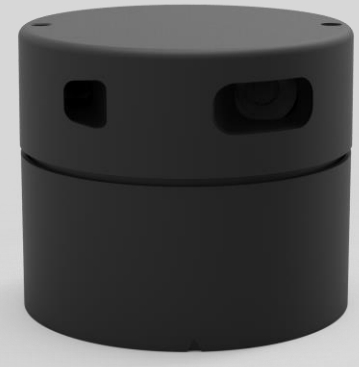
YDLIDAR F4PRO

USER MANUAL



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CONTENTS

YDLIDAR F4PRO DEVELOPMENT KIT

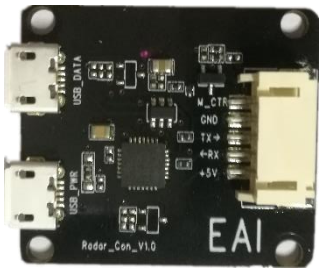
The YDLIDAR F4PRO (F4PRO) development kit is designed to facilitate users' performance evaluation and early rapid development of the F4PRO. Through F4PRO's development kit and matching evaluation software, users can observe the point cloud data scanned by F4PRO on their environment or develop on the SDK.

Development Kit

The F4PRO development kit has the following components:

F4PRO Lidar

MicroUSB cable



USB adapter board

FIG 1 YDLIDAR F4PRO DEVELOPMENT KIT

CHART 1 YDLIDAR F4PRO DEVELOPMENT KIT DESCRIPTION

Item	Qty	Description
F4PRO Lidar	1	The standard F4PRO has an integrated motor drive that enables motor stall control and motor control.
MicroUSB Cable	1	Use with USB adapter board to connect F4PRO and PC. It is both a power supply line and a data line.
USB adapter board	1	This component implements the USB to UART function to facilitate the fast interconnection of F4PRO and PC. It is used to control the motor transfer stop of the F4PRO on the serial port DTR signal. A USB Type-C Power Interface (PWR) for auxiliary power supply is also provided.

Note: USB adapter board has two MicroUSB interfaces: USB_DATA, USB_PWR.

USB_DATA: Data supply multiplex interface. In most cases, just using this interface can meet the power and communication needs.

USB_PWR: Auxiliary power interface. The USB interface of some development platforms has weak current drive capability, and auxiliary power supply can be used.

WINDOWS INSTRUCTIONS

Device connection

When evaluating and developing F4PRO under Windows, you need to interconnect F4PRO and PC. The connection steps are as follows:

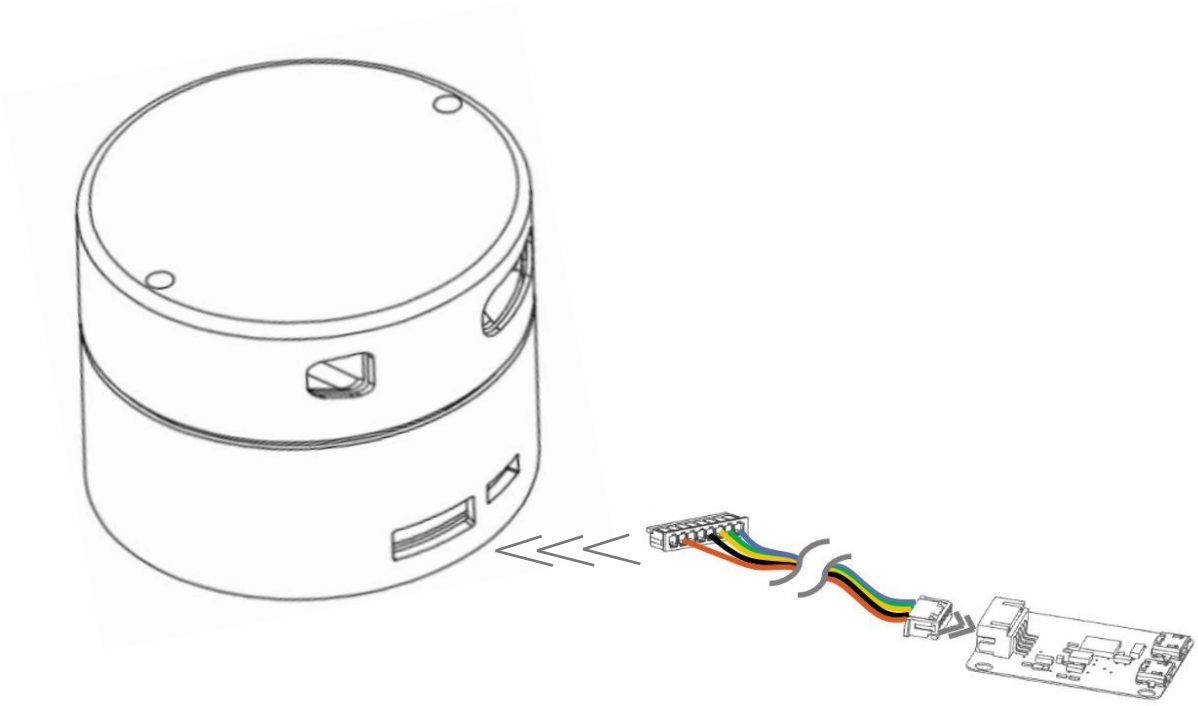


FIG 2 YDLIDAR F4PRO CONNECT STEP 1

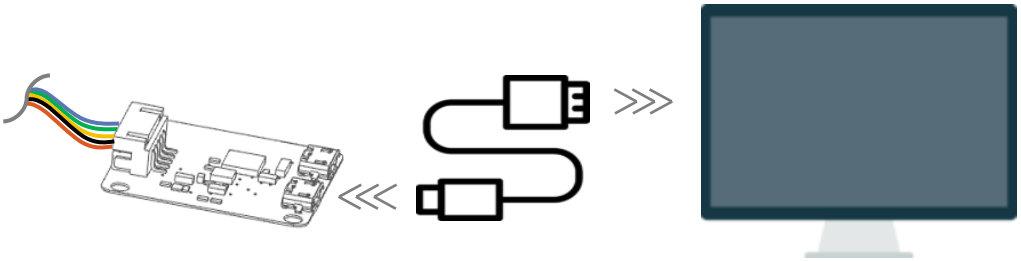


FIG 3 YDLIDAR F4PRO CONNECT STEP 2

Connect the adapter board and F4PRO first, and then connect the USB cable to the USB port of the adapter board and PC. Note that the USB-DATA interface of the USB cable is connected to the USB_DATA of the USB adapter board. After the F4PRO is powered on, it enters the idle mode and the motor does not turn.

If the drive current of the USB port of some development platforms or PCs is weak, F4PRO needs to access the +5V auxiliary power supply. Otherwise, the radar will work abnormally.

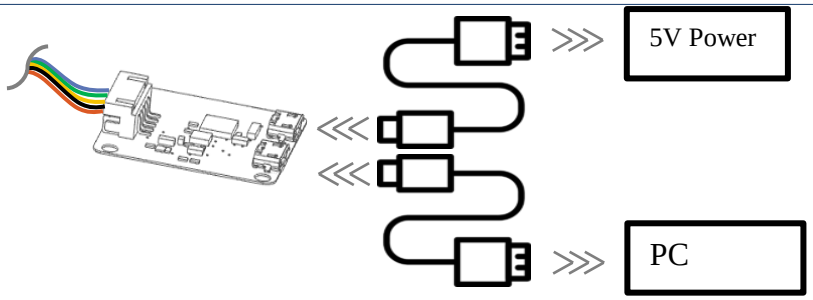


FIG 4 YDLIDAR F4PROAUXILIARY POWER SUPPLY

Driver Installation

When evaluating and developing the F4PRO under Windows, you need to install the serial port driver of the USB adapter board. The USB adapter board of this kit adopts CP2102 chip to realize serial port (UART) to USB signal conversion. Its driver can be downloaded from our official website or downloaded from the official website of Silicon Labs:

http://eaibot.com/

http://cn.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers

After extracting the driver package, execute the CP2102's Windows driver installation file (exe file under CP210x_VCP_Windows). Please select the 32-bit version (x86) or 64-bit version (x64) installation program according to the version of the windows operating system.

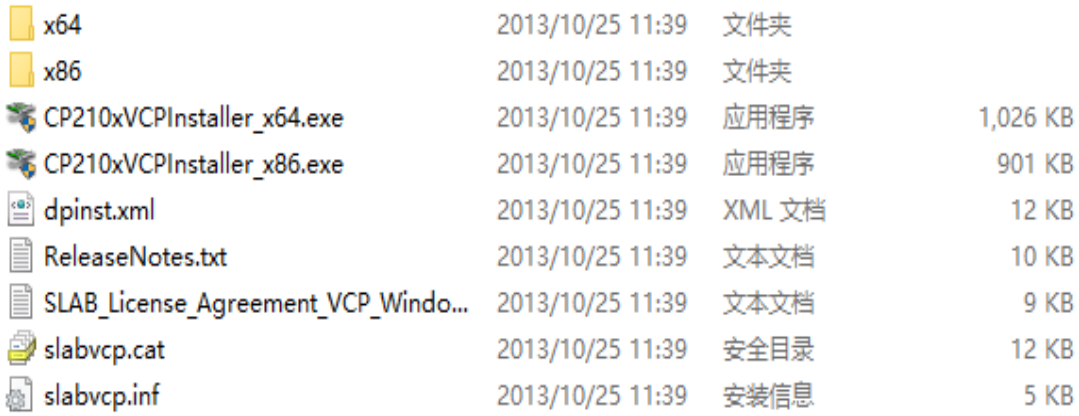


FIG 5 YDLIDAR F4PRODRIVER VERSION SELECTION

Follow the prompts to install.

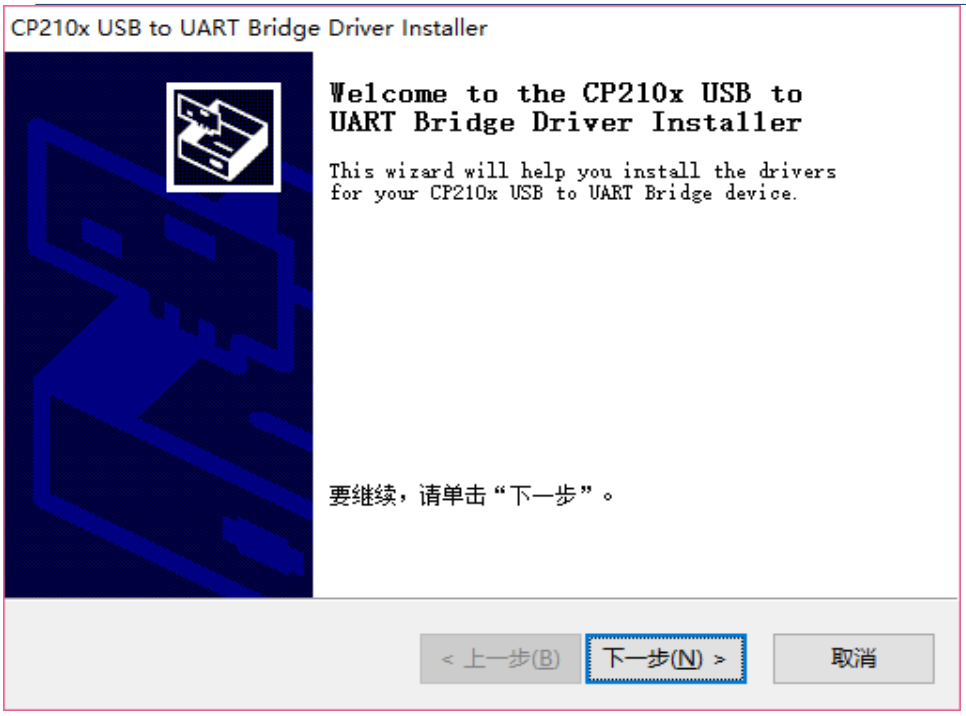


FIG 6 YDLIDAR F4PRO DRIVER INSTALLATION PROCESS

After the installation is complete, you can right-click on My Computer and select Properties. On the Open system interface, select Device Manager from the left menu to enter the device manager and expand Ports. The serial port name corresponding to the identified USB adapter is the driver installation successful. The following figure shows COM3. (Note that the port must be checked with F4PRO and PC interconnected)

Note: The user can also select Type-C on the F4PRO to quickly get started and use the Type-C data cable to connect the PC and F4PRO directly. After downloading the VCP serial driver of F4PRO on the official website, after the installation is successful, start PointCloud Viewer to scan the map, and then you can observe the point cloud data.

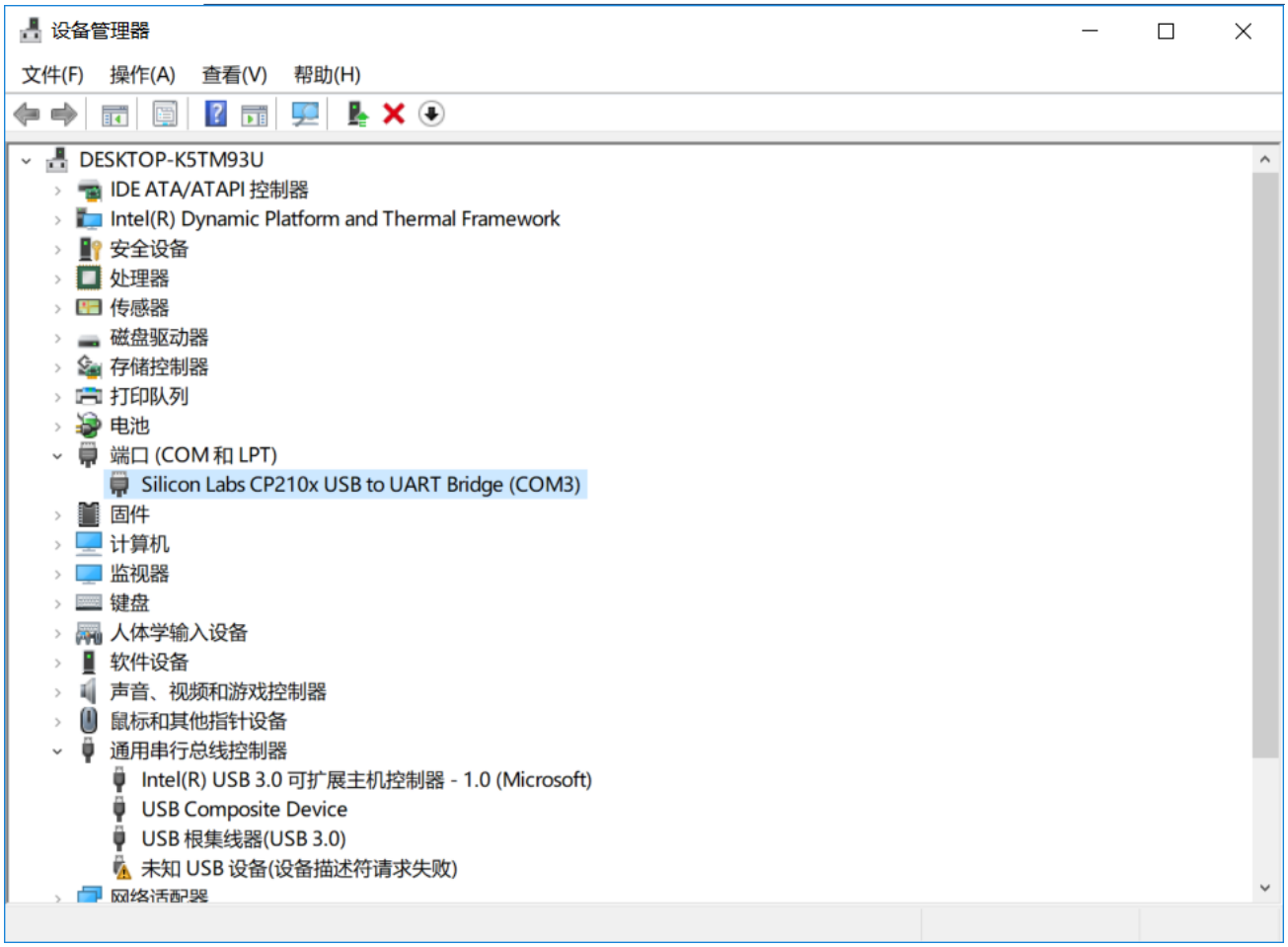


FIG 7 YDLIDAR F4PRODRIVE INSTALLATION CHECK

Evaluation software

YDLIDAR provides Point Cloud Viewer, point cloud data visualization software for F4PRO real-time scanning. Users can use this software to visually observe the F4PRO's scanning effect chart. YDLIDAR provides F4PRO real-time point cloud data and real-time scanning frequency. At the same time, F4PRO version information can be read, and scan data can be saved offline to an external file for further analysis.

Before using YDLIDAR, make sure that the F4PRO's USB adapter board serial port driver has been successfully installed, and interconnect the F4PRO with the PC's USB port. Run the evaluation software: PointCloudViewer.exe, select the corresponding serial number and model number, and select the power-off protection mode (refer to this product development manual). At the same time, the user can also choose the language and software style (upper right corner) according to personal circumstances.

FIG 8 YDLIDAR F4PRO EVALUATION SOFTWARE DESCRIPTION

Note: Lidar does not turn on power protection by default. This function requires continuous sending of scanning commands for the laser radar to work properly. If you stop sending the scan frequency, Lidar will stop scanning. At present, F4PRO and F4 are compatible with this function, and X4 is not compatible.

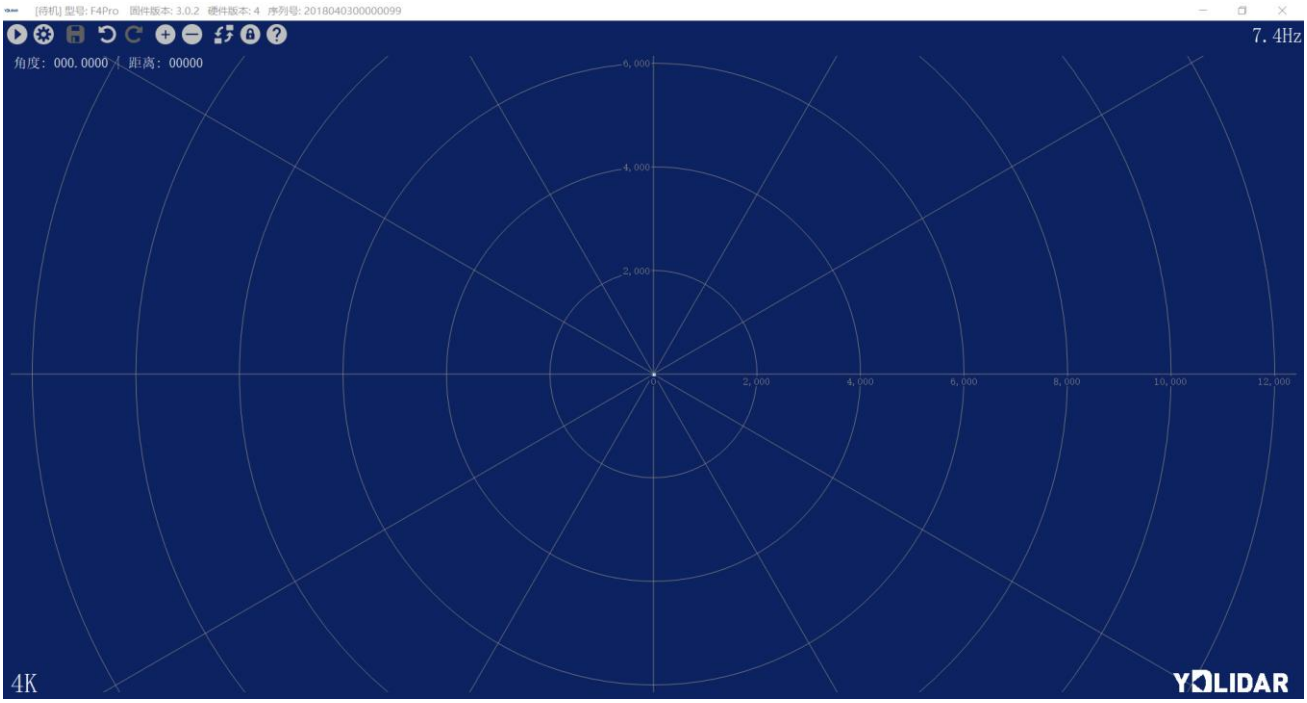


FIG 9 CLIENT SOFTWARE INTERFACE

START SCANNING

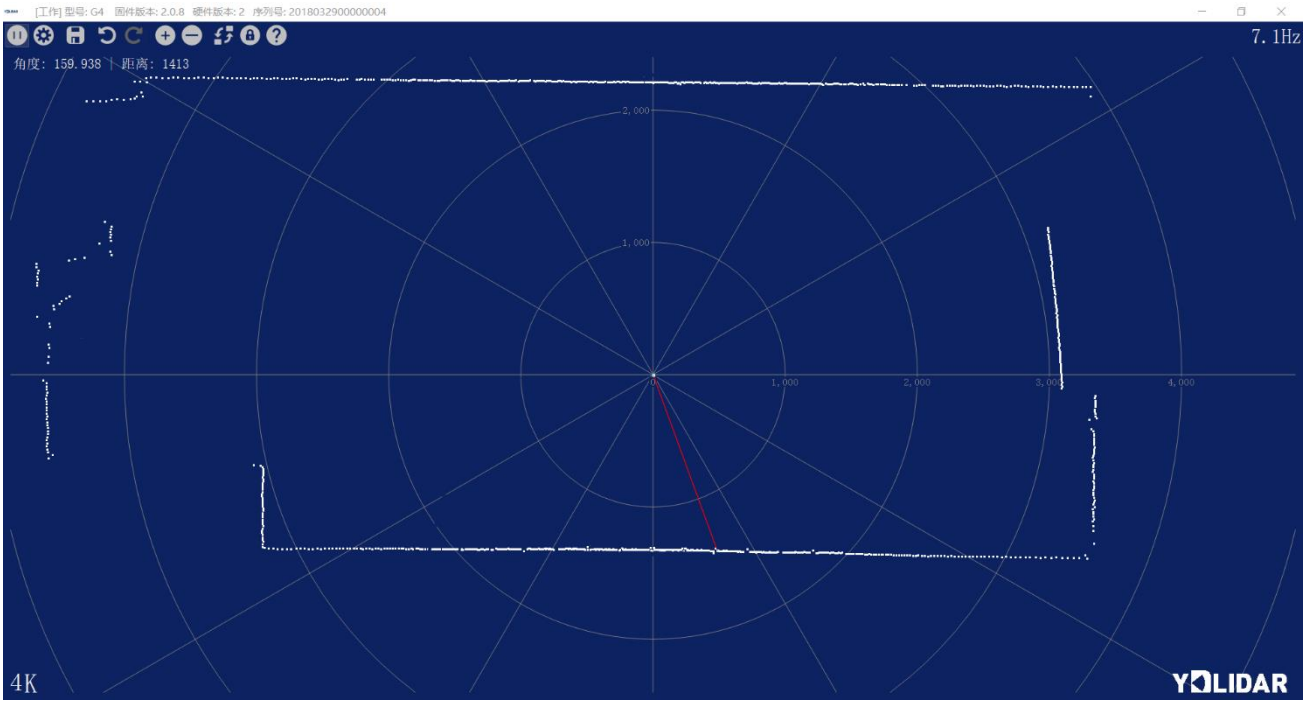


FIG 10 SCANNING POINT CLOUD DISPLAY

SYSTEM SETTINGS

Setting ⚙:

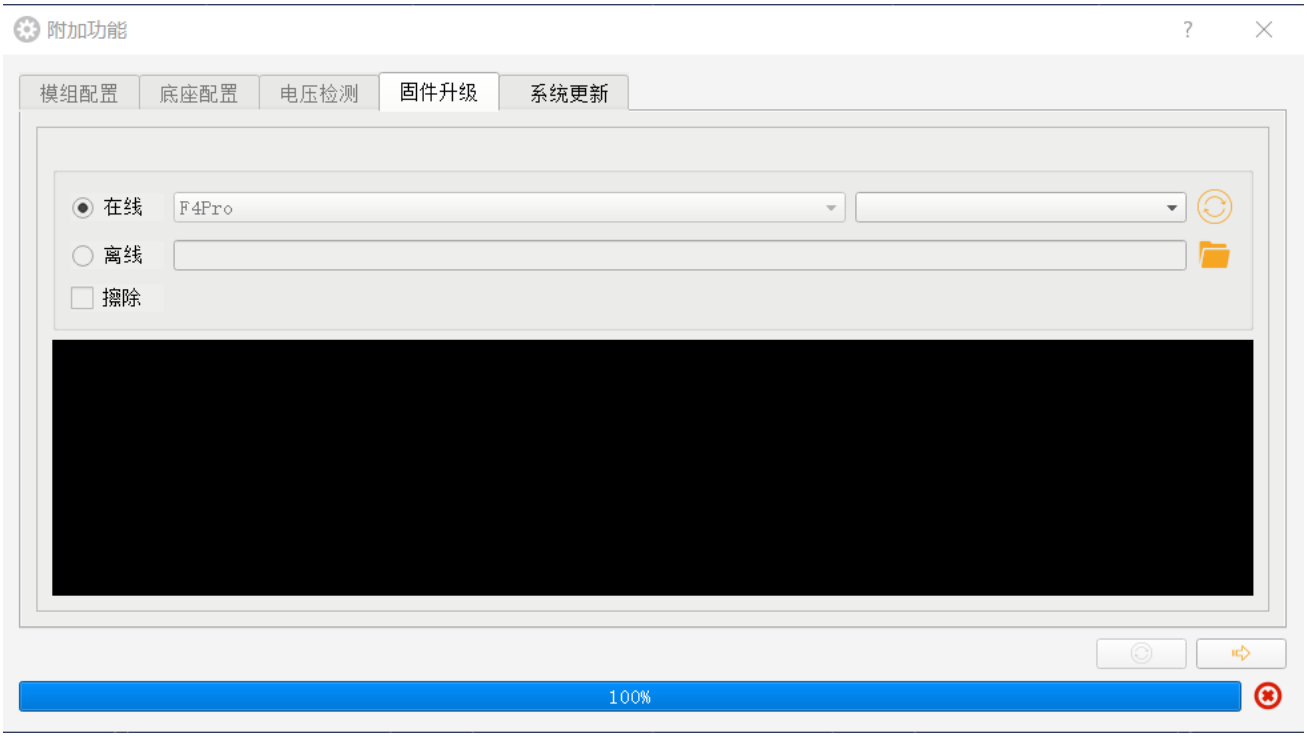


FIG 11 CLIENT SOFTWARE SETTINGS

As shown in the figure, you can set up the page to configure and detect the lidar, as well as the lidar firmware upgrade and client software upgrade.

SAVE DATE

According to prompts to save the point cloud data, the system will save a circle of point cloud information in the following format.

```
angle:9.5469    ,    distance:4654
angle:9.8125    ,    distance:4709
angle:10.094    ,    distance:4763
angle:10.625    ,    distance:4947
angle:11.125    ,    distance:6204
angle:11.203    ,    distance:0
angle:11.391    ,    distance:6253
angle:11.766    ,    distance:0
angle:12.609    ,    distance:0
angle:12.719    ,    distance:7895
```

FIG 12 POINT CLOUD DATA STORAGE FORMAT

SCANNING DIRECTION

The lidar's scanning direction (rotation direction) can be adjusted. When the lidar is in the scanning state, you need to click the scan control again after switching the scan direction.

SCANNING FREQUENCY

This button is used to adjust the laser radar scan frequency (motor speed). Click any one of them; the system will pop up the frequency setting bar for automatic adjustment according to the demand. When the lidar is in the scanning state, you need to click the scan control again after adjusting the scanning frequency.

RANGING FREQUENCY

This button is used to switch the Lidar's ranging frequency. F4PRO supports 4K, 8K and 9K ranging frequency switching. F4Pro supports 4K and 6K scanning frequency switching. Other versions of Lidar do not support this feature and invalid clicks. When the lidar is in the scanning state, you need to click the scan control again after switching the ranging frequency.

ANGLE CALIBRATION

During the process of mechanical assembly of the laser radar, users may experience deviations in the zero angle. At this time, the client's angle calibration function can be used to calibrate according to actual needs. The specific operation is as follows:

（1） Unlock calibration function

Click , The system will pop up a login box. The default password is *eaibot*.

（2） Set the baseline

Click , The system provides a baseline of the appropriate size for use as a guide for adjustment.

（3） Adjusting the angle

Click , and adjust the angle.

（4） Save Setting

The system will save calibration parameters and save the calibration.

（5） Locking calibration function

After the calibration is saved, click again; Lock this function to prevent misoperation.

FIRMWARE UPGRADE

Click System Settings and select Firmware Upgrade, as shown in Figure 11.

Note: During the firmware upgrade, keep the lidar powered, the communication is stable, and the network is normal. Do not remove the lidar serial port.

SOFTWARE UPGRADE

The client software will make version changes. Users can update to the latest version for a better experience.

FIG 13 SYSTEM UPDATE

LINUX ROS OPERATION

There are many Linux distributions. This article only uses Ubuntu 16.04 Kinetic version ROS as an example.

File description

Download YDLIDAR's latest ROS driver package on official website http://www.eaibot.com/download;

There are the following files in this directory:

CHART 2 LAUNCH

File	Description
F4PRO.launch	F4PRO runs the file, starts scanning, no data, no point cloud.
F4PRO_view.launch	F4PRO runs the file, starts scanning, and outputs point cloud data.
g4.launch	G4 runs the file, starts scanning, no data, no point cloud.
g4_view.launch	G4 runs the file, starts scanning, and outputs point cloud data.
x4.launch	X4 runs the file, starts scanning, no data, no point cloud.
x4_view.launch	X4 runs the file, starts scanning, and outputs point cloud data.

Lidar. launch	F4PRO, G4, X4 runs the file, starts scanning, no data, no point cloud.
Lidar_view. launch	F4PRO, G4, X4 runs the file, starts scanning, and outputs point cloud data.

Note 1: The user needs to select the correct file to run. Such as: F4PRO can not run g4_view.launch, you can run F4PRO_view.launch and Lidar_view.launch;

Note 2: Before running Lidar_view.launch and Lidar.launch, it is necessary to confirm whether the configuration information of Lidar.launch is correct. Please refer to the configuration instructions for details.

Configuration instructions

The F4PRO configuration file is saved in F4PRO.launch. When modifying the parameters of Lidar.launch, refer to the configuration in F4PRO.launch. The configuration instructions are as follows:

CHART 3 CONFIGURATION INSTRUCTIONS

File	Description
port	Serial port number, the default is ydlidar. When connecting multiple lidars, duplicate name error occurs when connecting multiple lidars.
baudrate	230400
frame_id	laser_frame
angle_fixed	Angle correction settings, default is true
intensities	Signal strength settings. G4, X4, F4PRO fixed to false
angle_min	Scanning start angle soft setting, the default direction is clockwise
angle_max	Scan end angle soft setting, the default direction is clockwise
range_min	Minimum range, the default is 0.08
range_max	The maximum ranging range, the default is 12.0
ignore_array	Scan angle is hard to set, default is not set, the system uses soft settings by default

In general, F4PRO can be configured as below:

```
<launch>
  <node name="ydlidar_node"  pkg="ydlidar"  type="ydlidar_node" output="screen">
    <param name="port"         type="string" value="/dev/ydlidar"/>
    <param name="baudrate"     type="int"    value="230400"/>
    <param name="frame_id"     type="string" value="laser_frame"/>
    <param name="angle_fixed"  type="bool"   value="true"/>
    <param name="intensities"  type="bool"   value="false"/>
    <param name="angle_min"    type="double" value="-180" />
    <param name="angle_max"    type="double" value="180" />
    <param name="range_min"    type="double" value="0.08" />
    <param name="range_max"    type="double" value="12.0" />
    <param name="ignore_array" type="string" value="" />
  </node>
  <node pkg="tf" type="static_transform_publisher" name="base_link_to_laser4"
    args="0.2245 0.0 0.2 0.12 0.0  0.0 /base_footprint /laser_frame 40" />
</launch>
```

FIG 14 F4PRO.LAUNCH DEFAULT CONFIGURATION

Device connection

Under Linux, the F4PRO and PC interconnection process is consistent with that under Windows. See Device Connection under Window.

ROS Driver Installation

Before doing the following, make sure that the Kinetic version ROS environment is installed correctly.

（1） Use the command to create the ydlidar_ws workspace and copy the ROS driver package ydlidar in the F4PRO package to the ydlidar_ws/src directory, switch to the ydlidar_ws workspace and recompile.

```
$ mkdir -p ~/ydlidar_ws/src
$ cd ~/ydlidar_ws
$ catkin_make
```

（2） After the compilation is complete, add the ydlidar environment variable to the ~/.bashrc file and make it effective.

```
$ echo "source ~/ydlidar_ws/devel/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

（3） Add a device alias /dev/ydlidar to F4PRO's serial port.

```
$ cd ~/ydlidar_ws/src/ydlidar/startup
$ sudo chmod +x initenv.sh
$ sudo sh initenv.sh
```

RVIZ Installation

（1） Networking installation dependencies.

```
$ sudo apt-get install python-serial ros-kinetic-serial g++ vim \
 ros-kinetic-turtlebot-rviz-launchers
```

（2） If there is a problem with the installation, update the source cache first and then reinstall it.

```
$ sudo apt-get update
```

RVIZCheck the scan results

Run the launch file and open rviz to see the F4PRO scan results, as shown in the following figure:

```
$ roslaunch ydlidar  lidar_view.launch
```

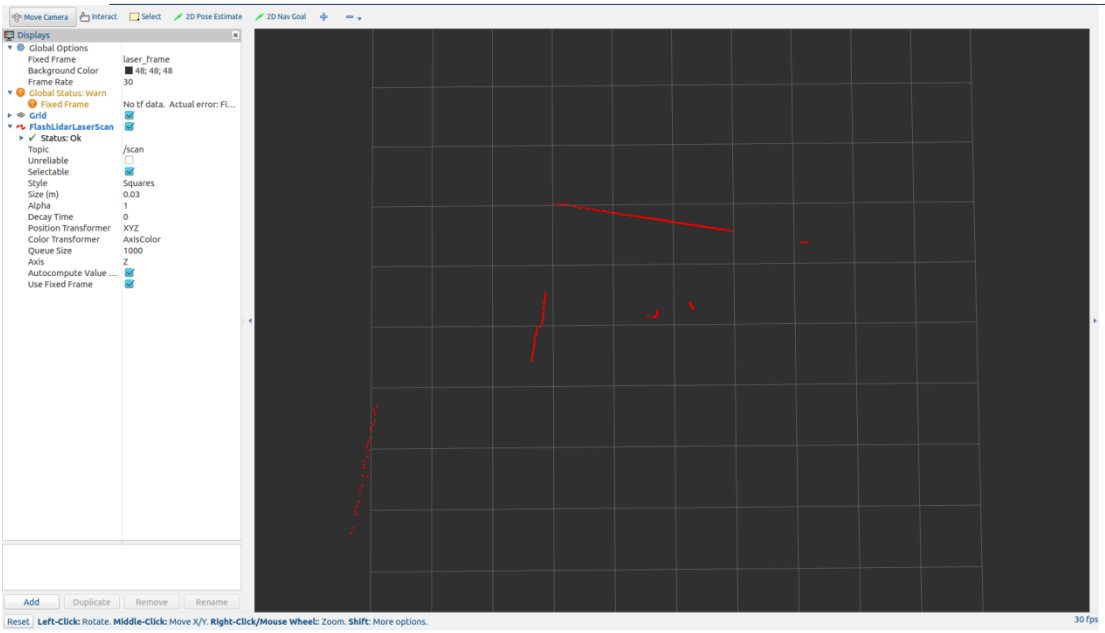


FIG 15 YDLIDAR F4PRO RVIZ

Modify the scan angle

The scan data seen by running the launch file is displayed by default with 360-degree data. To modify the display range, modify the configuration parameters in launch. The specific operation is as follows:

（1） Switch to the directory where F4PRO.launch is located and use vim to edit F4PRO.launch. The contents are as shown in the figure:：

```
$ roscd ydlidar/launch
$ vim  F4PRO.launch
```

```
<launch>
  <node name="ydlidar_node"  pkg="ydlidar"  type="ydlidar_node" output="screen">
    <param name="port"         type="string" value="/dev/ydlidar"/>
    <param name="baudrate"     type="int"    value="230400"/>
    <param name="frame_id"     type="string" value="laser_frame"/>
    <param name="angle_fixed"  type="bool"   value="true"/>
    <param name="intensities"  type="bool"   value="false"/>
    <param name="angle_min"    type="double" value="-180" />
    <param name="angle_max"    type="double" value="180" />
    <param name="range_min"    type="double" value="0.08" />
    <param name="range_max"    type="double" value="12.0" />
    <param name="ignore_array" type="string" value="" />
  </node>
  <node pkg="tf" type="static_transform_publisher" name="base_link_to_laser4"
    args="0.2245 0.0 0.2 0.12 0.0  0.0 /base_footprint /laser_frame 40" />
</launch>
```

FIG 16 LIDAR.LAUNCH CONTENT

F4PRO radar coordinates follow the right-hand rule within ROS. The angle range is [-180, 180], "angle_min" is the start angle, and "angle_max" is the end angle. The specific angle range can be modified according to actual use.

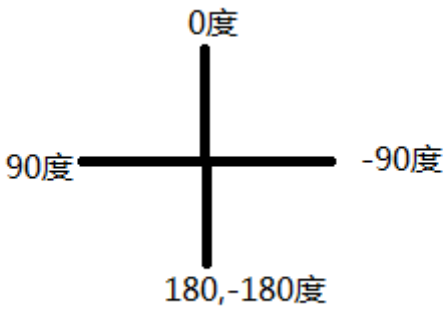


FIG 17 YDLIDAR F4PRO COORDINATE ANGLE DEFINITION

USE CAUTION

Ambient temperature requirements

When the ambient temperature of the F4PRO is too high or too low, it will affect the accuracy of the distance measuring system, and may damage the structure of the scanning system and reduce the service life of the radar. Avoid use in high temperature (>40 degrees Celsius) and low temperature (<0 degrees Celsius) conditions.

Ambient lighting

The ideal working environment for the F4PRO is indoor. Indoor lighting (including no light) does not affect the F4PRO's operation. However, avoid using a strong light source (such as a high-power laser) to directly illuminate the F4PRO's vision system.

If you need to use it outdoors, please avoid the F4PRO's vision system directly facing the sun, which may cause permanent damage to the vision system's photosensitive chip, thus invalidating the ranging.

If the F4PRO scans outdoors, the ranging results can be disturbed by strong sunlight.

Power supply requirements

During the development process, because the drive current of the USB interface of each platform or the USB interface of the computer may be too low to drive the F4PRO, the F4PRO needs to be connected to the external power supply of +5V through the USB_PWR interface of the USB interface board. It is not recommended to use mobile phone charging power supply because some brands have larger voltage ripples.