



SparkNavi

SparkNavi TinyPOS-900

User Manual

Product Number	SparkNavi TinyPOS-900
Author	Ethan Huang
Version	V1.2
Update Date	2024-10-17

Revision Record

Date	Version	Description	Arthor
2024-10-14	V1.0	First Release Version	Ethan
2024-11-07	V1.1	Modify the GPS output baud rate	Ethan
2024-11-17	V1.2	Add AT Command description and RTK configure	Ethan

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This technical document supports the following TinyPOS models.

TinyPOS 900



SparkNavi TinyPOS900 Specifications

Appearance



Specification

Features

The TinyPOS is a compact, lightweight GNSS/INS (Global Navigation Satellite System/Inertial Navigation System) navigator specifically designed for drones, fully compatible with Pixhawk and Ardupilot platforms. By combining the strengths of GNSS and Inertial Measurement Unit (IMU), this all-attitude navigator delivers exceptional positioning accuracy and stability, offering continuous position and orientation data even in challenging signal environments or GNSS outages. The system features a built-in high-speed storage device, ensuring self-contained operation for precision applications.

Built-In SparkNavi IMU600



- Gyroscope In-Run Bias Stability 0.9 °/h
- Triple Gyroscopes ± 125 °/s /
- Tri-Axis Accelerometer ± 6 G

Gyro Analysis:

gyro_x:

Bias Instability: 0.538979 deg/hour

Noise (Std Dev): 0.008192962 deg/s

ARW (Angle Random Walk): 0.764686 deg/ $\sqrt{\text{hr}}$

gyro_y:

Bias Instability: 0.549252 deg/hour

Noise (Std Dev): 0.009673080 deg/s

ARW (Angle Random Walk): 0.741116 deg/√hr

gyro_z:

Bias Instability: 0.568994 deg/hour

Noise (Std Dev): 0.006763415 deg/s

ARW (Angle Random Walk): 0.754317 deg/√hr

Accel Analysis:

accel_x:

Bias Instability: 2.477705 m/s/hour

Noise (Std Dev): 0.027623636 m/s²

VRW (Velocity Random Walk): 41.2951 mm/s/√hr

accel_y:

Bias Instability: 2.086176 m/s/hour

Noise (Std Dev): 0.023265226 m/s²

VRW (Velocity Random Walk): 34.7696 mm/s/√hr

accel_z:

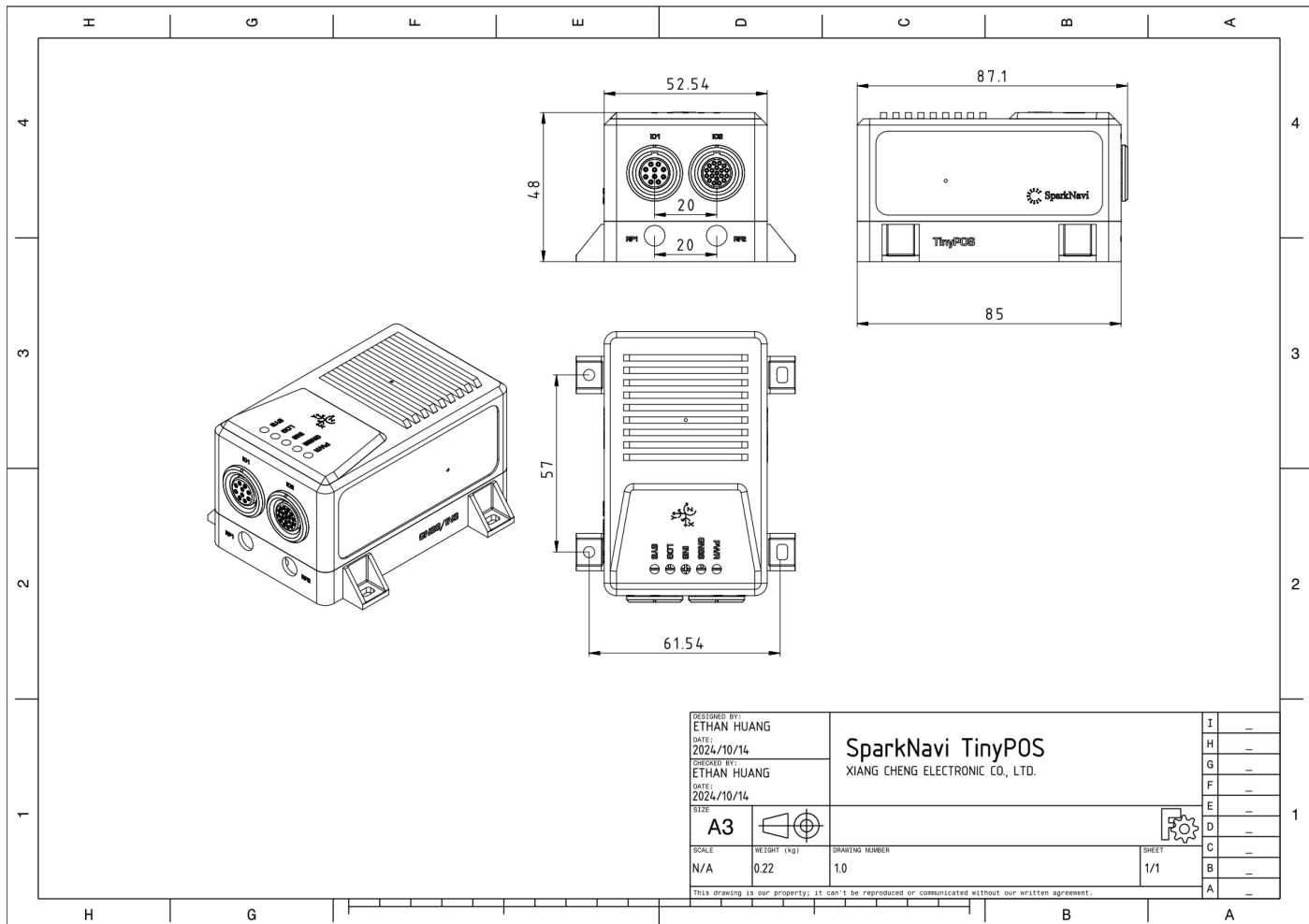
Bias Instability: 5.738274 m/s/hour

Noise (Std Dev): 0.063863667 m/s²

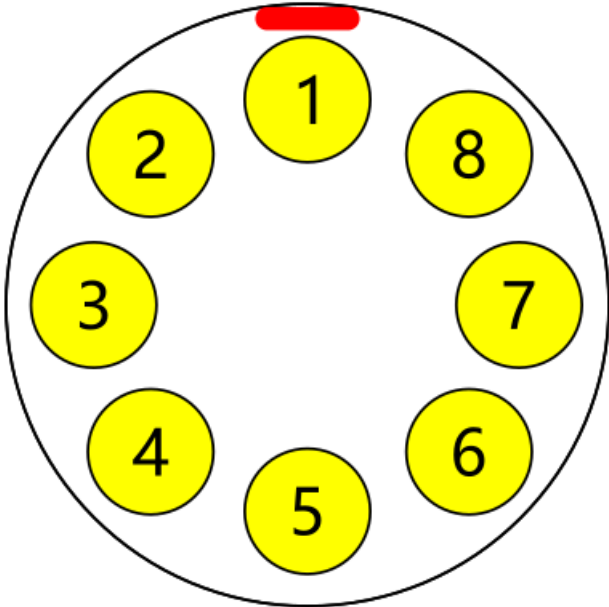
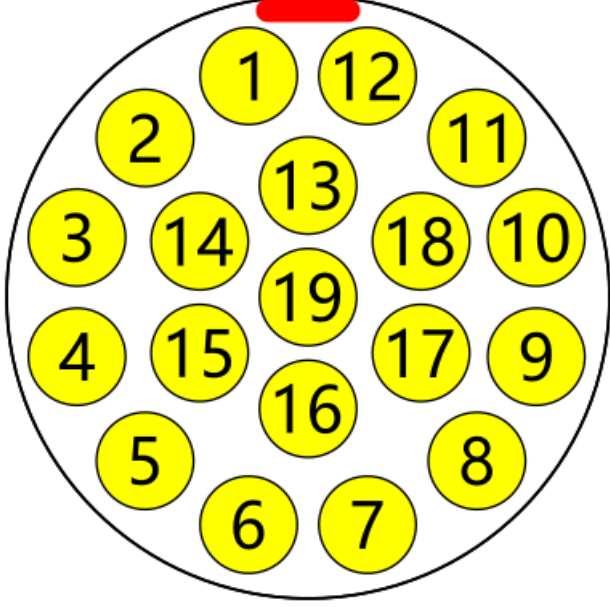
VRW (Velocity Random Walk): 95.6379 mm/s/√hr

GNSS Signals	GPS L1C/A, L2C GLONASS L1OF, L2OF, Galileo E1-B/C, E5b, BeiDou B1I, B2I
INS System Time to Position Fix	60 seconds
RF	Default 4G LTE Cat.4 (Order placement options: 4G / 433MHz / 915MHz / 2.4GHz)
Temperature Operating	Temperature Operating -40°C to +85°C
Interfaces	<ul style="list-style-type: none"> ● INS Position UBX Protocol Output x 1 ● GNSS UBX Protocol Output x 1 ● INS Position Raw Data Output x 1 ● 1PPS out ● 1Hz Trigger out ● 5Hz Trigger out
Dimensions	- Length: 85mm - Width: 70.5 mm - Height: 48.5 mm
Weight	<ul style="list-style-type: none"> ● Net weight of the machine : 218g ● Connector: 55g
Place of origin	Design and made in Taiwan
Power Input	DC +12V ~ +55V

Engineering Dimension Diagram



IO1/IO2 Interface Description

Pin Configuration and Color Correspondence	
 <p>IO1 Front View</p>	 <p>IO2 Front View</p>

SparkNavi- Aviation Connector IO Definition

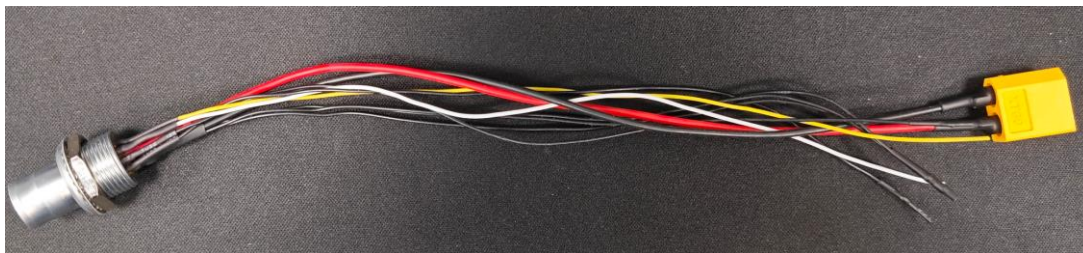
IO1		
8 Pin		
No.	8 Pin	Description
1	VIN	DC +12V ~ +55V
2	VIN	
3	TriggerIO1	1Hz Trigger Out
4	TriggerIO2	5Hz Trigger Out
5	Reversed	
6	Reversed	
7	GND	Ground
8	GND	

IO2		
19 Pin		
No.	19 Pin	Description
1	VDD_3V3	
2	IPPS	IPPS Output
3	GPS_RX2	GNSS UBX Protocol Output
4	GPS_TX2	
5	GND	Ground
6	USART1_RX	INS Position UBX Protocol Output
7	USART1_TX	
8	GND	Ground
9	USB_DP	Upgrade Firmware and AT Command
10	USB_DM	
11	GND	Ground
12	Reversed	
13	Reversed	
14	GND	Ground
15	USART2_RX	INS Position Raw Data Output
16	USART2_TX	
17	USART2_RTS	
18	USART2_CTS	
19	GND	Ground

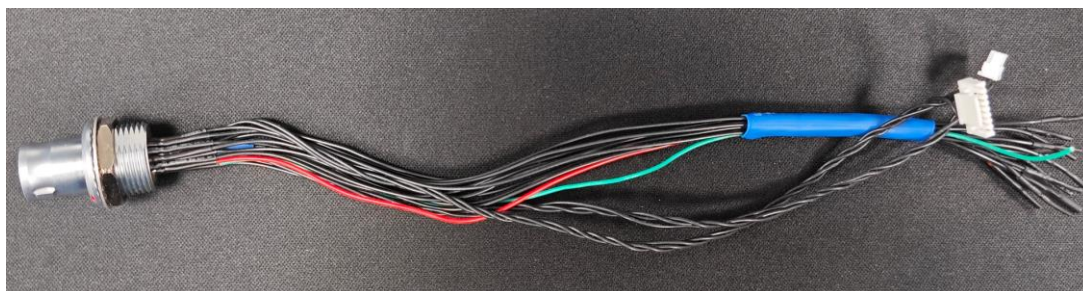


IO1/IO2 Aviation Connector Appearance

IO1 Connector

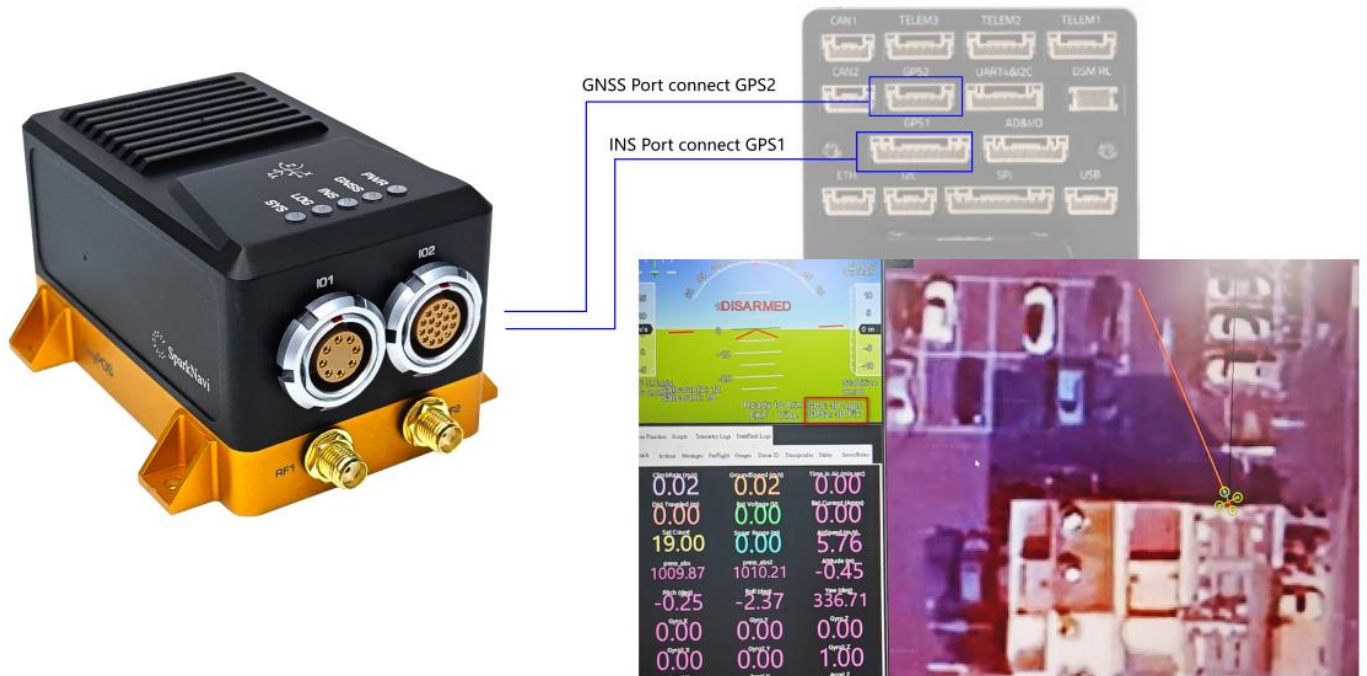


IO2 Connector



Installation Steps

1. Connect the INS data to the GPS1 port of the flight controller computer
2. Connect the GNSS data to the GPS2 port of the flight controller computer



For actual wiring with the flight controller computer, please refer to the diagram below:



Flight controller parameters are set as follows:

GPS1 for GNSS, GPS2 for INS

AHRS_GPS_USE = 0

GPS_TYPE = 5

GPS_TYPE2 = 1

SERIAL3_BAUD = 57

SERIAL3_PROTOCOL = 5

SERIAL4_BAUD = 230

SERIAL4_PROTOCOL = 5

The SERIAL3_BAUD is 57600 and SERIAL4_BAUD is modified to 230400, which is a good baud rate choice, because sometimes we will use this baud rate to receive GPS data from the Telemetry module or from TinyPOS.

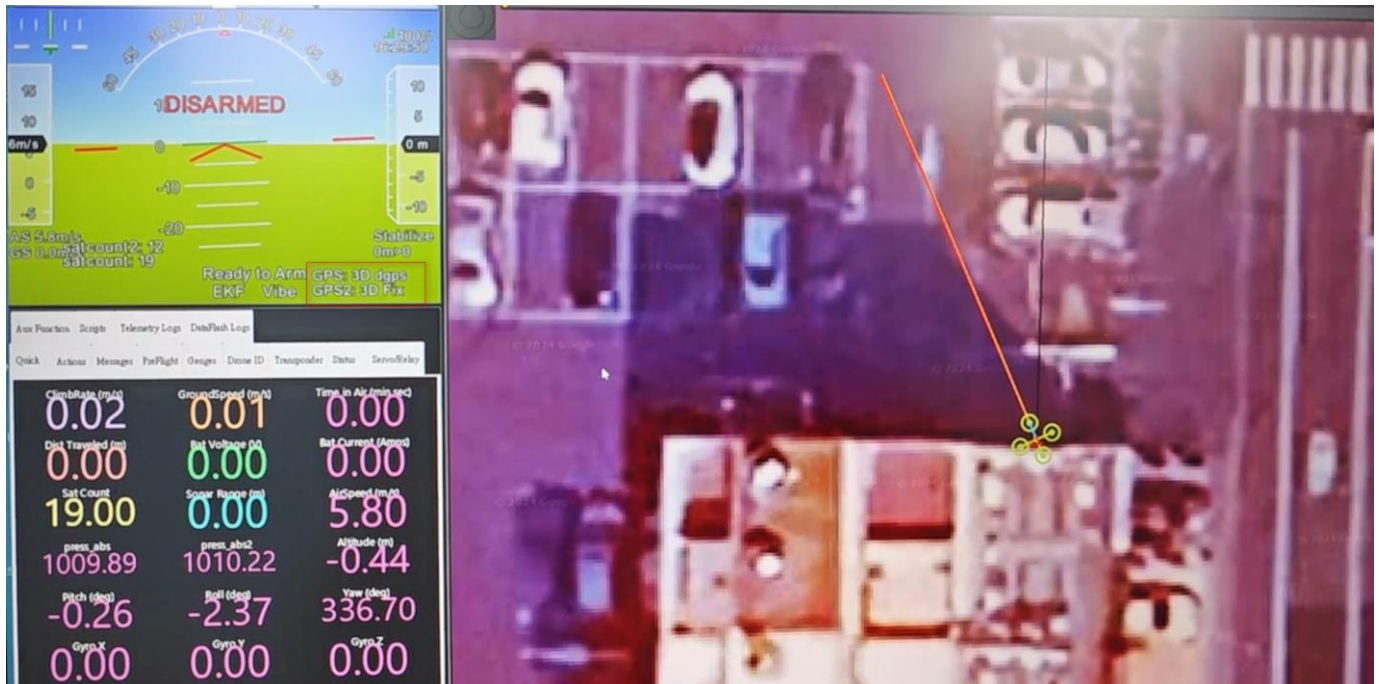
AHRS_GPS_USE	0	0:Disabled 1:Use GPS for DCM position 2:Use GPS for DCM position and height
--------------	---	---

Name	Value	Units	Options
GPS_TYPE	1		0:None 1:AUTO 2:uBlox 5:NMEA 6:SRF 7:HIL 8:SwiftNav 9:DroneCAN 10:SBF 11:GSOF 13:ERB 14:MAV 15:NOVA 16:HemisphereNMEA 17:uBlox-MovingBaseline-Base 18:uBlox-MovingBaseline-Rover 19:MSP 20:AlyStar 21:ExternalAHRS 22:DroneCAN-MovingBaseline-Base 23:DroneCAN-MovingBaseline-Rover 24:UnicoreNMEA 25:UnicoreMovingBaselineNMEA 26:SBF-DualAntenna
GPS_TYPE2	5		0:None 1:AUTO 2:uBlox 5:NMEA 6:SRF 7:HIL 8:SwiftNav 9:DroneCAN 10:SBF 11:GSOF 13:ERB 14:MAV 15:NOVA 16:HemisphereNMEA 17:uBlox-MovingBaseline-Base 18:uBlox-MovingBaseline-Rover 19:MSP 20:AlyStar 21:ExternalAHRS 22:DroneCAN-MovingBaseline-Base 23:DroneCAN-MovingBaseline-Rover 24:UnicoreNMEA 25:UnicoreMovingBaselineNMEA 26:SBF-DualAntenna

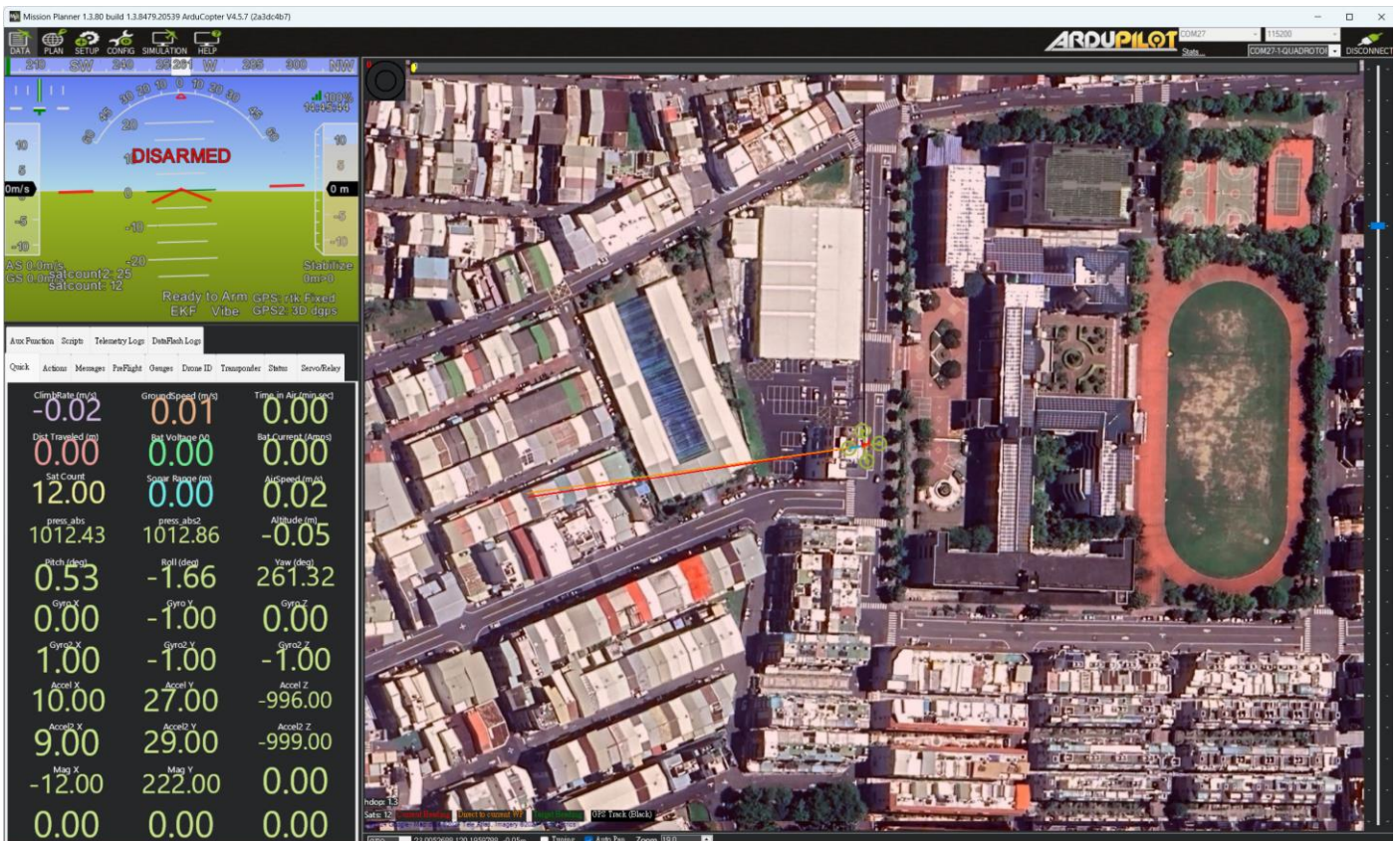
SERIAL3_BAUD	57	1:1200 2:2400 4:4800 9:9600 19:19200 38:38400 57:57600 111:111100 115:115200 230:230400 256:256000 460:460800 500:500000 921:921600 1500:1500000 2000:2000000
SERIAL3_OPTIONS	0	
SERIAL3_PROTOCOL	5	-1:None 1:MAVLink1 2:MAVLink2 3:Frsky D 4:Frsky SPort 5:GPS 7:Alexmos Gmbal Serial 8:Gmbal 9:RangeFinder 10:FrSky SPort Passthrough (OpenTX) 11:Lidar360 13:Beacon 14:Volz servo out 15:SBUS servo out 16:ESC Telemetry 17:Devo Telemetry 18:OpticalFlow 19:RobotixServo 20:NMEA Output 21:WindVane 22:SLCAN 23:RCIN 24:EFI Serial 25:LTM 26:RunCam 27:Hott Telem 28:Scripting 29:Crossfire VTX 30:Generator 31:Winch 32:MSP 33:DJI FPV 34:AirSpeed 35:ADSB 36:AHRS 37:SmartAudio 38:FETecOneWire 39:Torqeedo 40:AIS 41:CoDevESC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDS XRC 46:IMUDATA 48:PPP

SERIAL4_BAUD	230	1:1200 2:2400 4:4800 9:9600 19:19200 38:38400 57:57600 111:111100 115:115200 230:230400 256:256000 460:460800 500:500000 921:921600 1500:1500000 2000:2000000
SERIAL4_OPTIONS	0	
SERIAL4_PROTOCOL	5	-1:None 1:MAVLink1 2:MAVLink2 3:Frsky D 4:Frsky SPort 5:GPS 7:Alexmos Gmbal Serial 8:Gmbal 9:RangeFinder 10:FrSky SPort Passthrough (OpenTX) 11:Lidar360 13:Beacon 14:Volz servo out 15:SBUS servo out 16:ESC Telemetry 17:Devo Telemetry 18:OpticalFlow 19:RobotixServo 20:NMEA Output 21:WindVane 22:SLCAN 23:RCIN 24:EFI Serial 25:LTM 26:RunCam 27:Hott Telem 28:Scripting 29:Crossfire VTX 30:Generator 31:Winch 32:MSP 33:DJI FPV 34:AirSpeed 35:ADSB 36:AHRS 37:SmartAudio 38:FETecOneWire 39:Torqeedo 40:AIS 41:CoDevESC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDS XRC 46:IMUDATA 48:PPP

Start up TinyPOS and flight controller, then open Mission Planner to view the status of GPS1 and GPS2



When using the NTRIP client function or local RTK mode, we can see the 'RTK Fixed' status message on the Mission Planner screen.



AT Command

UDP Client Configuration

Command Format

AT+UDPCFG=<ip>,<port>

Parameter Description

- <ip>: Remote UDP Server IP address
- <port>: Remote UDP Server port number

Example

AT+UDPCFG=209.182.216.19,5254

Function Description

After configuration, TinyPOS will automatically transmit INS Data to the specified UDP Server

Data Transmission Format

\$573333.813,23.005344391,120.195922852,37.50,-0.000000,-0.005318,0.000000,0.00,0.00,180.00,1.95,0.42,0.20,E

Data Field Description

Field	Description	Unit
\$	Data start symbol	-
573333.8	INS Time	sec
23.00534	INS Latitude (N)	deg
120.1959	INS Longitude (E)	deg
37.5	INS Altitude	m
0	North velocity	m
-0.00532	East velocity	m
0	Down velocity	m
0	INS Orientation[0]	deg
0	INS Orientation[1]	deg
180	INS Orientation[2]	deg
1.95	roll	deg
0.42	pitch	deg
0.2	yaw	deg
E	End symbol	-

UDP Function Control

Command Format

AT+UDP=<mode>

Parameter Description

<mode>:

- 0: Disable UDP function
- 1: Enable UDP function

Example

- AT+UDP=1 // Enable UDP function
- AT+UDP=0 // Disable UDP function

Important Note

The UDP function must be enabled for the UDP Client to operate properly. Make sure to enable it before using UDP Client functionality.

Command Sequence

1. Enable UDP function: AT+UDP=1
2. Configure UDP Client settings (IP and Port)
3. Start transmitting INS data

NTRIP Function Control

Command Format

AT+NTRIP=<mode>

Parameter Description

<mode>:

- 0: Disable NTRIP function
- 1: Enable NTRIP function

Example

- AT+NTRIP=1 // Enable NTRIP function
- AT+NTRIP=0 // Disable NTRIP function

Important Note

The NTRIP function must be enabled for the NTRIP Client to operate properly. Make sure to enable it before using NTRIP Client functionality.

Command Sequence

1. Enable NTRIP function: AT+NTRIP=1
2. Configure NTRIP Client settings
3. Start receiving NTRIP correction data

NTRIP Client Configuration

Command Format

AT+NTRIPCFG=<ip>,<port>,<username>,<password>

Parameter Description

- <ip>: NTRIP Server IP address
- <port>: NTRIP Server port number
- <username>: Your NTRIP account username
- <password>: Your NTRIP account password

Example

AT+NTRIPCFG=210.241.63.193,81,username,password

Connection Status

When successfully connected, the Mission Planner will display "RTK Fixed" status.

Important Notes

1. Make sure to insert your 4G SIM card before configuration
2. The SIM card should **NOT** have a PIN code set
3. Ensure the NTRIP function is enabled (AT+NTRIP=1) before configuration

Setup Sequence

1. Insert SIM card (without PIN code)
2. Enable NTRIP function
3. Configure NTRIP Client settings
4. Check Mission Planner for RTK Fixed status

RTK Rover Configuration

Overview

TinyPOS can function as an RTK Rover for regional applications.

Hardware Connection

Connect TinyPOS IO2 pins to Telemetry module:

- GPS_RX2 (pin 3)
- GPS_TX2 (pin 4)
- GND (pin 5)

Communication Settings

- Protocol: GNSS UBX Protocol Output
- Default Baud Rate: 57600

Connection Diagram

TinyPOS IO2	Telemetry Module
-----	-----
GPS_RX2 (pin 3)	→ RX
GPS_TX2 (pin 4)	→ TX
GND (pin 5)	→ GND

Important Notes

1. Make sure to use the correct baud rate (57600) for communication
2. Verify proper pin connections before operation
3. Ensure proper grounding for stable communication

IO2		
19 Pin		
No.	19 Pin	Description
1	GPS_RX2	GNSS RX2
2	GPS_TX2	GNSS TX2
3	GPS_RX2	GNSS UBX Protocol Output
4	GPS_TX2	GNSS UBX Protocol Output
5	GND	Ground
6	GPS_RX2	GNSS RX2
7	GPS_TX2	GNSS TX2

RTK Base Setup with u-blox F9P Module

Overview

Ground station setup using a u-blox F9P module as RTK Base station.

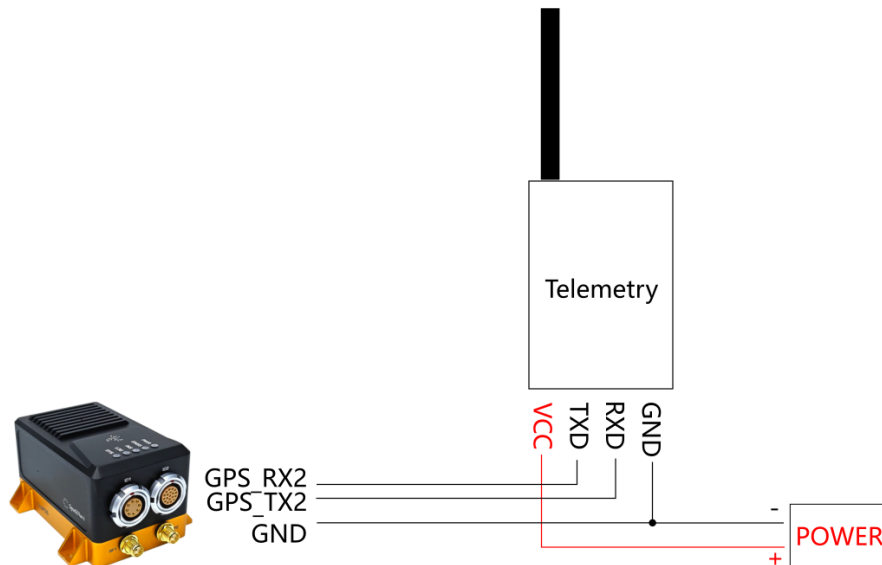
Connection Details

Pin Connections

1. F9P TX1 → Telemetry RX
2. F9P RX1 → Telemetry TX
3. F9P GND → Telemetry GND

Important Notes

1. Ensure proper ground connection for stable communication
2. Verify signal connections (TX→RX, RX→TX) are correct
3. Use appropriate power supply for both modules



RTK Base Configuration Guide

Port (PRT) Configuration Steps

UART1 Settings

1. Navigate to Configure → PRT
2. Configure the following settings:

Protocol Settings

- Protocol In: 0+1+5 (UBX+NMEA+RTCM3)
- Protocol Out: 0+1+5 (UBX+NMEA+RTCM3)

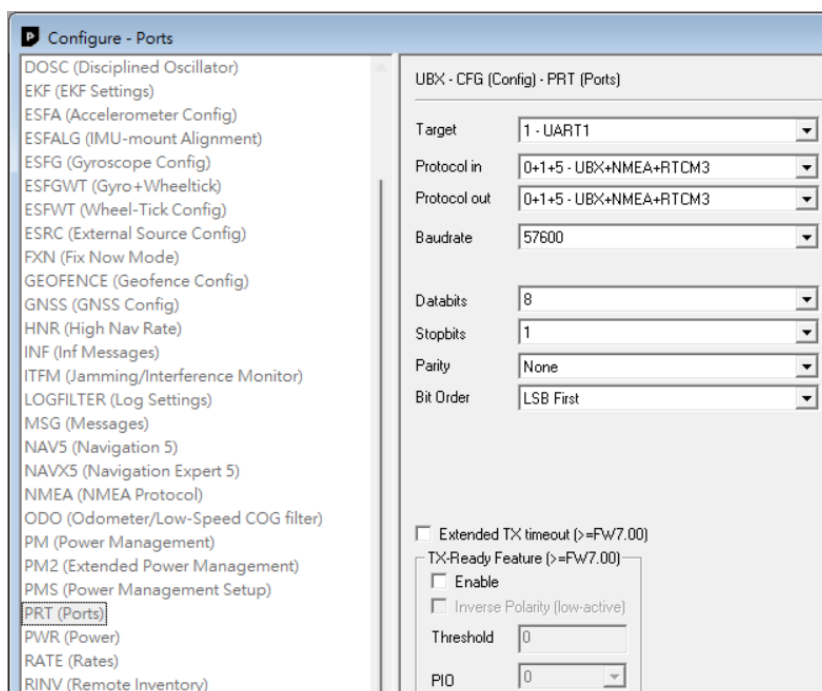
Communication Settings

- Port: UART1 (for Telemetry connection)
- Baud Rate: 57600

Port Configuration	
Protocol Settings Protocol In: 0+1+5 (UBX+NMEA+RTCM3) Protocol Out: 0+1+5 (UBX+NMEA+RTCM3)	UART1 Settings Port: UART1 Baud Rate: 57600
Important Notes: <ul style="list-style-type: none">• Configure UART1 if using Telemetry connection• Ensure RTCM3 is included in Protocol Out	

Important Notes

1. RTCM3 protocol must be included in Protocol Out
2. Only configure UART1 if using Telemetry connection
3. Match the baud rate with your Telemetry module (57600)



The screenshot shows the 'Configure - Ports' window. On the left is a list of configuration categories, with 'PRT (Ports)' selected. The main area is titled 'UBX - CFG (Config) - PRT (Ports)'. It contains several dropdown menus for configuration: 'Target' is set to '1 - UART1', 'Protocol in' is '0+1+5 - UBX+NMEA+RTCM3', 'Protocol out' is '0+1+5 - UBX+NMEA+RTCM3', 'Baudrate' is '57600', 'Databits' is '8', 'Stopbits' is '1', 'Parity' is 'None', and 'Bit Order' is 'LSB First'. At the bottom, there are checkboxes for 'Extended TX timeout (>=FW7.00)' (unchecked), 'TX-Ready Feature (>=FW7.00)' (unchecked), 'Enable' (unchecked), and 'Inverse Polarity (low-active)' (unchecked). There are also input fields for 'Threshold' (set to 0) and 'PIO' (set to 0).

RTK Base Message Configuration

Configure → MSG (Messages) Settings

Required RTCM3.3 Messages

Enable the following messages for UART1 (Telemetry connection): °

Message ID	Description	Status
RTCM 1005	Station Coordinates	✓
RTCM 1074	GPS MSM4	✓
RTCM 1084	GLONASS MSM4	✓
RTCM 1094	Galileo MSM4	✓
RTCM 1124	BeiDou MSM4	✓
RTCM 1230	GLONASS Code-Phase Biases	✓

UBX - CFG (Config) - MSG (Messages)

Message

F5-05 RTCM3.3 1005

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

SPI

☐ On

0

UBX - CFG (Config) - MSG (Messages)

Message

F5-4A RTCM3.3 1074

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

SPI

☐ On

0

UBX - CFG (Config) - MSG (Messages)

Message

F5-54 RTCM3.3 1084

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

SPI

☐ On

0

UBX - CFG (Config) - MSG (Messages)

Message

F5-5E RTCM3.3 1094

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

SPI

☐ On

0

UBX - CFG (Config) - MSG (Messages)

Message

F5-7C RTCM3.3 1124

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

SPI

☐ On

0

UBX - CFG (Config) - MSG (Messages)

Message

F5-E6 RTCM3.3 1230

I2C

☐ On

0

UART1

☒ On

1

UART2

☒ On

1

USB

☒ On

1

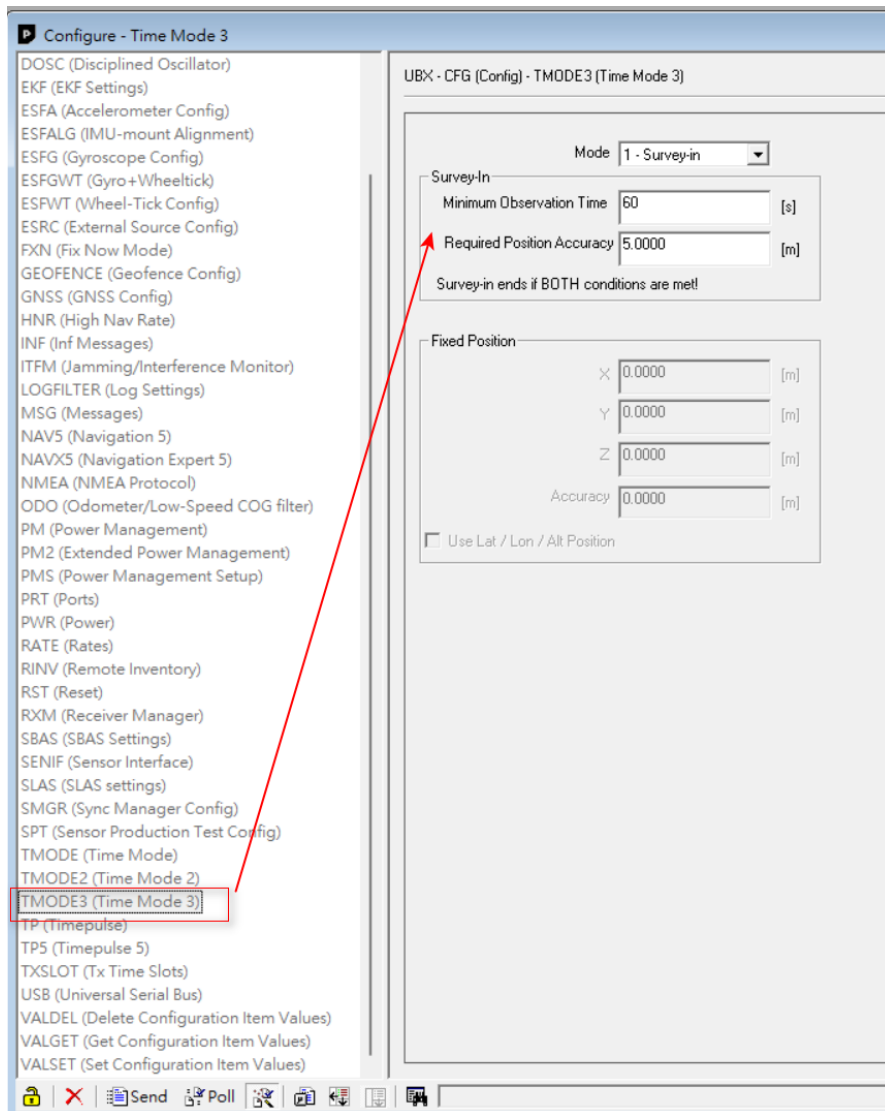
SPI

☐ On

0

Please set the following in Configure→TMODE3:

- Mode = 1. Survey-in
- Minimum Observation Time: 60 s
- Required Position Accuracy: 5 m



Please right-click on UBX → NAV → PVT to open the Message.

