Ultrasonic Sensor SU04
User Manual

Introduction

SU04 is a transmitting receiving hybrid ultrasonic sensor, it compatible with PIXHAWK and MINI PIX. SU04 will helps the drones achieve autonomous obstacle avoidance in 8 directions horizontal, obstacle avoidance to the upward side and altitude hold to the downward. The detection distance of SU04 is 40cm to 450cm.The flight controller support 3 modules connect at the same time. The 3 module connection ports are telem1, telem2, and i2c ports.

Obstacle Avoidance

Firmware ask to be Upgrade

Firmware for Mini Pix

Brush the latest firmware (that is, firmware above V3.5.5) directly with our RadioLink ground station Mission Planner.
Firmware for Mini Pix can be downloading here: https://www.radiolink.com/minipix_firmware

Firmware for PIXHAWK

Automatic obstacle avoidance function asks the firmware of PIXHAWK is version 3.6 or later version. You can just flash the firmware above V3.6 from the MP.
Note: the firmware below 3.5 is not supported.
After flashing the firmware, the previous functions are unchanged, the parameters will not be changed, and there is no need to calibrate.
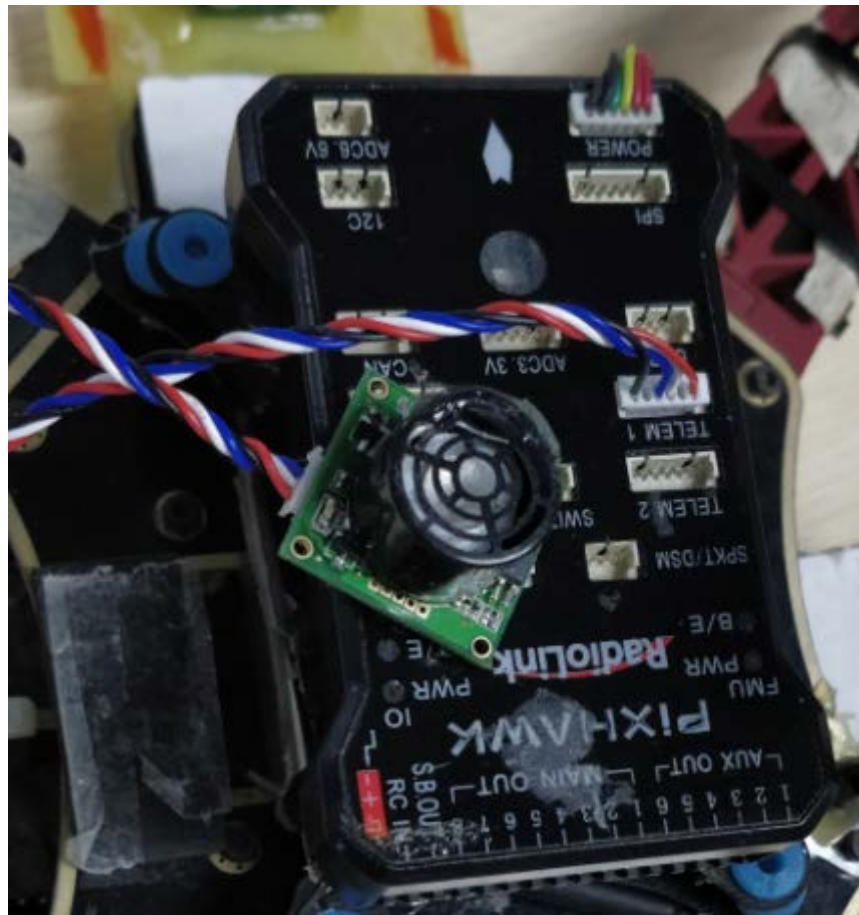Firmware for PIXHAWK can be downloading here:
https://www.radiolink.com/pixhwak_firmware

How to Connect

Connect to PIXHAWK

Use the 6pin wire connects the Ultrasonic Sensor SU04 to the TELEM1 or TELEM2 port of PIXHAWK.

Please use a Li-Po battery power for SU04, do not power it with the USB cable directly when you use the SU04.

Connect to Mini Pix

Use a 4 Pin to 6 pin cables with only 3 cables, the 4pin end is connected to the module, and the 6pin end is connected to the flight control, as shown in the figure below.

How to Setup

Module Type Setup

PIXHAWK support four kind of obstacle avoidance module, you can choose SU04 to work by setup PRX_TYPE in Mission Planner.

Setting Steps

Choose CONFIG/TUNING--click "Full Parameter List" --write down "PRX_TYPE" (obstacle avoidance module type) in search column and then press Enter button, it will show the options of proximity sensor type in the MP. Please setup the value of proximity sensor type is 2(that means the ultrasonic sensor SU04 will connect to the flight controller with MAVLink communication by TELEM port). Click "Write Params" after all the parameters finished setup to save the settings.
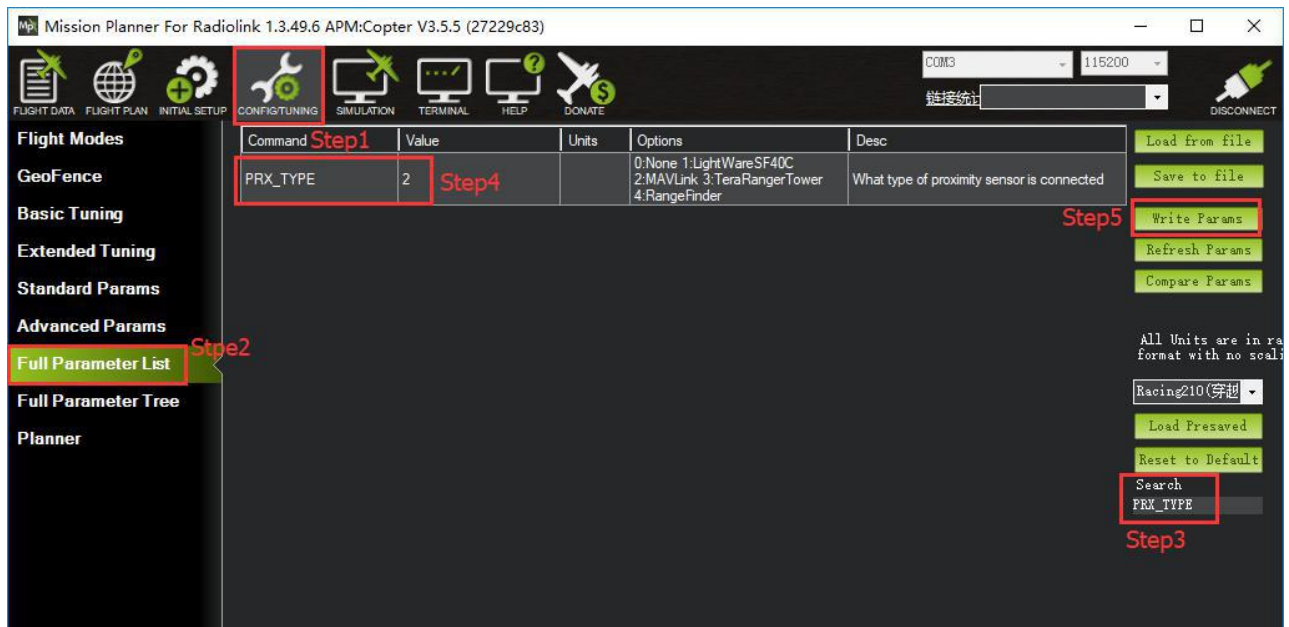
Avoidance Enables Setup

(1) The avoidance distance of ultrasonic sensor SU04 can setup by change the value of AVOID_DIST_MAX or AVOID_MARGIN.
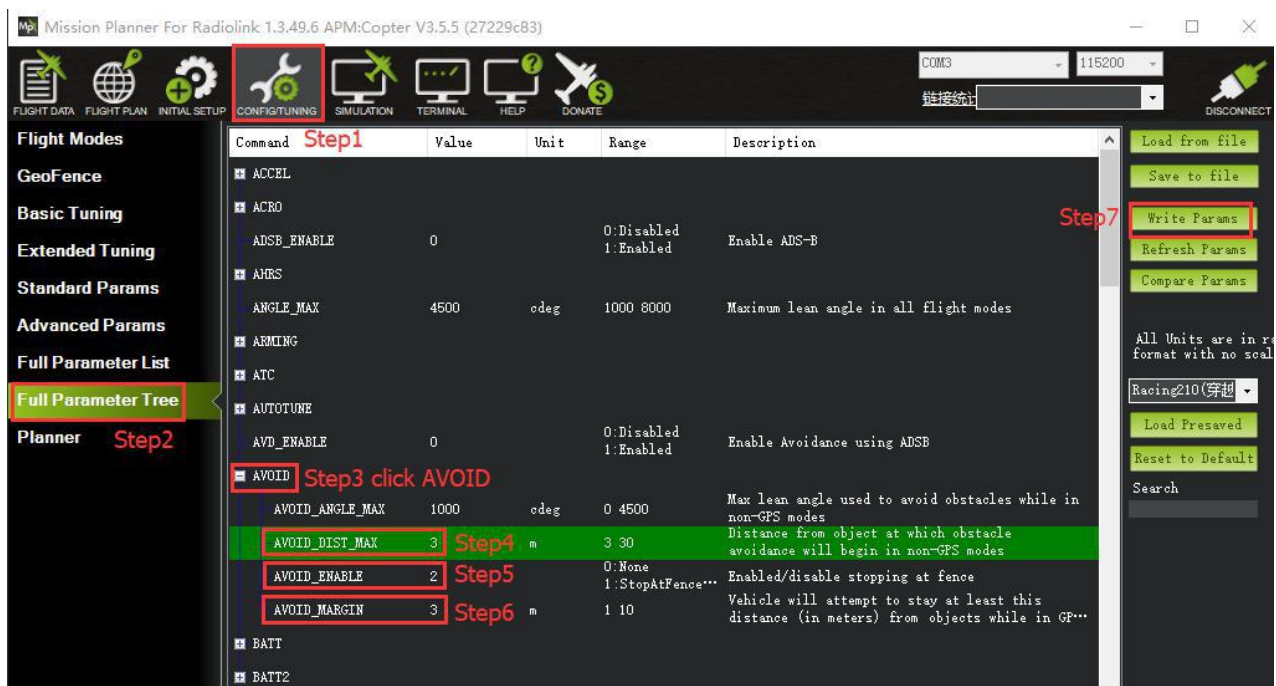
① AVOID_DIST_MAX: the max avoidance distance at AltHold mode, the unit is meter

② AVOID_MARGIN: the max avoidance distance at Loiter mode, the unit is meter

 (2) The avoidance enable/disable of ultrasonic sensor SU04 can setup by change the value of AVOID_ENABLE.

AVOID_ENABLE: setup the value of AVOID_ENABLE is 0(options is None) means the avoidance function is off and the value is 2(options is Use Proximity Sensor) means the avoidance function is on.

Setting Steps

Choose CONFIG/TUNING—click "Full Parameter Tree" --click the

"AVOID", it will show the parameters of "AVOID_DIST_MAX", "AVOID_ENABLE" and "AVOID_MARGIN". Please setup the value of AVOID_DIST_MAX is 3(3 meters) means the effective value of the max avoidance distance is 3 meters to 4.5 meters. Setup the value of the AVOID_ENABLE is 2(use proximity sensor) means make avoidance sensor enable. Setup the value of AVOID_MARGIN is 3(3 meters, the effective value is from 1 to 10) means vehicle will attempt to stay at least in 1 to 10 meters from objects while in GPS modes. Please click "Write Params" after you finished setup all the parameters to save the settings.

Avoidance Set by Transmitter

It depends on your usage habits to whether setup avoidance function enables or disable by transmitter or not.

PIXHAWK is default the avoidance function is always automatic enable at the AltHold Mode and Loiter Mode and will automatically disable if the flight controller changes to Stabilize Mode.

But if you want make the avoidance function enable or disable controlled by transmitter, you have to setup in the Mission Planner.

Parameters Setup

Setup in Mission Planner

Choose CONFIG/TUNING--click "Full Parameter List" --write down "CH7_OPT" (choose the CH7 for make the avoidance function enable or disable) in search column and then press Enter button, you can select which function is performed when CH7 is above 1800 PWM by setup the corresponding value.

Please setup the value is 40(Object Avoidance), it means to press the switch which control CH7 will makes the avoidance function enable or disable. Click "Write Params" after all the parameters finished setup to save the settings.

Setup in Transmitter

Choose a 2-position switch (the SWA of AT9S for example) to control CH7 and then you can check the PWM value of CH7 in the FailSafe menu of MP.
Click "INITIAL SETUP" -- click "FailSafe" --press the SWA switch to the bottom position, you can find out the PWM value of CH7 is greater than 1800, the avoidance function is enabled at this time while press the SWA switch to the top position, you can find out the PWM value of CH7 is less than 1800, the avoidance function is disable at this time.

press the SWA switch to the bottom position, you can find out the PWM value of CH7 is greater than 1800, the avoidance function is enable at this time
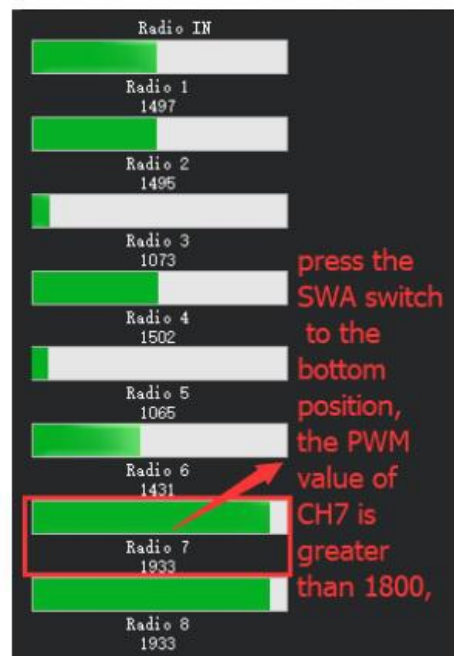
press the SWA switch to the bottom position, the PWM value of CH7 is greater than 1800,

press the SWA switch to the top position, you can find out the PWM value of CH7 is less than 1800, the avoidance function is disable at this time
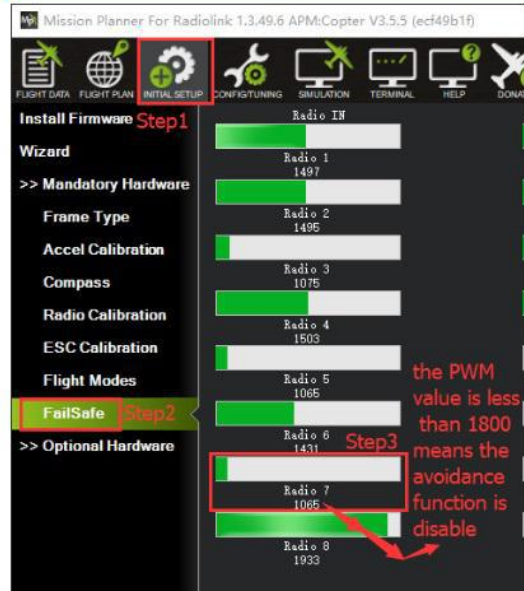
Check the Avoidance Effect

You can check the avoidance effect of the Ultrasonic Sensor SU04 after all the parameters have setup and connect the sensor SU04 to the PIXHAWK.

Disconnect the PIXHAWK and reopen the Mission Planner, it will automatic open a new menu that will shows the working condition of sensor SU04(Please click the icon of this sensor on the desktop taskbar if the working condition menu have not open automatically).

Flight Modes

Flight modes need to setup after the parameters of PIXHAWK have setup and the Ultrasonic Sensor SU04 work normal, the basic flight modes are 1: Stabilize, 2: AltHold, 3: Loiter.
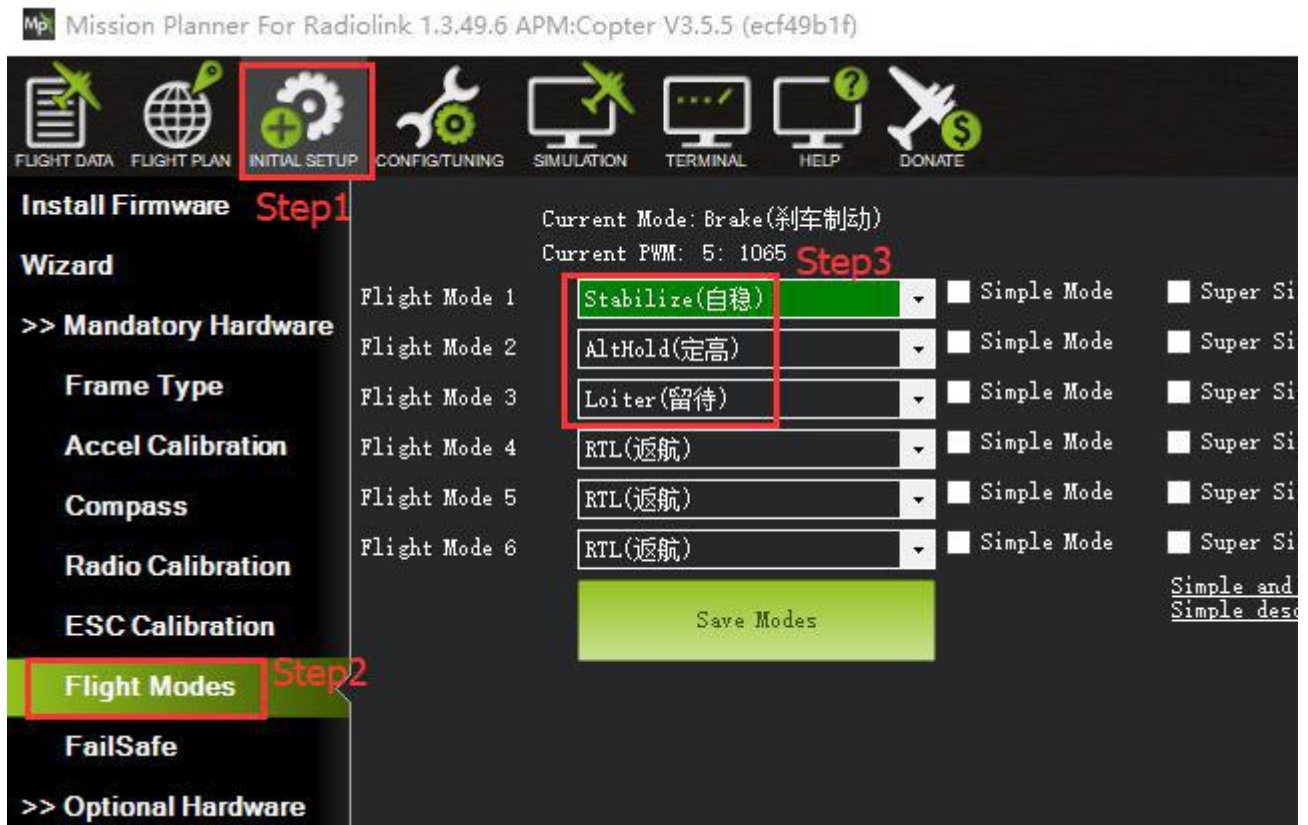
Working Condition

Pay attention: please reconnect the PIXHAWK and reopen the MP after all the parameters setup as all the above steps.

  After verifying setup all the parameters success, you can find a wide range of locations with walls or other obstacles to have a test when you ready for the first flight.

  The usual sequence of flight-testing steps is:

1.   Power on your drones and wait till the blue LED of PIXHAWK blinking that means the initialization of PIXHAWK is complete.

2.   Press the safety switch about 1 to 2 seconds till the red LED of safety switch is on when the blue LED of PIXHAWK is blinking.

3.   Disarmed by put the throttle stick to the bottom right corner (if your transmitter is Mode2, while put the throttle stick to the bottom left corner and the aileron stick to the bottom if your transmitter is Mode1), the motor will begin to move when disarmed successful, and then push the throttle stick slowly, change the flight mode to Loiter when the drone going to flight.

4.   Press the SWA (or any other 2 position switches, it depends on which you setup at the very begging) to turn on the avoidance function, push the throttle and aileron sticks to make the drone close to the wall or the obstacle, the drone will control the racing speed and stopped at the 3 meters far from the wall or obstacle automatically. The drone will flight back to the position where 3 meters far from the wall or obstacle automatically if the drone is less than 3 meters far from the obstacle because the speed is too fast or because of the inertia effect.

Notes

1.　　PIXHAWK have to powered by LiPo battery, cannot power by USB when you use the Ultrasonic Sensor SU04. SU04 cannot work normal if power by USB cable which connect to computer.

2.　　When you ready for the first flight, please make your drone at a lower speed to keep the safe flight.

3.　　At AltHold mode, when the drone encounters an obstacle the slant angle of drone will combine pitch with roll and then make a response, it may too late to brake if the drone flight as the full speed. While, the drone will stop to go ahead when encounter an obstacle no matter how fast both the pitch and roll are at the PosHold Mode. So, it suggests use the horizontal obstacle avoidance function at the PosHold Mode.

4.　　SU04 will helps the drones achieve autonomous obstacle avoidance in 8 directions horizontal, you can change the direction of the module by press the button on the sensor module (it defaults the direction is forward, it will rotate 45 degrees clockwise when press the button and the LED of the sensor will blinking corresponding times same as the times you press the button (that is: it will rotate 90 degrees and the LED will blinking twice if you press the button twice).

Press this button to change the direction of obstacle avoidance, it will rotate 45 degrees clockwise when press the button once.

You can check the direction of the sensor in MP.

Radius(+/-): 5m MAV size([/]): 0.8m
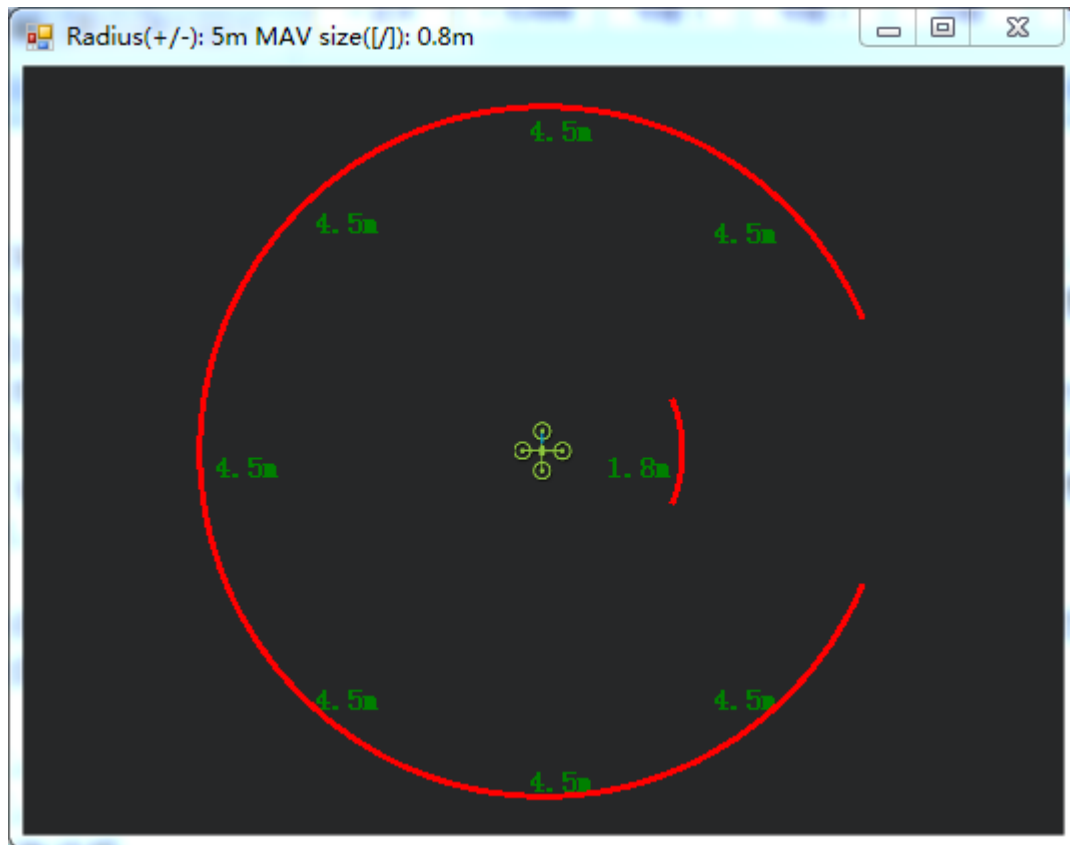
This picture shows the direction of obstacle avoidance is towards to right

5.　　When the LED (green) of module is always on means the SU04 is detected the obstacle while if the LED is blinking that means the module cannot detected the obstacle.

6.　　The LED of module will be blinking quickly 4 to 6 times when connect it to the computer and then always on if connect successful.

7.　　The fade area of SU04 zero, but it will show 40cm if the detection distance is less than 40cm because the SU04 is a transmitting receiving hybrid ultrasonic sensor, the detection distance of SU04 is 40cm to 450cm.

8.　　You just can check the detection distance of horizontal direction in the sensor SU04 menu, if there's no detection distance value, it maybe the direction of obstacle avoidance is towards to upward, you have to check the distance by DataFlash Logs.

Collision Avoidance(Upward)

1.　　The collision avoidance towards to upward function is same as the obstacle avoidance function, you just need setup the direction of collision avoidance is towards to upward by press the direction button. The LED of direction adjustment will be blinking quickly about 5-6 times at the first time, you can check the value like this picture below:
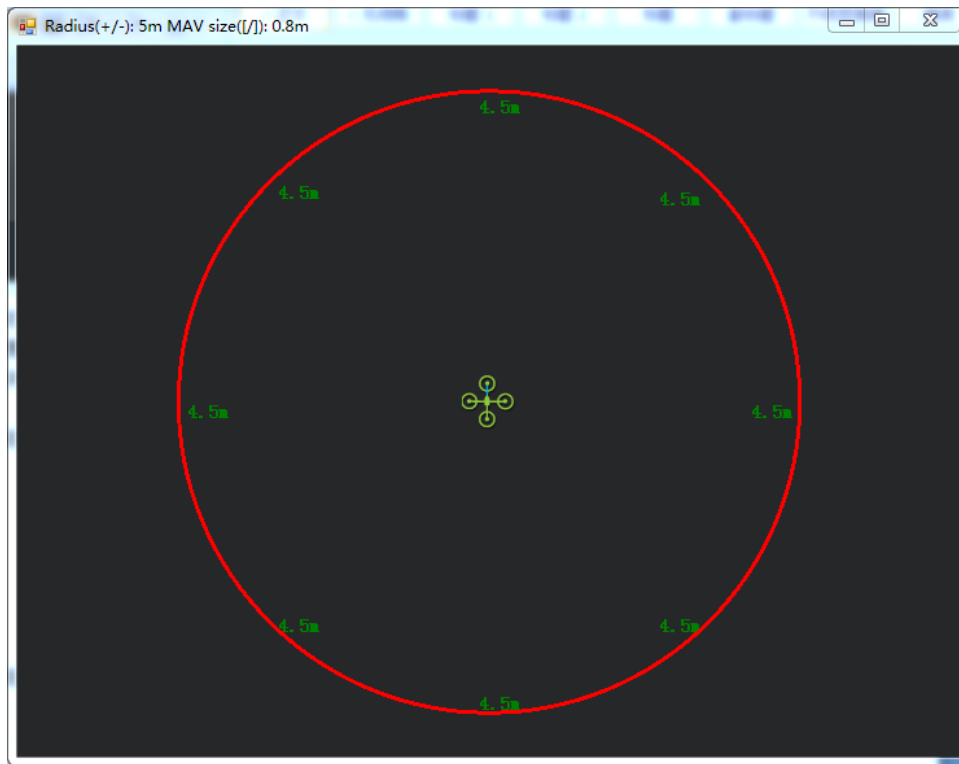
This picture shows the direction of obstacle avoidance is towards to upwards

The collision avoidance distance can be setup in MP, the AVOID_MARGIN Menu

AltHold Function

How to Connect

Connect to PIXHAWK

One port of the 4pin wire connect to the I2C port of PIXHAWK and the other port of 4pin wire connect to the sensor SU04, as the picture below:

Please make sure the direction of the sensor is to the downward

Connect to Mini Pix

One port of the 6pin wire connect to the I2C port of MINI PIX and the other port of 4pin wire connect to the sensor SU04, as the picture below:
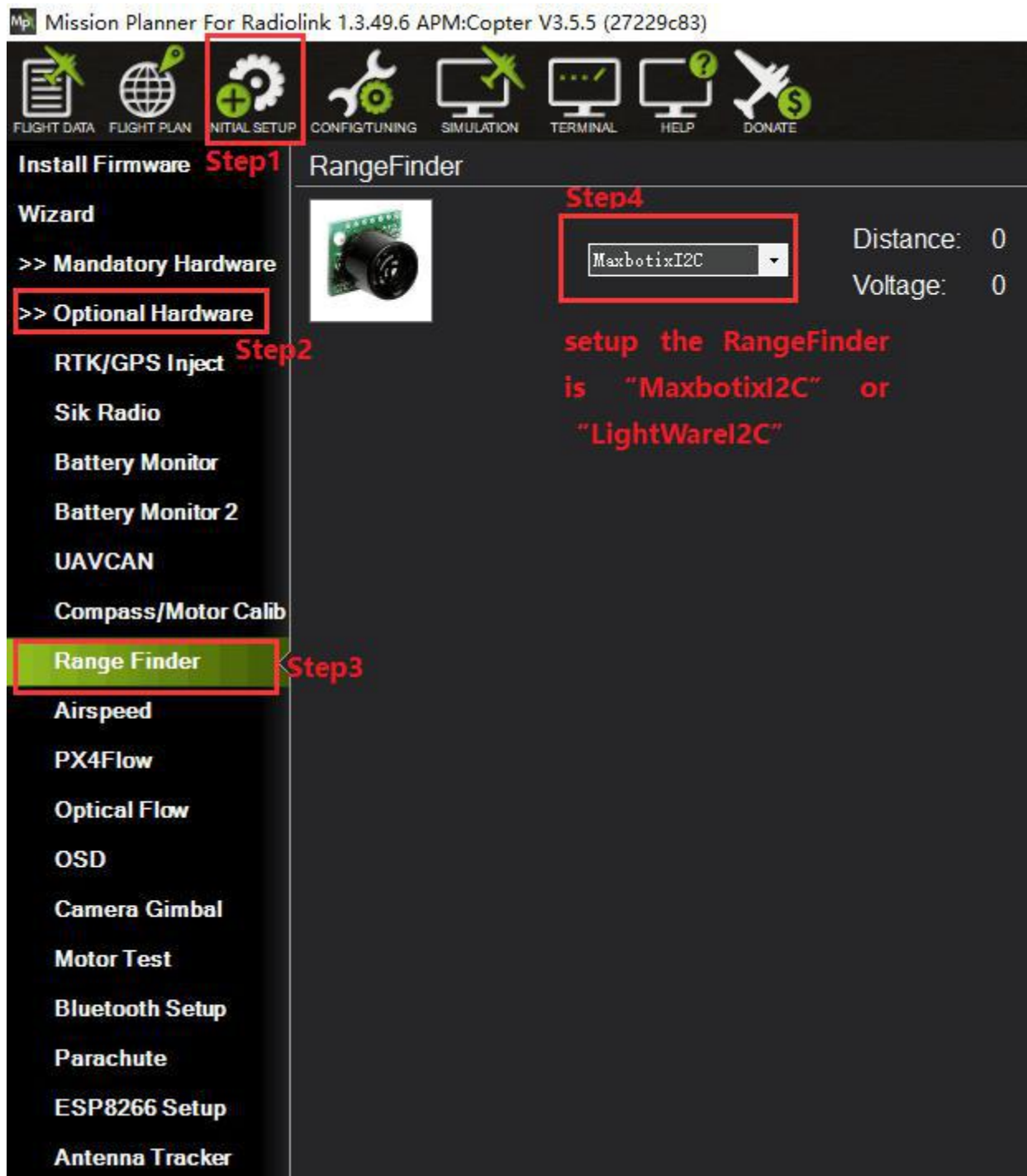

OR connect by I2C expansion board
One port of the 4pin wire connect to the I2C expansion board of MINI PIX and the other port of 4pin wire connect to the sensor SU04, as the picture below:

Parameters Setup(AltHold)

Click "INITIAL SETUP" -- click "Optional Hardware" --click "Range Finder" --setup the RangeFinder is "MaxbotixI2C" or "LightWareI2C"

After the Range Finder setup, reconnect the flight controller and back to this Range Finder parameter setup menu, it will show the detection distance details means all the Range Finder parameters setup successful.

Setup the value of RNGFND_MAX_CM is 450 and the value of RNGFND_MIN_CM is 40(the unit is meter), please click "Write Params" after all the parameters setup to save the settings.
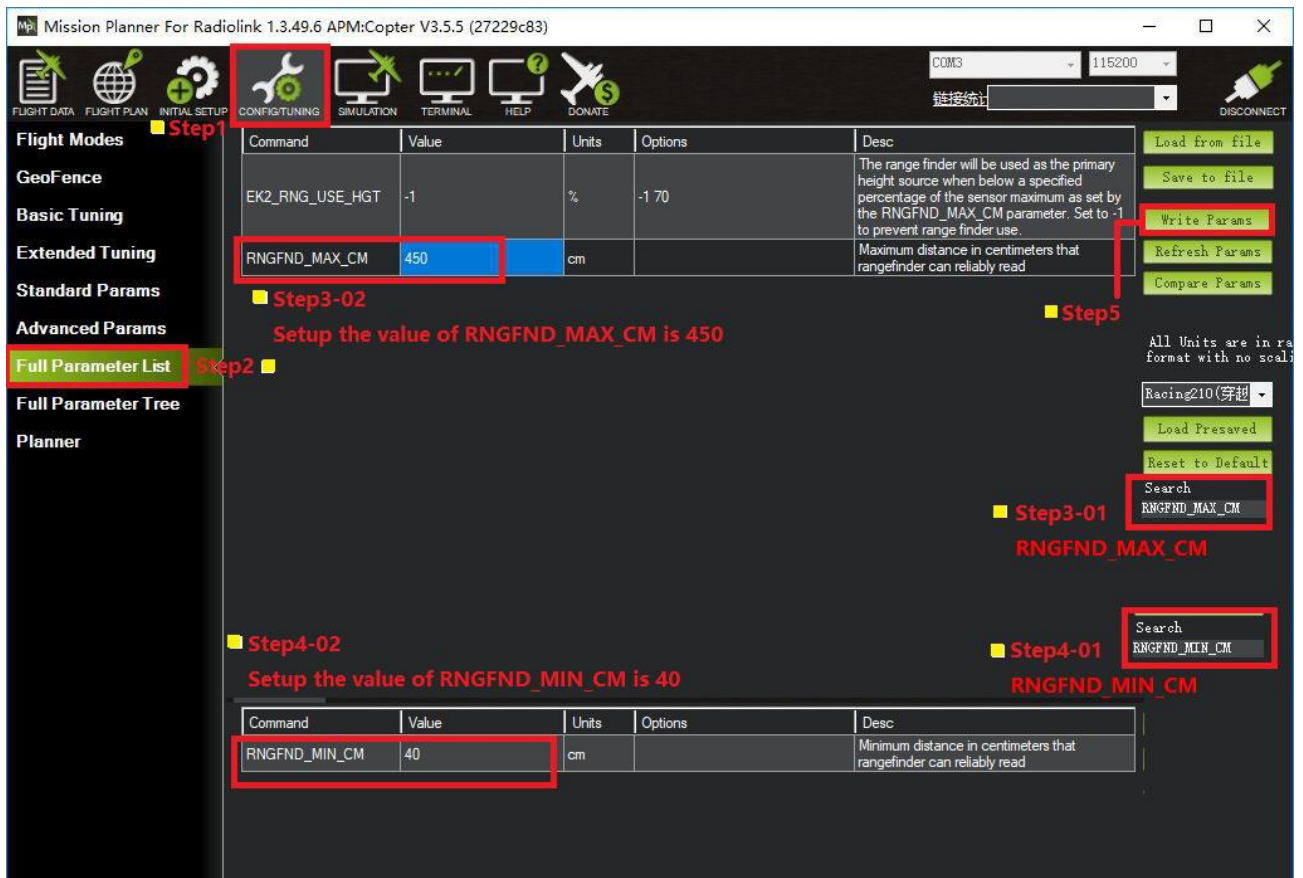
RNGFND_MAX_CM means the max detection distance that can identify at the AltHold Mode.

RNGFND_MIN_CM means the minimum detection distance that can identify at the AltHold Mode.

The flight controller cannot identify the detection distance when the sensor is far from the obstacle more than 450cm, it will altitude hold by barometer.