Ultrasonic Sensor SUI04
User Manual

Parameters:

- Size: 20*22*19mm
- Weight: 8g (with wires)
- Input voltage: 4.5~5.5V(do not support HV)
- Current: 18mA@5V
- Power: 90mA
- Operating temperature: -20°C~80°C
- Detection distance: 40cm~450cm
- Detecting precision: 0.1cm
- Acoustic emission frequency: 40±1.0KHz
- Beam angle: 60° (transmitting receiving hybrid)
- Fade area: 0 (it will show 40cm)
- Output protocol: I2C
- Duty Cycle: 30ms

Introduction：

SUI04 is a ultrasonic ranging sensor transceiver and compatible with PIXHAWK and MINI PIX. It helps drones achieve autonomously omnibearing obstacle avoidance including 4 horizontal directions, upward side and altitude hold downward. The detection distance of SUI04 is 40cm to 450cm.

Function One：Obstacle Avoidance

I. Firmware support

Obstacle avoidance firmwares are available with the below 2 links then uploaded to the flight controller (PIXHAWK/ MINI PIX) by Mission Planner.

WARNING: Other firmwares do not support this obstacle avoidance function.

Notice: RADIOLINK firmwares are modified from Copter V3.5.7. When it's uploaded, the previous functions and parameters are remained and there's no need to readjust.

MINIPIX firmware link as below:
http://www.radiolink.com.cn/firmware/Copter/ultrasonic_avoid/Multiple/minipix.px4

(OR   https://pan.baidu.com/s/1RSghDz8cEltsEhCX9-kcJg)

PIXHAWK firmware link as below:

http://www.radiolink.com.cn/firmware/Pixhawk/avoid_multiple/Pixhawk.px4

(OR https://pan.baidu.com/s/1PTGG58EPP84gEM21xIHCjQ）

II. How to connect
2.1 With PIXHAWK
2.1.1 Individually with PIXHAWK
Connecting the module (eg. SUI 04) and the I2C port of PIXHAWK with a 4 pin to 4 pin wire

2.1.2 Connecting with PIXHAWK by I2C wiring board
2 wires of 4 pin to 4 pin are needed: one for connecting I2C port of PIXHAWK and I2C wiring board; one for connecting I2C wiring board and SUI04
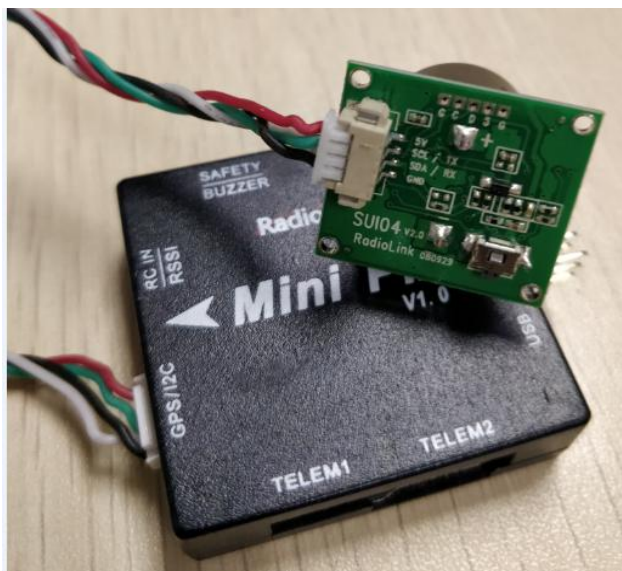
2.2   With MINIPIX

WARNING: NO memory card inside.

2.2.1 Individually with MINIPIX

A 4 pin to 6 pin wire is needed: the 4 pin end to SUI04 and the 6 pin end to the GPS port of MINIPIX

2.2.2 Connecting with MINIPIX by I2C wiring board

1. Take a 6 pin to 6 pin wire with one end to the GPS port of MINIPIX and one end to the I2C expansion board.
2. Take a 4 pin to 4 pin wire with one end to the I2C expansion board and one end to the I2C wiring board.
3. Take another 4 pin to 4 pin wire with one end to the I2C wiring board and one end to the SUI04

III. Parameters Setup

3.1 Module type setup

PIXHAWK support four kinds of obstacle avoidance modules. SUI04 can be chosen by setting the value of PRX_TYPE in Mission Planner(MP).

Setting steps:

1) Choose CONFIG/TUNING on the top of the interface.

2) click "Full Parameter List" on the left.

3) Input "PRX_TYPE" (obstacle avoidance module type) in search column at the lower right corner and press "Enter".

4) As the searched proximity sensor type shown in the MP, change the proximity sensor type value to 4 (that is , the chosen module type is Range Finder,which is SUI04).

5) Click "Write Params" on the right to save the parameters when the setting is complete.
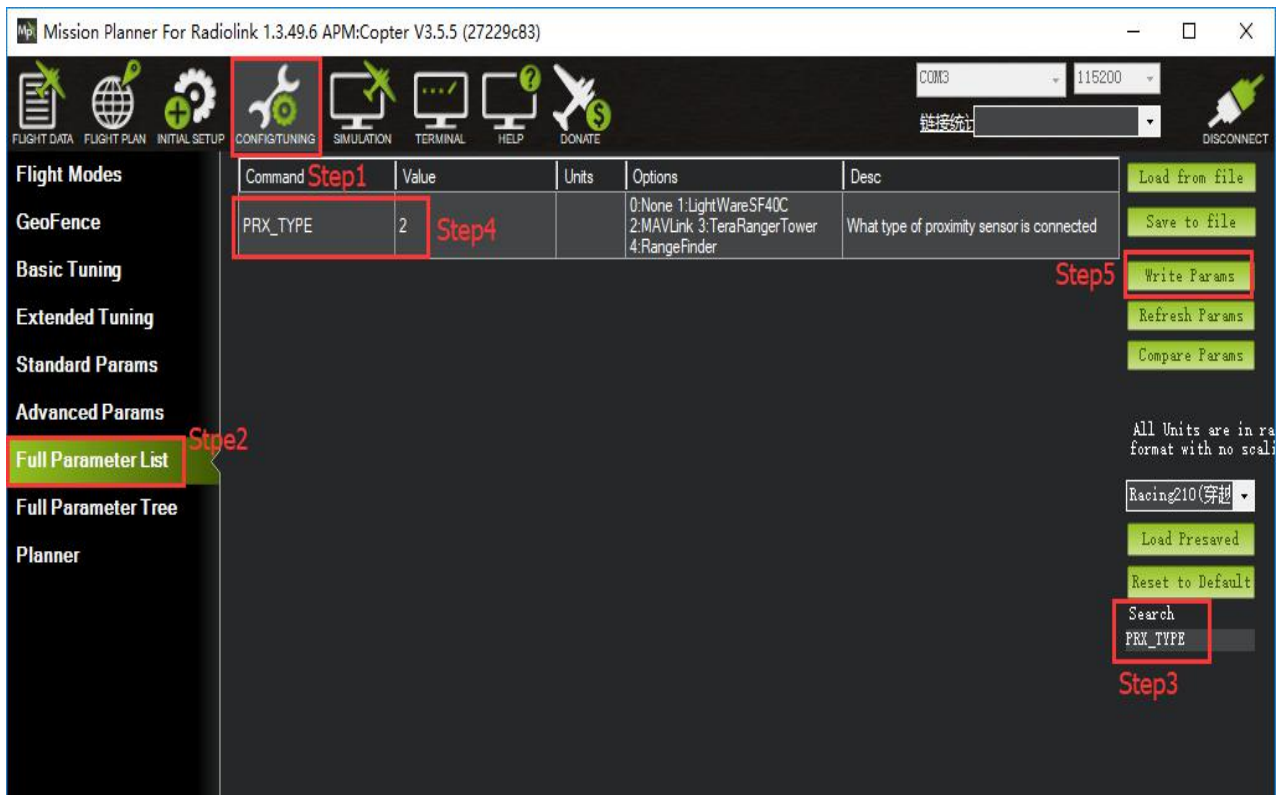
3.2 Setup the avoidance distance and the avoidance enable/disable

The avoidance distance of ultrasonic sensor SUI04 can bechanged by setting the value of AVOID_MARGIN.

AVOID_MARGIN: the max avoidance distance at LoiterMode, the unit is meter

The avoidance enable/disable of ultrasonic sensor SUI04 can be set by changing the value of AVOID_ENABLE.

AVOID_ENABLE: the value of AVOID_ENABLE0(options is None) means the avoidance function is off and the value 2(options is Use Proximity Sensor) means the avoidance function is on.

Parameters Setting Steps on MP:

1) Choose CONFIG/TUNING on the top of the interface

2) Click "Full Parameter Tree"

3) Click the "AVOID", the parameters of "AVOID_ENABLE" and "AVOID_MARGIN" are shown

4) Set the value of the AVOID_ENABLE 2(use proximity sensor) means make avoidance sensor enable

5) Set the value of AVOID_MARGIN 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.

6) Click "Write Params" on the right to save the parameters when the setting is complete.
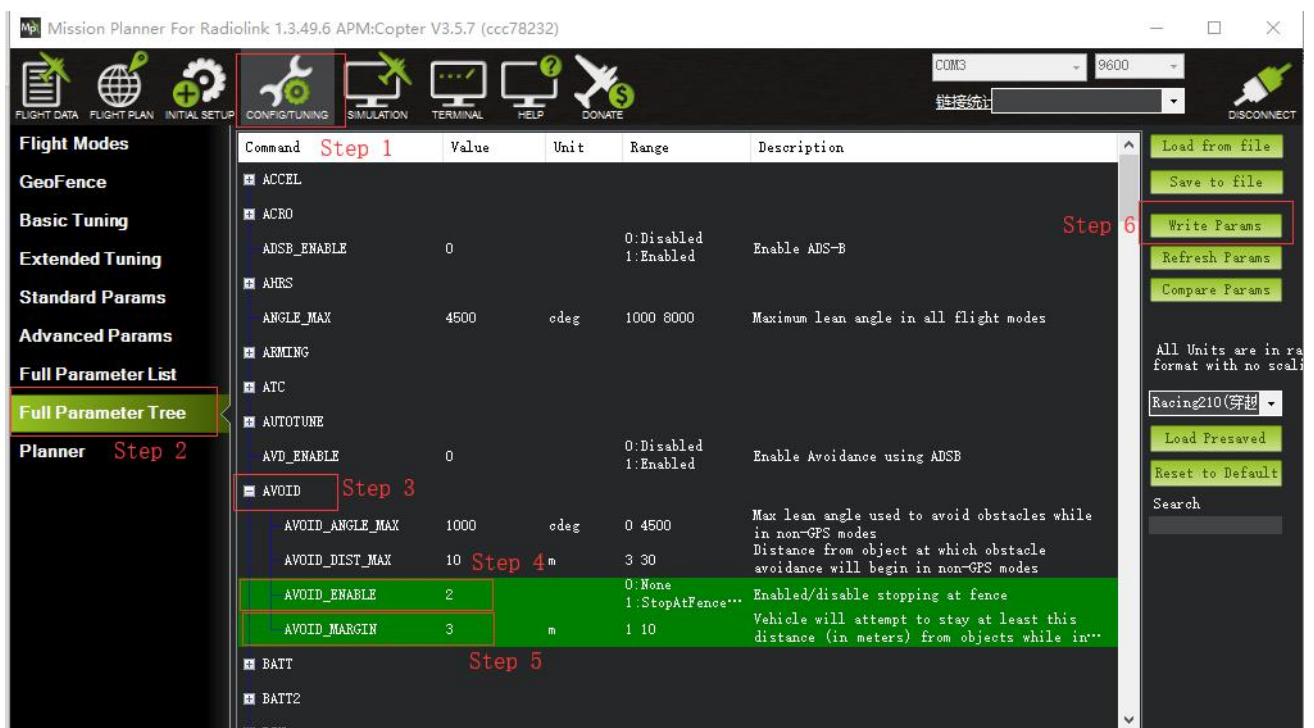
3.3 How to Enable/Disable the avoidance function by transmitter(Optional)

This setup depends on users' habit and is optional.

The avoidance function of flight controller is always automatically enabled a *LoiterMode*by default anddisabled ifchange to Stabilize Mode.

If users prefer enabling/disabling the avoidance function by transmitter, setup in the Mission Planner as

Below steps is necessary.

Flight Controller Setting steps (CH7_OPT Parameters)**:**

1) Choose CONFIG/TUNING on the top of the interface

2) click "Full Parameter List" on the left

3) Input "CH7_OPT" (choose the CH7 to make the avoidance function enable or disable) in search column at

the lower right corner and press "Enter"

4) As the searched CH7_OPT shown in the MP, change the value to 40 (Object Avoidance).It means switchon/off CH7 enable/disable the avoidance function.

5) Click "Write Params" on the right to save the parameters when the setting is complete.
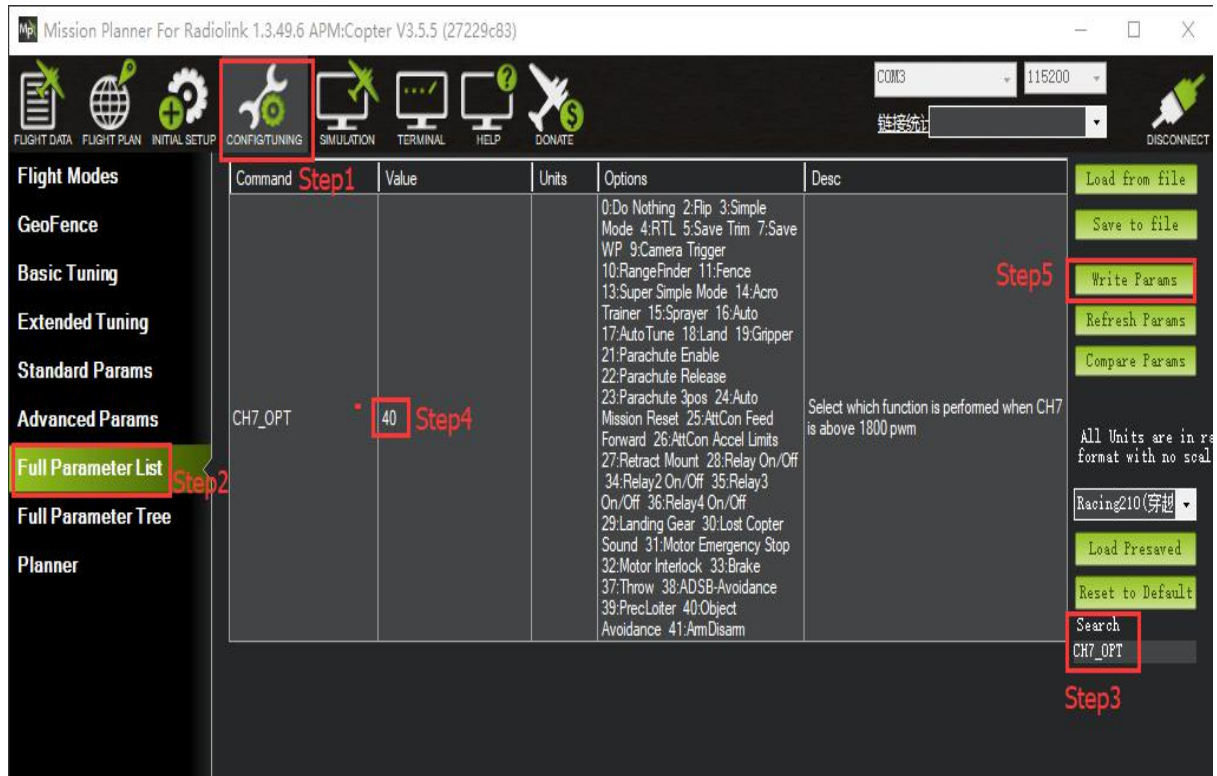
Transmitter setting steps

1) Choose a 2-position switch(the SWA of AT9S for example) to control CH7

2) Choose INITIAL SETUP on the top of the interface

3) Click "FailSafe" in the pull-down menu of "Madatory Harware" on the left and the PWM value interface of CH7 is shown

4) Toggle the switch. If the PWM value of CH7 is more than 1800, it means the avoidance function is enabled when the switch is at the bottom position. If the PWM value of CH7 is less than 1800, it means the avoidance function is disabled when the switch is at the top position.

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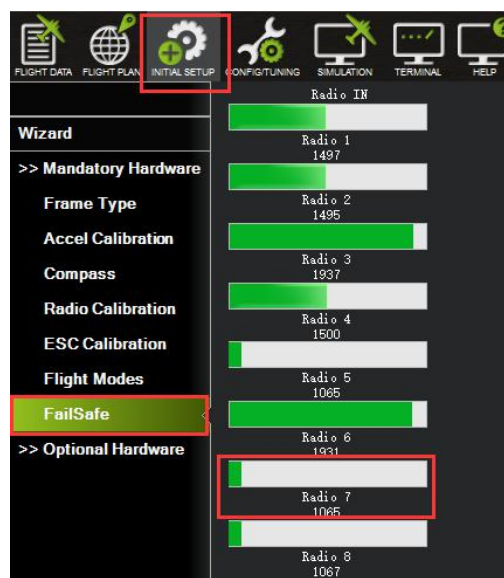
4. Button Functions of SUIO4

Flight controller PIX can simultaneously support 6 modules (eg. SUI04) including front/back/left/right/upward/downward. So the direction of each module should be set. Every press on the button, the module direction changes once accordingly clockwise and the module LED flashes. Different flash frequencies means different directions. Once-Front, Twice-Right, 3 Times-Back, 4 Times-Left, 5 Times-Downward, 6 Times- Upwards.
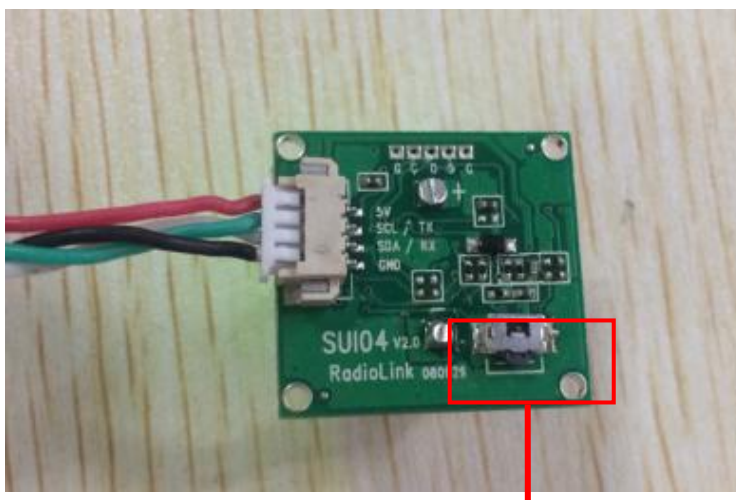
(Press this button to change the direction of obstacle avoidance, it will rotate 90 degree clockwise when press the button once.)

NOTICE: Every direction changed, the flight controller and the module need to be restarted.

5.Data Check

As the data of the latest official MP is not well shown, it's suggested to download the Mission Planner specially for MINIPIX to check data.

http://www.radiolink.com.cn/firmware/MissionPlanner/MissionPlanner-1.3.49.6.exe

After the above setups are complete, the SUI04 data can be checked on MP. Disconnect the PIXHAWK and restart the Mission Planner. When the MP is connecting, a new interface (as shown below) will come out automatically and the working condition of SUI04 can be checked . If it doesn't come out, please click the icon at the task bar on the desktop.

(Current direction: Forward)　　　　　(Current direction: Right)
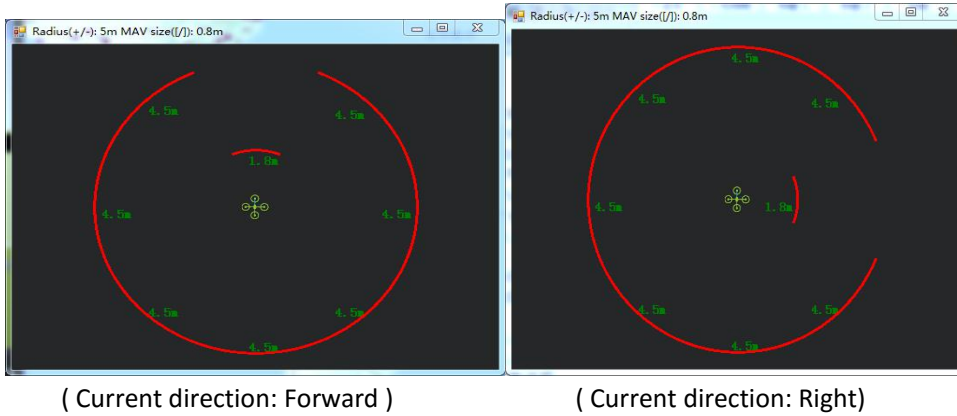
6. Flight Modes

Flight modes need to setup after the parameters of PIXHAWK have been set and the Ultrasonic Sensor SUI04 works , the basic flight modes include 1: Stabilize, 2: Loiter.

7. Working Condition

WARNING:*Reconnect the PIXHAWK and restart the MP after following all the above steps to ensure the successful parameters setup for failsafe.*

After verifying all the parameters setup, it's strongly suggested to find a large place with walls or other obstacles to have a test when ready for the first flight.

Flight testing steps:

1) Power on the drone and wait till the blue LED of PIXHAWK blinks,meaning the initialization of PIXHAWK is complete.

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

3)Unlock the drone and the motors will begin to move if armed successfully. Push the throttle stick slowly, change the flight mode to Loiter when the drone takes off.

4) Toggle the CH7-SWA(or any other 2 position switch, it depends on which you setup at the very beginning) to turn on the avoidance function.

5) Push the throttle and aileron sticks to make the drone close to the wall/obstacle, the drone will control the racing speed and stopped at the 3 meters far from the wall/obstacle automatically. If the flight speed is too high and the distance to the wall/obstacle is less than 3meter because of the inertia, the drone will stay at 3 meters away from the wall or obstacle automatically.

Notice: To unlock a drone, put the throttle stick to the bottom right corner if the transmitter is Mode2. Or put the throttle stick to the bottom left corner and the aileron stick to the bottom right if your transmitter is Mode1

8. Notices:

① No memory card allowed when connecting MINIPIX.

② Avoidance function is automatically enabled when at Alt-Hold Mode. If needs to be disabled, please follow the above steps and change the value of AVOID_DIST_MAX to 0 in Param Setup in MP.

③ Never enable the avoidance function of SUI04 at Alt-Hold Mode but Loiter Mold.
(At Alt-hold mode, when the drone encounter obstacles, its slant angle will combine pitch with roll then response.It may be too late to stop if the drone is at full speed. But at Loiter Mode, the drone will stop immediately when encounter an obstacle no matter how big both the pitch and roll are. So, it's suggested use the horizontal obstacle avoidance function at the Loiter Mode.)

④ When obstacles detected, the LED of SUI04 is always on; When no obstacle detected, the LED of SUI04 keeps flashing.

⑤ If connection is successfully done, the LED of SUI04 will flash 4 to 6 times and be off when power on.Then always on after the initialization.

⑥ Be sure to avoid the interference from propellers and frame to signals when connecting the flight controller.

⑦ As SUI04 is a transceiver, there is a blind area of 40cm, including the area less than 40cm.

⑧ Only the distance of horizontal directions can be checked on the data check interface. When there's no distance shown, the current direction of SUI04 may be upward, which can be checked on DataFlash Logs.

9. Errors Report on Mission Planner

1) MP note: Bad LiDAR Health, as shown below
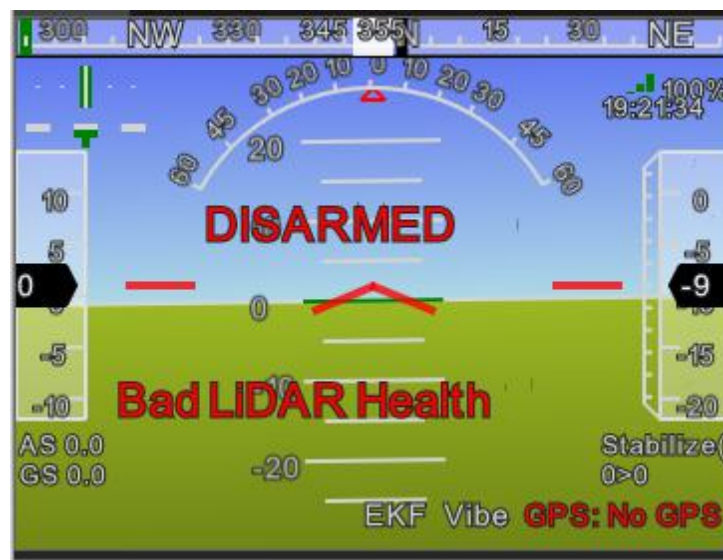
The ultrasonic shown in the above pic is under unusual working condition.The possible reasons are:

a.   PRX_TYPE value is set wrong

b.   PRX_TYPE value is set 4, but SUI04 is not connected. If SUI04 need to be turned off, PRX_TYPE value should be set 0.

c.   SUI04 connect incorrectly

2) MP note: PreArm: Proximity X deg,0.40m, as shown below

The above screenshot shows SUI04 detects the distance less then 60cm and is locked by the flight controller. To armed SUI04, the distance between the drone and obstacles should be more than 60cm.

Function Two : Collision Avoidance Upward

The collision avoidance upward function is same as the obstacle avoidance function, the direction of SUI04 upward can be setup by pressing the same button.

Press the button 6 times and the LED flashes 6 times, and the direction of SUI04 is set upward.

The corresponding distance of collision avoidance can be set by the value of AVOID_MARGIN as the previous steps instructed.

As only the horizontal distances are available on the data check interface, upward data can be checked on DataFlash Logs.

![RadioLink logo]

1) DataFlash Logs Download

Connect the flight controller with MP and follow the below steps to download DataFlash Logs

Clickthe logs   and download
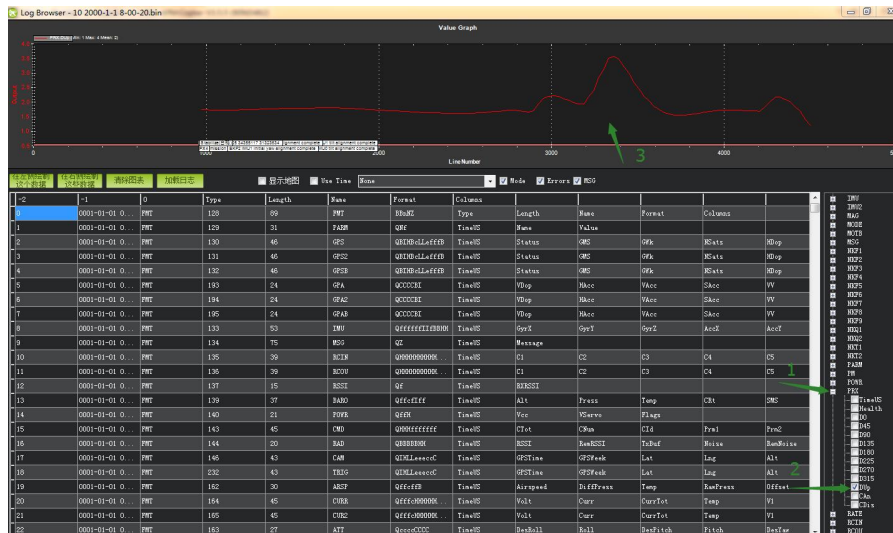

2) Log check

Open the log files

Click the log review and open the log

Follow the Step 1 and Step 2 shown in below pic:

(The data that arrow points to means the distance that SUI04 detects.)

Function Three：Alt-Hold Function Downward

I. How to Connect

The Alt-Holddownward function is same as the obstacle avoidance function, the direction of SUI04 downward can be setup by pressing the same button.

Press the button 5 times and the LED flashes 5 times, and the direction of SUI04 is set downward.
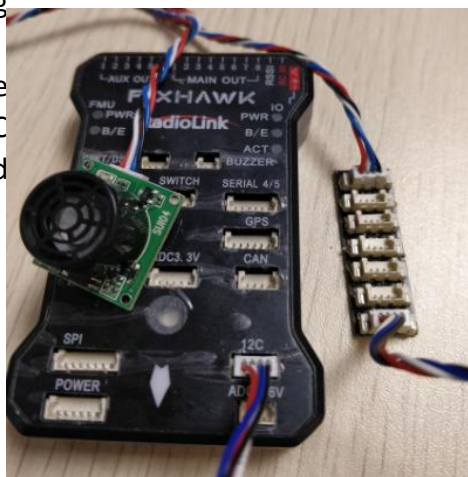
1.1 With PIXHAWK

1.1.1 Individually with PIXHAWK

Connect SUI 04 and the I2C port of PIXHAWK with a 4 pin to 4 pin wire

1.1.2 Connecting with PIXHAWK by I2C wiring board

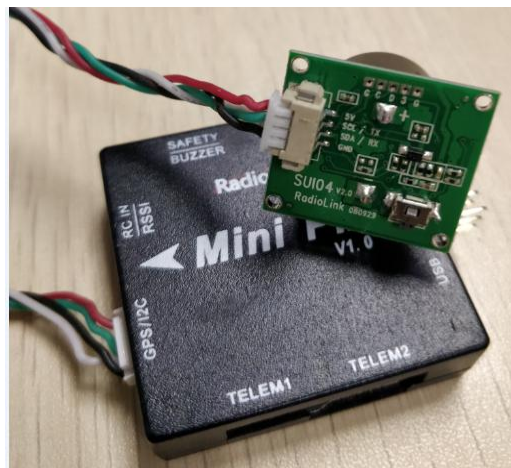2 wires of 4 pin to 4 pin are needed: one for connecting I2C port of PIXHAWK and I2C wiring board; one for connecting I2C wiring board and SUI04

1.2 With MINIPIX

WARNING: *NO memory card inside.*

1.2.1 Individually with MINIPIX

A 4 pin to 6 pin wire is needed: the 4 pin end to the module (eg. SUI04) and the 6 pin end to the GPS port of MINIPIX

1.2.2 Connecting with MINIPIX by I2C wiring board

1. Take a 6 pin to 6 pin wire with one end to the GPS port of MINIPIX and one end to the I2C expansion board.
2. Take a 4 pin to 4 pin wire with one end to the I2C expansion board and one end to the I2C wiring board.
3. Take another 4 pin to 4 pin wire with one end to the I2C wiring board and one end to the SUI04
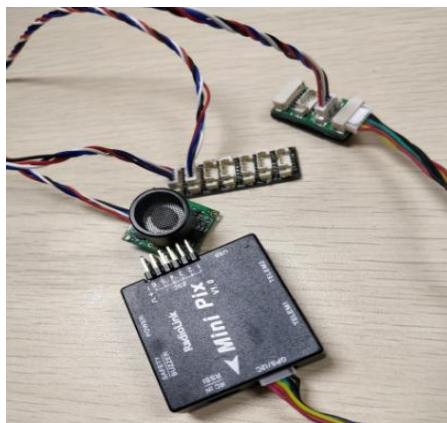
The alt-hold function is same as the obstacle avoidance function, the direction of SUI04 downward can be setup by pressing the same button.

Press the button 5 times and the LED flashes 5 times, and the direction of SUI04 is set upward.

II. Parameters Setup

2.1 Module type setup:

1) Click "INITIAL SETUP" on the top
2) Click "Optional Hardware" on the left
3) Click "Range Finder" and the RangeFinder interface is on the right
4) Click the pull-down menu and choose "MaxbotixI2C" or "LightWareI2C"
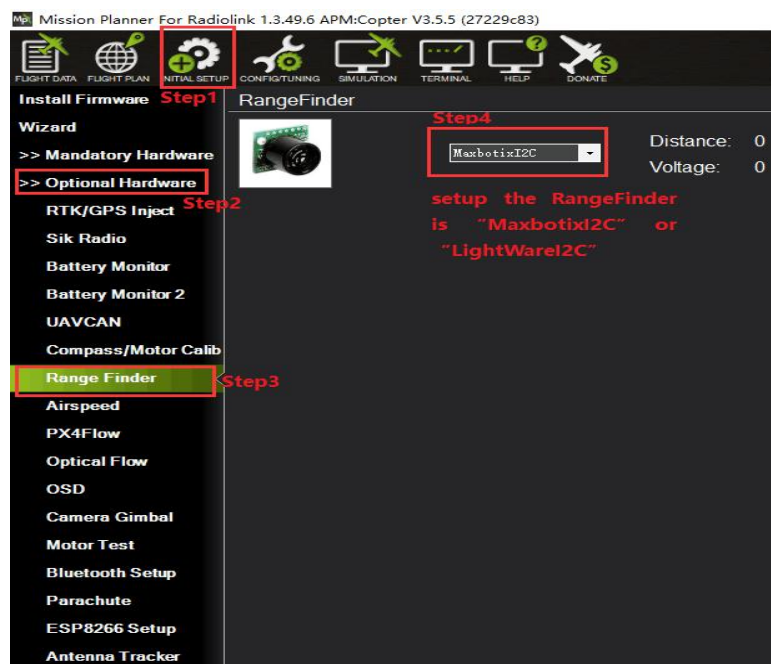
After the Range Finder setup,restart the flight controller and back to this Range Finder setup menu， the shown detection distance details means the parameters setup is complete.

2.2 Setting steps:

1) Choose CONFIG/TUNING on the top of the interface

2) Click "Full Parameter List" on the left

3) Input "RNGFND_MAX_CM" and "RNGFND_MIN_CM" in search column at the lower right corner and press "Enter"

4) As the searched the two items shown in the MP, change RNGFND_MAX_CM value to 450cm and RNGFND_MIN_CM value to 43 cm

5) Click "Write Params" on the right to save the parameters when the setting is complete.

RNGFND_MAX_CM is the detectable max distance of flight controller at Alt-Hold Mode

RNGFND_MIN_CM is the detectable min distance of flight controller at Alt-Hold Mode
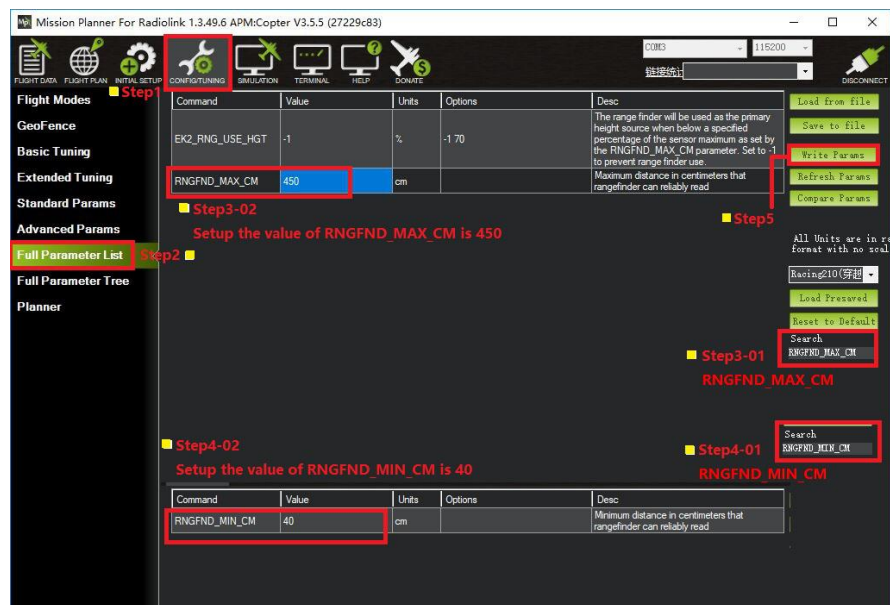
2.3 How to Enable/Disable the function by transmitter(Optional)

This setup depends on users' habit and is optional.

The Alt-Hold function of SUI04 is always automatically enabled at Alt-Hold Mode and Post-Hold Mode by default anddisabled ifchange to Stabilize Mode.

If users preferenabling/disabling the Alt-Hold function by transmitter, setup in the Mission Planner is necessary.

Flight Controller Setting steps (CH8_OPT Parameters)**:**

1) Choose CONFIG/TUNING on the top of the interface

2) Click "Full Parameter List" on the left

3) Input "CH8_OPT" (choose the CH8to make the Alt-Hold function enable or disable) in search column at the lower right corner and press "Enter"

4) As the searched CH8_OPT shown in the MP, change the value to10 (Object Alt-Hold).It means switchon/off CH7 enable/disable the avoidance function.

5) Click "Write Params" on the right to save the parameters when the setting is complete.
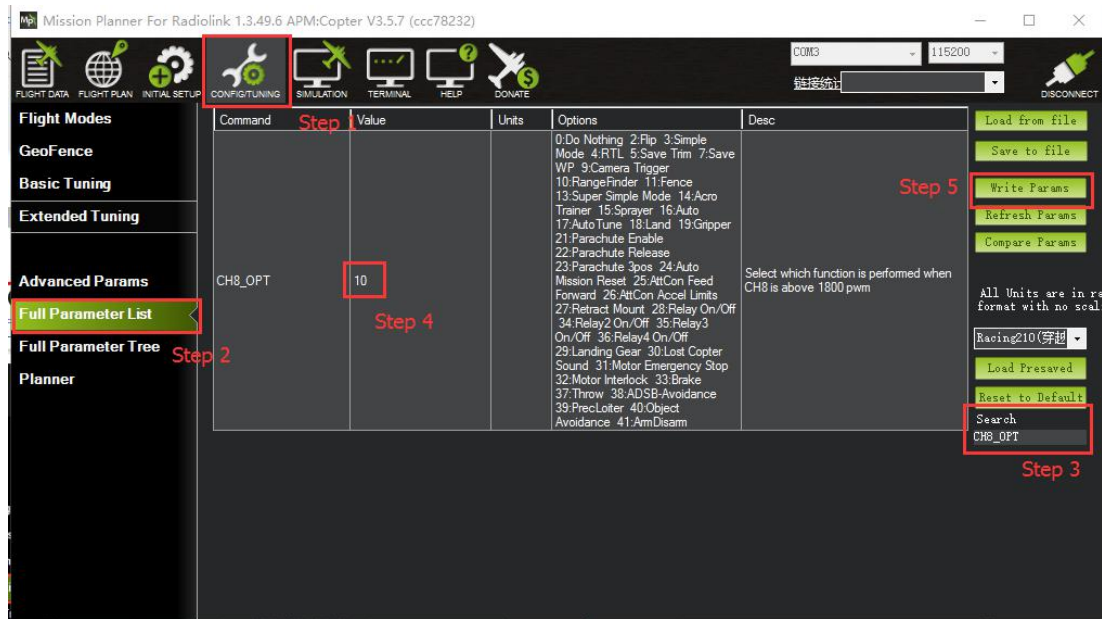
Transmitter settings

1) Choose a 2-position switch to control CH8

2) Choose INITIAL SETUP on the top of the interface of MP

3) Click "FailSafe" in the pull-down menu of "Madatory Harware" on the left and the interface of CH8 PWM value is shown

4) Toggle the switch. If the PWM value of CH8 is more than 1800, it means the Alt-Hold function is enabled when the switch is at the bottom position. If the PWM value of CH8 is less than 1800, it means the Alt-Hold function is disabled when the switch is at the top position.