N200

GNSS Land Leveling System

User Manual

First Edition

Content

User Notice

A. Before using this product, please read all the user information provided with it carefully to understand the usage and precautions of this product.

B. Do not disassemble or assemble the relevant cables in the satellite flat ground navigation system equipment when the power is on.

C. Please connect your device strictly according to the requirements in the manual. For data cables and other cables, do not pull, rotate, or squeeze excessively; otherwise, it will easily cause broken needles and lead to poor contact.

D. When supplying power to this product (system), please pay attention to the power supply requirements of the equipment (the power supply voltage must be 12V, and the rated current must not be less than 5A).

E. Do not continue to use the cables after they are damaged. Please purchase and replace them in time to avoid affecting the use effect.

F. The equipment is damaged due to force majeure(lightning strike, high pressure, collision, scratching), which does not belong to the free maintenance scope of our company.

G. Please do not disassemble the product shell by yourself; otherwise, the warranty will not be given.

Notice before Use

A. The Basic Principle

a. Please fully understand the product and its operating requirements before use and comply with the "common-sense health and safety operating regulations" of your country and region while following the instructions for use.

b. Accident prevention measures, common-sense safety technology, labor protection, medical, and traffic regulations must also be followed.

c. Listening to suggestions for product operation can help avoid malfunctions and accidents.

d. When the product is delivered, you should get the receipt list and instruction manual and follow our company's technical guidance for installation and operation.

B. Personnel Requirements

a. Terminal users need to operate the system while driving the tractor. Operators are required to be proficient in driving the tractor and could deal with emergencies while driving.

b. The operator needs to have a certain understanding of the land leveling work, and clearly know that the various functions of the system will be used flexibly when leveling different terrains; the operator understands the installation and operation principles of related software and hardware, and has the ability to safely handle common faults.

c. Individuals under the age of 18 and those with disabilities that hinder safe operations should not participate in agricultural machinery operations.

C. Preparation Before Working

a. Check whether there are obstacles around the scraper and other factors that endanger safe operations, and let irrelevant personnel leave the work area.

b. According to the requirements of daily maintenance, carefully check the scraper for loose parts, missing parts, excessive wear, and sediment accumulation.

c. Operators must master the operating devices of the product and their functions.

D. Precautions During Installation

a. Make sure that the solenoid valve cable is correctly connected to the GNSS antenna cable. After the connection, it should be allowed to sag naturally and cannot be dragged or squeezed to prevent the normal operation of the system from being cut off.

b. A protection chain must be hung between the end of the tractor and the scraper to ensure the safe use of the system.

1. Introduction

1.1 Abstract

NST's N200 GNSS Land Leveling System is an important innovation in the field of GNSS high-precision positioning applied to precision agriculture. The system is composed of high-precision GNSS positioning equipment, controllers, data communication equipment, and high-brightness display equipment. It uses a base station with a mobile vehicle terminal or connects to network base stations for operation.

1.1.1 General Features

A. The scraper can be controlled through manual and automatic modes, and the tablet displays the datum plane and height-related reference datum plane in real time.

B. In the automatic mode, the field can be leveled automatically according to the height of the set datum, and it supports the leveling of slope and horizontal field.

C. The terrain information is displayed in different colors, which greatly improves work efficiency. It can understand the height and level of the entire field in real time. It can help make accurate judgments during operation, improve work efficiency by more than 40%, and greatly save time and cost. It has a greater working advantage compared with conventional laser land leveling systems and ordinary satellite leveling systems.

D. The onboard terminal is compatible with our autopilot system, intelligent spray system, driving assistance system, etc., which can greatly reduce the cost of various equipment. For specific operation items, please refer to the following detailed description.

1.1.2 Benefits after Land Leveling

A. Increase Yield

Using a GNSS Land Leveling System to accurately level the land can increase production by 20—30% compared with traditional leveling technology, which is 50% more than the unleveled land. These impressive results are obtained by applying the appropriate amount of water to the plants for their growth. The even distribution of water improves the environment for seeds' sprouting and growth and increases the yield of crops.

B. Save Irrigation Water

After the field is leveled, the water can be fully used, so that the water can be evenly distributed throughout the field, so that it will not cause any waste or increase the cost of the irrigation water.

C. Reduce Fertilizer Loss

After the field is precisely leveled, not only can the water be accurately used, but the fertilizer can also be stored right in the roots of the plants, which can greatly reduce the loss of fertilizer during irrigation and drainage.

D. Save Measurement Cost

There is no need to hire a survey team to measure the elevation of the land anymore; with just a few minutes of training, anyone can accurately and quickly measure the elevation of the land.

E. Control High Location Soil

Precision grading of elevated terrain ensures a uniform surface elevation, which mitigates water erosion of topsoil on slopes and prevents sediment accumulation in low-lying areas.

1.2 Devices and Components

1.2.1 M20-1 Mobile Base Station

Table 1

No.	Device Name	Part No.	Image	Quantity
1	GNSS Receiver	M20-1-FTJZ		1
2	GNSS Antenna	GPS300		1

No.	Device Name	Part No.	Image	Quantity
3	GNSS Cable	GL01		1
4	Mounting Bracket	DT04		1
5	Power Cable	PL05		1
6	Radio Antenna	DT02		1
7	Suitcase	STX01		1

1.2.2 N200 Land Leveling System

Table 2

No.	Device Name	Image	Quantity
1	NT200 Tablet		1

No.	Device Name	Image	Quantity
2	GNSS Antenna		1
3	Radio Antenna		1
4	RAM Mount		1
5	Handheld Controller		1
6	Control Box		1
6	Power Cable		1
7	GNSS Antenna Cable		1

No.	Device Name	Image	Quantity
8	Solenoid Valve Control Cable		1

1.3 Working Principle

The satellite provides the base station with positioning reference information, and the base station transmits the radio signal to the controller through internal calculation, so that the controller can obtain more precise position information.

The controller calculates the reference datum by real-time sampling, compares the position of the scraper body with the reference datum plane. Then it combines the corresponding algorithm to obtain the expansion and contraction amount of the limit cylinder.

When leveling the ground, the limit cylinder is constantly expanding and contracting according to the terrain, and the scraper body continuously removes and fills the soil (when the scraper blade is above the reference plane, the limit cylinder automatically retracts, causing the blade to lower and begin scraping soil; when the scraper blade is below the reference plane, the limit cylinder automatically extends, causing the blade to rise and allowing the soil inside the blade to fall onto the ground). After leveling for a period, the field can form a plane on the terrain.

2. System Installation

2.1 Device Installation

2.1.1 GNSS Antenna Installation

The installation of GNSS antennas in the entire GNSS Land Leveling System is particularly important.

Choosing a suitable installation location is the prerequisite for ensuring the leveling effect: due to the difference in the model and appearance of the leveler, the installation location must also be chosen according to the actual situation. Please note that the GNSS antenna must be placed directly above the center of the grader scraper, as shown in Figure 1 below.

When installing the GNSS antenna, you can choose the 3M double-sided tape or a magnet for fixed installation.

Figure 1

2.1.2 Radio Antenna Installation

The radio antenna is used to receive the radio signal from the base station. It can be fixed on the roof with the 3M double-sided tape or magnet, as shown in Figure 2:

Figure 2

2.1.3 Cables Connection

Install the system according to Figure 3 or ask for the installation video from our technician.

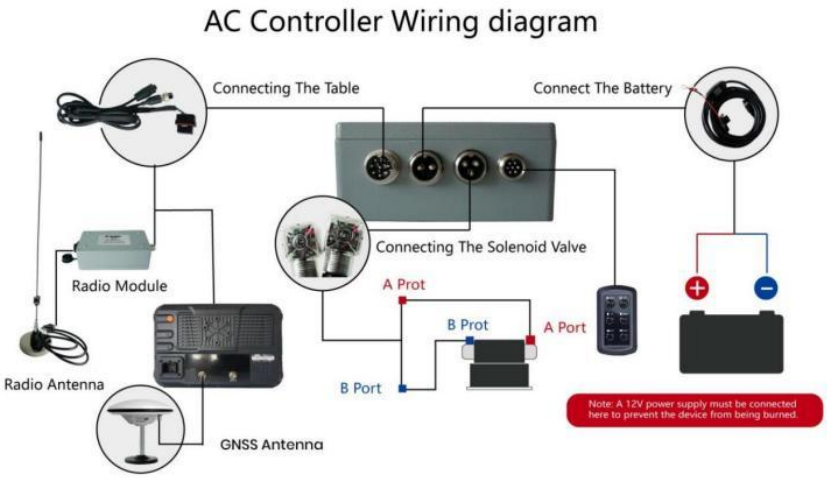

Figure 3

Note:

A. Choose the correct cable layout location.

B. The solenoid valve control cable and the antenna cable are arranged separately; try to avoid the two getting entangled.

C. The solenoid valve control cables independently manage the raising and lowering of the leveler's hydraulic cylinder. During installation, to ensure the lifting direction matches the intended operation, an external lift switch can be used for testing. If the movement is reversed, simply swap the two control cable terminals before finalizing the installation.

2.1.4 Installation of the Tablet and Controller

The tablet is the main equipment for the driver to interact with the system. Its installation position should be in the cab where it is convenient for the driver to operate, such as the right or front of the seat. A built-in wire hole inside the tractor cab can be used to fix the mounting bracket, providing a convenient spot to mount the tablet.

3. Features of Software

3.1 Land Leveling System Software

Figure 4

As shown in Figure 4, it is the icon of the Land Leveling System software, which is used to enter the main interface. Normally, there is no need to click the icon; the leveling software will start automatically when the system starts.

3.2 Software Button Features

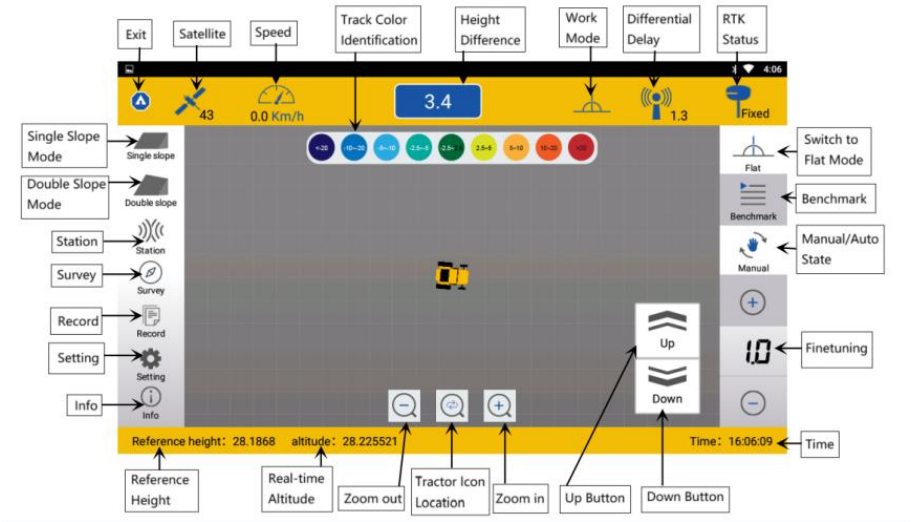

Figure 5

The function and role of each button will be explained in detail below.

Table 3

Item	Function Description	Item	Function Description
1	**Exit:** Exit the application.	2	**Satellite:** Number of satellites received by the mobile station

Item	Function Description
3	 **Speed:** The tractor's working speed
4	 **Track color identification:** Mark elevation differences by color.
5	 **Height difference:** If the real-time elevation of the blade is higher than the reference datum, a positive number is displayed; if it is lower than the reference datum, a negative number is displayed.
6	 **Work mode:** Flat or Slope
7	**Differential Delay:**  Indicate the time interval for the mobile station to receive the last set of differentials in seconds, generally required to be within 3 seconds.
8	**RTK Status:**  "Fixed" means the signal connection with the base station is normal. "Floating" means the signal is connected to the base station but unstable. "Single Point" means the signal is not connected to the base station.
9	 **Single Slope:** Click to access Single Slope.
10	 **Double Slope:** Click to access Double Slope.

Item	Function Description
11	 **Station:** Click to select the radio or Network connection method.
12	 **Survey:** Click to select Terrain, Length, and Area.
13	 **Record:** Record different work modes.
14	 **Setting:** Click to set software parameters.
15	**Info:**  Click to view facility information, device registration, administrator login, and system update.
16	 **Flat:** Switch to Flat mode.
17	 **Benchmark:** Reset Benchmark.
18	 **Manual/Auto switch:** Click to switch between manual and automatic modes.
19	 **Fine-tuning:** Click "+" to raise the datum, click "-" to lower the datum. The fine-tuning values are demonstrated in the middle, like "1.0" here.
20	 **Reference height:** Reference height for flat or slope working mode.  **Real-time altitude:** The real-time altitude of the blade during operation.

Item	Function Description
21	 **Zoom out/in:** Click "+" to zoom in on the tractor display track, click "-" to zoom out.
22	 **Tractor Icon Location:** Click to position the tractor icon in the center of the software.

Item	Function Description
23	 **Up/Down Button:** Click the up arrow to raise the blade, and click the down arrow to lower the blade.
24	 **Time:** Display local time.

4. Working Mode

The working mode includes two modes: Flat mode and Slope mode.

4.1 Flat Mode

Note: The device must be in a fixed state.

Step1. Drive the vehicle to a relatively flat area, click the manual up and down button, and put the blade close to the ground.

Step2. Click the Flat button to enter Flat mode. (Figure 6)

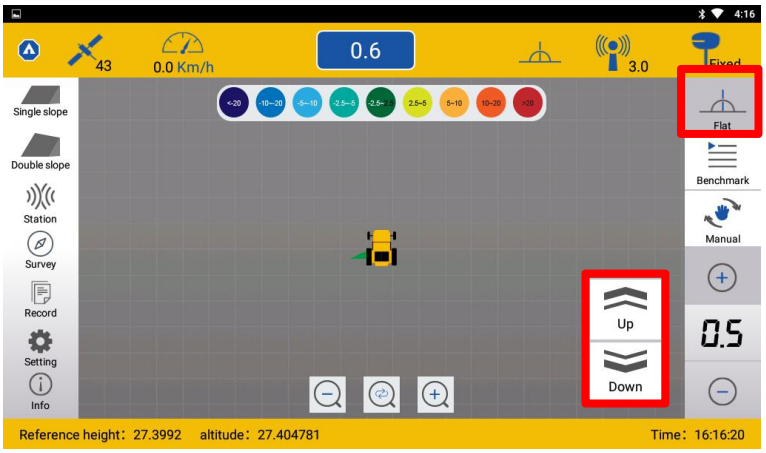

Figure 6

Step3. After clicking the Benchmark button, the blade should remain on this datum plane.

Step4. Click the manual-automatic switch button to switch to the automatic mode. Start working in automatic mode. (Figure 7)

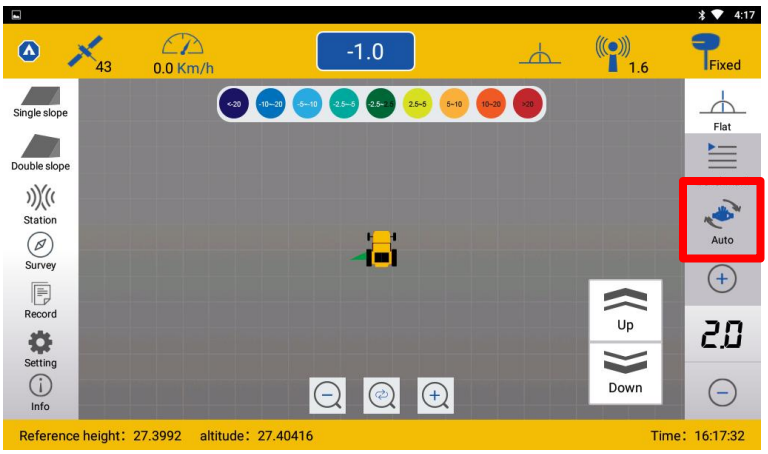

Figure 7

Step5. During the operation (automatic mode), you can click to fine-tune the benchmark.

Step6. If the benchmark is too high and the blade does not scoop the soil, you can click the fine-tuning button to lower the Benchmark; if the benchmark is too low, it causes the blade to scrape too much soil. You can click the fine-tuning button to raise the Benchmark.

4.2 Single Slope

Step1. Click to select Single slope mode on the main interface. (Figure 8)

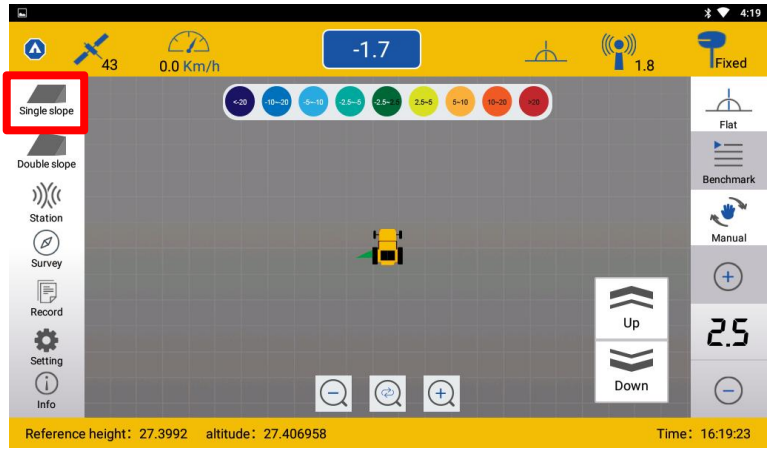

Figure 8

Step2. Enter the height difference between high point A and low point B on the interface, in centimeters. (Figure 9)

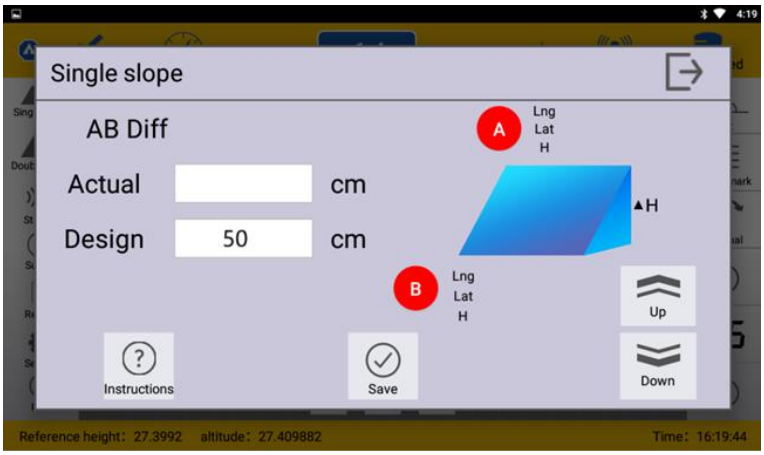

Figure 9

Step3. Click the up button to raise the blade to avoid touching soil while driving.

Step4. Drive to the highest point A, click the down button to stick the blade to the ground, click the A icon on the interface, and the icon turns green to indicate that the high point collection is complete. (Figure 10)

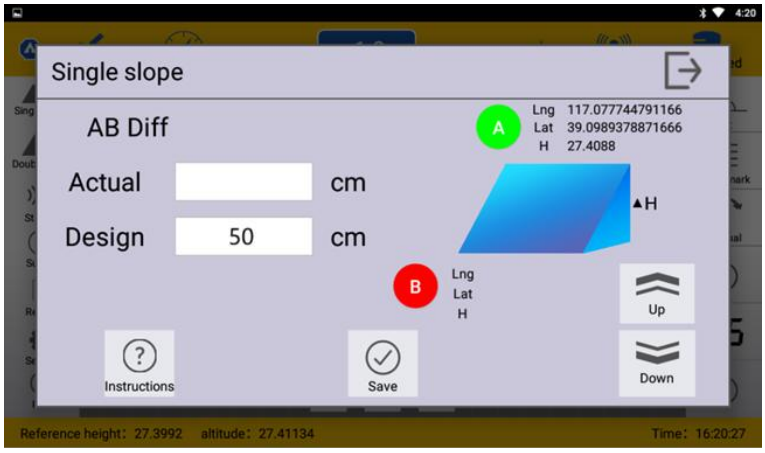

Figure 10

Step5. Click the up button to lift the blade and drive to the low point B (the orientation of the slope is determined by the line from point A to point B). After clicking the down button to stick the blade to the ground, click the B icon on the interface, and the icon turns green to indicate that the point collection is complete. (Figure 11)

After the settings of points A and B are completed, the software will display the actual elevation between points AB. (Figure 11)

Figure 11

Step6. Click the Save button to complete the point collection work and apply the parameters to the work.

Step7. Click the manual-automatic switch button to switch to automatic mode. Start working in automatic mode. (Figure 12)

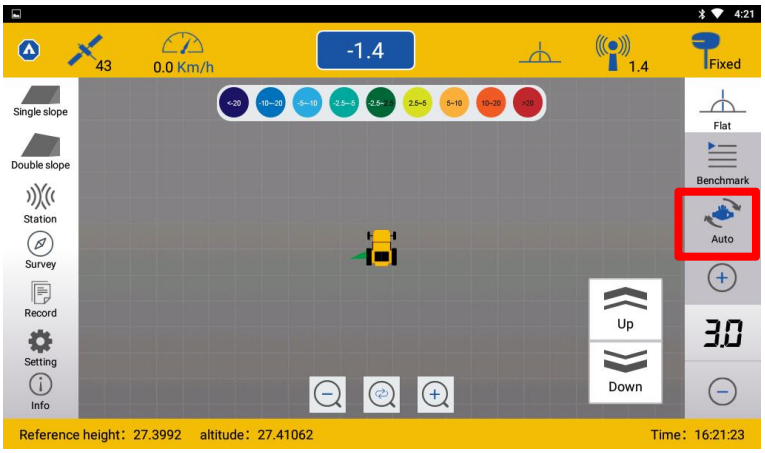

Figure 12

Step8. During the operation (automatic mode), you can click  to fine-tune the benchmark.

Step9. If the benchmark is too high and the blade does not scrape the soil, you can click the fine-tuning button  to lower the Benchmark; if the benchmark is too low, it causes the blade to scrape too much soil. You can click the fine-tuning button  to raise the Benchmark.

4.3 Double Slope

Step1. Click to select Double slope mode on the main interface. (Figure 13)

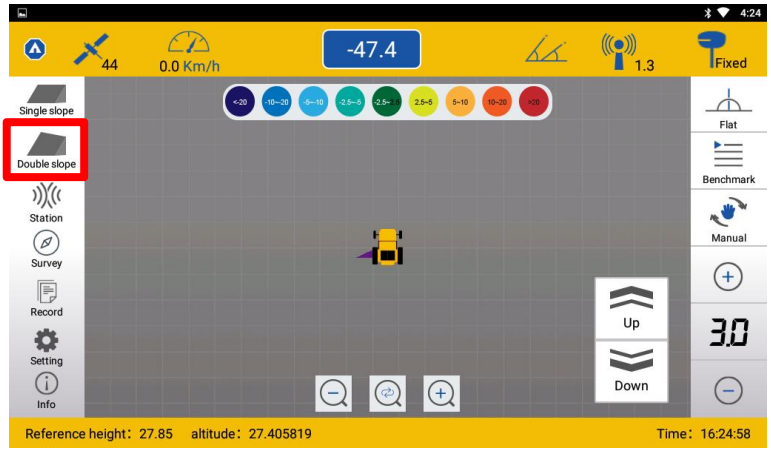

Figure 13

Step2. Enter the height difference between AB and AC in centimeters. A is the highest point, C is the second highest point, and B is the lowest point. Refer to Figure 14 below for the sampling point location.

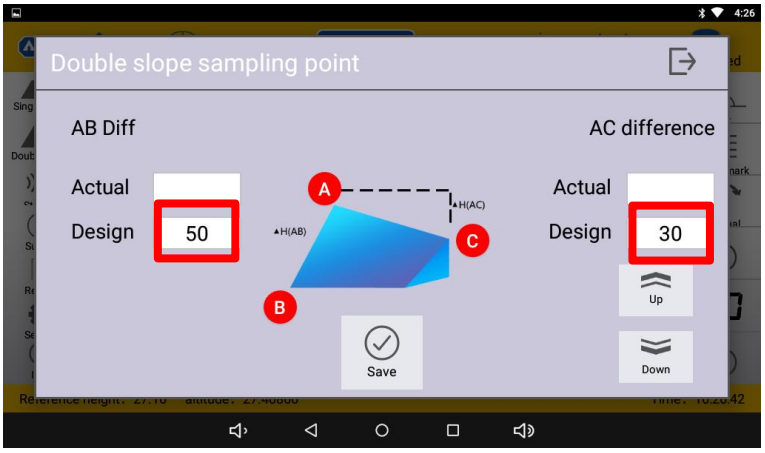

Figure 14

Step3. Click the up button to raise the blade to avoid touching soil while driving.

Step4. Drive to the highest point A, click the Down button to stick the blade to the ground, click the A icon on the interface, and the icon turns green to indicate that the high point collection is complete. (Figure 15)

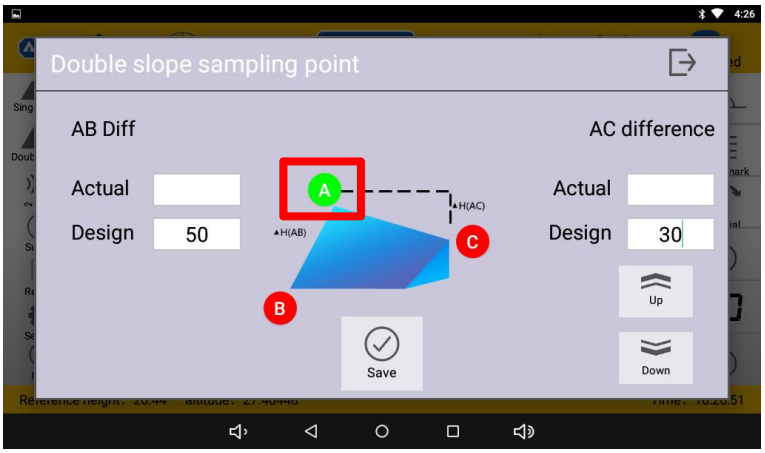

Figure 15

Step5. Click the Up button to lift the blade and drive to the second-highest point C. After clicking the down button to stick the blade to the ground, click the C icon on the interface, and the icon turns green to indicate that the point collection is complete. After the settings of points A and C are completed, the software will display the actual elevation between the AC points. (Figure 16)

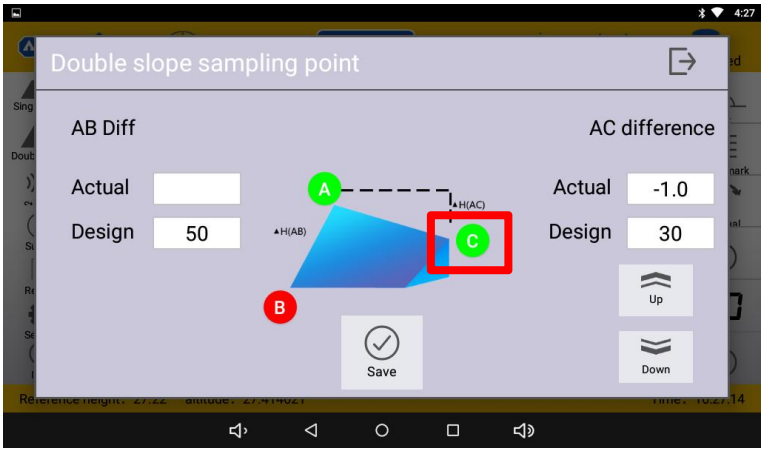

Figure 16

Step6. Click the Up button to lift the blade and drive to the low point B. After clicking the Down button to stick the blade to the ground, click the B icon on the interface, and the icon turns green to indicate that the point collection is complete. The software will display the actual elevation between points A and B. (Figure 17)

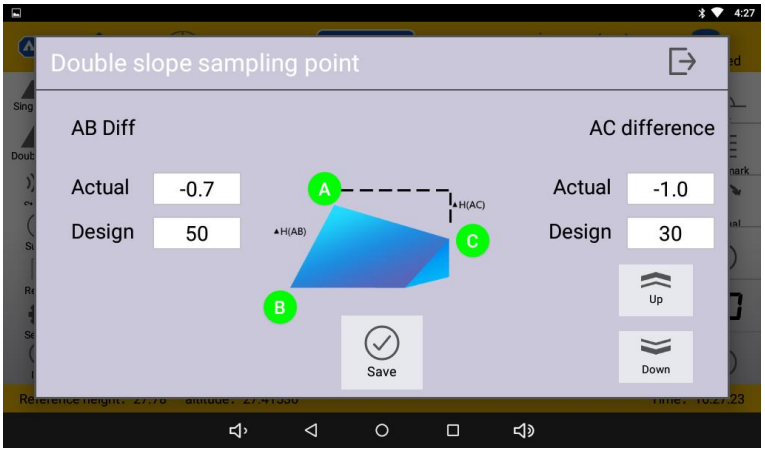

Figure 17

Step7. Click the Save button to complete the point collection work and apply the parameters to the work.

Step8. Click the manual-automatic switch button to switch to automatic mode. Start working in automatic mode. (Figure 18)

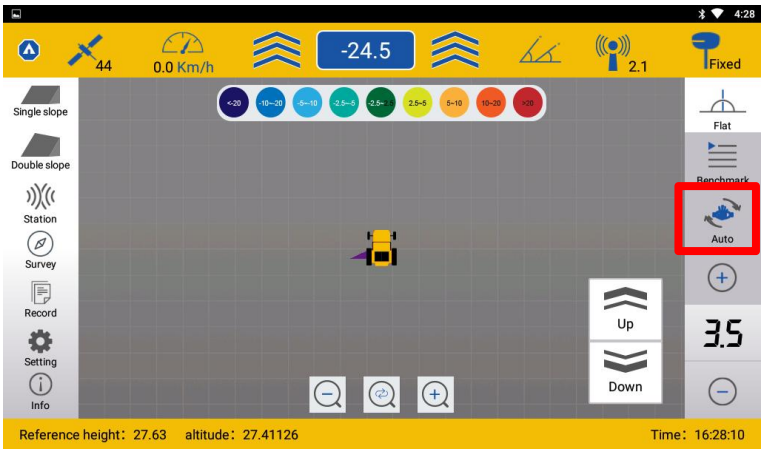

Figure 18

Step9. During the operation (automatic mode), you can click  to fine-tune the benchmark.

Step10. If the benchmark is too high and the blade does not scrape the soil, you can click the fine-tuning button  to lower the Benchmark; if the benchmark is too low, it causes the blade to scrape too much soil. You can click the fine-tuning button  to raise the Benchmark.

5. Other Main Functions

5.1 Survey

After clicking the button Survey, three major functions of Survey, Terrain, Length, and Area will be displayed.

5.1.1 Terrain

Step1. Click Survey and select Terrain to enter the terrain mode. (Figure 19)

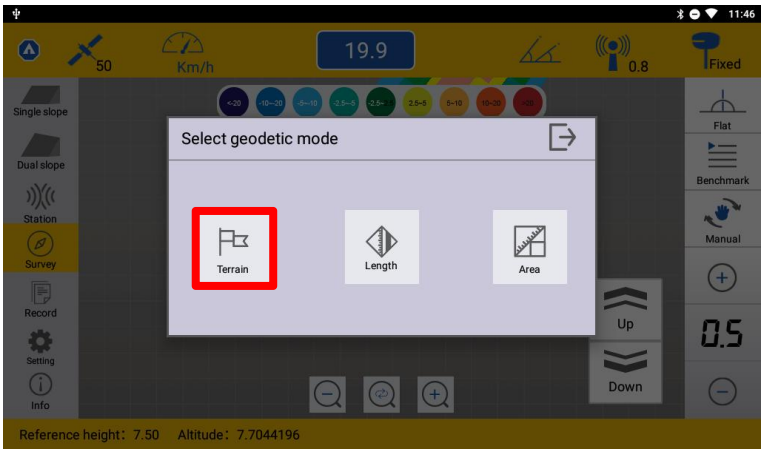

Figure 19

Step2. Click the Down button to lower the blade to the ground. Then click the GROUND SAMPLING button. (Figure 20)

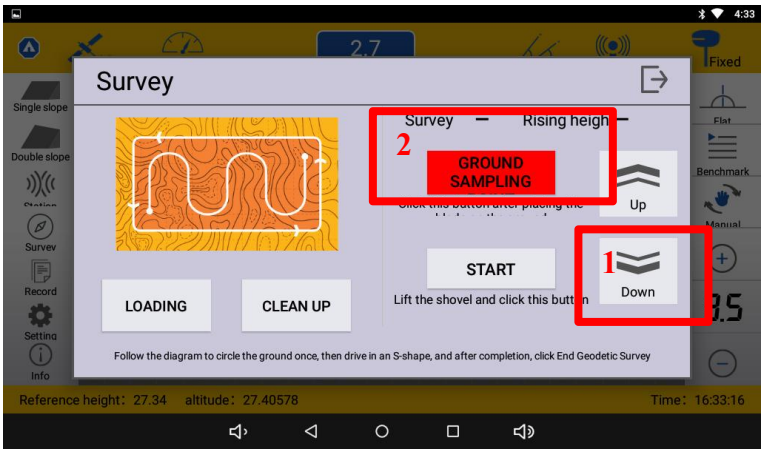

Figure 20

Step3. Click the Up button and click the START button. (Figure 21)

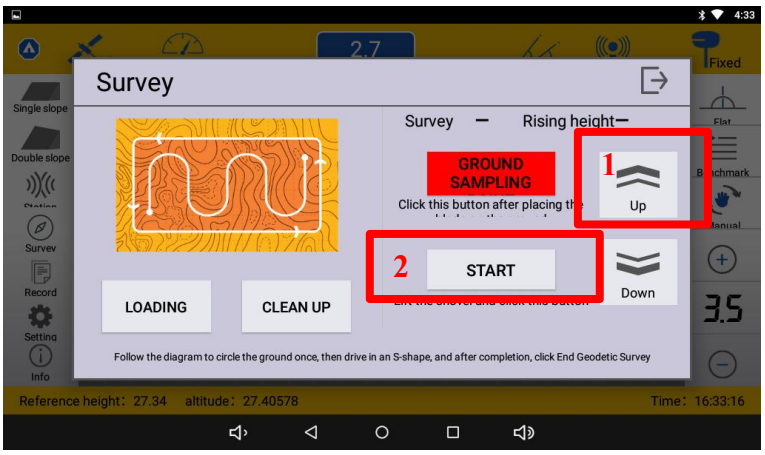

Figure 21

Step4. The tractor makes an S- or U-shaped path around the field. After the collection is completed, click the End button (it is best to have more than 100 measurement points; the more, the better). (Figure 22)

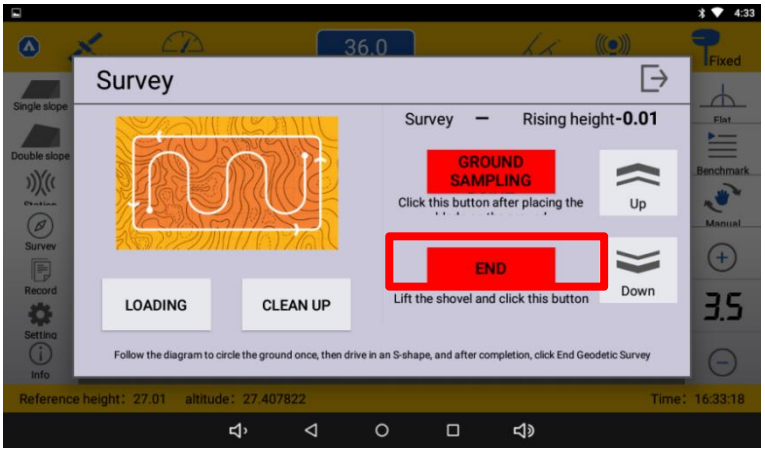

Figure 22

Step5. Click the TRAJECTORY button to switch to the relief map interface. Click the NO SHOW button to display the height difference value. (Figure 23)

◆Fill: Earthwork volume Fill value.

◆Excavation: Earthwork volume excavation value.

◆Area: Measured land area.

◆TRAJECTORY/TERRAIN: Track map and terrain map switch button.

◆NO SHOW/SHOW: Height difference value, close or display switch button.

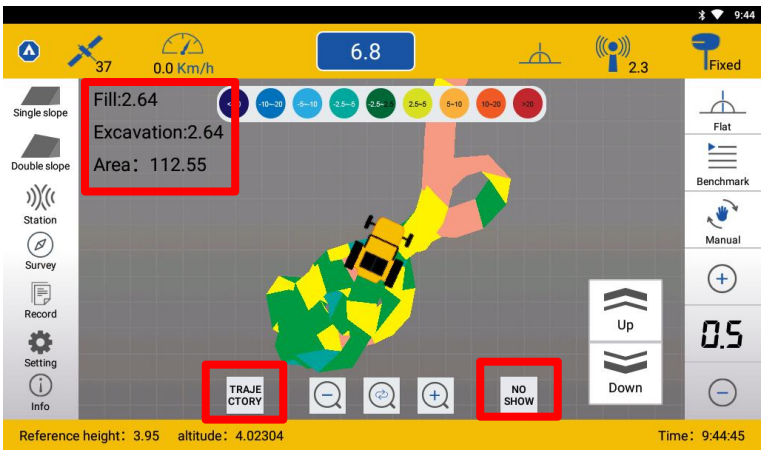

Figure 23

Step6. Select Flat or Slope mode and start working. (Figure 24)

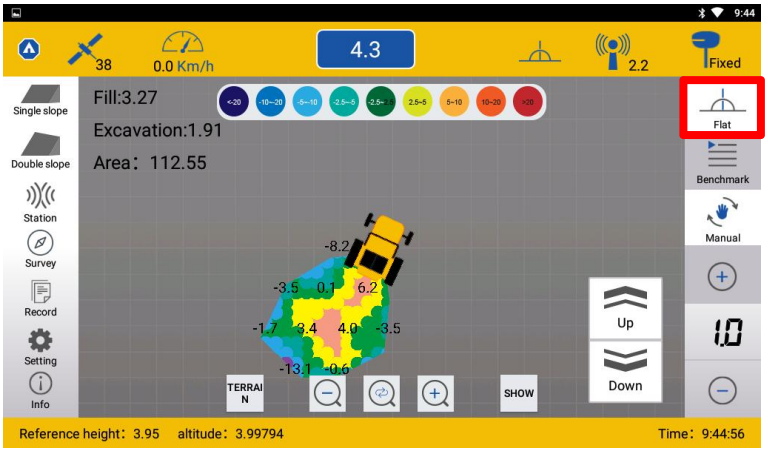

Figure 24

5.1.2 Length

Step1. Click the Survey button and select Length. (Figure 25)

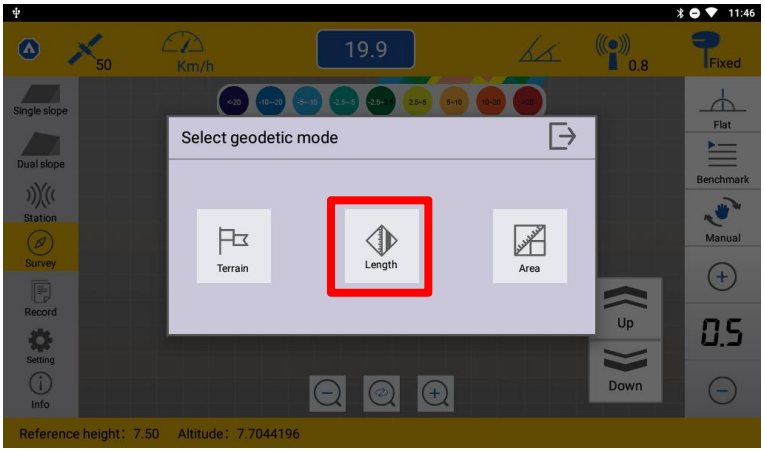

Figure 25

Step2. Drive the tractor to the starting point and click the Start button. (Figure 26)

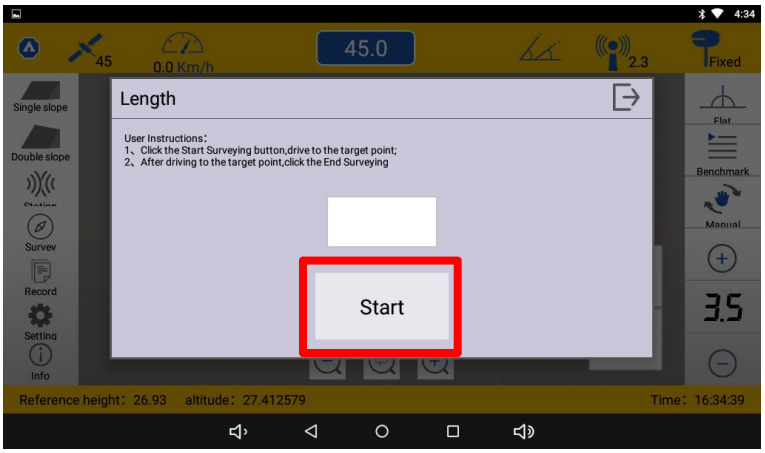

Figure 26

Step3. Drive the tractor to the endpoint and click the End button. (Figure 27, 28)

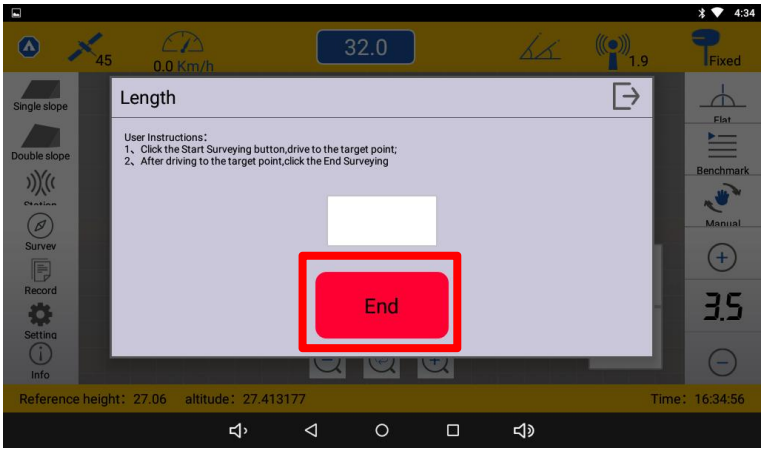

Figure 27

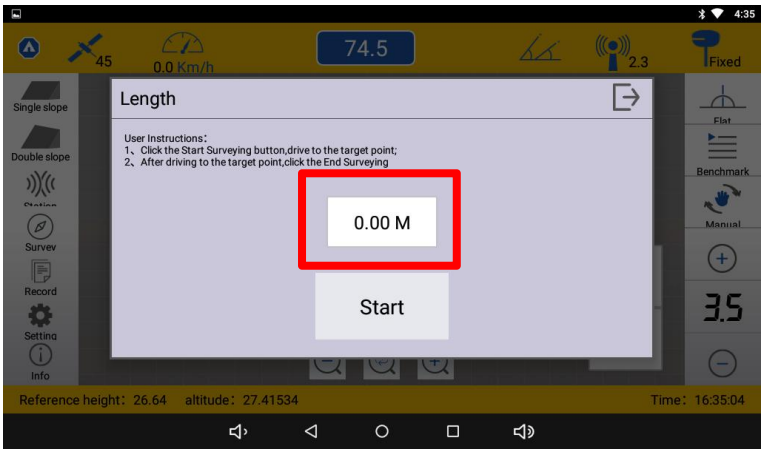

Figure 28

5.1.3 Area

Step1. Click the Survey button and select Area. (Figure 29)

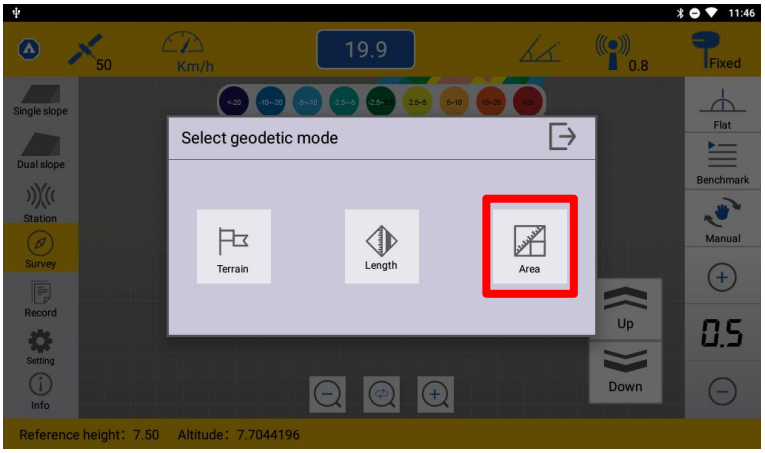

Figure 29

Step2. Drive the grader around the work site (the GNSS antenna is the positioning point, and the satellite antenna needs to be placed at the boundary of the ground during the test) and click the Start button. (Figure 30)

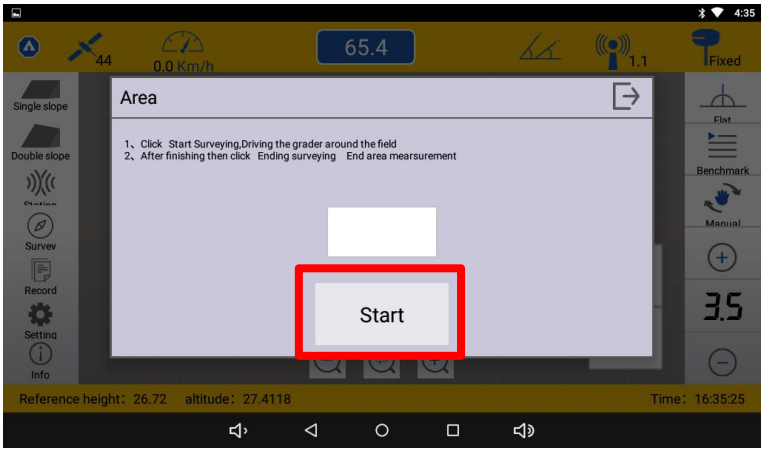

Figure 30

Step3. After completion, click End to display the measured area. (Figure 31, 32)

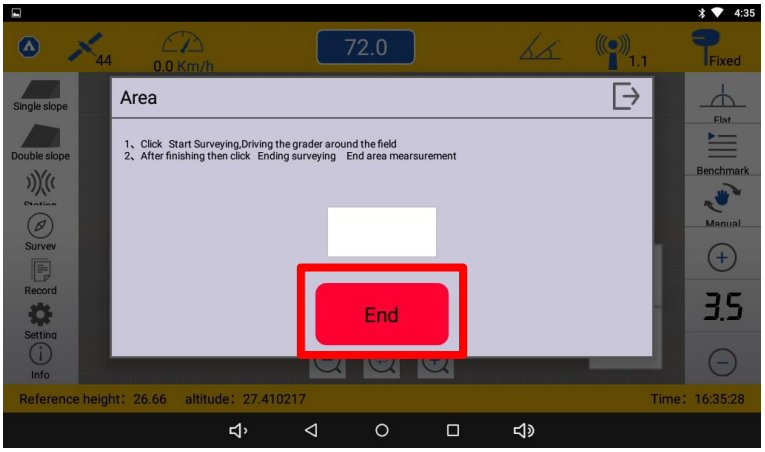

Figure 31

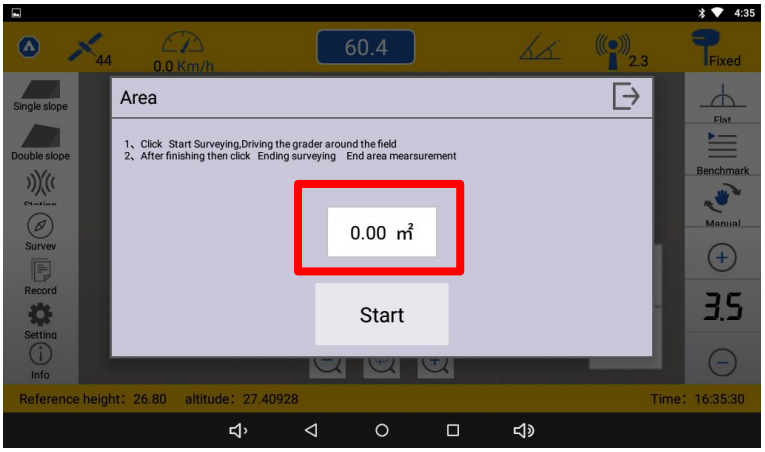

Figure 32

5.2 Record

Tips: we need to record the operation date corresponding to the plot. This function cannot be used after the radio base station has been moved or powered off.

5.2.1 Record — Flat

Click SAVE DATUM to record the datum of the base's elevation. Click to select it, and long press to delete. (Figure 33)

Figure 33

5.2.2 Record — Single Slope

After the Single Slope mode setting is completed, it will be recorded in the Record: the height difference of points A and B, the distance of points A and B, and the slope value of points A and B. Click to select it, and long press to delete. (Figure 34)

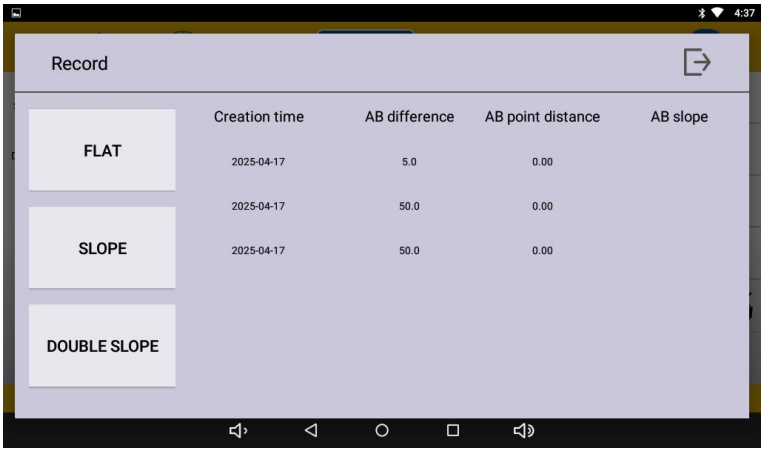

Figure 34

5.2.3 Record — Double Slope

After the Dual Slope mode setting is completed, it will be recorded in the Record: the height difference of points A and B/C, and the distance of points A and B/C. Click to select it, and long press to delete. (Figure 35)

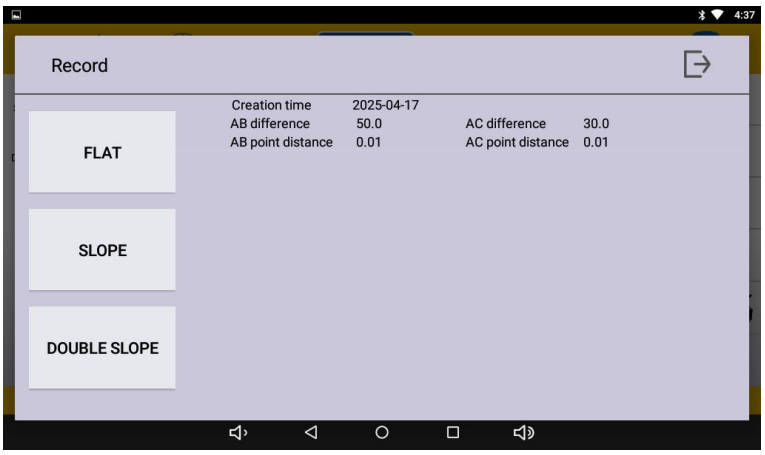

Figure 35

5.3 Setting

Click Setting, and enter the parameter setting interface. (Figure 36)

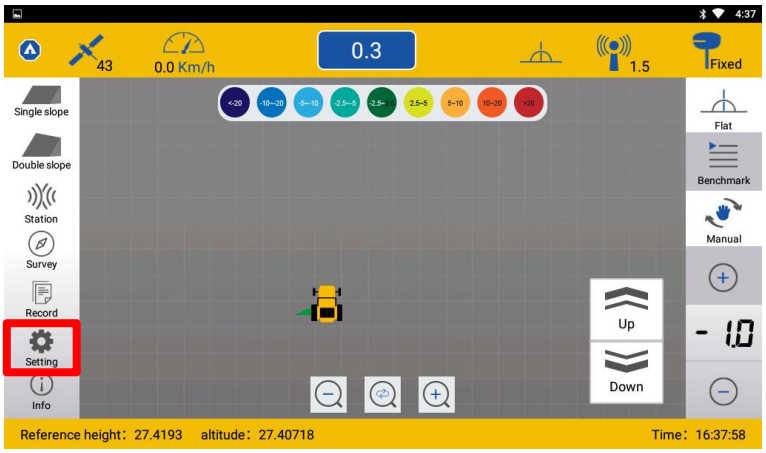

Figure 36

◆Accuracy

Adjusting the control accuracy aims to improve blind spot accuracy. The lower the accuracy value, the higher the control precision and the fewer the leveling errors. However, if the control accuracy value is adjusted too low, the blade will jump on its own, which will affect the leveling effect.

It is recommended that when the satellite signal is good, the control accuracy value can be appropriately reduced to achieve a better effect. The specific control accuracy value should be adjusted according to the actual situation (the recommended value is 1.5 — 3 cm). (Figure 37)

◆Width

The actual width of the blade. (Figure 37)

◆Blade parameters

Fine-tune the time for the blade to rise and fall for each click. The recommended value is 7. (Figure 37)

◆PWM (Pulse Width Modulation): 1-100

For blade movement (rising and falling), it is recommended to retain the default power setting of 99. (Figure 37)

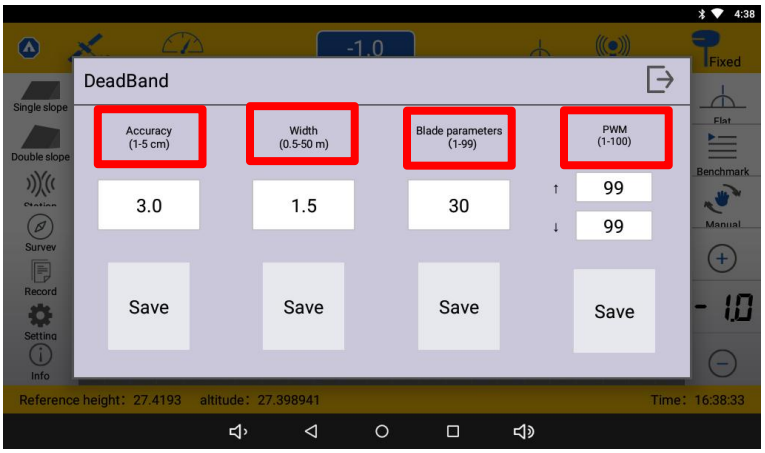

Figure 37

5.4 Exit

Click  to exit the software. (Figure 38)

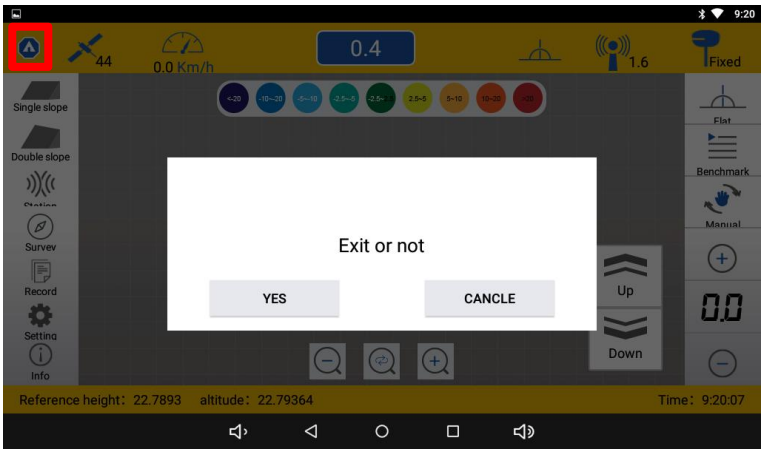

Figure 38

5.5 Device Info

5.5.1 Register

This interface allows you to view the SN(serial number) and registration date of the device.

Step1. Click Info and select Register. (Figure 39)

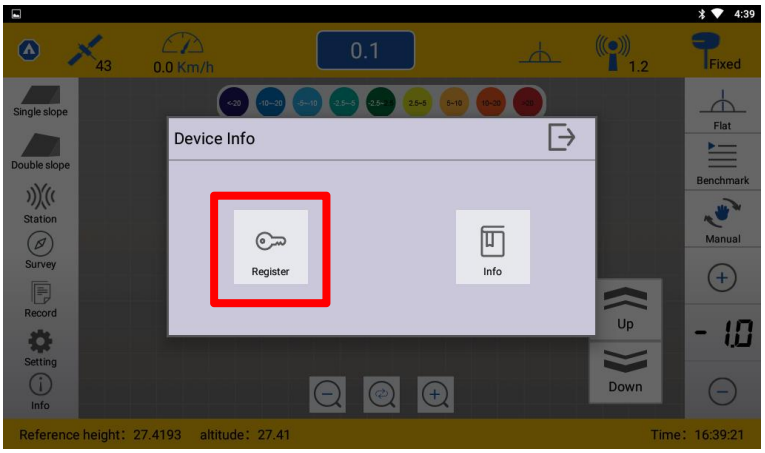

Figure 39

Step2. The SN code needs to be given to the sales staff or customer service staff to complete the registration. (Figure 40)

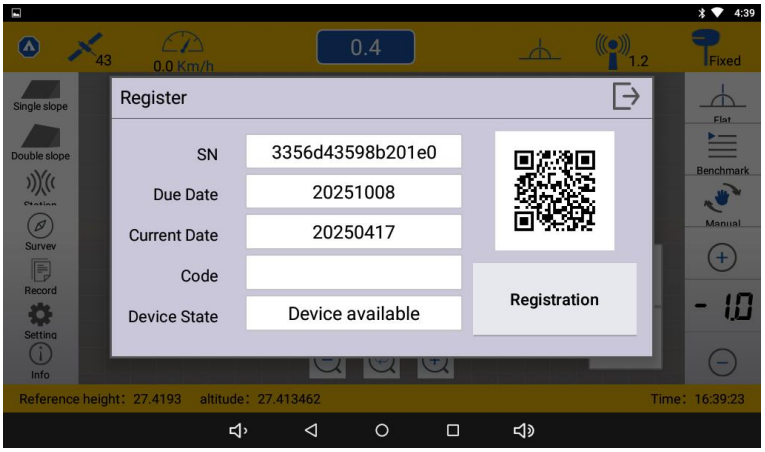

Figure 40

5.5.2 Info

This interface always shows the facility information, administrator settings, and system updates. Click Info to view the facility information. (Figure 41, 42)

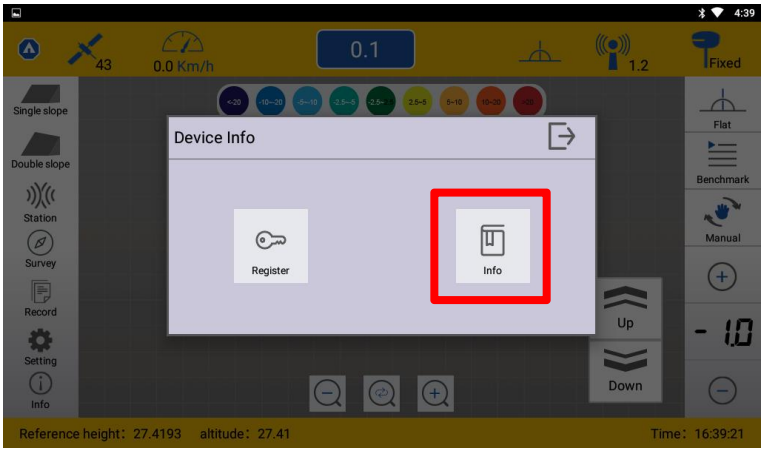

Figure 41

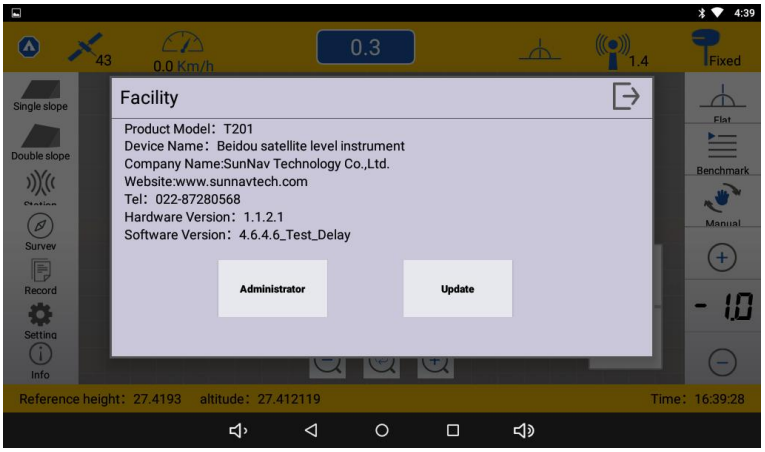

Figure 42

◆Administrator

Click to enter the administrator mode, the password is 20130313. If the device is running normally, do not modify the parameters here. (Figure 43—45)

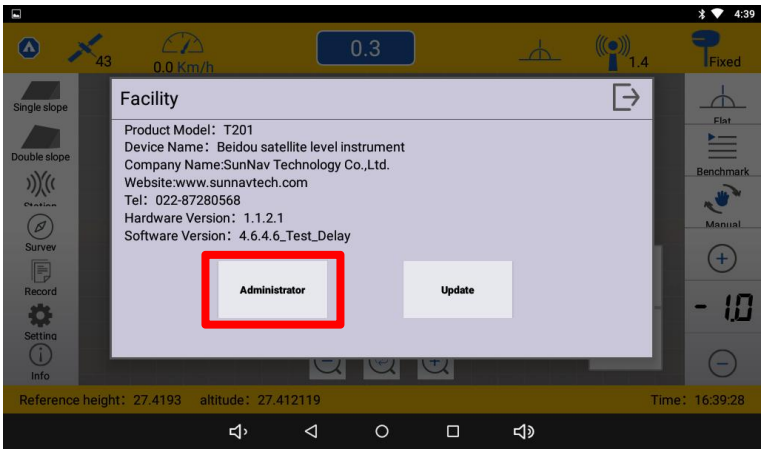

Figure 43

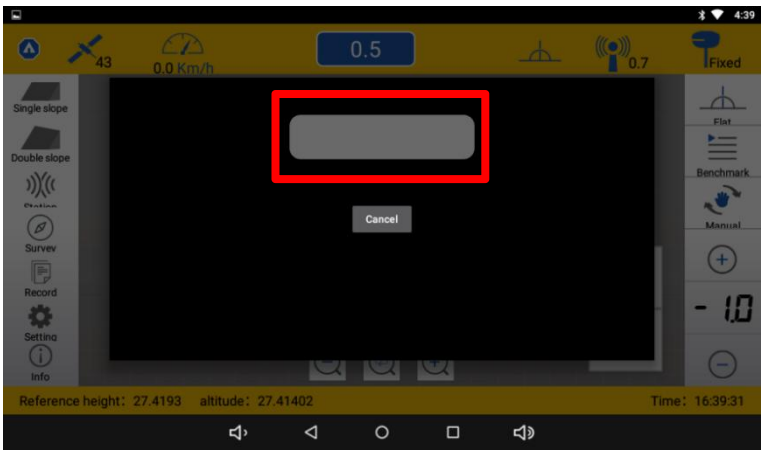

Figure 44

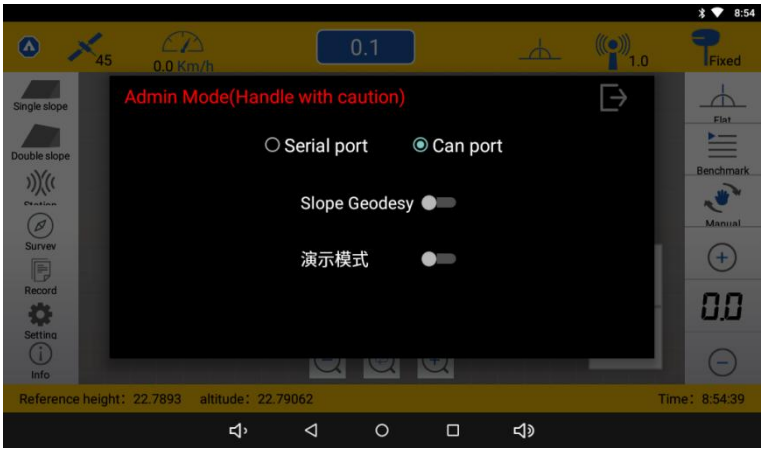

Figure 45

◆Update

Click to download the SMSS software, and upgrade the software and controller firmware. The password is 2013.

Step1. Click Update and input the password. (Figure 46, 47)

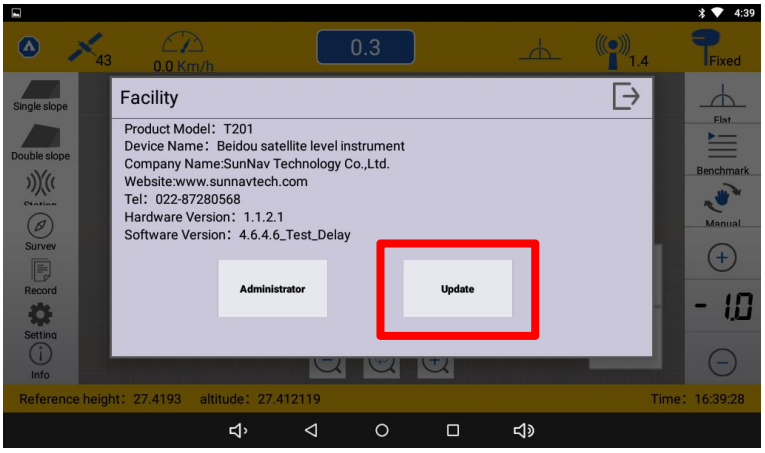

Figure 46

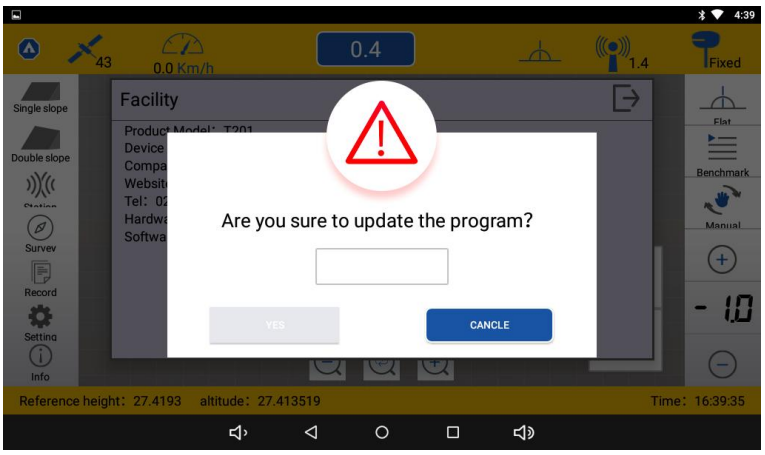

Figure 47

Step2. The system will download the SMSS software automatically. (Figure 48)

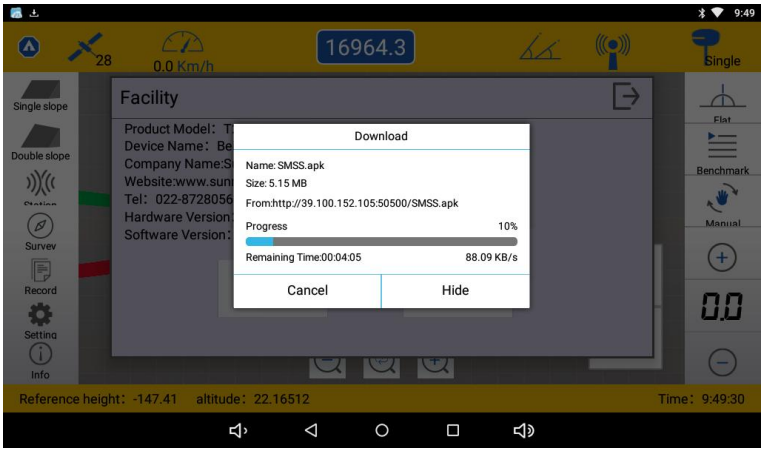

Figure 48

Appendix: Q&A

Q1: The Base Station Satellite light does not light up.

Analysis: The base station does not receive satellite signals, or the RTK is not fixed.

Solutions(check by step, go to the next step if the signal cannot be restored):

- If the power cable is connected, check if the equipment is powered normally.
- Check whether it is blocked by tall trees or buildings, and whether there is a high-voltage line influence.
- Reconnect the cables and restart the device.
- Reconfigure M20-1 with BRD software.

Q2: The base station does not transmit radio signals.

1. Analysis: Base station RTK is not fixed.

Solution: Refer to **Q1**.

2. Analysis: The Base station is not working in radio mode.

Solutions:

- Change the base station channel.
- Reconfigure M20-1 with BRD software.

3. Analysis: The receiver has internal damage.

Solution: Send it back to the company for repair.

Q3: The state of the mobile vehicle terminal is abnormal.

1. Analysis: The number of satellites is less than 12.

Solutions:

- If the power cable is connected, check if the equipment is powered normally.
- Check whether it is blocked by tall trees or buildings, and whether there is a high-voltage line influence.
- Reconnect the cables and restart the device.

2. Analysis: Radio signal reception is abnormal.

Solutions:

●Change the base station channel.

●Reconfigure M20-1 with BRD software.

Q4: Scraper lifts slowly.

Analysis: Pressure is insufficient.

Solution: Adjust the Blade parameters to increase the pressure in the Setting. (Figure 49)

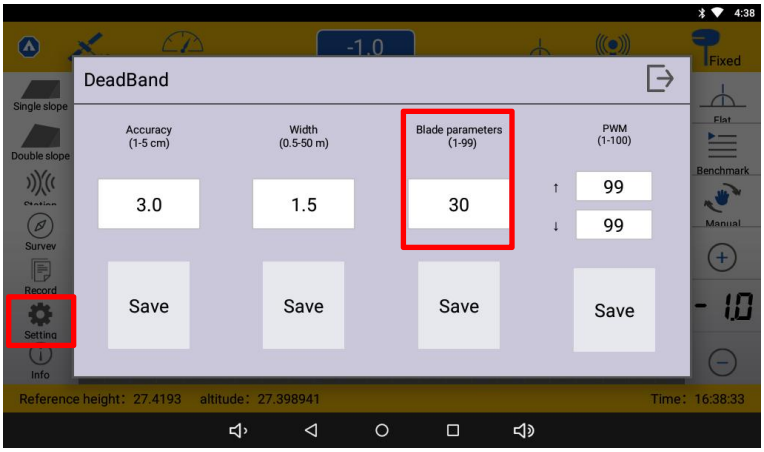

Figure 49

Q5: Waves appear during leveling.

1. Analysis: System signal reception is abnormal.

Solution: Check whether the signal reception is normal. If it is abnormal, refer to **Q3**.

2. Analysis: Local plots are too hard.

Solution :

●Plow again.

●Change the direction of the leveling operation, or level the waves several times.

3. Analysis: The scraper shakes frequently.

Solution:

●Enter the accuracy adjustment in Settings and adjust the accuracy to 1.5—2.5cm. (Figure 50)

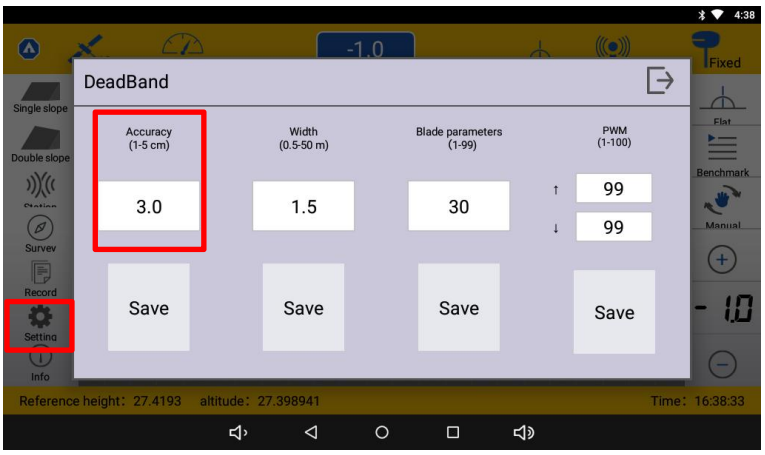

Figure 50

●Enter the Setting and adjust the PWM value to 60—100. (Figure 51)

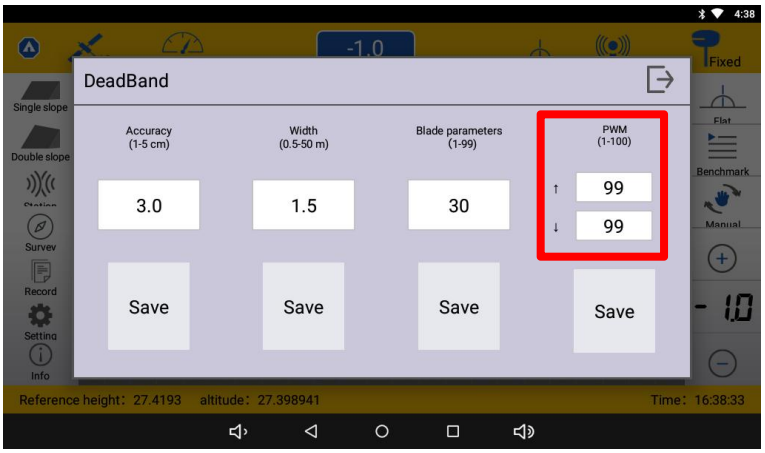

Figure 51

Q6: Scraper reactions are slow during leveling.

Analysis: Sensitivity value is too low.

Solution: Enter the Setting and adjust the PWM value to 60—100. (Figure 52)

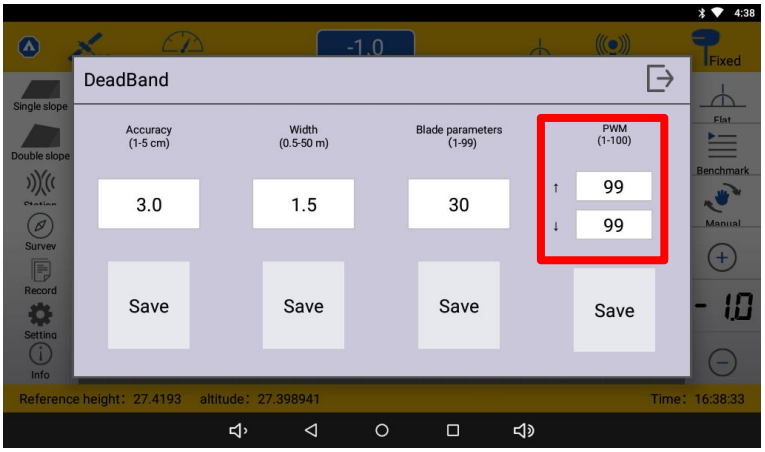

Figure 52