CGI-830 GNSS&IMU Sensor

User Manual

Navigation | August 2024

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Preface

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Guide Overview

Welcome to the CGI-830 Product User Guide. This guide primarily uses the CGI-830 receiver as an example to describe how to install, set up and use this series of products.

Revision History

Revision Date	Revision Number	Revision Summary
2024.02	Ⅰ	Product User Guide
2024.08	Ⅱ	Optimize document content

Guide Conventions

Example	Description
【Files】→【Exit】	Click the “File” menu, then select “Exit” from the submenu.
Point Name	Shaded content indicates input fields or labels within dialogs or windows.
OK	Press or click the button or key labeled “OK”.

TIP

Supplementary information that aids in the maintenance and setup of the system or device.

NOTICE

Supplementary information that impacts system operation, device performance, field observations, or personal safety.

WARNING

Operational precautions that may result in system damage, data loss, voided warranty, or personal injury.

DANGER

Under no circumstances should this operation be performed.

Disclaimer

CHCNAV is dedicated to continually enhancing the functionality and performance of our products. As such, product specifications and guide content may be subject to change without prior notice. And CHCNAV will not be responsible for any loses caused by the wrong operation or misunderstanding of this User Guide. We appreciate your understanding. In the event of any discrepancies between the icons, images, or other content in this guide and the actual product, please refer to the physical product. The company reserves the right to make the final interpretation of all technical parameters and graphical information.

Before using this product, please read this guide thoroughly. CHCNAV will not be liable for any losses resulting from improper use of the product due to failure to follow the instructions or misunderstanding of the guide.

This product is designed to withstand certain harsh environments. However, as a high-precision electronic instrument, it should be handled with care. Operating or storing the receiver outside the specified temperature range may cause damage.

Technical Support and Services

CHCNAV Knowledge Base

CHCNAV Knowledge Base (https://support.chcnav.com/kb/) is an official website for sharing all official product materials, including guides, software, firmware, presentations, and videos. It helps to learn product operations and solve common after-sales problems. CHCNAV continually updates the knowledge base to make your work more efficient.

For dealers, please provide username, e-mail address, country, and company information to your regional technical support engineer to apply for an account.

Any technical issue, please visit the CHCNAV knowledge base for a solution.

Before Contacting Customer Support

If you still encounter problem after checking CHCNAV website (www.chcnav.com) or knowledge base, please contact local technical support and provide the following information:

1.Firmware and hardware versions of the receiver.

2.Download the system run log file.

3.Clearly describe the problem.

4.Pictures or videos about the problem.

5.Send all the information to support: support@chcnav.com.

Safety Information

Before using CHCNAV products, please ensure that you have carefully read and understood this user guide and the safety requirements.

1 Introduction

1.1 Overview

The CGI-830 is a combined navigation product developed by Shanghai Huace Navigation Technology Co., Ltd. That integrates satellite positioning with inertial measurement through multi-sensor data fusion technology. The product adopts an all-constellation multi-frequency solution, offering all-weather, global coverage with high precision, efficiency, and wide applicability. To address challenges like satellite signal blockage in urban canyons, buildings, forests, and multipath interference, the CGI-830 is equipped with a high-precision MEMS gyroscope and accelerometer and supports external odometer input. Leveraging the next-generation multi-sensor data fusion technology, the system's reliability, accuracy, and dynamic performance are significantly enhanced, providing real-time, high-precision information on carrier position, attitude, speed, and sensors. This meets the demanding requirements for long-duration, high-precision, and high-reliability navigation in complex environments such as urban canyons.

1.2 Features

The CGI-830 GNSS&IMU Sensor has the following features:

(1) Supports all-constellation and multi-frequency signal tracking, including BDS B1/B2/B3, GPS L1/L2/L5, GLONASS L1/L2, Galileo E1/E5a/E5b, and QZSS L1/L2/L5. Powered by the Full-constellation Multi-frequency RTK Algorithm Engine.

(2) Equipped with a high-precision MEMS IMU featuring a bias instability of 0.03°/h (Allan, 1σ), which ensures superior accuracy in navigation and orientation.

(3) The orientation accuracy of 0.1°/2 meters baseline makes it suitable for use in railway track inspection and underwater measurement applications.

(4) Utilizes CHCNAV CTCLIB 2.0 tightly coupled algorithm engine for more reliable positioning in complex scenarios.

(5) Supports external Doppler Velocity Log (DVL) and Ultra-Short Baseline (USBL) positioning systems, and can be used for underwater navigation with heave compensation algorithms.[1]

(6) Supports Wi-Fi wireless access and offers a web-based interface for easy user configuration.

(7) Features compact internal vibration damping technology with strong adaptability to vibration and shock, ensuring high reliability.

(8) Includes a dedicated post-processing parameter model that supports POS post-processing.

(9) IP67 protection rating, suitable for various harsh environments.

(10) Built-in universal 4G communication module.

(11) Supports up to 100Hz data updating.

(12) Supports pure inertial navigation for self-alignment to true north.

(13) Supports external odometer connection.

Note: [1] USBL functionality is under development and will be supported in future upgrades.

1.3 Specifications

INS Performance	Coupling Type	Tightly Coupled Algorithmic Engines （CTCLIB2.0）
	Position Error (RMS)	≤0.15% (GNSS Outage 1km or 60s)
	Heading Error (RMS)	≤0.15° (1km or 60s)
	Attitude Accuracy (RMS)	≤0.1
	Initialization Time	< 60 Seconds
	Initialization Reliability	> 99.9%
	Data Format	NMEA 0183, CHC (Configurable)
	Operating Mode	Vehicle, Construction Machinery, AHRS
	Input	Wheel Speed Info (Configurable)
POS Reprocessing	Data Format	Ephemeris Data：GPS/BDS/GLO/GAL/QZSS IMU Data: Rawimu/Rawimusb
	Inertial Explorer	Support
GNSS Performance Indicators	Signal Tracking	BDS: B1/B2/B3 GPS: L1/L2/L5 GLONASS: L1/L2 Galileo: E1/E5a/E5b QZSS: L1/L2/L5
	Horizontal Positioning Accuracy (RMS)	Single point: 1.2 m DGPS: 0.4 m RTK: 1 cm + 1 ppm

	Altitude Positioning Accuracy (RMS)	Single: 2.5 m DGPS: 0.4 m RTK: 2 cm + 1 ppm
	Heading Accuracy (RMS)	0.1°/2 m Baseline
	Velocity Accuracy (RMS)	0.03 m/s
	PPS Timing Accuracy (RMS)	20 ns
	Cold Start Time	≤45 s
Data Rate	GNSS Raw Data Rate	Configurable [1] 20 Hz MAX
	IMU Raw Data Rate	100 HZ
	INS Position/Attitude Rate	Up to 100 Hz [2]
IMU Performance Specifications	Type	MEMS
	Gyro Dynamic Range	±300°/s
	Gyro Bias Instability (Allan Variance)	0.03°/h
	Gyro Angular Random Walk (Allan Variance)	0.03°/√h
	Accelerometer Dynamic Range	±10g
	Accelerometer Bias Instability (Allan)	30ug
	Accelerometer Angular Random Walk (Allan)	0.02m/s/√hr
Communication Interface	External Interface	2 × RS232 Serial Port 1 × RS422Serial Port 1 × CAN Port 1 ×Ethernet Port 1 × MINI USB
		2 × GNSS Antenna Connector (TNC) 1 × 4G Antenna Port (TNC) 1 × Powe （DC5525）

	Web User Interface		Allows remote configuration, data retrieval and firmware updates, INS calibration, NTRIP login					
	Network Modem		LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28 LTE-TDD: B38/B39/B40/B41 UMTS: B1/B2/B4/B5/B6/B8/B19 GSM: B2/B3/B5/B8					
	Wi-Fi		802.11 b/g/n,Access Point Mode Default IP 192.168.200.1					
	Data storage		8 GB High-Speed Memory					
Environmental Tolerance	Operating Temperature		-40°C ~ +75°C					
	Storage Temperature		-40°C ~ +85°C					
	Humidity		95% RH NC					
	Anti-static		ISO10605 Contac ±8 kv, Air ±15 kv					
	Ingress Protection (IP) Rating		IP67					
	Vibration		MIL-STD-810G (20g)					
	Impact		IEC-60028-2-27 (10g)					
Physical Property and Electrical Characteristics	Power Input		9 to 32V DC input (Standard Adaptation 12V DC)					
	Power Consumption		< 5 W (Typical)					
	Physical Dimensions		169×121×55 mm					
	Weight		1.15Kg (without antenna and cable)					
Performance During GNSS Outages (RMS)[3]	GNSS Outages Duration	Positioning Mode	Location Accuracy (m)		Velocity Accuracy (m/s)		Attitude Accuracy (°)	
			Horizontal	Vertical	Horizontal	Vertical	Attitude	Heading

	0s	RTK	0.02	0.03	0.02	0.01	0.03	0.08
		Post-Processed	0.01	0.02	0.01	0.01	0.003	0.01
	10s	RTK	0.15	0.10	0.05	0.02	0.03	0.10
		Post-Processed	0.01	0.02	0.01	0.02	0.003	0.01
	60s	RTK	1.50	1.00	0.05	0.05	0.05	0.12
		Post-Processed	0.10	0.05	0.01	0.05	0.004	0.014

Notes: [1] With GNSS receiver, GNSS RTK results up to 20Hz output, 1Hz raw data.

[2] INS solution data is CHCNAV tightly coupled real-time data output frequency, post-processing output frequency can be configured according to software.

[3] Post-processing results using Inertial Explorer software. The parameter values listed in this document are either theoretical values or values measured by CHCNAV personnel under specific controlled test conditions. Due to individual product differences, firmware versions, and usage conditions, the actual values during usage may vary. Please refer to the actual usage conditions. To provide the most accurate product information and parameter values, CHCNAV may make real-time adjustments and corrections to the text, parameter values, and other content in this document to match the actual product performance, specifications, and other information. Due to real-time changes in product batches and production supply factors, we may not notify you of such modifications and adjustments. Please refer to the real-time information on the official website.

1.4 Data Protocol

1.4.1 GPCHC Data Protocol

It can be output through RS232_C port and RS422 port, the default baud rate is 230400, and the baud rate can be customized as 9600, 19200, 38400, 57600, 115200 and 460800.

$GPCHC,GPSWeek,GPSTime,Heading,Pitch,Roll,gyro x,gyro y,gyro z,acc x,acc y,acc z,Lattitude,Longitude,Altitude,Ve,Vn,Vu,V,NSV1,NSV2,Status,Age,WarningCs<CR><LF>

Field	Name	Explain	Format	Example
1	Header	GPCHC	$GPCHC	$GPCHC
2	GPSWeek	From 1980-1-6 to current week (GMT)	wwww	1980

3	GPSTime	Number of seconds from 0:00 this Sunday to the current time (GMT)	ssssss.ss	16897.68
4	Heading	0 to 359.99	hhh.hh	289.19
5	Pitch	-90 to 90	+/-pp.pp	-0.42
6	Roll	-180 to 180	+/-rrr.rr	0.21
7	gyro x	gyro X axis	+/-ggg.gg	-0.23
8	gyro y	gyro Y axis	+/-ggg.gg	0.07
9	gyro z	gyro Z axis	+/-ggg.gg	-0.06
10	acc x	acc X axis	+/-a.aaaa	0.0009
11	acc y	Acc Y axis	+/-a.aaaa	0.0048
12	acc z	Acc Z axis	+/-a.aaaa	-1.0037
13	Latitude	-90 to 90	+/-ll.lllllll	38.8594969
14	Longitude	-180 to 180	+/-ll.lllllll	121.5150073
15	Altitude	Geodetic height (meter)	+/-aaaaa.aa	121.51
16	Ve	Eastward speed (m/s)	+/-eee.eee	-0.023
17	Vn	Northward speed (m/s)	+/-nnn.nnn	0.011
18	Vu	Upward speed (m/s)	+/-uuu.uuu	0.000
19	V	Vehicle (m/s)	uuu.uuu	1.500
20	NSV1	Number of main antenna satellites	nn	14
21	NSV2	Number of secondary antenna satellite	nn	6

22	Status	System state (lower half byte): 0 initialization 1 Satellite navigation model 2 Integrated navigation mode 3 IMU navigation mode Satellite state (high half byte): 0:No position and no heading; 1:single position and heading; 2:DGPS position and heading ; 3:Integrated navigation; 4:RTK fixed position and heading ; 5:RTK float position and heading; 6:single position and no heading; 7:DGPS position and no heading; 8:RTK fixed position and no heading; 9: RTK float position and no heading	ss	42
23	Age	differential delay	aa	0
24	Warming	bit0:1:no GPS message，0:normal bit1:1:no vehicle message，0:normal bit3:gro wrong，0:normal bit4:acc wrong，0:normal	ww	2
25	Cs	XOR checkout	*hh	*47
26	<CR><LF>	Fixed the ending		<CR><LF>

1.4.2 GPCHCX Data Protocol

It can be output through RS232_C port and RS422 port, the default baud rate is 230400, and the baud rate can be customized as 9600, 19200, 38400, 57600, 115200 and 460800.

$GPCHCX,2277,271768.00,271.21,-1.67,-2.16,0.48,-0.14,0.11,0.0387,-0.0281,0.9986,31.15959761,121.17848221,52.17,0.01,0.00,0.03,0.01,28,23,61,0,2,2.68,3.01,3.30,0.01,0.01,0.02,0.39,0.39,1329.22,X,0.00,180.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,40,27,3512308*7F

Field	Name	Explain	Format	Example
1	Header	GPCHC	$GPCHC	$GPCHC

2	GPSWeek	From 1980-1-6 to current week (GMT)	wwww	1980
3	GPSTime	Number of seconds from 0:00 this Sunday to the current time (GMT)	ssssss.ss	16897.68
4	Heading2	Heading angle (0 to 359.99 degrees), with north-eastward clockwise direction as positive.	hhh.hh	289.19
5	Pitch	Pitch angle (-90 to 90 degrees), with the nose-up direction as positive.	+/-pp.pp	-0.42
6	Roll	Roll angle (-180 to 180 degrees), with the right roll of the vehicle as positive.	+/-rrr.rr	0.21
7	gyro x	gyro X axis	+/-ggg.gg	-0.23
8	gyro y	gyro Y axis	+/-ggg.gg	0.07
9	gyro z	gyro Z axis	+/-ggg.gg	-0.06
10	acc x	Acc X axis	+/-a.aaaa	0.0009
11	acc y	Acc Y axis	+/-a.aaaa	0.0048
12	acc z	Acc Z axis	+/-a.aaaa	-1.0037
13	Latitude	-90 to 90	+/-ll.lllllll	30.18787518
14	Longitude	-180 to 180	+/-ll.lllllll	120.20433095
15	Altitude	Geodetic height (meter)	+/-aaaaa.aa	121.51
16	Ve	Eastward speed (m/s)	+/-eee.eee	-0.023
17	Vn	Northward speed (m/s)	+/-nnn.nnn	0.011
18	Vu	Upward speed (m/s)	+/-uuu.uuu	0.000
19	V_2D	Vehicle planar velocity (m/s)	uuu.uuu	1.500

20	NSV1	Number of main antenna satellites	nn	14
21	NSV2	Number of secondary antenna satellite	nn	6
22	Status	System state (lower half byte): 0 initialization 1 Satellite navigation model 2 Integrated navigation mode 3 IMU navigation mode Satellite state (high half byte): 0:No position and no heading; 1:single position and heading; 2:DGPS position and heading ; 3:Integrated navigation; 4:RTK fixed position and heading ; 5:RTK float position and heading; 6:single position and no heading; 7:DGPS position and no heading; 8:RTK fixed position and no heading; 9: RTK float position and no heading	ss	42
23	Age	differential delay	aa	0

24	Warming	bit0: GNSS module data (reserved), 0: Normal 1: Interruption >1 minute bit1: Vehicle wheel speed data, 0: Normal 1: Interruption >1 minute bit2: PPS signal (reserved), 0: Normal 1: Interruption >1 minute bit3: Gyro data (reserved), 0: Normal 1: Abnormal >1 second bit4: Accelerometer data (reserved), 0: Normal 1: Abnormal >1 second bit5: Main antenna short circuit, 0: Normal 1: Abnormal >1 minute bit6: Main antenna open circuit, 0: Normal 1: Abnormal >1 minute bit7: Auxiliary antenna short circuit, 0: Normal 1: Abnormal >1 minute bit8: Auxiliary antenna open circuit, 0: Normal 1: Abnormal >1 minute bit9: Mobile network signal (reserved), 0: Normal 1: Abnormal bit10: SIM card status (reserved), 0: Normal 1: Abnormal bit11: COSR account (reserved), 0: Normal 1: Abnormal Notes for bit9: 1. If the product lacks the relevant function or detection capability, the default value is 0. 2. Mobile network signal threshold (reserved): 4G, -100 dBm 5G, -100 dBm	1	4
25	Lattitude_std	Latitude standard deviation (m)	nn.nn	0.22
26	Longitude_std	Longitude standard deviation (m)	nn.nn	0.33

27	Altitude_std	Altitude standard deviation (m)	nn.nn	0.85
28	Ve_std	Eastward Velocity Standard Deviation (m/s)	aa.aa	0.03
29	Vn_std	Northward Velocity Standard Deviation (m/s)	aa.aa	0.06
30	Vu_std	Upward Velocity Standard Deviation (m/s)	aa.aa	0.10
31	Roll_std	Roll Angle Standard Deviation (degree)	ss.ss	0.04
32	Pitch_std	Pitch Angle Standard Deviation (degree)	ss.ss	0.04
33	Heading2_std	Heading Angle Standard Deviation (degree)	ss.ss	0.05
34	Separator_X	separating fields 'X' Note: For ease of parsing and reference	X	X
35	Heading	Track Angle (0-359.99), with north-eastward clockwise direction as positive	+/-nnn.nn	120.21
36	Heading_std	Course Angle Standard Deviation (degree)	hh.hh	0.21
37	Ins2gnss_vector_x	Device to antenna position, X-axis lever arm within the vehicle coordinate system (m)	+/-nn.nn	-0.44
38	Ins2gnss_vector_y	Device to antenna position, Y-axis lever arm within the vehicle coordinate system (m)	+/-nn.nn	0.21
39	Ins2gnss_vector_z	Device to antenna position, Z-axis lever arm within the vehicle coordinate system (m)	+/-nn.nn	0.25
40	Ins2body_angle_x	Euler angle rotation from device coordinate system to vehicle coordinate system in Z-X-Y order (degree) Note: Compensates for small angles, does not include large installation angles.	+/-kk.kk	0.10
41	Ins2body_angle_y		+/-kk.kk	-0.1
42	Ins2body_angle_z		+/-kk.kk	0.1

43	Gnss2body_angle_z	Rotation angle from vehicle heading to GNSS orientation direction, rotating around the vehicle coordinate system's Z-axis (degree) Note: Compensates for small angles, does not include large installation angles.	+/-kk.kk	-0.2
44	VisNSV1	Number of visible satellites for primary antenna 1	ss	30
45	VisNSV2	Number of visible satellites for secondary antenna 2	bb	27
46	SN	Device Serial Number (SN)	abcdefe	6000006
47	Sum	XOR (Exclusive OR) checksum	*hh	*47
48	<CR><LF>	Packet trailer		<CR><LF>

1.4.3 CAN Data Protocol

The CAN port only supports CAN version 2.0, with default settings of Motorola format, baud rate 500K, standard frame, and the following protocol (default ID):

(1) Time CAN_ID (dec): 800

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	WeekTime	16	1	Week	From 1980-1-6 to current week (GMT)	0	uint_16
16	GpsTime	32	0.001	Second	Number of seconds from 0:00 this Sunday to the current time (GMT)	0	uint_32

(2) IMU angular velocity raw value CAN ID (dec): 801

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format

0	AngRateRawX	20	0.01	deg/s	X axis	0	int_20
20	AngRateRawY	20	0.01	deg/s	Y axis	0	int_20
40	AngRateRawZ	20	0.01	deg/s	Z axis	0	int_20

(3) IMU acceleration raw value CAN ID (dec): 802

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	AccelRawX	20	0.0001	g	X axis	0	int_20
20	AccelRawY	20	0.0001	g	Y axis	0	int_20
40	AccelRawZ	20	0.0001	g	Z axis	0	int_20

(4) INS positioning state CAN ID (dec): 803

Offset (bit)	Definition	Length (bit)	Coefficient	Explain	Offset Amount	Format
0	system_state	8	1	0: initialization 1: Satellite navigation model 2: Integrated navigation mode 3: IMU navigation mode	0	uint_8
8	GpsNumSatsUsed	8	1	Number of satellites used by the main antenna	0	uint_8

16	satellite_status	8	1	Satellite state (high half byte): 0: No position and no heading 1: single position and heading 2: DGPS position and heading 3: Integrated navigation 4: RTK fixed position and heading 5: RTK float position and heading 6: single position and no heading 7: DGPS position and no heading 8: RTK fixed position and no heading 9: RTK float position and no heading	0	uint_8
24	GpsNumSats2Used	8	1	Number of satellites used by the auxiliary antenna	0	uint_8
32	GpsAge	16	0.01	Differential delay	0	uint_16
48	GpsNumSats	8	1	Main antenna satellite tracking count	0	uint_8
56	GpsNumSats2	8	1	Auxiliary antenna satellite tracking count	0	uint_8

(5) Geodetic altitude CAN ID (dec): 805

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	PosAlt	32	0.001	m	Altitude	0	int_32

(6) Position std CAN ID (dec): 806

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	PosESigma	20	0.0001	m	Eastward std	0	uint_20

20	PosNSigma	20	0.0001	m	Northward std	0	uint_20
40	PosUSigma	20	0.0001	m	Upward std	0	uint_20

(7) Geodetic coordinate system velocity CAN_ID (dec): 807

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	VelE	16	0.01	m/s	Eastward velocity	0	int_16
16	VelN	16	0.01	m/s	Northward velocity	0	int_16
32	VelU	16	0.01	m/s	Upward velocity	0	int_16
48	Vel	16	0.01	m/s	Vehicle velocity	0	int_16

(8) Geodetic coordinate system velocity std CAN_ID (dec): 808

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	VelESigma	16	0.001	m/s	Eastward velocity std	0	uint_16
16	VelNSigma	16	0.001	m/s	Northward velocity std	0	uint_16
32	VelUSigma	16	0.001	m/s	Upward velocity std	0	uint_16
48	VelSigma	16	0.001	m/s	Vehicle velocity std	0	uint_16

(9) Vehicle coordinate system acceleration CAN_ID (dec): 809

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	AccelX	20	0.0001	g	X-axis acceleration	0	int_20

20	AccelY	20	0.0001	g	Y-axis acceleration	0	int_20
40	AccelZ	20	0.0001	g	Z-axis acceleration	0	int_20

(10) Attitude angle CAN_ID (dec): 810

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	AngleHeading	16	0.01	deg	Heading angle	0	uint_16
16	AnglePitch	16	0.01	deg	Pitch angle	0	int_16
32	AngleRoll	16	0.01	deg	Roll angle	0	int_16

(11) Attitude angle std CAN_ID (dec): 811

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	AngleHeadingSigma	20	0.0001	deg	Heading angle std	0	uint_20
16	AnglePitchSigma	20	0.0001	deg	Pitch angle std	0	uint_20
32	AngleRollSigma	20	0.0001	deg	Roll angle std	0	uint_20

(12) Vehicle coordinate system angular velocity CAN_ID (dec): 812

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	AngRateX	20	0.01	deg/s	X-axis angular velocity	0	int_20
20	AngRateY	20	0.01	deg/s	Y-axis angular velocity	0	int_20
40	AngRateZ	20	0.01	deg/s	Z-axis angular velocity	0	int_20

(13) Longitude CAN_ID (dec): 813

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	PosLon2	64	1E-008	deg	Longitude	0	int_64

(14) Latitude CAN_ID (dec): 814

Offset (bit)	Definition	Length (bit)	Coefficient	Unit	Explain	Offset Amount	Format
0	PosLat2	64	1E-008	deg	Latitude	0	int_64

1.5 User interface

1.5.1 Front Panel Interface

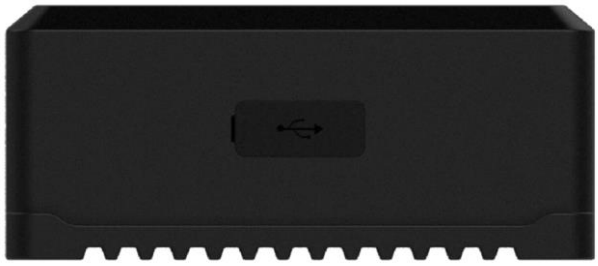
GNSS1: TNC interface for positioning antenna.

GNSS2: TNC interface for directional antenna.

4G: TNC interface for 4G antenna.

COM: customize aviation plug for hardware interface integration.

1.5.2 Rear Panel Interface



USB: MINI USB-B interface for data transfer.

1.5.3 LEDs and SIM card slot

The front side features 4 LED lights and 1 SIM card slot. To achieve an IP67 waterproof rating, it is equipped with built-in waterproof gaskets and secured with 4 M4 screws.

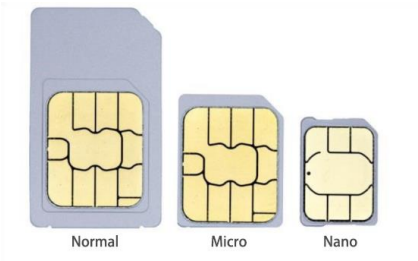
 Power LED: red color is always on after power-on, and off after power-off.

 Satellite LED: blue color shows the number of tracked satellites. When the receiver is searching for satellites, this LED flashes once every 5 seconds. When the receiver has tracked N satellites, the blue LED will flash N times every 5 seconds.

 Correction LED: yellow color indicates whether the receiver is receiving differential data. Flash once when receiving a package of data. Always means fix states.

 Status LED: green color indicates the receiver integrated navigation status. Always on means the completion of initialization.

SIM card slot: Use a Nano SIM card with the chip facing down.



1.6 Accessories

This section provides information on accessories. Before starting the installation, please ensure that all accessories used in the project meet the specifications and standards.

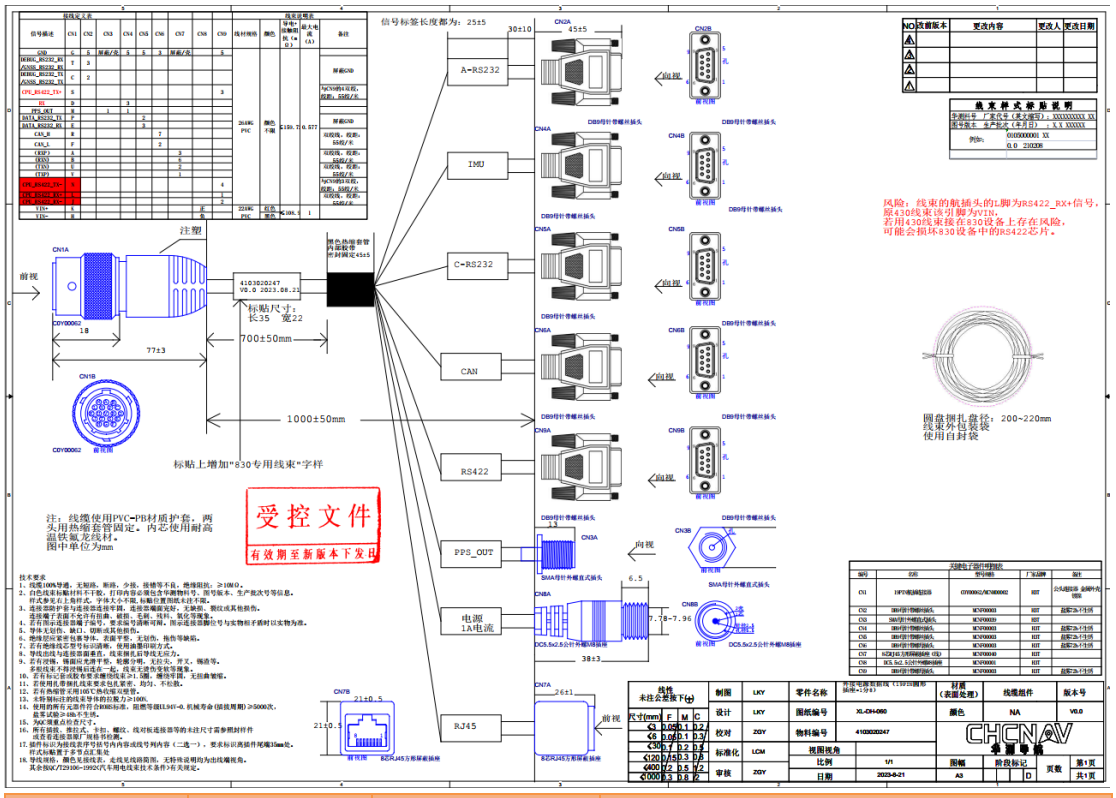
1.6.1 Accessory List

Name	Describe	Photo
CGI-830	Receiver	
Standard Accessories		

Data Cable	19-pin aviation connector	
Power Cable	External power cable	
4G Antenna (TNC)	External magnetic mount antenna for 4G signal enhancement of 3-meter	
GPS Antenna Cable (TNC)	5-meter x 2	
GNSS Antenna (TNC)	CSX627A x 2	
Magnetic Mount	M90SD x 2	

1.6.2 19-PIN Aviation Connector

The 19-PIN aviation connector cable mainly includes 2 RS232, 1 RS422, 1 CAN, 1 IMU, 1 PPS_OUT, 1 RJ45, and a power port.



19-PIN No	DB9 PIN No	Name	PORT
G	5	GND	A_RS232 (NMEA Data)
T	3	RXD	
C	2	TXD	
G	5	GND	C_RS232 (Integrated Navigation Data GPCHC)
E	3	RXD	
P	2	TXD	
G	5	GND	RS422 (Integrated navigation data)
N	4	CPU_RS422_TX-	
J	2	CPU_RS422_RX-	
L	1	CPU_RS422_RX+	
S	3	CPU_RS422_TX+	
G	3	GND	CAN (Integrated Navigation Data)
R	7	CAN_H	
F	2	CAN_L	
K	DC Jack	POWER+	2A Electricity

H	DC Jack	POWER-	

(1) A_RS232: Supports switching between a pass-through port and a DEBUG port. When functioning as a pass-through port, it can be configured for 1Hz GPGGA and 1Hz GPRMC outputs and supports command-line configuration for NMEA data output. It is capable of differential input and includes RTK data forwarding functionality, with a default baud rate of 9600. When used as a DEBUG port, it can output NMEA data such as GGA.

(2) C_RS232: It can be configured via a web page to select the output of integrated navigation fusion data (including GPCHC, GPCHCX, GPGGA, GPRMC, etc.), with the highest output frequency of 100Hz and a default baud rate of 230400.

(3) CAN: Configurable via web page to output integrated navigation fusion data, default baud rate is 500Kbit/s. The highest output frequency is 100Hz.

(4) RS422: It can be configured via a web page to select the output of integrated navigation fusion data (including GPCHC, GPCHCX, GPGGA, GPRMC, etc.), with the highest output frequency of 100Hz and a default baud rate of 230400.

(5) IMU Interface: Supports external inertial navigation units, capable of receiving IMU data through the IMU serial port, with processing logic consistent with the internal IMU.

(6) RJ45: Configurable via web page for setting receiver IP address, etc., used for network data transmission.

(7) Power Supply: Input voltage range is DC 9-32V, standard adapter is DC 12V.

1.6.3 Additional Equipment

(1) General equipment: Phillips screwdriver, applied to SIM card installation.

(2) Measuring equipment: multimeter, can be applied to the power supply voltage.

(3) Power supply: recommended use of regular manufacturers adapter, or battery.

(4) Communication cables: DB9 serial line, CAN line, network cable, etc.

(5) Computer or industrial control machine.

(6) Tape measure: used to measure the parameters of the inertial rod arm.

1.6.4 Additional Software

(1) Serial port debugging tool: Used for data reading and storage.

(2) Browser: It is recommended to use Google Chrome or Microsoft Internet Explorer.

(3) Maps: It is recommended to use Google Earth.

(4) Strsvr: A tool for debugging serial and network ports.

(5) RTKplot: Directly view the route trajectory and the degree of trajectory overlap.

1.7 Environmental Considerations

1.7.1 Temperature

Operating temperature: -40°C to +70°C.

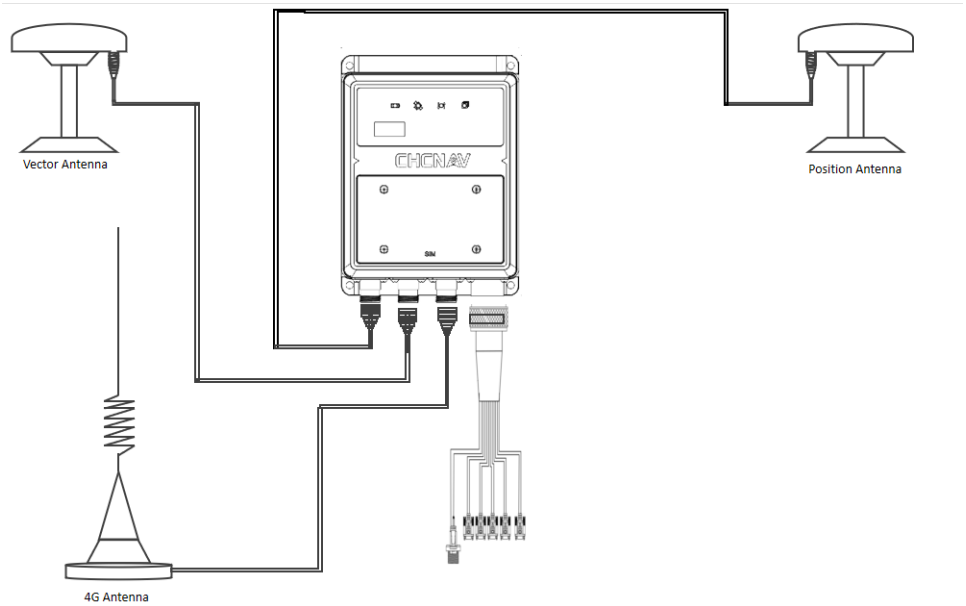
Storage temperature: -40°C to +85°C.

1.7.2 Humidity

The receiver is designed for IP67 level for water and dust proof but the connection part between power supply is not waterproof and shall be protected to avoid electrical shorting.

1.8 Installation Instruction

The connection method of the CGI-830 data cable is shown in the figure below, which includes the main device, GNSS antenna, 4G antenna, and 19-PIN aviation connector cable.

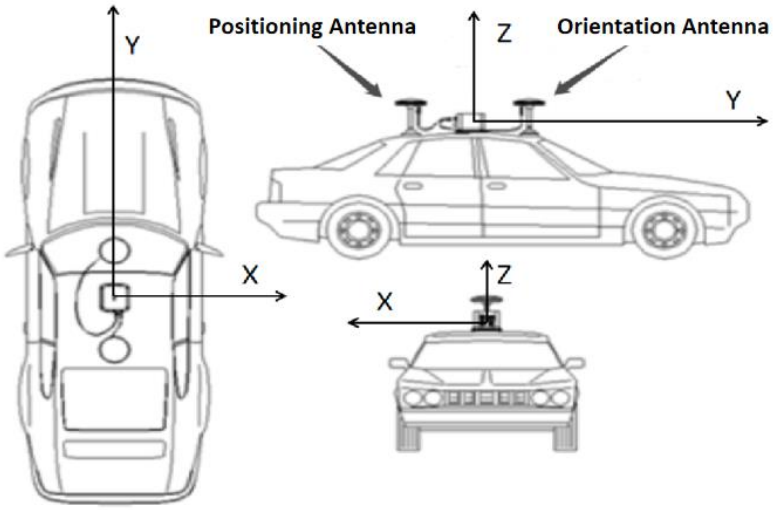


1.8.1 Antenna Installation

Screw the GNSS antenna onto two strong magnetic bases and secure them on the test vehicle

in the forward direction (for the directional antenna GNSS 2) and the rearward direction (for the positioning antenna GNSS 1). Ensure they are placed at the highest point on the test vehicle to receive a good GNSS signal. At the same time, make sure that the line connecting the phase centers of the two GNSS antennas is consistent with or parallel to the central axis of the test vehicle, as shown in the figure below.

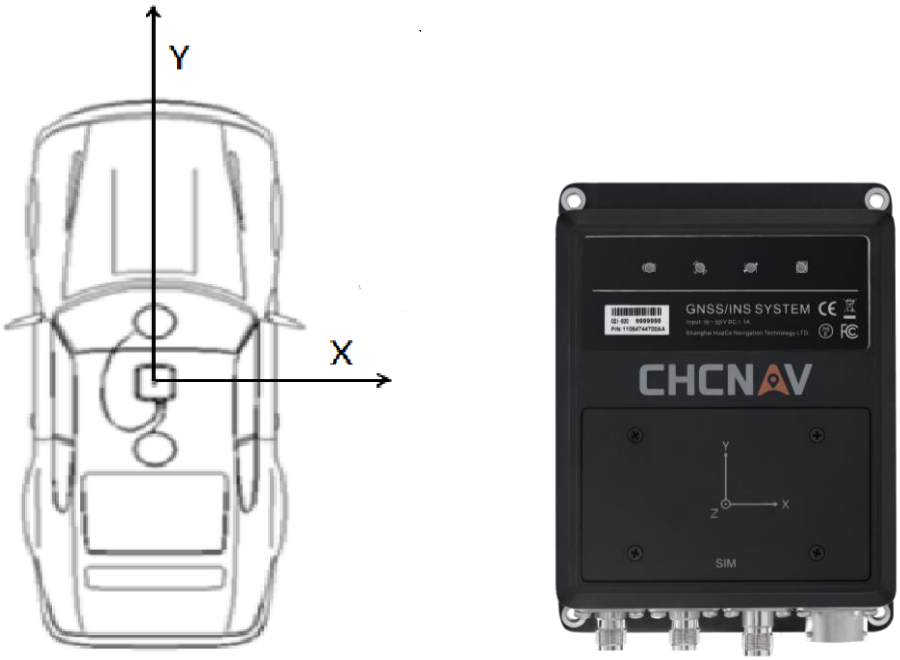
Note: When installing GNSS antennas, keep them away from LiDAR, cameras, etc., to prevent interference with the GNSS antennas.



1.8.2 Receiver Installation

Install the CGI-830 receiver on the carrier as shown in the figure below, ensuring that the coordinate system surface indicated on the receiver's nameplate is as parallel as possible to the reference surface of the carrier being measured, with the Y-axis parallel to the central axis of the carrier's forward direction.

Note: The receiver must be rigidly attached to the carrier being measured. It is recommended that the installation be performed with the Z-axis of the coordinate system indicated on the receiver's nameplate facing upwards.

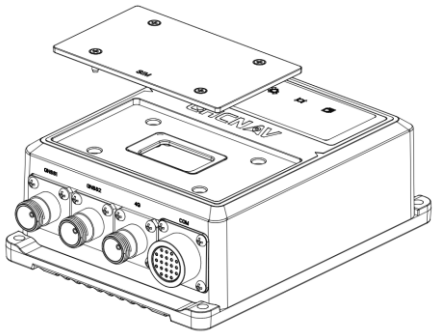


1.8.3 SIM Card Installation

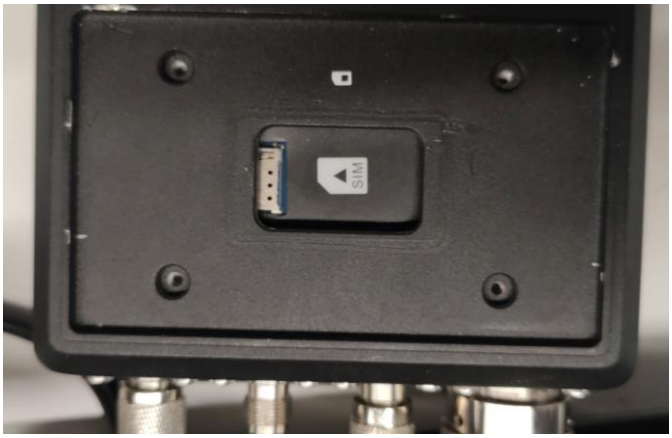
The specific installation process for the SIM card is as follows: (Please ensure that the SIM card has data allowance).

(1) Cut off the power supply and perform the installation without power.

(2) Use a Phillips screwdriver to unscrew the four screws on the SIM card cover and remove the cover. The SIM card slot is shown in the figure below.

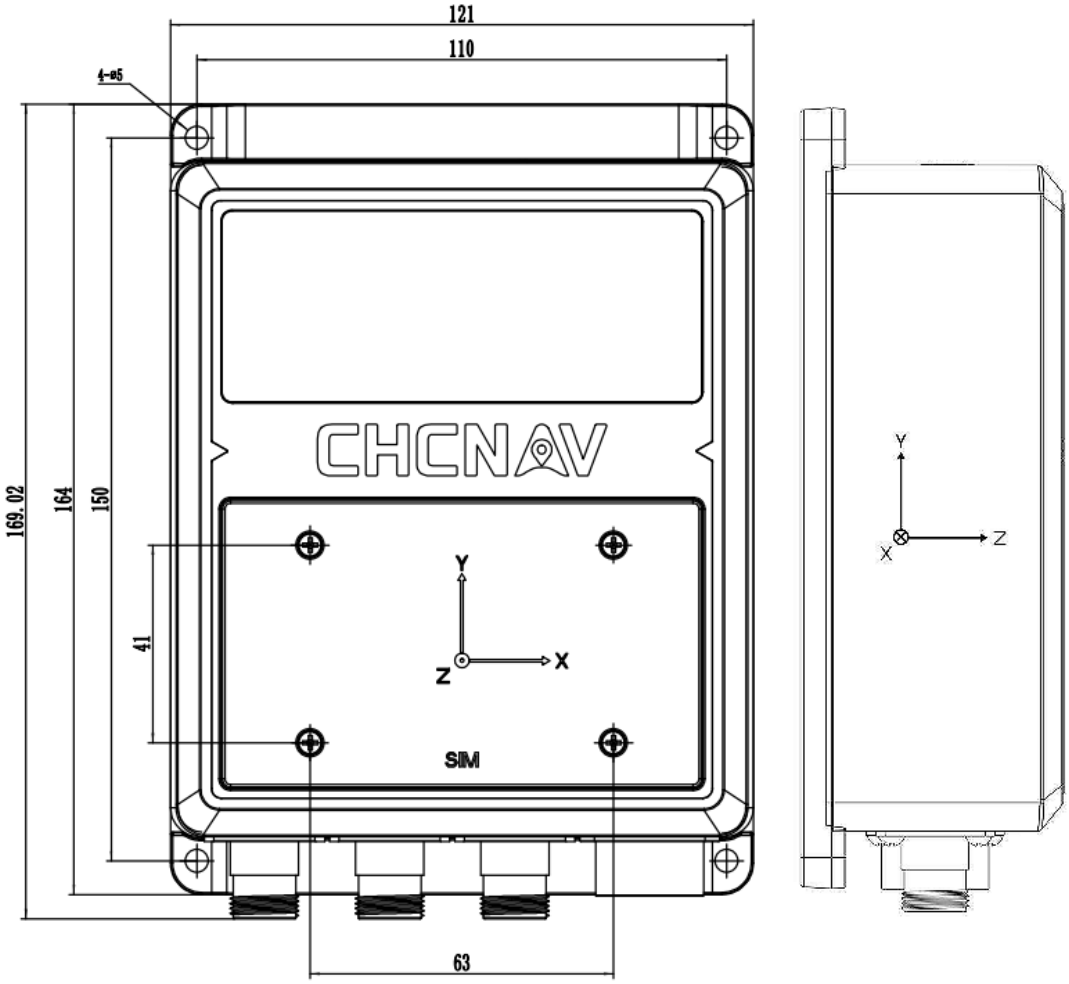


(3) Open the SIM card cover in the direction indicated by the slot, insert the SIM card in the direction shown in the figure below, and then close the SIM card cover.

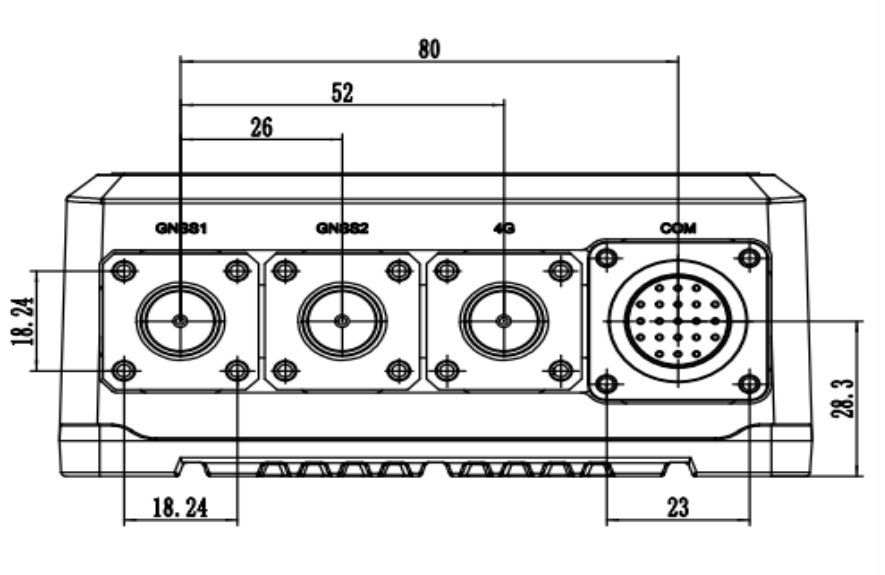


1.8.4 Receiver Dimensions

The dimension specifications are shown in the figure below:

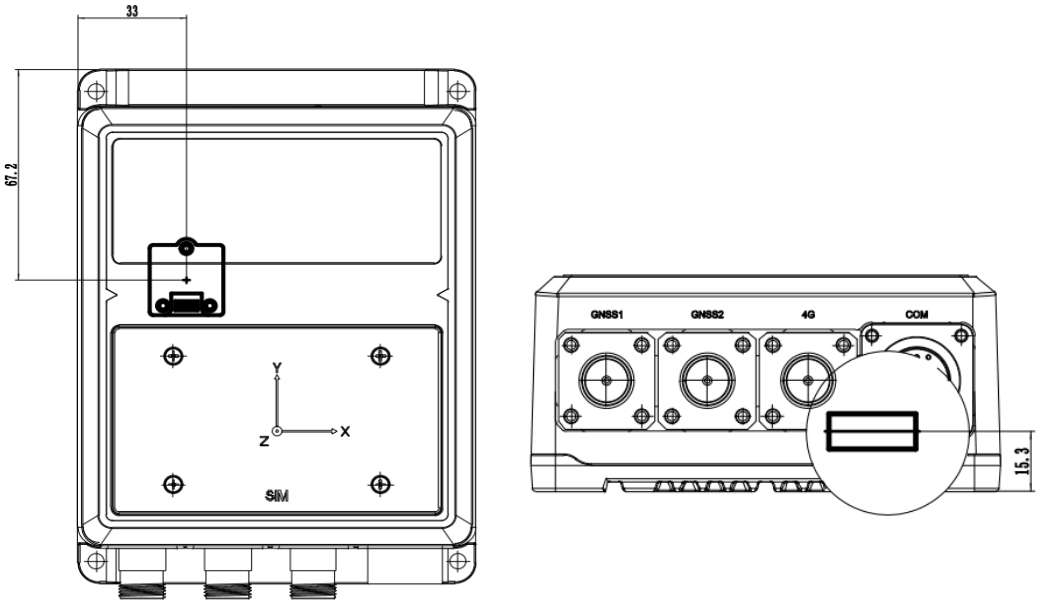


Unit: mm.



Unit: mm.

The location of the IMU's center point is shown below:



2 Web Interface

The receiver is set up through a built-in web page that is integrated into the receiver's firmware. This includes various application settings such as the receiver's operating status, working mode settings, inertial navigation operation settings, and data output settings. Before operating the receiver, please ensure that the receiver is functioning properly. All operation images are screenshots taken from a browser on a Windows 10 system and are for reference only.

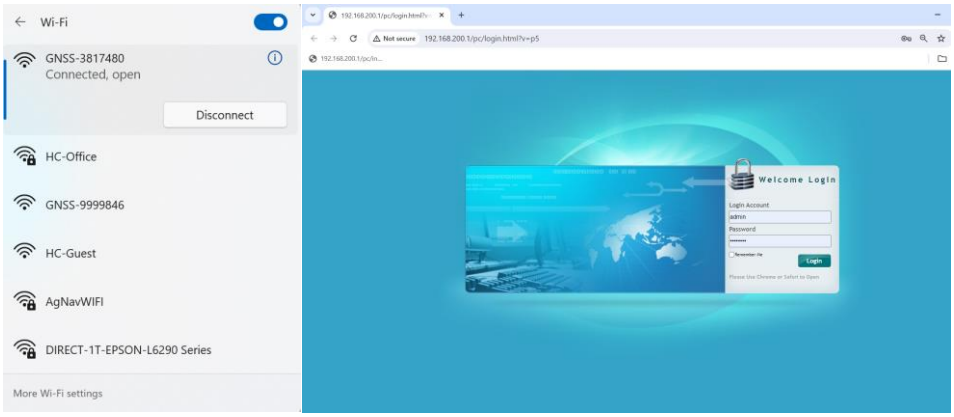
After the antenna and cables are installed, power on the receiver to start it up. Once the receiver starts, you can access, configure, and monitor it using Wi-Fi without the need to connect to the receiver's cables. Follow these steps to begin with the web page via Wi-Fi.

After installing the antenna and cables, power on the receiver. Once the receiver has started, you can access, configure, and monitor it via Wi-Fi without needing to connect to its cables. Follow these steps to begin using the web interface via Wi-Fi:

(1) Turn on your computer's Wi-Fi and search for a wireless network named "GNSS-XXXXXXX" (where XXXXXXX represents your receiver's serial number). Connect to this network. If prompted for a password, enter "12345678."

(2) Open your browser and enter "192.168.200.1" in the address bar to access the login page. Use "admin" as the username and "password" as the password.

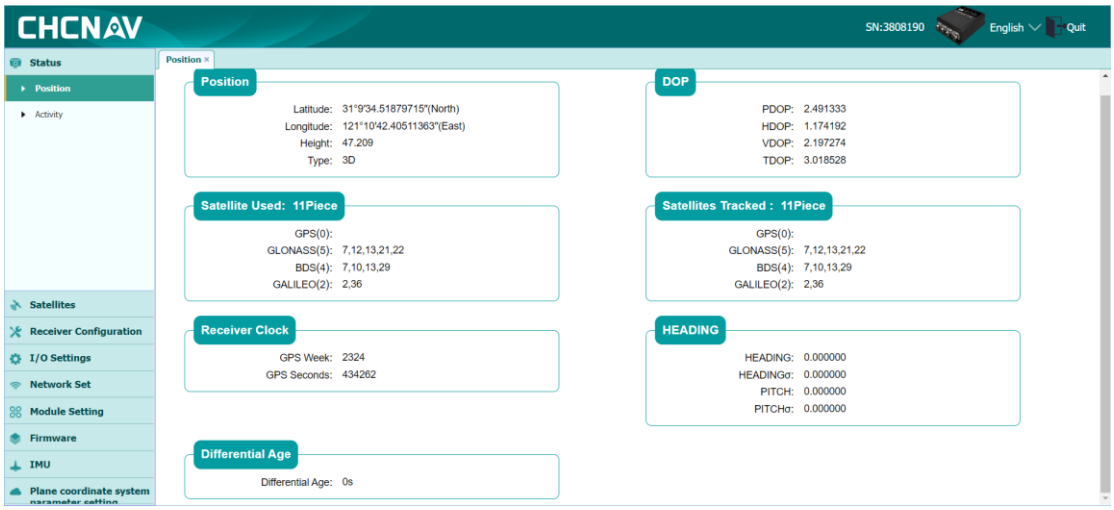
(3) If you select the "Remember Me" option, your browser will save your login credentials for future logins. *(Note: It is recommended to clear your browser's cache each time you access the web interface.)*



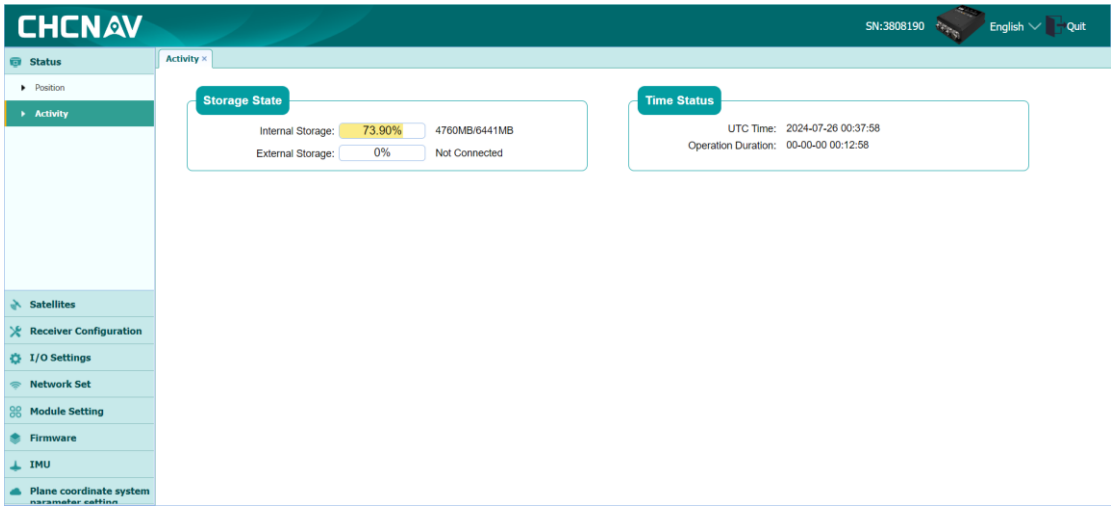
2.1 Status Interface

The Status interface primarily allows you to view information related to the receiver's position and activities. In the "Position" subsection, you can see details such as the receiver's approximate location, DOP values, satellites in use, satellites being tracked, receiver clock status, current antenna attitude, and differential age. This field specifically displays the differential age of the GNSS board.

Note: The webpage images in this user guide are for reference only. Actual data input should be based on the real-time situation.



In the "Activity" subsection, you can view details such as the current UTC time and storage status.

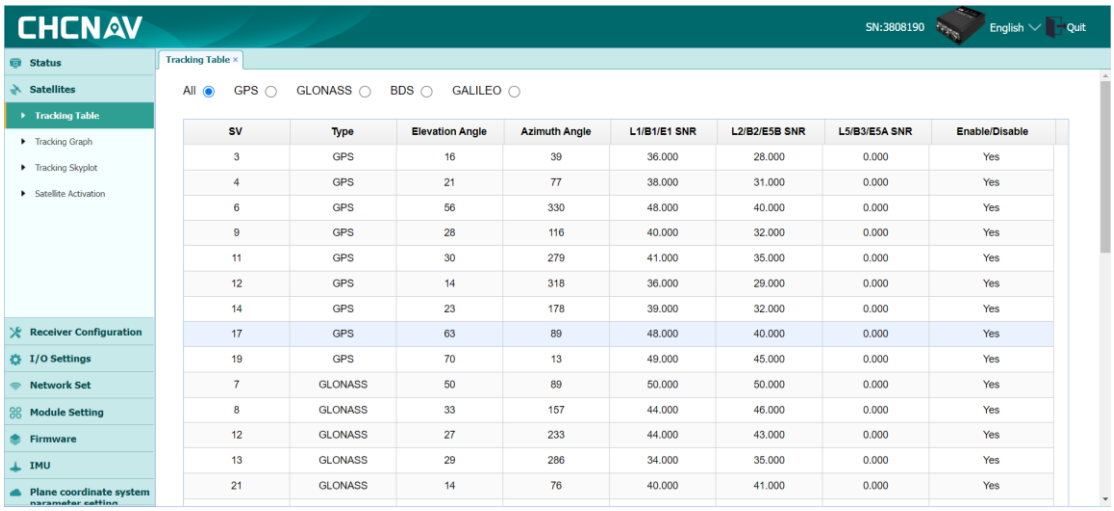


2.2 Satellites Interface

The Satellites interface displays the satellites that the receiver is tracking, presenting the relevant information of each tracked satellite in both list and chart formats. This includes details such as satellite number, satellite type, elevation angle, azimuth angle, L1 signal-to-noise ratio, L2 signal-to-noise ratio, L5 signal-to-noise ratio, and whether the satellite is being used or not.

2.2.1 Tracking Table

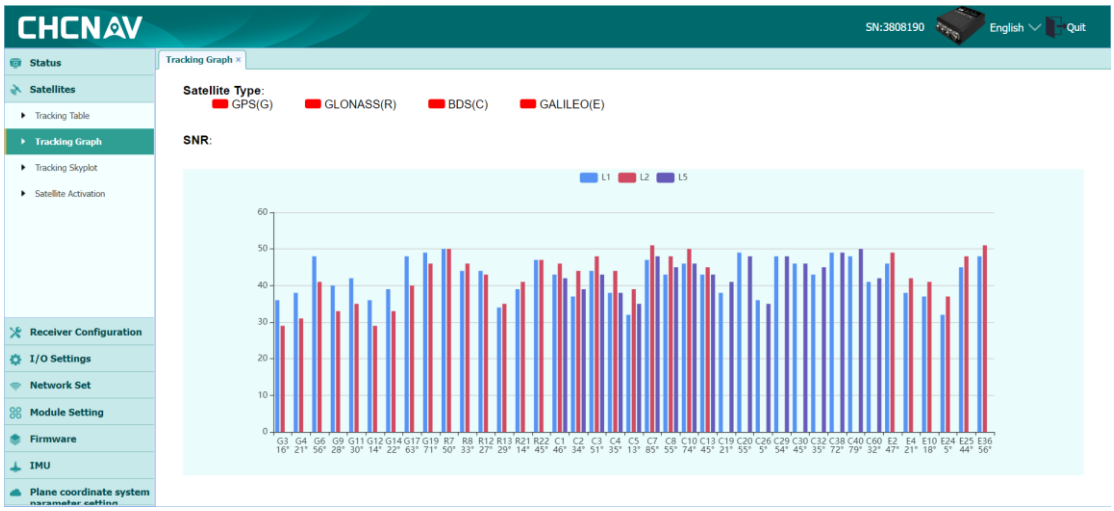
By clicking on “Tracking Table”, you can view satellite information in a graphical format. You can select the categories of satellites you wish to view and see the relevant information.



SV	Type	Elevation Angle	Azimuth Angle	L1/B1/E1 SNR	L2/B2/E5B SNR	L5/B3/E5A SNR	Enable/Disable
3	GPS	16	39	36.000	28.000	0.000	Yes
4	GPS	21	77	38.000	31.000	0.000	Yes
6	GPS	56	330	48.000	40.000	0.000	Yes
9	GPS	28	116	40.000	32.000	0.000	Yes
11	GPS	30	279	41.000	35.000	0.000	Yes
12	GPS	14	318	36.000	29.000	0.000	Yes
14	GPS	23	178	39.000	32.000	0.000	Yes
17	GPS	63	89	48.000	40.000	0.000	Yes
19	GPS	70	13	49.000	45.000	0.000	Yes
7	GLONASS	50	89	50.000	50.000	0.000	Yes
8	GLONASS	33	157	44.000	46.000	0.000	Yes
12	GLONASS	27	233	44.000	43.000	0.000	Yes
13	GLONASS	29	286	34.000	35.000	0.000	Yes
21	GLONASS	14	76	40.000	41.000	0.000	Yes

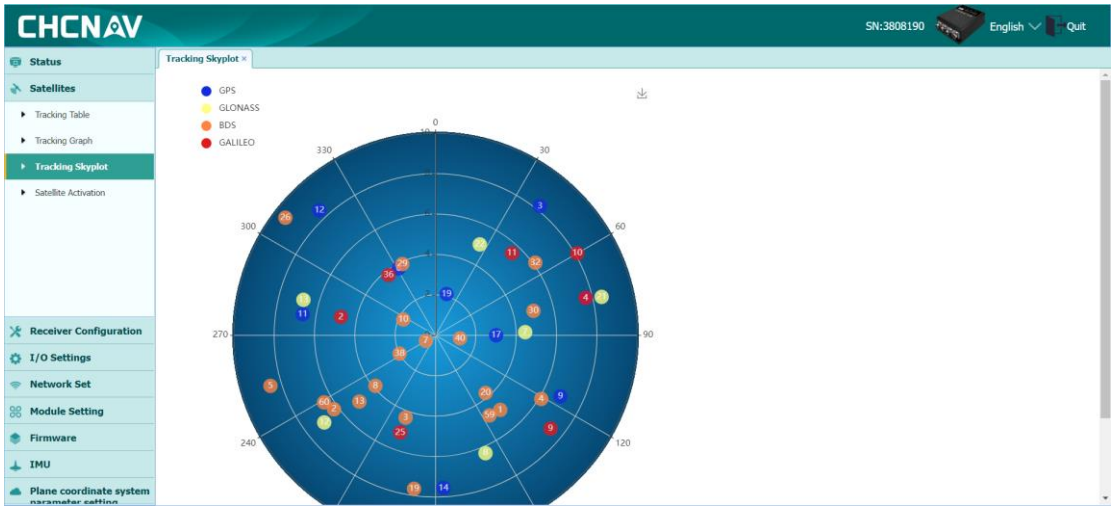
2.2.2 Tracking Graph

By clicking on 'Tracking Graph', you can view satellite information displayed in graphical form. You have the option to select the satellite categories and signal-to-noise ratio (SNR) you wish to inspect for relevant information. The display of real-time satellite SNR information refreshes at a frequency of 10 seconds.



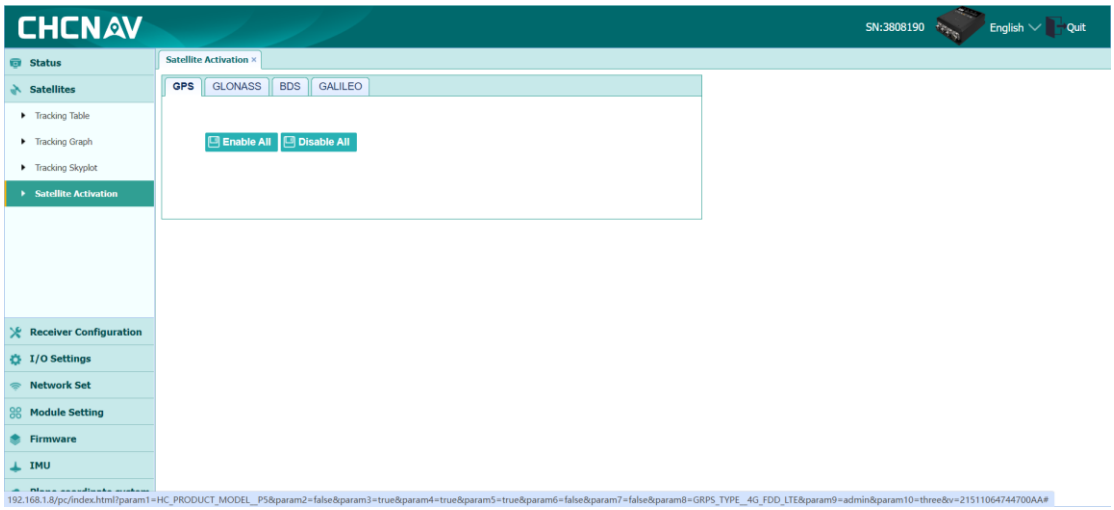
2.2.3 Tracking Skyplot

By clicking on "Tracking Skyplot," you can display the sky plot for the current location of the receiver, which illustrates the satellite positions in the sky relative to that location.



2.2.4 Satellite Activation

By clicking on "Satellite Activation", you can choose to enable or disable specific satellite constellations.

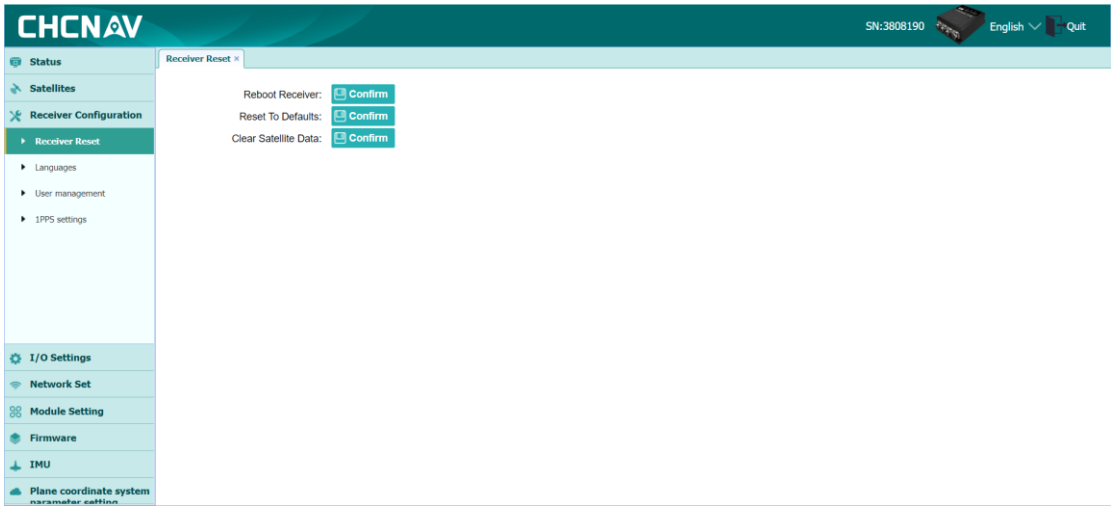


2.3 Receiver Configuration Interface

On the Receiver Configuration interface, you can reset the receiver to its factory settings, clear satellite data, change the language, and check the PPS pulse width, among other settings.

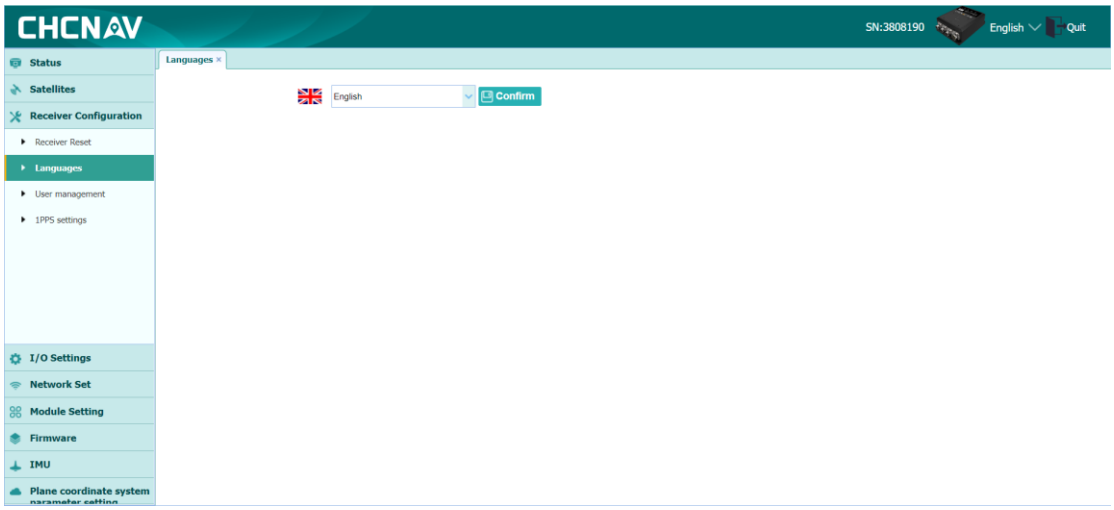
2.3.1 Receiver Reset

Clicking “Receiver Reset” allows you to perform operations such as reboot receiver, reset to defaults, and clear satellite data. Reboot receiver refers to relaunching the receiver; reset to defaults refers to clearing the settings in the receiver and returning to the configuration at the time of manufacture; clear satellite data refers to erasing the satellite ephemeris received by the receiver.



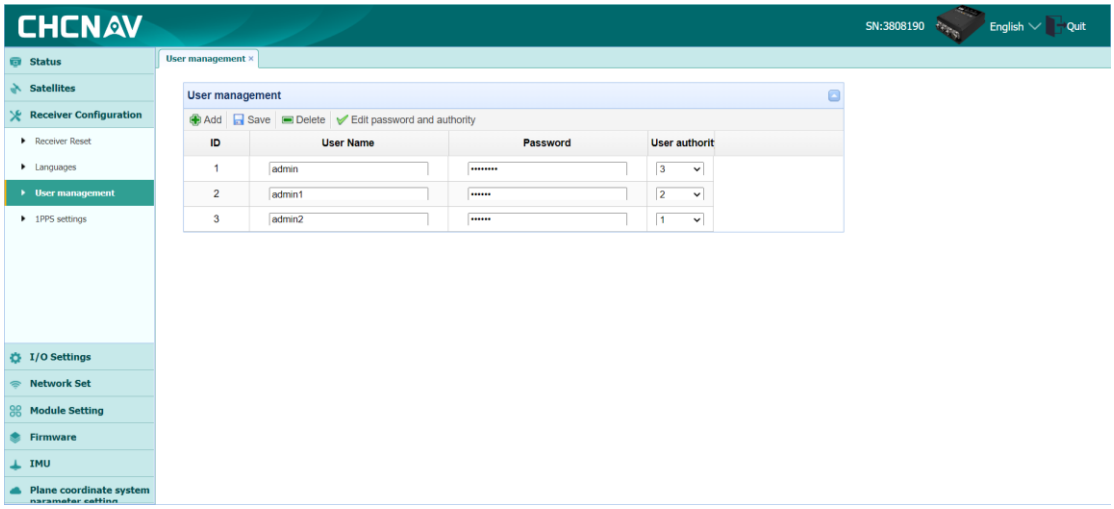
2.3.2 Languages

Clicking “Language” allows you to select three languages: Chinese, English, and Russian.



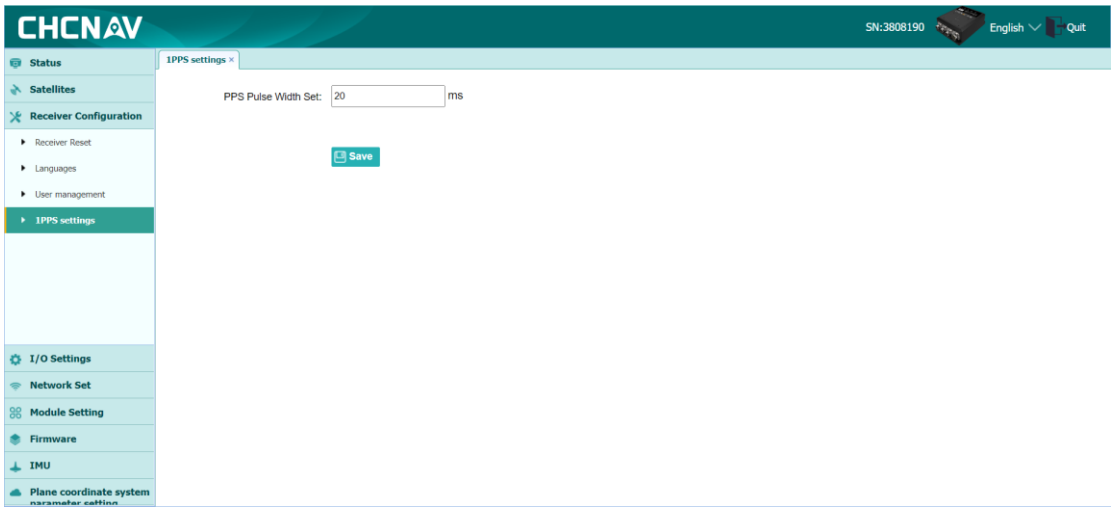
2.3.3 User Management

Clicking “User Management” enables you to configure additional login accounts and passwords, as well as their permissions.



2.3.4 1PPS Settings

Clicking “1PPS settings” allows you to view the pulse width of the 1PPS (One Pulse Per Second) timing signal, which is currently fixed at 20 milliseconds.

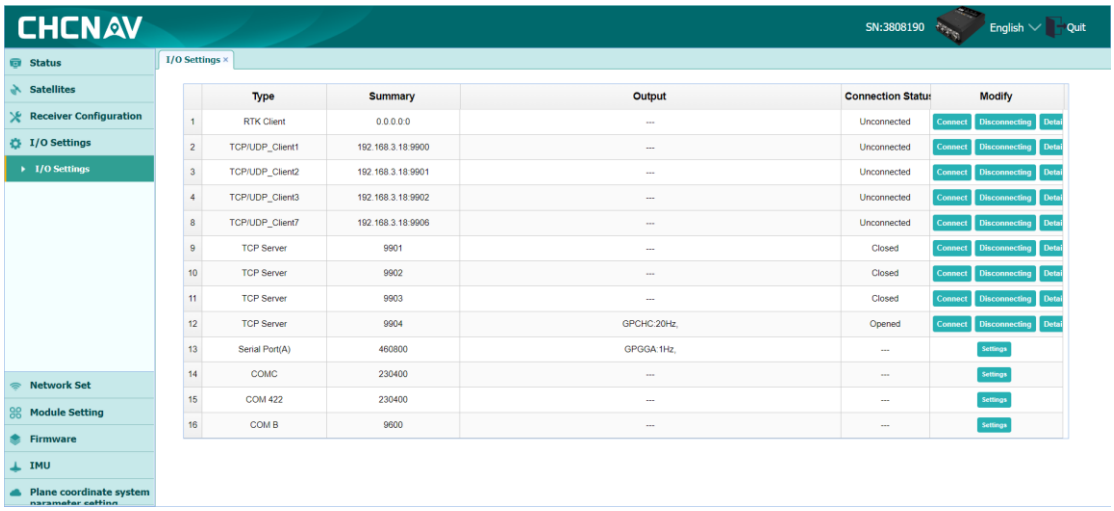


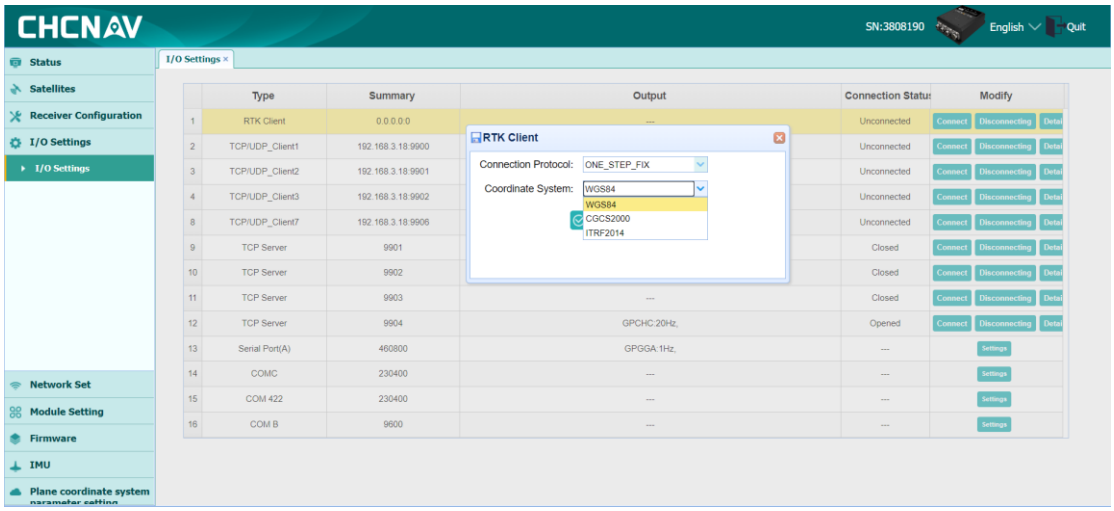
2.4 I/O Settings Interface

The I/O settings interface is primarily for configuring the working mode of the receiver in obtaining differential data, as well as the method of data output.

2.4.1 RTK Client

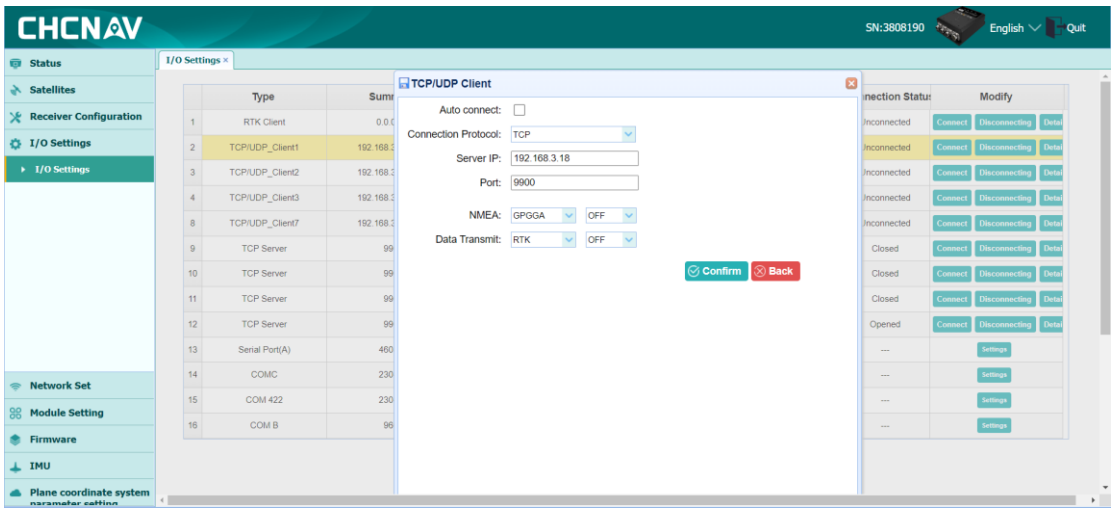
Clicking “RTK Client” allows you to set the working mode for the receiver to obtain differential data. The interface mainly has four methods for obtaining differential data: NTRIP, TCP, UDP, and ONE_STEP_FIX.





2.4.2 TCP/UDP_Client

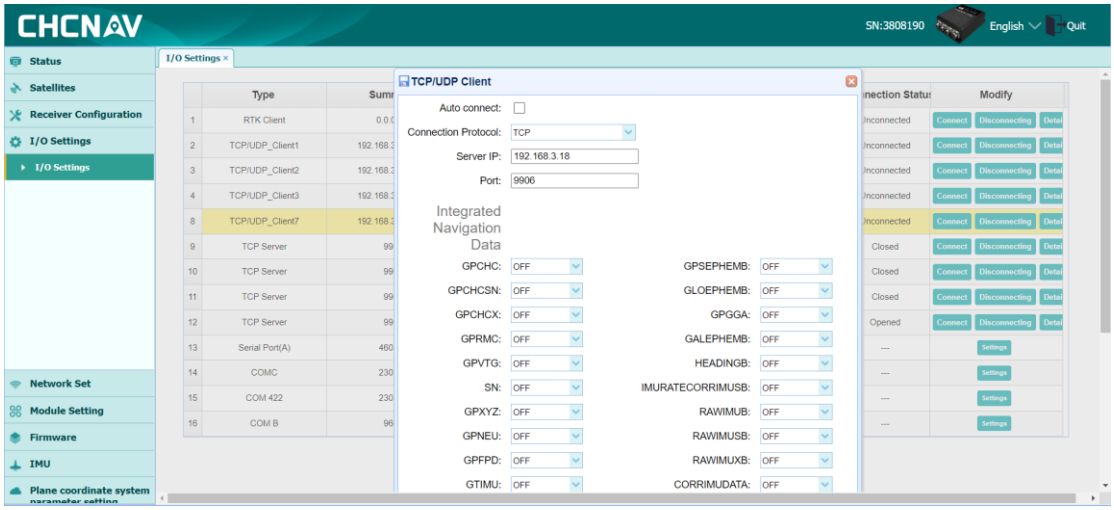
Clicking “TCP/UDP_Client” allows the device to act as a client for network data output. Specifically, TCP/UDP_Client1, TCP/UDP_Client2, and TCP/UDP_Client3 can transmit 1Hz NMEA data, which consists of navigation satellite data. It is recommended to check the option for automatic connection upon power-up when making settings. When the client is successfully connected to the server, the option's background color will change from yellow to green.



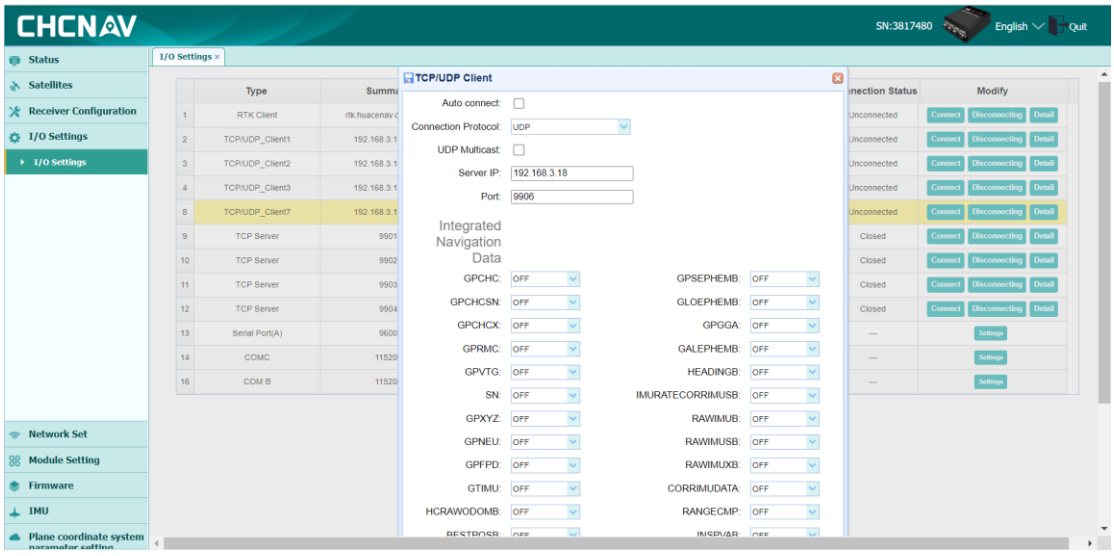
2.4.3 TCP/UDP_Client7

Clicking “TCP/UDP_Client7” enables the device to transmit a variety of data types, including pure GNSS data, integrated data, raw board data, and raw IMU (Inertial Measurement Unit) data. When the client is successfully connected to the server, the background color of the option will change from yellow to green.

The picture indicates that all data outputs are turned off.

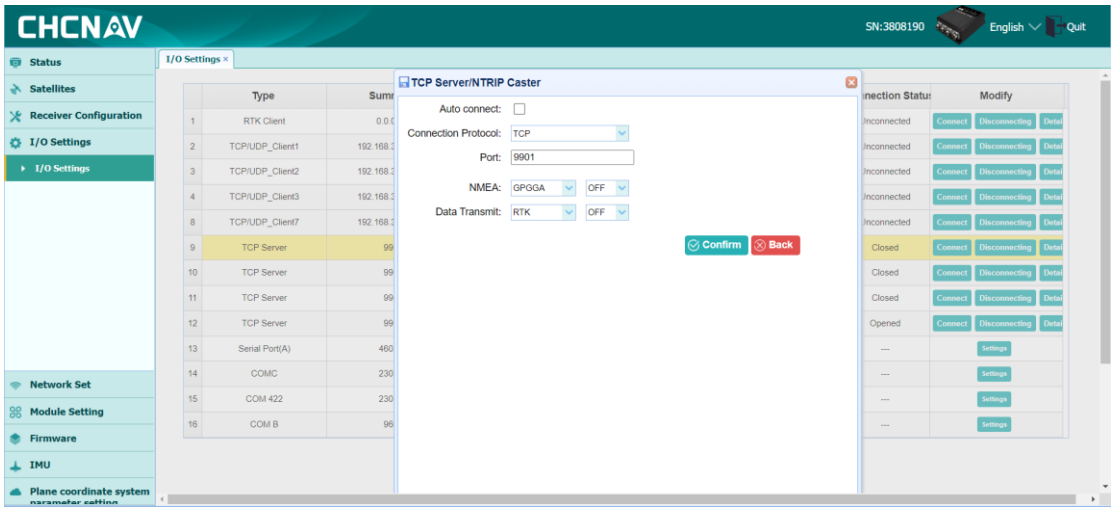


The picture indicates that all data outputs are turned on at the highest frequency.



2.4.4 TCP Server

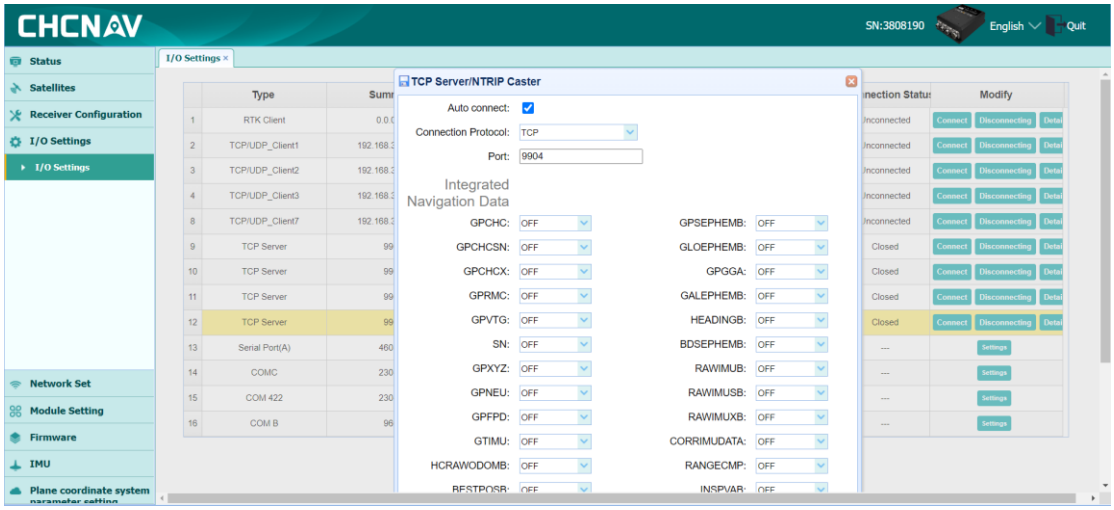
“TCP Server1”, “TCP Server2”, and “TCP Server3” are capable of transmitting 1Hz NMEA data, which is pure GNSS data. It is recommended to select the option for automatic connection upon startup when configuring. When the client is successfully connected to the server, the background color of the option will change from yellow to green.



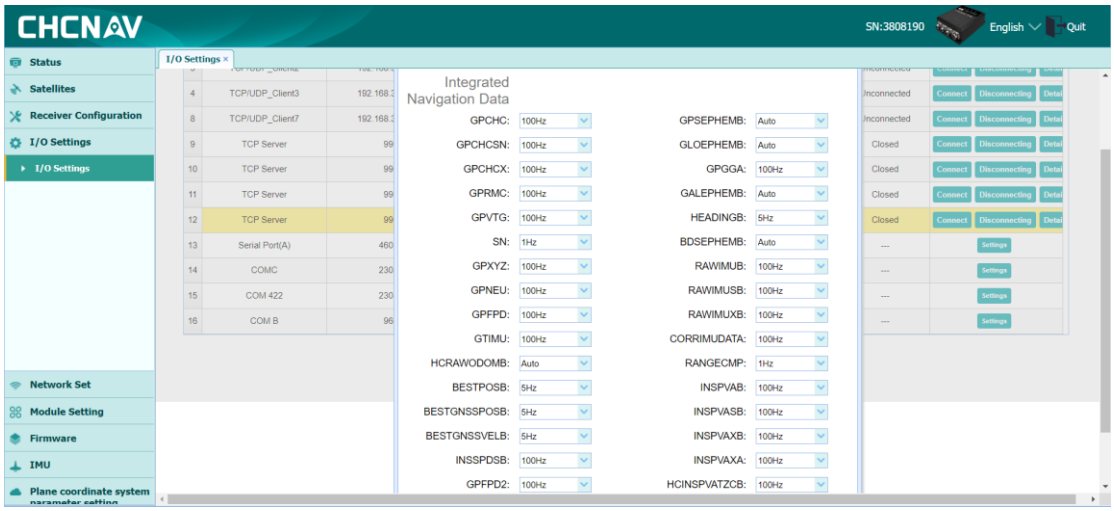
2.4.5 TCP Server4

“TCP Server4” can transmit a range of data types, including pure GNSS data, integrated data, raw board data, and raw IMU (Inertial Measurement Unit) data. When setting it up, it is recommended to check the option for automatic connection upon power-up. When the client is successfully connected to the server, the background color of the option will change from yellow to green.

The picture indicates that all data outputs are turned off.

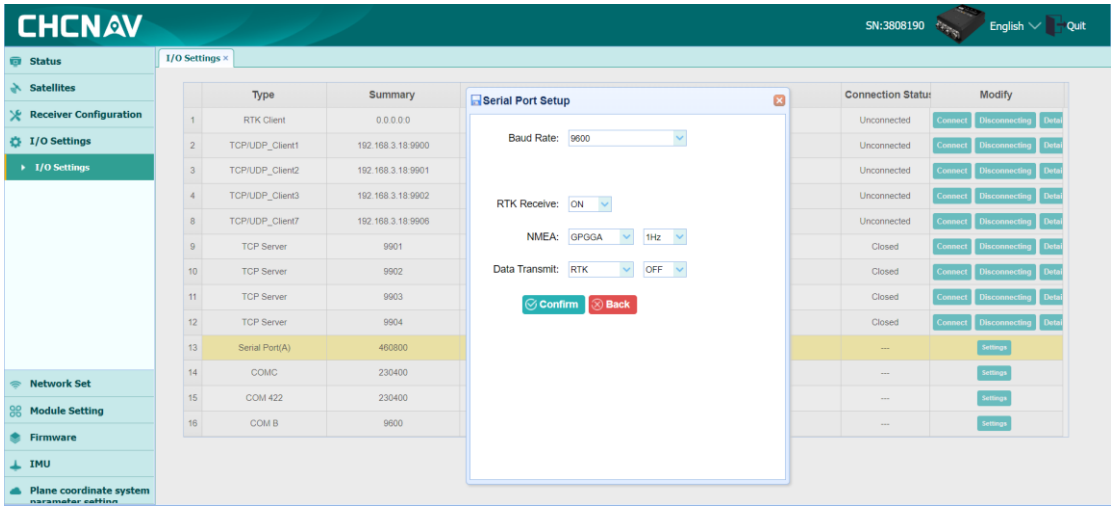


The picture indicates that all data outputs are turned on at the highest frequency.



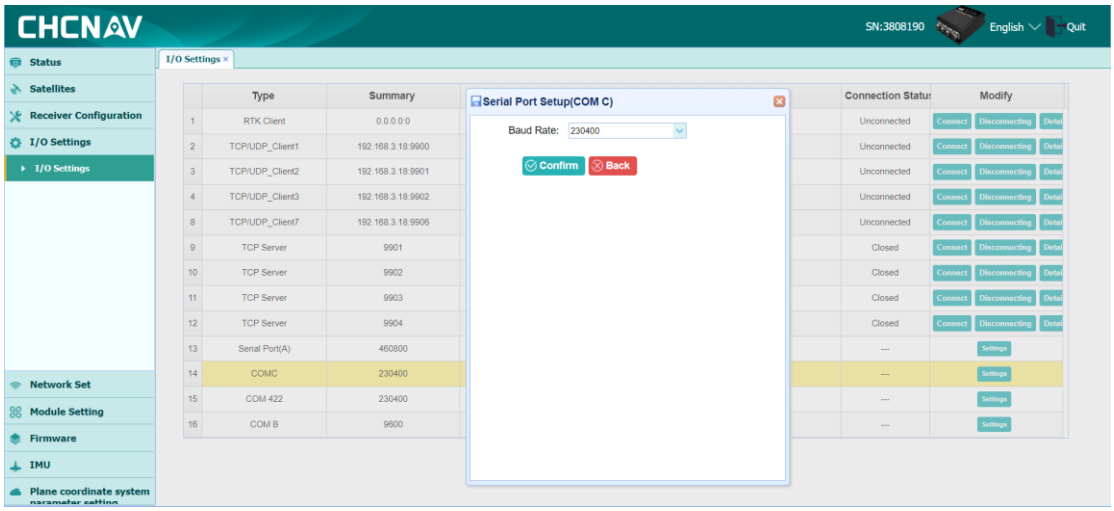
2.4.6 Serial Port A

“Serial Port A” has a default baud rate of 9600 and supports the output of 1Hz NMEA data. When RTK Receive is activated, Serial Port A can be selected as the differential data input port, which means differential data can be fed to the device via the serial port. The background color of the option will not change when the data output and input ends are successfully connected.



2.4.7 Serial Port C

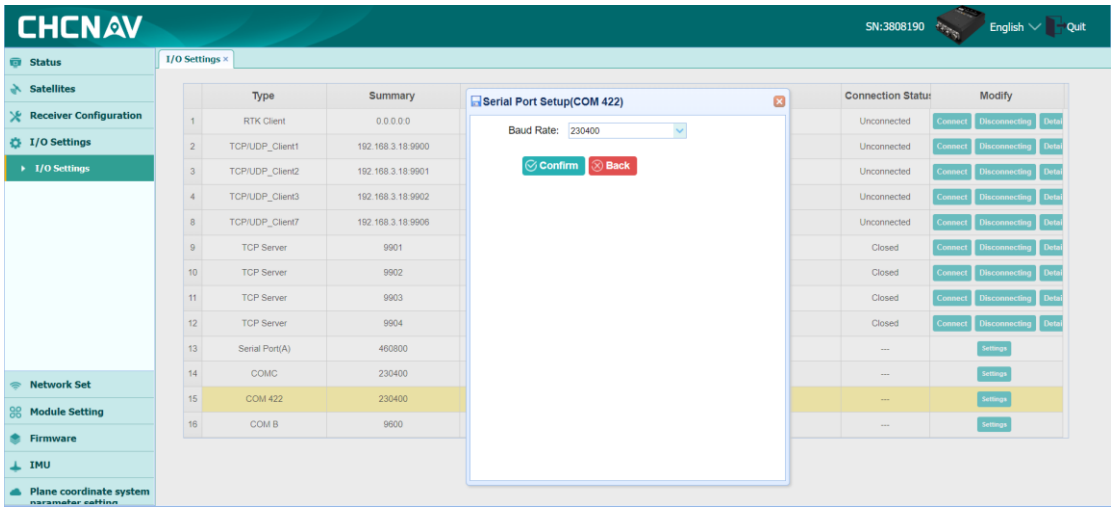
“Serial Port C” has a default baud rate of 230400, with the highest support up to 460800. The settings for Serial Port C on the IO settings page can only adjust the baud rate and cannot set data output. In the product design, the data output for Serial Port C is configured in *Section 2.8* of the content.



2.4.8 Serial Port 422

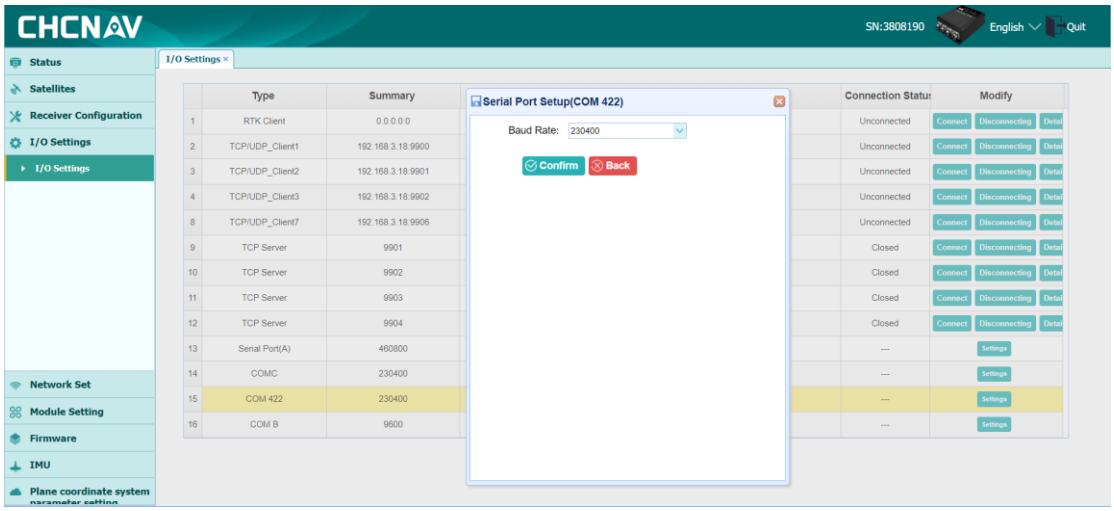
"Serial Port 422" has a default baud rate of 230400, with the highest support up to 460800. The settings for Serial Port 422 on the IO settings page can only adjust the baud rate and cannot set data output. In the product design, the data output for Serial Port 422 is configured in *Section 2.8* of the documentation.

Note: Do not send differential data to the receiver through the Serial Port B.



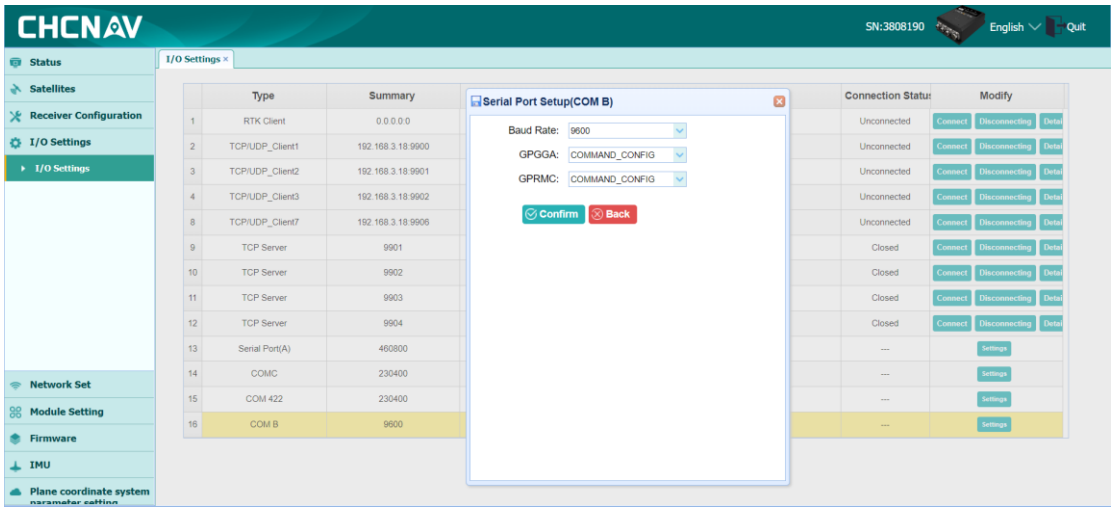
"Serial Port 422" has a default baud rate of 230400, with the highest support up to 460800. The settings for Serial Port 422 on the IO settings page can only adjust the baud rate and cannot set data output. In the product design, the data output for Serial Port 422 is configured in *Section 2.8* of the documentation.

Note: Do not send differential data to the receiver through the Serial Port B.



2.4.9 IMU Cable

In the device's web page under the IO settings menu, the data output cable corresponding to Serial Port B has been changed to connect to an external IMU. Even if the parameters for Serial Port B are set, there will be no data output.

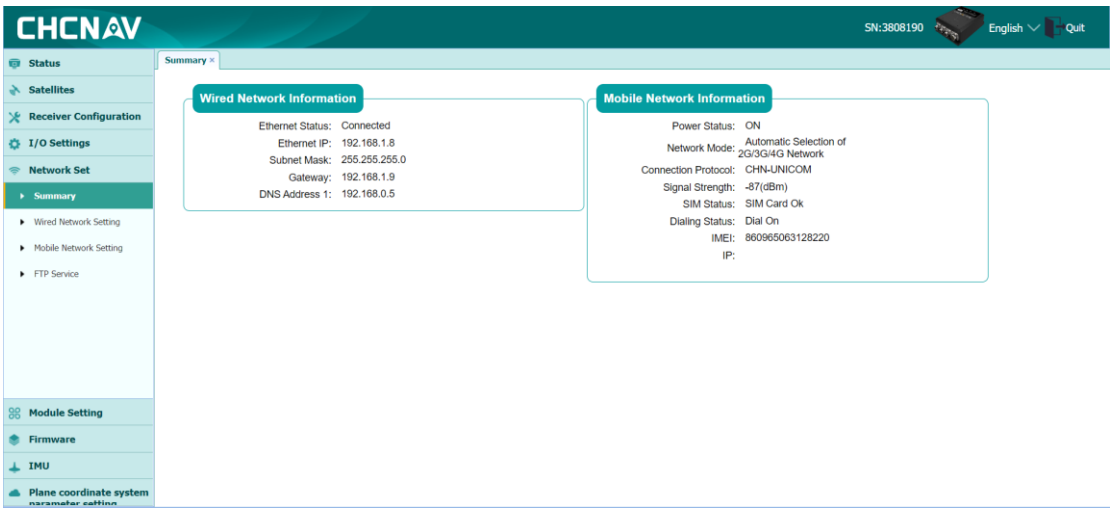


2.5 Network Set Interface

2.5.1 Summary

In “Summary”, you can view both wired network information and mobile network information. The wired network information displays the wired network's ethernet status, IP address, subnet mask, gateway, and DNS address; as well as the mobile network's power status, network mode, operator, signal strength, SIM status, dialing status, and IMEI information.

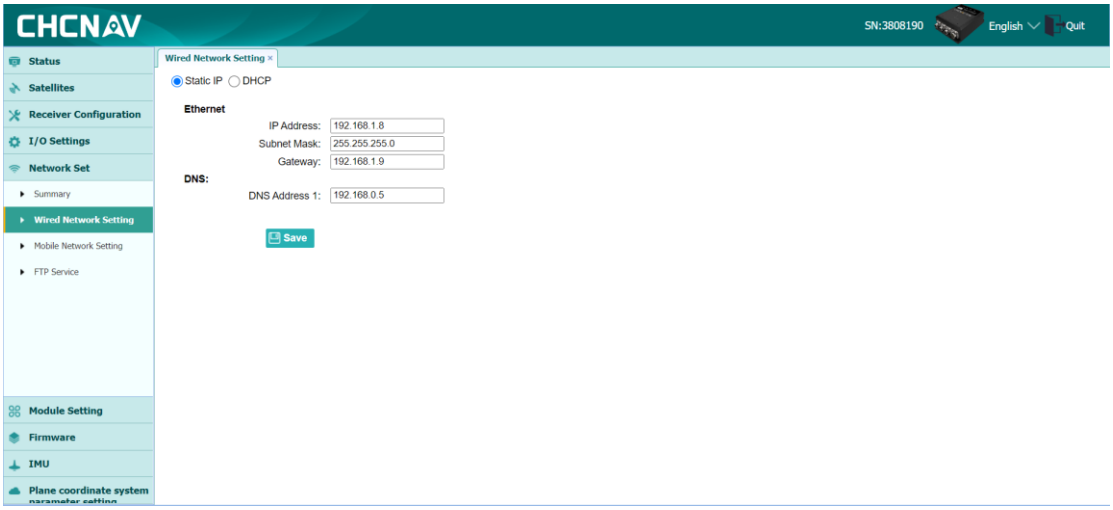
the IP address of your wired network connection. The mobile network information provides details such as signal strength, SIM card status, dialing status, and more.



2.5.2 Wired Network Setting

Clicking on "Wired Network Setting" allows you to configure the receiver's Ethernet IP address, subnet mask, and gateway. The default Ethernet IP address from the factory is 192.168.45.100. When selecting static configuration, you need to manually enter the IP address, subnet mask, and gateway information. When the device's Ethernet port is connected to a broadband router, you can choose to obtain settings by the network, and the device's IP address, subnet mask, and gateway information will be automatically assigned by the router.

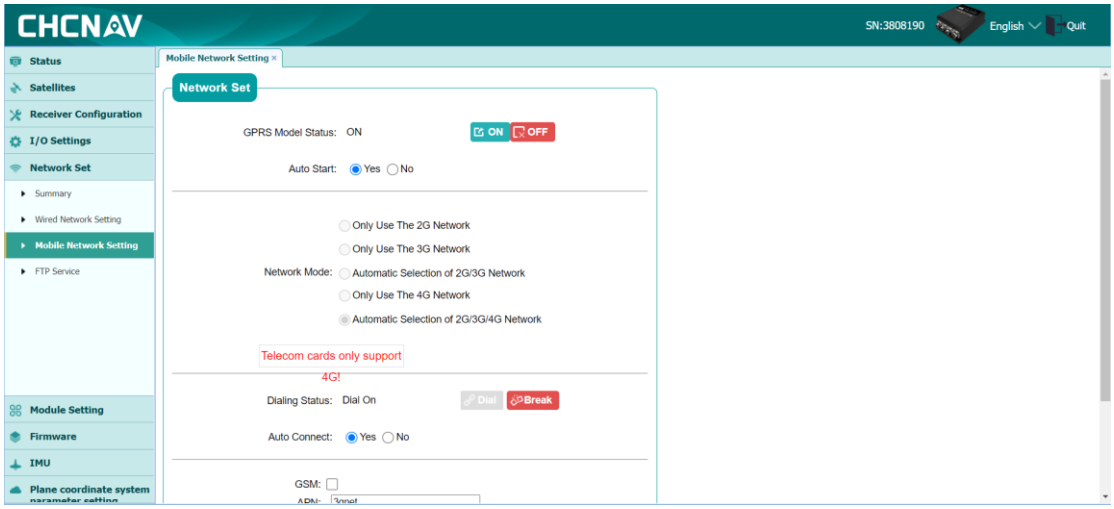
Note: Do not configure the device's wired network IP in the 192.168.200 subnet.



2.5.3 Mobile Network Setting

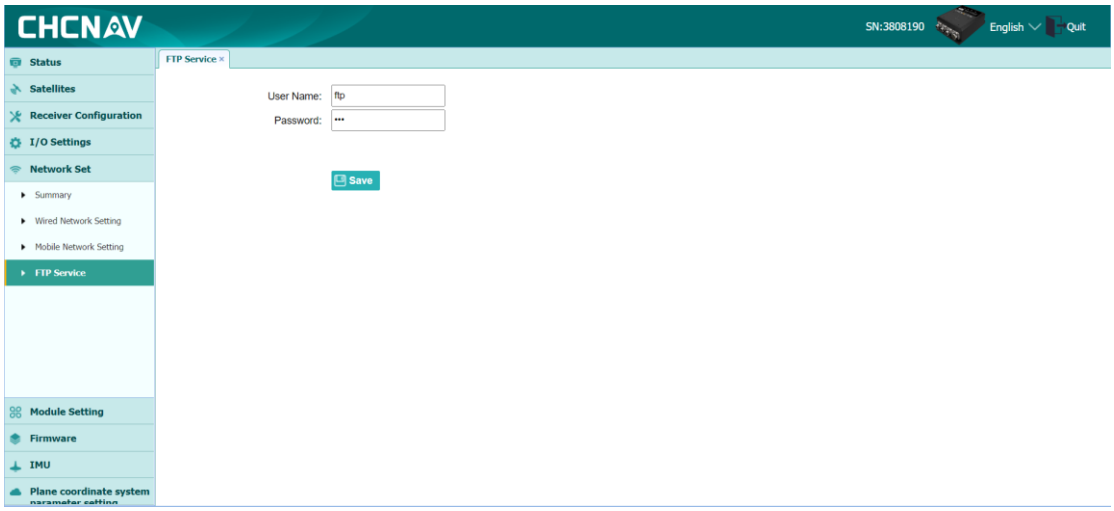
Clicking on "Mobile Network Setting" enables you to configure the network module status, whether to start automatically upon power-up, the network mode, dialing status, whether to connect automatically upon power-up, and other APN information. The device currently supports 5G IoT cards.

The default network module status is set to on, with automatic start upon power-up enabled, the network mode is set to auto-select 2/3/4G networks, and automatic connection upon power-up. Do not modify the GSM, APN, service provider number, dialing username, and dialing password privately; keep the default settings. Otherwise, it may cause the mobile network SIM card to fail in dialing, resulting in the device being without a network and being unable to log in to the differential account configured in the IO settings.



2.5.4 FTP Service

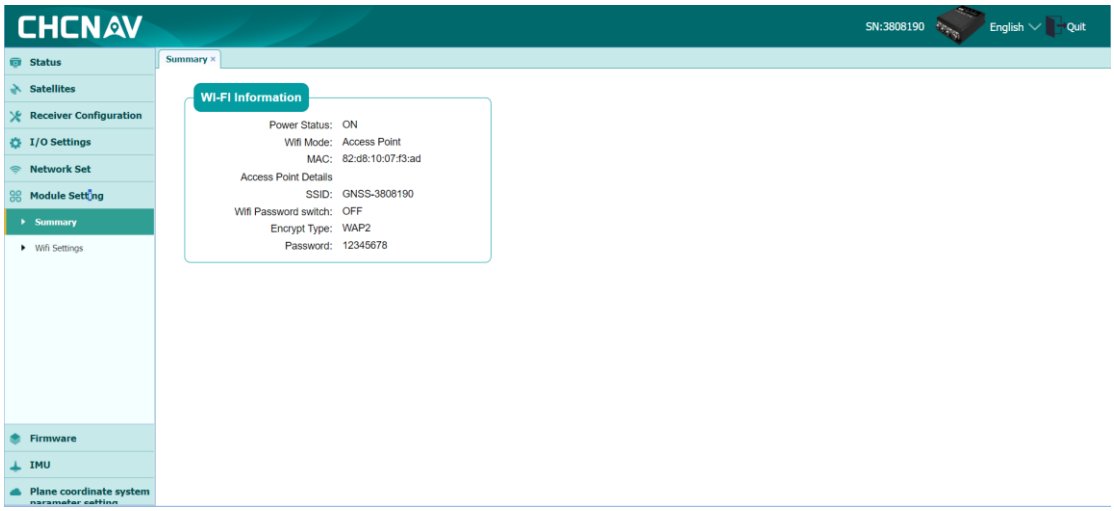
Clicking on FTP Service allows you to change the account and password for FTP data transfer. The default account is "ftp”, and the default password is also "ftp".



2.6 Module Setting Interface

2.6.1 Summary

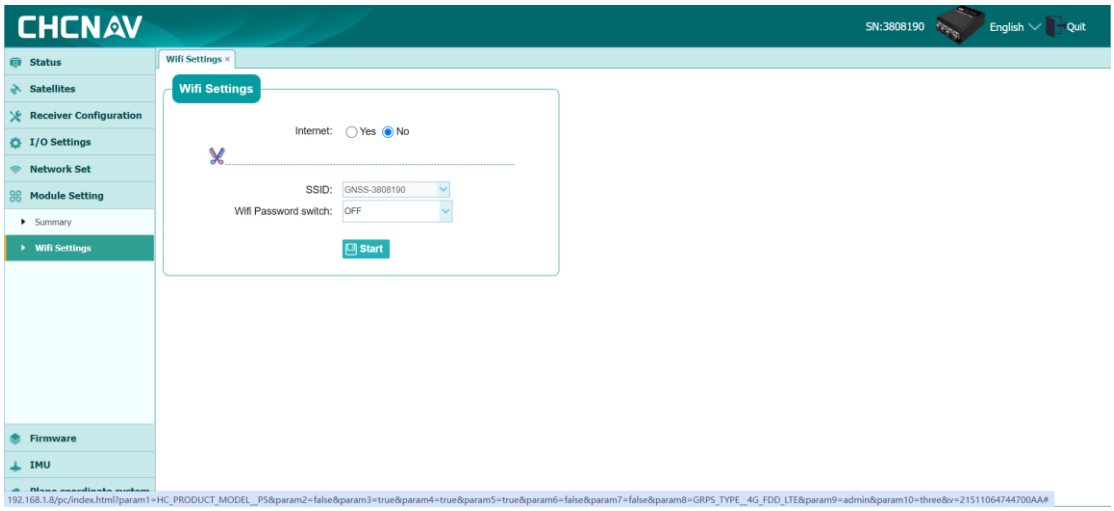
Clicking on "Summary" allows you to view the Wi-Fi information.



2.6.2 WIFI Settings

Clicking on "WIFI Settings" enables you to configure the visibility of the receiver's Wi-Fi, set passwords, and manage network sharing features.

Note: After enabling Internet access, devices connected to the receiver's Wi-Fi can use its network to go online. You can turn off Internet access to prevent exceeding data usage limits.

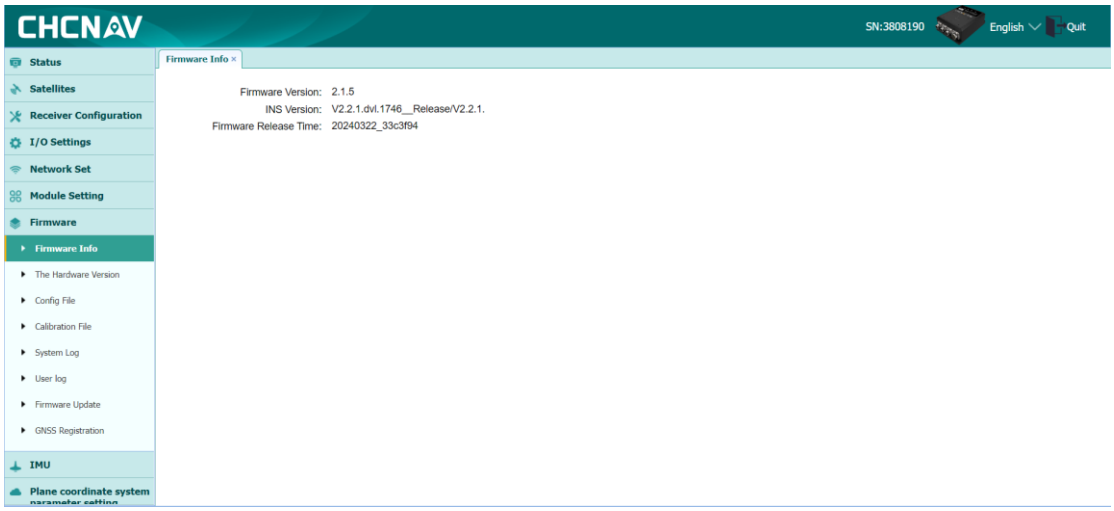


2.7 Firmware Interface

This interface is primarily for receiving the current firmware information, hardware version, configuration file, calibration file, system log, user log, firmware upgrade, and GNSS receiver registration. *(Note: Please refer to the actual published version for specific firmware details.)*

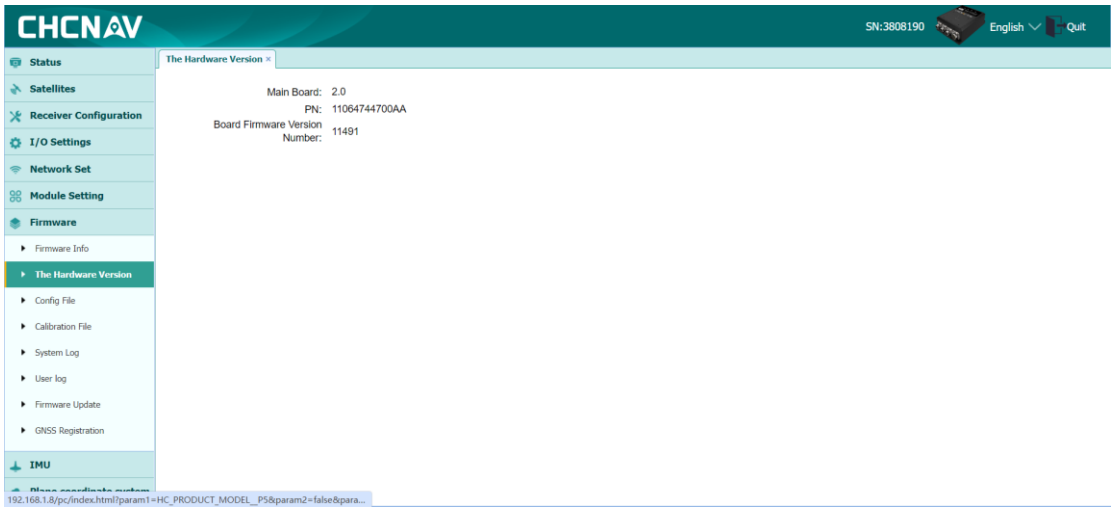
2.7.1 Firmware Info

“Firmware Info” includes details of the firmware version as well as the algorithm version, release logs, and protocol version number.



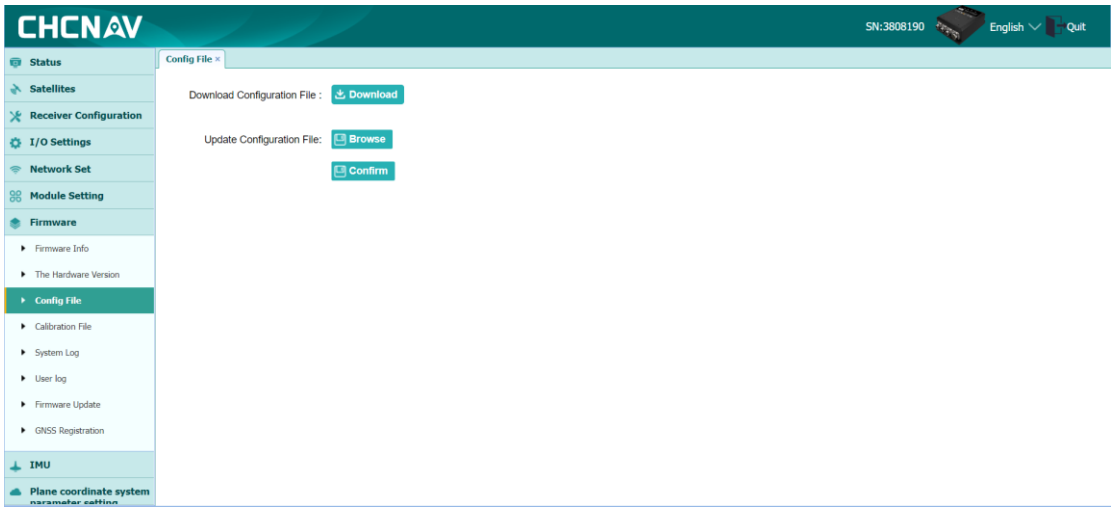
2.7.2 The Hardware Version

“The Hardware Version” interface allows you to check the hardware version, main board and PN number.



2.7.3 Config File

“Config File” includes two options: Configuration File Download and Configuration File Update. The downloaded configuration file contains the current device's parameter settings, which is suitable for scenarios involving the mass installation of devices.



2.7.4 Calibration File

“Calibration File” supports functions for downloading and updating calibration files. In manual calibration mode, once the calibration files are imported from an external source, the device does not need to be calibrated unless a re-calibration is triggered by a command. It is possible to enter the integrated navigation state with dual-antenna static mode. This is suitable for scenarios where you need to analyze the calibration parameters of the device and calibrate devices in bulk.