FJDynamics Autosteering Kit

Software User Manual

FJNBD-2.5RD

©FJ Dynamics Technology Co., Ltd. All rights reserved.

Safety Instructions

Before using this FJDynamics Autosteering Kit (shorten as the kit), please read the entire contents of the “FJDynamics Autosteering Kit Software User Manual” carefully, and keep in mind when operate it.

Operator Requirements

1. Persons under the age of 18 are prohibited from operating.
2. Drunk driving is prohibited
3. Fatigued driving is prohibited.
4. Drivers must obtain the relevant driving license required by the local laws.

Operation Environment

1. Please drive in an open area far from the crowd and ensure that there are no irrelevant personnel and vehicles in the operation area.
2. Please stay away from people, livestock, obstacles, electric wires, tall buildings, airports, signal towers, etc. So as not to interfere with the signal and affect the operation.
3. Please work in good weather (not extreme weather such as heavy rain, heavy fog, snow, lightning, strong wind, etc.);
4. When the kit is under the testing, calibration, adjustment, or automatic steering, please ensure that there are no people or obstacles near the running track to prevent personal injury or property damage.

Operation Rules

1. During driving or operating, it is strictly prohibited to get on or off the vehicle during driving.
2. The vehicle must be kept under monitoring by the driver to ensure timely intervention.

3. When the vehicle equipped with this kit is driving on public roads or public areas, please ensure that the kit is powered off.

Checking

1. Make sure to have enough fuel in the driving vehicle.
2. Ensure that the parameters in the kit are calibrated before the automatic driving operation.
3. Make sure the antenna and angle sensor are installed properly. If there is any movement, please calibrate it again before using it.
4. Please do not use worn or damaged cables. Please purchase and replace new cables in time.

Others

1. Do not disassemble the product yourself, or it will affect the warranty service.
2. The equipment damages caused by force majeure (lightning strike, high voltage, collision), are not included in the free maintenance service.
3. Please connect the device strictly according to the instructions in the manual. For cables such as data cables, you need to pinch the root of the plug and insert it gently. Do not pull it hard or even rotate it, which may cause needle breakage.
4. When supplying power to this product (the kit), please pay attention to the power supply requirements of the device (controller and electric steering wheel power rating is 10-30V).

Contents

Chapter I About This Document

1 Purpose

This document describes how to use the FJDynamics autosteering kit for agricultural vehicles. The language used in the document is concise, and the operation process is simple and clear, so that the user can learn to perform each operation easily, quickly and accurately.

2 Technical Support

Users will be provided with the technical support and upgrade services by FJ Dynamics Technology Co., Ltd. for a long time from the date of purchase of this product.

Official website of FJ Dynamics: **https://www.fjdynamics.com**

Chapter II Product Overview

1 Introduction

Launched by FJ Dynamics, FJDynamics Autosteering Kit for agricultural vehicles supports assistant straight driving and fully unmanned transformation. The kit can not only control the steering to provide driving assistance for the vehicle, but also realize the fully unmanned transformation of agricultural vehicles through the control of the vehicle's accelerator, brake, clutch, gearbox, and operation components. The kit is composed of the in-vehicle display and control terminal, GNSS high-precision positioning equipment, steering motor, angle sensor, attitude sensor, communication antenna, cable harness and so on. Among them, the in-vehicle control terminal is equipped with the auto steering driving software independently developed by FJ Dynamics.

2 Main Components

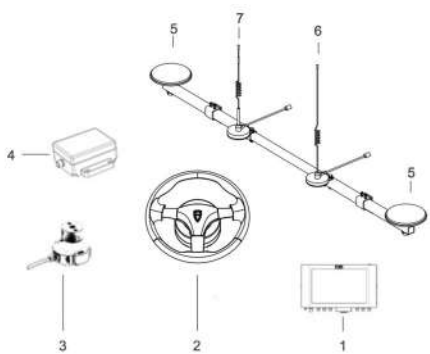


Figure 2.2.1 Main components

1. Control Terminal

An interface of human-computer interaction, acting as vehicle control and communication terminal.

2. Steering Wheel

It provides steering control in vehicles.

3. Angle Sensor

It monitors the wheel rotation angle to determine the direction of the vehicle in real-time.

4. IMU

All-terrain data compensation is achieved to ensure the accuracy of agri-robots in sloping fields and high-speed operating environments.

5. GNSS Antenna

It receives satellite data to obtain vehicle latitude and longitude.

6. 4G Antenna

It realizes communication with cellular data (4G). (Item ⑥ is the 4G antenna and it is shorter than item ⑦)

7. Radio Antenna

It realizes communication with Portable Base Station (RTK).

Precaution for the Installation of Antenna

1. Do not disassemble the antenna or plugin/out the cable when the power is on.

2. When installing antennas outdoors, proper lightning protection should be taken to prevent lightning strikes.

3. During the outdoor installation of the base station equipment, the base station host should be waterproofed.

4. When using or testing, the base station radio antenna must be placed in the outdoor open environment.

5. The transmitting station may generate heat during use. Please be careful to avoid burns.

6. Avoid or reduce unnecessary coverings on the surface of the station and

maintain a good ventilation environment.

3 Hardware Interface Description of Control Terminal

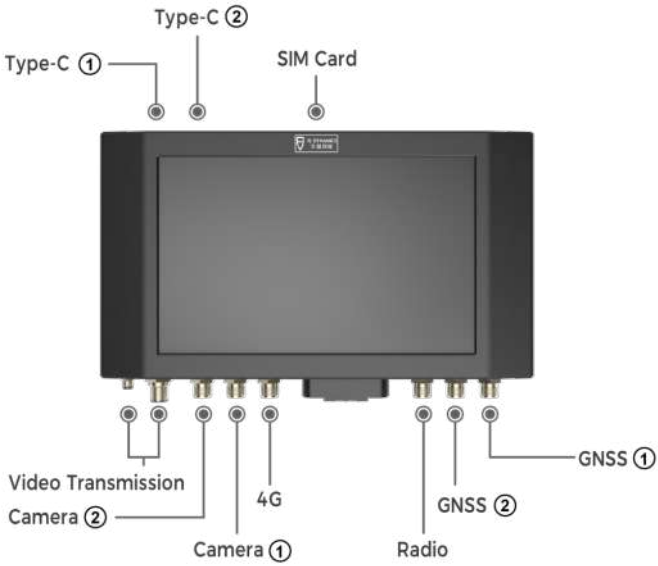


Figure 2.3.1 Hardware interface description of control terminal

Chapter Ⅲ Software Operation

Instructions of Control Terminal

1 Workflow Overview

In order to make it easier for users to understand the operation and use of the software, this document describes the operation procedure and related auxiliary functions of the operating workflow of the kit from a new user's perspective. A new user needs to complete the installation, configuration and preparatory operations before using the kit for the first time and smoothly entering the auto steering driving

2 Commissioning

The initial commissioning process of FJDynamics Autosteering kit is as follows:

Select a language → Register and log in to your account → Enter installation information → Connect to RTK → Set vehicle parameters → Calibrate the angle sensor → Calibrate the whole vehicle → Complete commissioning

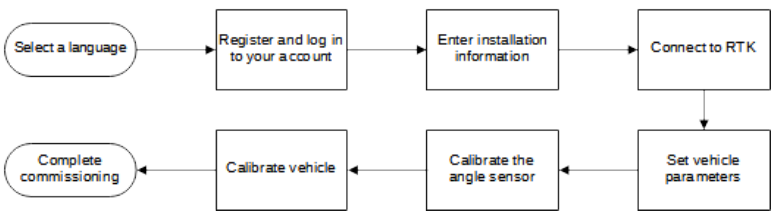


Figure 3.2.1 Initial commissioning workflow

2.1 Selecting a Language

Turn on the in-vehicle control terminal and select a language for this kit. tap Next step. The screen for registration and login is displayed.

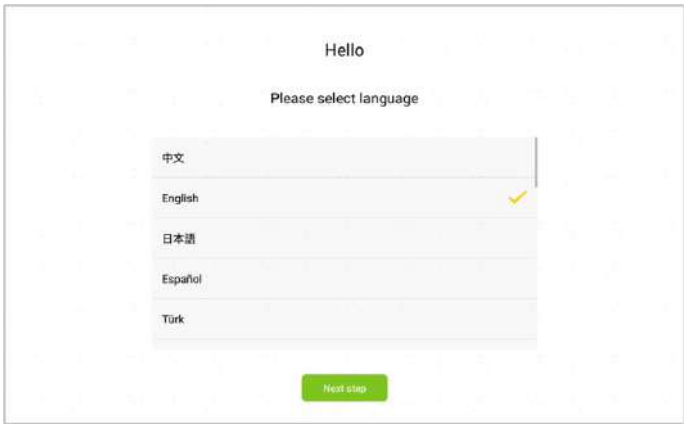


Figure 3.2.2 Selecting a language

2.2 Register/Login

After completing the language settings, you will enter the registration and login screen.

Account Registration: You are required to register an account for the initial use of the kit. tap Register immediately. On the displayed screen, enter your email address, verification code, and password, and tap I agree in User Privacy Policy.

Account Login: If you have an account registered, you can log in directly by entering your user name (email address) and password to enter the home screen of the kit.

Forgot Password: allows you to enter the password resetting screen when you forgot your password. Enter your email address, verification code, and new password. Then, tap Login to enter the home screen of the kit.

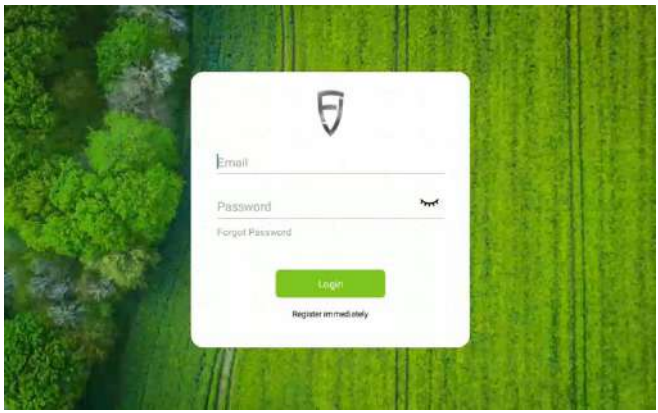


Figure 3.2.3 Home screen of login and registration

2.3 Entering Installation Information

After successfully registering and logging in for the first time, you need to enter related installation information, user information and Auto-kit information. Please note that the initial information you have entered will directly or indirectly affect your after-sales service. Therefore, please strictly follow the following procedure:

Step 1： Enter user information after the successful user registration and tap Next step.

Figure 3.2.4 Entering user information

Step 2： Enter this information and tap Next step. The screen for entering agricultural vehicle information is displayed.

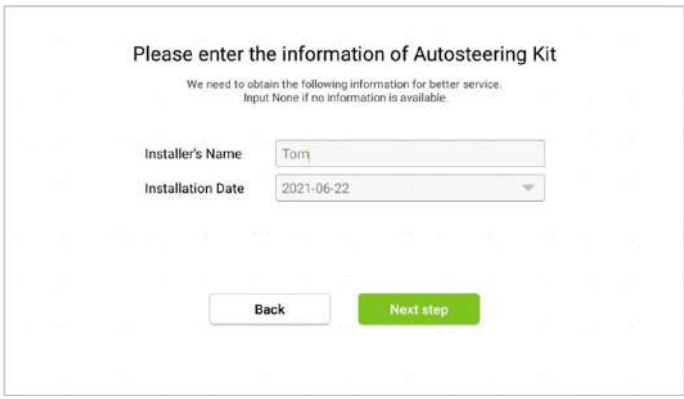


Figure 3.2.5 Entering Auto-kit information

Step 3： Specify all parameters about the agricultural vehicle and tap Next step.

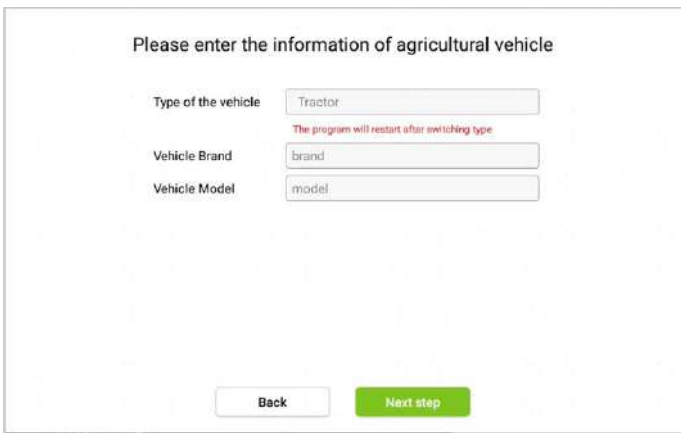


Figure 3.2.6 Entering agricultural vehicle information

After you select a type of the vehicle, the kit will directly enter the corresponding agricultural vehicle kit. Please select the type of the vehicle you will actually use.

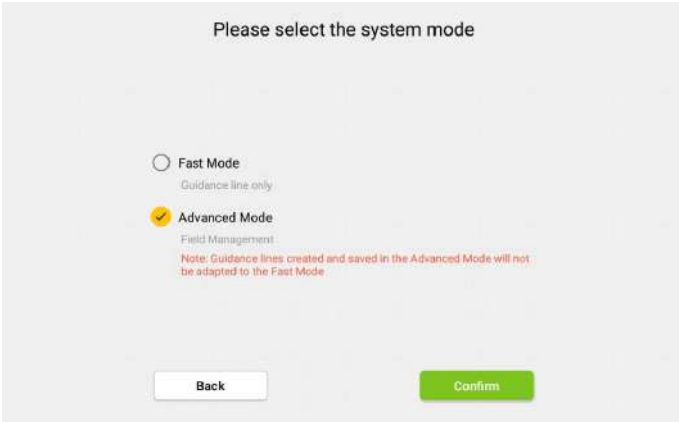


Figure 3.2.7 Selecting system mode

Step 4: In terms of system mode, select the corresponding one.

Please choose carefully according to the actual usage and tap Save. The home screen is displayed.

Fast mode

The operation is simpler. The task can be started directly after importing the guidance line.

Advanced mode

Upgrade the field management function, start the operation after completing the task configuration, and have a more systematic management of the field data.

Note: The guidance line used in the advanced mode cannot be adapted to the Fast Mode.

2.4 Home Screen

After successfully logging in to the system, you will enter the home screen. You can view the network connection status and operation status in real time. Your account login record will be automatically saved locally. Therefore, you can directly enter the home screen of the kit every time you open the kit.

2.4.1 Main Interface of Fast Mode

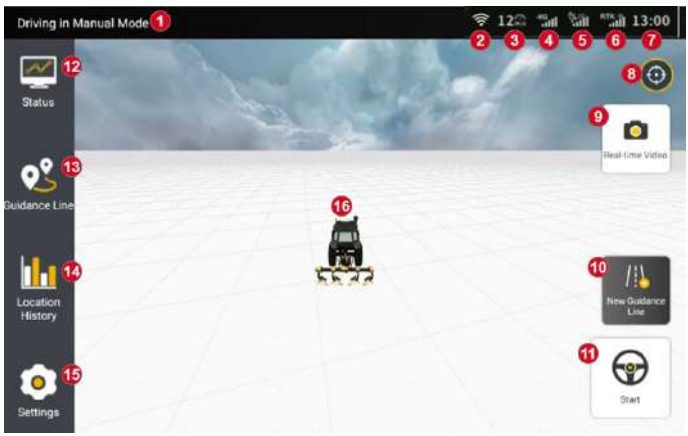


Figure 3.2.8 The main interface of Fast Mode

1. Current driving mode : Shows the current driving mode, including manual driving mode and autosteering driving.

2. WiFi signal: Shows that the current device is connected to the wireless network.

3.Real-time speed: Displays the running speed of the current agricultural machine, and the speed unit can be changed in the setting.

4. 4G signal: The mobile network signals, shows the real-time cellular data communication of the autonomous driving system.

5. GNSS signal: The satellite signal, shows the connection status of the system.

6. RTK signal: The carrier phase differential signal. It includes two modes of the portable base station and network RTK, showing the differential signal strength in real-time.

7.Time: Android system time, users can manually changed the time zone in Android system.

8. Perspective switch: Fix the perspective of three-dimensional view by tapping the button.

9. Real-time video: Real-time monitoring of machine tool operation status through Wi-fi camera, real-time feedback of operation status. (Note: Wi-fi camera needs to be purchased separately.)

10. New Guidance line: Set new guidance line by tapping this shortcut button.

11. Autosteering Start / Stop button: Tap to start or stop the vehicle.

12. Status: Tap to access the real-time information and current status of agricultural machines.

13. Guidance line: Tap to access the Guidance line detailed page for checking, adding, selecting and deleting guidance line.

14. Location history: Click to expand the historical operation data information, and view the operation time, operation area, operation width, operation efficiency, historical operation trajectory etc.

15. Settings: Tap to access Parameter Settings, RTK Settings, Trouble Checking, System Upgrade, and Version.

16. Vehicle: Shows the movement of vehicles in real-time.

2.4.2 Main Interface of Advanced Mode

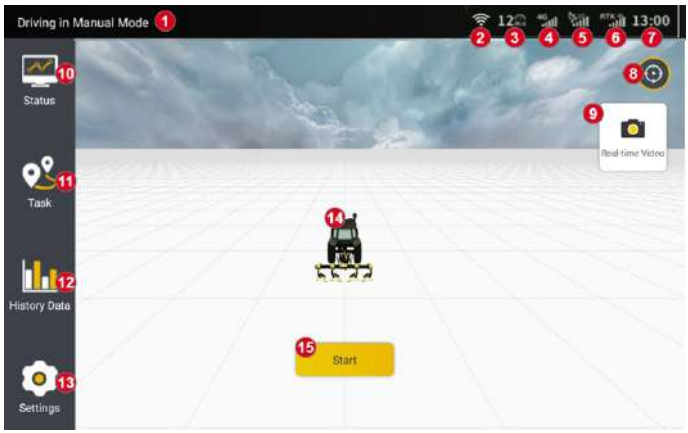


Figure 3.2.9 Main interface of advanced mode

1. Current driving mode： Shows the current driving mode, including manual driving mode and autosteering driving.

2. WiFi signal: Show that the current device is connected to the wireless network.

3. Real-time speed: Displays the running speed of the current agricultural machine, and the speed unit can be changed in the setting.

4. 4G signal: The mobile network signals, shows the real-time cellular data communication of the autonomous driving system.

5. GNSS signal: The satellite signal, shows the connection status of the system.

6. RTK signal: The carrier phase differential signal. It includes two modes of the portable base station and network RTK, showing the differential signal strength in real-time.

7. Time: Android system time, users can manually changed the time zone in Android system.

8. Perspective switch: Fix the perspective of three-dimensional view by tapping the button.

9. Real-time video: Real-time monitoring of machine tool operation status through Wi-fi camera, real-time feedback of operation status. (Note: Wi-fi camera needs to be purchased separately.)

10. Status: Tap to access the real-time information and current status of agricultural machines.

11. Task configuration: Click to configure the field, boundary, guidance line and task setting information of each task.

12. History data: Click to expand the historical operation data information, and view the operation time, operation area, operation width, operation efficiency, historical operation trajectory etc.

13. Settings: Tap to access Parameter Settings, RTK Settings, Trouble Checking, System Upgrade, and Version.

14. Vehicle: Shows the movement of vehicles in real-time.

15. Start task: After clicking, if the task configuration has been completed, it will enter the operation status; otherwise, it will enter the task configuration interface.

2.5 Connecting to RTK

After successfully entering the home screen, you need to connect the kit to the RTK. Perform the following operations to connect the kit to the RTK:

Step 1： Choose Settings -> RTK settings. The RTK settings screen is displayed.

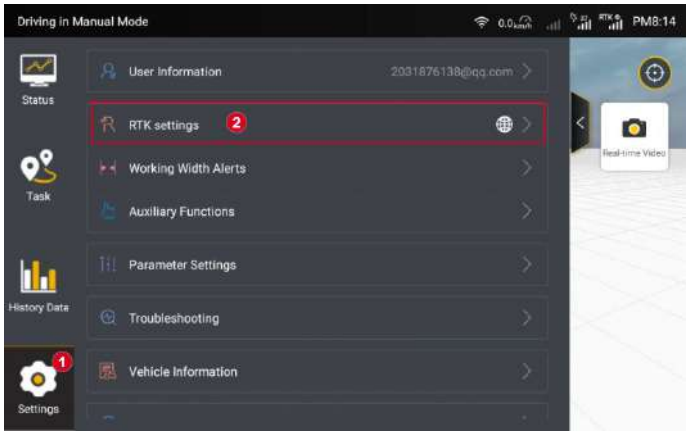


Figure 3.2.10 Settings list

Step 2: Select the RTK connection mode you want to use.

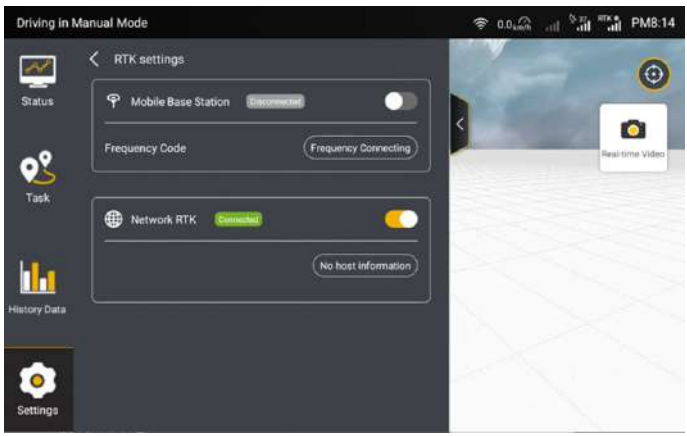


Figure 3.2.11 Connecting to RTK

This kit can be connected to base station RTK or Internet RTK. The kit is connected to a mobile base station by default. You can switch the connection mode by using the Enable/Disable switch. If the kit is switched to the RTK mode, this mode will be displayed by default in your next login.

- If you want to connect mobile base station RTK, please enable Mobile Base Station. Then, tap Frequency Connecting. In the displayed dialog box, enter the required frequency code of the connected base station. (For details about the rules for entering the base station's frequency code, refer to the Base Station User Manual.)

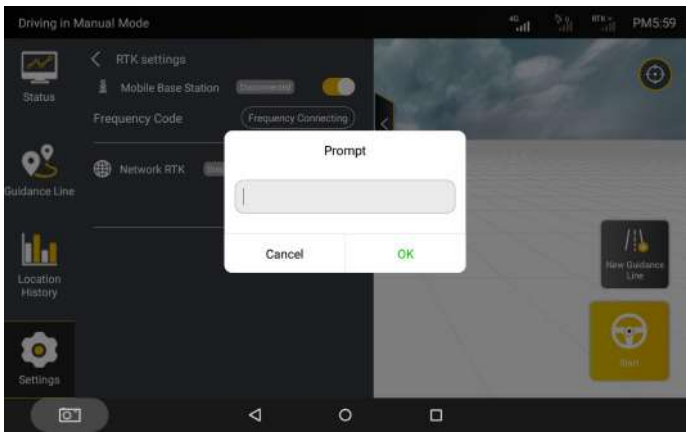


Figure 3.2.12 Entering the frequency code

- If you want to connect Internet RTK, please enable Internet RTK and tap Connect. In the displayed dialog box, enter your Ntrip domain name and account information.

Ntrip domain name information: Specify Host and Port and tap Get Source. The port with the strongest signal matching the kit will be automatically displayed by default in Source Node, which indicates that Ntrip domain information is completed.

Ntrip account information: Enter your account information in Account and

Password after specifying Ntrip domain information. Then, tap Connect to connect to the corresponding Internet RTK.

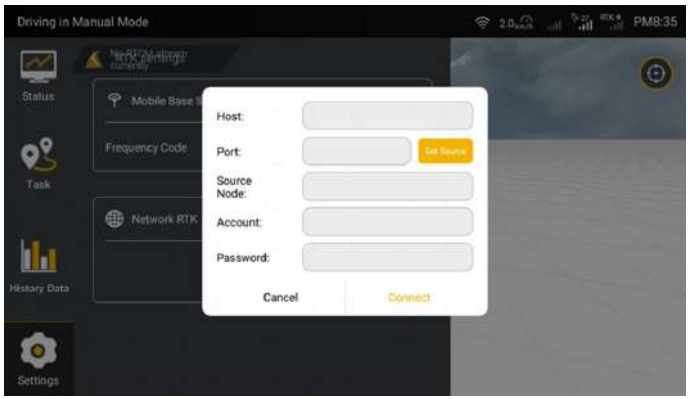


Figure 3.2.13 Connect Network RTK

Notes for RTK connection:

1. It will take up to 3 minutes to connect to the frequency of base station, and please be patient.

2. If the RTK connection always fails, please try to switch to the RTK connection twice. If the fault persists, please check whether the RTK is displayed abnormally by choosing Settings -> Troubleshooting, as shown in the following figures.

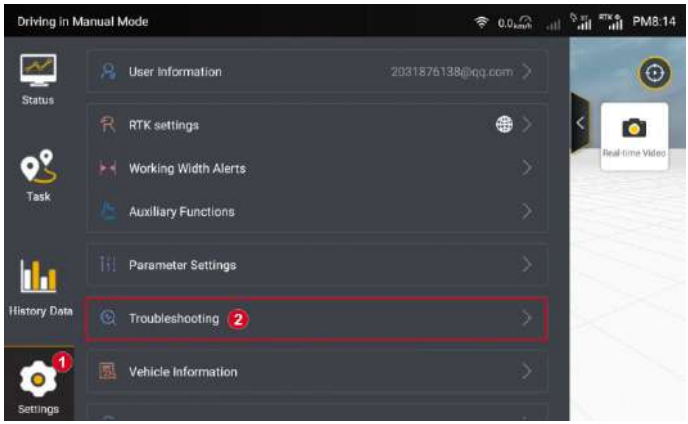


Figure 3.2.14 Setting list

Troubleshooting:

The troubleshooting detection is divided into two states, the green one means passing the test, and the red one means failing.

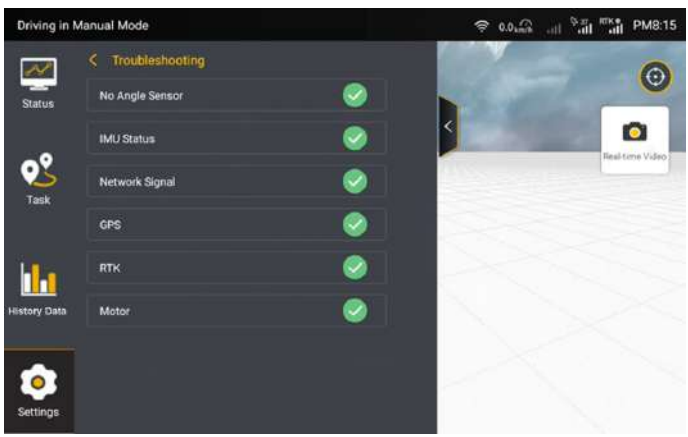


Figure 3.2.15 Troubleshooting

2.6 Setting Vehicle Parameters

After entering the home screen of the kit, perform the following operations to set vehicle parameters:

From the sidebar, choose Settings -> Vehicle Information.

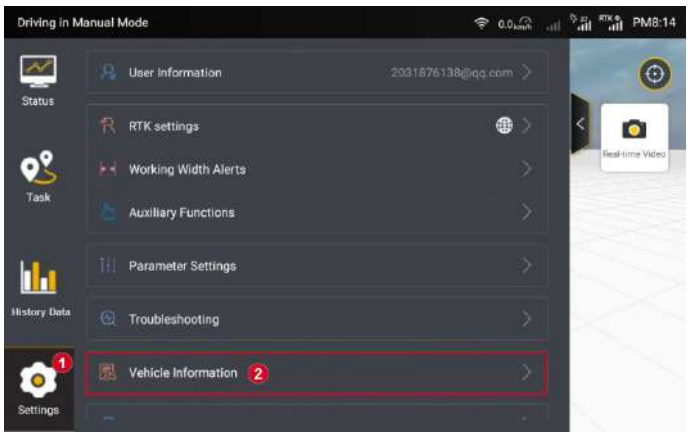


Figure 3.2.16 Setting List

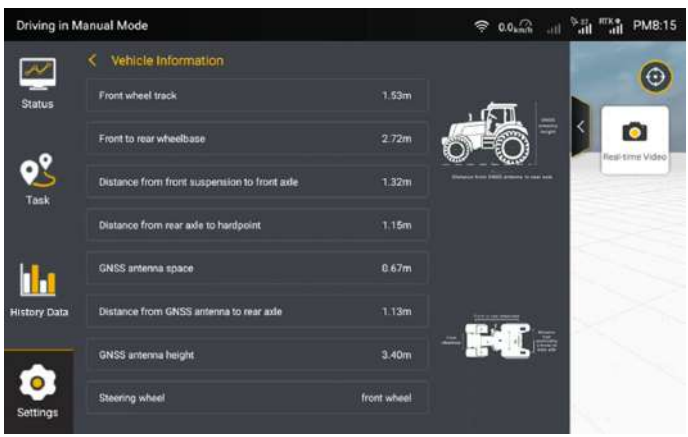


Figure 3.2.17 Vehicle information

*For details about the measurement operations, please check the corresponding commissioning instruction video.

2.7 Calibrating Angle Sensor

After completing vehicle parameter settings, you need to calibrate the angle sensor. Perform the following operations to calibrate the angle sensor:

Step 1: Choose Settings -> Parameter Settings.

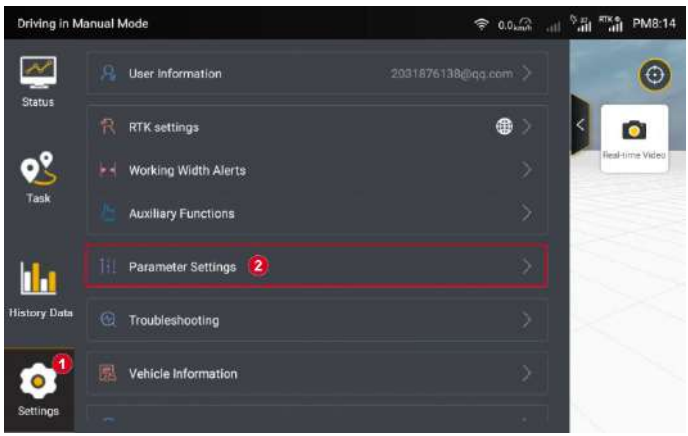


Figure 3.2.18 Setting list

Step 2: Tap ”Angle Sensor Calibration” in the detailed page of parameter settings.

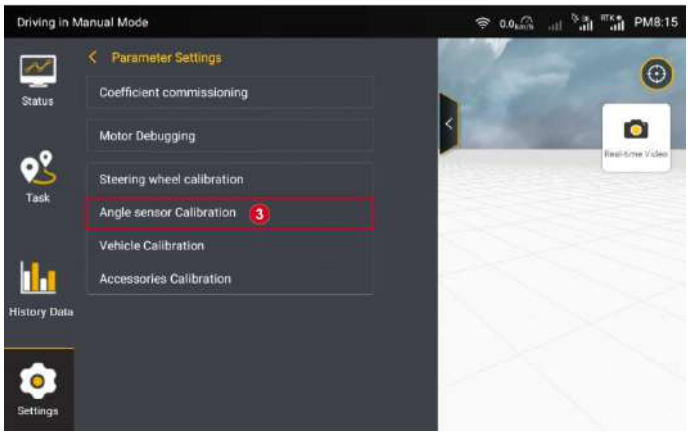


Figure 3.2.19 angle sensor calibration

Step 3: User needs to select the sensor type after getting into the angle sensor setting page.

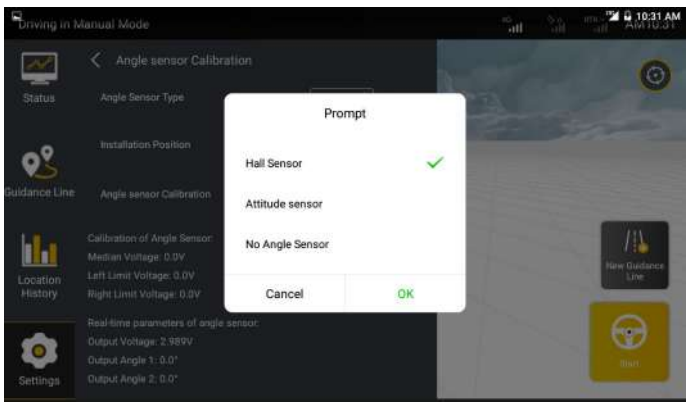


Figure 3.2.20 Select angle sensor type

- If the selected type is "Hall Sensor", then the user needs to select the installation position of the angle sensor. After selecting the installation location, click "Calibrate" to directly enter the calibration process. Please follow the prompts in the following interface to calibrate. Rotate the steering wheel

according to the process "leftmost-rightmost-center" and tap “OK” after each action finished.

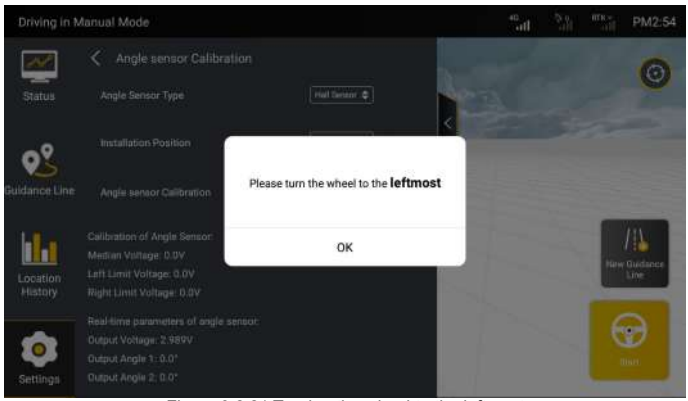


Figure 3.2.21 Turning the wheel to the leftmost

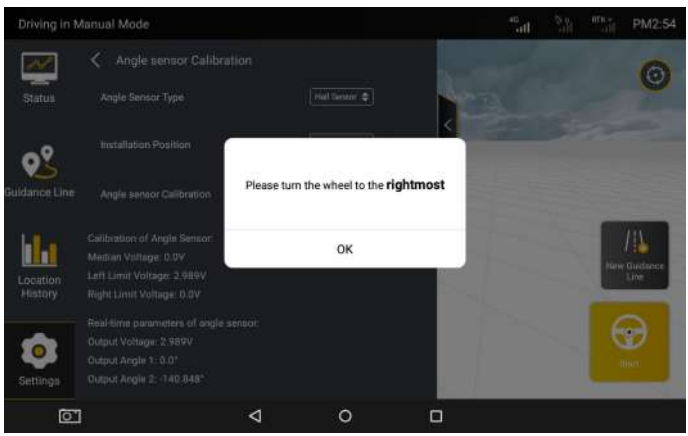


Figure 3.2.22 Turning the wheel to the rightmost

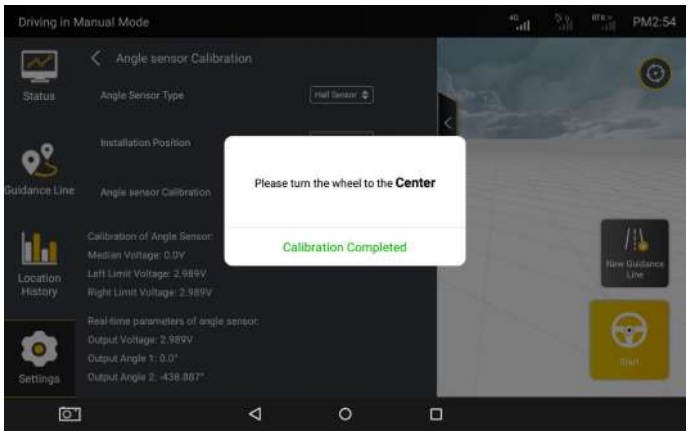


Figure 3.2.23 Turning the wheel to the center

- If the angle sensor type is selected as "attitude sensor", please then select the installation position of your angle sensor.

Note: when you choose “attitude sensor”, you shoule drive straight for 15-20m in manual mode to complete data convergence everytimes you open the system.

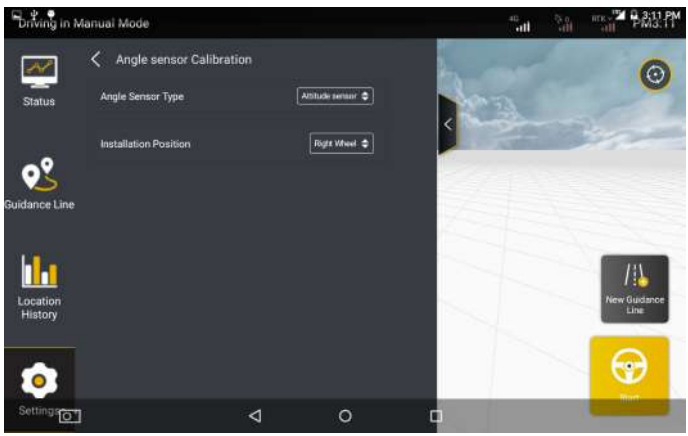


Figure 3.2.24 attitude sensor

- If the angle sensor type is selected as "no angle sensor", after selecting "no angle sensor", enter its interface as shown below.

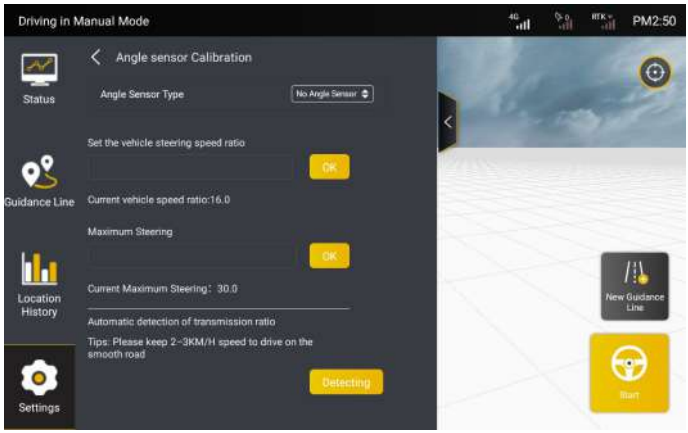


Figure 3.2.25 No angle sensor

After entering the setting screen for no angle sensor, put the vehicle's gear into the low gear first. Then, tap Detect and step on the accelerator to make the agricultural vehicle run straight for about 20 m on a level surface freely at a low speed (2–3 km/h) until the Detection Succeeded prompt box is displayed. Then, the vehicle steering speed ratio is automatically detected and the setting of no angle sensor is completed.

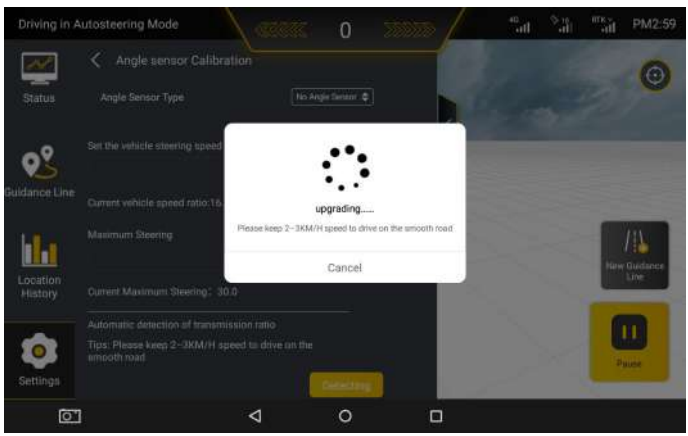


Figure 3.2.26 Detecting the speed ratio

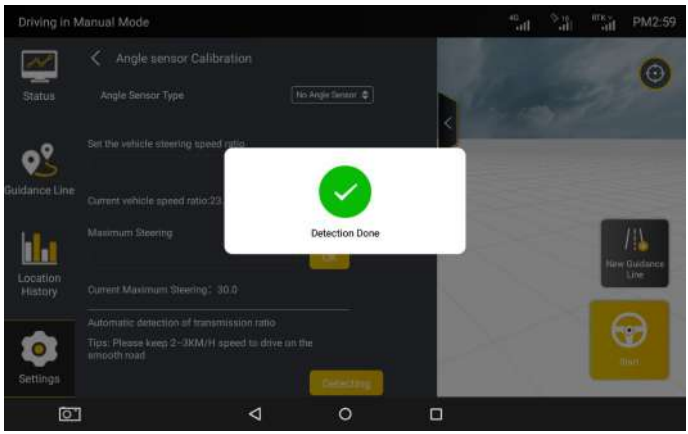


Figure 3.2.27 Detect finished

If the sensor type is switched, the device needs to be restarted after the sensor is switched to take effect.

2.8 Vehicle Calibration

After angle sensor calibration finished, you need to calibrate vehicle to correct working offset . Perform the following operations to calibrate vehicle:

Step 1: On the displayed Settings screen, tap the Parameter Settings.

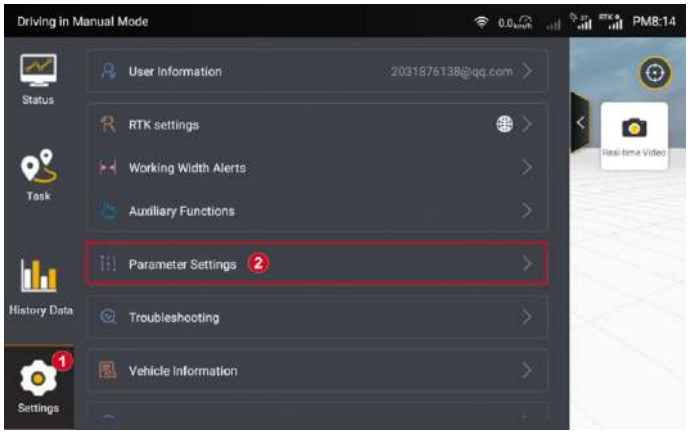


Figure 3.2.28 Setting List

Step 2: Tap into “Vehicle Calibration” in the parameter page.

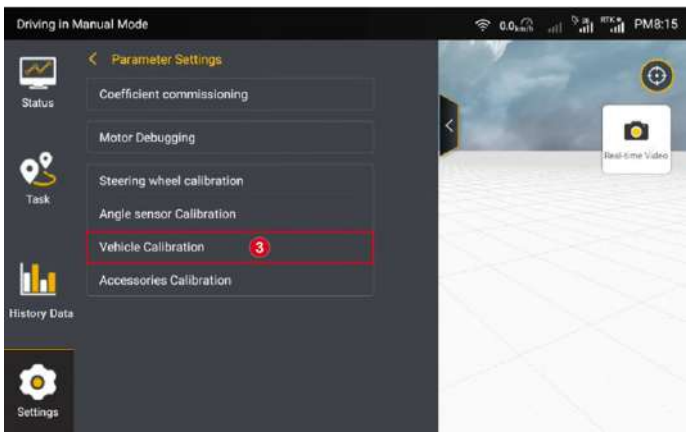


Figure 3.2.29 Vehicle Calibration

Step 3: Tap “Start Calibration” in the vehicle calibration page, and then getting into the calibrating process.

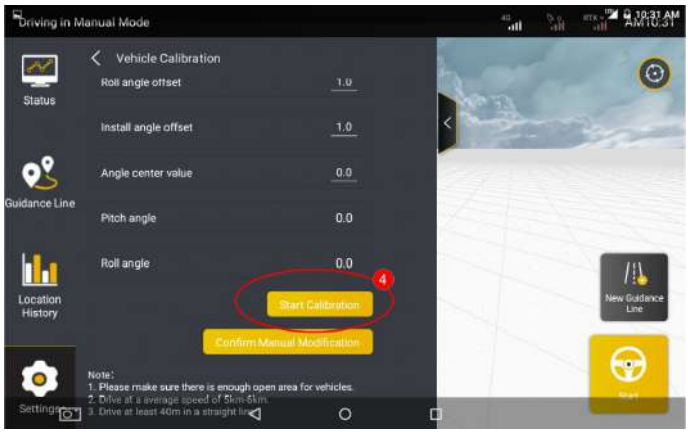


Figure 3.2.30 Start Calibration

Step 4: On the calibration screen, carefully read the current calibration step displayed. Then, determine Points A and B exactly as prompted on the screen. Move the agricultural vehicle to the starting point and tap Comfirm Point A on the screen.

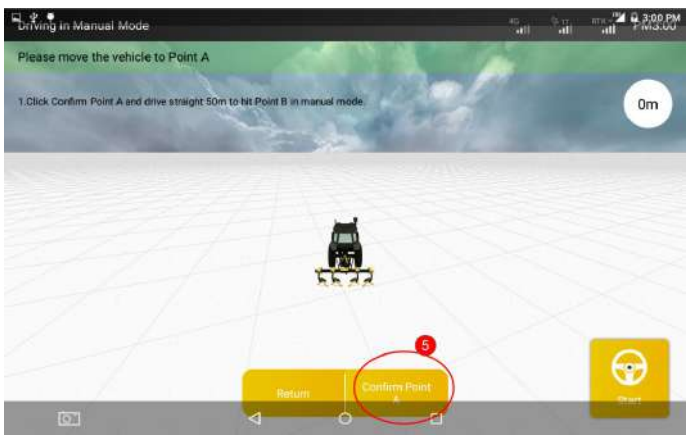


Figure 3.2.31 Comfirm Point A

Step 5: After confirming Point A, manually drive the vehicle straight for 50m

and Comfirm Point B.

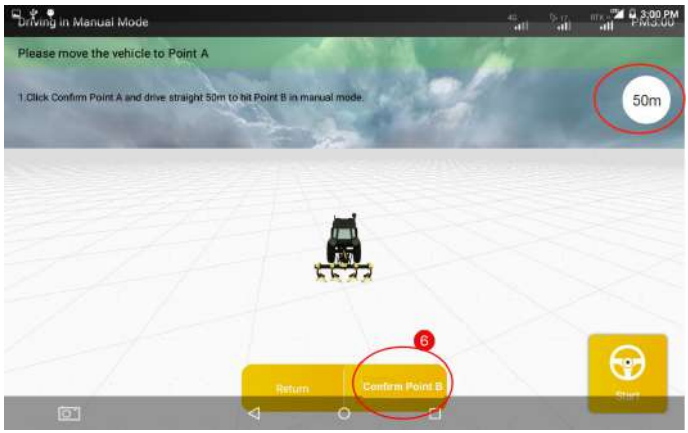


Figure 3.2.32 Confirm Point B

During the driving towards Point B, the distance traveled will be displayed on the upper right corner of the screen in real time. You can check whether the current distance from Point A meets the distance requirement of 50m based on this value.

Step 6: After confirming Point B, please follow the instructions in Step 3 on the screen to manually turn the vehicle around and make it return to Point B on the guidance line just confirmed (with the front end of the vehicle facing Point A). After the adjustment is completed, tap Start to make the vehicle run to Point A in the auto steering driving mode according to the guidance line just confirmed.

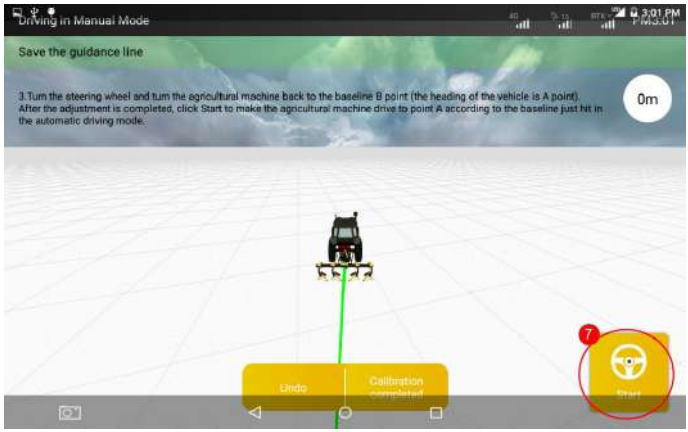


Figure 3.2.33 Starting auto steering driving after turning around

Step 7: tap Stop after the vehicle arrives at Point A in the autosteering driving mode.

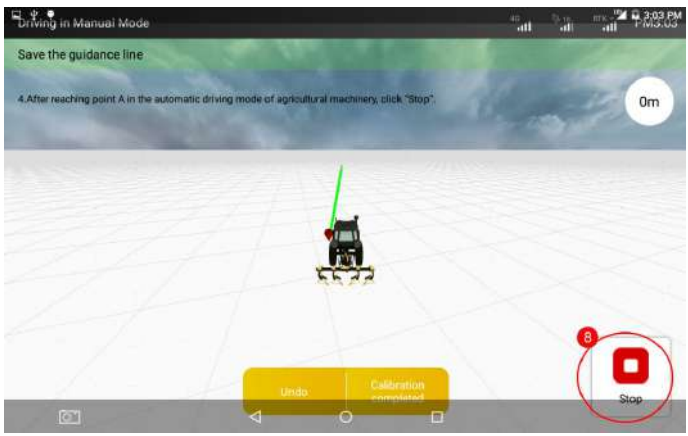


Figure 3.2.34 Stopping auto steering driving

Step 8: Manually turn the vehicle around to make it return to Point A on the guidance line (with the front end of the vehicle facing Point B). Then, tap Start to make the vehicle run from Point A to Point B in the auto steering driving mode.

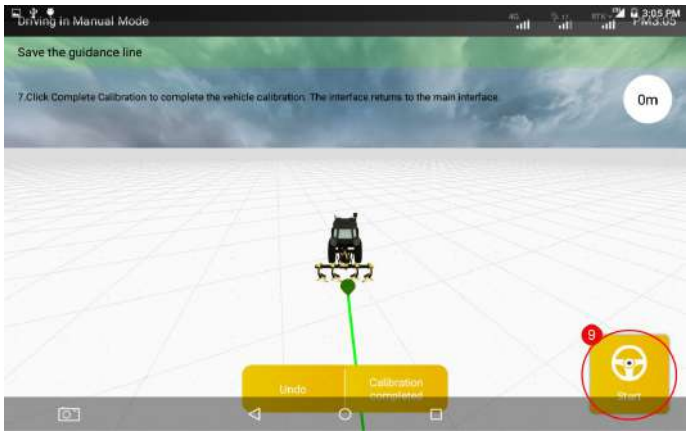


Figure 3.2.35 Manually turning around and start the auto-working

Step 9: After the vehicle reaches Point B in the auto steering driving mode, tap Stop to stop the current auto steering driving operation.

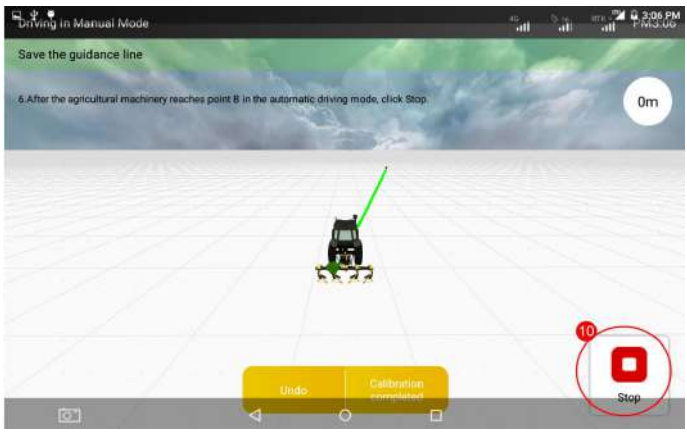


Figure 3.2.36 Stop autosteering driving after reaching the point A

Step 10: tap Calibrating completed to complete the vehicle calibration and return to the home screen.

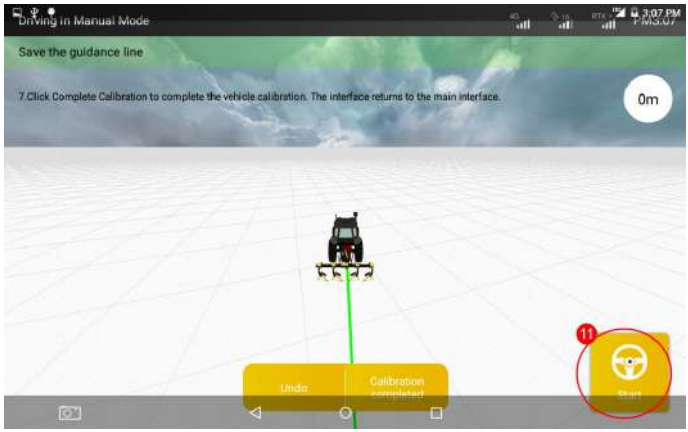


Figure 3.2.37 Calibration finished

After completing the above steps of commissioning, you can start to use control terminal for intelligent operations.

3 Preparatory Operations

3.1 Preparatory Operation in Fast Mode

Confirm RTK connection → Add guidance line → Import guidance line → Start operation

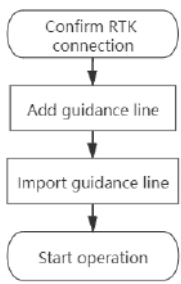


Figure 3.3.1 Preparatory operation procedure

3.1.1 Check RTK Connection

Confirm the current connection to the RTK before performing preparatory operations.

(1) Check whether the current RTK connection mode is correct.

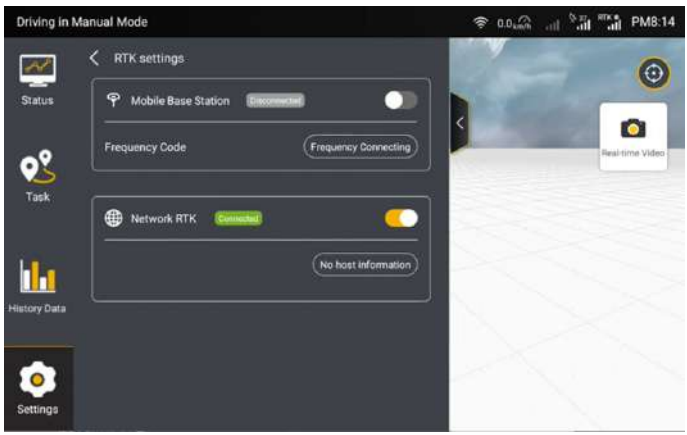


Figure 3.3.2 RTK Settings

(2) Check whether the current RTK connection is stable.

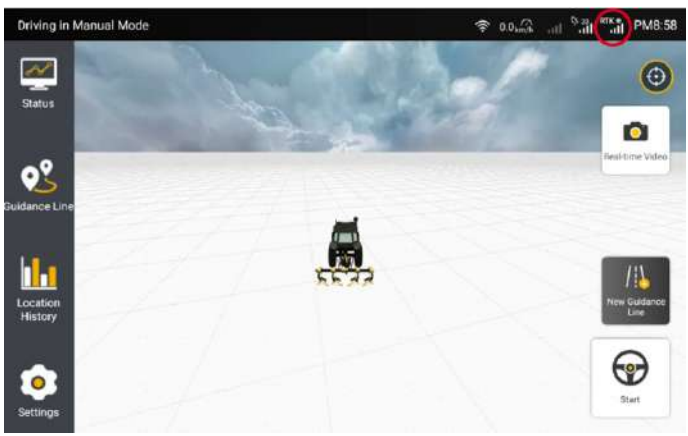


Figure 3.3.3 Home page

Check if the RTK signal display in the status bar is full, or if RTK Status in Real-time Status is 4.

3.1.2 Adding New Guidance Line

After confirming the connection to the RTK, you can start setting points. You can follow the prompts to complete setting points A and B to save a new guidance line, and import the new guidance line to the current operation, as follows:

- Linear Mode

Step 1: Tap "New Guidance Line" in the home page to start the procedure for creating a new guidance line.

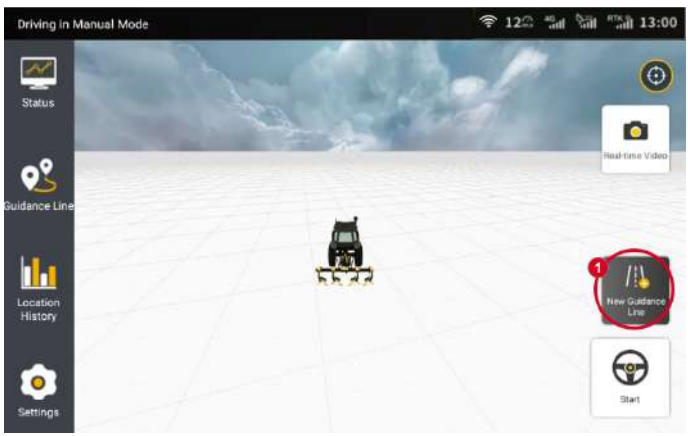


Figure 3.3.4 Home Page

Or tap the sidebar "Guidance Line" to expand the guidance line details page, and tap "Add" in the interface on the guidance line details page to start the process of creating a new guidance line.

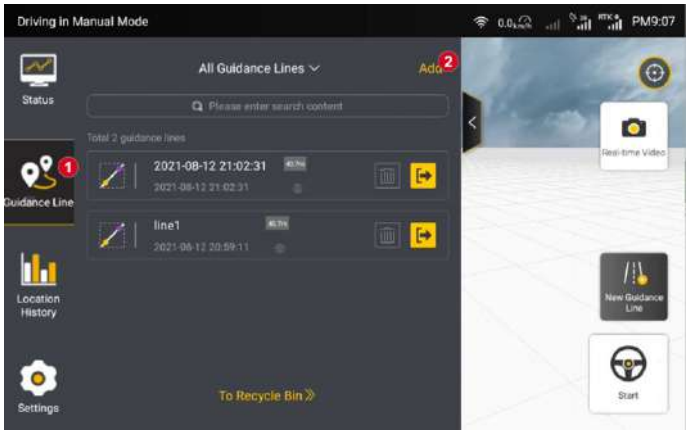


Figure 3.3.5 Guidance Line List

Step 2: Move the vehicle to the starting point of the operation, and tap **Confirm Point A** on the screen of control terminal to determine the current position as Point A of the new guidance line. After confirming Point A, manually drive the vehicle straight for 15–20 m.

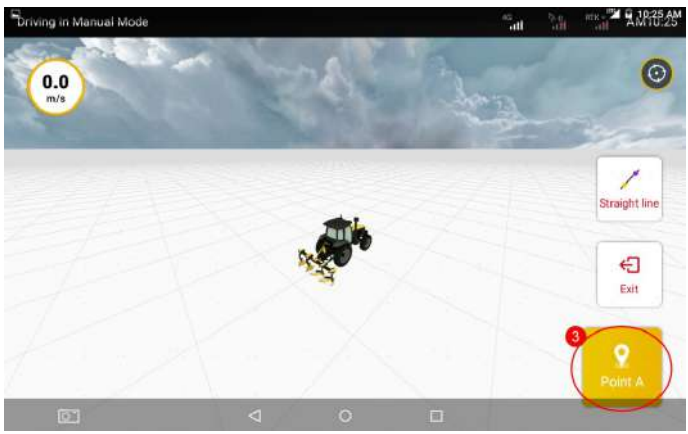


Figure 3.3.6 Confirming Point A

Step 3: Brake the vehicle and tap Confirm Point B on the screen of the in-vehicle control terminal to determine the current position as Point B on the guidance line.

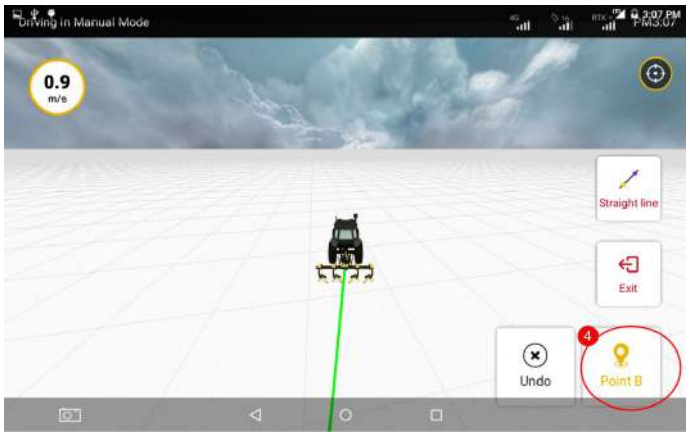


Figure 3.3.7 Confirming Point B

Step 4: After confirming Point B, please tap “Import” and enter the guidance line name in the prompt. Then go back to the list of guidance lines after naming the new line. And the newly added guidance line will be displayed on the top of the list.

Figure 3.3.8 Import Guidance Line

- Curve Mode:

Step 1: Tap "New Guidance Line" in the home page to start the procedure for creating a new guidance line.

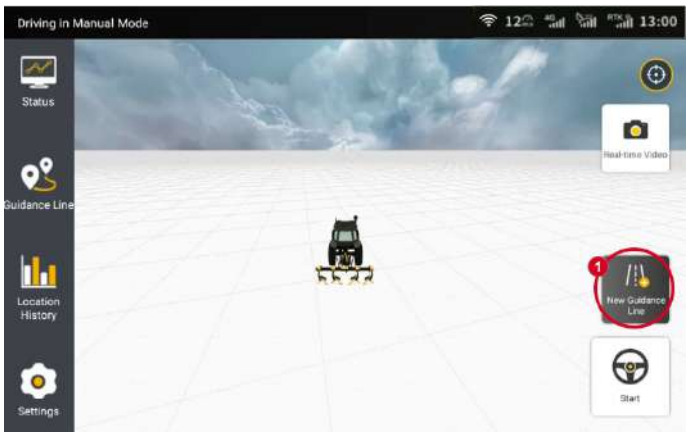


Figure 3.3.9 Home Page

Or tap the sidebar "Guidance Line" to expand the guidance line details page, and tap "Add" in the interface on the guidance line details page to start the process of creating a new guidance line.

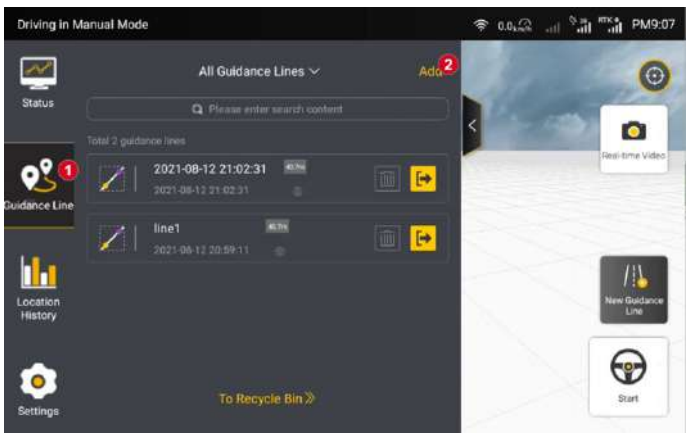


Figure 3.3.10 Guidance Line List

Step 2: On the displayed Guidance Line setting page, tap Straight Line to switch the plotting mode to the curve.

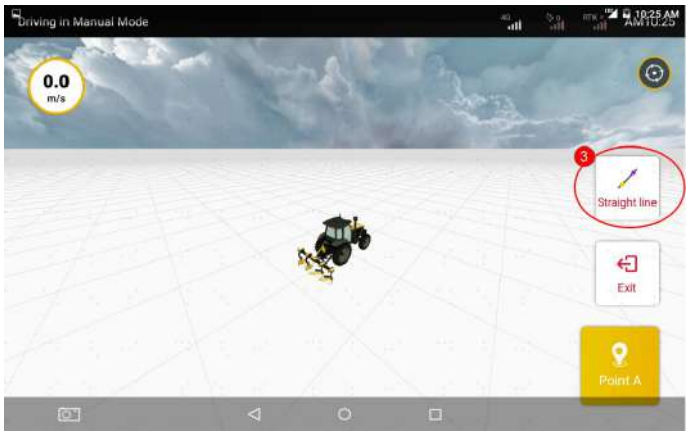


Figure 3.3.11 Switch plotting mode to the curve

Step 3: After switching to the curve mode, please move the vehicle to the starting point of the operation, and tap Confirm Point A on the screen to confirm the current position as Point A on the curvilinear guidance line.

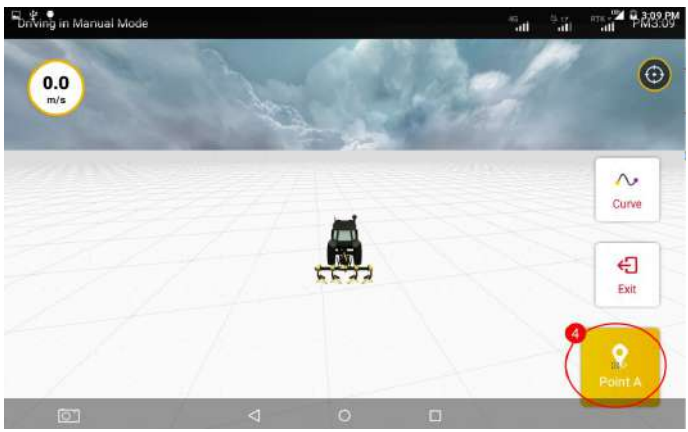


Figure 3.3.12 Confirming Point A

Step 4: After confirming Point A, please directly curve the vehicle's path to the ending point of another side you want to determine (for example, from the starting point to the other field edge) in manual mode and tap Comfirm Point B.

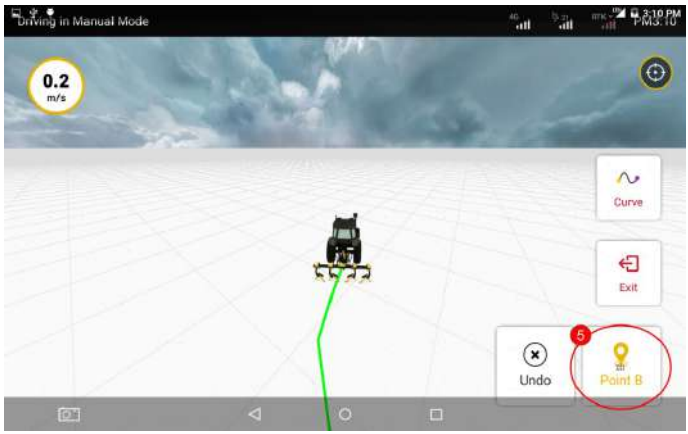


Figure 3.3.13 Comfirming Point B

Notes for the curve mode:

1. In the curvilinear mode, Point A is the starting point and Point B shall be a point on another field edge.

2. In multi-line mode, make sure to travel in the same line lengths as the curvilinear guidance line, or the route beyond the curvilinear guidance line will gradually tend to a straight line.

3. In curvilinear mode, after comfirming Point A, you cannot directly tap Linear to switch to linear mode. Please cancel the plotting before switching the mode.

Step 5: After confirming point B, please tap Import and enter the new line's name, and then you can get into the curve mode working page.

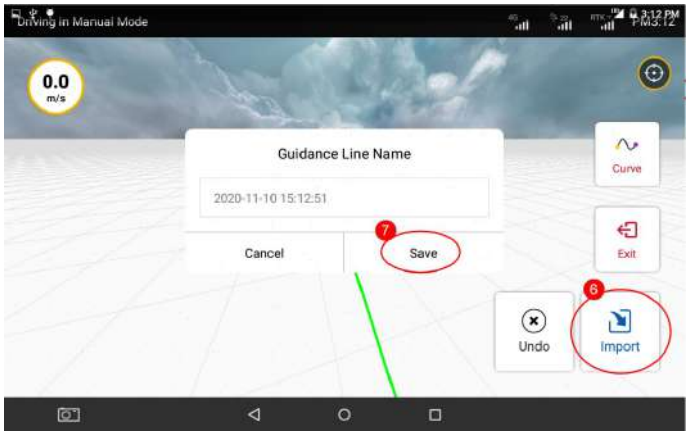


Figure 3.3.14 Import new guidance line

Step 6: The kit will automatically import this curvilinear guidance line to the current operation, as shown in the following figure.

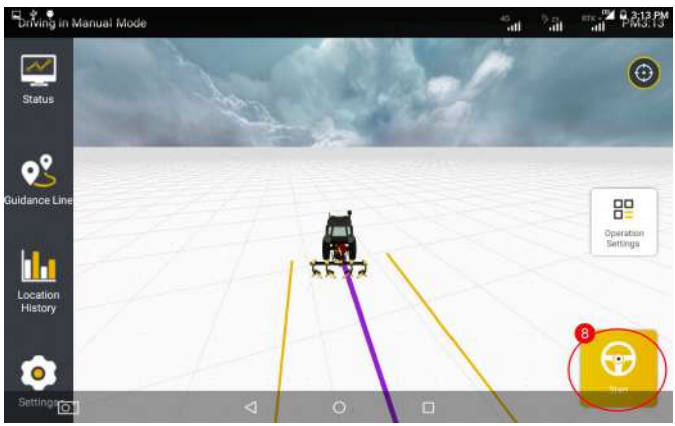


Figure 3.3.15 Auto-working in Curve mode

3.1.3 Import Guidance Line

You can directly import the required guidance line from the list of guidance lines to the current operation as follows:

Step 1: If you have already saved the guidance line before, please find out

the line you want to import in the list of guidance lines. And then tap Import buttom in the required guidance line tab to import the line to the current operation.

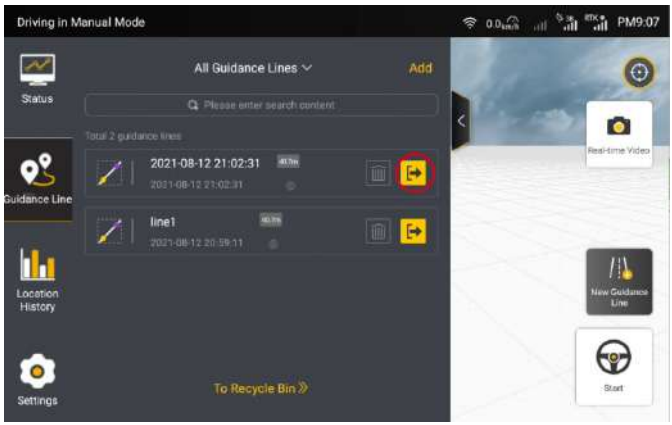


Figure 3.3.16 Guidance line list

If Multi Line Mode is needed, please enter into Settings -> Parameter Settings -> Working width Alerts to set the working width for the preparatory operation in multi line mode, as shown in the following figure.

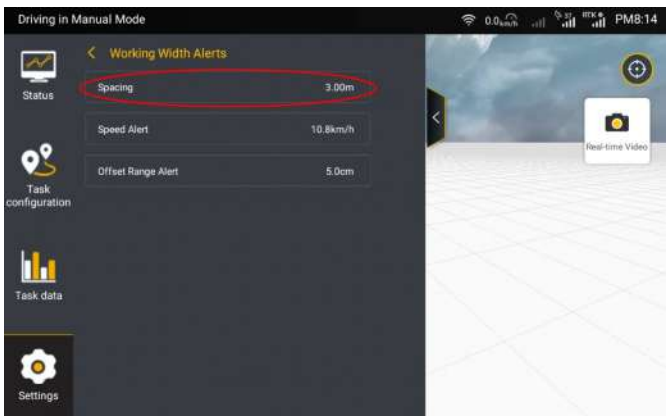


Figure 3.3.17 Setting the operating space

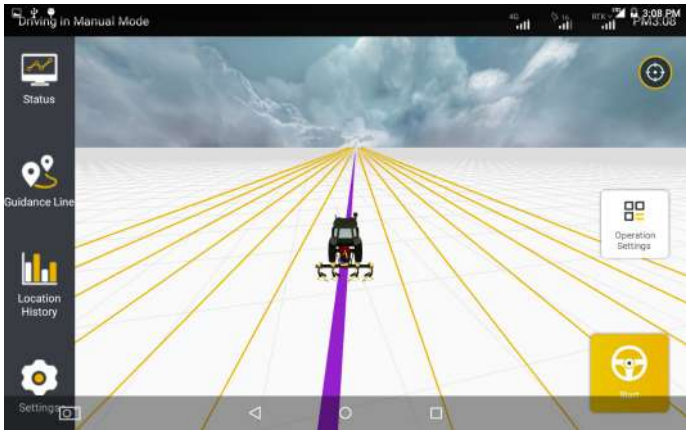


Figure 3.3.18 Guidance line imported

3.2 Preparatory Operation for Advanced Mode

Confirm RTK connection → Add and select field → Add and select boundary → Add and select guidance line → Add and select task setting → Confirm task configuration → Start operation

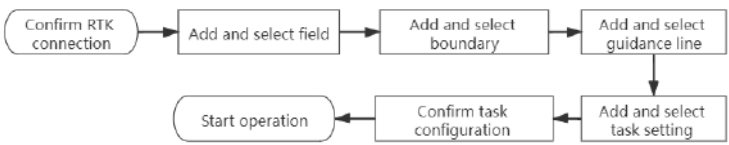


Figure 3.3.19 Preparatory operation flow chart

3.2.1 Confirm RTK Connection

Before preparing the operation, please confirm the current RTK connection. For the specific operation steps, see 3.1.1 Confirm RTK connection.

3.2.2 Add and Select Fields

Click "Task" button on the left to enter the task configuration interface. First,

add and select an operation field.

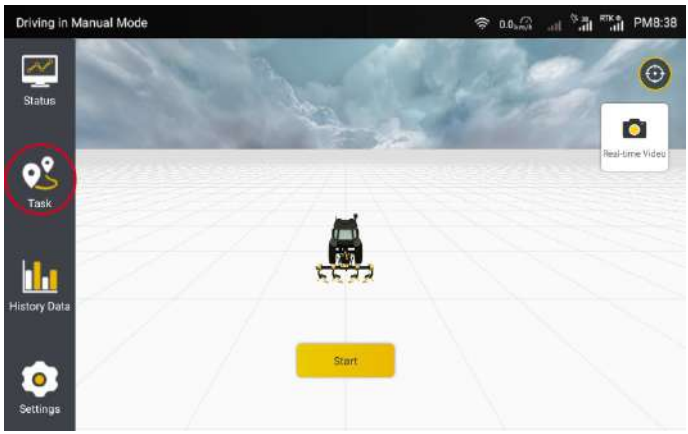


Figure 3.3.20 Task configuration entry

The configuration field interface is shown in the figure below:

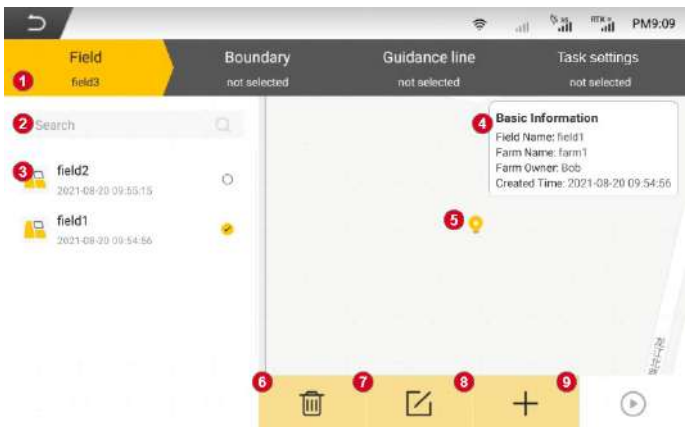


Figure 3.3.21 Configure field interface

1. Task configuration items: Select the field, boundary, guidance line and task settings required for the operation. Yellow represents the current configuration items. Under each item, it will display current selection. If it has not

been selected, it will display "not selected". Otherwise, the corresponding option is displayed below.

2. Search box: Find the target field by searching the field name.

3. Field list: Display existing fields, including field name and creation time. Click to select the field to be operated.

4. Field basic information: Including field name, farm name, farm owner and creation time.

5. Field map: Display the current position and selected boundary and guidance line position.

6. Delete field: Click to delete the field, and the associated boundary, guidance line and history data will be deleted after deletion and cannot be restored.

7. Modify field information: Click to modify the field name, farm name and farm owner information.

8. Add field: Click to add a new field, fill in field name, farm owner and farm name.

9. Run configuration: If the task configuration is not completed, it is impossible to click; after the configuration is completed, Click pop-up task information configuration confirmation box to confirm the information and start the operation.

Note: If the field is not selected, it is impossible to set the boundary, guidance line and task setting cannot be selected

Add field

After filling in the corresponding field name, farm owner and farm name, click “Save”.

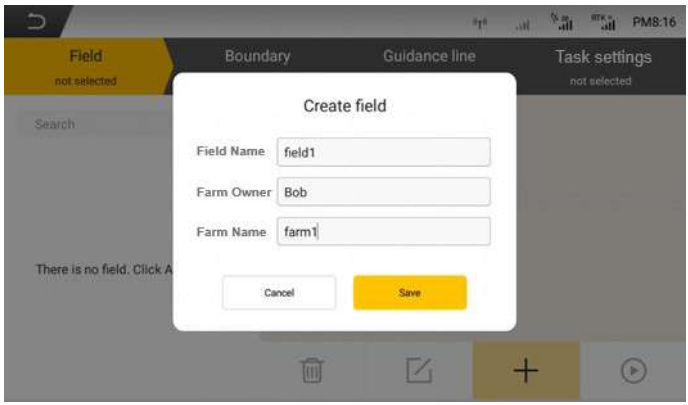


Figure 3.3.22 Interface for adding field

3.2.3 Add and Select Boundary

Click boundary item to add and select the boundary required by the operation in the list. If the operation does not require a boundary, user can select the "No boundary" option.

The configuration boundary interface is shown in the figure below:

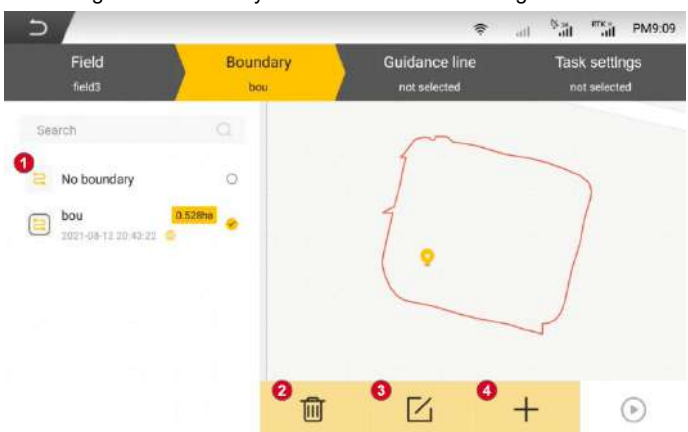


Figure 3.3.23 Interface for configuring boundary

1. Boundary list: Display the existing boundary, including name of boundary, the workable area enclosed and the creation time.

2. Delete boundary: After selecting the boundary, click "Delete" icon, and the deleted items can be restored in the recycle bin within 30 days after deletion. For details about the recycle bin, please refer to the introduction of the recycle bin in 5.3.7 System Settings.

3. Modify boundary name: Click to modify the selected boundary name

4. Add boundary: Click to enter the interface of adding boundary and guidance line.

Add boundary

As shown in the figure below, follow the prompts to Click "Start Recording" button to start driving the agricultural machine around the field edge to record the field boundary.

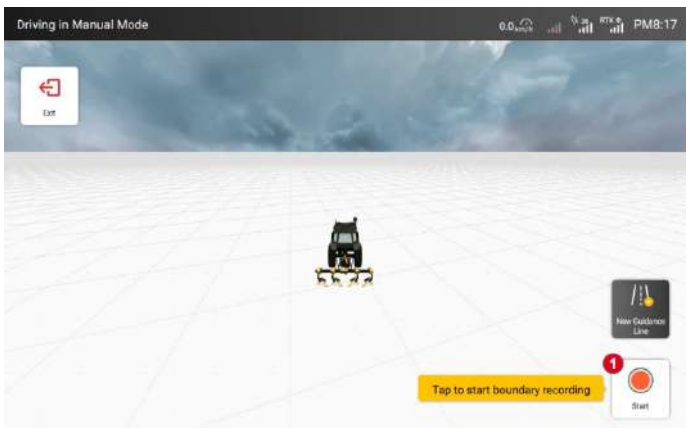


Figure 3.3.24 Interface for adding boundary

After finishing recording, Click "Pause Recording" button, and then Click "Save" button.

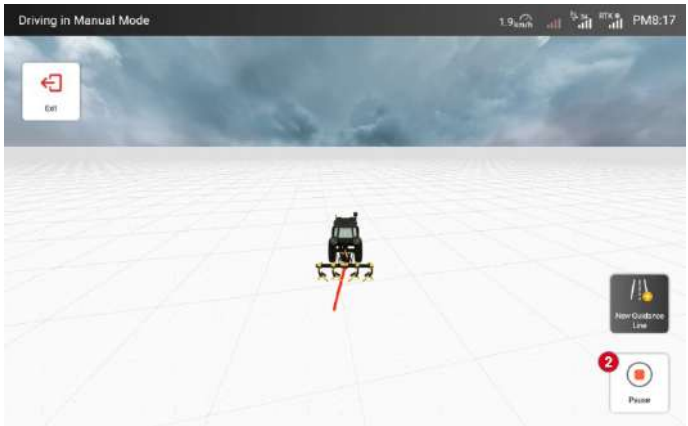


Figure 3.3.25 Interface for completing boundary recording

When saving, it is required to fill in the boundary name, the distance between the field and the boundary, and the positional relationship between the field and the boundary, and then save the boundary after filling in.

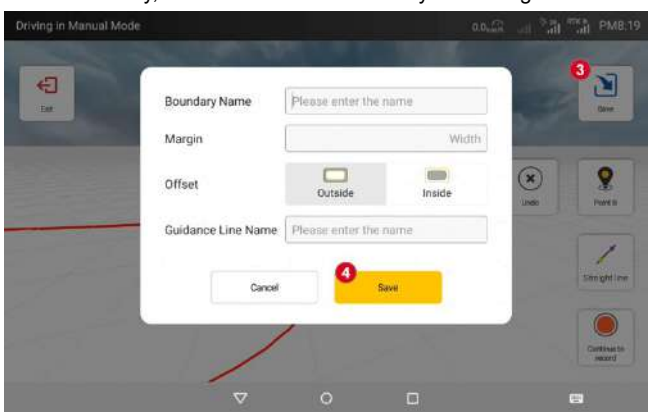


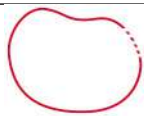
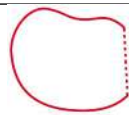
Figure 3.3.26 Save boundary interface

When the recording is completed and click “save”, if the distance between the beginning and the end of the boundary is less than 10m, the system will intelligently complete the remaining boundary;

If 10m<distance between the beginning and the end of the boundary <50m, and user confirms to save the boundary, the system will connect the beginning and the end of the boundary with a straight line.

If the distance between the beginning and end of the boundary is greater than 50m, it is impossible to save and should continue to record the boundary.

Table 3.3.1 The processing method for not connecting the beginning and end of boundary

Distance(x)	x<10m	10m<x<50m	50m<x
method	Intelligent completion boundary	Connect the beginning and end of the boundary with straight line	Continue recording boundary
Diagram			

3.2.4 Add and Select Guidance Line

Click guidance line item, add and select the guidance line required by the operation in the list.

The guidance line configuration interface is shown in the figure below:

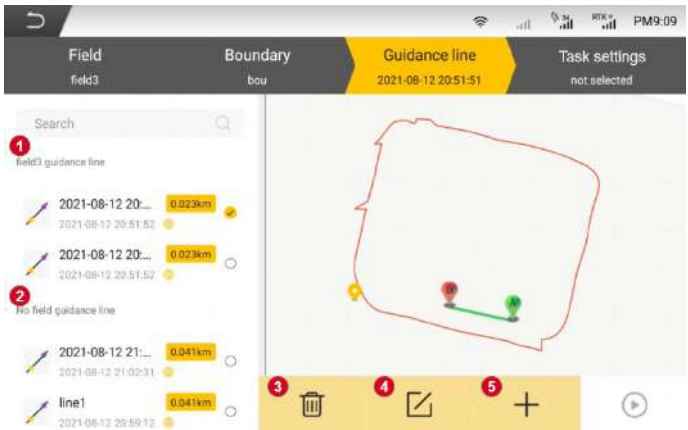


Figure 3.3.27 Interface for configuring guidance line

1. The guidance line list of the field: Display the existing guidance lines, including the name, length and creation time of the guidance line.

2. List of guidance lines without attribution: Display the guidance lines generated in the extreme Fast Mode.

3. Delete the guidance line: Click “Delete” to select the guidance line, and deleted item can be restored in the recycle bin after deletion. For details about the recycle bin, please refer to the introduction of the recycle bin in 5.3.7 System Settings.

4. Modify the name of the guidance line: Click to modify the selected guidance line name

5. Add guidance line: Click to enter the interface of adding boundary and guidance line. For specific operation steps, see 3.1.2 Add guidance line.

3.2.5 Add and Select Task Setting

Click task settings item, add and select the task setting required for the operation in the list.

The task settings configuration interface is shown in the figure below:

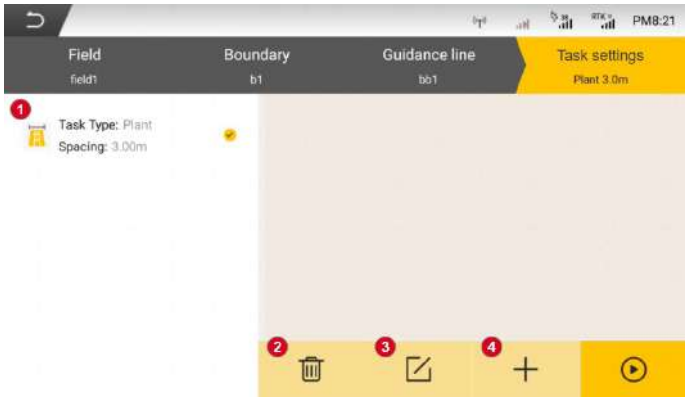


Figure 3.3.28 Setting Interface for configuring operation

1. Task settings list: Task settings that has been created.

2. Delete task setting: Delete the selected task setting, which cannot be restored after deletion.

3. Modify task setting: Modify the operation type and operation width of the selected task setting.

4. Add task setting: Add new task setting, which requires filling in the operation type and operation width.

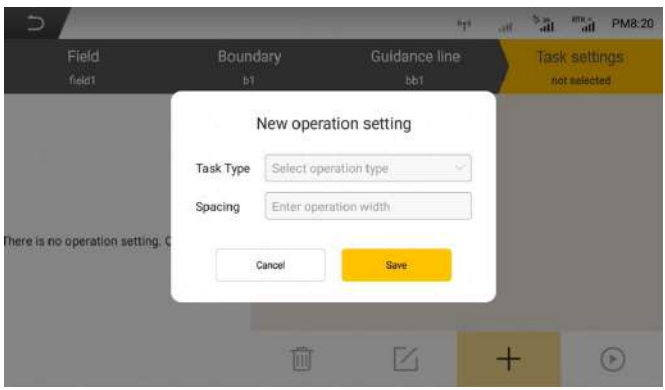


Figure 3.3.29 Setting interface for adding operation

3.2.6 Confirm Task Configuration

After all the information are selected, Click confirm button, and an information confirmation window will pop up. After confirming that the configuration information is correct, click “OK”. Click "Start " button on the homepage to enter the operation interface.

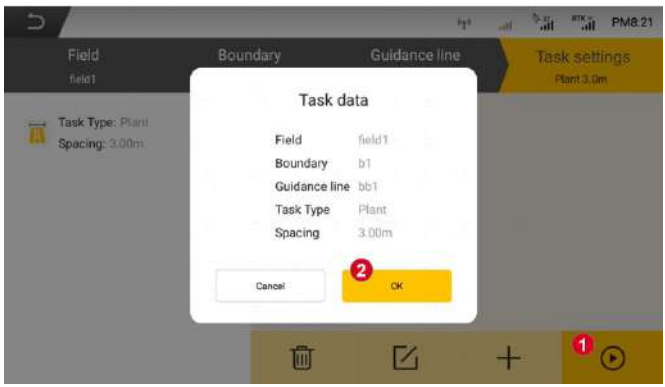


Figure 3.3.30 Interface for confirming configuration

4 Start Operation

4.1 Operation Interface

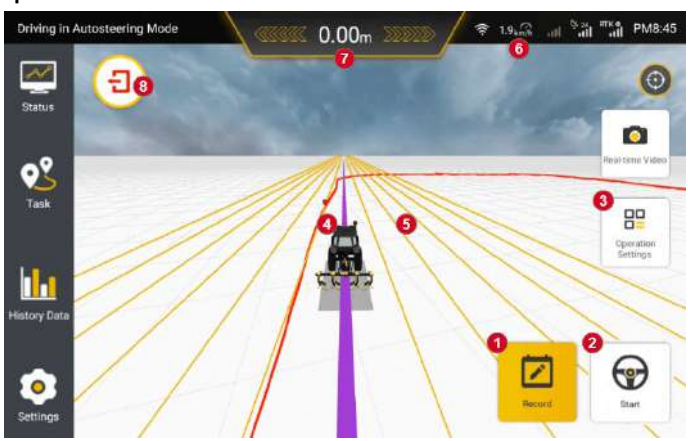


Figure 3.4.1 Operation interface

1. **Operation record button:** Yellow means that the current operation data is recording. And white means that the current operation data is not recorded. Click to switch the recording status.

2. **Auto-driving button:** Yellow means it is in auto-driving status. White means it is not in auto-driving status.Click to switch driving status.

3. **Operation setting:** Including marking field, multi-line/single-line mode, translation guidance line, translation guidance line to the current position, offset adjustment and other functions.

4. **Operation boundary:** A field warning will appear when approaching the field position associated with the boundary.

5. **Guidance line for operation:** The navigation line during operation.

6. **Real-time speed:** Display the current driving speed of the agricultural machinery, the speed unit can be changed in the settings.

7. **Offset distance:** The offset distance of the current operation relative to the guidance line is displayed in a real time manner, and the offset unit can be changed in the settings.

8. **End task:** Click to end the task.And user can view the details of this operation in the History data.

4.2 Operation Setting

After completing the installation and commissioning and task configuration procedures in sequence according to the above operations, it will start automatic driving operation. During the operation, according to the user's actual operation needs, five operations can be carried out: switching operation record status, switching driving mode, shifting the guidance line, switching operation mode, and marking the field. The specific operation process is as follows:

(1) Switch operation record status

Click "Start Recording/Recording" button in the lower left corner of the main interface to switch the status of the operation record.

Non-recording operation status: The operation data and operation traces during the non-recording time are not recorded in this operation.

Record operation status: operation data and operation traces during the recording time are recorded in this operation.

(2) Switch driving mode

Click "Start/Stop" at the bottom right corner of the main interface to switch the driving mode.

Manual driving status: The user manually controls the steering wheel to assist straight line operations. When driving manually, user can perform operations such as shifting the guidance line, switching operation modes, and marking the boundary.

Autopilot status: Navigation automatically controls the steering wheel to assist straight line operations. The operation of marking the field can be carried out during automatic driving, and other operation setting operations should be switched to manual mode.

(3) Shift the guidance line

Figure 3.4.2 Selecting shifting method of guidance line

In the manual mode after starting the task, the user adjusts the guidance line in the current multi-line mode to the left and right according to the needs of the actual operation, and drives according to the adjusted guidance line.

1. **Shift the guidance line.** You can shift the guidance line in the current multi line mode by taping guidance line shift on the operation screen firstly. Specifically, you can then set the direction and distance in the current guidance line according to the actual needs. Then, tap OK to complete the settings after enter the adjusted distance.

tap Start/Continue. After shifting the current guidance line, please tap Start/Continue in the home screen, and the vehicle will enter into autosteering driving according to the adjusted guidance line.

Figure 3.4.3 Shift guidance line

2. **Shift the guidance line to the current position.** Click "Shift to current position" in the operation setting to move the guidance line to the position of the agricultural machine.

3. **Offset adjustment.** Click "Offset fine-tuning" button in the operation setting, the user can shift the current guidance line to the left and right according to the actual operation needs, and click "√" to complete an adjustment. This operation will adjust the machine calibration parameters synchronously, which can be used to quickly solve the problem of inconsistent row operation spacing.

Figure 3.4.4 Offset correction

Note for The Use of Shifting Guidance Line:

Shift guidance line function is available only in the manual driving status in the multi-line mode.

(4) Switch operation mode

The operation mode is divided into single-line mode and multi-line mode. The user can click "multi-line mode/single-line mode" in the operation setting to switch the current operation mode. If the specific operation mode is easy to be confused, please judge the current operation mode status based on the single-line/multi-line interface background of the operation

Multi-line mode: Auxiliary straight line operation under equidistant conditions;

Single-line operation: Auxiliary straight line operation under free spacing;

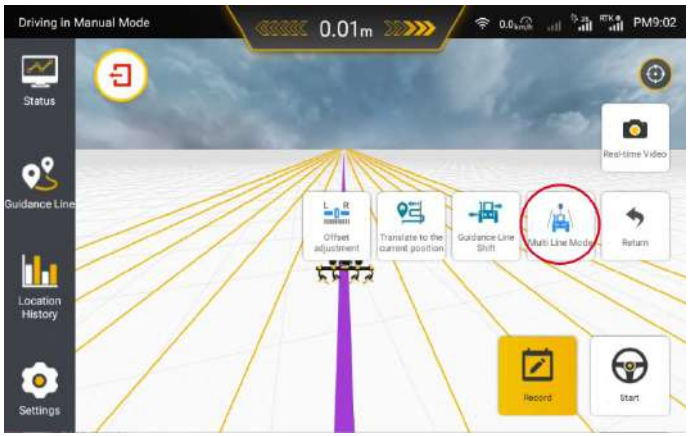


Figure 3.4.5 Multi-line mode

Figure 3.4.6 Single-line mode

(5) Mark the Edge

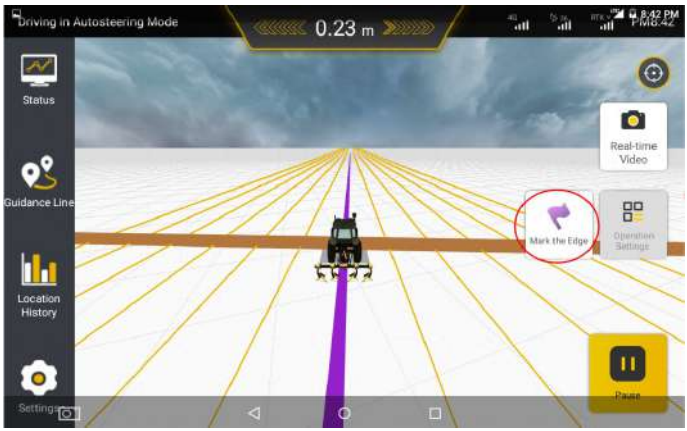


Figure 3.4.7 Marking the field edge

After importing guidance line or during the intelligent operation, you can enable the function of marking the field edge according to the actual needs. This function can alert the user when the vehicle is about to reach the field edge of another side, thereby effectively avoiding safety accidents especially in dark environment.

1. After importing the guidance line or during an intelligent operation, if you want to use this function, drive the vehicle to the field edge and tap Mark the field edge to mark the current position of the vehicle as the field edge.

2. The system will provide an alert sound and alert message for careful driving when the vehicle travels 20m away from the marked field edge.

3. When the system warns driver, you can tap Pause to suspend the current autosteering driving and resume the manual driving mode. Then, the alert sound and alert message will disappear immediately.

Notes for marking the field edge:

Only one field edge is allowed in the same direction.

In addition to completing commissioning and autosteering operations, you also can check the real-time status of the operating vehicle and undertake other system settings on the in-vehicle control terminal.

5 Other Functions

5.1 Status

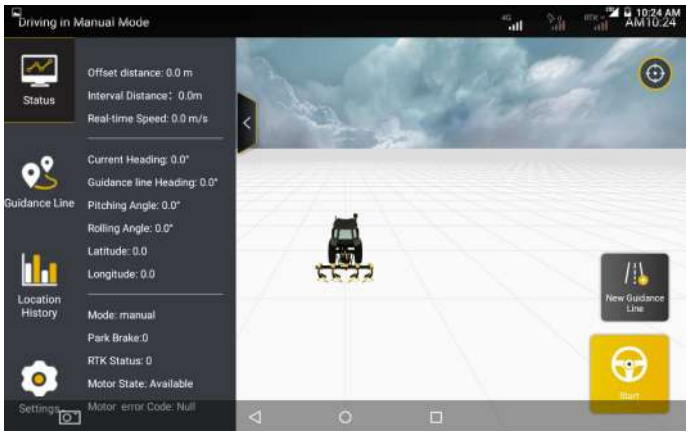


Figure 3.5.1 Status

Users click the "Status" to access the working status and operation of the vehicle.

Offset distance: Offset distance of the vehicle;

Real-time speed: Real-time speed of the vehicle;

Current heading: Current heading angle of the vehicle;

Guidance line heading: The heading angle of the AB line;

Pitching angle: the overall pitching angle of the vehicle;

Rolling angle: the overall rolling angle of the vehicle;

Longitude and latitude: The real-time latitude and longitude of the vehicle;

Mode: Manual, automatic interval such as AB line, misalignment of heading, the distance of AB point is too small, heading update timeout, position update timeout, and heartbeat timeout;

Park brake: Emergency braking;

RTK status: The current status of RTK connection. The RTK connection is very stable when it shows the value of 4, otherwise, please check the working environment.

Motor status: The status of the motor;

Motor error code: the error number when an error occurs;

5.2 Location History

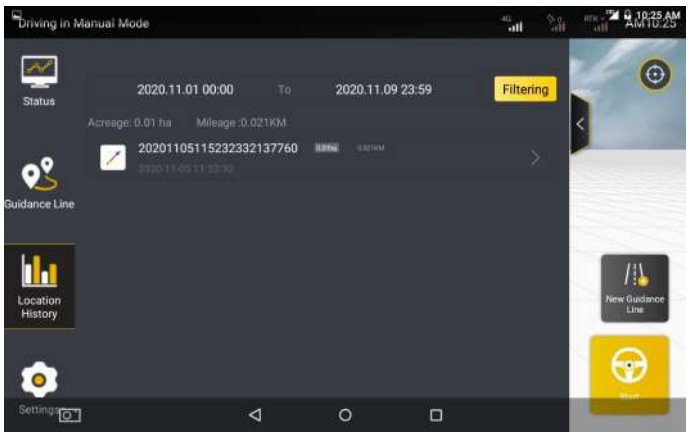


Figure 3.5.2 Operation Data

1. **Check the operation list.** After expanding the operation data details page, users can view the single information of historical operations here, including: operation time, operation width, operation area, operation efficiency etc.

2. **Filter the job list.** Users can filter the operation information by month. After the data is filled in, click “FILTERING” to refresh the list.

3. **Filter the operation list.** In the Fast Mode , users can filter the operation data by the operation time; in the advanced mode, users can filter the historical operation information by date, field and operation type. After the filter data is filled in, click "Filter" to refresh the operation data list.

Precautions of operation data:

1. Historical operation data is the operation data accumulation of each Guidance line.

2. The latest operation is placed on the top of the list, sorted by date.

3. The date on the list is the date on which the field was saved, not the date of the last job operation.

4. The acre and time are cumulative items of historical operations instead of a single data of the latest operation.

5.3 Settings

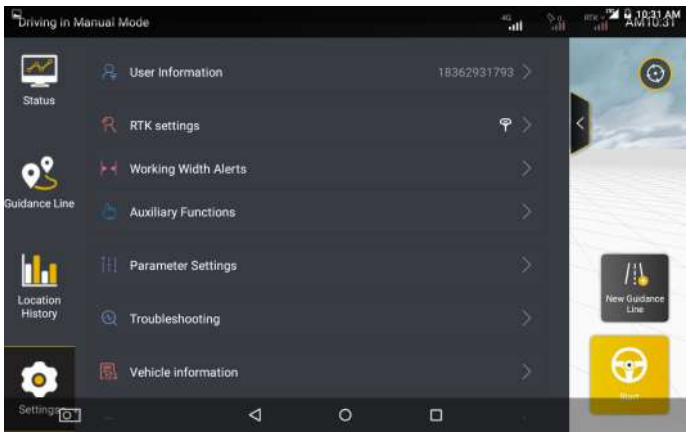


Figure 3.5.3 Setting list

The user clicks "Setting" to expand the setting details page and display the setting items.

5.3.1 RTK Settings

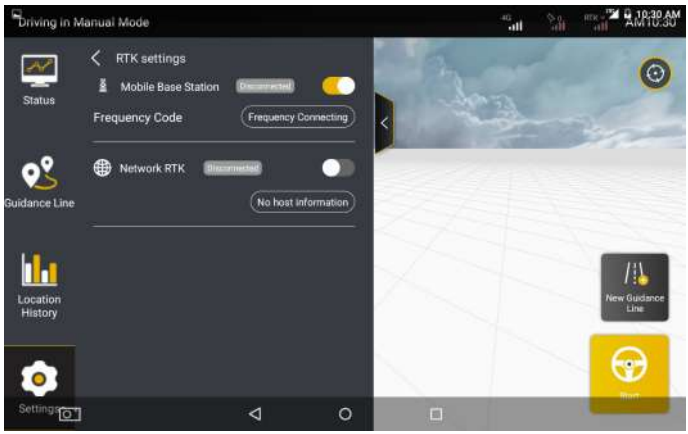


Figure 3.5.4 RTK Settings

RTK is such a technology that can ensure a centimeter-level high-precision positioning of the agricultural machinery. There are network RTK and mobile base station. Network RTK is provided by local telecom operators, while mobile base station service needs to purchase FJD base stations.

1. Before using the network RTK, users need to purchase the services from the local RTK service provider to get the ntrip account information.

2. Based on the premise that the above ntrip information is available, turn on the network RTK, click the connect button to enter your Ntrip information. Then, tap Connect. The system will automatically display a prompt box for you to enter domain name and account information. Then, tap Get Source to save the connection and finish the RTK settings.

3. After it has been successfully deployed, it will be automatically accessed by default the next time the system boots, if necessary, you can manually disconnect it.

5.3.2 Working Width Alerts

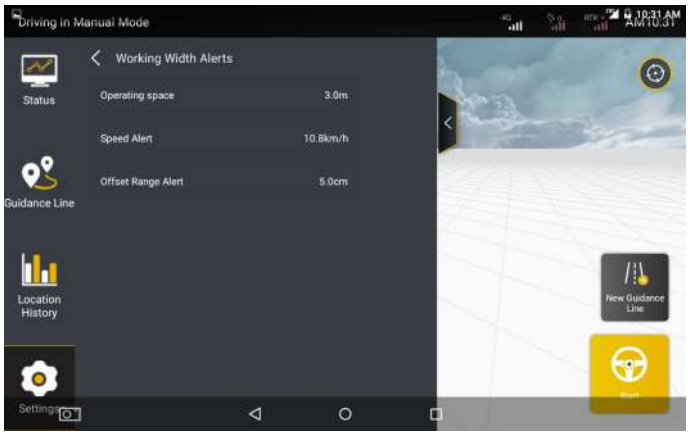


Figure 3.5.5 Working width alerts

On the displayed Parameter Settings screen, tap the Working width Alerts tab. The displayed details screen allows setting Operating space, Speed Alert, Offset Range Alert, and Driving distance warning. tap the item that needs to be set and enter the corresponding value.

Operating spacing: indicates the distance between adjacent guidance lines in multi line mode.

Speed alert: indicates the warning speed preset. It allows the system to prompt the driver to manually slow down the vehicle in auto steering driving mode in the case of speeding.

Offset range alert: indicates the warning offset preset for the vehicle in autosteering driving.

5.3.3 Accessibility

- **NMEA**

Turn on the NMEA function to transmit the GPS information received by the automatic navigation device to other electronic devices. User should enable it in

Settings-Accessibility.

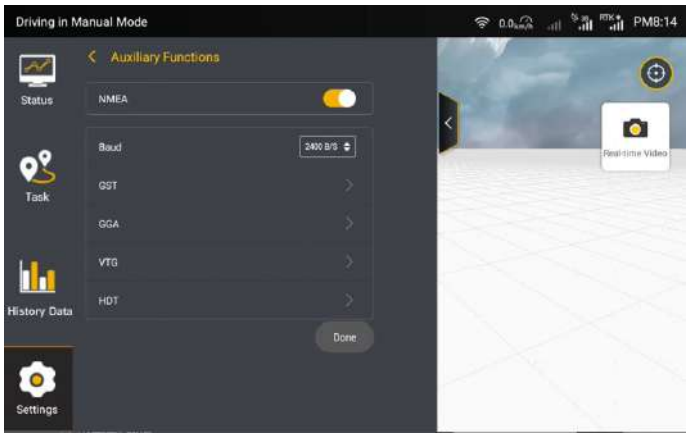


Figure 3.5.6 NMEA settings

- **Data Transfer**

Step 1: Insert the mobile storage device into the T1 port above the vehicle display control terminal (the T1 port is a USB Type-C port, if the mobile storage device is a Type-A port, it is required to purchase a connector converter).

Figure 3.5.7 Connection diagram of mobile storage device

Step 2: Enter the data transfer interface, user can export map information

via USB, such as: fields, boundary, guidance line, mission data etc., for use by other terminals, and user can also import map information from other devices to FJDynamics Autosteering kit. Data information in some formats may not be imported. For details, refer to the description of the importable format displayed in the interface.

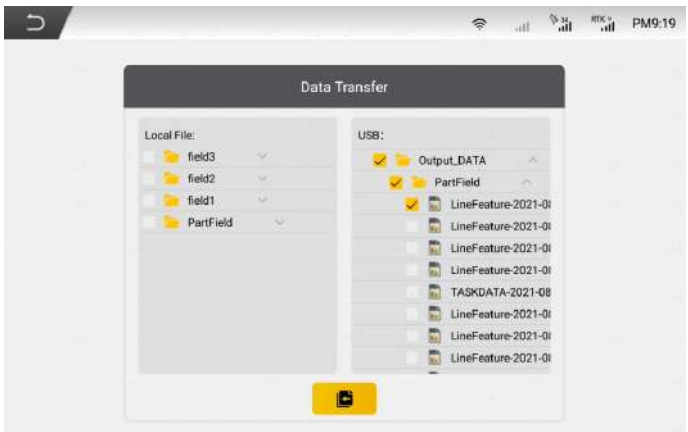


Figure 3.5.8 Data transfer interface

- **Terrain Compensation**

If the operation field contains more slopes, the terrain compensation can be turned on to achieve a more precise navigation effect.

- **Super Low Speed**

When using the Hall angle sensor, the ultra-low speed mode can be turned on to ensure the accuracy and stability of the operation at ultra-low speeds below 0.3km/h.

5.3.4 Vehicle Parameters

Figure 3.5.9 Vehicle parameter settings

Tap the “Vehicle Parameters” tab. On the displayed details screen, tap the required items and enter the corresponding vehicle data to complete vehicle parameter settings. For specific measurement details, please refer to the instruction video.

Positioning antenna spacing calibration

If there is a problem of large and small lines in the multi-line mode during the operation, the user is required to calibrate the positioning antenna spacing according to the following diagram.

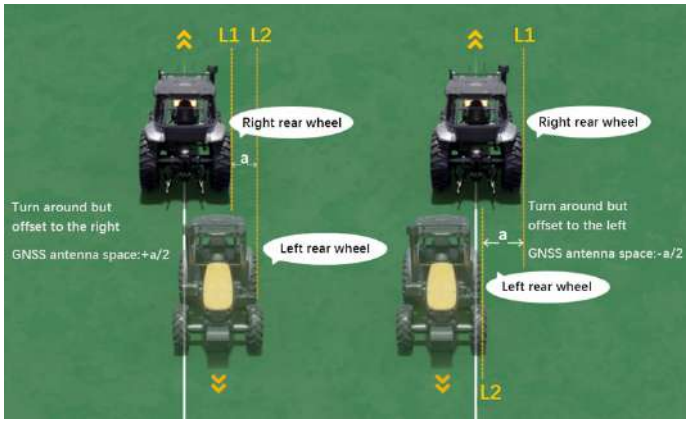


Figure 3.5.10 Positioning antenna spacing calibration

Step 1: Create a guidance line: create and import a guidance line. (The starting point is point A, the end point is point B)

Step 2: Set the line spacing and select the operation mode: set the operation spacing in the "parameter setting" to 10 meters, and select the operation mode as multi-line mode.

Step 3: Drive two times.

First driving: Drive the vehicle at a low speed from point A to point B. If the vehicle is stable (the offset error displayed on the screen is less than 2 cm), stop after the driving distance is not less than 10 meters, and mark at the right rear tire position of vehicle, confirm the marking line L1.

Second driving: After marking the marking line L1, turn the vehicle around and continue driving in the reverse direction along the driving route just now. When driving to the vicinity of the marking line L1 in the second step (note: ensure that the driving status is stable at this time, that is, the offset distance displayed on the screen is less than 2 cm), stop and draw the marking line L2 at the left rear wheel position.

Step 4: Measuring error: use a tape measure to measure the distance between the two marking lines, and record the value a (unit: m)

Step 5: Please enter a value in the interface of "Positioning Antenna-Central Axis Distance", and click "OK" to complete the corresponding positioning antenna spacing calibration.

5.3.5 Parameter Setting

Choose Settings -> Parameter Settings. On the displayed screen, you can set Angle Sensor, Vehicle Calibration and Calibration of Accessories to ensure operational accuracy.

- **Angle Sensor**

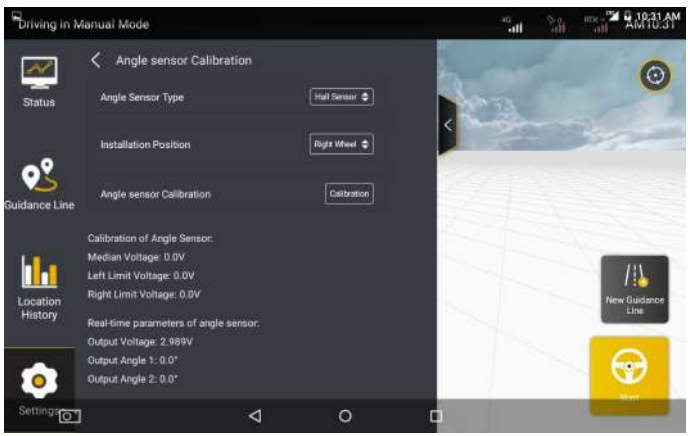


Figure 3.5.11 Angle sensor settings

Tap the Angle Sensor Calicration tab in parameter calibration page. On the displayed details screen, set Angle Sensor Type, Installation Position and tap Calibration to calibrate the angle sensor in this position. For details, see section 2.5 “**Calibrate the angle sensor**” in Chapter IV “**Software Operation Instructions of In-vehicle Control Terminal**”

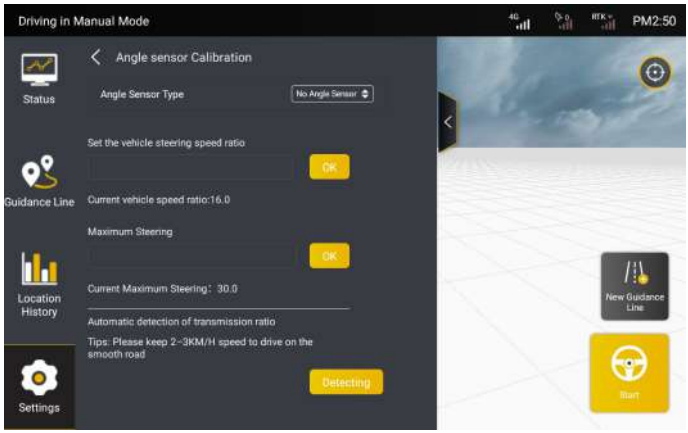


Figure 3.5.12 Settings for no angle sensor

- **Calibration of Accessories**

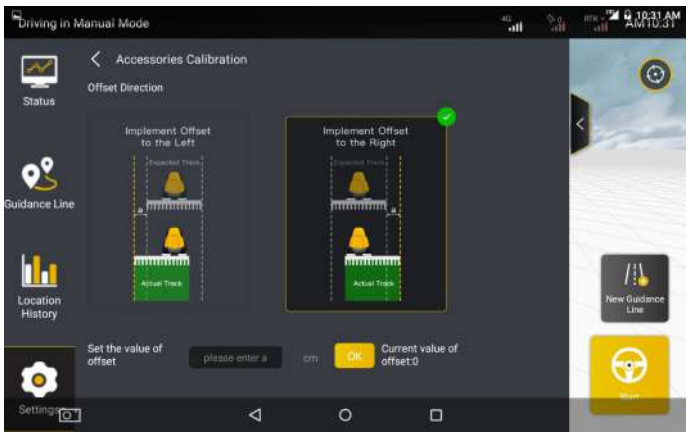


Figure 3.5.13 Settings for calibration of accessories

When autodriving path has a offset within 3 cm after the implement is equipped, please measure the value. If the autodriving path tends to the left comparing to the pre-set guidance line, please select "implement offset to the left" and enter the deviation value “a”, and then click "OK" to save the setting; if

the autodriving path tends to the right, select "implement offset to the right" and enter the deviation value a, and click "OK".

- **Parameters Commissioning (for FAE Only)**

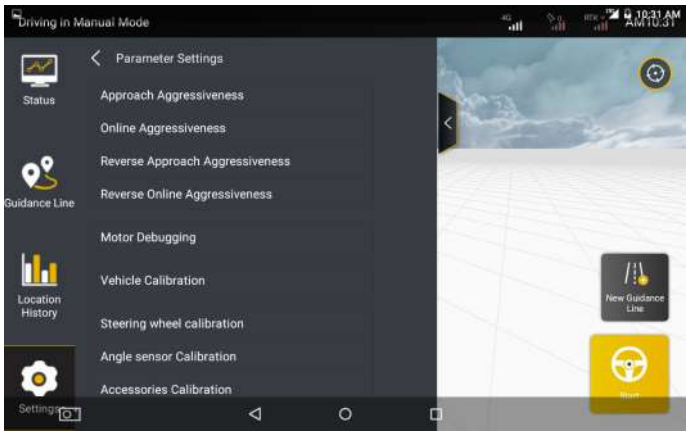


Figure 3.5.14 Parameter settings

Approach Aggressiveness: affects the time for the vehicle to enter the next guidance line when making a turn. The larger the value is, the shorter adjustment time the process needs. However, the driving instability is higher.

Online Aggressiveness: affects the linear driving accuracy of the vehicle. The smaller the value is, the higher the control degree, but the instability will increase accordingly. For example, the possibility of an “S” turn is greater.

Vehicle Calibration

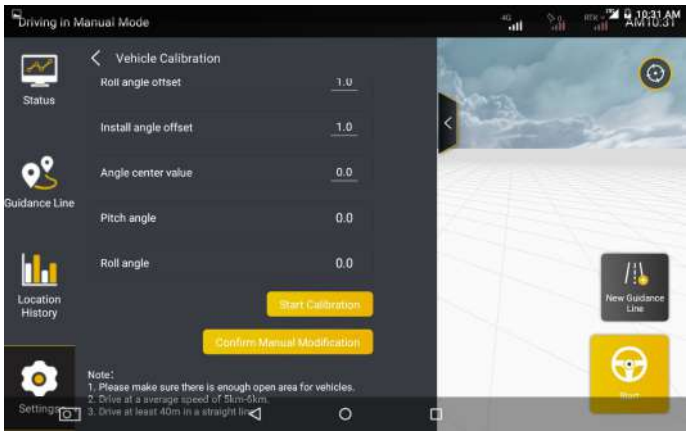


Figure 3.5.15 Vehicle calibration

For detailed operations, see section 2.8 Vehicle Calibration in Chapter IV Software Operation Instructions of In-vehicle Control Terminal.

5.3.6 Troubleshooting

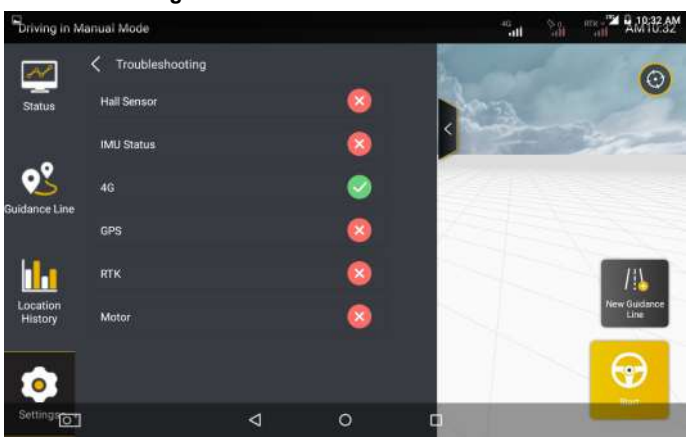


Figure 3.5.16 Troubleshooting

If encountering any problem during use, the user can enter “Troubleshooting” to perform software and hardware detection of the vehicle. The user can promptly adjust the fault items displayed as "×" in the screen, the interface is as shown in the figure above.

5.3.7 System Settings

- **System version (OTA upgrade)**

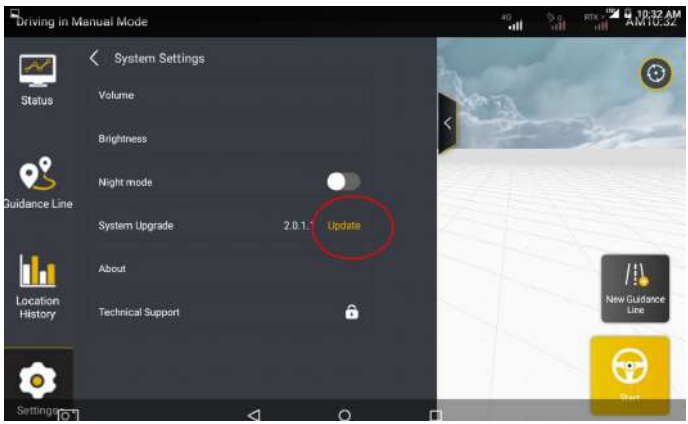


Figure 3.5.17 OTA Upgrade

When there is an update to the software version, you can perform the following operations to achieve a one-tap upgrade of the auto steering kit:

1. Turn on the in-vehicle control terminal of the autosteering kit. Make sure that the control terminal can access the Internet through network SIM card/WiFi network and that the network status is stable (please make sure the 4G antenna is connected properly).

2. If there is a new version, the system will automatically display a prompt for upgrade.

3. Tap Confirm Update in the prompt box to enter into the upgrade process.

4. Do not take any operation during the upgrade. You can check the upgrade

progress through the displayed information and wait for its completion.

5. After the upgrade is successful, the system will display a prompt that the upgrade is successful and then automatically enter the new version.

6. If the upgrade fails, the system will prompt you to retry. tap Retry to re-upgrade the system.

Notes for OTA upgrade:

1. Ensure that the network status is stable throughout the upgrade process.
2. Do not power off the terminal during the upgrade process.
3. If you encounter any problems during the upgrade, please contact your local dealer for help or call the technical service hotline.

- **Mode selection**

User can switch between Fast Mode and advanced mode here.

- **Recycle bin**

Boundary, guidance line and History data deleted within 30 days can be restored in the recycle bin.

- **Unit settings**

User can choose the unit to display as metric or imperial units, or define own unit combination based on unit usage habits.

5.3.8 WiFi Camera (Optional)

Two WiFi cameras can be connected via hotspot. The operation is as follows:

1. For the first use, please turn on the Wi-fi camera in the settings.

2. Turn on the hotspot mode before binding, and scan the code via camera to identify and bind the camera. Up to two cameras can be bound via scanning the code. The scanned camera is displayed on the right side. Click “OK” to enter the camera view page.

3. The current video stream can be viewed on the camera list page. If it is

required to bind other cameras, click “Delete” and repeat the binding steps to bind.

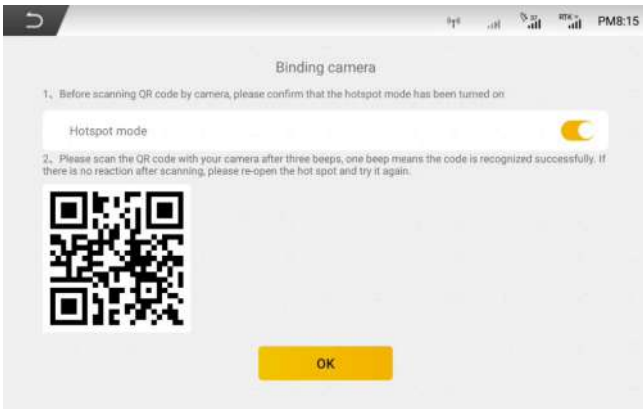


Figure 3.5.18 WiFi camera configuration

4. After the binding is completed, user can click return button in the upper left corner to enter the working interface, and Click real-time video button to open the main interface display.

5. Click “Switch” button to switch the camera.Click “Full Screen” button to maximize the camera interface, and click again to restore. Click “Close” to close the camera window in a real time manner.

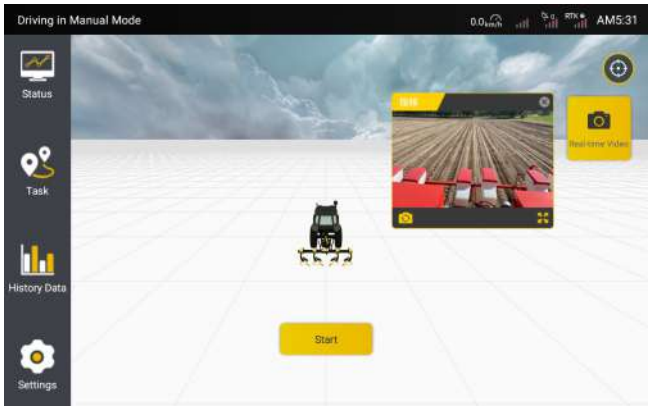


Figure 3.5.19 Real-time video

5.3.9 Remote Debugging

Turn on the remote debugging function, which should use with the background control program to realize the remote control screen function; user should turn on the remote debugging switch in the settings.

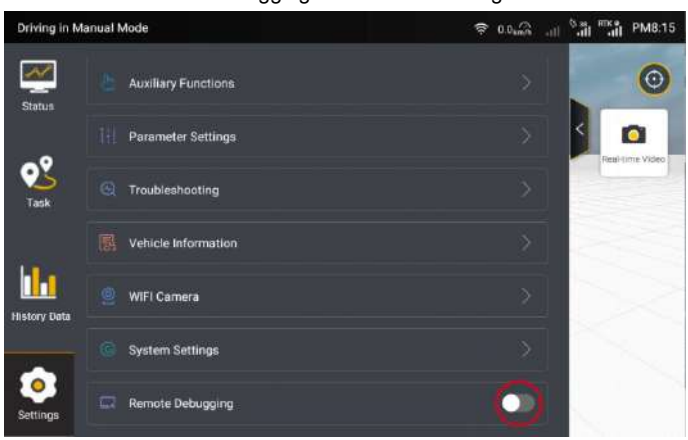


Figure 3.5.20 Remote commissioning

5.3.10 Other Settings

In addition to Parameter Settings, RTK settings, and Troubleshooting, the Settings screen allows setting and querying other general information such as Volume, Brightness, and device information.

Chapter Ⅳ FAQs

No	Fault	Troubleshooting
1	"S" turn in autosteering operations	Check if the rolling angle and pitching angle data changes in real time.
		Calibrate the angle sensor
		Check whether the GNSS antenna installation connector is correct.
2	Steering wheel malfunction during autosteering operations	Check the brake status.
		Test the motor
		Power off and restart the vehicle.
		Check whether the angle sensor is installed correctly.
		Check whether the GNSS antenna installation connector is correct.
		Re-calibrate the angle sensor on the Settings screen.
3	No 4G signal	Check if the SIM card is inserted.
		Check if the 4G antenna is connected properly.
4	No RTK signal	When the mobile base station is connected, please check whether the base station is powered/used normally.
		When the Internet RTK is connected, please verify that 4G signals are normal.
		When the Internet RTK is connected, please verify that the Ntrip account is available.
5	Inconsistent line	Please verify that the vehicle parameters are

	spacing in multi-line mode	entered correctly.
		Please verify that vehicle calibration in Settings is completed.
		Please re-calibrate the accessories.

Chapter Ⅴ Main Hardware and its Specifications

No.	Assembly	Components	Specifications
1	Control Terminal	Control Terminal	Size: 300×190×43mm; 10.1-inch capacitive touch screen, LED backlight, 1280*800 pixels, 700cd/m2 LCD; Dual speaker; 2G RAM, 8G ROM; Various digital and analog output interfaces, etc. Power supply: 10-30V; RF signal, Positioning satellite and 4G signal etc.; Operating temperature: -30℃~+70℃; Storage temperature: -40℃~+85℃; IP rating: IP65; Relative Humidity: 0% to 95%, @40℃ (non-condensation)

			WIFI specification: 2.4GHz frequency band, frequency range: 2.4GHz-2.5GHz, output power: 14dB±1.5dB
2	Antenna Assembly	GNSS Antenna	Frequency range: GPS L1/L2, GLONASS L1/L2, BDS B1/B2/B3; Operating voltage: 3.3~12VCD; Operating current: ≤45mA; Size: 152*63mm
3		4G Antenna	Suction cup antenna: Frequency range: B1/B2/B3/B5/B8/B38/B39/B40/B41; VSWR: ≤2.0; Gain (dBi): 2±0.5; Impedance (Ω): 50; Polarization: Linear, Vertical; Antenna size: Φ370*82mm; Operating temperature: -20℃~+60℃
4		Radio Antenna	Suction cup antenna: Frequency range: 433/470MHz; VSWR: ≤2.0; Gain(dBi): 1±0.5; Impedance (Ω): 50; Polarization: Linear, Vertical; Antenna size: Φ490*82mm; Operating temperature: -20℃~+60℃
5	IMU	IMU	Power input: 5V;

			Acceleration accuracy: 0.09mg; Gyroscope accuracy: 0.004°/s; Heading angle accuracy: 1°; Roll and pitch angle: 0.5°
6	Angle Sensor	Angle Sensor	Power supply: 5V; Update frequency: typical 3.4KHz; Resolution: < 0.1°; IP rating: IP67; Operating temperature: -40℃~+85℃
7	Electric Steering Wheel	Steering Wheel	Power supply: 12V/24V; Peak torque: 20Nm (12V); 30Nm (24V); IP rating: IP65
8		Steering Motor (12V /24V)	Power supply: 12V/24V; Peak torque: 20Nm (12V); 30Nm (24V); IP rating: IP65