Automated steering system

AG360 Pro

User Guide

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1 Instructions For Product Use

Please read the following precautions carefully before using this product:

a) During the outdoor use of the base station equipment, Long term waterproof treatment shall be done for the base station host. During the use or test, the base station antenna must be placed in the open environment, and there are no tall buildings or trees within 20 meters around.

b) Do not disassemble the antenna of the base station or plug and unplug the serial port cable and other cables when the power is turned on.

c) Please connect your equipment in strict accordance with the requirements in the manual. For the 7-pin data cable and other cables, it is necessary to hold the root of the plug and gently insert and pull it. It is not allowed to drag or rotate it, otherwise it may cause pin breakage.

d) When supplying power to the system, please pay attention to the power supply requirements of the equipment (the power supply voltage must be 12-14vdc, the rated current must not be less than 50A, and the tractor with the power supply voltage of 24V needs to be equipped with a voltage conversion module).

e) The base external radio may generate high temperature during use. Please be careful not to burn. In addition, covers on the surface of the external radio must be avoided or reduced to enable good heat dissipation.

f) When using the radio for a long time and transmitting at high power, people should keep a distance of more than 2 meters from the transmitting antenna to avoid radiation.

g) When installing antennas outdoors, users should take appropriate lightning protection measures to prevent lightning strikes.

h) Please do not continue to use after the connecting cables are damaged. Please replace new cables in time to avoid unnecessary damage to the equipment or affecting the use.

i) Equipment damage due to force majeure (lightning strike, high voltage, collision) does not belong to the scope of free maintenance of ComNav.

j) Please do not disassemble this product by yourself, otherwise it will not be warranted.

k) Comnav shall not be responsible for the problems caused by man-made

operation during automatic driving (such as people leaving the cab during driving, vehicle problems during normal automatic driving, etc.).

l) Please note that since there is no obstacle avoidance system, the AG360 / AG360 PRO system must always have someone present during automatic operation. When the vehicle runs towards people, animals, trees, ditches, buildings, etc., it is necessary to timely control the vehicle.

m) The AG360 / AG360 PRO system cannot control the speed of the vehicle. The driver must manually adjust the speed of the vehicle to ensure that the driving is at a safe speed and avoid overturn or lose control.

n) When the AG360 / AG360 PRO system is activated during testing, calibration, adjustment and automatic steering operation, the AG360 / AG360 PRO system will take over the steering system of the vehicle. The steering shaft, track, joint point or wheel of the vehicle may move unpredictably when activated. When the vehicle is started or the AG360 / AG360 PRO system is activated, ensure that all people and obstacles are removed to prevent personal injury or property damage.

o) AG360 / AG360 PRO system does not allow the installed vehicle to drive on public roads or in public places. Please ensure that the auto drive system turns off the power before driving on roads or in public areas.

p) Before and after the use of AG360 / AG360 PRO system, please ensure that the GNSS antenna and body angle sensors on the vehicle do not move. In case of any abnormality, please contact the technical personnel of the company in time to repair under the guidance of professional personnel.

2 Product Overview

2.1 System Components

Figures	Name	Account
	P300 plus Tablet	1（Optional）
	HUB	1
	Motor	1
	Steering Wheel	1
	GNSS Pole	1

	Antenna Holder	**2**
	Body Angle Sensor	**1**
	Front Wheel Angle Sensor	**1**
	Tablet Holder	**1**
	UHF Antenna	**1**
	Motor Holder	**1**

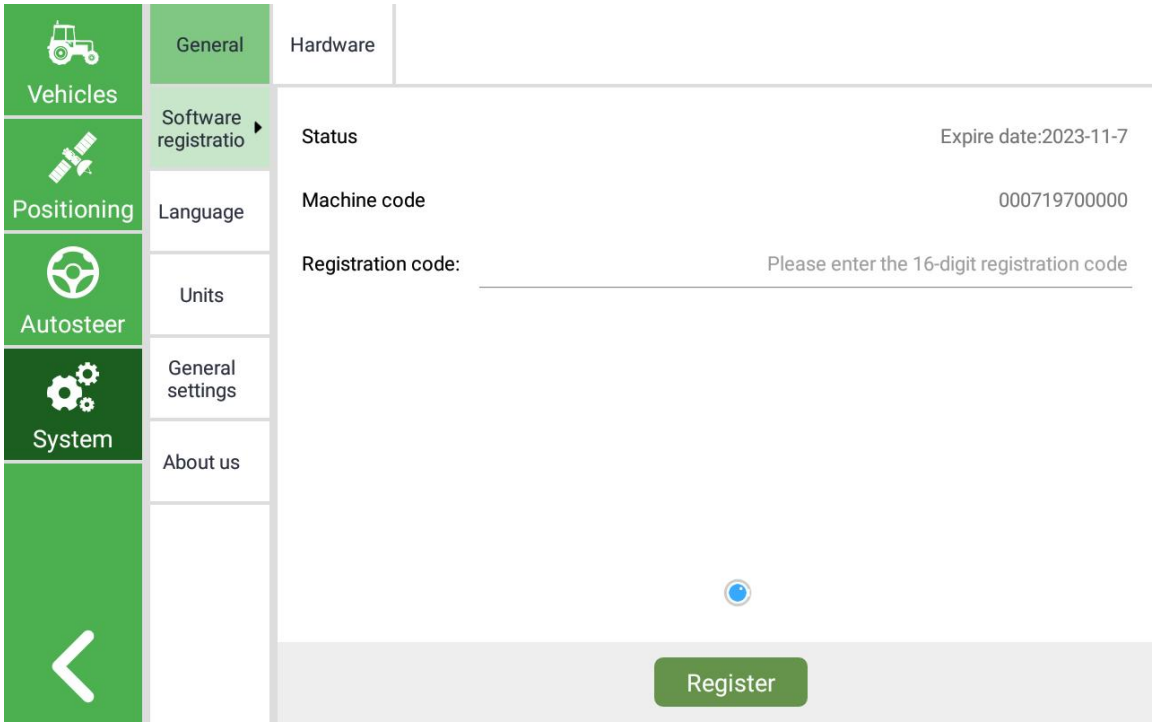
	GNSS Pole Subplate	**2**
	Power Cable	**1**
	7-pin Lemo to 7-pin Lemo Cable	**1**
	Motor Cable	**1**
	7-pin Lemo to 7-pin Lemo Cable	**1**

	Screw Suit	**1**

2.2 Software registration

Software will be registered as required when it installed in controller. If the registration is expired or reinstall the software, a registration prompt will pop up. You need to contact us to get the registration code.

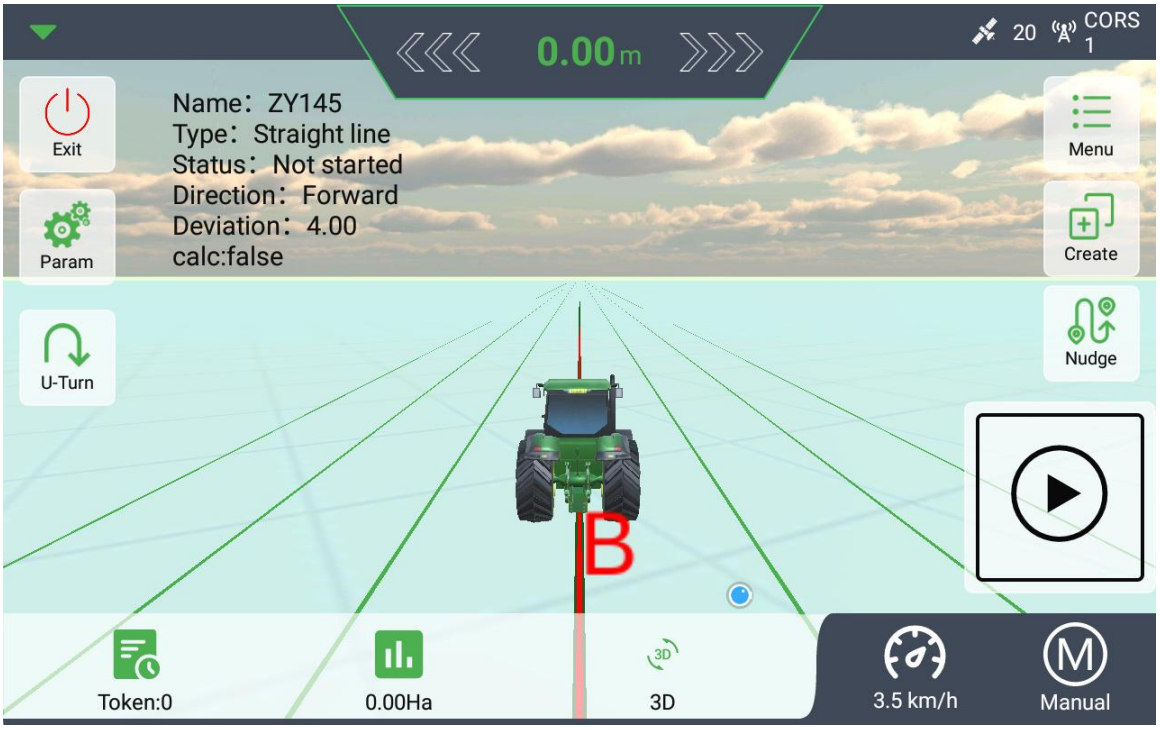
You can click the ***Menu*** button, select the **System**, and then you will see the ***software registration***, as shown in the below picture.



If you want to register, you need to connect the GNSS antenna first. When the receiver has successfully received the GNSS data, the unregistered device will have a pop-up window prompting to register.

2.3 Interface Icons

The main interface of normal work is shown in the figure below.



The meanings of the icon are shown as the table below.

	Name	Icon	Meaning	Remarks
Software running information	Basic running information	Name: ZY145 Type: Straight line Status: Not started Direction: Forward Deviation: 4.00 calc:false	Provide basic information such as task type, task name, task area, current line number, driving status, heading angle for users to use.	
		Token:0		
		0.00Ha		
		3D		
Positioning information	Positioning mark	20	Number of satellites locked by the left antenna	
	Base mark	CORS 1	Diff age	
Device information	Motor		Not connected	

			Connected	
	Wheel angle sensor		Not connected	
			Connected	
	Body angle sensor		Not connected	
			Connected	
	Antenna connection		Not connected	
			Connected	
Autonomous driving Information	Point A	A	Mark point A	Autonomous driving cannot be started until the initial setup is completed and the AB point is determined.
	Point B	B	Mark point B	
	Autonomous driving		Not start	
			Started	
Speed and offset	Lateral offset	0.00m		/
	Speed	3.5 km/h		/
Other	Menu	Menu		settings
	Create new task	Create		/
	Nudge	Nudge		
	Parameter adjustment	Param		/
	Turn around	U-Turn		/

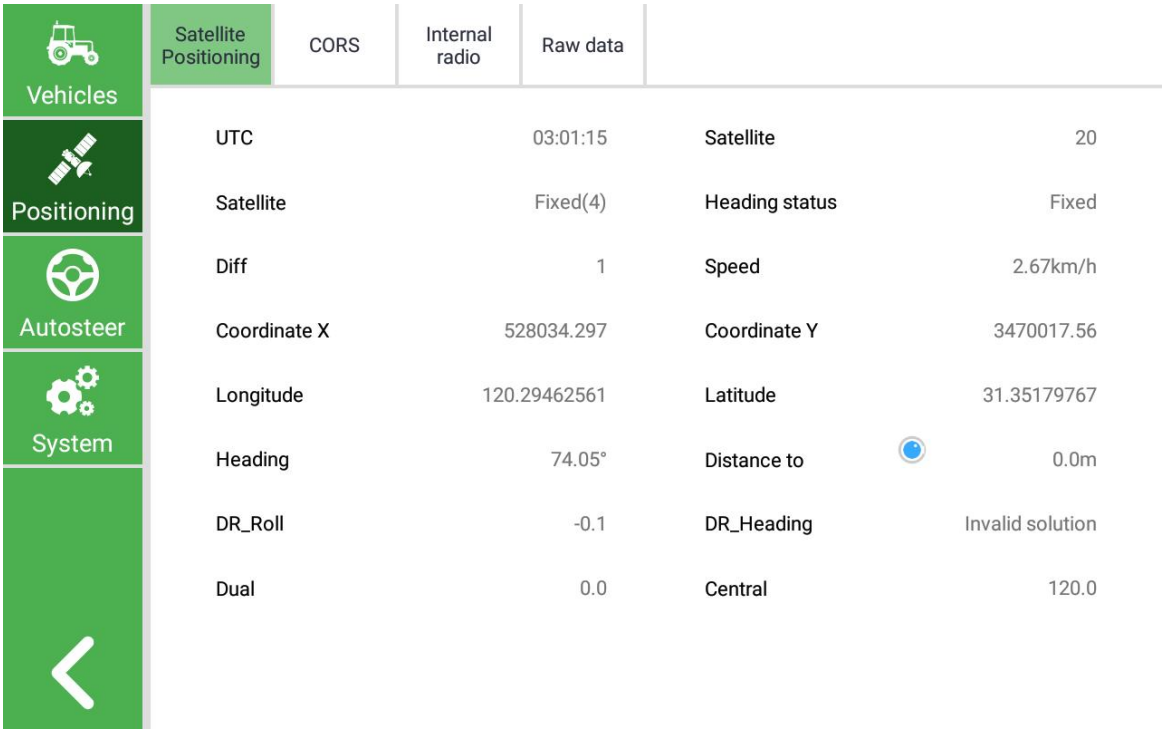
	Exit		Exit the software

3 Workflow

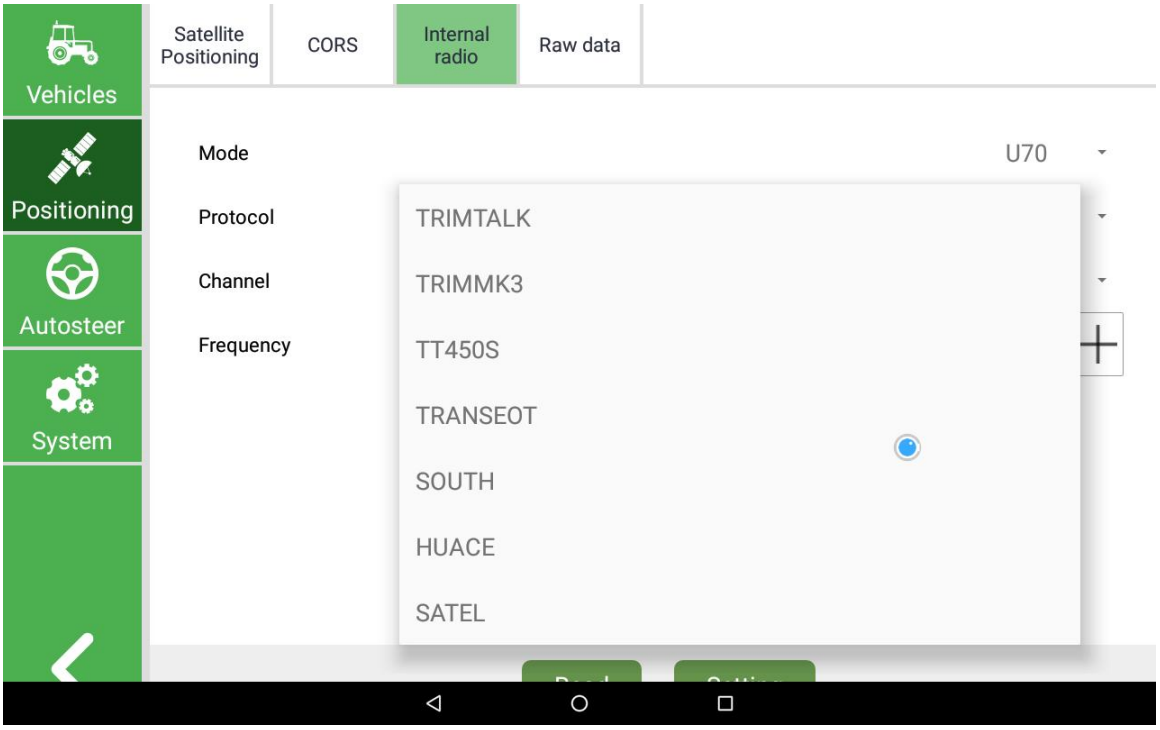
3.1 RTK Configuration

We currently provide two methods to get correction data: Internal radio and CORS.

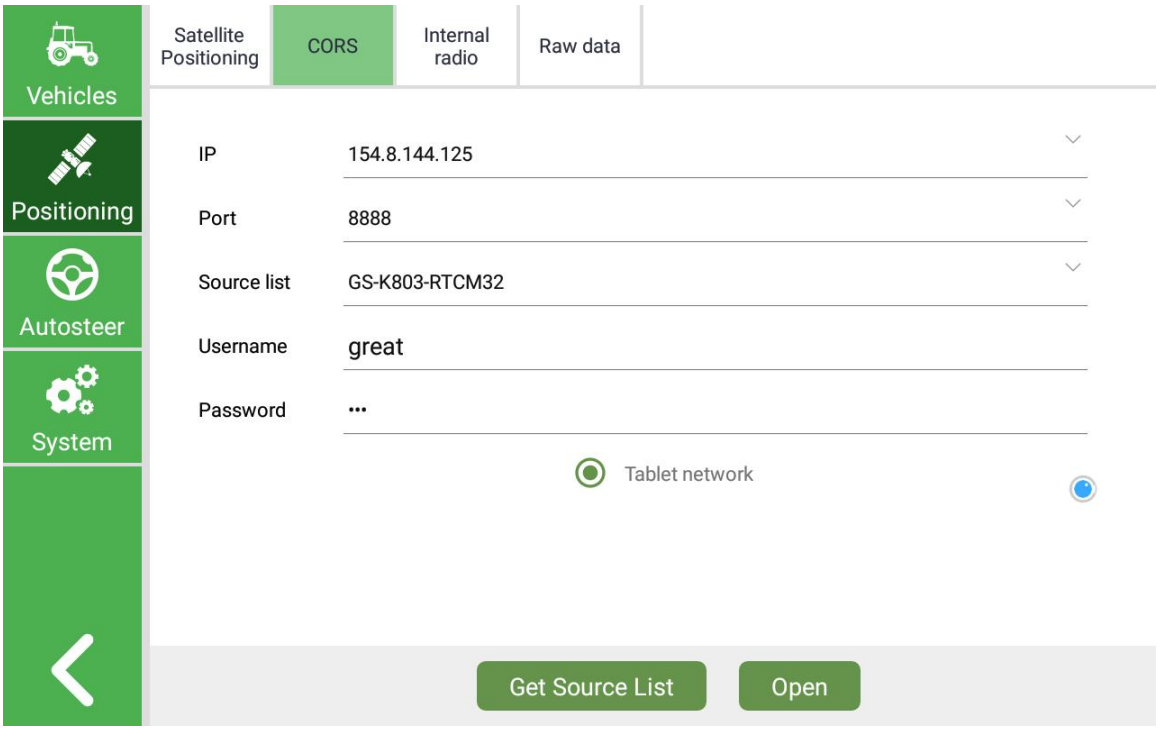
Click ***Meau*** > ***Positioning***



(1) Click ***Internal radio*** to configure radio information and get a fixed solution. Choose the correct channel to receive the correction data from base station.



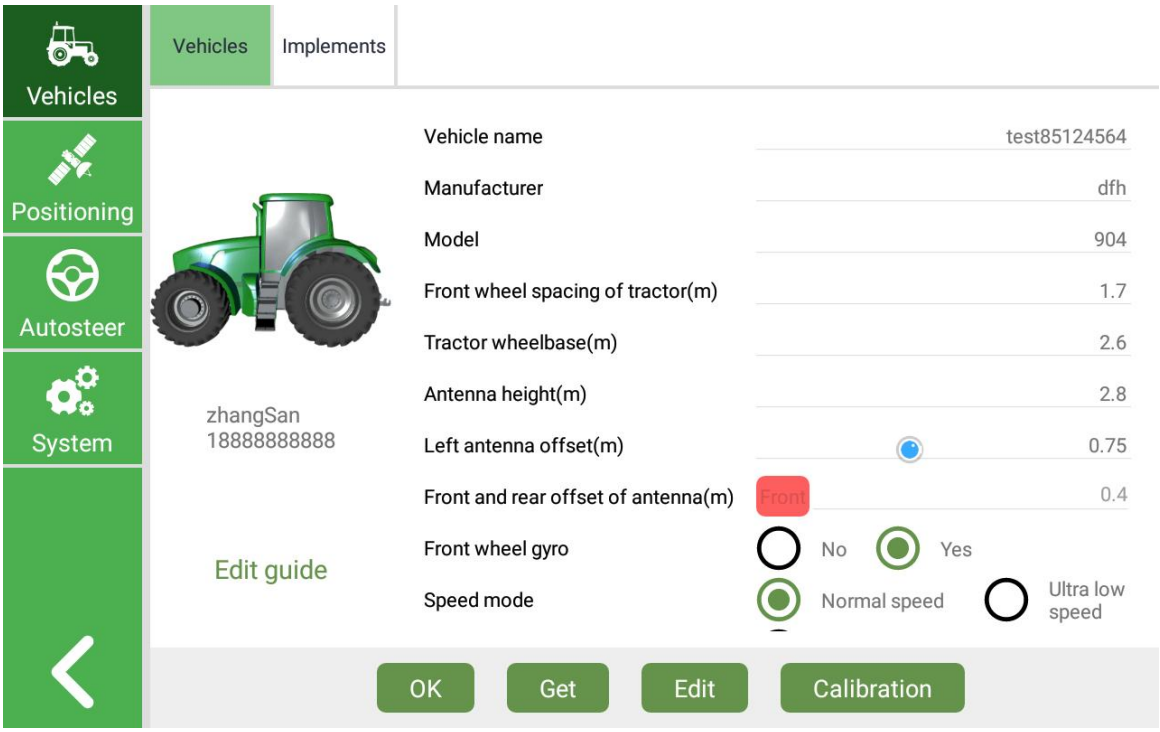
(2) Click ***CORS*** to configure IP, port, source list, username and password. Use SIM card and then click ***Get Source List***. After that, you can get the cors station ,choose a stable mount point ,then click ***Open*** . Check if get a fixed solution.



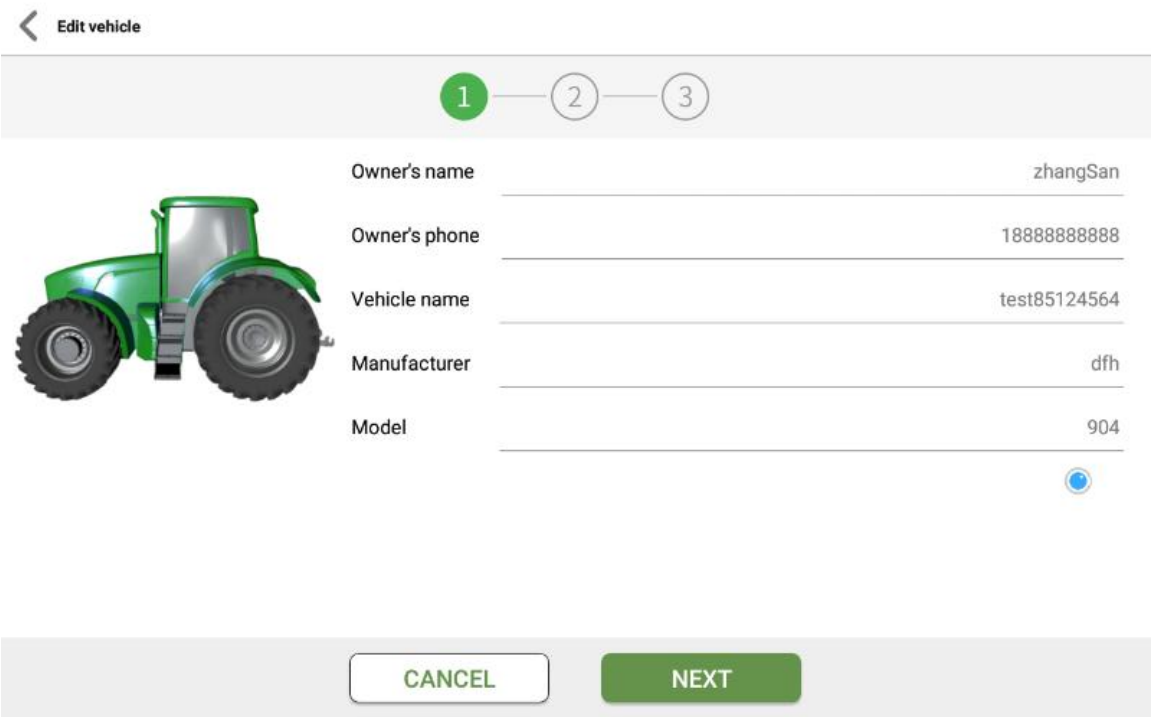
3.2 Create an vehicle

1) Create vehicles

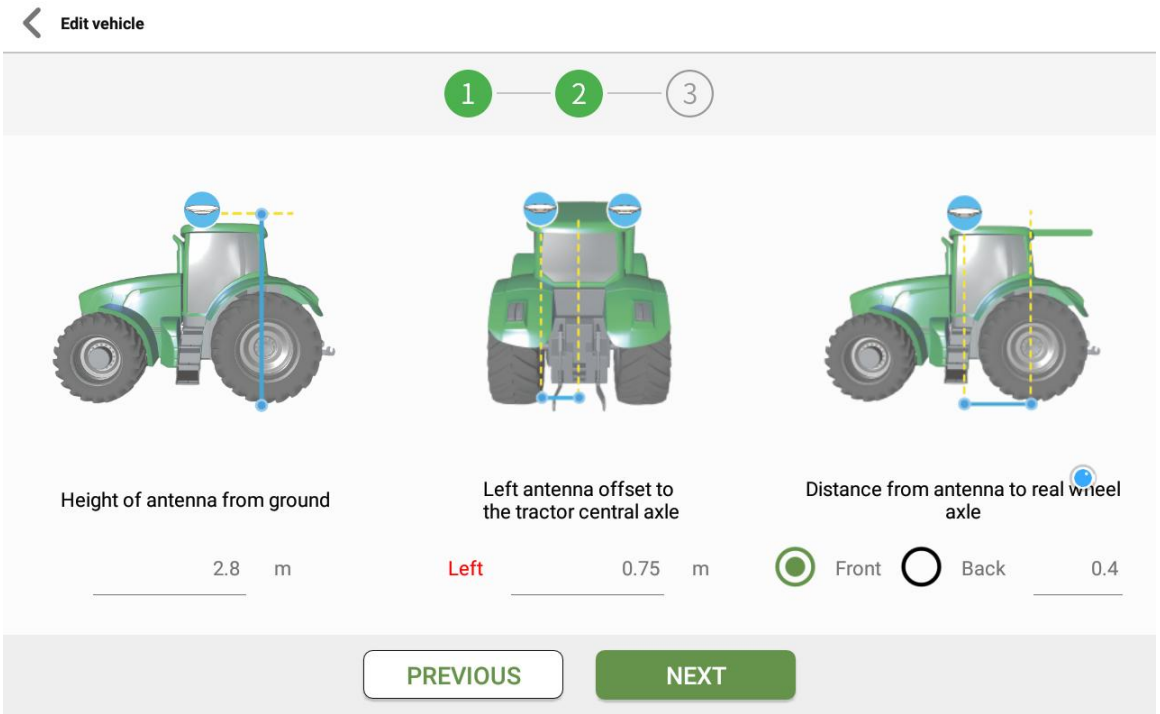
Click ***Meau***> ***Vehicle management***, choose ***Edit guide*** on the left and start editing the model of agricultural machinery.

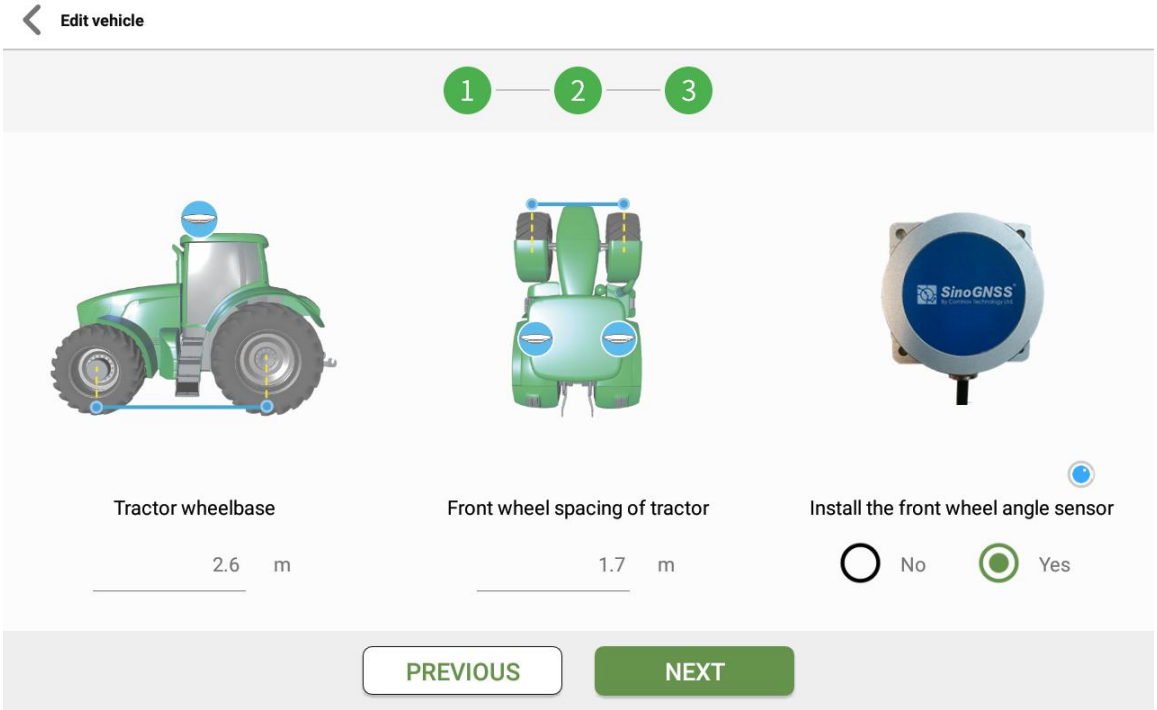


Create user information.



Create antenna and body information.

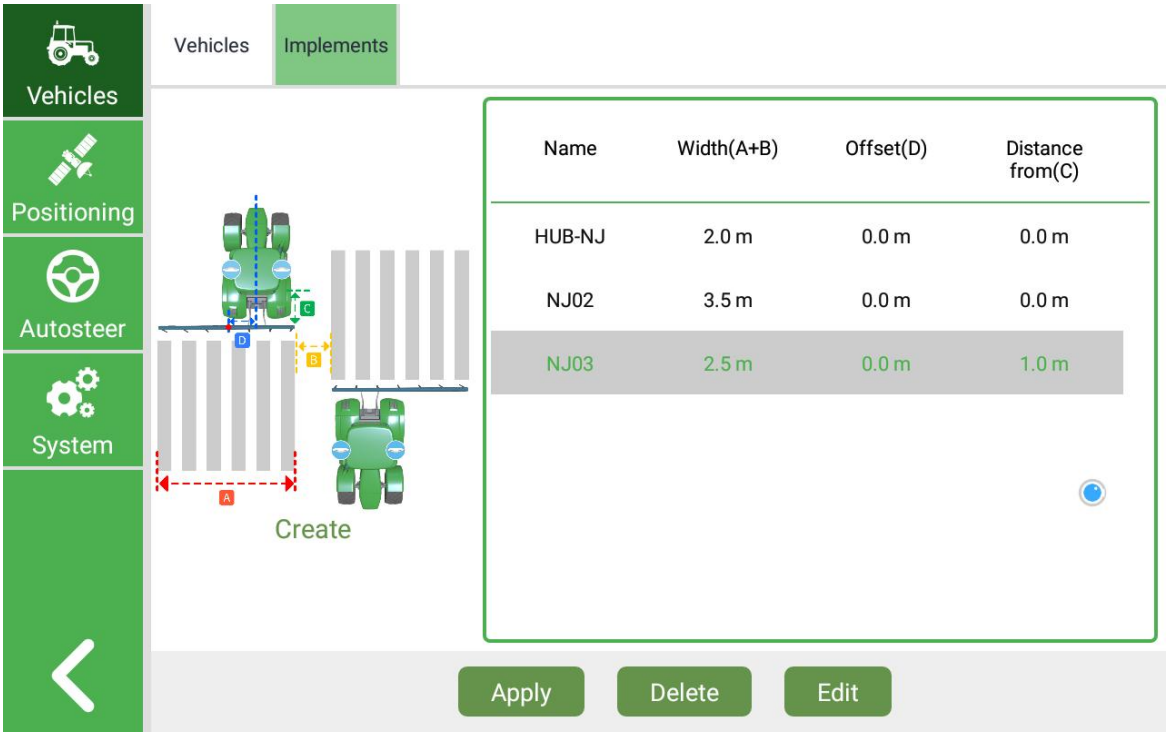




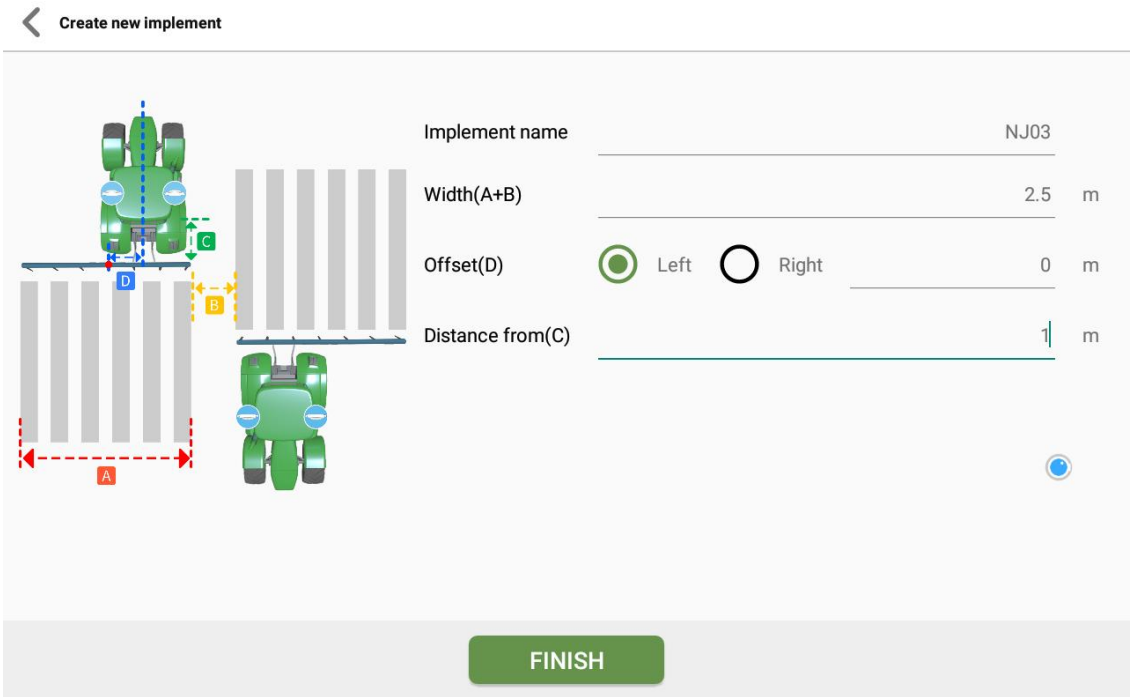
After editing, click ***Next***, return to the interface ,and click ***OK***

2) Create an implement

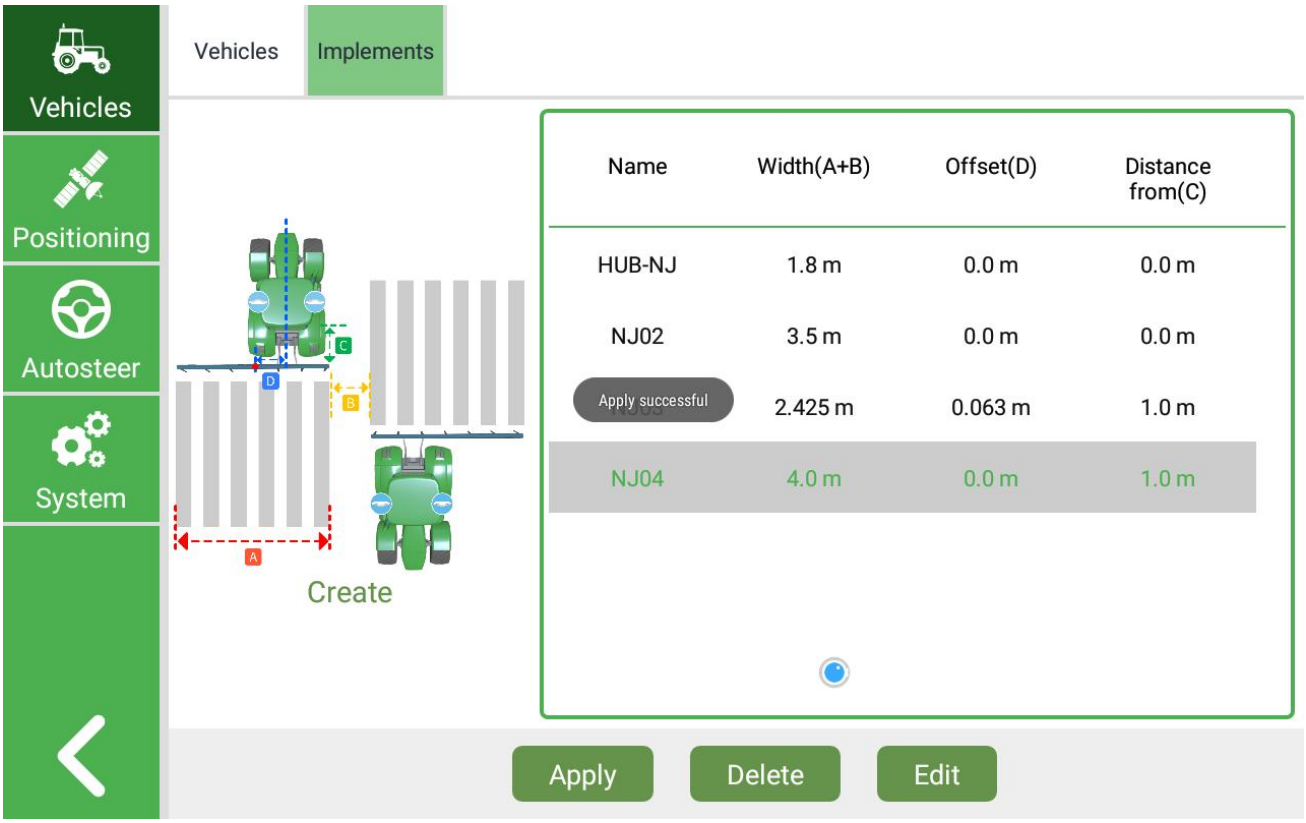
Click ***MEAU*** > ***Vehicle*** , choose ***Implement***.



Click ***Create*** button, and follow the prompts to enter the information.

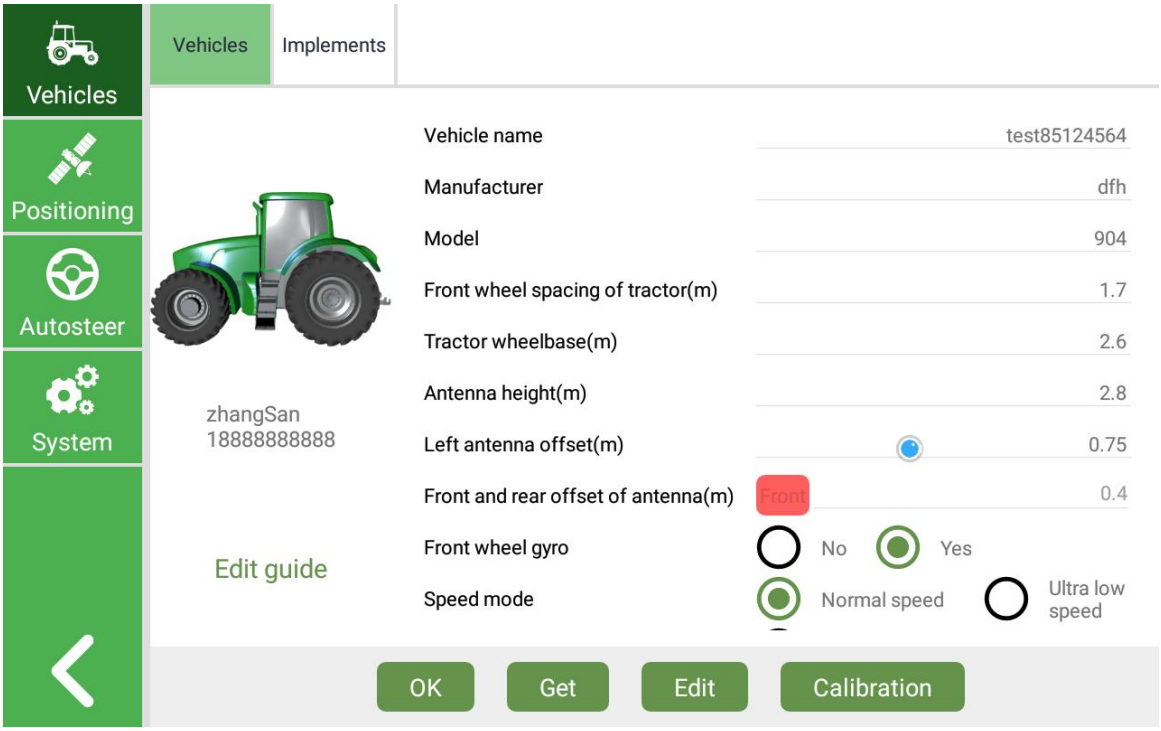


After finishing creation, select the implement you want to use, click ***Apply*** button, and the implement information turns green to indicate that the application is successful.



3.3 Parameter calibration

After creating the agricultural tools, return to the agricultural machinery interface, click Calibrate, and three calibration steps will appear. Follow the instructions in turn



1 Rate Gyro calibration

Front Wheel

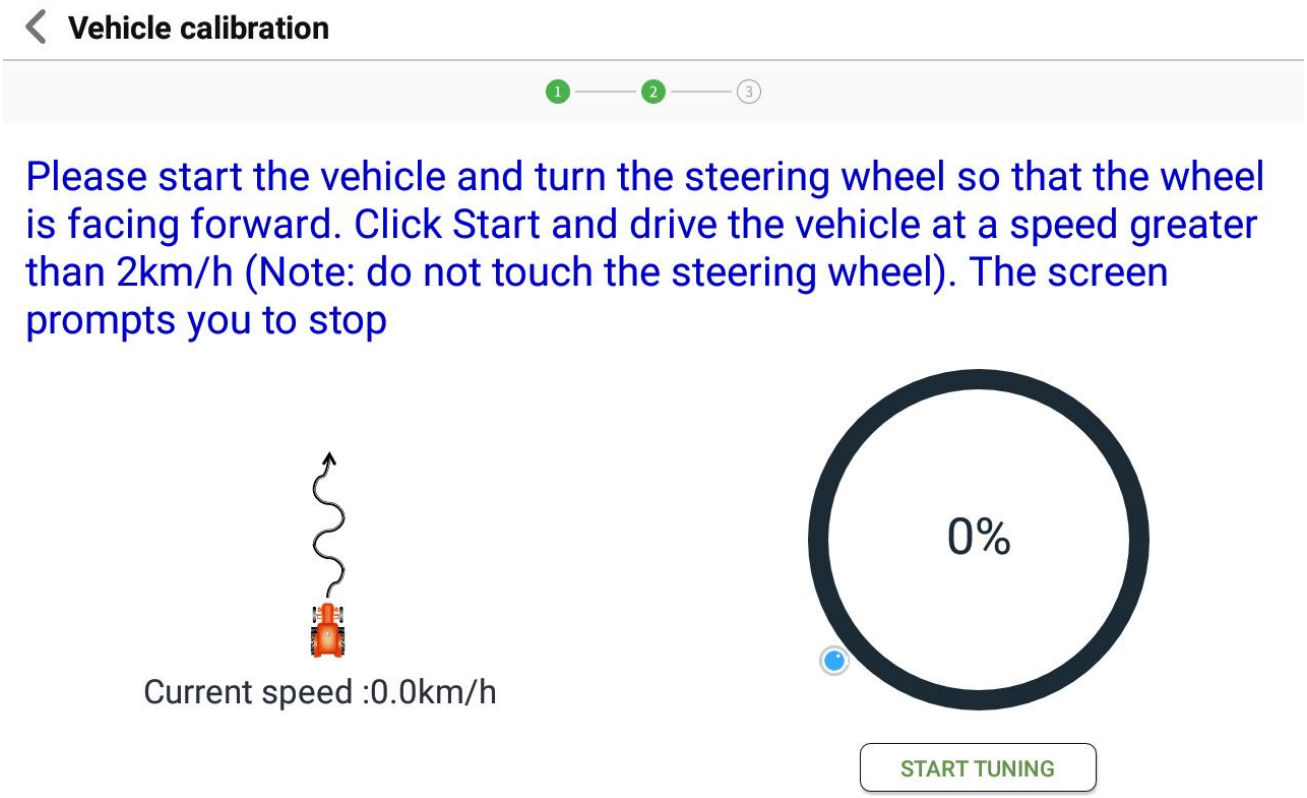
Please keep the vehicle stationary, select a single axle and observe its change value. The absolute value should not exceed ***0.15***. If it exceeds the limit, click the ***Gyro calibration*** button。

Body

Please keep the vehicle at standstill, select the three-axis and observe its change value. The absolute value should not exceed 0.15. If it exceeds the limit, click the ***Gyro calibration*** button

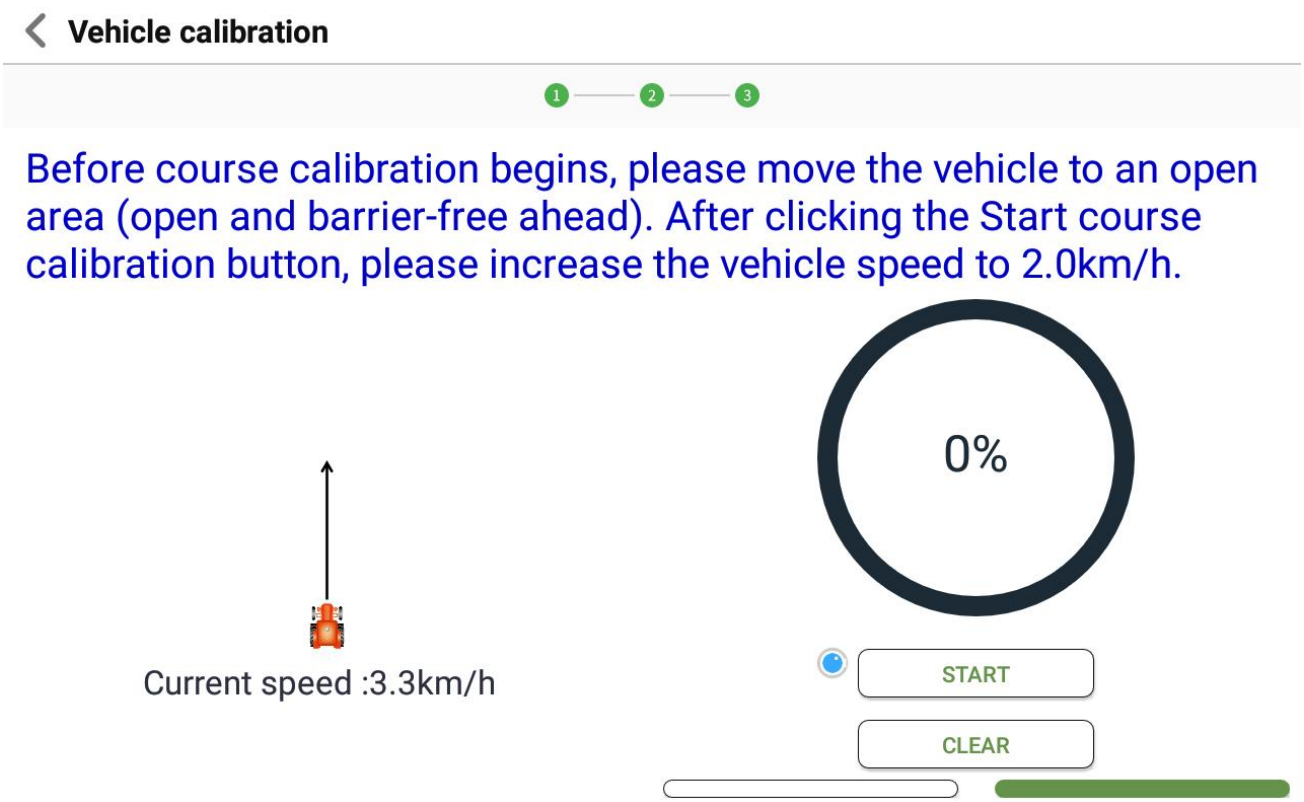
2 Adjust parameters adaptively

Please start the vehicle and turn the steering wheel so that the wheel is facing forward. Click ***Start Tuning*** and drive the vehicle at a speed greater than 2 km/h(Note: do not touch the steering wheel). The screen prompts you to stop. This is to adjust the turning sensitivity of the steering wheel.



3 Course (Heading) Calibration

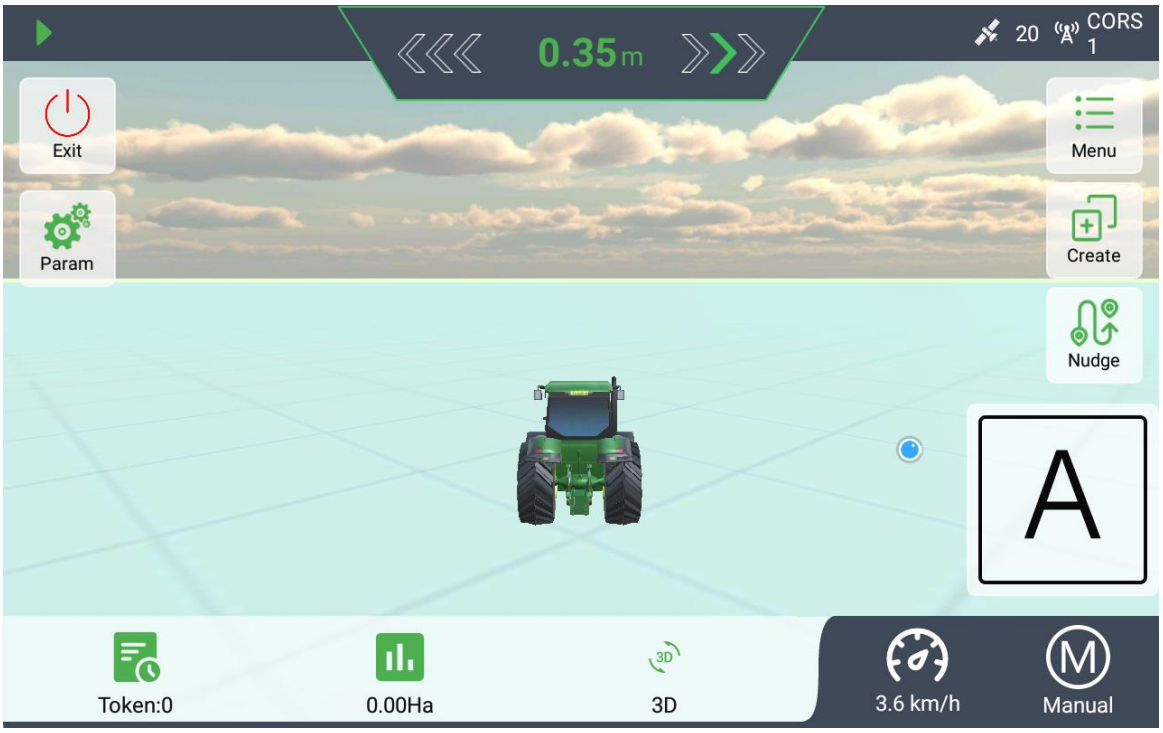
Before course calibration begins, please move the vehicle to an open area(open and barrier-free ahead). After clicking the Start course calibration button, please increase the vehicle speed to 2 km/h. This is to adjust the correct position information of the antenna.



3.4 Create a new task

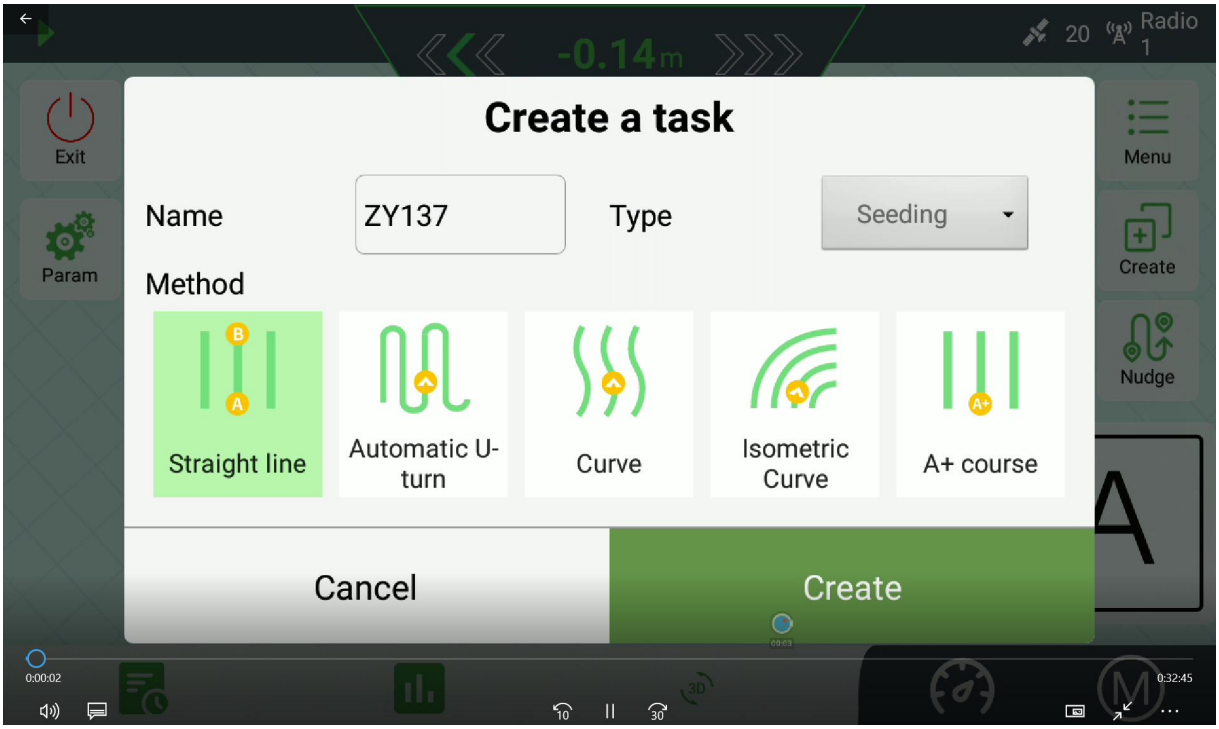
1) Create a new task

Drive the tractor to the starting point (beginning of the field), choose a good location and stop, click ***Create*** button , then enter the task name, working type, and working method. If they are correct, click ***Create*** button in the lower right corner.



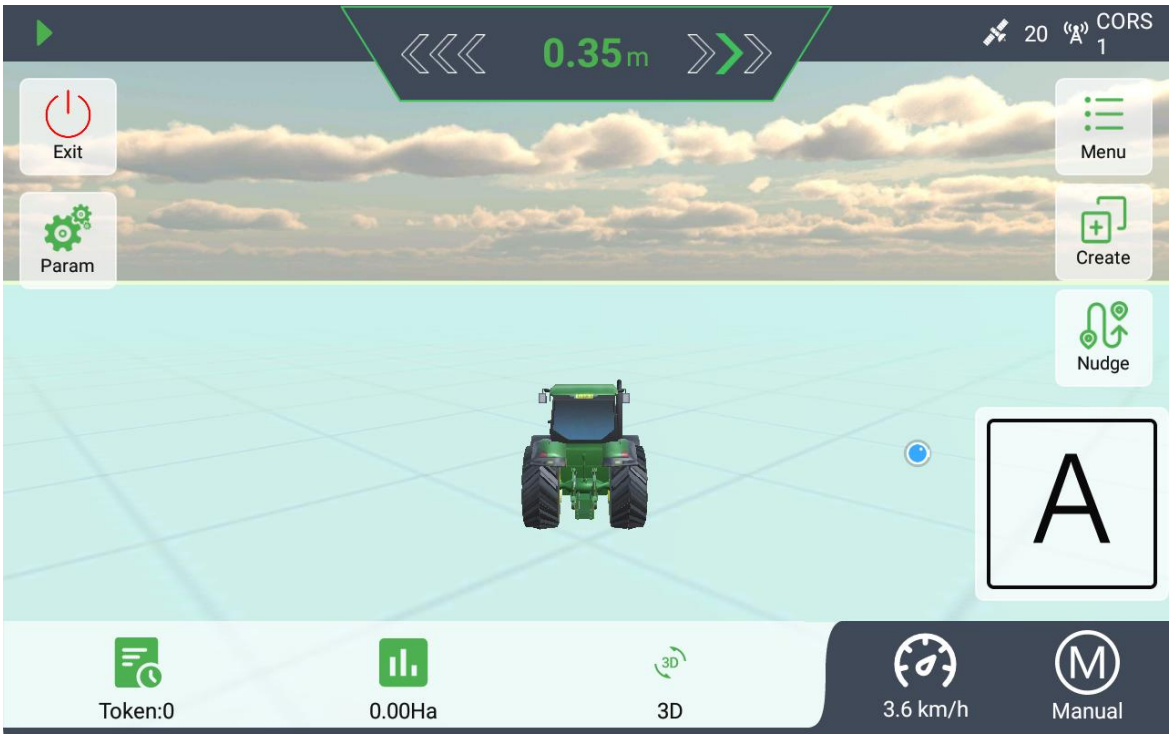
There are five ways of operation, namely: Straight line, Automatic U-turn, Curve, Isometric Curve, A+ course.

For details, please refer to **4.6.2**

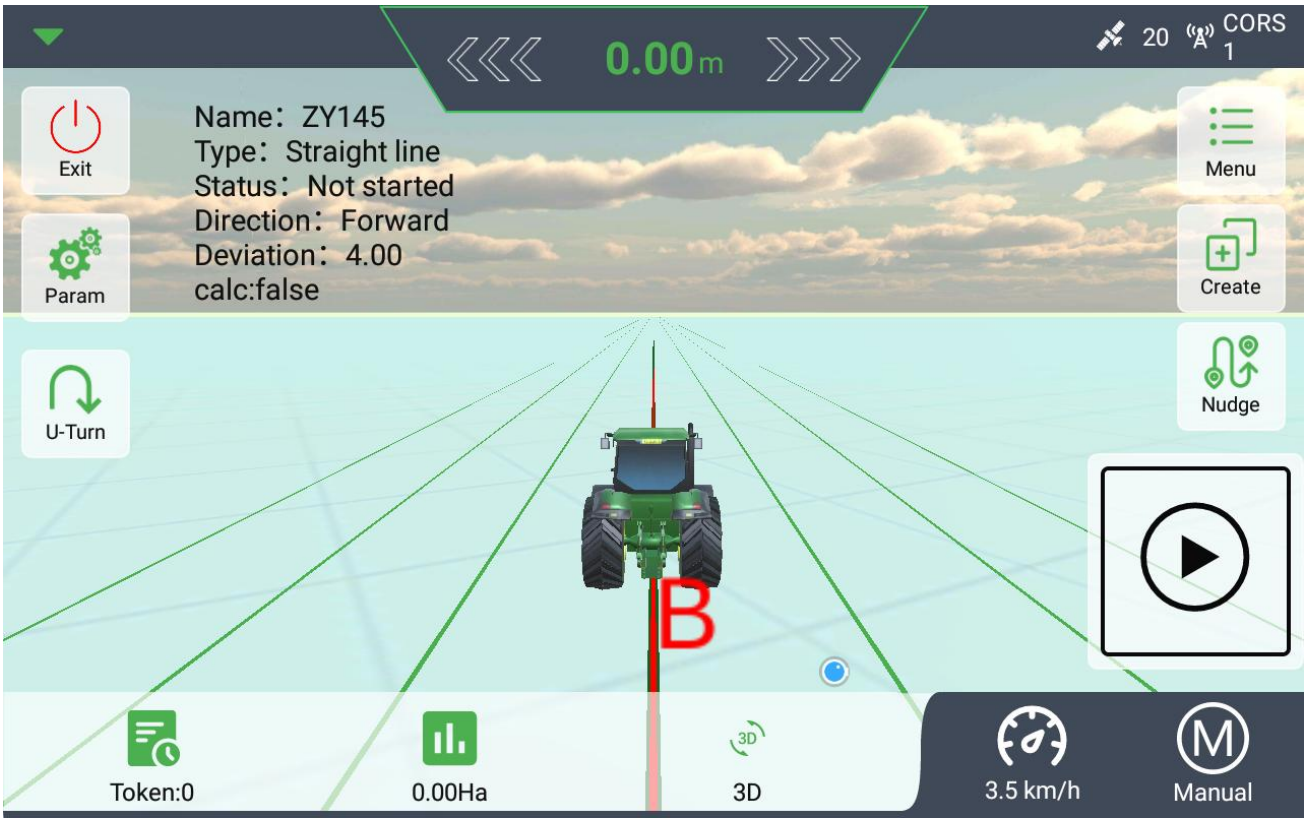


2）Survey point A and point B

Click ***A*** button to survey point A.

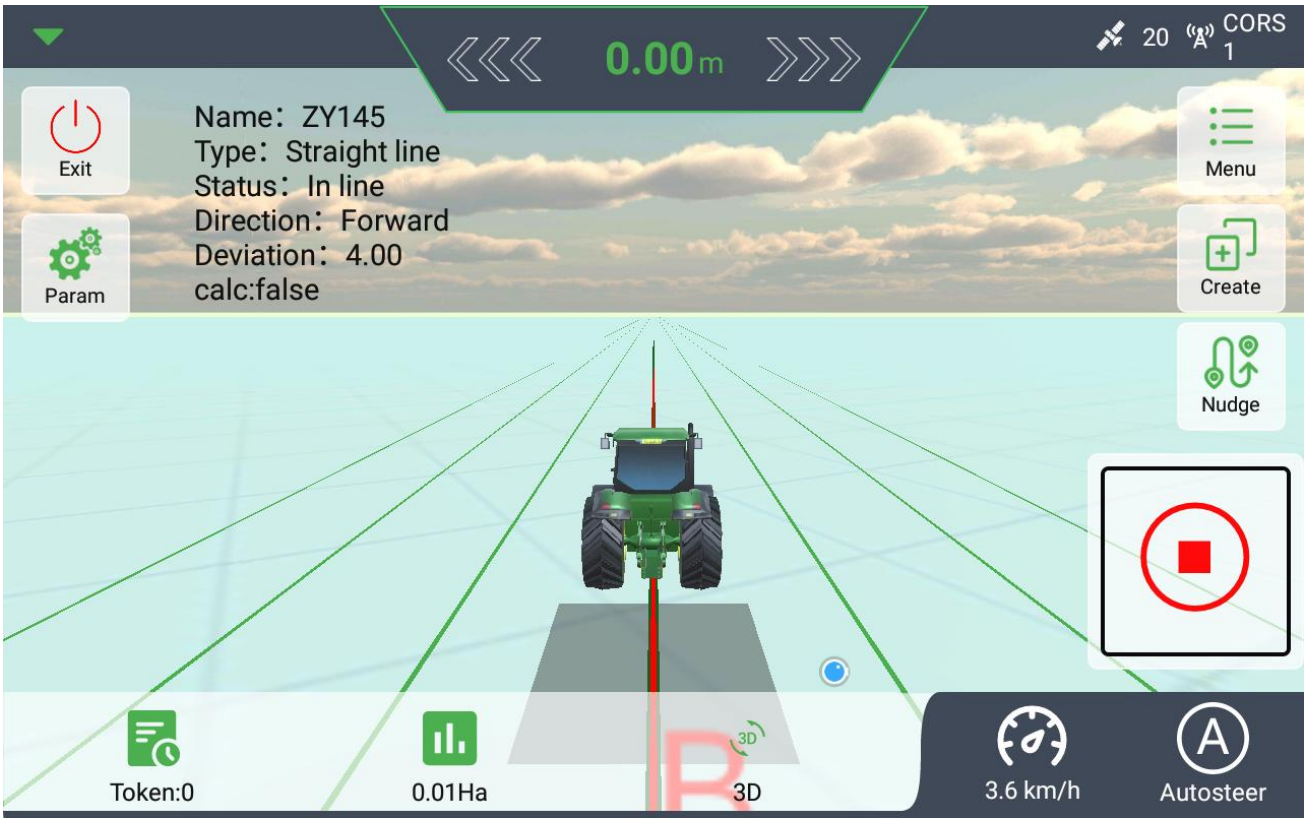


Hold the steering wheel to drive tractor to the other end of the field, choose the location and stop, click ***B*** button, and the AB line will be confirmed. The lateral deviation value will also return to 0 (The distance between point A and point B is at least 20 m)



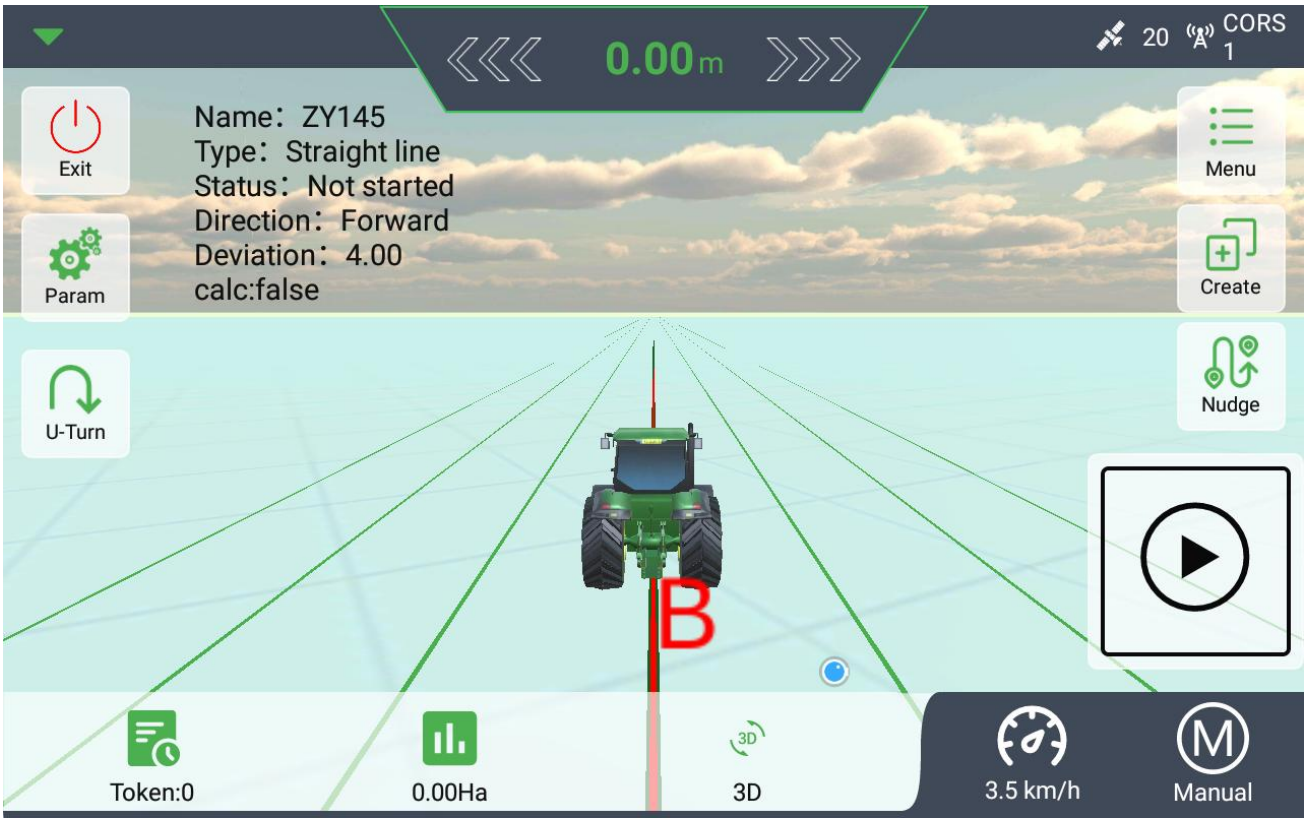
3.5 Start automatic steering

The prerequisite for enabling automatic driving is that the equipment is connected correctly, the RTK configuration is complete, information of vehicle, implement, field and task are complete. Click ***Start*** button to turn on the automatic driving. There will be a 2-second self-checking process during which the steering wheel is controlled. And it is strictly forbidden to turn on the vehicle before the button turns from gray to red.



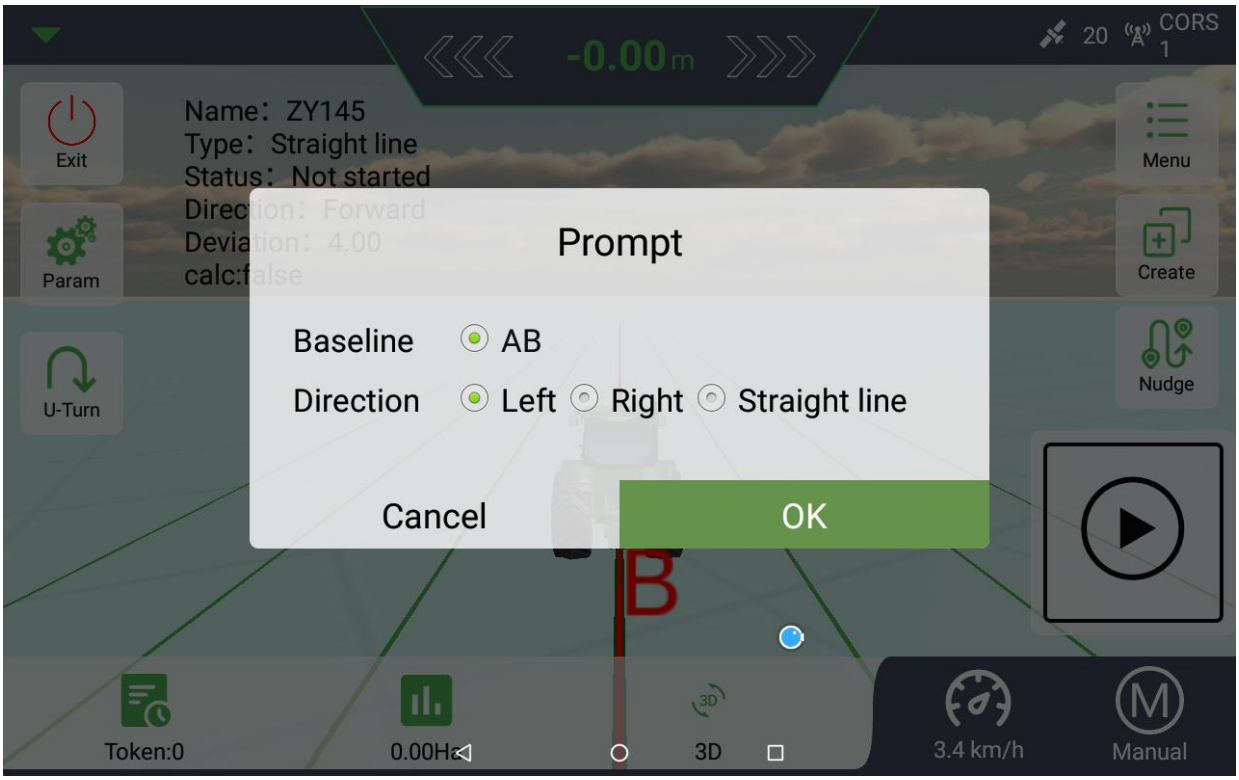
Click ***Stop*** button in the lower right corner to exit autopilot.

There is also a delay in exiting autopilot. This button changes from gray to blue for about 2 seconds. But when the button is clicked, the motor will be released immediately and the steering wheel can be controlled manually.



Each time you stop automatic driving, the ***U-turn*** around option will appear in the lower left corner. You can select the turning direction for the next driving as required.

It is worth noting that when you do not exit the automatic driving state, the agricultural machinery will automatically get the following turning direction according to the first turning direction, that is, automatic turning.



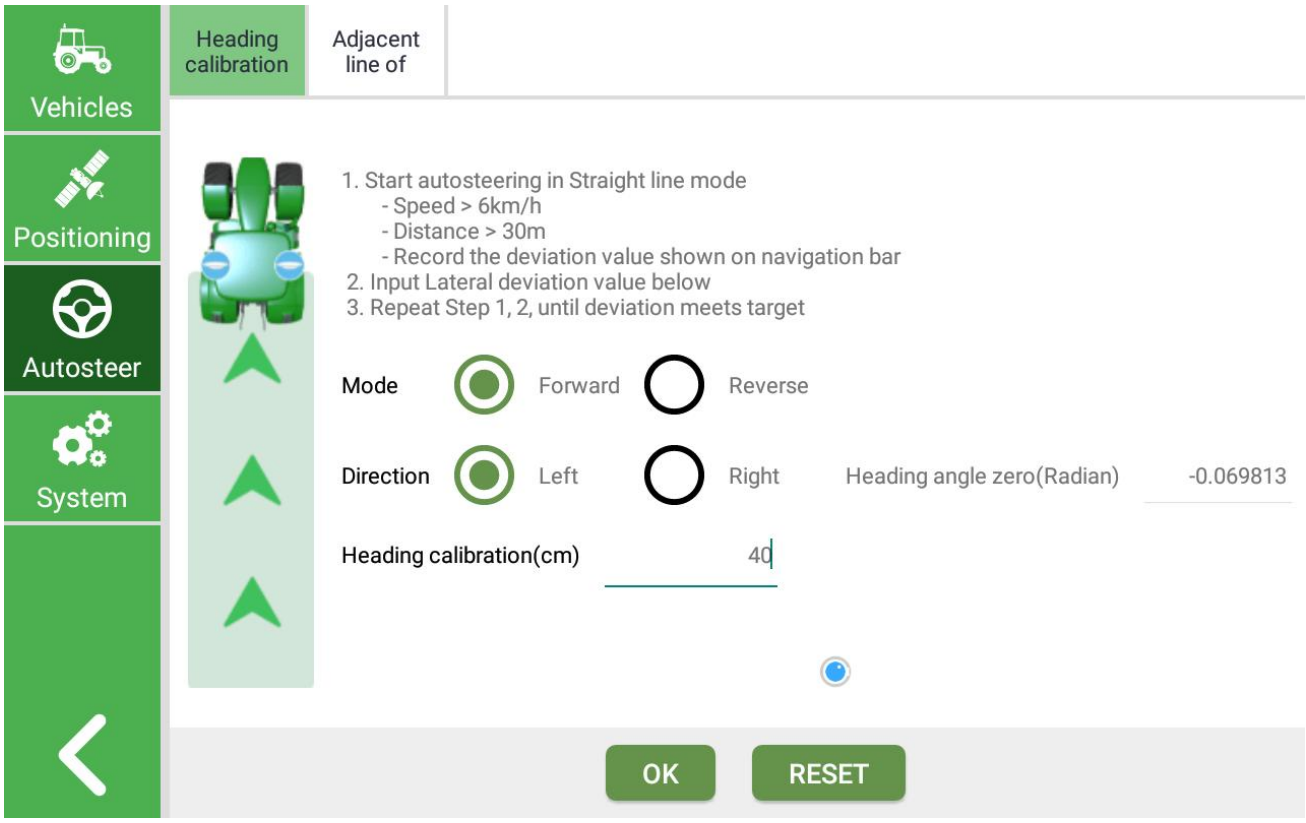
3.6 Error adjustment during driving

Manual heading calibration

Perform the operation after automatic course calibration. when the following conditions occur during the operation, the error value needs to be entered manually:

The change of lateral deviation value in the main interface, such as: 0.00m→0.20m→0.30m→0.40m→0.00m→0.20m→0.30m→0.40m(When the maximum value is reached, it suddenly returns to 0)

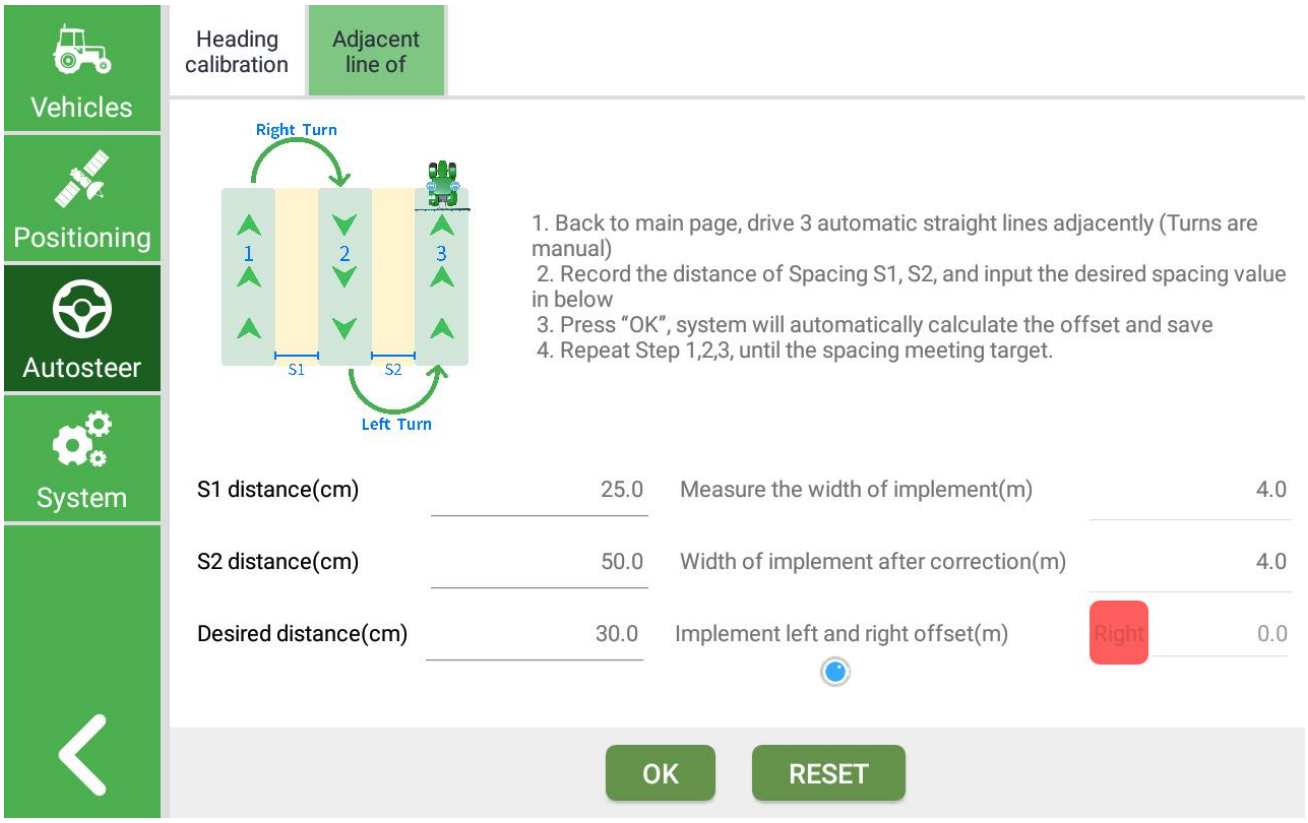
At this time, we need to input the maximum value before it returns to 0, and the software will automatically calculate the heading angel zero and correct it.



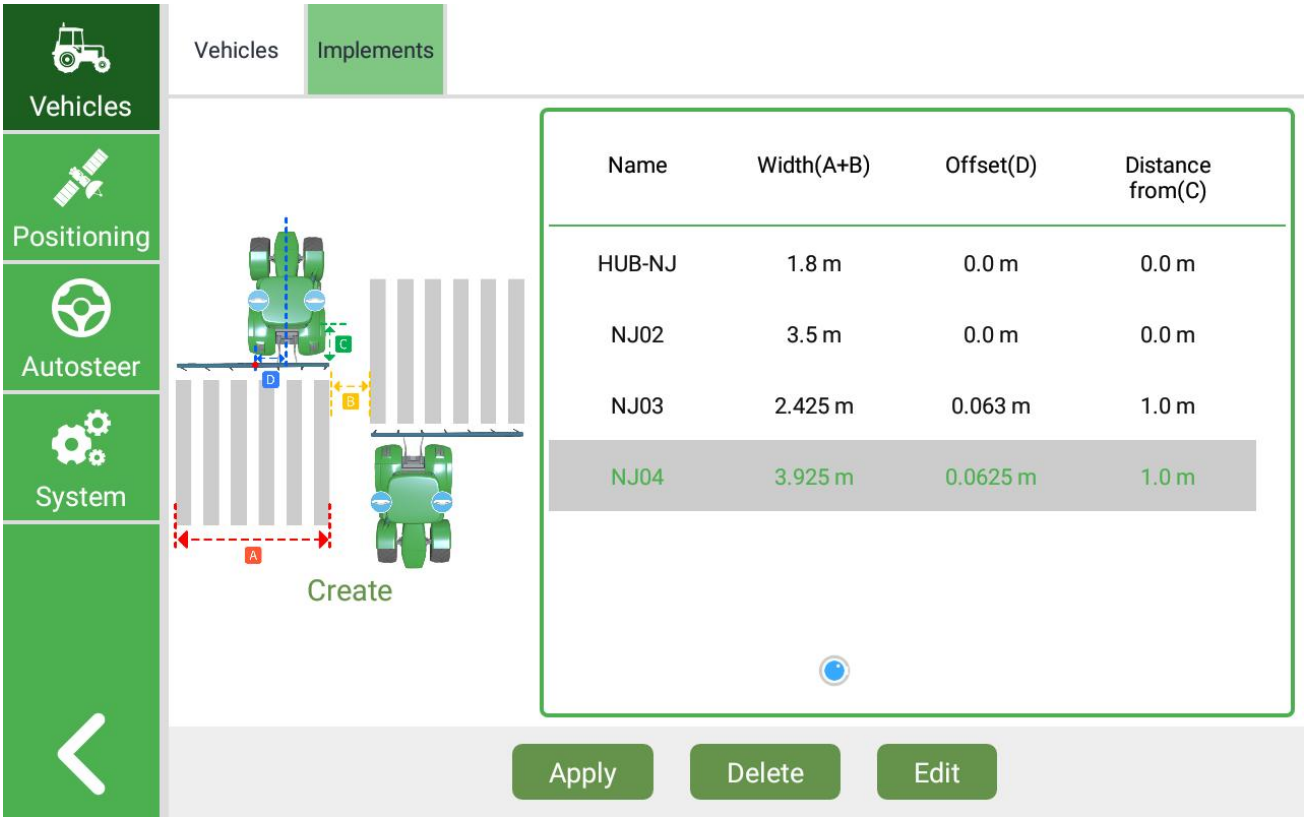
Adjacent line of error adjustment

Back to main page, drive 3 automatic straight lines adjacently(Turns are manual).Record the distance of spacing S1,S2,and input the desired spacing value in below. Press ” **OK** ”, system will automatically calculate the offset and save. Repeat step before , until the spacing meeting target.

S1, S2 is the actual measured value, Desired distance is your expected value. Input them , and click “ ***ok***” , it will automatically calculate the later correction value.



At this time, the parameters in the farm tool settings also change accordingly. Click ***Apply.***



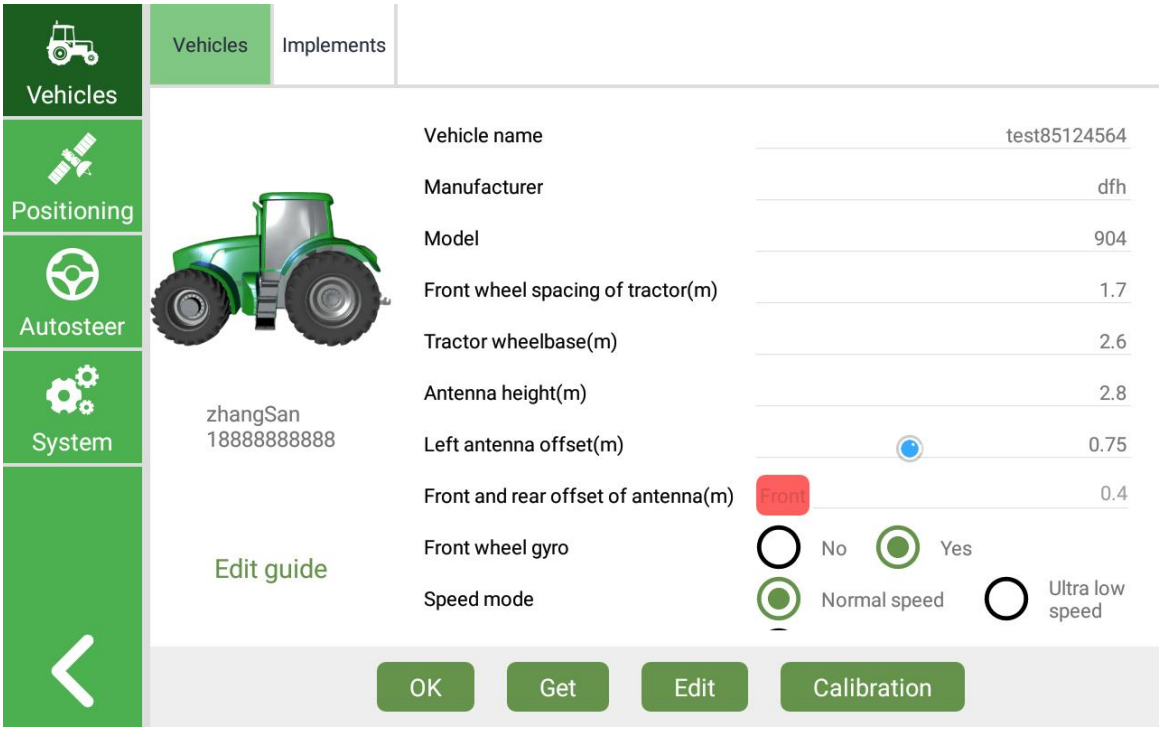
After calibration, formal operation can be started

4 Basic function

4.1 Vehicle management

4. 1. 1 Vehicles

Click ***Meau***> ***Vehicle management***, choose ***Edit guide*** on the left or ***Edit*** and start editing the model of agricultural machinery.

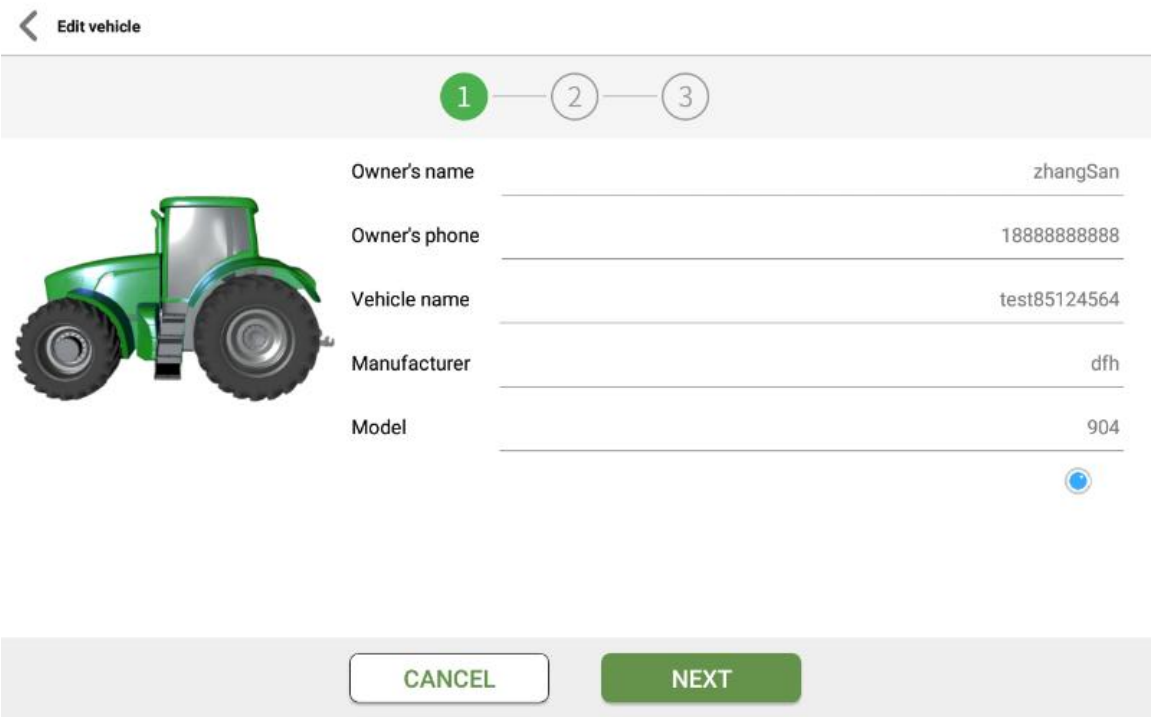


"Get": The previously set Vehicles parameters will be saved in HUB. Click ***Get*** to get the previous configuration

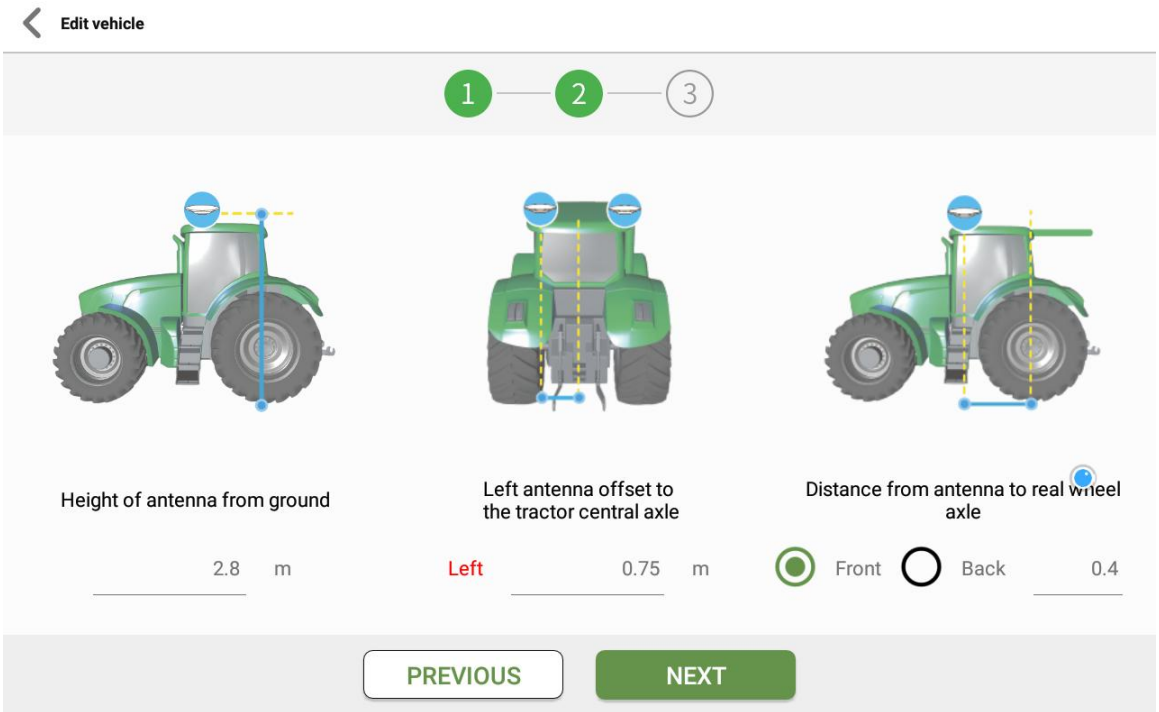
"Edit": Click ***Edit*** to modify Vehicles parameters directly in the current interface without resetting

"Calibration": Calibrate the machine, please refer to ***3.3***

Create user information.



Create antenna and body information.



"Height of antenna from ground": Vertical distance from antenna to ground.

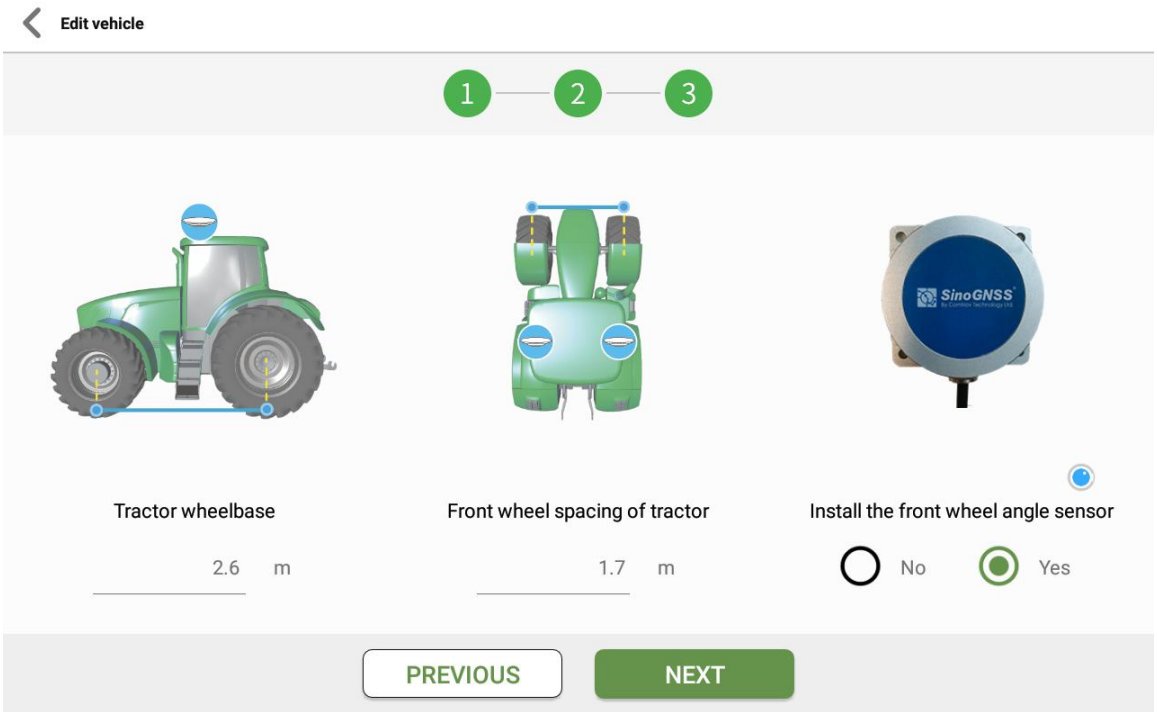
"Left antenna offset to the tractor central axle": Half the horizontal distance between two antennas(The left and right distance should be equal, the fixed value is 0.75m, and the center should coincide with the center of agricultural machinery)

“Distance from antenna to real wheel”: Horizontal distance from antenna to rear wheel center

“Tractor wheelbase”: Horizontal distance from front wheel axle center to rear wheel center of gravity

“Front wheel spacing of tractor”: Distance between two front wheels

“Install the front wheel angel sensor”: Select “Yes”

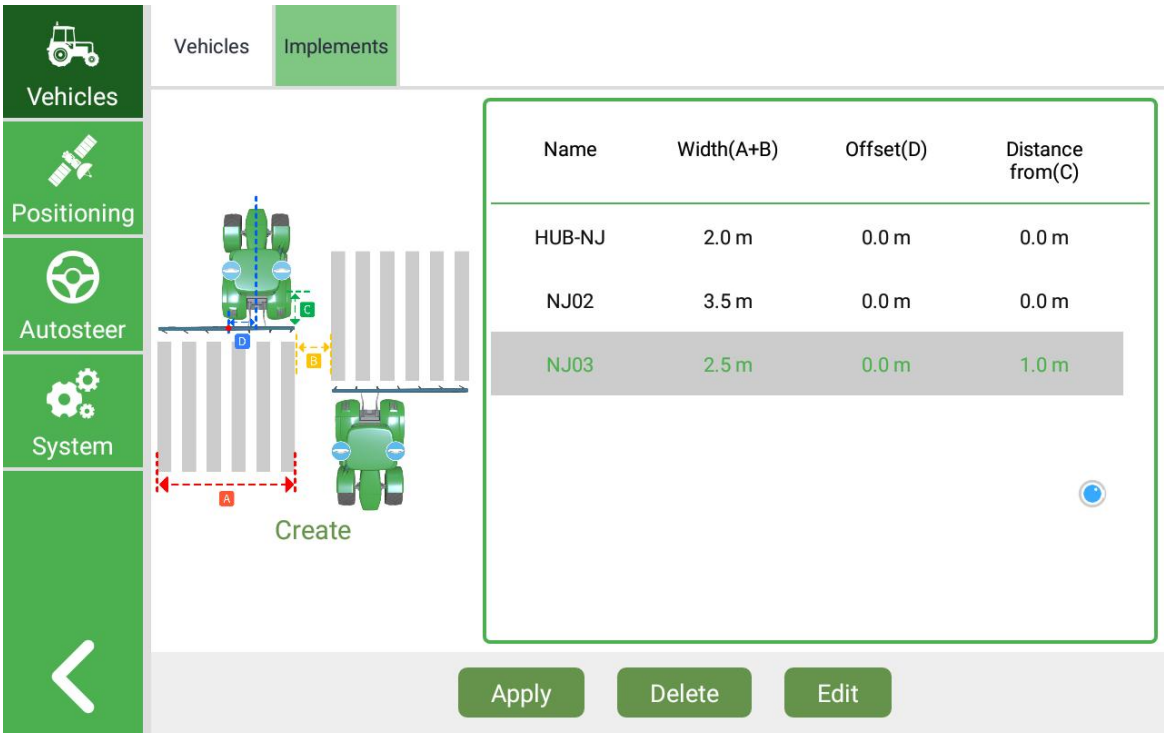


After editing, click ***Next***, return to the interface ,and click ***OK***

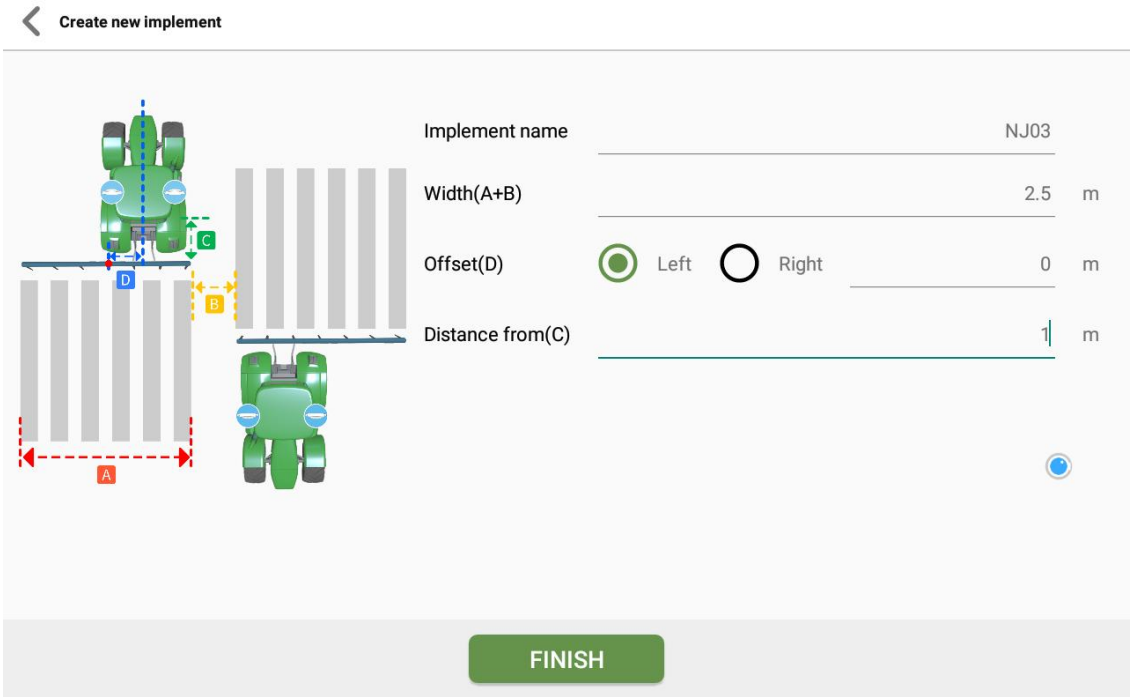
4. 1. 2 Implement

After creating vehicle, you need to create implement.

Click ***MEAU*** > ***Vehicle*** , choose ***Implement***.



Click ***Create*** button, and follow the prompts to enter the information.

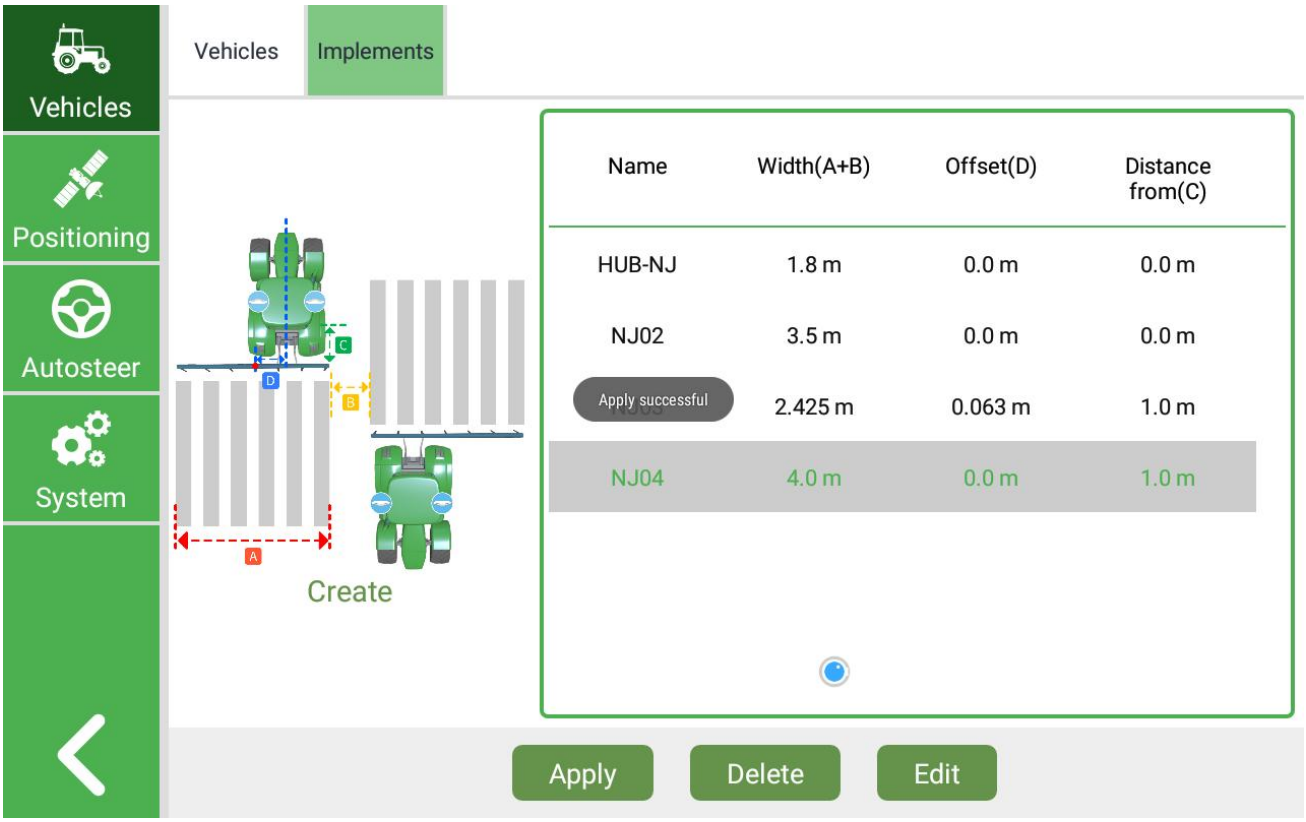


“Width(A+B)”: (A)Agricultural implement + (B)Adjacent line

“Distance(C)”: Horizontal distance from rear wheel center to agricultural tool

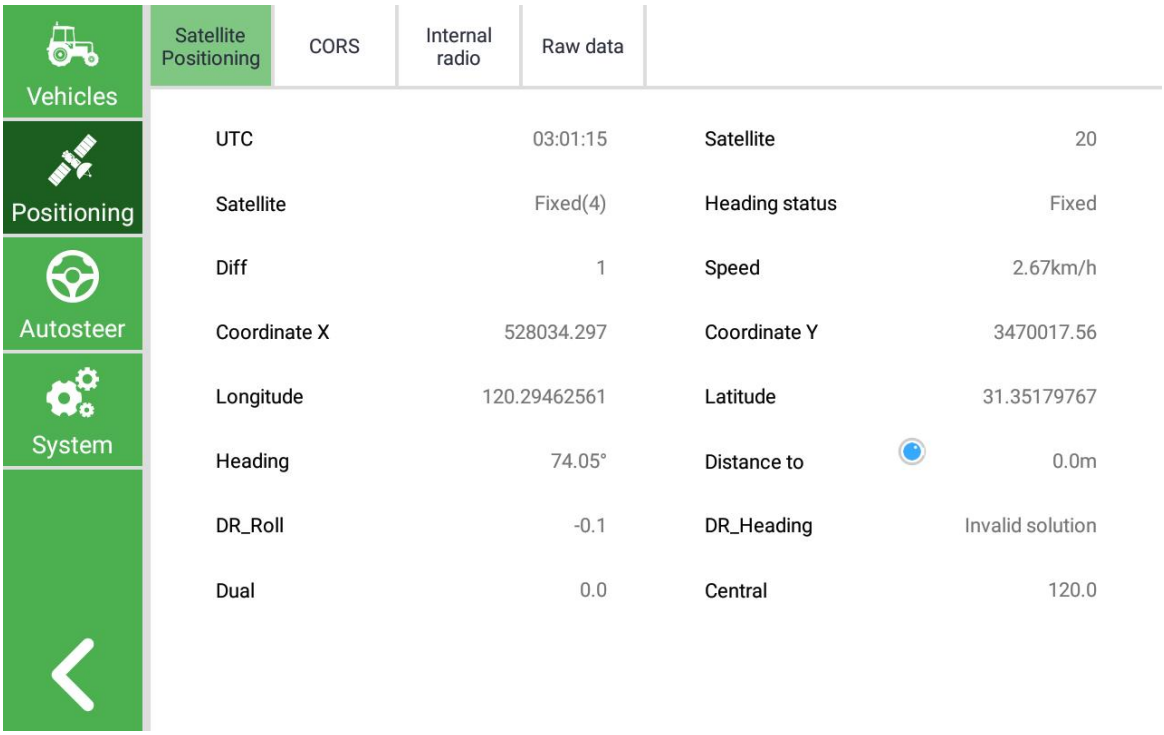
“Offset(D)”: Offset distance from the center of agricultural implements to the central axis of the vehicle

After finishing creation, select the implement you want to use, click ***Apply*** button, and the implement information turns green to indicate that the application is successful.

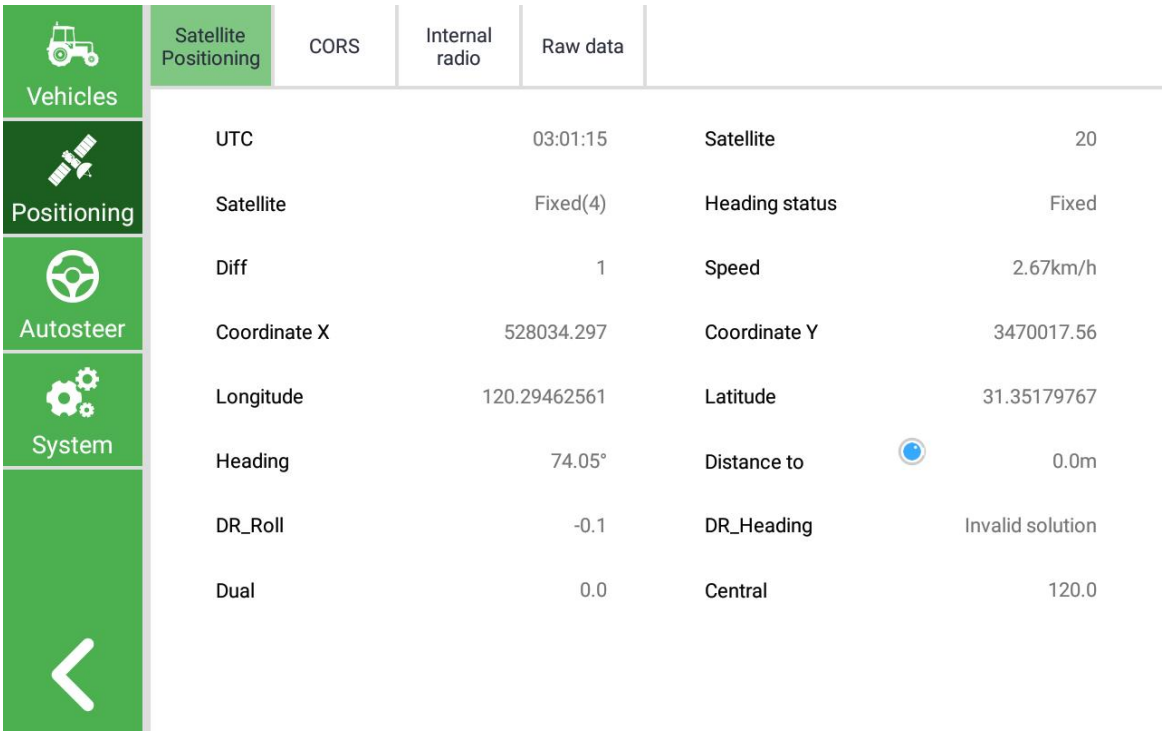


4.2 Satellite Positioning

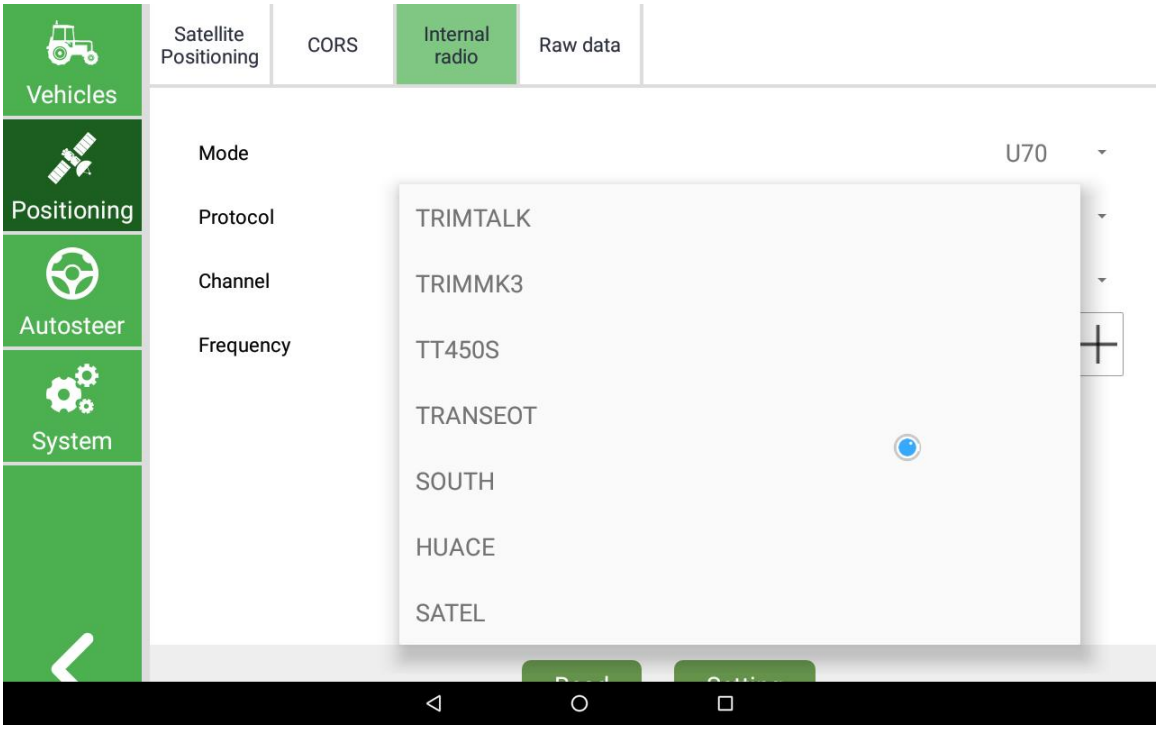
Click ***Manual*** > ***Positioning***



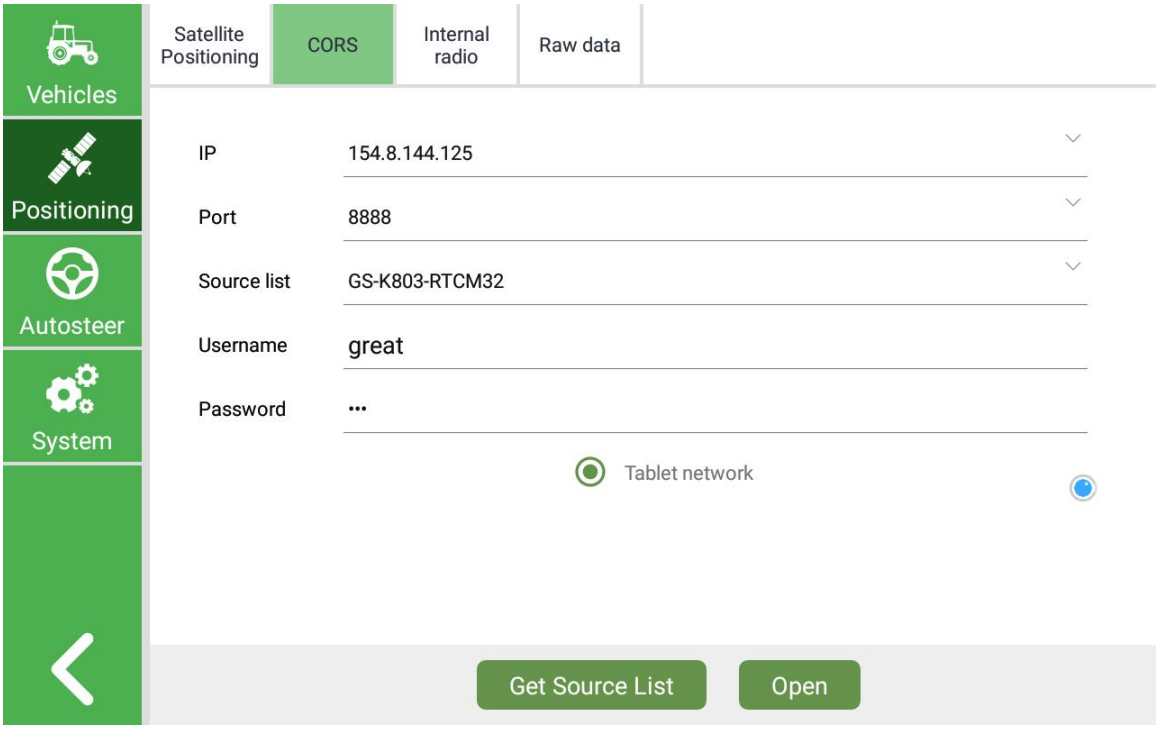
(1) Click ***Satellite Positioning*** to check satellite positioning status.



(2) Click ***Internal radio*** to configure radio information and get a **fixed** solution. Choose the correct channel and protocol. Then click ***setting*** >***read*** to receive the correction data from base station.



(3) Click ***CORS*** to configure **IP, port, source list, username and password**. Use SIM card and then click ***Get Source List***. After that, you can get the CORS station , choose a stable mount point ,then click ***Open*** . Check if get a **fixed** solution.



(4)Click Raw data to check the message from board.

4.3 Autosteer Parameter calibration

Due to the antenna installation error, the installation error of the body angle sensor, and the matching of agricultural implement mounting. In order to ensure the effect of automatic driving, calibration is required before automatic driving, including two calibrations, heading calibration and adjacent line of implement.

The adjacent line of implement needs to mount the implement for calibration. This calibration work can be performed before the actual operation, and the calibration needs to be carried out in the spacious and barrier-free farmland. Heading calibration can be calibrated after installation, and calibrated on a flat road.

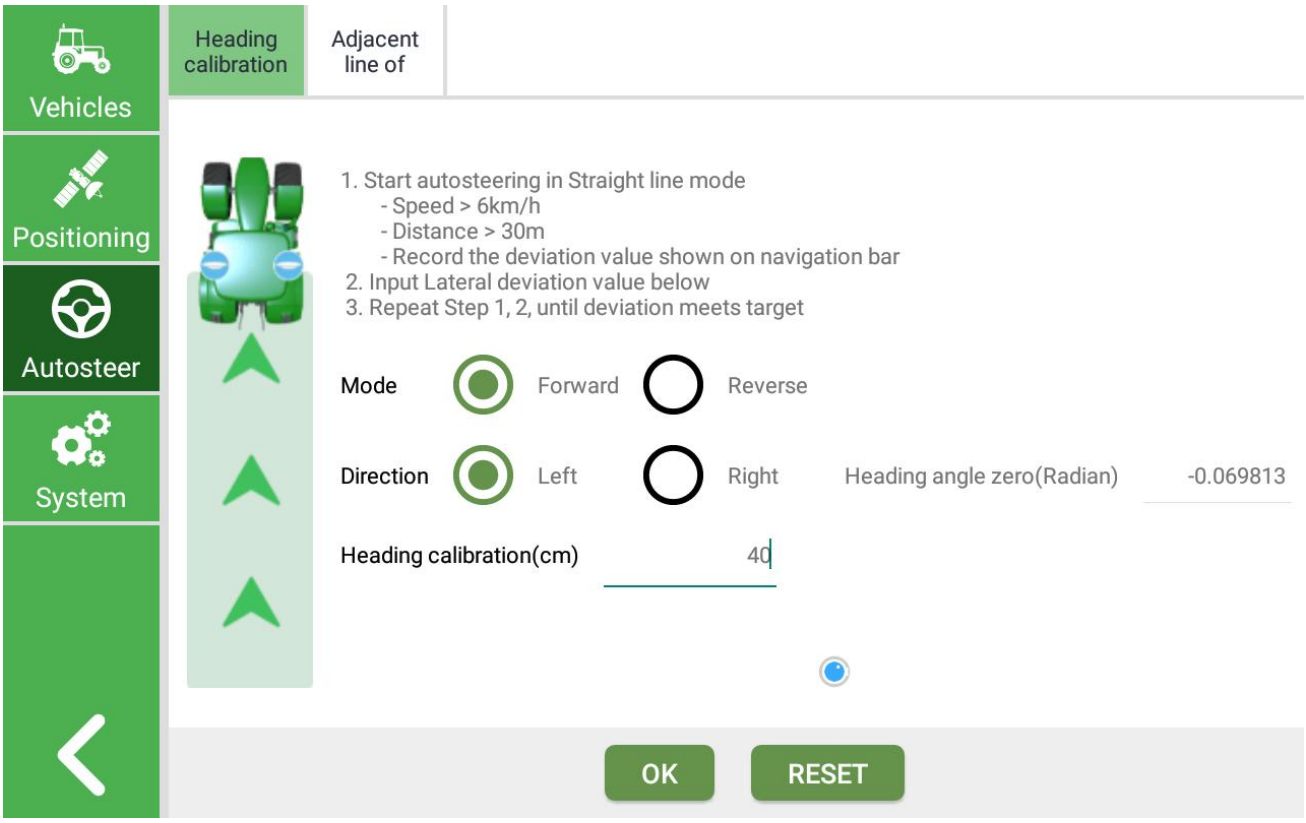
4.3.1 Heading calibration

The heading calibration is mainly to calibrate the installation error of the dual antennas to ensure that the heading angle output by the dual antennas is consistent with the true heading angle of the vehicle.

Turn on automatic driving on a flat concrete road. The speed is not less than 6 km/h. The length of the road is not less than 30 m.

The heading calibration interface is shown in the figure below. Please read the calibration procedure and method carefully.

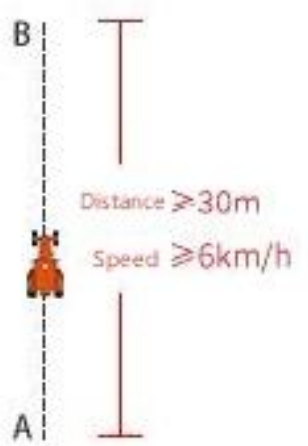
Click ***Menu***> ***Autosteer>Heading calibration***



Return to the main interface and start automatic driving. You need to observe the lateral offset displayed on the main interface, and the observation time should be longer than 30s. Then stop the automatic driving, and manually estimate the average value of the lateral offset during this period of time. Fill in the left or right distance in the heading calibration interface, and click ***OK***. Turn on the automatic driving again to observe the effect and repeat this step until the lateral offset meets the actual work requirements.

Required standard: On a flat road, the vehicle speed is about 6 km/h, the lateral offset should be kept within ±1cm, and the deviation probability of left and right is basically the same. If it is only to the left or to the right, heading calibration is required.

The heading calibration diagram is as follows.

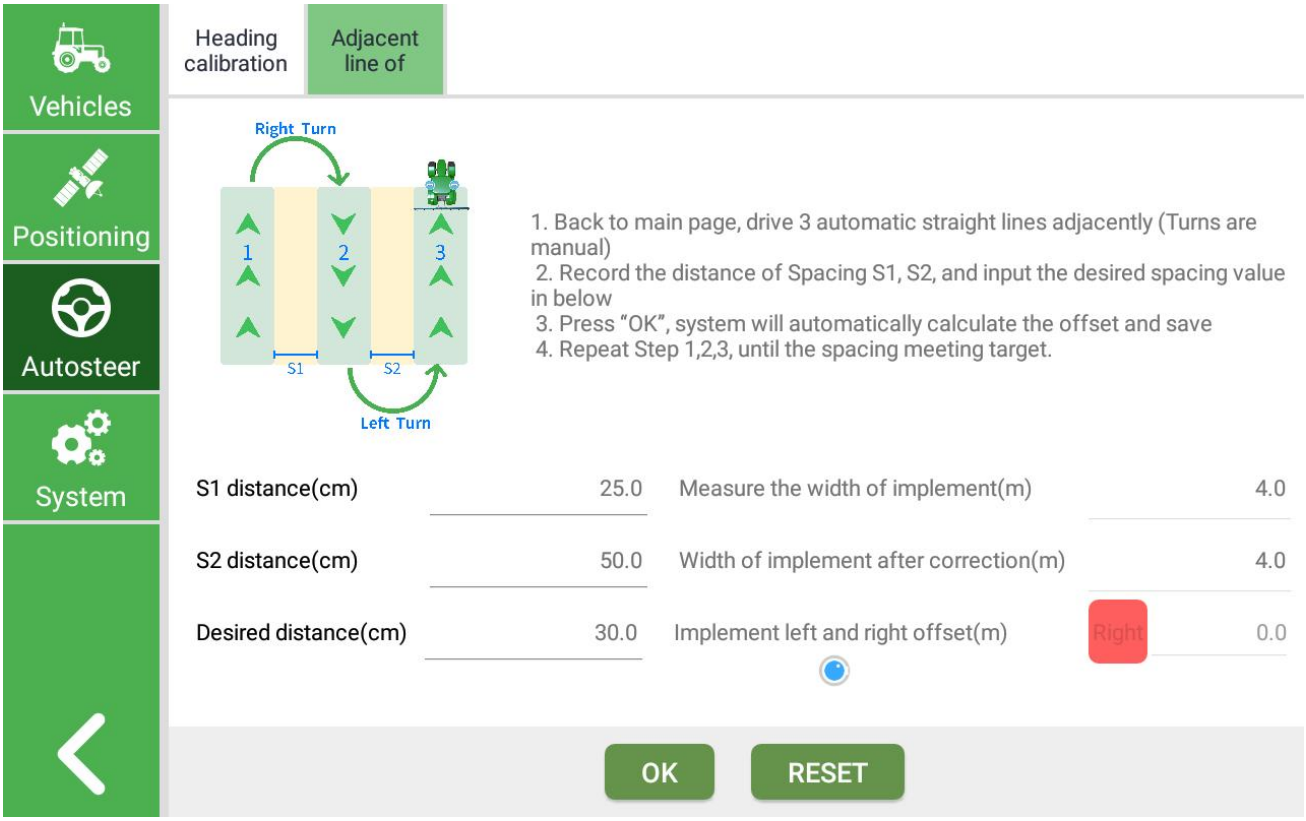


4.3.2 Adjacent line of implement

Click ***Menu***> ***Autosteer>Adjacent line of***

Before the formal operation, the implement must be mounted. After the implement is mounted, the adjacent lines generated by the actual operations need to be tested and calibrated to ensure that the sizes of the adjacent lines are same and meet the actual operation requirements.

The calibration interface of adjacent line is shown in the figure below. Please read the calibration procedure and method carefully.

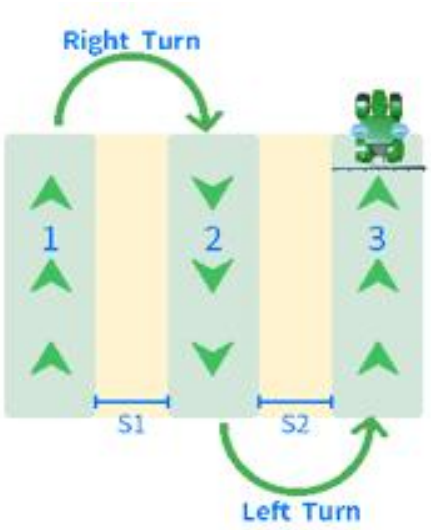


Return to the main interface to start automatic driving, which needs to be tested in farmland.

Select three adjacent roads for automatic driving, record the number of adjacent lines generated after implement operation, fill in the required parameters, and click ***OK*** to complete the calibration.

The adjacent line of implement diagram is as follows.

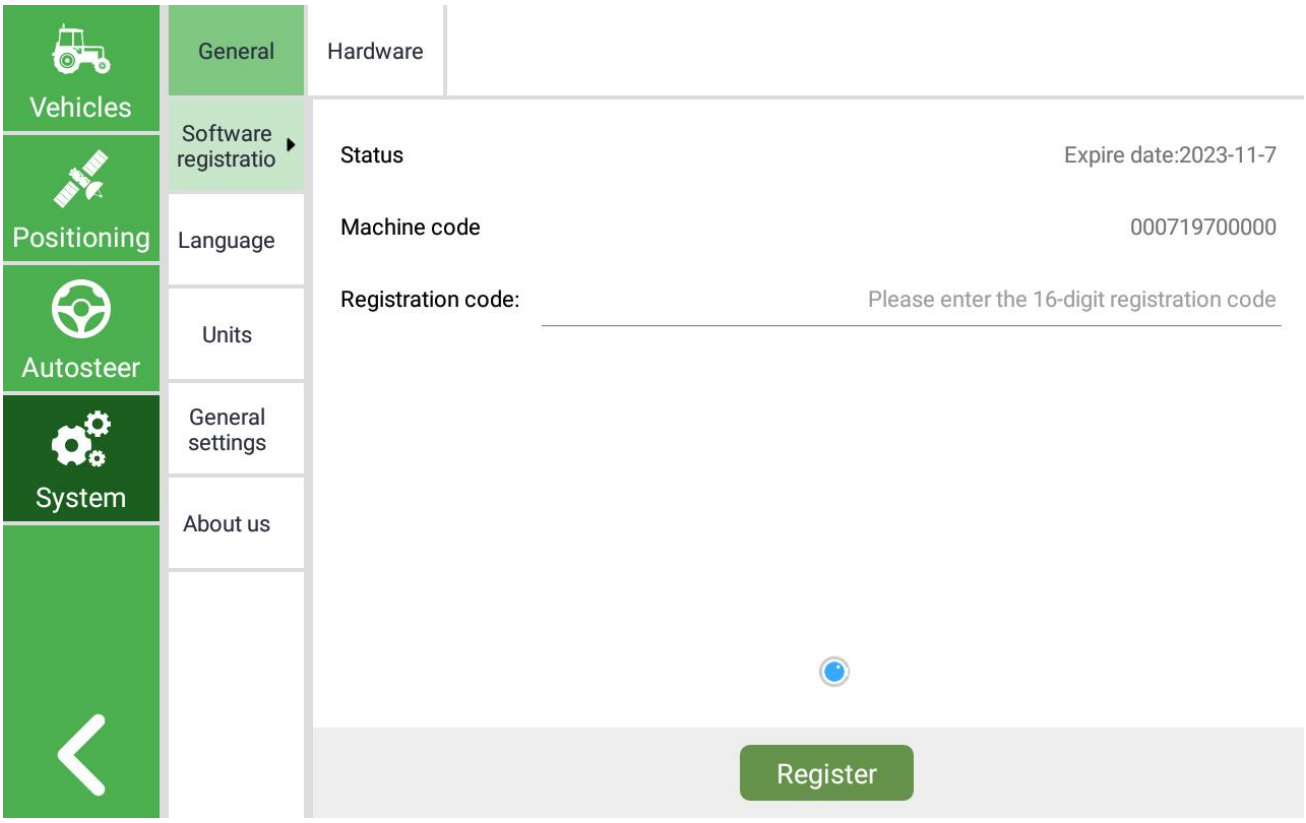
(Tip: After the same tractor is successfully calibrated, there is no need to do attitude calibration, heading calibration and antenna alignment again. The calibration of the implement adjacent line only needs to be calibrated after the implement is replaced. It is recommended to calibrate in the field.)



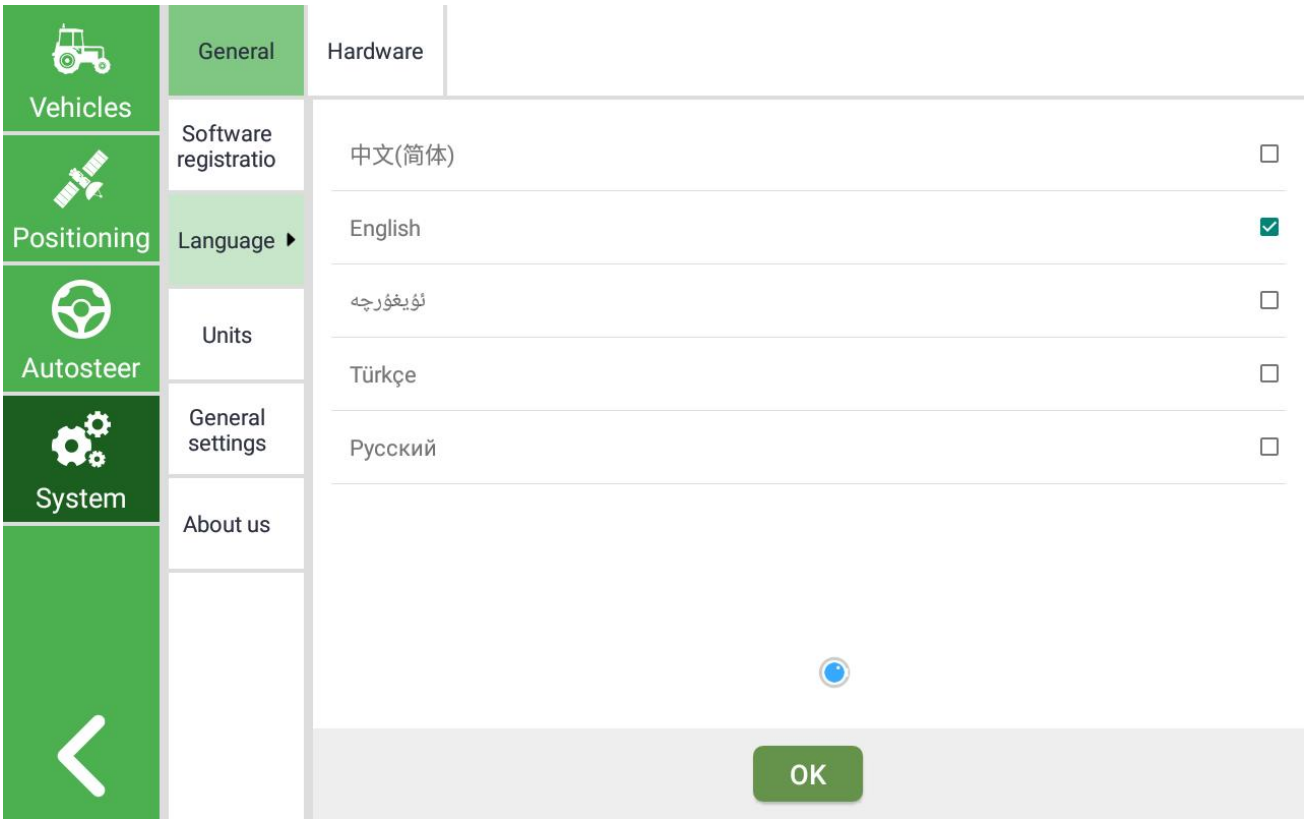
4.4 System Settings

4.4.1 General settings

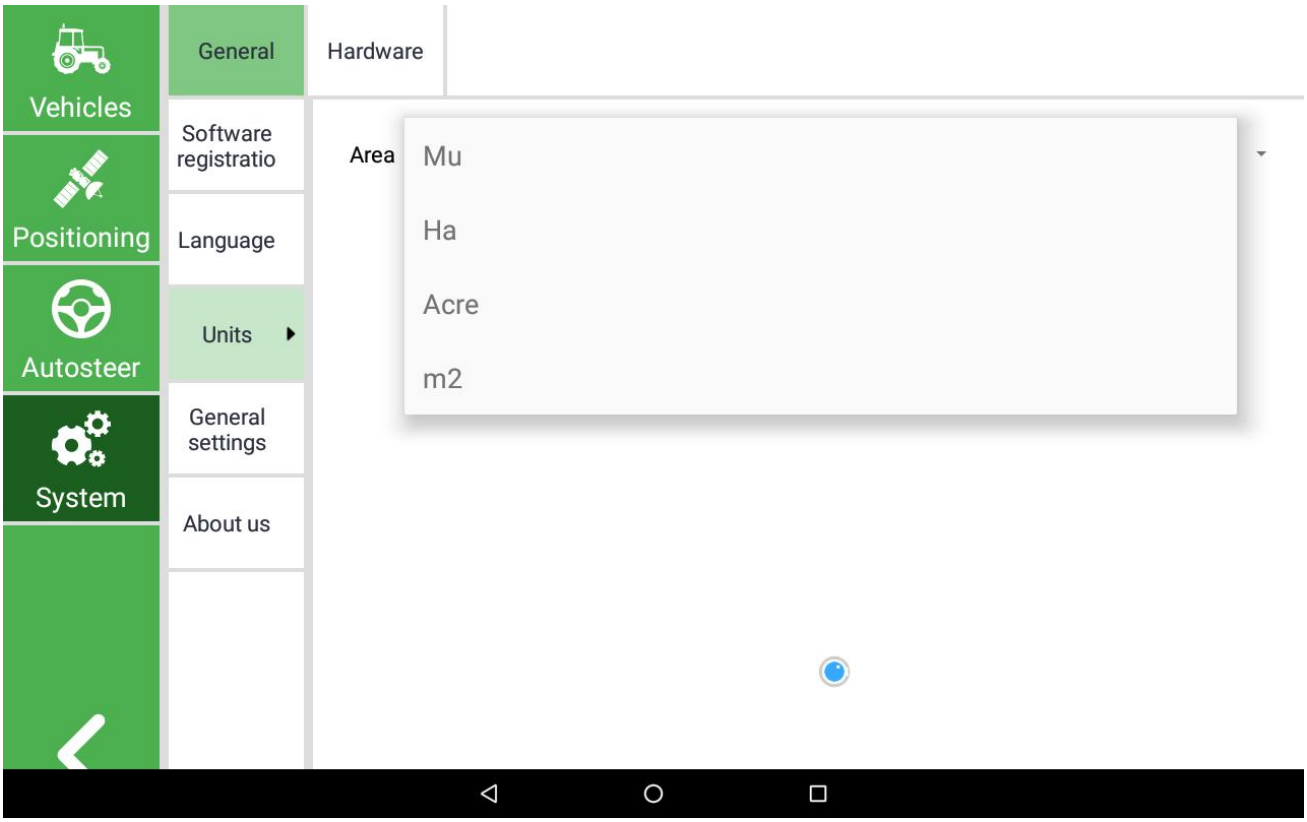
(1) Click ***Software registration***, you can check the current registration status. If the registration code expires or is about to expire, you can contact us to get a new registration code.



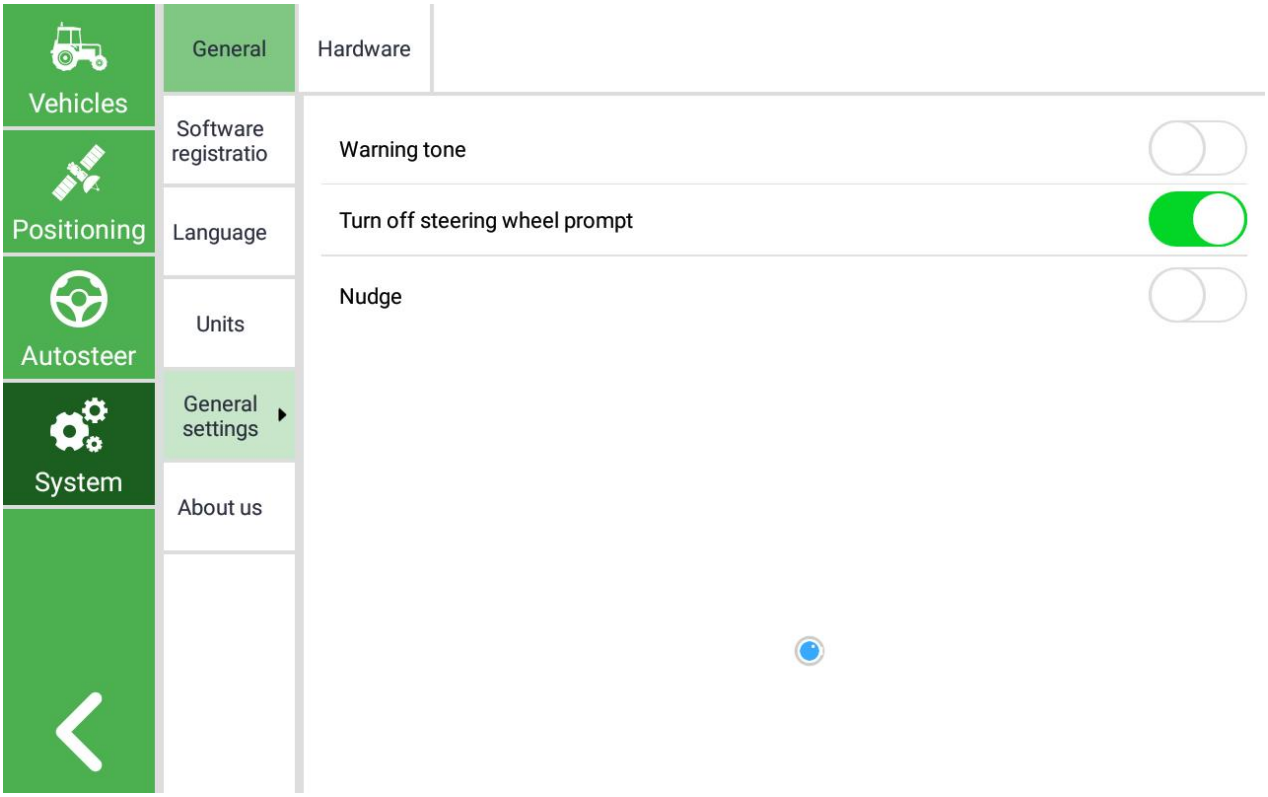
(2) Click ***Language***, we currently provide Chinese, Uygur, English and Turkish.



(3) Click ***Units***, you can select the unit of work area. we currently provide Mu, Ha, Acre, m^2 .

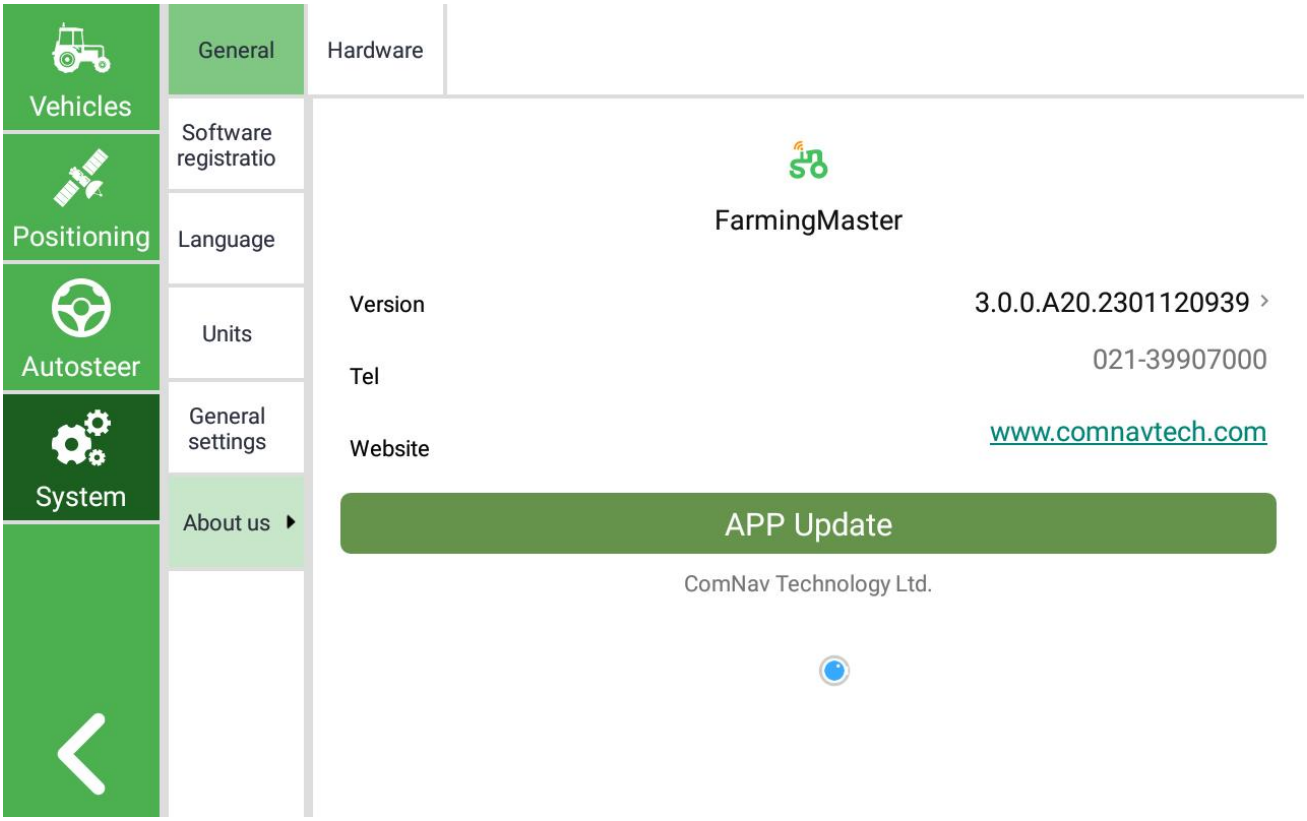


(4) Click ***General settings***, the warning tone and steering wheel prompt can be turned on and off



(5) Click ***About us***, you can check current version of software and our website

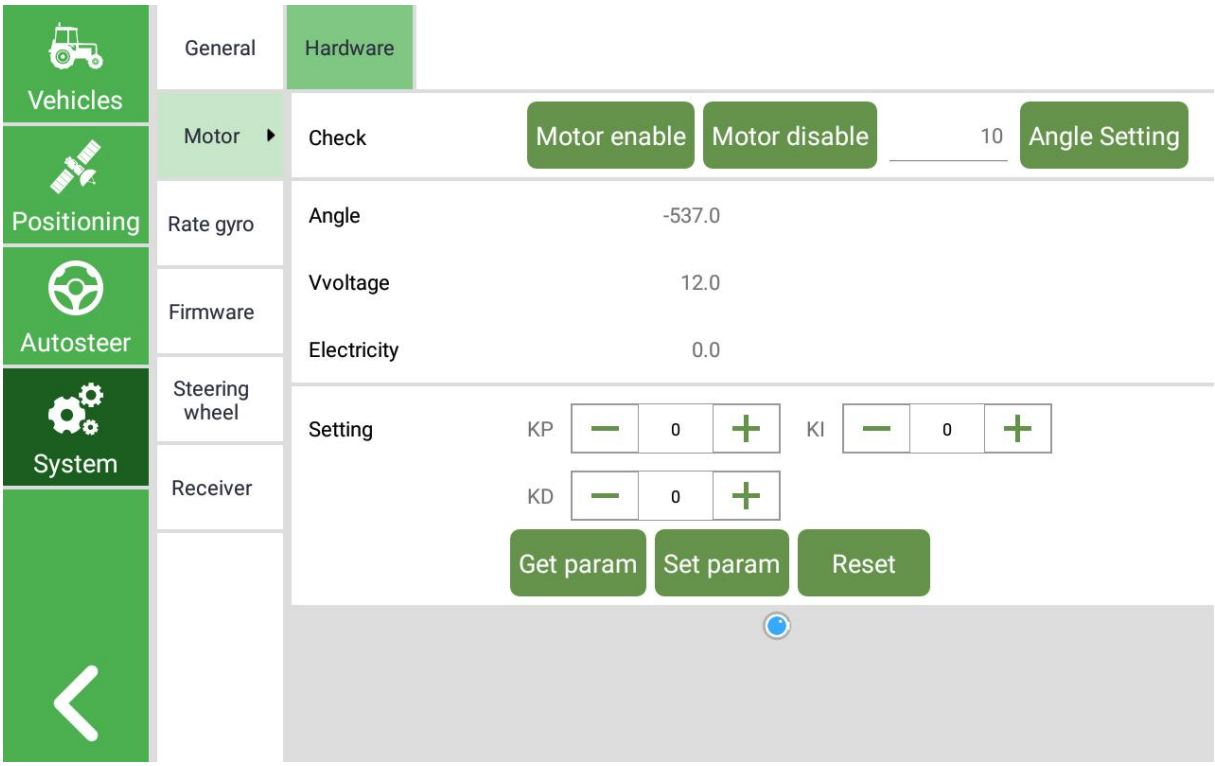
address.



4.4.2 Hardware

Click ***Menu***> ***system>Hardware***

Hardware is mostly used for reference, no operation

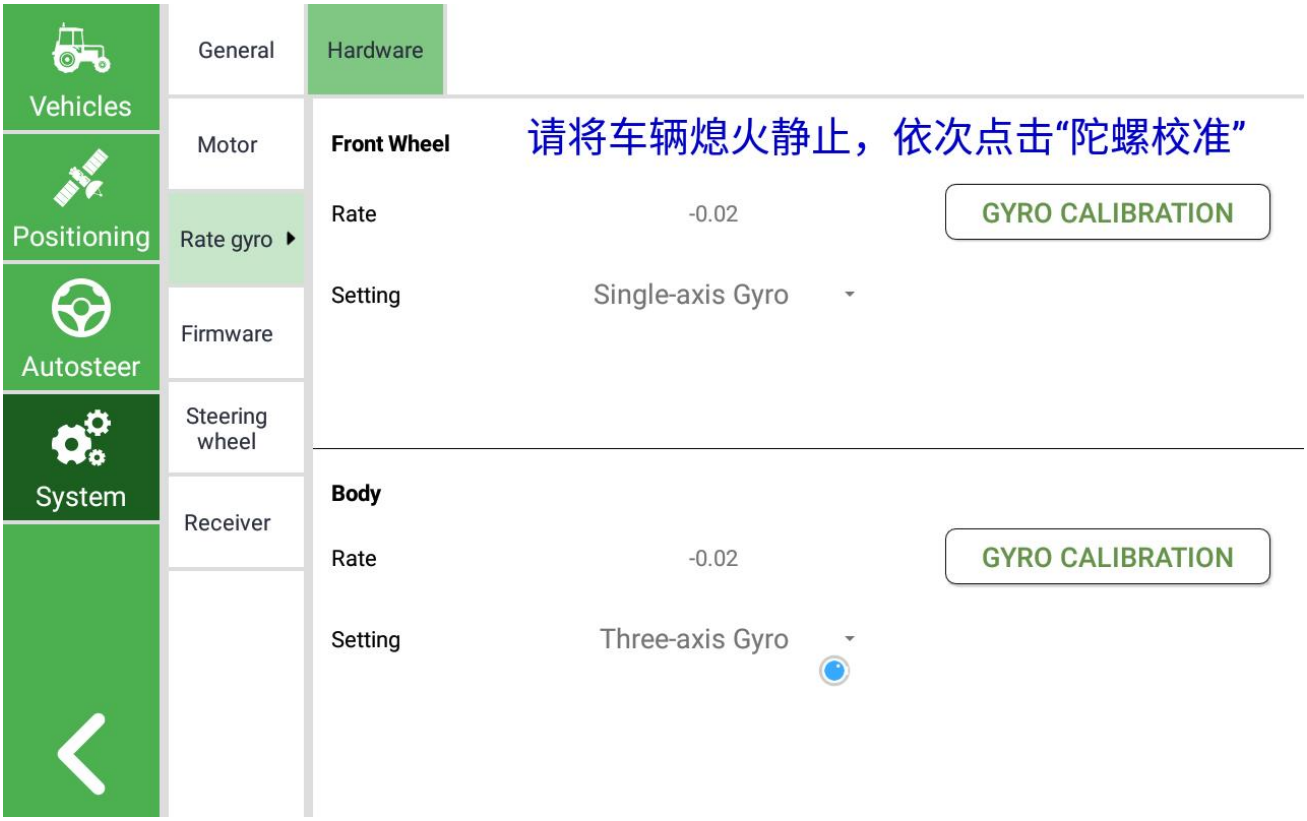


(1) Click ***Motor***, you can check whether the communication of the motor is normal through ***Motor enable***, ***Motor disable*** and ***Angle Setting***.

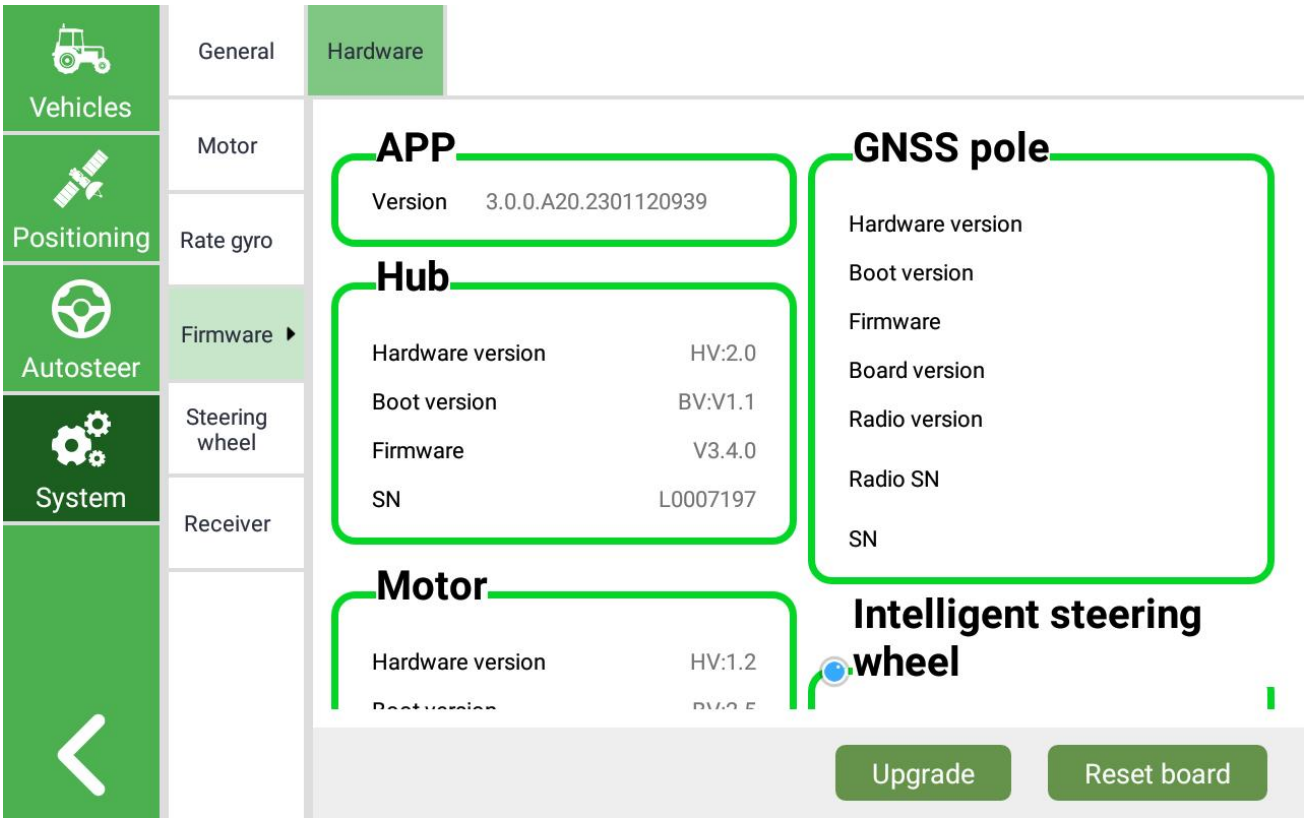
(Usually, this function is only used for maintenance and inspection. Users don't need to pay attention to it)

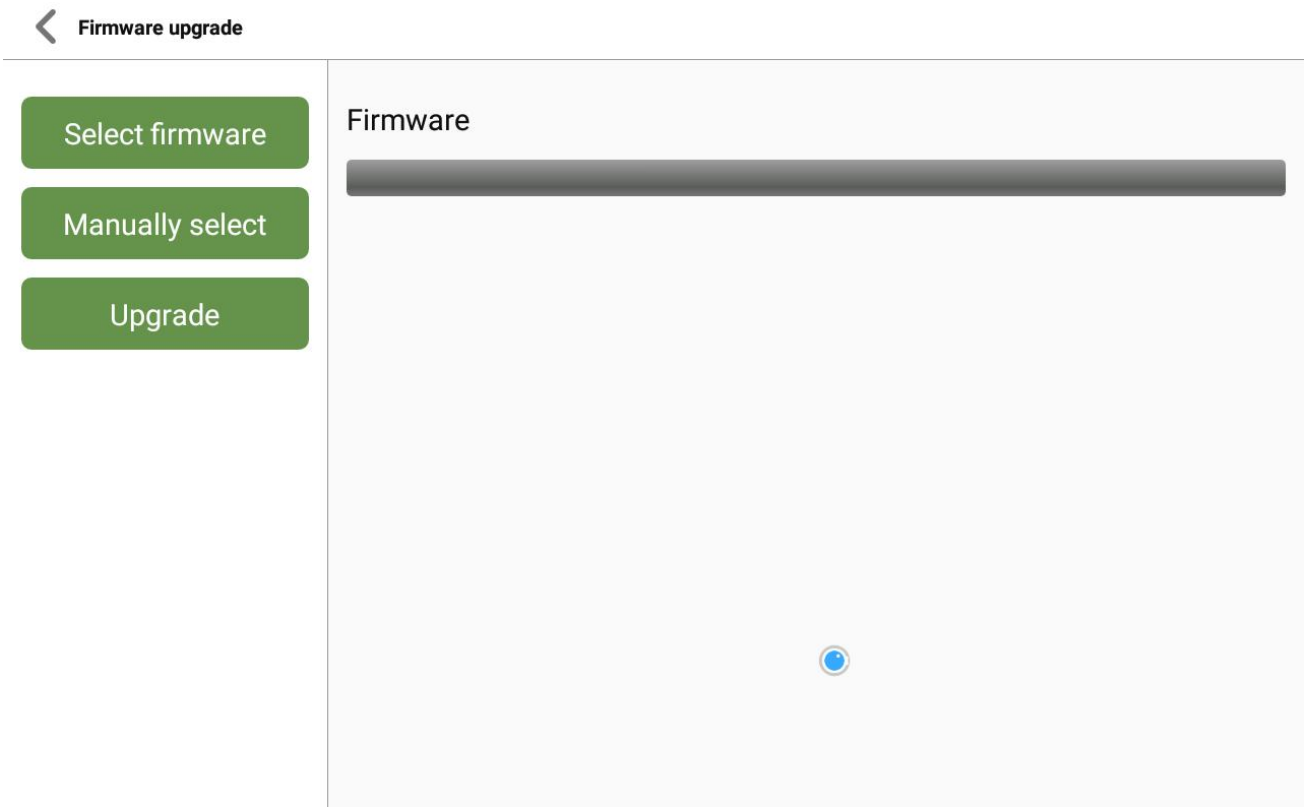
(2) Click ***Rate gyro***, you can check whether the communication is normal by

turning the angle sensor. For details, please refer to 3.3

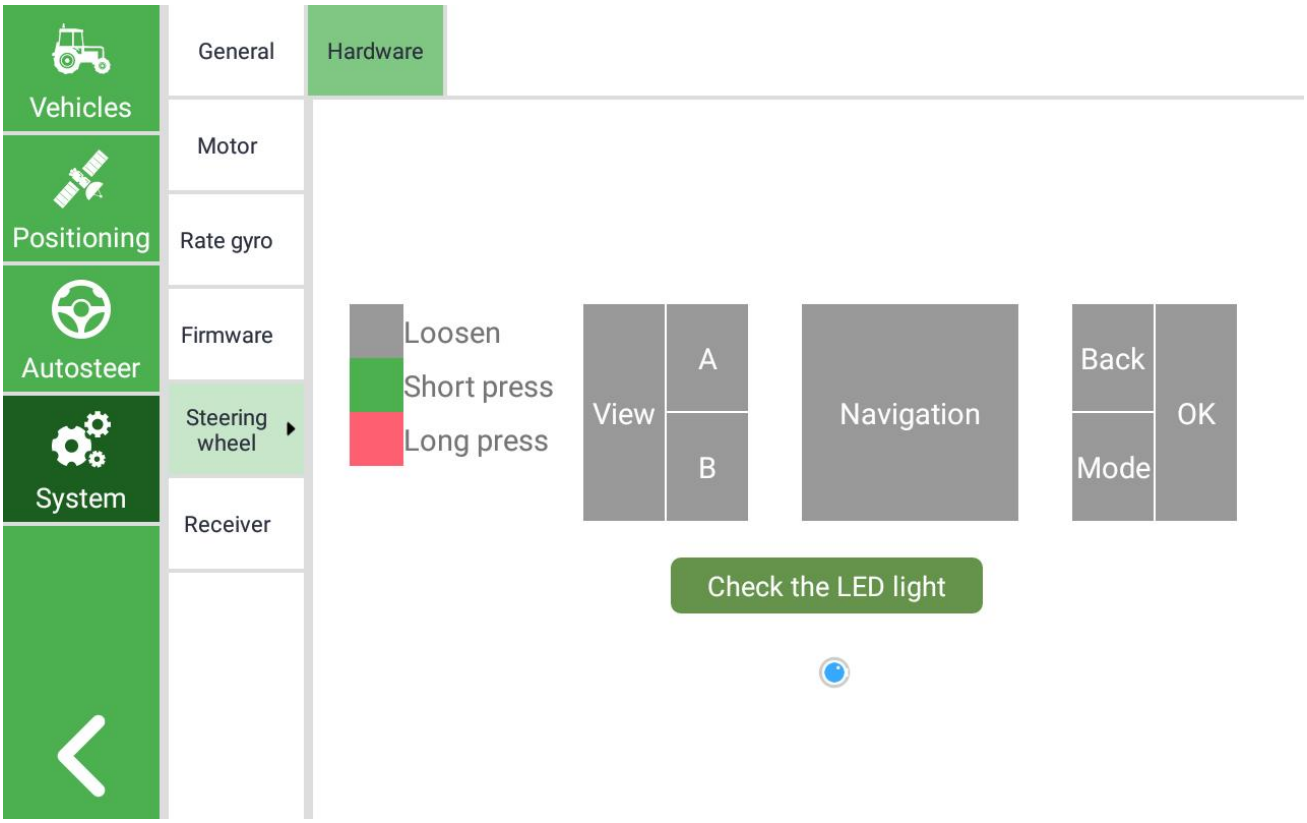


(3) Click ***Firmware***, you can check and upgrade the current firmware.

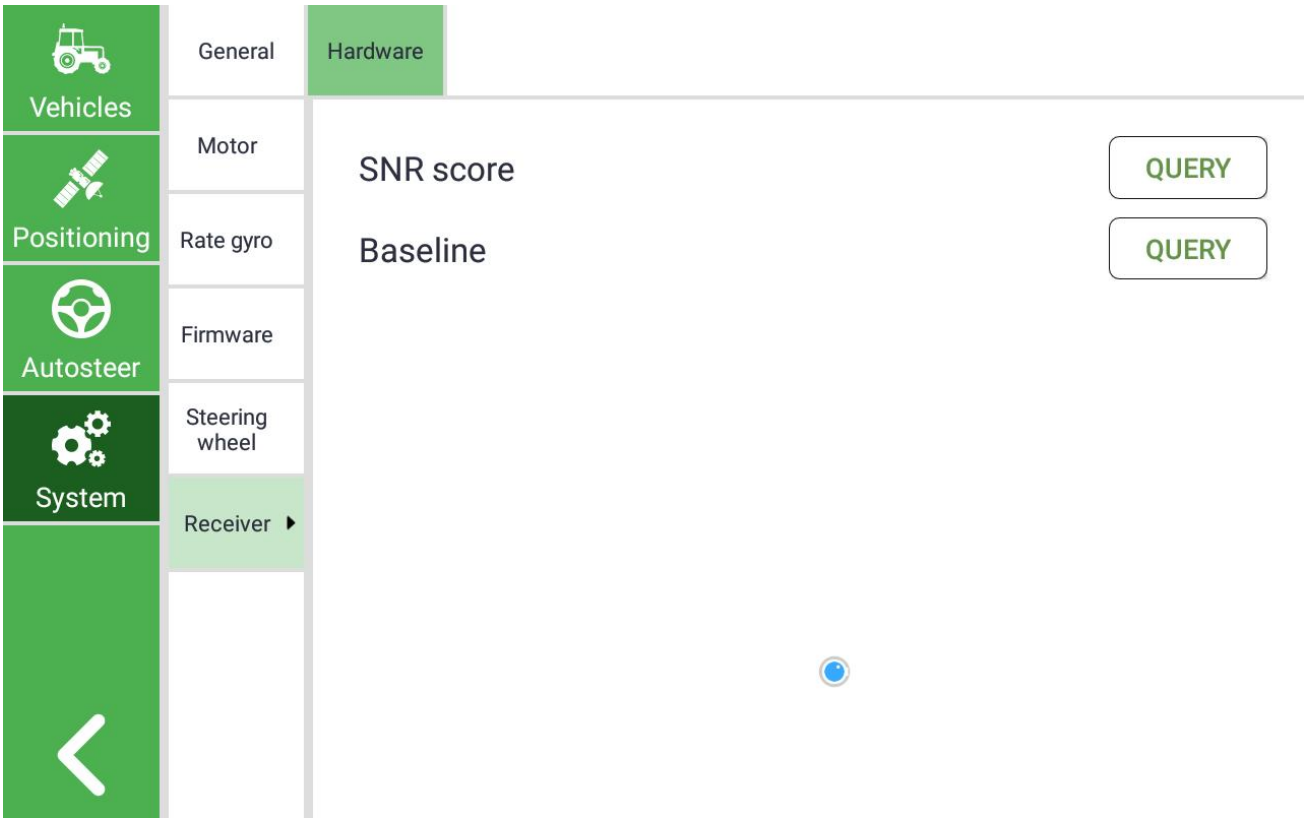




(4) Click ***Steering wheel***, you can check the status of steering wheel.

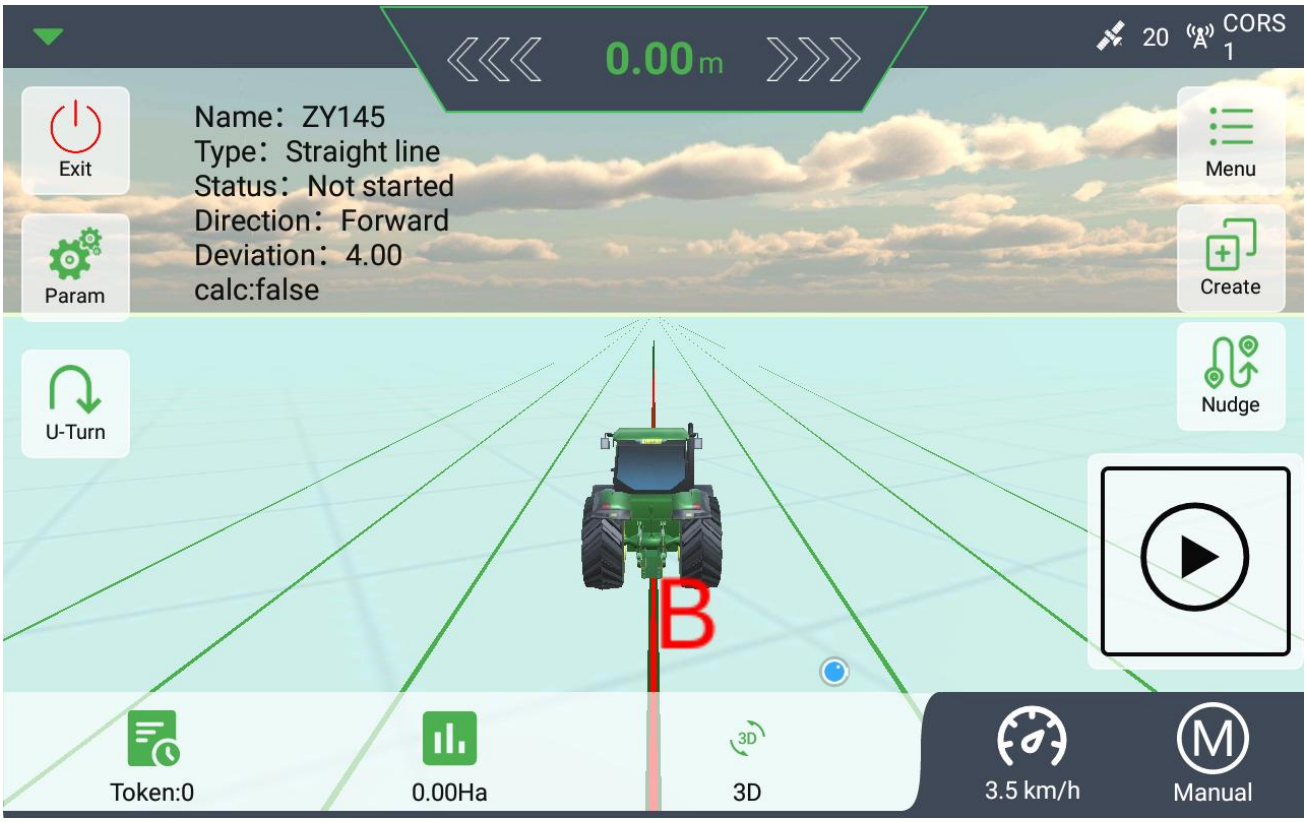


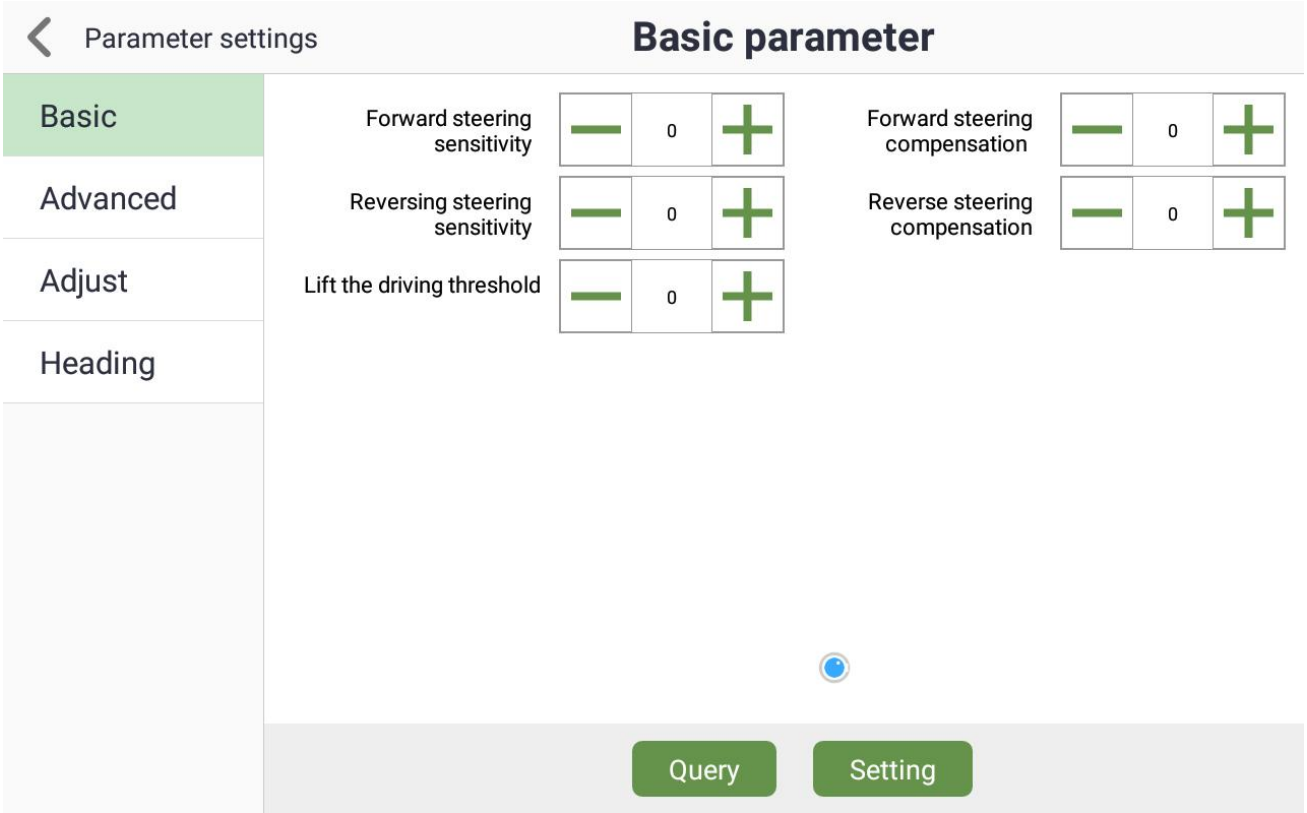
(5) Click ***Receiver***, you can check the SNR score and baseline.



4.5 Parameter Settings

In the main interface, there is a ***param*** button. After you finish the calibration, if you are not satisfied with the result, you can manually adjust it





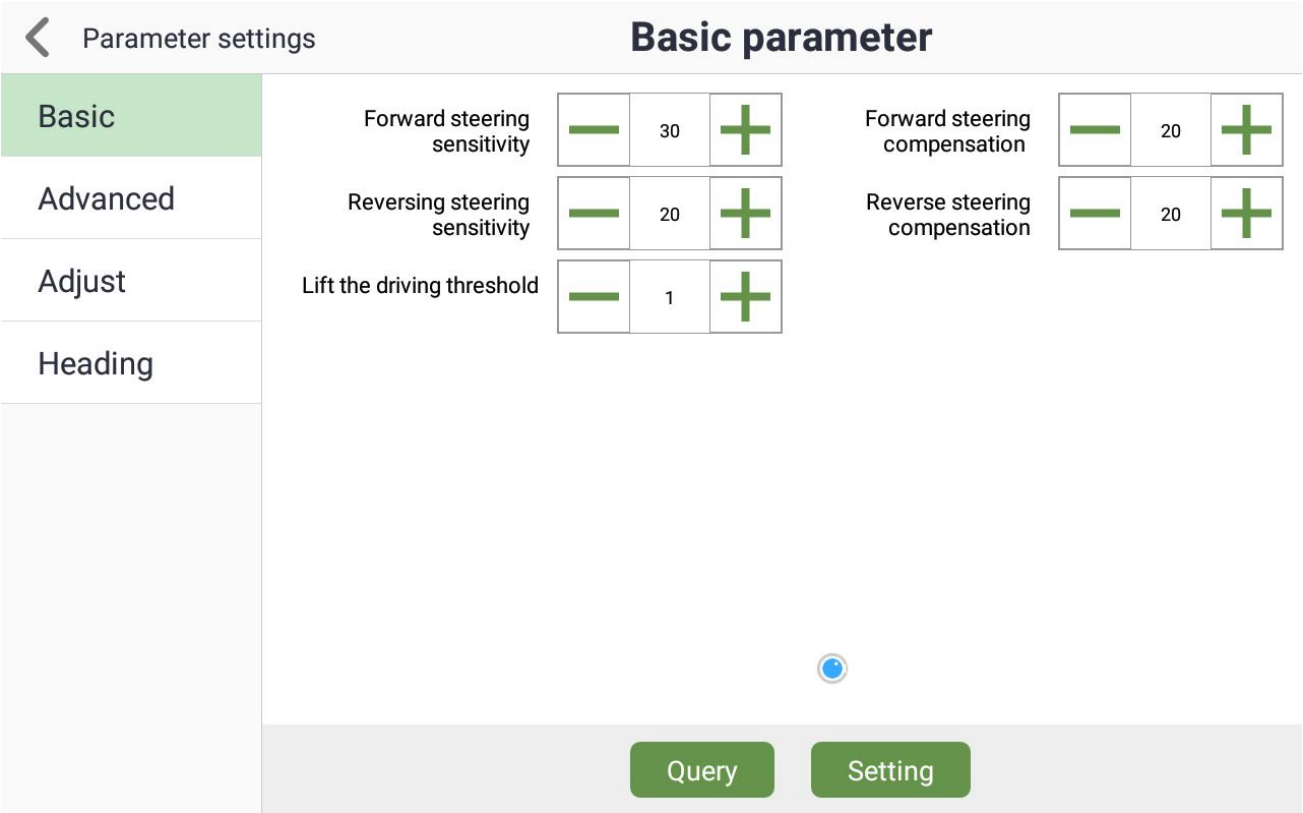
1) Basic parameter

After the adaptive parameter adjustment, the rough fit value will be automatically obtained. Also can manually adjust them.

“Forward steering sensitivity”: How fast or slow the steering wheel turns when the vehicle is moving forward, value(0,+) .The smaller the value, the lower the steering sensitivity of the steering wheel, and the higher the reverse . Usually about 30.

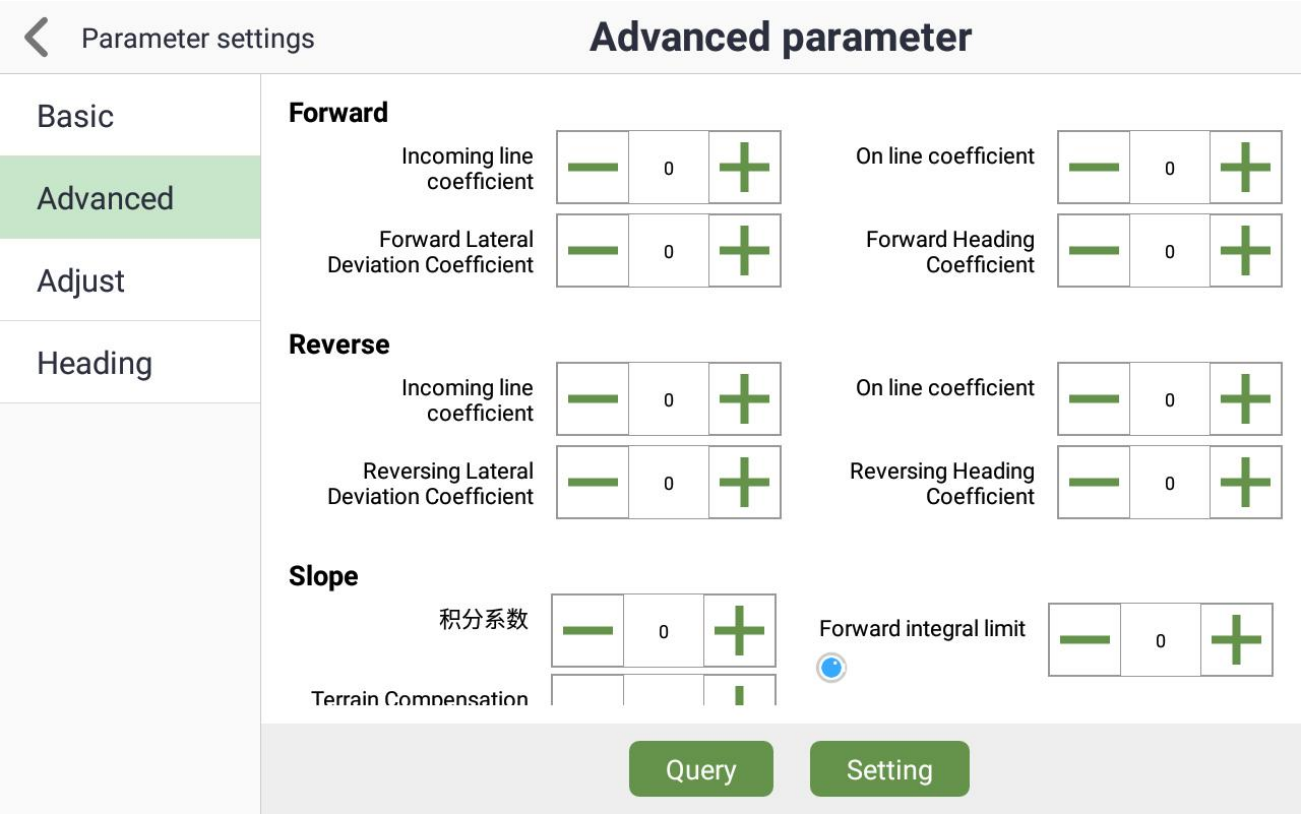
“Forward steering compensation”: Control the degree of steering wheel alignment to prevent the impact of steering wheel automatic steering inertia on driving. Usually about 20.

“Lift the driving threshold”: When in the automatic driving state, manually turn the steering wheel to the left or right to the end, hold for 5-10s, and the automatic driving state will be automatically exited. This value represents how much force is needed to turn the steering wheel.



2) Advanced parameter

Generally, users do not need to change this and keep the default value



3) Adjust

Please refer to 3.3

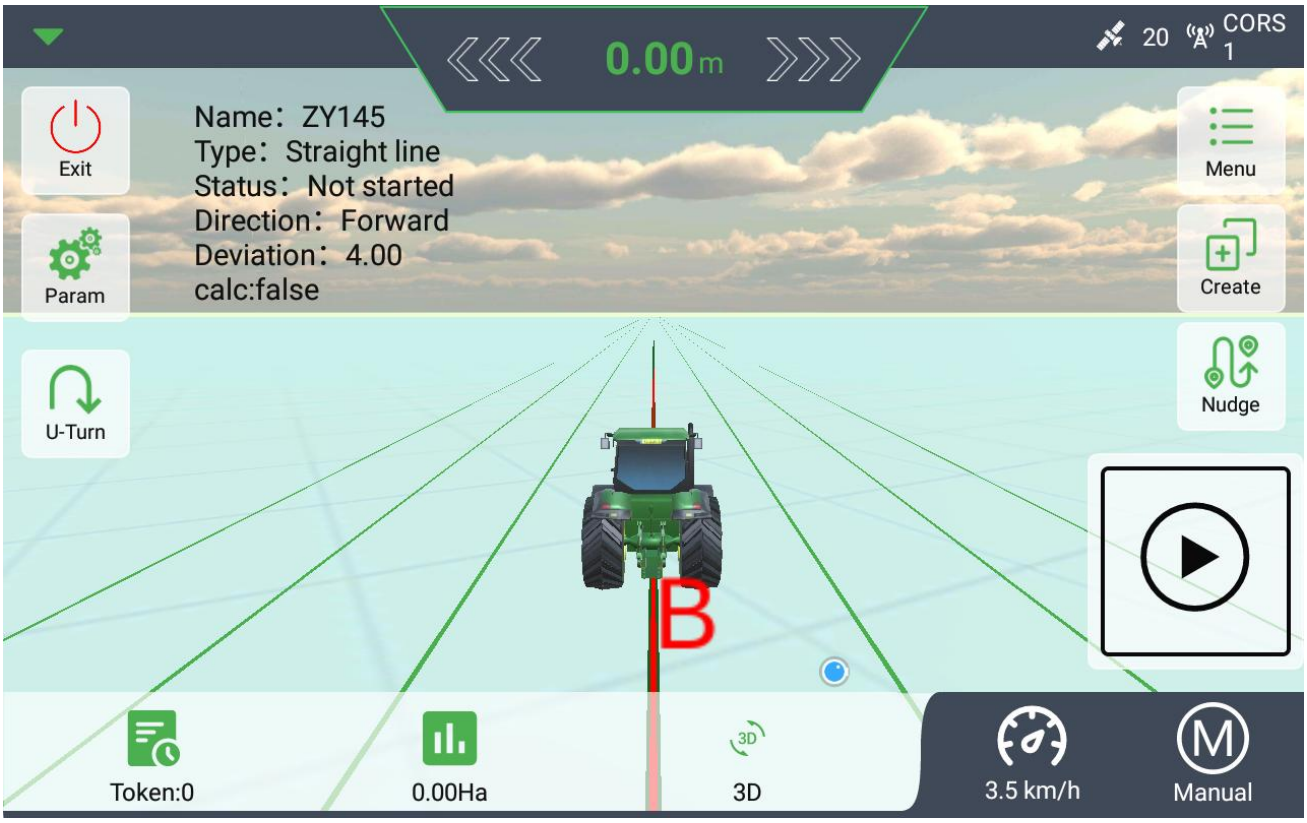
4) Heading

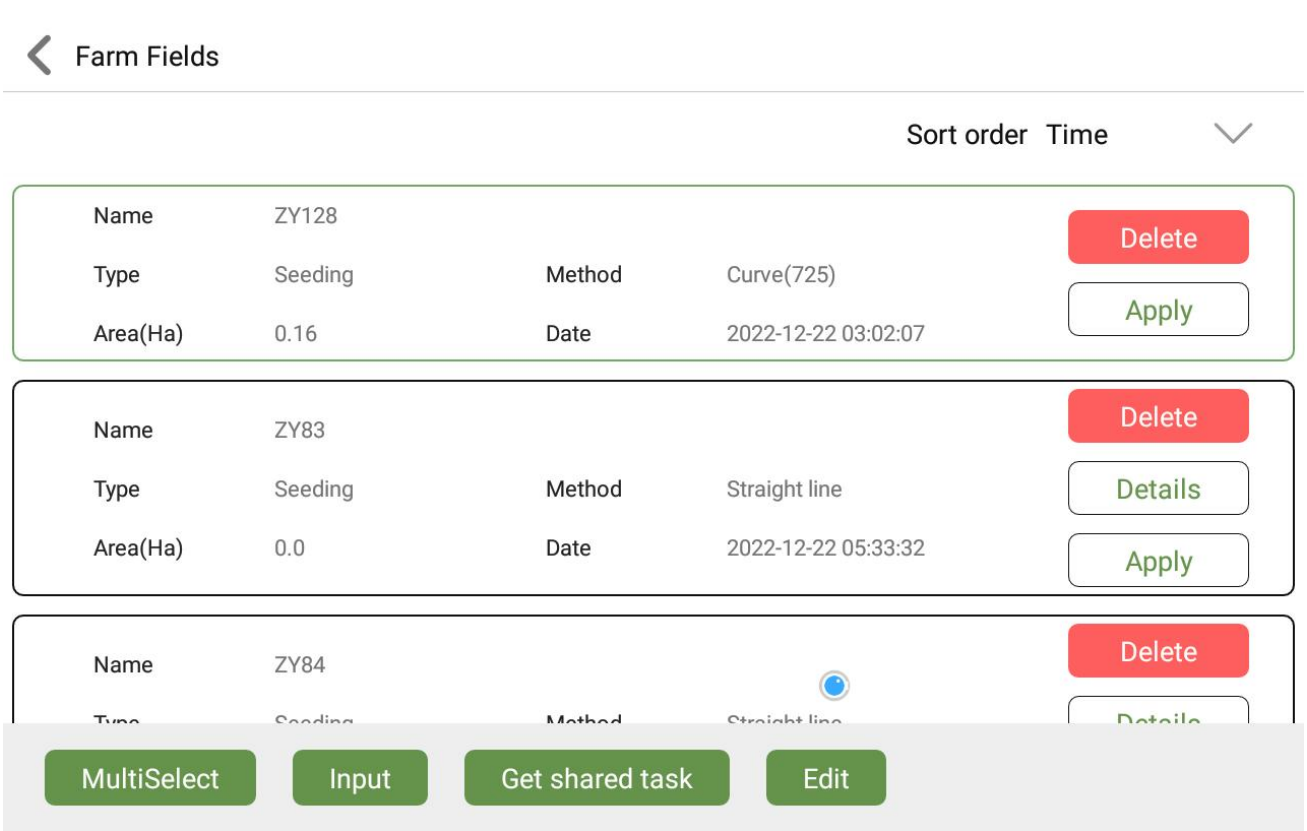
Please refer to 3.3 and 4.3.1

4.6Farm and Task

4.6.1 Farm fields

Click ***Token*** to get the information of farm fields

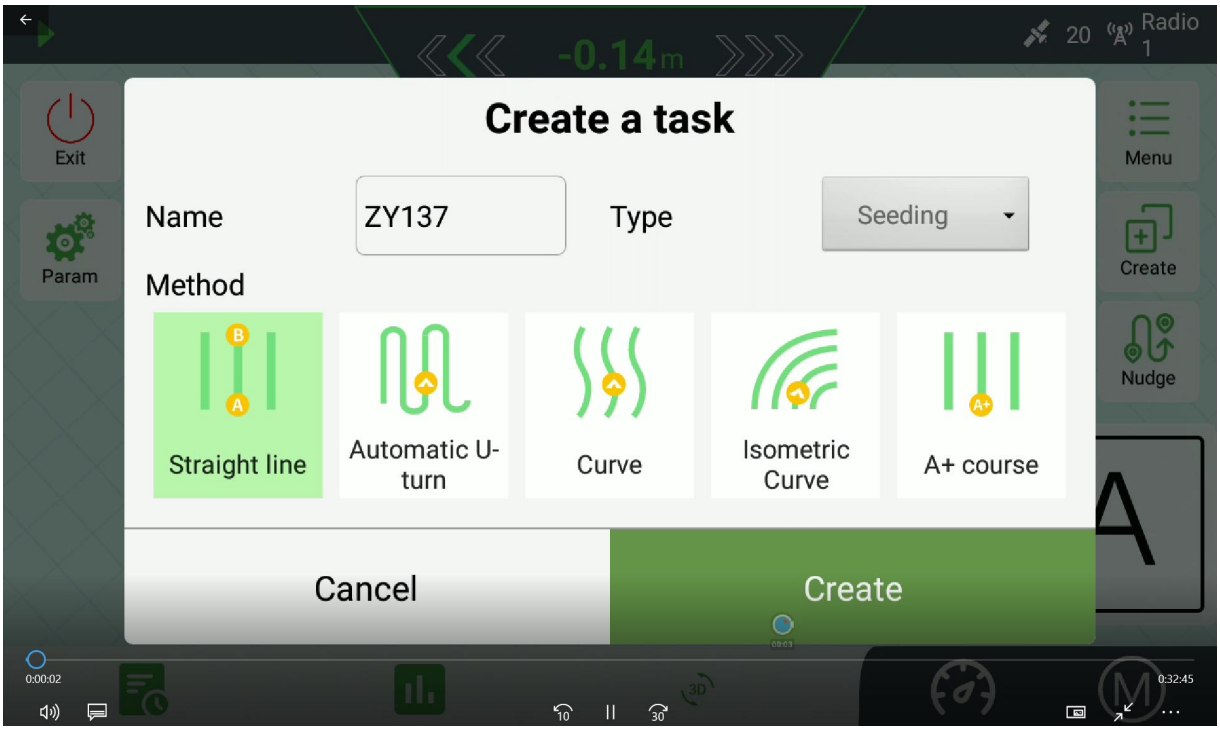




The task you created will be saved to the device, and you can use the previously created task.

4.6.2 Task

There are five ways of operation, namely: Straight line, Automatic U-turn, Curve, Isometric Curve, A+ course.



1) Straight line

For straight line operation, only two points (A and B) need to be taken to determine the operation line. After confirming the operation line, start working, select the direction of the first turn, and then automatically adjust the direction of the turn and make the automatic turn.

2) Automatic U-turn

For automatic turning operation, 4 points(A,B,C,D) need to be determined in sequence. After the four points are determined, the operation will be started and will automatically turn around.

3) Curve

For curve operation, after determining point A, start to manually drive to determine the shape of the curve (in fact, each step will determine a point and divide the curve into countless points), and finally hit point B at the end to determine the curve. Also need to select the left and right directions at the first turn, and then turn around automatically

4) Isometric Curve

Same as curve operation, except that the tangent vertical distance of each operation line is equal

5） A+ course

For the A+ course, after determining the point A, you need to enter an angle, which is the included angle with due north. After input, the agricultural machinery will move forward infinitely according to this angle and cannot turn around automatically.

5 Repair and Maintenance

Display

It is better not to film the display (which may cause the touch screen to be insensitive)；

When not working, cover it with a cloth bag or plastic bag (or take it indoors) to prevent dust from entering；

When using the touch screen, press it lightly. If you press it hard often, it may cause the touch screen to be insensitive.

Wheel angle sensor

It is better not to load, unload or move the position at will. If it has been moved, it is necessary to re-calibrate the parameters before the next automatic driving；

The cable connecting the angle sensor shall be protected to prevent scratching.

Body angle sensor

The body angle sensor is a core component. Please do not put anything on the body angle sensor to prevent damage during use. Do not move the position arbitrarily before and after use, otherwise the vehicle calibration needs to be carried out again.

Electric steering wheel

The electric steering wheel is the core component, so as to avoid the collision. In order to prevent the intrusion of dust in the vehicle, it should be cleaned and wiped regularly.

Connection Cable

Please fix the connecting wire to prevent scratching and keep it away from the exhaust pipe to avoid burning.

Operating instructions

Before each operation, the user needs to check whether the bonding line meets the operation requirements. After each replacement of agricultural tools, the bonding line must be tested 2 to 3 times. If the error of the bonding line is greater than 2cm, it is recommended that the user debug the bonding line according to the manual. If the user does not consult the technician to adjust it at will, the consequences will be borne by the user.

FCC Caution:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception ,which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.
To maintain compliance with FCC’s RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 50cm the radiator your body: Use only the supplied antenna.