

SMAJAYU(SHENZHEN) CO., LTD

Precision User manual

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# 1、 Introduction

## 1.1 Purpose of preparation

The purpose of writing this operation manual is to fully describe the functions and operating environment of the software, so that users can understand the scope and method of use of the software, and provide necessary information for software maintenance and update.

## 1.2 Reference material

None.

## 1.3 Terms and abbreviations

Sensitivity: equivalent to the line stability coefficient of the previous automatic driving software. It mainly adjusts the motor sensitivity. The higher the value setting, the more sensitive the motor rotation is, and the lower the value, the less sensitive it is.

Confidence degree: different values can be selected for the confidence degree, which mainly adjusts the sensitivity of the gyroscope. The smaller the set value, the higher the sensitivity. Generally, the default value is 0.01.

Automatic calibration: mainly calibrate azimuth offset.

Slope correction: real time correction of roll.

Speed limit threshold: the maximum speed allowed under automatic driving mode. If it exceeds, automatic driving will be released. The adjustment range is 0-50km / h, and the default is 20km / h.

Flow control: GNSS intelligent spray control system.

# 2、 Software overview

## 2.1 Software purpose

The previous automatic driving software can be widely used in sowing, ploughing,

ditching, ridging, spraying, transplanting, land consolidation, harvesting and other operation scenarios, but it can only correspond to one operation mode. The development of this software is to integrate multiple software into one software without installing multiple software. In this way, different operations can be carried out with only one software, and operations can also be combined, For example, two different jobs are operated simultaneously with one software.

## 2.2 Software running

The hardware environment of the software: Android 4 or above tablet (mobile) devices, and the software environment: eclipse and Android studio environment. After the software is installed, you can directly click the corresponding icon to enter the software.

## 2.3 Software performance

①Response speed of software simple page operation (simple operation of adding, editing, deleting and viewing details), time  $\leq 1s$ ; ②Response speed of complex page operation (complex display, list, configuration and other interfaces), time  $\leq 1s$ ; ③The software runs continuously without jamming within 24 hours.

## 3、 Software function introduction

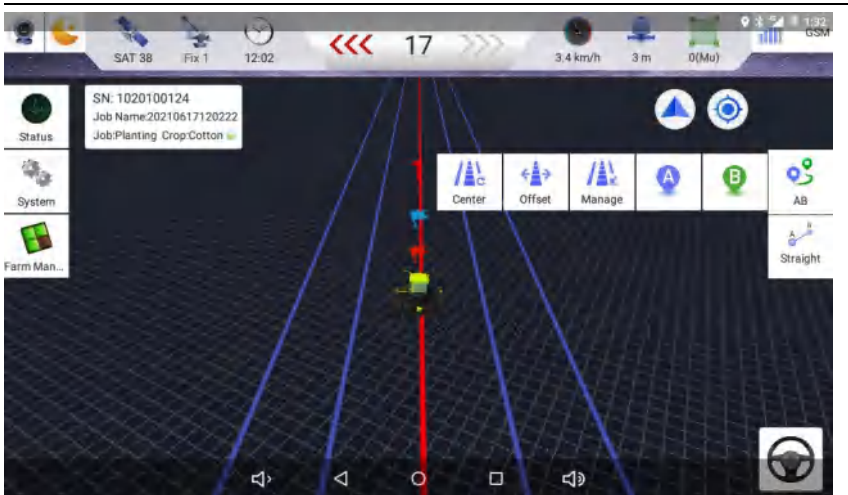
### 3.1 Interface display and hiding function



#### 3.1.1 Day night mode



Switching between day mode and night mode, the default is day mode.



### 3.1.2 Camera

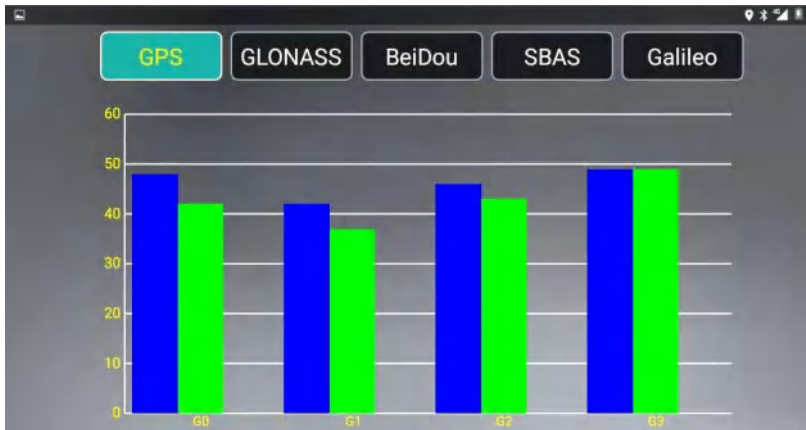
When the camera is turned on or off, it is turned off by default. Zoom in on the full screen button and the camera can be turned off at the secondary point.



### 3.1.3 Satellite

Number of nearby satellites, hiding function: View star map and signal-to-noise

ratio.



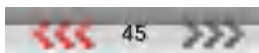
### 3.1.4 Base station status and differential delay



Current equipment and base station connection status and differential delay.

**Hide function:** Click to quickly jump to the base station connection.

### 3.1.5 Deviation from ab line error





When automatic driving is on, the deviation error of the vehicle from the AB line is displayed in real time.

### 3.1.6 Real time operation speed



Real time speed monitoring and hiding function when the vehicle is running:

Click to jump to the system setting and set the speed limit threshold.

### 3.1.7 Width of agricultural tools



After adding farm tools, the width of the set farm tools will be displayed.

### 3.1.8 Time display



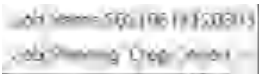
Time display in the format of hours, minutes and seconds.

### 3.1.9 Network operators and signal strength and hotspot connections.



For the display of network operators and network signal strength used by the tablet, only one card is displayed.

### 3.1.10 Current job name and job type



Display and hide the current job name and job type after creating line AB / job: Click to modify the job type and crop type.

### 3.1.11 Head up or top view angle switching



Switch the head up or top view of the operation interface according to personal needs during operation.

### 3.1.12 Quick positioning



When the vehicle and ab line disappear and cannot be seen, click to quickly return to the center of the screen.

### 3.1.13 Working area



Real time display of work area during operation (can also be turned off), hidden

function: long press to delete the track, clear the current work area, and change the work line name to the current default line name.

#### 3.1.14 Equipment status display and self-inspection



Real time display of equipment status and self inspection function of equipment.

#### 3.1.15 System



The various settings of the device include satellite settings, farm implements management, automatic navigation, intelligent spray, system setup, hidden function: long press can push out or turn off the automatic driving shortcut button, including sensitivity, farm implements management, manual record button and operation area. When the traffic flow is opened, there will be a quick function of the flow can be switched off or off.

#### 3.1.16 Informa ionize



Including user information, equipment information and job statistics.

#### 3.1.17 Farm tools



This is the shortcut button of farm tool setting on the interface, which can be closed.

#### 3.1.18 AB line



It is used for automatic driving straight line, curve and path setting operation line.

3.1.19 Manual record shortcut button



It is used to record the track manually. When this button is turned on, there will be no track generation when autopilot is turned on. Only when it is turned on can there be track generation.

3.1.21 Sensitivity shortcut button



That is, it is equivalent to the previous line stability coefficient.

3.1.22 Autopilot switch button



Used to start or end autopilot.

3.1.23 Warning prompt

It includes the connection between the base station and the network, as well as the hardware connection. See the following table for details. Hidden functions: in case of base station warning, clicking the warning will jump to the base station connection, in case of other warning, clicking the warning will jump to the equipment status, and clicking self inspection can check the problem.

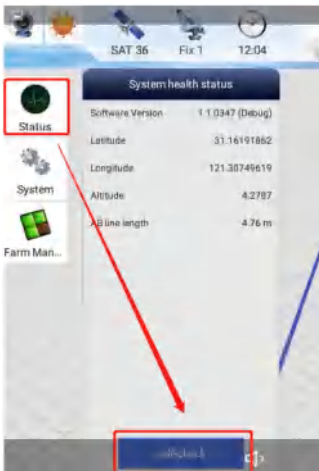
Category	Prompt content	Problem description	Problem causes	Solution
Base station and network	No satellite data	The number of satellites is 0	1.GNSS antenna is not connected 2.The GNSS line or GNSS antenna is damaged 3.The vehicle is indoors or heavily blocked	1.Connect the GNSS antenna 2.Replace the corresponding equipment 3.Drive the vehicle to an open area
Base station and network	No network	1.Single point state 2.Tablet without internet	1.Poor network signal 2.The network antenna is not connected	1.Drive the vehicle to a place with good network signal

			3.The network antenna is damaged	2.Check if the network antenna is well connected 3.Replace the network antenna
Base station and network	Abnormal orientation data	No heading information	1.The right GNSS antenna is not connected 2.The GNSS cable or GNSS antenna is damaged 3.The vehicle is indoors or heavily blocked	1. Connect the GNSS antenna 2. Replace the corresponding equipment 3. Drive the vehicle to an open area
Base station and network	The base station is not connected	No base station data is received when the network is normal	1.No base station selected in network service mode 2.Radio base station problem or no network in D21 mode 3.Not logged in in CORS mode	1. Connect to the base station 2. Check the radio base station/D21 3. Log in to CORS
Base station and network	Poor signal quality	Floating, pseudorange	1. Too far away from the base station 2.The current environment occlusion 3. Obstacles blocking the base station	1.Connect to a base station that is closer 2.Drive to the open area 3.Connect to other base stations nearby
Base station and network	Breakpoint to continue line 300 (countdown)	Differential delay exceeds 300S	No base station data	1. Check the network 2. Change to connect to other base stations nearby
Hardware connection	The motor is not	Prompt when there is no	1.Poor contact of the	1.Replacement of main

	connected	motor heartbeat data	main wiring harness 2. There is a problem with the power switch	wiring harness 2. Replace the switch 3. Restart the device
Hardware connection	IMU is not connected	No gyro data	1.Gyro damage 2.Cable failure	1. Replace the gyro 2. Replace the cable
Hardware connection	Angle sensor is not connected	No angle sensor value	1.Cable failure 2.Angle sensor failure 3. The angle sensor is out of the measurement range	1. Replace the cable 2. Replace the angle sensor 3. Adjust the position of the angle sensor

### 3.2 State

When it is turned on, the equipment status will be displayed, including software version, longitude and latitude, motor related, etc. if there is a problem, self-inspection can be carried out to check the problem.



### 3.3 System

#### 3.3.1 Satellite settings

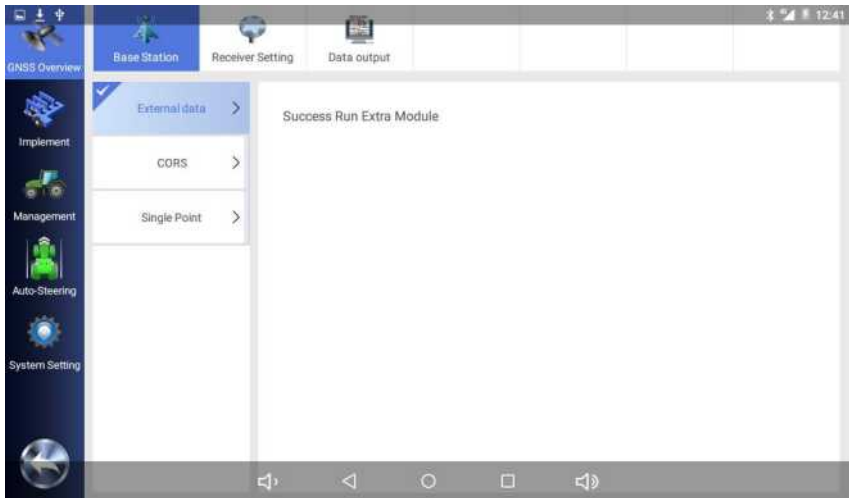
##### 3.3.1.1 Base station connection

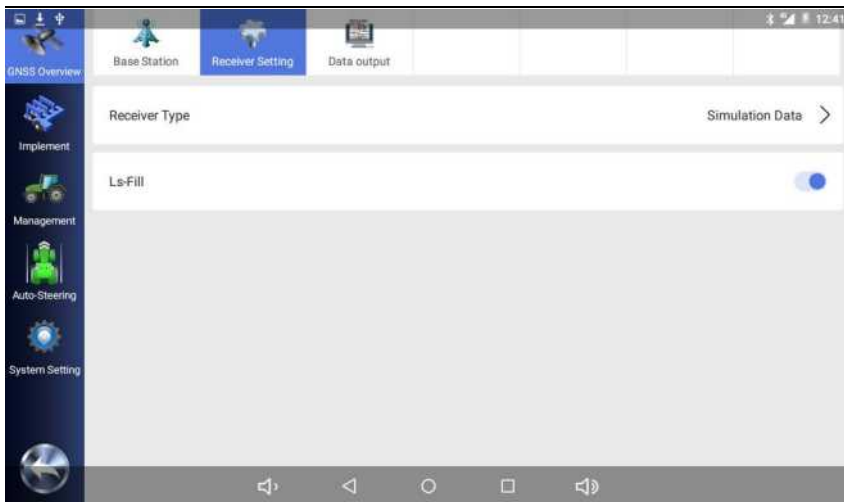
**Mode selection :** There are three modes: network service, external communication

module (D21 / D10) and CORS. The mode of use: network service is to connect to the network base station. When connecting, first click refresh, and then select the base station close to the connection; The external communication module is the radio base station. When using the radio base station, you can select the channel, read and set the radio frequency; The CORS mode needs to log in to the CORS account. Enter the account and click log in. It can be used after success.

### 3.3.1.2 Receiver settings

At present, there are two functions of receiver type and breakpoint endurance. Five receiver types can be selected: T100 all-in-one dual antenna, T100 all-in-one single antenna, R21, r70 and analog data. Breakpoint endurance is enabled by default. Data output port and data output baud rate are none by default.



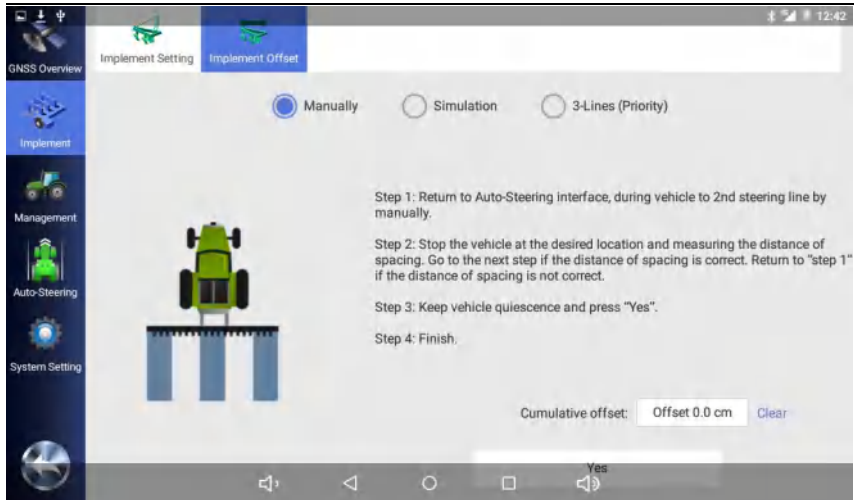


### 3.3.2 Farm tool management

**Agricultural tool setting:** Click the current agricultural tool to add agricultural tools, and click the plus sign in the window to add. After adding the name, you can set the parameters of agricultural tools and modify the operation / crop type.

Farm tool correction: there are three methods, and the specific operation steps are described in detail on the page.





### 3.3.3 Autopilot

#### 3.3.3.1 Navigation settings

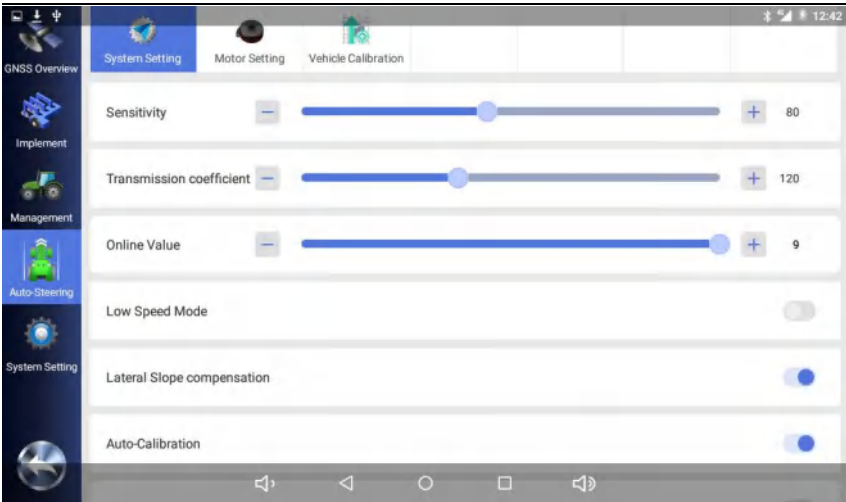
**Sensitivity :** That is, the line stability coefficient of the previous automatic driving software. The higher the value is set, the more sensitive the motor rotation is, and the lower the value is, the less sensitive it is.

**Slow mode:** This is used for low-speed operation.

**Slope correction :** It is turned on by default, and real-time correction of rolling can improve the operation accuracy, especially when the slope ground condition is bad.

**Automatic calibration:** It is on by default. It is used to calibrate the azimuth offset of single and double gyroscopes in real time and improve the straightness level of the vehicle. If it is the angle sensor mode, it is recommended to turn it off after debugging.





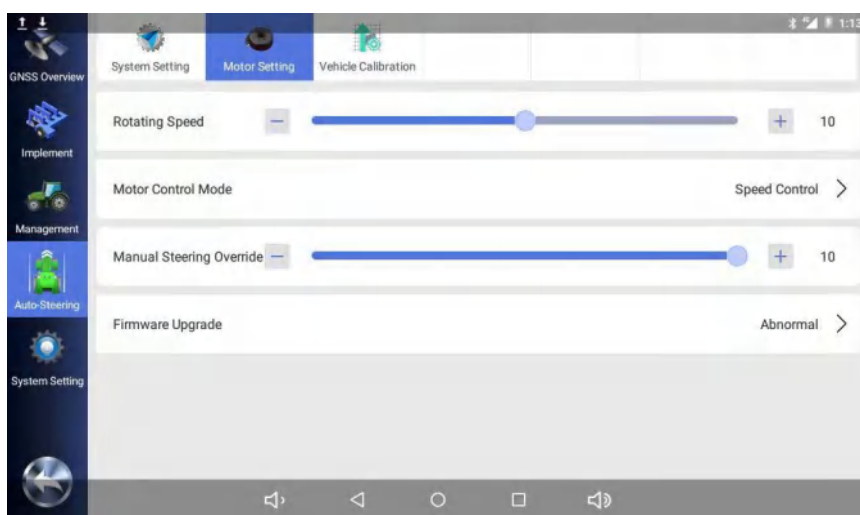
### 3.3.3.2 Motor setting

**Motor speed:** The speed of the motor correction speed. The larger the speed, the faster the correction, and the smaller the speed, the slower.

**Motor control mode:** Including speed control and position control. The default is speed control.

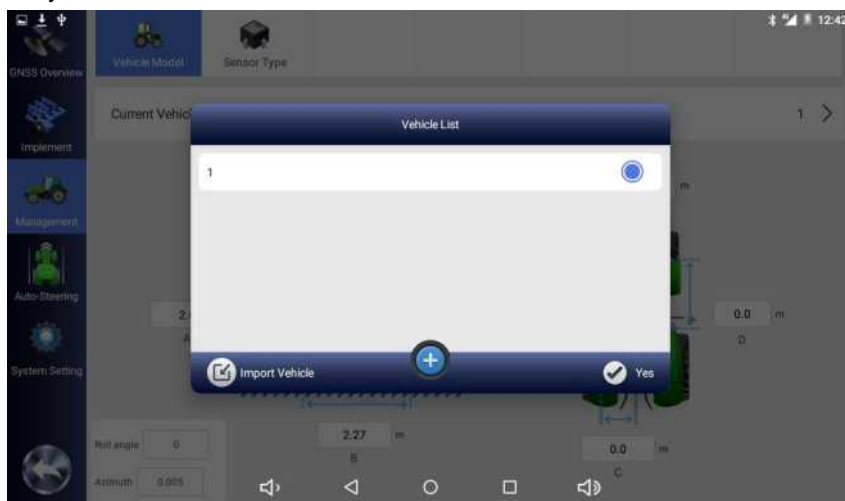
**Manual release sensitivity:** The difficulty of manually releasing navigation. The larger the value, the more difficult it is to release, and the smaller the value, the easier it is to release.

**Firmware update:** The motor firmware version can be upgraded online on v2320 and later software. If there is new firmware, clicking firmware upgrade will prompt "the latest motor firmware version is detected, whether to upgrade". After confirmation, the upgrade progress bar will appear. After the progress bar is completed, it will prompt "upgrade succeeded".



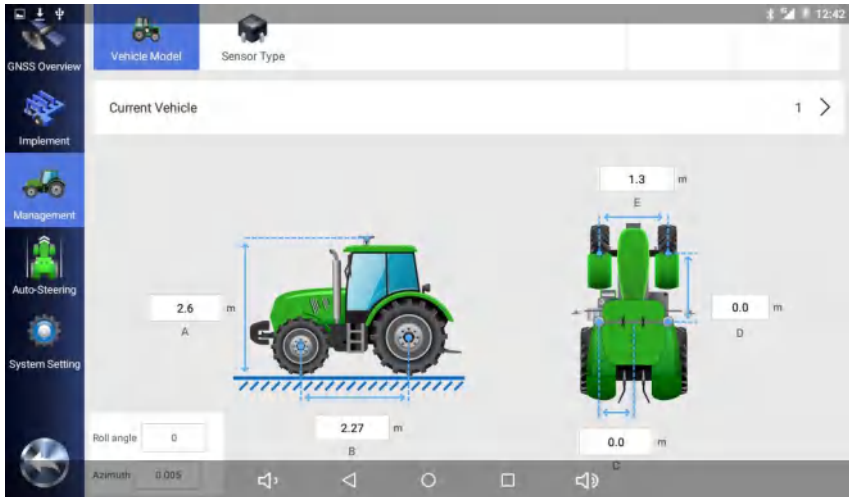
### 3.3.3.3 Vehicle management

**Current vehicle:** Click to add different vehicles or import vehicles from the database, including vehicle type, brand, model and vehicle model. Hiding function: long press the tractor in the list to delete vehicles. Long press to delete vehicles when there are many vehicle information or vehicles with errors.



After adding the vehicle, you can enter the vehicle parameters and select the sensor

type.

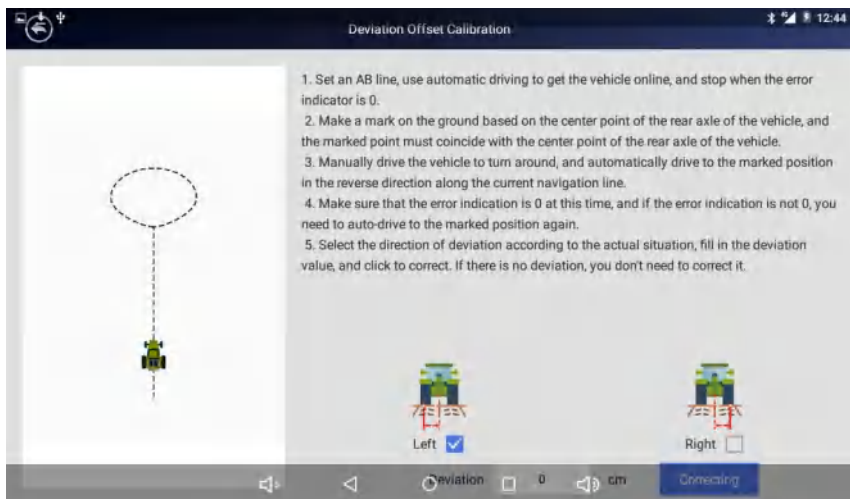


### 3.3.3.4 Vehicle commissioning

**Sensor calibration:** This function is available only in the mode of attitude sensor and non-contact angle sensor. It will not appear in the mode of angle sensor and encoder. Click calibration during commissioning, wait for the progress bar to finish, and the calibration is completed when the confidence is calibrated. (Different values can be selected for the confidence degree, which mainly adjusts the sensitivity of the gyroscope. The smaller the set value, the higher the sensitivity. Generally, it defaults to 0.01)



**Repeat line commissioning:** During commissioning, operate in sequence according to the steps and legend.



### 3.3.4 System settings

#### 3.3.4.1 System settings

**Speed limit threshold:** The maximum speed allowed in the automatic driving mode will be released when it is exceeded; The adjustment range is 0 ~ 50km / h, and the default is 20km / h.


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**Language :** There are three options: "follow system", "Uyghur" and "English". The follow system is what language the tablet uses and what language will be used in the software. Now English and Uyghur can be switched directly in the software, but Uyghur has not been fully adapted yet.

**Operation record unit:** There are four types: Mu, ha, M2 and acre. You can directly switch the settings here.

**Length unit:** There are two options: meter and foot.

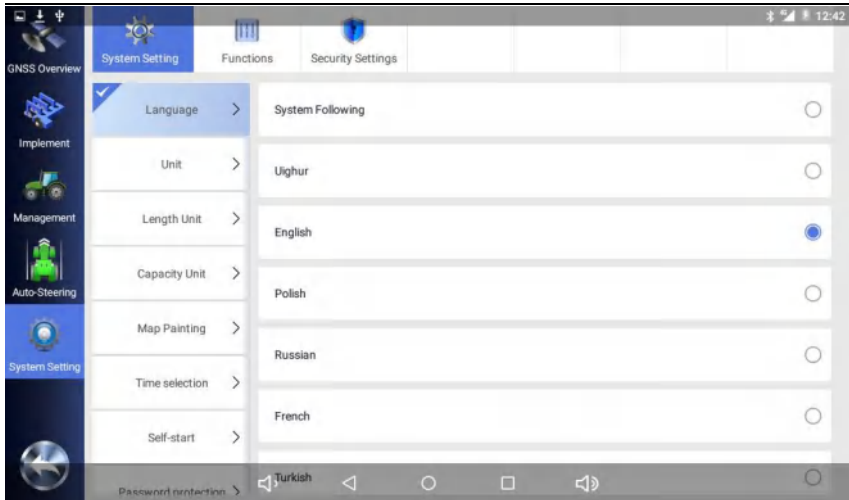
**Capacity unit:** There are liters and gallons, domestic liters and foreign gallons.

**Operation record mode:** There are two types: manual and automatic. This can be set according to the needs. Automatic driving is the same as previous automatic driving. When the navigation is turned on, smoke will be drawn. Manually, there will be a "manual record button"  to record smoke. If it is not turned on, smoke will not be recorded.

**Dual card switching:** China Mobile and China Telecom have two options, and the appropriate one can be selected according to the local signal.

**Load backup parameters:** As long as the parameters in the settings are modified, they will be saved automatically. If the modified effect is not good, but the previous parameters are forgotten, the backup parameters can be loaded.

**Software upgrade:** A new version of the software will be put on the server. If you click it, you will be prompted to update it. If it is the latest version, you will be prompted that it is the latest version and there is no need to update it.



### 3.3.4.2 Function settings

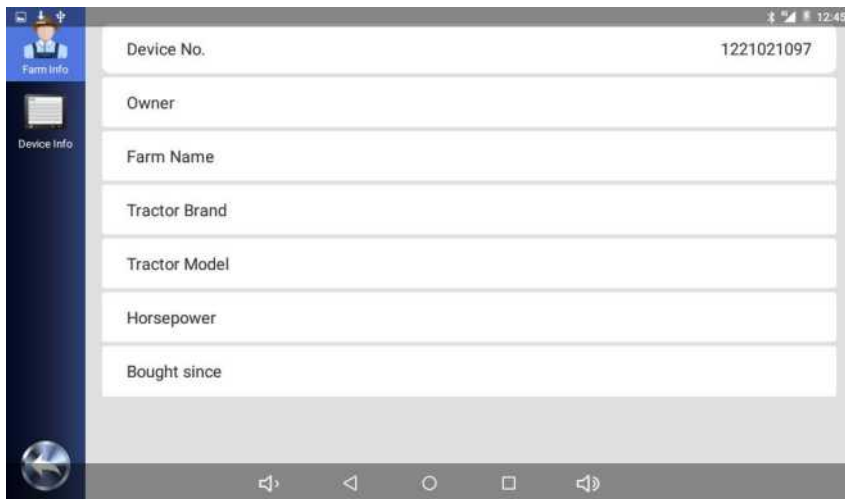
Turn on / off the corresponding functions according to the purchased functions / needs; The functions that can be used temporarily include automatic driving and flow control; The payment is flow fee, which can be paid at different times; The equipment registration is temporary registration, and the technician needs to give the registration code.



### 3.4 Informatization

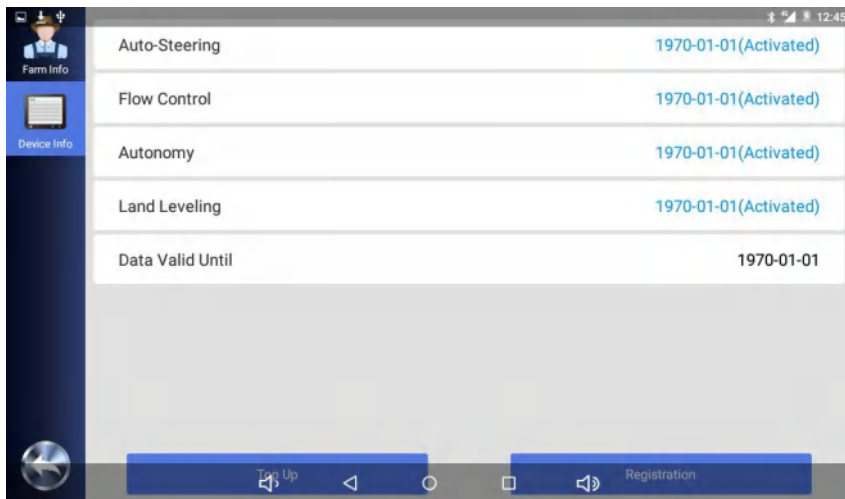
#### 3.4.1 User information

The corresponding information will be obtained according to the uploaded information.



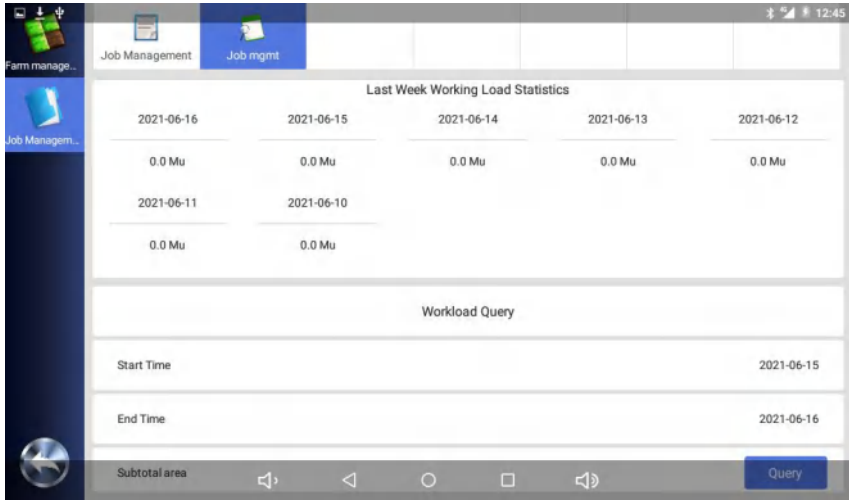
#### 3.4.2 Equipment information

It is also obtained and displayed according to the uploaded and registered information.



### 3.4.3 Job statistics

It supports the statistics of work area, query of work area and total work area in the last week. This function will be convenient for users to a great extent.



### 3.5 AB line

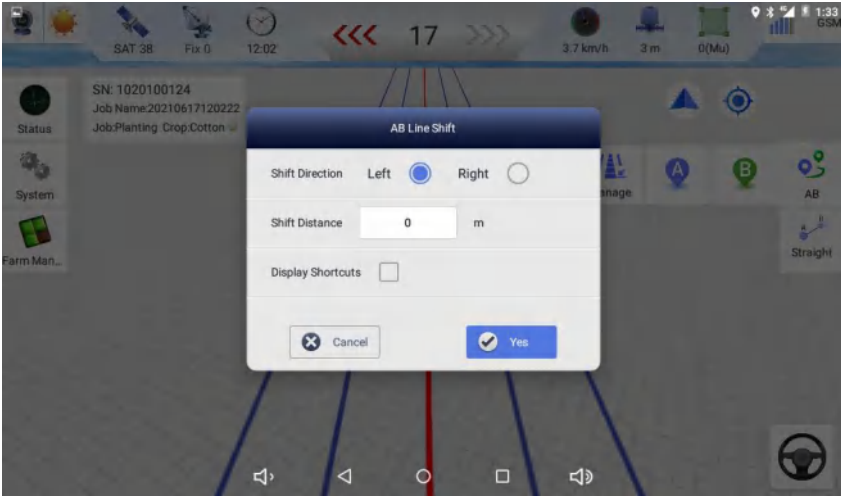
Operation AB line setting, which can set straight line, curve, rake and path. The functions include reset line, translation line and import line.



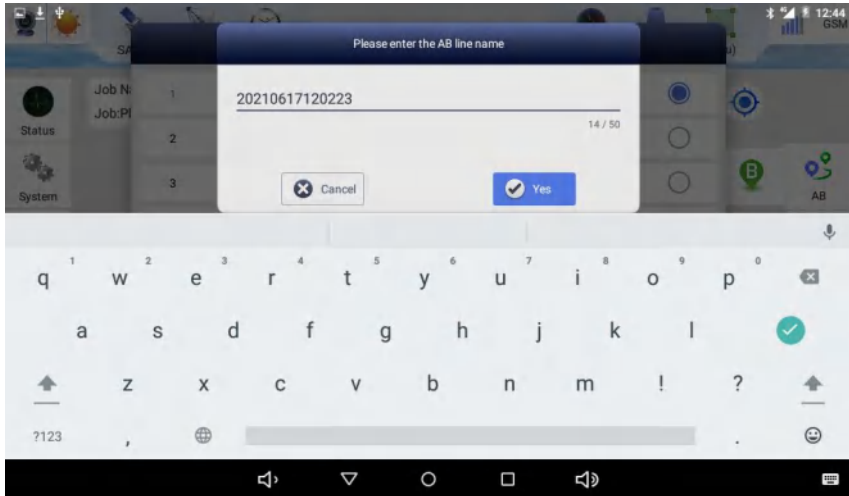
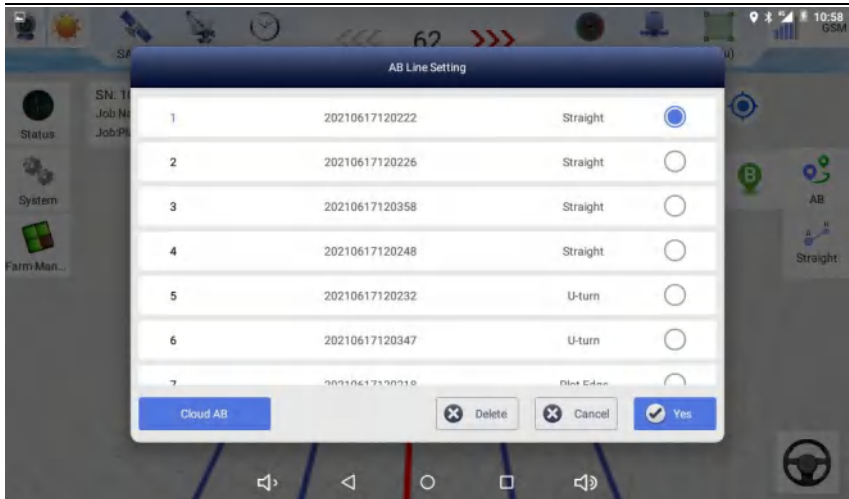
Translation line: translate the current AB line to the left and right. Quick move

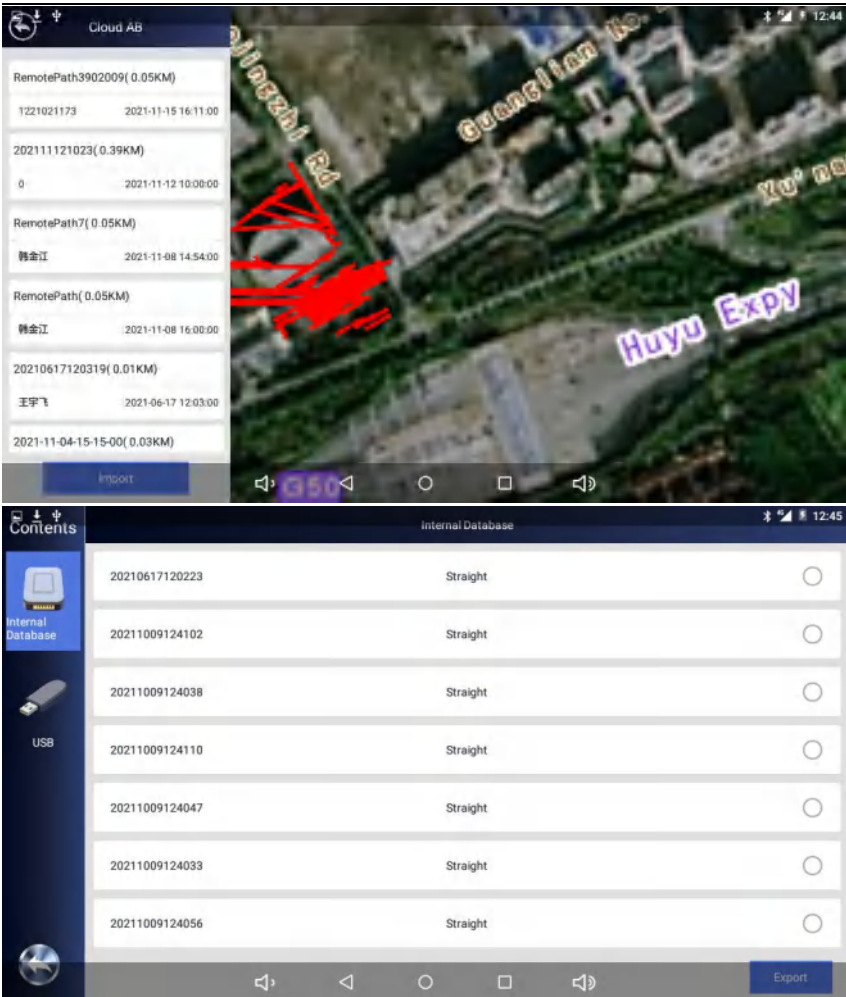


button: check the display. If it is not checked, it will not be displayed. Set the translation distance. Click the left and right arrows in the operation interface to translate the corresponding distance according to the set value.



Import line: upload AB line and import the previous ab line or delete AB line (AB line currently used cannot be deleted), network AB line (uploaded AB line), USB flash disk can import / export AB line (select the required AB line during operation). For self-typed AB line and uploaded, you can edit the name of AB line, Just click the name of AB to modify the name you want.





## 4、 Use process and specification

### 4.1 Information entry and registration

After the equipment is installed, use a small program to enter the information,

including user information and equipment information, and then register the software before it can be used.

## 4.2 Vehicle parameter entry

**System → automatic navigation → vehicle management → add vehicle / import vehicle → parameter entry → sensor type selection**

The parameters include the height of the main antenna, the distance between the main and auxiliary antennas, the distance between the antenna and the center axle, the distance between the antenna and the front axle, the wheelbase of the tractor and the wheelbase of the front wheel of the tractor.

These parameters need to be accurately measured and input into the plate. Note that the unit of the parameter is meter. Be sure to pay attention to the unit conversion, otherwise it will affect the actual use.

Sensor type selection: select the corresponding sensor type according to the installed sensor.

## 4.3 Select base station and connect

**System → satellite setting → mode selection → base station connection**

Select network service, CORS mode or external communication module. If D10 or D21 is connected, select external communication module.

## 4.4 Automatic driving commissioning

**System → automatic navigation → vehicle commissioning → sensor calibration (not required if not) → repeat line commissioning**

**Sensor calibration:** This function is available only in the mode of attitude sensor and non-contact angle sensor. It will not appear in the mode of angle sensor and encoder. Click calibration during commissioning, wait for the progress bar to finish, and the calibration is completed when the confidence is calibrated. (Different values can be selected for the confidence degree, which mainly adjusts the sensitivity of the gyroscope. The smaller the set value, the higher the sensitivity. Generally, it defaults to 0.01)

Repeat line debugging: if there is sensor calibration, calibrate the sensor first, and then repeat line debugging. If there is no sensor calibration, directly conduct repeat line debugging. Open the repeat line debugging interface and debug according to the

prompted steps.

1、 Set a line AB, use automatic driving to put the vehicle on line, and stop when the error indication is 0;

2、 Make a mark on the ground based on the center of the rear axle of the vehicle, and the mark point must coincide with the center point of the rear axle of the vehicle;

3、 Manually drive the vehicle to turn around and automatically drive to the marked position in the reverse direction along the current navigation line;

4、 Make sure that the error indication is 0 at this time. If the error indication is not 0, you need to drive automatically to the marked position again;


5、 Select the deviation direction according to the actual situation, fill in the deviation value, and click correction. If there is no deviation, there is no need to correct.

#### 4.5 Automatic driving use

**Width setting of farm tools → handover line setting → line AB setting → ride the vehicle on line AB manually → turn on navigation for operation**

When setting line AB, the tractor must not operate and must run empty. Park the tractor at this end of the land, face the front of the tractor in the direction of operation, click the "a" button on the screen to set point a. Drive the tractor along the direction of the front to the other end of the land, stop, click the "B" button on the screen and set point B. At this time, enter the name of this line (the default is tablet code + current time).

**Attention:** Whenever the tractor arrives at a new land that has not been operated, it is necessary to reset the AB line. When setting the line, pay attention to whether the AB line is in straight line mode. If the operation is not completed on the same day, you can call the same AB line to continue the operation the next day.

There is a navigation button at the bottom right of the navigation interface. 

Click it to start navigation; Click again to end navigation