CHC® X900U+ GNSS Receiver

User Guide

Make your work more efficient

Revision 1.0

June 10, 2018

Table of Content

Preface

Copyright

Copyright 2014-2015

CHC | Shanghai Huace Navigation Technology Ltd. All rights reserved. The CHC is a trademark of Shanghai Huace Navigation Technology Limited. All other trademarks are the property of their respective owners.

Trademarks

All product and brand names mentioned in this publication are trademarks of their respective holders.

Safety Warnings

The Global Positioning System (GPS) is operated by the U.S. Government, which is solely responsible for the accuracy and maintenance of the GPS network. Accuracy can also be affected by poor satellite geometry and obstructions, like buildings and heavy canopy.

FCC Interference Statement

This equipment has been designed to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules in the Portable Mode. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide resonable protection against harmful interference in a residential installation. This equipment generates, uses instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this be determined by harmful interference to radio or television reception, which can be determined by one or more of by turning the equipment off and on, the user is encouraged to try to correct the interference the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

CE Interference Statement

Declaration of Conformity: Hereby, Shanghai Huace Navigation Technology Ltd. declares that this X900U+ is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. A copy of the Declaration of conformity can be found at Shanghai Huace Navigation Technology Ltd.

CE FC

1 Introduction

The X900U+ GNSS Receiver User Guide describes how to set up and use the CHC®
X900U+ GNSS receiver.

In this manual, "the receiver" refers to the X900U+ GNSS receiver unless otherwise
stated.

Even if user has used other Global Navigation Satellite Systems (GNSS) products before,
CHC recommends user spend some time reading this manual to learn about the special
features of this product. If user is not familiar with GNSS, go to www.chcnav.com for
an interactive look at CHC and GNSS.

1.1 Safety Information

1.1.1 Warnings and Cautions

The absence of specific alerts does not mean that there are no safety risks involved.

A Warning or Caution information is intended to minimize the risk of personal injury
and/ or damage to the equipment.

⚠ WARNING - A Warning alerts the user to a potential misused or wrong setting
of the equipment.

⚠ CAUTION - A Caution alerts the user to a possible risk of serious injury to user's
person and/ or damage to the equipment.

1.1.2 Regulations and Safety

The receivers contain a built-in wireless modem for signal communication through
Bluetooth® wireless technology or external communication datalink. Regulations
regarding the use of the wireless modem vary greatly from country to country. In some
countries, the unit can be used without obtaining an end-user license. However, in
some countries, the administrative permissions are required. For license information,
consult user's local dealer. Bluetooth® operates in license-free bands.

Before operating an X900U+ GNSS receiver, determine if authorization or a license to
operate the unit is required in user's country. It is the responsibility of the end-user to

obtain an operator's permit or license before operating the receiver at the location or country.

1.1.3 Use and Care

This receiver is designed to withstand the rough environment that typically occurs in the field. However, the receiver is high-precision electronic equipment and should be treated with reasonable care.

⚠ CAUTION - Operating or storing the receiver outside the specified temperature range can cause irreversible damage.

1.2 Technical Support

If user has a problem and cannot find the information user needs in this manual or CHC website (www.chcnav.com), contact user's local CHC dealer from which user purchased the receiver(s).

If the user needs to contact CHC technical support, please contact us by email (support@chcnav.com) or Skype (chc_support).

1.3 Disclaimer

Before using the receiver, please make sure that user have read and understood this User Guide, as well as the safety information. CHC holds no responsibility for the wrong operation by users and for the losses incurred by the misunderstanding about this User Guide. However, CHC reserves the rights to update and optimize the contents of this guide regularly. Please contact user's local CHC dealer for new information.

1.4 User's Comments

User's feedback about this user guide will help us to improve it. Please email user's comments to support@chcnav.com.

2 Getting Started with X900U+

2.1 About the Receiver

X900U+ GPS+GLONASS+BDS+Galileo system is designed to enable every surveyor to access to high precision, robust performances and reliable technology but without the typical price constraints usually associated with GNSS investment. X900U+ GPS matches a wide range of applications requiring static positioning.

Multiple frequency support with GPS, GLONASS and BDS enable X900U+ to break the price barrier for cm accuracy positioning and provides a swift return on investment compared to equivalent GNSS technology or traditional optical survey equipment.

X900U+ compact design of 179 mm × 84 mm (7.0 in × 3.3 in) with less than 1.4 kg (49 oz) makes it an easy-to-carry GNSS receiver for daily field work.
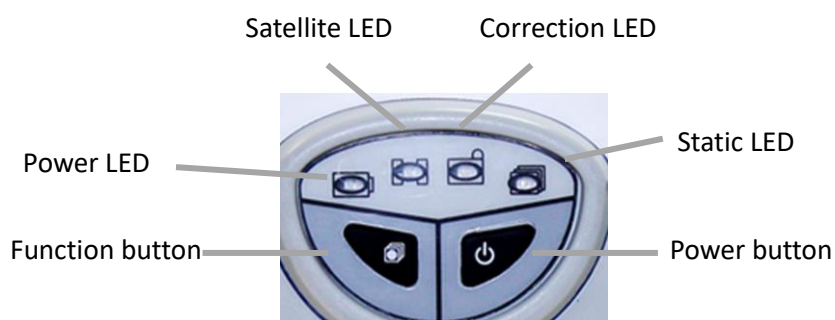
2.2 Parts of the Receiver

The operating controls are all located on the front panel. The battery compartment and SIM card slot(function cancled) are on the backside. Serial ports and connectors located on the bottom of the unit.

2.2.1 Front Panel

The following figure shows a front view of the receiver.

Front Panel

The front panel contains four indicator LEDs, and two buttons.

Name	Description
Power LED (Red)	Shows the power status of the receiver. • When the receiver is powered on, the red LED lights up.
Satellite LED (Blue)	Shows the number of satellites that the receiver has tracked. • When the receiver is searching satellites, the blue LED flashes once every 5 seconds. • When the receiver has tracked N satellites, the blue LED flash N times every 5 seconds.
Correction LED (Green)	Indicates whether the receiver is transmitting/ receiving differential data. The green LED flashes once per second when successfully transmitting differential data.
Fn button	Long press to switch on/off static recording.
Power button	Press and hold this button for 3 seconds to turn on or turn off the receiver.

For more information about the front panel and relevant operations, see **3 Front Panel Operation**.

2.2.2 Lower Housing

The lower housing contains one SIM card slot(canceled), battery compartments, one communication and power ports, one GPRS antenna connector, one TNC radio radio antenna connector, one 5/8-11 threaded insert, and two nameplates.

2.2.3 Receiver Ports

Name	Description
IO port	• This port is a 10-pin Lemo connector that supports RS-232 communications and external power input. • Users can use GPS to PC Data Cable supplied with the system to realize RS-232 communications between the receiver and computer or controller. Also, users can use a 10-pin cable to transmit differential data to an external radio.
GPRS antenna connector	Can't be used.
TNC radio antenna connector	Can't be used.

2.3 Batteries and Power

2.3.1 Internal Batteries

The receiver has one Lithium-ion batteries, which is rechargeable.

2.3.1.1 Charging the Battery

The rechargeable Lithium-ion battery is supplied partially charged. Charge the battery

completely before using it for the first time. To charge the battery, first, remove the battery from the receiver, and then place it in the battery charger, which is connected to AC power.

⚠️ WARNING - Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/ or equipment damage.

To prevent injury or damage:

(1) Do not charge or use the battery if it appears to be damaged or leaking.
(2) Charge the Lithium-ion battery only in a CHC product that is specified to charge it. Be sure to follow all instructions that are provided with the battery charger.
(3) Discontinue charging a battery that gives off extreme heat or a burning odor.
(4) Use the battery only in CHC equipment that is specified to use it.
(5) Use the battery only for its intended use and according to the instructions in the product documentation.

2.3.1.2 Battery Safe

⚠️ WARNING - Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire and can result in personal injury and/ or property damage.

To prevent injury or damage:

(1) Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
(2) Do not expose the battery to fire, high temperature, or direct sunlight.
(3) Do not immerse the battery in water.
(4) Do not use or store the battery inside a vehicle under hot weather condition.
(5) Do not drop or puncture the battery.
(6) Do not open the battery or short-circuit its contacts.

⚠️ WARNING - Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/ or property damage.

To prevent injury or damage:

(1) If the battery leaks, avoid with the battery fluid.

(2) If battery fluid gets into user's eyes, immediately rinses user's eyes with clean water and seek medical attention. Please do not rub user's eyes!

(3) If battery fluid gets on user's skin or clothing, immediately wash them off under running water.

2.3.2 External Power Supply

Two methods are available for providing the external power to the receiver by the GPS to PC Data Cable + Power Adapter, or GPS to PC Data Cable + external power cable (option purchase) + vehicle battery.

In the office:

The Power Adapter is connecting with AC power of 100-240V, the output port of the Power Adapter connects to the Power Port of the GPS to PC Data Cable.
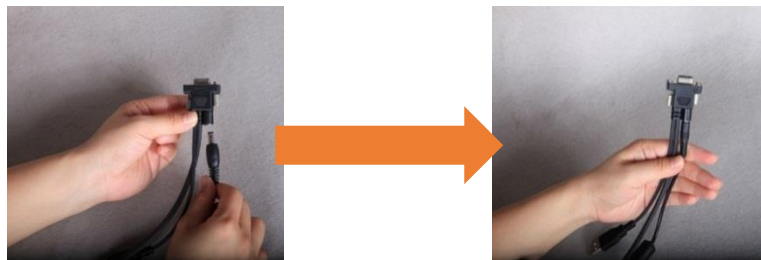
In the field:

The external power cable is connecting to a vehicle battery, the output port of the external power cable connects with the Power Port of the GPS to PC Data Cable/USB Cable.

 WARNING - Use caution when connecting external power cable's clip leads to a vehicle battery. Do not allow any metal object to connect (short) the battery's positive (+) terminal to either the negative (-) terminal or the metal part of the vehicle battery. This could result in high current, arcing, and high temperatures, exposing the user to possible injury.

2.4 Product Basic Supply Accessories

Item	Picture

X900U+ GNSS Receiver	
GPS to PC Cable	
Lithium Battery	
C300 Battery Charger	
H.I. Tape	
Extension Pole	
Tribrach with Optical Plummet	
Tribrach Adaptor	

Transport Hard Case	

2.5 Connecting to Controller with LandStar 7

This section uses **Smartphone** as the example to show how to connect the receiver to the controller using LandStar 7 via Bluetooth.

Turn on the receiver → Launch LandStar 7 → press config on the bottom of the screen → choose **Connect**.

In the **Connect** screen, set **Manufacturer** as **CHC**, **Device Type** as **X900U+**, **Connection Type** as **Bluetooth**.

Tap **Bluetooth** icon at the end of Bluetooth row, press **Bluetooth Manager** and connect to the receiver's Bluetooth whose name is the GNSS-XXXXXXX (the SN of the current receiver).

One step back, choose paired Bluetooth device with the receiver's SN. Set **Antenna Type** as **CHCX900U+** and press **Connect** on the lower right of the screen.

2.6 Firmware Upgrade

(1) Connect the receiver to PC with data cable. Please keep the receiver power off.
(2) Double click the proper firmware file (.exe), go to **Connect** → **Setup**, choose the correct port and click **OK**. Sometimes you need to run the firmware as administrator. Find the firmware in PC and double-click on it.
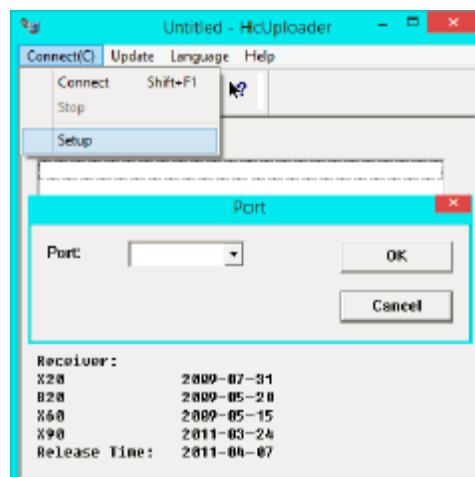
(3) Click **Link** and then **Update**. Then please power on the receiver and the uploading will start automatically.
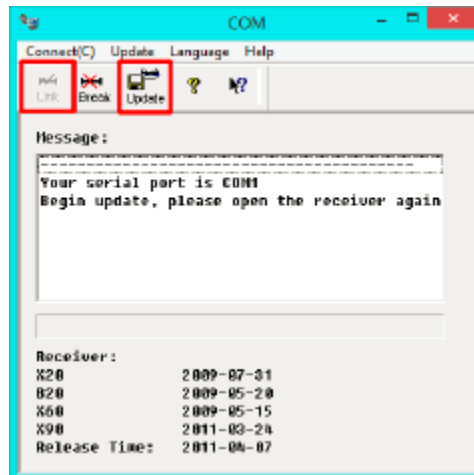
(4) After the processing completes, please close the uploader, and then power off and power on the receiver again.

(5) Now, the whole update has been finished successfully.

2.7 Downloading Logged Data

Data logging involves the collection of GNSS measurement data over a period at a static point or points, and subsequent post-processing of the information to accurately compute baseline information. Data logging using receivers requires access to suitable GNSS post-processing software such as the CHC Geomatics Office (CGO) Software.

The procedures for downloading logged data in the receiver are as follows:

(1) Switch on the receiver and connect it to a computer by USB Cable. After the successful connection, a removable disk named as the Serial Number (SN) of the receiver will appear on the computer.

(2) Double-click the removable disk, and the user can see the folder named as "repo". Double click this folder, the user can see 2 folders. The "log" folder is used to save the log files.

(3) Double-click the folder that user has configured to store the static data, and then see the folder(s) created by the X900U+ system automatically and named by the date which is decided by GPS time when user start to log data.

(4) Select the destination folder and double-click it, and then two folders named as different data format (hcn and rinex) will be displayed.

(5) Select the data format that user has configured to save the static data, and user will find the static raw data.
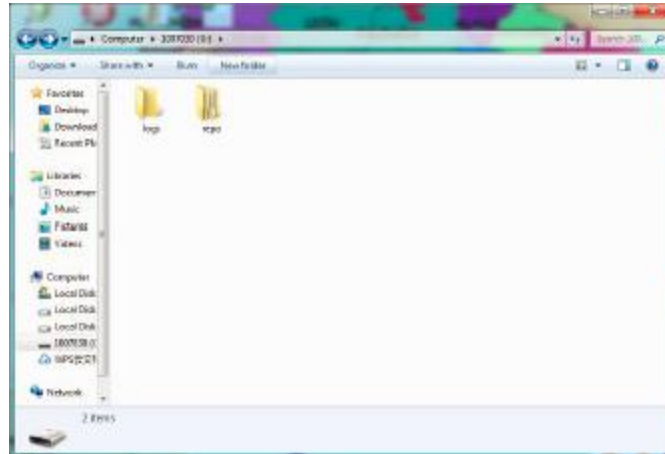
Notes:

For hcn files, the name of the file is represented as XXXXXXDDDNN, where XXXXXX is the SN of the receiver, DDD is day of year, and NN is the recording session.

⚠️ WARNING – The static data will be saved in the first logging session, the "record_1" folder, by default. Old files will be deleted if the storage space is full. If the user configures not to auto delete old files when the memory is low, the receiver will stop data logging.

3 Rover Station Setup and Operation

This chapter provides the information to help the user identify good setup locations, describes the conventional process to set up the rover station and the configuring procedure that required for receiving correction data.

3.1 Rover Station Setup Guidelines

For good rover operation, please follow the following setup guidelines:

Place the GNSS antenna in a location that has a clear view of the sky in all directions. Do not place the antenna near vertical obstructions such as buildings, deep cuttings, site vehicles, towers, or canopy. GNSS rovers and the base station receive the same satellite signals from the same satellites. The system needs at least five common satellites to provide RTK positioning.

⚠ WARNING – Do not touch overhead power lines with the CHC X900U+ GNSS receiver or the range pole when moving the equipment into position. Touching overhead power lines may cause electrocution, leading to serious injury.

- GNSS satellites are constantly moving. The fact that user cannot measure at a specific location at the moment does not mean that user will not be able to measure there later when satellite coverage at the location improves.
- To get a fixed position solution with centimetre precision, initialize the RTK rover receiver. For initialization to take place, the receiver must track at least five satellites that the base station is also tracking. In a dual-satellite constellation operation, for example, GPS and GLONASS, the receiver must track at least six satellites.
- To continue to survey at centimetre precisions, the rover must continuously track at least four satellites that the base station is also tracking.
- Loss of the satellite signals will result in a loss of centimetre position precision.

3.2 Configuring the Rover Station via LandStar 7 Software

3.2.1 Receiving Static Data

(1) Power on the receiver.
(2) Run LandStar 7 on the controller → create a new project or open an existing project → establish the connection with the receiver via Bluetooth.
(3) On the **Static Setting** screen, set parameters as need and then click **Set** to finish.

3.2.2 Receiving Corrections Using Cellular Modem in the Controller

(1) Power on the receiver.
(2) Run LandStar 7 on the controller → create a new project or open an existing project → establish the connection with the receiver via Bluetooth.
(3) On the **Work Mode** screen, choose **PDA Network** as **Datalink**; **Ntrip** as **Protocol**.
(4) Input or choose the corresponding **Ntrip IP** and **Port**, and then, click download icon ⬇ to get the source table.
(5) Click the location icon at the end of source table row; users can have a view of the distance between current position and a single station in source table interface. Given this table, users can choose the closest single station.
(6) Input **User Name** and **Password**.
(7) Configure the related parameters from the dropdown list or enter the value with the soft keyboard: **Data Format**, **Elevation Mask**, **PDOP Limit**, **Safe Mode** and **Iono Condition**.
   Note: Select the Data Format the same as that of the base receiver. Turning on or off of RTCM 1021-1027 messages depend on messages from the mount point and user's need.
(8) Click **Save** and give a name to this work mode. Then, accept the work mode.
(9) Users can conduct surveying work after the rover receiver receives correction data (with correction LED flashes once per second) and gets a fixed solution.

4 Survey with LandStar 7 Software

The CHC LandStar 7 Software ("LandStar 7") is a field survey software which developed based on more than ten years of development experience of CHC and feedback of surveyors from different fields of application. LandStar 7 provides with a complete set of features for any survey projects, including data collection, stakeout, COGO (Coordinate Geometry) function, and more, which makes this software an ideal option for everyday field work.

This chapter briefly introduces the basic survey workflows of LandStar 7, combining with X900U+ GNSS receiver.

4.1 New Project

Turn on the controller, run LandStar 7 software and establish the connection with the receiver via Bluetooth, and then create a new project or open an existing project before measuring any points or making any calculations.

To create a new project:

(1) Click **Project** icon in **Project** menu, and then click **New** to add a new project.
(2) Enter the information of the project including project **Name**, **Author** and **Time Zone**. Then, select the appropriate **Coordinate System** for the survey and **Accept**.
(3) Click **OK** to finish the setting of this new project.

4.2 Points

(1) In the main menu, at **Project** menu and tap **Points**.
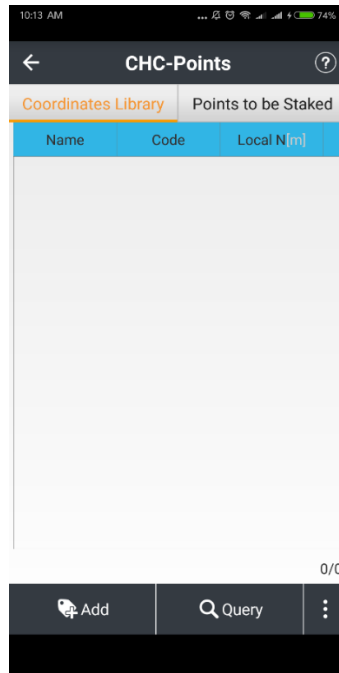
(2) Tap add button in the lower left corner of **Points** screen, and then configure the related parameters of the new point as follows:
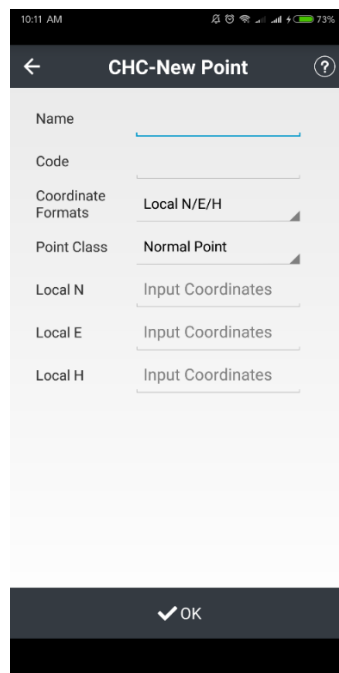
Name: Enter the point name.

Code: Enter the code of the point, if required.

Coordinate Format: Select the coordination format from the dropdown list. There are five available options: Local N/E/H, Local Lat/Lon/H, Local X/Y/Z;

WGS84 Lat/Lon/H, WGS84 X/Y/Z.

Coordinate: depend on the coordinate format user choose.

(3) Tap ✅ ok button at the bottom of **New** point screen to save the point.

4.3 Measure Points

Note: To ensure the accuracy of the coordinates measured; please perform measurements after the rover receiver receives correction data (with correction LED flashes once per second) and gets a fixed solution.

4.4 Measure Points in PDA Mode

(1) In the main menu, tap **Survey** → tap **PT Survey**.
(2) Enter the point name in the input frame on the first row.
(3) **Notes**: The system will automatically increase the numeric component of the measured point name.
(4) The measured points will be automatically increased from "P1", by default.
(5) If necessary, enter the feature code in the input frame on the second row.
(6) For [Method] row, click the method follows, and select the right Method for the survey from the dropdown list.
(7) **Notes**: Users can tap **Setting** icon which is located at upper right to configure the settings of each measurement method in the pop-up **Survey Option** screen.
(8) The auto survey function is available for two measurement modes: **Topographic PT Mode**, Compensate PT Mode.
(9) When untick **Auto Survey** in the **Survey Option** screen:
(10) If the settings of the selected measurement method have been changed, click left arrow at upper left directly to save the change and go back to the **Point Survey** screen.

(11) Tap 🔲 button, hold the range pole still and vertical until the countdown timer disappears, and then, move to next point and continue the survey.

(12) To exit the **Auto Measure** mode, tap ⬅ button.

4.5 Point Adjust (Site Calibration)

Point adjust, also known as "site calibration", is used to transform WGS-84 coordinates into local grid coordinates.

Notes:

- General speaking, if a three- or seven-parameter datum transformation has been configured for the project, users can skip the site calibration and the coordinates measured will be transformed automatically into local grid coordinates.
- If a projection and datum transformation have already been specified, users can reduce any discrepancies between the WGS-84 coordinates and the local grid coordinates by performing a site calibration.
- To perform the site calibration, users need to measure the control points with GNSS receiver first.

To perform site calibration:

(1) In the main menu, tap **Survey** → tap **Site CAL**.
(2) Tap **Add** at the lower left corner to add point pair(s).
(3) In the pop-up screen, tap icon located at the same row with **Name** at the first row of **GNSS Point** section to add the existing GNSS point or key in a GNSS point.
(4) Tap icon located at the same row with **Name** at the first row of **Known Point** section to add the existing known point or key in a known point.

(5) Choose the method of calibration at the bottom of the screen and click **OK** to finish the chosen for this pair.
  Notes:
  Users can determine whether this point pair is involved in the computation of either horizontal or vertical adjustment or both.
(6) Continue the **Step 2** to **Step 5** to add all the point pairs.
(7) After entering all the existing pairs, go back to **Site Calibration** screen, choose an appropriate **Height Fitting Method** and click **Calculate** button.
  Notes:
  The height fitting methods are "Surface Fitting", "Best Practice" (by default) and "Fixed difference" respectively. For best results, make sure that the control points are evenly distributed to the extent of the job area.
(8) Click **Application** the prompt is "Whether replace the current project parameters or not", choose **Yes** and apply the result to the whole project.
  Notes:
  Users can log to view plane correction and vertical fitting parameters. Otherwise, those are invisible. The default login values of display function are "admin" for **Name** and "123456" for **Password**.

4.6 Base Shift

Typically, the Real-time kinematic (RTK) operation requires a data link to send observations or corrections from the base station to the rover, and then the rover will calculate its position in real time.

Within a project, when the base receiver is restarted or moved, the base coordinated system will shift each time the position of the base station is changed. Normally, the coordinates determined by the base station that set up on a control point should be in the same coordinate system. However, coordinates determined by the base station that set up on an autonomous point should be carried out a base shift, which provided by CHC LandStar 7 software, to keep their base station messages the same as the initial coordinate system.

Notes: To perform the base shift, make sure that the two base stations have been linked together by at least one common point that surveyed with the same position, which means that the common point not only has the coordinate determined by the initial coordinate system, but also own the coordinate surveyed from another base coordinate system that need to be shifted.

To perform a base shift:

(1) In the main menu, tap **Survey** → tap **Base Shift**.
(2) Tap the icon at the end of the row of **GNSS Point** field to select the common point surveyed from the base coordinate system that needs to be shifted.
(3) Tap the icon at the end of the row of **Known Point** field to select that common point determined by the initial coordinate system.
(4) The offset information of base coordinate system that needs to be shifted will be displayed automatically.
(5) Tap **OK** → a message will pop up asking the user whether to apply the shift parameters.
(6) If tap **Yes** button, all the coordinates determined by the current base coordinate system will be translated. Also, the **Point Library** screen will pop up to help user check whether the coordinates determined by the current base coordinate system have changed.
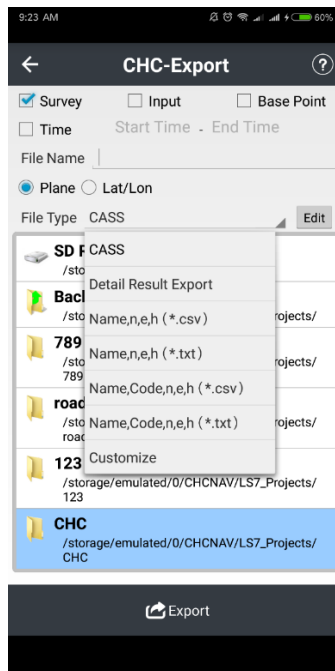**Notes**:
The coordinates translated are local grid coordinates rather than WGS-84 coordinates.

4.7 Data Export

(1) In the main menu, tap **Project** → tap **Export**.
(2) Select one data format (for example, **Custom Format**) according to user's

requirement.

(3) Tick the point type(s) → enter the **File Name** → select the **File Type** from the dropdown list → select the path that used to store the file.

(4) Tap **Export** → the software will prompt whether the file has been successfully exported.

Notes:

When select customize format, users can define the file content according to user's requirement.

(5) After the file has been successfully exported in the controller, connect the controller to the office computer for file transfer (please refer to the corresponding user guide of the controller that user are using for instruction) and post-processing.

4.8 Receiver Registration

When the software prompt that the receiver is overdue, users need to contact user's local CHC dealer to get the registration code.

To register the receiver:

(1) In the main menu, tap **Config** → tap **Device Info**.

(2) Tap **Register** and enter the registration code in the pop-up window.

(3) Tap **OK** button to complete the registration, and then the software will show the expire date at the **Device Info** list.

CHCNAV

CHC - Shanghai Huace Navigation Technology Ltd.

599 Gaojing Road, Building D

Shanghai, 201702, China

Tel: +86 21 542 60 273

Fax: +86 21 649 50 963

Email: sales@chcnav.com | support@chcnav.com

Website: www.chcnav.com

Make your work more efficient