CHCNAV TX63

Installation and Commissioning Guide

Machine Control | Dec 2023

Make your work more efficient

CONTENTS

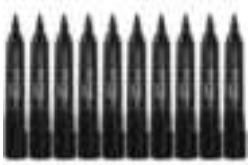
1 System Component

This system adapts high positioning integrated panel, make the installation easier, with two solid industrial antennas and four high dynamic accuracy tilt sensors, ensure the accuracy of bucket tip can reach to +/-3cm.

2 Installation

2.1 Tools Preparation

Tools Check List

Types	Caption
Spanner 13/16 adjustable spanner	
Hex key	
Marker pen	
Plumb	
Tape measure 10m	

Multimeter	
Electric tape	
Electric hand drill	
Tape and glue	
Pliers	
Scissors	

2.2 Machinery Pre-check

1. Check the service life of machine and the gap between manipulator shaft system

Excavator bucket shaft inspection

Check whether the bucket does not shake or shakes slightly when the excavator rotates left and right, otherwise it is necessary to add gaskets or replace shafts, bushings, etc., the looseness of the bucket card shaft will cause a few centimeters of error after the calibration is completed, reducing the accuracy of the system.

Check hydraulic cylinder seals

The seal of the hydraulic cylinder will affect calibration of the sensor. Adjust the excavator so that the bucket is suspended, mark the seal of the hydraulic cylinder with a marker pen, and observe it for about 2-5 minutes to see if the mark sinks.

Check body shake

If the body of excavator also rotates when the arm is retracted, it will affect the calibration of excavator and cause a large deviation in calibration. No installation is allowed for such an excavator.

Check the shaking of the bucket steel plate

1. In order to brush a slope, steel plates are added to the buckets of the excavator. Some steel plates are fixed by welding, and some are fixed by riveting. Generally, this problem does not exist in the welding. Looseness will not only affect calibration, but also affect the detection comparison between the excavator system and the rover, causing the calibration to fail.

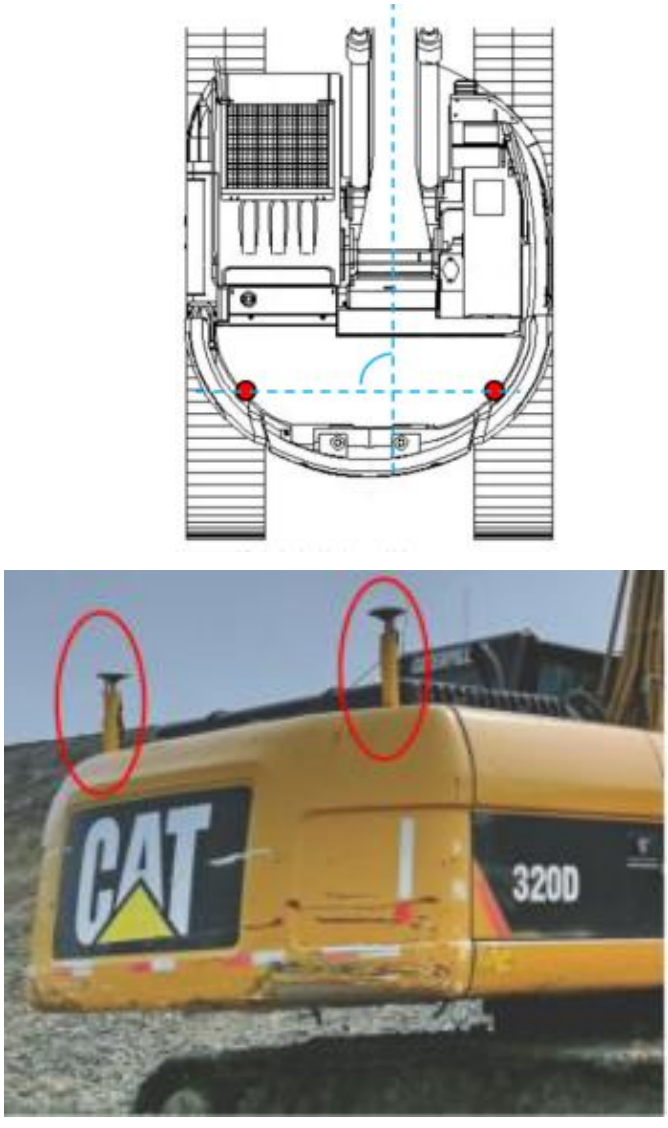
2. Check the location and wiring method of the mechanical power supply to be installed

3. Check the mounting position of the monitor stand, so that the system can give users a better experience

2.3 Welding and Installing

2.3.1 Antenna Bracket Installing

The antenna bracket is welded on the mechanical counterweight. The welding distance between two antenna brackets should be as far as possible, and the welding position should be as flat as possible. The main and auxiliary antenna connecting lines should be at a 90-degree angle with the central axis of the vehicle's boom. Installation diagram and specific installation diagram as follows:



2-1 Antenna bracket installing

2.3.2 Tilt Sensor Installing

1. Body sensor installing

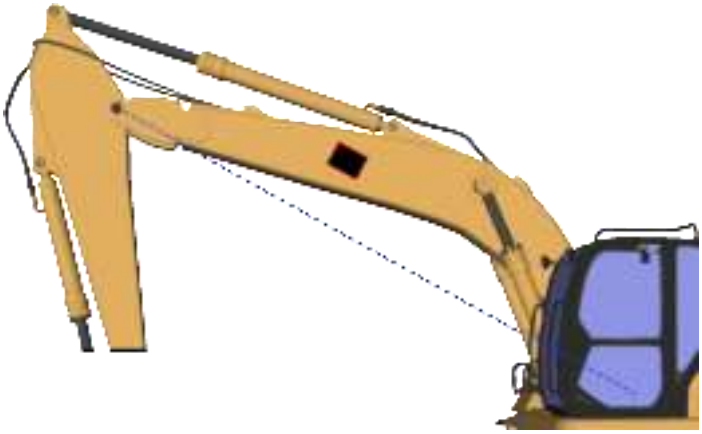
When welding the iron plate of the body sensor, ensure that the long side is parallel to the side of the body. The schematic diagram and actual installation diagram are as follows:

2-2 Body Sensor installing

Use screws to fix the sensor on the body sensor bracket, and the male port points to the rear of the machine.

2. Boom sensor installing

Boom sensor should be installed at left side of machine. The welding position should parallel to the axis of the body-boom connecting shaft and the axis of the boom-shaker connecting shaft to ensure firmness. The schematic diagram and the actual installation diagram are as follows:



Note: The welding can be roughly parallel. You can use the total station to adjust the two connecting axes to the same horizontal line, and then use the spirit level to find the parallel line. The specific operation method depends on the situation on site.

Use screws to fix the sensor on the boom sensor bracket, the male port points to the rear of machine.

3. Stick sensor installing

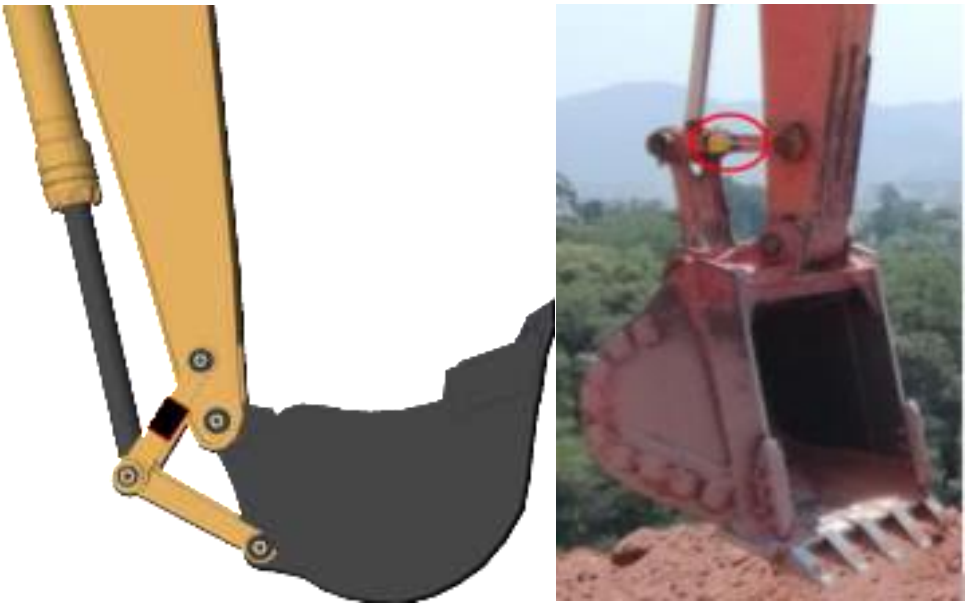
Stick sensor should be installed at left side of machine. The welding position should parallel to the axis of the boom-shaker connection shaft and the shaft of the shaker-bucket connection shaft to ensure firmness. The schematic diagram and the actual installation diagram are as follows:

Note: The welding can be roughly parallel. You can use the total station to adjust the two connecting axes to the same plumb line, and then use the spirit level to find the parallel line. The specific operation method depends on the situation on site.

Use screws to fix the sensor on the stick sensor bracket, the male port points to the rear of machine.

4. Rocker sensor installing

The welding position is parallel to the rocker to ensure firmness. The schematic diagram and actual installation diagram are as follows:



Use screws to secure the sensor to bracket with the male port face to the cab.

2.3.3 H10-D panel Installing

Assemble the tablet/switch holder/tablet holder together, fix them in a convenient place with RAM bracket and adjust the angle of the bracket so that it can be easily observed.

2-3 H10-D panel installing

2.3.4 ER-2 Radio Host Installing

The ER-2 receiving radio host is connected to the RS232-1 port in the Rollnav6.0 standard main cable through the external radio M12 transfer cable radio terminal port, the car radio antenna is connected to the ER-2 receiving radio host radio port, and the ER-2 radio host is placed in a free area in the cab is sufficient.

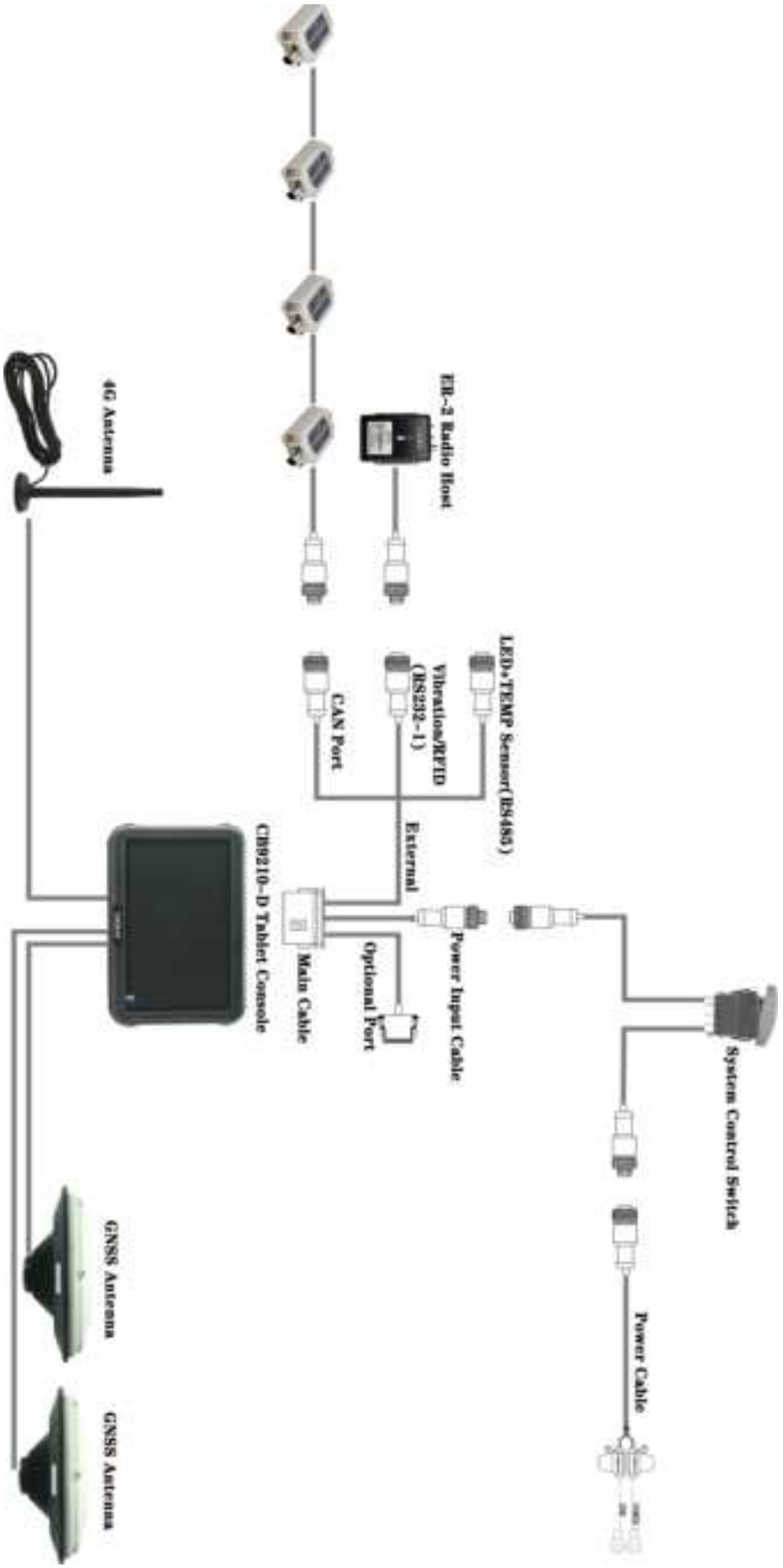
2-4 ER-2 radio host installing

2.3.5 Cable Connecting and Fixing

When installing the cables of the system, use ties or buckles to route the cables along the expected path of the cables.

The following figure shows connection diagram:

2-11 Schematic Diagram of System Harness Connection



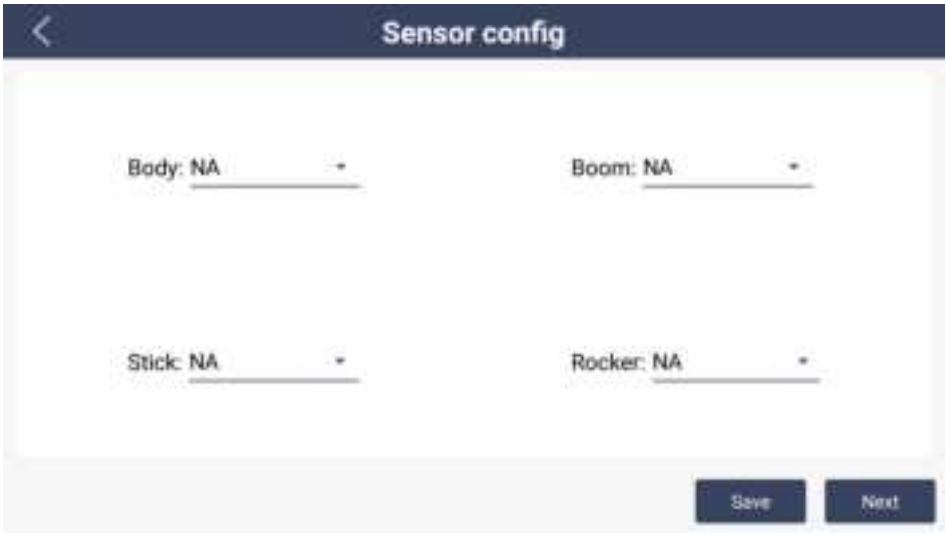
After the wiring harness is installed, drive the excavator to move and stretch or curl the bucket to check whether the wiring harness interferes.

3 Calibration

This chapter describes how to measure an excavator to provide accurate control. Before start calibration, a total station and a RTK rover are required.

3.1 Sensor ID configuration

Enter the mechanical management-sensor configuration interface, write the IDs of the sensors in different positions to the corresponding positions, and click the [save] button.



Note: Each sensor only allowed to be configured with ID ONE time.

3.2 Work equipment measurement and calibration

3.2.1 Boom、Stick and Antenna height measurement

Click [Next] to enter the measurement interface of the boom/stick and antenna height measurement

Boom length measurement: select the connection axis of the body and boom as the starting point, and select the connection axis of the boom and stick as the

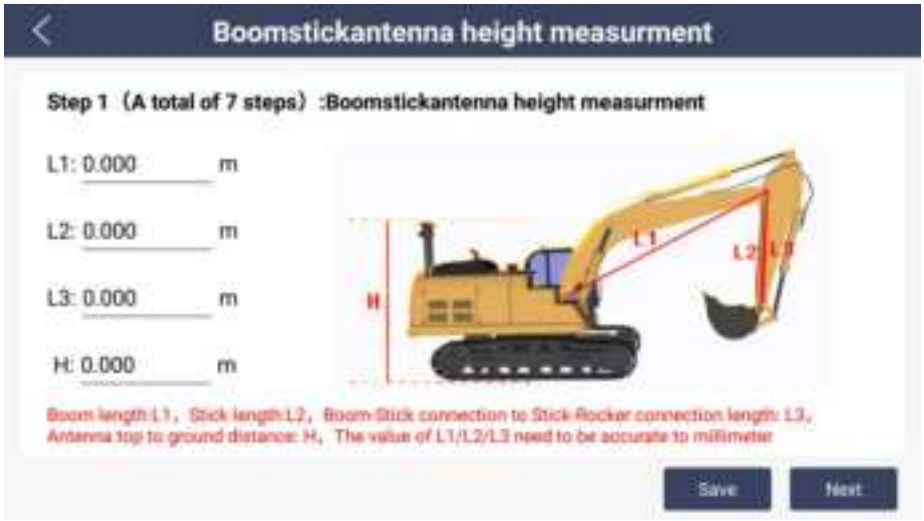
end point. Use a tape measure to measure the distance between these two points and input it into the L1 blank.

Stick length measurement: Use the tape measure to select the connection axis of the boom and the stick as the starting point, and the connection axis of the stick and the bucket as the end point, measure the distance between these two points, and input it into the L2 blank.

Stick to link length measurement: Select the connection axis of the boom and stick as the starting point, and select the connection axis of the stick and the link as the end point. Use a tape measure to measure the distance between these two points and input it into the L3 blank.

Antenna height measurement: Use a tape measure to measure the phase center of the main antenna to the ground height and input it into the H blank.

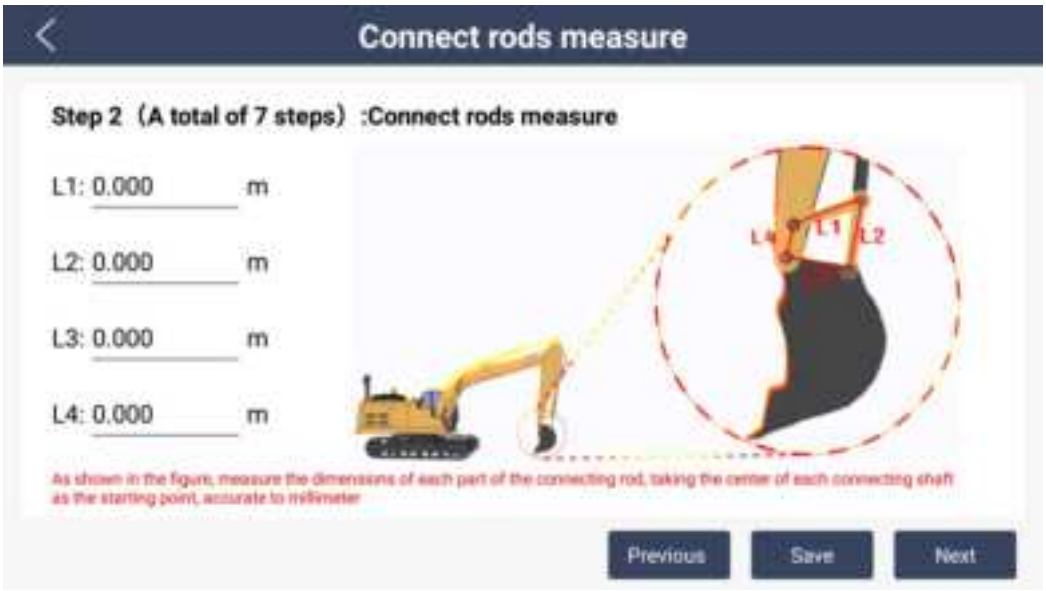
Note: For the measurement size, please refer to the animation and description text on the right side of the page. After the parameter input is completed, you need to click the [Save] button. Generally, the precise arm length will be marked in the mechanical manual. You can refer to the data input interface provided by the manufacturer.



After confirming and entering the size, click [Save] to proceed to the next step

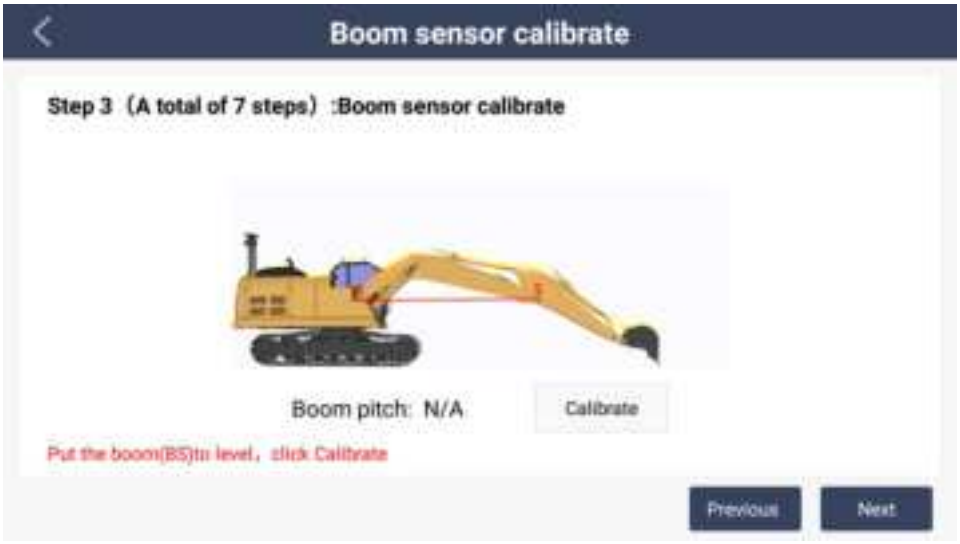
3.2.2 Connect rods size

Click [Next] to enter the [Connect rods measure] interface, use the tape measure to measure the length of each connecting axis according to the animation demonstration, input then into the L1, L2, L3 and L4 blanks, click [Save] button. Each length should be accurate to millimeters.

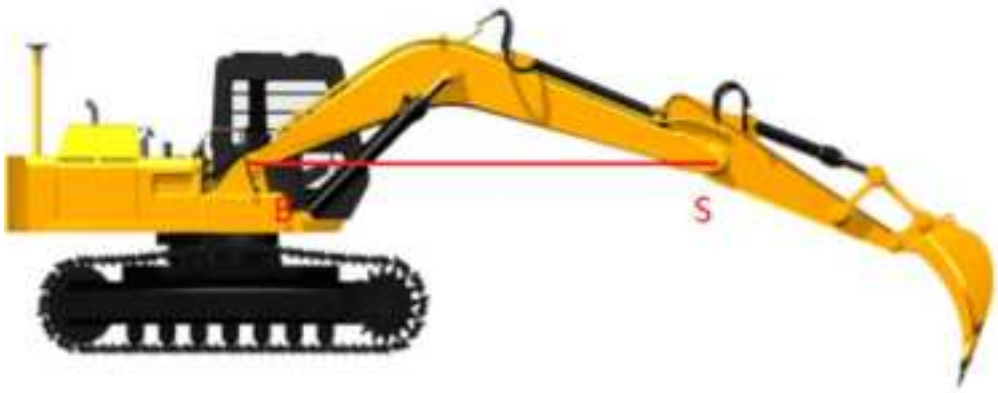


3.2.3 Boom sensor calibration

Click [Next] to enter the calibration interface of the boom sensor, adjust the BS two-point connection line in the animation demonstration to the level, and click the [calibration] button. After finish the calibration, the boom pitch angle should appear to approach 0°.



Calibration method: use a total station to calibrate the boom sensor. The total station is erected in the middle of the boom and leveled facing the center. The total station is aligned with the axis of the body and the boom to lock the vertical axis. Rotate the total station horizontally to the axis of the boom and stick, and observe the relationship between the boom and the stick. Check whether the pivot point of the forearm coincides with the horizontal axis of the cross axis of the total station, and guide the cab technician to move the boom until the two pivots are absolutely horizontal.



3.2.4 Stick &Rocker sensor calibrate

Stick Sensor Calibration：

Click [Next] to enter the stick and bucket sensor calibration interface, adjust the SK two-point connecting line in the animation demonstration to be vertical, and click the [calibration] button. After calibration is complete, the stick sensor angle should appear to be approaching -90°.

Calibration method: first calibrate the stick, put the stick into the state shown in the above picture, make the total station levelling, the sight axis is aimed at the connecting axis of the boom and the stick, move the vertical plate until the axis of the sight axis is aligned with the axis of the stick and the bucket. The excavator operator cooperates to adjust the two axles to vertical. Click the [Calibration] and the pitch value of the stick becomes -90°.

Rocker Sensor Calibration:

Use the total station to adjust the DK two-point connection line in the animation demonstration to vertical, and then adjust DC to horizontal, so that ∠CDK is 90°, and click the [Calibration] button. After the calibration is complete, the connecting rod sensor angle should show towards 0°.

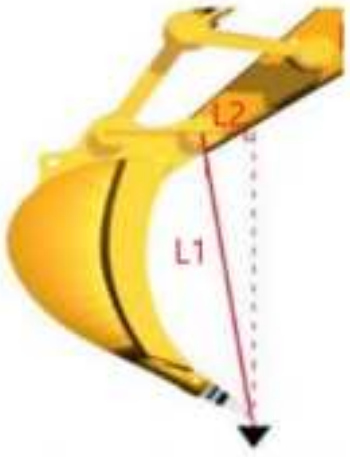
3.2.5 Connect rods check

Click [Next] to enter the link inspection interface, adjust the excavator according to the animation demonstration and the description text, measure the CK value and input it into the CK input box, and then click the [Inspection] button (at least 3 sets of data are added). After passing, click [Next], if not, please check the link size and rocker sensor calibration.

3.2.6 Bucket set

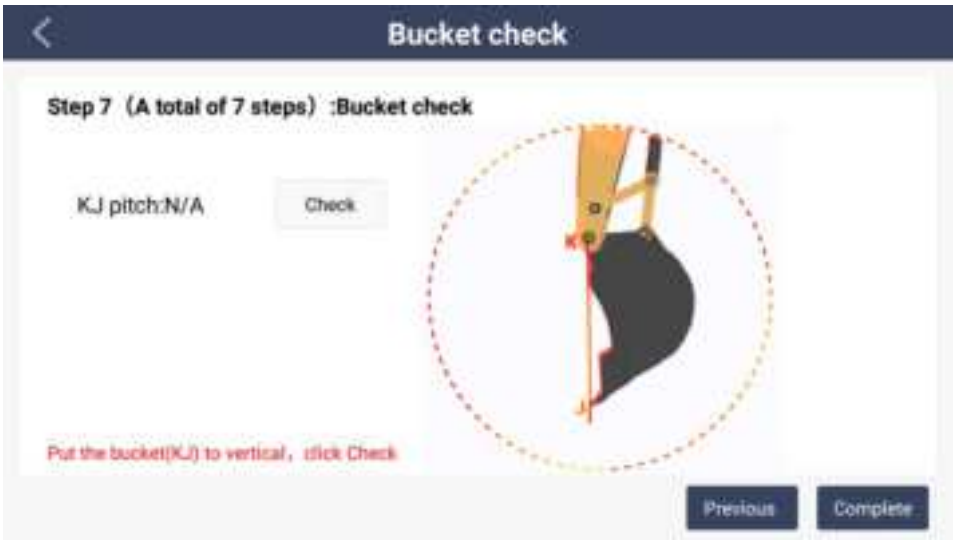
Click [Next] to enter the bucket setting interface, click the [New] button, input the name of the new bucket, and press the moving diagram to demonstrate the measurement of the bucket width W, the distance L1 from the forearm bucket connecting axis to the bucket tip, and the forearm bucket connecting axis The horizontal distance L2 from the heart to the bucket tip (measured several times to get the average value), click [Save], select the bucket in the list, and click the [Apply] button.

Measuring method: Use a total station or a spirit level to adjust the axis of the forearm bucket and the connecting rod of the bucket to the level, and the distance L1 from the axis of the forearm bucket to the bucket tip; use a plumb bob to be perpendicular to the bucket tip , measure the horizontal distance L2 from the connecting axis of the forearm bucket to the plumb line (that is, the horizontal distance L2 from the connecting axis of the forearm bucket to the bucket tip).



3.2.7 Bucket check

Click [Next] to enter the bucket inspection interface, adjust the bucket with the help of a plumb bob, and keep the KJ vertical (that is, the connection axis of the forearm bucket is perpendicular to the shovel tip, click the [Check] button. The KJ pitch angle check result is -90° +/-0.3. When it is within 0.3°, the check will be passed, but if the check fails, the calibration can still be completed. The KJ pitch angle does not participate in the calculation of coordinates. If it fails, check the bucket size setting.

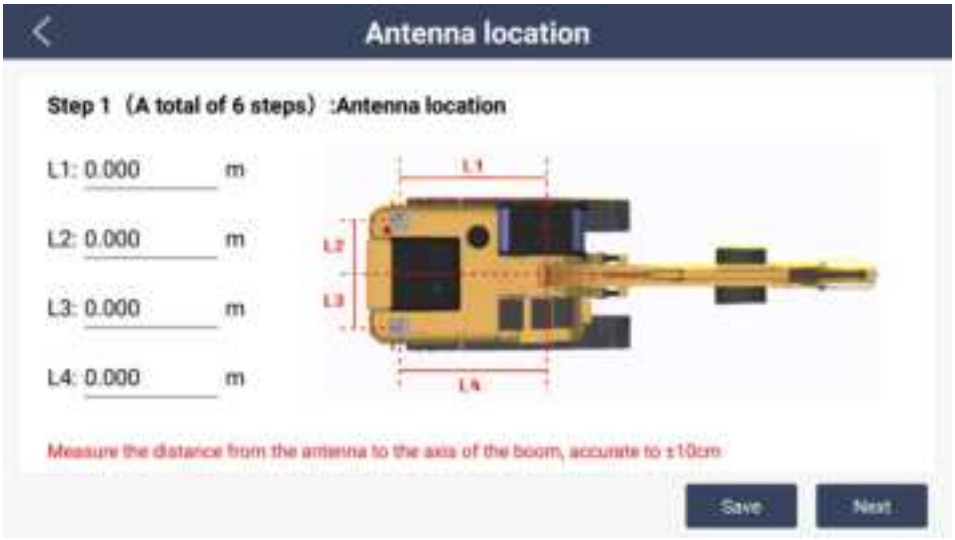


3.3 Body size measure and sensor calibrate

3.3.1 Antenna location

Click to enter the mechanical management - body measure & calibrate- antenna location interface, take the excavator boom and the body axis as the vertical axis, and the central axis of the boom as the horizontal axis. During the measurement process, it is necessary to mark the position of the cross axis on the excavator with the aid of a spirit level and a plumb bob, and use a marker to mark it on the excavator. According to the animation demonstration, use a tape measure to measure the distance L1 from the main antenna to the center axis of the boom, the distance L2 from the main

antenna to the boom and the body axis, the distance L3 from the auxiliary antenna to the center axis of the boom, and the distance from the auxiliary antenna to the boom and the vehicle body axis. The center distance L4, fill in the input boxes respectively, and click the [save] button.



3.3.2 Body sensor calibrate

Click [Next] to enter the body sensor calibration interface. The calibration method is as follows:

1. Park the excavator to a flat and open place (the longitudinal slope is controlled within 10° , and the transverse slope is controlled within 5°), the body is parallel to the track, and click the [Start] button (only the transverse and longitudinal slopes meet the requirements, the start button can be clicked)

2. Rotate the excavator 180 degrees, so that the rotation angle is within the range of 180° +/-0.3° , and click the [Calibration] button (only the rotation angle is within the range, the calibration button can be clicked);

3. Rotate the excavator 180° and turn it back clockwise, so that the rotation angle is within the range of 360° +/-0.3° , and click the [Check]

button again (only the rotation angle is within the range, the check button can be clicked), if check If it does not pass, you need to re-calibrate the first 3 steps.

3.3.3 Size calibrate

3.3.3.1 Elevation calibrate

Click [Next] to enter the elevation calibration interface. The calibration method is as follows:

1. Place the excavator in any place, adjust the excavator to curl up and stretch randomly so that the bucket touches the ground, choose to measure the left bucket tip or the right bucket tip, click the [Collect] button, and mark the bucket tip position;

2. Use the mobile station to measure the elevation at the mark and fill in the elevation input box;

3. Click the [Add] button, the software will display the collected value, measured value and difference value in the list;

4. Repeat steps 1-3 for any posture. When the number of samples

reaches 5 groups, click the [Calibration] button.

Note: The software will calculate the correction value of 5 sets of data. When the correction value is less than 0.02m, the calibration can be passed. When the actual elevation accuracy requirement is not high, and the correction value is greater than 0.02m, you can choose whether to pass the calibration or not, and carry out Next step.

3.3.3.2 North coordinate Calibrate

Click [Next] to enter the north coordinate calibration interface. The calibration method is as follows:

1. Point the excavator to the north or south, choose to measure the left or right bucket tip of the bucket, stretch the boom and stick, slightly rotate the body to make the accuracy less than 1cm, let the bucket tip touch the ground, and mark the position of the bucket tip;

2. Use the rover to measure the north coordinate of the marked point, and fill in the north coordinate input box;

3. Click the [Capture] button at this time (the capture button can only be clicked if the accuracy is less than 1cm);

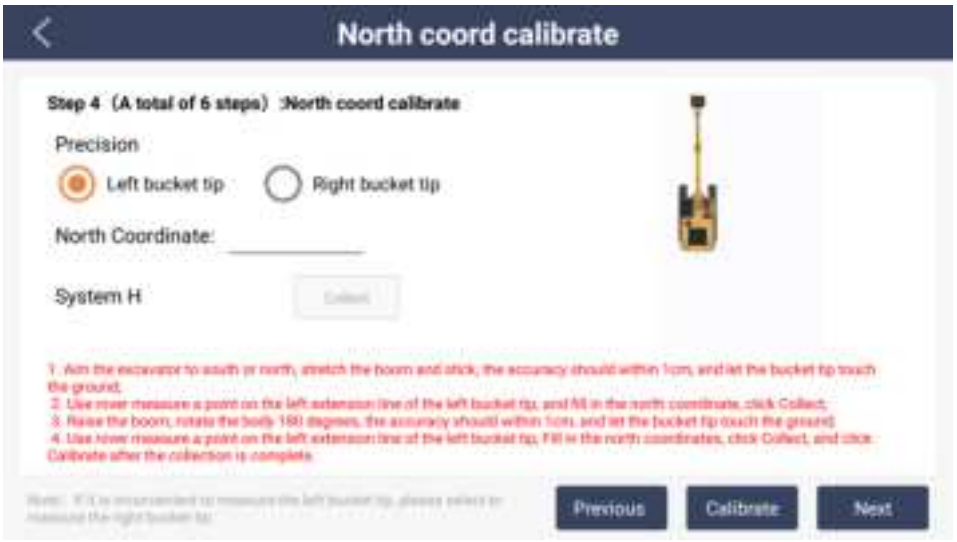
4. Raise the boom, then rotate the body 180° and the crawler does not move, make the excavator face the opposite direction, slightly rotate the body to make the accuracy less than 1cm, lower the boom so that the shovel tip touches the ground, and mark the position of the shovel tip;

5. Use the rover to measure the north coordinate of the marked point, and fill in the north coordinate input box;

6. Click the [Capture] button at this time (only the accuracy is less than 1cm, the capture button can be clicked);

7. Click the [Calibration] button. When the correction value is less than 0.02m, the calibration can be passed. When the correction value is greater than 0.02m, steps 1-6 need to be repeated until the correction value is less than 0.02m.

Note: For the specific excavator operation, please refer to the animation demonstration.



3.3.3.3 Heading calibrate

Click [Next] to enter the heading angle calibration interface. The calibration

method is as follows:

1. Facing the excavator to the north or south, choose to measure the left or right bucket tip of the bucket, curl the boom and stick, slightly rotate the body, make the accuracy less than 1cm, let the bucket tip touch the ground, and mark the position of the bucket tip;

2. Use the rover to measure the east coordinate of the marked point, and fill in the east coordinate input box;

3. Click the [Capture] button at this time (the capture button can only be clicked if the accuracy is less than 1cm);

4. Extend the boom and stick, slightly rotate the body to make the accuracy less than 1cm, lower the boom to make the shovel tip touch the ground, and mark the position of the shovel tip;

5. Use the rover to measure the east coordinate of the marked point, and fill in the east coordinate input box;

6. Click the [Capture] button at this time (only the accuracy is less than 1cm, the capture button can be clicked);

7. Click the [Calibration] button. When the correction value is less than 0.02m, the calibration can be passed. When the correction value is greater than 0.02m, steps 1-6 need to be repeated until the correction value is less than 0.02m.

Note: For the specific excavator operation, please refer to the animation demonstration.

3.3.3.4 East coordinate calibrate

Click [Next] to enter the east coordinate calibration interface. The calibration method is as follows:

1. Facing the excavator to the north or south, choose to measure the left or right bucket tip of the bucket, curl the boom and stick, slightly rotate the body, make the accuracy less than 1cm, let the bucket tip touch the ground, and mark the position of the bucket tip;

2. Use the rover to measure the east coordinate of the marked point, and fill in the east coordinate input box;

3. Click the [Capture] button at this time (the capture button can only be clicked if the accuracy is less than 1cm);

4. Extend the boom and stick, slightly rotate the body to make the accuracy less than 1cm, lower the boom to make the shovel tip touch the ground, and mark the position of the shovel tip;

5. Use the rover to measure the east coordinate of the marked point, and fill in the east coordinate input box;

6. Click the [Capture] button at this time (only the accuracy is less than 1cm,

the capture button can be clicked);

7. Click the [Calibration] button. When the correction value is less than 0.02m, the calibration can be passed. When the correction value is greater than 0.02m, steps 1-6 need to be repeated until the correction value is less than 0.02m.

Note: For the specific excavator operation, please refer to the animation demonstration.

After the above 14 steps of dimension measurement and calibration are completed, the accuracy of the bucket tip can be checked. If the accuracy meets the requirements, the design data can be imported, and the guided construction can be carried out normally.

4 Base Station

4.1 Installation

4.1.1 Installation Standard

In terms of basic principles, the base station is best set up in a place with wide vision, open environment and high terrain. Such an environment usually has better effects in signal reception and transmission, which can not only ensure that

the base station receives satellite signals, but also ensure that there is a good radio transmission path between the base station and the system, so as to make the operation distance longer. Avoid obstructions within the height cut-off angle of 15 °, and relax to 20 ° in mountainous areas, and ensure that there are no obstructions on at least three sides.

At the same time, it is necessary to avoid setting up the base station in areas with radio interference, such as radio power stations, high-voltage lines, transformers, meteorological radars and military bases. Such an environment has the risk of electromagnetic interference, which may have an adverse impact on the transmission and reception of signals. If it cannot be avoided, keep away from interfering objects for more than 200m.

On the other hand, it is also necessary to avoid setting up base stations under the shade of trees and between large-scale waters. The leaves may block the satellite signal. The gap between the leaves may cause the diffraction of the satellite signal and reduce the accuracy, while the large-scale waters may reflect the signal, can cause multipath effect and form interference.

For the requirements of base station support, expansion screws must be used to fix the base on the wall and rigid base, and the bearing wall column must be firm and stable. If possible, the concrete antenna base shall be built according to the erection requirements of CORS station; If the conditions are not so good, the tripod can be erected on the roof, and the three legs can be fixed with concrete. It is strictly prohibited to erect above the slab house or in an unstable position.

Under general electromagnetic conditions, when the bade station adopts 25W external radio, the relationship between the erection height and the working distance is shown in the table below:

Height(m)	Typical distance(km)	Maximum distance (km)
>30	9-11	10-12

20	7-9	8-10
10	5-7	6-8

4.1.2 Installing

Please refer to the Installation and Commissioning Manual of X1/X7

FCC Warning:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The device has been evaluated to meet general RF exposure requirement.
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
This equipment should be installed and operated with minimum distance 40cm between the radiator & your body.