



P2 GNSS Sensor User Guide



Make your work more efficient

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Preface

Copyright

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Trademarks

The CHC and CHCNAV are trademark of Shanghai Huace Navigation Technology Limited. All other trademarks are the property of their respective owners.

Safety Information

Before using CHCNAV product, please make sure that you have read and understood this User Guide carefully, as well as the safety requirements.

Limits of Use

This product is designed to withstand the rough treatment and tough environment that typically occurs in construction applications. However, the receiver is a high-precision electronic instrument and should be treated with reasonable care. Operating or storing the receiver outside the specified temperature range could cause irreversible damage.

Responsibilities

CHCNAV is responsible for supplying the product, including the user manual and CHCNAV original accessories. And CHCNAV will not be responsible for any lose caused by the wrong operation or misunderstanding of this User Guide. CHCNAV reserves the rights to update and optimize the contents in this guide regularly. Please contact local CHCNAV dealer for updated information.

Person who is responsible for the product is recommended to understand the safety instructions on the product and the instructions in this user manual.

Please ensure that it is used in accordance with the instructions.

Certification

EMC

Electromagnetic radiation can cause disturbances in other equipment and the disturbances can result in erroneous measurements. Although the product meets the strict regulations and standards which are in force in this respect, CHCNAV cannot completely exclude the possibility that the product may be disturbed by intense electromagnetic radiation, for example, near radio transmitters, two-way radios or diesel generators.

And there is a risk that disturbances may be caused in other equipment if the product is used with accessories from other manufacturers, for example non-standard cables or external batteries or other electronic equipment. So please use the equipment and accessories recommended by CHCNAV only and pay attention to the information about electromagnetic compatibility provided by the manufacturer.

CE

CE marking is a certification mark that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA). The CE marking is also found on products sold outside the EEA that are manufactured in, or designed to be sold in, the EEA.

The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EC directives. For the P2 GNSS sensor, CHCNAV has completed and passed the following standard test parts:

1. EN303 413
2. EN301 489-1/-19
3. LVD
4. EN50498

The first three is for the GNSS part and the fourth is for EMC part.

FCC

The FCC Declaration of Conformity or the FCC label or the FCC mark is a certification mark employed on electronic products manufactured or sold in the United States which certifies that the electromagnetic interference from the device is under limits approved by the Federal Communications Commission.

The FCC label is found even on products sold outside the US territory, because they are either

products manufactured in the US and had been exported, or they are also sold in the US.

For the P2 GNSS sensor, CHCNAV has completed and passed the FCC PART15B standard test parts for GNSS.

IP (INGRESS PROTECTION)

The IP (Ingress protection) classifies and rates the degree of protection against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures.

The IP protection level is composed of two numbers. The first number indicates the level of dustproofing of the appliance to prevent foreign objects from entering. The second number indicates the degree of airtightness of the appliance against moisture and water immersion. The larger the number is, the higher the protection level is.

The receiver is designed with IP67 protection.

1 Introduction

The P2 GNSS Sensor User Guide describes how to set up and use the CHC® P2™ GNSS sensor. In this manual, “the receiver” refers to the P2 GNSS sensor unless otherwise stated.

Even if you have used other Global Navigation Satellite Systems (GNSS) products before, CHCNAV recommends spending some time reading this manual to learn about the special features of this product.

1.1 Over Viewer

The CHCNAV P2 GNSS sensor incorporates a GNSS board in a rugged unit that is ideally suited for positioning applications.

LEDs enable to monitor power status, satellite tracking and data transmission status. Embedded configuration webpage makes the receiver set up effective.

1.2 Receiver Features

The receiver has the following features:

1. The advanced positioning technology for high accuracy
2. 336 channels for all current and future GNSS signals:
 - GPS: L1C/A, L2C, L2E, L5
 - GLONASS: L1C/A, L2C/A, L3 CDMA
 - Galileo: E1, E5A, E5B, E5 AltBOC, E6
 - BeiDou: B1, B2, B3
 - SBAS: L1C/A, L5 (position antenna only)
 - QZSS: L1C/A, L1-SAIF, L1C, L2C, L5
 - IRNSS: L5
 - MSS L-Band : OmniSTAR, RTX (position antenna only)
3. Easy configuration with built-in webUI
4. Tracking all SBAS systems (WAAS/EGNOS/MSAS/GAGAN)
5. OmniSTAR and RTX service (optional)
6. IP67 designed for harsh environment
7. Rich hardware interface designed for integration solution

1.3 Technical Support

CHCNAV Knowledge Base

CHCNAV Knowledge Base (<https://support.chcnav.com/kb/>) is an official website for sharing all official product materials, including manuals, 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 user name, 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 CHCNAV dealer and provide the following information:

1. Firmware version of the receiver
2. Hardware version of the receiver
3. Download the system run log file
4. Describe clearly the problem
5. Pictures or videos about the problem
6. Send all the information to support: support@chcnav.com

Contact Information

CHCNAV support can be reached online via skype, email or phone.

Skype: chc_support | E-mail: support@chcnav.com | Phone: +86 21 542 60 273

2 Installation

This chapter provides instructions and guidelines of installation, introduction of the receiver. Before installing, please make sure that the safety information has been read and understood correctly.

2.1 User interface

This part introduces the connectors and LEDs of the receiver.

2.1.1 Front Connectors

The following picture shows a front view of the receiver. The front panel contains two connectors, respectively are GNSS and COM port.



GNSS Connector: TNC male connector for positioning antenna

COM Connector: customize aviation plug for hardware interface integration, see more information in *chapter 2.2 accessories*

2.1.2 LEDs

The following picture shows the main panel include three LEDs designed for different receiver status.



Battery LED: red color is always on after power-on and off for power-off.



Satellite LED: blue color indicates that the unit has acquired satellites. A rapid flash indicates that the unit has less than 5 satellites acquired while a slow flash indicates greater than 5 satellites acquired. This LED will stay on if the unit is in monitor mode.



RTK Correction LED: yellow color indicates that the unit is receiving corrections. This will also flash when the unit is in monitor mode.

2.2 Accessories

This chapter provides accessories information for the receiver.

2.2.1 Accessory List

The table below provides an overview of the different items of the P2 package, includes standard accessories and optional accessories.

Name	Describe	Photo
P2	Receiver	
Standard Accessories		
Data Cable	19 Pin aviation plug	
Power Cable	External power cable	
Optional accessories		
Power adapter	Power adapter with cord (both European/North American/British Standard optional)	
GPS Antenna Cable (TNC)	RG58, 5-meter * 2	
GNSS Antenna (TNC)	A220GR * 2	
Magnetic Mount	M90SD * 2	

Name	Describe	Photo
Choke Ring antenna	C220GR Geodetic Choke Ring Antenna Constellation	
Aerial antenna	B220 Geodetic GNSS Antenna Constellation	
GPS Antenna Cable (TNC)	RG58, 10-meter * 2	
Network line	5-meter	

2.2.2 Connector Definition

This chapter provides a brief introduction of the hardware interface and focus on 3rd party integration.

2.2.2.1 DB9 Female Connector

The DB9 female connector always used as RS232 serial port for data transmission and the pin definition is as shown below:

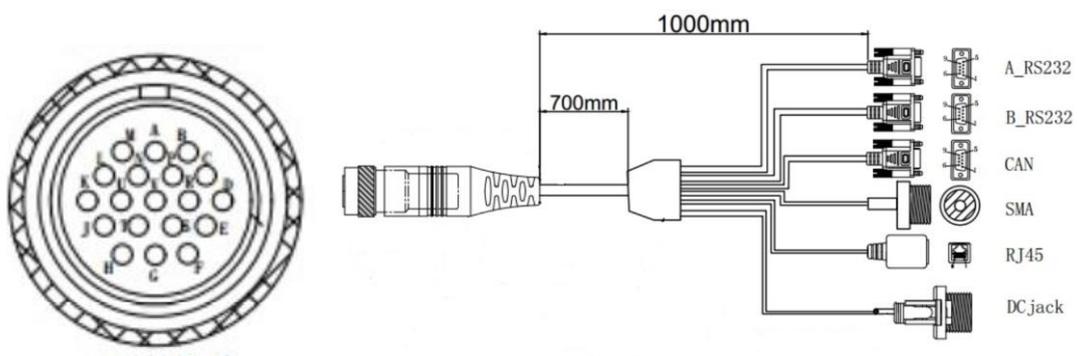


PIN	Signal Name	Description
1,4,6,7,8,9	Not Used	Not Used
2	TXD	RS232-TX (transmit data through this pin)

PIN	Signal Name	Description
3	RXD	RS232-RX (receive data through this pin)
5	GND	External Power Ground

2.2.2.2 19 PIN aviation plug interface

The 19 PIN aviation plug is customized by CHCNAV to make the integration more convenient. The hardware interface designed as below:



PIN name	PIN definition	Port type	Port Name
G	3	BD9 female-1	A_RS232
T	5		
C	2		
M	1	SMA female	SMA
G	Shell/Shield		
G	5	BD9 female-2	B_RS232
S	2		
D	3		
G	6	BD9 female-3	CAN
P	8		
E	9		
G	3		
R	7		
F	2	RJ45	RJ45
G	RJ45/Shield		
A	3		
B	6		

PIN name	PIN definition	Port type	Port Name
U	2		
V	1		
K	DC Jack	POWER+	2A Current
L	DC Jack		
H	DC Jack	POWER-	
J	DC Jack		

A_RS232: DB9 female RS232 port, direct connection with built-in GNSS board

B_RS232: DB9 female RS232 port, direct connection with built-in GNSS board

CAN: CAN port, worked as a CAN device, used for data output

SMA: PPS signal port, used for PPS time service

RJ45: Ethernet port, used for login the webpage of built-in GNSS board

DC Jack: Power supply port (voltage range: 9 ~ 36V DC)

2.3 Additional Equipment and Software

For an optimal installation, the following equipment and software are required.

2.3.1 Additional Equipment

1. General-purpose tools: portable drill, pliers, wire cutters, screwdrivers, wire, mounting bolts and wrenches
2. Measuring instrument: Accurate voltmeter or multi-meter
3. Power Supply: External battery (voltage range: 9 ~ 36V DC) or power adapter with cord
4. Communication Cables: Serial, USB or Ethernet data cable
5. Computer or laptop

2.3.2 Additional Software

1. Serial debugging tool: Used for data output testing and connection confirmation
2. Network debugging tool: Used for data output testing
3. Winflash software: Used for IP configuration and firmware update for the built-in GNSS board

4. Browser (recommended: Google Chrome, Microsoft Internet Explorer version 10, or higher, Apple Safari): Used for webpage login for the receiver configuration and built-in GNSS board configuration.

2.4 Environmental Considerations

2.4.1 Temperature

Please make sure that the receiver's operating and storage temperature ranges are not exceeded:

- Operating: -40 °C to +75 °C (-40 °F to +167 °F)
- Storage: -55 °C to +85 °C (-67 °F to +185 °F)

2.4.2 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.

2.4.3 Electronic Interference

High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. It can prevent the receiver electronics from functioning correctly.

Avoid locating the receiver or antenna within 400 meters to a powerful radar, television, other transmitters or GNSS antennas. Low-power transmitters, such as those in cell phones and two-way radios, normally do not interfere with receiver operations.

2.5 Power Supply

The receiver provides two kinds of power supply, power adapter or battery both are supported. For power supply, please follow the guidelines below:

1. This receiver is not intended to be used in a wet environment, or an environment that may become wet when it is powered by the external DC/AV power supply.
2. The external power adapter and its associated power cord and plug are not intended to be installed outdoors or in a wet location.
3. Do not power the receiver through external power when operating in a wet

environment or an environment that may become wet. The power input connections must be protected.

2.5.1 Power Adapter

Power adapter is a worldwide AC power supply. Different cords with appropriate plugs for different countries are supplied with adapter. The recommended power adapter supports three standards of cord, respectively are European standard, North American Standard and British Standard.



Europe Standard

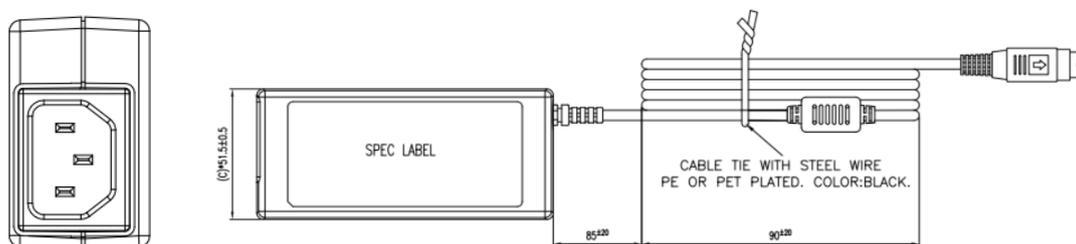


North America Standard



British Standard

Please choose the right one according to your needs. And the following chart show the specification about the power adapter,



Power adapter Exterior

Characteristics	Type	Specification
Input	Normal Voltage	100~240V AC
	Input Voltage	90~264V AC
	Normal Frequency	50~60Hz
	Input Frequency	47~63Hz
Output	Rated Voltage	12V DC
	Voltage Range	11.4~12.6V DC
Temperature	Operating	-30 °C to +40 °C
	Shipping/Storage	-20 °C to +70 °C
Mechanical	Dimension	L*W*H :115*51.5*30.5mm

Characteristics	Type	Specification
	DC cable length	1200mm

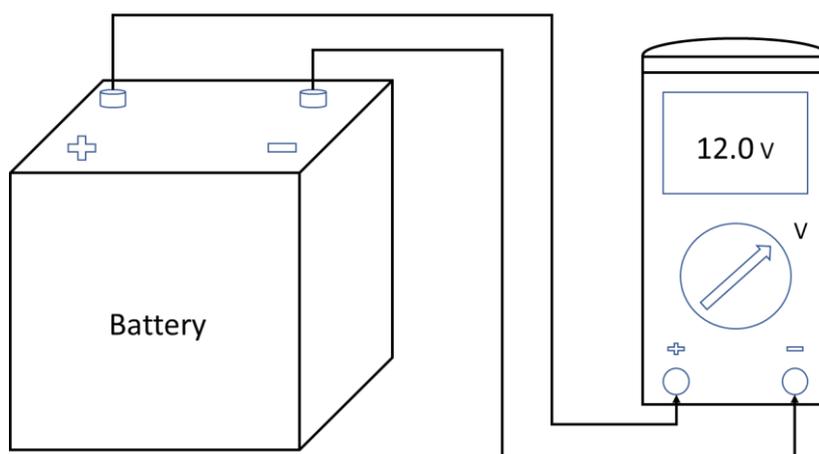
Power Adapter Specification

And other type of power adapter also can be used to work with the receiver, please pay attention to the specifications of the adapter, especially output voltage, temperature and safety requirements.

2.5.2 Battery

The receiver does not have built-in battery but can be powered by external battery via its power cable.

Before connecting the receiver’s power cable with battery cable’s clip, please check that the battery has enough power. As shown below:



Battery Checking with Multi-meter

While connecting battery cable's clip leads to a battery, please do not allow any metal object to connect (short) the battery's positive (+) terminal, neither the negative (-) terminal. This could result in high current, arcing, and high temperatures, exposing the user to possible injury.

2.6 Mounting GNSS Antennas

One antenna in the receiver used for positioning application to provide positioning information. The correct position of the antenna is very important. Firstly, find a suitable

installation place, then according to the installation instructions.

2.6.1 Location Selection

The selection of GNSS antenna installation location is very important to guarantee the performance, it will directly affect data quality. In addition to paying attention to electromagnetic interference, please follow the guidelines below:

1. Choose an antenna location with a clear view of the sky, in order to track more satellites.
2. Mount the antenna on a secure, stable structure capable of safe operation.
3. Ensure the antenna cannot move due to shake.
4. Mount the primary and secondary antennas as far apart as possible. A minimum separation distance of 1 meter is recommended.

2.6.2 Antenna Selection

GNSS antenna behaves as both a spatial and frequency filter, therefore, selecting a right GNSS antenna is critical to optimize performance. An antenna must match the receiver’s capabilities and specifications, such as size, weight, environmental and mechanical specifications of the intended application. There are 3 antenna types recommended for work together with the receiver to meets typical application for dual antenna heading.

Antenna Type	Constellation and signals	Weight	Certification	Size
A220GR Geodetic GNSS Antenna	GPS L1, L2; GLONASS L1, L2; BDS: B1, B2, B3; Galileo: E1, E5a, E5b; SBAS: L1 C/A, L5; QZSS: L1 C/A, L1 SAIF, L2C, L5;	0.4kg	NGS MIL-STD-810G IP65	

Antenna Type	Constellation and signals	Weight	Certification	Size
B220 Geodetic GNSS Antenna	GPS L1, L2, L5; GLONASS L1, L2; BDS: B1, B2, B3; Galileo: E1, E5b; SBAS: L1 C/A, L5; QZSS: L1 C/A, L1 SAIF, L2C, L5;	0.15 kg	IP67	
C220 Geodetic GNSS Antenna	GPS L1, L2, L5; GLONASS L1, L2; BDS: B1, B2, B3; Galileo: E1, E2, E5a, E5b, E6; SBAS: L1 C/A, L5; QZSS: L1 C/A, L1 SAIF, L2C, L5; L-Band;	4.9 kg	IGS MIL-STD-810G IP67	

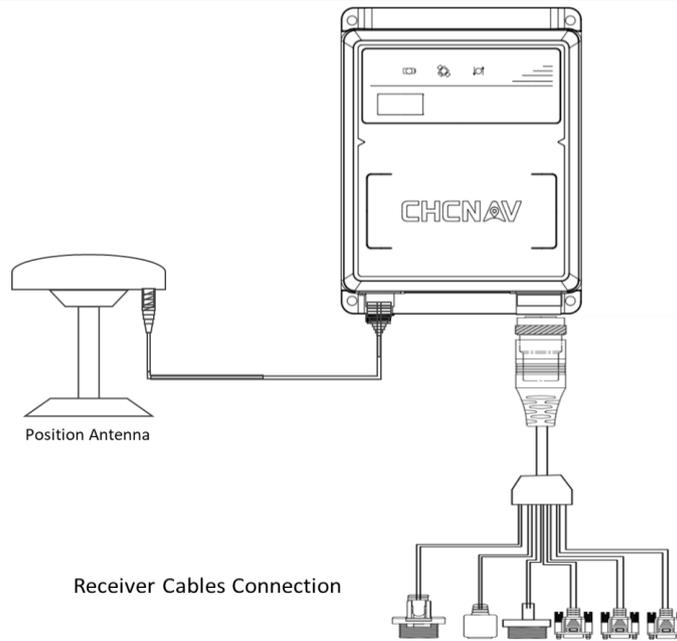
Other GNSS antennas may be used, please ensure that the antenna receives the proper GNSS frequencies and operates at either 3.3 V or 7.1 V with a signal greater than 40 dB at the antenna port.

2.7 Mounting Cables

This chapter mainly makes the introduction about the connections between the receiver and the accessories. Please read this part carefully to avoid some installation errors.

2.7.1 Over Viewer

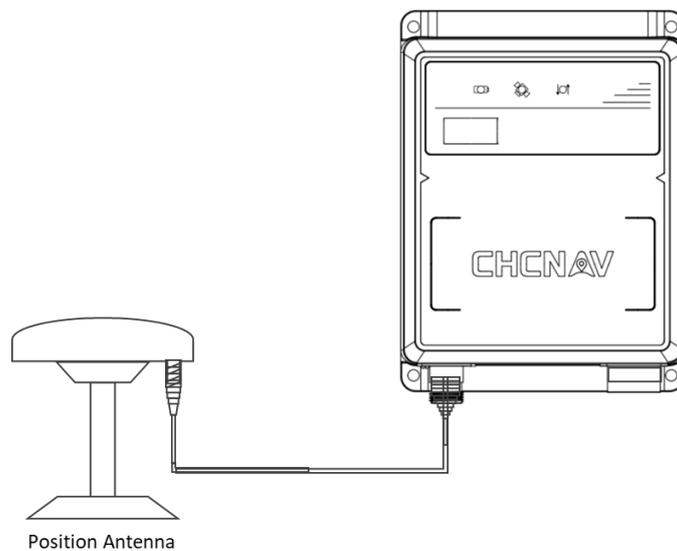
The full connections about the receiver and the accessories are shown as below. It's necessary for you to make all the connections right to start the work. The connection of accessories depends on the application.



2.7.2 GNSS Antenna Cable

The receiver provides one TNC-type male connectors for connecting to GNSS antenna. The receiver is intended for use with one CHC Geodetic GNSS antennas. Connect the antenna to the TNC plug socket of the receiver via the GNSS antenna cable.

1. Choose the right connector for GNSS antenna connection.
2. Choose the proper length of the GNSS antenna cable according to your application, the standard length of this cable is 5 meters.
3. Make sure the connectors in the receiver and antenna both are tightened.



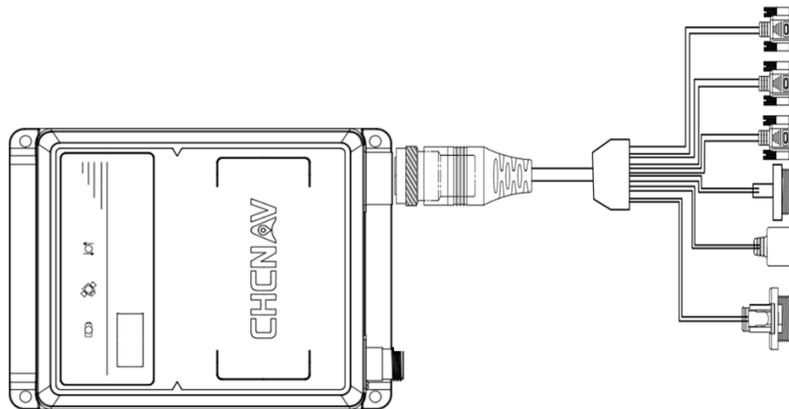
2.7.3 Aviation Plug Cable

The connection between the aviation plug cable and the receiver connector is showed in the picture as below. Please follow the steps below to complete the connection.

Step1: Align the connector and the aviation plug cable grooves

Step2: Pull the plug into the connector for about 5 millimeters.

Step3: Pull the locker forward to the head of the plug and rotate it to the connector.



After all installation, please follow the instructions below to check the installation again:

1. Ensure that the system components are securely mounted and will not lose due to vibrations.
2. Ensure that the cable to the receiver is well secured with clamps or alternative fasteners.
3. Ensure that cabling and wiring do not cause any strain on the connectors.

2.8 Power on & Operating Check

The power port of the receiver is designed with DC jack type in the aviation plug cable which should be connected before power on. The receiver supports both external battery and adapter power supply. Please follow the following steps.

For the external battery power:

1. Check the battery level with multimeter.
2. Use the battery cable clip clamp to the external power cable pins.

3. Insert the external power cable into the DC jack port.

For the adapter power supply:

1. Connect the adapter cord to the adapter.
2. Plug the adapter into an electrical outlet which is powered on.
3. Insert the adapter output port into the DC jack port as below.



After power on, the following will indicate that the system is running normally.

1. Three LEDs lighting up at the same time.
2. Three LEDs all flash once in about 300ms.
3. All the LEDs extinguished and the power LED lighting up in red color.
4. About 6 seconds later, the satellite LED start flashing quickly.
5. About 30 seconds later, the satellite LED and correction LED both flash slowly.

3 Operation

This chapter describes the operation to set up the receiver via built-in webpage, including receiver running status monitoring, receiver work mode, data output and other settings for different applications. Before working with the receiver, please make sure the receiver is powered on and running normally.

Please note that all the operation pictures depicted Google Chrome browser in a Windows 10 environment, for reference only.

3.1 Receiver Connection

This chapter is mainly about how to set the built-in GNSS board with WinFlash software for advanced settings.

3.1.1 Requirements

Before making the settings about the GNSS board, some devices, cables and software are necessary. Please prepare the accessories according to your requirements. All the requirements are shown as below.

Devices:

1. Personal computer with USB port or COM port;
2. USB to RS232 converter;

Cables:

1. Network cable;
2. Serial cable;

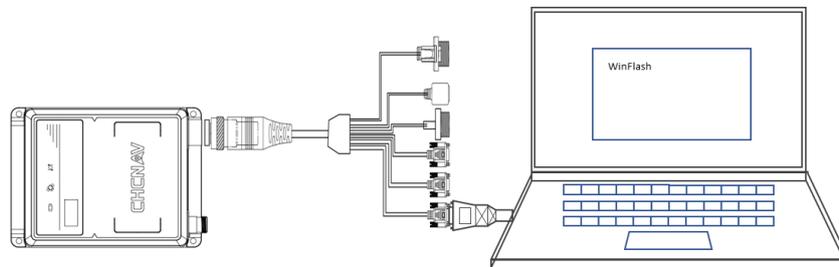
Software:

1. WinFlash software;
2. USB to RS232 converter driver software;
3. Browser software;

Please make sure that all the devices and cables are in good condition and are properly connected to the receiver. And all the software shall be installed correctly in your PC.

3.1.2 Communication

The following picture shows the connection between the receiver and the pc with a USB to RS232 converter.

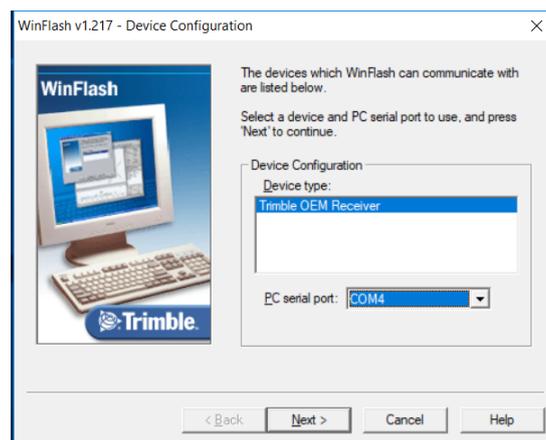


Before making the settings, please turn ON the receiver first. And please notice that the USB converter’s RS232 male connector is connected to the B-RS232 connector in the aviation plug cable. The wrong connector may lead to the failure of connection.

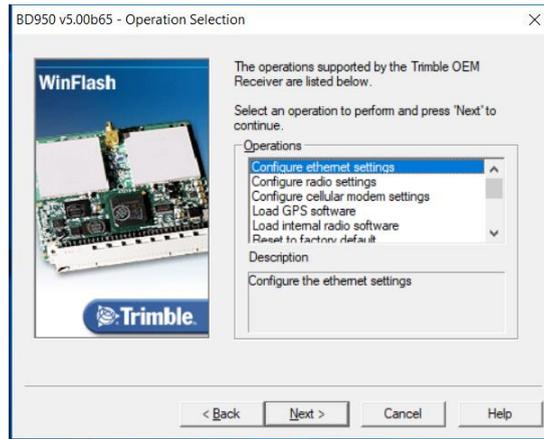
3.1.3 IP Configuration

After the connection of the GNSS board and the receiver, please follow the steps below to configure the IP.

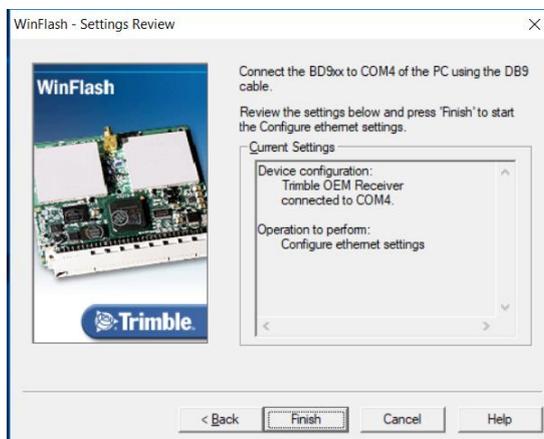
- Step 1. Run WinFlash software in your pc;
- Step 2. Select a proper serial port in the drop-down box and click next;



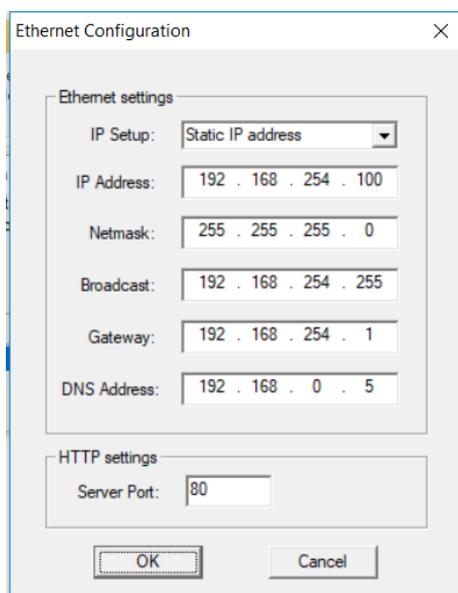
Step 3. Select the operation for “Configure ethernet settings” and click next.



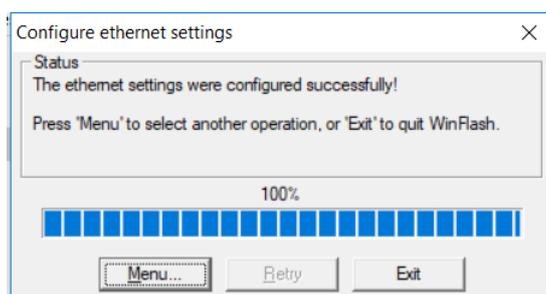
Step 4. Click “Finish” option to start the IP configuration.



Step 5. Select the “Static IP address” in the drop-down box and type the proper IP address, Netmask, Broadcast, Gateway and DNS address. The server port is recommended as the default. Click “OK” to make the settings effective.



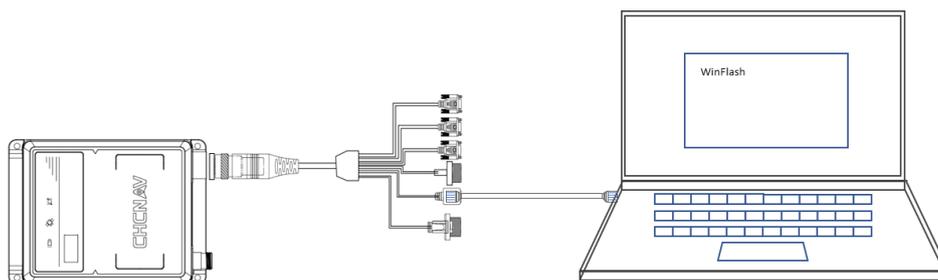
Step 6. When the progress bar is 100%, click the “Exit” button to finish the settings.



3.1.4 WebUI Login

By connecting to the static IP address of the GNSS board, users can easily login the webpage to set up the board.

Before login the webpage, the connection between the receiver and your PC is shown as below. And a LAN cable with two male connectors is necessary for the connection.



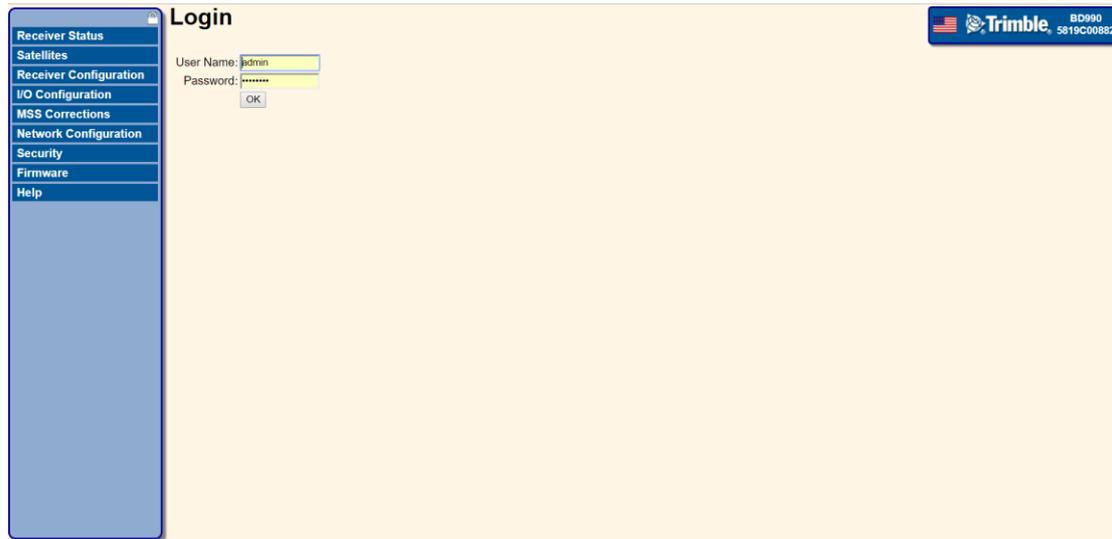
If it is the first time to login the webpage, please follow the steps below to make connection and login work well. And if the configuration of static IP is set up before, please directly using this static IP to login.

Step 1. Plug male connectors of the LAN cable into the female connector for the receiver and your PC.

Step 2. Set your PC IP address as the same network of the receiver.

Step 3. Open the browser and enter the receiver’s IP address in the URL box.

Step 4. Enter default User name = admin and Password = password for login.

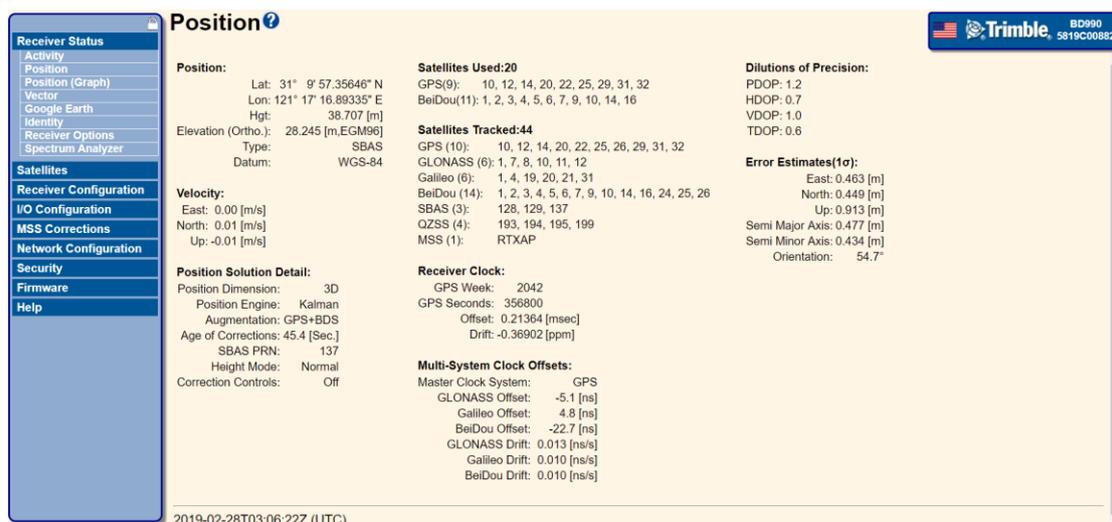


Step 5. Finished.

3.2 Status Monitoring

With built-in webUI designed for the receiver, you can check and monitor the receiver operating status and configuration parameters conveniently. For this chapter, mainly including three parts, position status, satellite status and general configuration.

3.2.1 Position Status



This page shows general information about the current position solution derived from satellite measurements. This information mainly includes:

Position – Shows the current position solution.

Lat – Latitude in degrees, minutes, and seconds.

Lon – Longitude in degrees, minutes, and seconds.

Hgt – Height above the ellipsoid to the Antenna Phase Center in meters.

Type – Current position type.

Old – No updated position available.

Autonomous – Position has no satellite corrections applied.

Code Diff – Code differential solution – typically a single-frequency solution.

Phase Diff – Carrier phase differential solution (also known as Real-Time Kinematic (RTK) solution), typically a dual-frequency solution.

Beacon DGPS – Code phase differential solution using RTCM correction from an internal IALA MSK beacon receiver.

OmniSTAR VBS – Position using OmniSTAR VBS satellite-based correction service.

OmniSTAR XP – Position using OmniSTAR XP satellite-based correction service.

OmniSTAR HP – Position using OmniSTAR HP satellite-based correction service.

OmniSTAR HP+G2 – Position using OmniSTAR HP and G2 satellite-based correction service.

CDGP – Position using the Canadian DGPS corrections.

SBAS+ – Position using the SBAS Plus corrections.

SBAS – Position using SBAS corrections.

GVBS – Position using the clocks and orbits information from RTX corrections to augment the autonomous solution.

RTK and RTK Location – Carrier phase double difference position correction service.

RTX – Position using Trimble CenterPoint RTX satellite-based or IP correction service.

xFill – Position using Trimble xFill RTK augmentation service (5 minute duration limit).

xFill-RTX – Position using Trimble xFill RTK augmentation service with unlimited duration. Service requires a CenterPoint RTX subscription.

Satellites Used – Shows the list of satellites used in the current position solution. Satellites

may be tracked by the receiver but not used in the position solution. Satellites may not be used if no ephemeris available, measurements do not meet the receiver's quality requirements, or differential correction data is not available.

Satellites Tracked – Shows the list of all satellites being tracked by the receiver. Some of the satellites tracked may not be used in the position solution. The number of satellites tracked by each antenna is shown in brackets.

Dilutions of Precision – Shows information about the strength of the satellite constellation with respect to a specific position attribute. The various DOPs take into account the location of each satellite relative to other satellites in the constellation, as well as their location relative to the receiver. Low DOP values indicate a higher probability of precision (lower precision dilution).

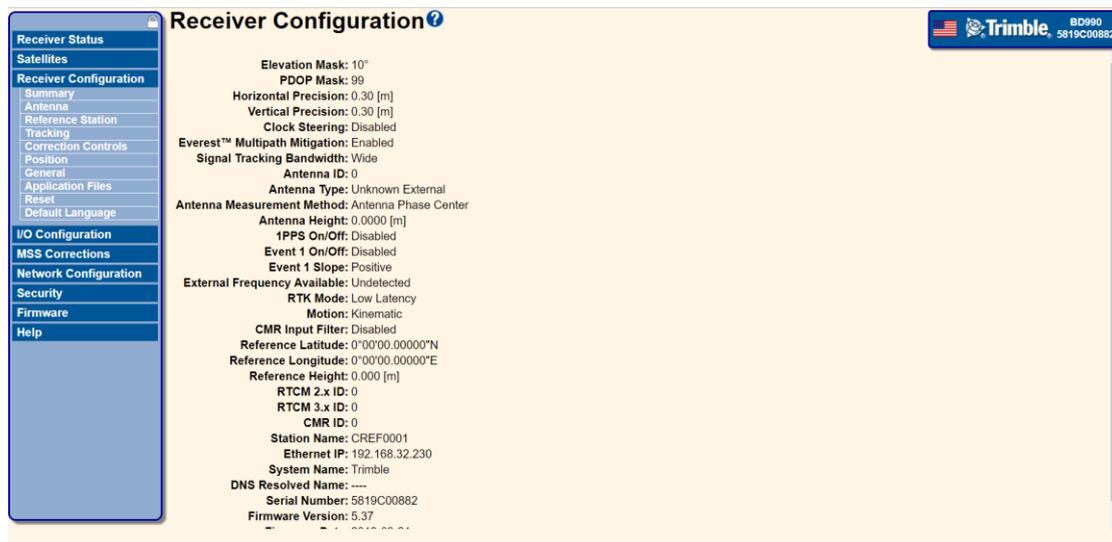
PDOP – Position DOP, indicates the strength of the satellite constellation for general position precision.

HDOP – Horizontal DOP, indicates the strength of the satellite constellation for horizontal position precision.

VDOP – Vertical DOP, indicates the strength of the satellite constellation for vertical position precision.

TDOP – Time DOP, indicates the strength of the satellite constellation for determining time and the clock offset.

3.2.2 General Information



This page displays the current settings of the receiver.

Elevation Mask – The elevation mask below which the receiver will not track satellites.

PDOP Mask – The value for PDOP above which the calculation of new RTK positions is suspended until the PDOP falls below the mask value again. A DGPS position is output when the PDOP for the RTK position exceeds the PDOP Mask.

Clock Steering – When enabled, the receiver clock is steered to GPS system time rather than periodically introducing 1 ms steps and constraining the clock to ± 0.5 ms. Disabled by default; this setting does not affect performance.

Antenna ID – A numeric representation of the selected antenna type being used with the receiver.

Antenna Type – The selected antenna type being used with the receiver.

Antenna Measurement Method – Select how the antenna height is being measured. This setting is only applied at the base station in the generation of correction messages (CMR or RTCM). The height output from the receiver does not account for this offset; the Antenna Phase Center (APC) height is always given.

Antenna Height – The height of the antenna reference point. This setting is only applied at the base station in the generation of correction messages (CMR or RTCM). The height output from the receiver does not account for this offset; the Antenna Phase Center (APC) height is always given.

1PPS On/Off – Indicates the state of the 1PPS output on Serial 3 port.

RTK Mode – Indicates if the receiver is in a synchronized or low latency RTK mode. This mode determines if the unit is Static or Moving for base station applications, OmniSTAR initialization, and RTK rover operation. This mode does not affect autonomous, SBAS, or DGNSS operation

Reference Latitude – The WGS-84 reference station latitude.

Reference Longitude – The WGS-84 reference station longitude.

Reference Height – The WGS-84 reference station ellipsoid height.

RTCM 2.x ID – A unique identifier for the RTCM messages. Can be any value from 0 to 1023.

RTCM 3.x ID – A unique identifier for the RTCM messages. Can be any value from 0 to 4095.

CMR ID – A unique identifier for the CMR message. Can be any value between 0 to 31.

Station Name – The sixteen-character name of the reference station.

Ethernet IP – The Ethernet IP address of the receiver.

System Name – The unique system name for the receiver.

DNS Resolved Name – The name returned by the DNS system.

Serial Number – The serial number of the receiver.

Firmware Version – The version of the firmware currently installed in the receiver.

Firmware Date – The production date of the firmware currently installed in the receiver.

3.2.3 Satellite Status

	Tracked # Satellites	Constellation # Satellites
GPS	10 10, 12, 14, 20, 22, 25, 26, 29, 31, 32	32 1, 2, 3, 5...32 Unhealthy: 4
GLONASS	6 1, 7, 8, 10, 11, 12	24 1...24
Galileo	6 1, 4, 19, 20, 21, 31	26 1...5, 7, 8, 9, 11, 12, 13, 15, 19, 21, 24...27, 30, 31, 33, 36 Unhealthy: 14, 18, 20, 22
QZSS	4 193, 194, 195, 199	4 193, 194, 195, 199 Disabled: 196, 197, 198, 200, 201, 202
BeiDou	14 1...7, 9, 10, 14, 16, 24, 25, 26	30 1...14, 16, 19...30 Unhealthy: 15, 17, 18
IRNSS	0	7 Unhealthy: 1...7
SBAS	3 128:GAGAN - GSAT 10 137:MSAS-2 129:MSAS-1	
MSS	1 RTXAP	

2019-02-28T03:07:27Z (UTC)

This page shows overview information about the satellites being tracked and the overall satellite constellation. The information on this display is updated every five seconds.

Tracked – Shows the total count and PRN numbers of the satellites currently being tracked; the display includes GPS, BeiDou, SBAS, OmniSTAR, GLONASS, and Galileo.

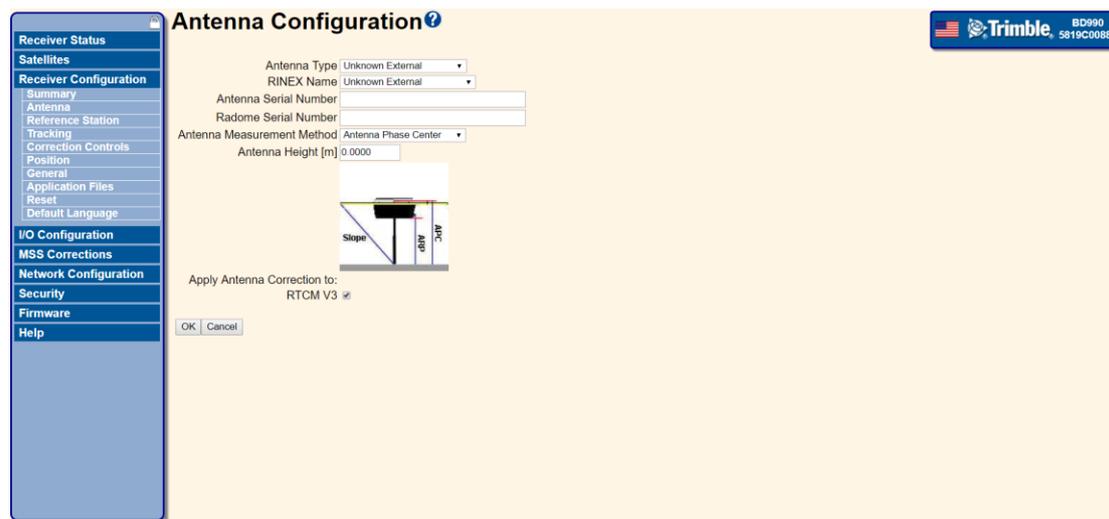
Constellation – Shows how many satellites are currently in orbit for the named constellation, and which, if any, are Unhealthy. This information comes from the most recent data transmitted in satellite almanacs.

Ignore Health – Shows how many satellites have been selected by the user to be tracked even if they are currently thought to be unhealthy. Typically, unhealthy satellites will not be tracked, measured, or used in position calculations.

3.3 Work Mode Setting

This chapter gives a quick description about the receiver work mode, including antenna configuration, reference station and receiver reset.

3.3.1 Antenna Configuration



Use these settings to define the antenna being used by the receiver.

Antenna Type – Select the type of antenna being used with the receiver. The antenna serial number is automatically shown for the GNSS smart antenna. Setting this field will automatically set the “RINEX Name” in the following field.

RINEX Name – Allows the selection of the type of antenna being used with the receiver using the RINEX name of the antenn. Setting this field will automatically set the “Antenna Type” in the preceding field.

Antenna Serial Number – Enter the serial number of the antenna being used.

Antenna Measurement Method – Select how the antenna height is being measured. This setting is only applied at the base station in the generation of correction messages (CMR or RTCM). The height output from the receiver does not account for this offset; the Antenna Phase Center (APC) height is always given.

Antenna Height [m] – Enter the measured height of the antenna. This is typically measured from a ground marker or the mounting point of the antenna. This setting is only applied at the base station in the generation of correction messages (CMR or RTCM). The height output from the receiver does not account for this offset; the Antenna Phase Center (APC) height is always

given.

3.3.2 Reference Station



Use this page to set the general receiver settings.

Enable Shared Port – Sets the shared port on the receiver to be an additional serial port, a CAN bus, or a second Event Marker.

Autobase – Enable with Warning or disable the AutoBase function of the receiver.

- **Disable** – When a receiver is turned on, it automatically installs the CURRENT Application file and starts running, applying all previous settings.
- **Enable with Warning** – After the receiver has a stable position; it uses that position to search for a base position in the stored Application files in the receiver. If there is no base position within the AutoBase search distance (20 m 2D) of the current position in any of the stored application files, then AUTOBASE FAILED warning appears on the modular receivers that have the 2-line display so you can intervene and fix the problem. The receiver continues to use the CURRENT Application file, until you update the configuration or set up a new reference base setting. If corrections are turned ON in the previously mentioned CURRENT Application file, the receiver continues sending corrections with the previous base position in the CURRENT Application file. If the CURRENT Application file does not have any corrections set up, then there will not be any transmissions.

Operation Mode – Choose between Base, Rover, Moving Base, and Heading modes.

- **Base** – Provides base station functionality. The Motion is set to Static.
- **Rover** – Provides rover functionality. The Motion is set to Kinematic.

- Moving Base – Provides Moving Base functionality. The Motion is set to Kinematic and a CMR output is configured on Serial 3. To reconfigure this, select I/O Configuration / Port Configuration. The RTK Mode is set to Low Latency to allow for the use of static CMR or RTCM corrections. However, you can change it to Synchronous if you use Moving Base CMR corrections from another Moving Base receiver.

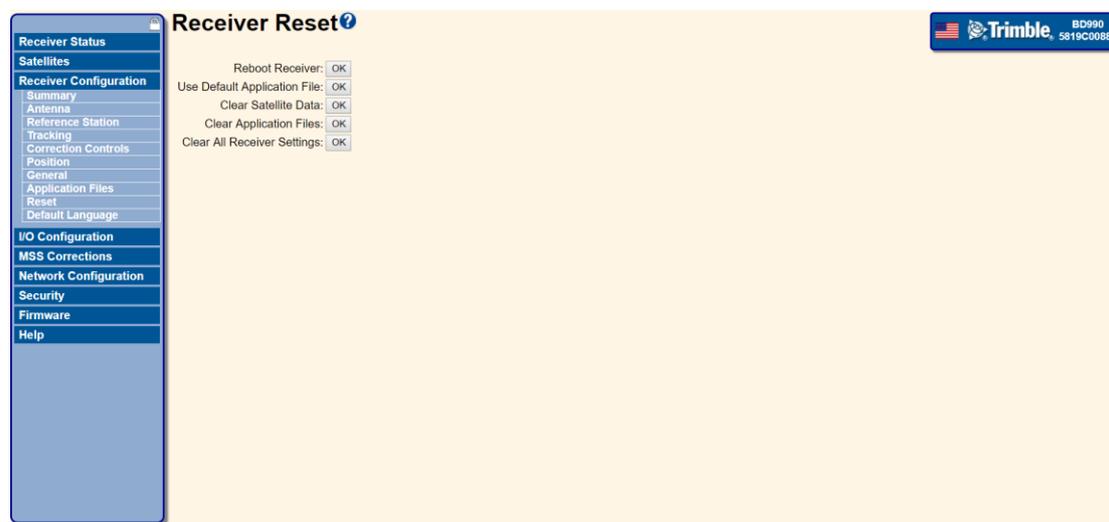
Note – The internal radio does not support transport of Moving Base CMR corrections.

- Heading – Provides Heading functionality. Requires CMR input from a Moving Base receiver. The Motion is set to Kinematic and the RTK Mode is set to Synchronous. If CMR corrections are available from a Moving Base receiver, the Heading (True North) is displayed on the receiver front panel.

Automatic MBase output – When enabled, the MBase CMR output is automatically configured to output on Serial 3 when Operation mode is set to Moving Base.

1PPS On/Off – Enable or disable the 1PPS (one pulse-per-second) output regardless of whether or not the clock has been set, and to continue to output even after the clock is believed to have degraded.

3.3.3 Receiver Reset



Reboot Receiver – Select this option to restart the receiver. All data and settings are kept.

Use Default Application file – Select this option to reset the receiver to its factory default settings. The satellite ephemeris and almanac data and all logged data files are kept. The receiver does not restart.

Clear Satellite Data – The satellite ephemeris and almanac data is cleared, and the receiver

restarts.

Clear Application Files – Select this option to reset the receiver to its factory default settings and clear any application files resident in non-volatile memory. The receiver restarts. All Ethernet network settings are kept and satellite ephemeris and almanac data is preserved.

Clear All Receiver Settings – Select this option for the receiver to perform the three operations above and also clear all Ethernet network settings. The receiver restarts.

3.4 Data Output Setting

This chapter mainly describe the usage of the IO configuration, including data output settings via TCP/IP, NTRIO Client, NTRIP Server, NTRIP Caster, Serial and USB.

3.4.1 I/O Configuration

Type	Port	Input	Output
TCP/IP	5017	-	-
TCP/IP	5018	-	-
TCP/IP	28001	-	-
TCP/IP	28002	-	-
NTRIP Client 1	-	-	-
NTRIP Client 2	-	-	-
NTRIP Client 3	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (115K-8N1)	-	-
Serial	COM2 (115K-8N1)	-	-
Serial	COM3 (115K-8N1)	-	-
USB	-	-	-

This page displays the current receiver I/O configuration.

Type – Indicates what types of inputs/outputs are available.

- *TCP/IP* (Transmission Control Protocol/Internet Protocol) – A connection over an IP network.
- *UDP* (User Datagram Protocol) – A connection over an IP network.
- *IBSS/NTRIP Client 1, 2, 3* – A connection to IBSS or an NTRIP Caster for receiving correction data.
- *IBSS/NTRIP Server 1, 2, 3* – A connection to IBSS or an NTRIP Caster for sending correction data.

- *NTRIP Caster 1, 2, 3* – Allows up to ten users (NTRIP Clients) per port to request single base correction data.
- *Serial* – An RS-232 connection.
- *USB* (Universal Serial Bus) – A connection over USB.
- *CAN* (Controller Area Network) – A connection to a Controller Area Network (CAN).

Note – *NTRIP is Networked Transport of RTCM via Internet Protocol. IBSS is Internet Base Station Service.*

Port – Which port the input/output is being transferred on.

- *TCP/IP or UDP* – The port number will be displayed.
- *IBSS/NTRIP Client* – The type of the service and the name of the base station or Mountpoint it is connected to.
- *IBSS/NTRIP Server* – The type of the service and the name of the base station or Mountpoint being sent to the NTRIP Caster.
- *Serial* – Serial ports will indicate the receiver connector, baud rate, data bits, parity, and stop bits settings of the port.
- *USB* – No port will be displayed.
- *CAN* – No port will be displayed.

Input – The type of input that is received on the port. The correction stream input currently being used in the position solution will be shown in **bold** text.

Output – The type of output that is sent on the port.

Connection Colors – The color of the connection provides additional status information.

- **Green** – Indicates an active connection from another device on that port.
- **Yellow** – Indicates a connection is having problems or is not functioning properly.
- **Red** – Indicates no connection from another device on that port.
- No highlight – The serial port connections are not highlighted since it is not possible to distinguish if there is a connection from another device.
- **Bold** – Indicates that this correction stream input is currently being used for the position solution.

3.5 Other Settings

This chapter includes three important configuration menus about the receiver. Language setting menu, Firmware update menu and Network configuration menu all

in this chapter.

3.5.1 Language



Use this menu to select the default language of the web interface. The receiver language setting is contained in the web browser cache. To see the language change, clear the browser cache or open a new browser.

To change the language, click the option next to the corresponding country flag.

3.5.2 Firmware Update



This page provides a summary of the firmware currently installed on the receiver. You can also use it to install new firmware on the receiver.

Firmware Warranty Date – Indicates when the firmware support for the receiver will expire.

Once the date shown has passed, the receiver will not install new firmware. Before new firmware is loaded to the receiver, an Extended Warranty must be purchased from CHCNAV and the receiver must be updated.

Active Firmware Version – Shows the version of firmware that is currently installed on the receiver.

Active Firmware Release Date – Shows the date that the firmware currently installed on the receiver was produced.

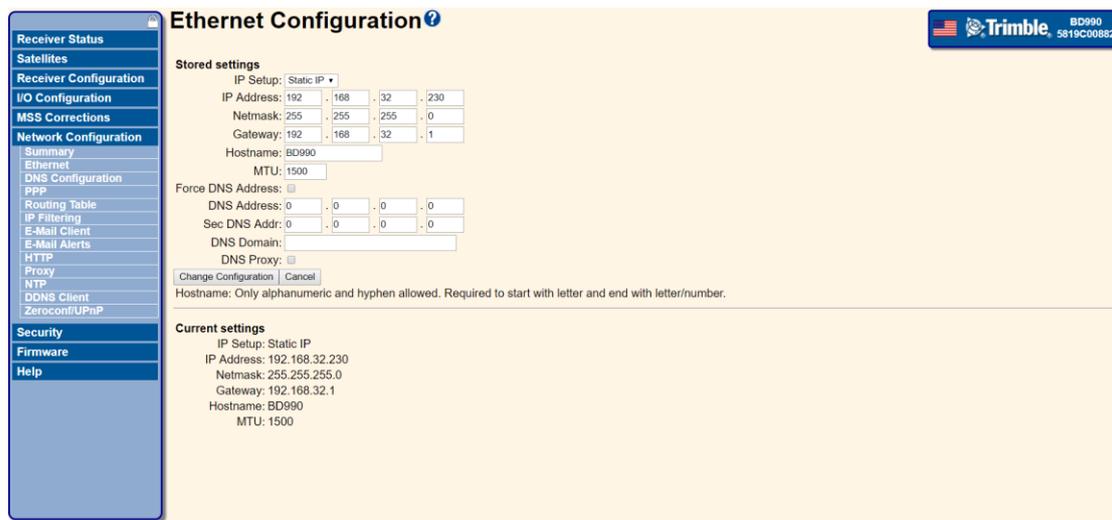
Active Firmware Warranty Date – Shows the warranty date for the firmware currently installed on the receiver. This can be different to the Active Firmware Release Date. The firmware will only load into the receiver if this date is prior to the Firmware Warranty Date set in the receiver.

Active Firmware Checksum – Used by support to verify that the current firmware of the receiver is correctly installed.

Choose File – Click Choose File to locate new firmware on your computer to install on the receiver.

Install New Firmware – Begins the installation of the newly uploaded firmware to the receiver. Status updates are given at the bottom of the page during a new firmware installation.

3.5.3 Network Configuration



These settings display the current receiver Internet configuration.

IP Address – Displays the current Ethernet IP address of the receiver.

Netmask – Displays the current netmask of the receiver.

Gateway – Displays the current gateway of the receiver.

Hostname – Displays the current hostname of the receiver.

MTU – Displays the current MTU value of the receiver.

DNS Address – Displays the IP address of the current Domain Name Server.

4 Care & Maintenance

The receiver is a sophisticated electronic device for high precision measurement. It has been designed to provide many years of reliable service within reasonable usage. The following care and maintenance tips will ensure the performance of the receiver.

4.1 Transport

When transporting the receiver by rail, air or sea, always use the complete original CHCNAV packaging, transport container and cardboard box, or its equivalent to protect against shock and vibration.

4.2 Storage

Respect the temperature limits while storing the receiver. Please refer to *chapter 5 Specification* for information about temperature limits.

5 Specifications

This chapter describes the specifications of the P2 GNSS receiver. Specifications are subject to change without notice.

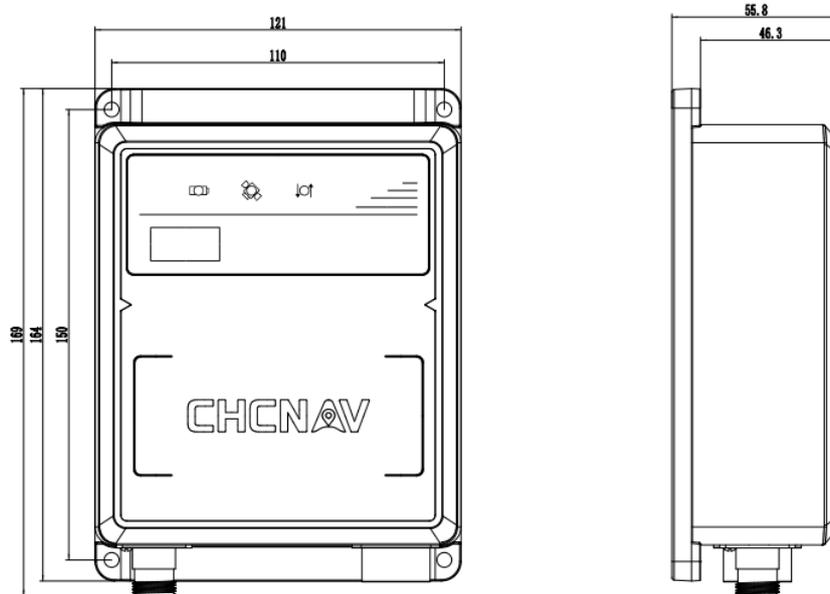
5.1 Receiver Performance

The key specifications are shown in the table below, mainly about positioning accuracy, signal tracking and some features about data output.

Parameter	Specification	
Real time kinematic Accuracy	Horizontal	8 mm + 1 ppm RMS
	Vertical	15 mm + 1 ppm RMS
Autonomous Accuracy	Horizontal	1.00 m RMS
	Vertical	1.50 m RMS
SBAS Accuracy	Horizontal	0.50 m RMS
	Vertical	0.85 m RMS
Code differential Accuracy	Horizontal	0.25 m + 1 ppm RMS
	Vertical	0.50 m + 1 ppm RMS
Time accuracy	20 ns RMS	
Channels	336	Positioning
Signal Tracking	GPS	L1 C/A, L2E, L2C, L5
	GLONASS	L1 C/A, L2 C/A, L3 CDMA
	BeiDou	B1, B2, B3
	Galileo	E1, E5A, E5B, E5AltBOC, E6
	IRNSS	L5
	QZSS	L1 C/A, L1 SAIF, L2C, L5, LEX
	SBAS (Position Antenna Only)	L1 C/A L5
	MSS L-Band (Position Antenna Only)	OmniSTAR, Trimble RTX (optional)
Time to first fix	Cold start	<45 s
	Warm start	<30 s
	Signal re-acquisition	<2 s
Data rates	Measurements	Up to 50hz
	Position	Up to 50hz

5.2 Mechanical

The receiver mechanical specifications are showed as below. This kind of information can be used for installation.



5.3 Electrical and Environmental

The chart below shows the electrical and environmental specifications about the receiver. Some key features about the built-in modules both showed in this part.

Feature	Specification	
Size	175.5 x 140 x 63.8 mm (6.9 x 5.5 x 2.5 in)	
Weight	1.0 kg (35.3 oz)	
Temperature	Operating	-40°C to +75°C (-40°F to +167°F)
	Storage	-55°C to +85°C (-67°F to +185°F)
Humidity	100% condensation	
Ingress protection	IP67, Waterproof and dust proof	
Shock	Designed to survive a 1.2 m hard ground drop	
Voltage	12V DC recommended, 9~36V DC supported	
Power consumption	2.7 W (depending on user settings)	

5.4 Data Communication

The data communication information is almost about the hardware interface for the receiver.

Port Type	Specification
A-RS232	Electrical format: RS232 Data rates: 460800 bps max
B-RS232	Electrical format: RS232 Data rates: 460800 bps max
CAN	Electrical format: RS232 Data rates: 250 kbps default CAN Bus throughput is determined by slowest device on the bus
SMA	PPS signal port as SMA format Pulse wide: about 8 microseconds Electrical Level: 3.3 V TTL
DC Jack	Power supply port 12V DC recommended, and 9~36V DC support
RJ45	Network connect port, used for GNSS board built-in webpage login

6 Trouble Shooting

Use this chapter to identify and solve common problems. Please read this section before contacting CHCNAV Technical Support.

Issue	Possible Reason	Solution
The receiver does not turn on.	Power is too low.	Check the charge on the external battery and, if applicable, check the fuse.
	External power is not properly connected.	Check that the power connector is seated correctly and that the cable is secured to the receiver. Check the pins are broken or bent in the connector.
	Faulty power cable.	Check that you are using the correct cable for the connection between power port and power supply. Check whether the correct external power supply is connected to a particular power port. Check pinouts with a multimeter to ensure internal wiring is intact.
The receiver is not responding.	Receiver needs a soft reset.	Turn off the receiver and then turn it back on again.
The receiver is not receiving satellite signals	The GNSS antenna cable is loose.	Make sure that the GNSS antenna cable is tightly seated in the antenna connector on the GNSS antenna.
	The cable is damaged.	Check the cable for any signs of damage. A damaged cable can inhibit signal detection from the antenna at the receiver.
	The GNSS antenna is not in clear line of sight to the sky.	Make sure that the GNSS antenna is located with a clear view of the sky. Restart the receiver as a last resort (turn off and then turn it on again).

7 Glossary

1PPS	Pulse-per-second. Used in hardware timing. A pulse is generated in conjunction with a time stamp. This defines the instant when the time stamp is applicable.
base station	Also called heading station. A base station in construction, is a receiver placed at a known point on a jobsite that tracks the same satellites as an RTK rover and provides a real-time differential correction message stream through radio to the rover, to obtain centimeter level positions on a continuous real-time basis. A base station can also be a part of a virtual heading station network, or a location at which GPS observations are collected over a period of time, for subsequent postprocessing to obtain the most accurate position for the location.
carrier	A radio wave having at least one characteristic (such as frequency, amplitude, or phase) that can be varied from a known heading value by modulation.
carrier frequency	The frequency of the unmodulated fundamental output of a radio transmitter. The GPS L1 carrier frequency is 1575.42 MHz.
carrier phase	The time taken for the L1 or L2 carrier signal generated by the satellite to reach the GPS receiver. Measuring the number of carrier waves between the satellite and receiver is a very accurate method of calculating the distance between them.
CMR	Compact Measurement Record. A real-time message format developed by Trimble for broadcasting corrections to other Trimble mainboard receivers. CMR is a more efficient alternative to RTCM.
CMR+	
DGPS	See real-time differential GPS.
differential correction	Differential correction is the process of correcting GPS data collected on a rover with data collected simultaneously at a base station. Because the base station is on a known location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the rover data. Differential correction can be done in real-time, or after the data has been collected by postprocessing.
Differential GPS	See real-time differential GPS.
DOP	Dilution of Precision. A measure of the quality of GPS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower,

	<p>and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GPS positions may contain a greater level of error.</p> <p>PDOP (Position DOP) indicates the three-dimensional geometry of the satellites. Other DOP values include HDOP (Horizontal DOP) and VDOP (Vertical DOP), which indicate the accuracy of horizontal measurements (latitude and longitude) and vertical measurements respectively. PDOP is related to HDOP and VDOP as follows:</p> $\text{PDOP}^2 = \text{HDOP}^2 + \text{VDOP}^2$
dual-frequency GPS	<p>A type of receiver that uses both L1 and L2 signals from GPS satellites. A dual-frequency receiver can compute more precise position fixes over longer distances and under more adverse conditions because it compensates for ionospheric delays.</p>
EGNOS	<p>European Geostationary Navigation Overlay Service. A satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS.</p> <p>EGNOS is the European equivalent of WAAS, which is available in the United States.</p>
elevation mask	<p>The angle below which the receiver will not track satellites. Normally set to 10 degrees to avoid interference problems caused by buildings and trees, and multipath errors.</p>
ephemeris / ephemerides	<p>A list of predicted (accurate) positions or locations of satellites as a function of time. A set of numerical parameters that can be used to determine a satellite's position.</p> <p>Available as broadcast ephemeris or as postprocessed precise ephemeris.</p>
epoch	<p>The measurement interval of a GPS receiver. The epoch varies according to the measurement type: for real-time measurement it is set at one second; for postprocessed measurement it can be set to a rate of between one second and one minute. For example, if data is measured every 15 seconds, loading data using 30-second epochs means loading every alternate measurement.</p>
firmware	<p>The program inside the receiver that controls receiver operations and hardware.</p>
GLONASS	<p>Global Orbiting Navigation Satellite System. GLONASS is a Soviet space-based navigation system comparable to the American GPS system. The operational system consists of 21 operational and 3 non-operational satellites in 3 orbit planes.</p>
GNSS	<p>Global Navigation Satellite System.</p>

GSOF	General Serial Output Format. A Trimble proprietary message format.
HDOP	<p>Horizontal Dilution of Precision. HDOP is a DOP value that indicates the accuracy of horizontal measurements. Other DOP values include VDOP (vertical DOP) and PDOP (Position DOP).</p> <p>Using a maximum HDOP is ideal for situations where vertical precision is not particularly important, and your position yield would be decreased by the vertical component of the PDOP (for example, if you are collecting data under canopy).</p>
L1	The primary L-band carrier used by GPS satellites to transmit satellite data.
L2	The secondary L-band carrier used by GPS satellites to transmit satellite data.
L5	The third L-band carrier used by GPS satellites to transmit satellite data. L5 will provide a higher power level than the other carriers. As a result, acquiring and tracking weak signals will be easier.
MSAS	MTSAT Satellite-Based Augmentation System. A satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. MSAS is the Japanese equivalent of WAAS, which is available in the United States.
multi-frequency GPS	A type of receiver that uses multiple carrier phase measurements (L1, L2, and L5) from different satellite frequencies.
multipath	Interference, similar to ghosts on a television screen that occurs when GPS signals arrive at an antenna having traversed different paths. The signal traversing the longer path yields a larger pseudorange estimate and increases the error. Multiple paths can arise from reflections off the ground or off structures near the antenna.
NMEA	National Marine Electronics Association. NMEA 0183 defines the standard for interfacing marine electronic navigational devices. This standard defines a number of 'strings' referred to as NMEA strings that contain navigational details such as positions. Most CHC GPS receivers can output positions as NMEA strings.
PDOP	<p>Position Dilution of Precision. PDOP is a DOP value that indicates the accuracy of three-dimensional measurements. Other DOP values include VDOP (vertical DOP) and HDOP (Horizontal Dilution of Precision).</p> <p>Using a maximum PDOP value is ideal for situations where both vertical and horizontal precision are important.</p>
postprocessing	Postprocessing is the processing of satellite data after it has been collected, in order to eliminate error. This involves using computer

	software to compare data from the rover with data collected at the base station.
real-time differential GPS	<p>Also known as <i>real-time differential correction</i> or <i>DGPS</i>. Real-time differential GPS is the process of correcting GPS data as you collect it. Corrections are calculated at a base station and then sent to the receiver through a radio link. As the rover receives the position it applies the corrections to give you a very accurate position in the field.</p> <p>Most real-time differential correction methods apply corrections to code phase positions. RTK uses carrier phase measurements.</p> <p>While DGPS is a generic term, its common interpretation is that it entails the use of single-frequency code phase data sent from a GPS base station to a rover GPS receiver to provide sub-meter position accuracy. The rover receiver can be at a long range (greater than 100 km (62 miles)) from the base station.</p>
heading station	See base station
rover	A rover is any mobile GPS receiver that is used to collect or update data in the field, typically at an unknown location.
RTCM	Radio Technical Commission for Maritime Services. A commission established to define a differential data link for the real-time differential correction of roving GPS receivers. There are three versions of RTCM correction messages. All CHC GPS receivers use Version 2 protocol for single-frequency DGPS type corrections. Carrier phase corrections are available on Version 2, or on the newer Version 3 RTCM protocol, which is available on certain CHC dual-frequency receivers. The Version 3 RTCM protocol is more compact but is not as widely supported as Version 2.
RTK	Real-time kinematic. A real-time differential GPS method that uses carrier phase measurements for greater accuracy.
SBAS	Satellite-Based Augmentation System. SBAS is based on differential GPS but applies to wide area (WAAS/EGNOS and MSAS) networks of heading stations. Corrections and additional information are broadcast via geostationary satellites.
signal-to-noise ratio	SNR. The signal strength of a satellite is a measure of the information content of the signal, relative to the signal's noise. The typical SNR of a satellite at 30° elevation is between 47 and 50 dBHz. The quality of a GPS position is degraded if the SNR of one or more satellites in the constellation falls below 39.
skyplot	The satellite skyplot confirms reception of a differentially corrected GPS signal and displays the number of satellites tracked by the GPS receiver,

	as well as their relative positions.
SNR	See signal-to-noise ratio
UTC	Universal Time Coordinated. A time standard based on local solar mean time at the Greenwich meridian.
VRS	<p>Virtual Heading Station. A VRS system consists of GNSS hardware, software, and communication links. It uses data from a network of heading stations to provide corrections to each rover that are more accurate than corrections from a single base station.</p> <p>To start using VRS corrections, the rover sends its position to the VRS server. The VRS server uses the heading station data to model systematic errors (such as ionospheric noise) at the rover position. It then sends RTCM or CMR correction messages back to the rover.</p>
WAAS	<p>Wide Area Augmentation System. WAAS was established by the Federal Aviation Administration (FAA) for flight and approach navigation for civil aviation. WAAS improves the accuracy and availability of the basic GPS signals over its coverage area, which includes the continental United States and outlying parts of Canada and Mexico.</p> <p>The WAAS system provides correction data for visible satellites. Corrections are computed from ground station observations and then uploaded to two geostationary satellites. This data is then broadcast on the L1 frequency and is tracked using a channel on the GPS receiver, exactly like a GPS satellite.</p> <p>Use WAAS when other correction sources are unavailable, to obtain greater accuracy than autonomous positions. For more information on WAAS, refer to the FAA website at http://gps.faa.gov.</p> <p>The EGNOS service is the European equivalent and MSAS is the Japanese equivalent of WAAS.</p>



CHC Navigation

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