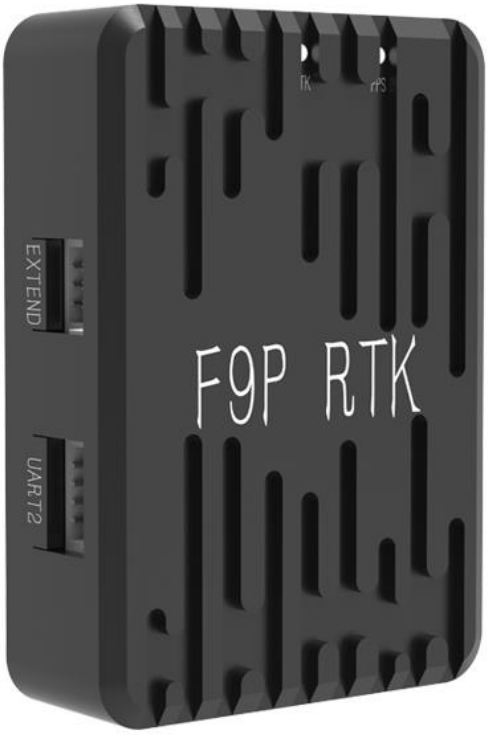
SIYI

F9P RTK

USER MANUAL



v1.0

April 2024

Thank you for purchasing SIYI product.

F9P RTK module is a high-accuracy centimeter-level four-satellite multi-frequency navigation and position system developed for autopilot systems. Through real-time kinematic position technology, the 3D position accuracy is improved from meter level to centimeter level. It integrates position, altitude detection and dual-module direction finding functions. RTK technology makes up for the shortcomings of traditional GPS, barometer, and magnetic compass, enables UAVs to adapt to complex magnetic field environments, and provides accurate and reliable systematic solutions for high-accuracy applications.

To ensure you a good experience of the product, please read this manual carefully. If you encounter any issue using the product, please consult the manual or check the online pages of this product on SIYI official website (https://siyi.biz/en). You can also write an email to SIYI official A/S center (support@siyi.biz).

SIYI User Group - Facebook

SIYI Official Website (*https://siyi.biz/en/*)

SIYI Official Store (*https://shop.siyi.biz*)

SIYI YouTube Channel (*https://www.youtube.com/c/SIYITech*)

User Manual Update Log

Version	Date	Updates
1.0	2024.4	Initial version.

CONTENT

READ TIPS

Icons

Please pay more attention to content indicated with the following marks:

DANGER Dangerous manipulation probably leads to personal injuries.

WARNING Warnings on manipulation possibly leads to personal injuries.

CAUTION Cautions on what manipulation may lead to economic losses.

Prohibited **Mandatory** **Mark**

Safety

SIYI F9P RTK is designed and manufactured for professional application scenarios. Operators need to have certain basic skills, so please use it with caution. SIYI Technology does not assume any responsibility for any unnecessary product damage caused by irregular or irresponsible operation of this product, economic losses or even personal injury to the user or others. Minors must have professionals present to supervise and guide minors when using this product. SIYI Technology's products are designed for commercial use, and it is prohibited to use SIYI products for military purposes. It is prohibited to disassemble or modify this product without SIYI Technology's permission.

Storage / Carrying / Recycling

When the SIYI product you own is idle, or you want to take the SIYI product out for work, or the product has reached the end of its service life, please pay special attention to the following matters:

⚠ DANGER

When SIYI products are not in use, they should be kept away from areas easily accessible to children.

Please avoid placing SIYI products in an environment that is too hot (above 60 degrees Celsius) or too cold (below minus 20 degrees Celsius).

⚠ CAUTION

Please avoid placing SIYI products in humid or sandy environments.

When carrying and transporting SIYI products, please avoid operations that may damage components such as vibration or impact.

1 INTRODUCTION

1.1 Product Features

Dual Module Direction Finding

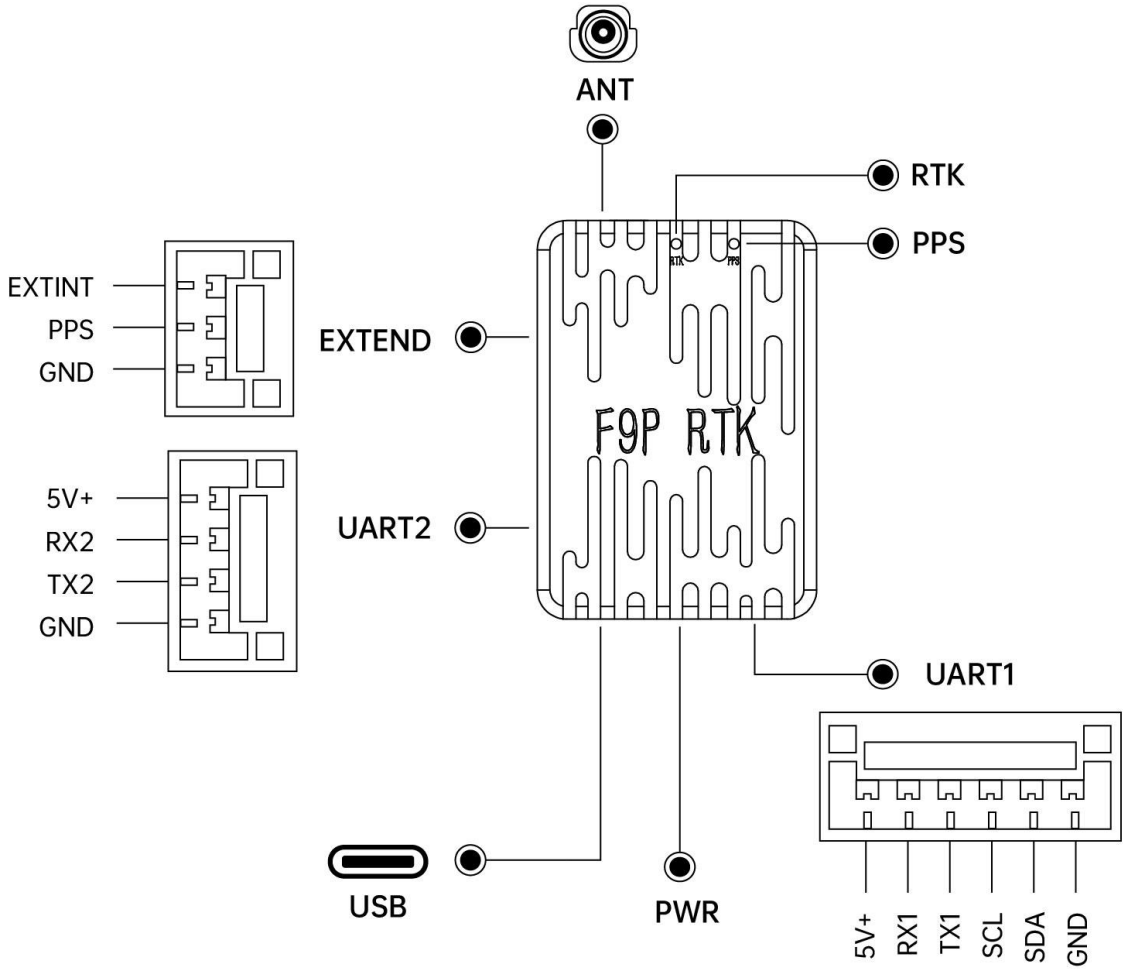
Adaptive in Complex Magnetic Field Environment

Using two RTK mobile stations can have the dual-module direction finding function as an alternative to compass to enable UAVs to work stably in complex electromagnetic environments such as power inspections.

Switchable Between Mobile Station and Base Station

RTK mobile station and base station adopt the same hardware design and can be freely switched only by loading different configuration parameters and matching the corresponding antenna.

1.2 Interface & Pinouts



EXTEND: Extension Port

UART 1/2: Flight Controller Communication

ANT: Antenna Connector

USB (Type-C): PC Configuration

PWR: Power Indicator

RTK: RTK Status Indicator

PPS: PPS Status Indicator

1.3 Technical Specifications

Hardware

Satellite Receiver	184 channel ZED-F9P (Ublox)
Electronic Compass	IST8310
Satellite Navigation System	GPS GLONASS Beidou Galileo
Satellite Bands	GPS-L1C/A, GPS - L2C, GLONASS - L1OF, GLONASS- L2OF GALILEO - E1B/C, GALILEO- E5b BeiDou - B1I, BeiDou - B2I QZSS - L1C/A, QZSS - L2C

Overall

Position Accuracy	1 cm + 1 ppm
Direction Finding Accuracy (Dual Module)	(0.25 / R) ° *R is the distance between two mobile station antennas in meters.
Single Point Position	1.5M CEP
SBAS Auxiliary Position	1.0M CEP
Surveying Time	RTK < 55 s
GPS Acquisition Time	Cold Start < 23 s Hot Start < 1 s
Antenna Gain	Mobile: 2 dBi Base: 5.5 dBi
Dual Module Direction Finding	Supported Yaw Accuracy: 0.35 edg (for reference)
Interfaces	2 x UART 1 x USB (Type-C)
Antenna Connector Type	MMCX
Working Voltage	4.5 ~ 5.5 V
Power Consumption	0.6 W

Working Temperature	–30 ~ 75 °C
Product Dimension	47 x 33 x 13 mm
Product Weight	31 g

Mark

Please format the SD card to FAT32 before firmware upgrade.

1.4 Packing List

Base Station

1 x F9P RTK Base Module

1 x Mushroom Head Antenna

1 x TNC to MMCX Antenna Cable
(Connect mushroom head antenna and F9P RTK base unit)

1 x Type-C to USB Cable

Mobile Station

1 x F9P RTK Mobile Module

1 x Four-Arm Spiral Antenna

1 x Antenna Bracket

1 x UART1 to GPS MODULE Cable
(Connect F9P RTK mobile station module’s UART1 port to autopilot’s GPS MODULE port)

1 x UART2 to PX4 GPS YAW UART2 Cable
(Connect F9P RTK mobile station module’s UART2 port to PX4 autopilot’s GPS YAW UART2 port)

1 x UART1 to TELEM4 Cable
(Connect F9P RTK mobile station module’s UART1 port to autopilot’s TELEM4 port)

1.5 Status Indicator Definition

Power Indicator

Solid Red: Module power supply is normal.

RTK Status Indicator

Blue Blinks: RTK function enabled.

PPS Status Indicator

Solid Green: No position.

Green Blinks: Successful position.

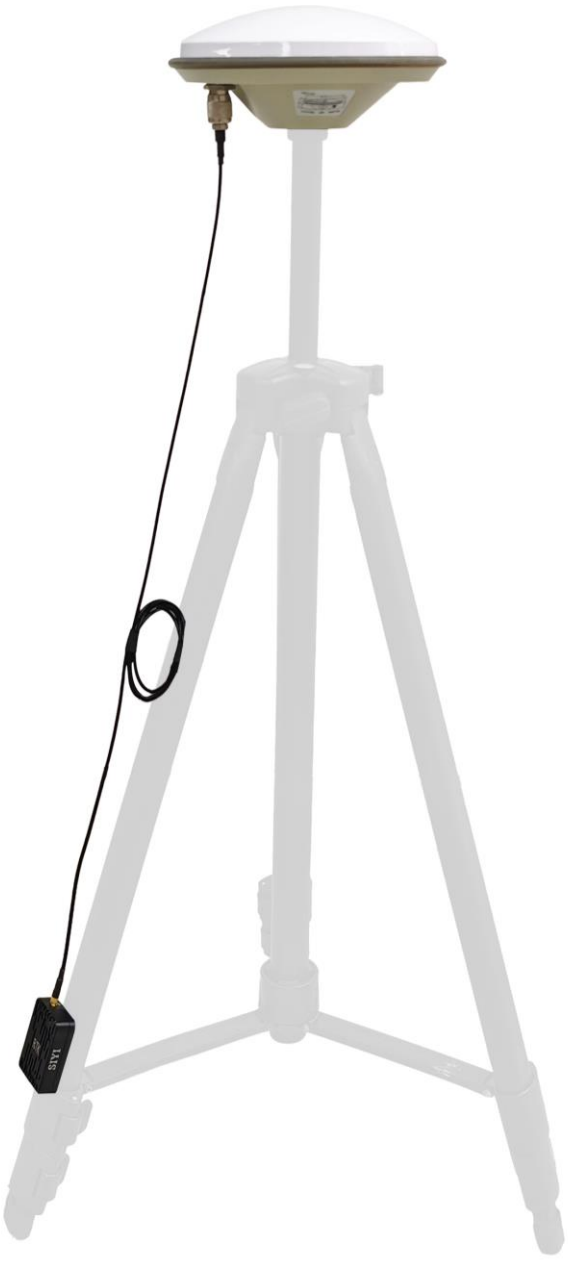
Mark

When RTK function is enabled, RTK status indicator is only available on the mobile station module. The RTK status indicator on the base station module will not light up.

2 GET READY TO USE F9P RTK

2.1 Installation

2.2.1 F9P RTK Base Station



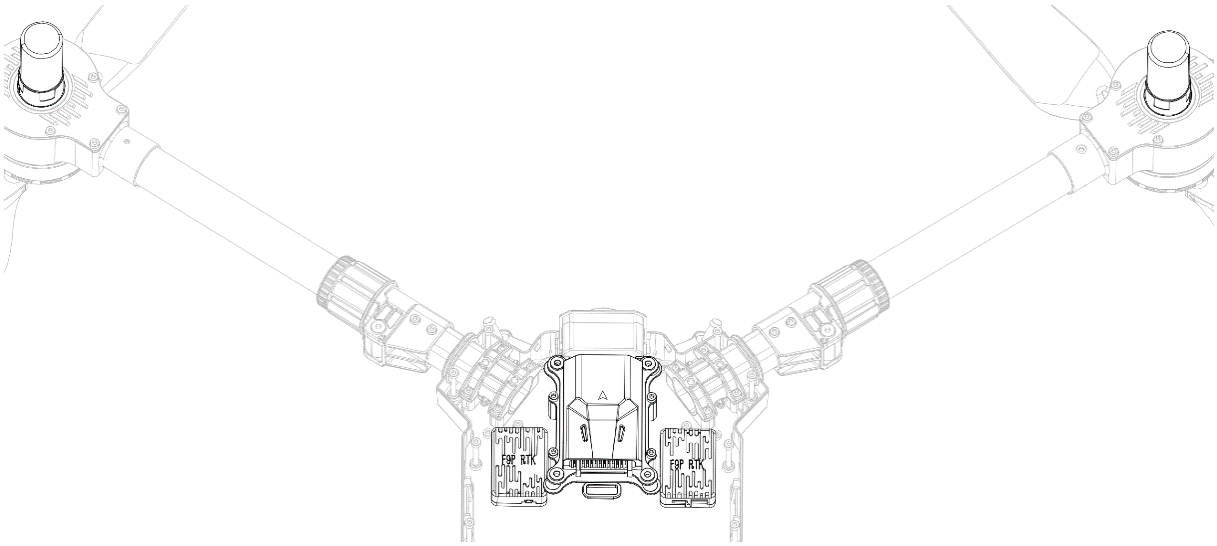
Please refer to the above picture to mount RTK base module and mushroom head antenna on the tripod and wire the antenna cable.

Mark

Customer should prepare the tripod.

Please make sure that there is no obstruction or interference around the RTK antenna to avoid any influences on survey time and position accuracy.

2.2.2 F9P RTK Mobile Station



Please refer to the above picture to mount RTK mobile modules on the frame and make sure they do not vibrate.

Arrow orientation on the RTK module should be the same with the flight controller arrow orientation (drone head orientation).

Mark

F9P RTK comes with built-in IST8310 compass. The RTK module should stay away from magnetics.

Mobile Station Antenna Bracket Installation

If there is no proper way to mount the RTK mobile station antennas at the motor position, then you can refer to below picture, and use the bracket to mount the four-arm spiral antenna on the frame and make sure it does not shake.

The arrow on the RTK module should align with the flight controller orientation (drone head).

Mark

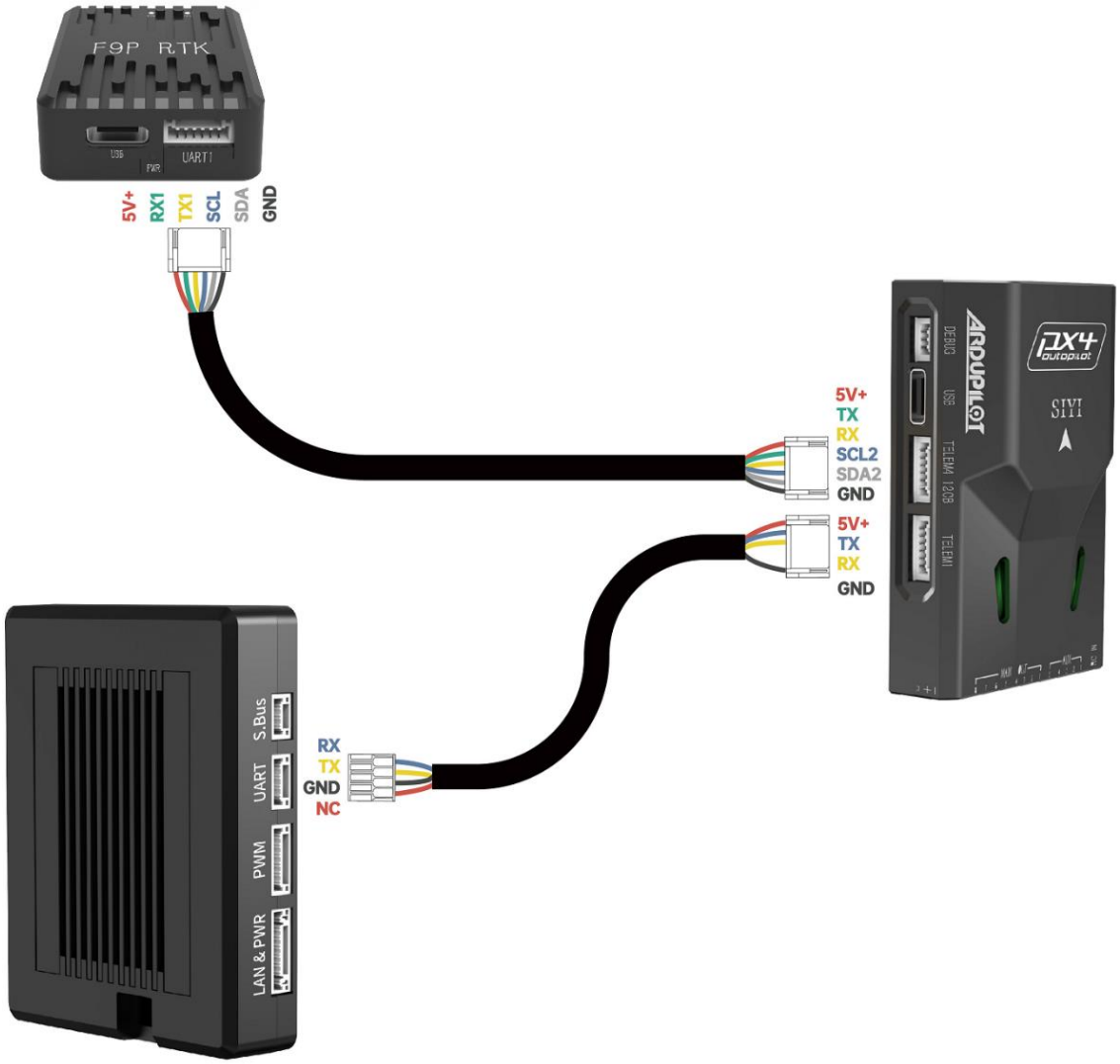
Do not block the RTK antenna to ensure the position performance.

RTK mobile station antenna bracket comes with the product package.

3 RTK CENTIMETER-LEVEL POSITION

RTK base station and mobile station work in combination and communicate with each other through flight controller and datalink can achieve centimeter-level position.

3.1 Mobile Station Connection Diagram



Please refer to the above picture and connect F9P RTK mobile station to the flight controller. The flight controller connects to the air unit of datalink.

Mark

Under this scenario, F9P RTK and N7 autopilot work in plug-and-play, no more configuration is required.

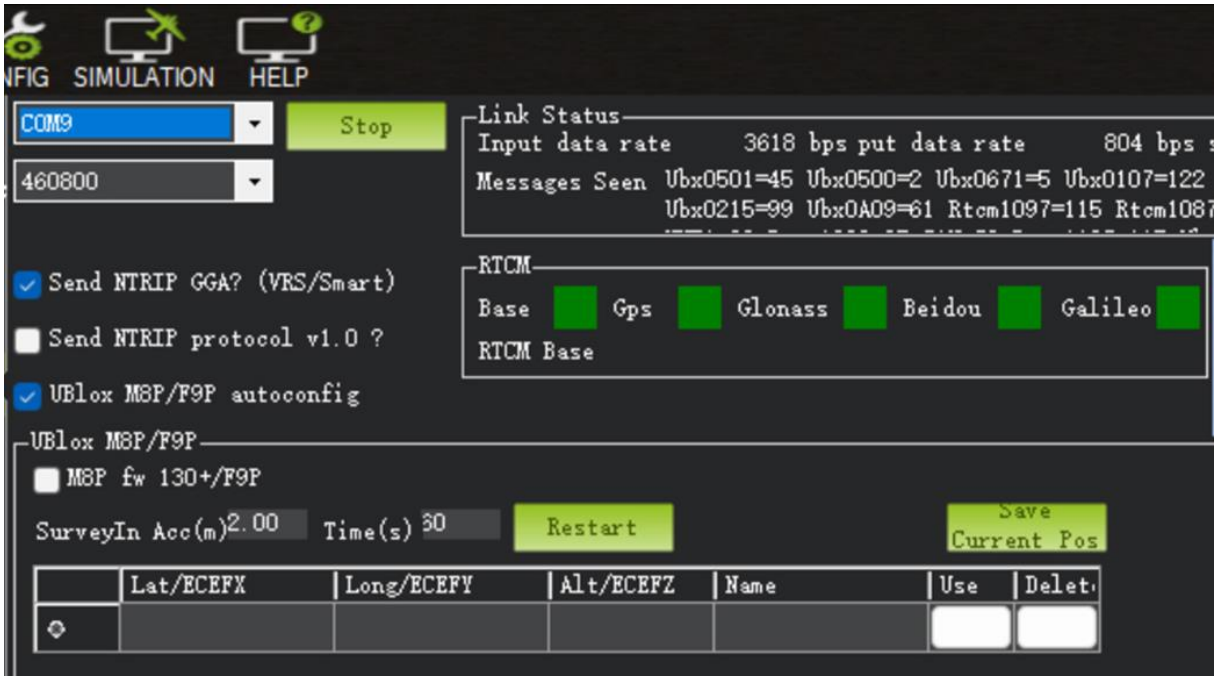
3.2 Base Station Connection Diagram

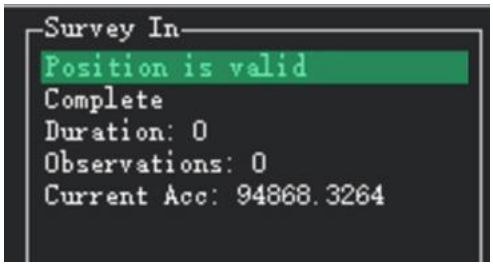
Please refer to the above picture and setup F9P RTK base station. The base station communicates to Windows GCS and sends real-time location of the RTK base station to flight controller.

GCS Configuration

Run Mission Planner GCS, go to “SETUP – Optional Hardware – RTK / GPS Inject”.

Please refer to the below pictures for configuration:





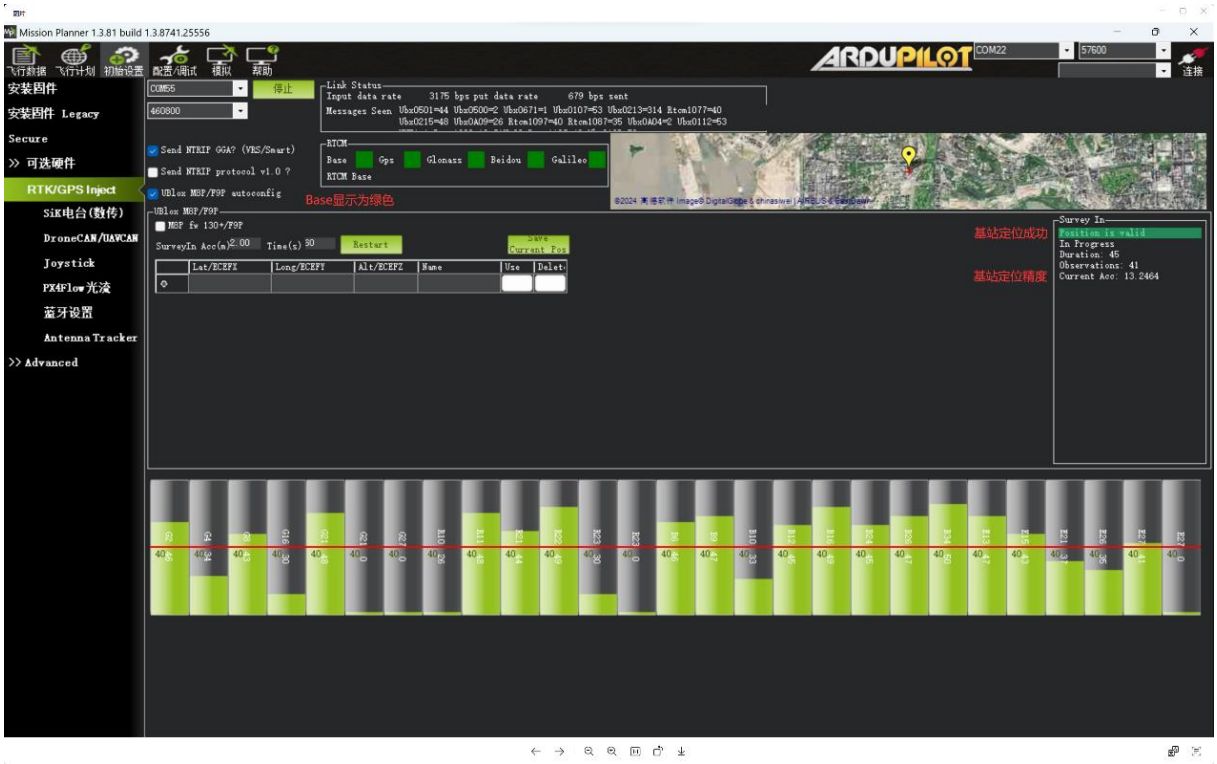
It is suggested to check “UBlox M8P/F9P autoconfig”, set “SurveyIn Acc” as 2.5 m, and “Time” as “60”.

After configuration, please click “Restart” to start.

CAUTION

If the base station has started position successfully, it is prohibited to move the base station!

When base station works normally and survey is finished, Mission Planner GCS will display as below.



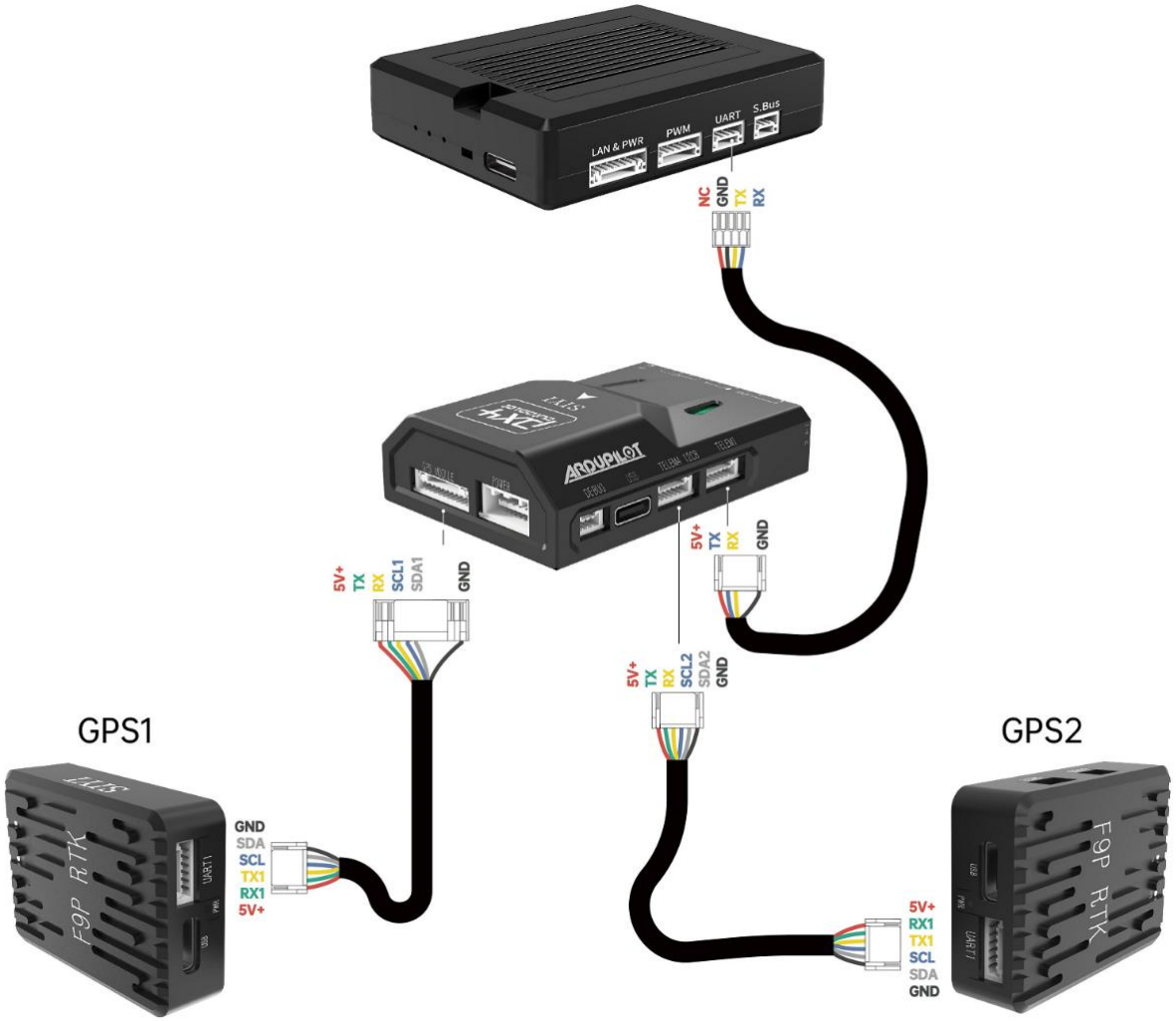
GPS status displays as “rtk fixed”. RTK has started position.


DATA
PLAN
SETUP
CONFIG
SIMULATION
HELP
345
N
15
30
39
NE
60
75
E
99%
17:22:00
DISARMED
1m/s
0 m
AS 0.8m/s
GS 0.0m/s
QLOITER
0m>0
Ready to Arm
GPS: 3D dgps
Bat1 25.92v 0.9 A 98%
EKF
Vibe
GPS2: rtk Fixed

4 DUAL MODULE DIRECTION FINDING (REPLACE COMPASS)

Dual RTK mobile stations can work together to replace compass and accomplish dual module direction finding function.

Instruction



Please refer to the above picture and connect two F9P RTK mobile stations to the flight controller. The flight controller connects to the air unit of datalink.

Flight Controller & RTK Mobile Station Configuration as Below:

- SERIAL3_PROTOCOL = 5 *GPS MODULE port as GPS
- SERIAL4_PROTOCOL = 5 *TELEM4 port as GPS
- GPS_TYPE = 17 *uBlox-MovingBaseline-Base
- GPS_TYPE2 = 18 *uBlox-MovingBaseline-Rover

- GPS_AUTO_CONFIG = 1 *AutoConfig Seria
- GPS_AUTO_SWITCH = 1
- EK3_SRC1_YAW = 2 (Dual module direction finding only), 3 (Return to compass when dual module direction finding is not enabled)

Set RTK Antenna Offset

GPS_POS1_Y = *The distance between GPS1 antenna's Y axis and flight controller: Positive means the antenna is on the right side of the flight controller. Negative means the antenna is on the left side of the flight controller.

GPS_POS1_X = *The distance between GPS1 antenna's X axis and flight controller: Positive means the antenna is on the front side of the flight controller.

Negative means the antenna is on the back side of the flight controller.

GPS_POS1_Z = *The distance between GPS1 antenna's Z axis and flight controller: Positive means the antenna is on the upside of the flight controller. Negative means the antenna is on the downside of the flight controller.

GPS_POS2_Y = *The distance between GPS1 antenna's Y axis and flight controller: Positive means the antenna is on the right side of the flight controller. Negative means the antenna is on the left side of the flight controller.

GPS_POS2_X = *The distance between GPS1 antenna's X axis and flight controller: Positive means the antenna is on the front side of the flight controller. Negative means the antenna is on the back side of the flight controller.

GPS_POS2_Z = *The distance between GPS1 antenna's Z axis and flight controller: Positive means the antenna is on the upside of the flight controller. Negative means the antenna is on the downside of the flight controller.

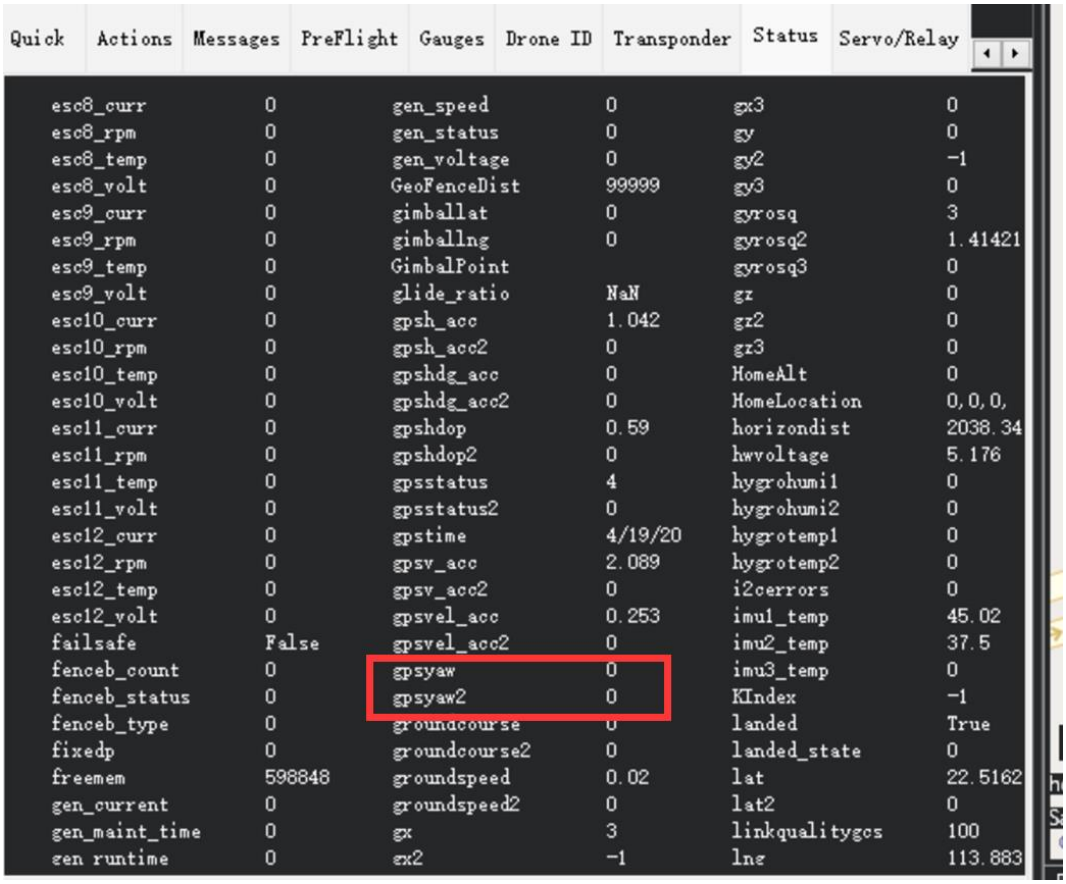
Mark

The horizontal distance between GPS1 antenna and GPS2 antenna must be at least 30 cm to guarantee the direction-finding accuracy.

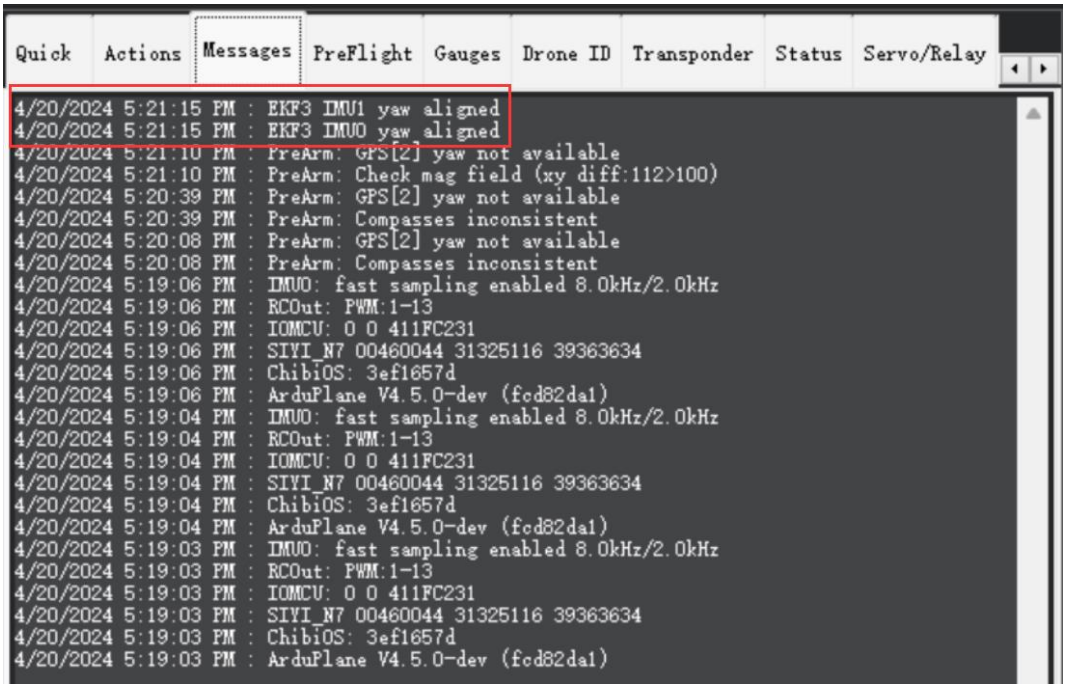
The RTK mobile module connected to SERIAL3 port is GPS1 in default. The RTK mobile module connected to SERIAL4 port is GPS2 in default.

Confirm Dual Module Direction Finding

Run Mission Planner GCS, check if the orientation of “GPS_YAW” aligns with the actual orientation. If yes, dual module direction finding configuration is successful. If not, “GPS_POS” configuration is wrong.



GCS messages say “EKF3 IMUx yaw aligned”, dual module direction-finding is successful.

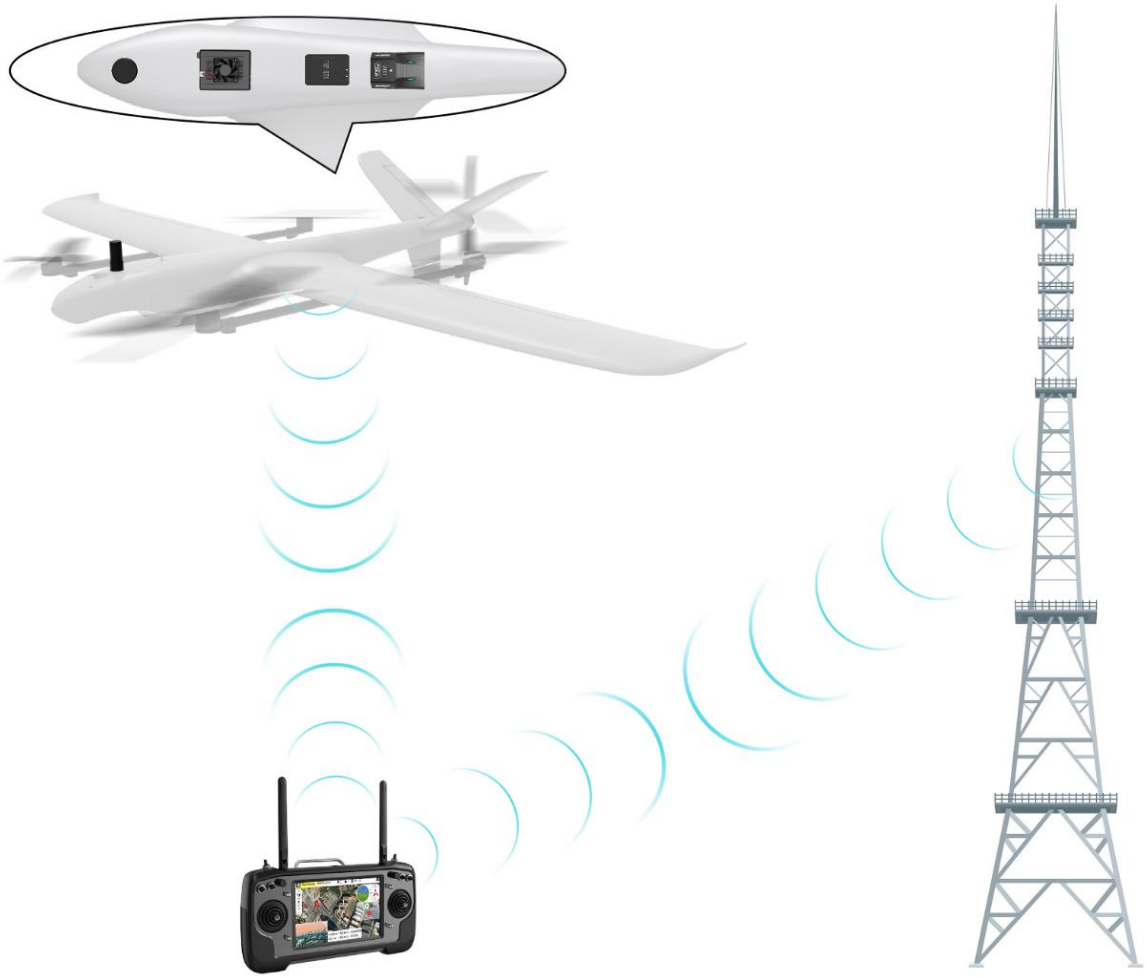

Quick
Actions
Messages
PreFlight
Gauges
Drone ID
Transponder
Status
Servo/Relay
4/20/2024 5:21:15 PM : EKF3 IMU1 yaw aligned
4/20/2024 5:21:15 PM : EKF3 IMU0 yaw aligned
4/20/2024 5:21:10 PM : PreArm: GPS[2] yaw not available
4/20/2024 5:21:10 PM : PreArm: Check mag field (xy diff:112>100)
4/20/2024 5:20:39 PM : PreArm: GPS[2] yaw not available
4/20/2024 5:20:39 PM : PreArm: Compasses inconsistent
4/20/2024 5:20:08 PM : PreArm: GPS[2] yaw not available
4/20/2024 5:20:08 PM : PreArm: Compasses inconsistent
4/20/2024 5:19:06 PM : IMU0: fast sampling enabled 8.0kHz/2.0kHz
4/20/2024 5:19:06 PM : RCOut: PWM:1-13
4/20/2024 5:19:06 PM : IOMCU: 0 0 411FC231
4/20/2024 5:19:06 PM : SIYI_N7 00460044 31325116 39363634
4/20/2024 5:19:06 PM : ChibiOS: 3ef1657d
4/20/2024 5:19:06 PM : ArduPlane V4.5.0-dev (fcd82da1)
4/20/2024 5:19:04 PM : IMU0: fast sampling enabled 8.0kHz/2.0kHz
4/20/2024 5:19:04 PM : RCOut: PWM:1-13
4/20/2024 5:19:04 PM : IOMCU: 0 0 411FC231
4/20/2024 5:19:04 PM : SIYI_N7 00460044 31325116 39363634
4/20/2024 5:19:04 PM : ChibiOS: 3ef1657d
4/20/2024 5:19:04 PM : ArduPlane V4.5.0-dev (fcd82da1)
4/20/2024 5:19:03 PM : IMU0: fast sampling enabled 8.0kHz/2.0kHz
4/20/2024 5:19:03 PM : RCOut: PWM:1-13
4/20/2024 5:19:03 PM : IOMCU: 0 0 411FC231
4/20/2024 5:19:03 PM : SIYI_N7 00460044 31325116 39363634
4/20/2024 5:19:03 PM : ChibiOS: 3ef1657d
4/20/2024 5:19:03 PM : ArduPlane V4.5.0-dev (fcd82da1)

5 RTK CENTIMETER-LEVEL POSITION & DUAL MODULE DIRECTION FINDING (REPLACE COMPASS)

Based on chapter 4, use dual RTK mobile stations and one base station together to accomplish RTK centimeter-level position and dual module direction finding function simultaneously.

6 USE NTRIP RTK ON SIYI HANDHELD CROUND STATION

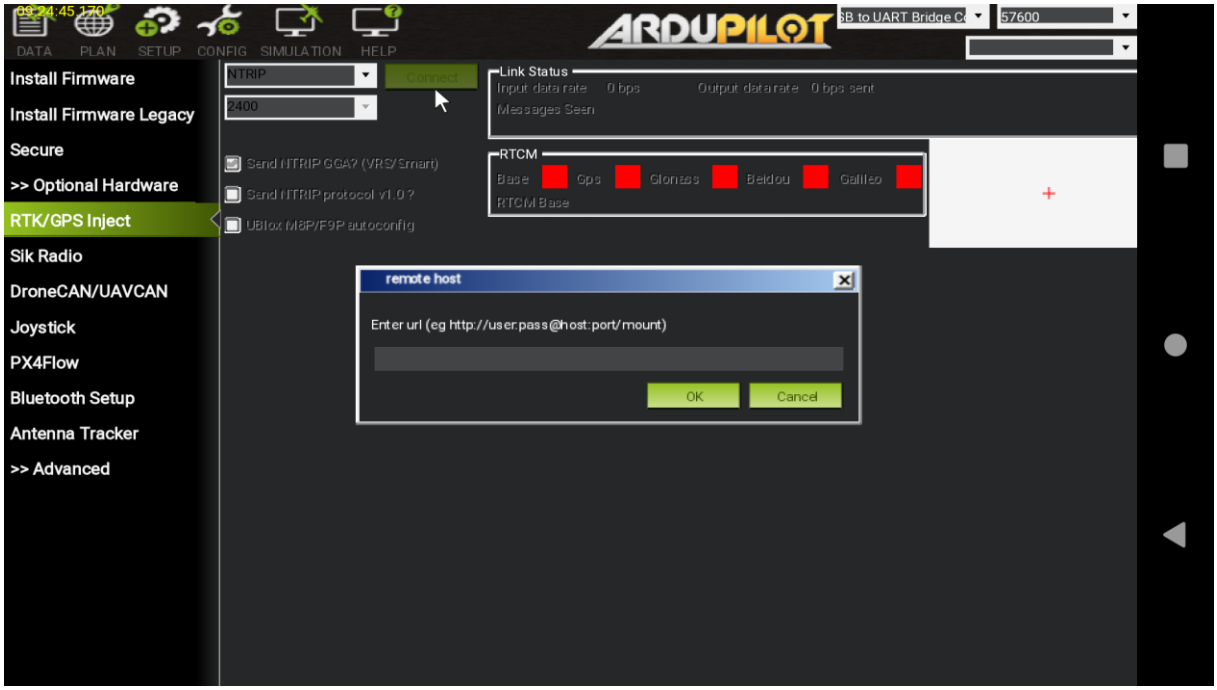
SIYI handheld ground station can work with RTK mobile station and network RTK base station to accomplish NTRIP RTK function.



Run Mission Planner on SIYI handheld ground station and connect SIYI handheld ground station to Internet. Go to “SETUP – RTK / GPS Inject – NTRIP”.

Network RTK URL (Taking an example of Qianxun RTK):

http://USER:PASSWORD@rtk.ntrip.qxwz.com:8002/RTCM32_GGB



USER: FindCM server account applied by customers.

PASSWORD: Password to the FindCM server.

Rtk.ntrip.qxwz.com: FindCM server addresses.

8002: Port number for forwarding WGS84 coordinate system data.

RTCM32_GGB: Data source for forwarding RTCM3.2 data format.

Mark

For more information, please consult your NTRIP RTK provider.

After the base station data is correctly obtained, information such as the protocol number, data rate, base station coordinates, satellite number, and signal-to-noise ratio can be observed on the RTK / GPS inject page.

Mark

Even though this chapter is written based on Android Mission Planner for RTK configuration, it is not suggested to use Android Mission Planner for flight configuration.

Please always use Windows Mission Planner for complicated flight configuration.

7 AFTER-SALE SERVICE

If there were any questions or problems using SIYI Technology's product, you can always try to send an email to SIYI Official A/S Center (support@siyi.biz) or consult your sales representative or dealer for answers or solutions.

7.1 Repair Service

If your purchased SIYI products cannot work properly, please contact SIYI Official A/S Center for consulting.

Usually there are two situations for acquiring repair service.

- Product Defect
- Product Damage

SIYI products under the two situations can be sent back to SIYI for repairing. Defect products with valid warranty can be repaired for free. Defect products without valid warranty or damaged products should be charged of repair fees after repairing. Please refer to SIYI's Official A/S Quotation for detail.

7.2 Warranty

SIYI Technology guarantees that, subject to the following conditions, Return & Refund Service, Replacement Service, and Warranty Repair Service can be requested. Please contact SIYI directly (support@siyi.biz or your sales manager) or authorized SIYI dealer for more detail.

7.2.1 7-Day Return & Refund

You can request Return & Refund Service:

Within seven (7) days of receiving a product if the product has no manufacturing defect, has not been activated and is still in new or like-new condition.

Within seven (7) days of receiving a product if the product has a manufacturing defect.

Return & Refund Service will not be provided where:

It is requested beyond seven (7) calendar days of receiving a product.

A product sent to SIYI for Return & Refund Service does not include all original accessories, attachments or packaging, or any item is not in new or like-new condition, i.e., with cracks, dents, or scratches.

A legal proof of purchase, receipt or invoice is not provided or is reasonably believed to have been forged or tampered with.

Any fault or damage of the product is caused by unauthorized use or modification of the product, including exposure to moisture, entry of foreign bodies (water, oil, sand, etc.) or improper installation or operation.

Product labels, serial numbers, waterproof marks, etc. show signs of tampering or alteration.

Damage is caused to the product by uncontrollable external factors, including fire, floods, high winds, or lightning strikes.

A product is not delivered to SIYI within seven (7) calendar days after Return & Refund Service confirmation is sent from SIYI.

Other circumstances stated in this policy.

7.2.2 15-Day Replacement

You can request Replacement Service:

Within fifteen (15) calendar days of receiving the product if the product has sustained a substantial damage in transit, provided always that the damage proof issued by the carrier can be provided to SIYI.

Within fifteen (15) calendar days of receiving the product if the product does not match the original description of the product in one or more significant respects.

Within fifteen (15) calendar days of receiving the product if the product suffers performance failure.

Replacement Service will not be provided where:

Service is requested more than fifteen (15) calendars days after receiving a product.

Legal proof-of-purchase, receipts, or invoices are not provided, or are reasonably believed to have been forged or tampered with.

A product sent to SIYI for replacement does not include all original accessories, attachments, and packaging, or contains items damaged by user error.

A product is found to have no defects after all appropriate tests are conducted by SIYI.

Any fault or damage of the product is caused by unauthorized use or modification of the product, including exposure to moisture, entry of foreign bodies (water, oil, sand, etc.) or improper installation or operation.

Damage is caused by uncontrollable external factors, including fires, floods, high winds, or lightning strikes.

Received product has not been sent back to SIYI seven (7) calendar days after replacement confirmation from SIYI.

Proof of damage during transit issued by the carrier cannot be provided.

Other circumstances stated in this policy.

7.2.3 1-Year Warranty Repair

You can request warranty repair service:

If a product does not function as warranted during the warranty period, you may obtain after-sales service by contacting SIYI's service center. You will need to provide a valid proof-of-purchase, receipt, or order number for the warranty service.

Charges may apply for services not covered by this Limited Warranty. Please contact SIYI for information specific to your location.

Please note that the warranty service is only available in the respective SIYI service regions where you purchased your SIYI product.

Warranty Repair service will not be provided where:

Crashes or fire damage caused by non-manufacturing factors, including but not limited to pilot errors.

Damage caused by unauthorized modification, disassembly, or shell opening not in accordance with official instructions or manuals.

Damage caused by improper installation, in correct use, or operation not in accordance with official instructions or manuals.

Damage caused by non-authorized service provider.

Damage caused by unauthorized modification of circuits and mismatch or misuse of the battery and charger.

Damage caused by operation in bad weather (i.e., strong winds, rain, sand/dust storms, etc.)

Damage caused by operating the product in an environment with electromagnetic interference (i.e., in mining areas or close to radio transmission towers, high-voltage wires, substations, etc.)

Damage caused by operating the product in an environment suffering from interference from other wireless devices (i.e., transmitter, video-downlink, Wi-Fi signals, etc.)

Damage caused by reliability or compatibility issues when using unauthorized third-party parts.

Damage caused by operating the unit with a low-charged or defective battery.

Products or parts with an altered identification label or from which the identification label has been removed.

SIYI Technology

Business Inquiry: info@siyi.biz

Phone: +86 400 838 2918

A/S Center: support@siyi.biz