HUIDA TECH

IMPLEMENTAR INTELLIGENCIA AGRÍCOLA GLOBAL

HD408
AUTOPILOT STEERING SYSTEM

User Manual



HEILONGJIANG HUIDA TECHNOLOGY CO.,LTD.

CONTENTS

I. INSTRUCTIONS FOR USING PRODUCTS 01

II. PRODUCT INTRODUCTION 01

1. Product Introduction 01

2. Product composition 02

3. Software interface 04

III. PRODUCT USE 06

3.1 Power-on 05

3.2 Confirm RTK and Peripheral states 05

3.3 Settings of farm tools 06

3.3.1 Set the width of farm tools 06

3.3.2 Width of next row 07

3.3.3 Set the distance from the working point of farm tools to the hanging point 07

3.3.4 Set the deviation of farm tools 07

3.4 Set the navigation route 07

3.4.1 Set AB straight line 07

3.4.2 Set parallel curves 08

3.4.3 Set diagonal harrowing 09

3.4.4 Set up a circular job 09

3.4.5 Set the loop operation mode 10

3.5 Autopilot 11

3.6 Power-off 11

IV. COMMON FUNCTIONS 11

4.1 Next row calculation 11

4.2 Drag 12

4.3 Plot sharing 12

4.3.1 Single machine sharing 13

CONTENTS

4.3.2 Nearby plot 13
4.4 Mark 13
4.5 Simple mode 14
4.6 Camera 14
4.7 WiFi hotspot 15
4.8 Clear interface, reset data, reset point B 15
4.9 Parameters 16
4.10 Live Map 16
4.11 Plot Boundary 17
4.12 U-turn Function 18
4.13 ISOBUS 21
4.14 File Import 23

V. COMMON PROBLEMS 25

5.1 Failure analysis of equipment information 25
5.2 Common failure analysis 25

I. INSTRUCTIONS FOR USING PRODUCTS

	When the equipment is not in use for a long time, please disconnect the power cord to prevent the vehicle battery from feeding.
	When supplying power to the product (system), you must note the equipment power supply requirements (the power supply voltage range is 12~24V).
	When the equipment is turned on for autopilot, the driver should not leave the cockpit.
	Autopilot system is strictly prohibited during non-working hours and non-working areas.
	The autopilot system cannot control the speed of the vehicle. The operator must manually adjust the speed of the vehicle to ensure that the operation is at a safe speed and will not cause the vehicle to overturn or lose control.
	Do not disassemble and assemble the equipment without permission, otherwise it will not be warrantied.
	Voice prompt is affected by the surrounding environment, so only prompt function is performed, and the driver should keep driving safely.Heilongjiang Huida Technology Co., Ltd. will not bear the losses caused by not hearing the voice prompt.

II. PRODUCT INTRODUCTION

1. Product Introduction

408 Agricultural Machinery Autopilot Navigation System with Navigation is an autopilot system independently developed and produced by Huida Tech, and a large torque motor is used to control steering wheel. It is suitable for tractors, transplanters, pesticide spraying machines, crawler tractors and other agricultural machinery.

Through practical application & verication, all supporting components are readily available, which is completely suitable for all agricultural machinery with steering wheels in In terms of design, the particularity of agricultural production and operation environment is fully considered, and the practical problems in the process of agricultural production and operation are perfectly solved.

- Improve the operation accuracy effectively, meet the requirements of standardized agriculture, and improve the quality of agricultural products;
- Change less crossing and no-omission under manual operation to no-crossing and no-omission under automatic operation, which improves the operation efficiency;
- Extend the operation time of agricultural machinery, operator stops but machine does not stop, and can work in the field at night;
- With simple operation, the intensity of driver is reduced, and the requirements for the operation level of driver are reduced;

2. Product composition

1) Onboard navigation terminal



- 10-inch high-brightness touch screen, which is clearly visible in the sun
- Built-in radio and other modules
- Wide temperature range of -40 ~ 70℃,which is suitable for working in special areas and extreme working environment
- Has the functions such as planning driving route and saving operation data

2) Satellite antenna



- Support GPS/GLONASS/Galileo/SBAS
- High receiving sensitivity improves vehicle positioning= and navigation accuracy

3) EM-100 motor



- DC motor with high torque, which is suitable for various vehicles
- Low operating noise, low calorific value and high accuracy

4) Attitude sensor



- Terrain compensation technology ensures navigation accuracy without fear of longitudinal slope and transverse slope
- IP67 protection level, compact size, easy to be installed

5) Hydraulic valve (optional)



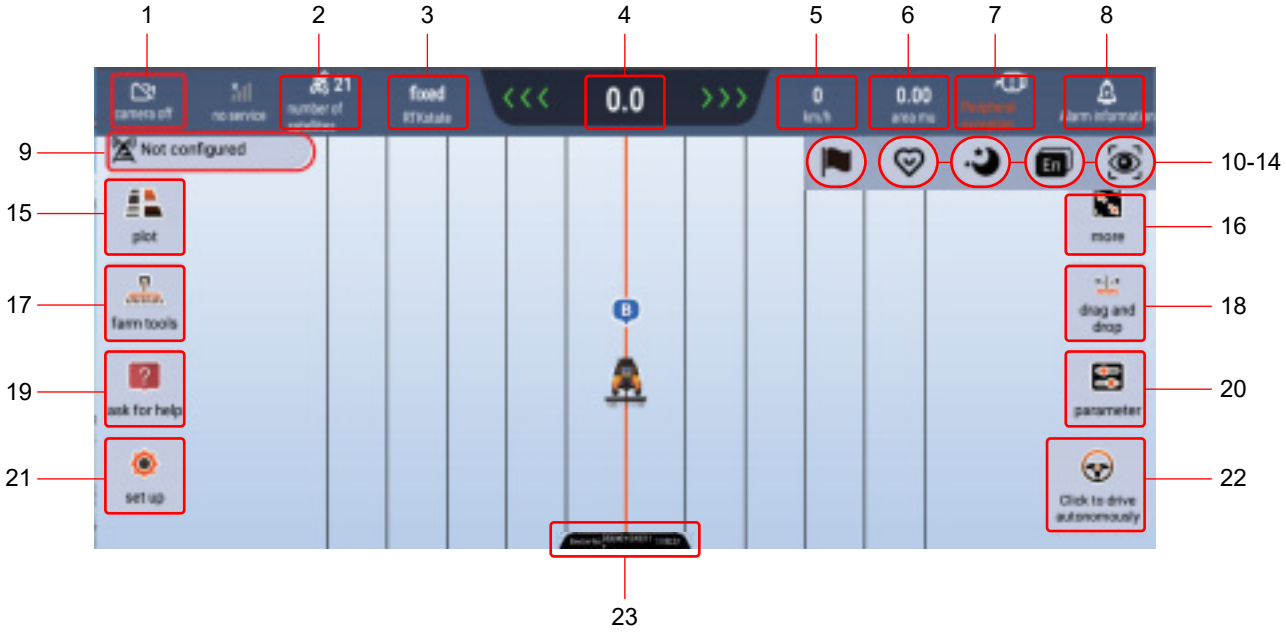
- Electronically controlled proportional hydraulic valve
- Maximum system pressure: 210Bar
- Minimum system pressure: 120Bar

6) Gyroscope angle sensor (optional)



- The left and right steering angles of the front wheels are detected and fed back to the controller
- It is used for correcting and improving the straight-line driving accuracy of vehicle
- Leading the application of gyroscope angle recognition scheme
- Support self-estimation of antenna error, easy to be disassem bled and assembled, and calibration is not required

3. Software interface



1. Camera switch	2. Number of satellites: Number of satellites searched
3. RTK differential state: fixed/floating/pseudo-range/ single point	4. Lateral deviation: It is negative when the vehicle is on the left side of the navigation route and is positive when the vehicle is on the right side of the navigation route
5. Real-time speed	6. Operating area: in mu
7. Connection state of equipment peripherals	8. Alarm information: Prompt for the cause of equipment failure
9. Base station information: It indicates the current base station form (temporary station, mobile cors, large base station and small base station)	10. Mark: Mark position
11. Care mode: Simple operation, interface with large font	12. Brightness display: Day/night mode switching
13. Language switching: Chinese/Uighur;	14. Best scale
15. Plot information: Including local plots and nearby plots (downloadable)	16. AB line setting: Including setting the field, clearing the interface, resetting the data and resetting the point B
17、Setting of farm tools; Including the width setting of farm tools and the quick setting of handover lines	18. Drag: Including left and right drag, restore AB line, and drag to here
19. Help: Including one-click help, instructions for use, SIM card renewal	20. Quick adjust of parameters
21. Interface settings	22. Manual/automatic driving status switching
23. Equipment number	

III. PRODUCT USE

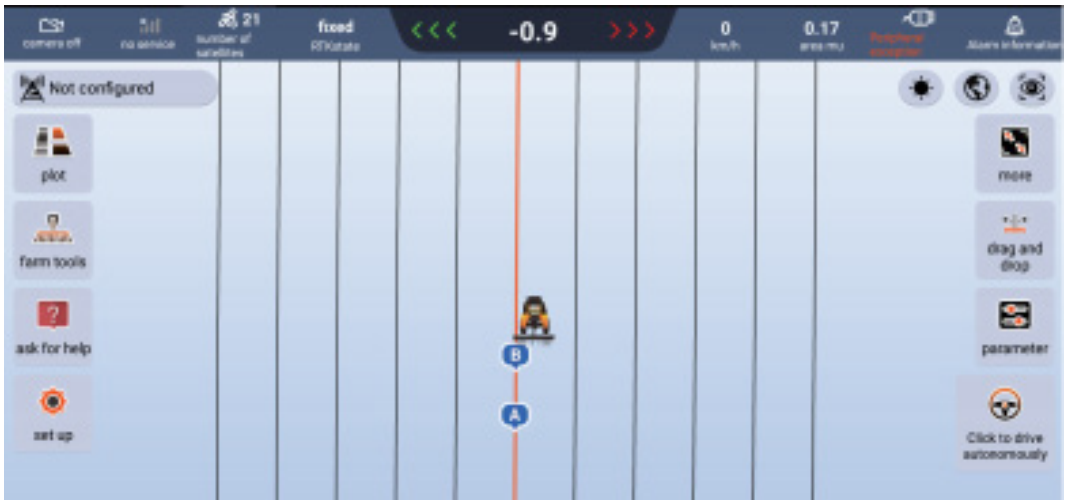
3.1 Power-on



Power on the navigation system
by pressing the display switch on side

3.2 Confirm RTK and Peripheral states

Before autopilot, check whether RTK and peripherals are normal. Go to the next step after they are normal



3.3 Settings of farm tools

Click the "Farm Tools" button on the left side of the screen to enter the setting interface of farm tools, which can set the width of farm tools, the distance from the operating point of farm tools to the hanging point, the width of connecting rows, the deviation of farm tools and other information.



3.3.1 Set the width of farm tools

As shown in the figure below, you should measure the operation width of the actual farm tools before operation, and measure the actual distance from the middle point of the track to the middle point of the track after dragging the farm tools.

Please ensure that the measured width of farm tools is correct, otherwise it will affect the combination ridge! ! ! Enter the width of farm tools after measurement



Width is the effective working width of farm tools

3.3.2 Width of next row

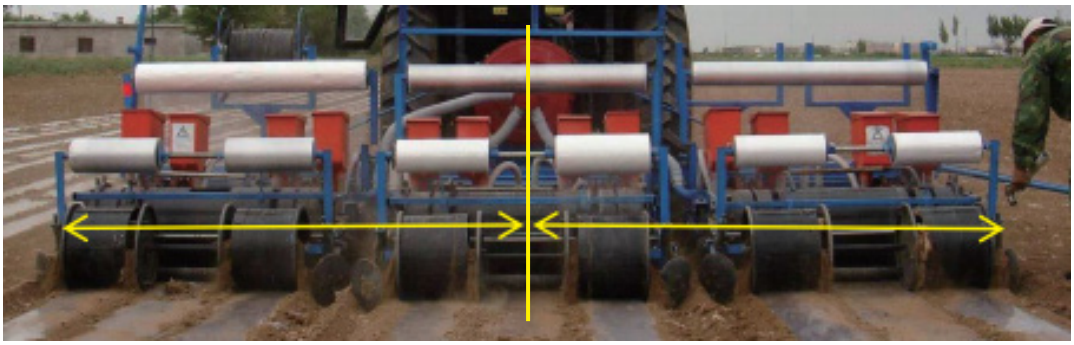
Overlap: The current operation width is overlapped when there is a duplicate area between the previous operation width and the current operation width
Omission: The area where there is a gap between the current operation width and the previous operation width is omitted

3.3.3 Set the distance from the working point of farm tools to the hanging point

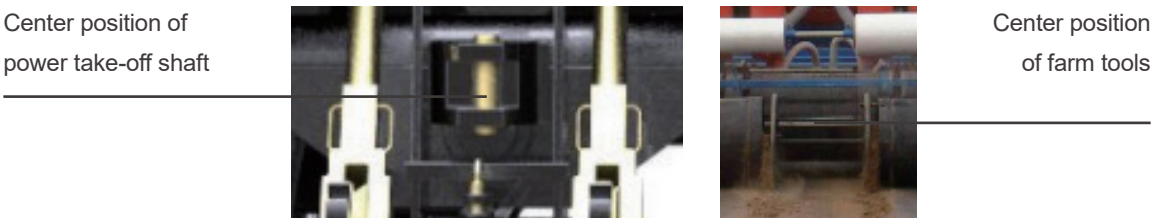
Fill in the actually measured value

3.3.4 Set the deviation of farm tools

Deviation of farm tools: The value is measured from the center of agricultural machinery to the center of farm tools, and it is more accurate to measure farm tools on the ground



Mark the central position of farm tools

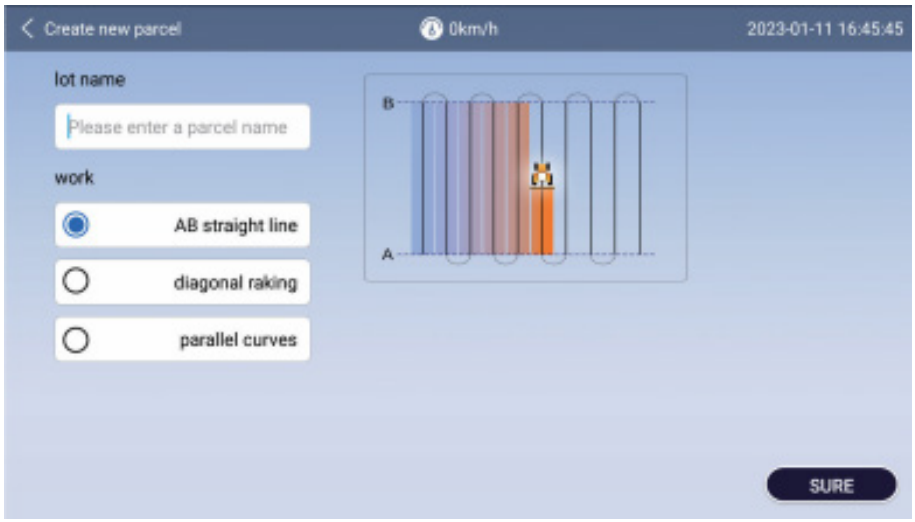


Attention: Mark the center of farm tools, adjust the lower pull rod of farm tools, and ensure that the center of farm tools and tractor are in the same line

3.4 Set the navigation route

3.4.1 Set AB straight line

When the vehicle is driven to the field edge, turn the front of the vehicle towards the direction of operation, click the "A" button on the screen, and set point A.
Drive the vehicle to the field end manually, click the "B" button on the screen, and set the point B. Complete the drawing of AB line.



Select AB line for type of operation mode

Notes:

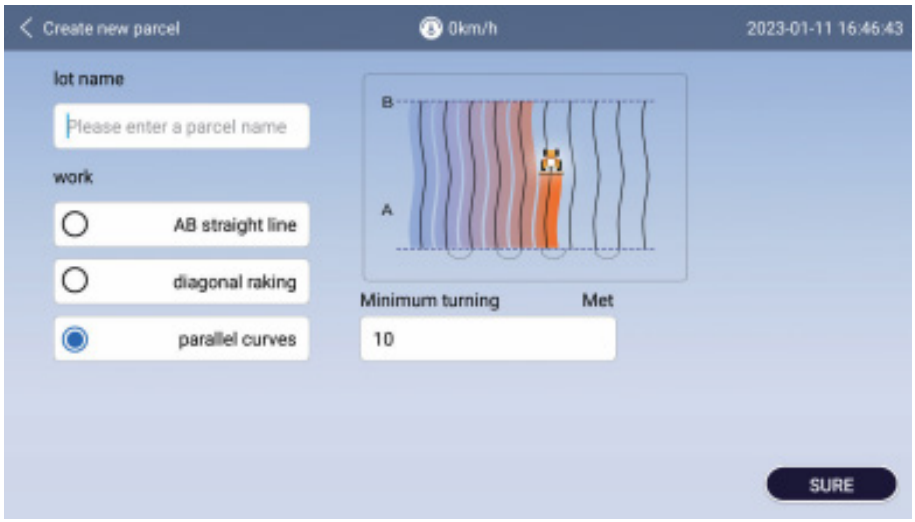
1. When setting up AB line, vehicle should not work as far as possible, and be driven without load.

2. Whenever the vehicle changes the plot, it is necessary to reset the AB line once. If the operation is not finished on the same day, the same AB line can be called to continue the operation the next day.

3.4.2 Set parallel curves

Select parallel curves for type of operation mode.

Click point A on the field edge, drive the tractor to the other end along the ground boundary, and click point B, and the generated AB line is a parallel curve.



Select parallel curves for type of operation mode

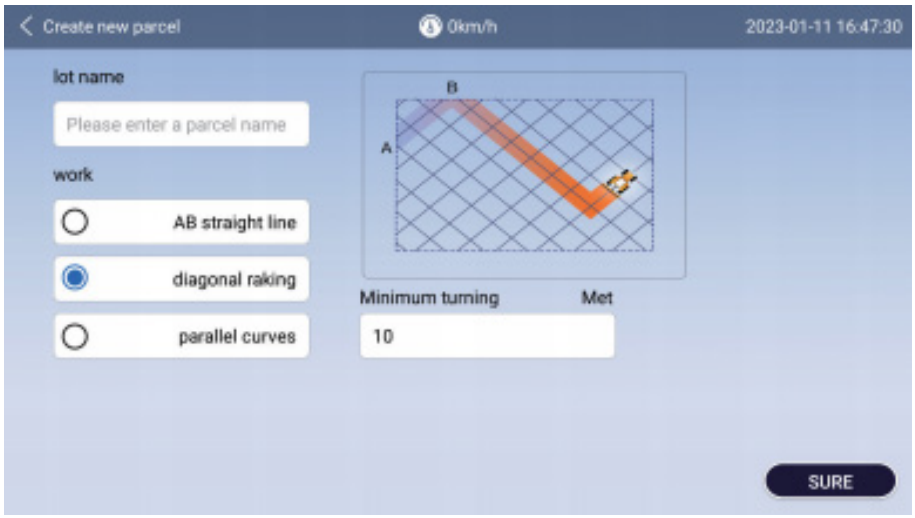
Notes:

① When setting up AB line, vehicle should not work as far as possible, and be driven without load.

②Whenever the vehicle changes the plot, it is necessary to reset the AB line once. If the operation is not finished on the same day, the same AB line can be called to continue the operation the next day.

3.4.3 Set diagonal harrowing

Click the Record Boundary button at the field edge, click point A, drive the tractor to the other end of the field, click point B, return the tractor from point B to point A along the other three sides, and click the "Stop Recording" button, and the generated trajectory is the diagonal harrowing trajectory.



Select diagonal harrowing for type of operation mode

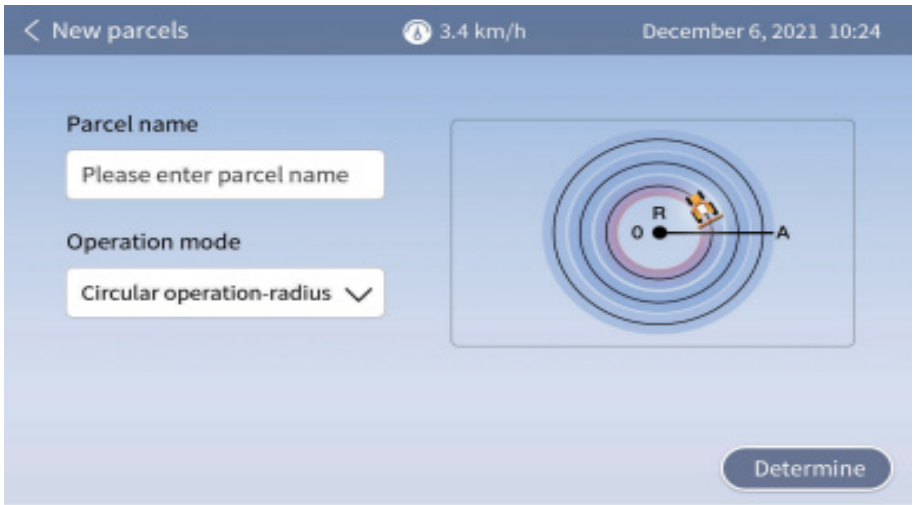
Notes:

1. When setting up AB line, vehicle should not work as far as possible, and be driven without load.
2. Whenever the vehicle changes the plot, it is necessary to reset the AB line once. If the operation is not finished on the same day, the same AB line can be called to continue the operation the next day.
3. It can turn automatically according to the planned path during diagonal harrowing operation.

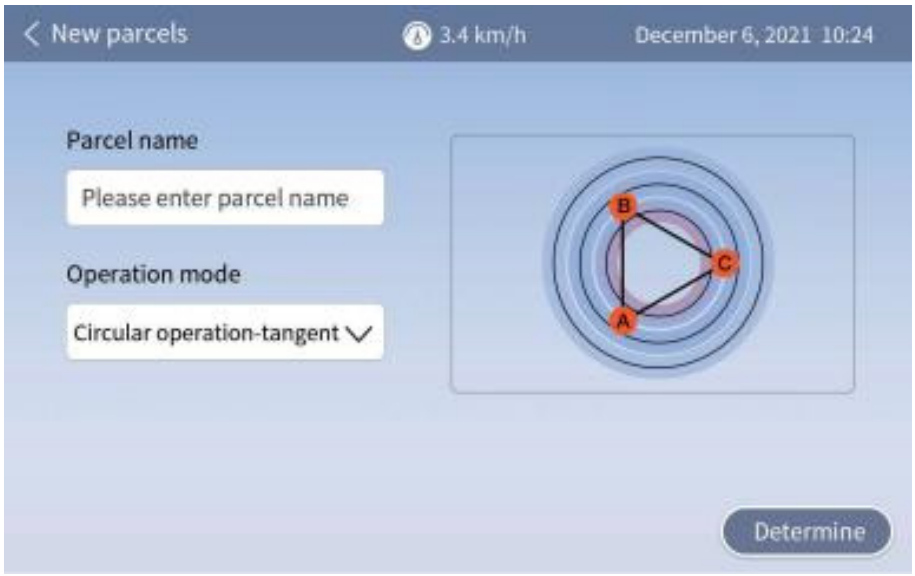
3.4.4 Set up a circular job

Select the routing mode according to the actual situation

Mode 1: For the radius method, it is at the center of the circle, the center of the tail of the farm tool is close to the center of the circle, click point O, drive to the boundary manually, tangent the left/right outer boundary of the farm tool to the outer boundary of the circular block, and click point A to generate the operation trajectory.



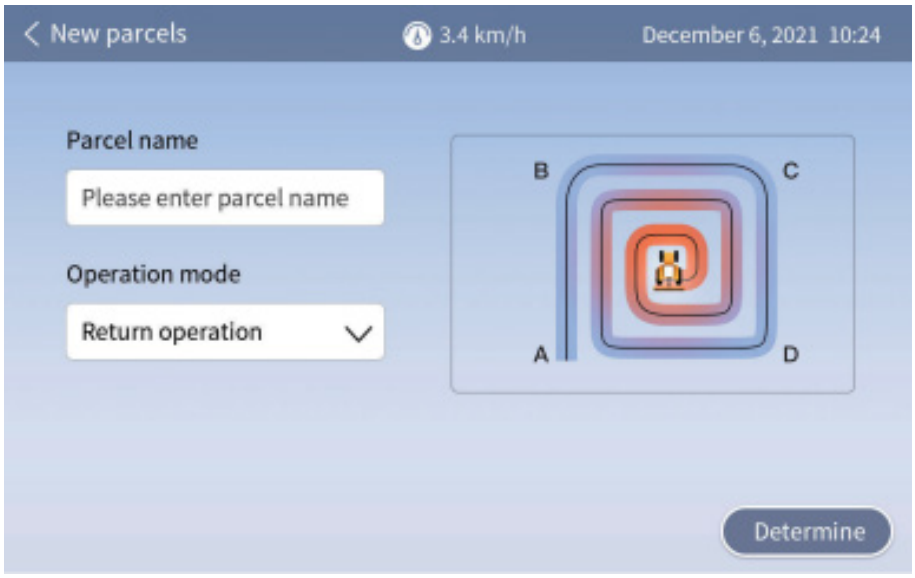
Mode 2: For the tangent method, it marks the boundary of circular working plot with the outer edge of farm tools on the same side. Click point A, in the same way, mark point B and point C, and the operation trajectory can be generated after point C is marked



Note: The positions of three points of ABC should be at the trisection of the circle. That is, the schematic diagram of operation mode.

3.4.5 Set the loop operation mode

Click point A at the field edge to mark, drive the vehicle to the other end of the field edge manually and click point B, then drive around the field edge for a circle manually, and mark point C and point D at the corner in turn to generate the operation trajectory



Select loop mode for type of operation mode

Note: The loop operation mode can only be applied to regular square and rectangular terrain

3.5 Autopilot

Icon	Indicates state	Function
Orange	System autopilot is ready	Click to start autopilot
Green	The system is under autopilot	Click to stop autopilot
Red	The system cannot start autopilot	Autopilot cannot be started, check the failure

3.6 Power-off



Power off the navigation system by pressing the display switch on side

IV. COMMON FUNCTIONS

4.1 Next row calculation

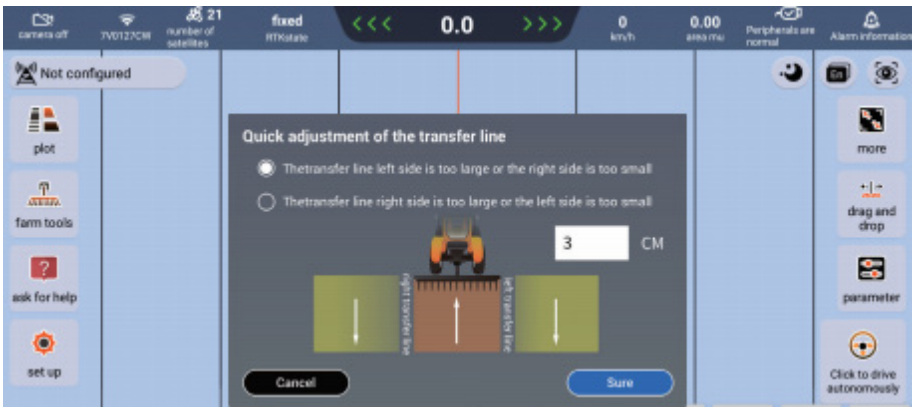
Basic conditions: The accuracy of navigation straight line is normal, the width and missing value of farm tools are set correctly, and the farm tools are fixed firmly without shaking.

Commissioning steps

a. Conduct autopilot operation, drive twice at a constant speed, and measure the width of the current bonding ridges. (Note: The operation width is the width of the outermost two seeding ports)

b. Data acquisition: For the current combined ridges, find the position with straight line accuracy of 0 ~ 1cm, measure the width of the combined ridge three times at a distance, calculate the average value, and calculate the difference between the actual value and the ideal value.

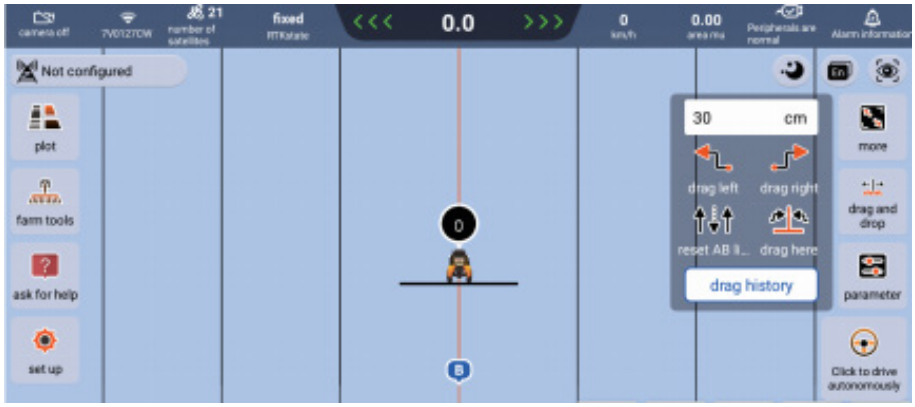
c. Input data: Select the actual deviation direction of the connecting row, input the difference value, and click OK to complete the quick adjustment of the connecting row.



4.2 Drag

You can drag the navigation route, and drag to left and right to make the navigation route reach the ideal position

Drag to left: Click Drag, the navigation route moves to left
Drag to right: Click Drag, the navigation route moves to right
Restore AB line: All dragging records will be cleared and the first AB line of the current plot will be restored Drag to
here: Drag navigation route to the specified location



4.3 Plot sharing

4.3.1 Single machine sharing

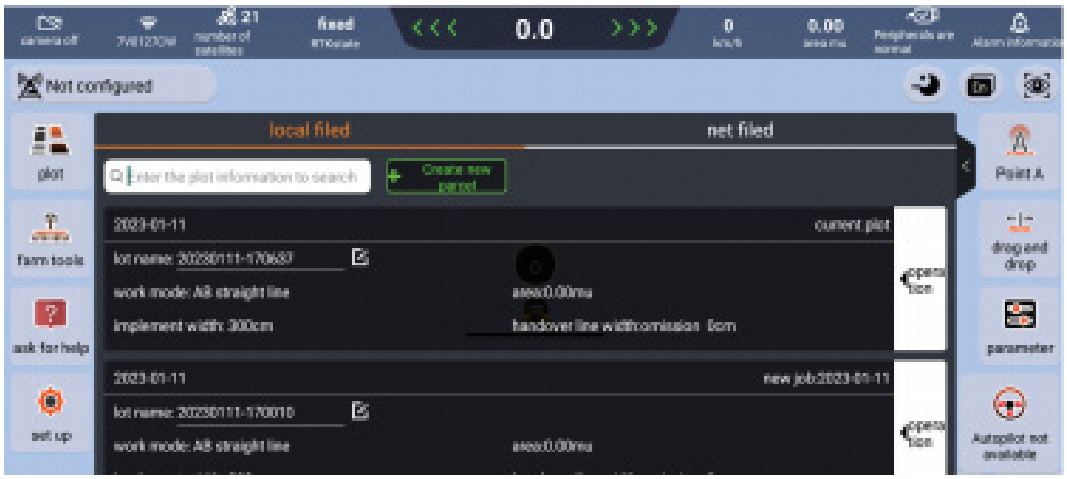
User 1 creates a new plot. After finishing the routing of AB line, click "Send Plot" in the "Operation" button to share the AB line with User 2.
You can also click "Upload Plot" to upload AB line to the cloud.



Notes:
1. User 1 should enter the device ID of User 2
2. User 2 should wait for sharing information in the main interface, and click Accept to share AB line with User 1.

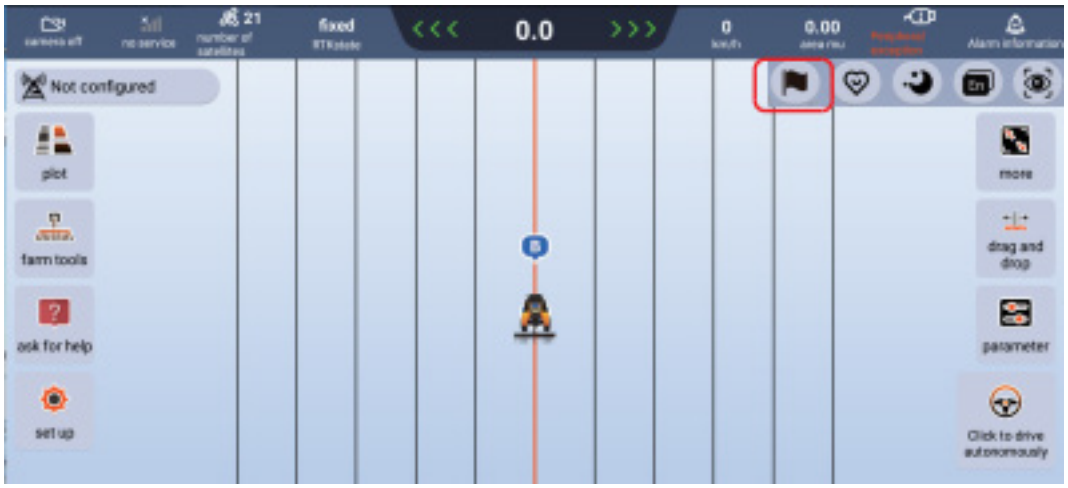
4.3.2 Nearby plot

Nearby plots contain list and map modes (the mode could be achieved with network available)
The user can import the required AB line through the list and map mode in nearby plots for operation.



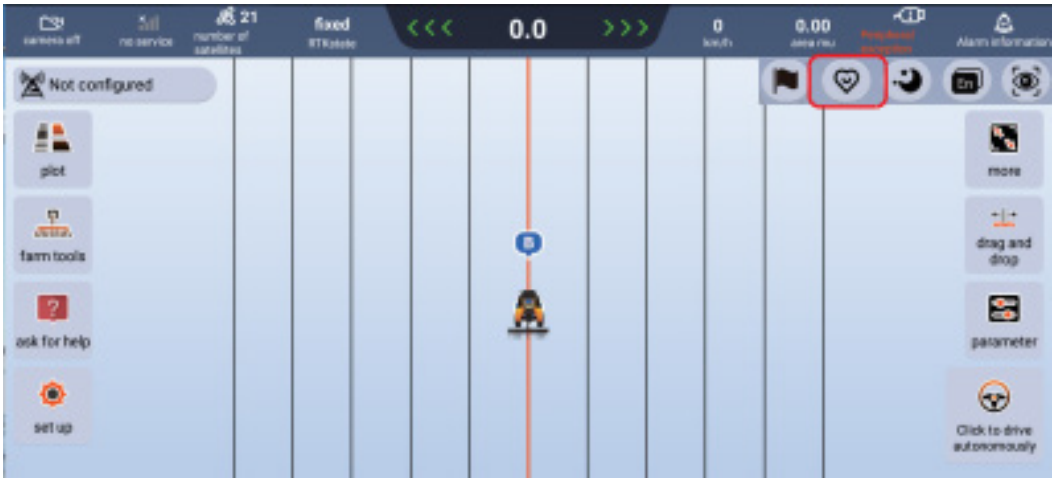
4.4 Mark

The location information of the current plot can be marked by the positioning of the vehicle, and then when the vehicle drives near the marked position in autopilot operation, it will be prompted



4.5 Simple mode

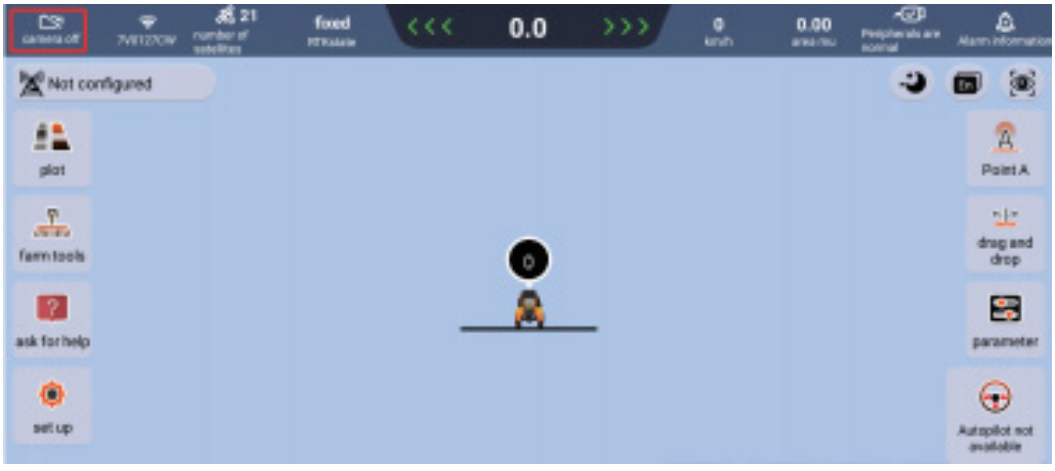
Under the normal interface, click "Simple Mode" icon to enter. The mode icon has larger text and simpler functions. The functions required are at hands, and the contents required are just around the corner.
Click the icon under "Simple Mode" to quickly return to "Normal Mode"



Note: If you want to debug the vehicle, please debug it in normal mode, and debugging is not supported in simple mode.

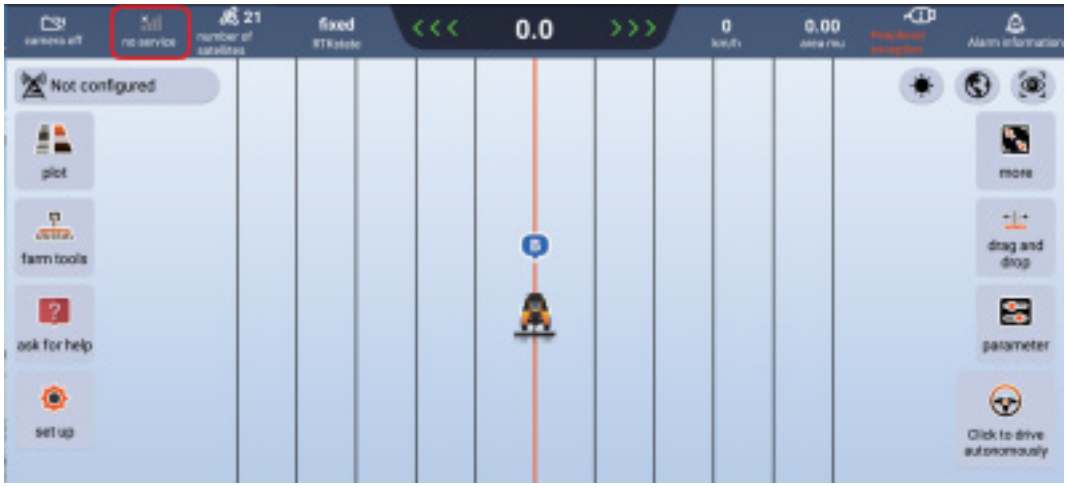
4.6 Camera

The camera provided by the system can monitor the operation of farm tools in real time.
You can click the camera button in the upper left corner to open or close it



4.7 WiFi hotspot

The user can connect to the mobile phone WiFi hotspot to connect to the network

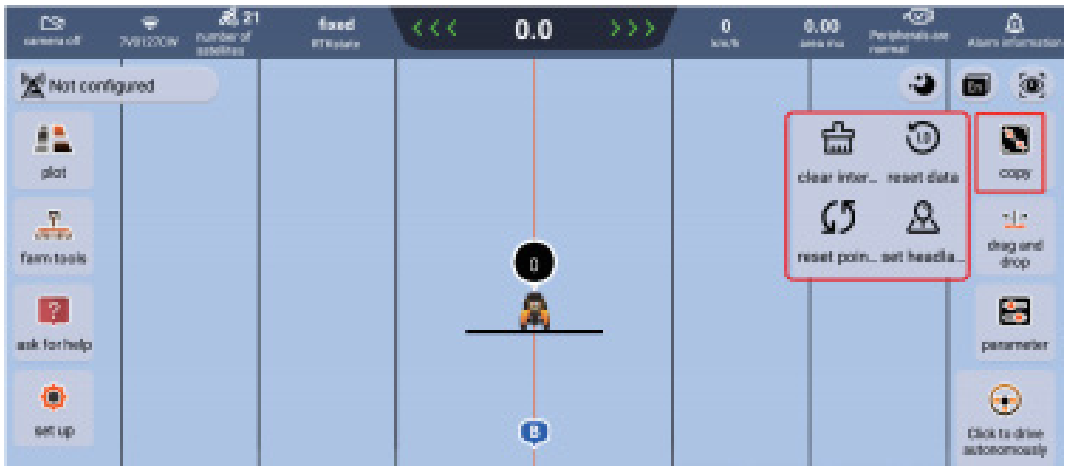


4.8 Clear interface, reset data, reset point B

Clear interface: Click the "Clear Interface" button to clear the driving trajectory of the current plot (yellow operation trajectory)

Reset data: Click the "Reset Data" button to reset the AB line of the current plot and its driving trajectory information.

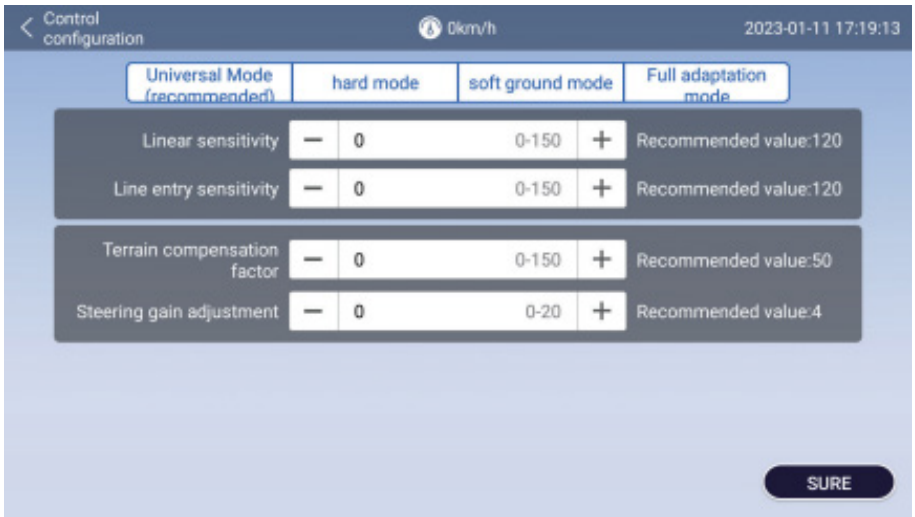
Reset point B: If point B is routed incorrectly, click the "Reset Point B" button on the screen to reset point B.



4.9 Parameters

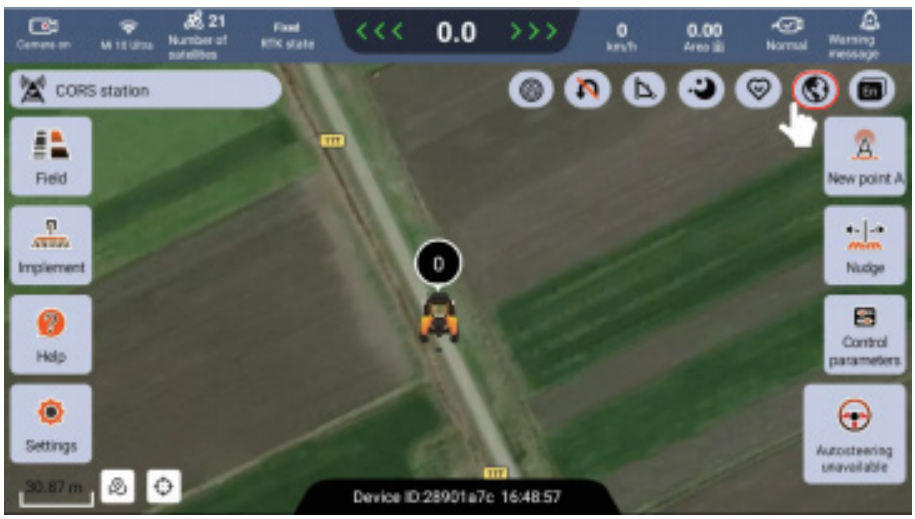
Lateral refers to lateral error deviation, and heading refers to heading angle deviation. Theoretically, the sensitivity is increased when the vehicle steering response to the deviation is not positive, and decreased when the vehicle steering response to the deviation is excessive.

Recommended value
Terrain compensation: 50 turning gain: 4
Universal mode (inlet 120-lateral 70-heading 30)
Hard ground mode (inlet 120-straight line 120)
Soft ground mode (inlet 120-lateral 70-heading 30)
Full adaptation mode (inlet 120-lateral 70-heading 30)
Generally, universal mode is used, and the soft ground mode should be used for soft ground condition



4.10 Live Map

On the main interface, clicking on the following function icon allows you to switch the background between the default and the live map. In the live map mode, the system displays the vehicle's location on the satellite map based on the current positioning. Internet connection is required when using this function.

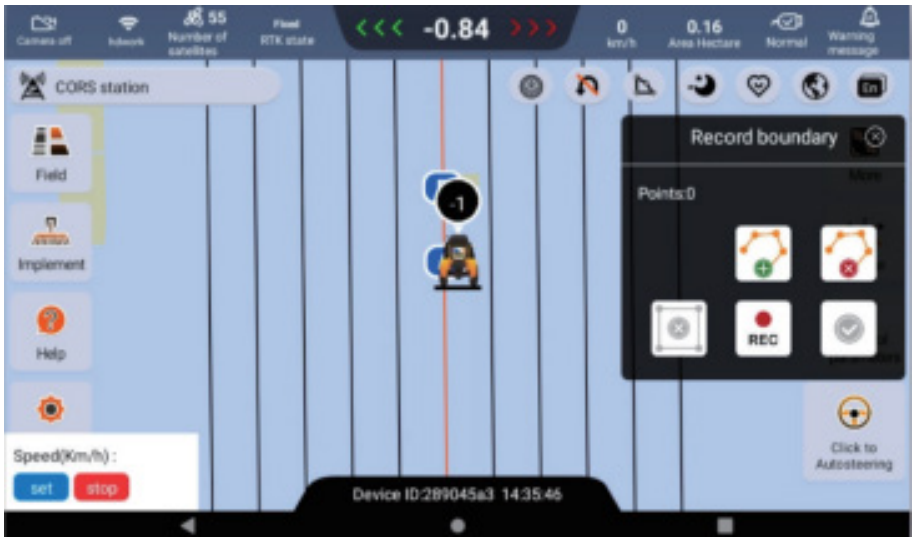


4.11 Plot Boundary

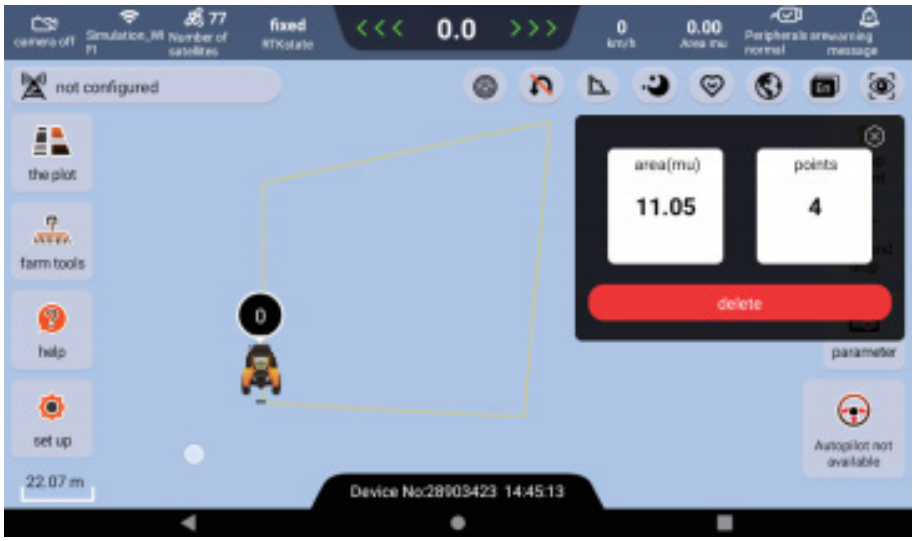
Certain functions, such as automatic U-turns, can only be used under the situation of specified plot boundaries. On the main interface, click on the following icon, then choose the way of importing boundaries. You can either import a boundary via an external file or utilize the system tools for boundary recording.



In the driving recording mode, you can choose the recording method based on the current plot properties.
Usually, the regular-shaped plot is suitable for the method of marking points. Otherwise, you'd better choose the method of following the vehicle trajectory.



After completing the boundary creation, the system will display the current plot boundary on the main interface. The pop-up window will show the area and number of points. If you are unsatisfied with the created boundary, you can delete the current boundary and recreate it.



4.12 U-turn Function

On the main interface, click on the following function icon to configure the U-turn function. Please confirm the relevant settings before use.



When setting U-turn function, you can obtain the best turning effect and improve safety during use by properly setting the number of rows crossed, turning radius, boundary reserve distance, and headland mode. The number of rows crossed: It refers to the number of rows between the next target line and the current target line after the agricultural machinery completes a U-turn. By setting a reasonable row number, the system can plan a more optimal turning path for the agricultural machinery, reducing the depth of space required for the U-turn action and allowing the machinery to complete the U-turn action more quickly.

Turning radius: Please set a turning radius for the agricultural machinery and then the system will refer to this turning radius when planning the U-turn path. This value cannot be smaller than the minimum turning radius that the agricultural machinery (with implements attached) can actually achieve, as this may cause the machinery to be unable to complete the planned U-turn path by the system.

Boundary reserve distance: It refers to a distance that must be guaranteed between the U-turn path planned by the system and the plot boundary. The plot boundary and this parameter value together determine the operation position of each U-turn in the plot.

Headland mode: Choose between straight mode and contour mode. This setting is specifically used for the system's planning strategy for the overall operation path of the plot under automatic U-turn mode.



Straight Mode Contour Mode



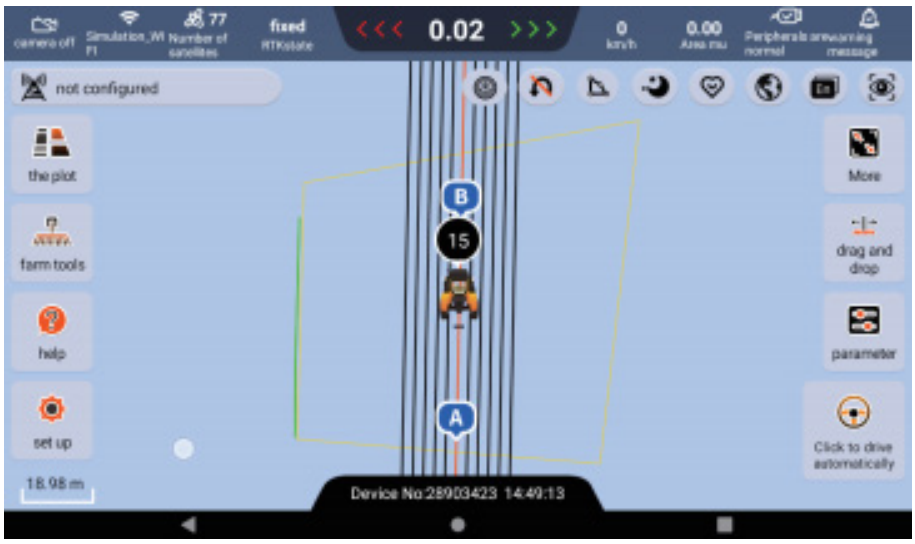
One-click U-turn

In the one-click U-turn mode, the operation interface will always retain control buttons for executing left and right U-turns, along with a shortcut setting for the number of rows crossed in the input box. When you click on the left or right U-turn button during the automatic driving process of the agricultural machinery, a blue dashed line will appear on the interface to indicate the U-turn path. Subsequently, the machinery will start automatic driving along this blue dashed line until it reaches the next target line.



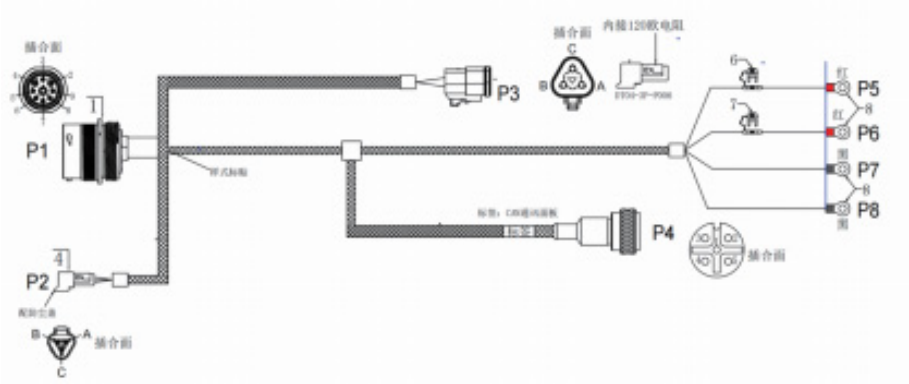
Automatic U-turn

Firstly, you must set a boundary for the current work before starting automatic U-turn. When the agricultural machinery is autonomously driving within the boundary, the system will automatically plan and execute a U-turn when the machinery reaches the boundary. The driver must carefully control the vehicle speed, especially on the beginning of the U-turn. If the speed exceeds the limit, the system will consider it a dangerous turn and interrupt the U-turn. In case of any other emergencies, the driver can also manually end the automatic driving and switch to manual operation.



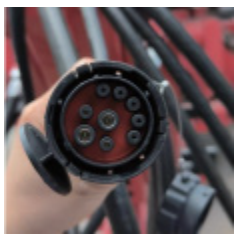
4.13 ISOBUS

The ISOBUS cable harness for the navigation terminal is as follows:



接 线 表										
信号定义	P1	P2	P3	P4	P5	P6	P7	P8	颜色	线性规格
GND	1			3			黑		黑	5.0mm²
	5. mm²			0.75mm²			5.0mm²			0.75mm²
ECU-GND	2							黑	黑	2.5mm²
PWR	3			1	红				红	5.0mm²
	5.0mm²			0.75mm²	5.0mm²					0.75mm²
ECU-PWR	4					红			红	2.5mm²
TBC-DIS	5	A							棕	0.75mm²
TBC-PWR	6	B							红	0.75mm²
TBC-RTN	7	C							白	0.75mm²
CAN2_H	8		A	4					黄	0.75mm²
CAN2_L	9		B	5					绿	0.75mm²

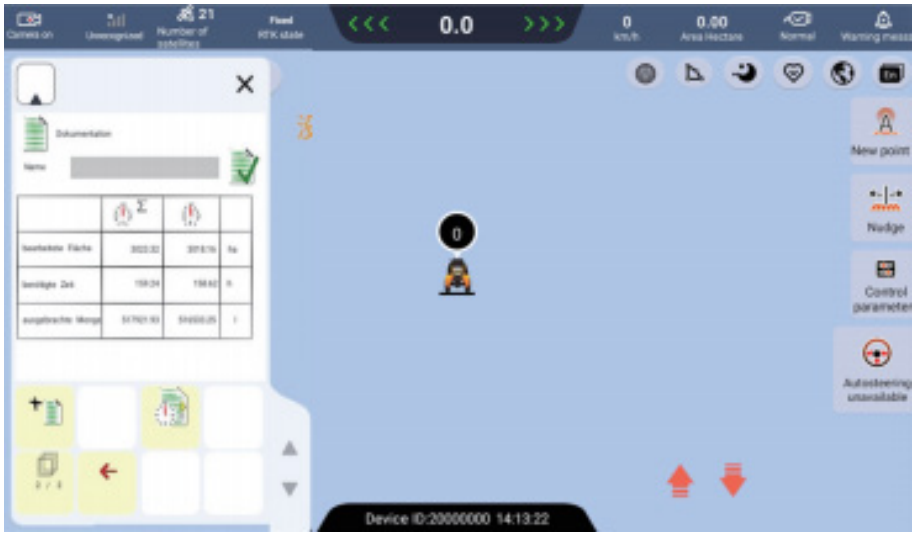
Find the ISOBUS interface cable harness as shown below on the agricultural implement:



Connect the P1 interface of the navigation terminal ISOBUS wire harness (as shown below) to the agricultural implement wire harness interface, and connect the P4 interface to the CAN interface of the navigation terminal.



On the main interface, click on the following icon to bring up the ISOBUS control panel on the ISOBUS UT page.



ISOBUS Data Loading Status:



ISOBUS Data Disconnected

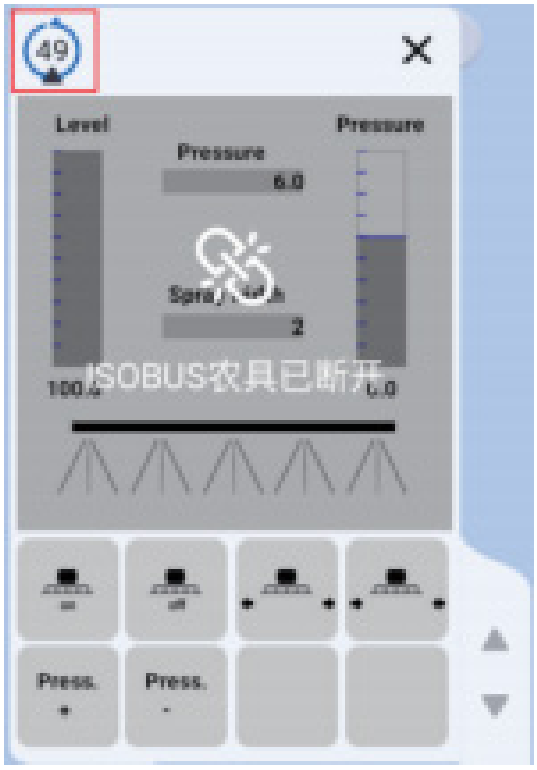


ISOBUS Data Loading



ISOBUS Data Loaded

When connecting to the agricultural implement for the first time, it may require loading time. The loading progress will be indicated at the top of the control panel.

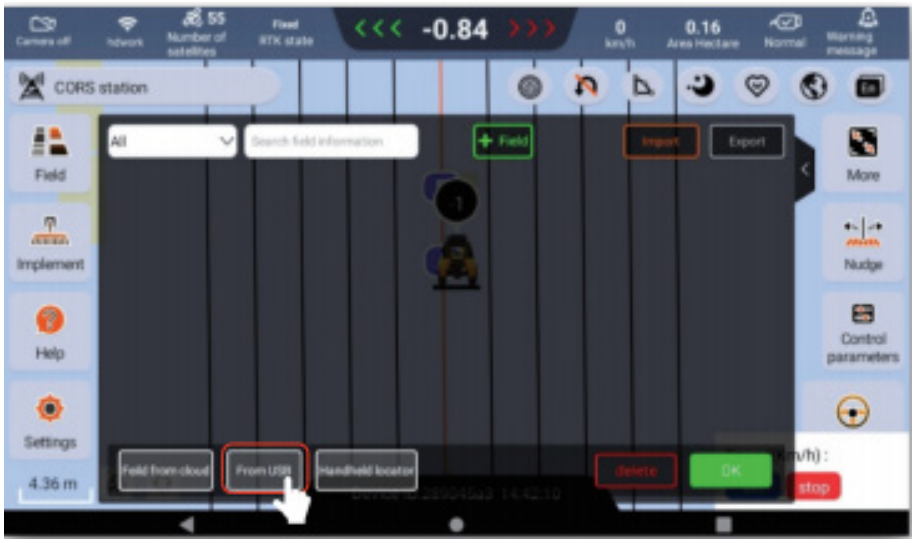


4.14 File Import

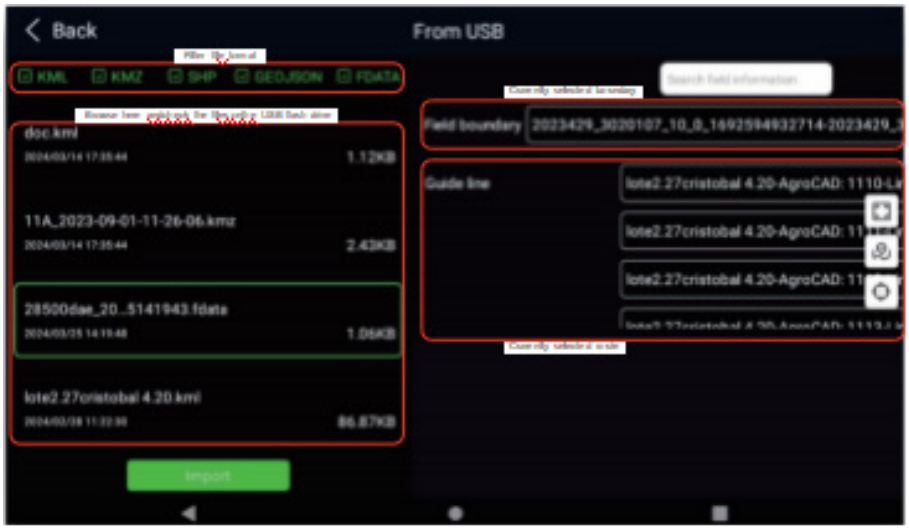
Open the plot, then click on the icon at the top right corner to enter the import interface.



Select "USB Drive" from the import options below.



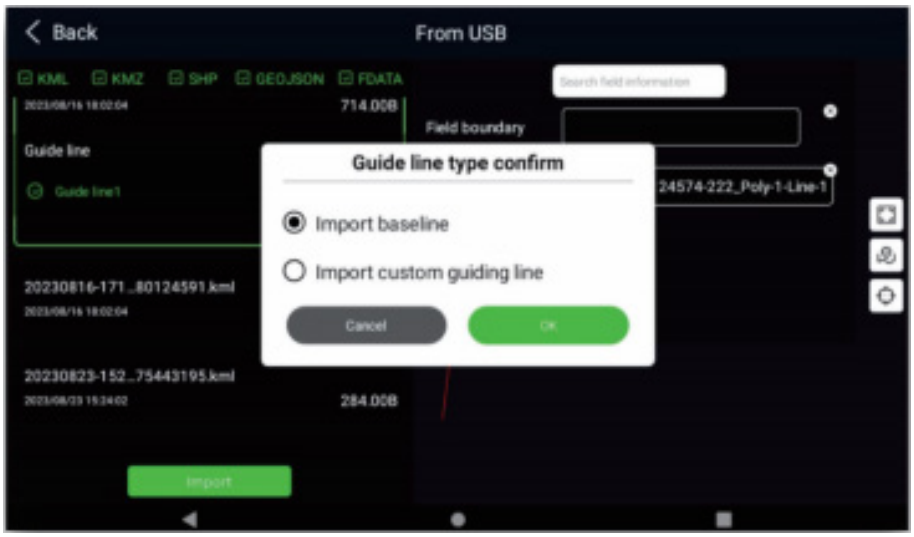
The system can import the following file formats: KML, KMZ, SHP, GEOJSON, and FDATA. You can import a single boundary and several guide lines at once, and they will be created as a local plot.



Depending on your need, you can choose the form that you want the added guide lines to be when imported into the system:

1. Import as Baseline: The system automatically assigns other guide lines based on this baseline.

2. Import as Customized Line: Import the guide line in its original form.



V. COMMON PROBLEMS

5.1 Failure analysis of equipment information

Status bar	State information	State analysis
Positioning state	Fixation	Normal
	Float	The number of satellites received by the equipment isless or the satellite signal is poor
	Pseudo range	Base station signal is not received
	Single point	Only one position point is resolved (the signal is not received)
	NGPS	No satellite signal
Data source	Not Configured	Base station is not configured
	Normal	Normal
Control box	Not connected	Check the connection main wire harness
	Connected already	Normal
Angle sensor	Not connected	Check wire harness connection of gyroscope
	Connected already	Normal
Front wheel angle	Uninitialized	Initialization will occur when the vehicle is stationary for a long time, and the vehicle will be started to travel forward for a certain distance (the speed is > 1.6km/h)

5.2 Common failure analysis

No.	Fault phenomenon	Cause analysis	Solution
1	Terminal is not started	Fuse is burnt	Change fuse
2	Motor is not rotating	Motor fault	Replace the motor
3	Blank screen flash screen	a. Display the terminal reason; b. Main harness of navigation dimension is damaged; c. Power supply of the main wire harness of the receiver is blocked; d. Battery feed/power harness loose	a. Replace the display terminal; b. Replace the main harness of navigation terminal; c. Replace the main wiring harness of the receiver; d. Charge the battery/tighten the power cord
4	Autopilot stop	Abnormal cable connection	Check cable connection

HUIDA TECH

Implementing Global Agricultural Intelligence

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