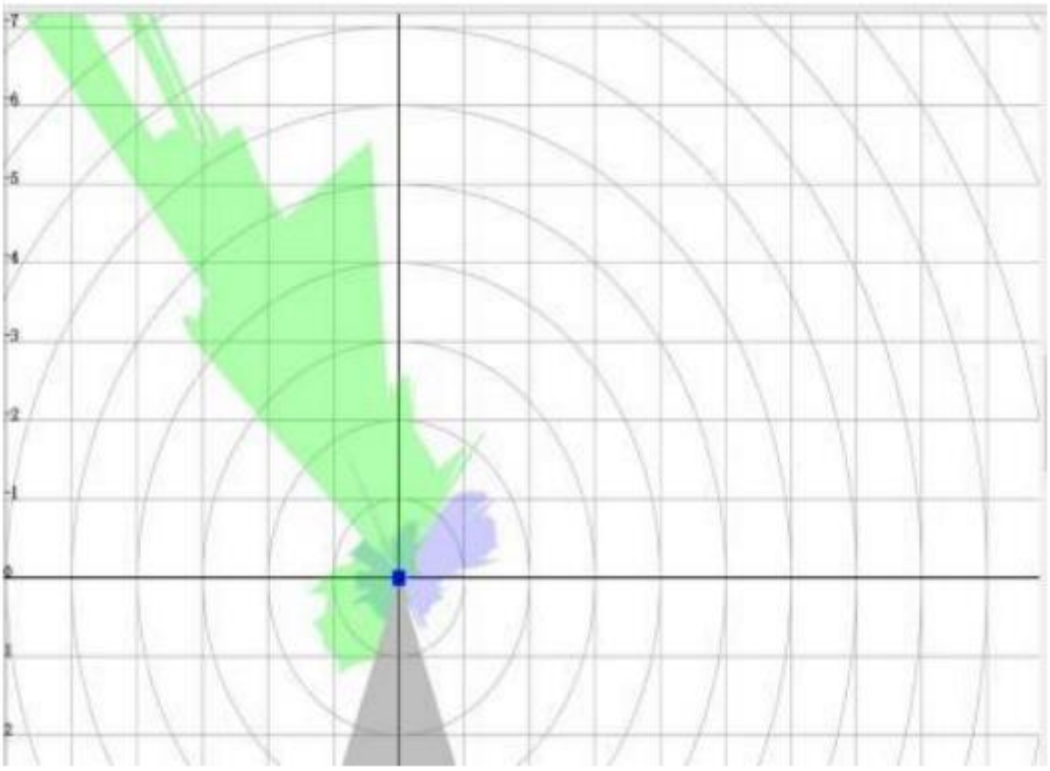
Remark: Point 8 is origin of coordinates

The distance and angle between each point of irregular shapes and coordinates origin in independent mode.



Remark: Point 7 is origin of coordinates.

Part 6: Scanning profile, reflective intensity, detection channel graphics, display area:



Remark: 1 green is the scanning profile;2. Blue shows the reflective intensity.

Part 8: 6 groups of switch inputs are selected to detect channels 0-63 (the selected channel can also be specified through Ethernet), and 3 groups of switches output status signals of 1, 2, and 3 respectively.

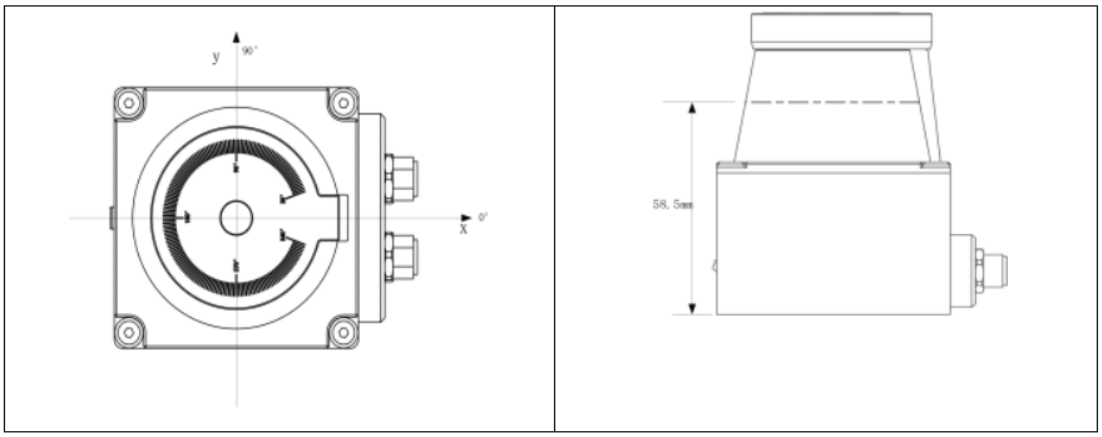
Part 9: Lidar Parameter

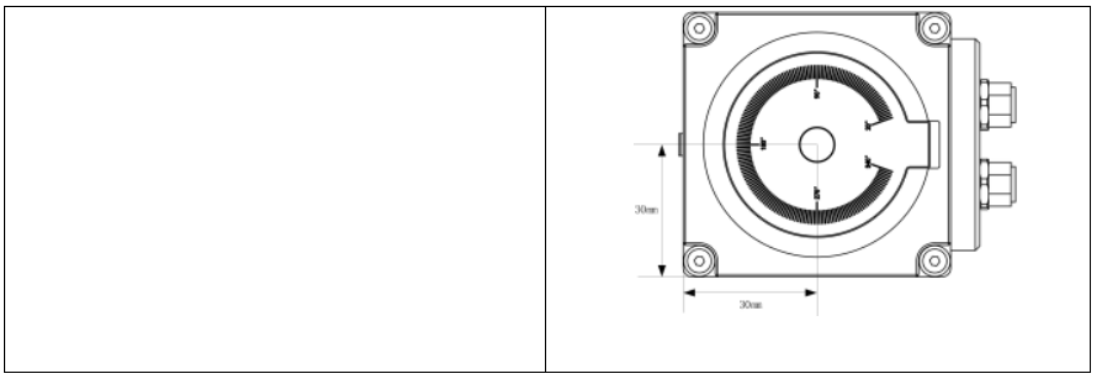
Parameter List	Parameter Value	Remark
Control method	IO connector control	When selecting the lidar channel for input, choose one from 3 options: IO, Modbus and Canopen. Only one valid at the same time. When outputting, IO is always valid.
	Modbus control	When selecting the lidar channel for input, choose one from 3 options: IO, Modbus and Canopen. Only one valid at the same time. When outputting, IO is always valid. Select Modbus, Modbus is always valid. **(LGA60 only ethernet and switch quantity valid)**
	Canopen communication control	When selecting the lidar channel for input, choose one from 3 options: IO, Modbus and Canopen. Only one valid at the same time. When outputting, IO is always valid. Select Canopen communication, Canopen is always valid. **(LGA60 only ethernet and switch quantity valid)**
RS485 address (1-127)	1-127	RS485 communication address 1-127 can be set (not available for LGA60)
RS485 baud rate	9600bps	RS485 baud rate can be set (not available for LGA60)
	19200bps	
	38400bps	
	57600bps	
	115200bps	
RS485 check digit	No parity	RS485 check code setting (not available for LGA60)
	Odd parity	
	Even parity	
RS485 communication stop	Stop 1 bit	RS485 stop bit setting (not available for LGA60)
	Stop 1.5 bit	
	Stop 2 bit	
CAN bus address (1-127)	1-127	CAN communication address 1-127 can be setting
CAN bus baud rate	125K	CAN bus baud rate
	250K	
	500K	
	1000K	
Lidar output logic	Normally open	Normally open, normally close setting
	Normally close	

Scanning speed	10HZ (600r/min)	Scanning speed setting
	20HZ (1200/min)	
Laser angle resolution	0.025° 0.050° 0.100° 0.250° 0.500°	Default resolution 0.05°
Filter level	Close Simple Medium Strict	Simple as default for filtering level setting
Installation direction	Front installation	Parameter are not effective currently
Crosstalk filtering enabled	Close Open	Default to open Turn on the anti-interference function of other sensors.
Crosstalk filter number	3-8	Default 5, the number of filter points. The more filter points, the better the anti-interference effect, but the image will have certain edge distortion.
Ethernet mode interface	TCP server	Default system is TCP
	UDP mode	
Laser detection frequency	144KHZ 288KHZ 576KHZ	3 frequency
Receive echo selection	First Last Maximum	First: lidar use 1st return signal; Last: lidar use last echo signal within the detection window; Maximum: lidar use the one with the greatest among all echo signal. The echo with the largest energy and the last echo have the ability to reduce dust, rain, fog and other environment on the lidar. (If the echo spacing is less than about 2.4m, the detection function will be affected, making it difficult to detect 2nd echo. The shorter the spacing, the more serious the impact. Low less than 1m, only the first echo can be detected)
Ethernet IP address	192 (192-254)	192.168.1.88
	168 (0-255)	
	1 (0-255)	
	1 (1-254)	
	Lidar (server) port fix in 8080	

5. Data Instruction

5.1 Sensor coordinate system





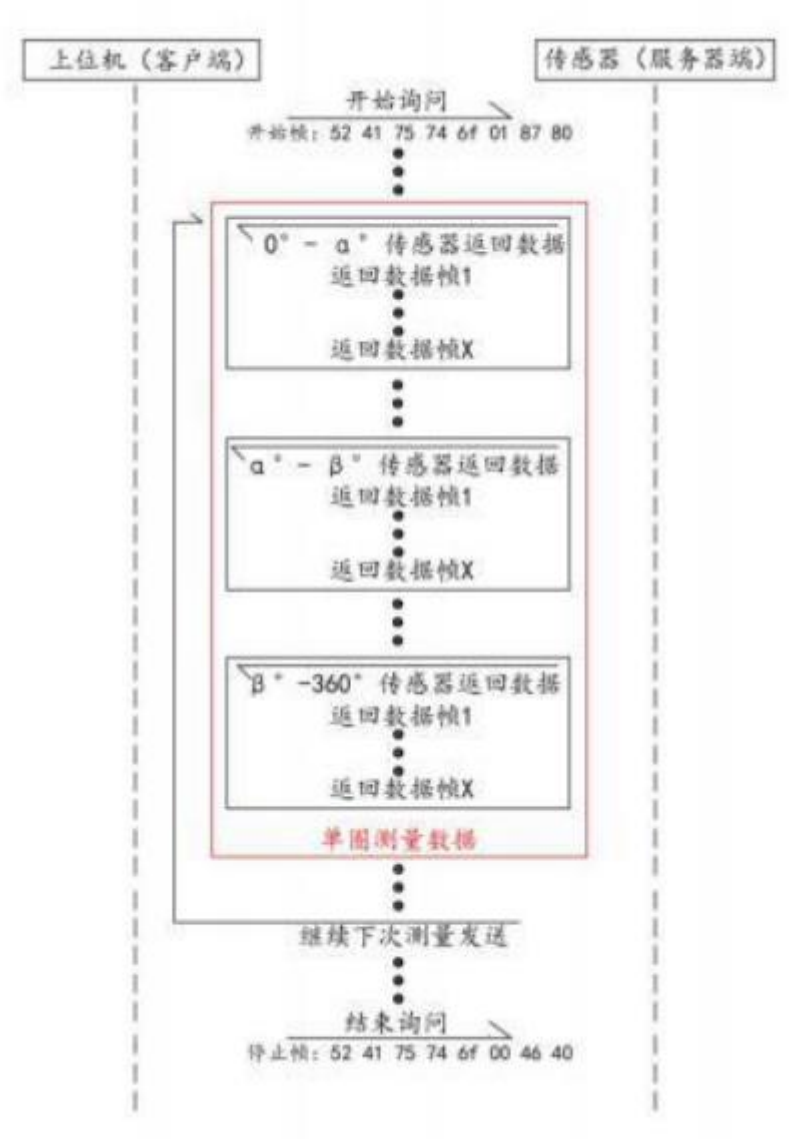
5.2 Ethernet data transmission

Data configuration

Open configuration software, enter lidar (system) setting interference, setting as below

Parameter name	Parameter value	Default
Ethernet mode	TCP server	TCP server
	UDP mode	
Ethernet IP address	192.168.1.1-254 Last byte 1-254 can be configured. Lidar (system) port fix in 8080	192.168.1.88

After the client initiates a request and establishes a connection, data transmission begins. The transmission method is as follows:



The host computer (client) sends a "start data frame" to the sensor (server), and the sensor returns measurement data of 20°-340° in several frames.
After returning complete measurement data of 20°-340° for a total of 320°, the sensor continues to send the next measurement data until the sensor receives the "stop data frame" sent by the host computer.

Start Data Frame (Hex)

Data frame

Start bit	Control bit	Parity bit
5 Byte	**1 Byte**	**2 Byte**

Start bit: fixed data 0x52, 0x41, 0x75, 0x74, 0x6F

Control bit: 0x01 lidar start to send data activity.
0x00 lidar stop to send data.
Parity bit: 0x87 0x80, low bite front, high bit last
Choose Modbus-CRC16 to check parity bit.

Detection Data Frame (Hex)

Data frame

Data frame header	Measurement data
16 Byte	Byte is not fixed

Data frame header format

Identifier	1 byte
	1 byte
	1 byte
	1 byte
Start angle	1 byte (high bit first)
	1 byte (low bit last
End angle	1 byte (high bit first)
	1 byte (low bit last
Total point number of current data frame	1 byte (high bit first)
	1 byte (low bit last
Sequence number of the last detection point of current data frame	1 byte (high bit first)
	1 byte (low bit last
Starting angle to end angle range	1 byte (high bit first)
	1 byte (low bit last
Total number of measurement points within the range of the starting angle to the ending angle	1 byte (high bit first)
	1 byte (low bit last

1. Identifier (4 byte): 0x48 0x49 0x53 0x4e
2. Start angle (2 byte): the starting angle of the currently returned measurement data;
3. Ending angle (2 byte):the end angle of the currently returned measurement data;
4. Total number of measurement points in the current data frame (2 byte);
   Due to different angle resolution, the total number of measured points in the range from the starting angle to the ending angle will also be different;
   Several data frames return measurement data.” Total number of measurement points

in the current data frame" is the sum of the number of measurement points returned by the current data frame.

5. The sequence number of the last detection point of the current data frame (2 byte):

   For example: the total number of measurement points in the range from the starting angle to the ending angle is 800, and the measurement data is returned in 2 frames. The current data frame returns the data from the 1st to 400th points, then the value of the sequence number of the last detection point of the current data frame is 400.
   If the current data frame returns the data from the 401st to the 800th point, then the value of "sequential number of the last detection point of the current data frame" is 800.
6. The total number of measurement points within the range from the starting angle to the ending angle (2 byte):
   The total number of measurement points within the range from the starting angle to the ending angle is determined by the current "laser scanning frequency", "scanning motor speed", and " single point sampling".
   "Number of Times" to determine, as shown below with samples.
7. Time mark (2Byte):
   Displays the internal timing time of the current frame transmission. The time unit is us. The time recording range is 0-65535us. The data is cleared when the record is full.

5. Detection Data (Hex)

1st point detection data (4 byte)				2nd point detection data (4 byte)				…….. (4 byte)				Last point detection data (4 byte)			
Detection Distance (2 byte)		Detection Intensity (2 byte)		Detection Distance (2 byte)		Detection Intensity (2 byte)		Detection Distance (2 byte)		Detection Intensity (2 byte)		Detection Distance (2 byte)		Detection Intensity (2 byte)	
L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H

Detection distance unit is mm, output data of distance between reflective point and lidar. Detection intensity reflect reflective intensity of point. The higher the value, the stronger the object's reflective ability.
The detection distance and detection intensity are both low byte in front and high byte after.

5. Stop data frame (Hex)

0x52 0x 41 0x75 0x74 0x6F 0x00 0x46 0x40
After host computer send stop data frame, then lidar will stop to send back detection data.

Example:

1. **Parameter setting as below:**
   Ethernet connector: TCP server
   Ethernet IP address: 192.16.1.88
   Scanning motor speed: 10HZ
   Lidar (server) port: 8080

   Important attention is lidar (server) port is fixed with 8080, host computer is successfully with lidar.
2. **Calculation of angle resolution:**
   Scanning frequency: the number of emitted laser beam in 1s, take 144KHZ as example;
   Scanning motor speed: the number of turns that drives the laser tube rotation motor to rotate in 1s. The following takes 10HZ (10r rotation in 1s) as an example;
   Sampling frequency: the number of repeated measurements of a single detection point. The following takes measurement of a single detection point once as an example;
   Measurement angle resolution=scanning motor speed *360 °/(laser scanning frequency/ number of single point sampling)=0.025 °.
   The measurement angle resolution is determined by the configuration software and does not require additional settings;
3. **Calculation of the total number of measurement points:**
   Detection
4.