JYL20

Land Leveling System

Guide

SMAJAYU(SHENZHEN) CO.,LTD

Shenzhen

China

User Notice

- 1. Before using this product, please read all the user information provided with it carefully to understand the usage and precautions of this product.
- 2. Do not disassemble or assemble the relevant cables in the satellite flat ground navigation system equipment when the power is on.
- 3. 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.
- 4. 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).
- 5. Do not continue to use the cables after they are damaged. Please purchase and replace them in time to avoid affecting the use effect.
- 6. The equipment is damaged due to force major (lightning strike, high pressure, collision, scratching), which does not belong to the free maintenance scope of our company.
- 7. Please do not disassemble the product shell by yourself, otherwise the warranty will not be given.



Notice before Use

- 1. The Basic Principle
 - (1) Fully understands the product and its operating requirements before use and comply with the "common-sense health and safety operating regulations" of the country and region while following the instructions in use!
 - (2) Accident prevention measures and common-sense safety technology, labor protection, medical and traffic regulations must also be followed.
 - (3) Listening to suggestions for product operation can help avoid malfunctions and accidents.
 - (4) 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.
- 2. Personnel requirements
 - (1) 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 during driving.
 - (2) 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 terrain; the operator understands the installation and operation principles of related software and hardware, and has the ability to safely handle common faults.
 - (3) Persons under the age of 18 and those with disabilities that hinder safe operations should not participate in agricultural machinery operations.
- 3. Preparation before Working
 - (1) Check whether there are obstacles around the shovel and other factors that endanger safe operations, and let irrelevant personnel leave the work area.
 - (2) According to the requirements of daily maintenance, carefully check the leveling shovel for loose parts, missing parts, excessive wear, and sediment accumulation.
 - (3) Operators must be familiar with the operating devices of the product and their functions.
- 4. Precautions During Installation
 - (1) 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 and squeezed to prevent the normal operation of the system from being cut off.
 - (2) A protection chain must be hung between the front end of the tractor and the shovel to ensure the safe use of the system.

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1. Introduction

1.1 Abstract

Smajayu 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 base station + mobile vehicle terminal or connects to network base stations for operation.

1.1.1 Features

- 1. The motor grader can be controlled through manual and automatic modes, and tablet display datum plane and height information reference datum plane in real-time.
- 2. In the automatic mode, the field can be leveled automatically according to the height of the set datum plane, and it supports the leveling of slope and horizontal field.
- Support information upload function, system working status, working hours, working location, working area and other information can be obtained through the platform and WeChat applet.
- 4. The terrain information is displayed in different colors, which greatly improves the work efficiency. It can understand the height and leveling of the entire field in real time. It can make accurate judgments during operation, improve work efficiency by more than 40%, and greatly save time and cost. It has a great working advantage compared with conventional laser land leveling systems and ordinary satellite leveling systems.
- 5. The on-board terminal is compatible with our Autopilot system, intelligent spray system, driving assistance system, etc., which can greatly reduce the purchase cost of various equipment. For specific operation items, please refer to the following detailed description.



1.1.2 Benefits after Land Leveling

1. Increase Yield

Using GNSS Land Leveling System to accurately leveling the land can increase production by 20-30% compared with traditional leveling technology, which is 50% of 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 germination and plant growth and increases the yield of crops.

2. Save Irrigation Water

After the field is leveled, the water used for irrigation can be fully utilized, so that the water can be evenly distributed throughout the field, so that the uneven flow of water will not cause the irrigation water cost to increase.

3. Save measurement cost

There is no need to hire a survey team to measure the elevation of the land, with just a few minutes of training, anyone can accurately and quickly measure the elevation of the land after using GNSS Land Leveling System.

4. Reduce Fertilizer Loss

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

5. Control High Location Soil

The high ground can be accurately leveled to obtain a uniform height, which reduces the erosion of the high soil by water and prevents the high soil from gathering in the low place.

1.2 Datasheet and Composition

1.2.1 R23 Mobile Base Station Device List

Table 1 R23 Device List

	R23 Mobil	e Base Station Devi	ce List
Name	Mode	Quantity	Figure
R23 GNSS	D22	1	-
Receiver	K23	1	
Terminal Antenna		1	
Disk		1	•
RTK Extension		1	
Rod		1	
Alligator Clip		1	0
Power Cable		1	
Nine-core setting line		1	0
Power Adapter		1	~
Power cable		1	-



1.2.2 JYL20 Land Leveling System Device List

Table 2 JYL20 Device List

	JYL20 Land Lev	eling System De	evice List
Name	Mode	Quantity	Figure
Tablet	T100	1	
RAM Bracket		1	*
U Type Clip		2	Ø
Drill Tail Wire		4	1
Controller	W20	1	
External Radio (optional)	D10	1	
D10 Communication Cable (optional)		1	1
GNSS Antenna	A10	1	
GNSS Antenna Cable		1	2
GNSS Antenna Sucker		1	
JYL20 Power Supply Cable		1	Ó
JYL20 Communicatio n Main Cable		1	Ø
External Lift Switch		1	0
Solenoid Valve Control Cable		1	Q
Vehicle Radio Antenna (Optional)		1	90
4G Antenna		1	⁽ C)



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 and through internal calculation, so that the controller can obtain more precise position information. The controller calculates the reference datum plane by real-time sampling, compares the position of the scraper body with the reference datum plane, and combines the corresponding algorithm to obtain the expansion and contraction amount of the limit cylinder. When the scraper body position is higher than the reference datum level, the limit cylinder automatically shortens, the scraper body descends, the scraper body remove the soil and drives the soil forward; when the scraper body is lower than the reference datum level, the limit cylinder automatically extends and the scraper body rises, and the soil in the scraper fills up to the lower ground. When leveling the ground, the limit cylinder is constantly expanding and contracting according to the terrain, and the scraper body continuously remove and fill the soil. After leveling for a period, the field can form a plane on the same terrain to achieve fine leveling.

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 installed 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 the figure below(Figure1); when installing the GNSS antenna, you can choose the antenna suction cup for fixed installation; it is recommended that the clients increase the antenna installation position and use a flange fixed and the leveling effect could be better.



Figure 1 GNSS Antenna Installation

2.1.2 Radio Antenna Installation

The vehicle-mounted radio antenna is used to receive the radio signal from the mobile base station. It can be placed on the roof of the vehicle when installed, and can be fixed



on the roof of the suction cup at the bottom of the vehicle-mounted radio antenna, as shown in the following figure (Figure2):



Figure 2 Radio Antenna Installation

2.1.3 Cables Connection

Install according to the schematic diagram of the on-board mobile terminal(Figure3), and the solenoid valve control cables respectively control the lifting of the hydraulic cylinder of the leveler; during installation, in order to prevent the lifting from being contrary to the actual situation, an external lifting switch can be used for debugging. If it is contrary to the actual situation, the control line Change the positions of the two ports and then fix them.



Figure 3 Cables Connection

Note:

- 1. Choose the correct cable layout location.
- 2. The solenoid valve control cable and the antenna cable are arranged separately, try to avoid the two entangled together.

2.1.4 Installation of Display and Controller

The display is the main equipment for the system to interact with the driver. Its installation position should be in the cab that is convenient for the driver to operate, such as the right or front of the cab seat. There is a tractor's own wire hole inside the cab. Fix the mounting bracket, if it is not possible to drill holes in a suitable position for fixing, then fix the monitor on the bracket.

2.2 Base Station Installation

2.2.1 Mobile Base Station Installation

Please reference figure below. (Figure5)



Figure 5 Mobile Base Station Installation

2.2.2 Installation Notes

- 1. Mobile base station powered by 12V battery.
- 2. When installing a mobile base station, pay attention to the surrounding environment and place it in a relatively open place to prevent interference

with satellite signals.

- 3. The GNSS antenna must be erected on a tripod or the height must be higher than 1.5 meters, and there must be no obstruction within the 360-degree range.
- 4. When the base station is working, observe whether it can work normally through the indicator light. During the normal working status, POW and SA are always on, and the LINK indicator flashes every second.
- 5. The coverage diameter of the mobile base station radio is about 2km. It should be noted that the distance between the vehicle-mounted terminal and the base station should not exceed its operating coverage during work. The specific coverage is related to the height of the base station radio antenna and the surrounding environment. The actual operating range shall prevail.
- 6. Mind the loss of battery power

3. Features

3.1 Land Leveling System Software

Figure 4 Land Leveling System Software

As shown in the figure (Figure6), it is the icon of Land Leveling System software, click to enter the main interface.



• <u>0</u>	💦 SAT (10 RTK Fix	<u></u> 23	56.3cr	n	Speed 7.4km/h	Type ^{® ® *4} 10:28 Level
Time: 0:0			Base he	eight :21.25	54m	Shovel H:0cm	Adjustment:0.0cm
(A) SIGNAL	>20cm +10~+20cm +5~+10cm +5~+2.5cm -2.5~+2.5cm						SET H
MODE	-2.5~-5cm -5~-10cm -10~-20cm <-20cm			*			ТАЗК
TOOL				1			
SYSTEM							
DATUM	4645	5.7					AUT
		-	Terrain h	eight :-2.30	08m		area(mu):0
		Ъ	\bigtriangledown	0		り	

3.2 Software Button Features

Figure 5 Software Button Features

As shown in the figure (Figure7), the main interface of the Land Leveling software is displayed on this interface: "Satellite", "RTK", "High Difference", "Speed", "Operation Mode", "Base Station", "Leveling Mode", "Auxiliary Function", "System Settings", "Information", "Datum Plane Fine-Turning", "One-key Height Setting", "Start Leveling/Auto Leveling", "Fine-Turning Value", "Total Earthwork", "Map Scale" and other information can facilitate the information interaction between the software and the driver.

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

3.2.1 Display at The Top of The Main Interface

1. Satellite: Shows the number of satellites found in real time. (Figure8)

Figure 6 Satellite

2. RTK: RTK status and data delay, fixed as available status. (Figure 9)



Figure 7 RTK

3. High Difference: The value displayed in the top middle position is the height difference between the real-time plane and the datum plane, It is marked as

✓ when higher than datum plane and flash (default 0.5S flash once),
 positive value, for instance: +15cm; It is marked as ▲ when lower than
 datum plane and flash (default 0.5S flash once), negative value, for
 instance: -15cm; It is marked as ● when within datum plane accuracy
 range and flash (default 0.5S flash once), for instance: -1cm (That is within
 the accuracy range, the range can be set by yourself). (Figure10)



Figure 8 High Difference

4. Speed: Real-time working speed (For reference tractor speed) .(Figure 11)



Figure 9 Speed

5. Leveling Mode: Current leveling mode, horizontal or slope mode. (Figure 12)



Figure 10 Leveling Mode

6. Camera: Real-time image data, Click to open the camera, half of the image and half of the leveling interface. (Figure 13)



Figure 11 Camera

7. Reset: Click to work with a fixed perspective of the tractor icon. (Figure14)



Figure 12 Reset

3.2.2 Display on The Left Side of The Main Interface

 Base Station: Base station mode selection and connection, there are three modes: Radio, CORS, and Smajayu Network. You can choose one of them according to local conditions during operation, as shown in the figure below (Figure 15).

0	SAT 39		<u></u> <u></u> <u></u> 2358	3.4cm	Speed 7.1km/h	Type ^{® • * 10:29} Level
Time: 0:0	>20cm +10~+200 +5~+10ct +5~+2.5c -2.5~+2.5 -2.5~-5cn -5~-10cm -10~20ct <-20cm	Current mode: RADIO Mobile	Base Set RADIO CORS e base station	LSCORS CRadio sett	CLOSE D21NET	Adjustment:0.0cm
		4645.7	Terrain heig	ht :-2.331m		area(mu):0
		Ŷ	\triangleleft		り	

Figure 13 Base Station Connection

Leveling Mode: After click button, there will be horizontal mode, slope mode, and control mode. The current horizontal mode and slope mode are available. You can choose according to the work situation during operation. After selection, there will be a detailed operation introduction, as shown in the following figure (Figure 16, 17, 18, 19, 20, 21).



-	SAT 39	GO RTK	42358.7cm	Speed 7.2km//	E Type" a	101	TAP SAT	PTK	2356.8cm	Speed Trave	The As
Time 0:0			Base height :21.254m	Shavel H.0cm	Adjustment:0.0cm	1mie: 0.0	1.0		Base height :21.254m	Shovel H:0cm	Adjustment:0.0cm
14 AP	>23em +10~+23cm #5~+10cm #5~+10cm				-	ALCON ALCON	220001 4110-47 45-4110 45-410	-	Contrast Contrast	danara -	
	antar Liivelu eside	E E E				.de	LEVEL E	Manual III Currs	n Estroper button ar single control mode is the ungle pro	NIG Commune	E.
	<		-			201	< 200m	rgeration Security 1	in mode, inert the Manual Commi Lift in Strape you and click Confirm Settings to com	Parine clare the	-
STETEN					<u> </u>	an a			CONFIRM	_	
DATIAN					AUT 0	DATUM	-				AUT
	1	445.7	Terrain height -2.336m		area(mu):0	_	1	1619.7	Terrain height -2,326m		Brea(mu):0
		5	4 0 D	=10				4	4 0 E	40	

Figure 14 Leveling Mode

Figure 15 Control Mode

1	SAT TIP	to and	4-2354.3cm	Speed column	E Type ⁰ B V	-	SAT 39	HIN N	2356.3cm	50red astroit	Type" a st
Time 0:0			Base height :21.254m	Shovel H:0cm	Adjustment:0.0cm	Time: 0:0			Base height :21.254	im Shovel H:0cm	Adjustment:0.0cm
<u>*</u>	>30cm -10~+320 +5~+10u +5~+2.5c	÷	Level			°A°	>250m +10=+25 15~+10c +2=+2.5c	1 khousti ooto	Onlade einin	ptim.	
Ander Trace	LEIGL S.	Manually If appropriate neigh builton below, Click the Ba return to the main	It the screamer to adjust the blade to the th from the ground, then drive the "OK" of form in the upper left comer to n interface.		TAIN	NOLE	4/782	2 Dick on the fire about 15cm on the fire about 15cm on the whictor while drawn	und Height Sauton; a hovel to raws ni aurope the aurope sturies	8	TAUN
STATES		_	5.5E	_	AUT		_	Covert James	eghan pera UND SURVEY	ENICH ENICH	ALT.
DATLET		46457	Terrain height ::2.29m		area(mu):0	EATIN	-	4645,7	Terrain height : 2:322	2m	orealmu) 0
		5	0 0	39				4	4 O	0 40	

Figure 16 Manual height setting in horizontal mode. Figure 17 Auto height setting in horizontal mode



Figure 18 Two-point fixed height in slope mode Figure 19 Directional height setting in slope mode

3. Accessibility: After operation the accessibility, there are area measurement, working hours, and briefing modes. After operation the area measurement and working hours, there are detailed introduction and operation instructions; Briefing mode: the simple interface is the same as the data called by the advanced interface, but the interface and operation are simplified, Which is convenient for operators with different usage habits and different requirements. This function is not yet open. (Figure 22, 23, 24)

11 2	SAT 🔂 HTK	▲2355.7cm	Speed 5	Type a star	1	SAT IV	🙆 🚏 📥 23	56.6cm	Spread Spread	Type Lovel &
Time: 0:0		Base height :21.254m	Shavel H:0cm	Adjustment 0.0cm	Time: 0,0		Bansh	minht -11 1Edm	Chouse H floors	Adjustment 0.0cm
SA2 S200 SEDIMAL S200 MC000 S200 MC000 S200 MC000 S200	m +abhran 20an 2.Bom +2.Sem -3am Sem -28on				A.	>2000 +11/+20/- +5/+100 +5/+200 -2 h+200 -2 h	Ordinary measurement sampled 3 1. Please are the well's of the m 2. The dis presidence are of the majorite	nationalien, stra mitale	Machine and Study	
TOOL AREA	TIME SLINGEY	Ŧ		9			3. Then clear (true) then drive the local of the work and the second the frameth politics when does. Note: The Come Political of the or equipment (1001)	n Bactor , chick the mine milat (exaBhg) all.	perce and (tru)	1
DUTTUM	4645.7	Terrain height :-2.299m		area(mu):0	LOUTINA.		iensi terrein	height :-2.236m		area(mu):0
	4		do				4	0 0	Ø₽	



Figure 21 Area Measurement



Figure 22 Working Hours

System Setting: After opening the system settings, there are three items: precision setting, threshold setting, and other settings. The specific operations are described in detail after opening the corresponding items, as shown in the figure. (Figure 25, 26, 27, 28)

1	SAT 39	G FTK	4-2357.2cm	Speed 7.1km/h	Lawii 2	-	SAT SAT	0.0	42355.9cm	Co Spread	Type Car
Time: D:1	-		Base height :21,254m	Shovel H:0cm	Adjustment:0.0cm	Time bill			Base height :21.254m	Shovel Hillom	Adjustment 0.0cm
A	Alfred Ifen					'A'	20000 100-100 100-100	6	with a		四
	10-42.300 3.5-47.500					-	+00.0- 0.9472	Ac	caracy salling(on) 💼 2.0	0	
LADOE	5~-1000- 1020-0				Eler		-310an -1020an	3. The a second	erians arcuracy is 2cm, and the moore by argument than 1 Bom mentic accuracy in write of 0 Tam	mended	
2	< 30am		<u>.</u>		0	2	Albert	Shire offer se	mended but to modify the pressed	an value	- 0
10-ak	-	-			0	P.1	-	in Prin a free per	atomatic state. He deniel frequently at any value can be increased according	hullwu ana. alei	
C CTEAN	- C					-	266 S		1		
					AUT					_	AUT
DATUM	-	RALT.				DATEM		No.7			
		2	Terrain height -2.314m		area(mu)0			22	Terrain height -2.312m	_	nien(um):0
		₩.		c])				4		49	
-84	SAT	Figure	e 23 System	Setting	FVDR ^Q = 74 +)		F	igure 2	24 Precision S	Setting	New 978 of Frank
-81	40 SAT	Figure	e 23 System 3	Setting	Lavel M	-	Fi	igure 2	24 Precision S	Setting	Den 28 Januar
Time: 0.0	SAT 40	Figure	e 23 System 3	Setting Shovel Hillom	Luvel Adjustment.0.0cm	Tene: 0.0		igure 2	24 Precision S	Setting Epeca Shovel H Dame	Adjustment 0.00m
Time: 0.0	Sohen 1915-edu ad-etiss	Figure	e 23 System S 	Setting Speed Shovel H:Dom	type ⁴ Adjustment:0.0cm	Time 0.0	Fi	igure 2	24 Precision S 2356.2cm Base height 21 254nu	Setting Breas Shovel Hüran	Aquistment 10 Dom
Time: 0.0	541 40 200mm 1111-420 45-420 45-420 45-420 45-420 45-40 45-40 45-40 45-40	Figure	e 23 System S -2357.8cm Bise height 21 254m vol 10 vol 10	Setting Speart Shovel H.Dom	type ⁴ a training Lynei Adjustment U.Dom	Tome: 0.0	Fi		24 Precision S	Setting Escars Shovel H.Clam	Aquatment D Dan
Time: 0.0	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Figure	e 23 System S 2357.8cm Base height 21 254m 	Setting Deret Deret Shovel H: Dom	bipe ^d a to go time Adjustment 2.0.cm	Time 0.0	SAI 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		24 Precision S	Setting Speed Shovel H Dam LEDOTES 17552	Adjustment B Dam
Time: 0.0 CAP Profit: Total	SAT 40 >30km 111~420 45~450 45~400 45~400 45~400 45~400 45~400 45~40000000000	Figure	e 23 System S 2357.8cm Bise height 21 254m 	Setting Showed Hilling Showed Hilling	Adjustment 50 Bom	Time O.C A Unit Unit	Starn St	igure 2	24 Precision S East height 2125400 East height 2125400 Common State Base height 2125400 Common State Common	Setting Provention Shovet Hilbarr LEDUTES LEDUTES LEDUTES LEDUTES	Adjustment til Dam
Time: 0.0	5 2000 10 2000 10 2000 10 2000 10 2000 10 2000 10 2000 10 2000 10 2000	Figure	e 23 System S 2357.8cm Base height 21.254m 	Setting Speed Black Shovel H:Dom	Adjustment 5 Dom		Files	igure 2	24 Precision S East height 21254rv Base height 21254rv Privace Constraining Privace	Setting Shove H Dan Shove H Dan Uppers Uppers Uppers Uppers Uppers Uppers Uppers Uppers	Adjustment til Dam
Time 00 CA Point Point Tool Tool Normal	500 40 500 10-10 10	Figure	e 23 System S -2357.8cm Base height 21,254m vol 17 vol 17 vol 17 vol 17 vol 17 vol 17 vol 17 vol 17 vol 17 vol 15 vol 15	Setting Shove(H:Com	Adjustment 9 Dcm	Time: 0.0 A Care Care Care Care Care Care Care Care	Fi Sar Sar Sar Sar Sar Sar Sar Sar Sar Sar	igure 2	24 Precision S East height 21254rv Base height 21254rv Million (Million Ymal) (Colorida)	Setting Shoret Hitam	Adjustment til barn
Time 0.0 Caras Pras Protection Tools Sector	500 200 200 200 200 200 200 200 200 200	Figure	e 23 System S -2357.8cm Base height 21.254m 	Setting Shove(H:Gom	Adjustment 5 Dcm		F: SMR Original Star Star Star Star Star Star Star Star	igure 2	24 Precision S 2356.2cm Base height 21254rv Filippe Outstrikt me per harper Outstrikt me per harper Outstrikt me per harper Outstrikt me	Setting Shoret Liber Shoret H Dan Liber	Adjustment til barn

Figure 25 Threshold setting

0

Figure 26 Other Setting

ch d

c12

3.2.3 Display on The Right Side of The Main Interface

- 1. Fine-tuning value: The fine-turning value means the value to move the input datum plane up or down. A positive value means a move up by "n" cm, and a negative value means a move down by "n" cm. Click the up/down arrow to increase/decrease 0.5 cm.
- 2. Datum plane fine-tuning: Open the datum plane fine-tuning, click the up arrow, the datum plane will move up, and adjust in 0.5cm units, and click the down arrow to move the datum plane down, as shown in the figure below (Figure29):

` @	SAT 39	10 RTK Fix	_ 23	358.7c	m	Speed 7.8km/h	Type ^{® • **} 10:32 Level
Time: 0:0			Base	height :21.2	254m	Shovel H:0cm	Adjustment:0.0cm
	>20cm +10~+20cm +5~+10cm +5~+2.5cm					t High	1 UP DOWN SET H
	-2.5~+2.5cm -2.5~-5cm -5~-10cm -10~-20cm <-20cm						ТАЗК
TOOL							
SYSTEM							AUT
DATUM	4	645.7	Terrain	height -2	329m		o area(mu):0
		-1.	- Internation	norgin 2.	52.711	-12	

Figure 27 Datum Plane Fine-turning

3. One key to set height: Click "One-key height fix", click "Height fix", then a confirmation dialog box pops up. Click "Confirm". Datum plane is reset successfully, and the datum plane is the current GNSS antenna height position. As shown below (Figure 30).

	SAT 39	00	RTK Fix	<u></u> <u></u> <u></u> 23	59.1c	m	Speed 7.1km/h	Level
Time: 0:0				Base he	ight :21.2	54m	Shovel H:0cm	Adjustment:0.0cm
MODE TOOL SYSTEM	> 20cm +10~+20 +5~+10ct +5~+2.5c -2.5~+2.5 -2.5~-5cn -5~-10cm -10~-20ct <-20cm	÷	Set elev	ation settings Real-High(m) Lock-High(m)	HIGH -2.337 21.254 CONFIRM	•		DOWN SET H
DATUM		4645.7		Terrain h	eight :-2.3	344m		AUT O area(mu):0
			Ϋ́	\bigtriangledown	0		り	

Figure 28 One Key to Set Height

4. Start Leveling / Automatic Leveling: Green button is manual control mode, red button is automatic control mode; the default is manual (green button) when the machine is turned on, click to change to automatic status display, and the system enters automatic control lifting operation mode.

3.2.4 The Main Interface Bottom Display

Map Scale: Use two fingers to zoom in and zoom out of the map and display the corresponding value according to the zoom in and zoom out ratio, unit in m (meters). (Figure31)



Figure 29 Map Scale

3.3 Working Flow

3.3.1 Start

 Start Software, set the same channel as the mobile base station on D10, click the base station, select the base station-mobile base station, and click SURE. (Figure 32)

	5.
C Base station Adjustment:	:0.0cm
>20cm Current mode: NONE CLOSE	Π
SIGNAL +3-+10cr RADIO CORS LSCORS D21NET +5+2.5	SET H
-2.5~-Scn -5~-10cm -10~-20cr <-20cm	TASK
SYSTEM	AUT O
G299.2 Terrain height :-2.313m area(m	nu):0

Figure 30 Base Station Setting

2. The base station is connected well, check whether the search star is normally,



whether the RTK is fixed, whether the elevation and other displays are normally.

0	SAT 39		^ -	30.2cm 🛆	Spee 6.6km	the Type 4:28 Level
			Base	height :-1.993m	Shovel H:0cm	Adjustment:0.0cm
(Å)	>20cm +10~+20c +5~+10cr	÷		New Job		
SIGNAL	+5~+2.5c -2.5~+2.5		project	2019-10-27-14-09-47		SET H
.04	-2.5~-5cn -5~-10cm -10~-20cr		user	usemame		F Ê
MODE	<-20cm		phone	telephone number		NEW TASK
2			Remarks	Lot Remarks		
TOOL				CREATE		
Q		-	-		-	AUT
SYSTEM						0
DATUM	62	199.2	Terrai	n height :-2.295m		area(mu):0

3. Enter the corresponding job information after creating a new job. (Figure 33)

Figure 31 Create a New Job

- 1:2 RTK SAT -42.7cm Speed Туре 0 1 0.0 1224 ۲ ž3 40 Fix 6.1km/h Level Base height :- 1.993m Shovel H:0cm Adjustment:0.0cm >20cm "Å +10~+200 11 Other +5~+10cr SIGNAL +5~+2.50 SET H -2.5~+2.5 -2.5~-5cm UPDATES Display Working mode <u>.</u> -5~-10cm Relief Layer Localization map -10~-20cr <-20cm MODE Height display All display track TASK ANGLE SET width(m) 3.0 2 SIM ST CONFIRM REGISTER TOOL \odot \bigcirc ×0 0 AUT ACCU VALUE OTHER 0 SYSTEM 6299.2 area(mu):0 Terrain height :- 2.42m
- 4. Click system setting other setting to setting width. (Figure 34)

Figure 32 Width Setting

- 5. Datum plane setting: Open the horizontal mode in the leveling mode, and you can set the datum plane by manual or automatic height setting. The specific operations are as follows:
 - (1) Manual height setting: start the power output, manually lift the blade of the scraper, adjust the blade of the scraper to a suitable height from the ground, enter the leveling mode, click manual height setting to complete the benchmark setting.
 - (2) Automatic height setting: Manually control the leveling scraper to the ground, click the ground height button, and manually control the leveling scraper to raise about 15cm (the tractor does not scrape the soil during driving), click to start measuring, and run a figure 8 in the work area. After driving, click Finish to complete the benchmark setting.

Note:

- 1. When setting the datum plane manually, you must choose a location with a moderate topography for setting.
- When setting the datum plane, mind the position of the hydraulic cylinder. It cannot be set at the limit position of the hydraulic cylinder, preferably half of the hydraulic cylinder.
- 6. Click to start Automatic Leveling. (Figure35)



Figure 33 Start Automatic Leveling

Appendix A: Q&A

Q1: Base Station SA does not light up

Analysis: The base station does not receive satellite signals or the RTK is not fixed. Solution: (Checking by step, go to next step if signal cannot be restored after check.)

- Power cable connect, check equipment powered normally;
- Check whether the substrate erection position is reasonable, whether it is blocked by tall trees or buildings, whether there is high-voltage line influence;
- Reconnect the cables and restart the device;
- Reconfigure R23 with Bluetooth software.
- Q2: The base station does not transmit radio signals
 - Analysis: Base station RTK is not fixed Solution: Reference Q1.
 - Analysis: Base station is not working in radio mode.
 Solution:
 - Change base station mode to A3. (Radio transmission mode)
 - Reconfigure R23 with Bluetooth software.
 - Analysis: Receiver internal damage.
 Solution: Send back to company for repair.





Figure 34 Base Station A3 Mode

Q3: Abnormal state of mobile vehicle terminal

- Analysis: The number of satellites is less than 12.
 Solution:
 - Power cable connect, check equipment powered normally;
 - Check whether the substrate erection position is reasonable, whether it is blocked by tall trees or buildings, whether there is high-voltage line influence;
 - Reconnect the cables and restart the device;
- Analysis: Radio signal reception is abnormal.
 Solution:
 - Change base station mode to A2. (Radio transmission mode);
 - Reconfigure R23 with Bluetooth software.

Q4. Scraper lifts slowly

Analysis: Lack pressure.

Solution:

• Enter the software interface to adjust the threshold setting to increase the lifting speed ratio.



1	SAT 40	OD RTK Fix	△2357.8cm	Speed 8.2km/h	Type Level
Time: 0:0	>20cm +10~+20 +5~+10c +5~+2.5c -2.5~+2.5c -2.5~+2.5c -5~-10cm -10~-20ct <-20cm	← Valve sp	Base height :21.254n VALUE Deed: Lifting speed: 60.0 Lifting ratio: 1.5 Filter: CONFIRM	n Shovel H:0cm	Adjustment:0.0cm
SYSTEM	ACCU VA	^{4645.7} 	Terrain height :-2.323r ⊲ O	n □ ⊰ ∌	AUT o area(mu):0

Figure 35 Adjust Lifting Ratio

• Adjust the speed of the output shaft and switch to the high-speed output gear.

Q5: Waves appear during leveling

1. Analysis: System signal reception abnormal.

Solution: Check whether the signal reception is normal. If it is abnormal, reference Q3.

2. Analysis: Uneven plowing, local plots are too hard.

Solution :

- Plow again
- Perform leveling operations perpendicular to the direction of the wave mark or leveling the waves several times.
- Analysis: The scraper shakes frequently Solution:
- Enter the accuracy adjustment under the system settings of the software interface and adjust the accuracy to 1.5—2.5cm; (Figure 38)



Figure 36 Adjust Accuracy Setting

• Enter the sensitivity adjustment under the system settings of the software interface and adjust the sensitivity value to 60-100. (Figure 39)

48	SAT 0	0.0	RTK	Not searching	Speed Type Bring Okm/h
				Base height :0m	Adjustment number:0.0cm
	>20cm +10~+2	4	1	VALUE	
E	-2.5~+2 -10~-2		Valve s	peed: Lifting speed: 🗧 60.0 💽	
Ł	-20~-10			Lifting ratio: 🗧 1.5 📑	TASK
				CONFIRM	
	cu	VALUE	ОТНЕ		AUT
	6	299.2		Terrain height :0m	area(mu):0

Figure 37 Adjust Lifting Speed

Q6: Scraper reactions slow during leveling

Analysis: Sensitivity value is too low

Solution: Enter the software settings to increase the sensitivity value, generally set to 60-100.



÷.	SAT 0	00	RTK	Not searching	Speed 0km/h	Type Level
				Base height :0m	Adjustme	ent number:0.0cm
	>20cm +10~+: +2.5~+ -2.5~+: -10~-2. -20~-10 <-20cm	ŧ	Valve s	VALUE peed: Lifting speed: Control Con		SET H
	CU 6	VALUE 299.2	OTHE	CONFIRM R Terrain height :0m		AUT o area(mu):0

Figure 38 Adjust Sensitivity Value



Appendix B Datasheet

1. T100 Display

Table 3 T100 Datasheet

T100 Display Datasheet				
Name	Value			
Operating Voltage	12V			
Screen Size	10 Inch			
Brightness	800nits			
Operating Temperature	$-10 \sim +70^{\circ}C$			

2. W20 Controller

Table 4 W20 Datasheet

W20 Controller Datasheet				
Name	Value			
Operating Voltage	12V			
Protection Level	IP65			
Operating Temperature	$-35 \sim +65^{\circ}C$			

3. R23 Receiver

Table 5 R23 Datasheet

R23 Receiver Datasheet				
Name	Value			
Operating Voltage	12V			
Static Plane Accuracy	$\pm (2.5 + 1 \times 10^{-6} \times D) mm$			
Static Elevation Accuracy	$\pm (5+1\times 10^{-6}\times D) mm$			
RTK Plane Accuracy	$\pm (10+1\times 10^{-6}\times D) mm$			



RTK Elevation Accuracy	$\pm (15+1\times 10^{-6}\times D) mm$
------------------------	---------------------------------------

4. D10 External Radio

Table 6 D10 Datasheet

D10 External Radio Datasheet				
Name	Value			
Operating Voltage	DC8-32V			
Protection	IP67, Waterproof, Dustproof, Strong			
Storage Temperature	$-40 \sim +85^{\circ}C$			
Operating Temperature	$-40 \sim +70^{\circ}C$			