



Software User Manual for FJD 3D Excavator

Guidance System



FJ Dynamics Technology Co., Ltd.

Safety Essentials

Before using this product, please read Software User Manual for FJD 3D Excavator Guidance System, understand the use method of this product and matters needing attention.

Requirements for Operator

- 1、 Operators under 18 are not allowed to operate the equipment.
- 2、 No driving while intoxicated.
- 3、 No fatigue driving.
- 4、 Drivers must hold the locally required driving licenses.

Operating Environment

- 1、 Please drive in an open area away from the crowd to ensure that there are no irrelevant personnel or vehicles in the operation area.
- 2、 Please stay away from people, livestock, obstacles, high-tension cable, tall buildings, airports and signal transmission towers. so as to avoid signal interference, which may affect the operation.
- 3、 Don't work in extreme weather such as heavy rain, fog, snow, thunder and lightning, strong wind, etc.
- 4、 When the system is in the process of testing, calibration, adjustment, or automatic excavation, ensure that there are no personnel or obstacles on the way to prevent injury or property damage.



Operating Regulations

- 1、 When this product is in working condition, don't get on or off the excavator during driving.
- 2、 The operation status should be monitored in real time to ensure manual intervention when necessary.
- 3、 When an excavator equipped with this system is driving on public roads or in public places, always drive it manually.

Inspection

- 1、 Ensure that the excavator gets sufficient fuel.
- 2、 Ensure that the on-board display and control terminal is properly calibrated before operation.
- 3、 Ensure that the antenna and attitude transducer are installed properly. If there is any movement, please calibrate them before using.
- 4、 Ensure that all cables are properly connected. If they are damaged, stop using them and replace them with new ones.

Others

- 1、 Do not disassemble the product housing, so as not to affect the warranty service.
- 2、 Damage to the equipment due to force majeure (lightning strikes, high voltages, collisions, etc.) is not covered by the company's warranty.
- 3、 Please connect the equipment strictly according to the requirements specified in the Manual. To connect/disconnect the wire harness and feeder, pull it in/out by plug, not the cable, otherwise the cords may get damaged.
- 4、 When supplying power to this product (system), attention must be paid to the power supply requirements of the equipment (10 ~ 30 V for the on-board display and control terminal).

Note: Due to the update of the software version, the actual function is subject to the real product.

Foreword

Purpose of the Manual

The document describes how to use FJD 3D Excavator Guidance System. The operation process is stated concisely, so that users can easily, quickly and accurately perform the operation.

Technical Support



Users will enjoy the technical support and upgrade services provided by FJ Dynamics.

FJD official website: <https://www.fjdynamics.com/>

Disclaimer

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- 2、 Due to product upgrades or other reasons, the contents of this document will be updated from time to time. FJD reserves the right to modify the contents of the document without any notice or prompt.
- 3、 This manual is only used as a guide. FJD has tried its best to ensure that the contents are accurate and reliable, but it doesn't guarantee that this manual is completely free of errors or omissions. Information in this manual does not constitute any express or implied guarantee.

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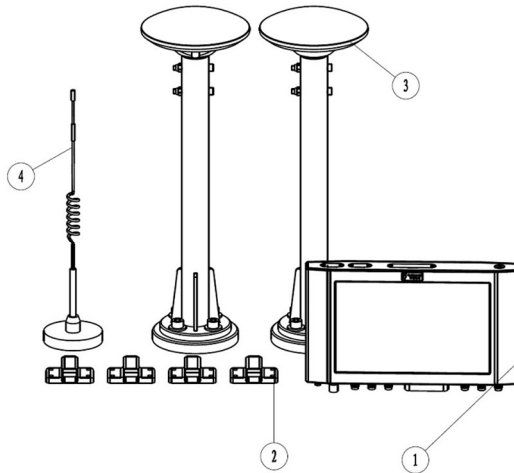


I Product overview

1.1 Introduction

FJD 3D Excavator Guidance System adopts Beidou high-precision real-time dynamic positioning technology. It gets the real-time precise 3D position information of the bucket by reading slope sensors installed on the excavator and calculating the calibrated main pivot sizes. And the current cut-and-fill workload is displayed in real time in coordination with the work tasks generated by the self-designed transformation software to complete the goal of digitally guided excavation and construction. Even in blind areas with poor eyesight, the bucket can complete the work accurately, completely changing people's understanding of the traditional construction method of excavators.

1.2 Main components





1. Control Terminal

Human-computer interaction interface, OBU control and communication terminal.

2. Attitude transducer

Terrain data compensation is realized to ensure the operation accuracy of excavators in sloping fields, highways and other environments.

3. GNSS antenna

Receiving Beidou satellite data and obtaining the latitude and longitude coordinates of the excavator.

4. 4G antenna

Communication with Cellular Data (4G) is realized.

Precautions for installation and use of antenna:

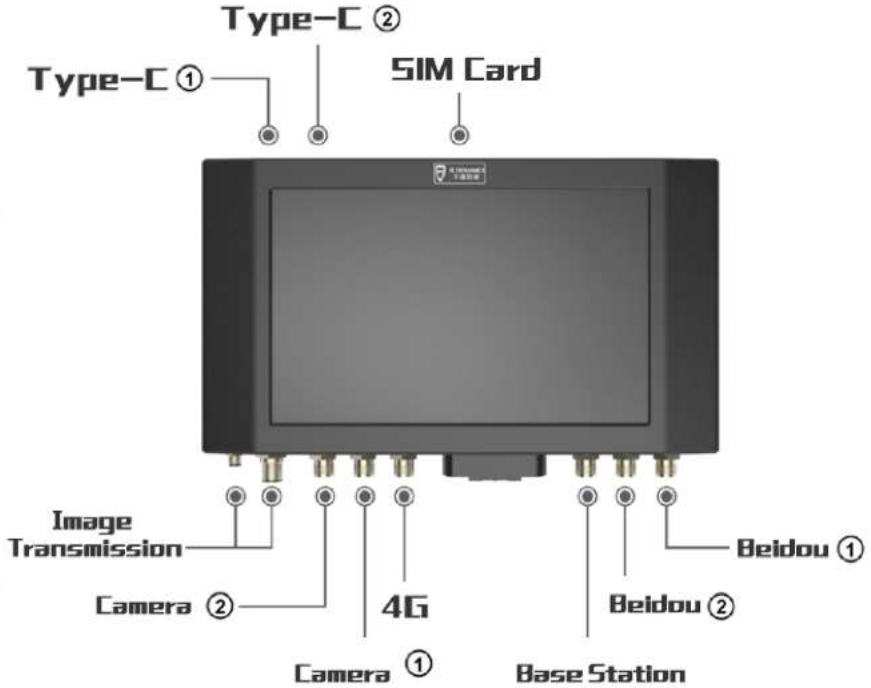
1. Do not remove the radio antenna or plug and unplug the serial cable and other connection cables when the power is on.

2. When installing the antenna outdoors, take appropriate lightning protection measures to prevent lightning strikes.



II Hardware operation instructions of on-board display and control terminal

2.1 Description of hardware interface of on-board display and control terminal





III Software operation instructions of on-board display and control terminal

3.1 Overview of operation procedure

In order to facilitate users to understand the operation of this software, this manual will introduce the main usage process and related auxiliary functions of this system from the perspective of new users. When new users use the system for the first time, they need to complete the installation configuration and preparation operations, and then enter the system to guide the construction operation.

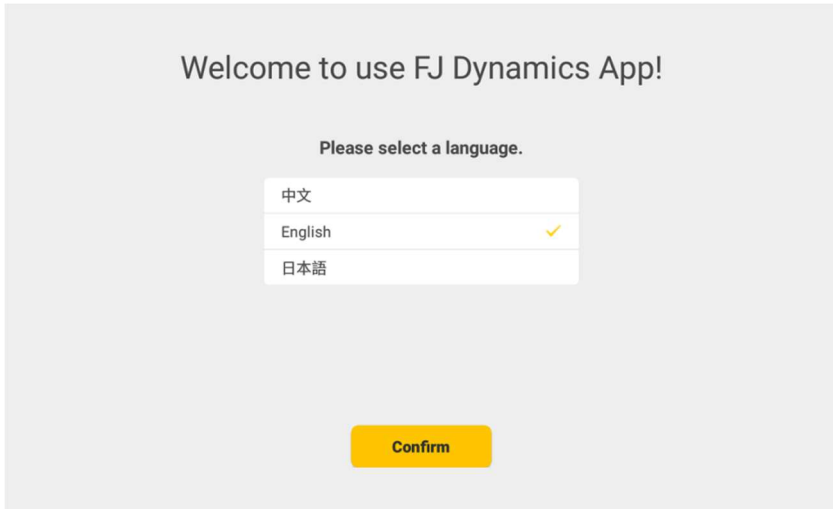
3.2 Installation and commissioning procedure

Initial installation and debugging process of 3D Excavator Guidance System:

Select language→register and log in→fill in installation information→fill in user information→fill in machine information →connect RTK→set specifications→calibrate→complete installation and debugging

3.2.1 Language selection

Turn on the on-board display and control terminal and select the language of the system. Click "Next" to enter the "Select Region" interface.



3.2.2 Registration/Login

1) Registration/Login in Chinese

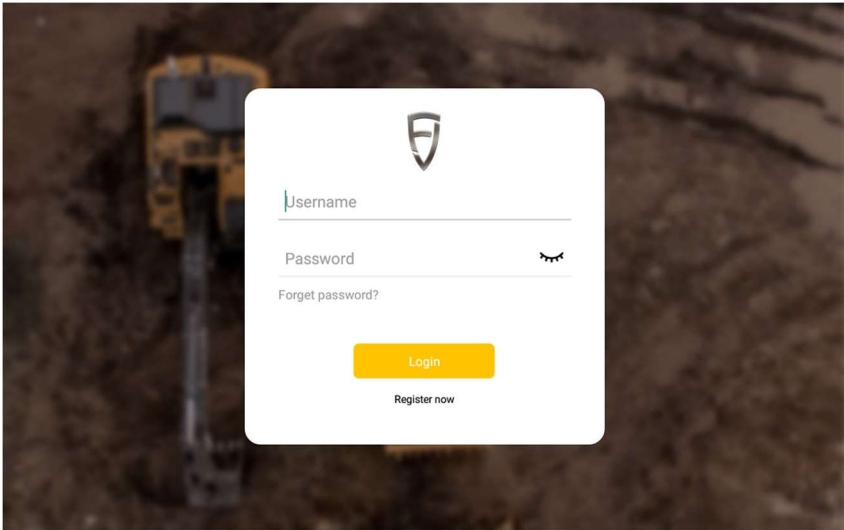
After the language setting, enter the Register/Login interface.



Account Registration: new users need to register their accounts when using the system for the first time. Click "Register Now" to enter the registration interface and fill in "Mobile Phone Number/Email + Verification Code + Password + Accept User Privacy Agreement" to complete user registration and enter the main interface of the system.

Account Login: registered users can directly enter "User Name (i.e. Mobile phone number/email) + Password" to log in and enter the main interface.

Forget Password: If a registered user forgets the password, he/she can click "Forget Password" to enter the password reset interface, fill in "mobile phone number/email + verification code + new password" and click "login" to enter the main interface.



2) Registration/Login in other languages

After selecting the corresponding language setting, enter the login/registration interface.

Account Registration: new users need to register their accounts when using the system for the first time. Click "Register Now" to enter the registration interface and fill in "Email + Verification Code + Password + Agree to User Privacy Agreement" to complete user registration and enter the main interface of the system.

Account Login: registered users can directly enter "User Name (i.e. Email) + Password" to log in and enter the main interface.

Forget Password: If a registered user forgets the password, he/she can click "Forget Password" to enter the password reset interface, fill in "email + verification code + new password" and click "login" to enter the main interface.



3.2.3 Fill in installation, user and machine information

After registration and login, the initial user needs to fill in installation, user and machine information. Please note that the initial information you fill in will directly or indirectly affect your after-sales service. Please follow the following procedures.

Step 1: Fill in "User Information", and then click "Next".

Please fill in user information

We need to obtain the following information to provide you with full-service.
You can fill in none if the item is unclear.

User name	<input type="text" value="Rick"/>
User age	<input type="text"/>

Next step

Step 2: Fill in "Installation Information", and then click "Next".

Please fill in device installation info.

We need to obtain the following information to provide you with full-service.
You can fill in none if the item is unclear.

Installer's name	<input type="text" value="Rick"/>
Installer's phone	<input type="text" value="18062797685"/>
Installation date	<input type="text" value="2021-03-01"/>
Device sn No.	<input type="text" value="1111111111"/>
SIM card No.	<input type="text" value="Unknown"/>

Last step **Next step**

Step 3: Complete all items in the machine information interface, and click "Save" to enter the main interface.



Please fill in machine info.

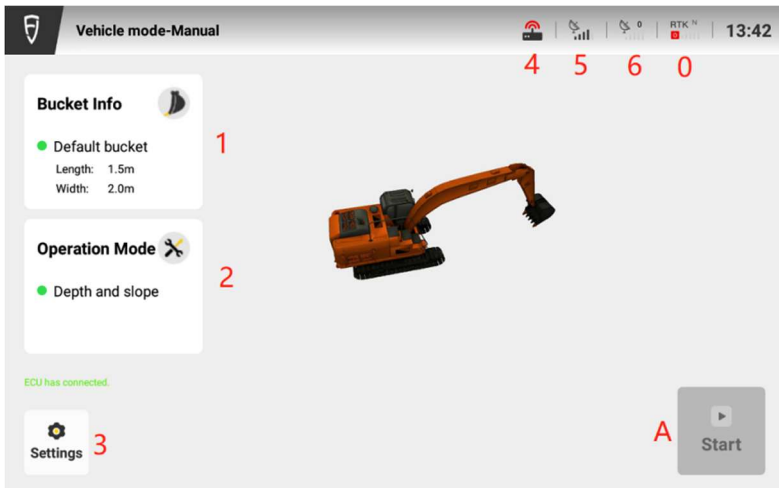
Construction mode	Intelligent Assisted Mode
Vehicle type	Excavator
Vehicle brand	
Vehicle model	
Purchase date	2021-03-01

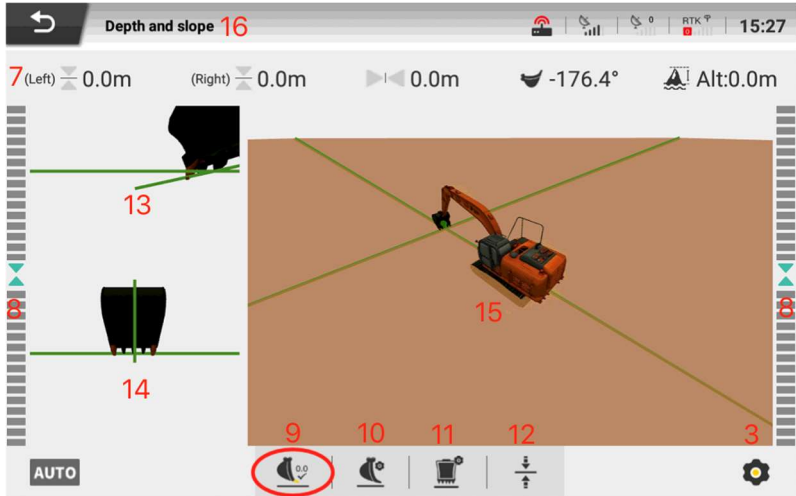
Last step Finish

The selection of "Model/Type" will enable the system to directly cut into the corresponding engineering machine system. Please carefully select based on the actual situation.

3.2.4 Main interface

After successfully logging in to the system, you will enter the main interface of the system. Users can view the network connection status, RTK status, satellite number and sensor connection status in real time. For the convenience of users, the login history will be automatically saved locally, and each time the system is turned on, it can automatically log in and directly enter the main interface.





0. RTK signals (i.e. carrier phase differential signals) are divided into three modes: built-in network RTK, Ntrip network RTK, and mobile base station. The icon displays the differential signal strength in real time;

1. “Bucket information”, Click it to add and edit the bucket;
2. “Operation mode”, Click it to enter the mode interface, including depth and slope gradient, design files and site design;
3. “Setting”, Click it to enter the setting interface, involving: user information, RTK setting, operation setting, operation vertical angle, operation horizontal angle, operation depth, bucket setting, benchmark setting, automatic mining, calibration, specification setting, and system version;
4. “Sensor connection state”, involving bucket sensor, arm sensor, boom sensor, and body sensor, where red means abnormal connection and green means normal connection;
5. “4G signal”, i.e. the mobile network signal. The icon displays the cellular data communication of the automatic navigation system in real time;
6. GNSS signal is satellite signal, The icon displays the connection status of Beidou Navigation Satellite System in real time;



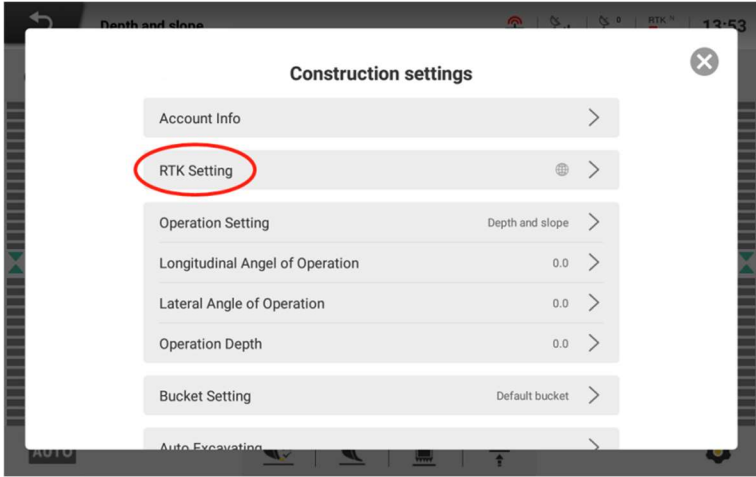
7. "Data display", including the distance from the left bucket tooth to the target, the distance from the right bucket tooth to the target, the distance to the center line, the current bucket angle, and the current altitude;
8. "Light target", color and sound prompt;
9. "Benchmark", the setting benchmark;
10. "Vertical angle setting of the operation" ;
11. "Horizontal angle setting of the operation" ;
12. "Depth setting of the operation" ;
13. "Front view of the bucket", showing the real-time distance from the bucket to the target;
14. "Side view of the bucket", showing the real-time distance from the bucket to the target;
15. "3D view of the excavator", showing the information of the excavator at all times;
16. "Operation mode", showing the current operation mode, including depth and slope gradient , design files ;

3.2.5 Connect RTK

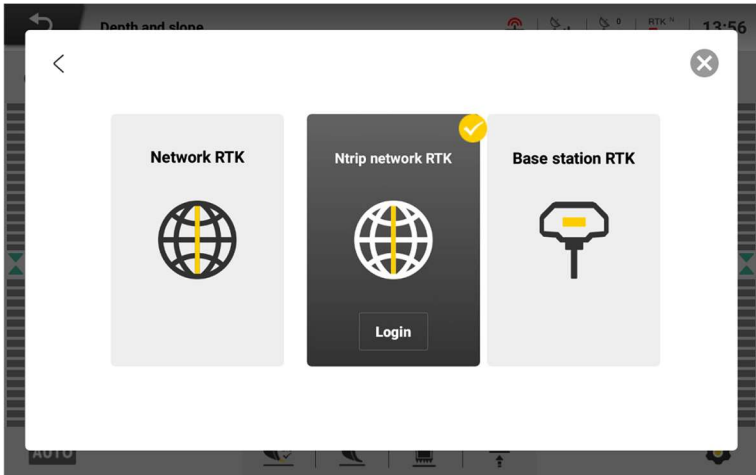
After entering the main interface, first connect to RTK. Click "RTK Setting" in the setting list to enter the RTK setting interface.

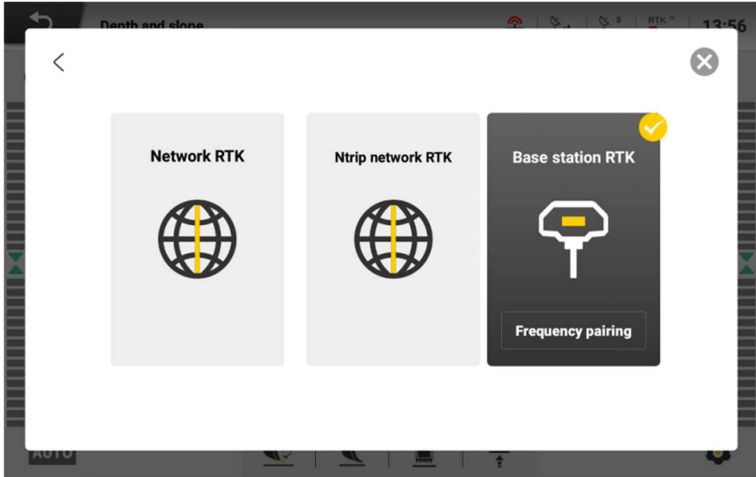
The specific connection process is shown below.

Step 1: Click "RTK Setting" in the setting list to enter the detail interface.



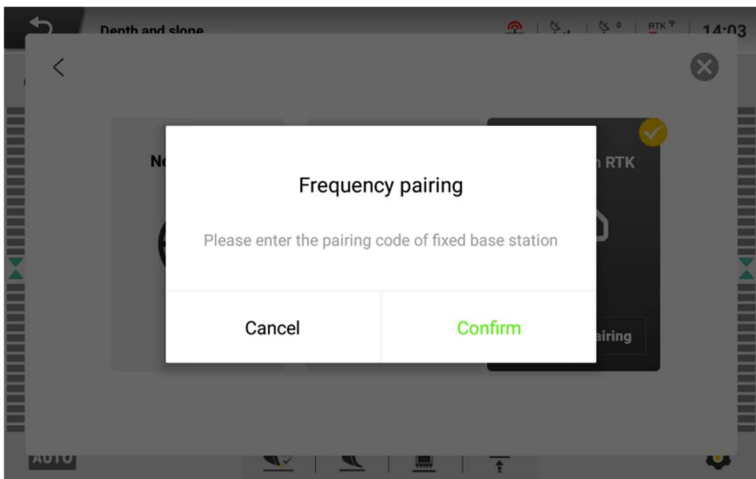
Step 2: After entering the “RTK Setting” detail interface (as shown below), select the desired RTK connection mode.





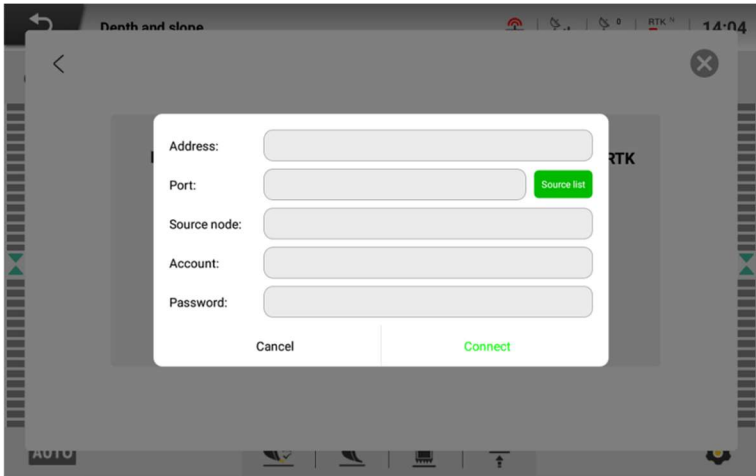
This system supports two connection modes, namely, Ntrip network, and Mobile base station. Users can switch to other modes. After a successful switch, the RTK mode before the last shutdown will be enabled by default for the next login.

1. If “Mobile base station” is selected, turn on the mobile base station, match the base station frequency, that is, turn on Mobile base station connection, click “Link”, and enter the corresponding code in the pop-up dialog box.(Refer to Operating Instructions of Base Station for the input rules of linking codes)





2. If “Ntrip network” mode is selected, click “Login” and enter account information to connect it



Pay attention to the following during RTK connection:

1. When using a mobile base station for the first time, the user needs to link the base station first. That is, click “Linking” and enter the linking code in the pop-up dialog box.

2. The linking code is the last four digits of the base station SN.

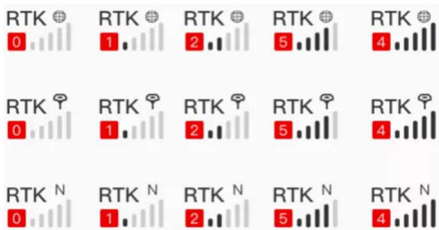
The base station linking will take up to 3 minutes.

3. Log in to the Ntrip network mode.

Enter the password, support Hi-Target, Qianxun, Sixents, etc.

Ntrip login will take up to 3 minutes, please wait patiently.

RTK Status:



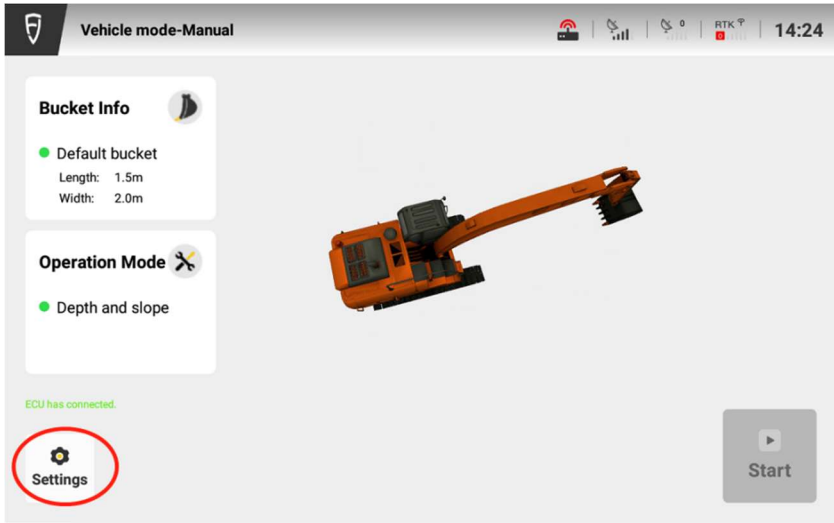


- 0: not connected
- 1: single point solution
- 2: weak point solution
- 4: fixed solution
- 5: floating point solution

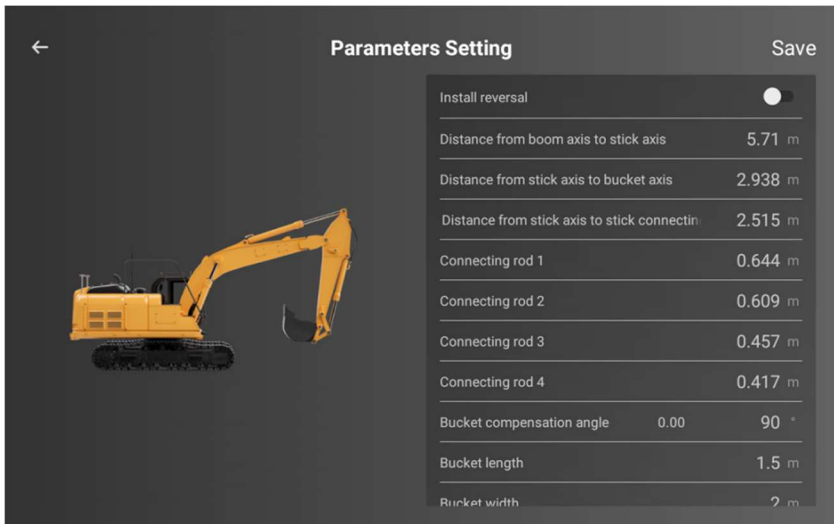


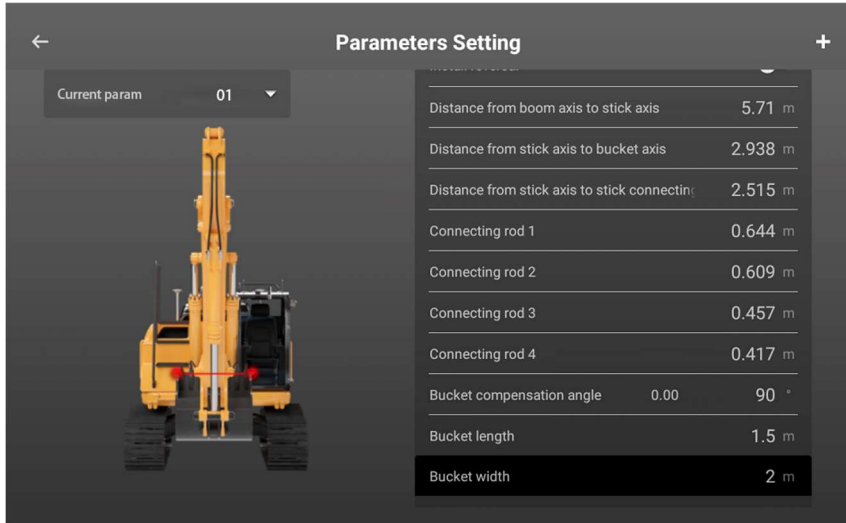
3.2.6 Setting excavator specifications

In the main interface, click “Setting” in the left sidebar to enter the setting list.



Enter the excavator specification setting; click the items to be set and enter the values.





Considerations for setting specifications:

1. This step can only be operated by installers.
2. Each measurement shall be conducted and filled in according to the graphic guidelines.

The specification list is as follows

1. Distance from boom axis to arm axis (required)
2. Distance from arm axis to bucket axis (required)
3. Distance from arm axis to arm connecting rod axis (required)
4. Rod 1 (required)
5. Rod 2 (required)
6. Rod 3 (required)
7. Rod 4 (required)
8. Bucket compensation angle (not required)
9. Bucket length (required)
10. Bucket width (required)
11. Rocker angle (not required)



- 12. Arm angle (not required)
- 13. Boom angle (not required)
- 14. Body angle (roll) (not required)
- 15. Body angle (pitch) (not required)
- 16. Boom axis-body axis lateral offset (required)
- 17. Boom axis-body axis longitudinal offset (required)
- 18. Boom axis-height (required)
- 19. GNSS main antenna 1 (required)
- 20. Course offset (required)

3.2.7 Real-time status

After setting the specifications, ensure the sensor, GNSS and RTK signals are good and then conduct calibration/construction.

Sensors

1) Sensors connected properly

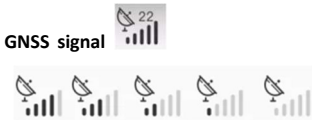


2) Sensors not connected properly



Ensure the sensors are connected properly.

GNSS signal



RTK signal

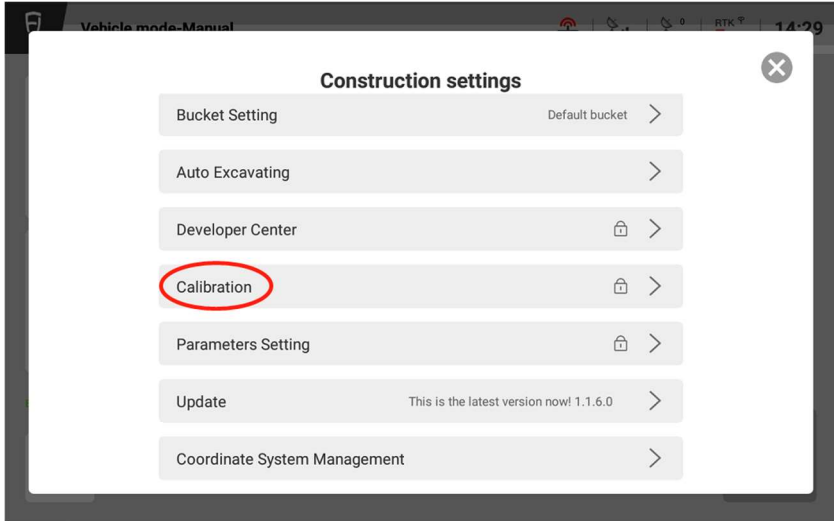


Check if the RTK signal displayed in the status bar is full or if the “RTK Status” number is 4.



3.2.8 Calibration

After setting the specifications, ensure the sensor, GNSS and RTK signals are good and then conduct calibration. Select “Calibration” from the setting to enter the calibration interface. The specific process is shown below.



Items to be calibrated for engineering vehicles.





Calibration of boom axis. Installers shall ensure that the machine is on the horizontal ground when calibrating.

< **Boom axis calibration(1/4)** Show diagram

Current boom pitch: 0°

Collect 3 sets of data with boom rotating over 5° each time.

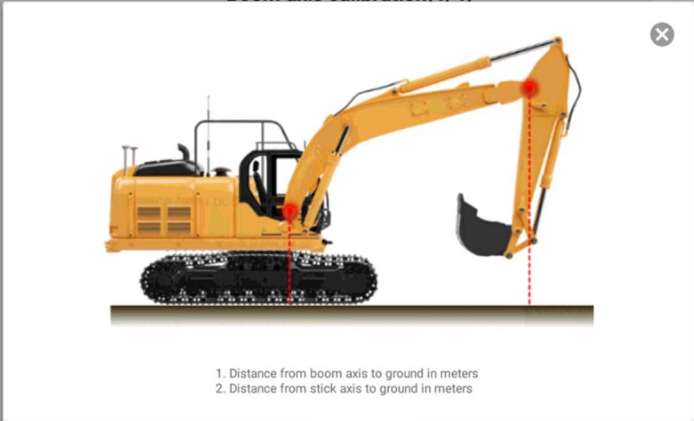
None	Distance from boom axis to ground	Collecting	N/A
	Distance from stick axis to ground		
None	Distance from boom axis to ground	Collecting	N/A
	Distance from stick axis to ground		
None	Distance from boom axis to ground	Collecting	N/A
	Distance from stick axis to ground		

Note: Keep the machine on Horizontal Ground when calibrating. Total difference: N/A

Complete Calibration

Click to view the schematic diagram to understand the measurement positions.

< **Boom axis calibration(1/4)** Show diagram



1. Distance from boom axis to ground in meters
2. Distance from stick axis to ground in meters

Complete Calibration



Calibration of arm axis. Installers shall ensure that the machine is on the horizontal ground when calibrating.



Stick axis calibration(2/4)

Show diagram

Current stick pitch: 0°

Collect 3 sets of data with stick rotating over 5° each time.

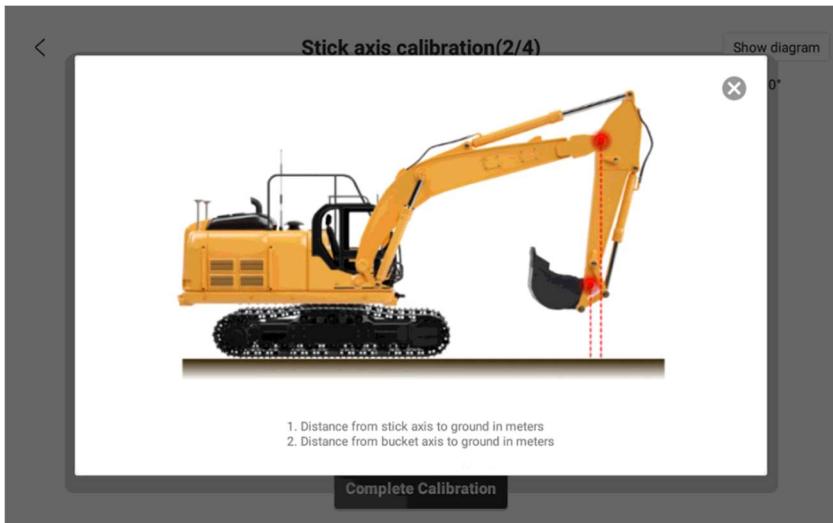
None	Distance from stick axis to ground	Collecting	N/A
	Distance from bucket axis to ground		
None	Distance from stick axis to ground	Collecting	N/A
	Distance from bucket axis to ground		
None	Distance from stick axis to ground	Collecting	N/A
	Distance from bucket axis to ground		

Note: Keep the machine on Horizontal Ground when calibrating.

Total difference: N/A

Complete Calibration

Click to view the schematic diagram to understand the measurement positions.





Calibration of bucket axis. Installers shall ensure that the machine is on the horizontal ground when calibrating.

< **Bucket calibration(3/4)** Show diagram

Current stick pitch: 0°
Current dogbone pitch: 0°

Fix the position of the boom, stick and bucket axis, make sure the bucket can be moved to the extreme position. Then collect 3 sets of data on both forward(F) and backward(B) side, 6 sets in total with bucket rotating over 5° each time.


None	(F) Distance from bucket axis to ground	Collecting	N/A
None	(F) Distance from middle bucket cusp to ground	Collecting	N/A
None	(F) Distance from bucket axis to ground	Collecting	N/A
None	(F) Distance from middle bucket cusp to ground	Collecting	N/A
None	(F) Distance from bucket axis to ground	Collecting	N/A
None	(F) Distance from middle bucket cusp to ground	Collecting	N/A

Note: Keep the machine on Horizontal Ground when calibrating. Total difference: N/A

Complete Calibration

Click to view the schematic diagram to understand the measurement positions.

< **Bucket calibration(3/4)** Show diagram



1. Distance from bucket axis to ground in meters
2. Distance from middle bucket cusp to ground in meters

Complete Calibration



Body calibration. Installers shall ensure that the machine is on the horizontal ground when calibrating.

< **Vehicle body calibration(4/4)** Show diagram

Current body heading: 0°

Keep RTK in high accuracy state and rotate the body at a slow speed, then stop rotation and wait 2-5 seconds before Collecting

Rotate body heading within 0°-30°	Collecting
Rotate body heading within 45°-70°	Collecting
Rotate body heading within 90°-120°	Collecting
Rotate body heading within 135°-165°	Collecting
Rotate body heading within 180°-210°	Collecting
Rotate body heading within 225°-255°	Collecting

Note: Keep the machine on Horizontal Ground when calibrating.

Complete Calibration

Click to view the schematic diagram to understand the measurement positions.

< **Vehicle body calibration(4/4)** Show diagram



Vehicle body rotating range within 30°

Complete Calibration



The Note on Calibration (for improving calibration pass rates)

Boom

1. The calibration range should not be less than 5°.
2. The calibration range should not exceed 10° per time. (wide-range calibration will affect the success rate)
3. Gradually calibrate from top to bottom or bottom to top, with the body not moving and in a horizontal position during calibration.
4. The angle of the boom should not be covered to a large angle; the total station should be in a horizontal position without moving during measurement.

Arm

1. Gradually calibrate from top to bottom or bottom to top, with the body not moving and in a horizontal position during calibration.
2. The calibration range should not be less than 5°.
3. The calibration range should not exceed 10° per time. (wide-range calibration will affect the success rate)
4. When calibrating, you had better move only the arm and not to adjust the boom; (boom adjustment will affect the calibration success rate)
5. When calibrating, the angle range of arm should be greater than or equal to -75°.

Bucket

1. Before calibration, adjust the bucket limits in advance to ensure that the total station observes 6 sets of values at the current position.
2. The vehicle cannot move and should be in a horizontal position during calibration.
3. Outside-in calibration in sequence; three sets of data are collected from the outside and three sets from the inside.
4. The values should not be taken where the bucket is vertical to ground.
5. When calibrating, you had better move only the bucket and not to adjust the position of boom and arm; (boom and arm adjustment will affect the success rate)
6. The values collected for calibration include the left and right limits to ensure that the bucket error is measured accurately.



7. When measuring the position of the bucket teeth, it is advisable to adopt the central point of bucket teeth, with a view to the thickness of the bucket.

vehicle

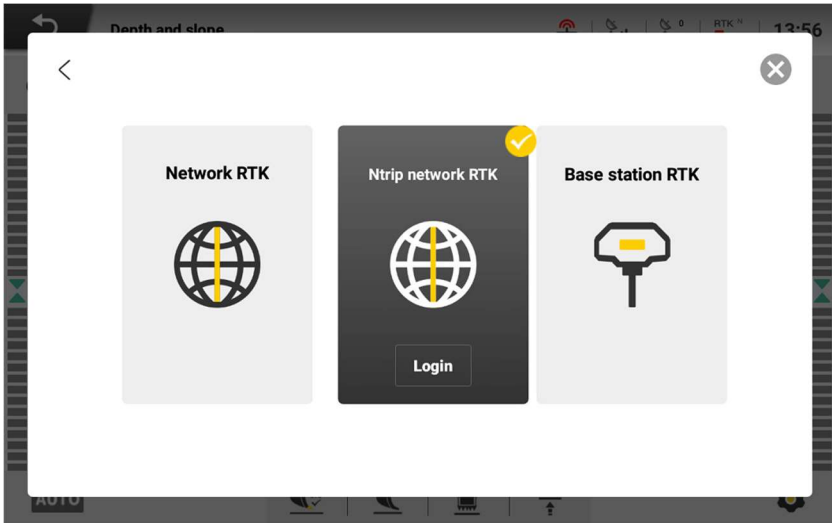
1. Ensure that the RTK antenna is connected correctly.
2. Ensure that the calibration is carried out when the RTK signal is connected and stable.
3. Stand still for 5 seconds each time when a predetermined angle is reached, with less fluctuation in the sensor angle before collecting the current angle.

3.3 Construction operation

Confirm RTK connection→connect sensors→select bucket→ select operation mode→start construction operation

3.3.1 Check RTK connection

- 1) Check if the current RTK connection is correct.



- 2) Check if the current RTK connection is normal.



Check if the RTK signal displayed in the status bar is full or if the "RTK Status" number is 4, as shown above.



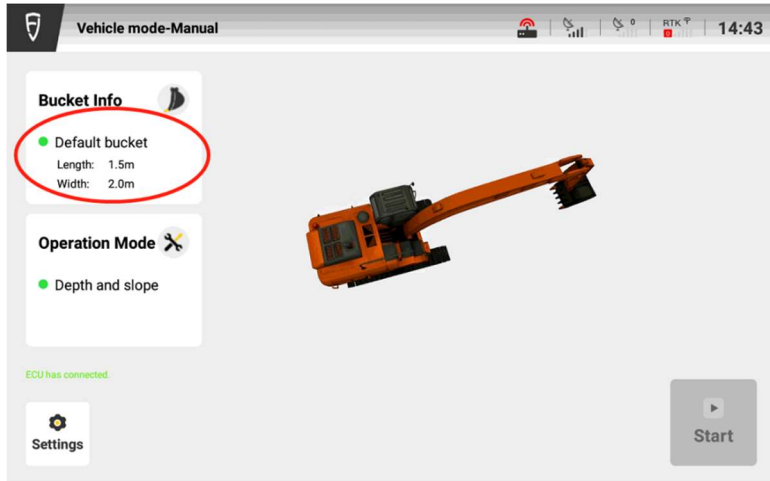
3.3.2 Confirm sensor connection



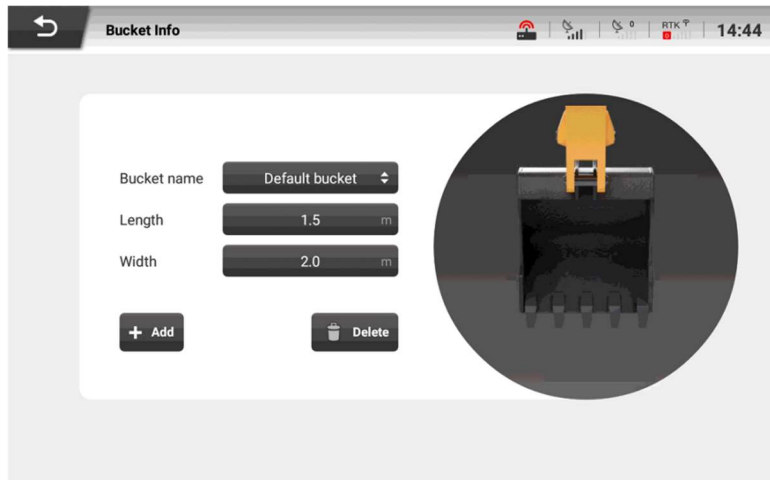
Ensure the sensors are connected properly, as shown above.

3.3.3 Select bucket information

1) Ensure the selected bucket, as shown below.



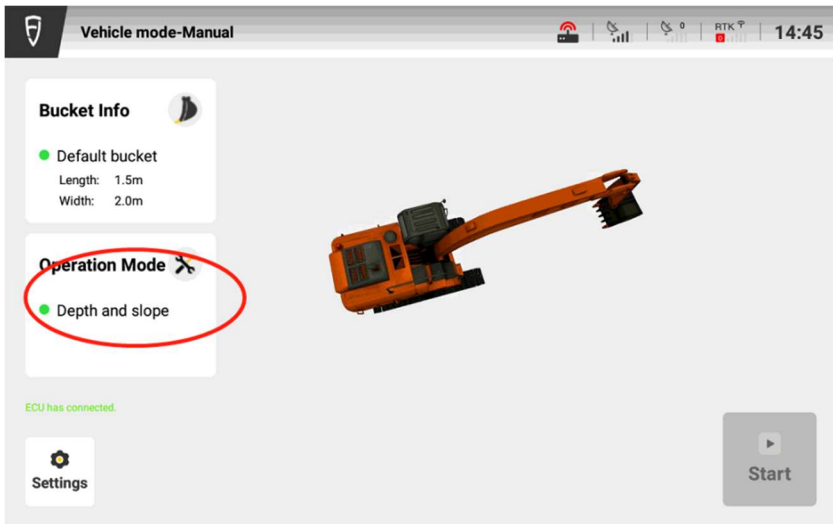
2) Add/delete the bucket information, as shown below.



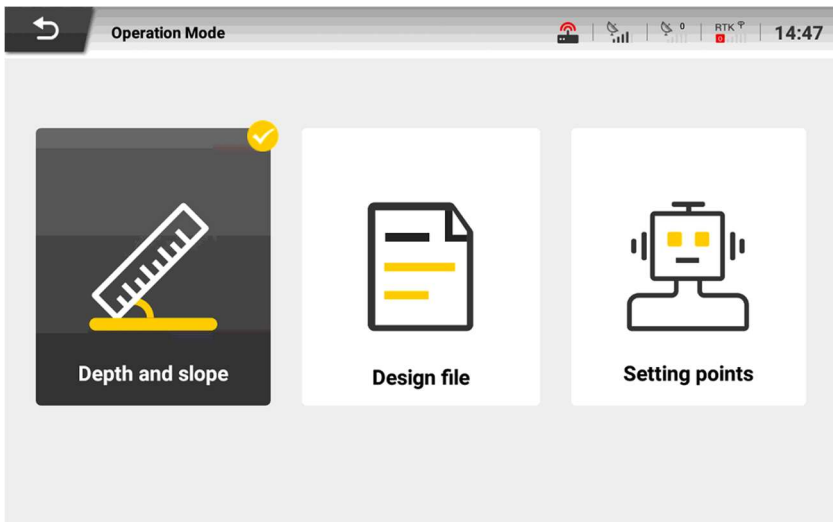


3.3.4 Instructions of depth and slope gradient

- 1) Click the operation mode in the main interface, as shown below.

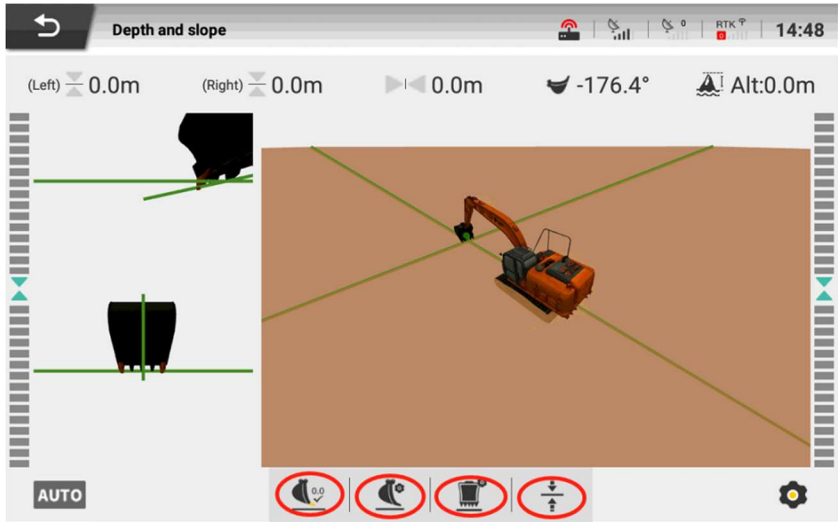


- 2) Select "Depth and slope gradient" as shown below.

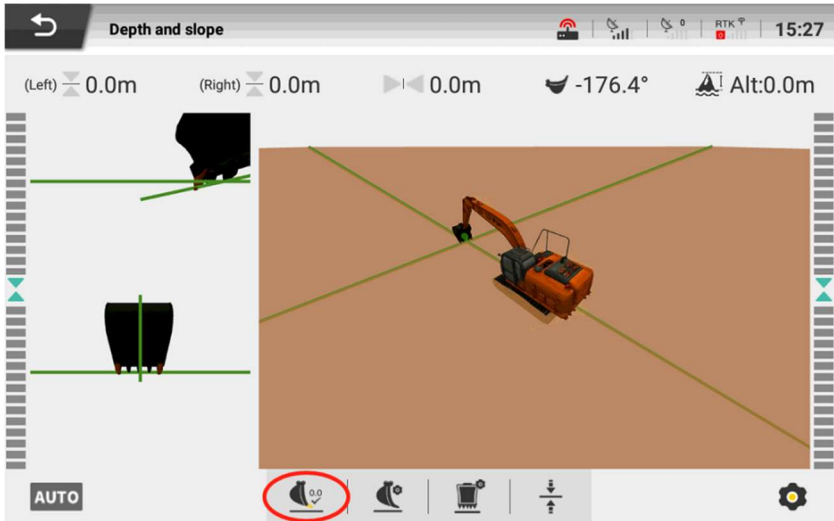


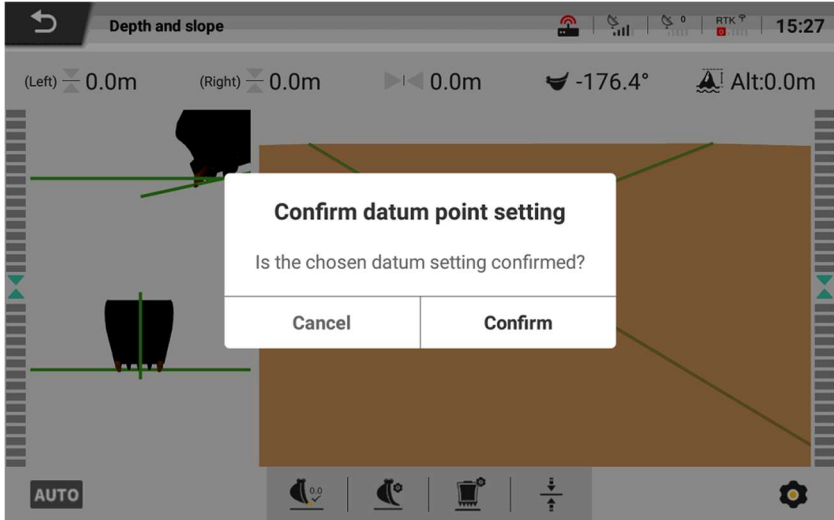



3) Click “Start” to enter the operation interface as shown below. Set depth, slope gradient (transverse slope, longitudinal slope) and benchmark according to the actual construction requirements.

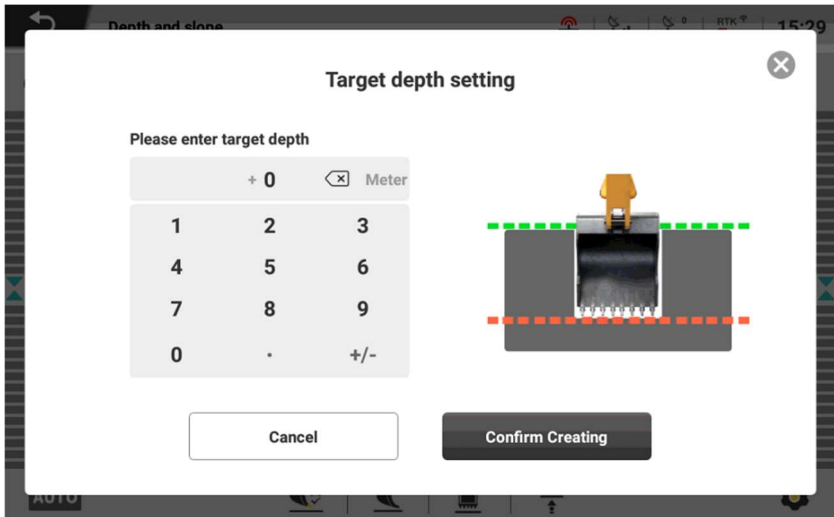


● To set the benchmark, after adjusting the bucket teeth to the marking point, click “Benchmark setting”.




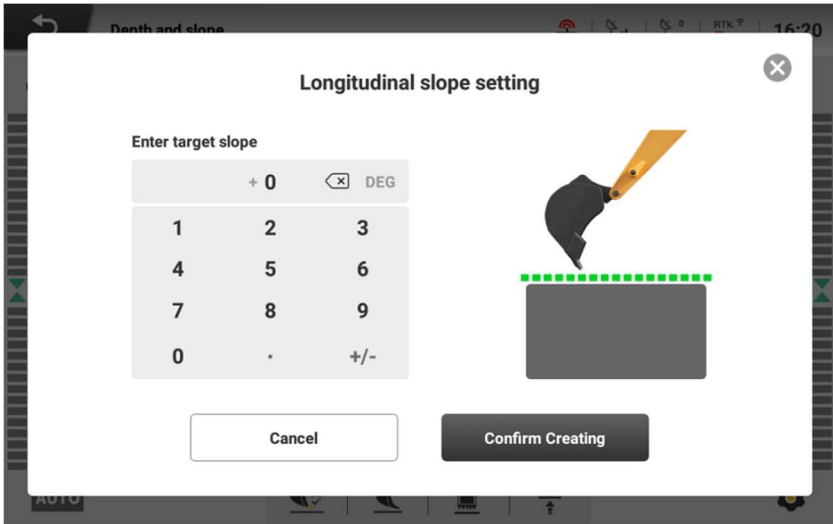


- To set the depth, click , where “-” means to dig down under the premise of the benchmark, and “+” means to fill up under the premise of the benchmark as shown below.



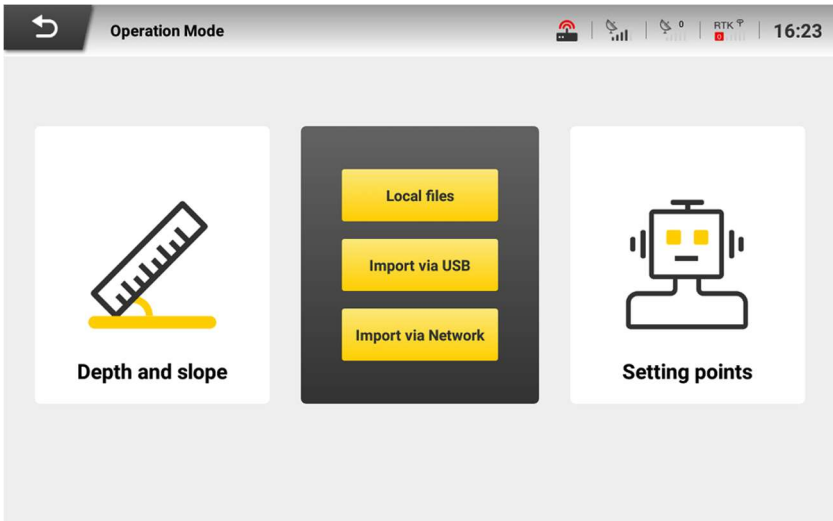


- To set the longitudinal slope, click , as shown below.



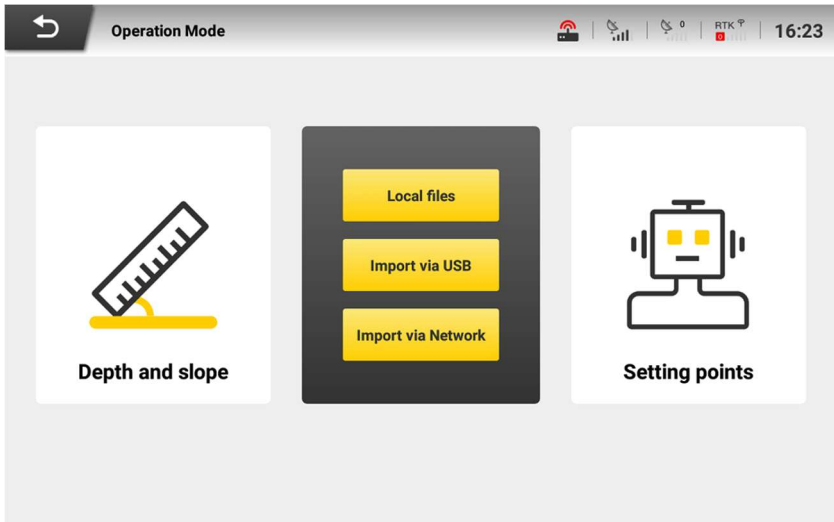
3.3.5 Instructions of design files

1. Click the operation mode and select “Design files” as shown below.

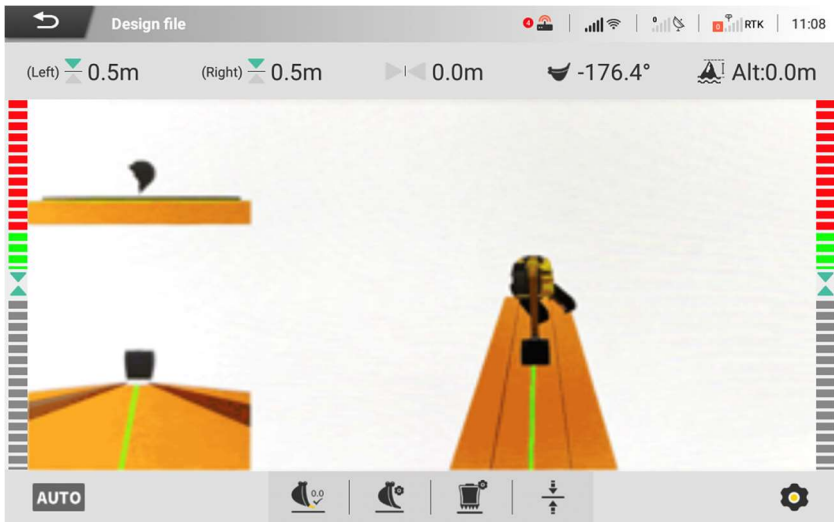




2. Files can be imported by USB and network. After import, they can be stored locally. Users can choose if to import or load local files according to their own needs.



3. After clicking to start the operation, the operation can be done through real-time data and drawings displayed on the interface, as shown below;

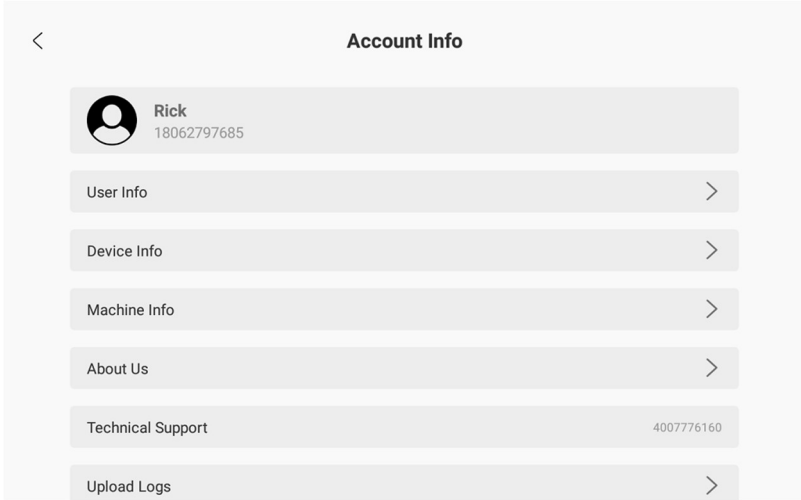




3.4 Other Functions

3.4.1 Setting

1) Account information



Click "Account" in Setting to view the currently logged-in user information and make relevant personal setting.

(1) View account information, Enter the user information to view the basic information of the currently logged-in user, including: name, gender, account number, and company name.

(2) Exit the account, Click "Exit account" to exit the current account and return to the registration/login interface.

(3) Equipment information, installer, installation phone, installation date, SN, SN card number, Network RTK account (Due).

(4) Machine information, machine type, machine brand, machine model, date of purchase.

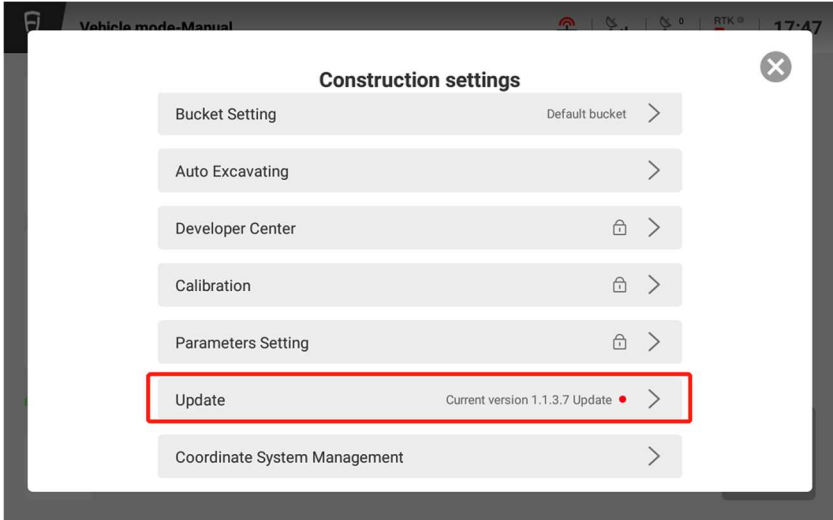
2) OTA upgrade

When there is an updated version, one-click upgrade is supported as below:

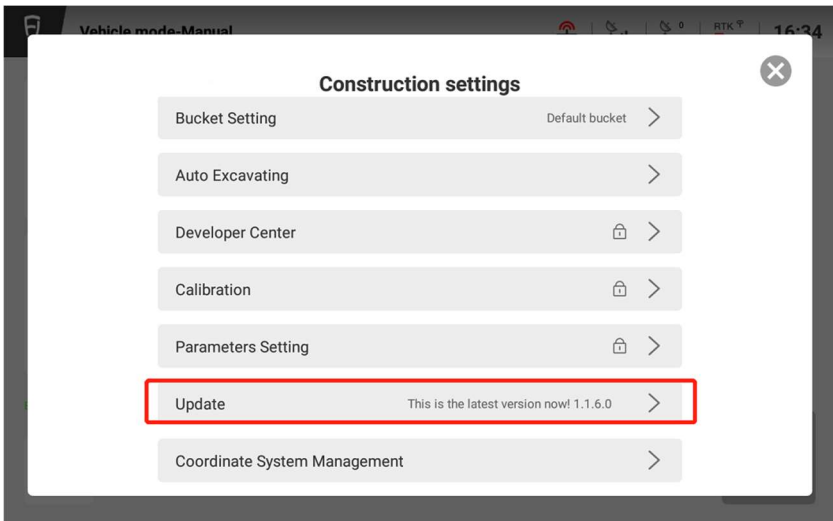
1. Turn on the on-board display and control terminal; ensure the display terminal can access the Internet through the wireless network card/Wi-Fi and the network status is stable (ensure the 4G antenna is properly connected).



2. If there is a new version, “Current version x.x.x.x + Update + Red Dot” will be displayed at the upgrade column.

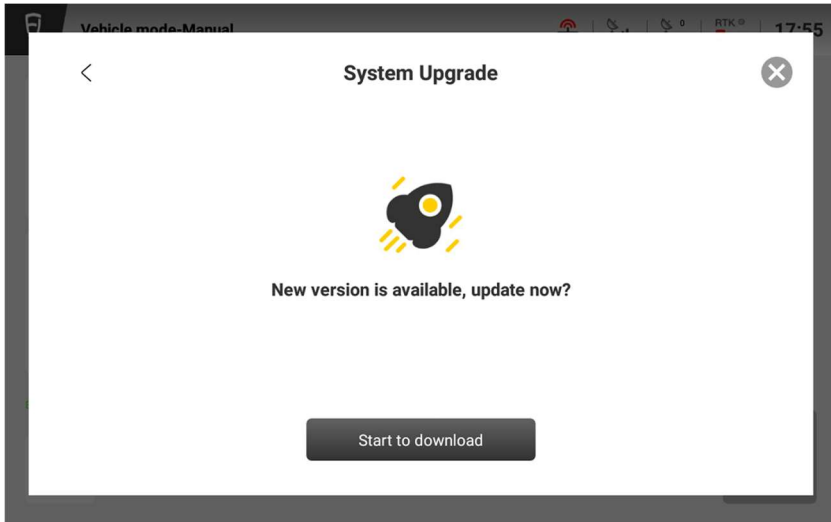


If there is no new version, “It is currently the latest version” will be displayed, which means there is no new version at this time.

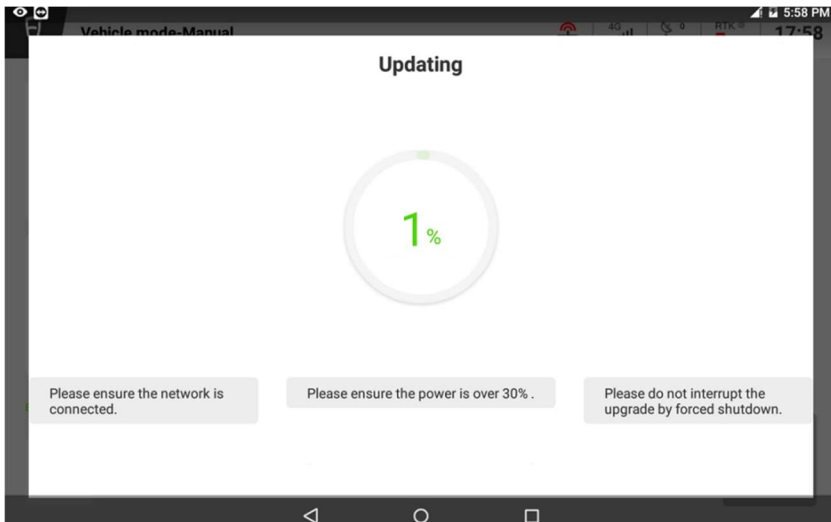




3. Click "Update" to enter the upgrade interface.

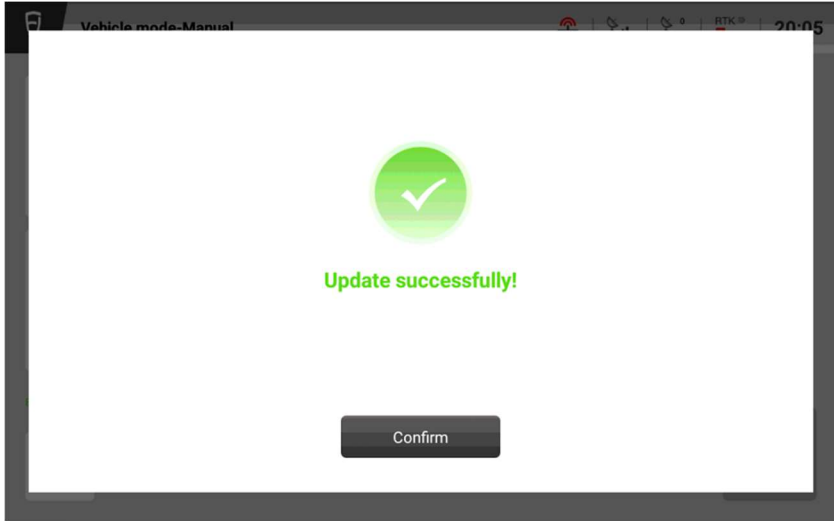


4. The interface is inoperable during the upgrade. The user can view the upgrade progress through the displayed upgrade information and wait for the end of the upgrade.

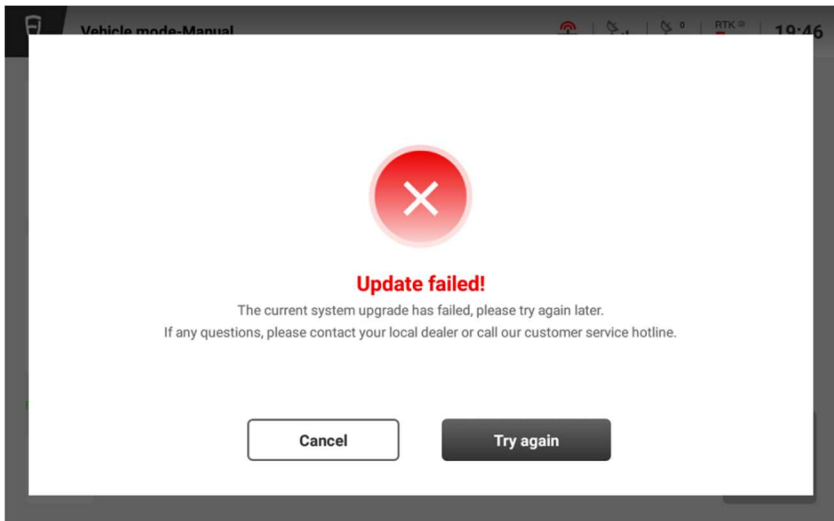




5. If the upgrade is successful, the system will prompt the successful upgrade and automatically enter the new version.



6. If the upgrade fails, the system will prompt to try again. Click “Retry” to upgrade again.





Precautions for online upgrade:

1. Ensure stable network status throughout the upgrade process.
2. Ensure that all components are connected properly before upgrading, and there is a regulated power supply connected during upgrading.
3. In case of any problems during the upgrade, please contact the local dealer or call the technical service hotline for help.

3) Coordinate system

Click “Setting” to enter the setting interface and click “Coordinate system management”.

Ellipsoid:

Coordinate system name		WGS84
Ellipsoid	Ellipsoid name	WGS84
	Equator radius	6378137.0
	Reciprocal flattening	298.257223563
	South azimuth	No

Projection

EPSG

Exit Save Apply



Projection:

Coordinate System Management

Coordinate system name: WGS84

Ellipsoid	Projection model	Gauss Kruger Projection
Projection	Central meridian	118.0
	Average latitude	0.0
EPSG	Scale factor	1.0
	Orbit height(m)	0.0
	False easting(m)	500000.0
	False northing(m)	0.0

Exit **Save** **Apply**



IV Chapter V Common faults and troubleshooting

S/N	Symptom	Solution
1	No 4G signal	Check if the SIM card is inserted.
		Check if the 4G antenna is connected properly.
2	No RTK signal	Check if the base station is powered/used normally in the mobile base station mode.
		Check if the 4G signal is normal in the network RTK mode.
		Under the built-in network RTK connection, check if the Qianxun account is available.
		Under the NTRIP network RTK connection, check if the account is available.
3	Boot promotion "Service not started, please power off and restart"	Power off the vehicle and restart it.
4	Sensors not connected	Plug/unplug the sensors.



V Appendix

1 Main hardware specifications

S/N	Assembly	Component	Specification
1	On-board display and control terminal	On-board display and control terminal	<p>Size: 300×190×43mm; 10.1" capacitive touch LED, backlight 1280*800 pixels,700cd/m2 LCD screen; double loudspeakers; 2G of run memory, 8G of storage memory; Covering a variety of digital and analog output interfaces, etc. ; Power supply: 10~30V; Covering radio, satellite-based, 4G and other signals; Operating temperature: -30°C~+70°C; Storage temperature: -40°C~+85°C; IP rating: IP65; Relative humidity: 0%~95%, @ 40°C; (non-condensation); Wi-Fi Specifications: 2.4 GHz Frequency band/range: 2.4GHz-2.5 GHz, Output power: 802.11 n 14 dB ± 1. 5dB;</p>
2	Antenna assembly	GNSS antenna	<p>Frequency range: GPS L1/L2, GLONASS L1/L2, BDS B1/B2/B3; Operating voltage: 3.3~12V DC; Operating current: ≤45mA; Dimensions: 152*63mm;</p>
		4G antenna	<p>Sucker antenna: range: B1/B2/B3/B5/B8/B38/B39/B40/B41; VSWR: ≤ 2.0 ; Gain (dBi) : 2 ± 0.5 ; Impedance(Ω): 50; Polarization: Linear, Vertical; Max. power: 100W; Antenna size: Φ370*82mm; Operating temperature: -20°C~+60°C;</p>
3	Attitude transducer	Attitude transducer	<p>Axes (Tilt): Pitch; Roll; Range: Pitch ±70°, Roll ±180°;</p>



			<p>Resolution: $<0.05^{\circ}$; Max Angular Rate: $\leq 400^{\circ}/s$; Static Accuracy: 0.15°; Dynamic Accuracy: 0.50°; Temperature Stability: 0.05°; Axes (Acceleration): X,Y,Z; Range: $\pm 78m/s/s$; Resolution: $0.01m/s/s$; Accuracy: $\pm 0.1m/s/s$; Output Data Rate (Hz): Selectable to 100 Hz; Working Voltage: 4.9~32V; Power:$<400mW$; Operating temperature: $-40^{\circ}C \sim +85^{\circ}C$; Protection class: IP 67;</p>
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