Configuration Guide v1.0

for ROPPOR Swarm

Drone Connection

Chemessen, Inc.

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1. H/W List

1-1. LTE Device & Companion Computer

1) Raspberry Pi 3A+ or 3B+

※ **Configuration Guide is based on Raspberry Pi 3A+. Therefore, if you want to add a device (e.g camera, etc.), use Raspberry Pi 3B+ with more USB ports.**

2) 16GB Micro SD Memory Card

3) Quectel EC25 Mini PCIe 4G/LTE Module

https://sixfab.com/product/quectel-ec25-mini-pcle-4glte-module/

4) LTE Full Band PCB Antenna – u.FL Plug – 100mm

https://sixfab.com/product/lte-full-band-pcb-antenna-u-fl-plug-100mm/

5) Sixfab Raspberry Pi 3G/4G&LTE Base HAT

https://sixfab.com/product/raspberry-pi-base-hat-3g-4g-lte-minipcie-cards/

1-2. Drone

1) Drotek Pixhawk 3 Pro

https://store-drotek.com/821-pixhawk-pro-autopilot.html

2) Drotek All-in-One module (Pixhawk 3 pro)

https://store-drotek.com/819-all-in-one-Pixhawk.html

3) Drotek Voltage & current & 5.3V power supply – Mounted

https://store-drotek.com/809-voltage-current-53v-power-supply-mounted.html

4) JST-GH to JWT 28AWG 6-pins Silicone cable

https://store-drotek.com/831-jst-gh-to-jwt-28awg-6pins-cable.html

5) Drotek SIRIUS RTK GNSS ROVER (F9P)

https://store-drotek.com/911-1007-sirius-rtk-gnss-rover-f9p.html#/157-sensor-rm3100

※ **If RTK is not used, low-cost GNSS device can be used.**
: https://store-drotek.com/287-positioning

1-3. Recommendations

- **Most common cause of collision between drones and drone crash are loose connections, screw tightening, cable damage, and defective soldering in drone manufacturing. Assemble with care.**
- **The shape of drone and overall hardware composition are user's choice.**
- **The company introduces the guide for connection with LTE based ROPPOR software a fter taking the shape of a general drone (quad-copter).**

2. Companion Computer & LTE Device

LTE devices that can connect with Raspberry Pi are constantly being updated by Sixfab, so user's drone weight reduction and compact shape change are possible through hardware update and connection test.

: https://sixfab.com/product-category/raspberry-pi-shields/

2-1. Preparation

1) Main Power Cable

Prepare the main power (5V) cable to supply power to the micro USB power of Raspberry Pi. This cable is not provided and thus can assemble your own power cable.

※ The company has supplied power by connecting 5V/3A UBEC to the PDB (12V) of the drone.

The method of the company does not guarantee drone control for the user.

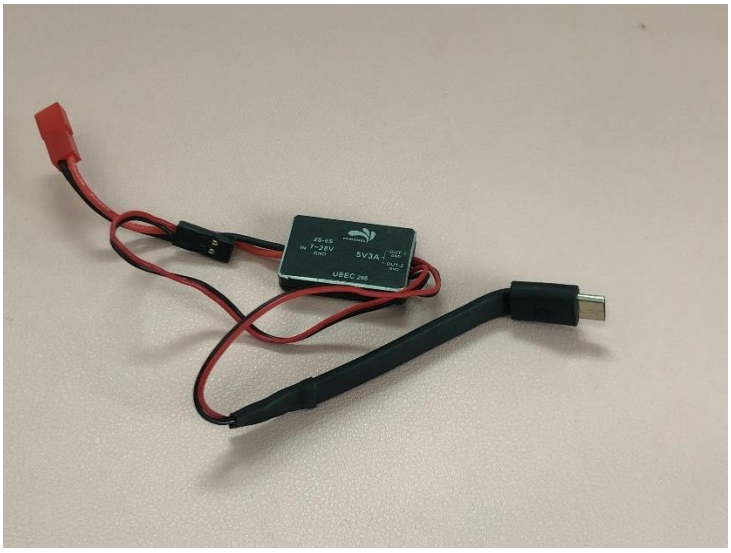

Figure # 1 Main Power Cable

2-2. Connection

Prepare a micro SD card installed with the Smart Device Application Software(SDAS), Raspberry Pi, LTE module, and LTE base hat.

※ For SDAS software installation method , please refer to the Smart Device Application Software Installation Document.

Connect as follows.

1) Companion Computer

Insert the micro SD card installed with SDAS to Raspberry Pi.

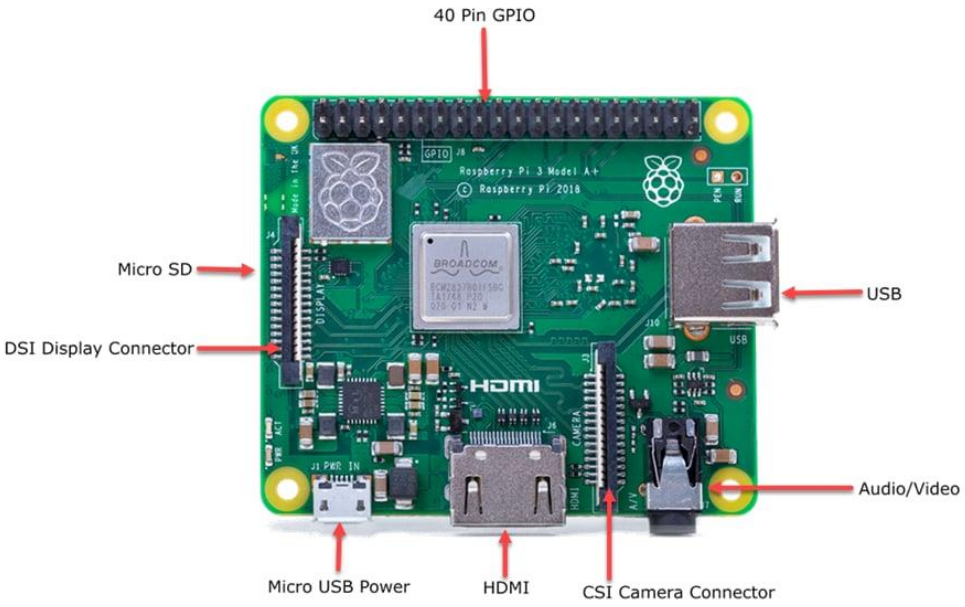

Figure # 2 Raspberry Pi 3A+ Layout

2) LTE Device

Mount the LTE module to the mini PCIe socket of the LTE base hat. Then insert the activated USIM into the SIM socket.

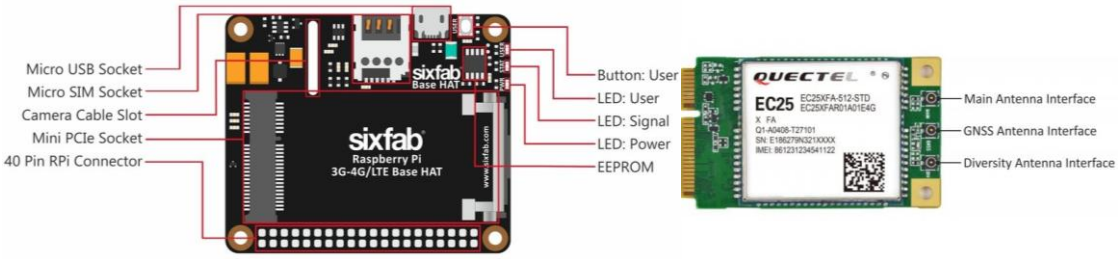

Figure # 3 LTE Base Hat/EC25 LTE Module Layout

Use the long header to connect the Raspberry Pi and the LTE base hat.

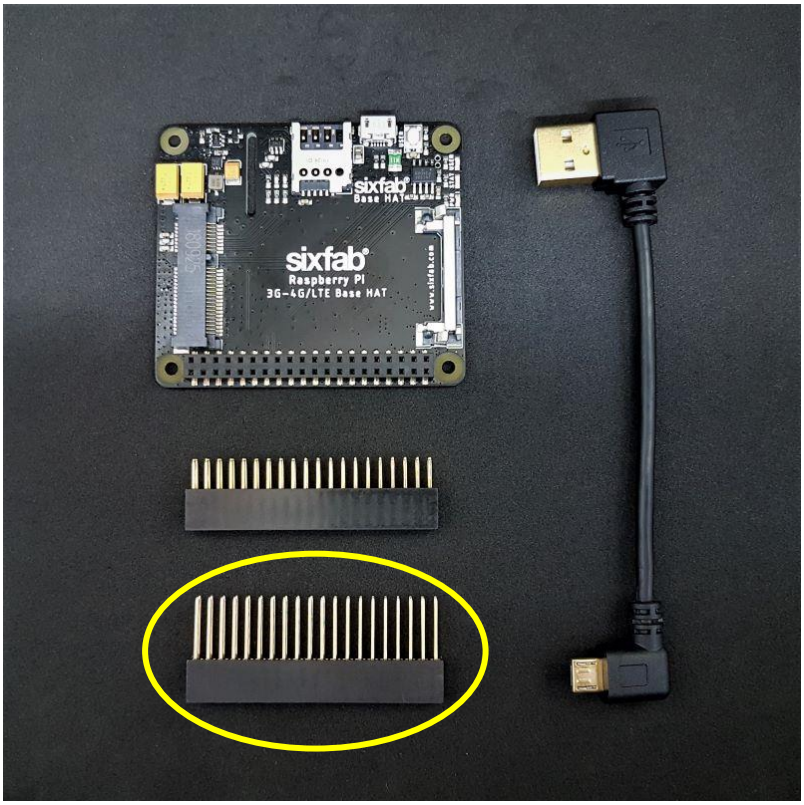

Figure # 4 Component - Long Header

3) Companion Computer & LTE Device

Figure # 5 Result of Connection

2-3. Connect

Connect the connected devices as follows.

1) Use the USB to micro USB cable to connect the Raspberry Pi and the LTE base hat.

2) Connect the LTE full band PCB antenna to the MAIN and DIY of the LTE module.

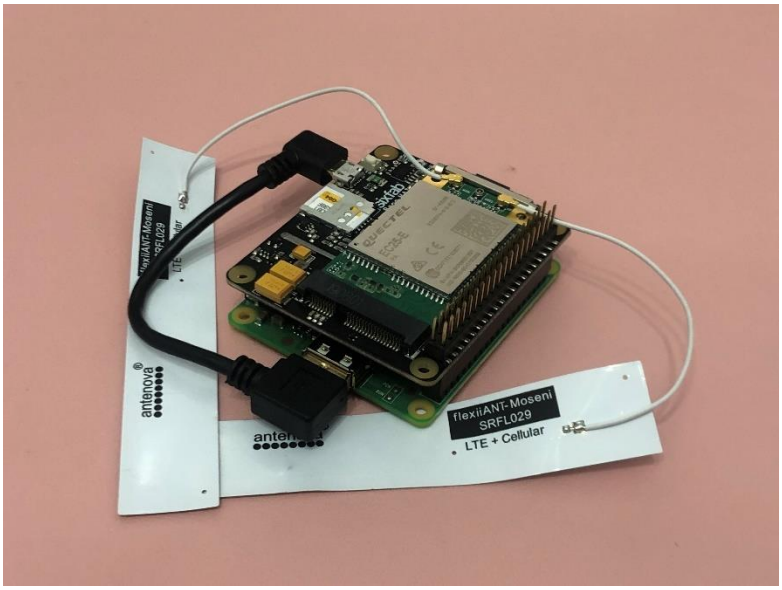

Figure # 6 Connection Result by Device

3) Use the JST-GH to JWT 28AWG 6-pins silicone cable to connect to the GND, TX, and RX of the LTE base hat to **Telem1 port** of Pixhawk 3 Pro. Make sure that the cable connected to the long header is stable.

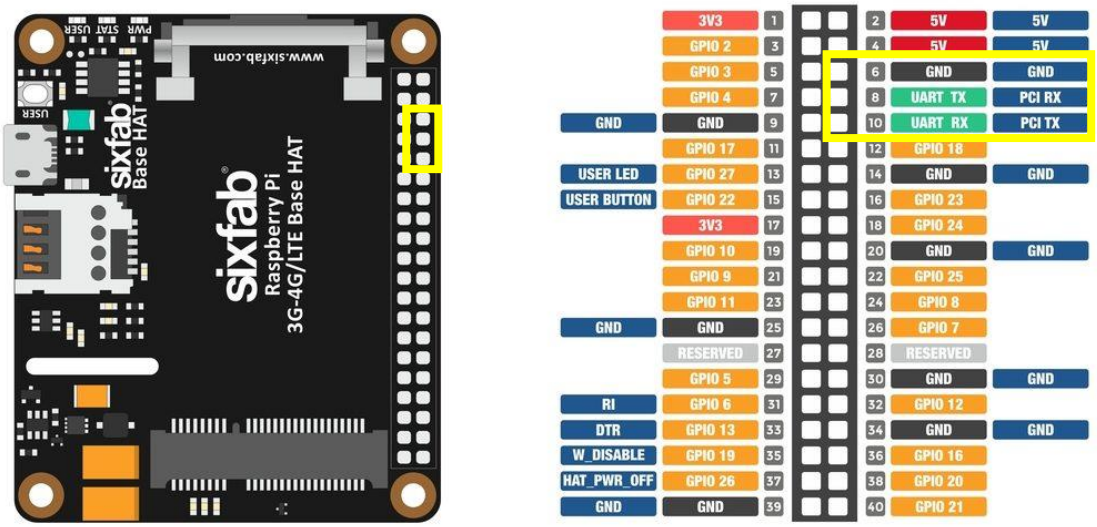

Figure # 7 LTE Base Hat Pinout

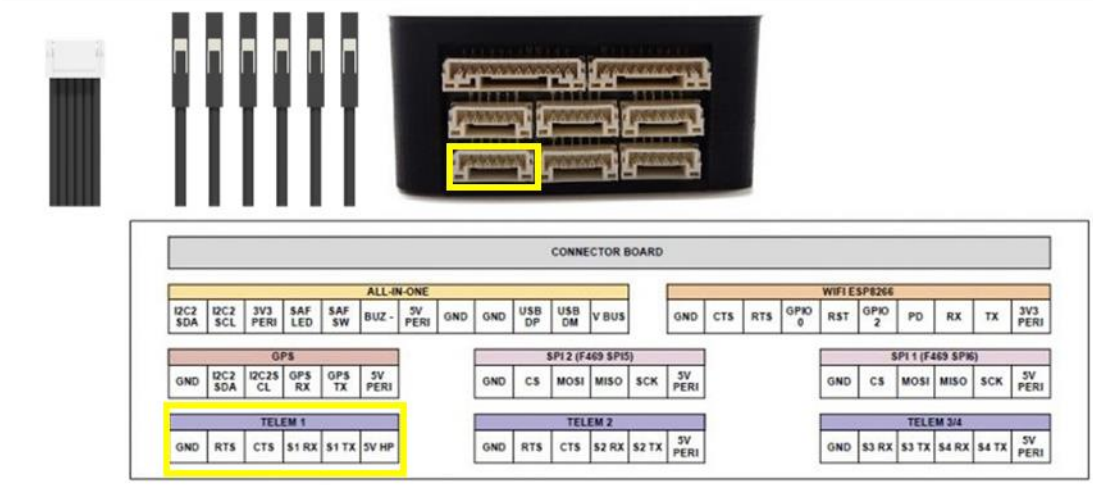

Figure # 8 JST-GH to JWT 28AWG 6-pins Silicone cable/Pixhawk 3 Pro Pinout

4) Last, connect the main power line to the micro USB power of the Raspberry Pi.

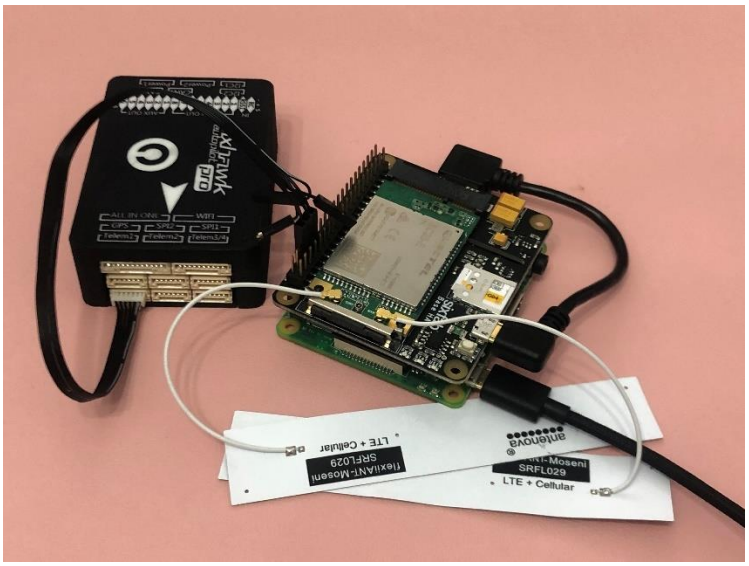

Figure # 9 Final Result

※ The method of the company does not guarantee drone control for the user.

2-4. Camera

To use video in ROPPOR, you should connect a camera to Raspberry Pi. Connect a camera as follows.

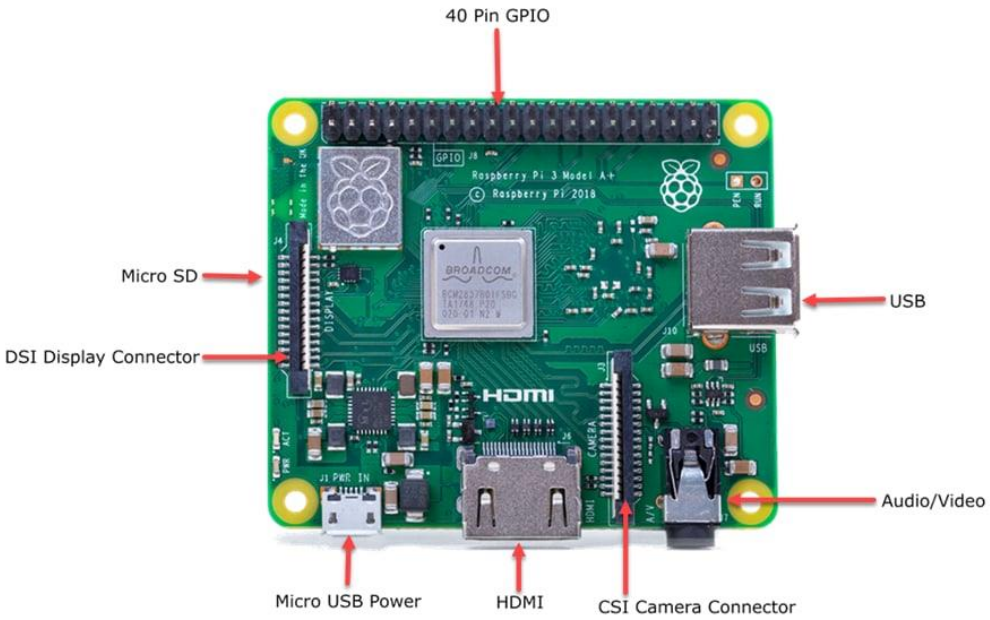

Figure # 10 Raspberry Pi 3A+ Layout

Connect the camera to the USB or CSI Camera Connector of Raspberry Pi.

※ The camera must be compatible with the USB of Raspberry Pi or CSI interface.

※ To connection ROPPOR with the camera, please launch the video streaming setting file when installing the Smart Device Application Software (SDAS) in Raspberry Pi.

※ For more information on installation, please refer to the Installation Guide of Smart Device Application Software (SDAS).

3. Firmware and Parameter

ArduPilot is continuing to update the firmware so you can access improved flight control and advanced control technology through tests.
: https://firmware.ardupilot.org/Copter/

3-1. Firmware Installation

Install the Mission Planner for firmware installation and hardware/software configuration.
: https://firmware.ardupilot.org/Tools/MissionPlanner/

Refer to the following document for basic firmware installation method.
: https://ardupilot.org/copter/docs/common-loading-firmware-onto-pixhawk.html#connect-autopilot-to-computer

※ **The company has completed the final test with Arducopter V4.0.3 Quad.**

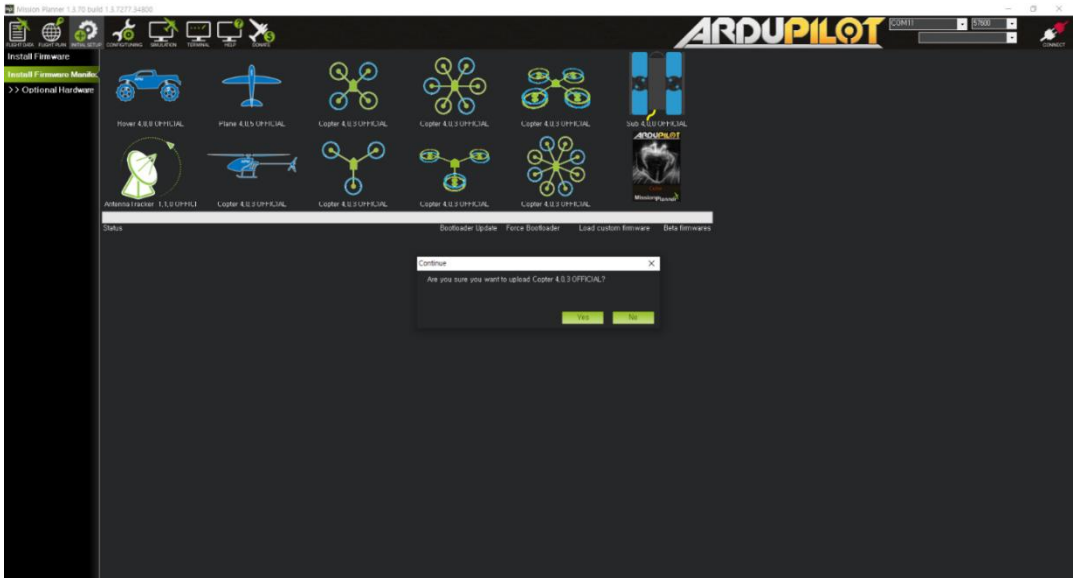

Figure # 11 Mission Planner - - Firmware Installation Screen

Use USB to micro USB to connect the PC and FC, and then use the Mission Planner to install the suitable firmware for the drone.

3-2. Parameter Change

Change the **Baudrate value of Telem1(based on Pixhawk 3 Pro, SERIAL1_BAUD) port** connected for communication between Raspberry Pi and FC to **"115200" (Default value : 57600).**

1) After firmware installation is complete, connect the FC and PC with USB to micro USB, and check that the version is correct through the Mission Planner.

Figure # 12 Mission Planner Message log – ArduCopter V4.0.3(ffd08628)

2) In Config/Tuning of the Full Parameter List, change the Baudrate value of Telem1(based on Pixhawk 3 Pro, SERIAL1_BAUD) port to "115200" (Input value : 115). And then click [Write Params] to apply and save.

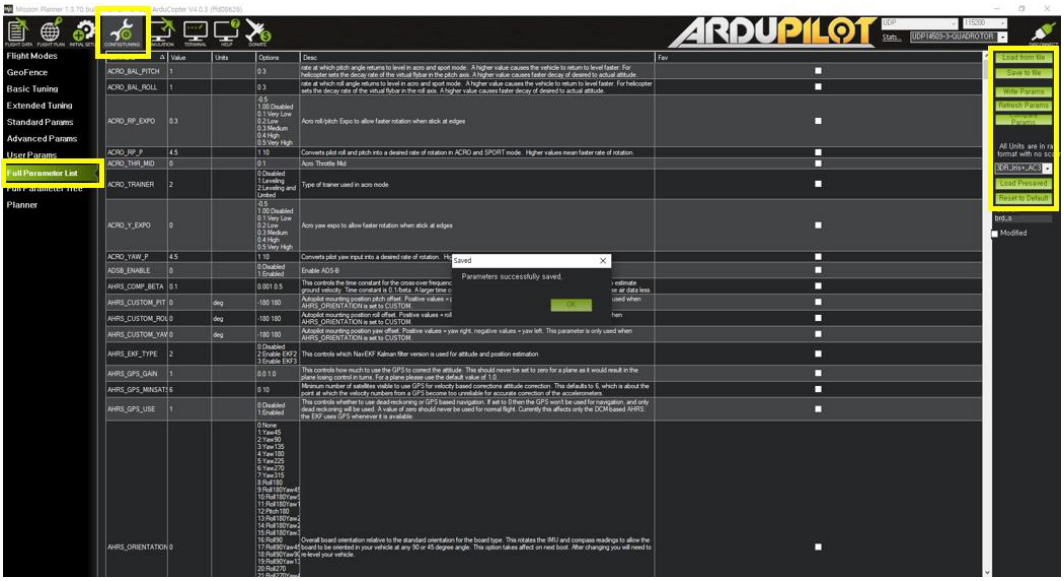

Figure # 13 Mission Planner Configuration – Full Parameter List

※ **Parameter values suggested by the company is irrelevant to the user's drone control. Configure and check the parameters according to user operation and hardware configuration aside from other applicable values before operation.**

Full parameter list provided by ArduPilot : https://ardupilot.org/copter/docs/parameters.html

4. Check Wireless Communication and Connection

When parameter changes are complete, the drone can wirelessly communicate with the operation PC (After completing the configuration of SDAS, VPN, etc.). Wireless communication is checked as follows.

1) Launch ROPPOR to check wireless communication. Disconnect the wired connection between the PC and the drone, and power the drone with a battery.

2) Rebooted drone is displayed on the ROPPOR screen within minutes, and you can check the IP for the drone in the [Dashboard].

Figure # 7 Check Connection in ROPPOR Dashboard - IP

3) Change the communication method of the mission planner to TCP, change the baud rate value to 115200, and then click [Connect]. Enter the IP for the drone in the remote host pop-up window, and enter "14000" in the remote port pop-up window, and try to connect. You can check the attempt of wireless communication trying to open the parameters.

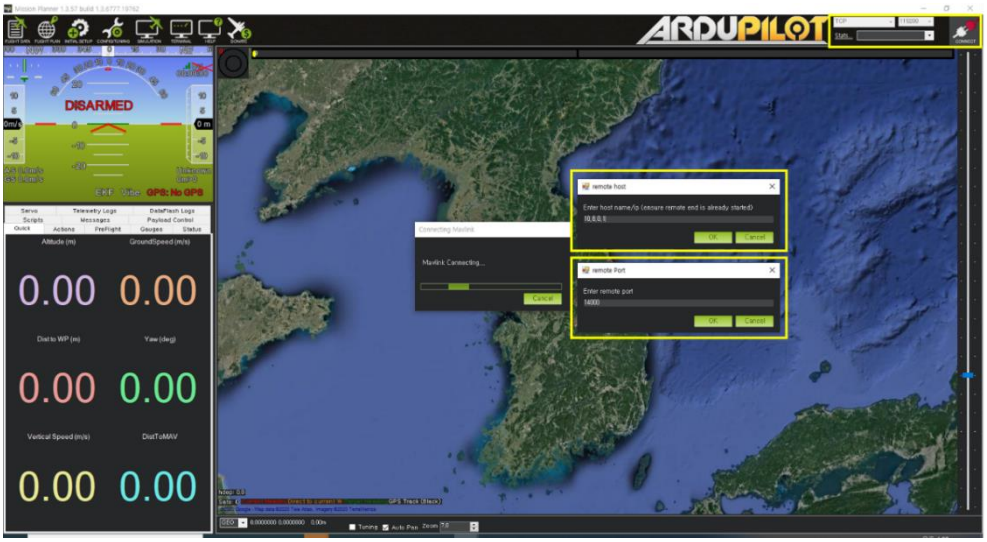

Figure # 15 Mission Planner Connect – remote host/Port

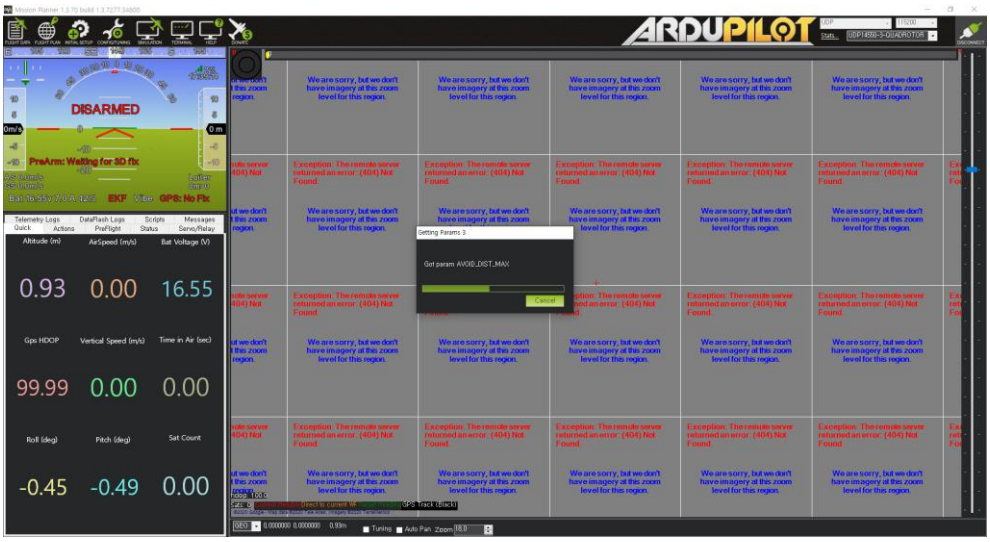

Figure # 86 Mission Planner – Wireless Communication Check

※ Configure according to the type and specifications of the drone such as frame type, accel calibration, compass, etc. After completing the flight test, use the ROPPOR software to fly.

Configuration provided by ArduPilot

: https://ardupilot.org/copter/docs/configuring-hardware.html