ILS-F31-C**Obstacle Avoidance** Laser Scanning Sensor User Manual



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1 Product overview

ILS-F31-C laser The scanning sensor adopts the principle of time-of-flight (TOF) ranging and integrates cutting-edge technologies in the fields of optics, electricity, and mechanical kinematics. ILS-F31-C is an industrial-grade scanning laser obstacle avoidance sensor, which has a wide range of requirements for the use environment and can work reliably indoors and outdoors, especially using intelligent multiple echo technology, precise temperature control system, and reliable airtight The flexible design enables it to work reliably in bad weather such as rain, fog, snow, and high and low temperatures.

The principle of TOF ranges: the laser transmitter emits a laser pulse wave, the system starts timing, and the time is t1. When the laser hits the object, part of the energy returns, the laser receiver receives the returned laser wave, and the system stops timing. The time is t2, and the laser The distance between the scanning sensor and the measured object is: $S=C\times(t2-t1)/2$, where C is the speed of light.

ILS-F31-C series sensor product features

1. Laser protection level 1, eye safety;

2. Large field of view, long-distance, high speed, accurate measurement;

3. Precise temperature control design, working temperature range -25° C \sim

+50°C;

4、 Reliable airtight design, protection grade IP65

2 Technical parameters

| | ILS-F31-C |
|-------------------------|--|
| Angular resolution | 0.25°/ 0.33 °/0.5°/1° |
| Working mode | Obstacle avoidance |
| area group | 16 area groups (each area group contains 3 areas) |
| switch input | 4 |
| switch output | 3*area output+1*sync/status output (maximum output |
| | current 100mA) |
| parameter setting | R\$232/Type-C |
| interface | Rozozy Type G |
| data output interface | RS232/Type-C |
| A construction of a sec | |

description:

1. F31-C series The product can support four angular resolution switching, and the default angular resolution is 0.33°.

General parameters

| Item | typical value | Item | typical value | |
|--------------------|---|---------------------|-------------------------|--|
| Scanning angle | 270° | Scanning frequency | 15Hz | |
| Maximum distance | 25m | 10% reflectivity | 8m | |
| | | Detection distance | | |
| Measurement | ±3cm | Repeat accuracy | 3cm ⁽¹⁾ | |
| accuracy | | | | |
| Resolution | <3m: 51 | mm <5m: 10mm <8 Met | er: 15mm ⁽²⁾ | |
| Laser class | 1 laser (complies with GB7247.1-2012), eye-safe | | | |
| laser wavelength | 905nm, | protection class | IP65 | |
| , working distance | 0.05~5m/8m | , working voltage | DC9~28V | |
| power consumption | <4W ⁽³⁾ | size | 60mm | |
| | *60mm*85mm | | | |
| Working | -25°C∼50°C | Storage temperature | -40°C ~70°C | |
| temperature | | | | |
| Light resistance | 80000Lux | | | |

(1) Test conditions: 10% reflectance within 8m

(2) Resolution: At different distances, the resolution of the device is different. Within the range of 3m, the minimum resolution of 5mm can be recognized, within the range of 5m, the minimum resolution of 10mm can be recognized, and within the range of 8m, the minimum resolution of 15mm can be

recognized.

(3) Due to the loss of the switching power supply itself, conversion efficiency and other factors, it is recommended to choose a power supply with a power greater than 4w.

| test project | technical requirements | | | |
|---|--|--|--|--|
| voltage terminals | meets the requirements of IEC61000-6-4:2011 Conducted disturbance limit | | | |
| power | terminals | | | |
| of the following radiation disturbances | meet the requirements of radiation disturbance limits in IEC61000-6-4:2011. | | | |
| Electrostatic discharge immunity | meets the requirements of IEC61000-6-2:2005 experimental levels (contact discharge 2kV, 4kV, air discharge 2kV, 4kV, 8kV), Meet the requirements of performance criterion A The | | | |
| continuous wave radiation disturbance immunity | meets the requirements of IEC61000-6-2:2005 test level (test voltage 10V/m), and meets the requirements of performance criterion A. | | | |
| The electrical fast transient burst immunity | meets the requirements of the IEC61000-6- 2:2005 experimental level (the test voltage of the power input port is 0.5kV, 1kV, 2kV), and meets the requirements of the performance criterion A. | | | |
| Surge (impact) immunity | Meet the requirements of IEC61000-6-2:2005 experimental level (line-line 0.5kV, 1kV, line-ground 0.5kV, 1kV, 2kV), meet the requirements of performance criterion A | | | |
| Continuous-wave conducted disturbance immunity | meets IEC61000-6 -2:2005 experimental level regulations (power input port test voltage 10V), meeting the requirements of performance criterion A The | | | |
| power frequency magnetic field immunity | in line with the IEC61000-6-2:20054 experimental level regulations (magnetic field strength 30A/m), To meet the requirements of performance criterion A, the | | | |
| voltage sag and short-term interruption immunity | meets the requirements of IEC61000-6-2:2005 experimental level. Voltage sag -30% reduction (0.5 cycles) meets the requirements of performance criterion A; voltage sag -60% reduction (5 cycles, 50 cycles) meets the requirements of performance criterion A; short-term voltage interruption (250 cycles) , to meet the requirements of performance criterion C. | | | |

EMC electromagnetic compatibility testing

3、 Series Product

1. Product Classification

| | | | | · · · · · · · · · · · · · · · · · · · |
|----------------|-----------------|--------|---------------------|---------------------------------------|
| Product Series | | Output | Driving | Ranging |
| | Model | Туре | Capability | Capability |
| N series | ILS-F31-CNL005 | NPN | low-level drive | 0.05m~5m |
| | ILS-F31-CNL008 | NPN | low-level drive | 0.05m~8m |
| P series | ILS-F31- CPH005 | PNP | high-level drive | 0.05m~5m |
| | ILS-F31-CPH008 | PNP | high-level drive | 0.05m~8m |
| D i i | | | | • |

Description:

1. Regarding the drive capability, the device marked as "low-level drive" means that the device has drive capability when it outputs low level. A device labeled "High Drive" indicates that the device has the ability to drive when it outputs a high level.

2. High-level voltage range: 9-28V, consistent with the power supply voltage.

2. Detailed description of

N series: idle state (no obstacle detected), output low level; trigger state (with an obstacle), output high level;

wiring method, OUT pin is connected to the cathode of the drive circuit, as shown in the figure below;



P series: In idle state (no obstacle detected), output high level; in trigger state (with an obstacle), output low level; in

connection mode, OUT pin is connected to the anode of the drive circuit.



4 Mechanical dimensions

(dimensions marked in the figure are in mm)





5 Electrical connection

1. pin definition (scattered wire)

| Power supply | | | | |
|------------------|-------------|----------------|--------------------------|--|
| serial number | Cable color | Pin definition | Pin function description | |
| 1 | red | V+ | power supply positive | |
| 2 | red | V+ | power supply positive | |
| 3 | black | V- | power supply negative | |
| 4 | white | V | negative | |

| RS232 | | | | |
|--------|-------------|------------|----------|--|
| serial | color | definition | function | |
| - | Pin | Cable | pin | |
| serial | description | port | number | |
| power | | | | |

|) | | | | | |
|---|-------------|-------|----------------------------|--|--|
| Black | (| and | Pin function description | | |
| 7 | white | OUT1 | Device Ready | | |
| 8 | brown | OUT2 | innermost detection output | | |
| Q | brown white | 01173 | middle layer detection | | |
| , , | brown white | 0015 | output | | |
| 10 | green | OUT4 | outermost detection output | | |
| Note: OUT1: Device Ready, abnormal device status output | | | | | |

| input | | | | |
|--------|-------------|------------|--|--|
| serial | coble color | tube Pin | Din Eurotian Decorintian | |
| number | cable color | Definition | Pin Function Description | |
| 11 | Yellow | СОМ | Input Common Terminal PNP: INGND NPN: IN 9~28 V | |
| 12 | Purple | IN4 | Switch Input | |
| 13 | Light Green | IN3 | Switch Input | |
| 14 | Pink | IN2 | Switch Input | |
| 15 | Gray | IN1 | Switch Input | |

2.DB15 Pin definition (custom DB15 connector)

| DB15 pin number | color | management definition | function | |
|--------------------|---|--------------------------|---|--|
| 1 | red/red/white/r ed parallel line | V+ | power supply positive | |
| 2 | orange | ТХ | RS232 sending pin | |
| 3 | red | V+ | power supply positive | |
| 4 | white | OUT1 | Device Ready | |
| 5 | black/black and white/ Black parallel | V- | power supply negative | |
| 6 | blue | RX | RS232 receiving pin | |
| 7 | black | V- | power supply negative | |
| 8 | gray | IN1 | switch input | |
| 9 | pink | IN2 | switch input | |
| 10 | light green | IN3 | switch input | |
| 11 | purple | IN4 | switch input | |
| 12 | brown | OUT2 | innermost Layer detection output | |
| 13 | Brown and white | OUT3 | Middle layer detection output | |
| 14 | Green | OUT4 | Outermost layer detection output | |
| 15 | Yellow | СОМ | input Common terminal PNP: INGND NPN: IN 9~28 V | |



3. Electrical connection diagram (scattered wires)

Note

1. 4 power supply wires All need to be connected, not just two wires.

2. The ground wire of the serial port and the power supply uses the same ground.

3. **Control unit:** The device outputs signals to the radar for zone group switching. If the COM terminal is connected to V-, the input pin needs to be connected to V+; if the COM terminal is connected to V+, the input pin needs to be connected to V-. The input only needs a voltage difference greater than or equal to 9V across the input to be detected.

4. **Controlled unit:** From the radar output signal to the device, it is used to indicate whether there is an obstacle at present, and the output high level is consistent with the radar power supply voltage.

5. **Measurement of the output signal of the controlled unit: The output** signals OUT1, OUT2, OUT3, and OUT4 are relative to the power supply ground. .

6 Area selection

ILS-F31-C can select the current working area group by switching the input IO signal or through the host computer. Note that the two methods are not compatible, and pay attention to selecting the correct radar according to the needs.

When the radar is an IO signal switching area group, it is controlled by the digital inputs IN1, IN2, IN3, and IN4, and 16 types of area selection signals can be switched. The selection conditions are as follows.

| | IN4 | IN3 | IN2 | IN1 |
|------------------|-------|-------|-----|-------|
| Field Group 1 | 0 | 0 | 0 | 0 |
| Field Group 2 | 0 | 0 | 0 | 1 |
| Field Group 3 | 0 | 0 | 1 | 0 |
| Field Group 4 | 0 | 0 | 1 | 1 |
| Field Group 5 | 0 | 1 | 0 | 0 |
| Field Group 6 | 0 | 1 | 0 | 1 |
| Field Group 7 | 0 | 1 | 1 | 0 |
| set 8 | 0Zone | 1 | 1 | 1Zone |
| set 9 | 1 | 0 | 0 | 0Zone |
| set 10 | 1 | 0 | 0 | 1 |
| set 11 | 1 | 0 | 1 | 0Zone |
| set 12 | 1 | 0 | 1 | 1Zone |
| set 13 | 1 | 1 | 0 | 0Zone |
| set 14 | 1 | 1Zone | 0 | 1 |
| area group 15 | 1 | 1 | 1 | 0 |
| area group 16 | 1 | 1 | 1 | 1 |

When the radar is the host computer to switch the area group, please refer to "Chapter

| 7 - | Software (| Operation". | The specific | communication | protocol is | as follows: |
|-----|------------|-------------|--------------|---------------|-------------|---------------|
| ' | bontinune | peration i | The opeening | communication | prococorio | ab follo iibi |

| Set the | | | | | | |
|-----------------------------|------------------------|--|--|--|--|--|
| byte sequence number | Content | description | | | | |
| 0-3 | AA 88 88 AA | frame header | | | | |
| 4 | main command number | 0xE3 | | | | |
| 5 | sub-command number | 0x13 | | | | |
| 6-9 | data frame length | includes all bytes of the frame header and frame tail, the high order is in the first | | | | |
| 10 | fields group | 1-16 | | | | |
| 11 | XOR check | reserved, fixed as 0 | | | | |
| 12-15 | 88 AA AA 88 | End of frame | | | | |
| description 1. After re- | ceiving the command, | the device will reply to the command execution | | | | |

status, 00 for success and 01 for failure.

| | Set working area group - reply | | | | | | |
|-------------------|--------------------------------|--|--|--|--|--|--|
| byte | | | | | | | |
| sequence | content | description | | | | | |
| number | | | | | | | |
| 0-3 | AA 88 88 AA | frame header | | | | | |
| 4 | main command | 0xF3 | | | | | |
| - | number | 0415 | | | | | |
| 5 | sub-command | 0x13 | | | | | |
| | number | | | | | | |
| 6-9 | data frame length | includes all bytes of the frame header and frame | | | | | |
| 0-9 | data france tength | tail, the high order is in the first | | | | | |
| 10 | data | 0-success 1-failure | | | | | |
| 11 | XOR check | reserved, Fixed to 0 | | | | | |
| 12-15 88 AA AA 88 | | frame end | | | | | |

| | Query the | | | | | | |
|----------|-----------|-------------|--|--|--|--|--|
| byte | content | description | | | | | |
| sequence | Contoint | uesenprion | | | | | |

| number | | |
|--------|------------------------|--|
| 0-3 | AA 88 88 AA | frame header |
| 4 | main command number | 0xE4 |
| 5 | sub-command number | 0x13 |
| 6-9 | data frame length | includes all bytes of frame header and frame end, the high order is reserved in the first |
| 10 | XOR check is | reserved, fixed at 0 |
| 11-14 | 88 AA AA 88 | Frame end |

| | query working area group - reply | | | | | | |
|----------------------------|----------------------------------|---|--|--|--|--|--|
| byte sequence number | content | description | | | | | |
| 0-3 | AA 88 88 AA | frame header | | | | | |
| 4 | main command number | 0xF4 | | | | | |
| 5 | subcommand number | 0x13 | | | | | |
| 6-9 | data frame length | includes all bytes of frame header and frame end, high order is in the first | | | | | |
| 10 | data | 1-16 current working area group | | | | | |
| 11 | XOR check | reserved , fixed at 0 | | | | | |
| 12-15 88 AA AA 88 | | Frame end | | | | | |

7 software operation

1. overview

ILS-F31-C obstacle avoidance laser sensor supports RS232 serial port and Type-C for data communication, please select the connection method as serial port when using, and then set the regional parameters configuration and query. When using, you can choose the connection method according to your needs.

The following ILS-F31-C obstacle avoidance laser sensors are referred to as F31-C for short.

| 题 北京因泰立科技有限公司 | |
|-----------------------------------|--------------------|
| 激光传感器连接方式 | 配置参数 |
| 连接方式: 串口 🗸 注:网络和串口连接不能同时使用 | 探测宽度: 🗸 🗸 資润 |
| 网络连接 | 恢复延时: s 设置 查询 |
| IP: 192.168.0.111 端口号: 4001 连接 断开 | 数据监控: ✓ 设置 查询 |
| 串口&无线 连接 | |
| 串口号: COM1->COM2 #BLTIM ▼ ¥10配置信息 | 指示以控制 |
| 波特率: 115200 🗸 打开 关闭 | 最外层: <u>∨</u> 设置 |
| 数据上报通道 | 中间层: |
| 上报通道: 🗸 🗸 查询 | 最内层: 🗸 🦉 🎽 |
| - 工作区域组设署 | ──区域轮廓配置(操作目标: 雷达) |
| 工作区域: ○ ②置 查询 | 读取配置文件 写入配置文件 |
| 软件信息 | |
| 软件升级 软件版本 时间信息 | 区域参数设置 |
| ILS_F31 避障型公开 | 版上位机V3.8 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 清列表框 | 退出 |

2. Software interface

Figure 2.1 Area detection threshold parameter setting interface

1. **Detection width:** the minimum width that can be detected, only when the width of the measured object is greater than this distance will the trigger signal be output.

2. **Recovery delay:** When the obstacle leaves the protection area, the output signal is switched to a barrier-free state.

3. **Data monitoring:** After it is set to enable, it can be monitored by the host computer software. The default is disabled each time the radar is powered on.

4. **Reporting channel:** It is divided into serial port upload and Type-C, which is selected according to the current connection status.

5. **Read configuration file:** read the device area information from the radar to the host computer.

6. **Write Configuration File:** Write the locale information to the radar.

7. Indicator light: used to set the color of the indicator light when different areas are triggered.

Note: For the detailed usage of the above parameters, please refer to "VII. Software operation----3. Detailed description".



Figure 2.2 Area outline setting interface

3. detailed description of

3.1. device connection

F31-C can currently connect devices through the RS232 serial port and Type-C.

3.1.1 Serial port connection

When using the serial port connection, the software will automatically identify the serial port cable that has been connected to the device after startup and display it in the form of a serial port number. The user can directly select the corresponding correct serial port number for the connection. When using the serial port, the baud rate of the serial port should be selected as 115200.

| 车接方式: | 串口 🗸 注:网络和串口连接不能同时使用 | |
|-----------|--|---|
| 网络连接 | | 1 |
| IP: 192 . | 168 . 0 .111 端口号: 4001 连接 断开 | |
| 串口&无线 | 连接 | |
| 串口号: | COM1->COM2 #ELTIM V W10配置信息 | |
| 波特率: | COM1->COM2 #ELTIMA Virtual Serial Port | |
| | COM14 #USB Serial Port | 1 |

Figure 3.1.1 Serial port connection

3.1.2 Type-C connection

When using a Type-C connection, the software will automatically identify the connected data cable in the device after startup and display it in the form of a serial port number. The user can directly select the corresponding correct serial port number for the connection. When using Type-C, the serial port baud rate should be selected as 115200.

The driver will be installed automatically when you use Type-C for the first time. If there is no automatic installation or the automatic installation fails, please install the driver manually. The driver is located in the "Driver" folder in the same path of the software. If there is no driver, the host computer will not be able to search for the serial port number.

| | 一激光传感器; 连接方式: | 住接方式 日口 ▼ 注: 网络和串口连接不能 | 同时使用 | |
|----------------|--------------------------|---|------|--------|
| | 一网络连接 IP: 192.1 | 68 . 0 .111 端口号: 4001 连接 | 断开 | |
| | -串口&无线 〕 串口号: 波特率: | 往接 COM13 #USB-SERIAL ✔ ¥10酉法 4 #Inte COM13 #USB-SERIAL CH340 | 信息 | |
| יטישר |] | Figure 3.1.2 Type connection | 7.± | ××1. |
| 🥵 Type-C驱动.EXE | | 2021/12/29 14:00 | 应用程序 | 460 KB |

Figure 3.1.3 Type-C driver

3.2. to get the software version number to

read the software version information of the laser sensor device.

| ▶ 串口&无线 词 | 生 接 | | | _ | | | | | |
|-----------|------------|----------|------|----|-------|-----|--|--|--|
| 串口号: | COM1->CO | M2 #ELTI | M ~ | | ₩10配置 | 信息 | | | |
| 波特率: | 115200 | | ~ | 打升 | Ŧ | 关闭 | | | |
| 数据上报通道 | - 数据上报通道 | | | | | | | | |
| 上报通道: | | | ~ | 设罚 | 5 | 查询 | | | |
| 一工作区域组订 | 工作区域组设置 | | | | | | | | |
| 工作区域: | | | ~ | 设 | 置 | 查询 | | | |
| 软件信息 | | | | | | | | | |
| 软件升 | 级 | ŧ | 次件版本 | | BZ | 间信息 | | | |

Figure 3.2.1 Obtaining the software version

3.3. parameter configuration and querying

3.3.1. the minimum detection width

is disabled by default, that is, the minimum detection width is limited to 0mm. In this state, the minimum object detection width of the device is an adaptive state, and the F31-C can maximize its use of Obstacle detection capability.

The minimum detection width can be set to 30mm, 40mm, 50mm, 70mm, 150mm, and 170mm, 190mm, 210mm, 250mm, a total of nine enabled working states. When the minimum detection width is manually set to any of the enabled states, the protection area will be forcibly limited. The trigger width of the inner obstacle, objects below this width will not trigger the protection zone alarm.

When any minimum detection width is enabled, the width of the obstacle that actually shields the protection zone alarm is affected by the distance between the object and the F31-C radar and the reflective surface of the object. The farther the distance is the larger the minimum detection width that can be identified.

| 探测宽度: | Omm | ~ | 设置 | 查询 |
|-------|-----|---|----|----|
| 恢复延时: | 2 | s | 设置 | 查询 |
| 数据监控: | 使能 | ~ | 设置 | 查询 |

Figure 3.3.1 Minimum detection width

3.3.2. detection and recovery delay

Detection and recovery delay is the delay time for the output signal to switch to the barrier-free state after the obstacle leaves the protection area. For the equipment collision in the three-dimensional space caused by the environment, the recovery delay is increased to ensure that after the equipment obstacle triggers the area alarm signal, the obstacle can completely leave the three-dimensional space where the protection area is located before the equipment starts to move.

The default detection recovery delay is 2s, which can be adjusted between 0 and 60s. When set to 0, the output signal will switch to the barrier-free state immediately after the obstacle leaves the scanning section of the F31-C. It is recommended that the user add delay protection after receiving the barrier-free signal.

| 探测宽度: | Omm | ~ | 设置 | 查询 |
|-------|-----|---|----|----|
| 恢复延时: | 2 | s | 设置 | 查询 |
| 数据监控: | 使能 | ~ | 设置 | 查询 |

Figure 3.3.2 Detection and recovery delay

The user can increase the security by setting the "Detection and recovery delay". If the detection and recovery delay is not required during use, the "Detection and recovery delay" can be directly set to 0.

3.3.3. Real-time data monitoring

F31-C supports regional detection results upload and laser cloud point data upload when performing regional settings. By default, after the device is powered on, the regional detection results and laser cloud point data will not be uploaded. During the test configuration process, you can modify the corresponding configuration parameters for data monitoring.

The data monitoring enable can be configured in two ways. One is to select the data monitoring under "Configuration Parameters" as "Enabled" state, and then click the "Set" button to return to when the setting is successful. Second, in the "Region Outline Setting" interface, click the "Start Monitoring" button to set the data monitoring to the "Enable" state.

It should be noted that when the detection and recovery delay is not 0, the level status output will have a delay, and there will be no delay in the output of the data monitoring interface results. At this time, the level status output results will be inconsistent with the monitoring interface.

| 探测宽度: | Omm | ~ | 设置 | 查询 |
|-------|-----|---|----|----|
| 恢复延时: | 2 | s | 设置 | 查询 |
| 数据监控: | 使能 | ~ | 设置 | 查询 |

Figure 3.3.3 Data monitoring enable setting



Figure 3.3.4 Data monitoring enable setting

3.3.4. Data reporting channel

F31-C obstacle avoidance radar currently supports two connection methods, serial port and wireless. " is "serial transmission", when using Type-C to connect, you need to confirm that the "data reporting channel" is "Type-C transmission".

| - 数据上报通道 | ē | 10 | |
|----------|------|----|----|
| 上报通道: | 串口传输 | 设置 | 查询 |

Figure 3.3.5 Data monitoring enables setting

3.3.5. indicator

F31-C obstacle avoidance radar currently supports 7 colors for the WORK indicator.

Default: outermost layer--green middle layer--yellow innermost layer-red

three areas have the same color settings: Flicker frequency outermost layer--2000ms middle layer--800ms innermost layer--200ms

color settings of the three areas are different The same: the outermost layer of flicker frequency--200ms, the middle layer--200ms, the innermost layer--200ms

| - 指示灯控制 | | |
|---------|---|------------|
| 最外层: | ~ | 设 署 |
| 中间层: | ~ | |
| 最内层: | ~ | 查询 |

3.3.6. working area group settings

F31-C obstacle avoidance radar supports two ways to switch area groups. 1. Switch the area group through input IO 2. Switch the area group through the host computer. The two methods are not compatible, please choose the correct radar according to your needs. Radar defaults to switching zone groups via IO.

When the radar switches the zone group by IO signal, please refer to section 3.6 (zone setting) of this chapter for setting.

When the radar switches the area group through the host computer, select the current area group to be used, and click Set.

| -工作区域组设 | 置 | | |
|---------|----|----|----|
| 工作区域: | ×. | 设置 | 查询 |

3.4. Area outline configuration

F31-C provides the function of the one-click configuration of equipment outline parameters. Users only need to configure the first machine used in the current environment, and subsequent installation and replacement of new equipment can directly download the area outline settings to the new equipment through the configuration file. in the device.

After the configuration of the first device is completed, through the "read configuration file" function, the configuration file of the set contour parameters in the device can be saved in the mobile device, and then the generated configuration file can be directly imported through "write configuration file" To the newly installed device, it can work directly after restarting.

| - 区域轮 | 廓配置(操作目标: | 雷达) | | |
|-------|-----------|-----|--------|--|
| | 读取配置文件 | | 写入配置文件 | |

3.5. Software upgrade

- Software upgrade steps
- 1. First, click the software upgrade button to enter the software upgrade window.

| 软件版本 | 时间信息 |
|------|------|
| | 软件版本 |

| 更新程序 | | | ~ |
|-------|----------|----------|---|
| 又任路径: | 10 | | Y |
| 更新模式: | ● 重新选择路径 | ◯ 保持上次路径 | |
| | | | |
| | | | |

Figure 3.4.1 Software upgrade button

Figure 3.4.2 Software upgrade window

2. After entering the software upgrade window, click "Software Upgrade", start the file manager to select the file, select the correct upgrade file, the upgrade file suffix is

打开 23 查找范围 (I): 🔰 intellin_M + 🗈 💣 💷 • • 修改日期 类型 名称 лаационногонось.b 2019/7/29 9:34 BIN 文件 865 KB 文件名 00 打开(0) 文件类型(T): -取消

Figure 3.4.3 Software upgrade file selection

3. After selecting the file and returning it, the program upgrade will start automatically. During the program upgrade process, the progress bar indicates the file transfer progress, and the program upgrade starts after the file transfer is completed. During the program upgrade process, you cannot power off and restart, and wait for the prompt.

| 软件 | 牛升级界面 | |
|----|---------------------------|---|
| | 2 程序升级 文件路径: 激光传感器程序文件 | × |
| | 更新模式: ● 重新选择路径 ○ 保持上次路径 | |
| | 软件升级 退出 | |

Figure 3.4.4 Software upgrade process

4. After the file transfer is completed, it takes about 40s to wait. After the program upgrade is completed, it will prompt to power off and restart. At this time, the laser sensor needs to be powered off and restarted.

.bin, and the file name format It is Intelly_F31_xxxxxxxx, where x is a number, indicating date and time.

| -程序升级 | 激光传感 | 器程序文件 | | | |
|---------|---------------|---------------------------|-------|-------------|---------------------|
| 更新: | 模式: | ● 重新选 | 择路径 | ○ 保持上次路 | [™] ▼ 径 |
| 任論 | <u>宗</u> 坚,诸勿 | 勿断由,等待说 | }备审新, | ★概4n≤时间! | |
| ाइ माग् | 元午,頃2 | | と単史制・ | 入版4USA3[4]: | |

Figure 3.4.5 Waiting time for program upgrade

| 软件 | 牛升级界面 | |
|----|-------------------------|---|
| 1 | 程序升级 文件路径: | |
| | | ~ |
| | 更新模式: 💿 重新选择路径 📀 保持上次路径 | |
| | | |
| 2 | 本次更新程序成功,设备请重新上电0(∩_∩)0 | |
| | 软件升级 退出 | |

Figure 3.4.6 Program upgrade completed

Note: Please do not power off before the prompt to power off and restart. If the program upgrade fails due to this operation, the device must be returned to the factory to be repaired again.

3.6. setting

the area outline, you need to click the "area parameter setting" button in the "area detection threshold parameter setting interface" to enter the secondary interface "area outline setting" interface to complete the setting of each area outline.

| 指示灯控制 | | | | | |
|--|------|--|--|--|--|
| 最外层: | ✓ 込業 | | | | |
| 中间层: | | | | | |
| 最内层: | 查询 | | | | |
| 区域轮廓配置(操作目标: 雷达) 读取配置文件 写入配置文件 | | | | | |
| 区域轮廓配置 | | | | | |
| 区域参数设置 | | | | | |

Figure 3.5.1 Jump button in the area setting interfaces



the "Area outline setting" interface

3.6.1. Area group signal selection

onThe enabled working state of group automatic switching starts to detect the state within the contour range, which is controlled by the switch input signals IN1, IN2, IN3, and IN4, and can switch 16 kinds of area selection signals. The selection conditions are as follows.

| | IN4 | IN3 | IN2 | IN1 |
|---------------|-----|-----|-----|-----|
| Field Group 1 | 0 | 0 | 0 | 0 |
| Field Group 2 | 0 | 0 | 0 | 1 |
| Field Group 3 | 0 | 0 | 1 | 0 |
| Field Group 4 | 0 | 0 | 1 | 1 |
| Field Group 5 | 0 | 1 | 0 | 0 |
| Field Group 6 | 0 | 1 | 0 | 1 |

| Field Group 7 | 0 | 1 | 1 | 0 |
|---------------|-------|-------|---|-------|
| set 8 | 0Zone | 1 | 1 | 1Zone |
| set 9 | 1 | 0 | 0 | 0Zone |
| set 10 | 1 | 0 | 0 | 1 |
| set 11 | 1 | 0 | 1 | 0Zone |
| set 12 | 1 | 0 | 1 | 1Zone |
| set 13 | 1 | 1 | 0 | 0Zone |
| set 14 | 1 | 1Zone | 0 | 1 |
| area group 15 | 1 | 1 | 1 | 0 |
| area group 16 | 1 | 1 | 1 | 1 |

3.6.2. detection sensitivity and response time

The area detection response time represents the trigger time of the F31-C to the object within the entry area outline. The higher the set response time level, the longer the response time, the first level time is about 60ms.

The area detection sensitivity represents the number of trigger points on the obstacle scanned by the laser. When the number of laser points scanned on the obstacle is greater than the set value, the radar outputs a trigger signal to shield the influence of noise in the environment on the radar. Both this parameter and the minimum detection width can control the size of the detected object, and the two can be set independently to take effect. The difference is that the minimum detection width is divided into bins, and this parameter is more flexible and delicate. When you need to filter specific objects in the scanning area, You can check the number of trigger points of the object through the waveform to filter out the object. Note that the object to be filtered and the real obstacle should be distinguished in the waveform to prevent misoperation.

For example the currently settable response time is divided into 5 levels and the sensitivity is 3 levels. Then it needs to detect the obstacle continuously for 300ms (5*60ms) and at least 3 laser points are scanned on the obstacle, and the radar outputs the trigger signal.



Figure 3.5.3 Area outline setting interface

3.6.3. Area outline drawing

Area outline setting interface can perform data monitoring and area outline setting at the same time, the current working area group is determined by four inputs, and a single area group can detect up to three different areas at the same time. To set a single area group, you need to set the "outermost" area, "middle layer" area, and "innermost layer" area. The default initialization area is a rectangular area with a width of 100cm and a length of 500cm.

The area outline display can display the outline settings of two working area groups at the same time, namely "current working area group" (the working area group determined by the four-way input) and "target working area group" (other selected on the host computer). area group). When the selected target area group is the same as the area group selected by the current input, only the outline of the "current working area group" is uploaded, and the outline of the current working area can be set. Otherwise, the contour of the corresponding target area group will be automatically uploaded, and at the same time, the outline of the "current working area group" will enter the grayscale display mode, and the contour of the target working area group can be set.



Figure 3.5.4 Only displays the "current work area group"



Figure 3.5.5 simultaneously displays the "current work area group" and "target work area group" The

origin "O" on the coordinate axis represents the laser emission point. -45° represents the left boundary of the laser scanning range, that is, the negative half-axis of the X-axis. 225° represents the right boundary of the laser scanning range, that is, the positive half-axis of the X-axis. The green sector in the figure indicates the allowable distance range.

The setting of the area outline can be completed during the data monitoring process. When setting the area in the area group, you need to select the target area level first, that is, "outermost layer", "middle layer" or "innermost layer". of.



Figure 3.5.6 Select

the target area level After selecting the corresponding target area level, you can modify the outline of the selected work area group, such as a rectangular area, you can drag and drop vertices or stretch an edge horizontally or vertically.



Figure 3.5.7 Rectangle outline modification

It should be noted that the internal parameters of the radar equipment will not be changed when dragging and stretching here. After the area outline modification is completed, you need to click the "Settings" button to set the radar equipment. At the same time, if you are not satisfied with the current operation result during the modification process, you can right-click on the contour parameter interface and select "Undo Single Step" or "Undo All" to return to the previous dragging result. After selecting "Undo Single Step", you can return to the previous contour. Set the location, you cannot go back after canceling.



Figure 3.5.8 Longitudinal stretch edge "P3-P4"



Figure 3.5.9 Right-click "Single Step Undo" to cancel the stretch operation.

The outline drawing methods of the area include the following six, and the corresponding drawing modes are "Rectangle" and "Single Sector", Overlapping Sectors, Sector Plot, Circle Plot, and Polygon Plot. The operation of completing the area outline is different in different drawing modes. Among them, in "Rectangle", "Single Sector", "Overlapping Sector", and "Sector Drawing" mode, you can complete the setting of the area outline by inputting the coordinates of the vertex position of the corresponding graph and clicking the mouse to draw, "Circle Drawing" and "Polygon Drawing" Mode" only supports the setting of the area outline by clicking the drawing with the mouse.

Select the drawing mode as "Rectangle", "Single Sector", "Overlapping Sector", and "Sector Drawing":

a. When the selected drawing mode is the same as the original

drawing mode of the selected area, you can drag the vertex pair identified by the circle in the coordinate system The outline of the graph can be modified. In the "Rectangle" mode, the outline of the rectangle can be stretched horizontally or vertically by clicking on the four sides of the rectangle.

b. Coordinate input and vertex dragging and extruding are only allowed within the range of the green sector, and the distance between the set outline graphic and the coordinate system center 'O' cannot exceed the maximum distance of the limit, otherwise, the setting will fail.

- c、 "Rectangle" setting rules:
- a) the coordinates of each point of the rectangle cannot appear on the negative half-axis of the Y-axis, the center of the coordinate system 'O' is the center of the radar laser emission, and the rectangular detection area is located in front of the radar scan.
- b) As shown in the figure, the vertex of the lower left corner of the rectangle is "P1", the vertex of the lower right corner is "P2", the vertex of the upper left corner is "P3", and the vertex of the upper right corner is "P4". Please keep "P1" in the lower left corner of the rectangle during the drawing process. Location, the other three points are similar.
- c) Rectangle area setting can directly input the coordinates of rectangle "P1", "P2", "P3" in the "Graphic Coordinate" column on the right to complete the rectangle outline setting, or drag and stretch on the set rectangle area outline. The position of the red circle in the figure below is an example of the position that can be dragged and stretched. After the mouse moves to this position, the shape of the mouse changes. The "fourdirection arrow" mouse can drag the vertices of the rectangle in the "north-south" or "east-west" direction. The arrow mouse can stretch the position of the corresponding side of the rectangle vertically or horizontally.



Figure 3.5.10

d、 "Single Sector" setting rule for outline drawing of rectangular area:A

 a) single sector can be set to the sector area by dragging the sector vertices "P1" and "P2", and the vertex position cannot exceed the green range when dragging.



Figure 3.5.11 For the outline drawing of a single sector area,

- b) you can directly input the coordinate positions of "P1" and "P2" in the "Graphic Coordinates" on the right to complete the drawing of the sector outline. The input coordinates must comply with the principle of sector closure. Failed to set successfully.
- c) Input the fan-shaped outline by coordinates. When the input coordinate position is different from the current upload area, the current input coordinate position is marked with a black dotted line and "P1'" and "P2'". In the figure below, due to the abnormal positions of the vertex positions



"P1'" and "P2'", the sector area cannot be closed, and the setting fails.

Figure 3.5.12 Abnormal coordinates of a single sector

- e verlapping sector" setting rule:
- a) Overlapping sectors are suitable for special detection areas. When setting, it is necessary to consider whether to set overlapping sectors according to the actual environment. When it is set to overlap sector, no obstacle detection will be performed inside the sector area formed by "P1" and "P2", and the detection in the overlapping sector area will also fail when there is an obstacle occluded.
- b) When setting the overlapping sector area, you can modify the radius and angle range of the overlapping sector by dragging the "P1", "P2", "P3", and "P4" vertices.



Figure 3.5.13 Outline drawing of overlapping fan-shaped area

- f. Setting rules of "fan-shaped drawing":
- a) In "fan-shaped drawing" setting mode, the fan-shaped outline can be set

directly by the mouse, or the area outline can be set by inputting the coordinates.

b) When setting the area outline in "Sector Drawing", within the allowable range, the first left-click determines the angle and radius of the left boundary of the sector, and the second left-click determines the right boundary of the sector. After the basic graphics are drawn, you can The sector outline is modified by dragging and clicking the position twice.



Figure 3.5.14 Outline drawing of fan-shaped drawing area



Figure 3.5.15

- g, "Circle drawing" setting the rule:
- a) In circular drawing mode, click the left button on the coordinate axis to determine a point, and use the position and coordinates of the point The axis center 'O' is used as the two vertices of a certain diameter of the target circular area to draw the outline of the circular area. The distance between the two points is the diameter of the outline of the circular area.

b) After the drawing is completed, you can modify the outline of the drawn circular area by dragging the mouse click position, and moving the position of the point will change the scanning range and diameter corresponding to the outline of the circular area.



Figure 3.5.16 Circular drawing area outline setting

- h, "Polygon drawing" setting rules:
- a) "Polygon drawing" mode contains at least three sides, within the allowable range of the coordinate system, click with the left mouse button to determine one side, click in sequence until a closed the outline of the polygon area or the maximum number of sides allowed.
- b) The starting point and cut-off point of the outline of the polygon area drawn in the "Polygon Drawing" mode must be the center of the coordinate axis. The starting point is automatically generated and determined at the beginning of the drawing, and the cut-off point needs to be set manually. When the mouse moves near the center 'O', a red circle will be generated.
- c) Select "Polygon Drawing" mode, and click the left mouse button arbitrarily within the distance limit of the coordinate system, and the first edge will be automatically generated, with the center 'O' as the starting point and the mouse click position as the boundary line of the end point. Continue to click to automatically generate a boundary line with the previous point as the location and the mouse click position as the end point.
- d) Under "Polygon Drawing", at least three clicks are required to complete the drawing of the area outline, and the last click position must be the center position '0' of the coordinate axis.

- e) After the polygon area contour closed graph is drawn, a draggable circular logo is automatically generated at the corresponding vertex position, and the coordinates of each vertex of the polygon area contour can be modified by dragging the corresponding circular logo.
- f) When you move the mouse to the position marked by the circle after the mouse changes from an arrow to a mobile "four-direction arrow", you can move the mouse to the target position by long-pressing the mouse to complete the modification of the polygon outline area. You can only move the mouse within the limited area to modify the area outline.



Figure 3.5.17 "First click"



of polygon drawing area outline setting Figure 3.5.18 "Second click"



of polygon drawing area outline setting Figure 3.5.19 "Last click"

b. polygon area that has been drawn, taking the innermost layer as a polygonal area as an example, after clicking the innermost layer, the movable vertices of the corresponding area in the area outline are marked with circles. At this time, the position of the corresponding vertex can only be modified by dragging. For the dragging method, see item f) in h illustrate. In addition, when you move the mouse to each position of the corresponding side of the polygon, the mouse turns into a rotating circle. At this time, click the right mouse button to add polygon vertices. You can drag and drop the new vertex to move the position.



Figure 3.5.20 Right-click menu



Figure 3.5.21 Add the polygon area where the polygon drawing vertices c, have been drawn. If dragging and dropping can not meet your needs, select the point, right-click to select Modify coordinates, enter new coordinates, and click OK, that is The coordinates can be fine-tuned.



d. The outline of the area displayed after clicking "Innermost" can only be modified by dragging and adding vertices. If you need to redraw the innermost polygon area, you can click "Clear Redraw" once, and the edit box prompts " At present, you can redraw the polygon outline or click the Clear button again. At this time, you can directly draw the outline of the polygon area, or click again to clear the current drawing and area selection.

e. In order to allow the user to draw the desired graph accurately, the function of zooming in and out of the coordinate axis is added. The user moves the mouse inside the green frame and slides the mouse wheel to change the scale of the coordinate axis.

f. During the drawing process, if the drawing graph is abnormal or the display is abnormal, you can restore the display by clicking the "Clear

Redraw" button.

g. If other unmentioned conditions are not met, please make corrections according to the prompts.

4. Data monitoring shows the

4.1. system status and detection results. The

laser equipment is initialized after power-on for about 15s and starts to enter the detection state. According to the parameters set by the user, it continuously detects whether there is an object in the target area. After the device is powered on, it will automatically start uploading laser cloud point data, regional detection results, and system working status.

The content of the data monitoring interface includes the current system status display, monitoring enable setting, input, and output status display, current working area group display, laser cloud point display mode, mouse position information, and outline display area group selection.

The current system status display includes "status code" and "monitoring status". The status code is the internal detection status of the device. When the output is "E00", it means that the system is running normally. The monitoring state is the data transmission state between the host computer and the radar device, including three states: "monitoring", "stop monitoring" and "communication abnormal". The "communication abnormal" state may be an abnormal serial connection or abnormal closing of the serial port. Repair by reconnecting the serial port or reopening the serial port.

The monitoring enables setting can set whether the current monitoring data is uploaded or not. When "Stop Monitoring" is clicked, the monitoring data will stop uploading, and the cloud point data and contour data in the host computer will be stopped from updating.

The input and output status display includes four inputs and three outputs. The fourway input selects the current working area group, and the three-way output corresponds to the detection status of the different levels of each area group. When the current area is triggered, the corresponding status indicator will display red. If it is not triggered, the corresponding status indicator will display green.

The current work area group is the work area group switched by the four input states detected by the current device. The detection result is based on the outline set by the current working area group.

The laser cloud point display mode can be switched between "point" and "line".

The displayed content of the mouse position information includes "coordinate position" and "angle position", where the coordinate position is the position in the coordinate system after converting the scanning angle and scanning distance, and the angular position directly displays the corresponding position of the current mouse in the radar scanning range Angle and distance, except angle, the unit of position information is cm.

Outline display target area group selection, only the current work area group is displayed after it is turned on by default. When the user selects an area group different from

the "current work area group" in the "target work area" on the right " is automatically selected, the outline of the "current working area group" turns into a gray dotted line to display, and the multi-color solid line displays the outline information of the "target working area group".



Figure 4.1.1 Data monitoring display information



Figure 4.1.2 Selected non-" current work area group" outline display

8 using the operating

device to start, make sure that the working power cord is connected to the switching power supply; ensure that the device window is clean.

Power on the switching power supply, the device can start and work normally. Disconnect the switching power supply, the device can be turned off.

Multi-color light radar default color: outermost layer--green middle layer--yellow innermost layer--red

| device status | | power indicator (red) | running indicator (green or other) | |
|-----------------------|---------|--------------------------|------------------------------------|--------------|
| barrier-free | | always | always | |
| | Outmost | | Color light | Single light |
| on, with obstacles | | always | 200ms blink | 2000ms blink |
| | Middle | | 200ms blink | 800ms blink |
| | Inmost | | 200ms blink | 200ms blink |

9. Assembly requirements

1. Precautions

- The following points should be paid attention to when installing the ILS-F31-C safety laser sensor:
- Please pay attention to the up and down elevation angle and left and right declination angle after the sensor is installed. The deviation of the installation angle will cause the device to not work properly. When the device operates in a narrow environment of 100cm, even if the detection area is set to be centered on the radar and 40cm to the left and right, if the deviation of the left and right angles of the sensor installation is too large, an alarm may be issued due to the detection of the left and right walls during operation. The deviation of the upper and lower elevation angles of the sensor installation is too large, and it may cause an alarm due to the detection of other objects on the ground or high-altitude during operation.
- Please ensure that the installation environment is dry and free from smoke or other air impurities, so as not to contaminate the device or affect the normal operation of the device. When the impurity particles in the air are too large and the smoke and steam are too strong, the equipment will not work properly.
- Please be careful not to point frequency observation lamps, fluorescent lamps, or other strong light sources directly at the scanning plane, as they can interfere with the normal operation of the sensor under certain circumstances.
- Please pay attention to maintain a sufficient minimum distance, only when there is a sufficient minimum distance from the hazardous area, the protection function of the ILS-F31-C can be achieved. The minimum distance depends on the approach speed of the body or body parts, the operating speed of the machine or equipment, the sensitivity of the ILS-F31-C safe area protection, the height of the scanning plane, and the possible switching time between monitoring field sets.
- Please confirm the switching timing between monitoring area groups. Taking into account the input delay and the possibility of a person in the protective field at the switching time, the protective field must be switched in time (before the person is at risk there) to ensure the effectiveness of the protective mechanism.

(

2. Installation method

When two or more sensors are installed opposite to each other, it is recommended

to incline more than 1.5° to prevent mutual interference.



• When two or more sensors are installed on the same plane and in the same direction, it is recommended to tilt more than 1.5° to prevent mutual interference.



● Due to the cone-shaped scattered emission of the sensor light spot, it is recommended that the laser obstacle sensor be installed at a height of ≥200mm from the ground. If the installation height is less than 200mm from the ground, it is recommended to tilt 1.5°.



10、 User Notice

In the process of use, please use the laser equipment strictly in accordance with the technical parameters and specifications. The equipment will not work normally in the usage scenarios beyond the specified scope of the technical parameters. The equipment damage caused by the use environment of the equipment does not meet the technical parameters and specifications, and the user shall be responsible for the equipment.

Using this machine for any other purpose and making any changes on the machine, even within the scope of assembly and installation, will result in the loss of any warranty rights for this laser equipment. Please ensure that the laser equipment is used correctly and in special application scenarios. Use and installation of protective devices below.