CHCNAV NX510
USER MANUAL

Precision Agriculture | Feb 2024

Table of Content

Preface

1.1 Copyright

1.1.1 Copyright 2023-2024

1.1.2 Trademarks

1.2 Safety Warning

When using the CHCNAV NX510 SE/Pro/Plus GNSS Auto Steering System, please observe the following safety warnings:

Before using the system, carefully read and understand the operating instructions in the user manual to ensure proper use of the system.

During system operation, strictly follow local traffic regulations and safety standards to ensure safe operation in safe environments and conditions.

Regularly check the condition and performance of the system and equipment when using the system to ensure normal operation and high-precision navigation performance.

Maintain concentration and alertness during system operation, avoid fatigue and distraction, and prevent accidents.

Avoid using the system in hazardous areas such as steep or cliff edges, water puddles, or muddy ground to prevent personal injury or equipment damage.

Stop using the system immediately and contact the system manufacturer or supplier for technical support and maintenance services when the system experiences abnormality or failure.

Protect the equipment from physical damage or weather factors when operating the system to ensure long-term stability and reliability.

Observe the relevant maintenance and upkeep requirements of the system and equipment during operation to prolong the life of the equipment and ensure normal

operation.

Pay attention to the safety of the surrounding environment and other personnel when using the system to avoid accidents and stop the machine promptly to handle any abnormal situations.

The above is for reference only, and specific safety warning content may vary slightly depending on the device model and local regulations and standards. When using the CHCNAV NX510 SE/Pro/Plus GNSS Auto Steering System, please carefully read and observe the relevant safety warnings and usage instructions to ensure the safety and normal operation of the system.

1.3 Conformity to National Regulations

1.3.1 FCC declaration of conformity

FCC Part 15 (applicable in US)

The products electromagnetic emission have been tested to conform to the applicable FCC Rules and Regulations:

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation.

NX510 SE/Pro/Plus Auto Steering System Contains FCC ID:

SY4-A02043

SY4-A02041

XMR201903EG25G

1.3.2 Conformity to Japanese regulations

Japanese Radio Law and Japanese Telecommunications Business Law Compliance.

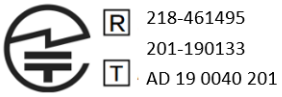
• This device is granted pursuant to the Japanese Radio Law and the Japanese Telecommunications Business Law .

• This device should not be modified (otherwise the granted designation number will become invalid).

R 218-230044
201-190133
T AD 19 0040 201

Specified Radio Equipment marking:

Receiver(PA-3 Plus, PA-3 SE, PA-3 Pro)



Tablet (CB-H10)

1.3.3 EU

Declaration of Conformity:

Hereby, Shanghai Huace Navigation Technology Ltd. declares that this NX510 is Auto Steering System 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 www.chcnav.com

1.3.4 ANATEL

MODEL: PA-3 SE, PA-3 PRO & PA-3 Plus and CB-H10

Este produto não é apropriado para uso em ambientes domésticos, pois poderá causar interferências eletromagnéticas que obrigam o usuário a tomar medidas necessárias para minimizar estas interferências.

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para mais informações, consulte o site da ANATEL – https://www.gov.br/anatel/pt-br

1.4 Introduction

The CHCNAV NX510 user manual describes how to install and use the CHCNAV® NX510 system. In this manual, “the system” refers to the NX510 agricultural system unless otherwise stated. Even if you have used other agricultural products before, CHCNAV recommends that you spend some time reading this manual to learn about the special features of this product.

1.5 Technical Support

If you have a problem and cannot find the information you need in this manual or CHCNAV website www.chcnav.com or contact your local CHCNAV dealer from which you purchased the system(s).

If you need to contact CHCNAV technical support, please contact us by email support@chcnav.com

1.6 Disclaimer

Before using the system, please make sure that you have read and understood this User Guide, as well as the safety information. CHCNAV holds no responsibility for the wrong operation by users and for the losses incurred by the wrong understanding about this User Guide. However, CHCNAV reserves the rights to update and optimize the contents in this guide regularly. Please contact your local CHCNAV dealer for new information.

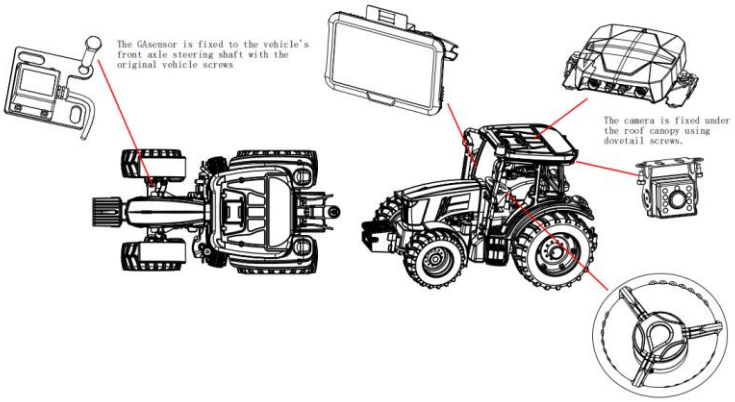
1.7 Your Comments

Your feedback about this user guide will help us to improve it in future revision. Please email your comments to support@chcnav.com

2 Product Overview

2.1 Introduction

The NX510 SE/Pro/Plus is an automated steering system that easily retrofits many types of tractors with a compact, up-to-date and all-in-one solution at a price each farm can afford. It provides significant productivity gains, works in all visibility conditions and reduces operator fatigue.



2.2 Main Components

Receiver: It is typically a Global Navigation Satellite System (GNSS) receiver, used to receive satellite signals to determine the accurate position, direction, and speed of the vehicle. It forms the foundation for autosteering system by providing precise information about the current location of the vehicle.

Electric steering wheel: Consists of a steering motor and a steering wheel. and provides steering control of the vehicle. The motor is primarily used to control the movement of the vehicle with steering. The autonomous driving system utilizes the motor to execute commands generated by path planning and navigation algorithms, ensuring the safe movement of the vehicle along predefined trajectories.

Tablet: The tablet serves as the user interface for interacting with the autonomous driving system. Farmers or operators can use the tablet device to set paths, monitor job status, and configure the system. The tablet is also employed for real-time monitoring of the vehicle's operation.

Wheel angle sensor: Obtains and provides angular velocity information of steering wheels during vehicle operation. This is crucial for ensuring the vehicle travels accurately along the predefined path. Sensor data helps calibrate the directional control system, maintaining precision in movement.

Camera: Placed in the rear of the vehicle to provide real-time images. Cameras have multiple uses in autonomous driving. They can be employed for obstacle detection, helping the machinery avoid collisions or damage to crops.

These components work together to enable the autonomous driving system to perform various tasks in the field, enhancing the efficiency and precision of agricultural production.

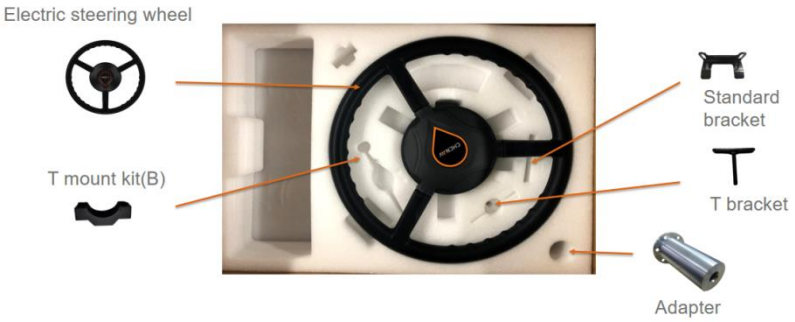
3 Installation

3.1 Product Package

All components are into one box.

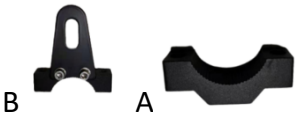
First Layer of NX510:

Second Layer of NX510:



List of components:

Device name	Model	Image	Quantity
Electric steering wheel	CES-T		1
Receiver	PA-3		1
Tablet	CB-H10		1

Wheel angle sensor	GASensor		1
Camera	F23A220-FC		1
Ball holder			2
Double socket arm			1
Standard bracket			1
T-bracket			1
T mount kit (A&B)		 B A	1
Integrated main cable			1
Wheel angle sensor cable			1
Camera cable			1
Radio Antenna			1

3.2 Installation Steps

3.2.1 List of tools

Tools	Materials	Image	Quantity	Purpose
H6-6mm hexagon screwdriver	M8*60 inner hexagon screw		3	Fix T mount kit (A&B)
PH2-5mm Phillips screwdriver	M5*11 Phillips screw		8	Fix the sleeve to electric steering wheel
16mm spanner	M10 nut		4	Fix the T-bracket to T mount kit
8mm spanner	M5*16 outer hexagon screw		6	Fix the T-bracket to motor
8mm drill	ST5.5*25 dovetail screw		10	Fix the wheel angle sensor/ camera/ tablet bracket
Electric welding m achine	T-bracket extension stud		1	Extend the length of the T-bracket
Cleaner	Harness fixing base		6	Fix the cable ties
10mm spanner	U-shaped fixing bracket		2	Fix the tablet bracket
	Cable ties		50	Fix the cables

3.2.2 Steering system inspection

Before installation, please check whether the vehicle steering gear is normal, whether the dead zone (steering clearance) is appropriate.

Dead zone < 20°	Available range
20°<Dead zone < 70°	Available to install NX510 but necessary to modify the dead zone to 10~30 degrees.
Dead zone > 70°	Repair the vehicle first.

3.2.3 Original steering wheel removal

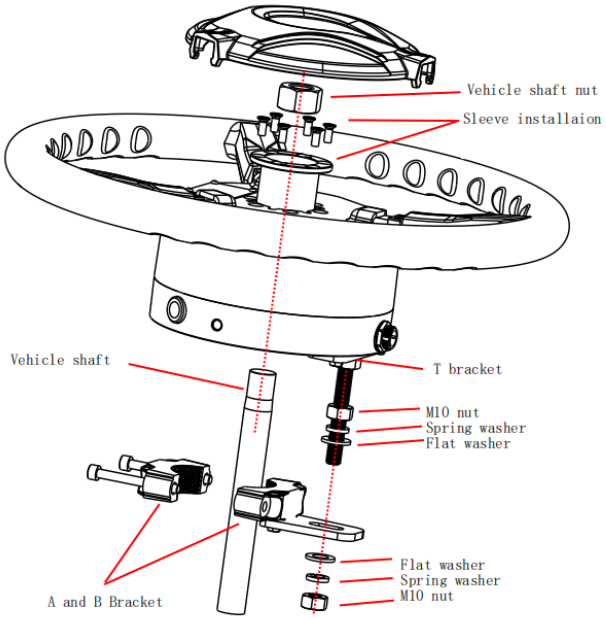
a) Remove the protective cover of the original steering wheel;

b) Stabilize the steering wheel, use the sleeve tool to loosen the original vehicle spline screws, and remove the original vehicle spline screws;

c) Pull out the steering wheel forcefully. If it is difficult to remove, it is necessary to strike the spline shaft to loosen it with a hammer and to be careful to avoid the steering wheel damage, or use of high quality puller tool to avoid damage on original steering wheel and shaft

d) Before install the sleeve into the steering wheel, please try it on the spline to check whether the size fits.

3.2.4 Steering wheel installation



a) If the sleeve can fit the spline, please remove the protective cover of the steering wheel, place the sleeve in it, and fix the sleeve with M5*11 phillips screws (6 pcs);

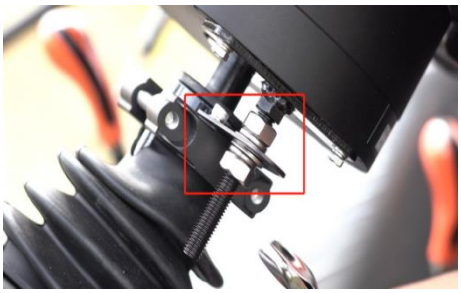
b) Install T bracket or standard bracket on the motor with M5*16 hexagon screws (2 pcs);

c) Fix the T mount kit to the shaft with M8*60 hexagon screws (2 pcs);

d) Insert T bracket through T mount kit;

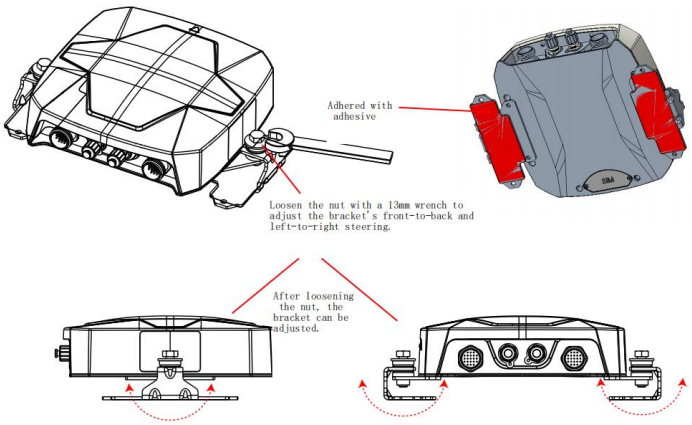
e) Hold the steering wheel and tighten the spline screws with tools;

f) Screw the T bracket to the T mount kit tightly with M10 nuts (2 pcs);



g) Finally shake the steering wheel, check whether it's tight, and check again whether the steering clearance is too large.

3.2.5 Receiver installation



a) The receiver needs to be installed on the central axis of the vehicle roof as possible, and the installation direction should be parallel to the vehicle as possible;

b) After confirm the installation position, wipe the roof clean and make sure the bracket installation is spotless;

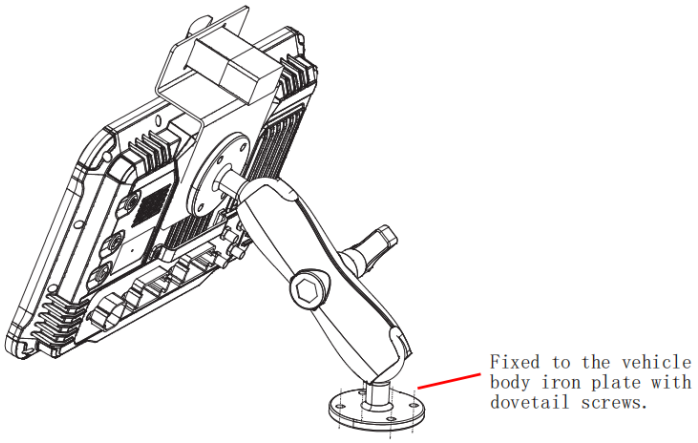
c) Adjust the receiver bracket to make sure the receiver is placed horizontally, also the receiver arrow must face forward.

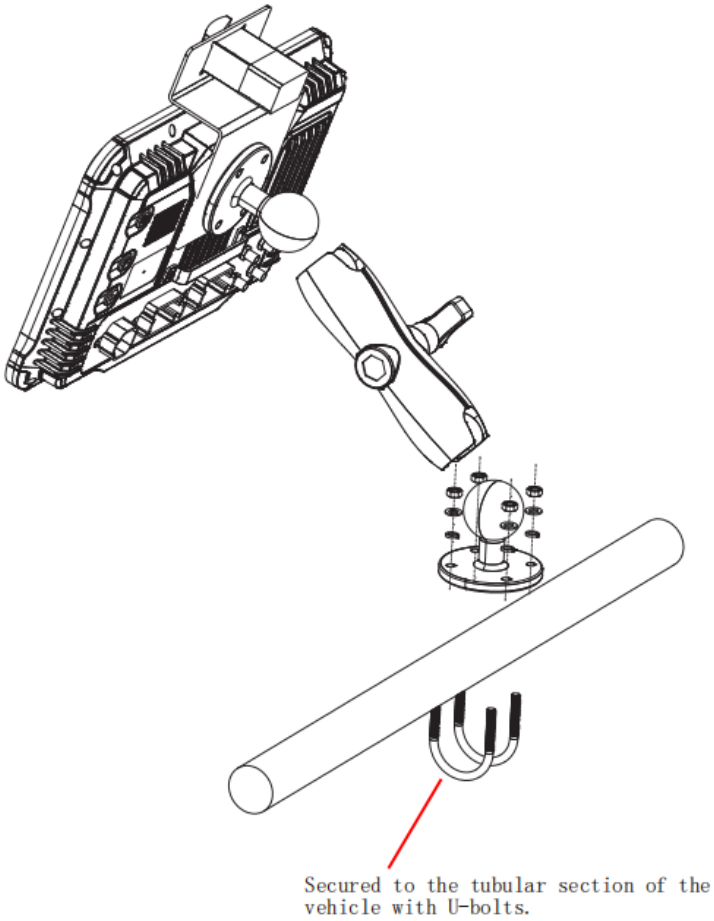
3.2.6 Tablet installation

The tablet installation requires the ball base to be installed in locations as suggested shown in the picture, and avoid damaging to the original vehicle cables. Usually there are two kinds of installation methods to fix the mounting bracket.

a. Drill more than 3 dovetail screws on the A-pillar or B-pillar to fix the ball base then install tablet with RAM bracket.

b. Fix the ball base with U bolt on the tractor crossbar and adjust it according to the driver's habits.





c) After complete the installation, it is available to adjust the tablet to a suitable position;

3.2.7 Wheel angle sensor installation

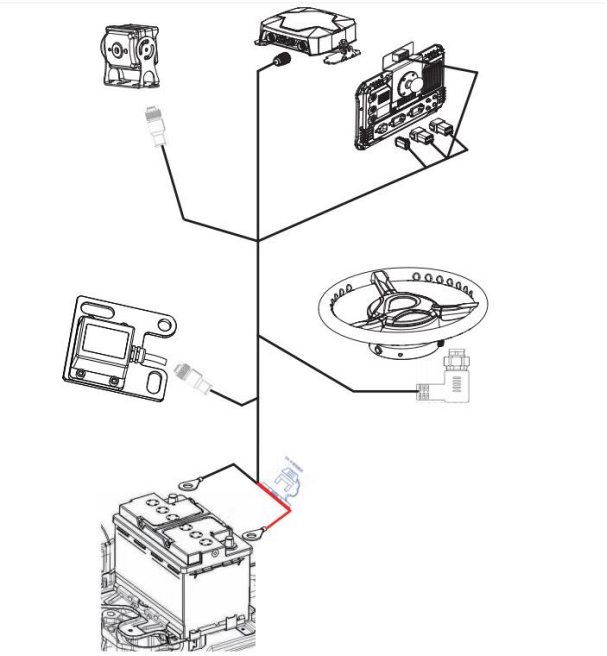
a) It is recommended to fix the wheel angle sensor as horizontal as possible on the right steering wheel which avoids collision with the vehicle;

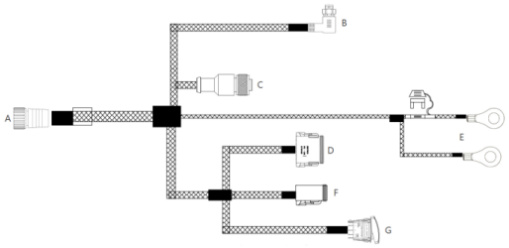
b) Pay attention to install the mount plate on the wheel platform.

3.2.8 Camera installation

The camera can be installed anywhere (within the wire harness length range).

3.2.9 Cables connection



Name	Cable diagram	Connection
Integrated main cable		A → Receiver B → Motor C → Wheel angle sensor cable D → Tablet Port 3 E → Battery F → Tablet Port 1 G: Rocker switch
Camera cable		H → Camera I → Tablet Port 2
Wheel angle sensor cable		J → C K → Wheel angle sensor

a) Wiring precautions

• When wiring, first confirm the location of the threading holes, and thread the wiring harnesses outside through the threading holes in sequence;

• When wiring, first arrange the outer wiring harnesses, then arrange the wiring harnesses in the cab;

• When wiring, pay attention to avoid high temperature, oily, sharp and abrasive areas, fans, exhaust pipes and other nearby areas;

• When wiring, keep a certain length to avoid over-tightening and loosening; the wiring harnesses layout should be smooth and cannot be twisted;

• When wiring, leave enough length in case of wheel turning to right/left all the way because the wheel angle sensor will rotate together with steer wheel;

• After wiring, cut off the extra length of cable ties. After complete the installation, please store the original vehicle accessories properly and clean up the garbage.

b) Electrical connection method and precautions

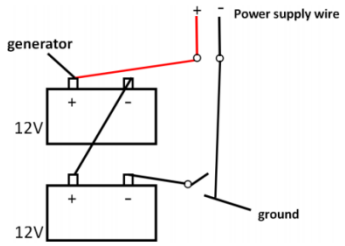
• Before connect to receiver, display, and steering wheel connectors, please connect to battery first to avoid damage caused by direct power-on or multiple power-offs;

• In the process of connecting the power cord to the battery, first connect to the positive electrode then to the negative electrode;

• Pay attention to the use of the wrench when connecting the positive electrode, and it is strictly forbidden to bonding (when the wrench contacts the positive electrode of the battery, the other end of the wrench is strictly prohibited from touching any conductive items, especially the metal parts of the original vehicle);

• 12V / 24V battery, when using the original battery power supply, please connect the positive wire to the positive electrode and the negative wire to the negative electrode;

• 12V / 24V battery, when additional battery is connected in series, connect the positive wire to the positive electrode and the negative wire to the negative electrode of the other battery, as shown in the diagram below.



3.2.10 Radio antenna installation

The installation of the radio antenna is not mandatory; it is only required when customers are using the NX510 built-in radio mode. Typically, we recommend to install the radio antenna on the vehicle's roof for better reception of base station signals.

a) Place the magnetic radio antenna on the top of the vehicle in areas containing metal, ensuring to keep the rubber protector at the bottom of the antenna. If the vehicle roof is made of plastic, alternative methods such as double-sided adhesive installation should be used.

b) Connect the radio antenna cable to the radio port on the PA-3 receiver.

3.2.11 ER-2 external Rx radio installation

For the NX510PRO and NX510PLUS models, which do not include a built-in radio, if customers want to use the internal radio mode, it is necessary to connect an external ER-2 Rx radio to receive data from the base station.

a) Before install the radio module, please turn off the power of the NX510 system.
b) The ER-2 product package includes external radio module, radio antenna, wiring harness.

Package box:

ER-2 radio module:

Magnetic radio antenna and cable:

Radio converter cable:

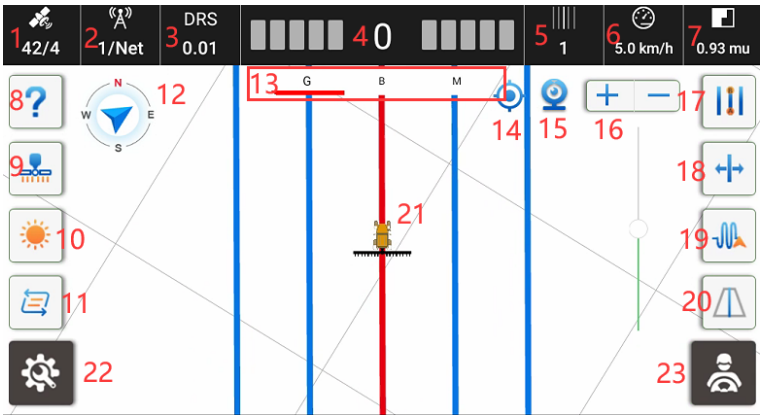
c) The wiring harness connection is as below,

1 means radio antenna port; 2 means communication port; 3 means tablet port3; 4 connects to main cable; 5 means two AMP ports for other CHCNAV devices and not useful for NX510PRO/PLUS.

Software configuration please refer to Chapter 4.2.7.1 Internal & External Radio

4 Software Functions

4.1 Main interface



1. Satellite status. There are two numbers displayed in the form of X / Y.

X represents the number of tracked satellites;

Y represents the RTK status:

1: Single/Autonomous 2: DGPS/SBAS 4: Fix 5: Float

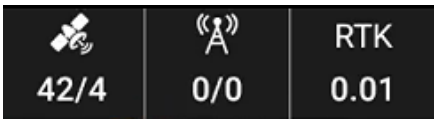
2. Base station status. There are two numbers displayed in the form of X / Y.

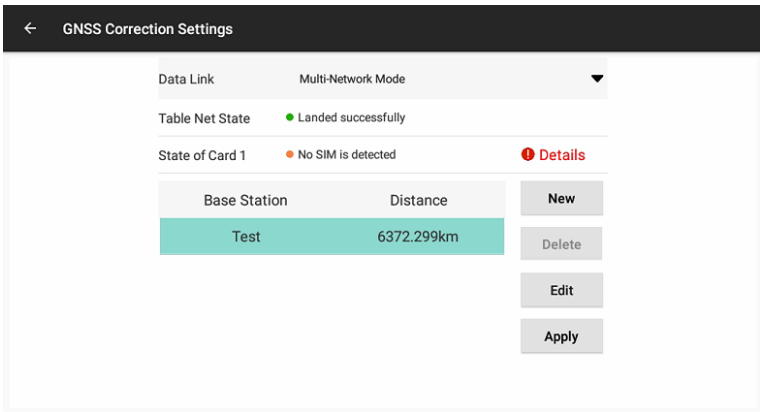
X represents the signal latency. The smaller the X, the more stable the signal is, usually the recommended value is less than 10 in auto steering mode for better performance.

Y is the current radio channel number if it's radio mode; Y will change to NET if it's network mode.

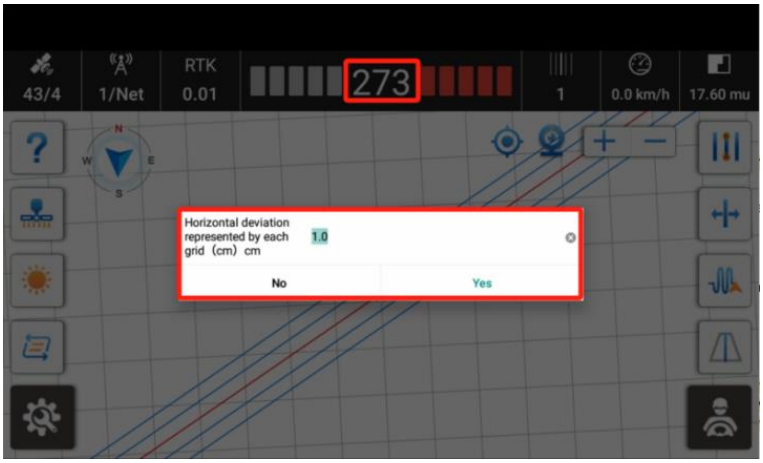
3. GNSS mode and position accuracy.

Tips: Click the Satellite status bar to enter the GNSS Correction Settings.





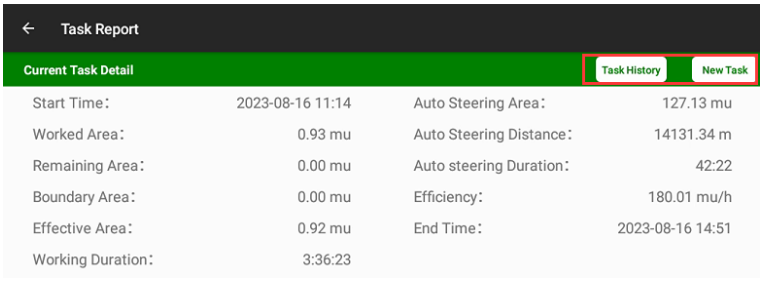
4. Lateral deviation. The real-time deviation between the current vehicle location and the marked guideline. The value is negative when the vehicle is on the left side of the guideline and positive when the vehicle is on the right side of the guideline. The default is 1cm per grid, and it's adjustable. It is able to click this part to set the grid configuration.



5. The current guideline number where the vehicle is located (the original guideline is 0).

6. Real-time vehicle speed.

7. Worked area. Mu is default unit, and it's adjustable in **Basic Settings**. Click this button to view the detailed task report.



Worked Area: The painting/drawing area with overlap.

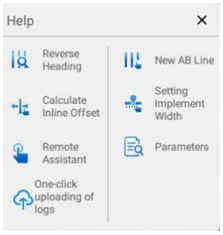
Remaining Area: The area which is subtracted effective area from boundary area.

Boundary Area: The inner area of boundary.

Effective Area: The painting/drawing area without overlap.

This interface allows to view historical tasks and create new tasks.

8. Help. It includes Reverse Heading, Calculate Inline Offset guidance, New AB Line guidance, Remote Assistant, Setting Implement Width guidance, One-click uploading of logs and Parameters.



Reverse Heading: When the vehicle is driving forward and the software interface indicates that it is reversing, please click it to get the correct heading. Also the shortcut can be turned on/off in **Other Settings-Reverse heading shortcut**.

Calculate Inline Offset: Guide users on how to adjust the inline offset.

New AB Line: Guide users on how to create AB line.

Remote Assistant: Contact technicians for remote assistance via an identification code.

Setting Implement Width: Guide users on how to input implement's parameters.

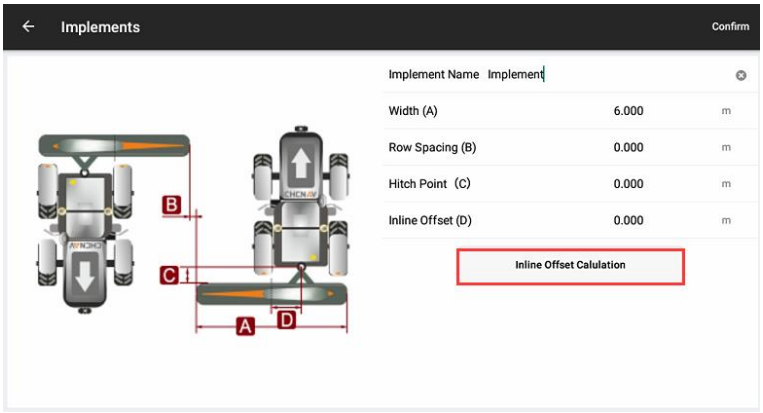
One-click uploading of logs: Quickly send logs to the server for technicians checking.

Parameters: Vehicle, configuration and calibration parameters, etc.

9. Implement settings.

A: ISOBUS UT (Requires extra activation)

B: Implement configuration



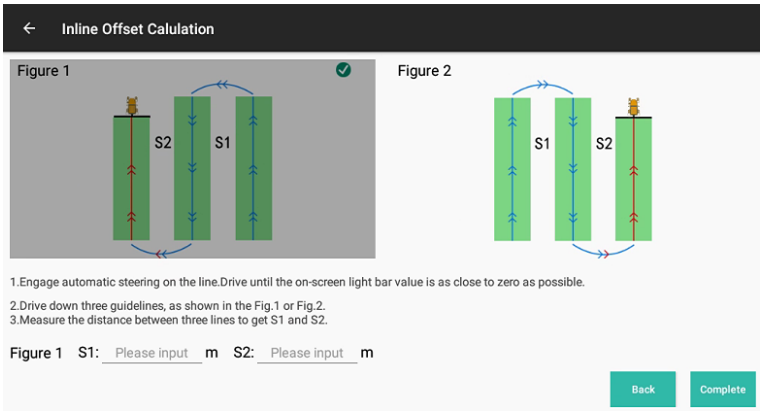
Width: Implement width, and the default value is 6m.

Row Spacing: The distance between two passes, and the default value is 0m.

Hitch Point: The distance from hitch point to implement, and the default value is 0m. The current algorithm do not use this value, so it has no practical significance.

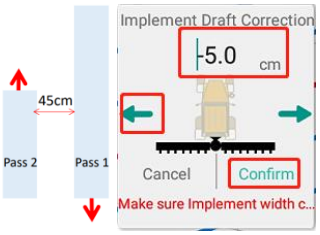
Inline Offset: The offset from implements center to vehicle center.

If there is the row spacing issue with skip or overlap, it is necessary to click **Inline Offset Calculation** to make offset calculation.



There are two methods to choose, then follow the instruction.

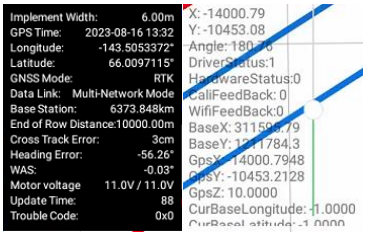
C: Setup the Center offset. For example, if the row spacing is 50 cm, drive two passes, then check the actual row spacing is 45 cm, click the left arrow 5 times to do the left shift with 5 cm.



10. Brightness configuration. There are three modes including sunny, cloudy and night modes.

11. Guideline switching button. Click the button to quickly switch guidelines when the field has multiple guidelines.

12. Compass. Click it once to check the basic information and click it seven times continuously to show the debugging information.



Base Station: The distance to base station.

Heading Error: The angle between guideline and vehicle heading.

WAS: The angle between guideline and front wheel.

Motor voltage: X/Y, X represents the current system voltage, Y represents the minimum voltage.

Error Code: The codes when there are system error messages. Clickce to open the message box to view the historical error information.

13. G/B/M. The feature can be enabled in **Other Settings-Show Headline Option View**.

G means guidelines, the vehicle will only recognize the guidelines and drive automatically after select.

B means boundary/headand, the vehicle will only recognize the boundary/headland and drive automatically after select.

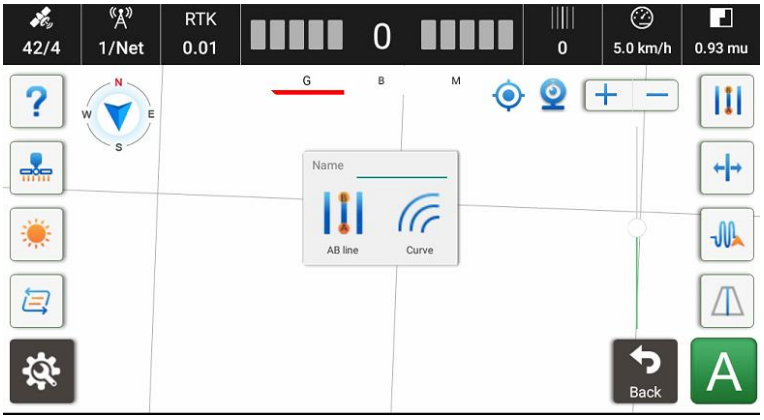
M means manual option, the vehicle will not be able to switch to the automatic driving mode after select.

14. View switch. Switch to free view or lock the vehicle position.

15. Camera. When it is turned on, the real-time image will show up.

16. Zoom in / out. It can also zoom in and out of the interface by swiping fingers across the screen.

17. Quick guideline. It can support AB line or curve quick creation.



18. Line offset.

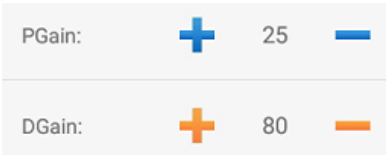
A: The guideline is shifted to the left

B: Enter the offset distance, the maximum value is 999cm

C: The guideline is shifted to the right

D: Make the lateral deviation and current guideline counts return to zero

19. Quickly adjust the steering wheel amplitude and frequency parameters.



PGain: Motor Adjustment speed ratio. The smaller the value, the slower the adjustment.

With wheel angle sensor, the recommended value is 20/25 but on the vehicle with small horsepower or small steering ratio generally less than 13, the recommended value is 25/30;

Without wheel angle sensor, the recommended value is 25/30 but on the vehicle with small horsepower or small steering ratio generally less than 13, the recommended value is 30/35;

DGain: The higher the frequency, the more obvious the vibration of the motor movement; the smaller the frequency, the more stable the motor movement;

With wheel angle sensor mode, the recommended value is 80;

Without wheel angle sensor mode, the recommended value is 60/80.

20. Work coverage track. The track switching method can be set in **Basic Settings-Coverage Logging**.

Switch Mode: Turn on/off the track manually.

Automatic Mode: Turn on the track automatically when engage the automatic mode.

21. Vehicle and guideline.

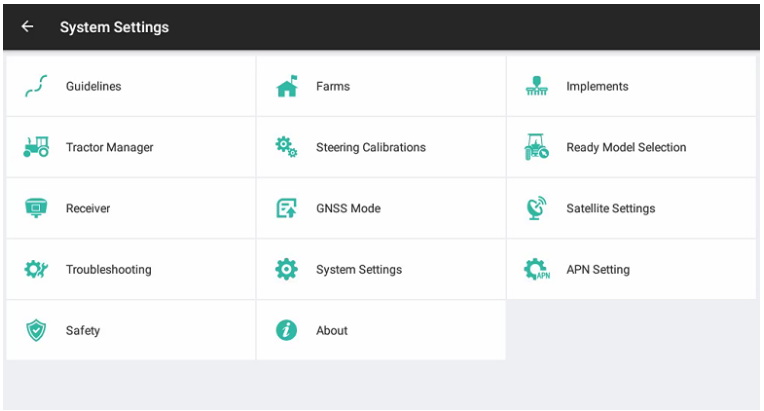
22. Settings. Click it to be direct to this interface with all functions.

23. Engage or disengage.

Automatic:

Manual:

4.2 System Settings



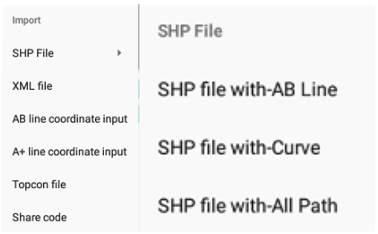
4.2.1 Guidelines

4.2.1.1 Guidelines Main Interface

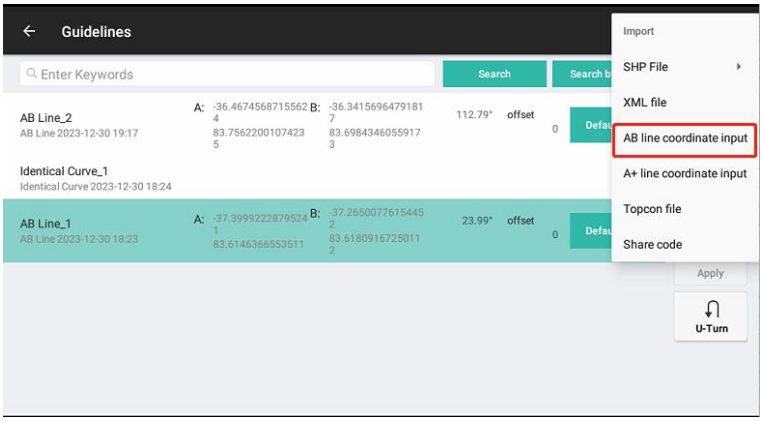
A: Click it to Import/Export guidelines.

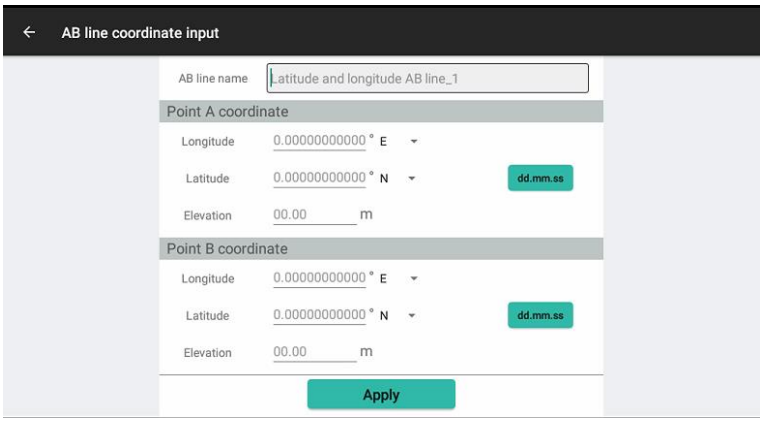
Currently AGNAV3.0 supports the SHP file, CHC XML file and Topcon file import. For SHP files, it can include AB lines, curve lines and all path lines three types.

All-path lines means the line projects with hundreds/thousands of lines which are planned desktop software in advance.

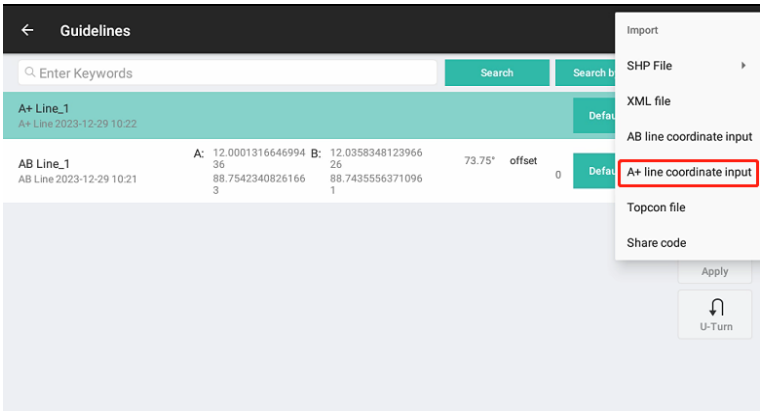


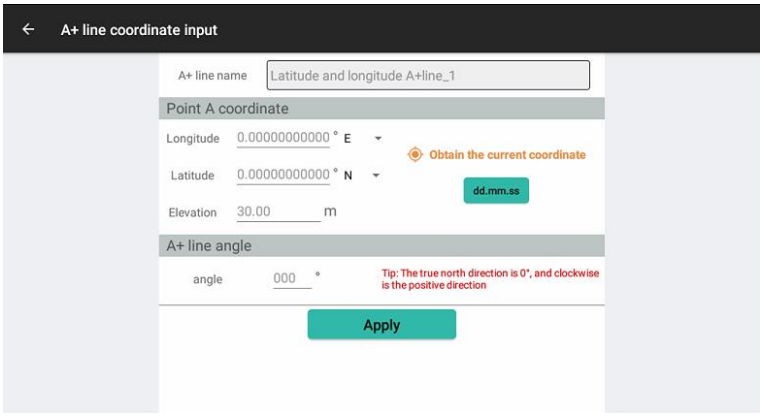
AB line with coordinate input:

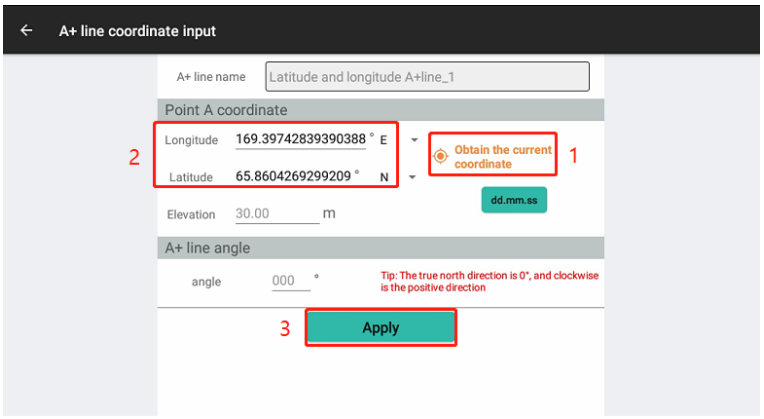




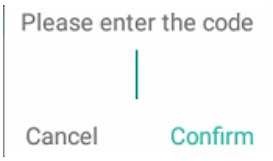
A+ line with coordinate input:



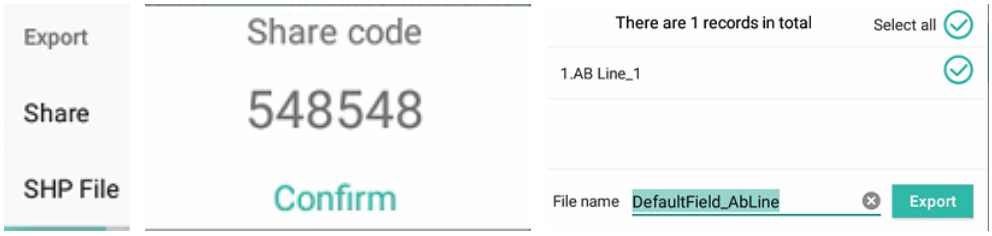




Share code: Get the code from another NX510



Also AGNAV3.0 can export guidelines via share code and SHP files. The exported SHP files are stored in ES-CHCNAV-AgNav3.0-Shp Export-Navline.



B: Search guidelines by name or type.

C: New guidelines.

D: Delete guidelines.

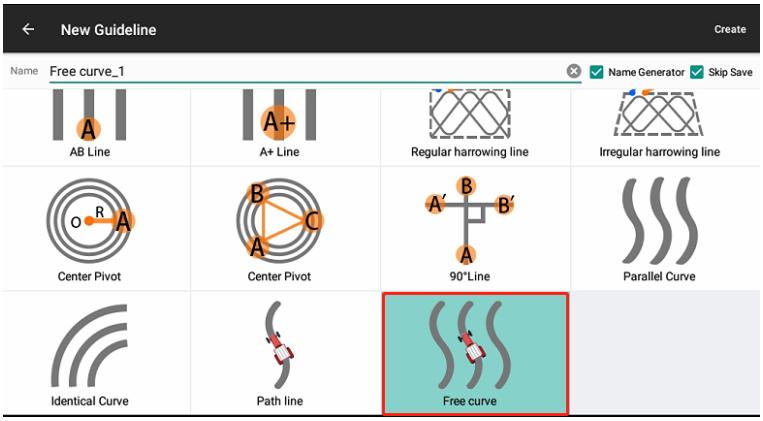
E: Edit guidelines. Edit the guideline name or zero the offset values.

F: Apply the selected guideline.

G: Set the guideline U-Turn method.

H: Here it can record the current AB line azimuth and offset value.

4.2.1.2 New



In this interface, select the type of guidelines, then click **Create** to return to the main interface and follow the instructions to complete creation.

AB Line: Create a guideline by locating two points. The current location will be used as point A, then drive the vehicle to the other end of the field as point B.

A+ Line: The current position will be used as point A to create the A+ line, which uses the heading of the vehicle as azimuth. This feature is recommended to be used for special scenarios which requests fast line creation.

Regular/Irregular harrowing line: Harrowing in fields. It can be applied to the case that the user need fuel-efficient target-ground routes.

Center Pivot(two/three points): The circular curve can be applied to the case where the vehicle drives a circular automatically, like cutting grass.

90° Line: Rotate the AB line or A+ line for 90° so there must be an existed AB Line or

A+ Line in the guideline list.

Parallel Curve: Create a curve and generate other curves that are parallel and consistent with it.

Identical Curve: Create a curve and generate other curves that are consistent with its trend.

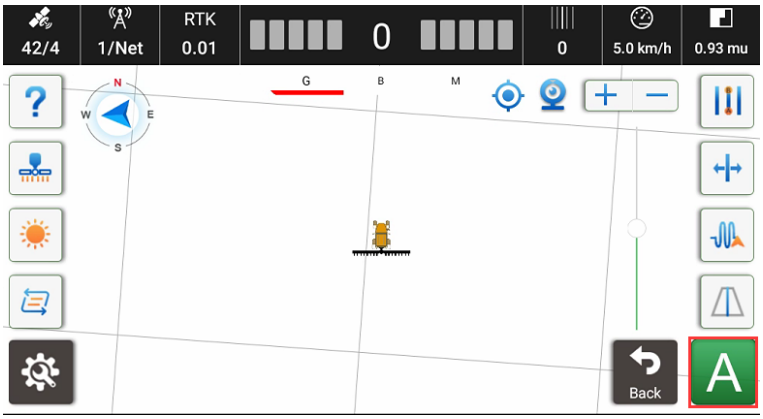
Path line: With this guideline mode, users can create the guideline with the actual trajectory of the vehicle.

Free curve: With this curve mode, it can support to combine the straight line and curve line, also it is with optimized algorithm so the curve line will be more stable and it is recommended to use instead of parallel curve and identical curve.

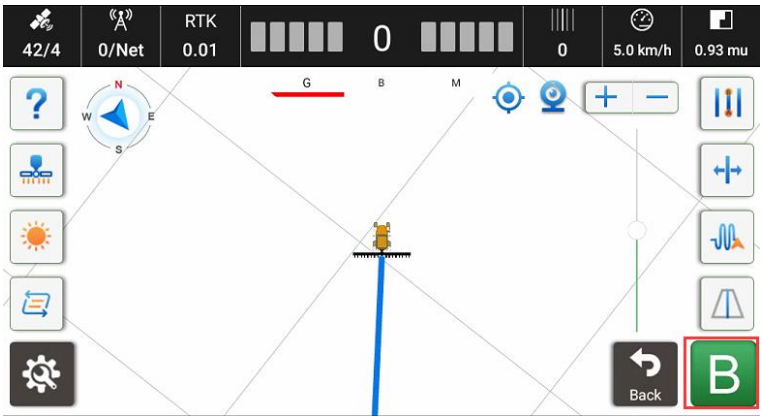
Take the example of creating an AB line, harrowing Line and free curve,

AB line:

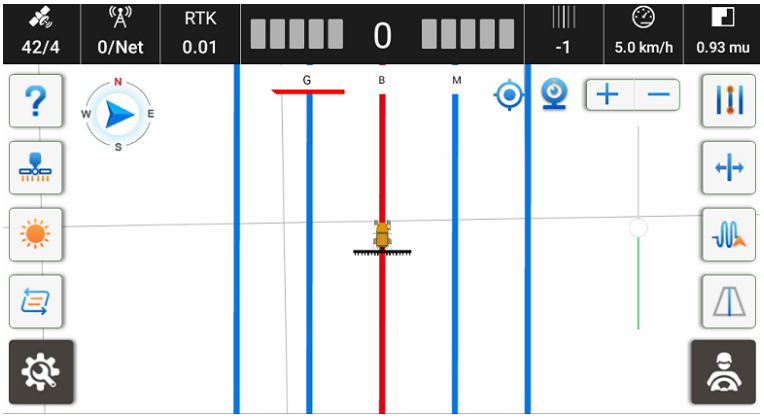
a) Click A in the current location;



b) Drive to another end of the field and click B;

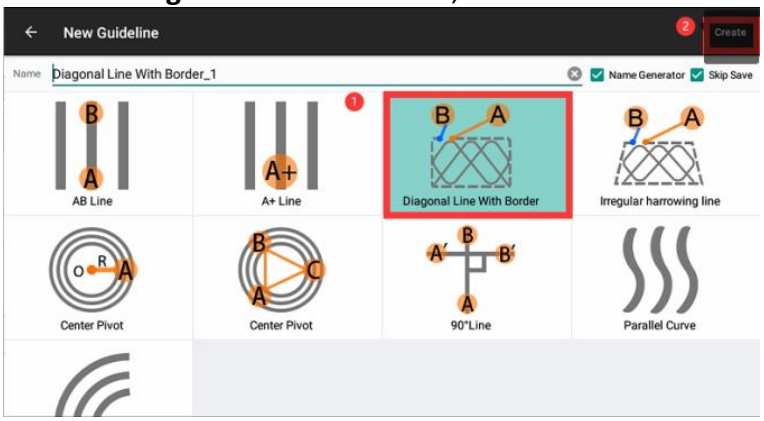


c) New AB line will be created successfully.

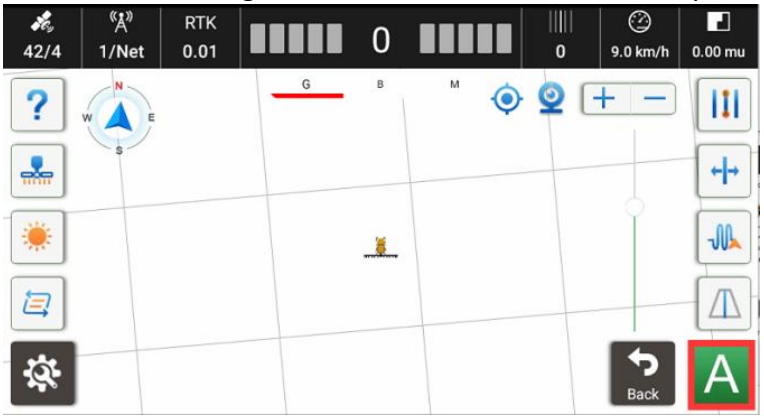


Harrowing Line:

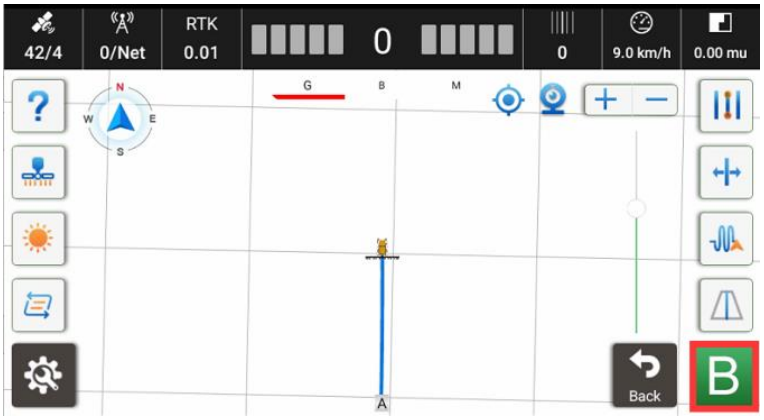
a) Select **Regular harrowing line** and click **Create**;



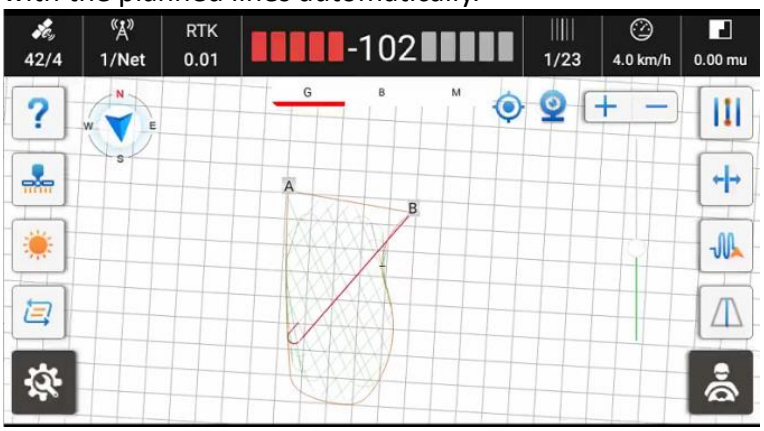
b) click the icon on the bottom right corner［**A**］,drive the vehicle to plan the border;



c) After painting, click the icon on the bottom right corner ［**B**］;

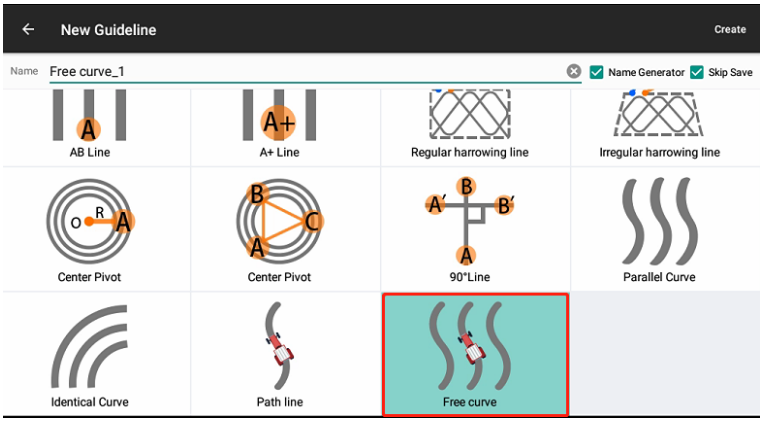


d) The system will plan the most fuel-efficient diagonal line then the vehicle can drive along with the planned lines automatically.

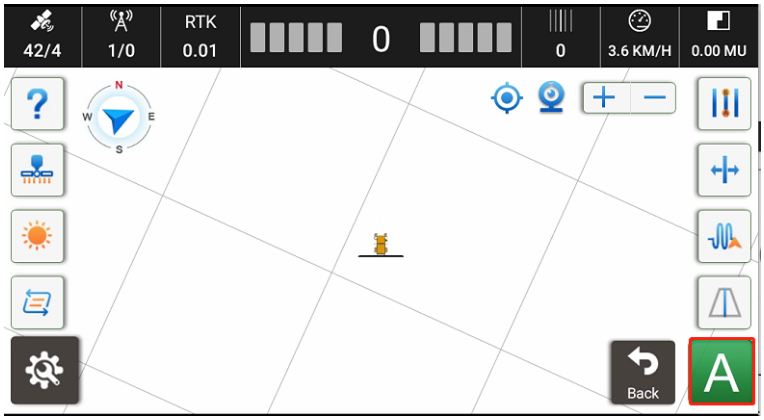


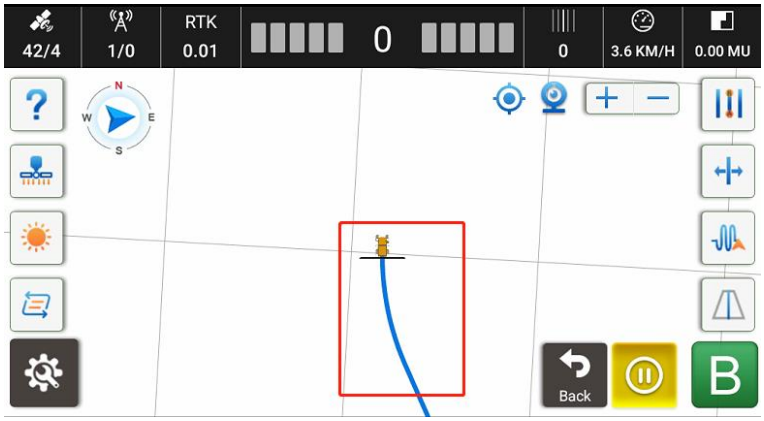
Free curve:

a) Select **Free curve** and click **Create**;

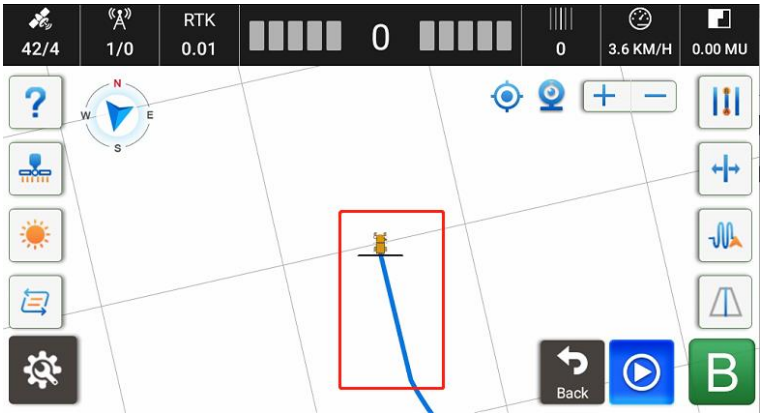


b) Click A to start the curve;

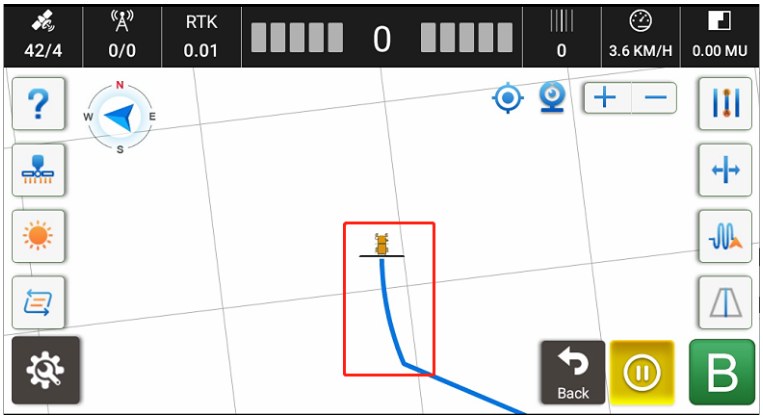




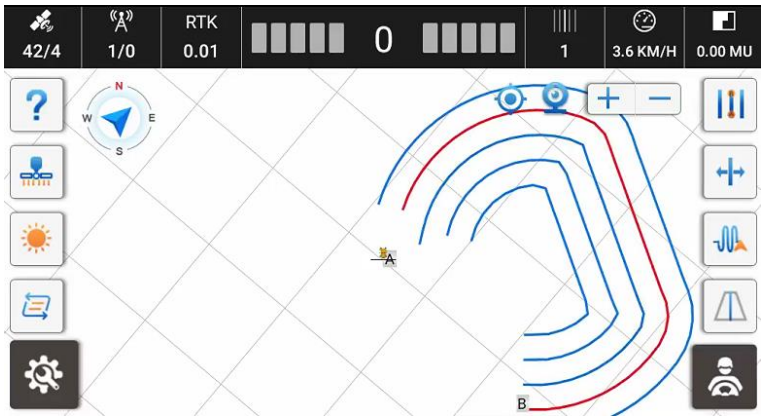
c) Click Pause to create straight line;



d) Click Start to continue curve line;

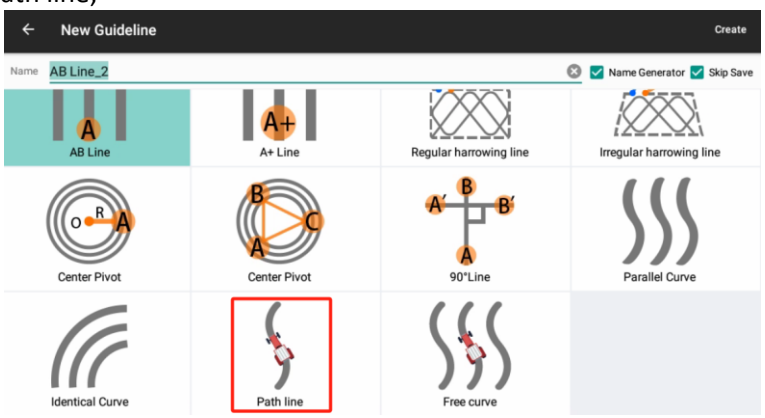


e) Click B to finish the line creation.

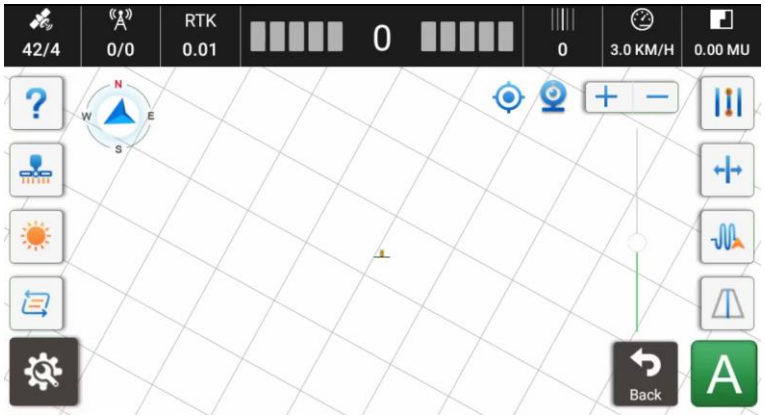


Path line:

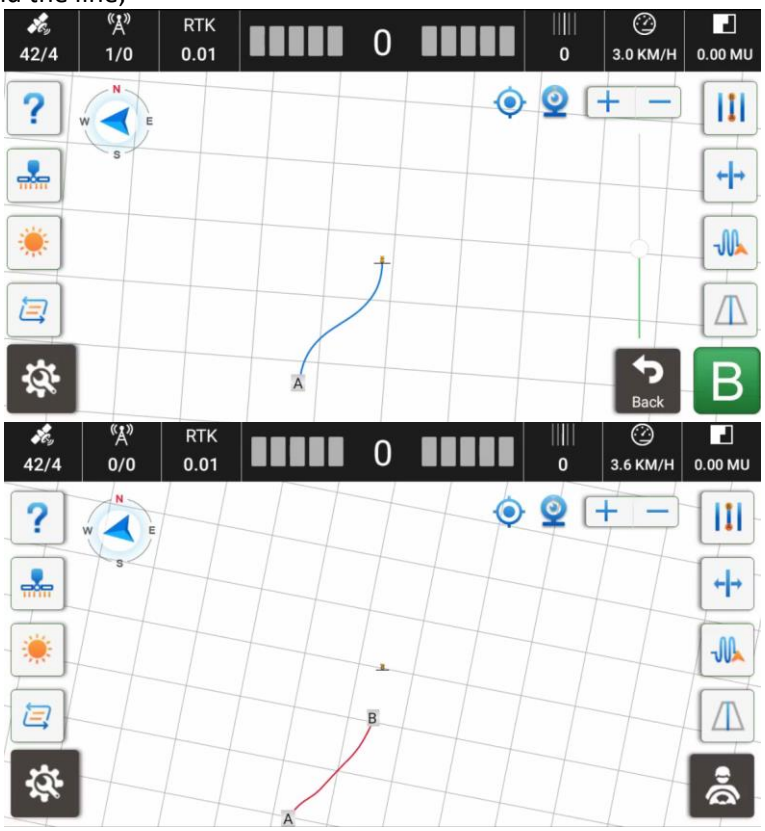
a) Select the Path line;



b) Click A to start the line;

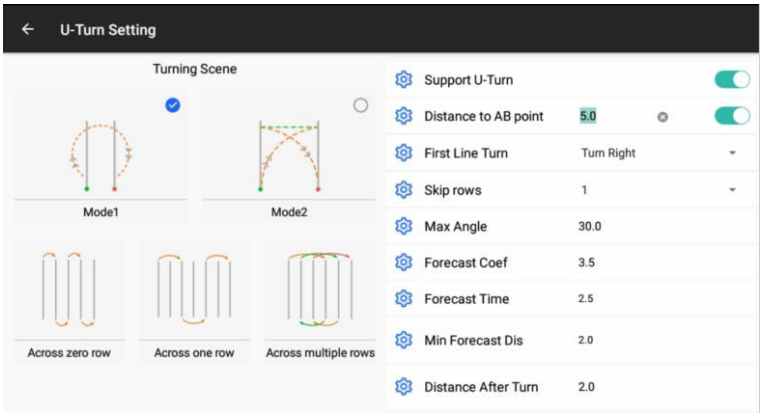


c) Click B to end the line;



4.2.1.3 U-Turn

There are two kinds of U-Turn modes supported currently.



With Mode 1 "*Bulb*" U-Turn, it can support to do rows skip. Also it can be configured with some parameters as below;

Support U turn: The option to enable/disable the U-turn feature;

Distance to AB point: The option to enable/disable Auto U-turn which is triggered based on the distance to AB point;

First line Turn: The option to set the turning direction of the first guideline;

Skip rows: The option to select how much rows skipping, currently 0-9 rows can be supported.

Max Angle: The maximum angle vehicle can turn. The range is around 30° to 50°, the default value is 30°.

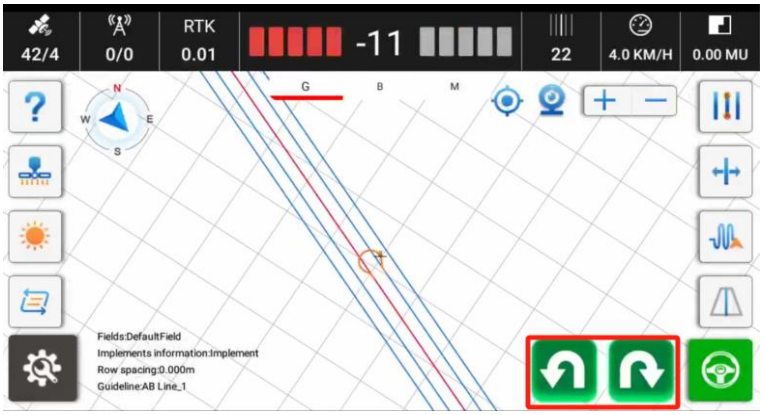
Forecast Coef: Decrease the value if the vehicle enters the next guideline slowly after U-turn. The range is from 2.5 to 3.0 and the adjustment interval is 0.5.

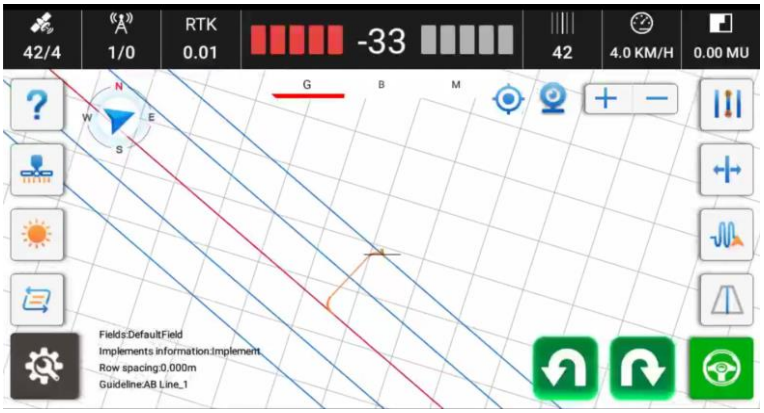
Forecast Time: Increase the value if the vehicle deviation distance is large during U-turn. The range is from 2.5 to 4.0 and the adjustment interval is 0.5.

Min Forecast Dis: Predict the turnaround path by the vehicle's current position to give sufficient time for U-turn. The smaller the value, the later the vehicle turns around. The range for transplanter is 1.7-2.5, for tractor is 2.0-4.0 and the adjustment interval is 0.1.

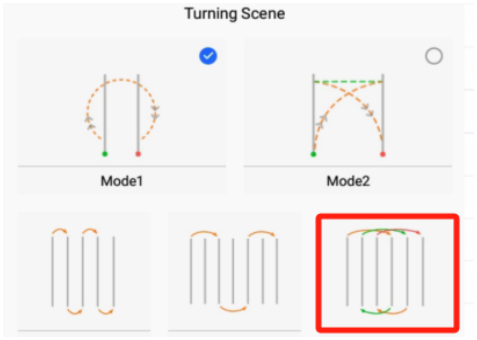
Distance After Turn: Distance required for vehicle to fully enter the guideline after U-turn.

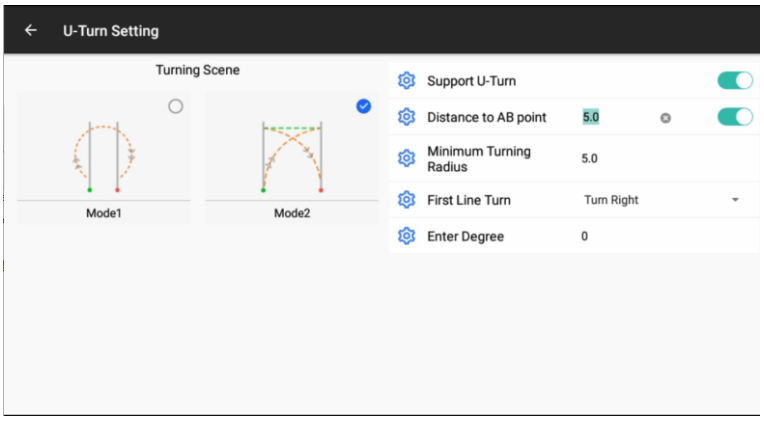
If the selected skipping row is 0 or 1, it will have Left/Right icon for manual setup.





If the selected skipping row is 2 or above, it will follow the designed path as below,





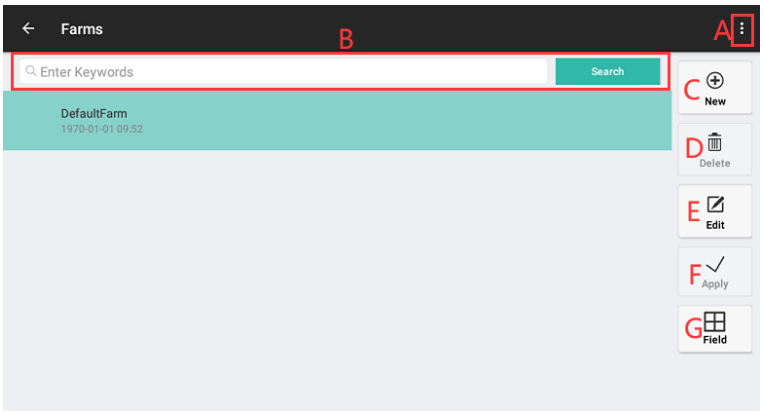
With Mode 2 "*Fish tail*" U-Turn, it can be configured with some parameters as below;

Minimum Turning Radius: Relate to the front wheels maximum turn angle, default value is 5.

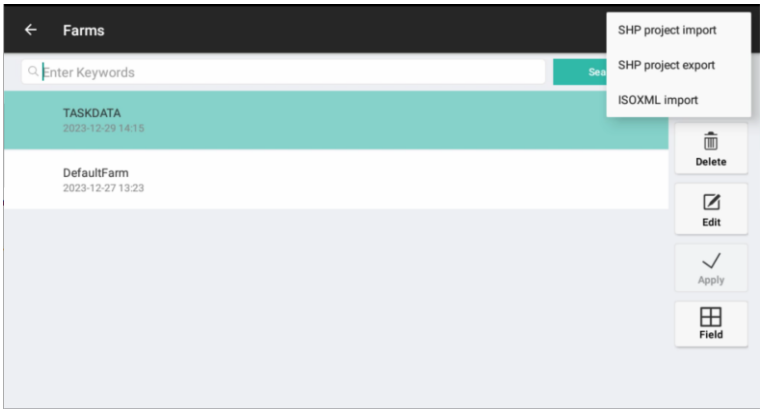
Enter Degree: The angle between vehicle and next guideline which is used for taking to the line in advance. The default is 0, the range is 0-30 and the recommended value is 15.

4.2.2 Farms

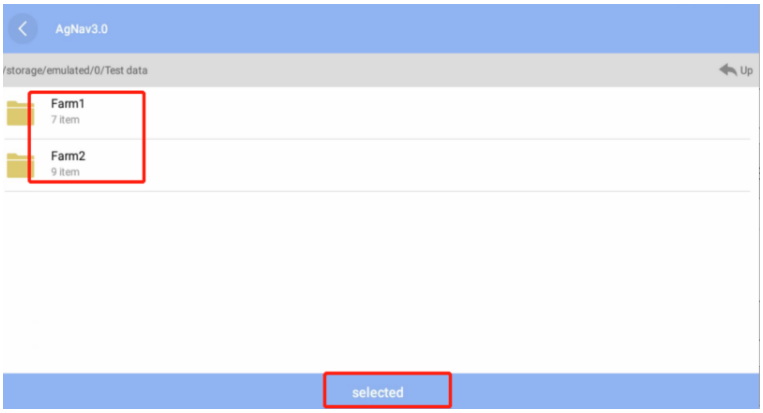
4.2.2.1 Farms Main Interface

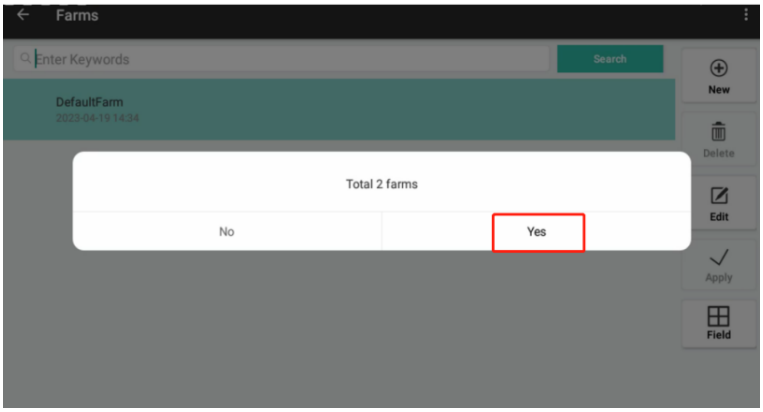


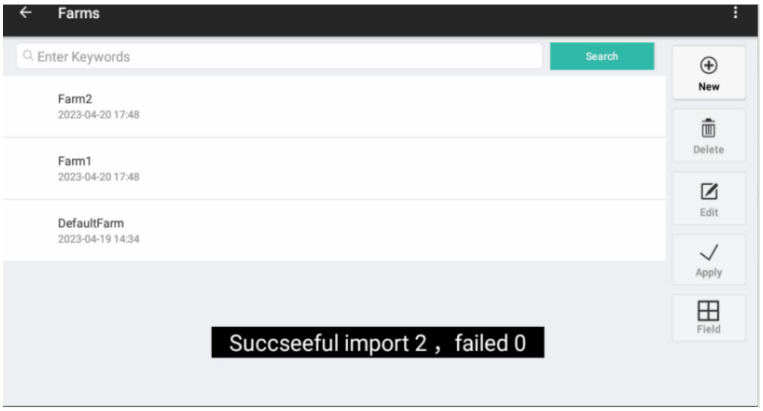
A: Click this button to Import/Export farms with SHP file and ISOXML file.



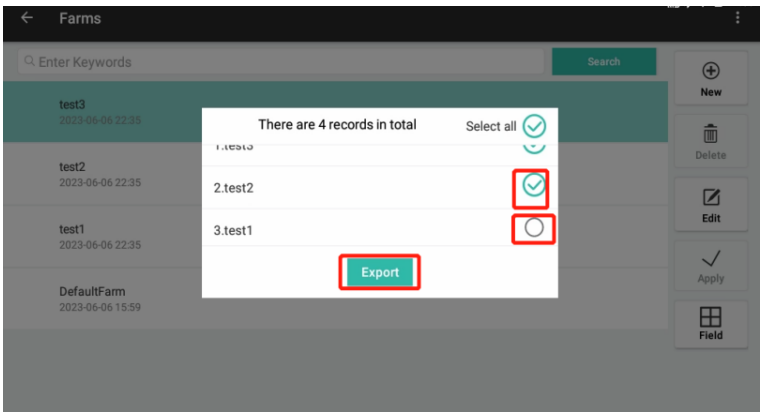
SHP project import:

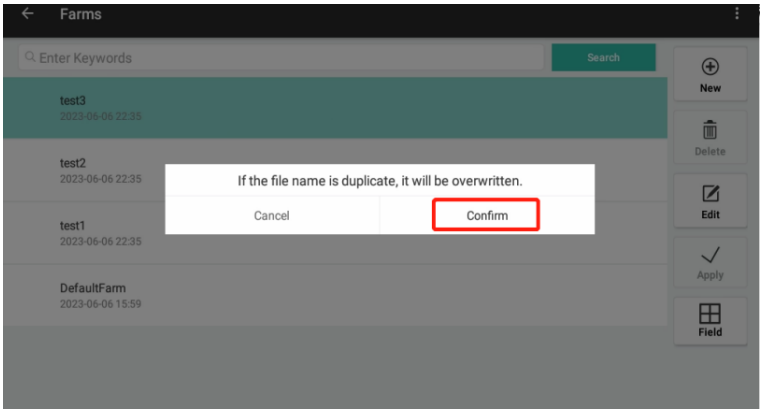


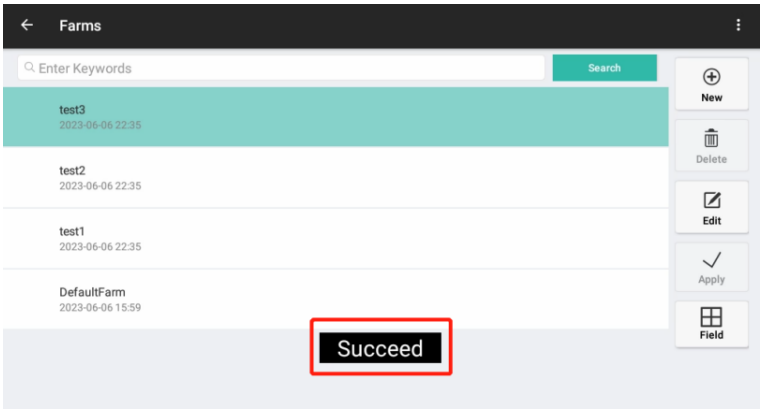




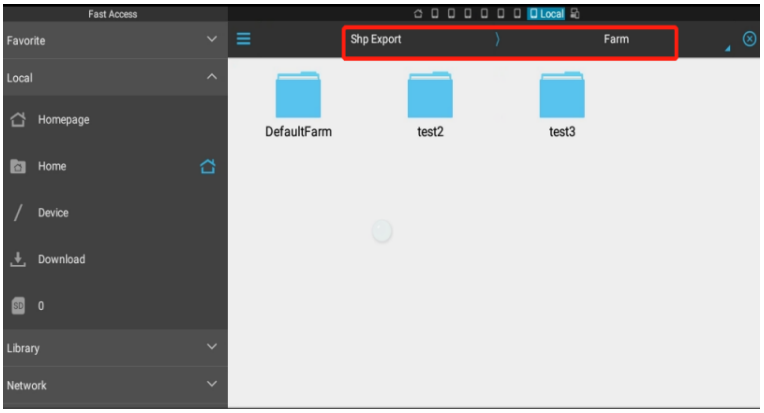
SHP project export:



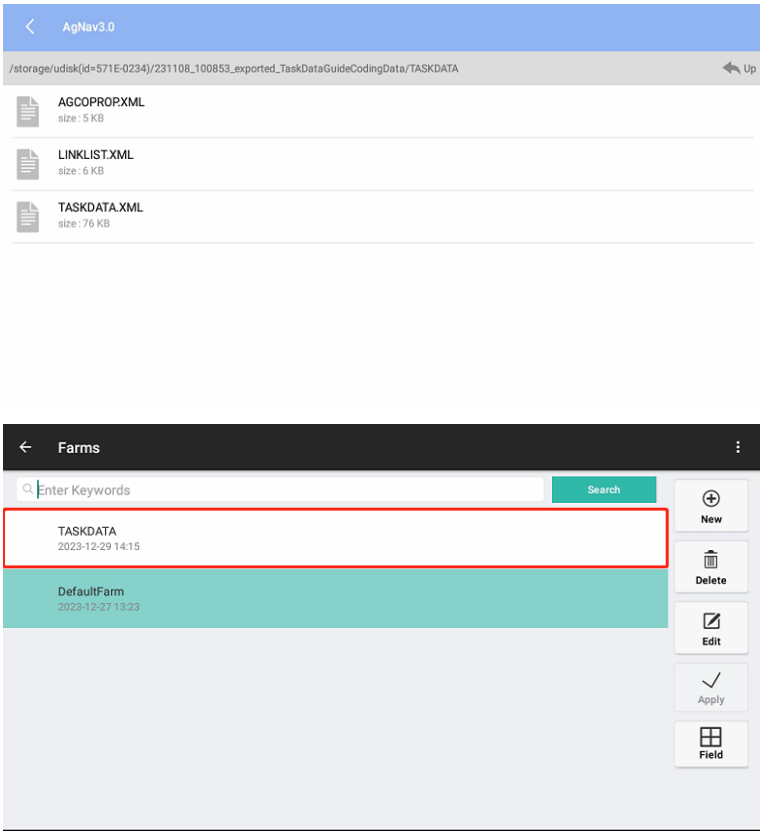




Go to CHCNAV---AGNAV3.0---SHP Export---Farm folder to check the farms what exactly export.



ISOXML file import:



B: Quickly search farms by the keywords if there are many farms.

C: New farms.

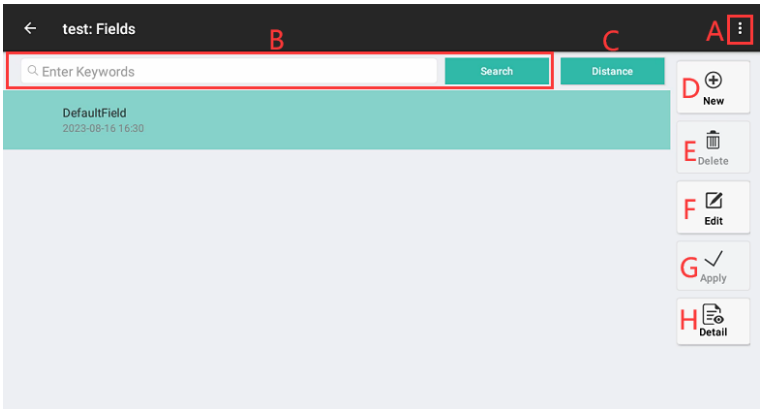
D: Delete farms. The currently applied farm and the last farm cannot be deleted.

E: Edit farms, edit the farm name.

F: Apply the selected farm.

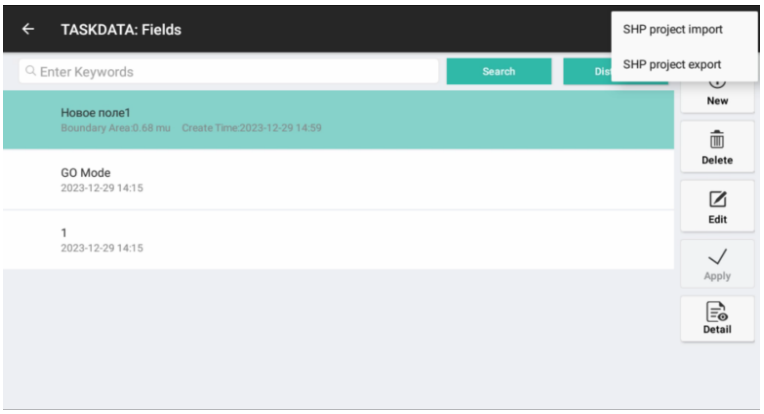
G: Enter to the field creation interface.

4.2.2.2 Field



A: Click this button to Import/Export farms with SHP file, it has similar procedure as

farm SHP file export/import. The exported SHP files are stored in ES-CHCNAV-AgNav3.0-Shp Export-Field.



B: Search fields.

C: Click this button to switch to displaying fields sorted by Distance or by Create Time.

D: New fields.

E: Delete fields. The currently applied field and the last field cannot be deleted.

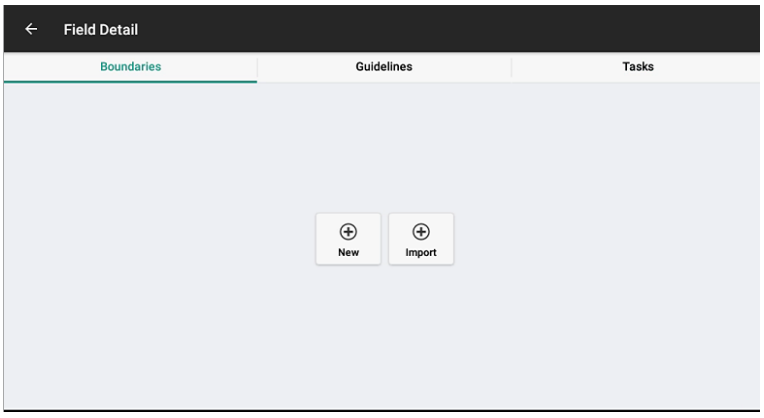
F: Edit fields, edit the field name/operator.

G: Apply the selected field.

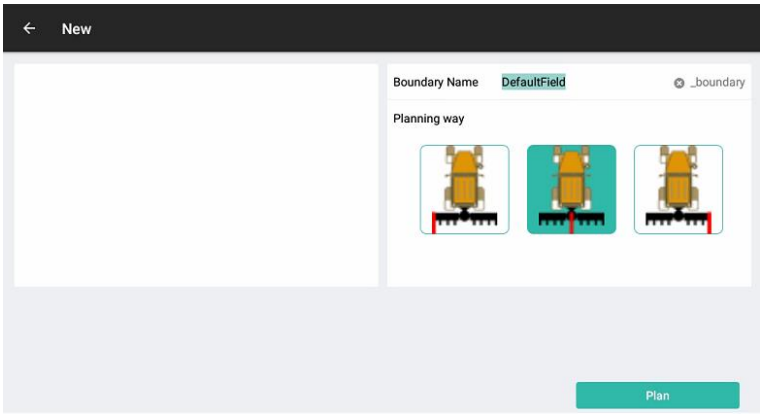
H: Enter the Field Detail interface to create boundaries, guidelines and view task reports.

4.2.2.3 Field Detail

1 Boundaries

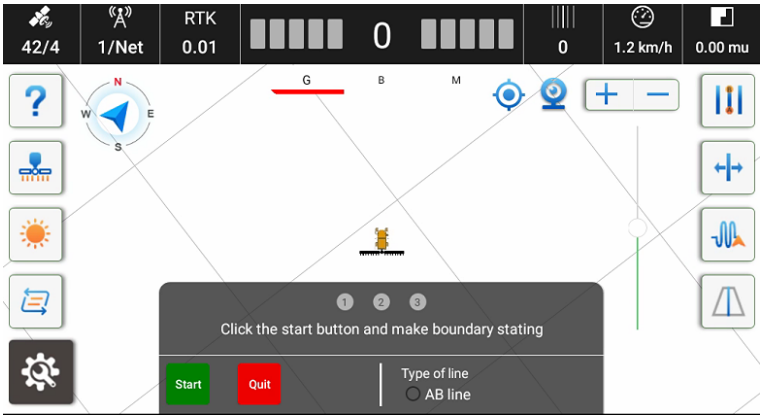


New: Click **New** to create the boundary, and select the planning way in the following interface then click **Plan**.

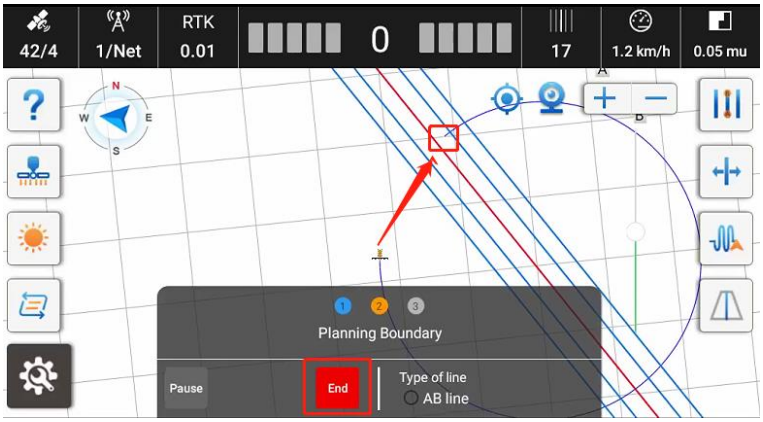


The software will return to the main interface to start creating, please follow the instructions to complete.

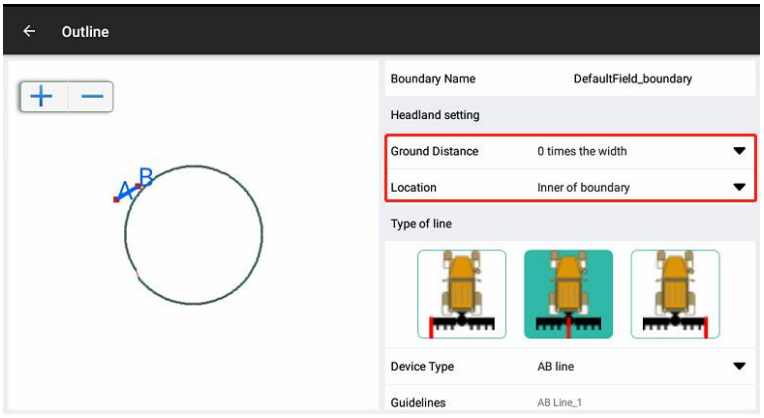
a) Click **Start** to create boundary.



b) Drive the vehicle around the field and back to the starting point. Then click **End**.

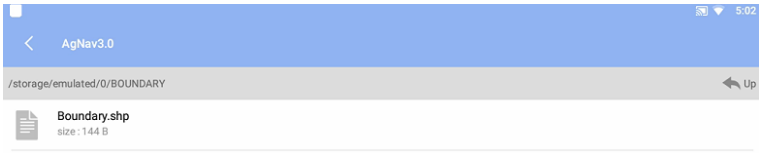


After set the boundary, it can generate headlines according to the operational requirements.



The exported files are stored in ES-CHCNAV-AgNav3.0-Shp Export-Boundary.

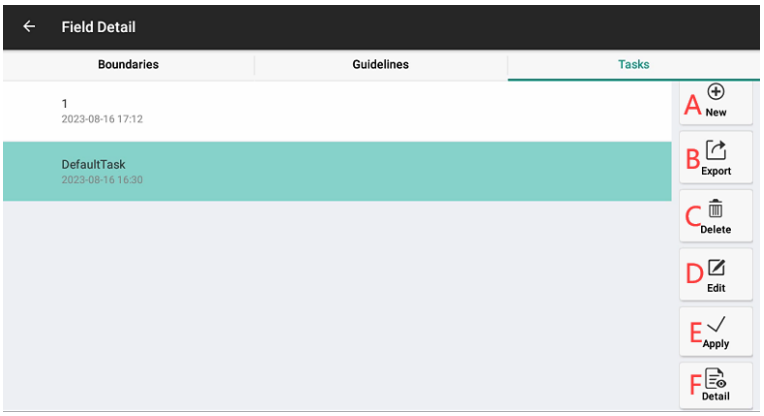
Import: Please find the folder where the boundary is stored and select the boundary file, then import it.



2 Guidelines

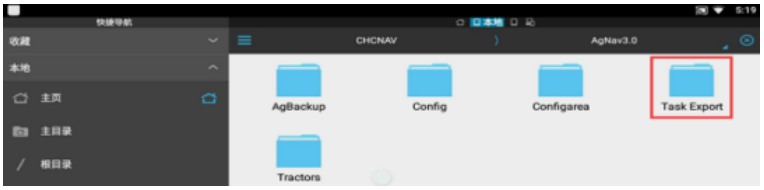
In this interface it can also create guidelines, please refer to **4.2.1 Guidelines** for details. The exported files are stored in ES-CHCNAV-AgNav3.0-Shp Export-NavLine.

3 Tasks



A: New task.

B: Export the tasks, the exported CSV files are stored in ES-CHCNAV-AgNav3.0-Task Export.



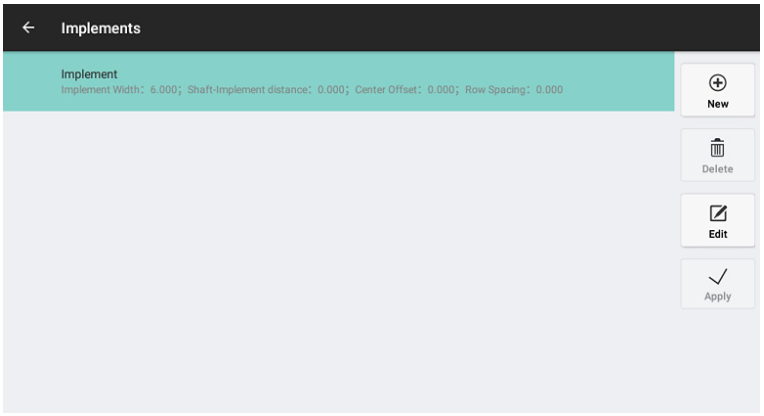
C: Delete task. The currently applied task and the last task cannot be deleted.

D: Edit task.

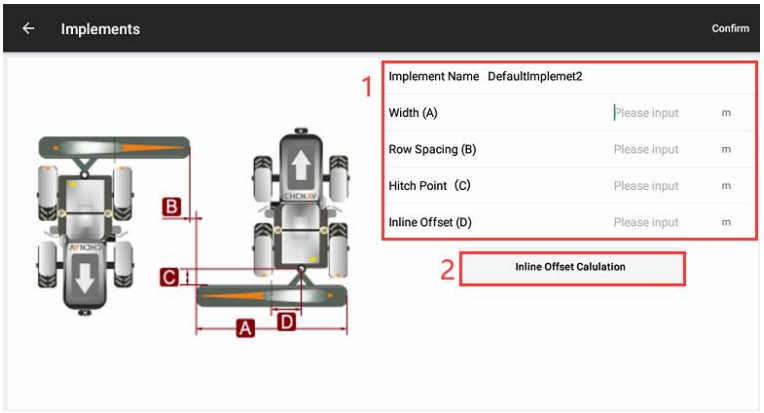
E: Apply the selected task.

F: Click to view the detailed report.

4.2.3 Implements



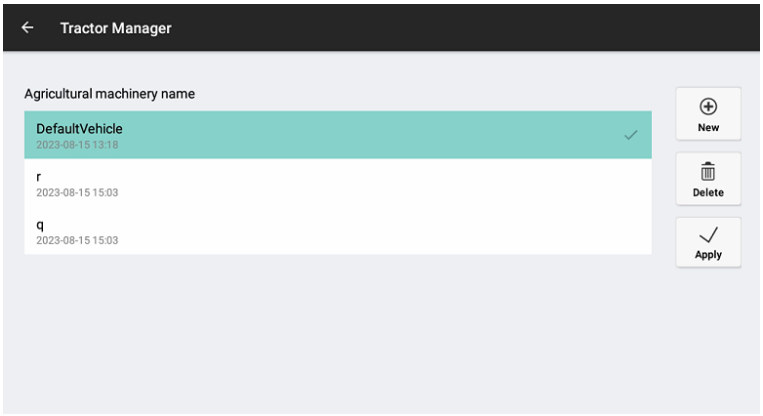
Click **New/Edit**, then can set the implement's parameters.



Please refer to [Main interface - 9 Implement settings] for details.

4.2.4 Tractor Manager

It is available to manage different vehicles in this interface.

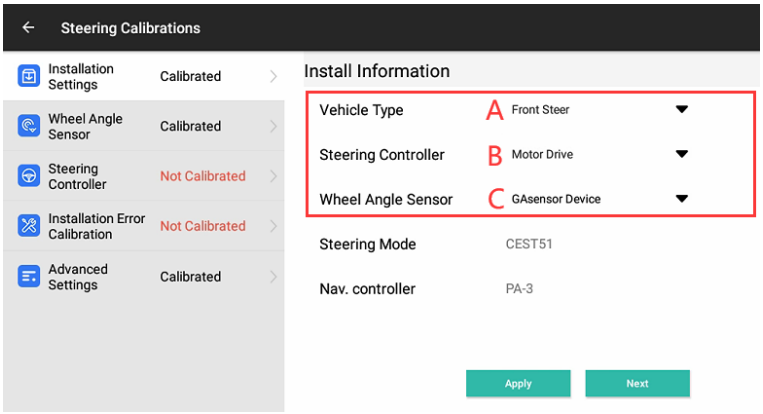


4.2.5 Steering Calibrations

Before performing the calibration, please make sure that there is no abnormality in the satellite signal and accuracy, please refer to **Main interface - 3 GNSS mode and position accuracy** for details.

4.2.5.1 Installation Settings

a) Set the basic information



A: Vehicle type: Currently support Front Steer, Rear Steer, Tracked, Articulated and Transplanter Steer.

B: Steering Controller: Currently support Hydraulic Drive and Motor Drive.

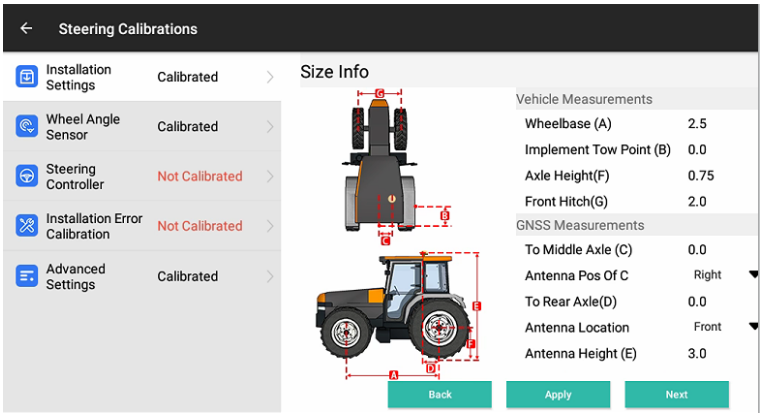
C: Wheel Angle Sensor: Currently support Potentiometer, GAsensor Device, Without WAS and Without WAS-Rice transplanter.

Note: Different vehicle types and wheel angle sensor types have different calibration methods, please follow the prompts to complete the calibration.

The following is an example of calibration with a conventional installation type (Front Steer + Motor Drive + GASensor).

b) Enter the vehicle parameters

Measure and enter the parameters of the vehicle, the unit is meter.



Wheelbase of front and rear wheels (A): Measure the distance between front wheel rotation axis and rear wheel rotation axis. Note that the tape measure needs to be parallel to the ground.

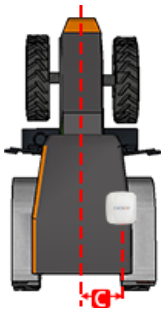
Implement Tow Point (B): Use the default value of 0 and it will be used in the futural development.

Axle Height (F): Measure the vertical height from the rear axis center to the ground.

Front Hitch (G): Measure the distance between the two front wheels.

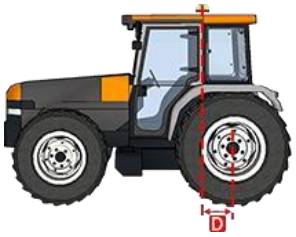
To Middle Axle (C): If the receiver is not mounted on the central axis, measure the

distance from the receiver to the central axis. If it is on the central axis, enter 0. In reality it is always better enter 0 and do the rest in assembly error calibration.



Antenna position of C: Fill in according to the receiver position.

To Rear Axle(D): Measure the horizontal distance from the antenna center to the rear wheel center.(It is convenient and accurate to project the antenna center and the rear wheel center onto the ground, then measure it.)



Antenna Location: The relative position between the antenna center(the position of the antenna center should be referred to the blue indicator) and the rear axis. Select **Front** if the antenna is in front of the rear axis, select **Rear** if the antenna is behind the rear axis.

Antenna Height (E): Measure the vertical height from the antenna center to the ground.

Confirm that all parameters are correct before clicking **NEXT**.

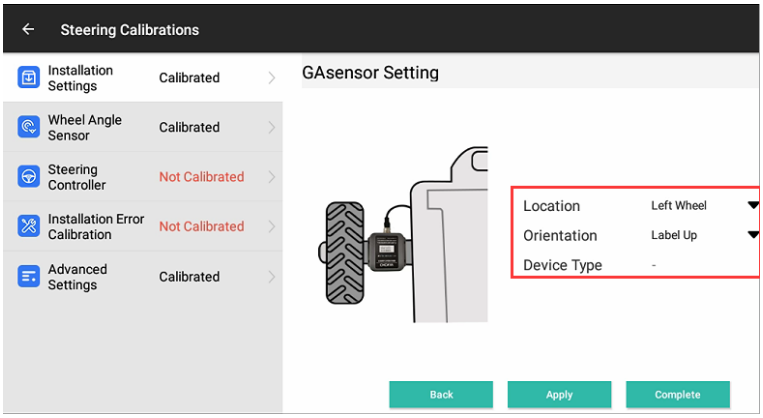
c) Set the GASensor

Location: GASensor mounting position with left or right wheel.

Orientation: The nameplate's orientation with label up or label down, most cases are with label up.

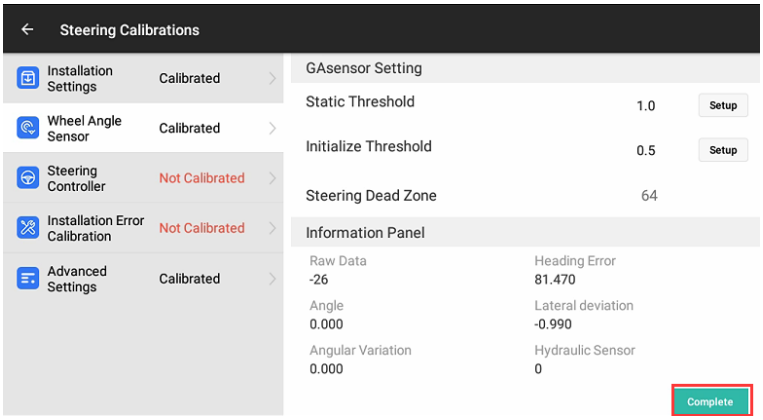
Device type: Automatic identification.

Click **Complete**.



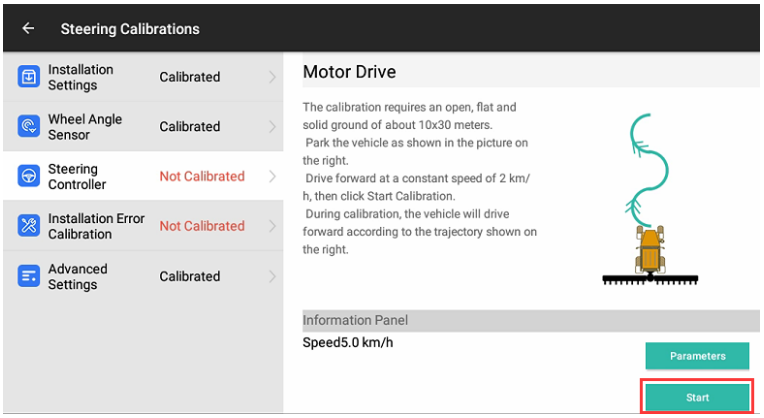
4.2.5.2 Wheel Angle Sensor

The default value of the static threshold and the initialize threshold are 0.5 and 1.0 respectively. Click **Complete** to enter the Steering Controller calibration.



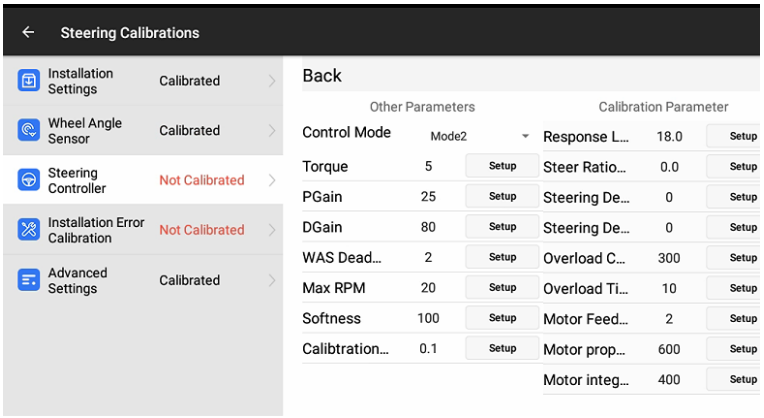
4.2.5.3 Steering Controller

Before starting calibration, please confirm that the electric steering wheel is turned on and an open space of 10 * 30 meters is reserved in front of the vehicle, then start the vehicle at 2km/h and click **Start**.



The vehicle will drive forward automatically with an "S" line. When Steering Controller calibration is completed, it will enter the **Installation Error Calibration** automatically.

Click **Parameters**, it can modify some necessary parameters here.



Torque: The strength of manually turning the steering wheel to stop the automatic driving, the minimum is 3, the maximum is 15.

WAS Dead Zone: 2 (no adjustment required).

PGain/DGain: Please refer to **Main interface - 19 Quickly adjust** for details.

MAX RPM: After the automatic steering of the vehicle goes online, the maximum motion speed of the motor, the default for front-wheel steering and rear-wheel steering vehicles is 20. The default for tracked and articulated vehicles is 10.

Softness: The default is 100 (no adjustment required).

Calibration Threshold: 0.1. Usually when do steering wheel calibration, there are three rounds of right and left turn calibration, there is the value difference between left steering ratio and right steering ratio in one round, formula is like below, V1 = VL – VR, and there is another value difference between two rounds and it is able to use calibration threshold to judge it, formula is like below, X = V2 -V1. When the vehicle is calibrated, if the vehicle condition is poor or the ground condition is poor, the calibration cannot be successful, increase the value to improve the pass rate, and can be set to 0.3.

Steering ratio: The proportional relationship between the steering wheel rotation angle and the wheel rotation angle calibrated by the steering wheel.

Steering Ratio Offset: The steering wheel rotation angle and the wheel rotation angle calibrated by the steering are asymmetrical to the left and right rotation angles; for vehicles with only one steering cylinder in the front wheel, the value is too large around ±5, and for vehicles with two steering cylinders, the value is around 0.

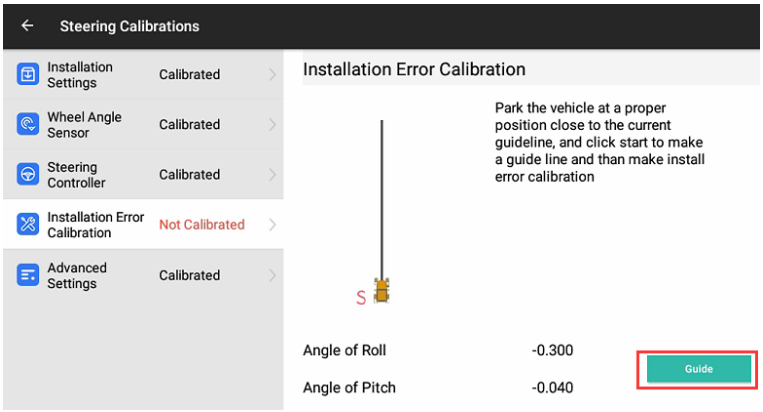
Steering Dead-zone: Mostly works in WAS (without angle sensor) mode. The default value is 10, which means the steering clearance is 20 degrees. If the steering clearance of the vehicle is large, the value needs to be increased, and the interval is 5 (10/15/20/25).

Motor Feedback Type: Steering startup type, the default is 2. If the T5.0 motor prompts that the Hall sensor is faulty, change it to 1, click set, and the steering will restart.

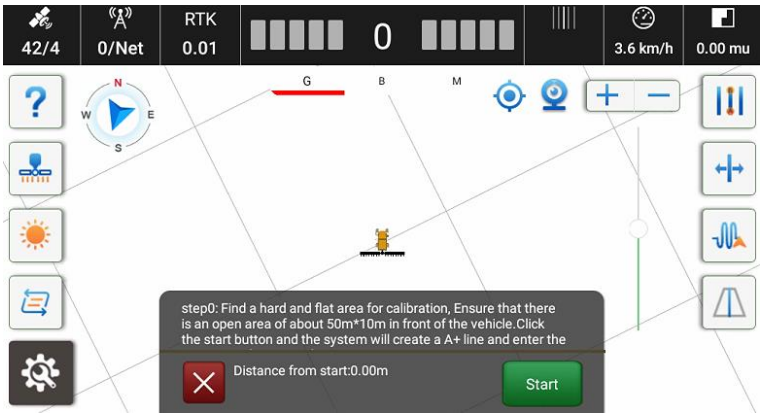
Overload Current, Overload Time, Motor proportional gain, Motor integral gain are all internal parameters of the steering and does not need to be adjusted.

4.2.5.4 Installation Error Calibration

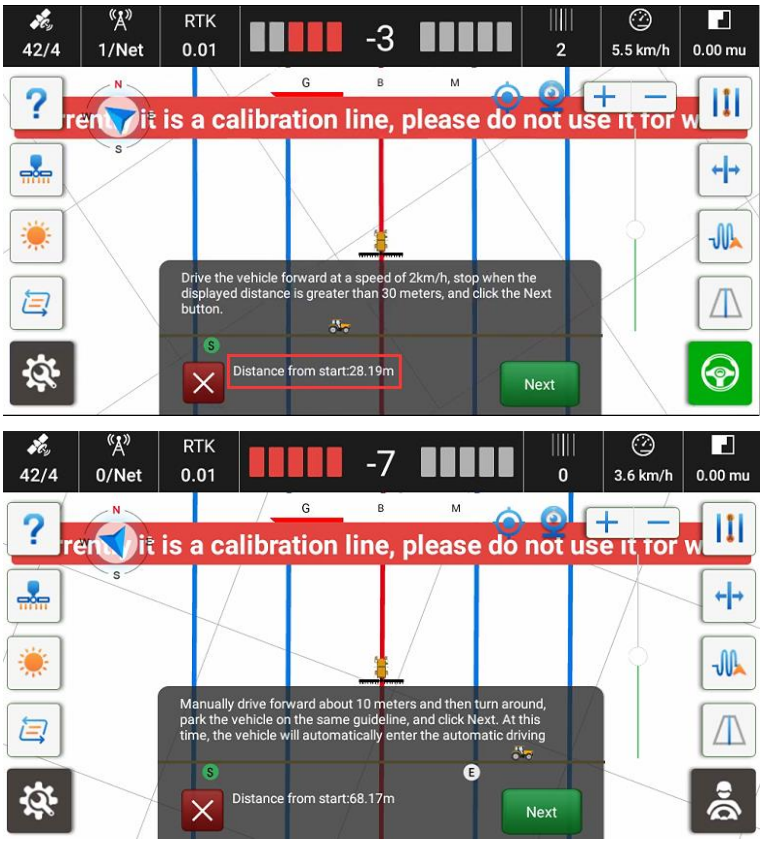
Please complete the calibration according to the instructions in the present interface.



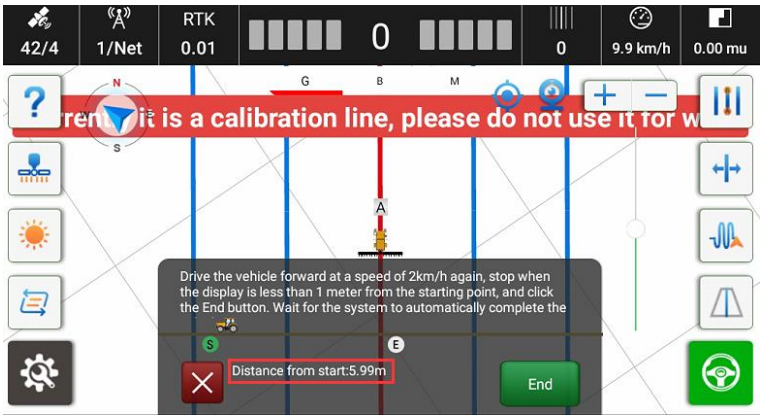
Click **Guide**, stop the vehicle on a flat and open place.



Then click **Start** and it will set a guideline automatically. The vehicle will get into the auto mode. When the distance from start is **over 30m**, stop the vehicle, click **Next**. Then it will record the END point and switch to manually mode.



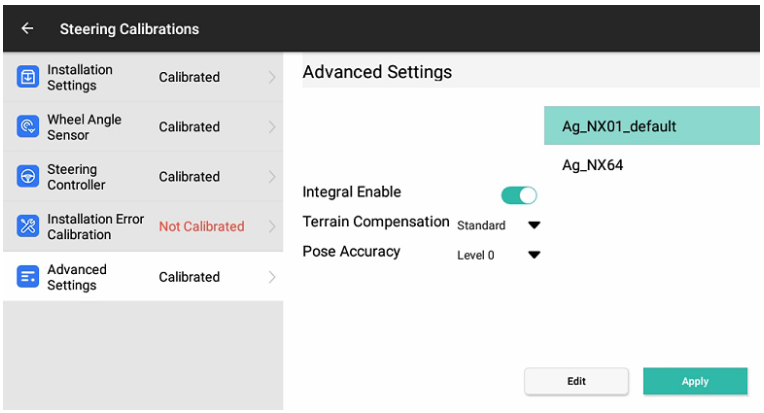
Turn around and back to the same guideline. After enter the line, click **Next** and the it will switch to Auto mode. Then drive forward automatically and keep the speed between 2-3km/h. Stop the vehicle when the distance from start point is **below 1m**. Click **End,** the system will calculate automatically.



Finally click **Complete** to finish the calibration.

4.2.5.5 Advanced Settings

In this interface, it can modify the advanced parameters, click **Edit**, enter the password **012** to edit.



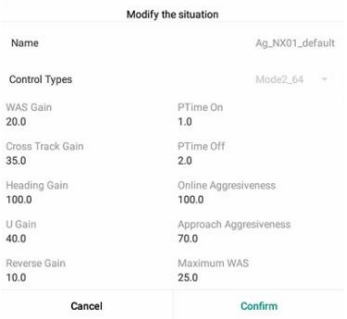
Integral Enable: It can optimize the fixed lateral deviation issue after turn off for front steer vehicle and see the performance. It is unnecessary to turn off for other vehicles. The default is on.

Terrain Compensation: It includes Slope and Standard two types. It is only useful for tracked vehicle. When switch to algorithm mode NX01, please use the standard; When switch to algorithm mode NX64, please use the slope.

Pose Accuracy: When the vehicle is standstill, the software displays a speed of 0.2/0.3/0.4 km/h, it can switch to level 1 which can eliminate the speed display. The default is level0.

Ag_NX01_default, Ag_NX64: Two sets of control methods. NX01 is suitable for most job scenarios

NX64 is suitable for the vehicle with medium/low speed and heavy load, or soft soil, such as potato operations.



WAS Gain: The default is 20, which is only valid in the without-angle mode. The smaller the steering sensitivity, the more sensitive the front wheel turns. When the vehicle steering clearance is large or the working soil is soft and sloping, the value needs to be reduced and set to 10.

Cross Track Gain, Heading Gain: No need to adjust, use online aggressiveness to adjust sensitivity.

Reverse Gain: The default is 10. When the vehicle is reversed by automatic steering, the deviation correction sensitivity is used. When the vehicle is reversed, the steering wheel swings to the left and right, and the value need to be reduced.

PTime On: Judgment time ratio on the line. The default value is 1.0.

PTime Off: Judgment time of approaching to the line, the default value is 2.0.

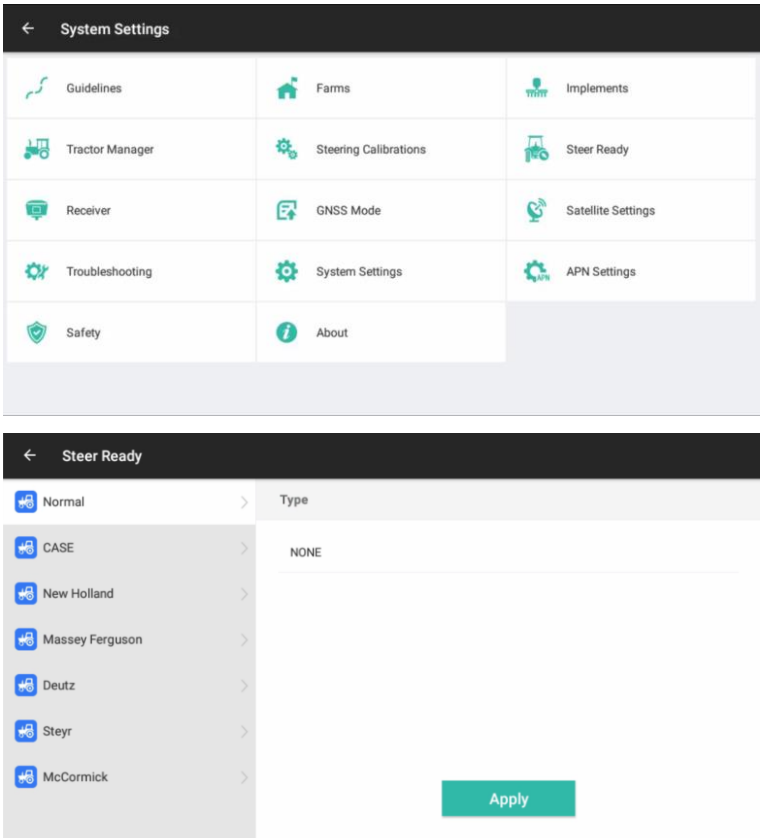
Online Aggressiveness: The default is 100, the sensitivity of the vehicle's online automatic driving bias correction. If deviation is prone to occur and deviation correction is slow, increase this value, 130/150.

Approach Aggressiveness: The default is 70, which controls the speed of the vehicle entering the guideline. If the steering wheel swings greatly when the vehicle enters the line, reduce the value, 40/50.

Maximum WAS: The default is 25, which represents the maximum angle the vehicle can turn.

4.2.6 Steer Ready

Here it is available to select the supported hydraulic vehicle, such as New Holland, Massey Ferguson, Deutz and MaCormick etc.



Brand	Type
CASE	optum 2704/optum 3004 PWM: Magnum 3154/Magnum 3404/puma 230
New Holland	T7.195/T7.230/T7.255/T7.295/T7.315
Massey Ferguson	MF5600/MF5700/MF6600/MF6700/MF7600/MF8600/MF8700/5s/6s/7s/8700s/8S.205
Deutz	Series 6185/Series 7250/Series9340
Steyr	6300
McCormick	None

Harness Connection

CANBUS : Two cables PN: 4103020172&4103020173

PWM: 4103020171

PLC controller PN: 4105170013

CANBUS installation

Notes

Different brands or different types has different Hydraulic CANBUS location and Hydraulic switch button in the cab, so it is necessary to find it correctly. For instance,

New Deutz Series9

E---CAN H F---CAN L

Turn on the first switch and Long press to turn on the second switch

Deutz Series 6

E---CAN H F---CAN L

Only turn on one switch

Steps

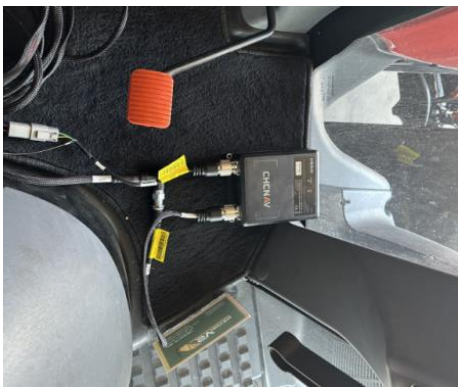
1. Find CANBUS interface in the Hydraulic tractor cab correctly, here take Steyr 6300 tractor as an example,

2. Try to find the correct CAN L and CAN H pinouts (H/J, or C/D)in this interface with tractor documentation or some can tool.
3. Connect to this interface with CHC CANBUS cable or customized cable depending on H/J or C/D pinouts, also in the middle side of the CANBUS cable, there are three connectors, one is male and another two are female, pls connect one of them as well depending on H/J or C/D pinouts.

4. Connect to CHC PLC controller COM2 with another end of CANBUS cable1 (4103020173), also connect to PLC controller COM1 with another CANBUS cable2 (4103020172) connecting to motor interface of NX510 main cable for supplying power and data communication.

5. Connect to power with NX510 main cable in the tractor cab or tractor battery depending on users.

6. Install NX510 PA-3, camera and tablet, etc on the top of tractor as the regular procedure, the place is better to close to rear axle, also PLC controller can be installed at the any place in the cab without leveling or some special notifications.



PWM installation

Steps

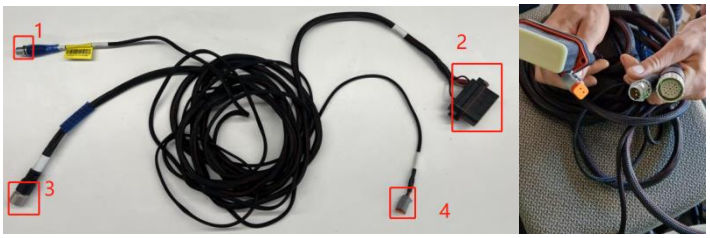
1. There are four connectors for PWM cable,

Port 1 is connected to the motor connector on the NX510 main cable

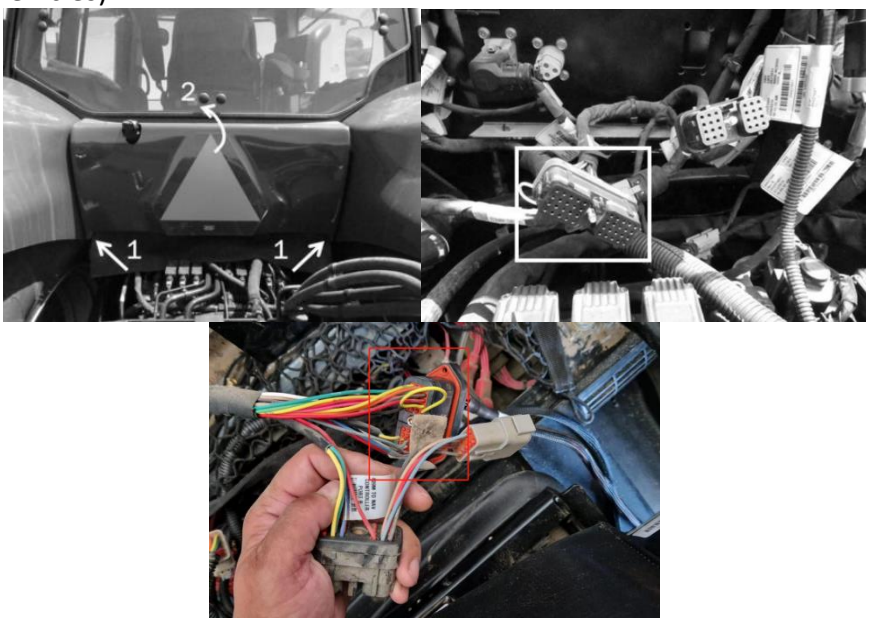
Port 2 is conencted to PWM 40 pin connector on the tractor

Port 3 is connected to CHC PLC controller

Port 4 is connected to the enable solenoid on the tractor.



2. Find the 40-pin Deutsch connector on the tractor rear side(Different location for different vehicles)



3. Open the hood by pulling on the latch and lifting on the handle located at the front of the hood. Route the black 2-pin Deutsch enable solenoid connector on the Interface. Cable under the right side of the cab up to the factory steering valve where the enable solenoid is located.

4. From the right side of the vehicle, reach over to the left side of the factory steering valve and unplug the factory 2- pin Deutsch enable connector. Plug the 2-pin Deutsch connector in place of the factory connector.

5. The vehicle is equipped with a guidance enable rocker switch, which allows power to the steering valve. The switch is located on the right hand console This switch must be set to the ENABLE position in order to auto steer the machine. **NOTE:** If this switch is left in the ENABLE position during vehicle start up, it may need to be cycled off and on to unlock the guidance system.

6. The vehicle is equipped with a guidance engage button. Press the button to engage/disengage the auto steer system. The operator can either engage the autosteer with the button switch on the console or with the display.

Post-Installation Checklist

□ Display Bracket and Display installed, and all fasteners are tight.

□ GPS antenna is installed.

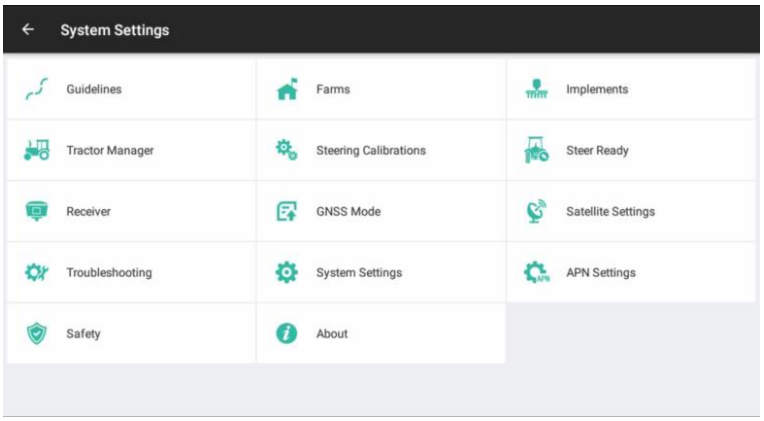
□ Steering Controller Module is installed firmly to frame, and all fasteners are tight.

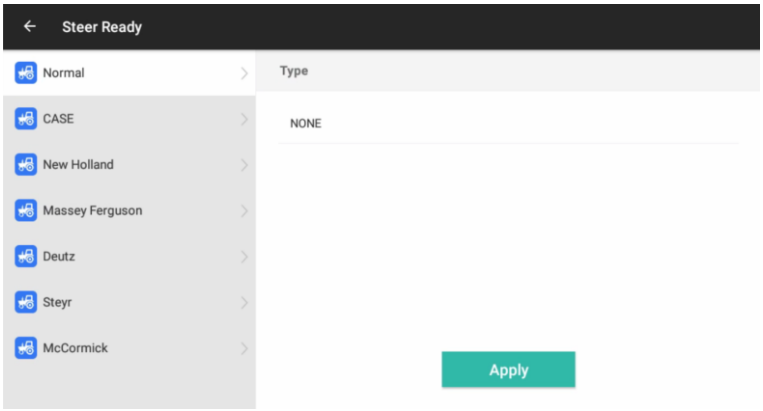
□ All cable ends and terminations are connected.

□ All cables are secured with cable ties.

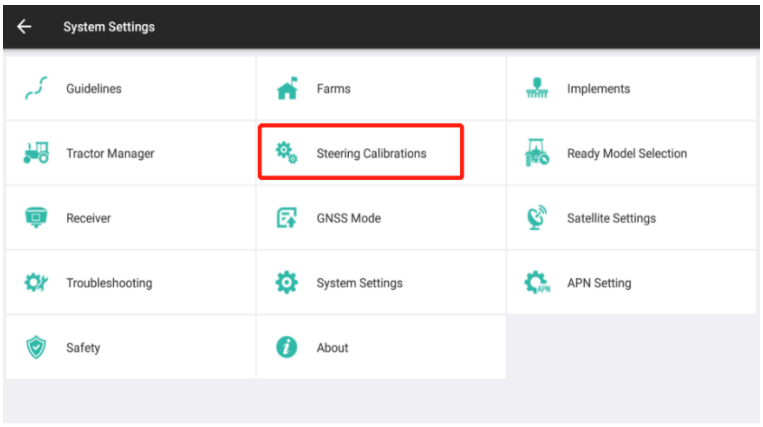
Software operation

1. Go to settings and click Ready Model Selection, then select the correct brand and model, finally click Apply to get it done.

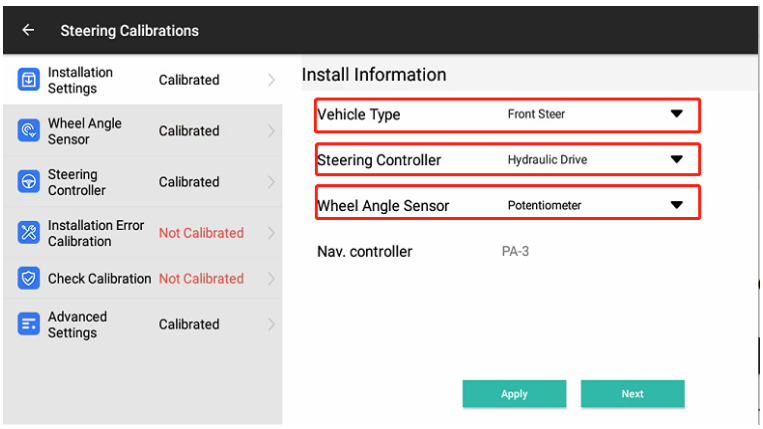




2. Click Steering Calibrations



3. Select the correct vehicle type, steering controller and wheel angle sensor as the picture below



It is necessary to calibrate the original angle sensor manually for this vehicle.

1) Select manual mode

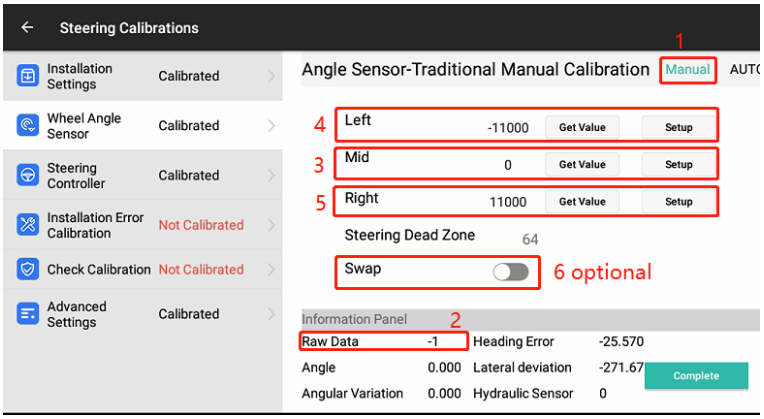
2) Turn the wheel to see if the raw data changes all the time

3) Turn the wheel to the middle to get a value then set up

4) Turn the wheel to left side with around 20 degrees to get a value then set it up

5) Turn the wheel to right side with around 20 degrees to get a value then set it up

6) Left value should be less than Mid value, if it is larger than it, pls click Swap then repeat it again



Also it is necessary to calibrate the hydraulic system.

1) Volt Min: Set Volt Min around 2.0-3.0 and Response as 1, then try to turn left and turn right, the wheel should turn a little bit within 5 degrees or just a light vibration/shake, also the vibration/degrees to right and left should be similar. If not working properly, pls adjust Volt Min and offset volt to make it work properly.

2) Volt Max: Set Volt Max around 3.5- 4.5 and Response as 100, then try to turn left and turn right, the wheel should turn around 20 degrees, also the degrees to right and left should be similar. If not working properly, pls adjust Volt Max and offset volt to make it work properly.

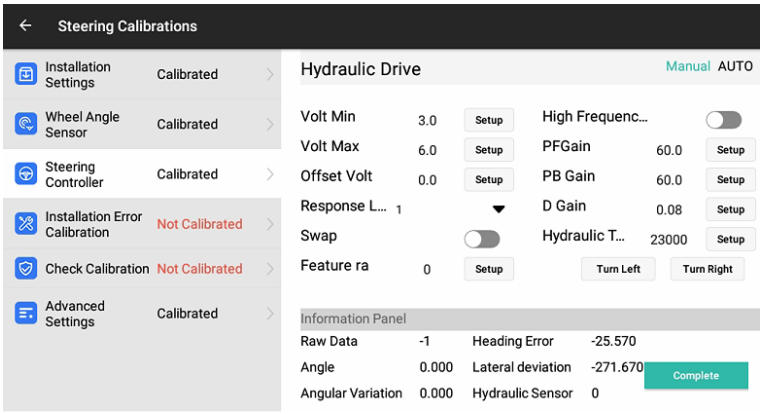
Description:

a) Response Linearity: It represents the percentage between the minimum voltage and the maximum voltage, 1 represents 1%, corresponding to the minimum voltage value, 100 represents 100%, corresponding to the maximum voltage value.
b) Swap: If click turn left, the wheel will turn right, so it is necessary to swap it.
c) High Frequency: Control the frequency of the solenoid valve; If it is off, the solenoid valve control frequency is 20HZ; If it is on, the solenoid valve control frequency is 40HZ
d) PF Gain: The proportional value when forward auto driving; The higher the value, the more sensitive the front wheel steering; The smaller the value, the smoother the front wheel steering;
Recommended value is 30 when high frequency mode is on; Recommended value is 60 when high frequency mode is off.
e) PB Gain: The proportional value when reverse auto driving; The higher the value, the more sensitive the front wheel steering; The smaller the value, the smoother the front wheel steering;
Recommended value is 30 when high frequency mode is on; Recommended

value is 60 when high frequency mode is off.

f) D Gain: The proportional value when backward auto driving; The higher the value, the more sensitive the front wheel steering; The smaller the value, the smoother the front wheel steering;
Recommended value is 0.8 when high frequency mode is on; Recommended value is 0.08 when high frequency mode is off.

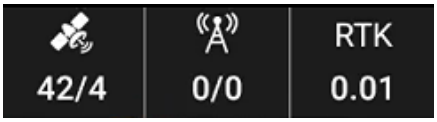
g) Hydraulic Threshold: Oil pressure threshold which represents the force to disengage auto driving. When the vehicle starts and keep the steering wheel stationary, please observe the real-time oil pressure value, then set the Hydraulic Threshold is 3000 higher than the real-time oil pressure value. If auto driving is easy to disengage and please increase this value; If it is not easy to disengage, please reduce the value.

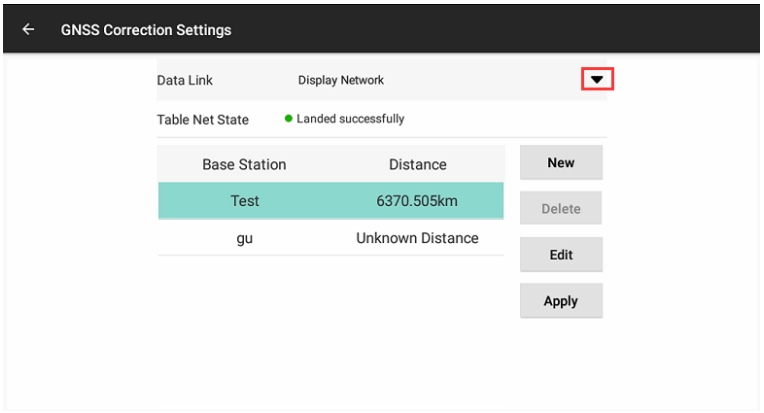


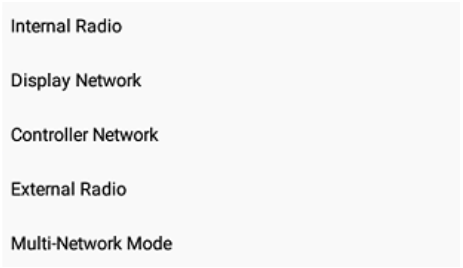
Finally it is necessary to do the installation error calibration as regular NX510 procedure.

4.2.7 Receiver

Before calibrating and using the software, please set up the satellite signal reception and check availability. Click the arrow to select the signal reception method (It can also access to this interface by clicking the Satellite status bar on main interface).

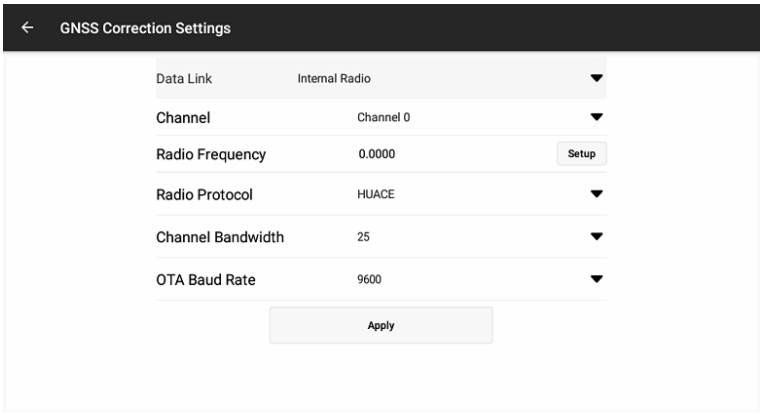




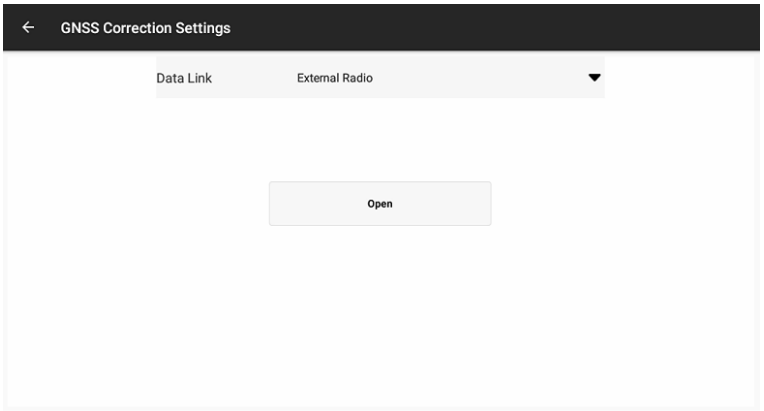


4.2.7.1 Internal & External Radio

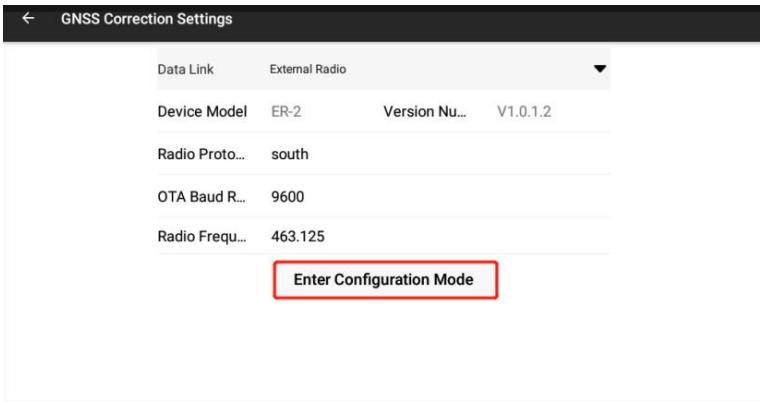
After set the radio mode of the base station, please note that the channel, frequency, protocol, bandwidth and baud rate are the same as the base station.

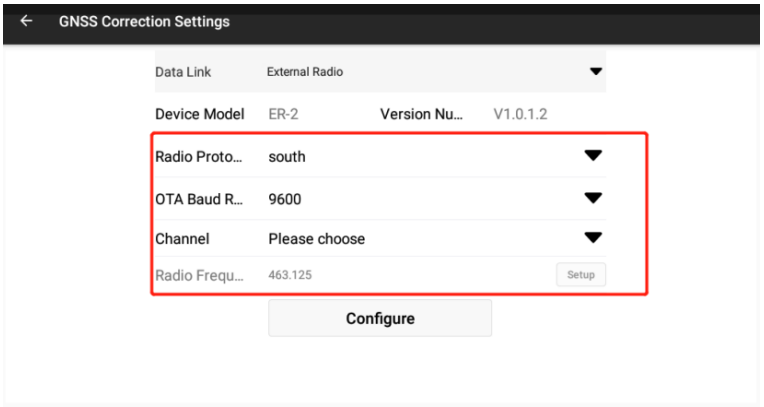


If use the external radio mode, the system will automatically recognize the radio module and enter the configuration interface.



Click to enter the configuration mode, select the corresponding channel, protocol, frequency, baud rate to link the radio base station.



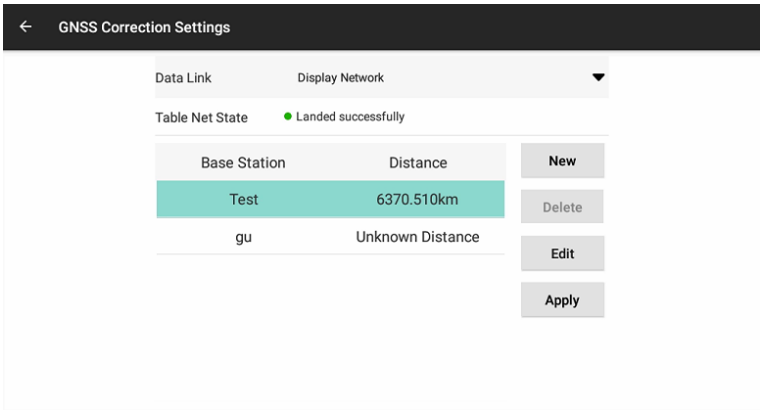


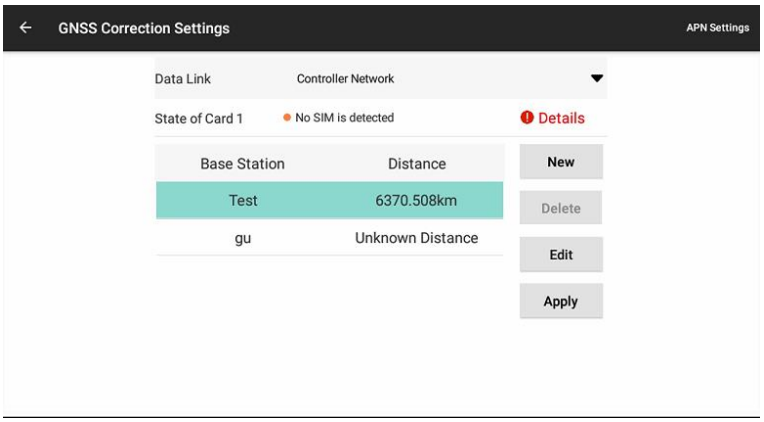
4.2.7.2 Multiple work modes

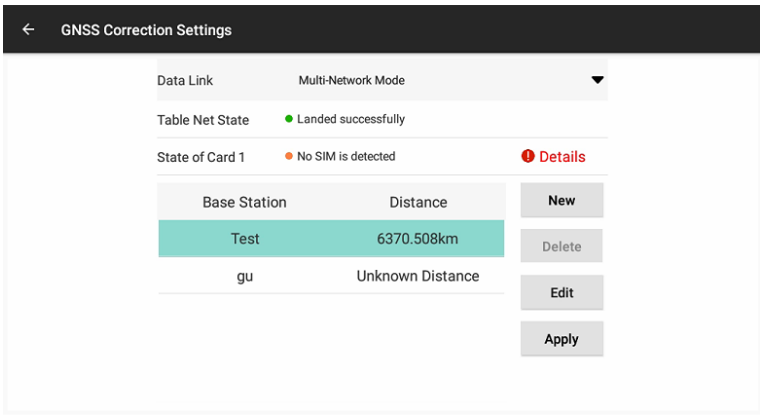
Display Network: Use the network with SIM card inserted in the tablet.

Controller Network: Use the network with SIM card inserted in the receiver.

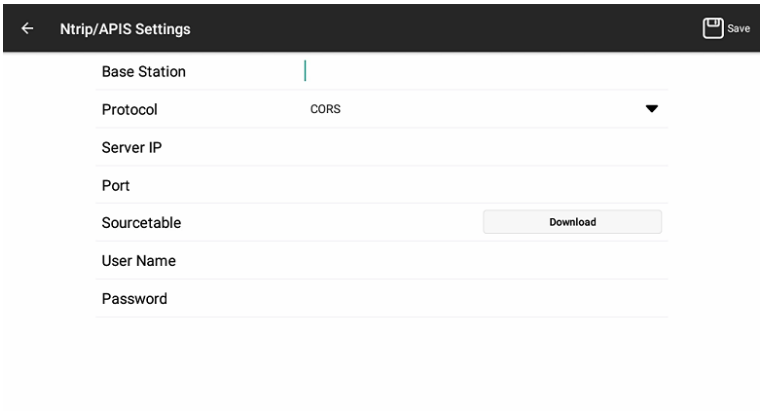
Multi-Network: Automatically applying the best signal in Display Network or Controller Network.



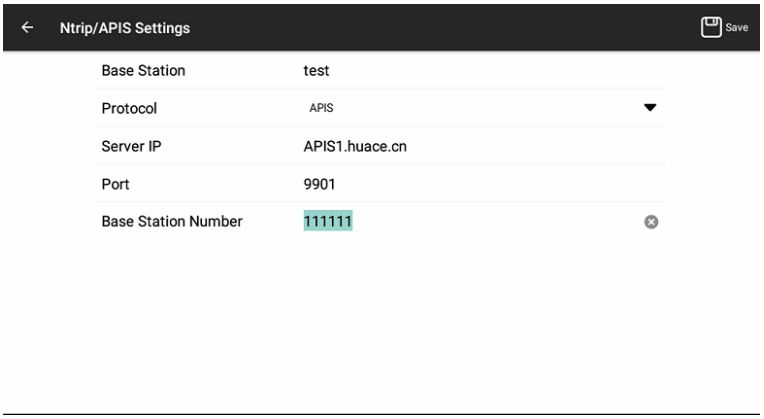




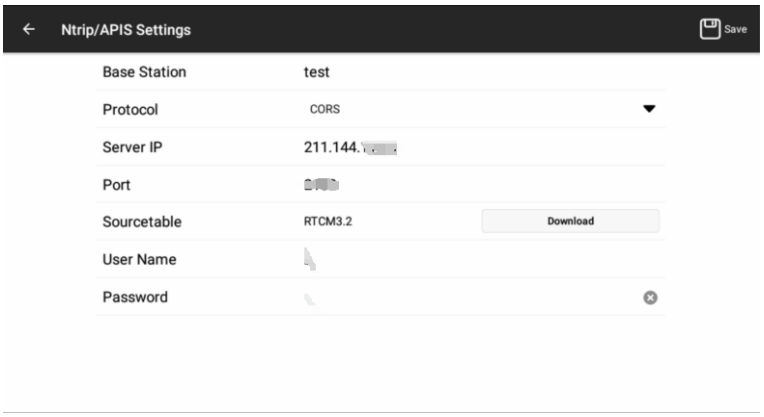
Click **New** to set up the base station information. Currently it supports CORS(NTRIP) and APIS protocols. APIS protocol is CHC own protocol and only works between CHC base station and agriculture systems.



If APIS protocol is selected, please make sure that the IP, port and base station number are the same as the base receiver settings.

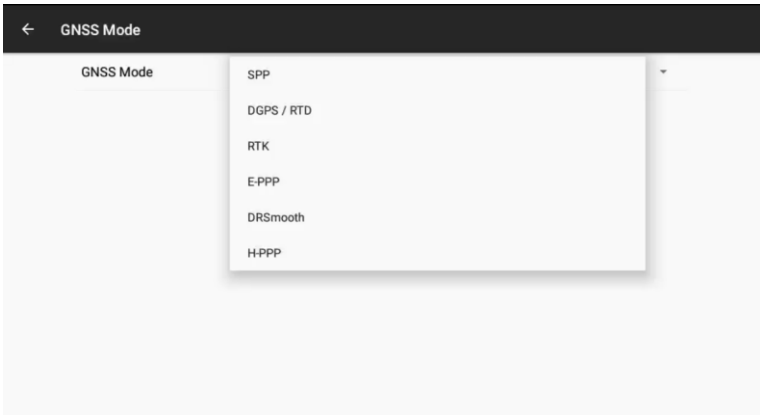


If CORS(NTRIP) protocol is selected, please make sure that the IP, port, source table, user name and password are typed correctly as local provider provided.



4.2.8 GNSS Mode

It is available to select the appropriate GNSS mode here based on practical operational scenarios.



SPP: Single Point Positioning Single Point Positioning. Traditional Single Point Positioning (SPP) relies on measuring pseudo-range observations (C/A code or P code) for positioning. Generally, it can only achieve an accuracy of tens of meters or even worse. Therefore, it is not considered a high-precision positioning method..

DGPS/RTD: It is regional augmentation system which includes WAAS, EGNOS, MSAS, etc by using geostationary orbit (GEO) satellites to carry satellite navigation enhanced signal transponders, various correction information such as ephemeris errors, satellite clock errors, and ionospheric delays can be broadcasted to users, achieving improvements in the positioning accuracy of the original satellite navigation system.

RTK: Real - time kinematic, this is the most used mode for usual operations based on radio mode or CORS network mode.

E-PPP:

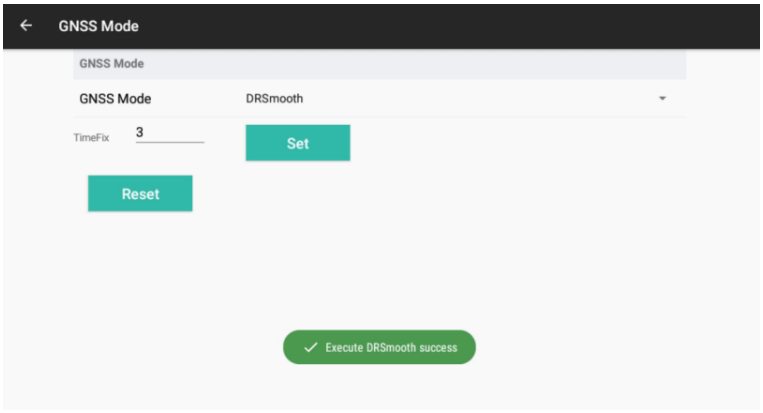
1) Satellites correction service from BDS B2b signal (Free but only for part of Asia with 10cm accuracy) for new NX510 SE PA-3 (J1PA01980102010005)

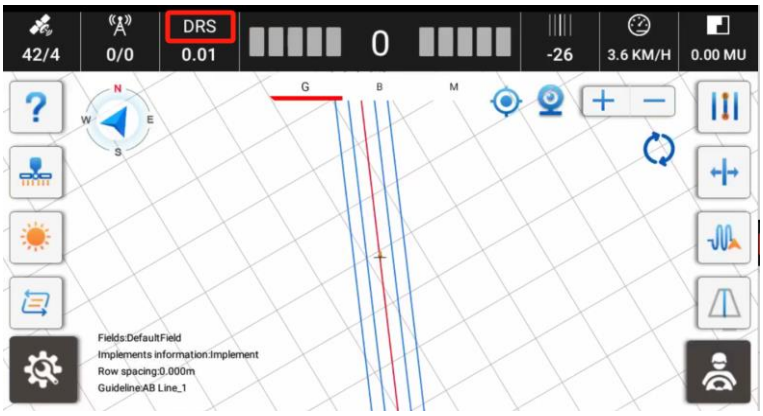
2) NX510 PRO Trimble RTX (Extra charged)

3) NX510 Plus NovAtel TerraStar (Extra charged)

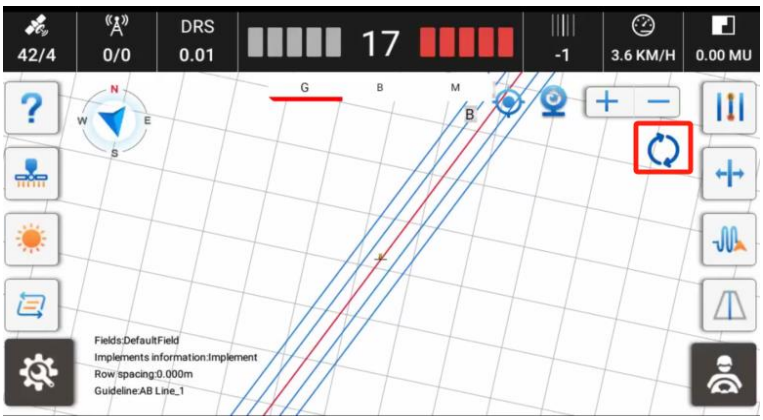
DRSmooth: It is CHC own positioning mode without base correction for new NX510SE PA-3 (J1PA01980102010005) to realize centimeter accuracy or submeter accuracy, but it keeps short time around 20 minutes then the accuracy will get worse, so it is necessary to reset per 20 minutes in the software.

It is available to switch to DRSmooth mode, then set a value to get Fix solution (The default time to fix value is 3 seconds and the range is from 3-100s);

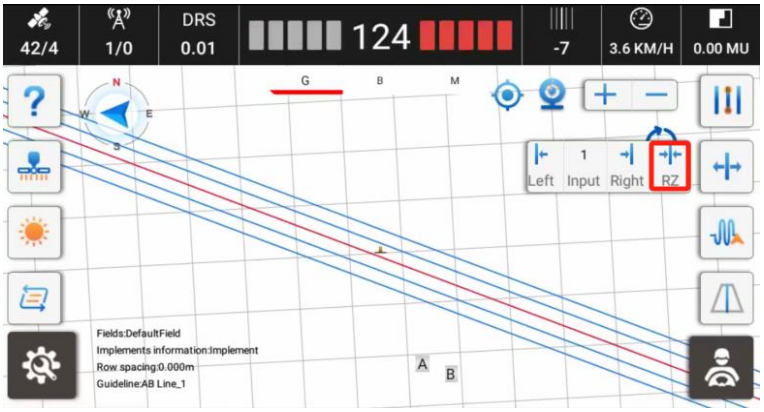




After getting worse accuracy as time goes, so it is necessary to do a reset;



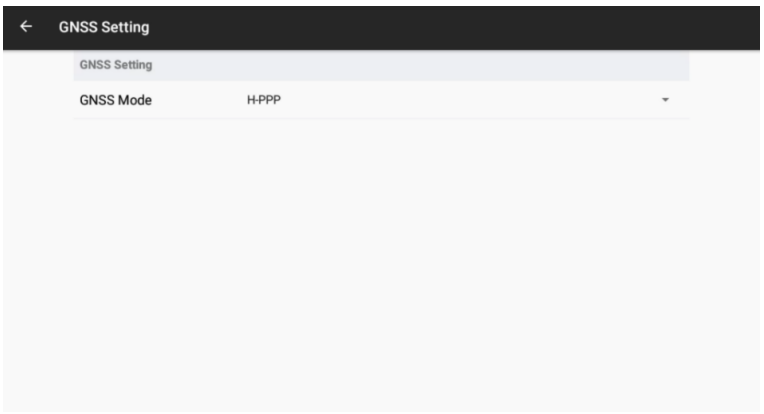
Do a RZ function based on previous guidelines, then it is able to continue to work as before.



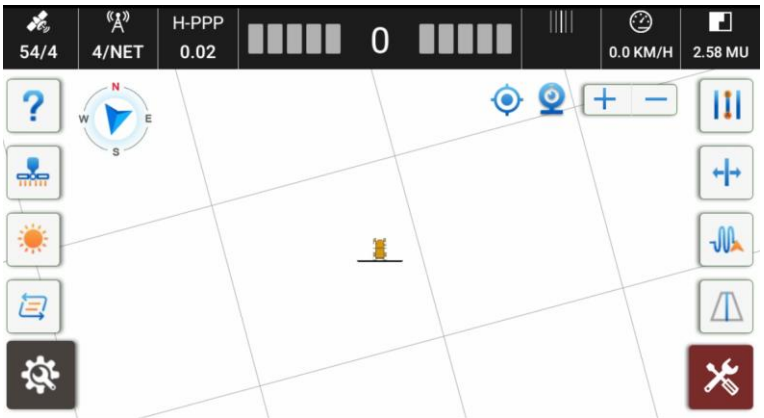
GLIDE: NovAtel's GLIDE technology offers superior 15 cm pass-to-pass performance for applications, such as agricultural guidance, where relative positioning is critical.

H-PPP: It provides free of charge access, through the Galileo signal (E6-B) and by terrestrial means (Internet), to the information required to estimate an accurate positioning solution using a Precise Point Positioning algorithm in real-time.

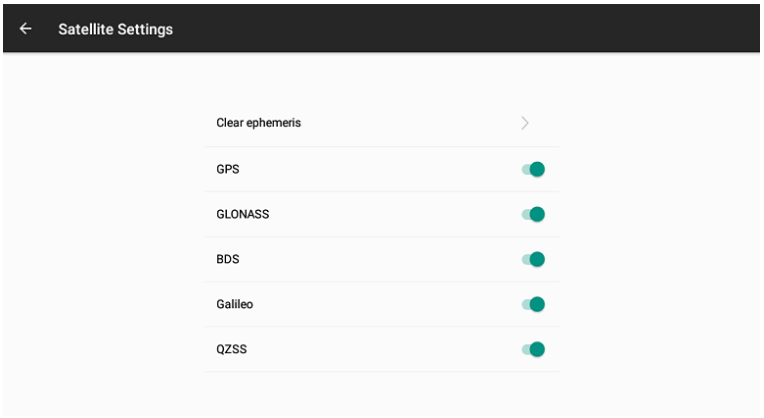
Select the H-PPP mode in the GNSS mode settings,



Go to main interface to wait for the convergence,



4.2.9 Satellite Settings

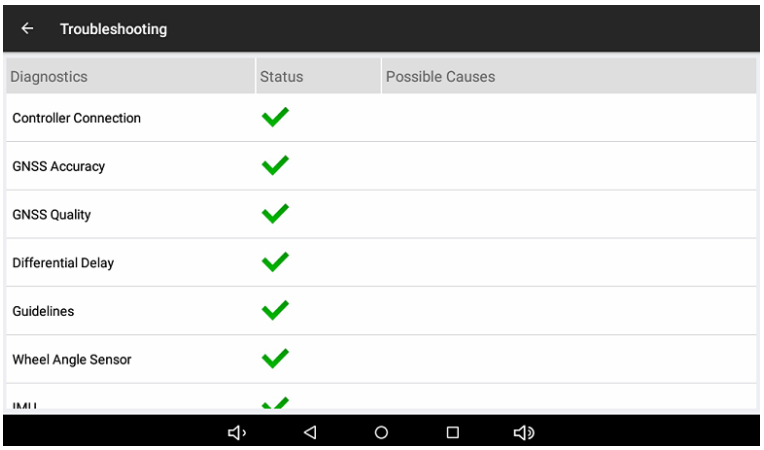


Clear ephemeris: Click **Clear ephemeris**, the receiver will reset and track satellites again.

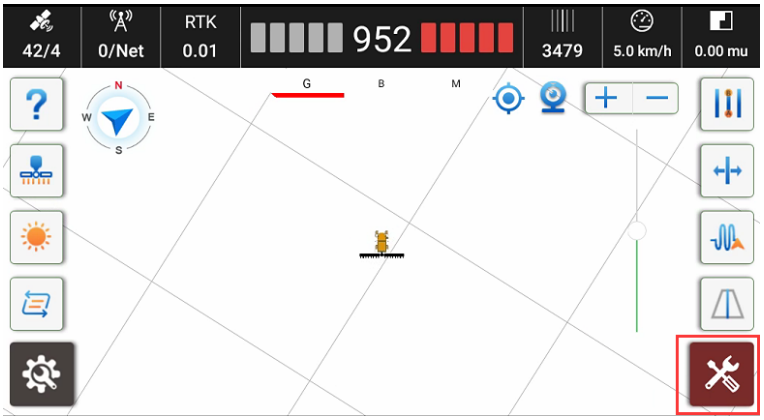
Multiple constellations enable/disable: Click the green switch behind the constellations to turn it on or off.

4.2.10 Troubleshooting

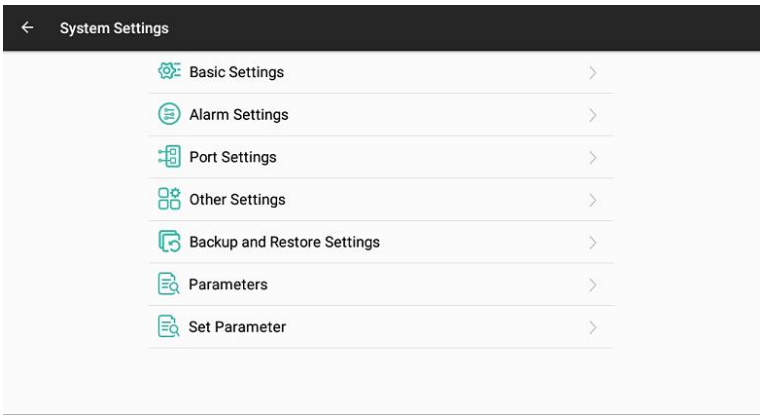
Check the failure status of each hardware modules and software functions in this interface.



This interface can also be accessed by the icon in the lower right corner of the main interface when there is a fault.

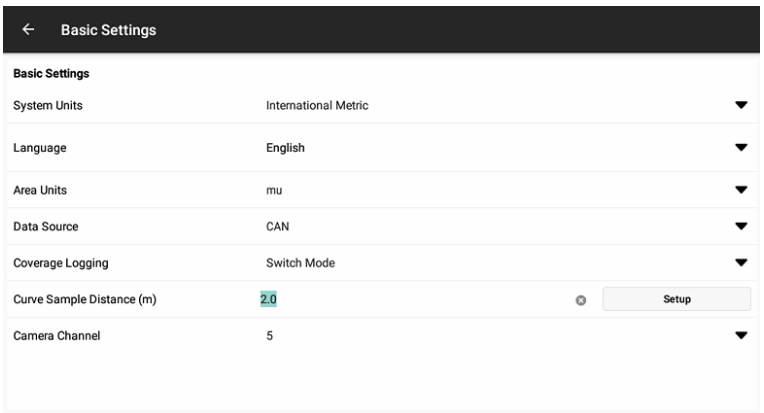


4.2.11 System Settings



4.2.11.1 Basic Settings

Units, languages, etc, basic settings can be configured here.



System units includes international metric and imperial units.

Language includes Bulgarian, Chinese, Czech, Danish, German, English, French, Croatian, Hungarian, Italian, Japanese, Korean, Lithuanian, Dutch, Norwegian, Romanian, Russian, Slovenian, Spanish, Serbian, Thai, Turkish, Vietnamese, Finnish,

Portuguese, Latvian, Polish and Ukrainian.

Area Units includes mu, ha, ㎡, acre and da.

Data Source: Demo mode can work when use the CAN Data with PA-3 receiver; Demo mode can work when use the Simulation Data without PA-3 receiver.

Coverage Logging: Work track need to be opened manually in Switch Mode; Work track will be opened automatically when entering autopilot in Automatic Mode.

Curve Sample Distance(m): The interval to record points when use curve line. The default is 2 meters and the minimum can be 1 meter for better smooth. The maximum points are 1800.

Camera Channel: Currently only the default Channel 5 is available for camera.

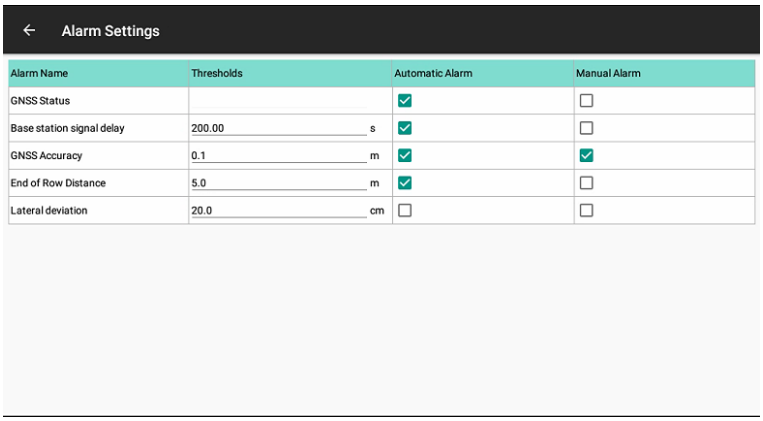
4.2.11.2 Alarm Settings

It is available to set the alarm modes and thresholds here based on practical operational scenarios.

End of Row Distance: It will sound the alarm when close to boundary/AB line within the threshold. If there is only an AB line, the system will recognize the distance from the A/B point; if there is only a boundary, the system will recognize the distance from the boundary; if there is both an AB line and a boundary, the system will only recognize the distance from the boundary.

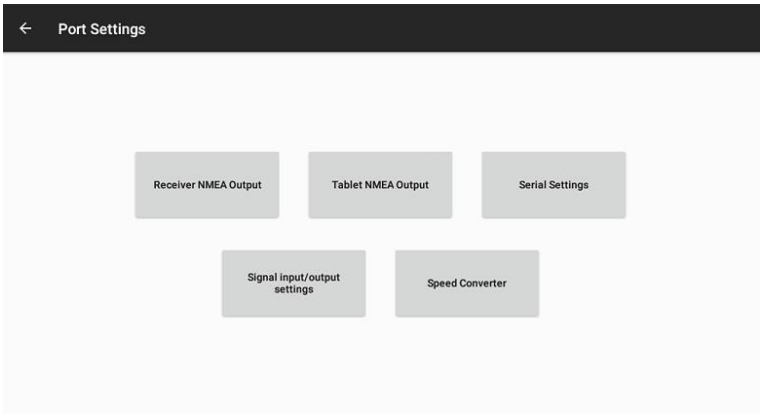
Automatic Alarm: It will have sound and message alarm when exceeds the thresholds during auto steering mode.

Manual Alarm: It will have sound and message alarm when exceeds the thresholds during manual mode.



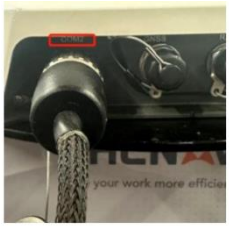
4.2.11.3 Port Settings

Here is the port settings to output NMEA information, set 5V pulse signal output and set Speed converter.

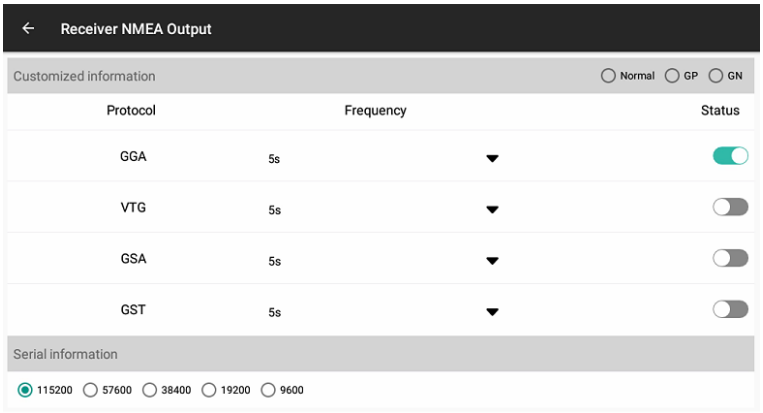


4.2.11.3.1 Receiver NMEA output

When set receiver COM2 to output NMEA, it is necessary to use COM2 NMEA cable (PN: 4103020118).



Please go to Receiver NMEA Output, then it is able to select header is GP or GN format which depends on the terminal devices decoding method, and 7 different NMEA message types including GGA, VTG, GSA, GST, GSV, ZDA and RMC with 5s to 10hz outputting frequency, then users can configure the baud rate from 9600 to 115200, finally it is necessary to enable the message status what configured. On the terminal side, it will decode the NMEA messages and get the correction information to display.

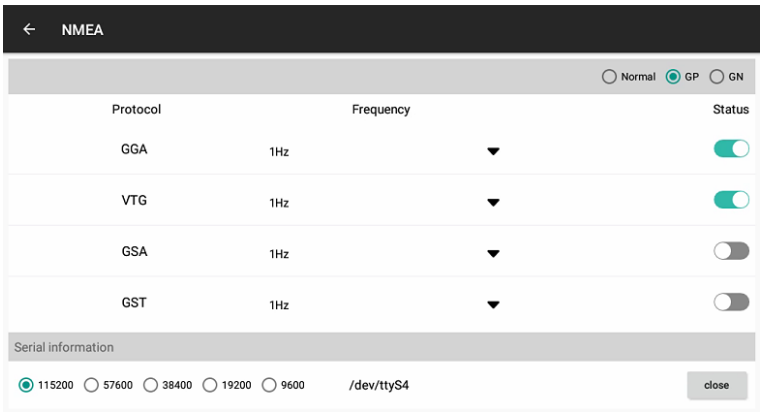


4.2.11.3.2 Tablet NMEA output

When set tablet to output NMEA, it is necessary to use adapter NMEA cable(PN: 4103020151).

Please go to Tablet NMEA Output, then it is able to find header is GP or GN, and 7 different NMEA message types including GGA, VTG, GSA, GST, GSV, ZDA and RMC

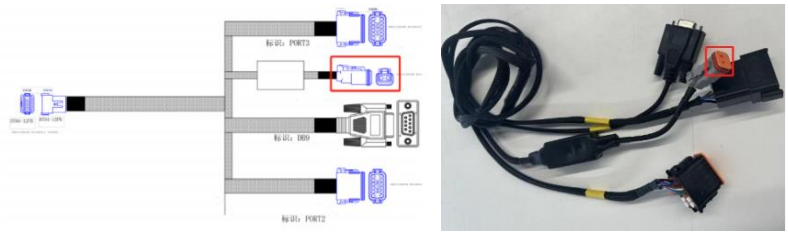
with 5s to 10hz outputting frequency, then users can configure the baud rate from 9600 to 115200, finally it is necessary to enable the message status what configured and click Open in the last step. On the terminal side, it will decode the NMEA messages and get the correction information to display.

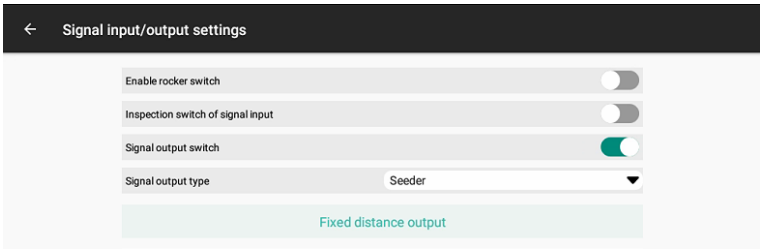


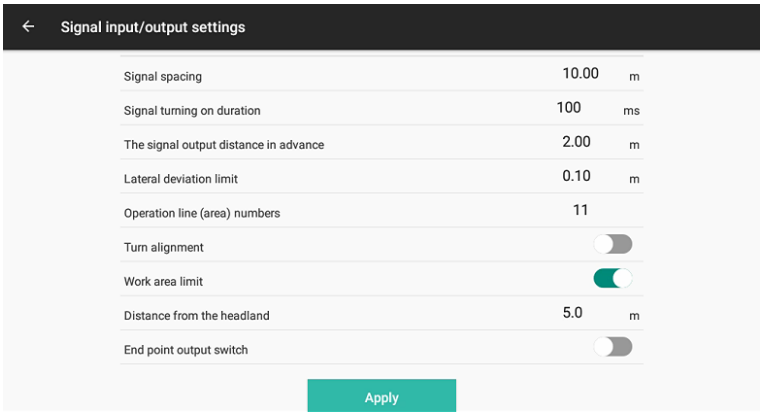
4.2.11.3.3 5V pulse signal output

5V pulse output is mainly for planting trees scene which can output signal to terminal devices and also can mark/display some information in the AGNAV3.0 software, this feature is mostly based on AB line and A+ line as well.

Also with the extra adaptive cable(PN: 4103020151) to connect to tablet Port3, then the these 2pin can be connected to terminal devices with outputting the signal.







Signal output switch: The switch to turn it/off the 5V pulse signal.

Signal output type: It includes Transplanter and Seeder these two types, 5V pulse signal advanced settings can be edited only after select the Seeder.

Signal spacing: The distance interval of outputting 5V pulse signal.

Signal turning on duration: The duration of outputting the 5V pulse signal.

Lateral deviation limit: Keep output 5V signal output within he tolerance of auto driving away the guidelines.

Operation area numbers: Every area with one interval as one operation number which is only used when turn on the Work area limit option.

Turn alignment: Keep the same output as the first guideline.

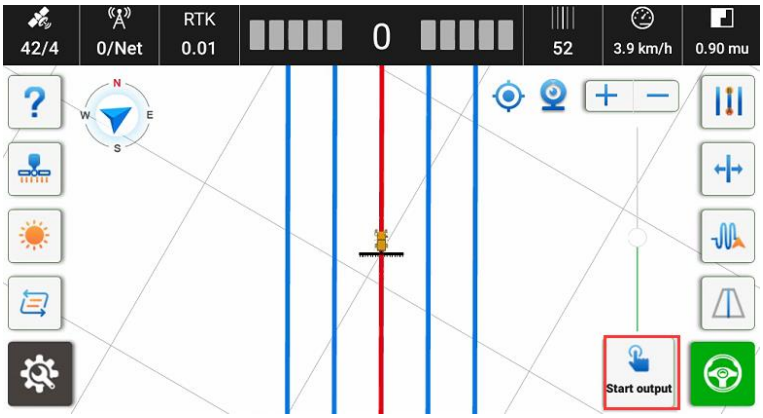
Work area limit: Set the area close to headland where not output the signal.

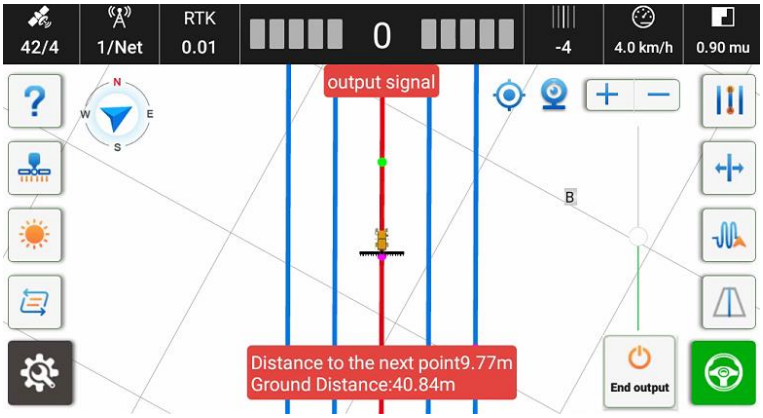
Distance from the headland: The distance from start point or end point when set the Work area limit.

All guidelines take point A as the starting point of the operation, and then calculate the position of the end point based on the Operation area numbers.

End point output switch: Output the signal at the end point when set the Work area limit.

Click **Apply**, it will skip to main menu automatically, it is able to click Start output this icon to start output after start auto steering and take to the line.





4.2.11.3.4 Speed Converter

For some implements that cannot get the tractor speed/coordinate with NMEA protocol or ISOBUS protocol, but can get the speed by receiving the speed pulse signal. It is necessary to use the speed pulse module to convert the NMEA GPGGA/GPVTG information from the tablet/receiver into pulse signal for the terminal implements to identify.

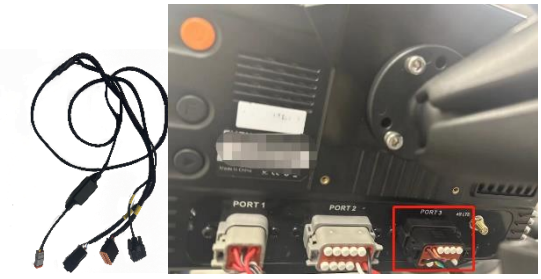
GPGGA: Output GPS positioning information

GPVTG: Output speed information

Connection Methods

When set PA-3 com2 to output NMEA, it is necessary to use COM2 NMEA cable.

When set tablet to output NMEA, it is necessary to use adapter NMEA cable.

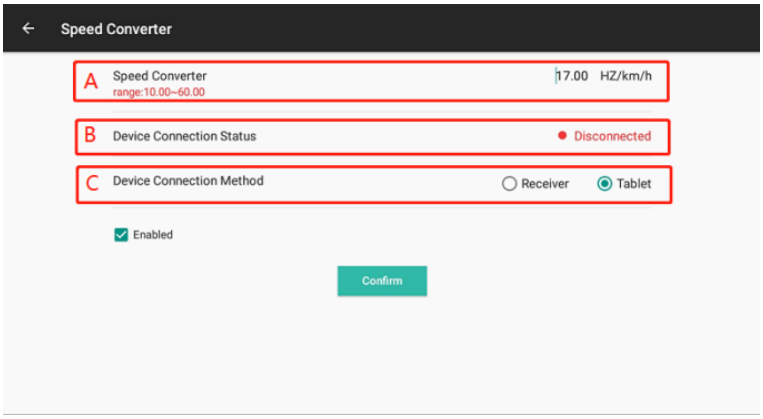


Then the NMEA information will be fed into the pulse module.

Take the tablet output as an example:

1. Pulse Module： **A→F, B→Implements, C→H, D→GA-Sensor**
2. Adapter NMEA cable: **E→Port3, G→I**
3. Main cable: **J→Port1**

Secondly, set the output method:

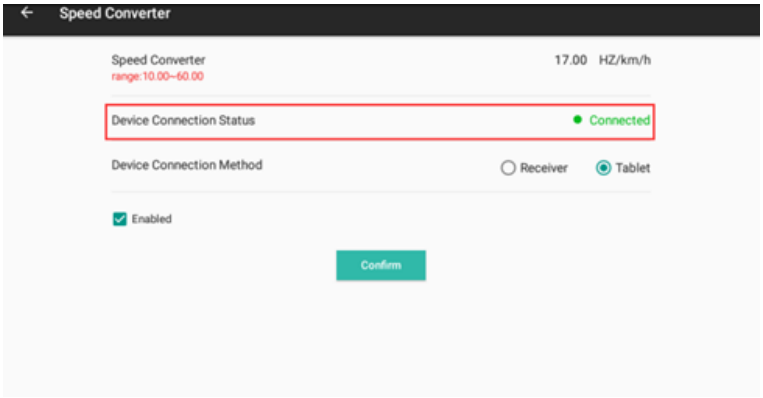


A: Set the output parameters, please note that the range is 10.00-60.00;

B: Check the connection status of the pulse module;

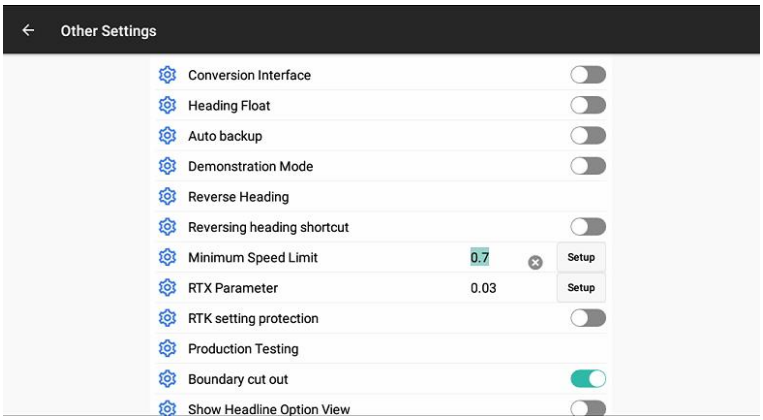
C: Select the corresponding NEMA data output method based on the used cable.

Finally, click Confirm when the setup is complete. When Succeed message appears on the screen, the NMEA data will be converted into a speed pulse signal and output to your implement.



4.2.11.4 Other Settings

The automatic backup function, the demo mode function, reverse heading function and the minimum operating speed, etc can be configured in the other settings.



Conversion Interface: If the main cable has some issues with serial connection, so it is necessary to convert to CAN connection. This is only for old cables and not very common.

Heading Float: It is CHC own RTK algorithm which is able to improve the fix rate under some cases which have RTK float issue and continue to get auto steering work, but it can not fully guaranteed to be fixed.

Auto backup: It is able to support data backup automatically. The maximum backup folder is 5 days. It will start to do backup after turn on software in 1 hour, also refresh again each 5 hours.

Demonstration Mode: It is able to perform simulation demonstration of all functions with the CAN Data on in the Basic Settings.

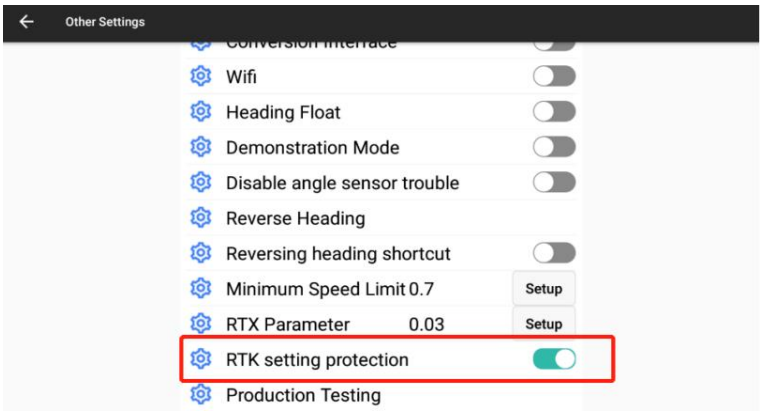
Reverse Heading: When the vehicle is driving forward but the software indicates that it is reversing, please click it to get the correct heading. It is due to reversed heading initialization when the vehicle starts.

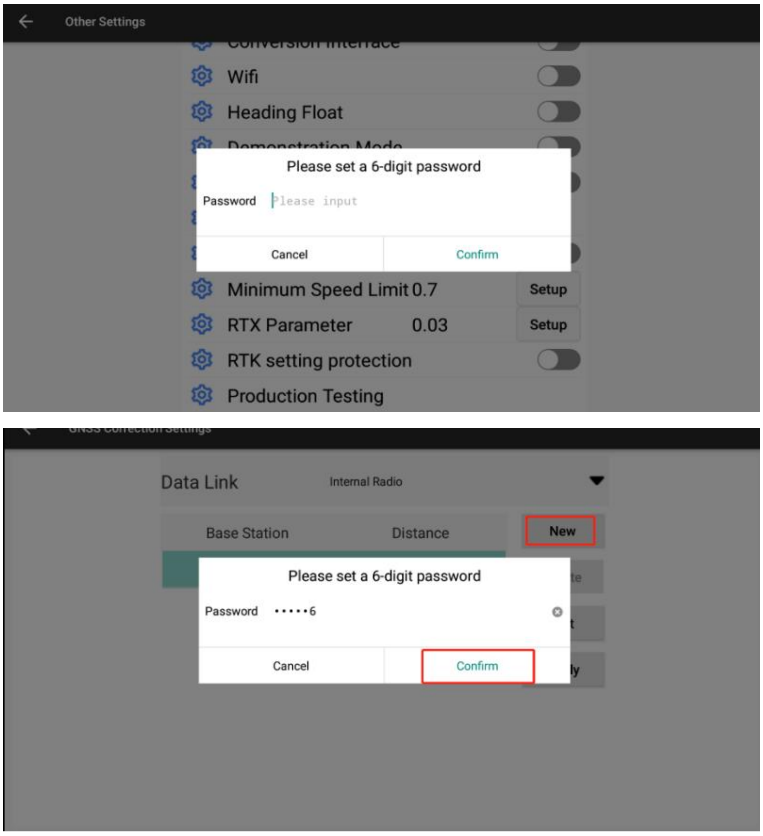
Reversing heading shortcut: The shortcut in Help interface can be turned on/off here.

Minimum Speed Limit: This is to set the minimum speed for Auto mode. When the speed exceeds the minimum speed, the electric steering wheel will steer left and right according to the command; When the speed is lower than the set value, the electric steering wheel will be locked and won't rotate.

RTX Parameter: In the NX510 PRO RTX mode, there may be a significant variation in positioning accuracy when the latitude is high, and this value can be increased. The default is 0.03 and the range is from 0.03 to 0.15.

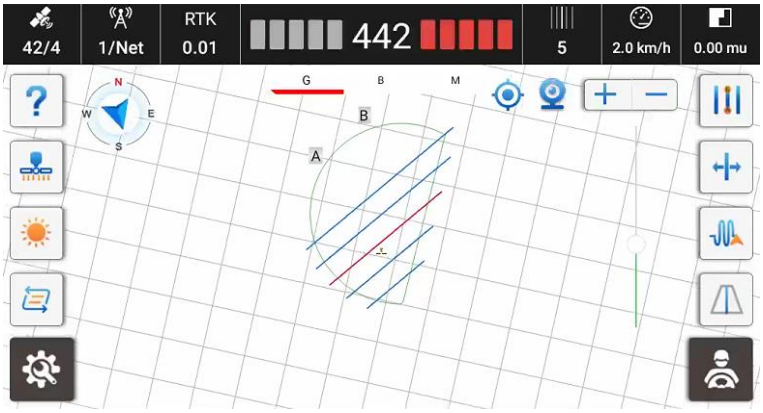
RTK setting protection: It can protect dealers' CORS station and radio information with defined password, so end users will not be able to delete or modify the related information. If it is necessary to reset the password, pls turn off RTK setting protection with the previous password, then turn on RTK setting protection to define the new password again. Also please remember passwords for different devices in your database.





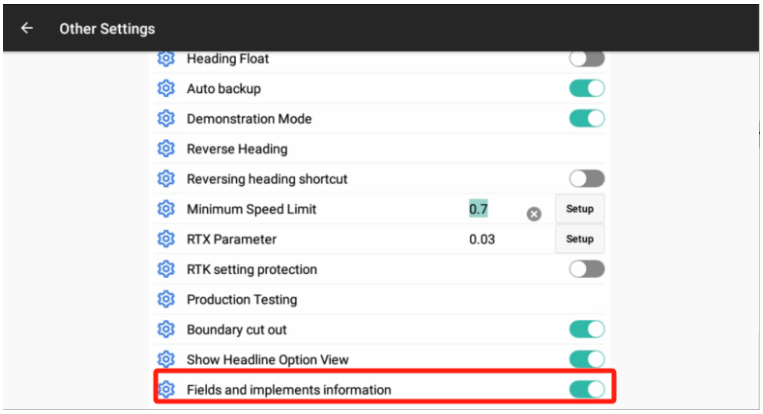
Production Testing: It is used for production team to test.

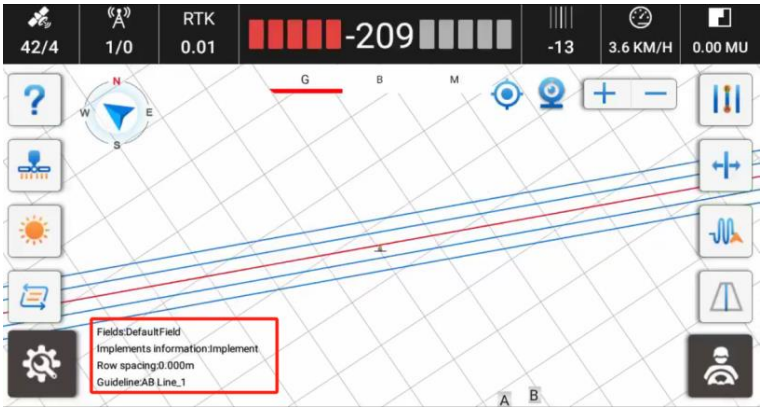
Boundary cut out: When it is on, it will display guidelines only within the boundary.



Show Headline Option View: It supports software recognizes only guideline, or boundary, or allows only manual mode. The shortcut will be displayed on the main interface.

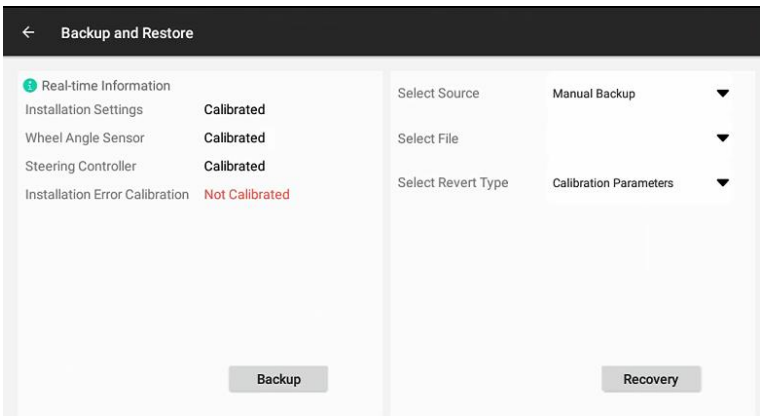
Fields and implements information: Display the current fields, implements, Row spacing value and guideline information on the main interface.

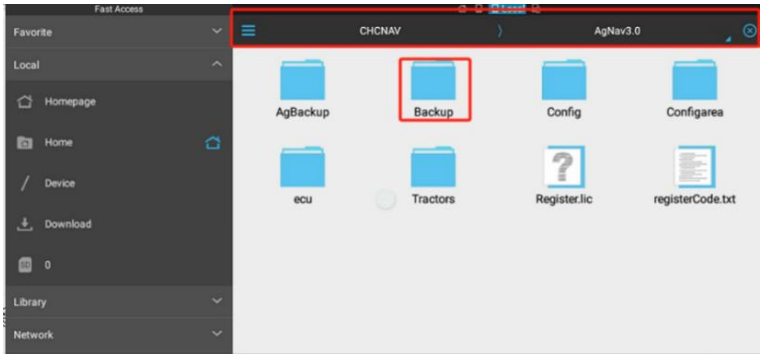




4.2.11.5 Backup and Restore Settings

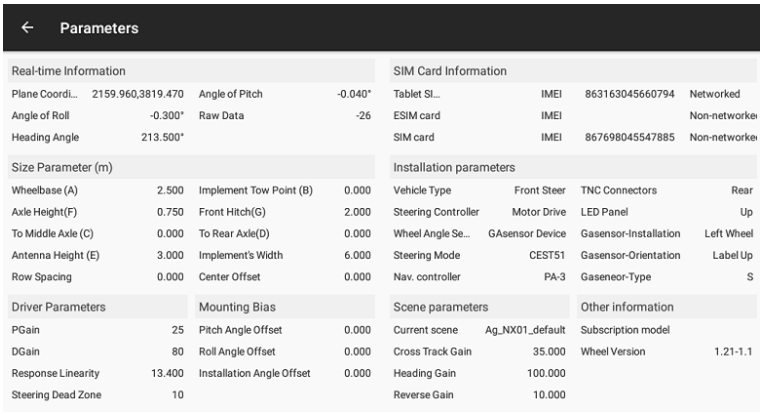
Information such as calibration parameters and farms can be manually backed up here and the backed up files are stored in CHCNAV-AgNav3.0-Backup. But usually software has auto backup so it is dispensable step.





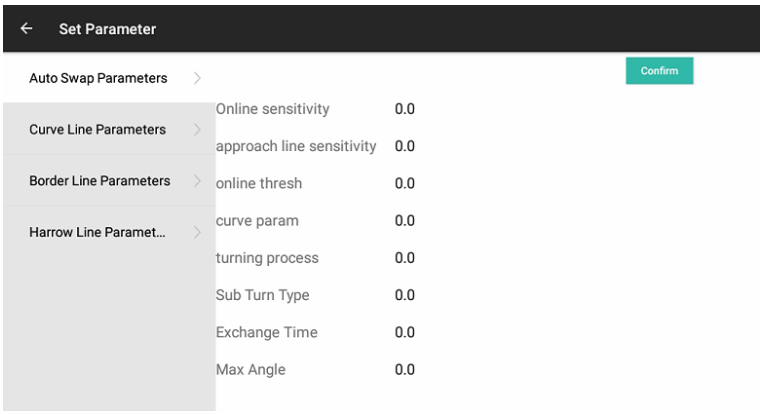
4.2.11.6 Parameters

In the parameters interface, users can view real-time IMU information, all vehicle size, configuration information and hardware information, etc.



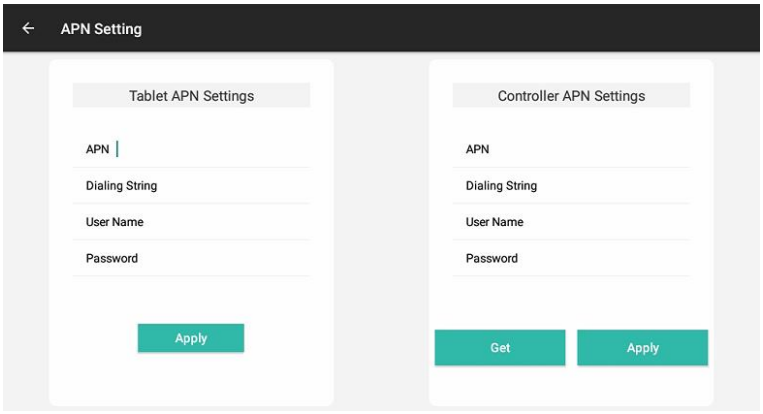
4.2.11.7 Set Parameter

It can modify some parameters through this page and usually it is not necessary.



4.2.12 APN Setting

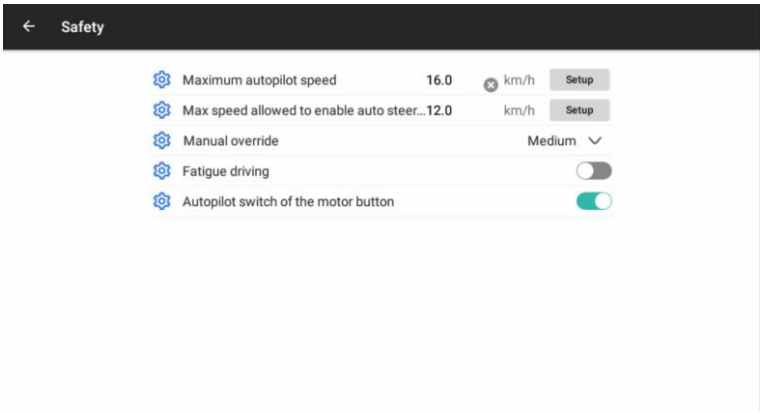
It is available to set up APN information according to the local SIM card provider.



After insert the SIM card into the tablet/receiver, it's necessary to manually enter the information got from the local SIM card provider, then click Apply.

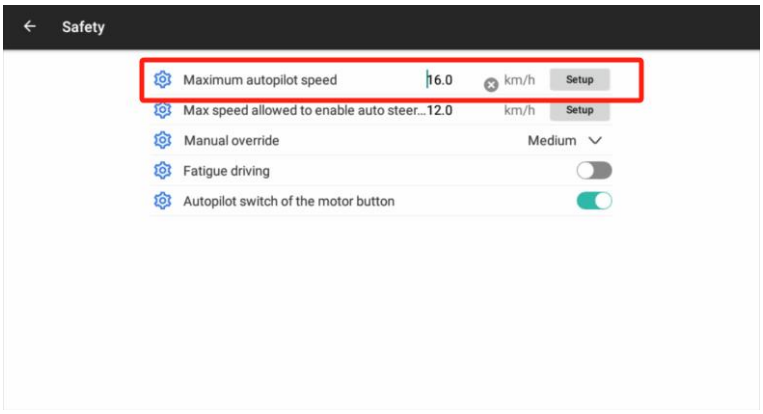
4.2.13 Safety

In order to ensure the safety, currently it is available to support users to set the maximum autopilot speed and the max speed allowed to engage the autopilot. It is also possible to set the level to manually disengage the autopilot.



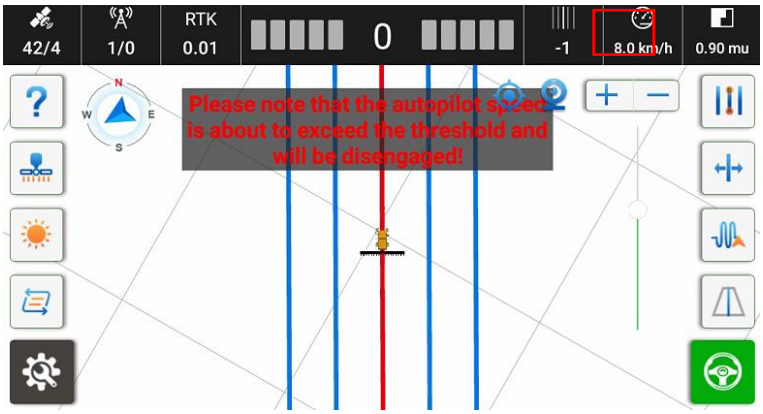
4.2.13.1 Maximum autopilot speed

Set the maximum autopilot speed, when the vehicle in autopilot mode, it's speed cannot exceed the set thresholds.

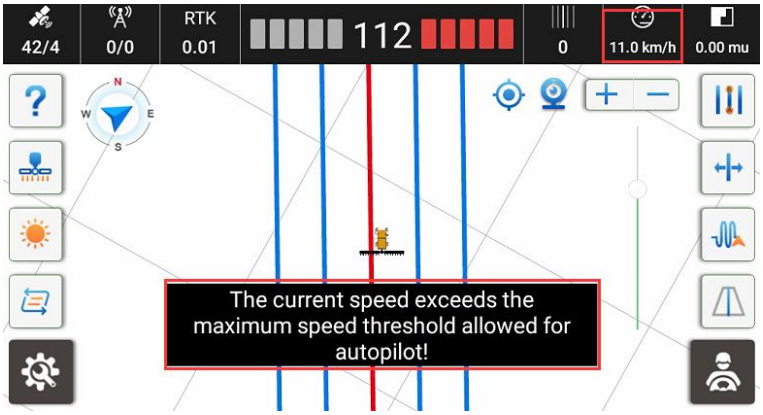


If the current speed is 2km/h below to the threshold, it will have message prompts and audible alarms which remind users the current speed is close to max limit and auto steering will be disengaged.

The default maximum autopilot speed is 16km/h and the configuration range is from 1km/h to infinity.



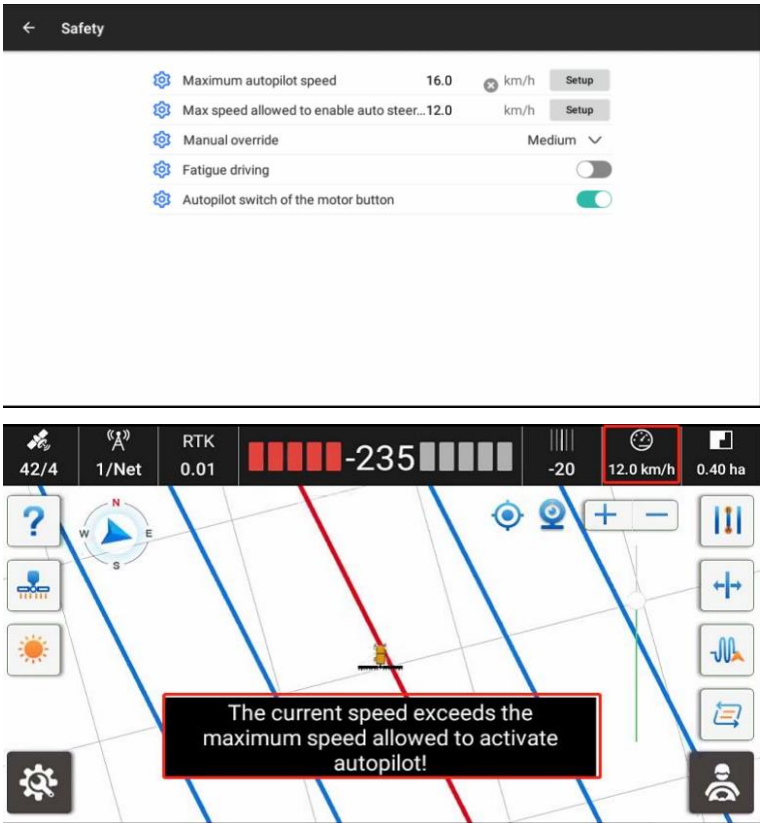
If the current speed exceeds the operators set, the auto steering will be disengaged.



4.2.13.2 Max speed allowed to enable auto steering mode

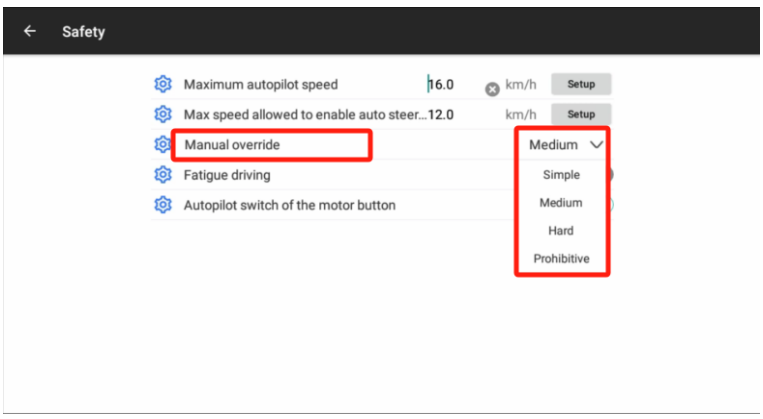
Set the max speed allowed to engage the autopilot, if the current speed exceeds the threshold, it can not enter autopilot mode.

The default maximum speed allowed to enable autopilot is 12km/h and the configuration range is from 1km/h to infinity. Also it should be less than the maximum autopilot speed as above.



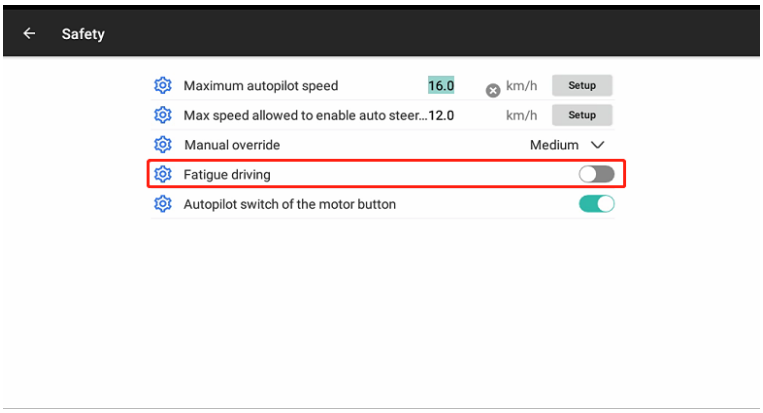
4.2.13.3 Manual override

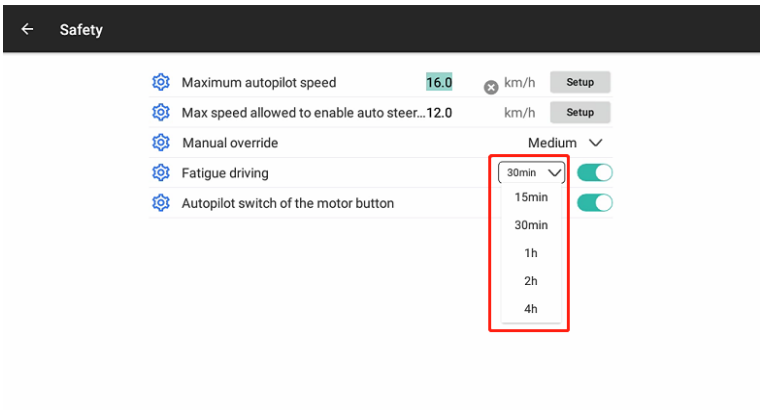
Manual override function allows users to turn the steering wheel to disengage autopilot mode in an emergency. It is allowed to set the different level to manually disengage the autopilot which includes the Simple, Medium, Hard, Prohibitive four modes.

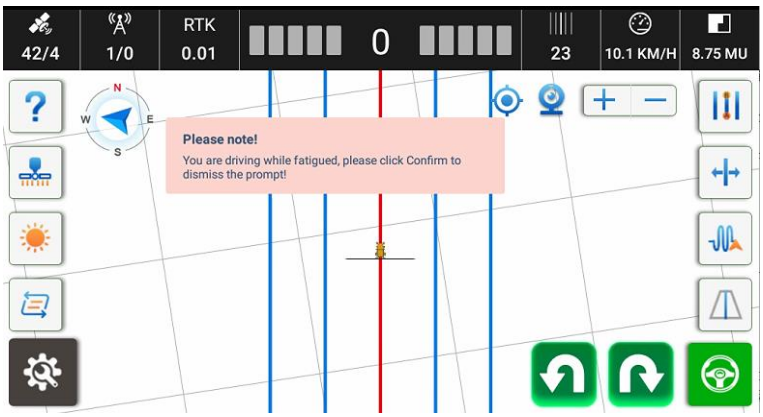


4.2.13.4 Fatigue driving

In order to ensure the safety, currently it is available to support users to set the fatigue driving alert and trigger time.

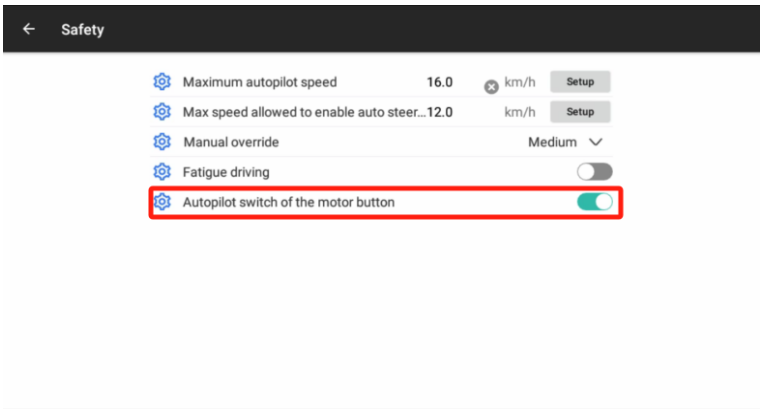






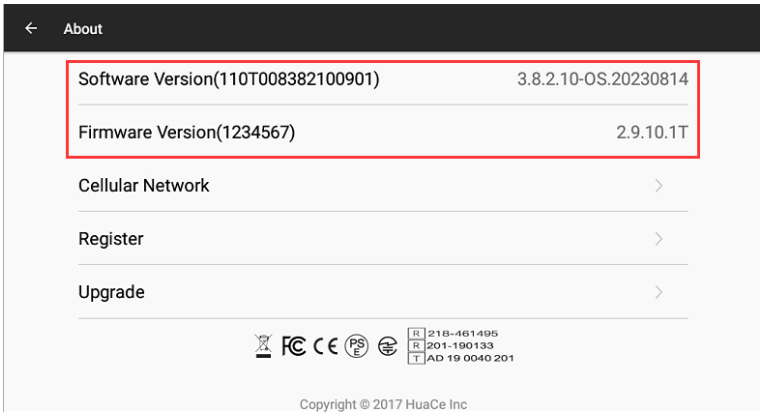
4.2.13.5 Autopilot switch of the motor button

Allow autopilot mode control via motor button. The default option is on and some users can turn it off in case of the safety reason.



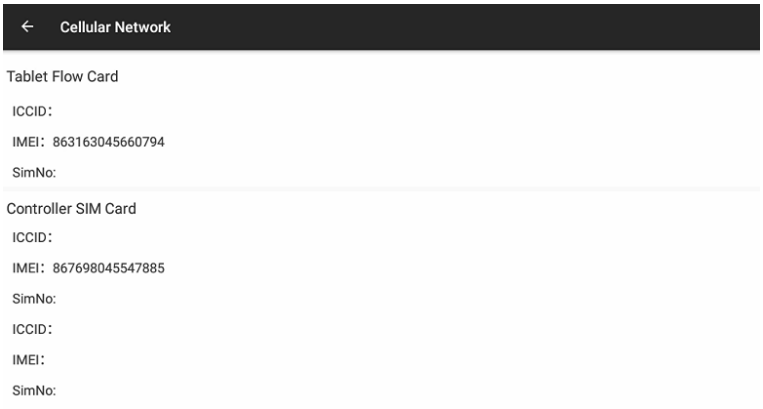
4.2.14 About

Check the software and firmware version on this interface.



4.2.14.1 Cellular Network

Check SIM card information like IMEI.

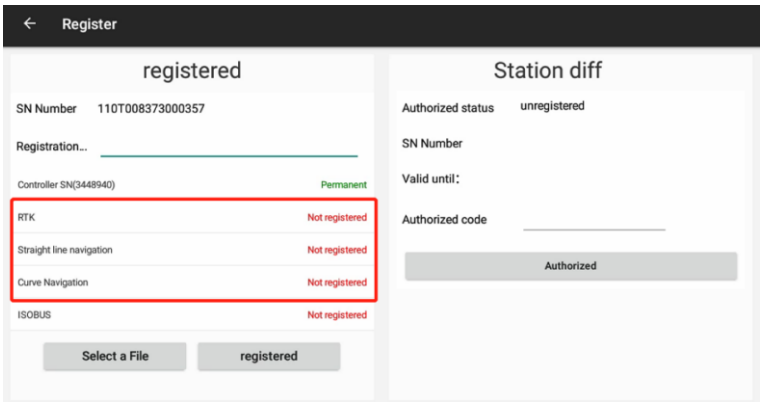


4.2.14.2 Register

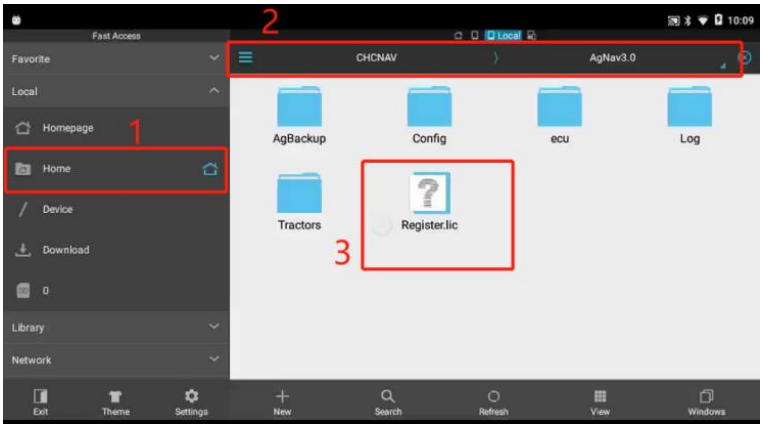
There are two methods to register software common feature.

a) File/code registration.

1) Get into [Settings]-[About]-[Register]
2) Provide the SN Number of the tablet to CHCNAV technicians and will provide you the registration file/code.



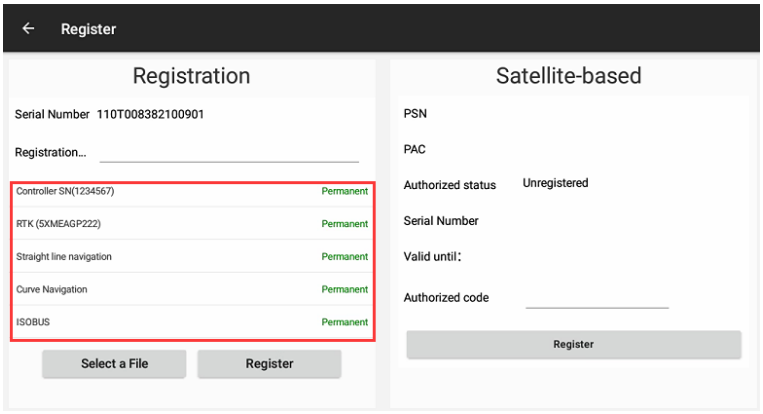
3) Copy the registration file to specific directory: Home/CHCNAV/AgNav3.0



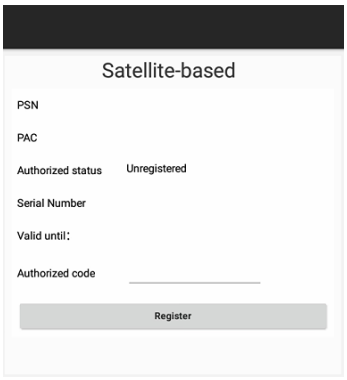
4) Restart the software which will register by itself, then go to [Settings] - [About] - [Register] again to check the registration status and expiration date.

b) Online registration.

Connect tablet to internet, and provide tablet SN to CHCNAV technicians, finally restart the software to activate the new registration after informed by CHCNAV technicians.

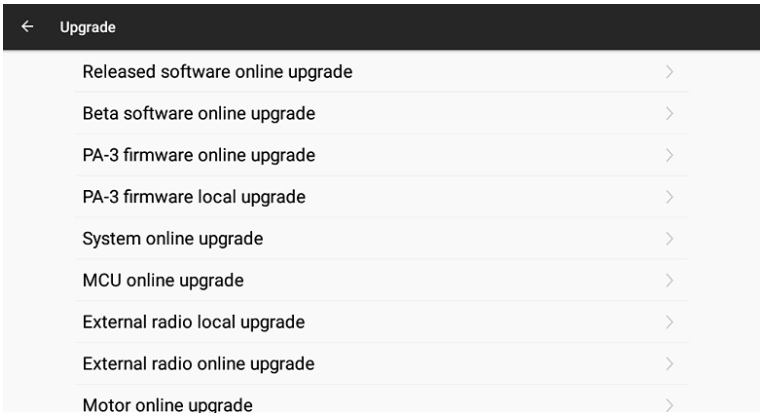


Also on the right side of this page, it is able to register the PPP feature includes Trimble RTX and Novatel TerraStar depending on which device customers use.



4.2.14.3 Upgrade

Software and firmware can be upgraded via online upgrade or local file upgrade.



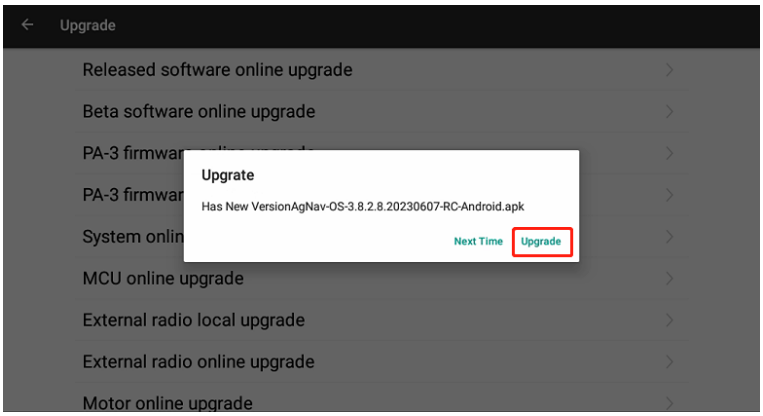
1. PA-3 Firmware online upgrade

Click **PA-3 firmware online upgrade** to download and upgrade the firmware with the tablet network. If software version is 1026 version below, it is necessary to select the

multiple network mode before updates.

2. Software online upgrade

Click Released software online upgrade, then click Upgrade-INSTALL-OPEN after the message box pops up.



3. Firmware local upgrade

a) Ask technical engineer for the latest firmware and copy it into a U disk. For example 2.9.5.5firmware version as below.

b) Connect USB disk to the tablet, then copy the file under the root directory on the tablet.

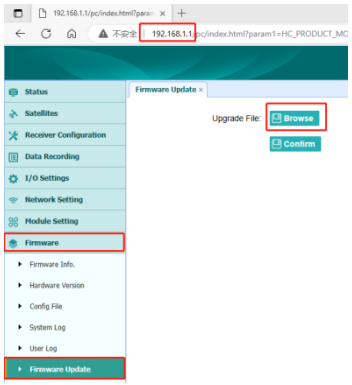
c) Click PA-3 firmware local upgrade, and go to root directory and select the firmware bin file to upgrade the firmware.

4. Firmware web page upgrade

a) Ask technical engineer for the latest firmware. For example 2.9.5.5 firmware version as below.

b) Connect to receiver's WiFi named '**GNSS-XXXXXXX**'.

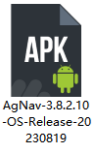
c) Open Google browser and enter **192.168.1.1**, then go to **Firmware-Firmware Update**.



d) Select the firmware file and click Confirm. Wait around 5 min to finish the update.

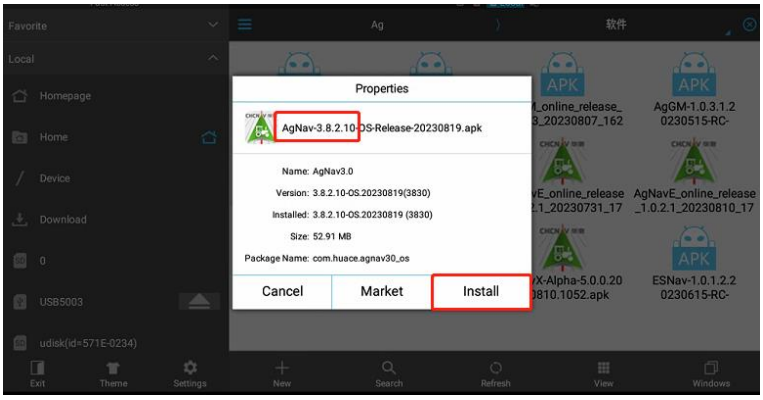
5. Software local upgrade

a) Ask technical engineer for the latest software apk file and copy it into a U disk. For example 3.8.2.10 software version as below.



AgNav-3.8.2.10-OS-Release-20230819

b) Connect USB disk to the tablet, then copy the file under the root directory on the tablet and click apk file to install.



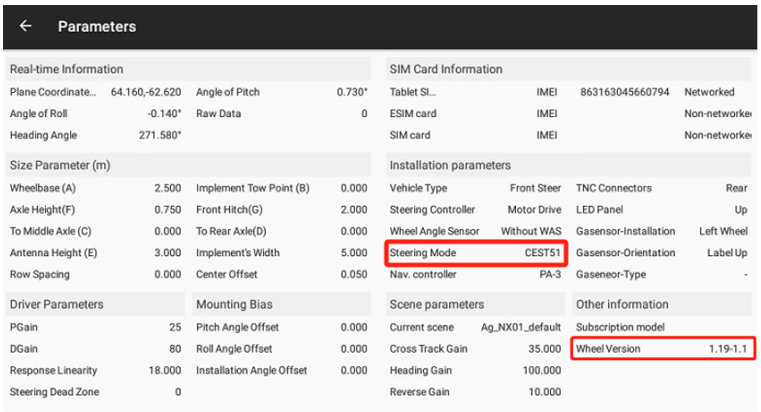
6. Motor updates

In some cases, it is also necessary to update the motor firmware but the motor type must be CES-T 5.1(PN:4006020035), and CES-T 3.X can not be updated any more. There are two methods to do updates for CES-T5.1.

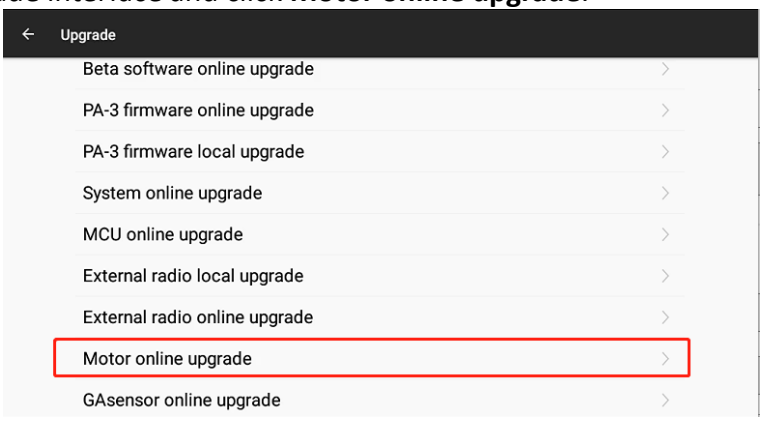
A. Online updates

1) Software and firmware version should be 3.8.2.8-OS.20230607 and 2.9.9.5T above.

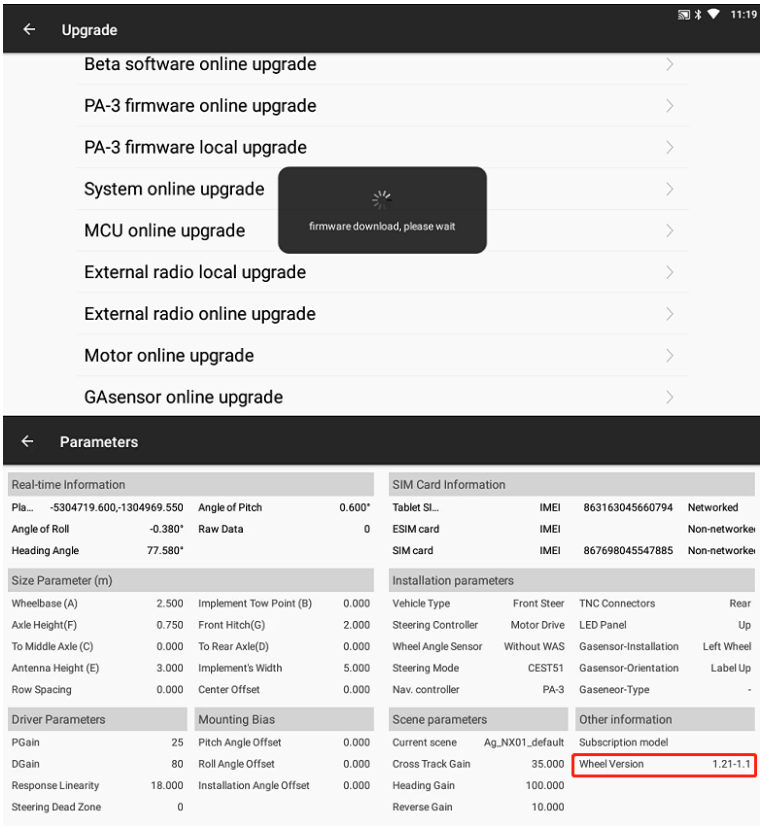
2) Check the previous motor firmware and see if it is necessary to be updated.
CEST51 means the current motor hardware type and it is the latest hardware version, 1.19-1.1 means the current firmware version for CEST51 motor is 1.19 version but it is necessary to update to the lastest firmware version 1.21.
Also there are previous version like CEST50 and CEST30 which can not support firmware updates.



3) Enter Upgrade interface and click **Motor online upgrade**.



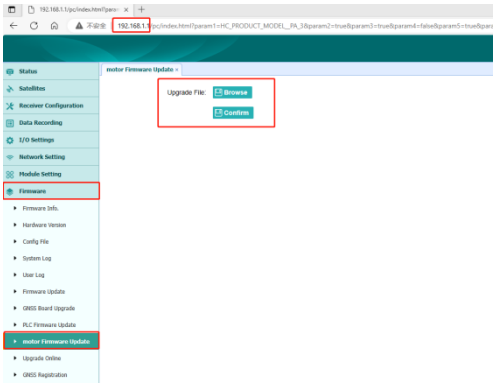
4) The firmware will be upgraded automatically, wait around 5 minutes and please do not touch the steering wheel at this time to avoid damage.



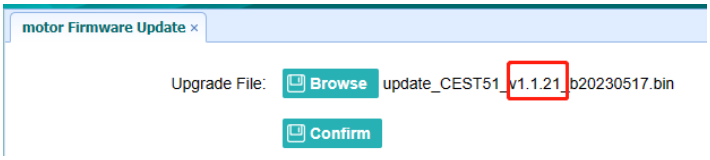
B. Website updates

1) Connect to receiver's WiFi named '**GNSS-XXXXXXX**'.

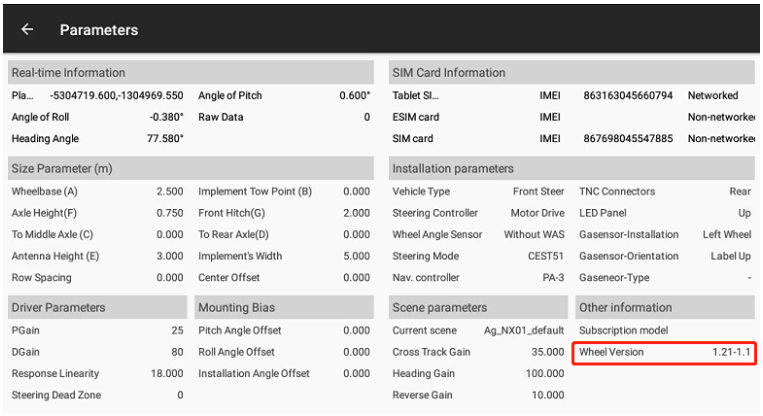
2) Open Google browser and enter **192.168.1.1**, then go to **Firmware-motor Firmware Update**. If there is no motor firmware update module, try clearing the browser cache and re-entering the receiver webpage.



3) Select the firmware file and click Confirm.



4) Wait around 5 min to finish the update.



5 Quick Guide

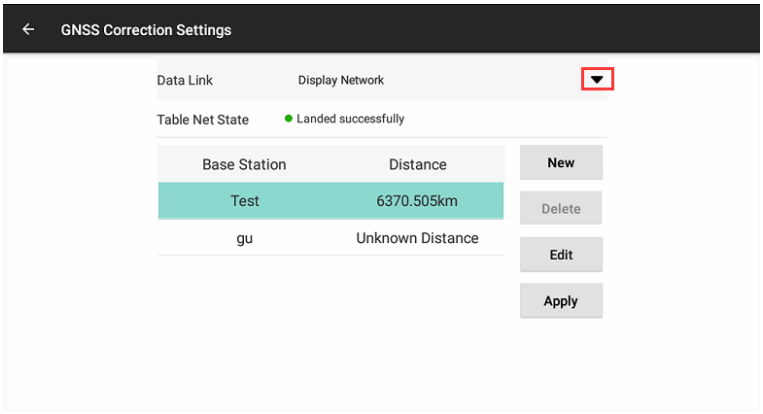
5.1 Power On

Press the rocker switch once, the system will boot if the green indicator light is on.

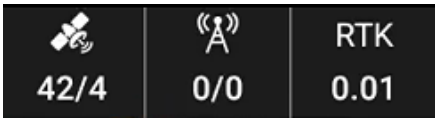
Note: Pls do not turn the steering wheel when turn on the system because the motor will initialize internally.

5.2 Receiver Settings and Check

Click the status bars in the upper left corner to enter the GNSS Correction Settings, please refer to 4.2.8 GNSS Mode for details.



Then check the status bars, when they are both grey, the system is ready to use.



5.3 Implement Settings

Click  in the main interface to enter the implements settings, please refer to Main interface - 9 Implement settings for details.

5.4 Guideline Settings

Click  in the main interface to enter the guidelines settings, please go to Guidelines for details.

5.5 Starting Autopilot

Click  to start autopilot after completing the above steps.

5.6 Turn Off

Press the button, the green light is off and the system is switched off.

6 Maintenance

1. To ensure the normal operation and service life of the equipment, please maintain the equipment under the instruction of the manual.
2. Please do not disassemble the main components of the system. If necessary, please contact the CHCNAV after-sales service support@chcnav.com.
3. Please use device under the instruction of user guide.
4. Regularly check each screw, wiring harness and connector of the system, such as controller fixing screws, angle sensor fixing screws, data cable connectors, etc.
5. Keep the motor clean.
6. Maintain the environment in which the motor is used. Please do not wrap materials such as cotton cloth and dustproof film on the motor.
7. Before starting the work, check whether the transmission device is flexible; whether the concentricity of the coupling is standard; the flexibility of the gear transmission.

7 Main hardware specifications

Receiver	PA-3
Build-in Module	GNSS Board, GNSS Antenna, Radio Module, 4G module and 4G antennas, IMU
GNSS board	BDS: B1I/B2I/B3I/B1C/B2a/B2b; GPS: L1CA/L2C/L2P(Y)/L5; GLONASS: L1/L2/L3; Galileo: E1/E5a/E5b; QZSS: L1/L2/L5; SBAS: L1/L5
GNSS antenna	Frequency range: GPS L1/L2/L5; BDS B1I/B2I/B3I/B1C/B2a/B2b; GLONASS L1/L2/L3; GALILEO E1/E5a/E5b/E6; QZSS L1/L2/L5/L6; IRNSS L5; L-Band 4G. WIFI(2.4GHz) Impedance: 50Ω Maximum gain: GNSS 5.5dBi WIFI 0.5dBi 4G 0.5dBi Operating voltage: +3.3~+12VDC Operating current: s40mA Size: L 152mm*W 145mm*H 16.9mm Operating temperature: -40°C~+85°C
Accuracy（RTK）	Horizontal: ±8mm + 1ppm RMS
	Vertical: ±15 mm + 1 ppm RMS
Channel	1408
Correction Format	CMR, RTCM 3.3/3.2/3.1/3.0
Output	NMEA 0183, up to 10HZ
Frequency	Up to 10Hz
I/O	2*CAN, 2*RS232, Wi-Fi
Cellular Module	4G module (EG25) LTE(FDD): B1,B2,B3,B4,B5,B7,B8,B20 DC-HSPA+/HSPA+/HSPA/UMTS: B1, B2, B5, B8 EDGE/GPRS/GSM 850/900/1800/1900MHz
Radio module	Built-in Rx Radio 410-470MHZ TT450S/Transparent/CHC/SATEL 3AS
IMU module	Size: 14.5*17*3.7mm Weight: 2g Operating temperature: -40℃ ~ 85℃ Power supply: 3.3V Gyroscope accuracy: 3.0 °/h zero bias stability 0.04/s zero bias repeatability 0.05 °/s output noise

	Acceleration accuracy: 30ug zero bias stability 1mg zero bias repeatability 0.7mg output noise Heading angle accuracy: ±2.5° Roll and pitch angle: ±0.3/0.8°
Power Supply	（9-36） V DC
Dimensions	220*205*60mm
Weight	1.5Kg
Material	PC+PBT, ADC12
Working Temperature	-25℃~ + 70℃
Storage Temperature	-40℃~+85℃
Water Proof	IP67
Shock Proof	5-10Hz: +5 dB/oct;
	10-75Hz: 0.10m²/s3(0.00104 g2/Hz)
	75-100Hz: -5 dB/oct
	Total root mean square acceleration: 7.8Grms
Electrical Steering Wheel	**CES-T**
Motor Type	Torque Motor
Rated Torque	7.5N.m
Peak Torque	>18N.m
Max RPM	180RPM
Rated RPM	120RPM
Rated Current	15A
Peak Current	38A
I/O	1*CAN
Power Supply	（9-32） V DC
Dimensions of Motor	165mm× 80.5mm
Weight	≤5.5Kg
Dimensions of Steer Wheel	D: 410mm
Material	WCB, PU， AL
Working Temperature	-20℃~+70℃
Storage Temperature	-40℃~+85℃
Water Proof	IP65
Shock Proof	5-10Hz: +5 dB/oct;
	10-75Hz: 0.10m²/s3(0.00104 g2/Hz)
	75-100Hz: -5 dB/oct
	Total root mean square acceleration: 7.8Grms
Tablet	**CB-H10**
CPU	quad-core, 1.8 GHz
Memory	2G RAM
	16G ROM
Screen	10.1 inch

Resolution	1024*600
Screen Type	Capacitive Touch Screen
Brightness	750nits
I/O	2*CAN, 2*RS232, camera input*2
Communication	4G: EG25; WIFI/BT: AW-NM372SM 2.4GHz WIFI, IEEE 802.11 b/g/n; BT 4.0, BLE USB 2.0*1
Power Supply	(9-36) V DC
Buttons	1* Power, 3*Button
Dimensions	281*181*42mm
Material	PC
Working Temperature	-20℃~+70℃
Storage Temperature	-40℃~+85℃
Water Proof	IP65
Shock Proof	MIL-STD-810G
Wheel angle sensor	**GASensor**
Type	Gyroscope Sensor
Power supply	9-36V
Measuring Range	100deg/s
Resolution Ratio	0.02°/s
Noise	0.1°/s RMS
Random Walk	0.4°/√h
Bandwidth	22Hz
I/O	CAN
Material	ADC12
Working Temperature	-25℃ ~ +75℃
Storage Temperature	-40℃～+85℃
Water Proof	IP67
Rear Camera	**F23A220**
Resolution	1280x720 pixels
Angle view	120°
Tablet 4G antenna	**QC400SI**
Frequency range(MHZ)	450-470
Bandwidth	20
Polarization	Vertical
Gain (dBi)	3.6
Impedance (Ω)	50
VSWR	≤3
Maximum power (W)	100
Length (cm)	45
Connector	TNC male

Cable length (cm)	50
Weight (kg)	0.15
Rated wind velocity (km/h)	120
Mounting	Magnetic mount

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