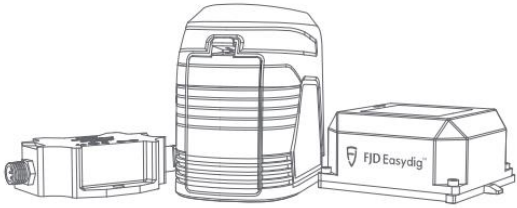
FJD Easydig

G21 Excavator Guidance System

Hardware Installation Manual



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Safety Instructions

Most accidents in product installation, operations, maintenance, and repair are caused by failure to comply with the safety instructions. Learning the safety instructions before installing and using the product can help avoid these dangers and accidents.

Personnel should read the manual in advance and understand the correct tool use so that they can install and use the product properly while complying with the safety instructions.

Do not perform any installation or commissioning operations of this product before you are familiarized with the operations.

Failure to comply with the safety instructions may cause personal injuries or even death of yourself and others.

1. Safety instructions for installation, maintenance, and repair

During installation, maintenance, and repair:

- Ensure that the excavator is shut down.
- Ensure that there are no irrelevant personnel in a radius of 2 m - 3 m around the excavator.
- Ensure that the excavator is on a level ground and properly supported when working under the excavator.
- Keep the excavator away from facilities such as high-voltage power lines.
- Use the electric wires and cables properly.
- Wear gloves to avoid cuts.

Put on a safety harness and attach it to a solid part when working at height on the excavator.

2. Safety instructions for operations

Before operation:

- Preheat the engine and hydraulic oil, and check the warning lights, horn, and other devices.
- Adjust the rear-view mirrors and ensure that you have the optimal view in the cab.

During operation:

- Remove obstacles around the excavator and stay away from the excavator if you are not a professional.
- Keep the excavator away from high-voltage power lines, ditches, and cliffs.
- Sit on the seat and fasten the seat belt when operating the excavator.
- Stop the excavator when a fault occurs. Troubleshooting is prohibited when the excavator is running.

3. Safety instructions for disassembly

- Do not frequently disassemble this product after installation; otherwise the ports and circuits can be damaged.
- Before disassembling this product, turn off all power supplies and disconnect the cable from the battery to avoid device damages and personal injuries.

4. Others

- Disassembling the product housing by yourself may invalidate the warranty.
- Damages caused by force majeure events, such as lightning strikes, overvoltage, and collision, are not covered by the warranty.
- Connect the devices strictly in accordance with this manual. When connecting the wiring harnesses and feeders, hold the end of the plug and gently plug or unplug it. Do not pull the plug by force or twist it, which may break the pins.
- Ensure that the power supply of this product meets the requirements. The operating voltage of the control terminal is 9 V–36 V.

  Note: The main hardware and components are constantly updated to support new features.

Disclaimer

- The purchased products, services, and features are stipulated by the contract. All or part of the products, services, and features described in this document may not be within the scope of your purchase or usage. Unless otherwise specified in the contract, all the content in this manual is provided "AS IS" without warranties of any kind, express or implied.
- The content of this manual is subject to change due to product upgrades and other reasons. FJDynamics reserves the right to modify the content of this manual without notice.
- This manual only provides guidance for use of this product. Every effort has been made in the preparation of this manual to ensure accuracy of the content, but no information in this manual constitutes a warranty of any kind, express or implied.

Preface

Thank you for using this FJD Easydig G21 Excavator Guidance System. This manual provides detailed hardware installation guide. If you have any questions, contact FJD customer service at service@fjdynamics.com or the local dealer.

Purpose and Intended Users

This manual introduces the physical characteristics, installation procedures, and technical specifications of the product as well as the specifications and use of the wiring harnesses and connectors.

Based on the assumption that the users are familiar with the terms and concepts related to this product, this manual is intended for users who have read the preceding content and have experience in hardware installation and maintenance.

Technical Support

- FJDynamics official website: https://www.fjdynamics.com/
- FJDynamics customer service: service@fjdynamics.com

Contents

1. Product Introduction

The FJD Easydig G21 Excavator Guidance System is an aftermarket excavator guidance system from FJD. By using the inertial navigation technology in tilt measurement and reading data from the sensors installed on the excavator, this product calculates with the calibrated dimensions of main pivots to obtain accurate and real-time relative positions of the bucket. Easydig uses FJD's own conversion software to generate tasks, providing digital guidance for excavator operations. Easydig enables the bucket to operate precisely even in areas where you cannot see. The system comes standard with the control terminal, body sensor, wireless sensors, and wiring harnesses. The control terminal runs the FJD excavator guidance system software developed by FJD and displays the excavation depth, gradient, length, width, and elevation in real time. A laser receiver is optional. For the use of the laser receiver, refer to the *FJD Easydig LR1 Laser Receiver User Manual*.

1.1 Main Hardware and Specifications

No.	Component	Specifications
1	Control terminal	Size: 275 x 180 x 40 mm Basic configuration: 10.1-inch capacitive touchscreen, LED backlight, 1280 x 800 pixels, 700 nit LCD, speaker, 2G RAM, 8G ROM Various communication interfaces Power supply: 9 V - 36 V Signals received: 4G and other signals Operating temperature: -20° C to 70° C Storage temperature: -40° C to 85° C Relative humidity: 0% - 95%, at 40° C (non-condensing) Wi-Fi: 2.4 GHz frequency band, frequency range: 2412 MHz - 2484 MHz, output power: 2.4 GHz 11 n 14±2 dBm

No.	Component	Specifications
2	Wireless sensor	Size: 100 x 87 x 43 mm Charging mode: solar charging + external DC power supply Charging voltage: 5 V/1 A DC Hibernation mode: supported Battery life: above 100 h Charging time: 10 h Battery capacity: 7800 mAh Operating temperature: -20° C to 85° C Charging temperature: 0° C to 60° C Communication protocol: CAN Effective communication distance: 30 m
3	Body sensor	Axes (tilt): pitch and roll Range: pitch ±90°, roll ±180° Resolution: 0.01° Max. angular velocity: ≤ 400°/s Static accuracy: 0.01° Dynamic accuracy: 0.50° Stability: 0.05° Axes (acceleration): X, Y, Z Range: ±78 m/s/s Resolution: 0.01 m/s/s Accuracy: ±0.1 m/s/s Data output rate: selectable, max. 100 Hz Operating voltage: 4.9 V - 32 V Power: < 400 mW Operating temperature: -40° C to 85° C

2. Preparation Before Installation

2.1 Safety Instructions

Before installation, read the safety advice in this manual carefully to avoid doing harm to people and equipment.

Note that the following safety advice cannot cover all possible dangerous situations.

Installation

1. Do not install the equipment in environments with high temperature, heavy dust, harmful gases, flammables, explosives, electromagnetic interference (for example, around large radar stations, transmitting stations, and substations), unstable voltages, great vibration, and strong noise.

2. Do not install the equipment in places where water is likely to accumulate, seep, drip, and condense.

3. Install and disassemble the equipment according to the instructions in this manual.

Disassembly

Before disassembly, turn off all power switches and unplug all power supplies and cables.

Electrical operations

1. Electrical operations must be performed by qualified personnel in accordance with local laws and regulations.

2. Carefully check the working area for potential hazards, such as wet ground.

3. Before installation, learn about the position of the emergency stop button. Use this button to cut off the power supply in case of accidents.

4. Before cutting off the power supply, ensure that the equipment is turned off.

5. Do not put the equipment in a humid place. Prevent the liquids from entering the equipment.

6. Direct or indirect contact with high voltage or utility power through wet objects may cause death.

7. Non-standard and incorrect electrical operations may cause accidents such as fires and electric shocks, leading to serious damage to the equipment, personal injuries, and death.

2.2 Requirements for Installation Site

To ensure the normal operation of the equipment and prolong its service life, the installation site must meet the following requirements.

Environment and position

1. Install the equipment in an open space as far as possible. If you have to install it in an enclosed space, ensure that good ventilation and heat dissipation systems are in place.

2. Ensure that the installation position is firm enough to support the control terminal and accessories.

3. Ensure that there is enough space to install the control terminal at the installation position, with some space set aside in every direction for heat dissipation.

Temperature and humidity

1. The temperature and humidity of the working environment should be kept within a reasonable

range to ensure the normal operation and service life of the equipment.

2. The equipment will be damaged if it works under improper environmental temperature and humidity.

3. When the relative humidity is too high, insulating materials may not perform well, causing leakage currents. Mechanical property changes, rusting, and corrosion may also occur.

4. When the relative humidity is too low, insulating materials will dry and contract, and static electricity may occur and damage the electric circuits of the equipment.

5. High environmental temperature is even more harmful. It will greatly reduce the reliability of the equipment. If the equipment works under high environmental temperature for a long time, its service life will shorten.

Air

Ensure that the contents of salt, acid, and sulfide in the air are within a reasonable range. Some hazardous substances will accelerate the rusting and corrosion of metals and the aging of parts. Keep the working environment free of harmful gases (for example, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, and chlorine).

Power supply

Input voltage: The system operating voltage is between 9 V - 36 V. The typical supply voltage is 24 V or 12 V.

2.3 Installation Tools

Prepare the following tools before installation.

No.	Tool	Model	Qty.	Function
1	Cross screwdriver	Medium size	1 piece	Install the control terminal and its bottom plate.
2	Hex key set	T3 - T6	1 set	Install the sensors.
3	Open-end wrench		1 set	Install the control terminal bracket.
4	Utility knife		1 piece	Unpack.
5	Scissors		1 piece	Cut cable ties and 3M double sided tape.
6	Multimeter		1 piece	Measure voltages and check circuits.
7	Total station or tape measure		1 piece	Measure the vehicle dimensions.
8	Oil cleaning agent		1 bottle	Clean oil stains on the vehicle.

2.4 Packing List

When you receive the package, unpack and check the items according to the following list.

No.	Name	Specifications	Qty.
1	Control terminal	The fourth generation	1 piece
2	USB-C cable		3 pieces
3	Laser level		1 piece
4	Body sensor	FJR1931-QJCGQ-BW	1 piece
5	Sensor label		1 piece

No.	Name	Specifications	Qty.
6	Control terminal bracket		1 set
7	Wireless sensor	FJR1931-QJCGQ-FJDBT3	3 pieces
8	Pan head screw with spring and flat washers	M5×16	3 pieces
9	Certification		1 piece
10	Hardware installation manual		1 piece
11	Software user manual		1 piece
12	Black nylon cable tie	4×200 mm	10 pieces
13	Mounting base of body sensor		1 piece
14	3M double sided tape	85×60 mm	1 piece
15	Extension rod aluminium plate		1 piece
16	Magnetic rod		1 piece
17	360° tripod head		1 piece
18	Screw adapter	5/8" female to 3/8" male	1 piece
19	Fixed length tube		1 piece
20	Telescopic tube		1 piece
21	3M double sided tape	80×20 mm	6 pieces
22	Mounting base of wireless sensor		3 pieces
23	Hexagon socket head cap screw	M5×8	5 pieces
24	Power harness		1 piece
26	Body sensor harness		1 piece

Above is the general shipping configuration. The actual shipment is subject to the contract and may differ slightly. Check the items in the package according to the packing list or the contract. If there is any doubt or discrepancy, contact your dealer.

3. Product Installation

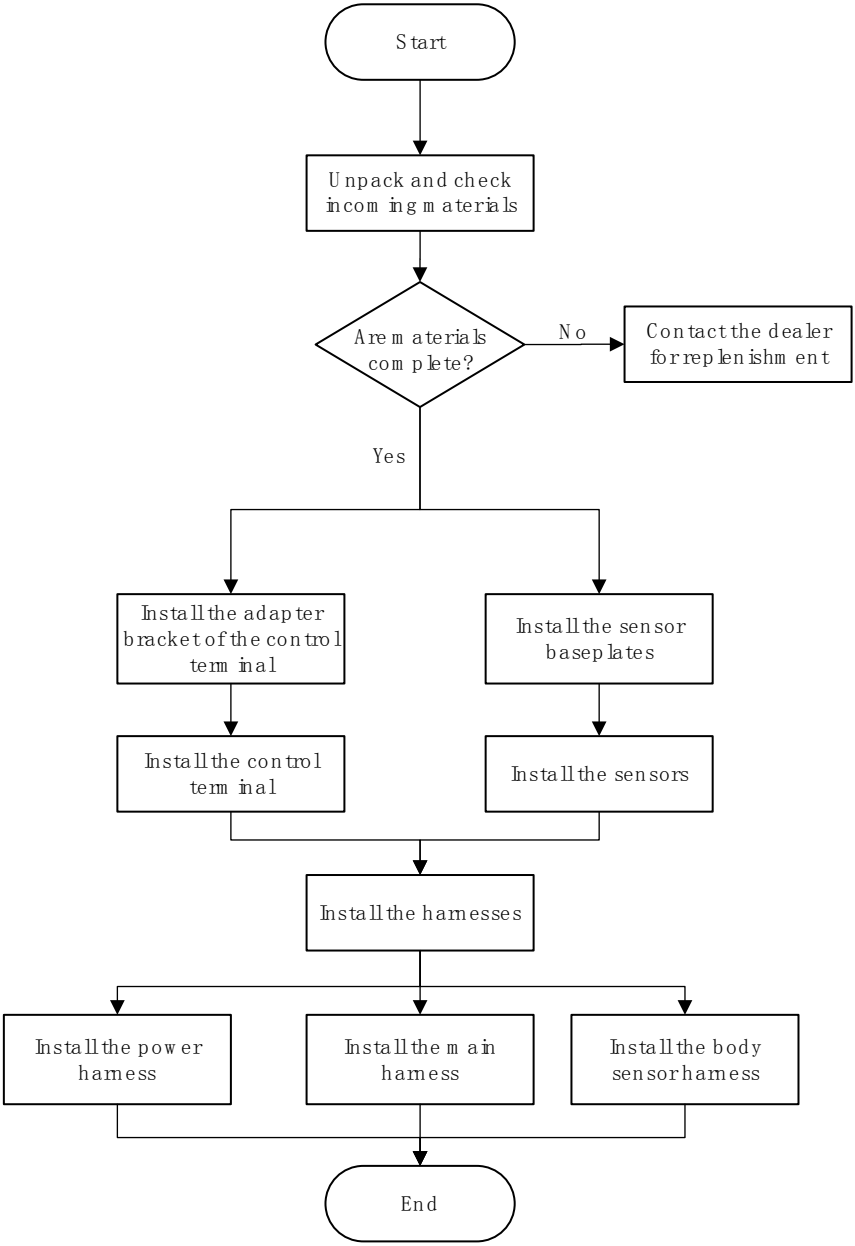
Ensure that you have read Chapter 2 carefully and all requirements specified in Chapter 2 are met.

3.1 Check Before Installation

Before installation, make a detailed plan and arrangement regarding the installation position, power supply, and wiring of the equipment, and ensure that the installation site meets the following requirements.

1. There is sufficient space to facilitate heat dissipation.
2. The environmental temperature and humidity meet the requirements.
3. The power supply and current meet the requirements.
4. The selected power supply matches the system power.
5. For user-specific equipment, ensure that the specific requirements are met.

3.2 Installation Procedure



3.3 Precautions for Installation

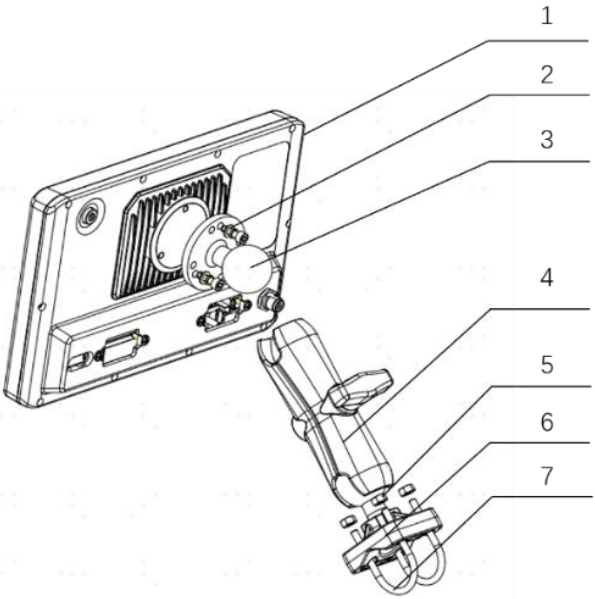
1. Cut off the power supply when installing the equipment.

2. Place the equipment in a well-ventilated environment.
3. Do not place the equipment in a high-temperature environment.
4. Keep the equipment away from high-voltage cables.
5. Keep the equipment away from strong thunderstorms and electric fields.
6. Unplug the power supply before cleaning.
7. Do not clean the equipment with liquids.
8. Do not disassemble the equipment housing.
9. Fix the equipment firmly.

4. Installation Procedure

4.1 Install the Control Terminal

4.1.1 Required Materials

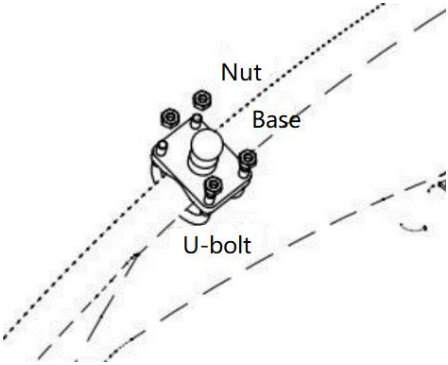


No.	Name	Qty.	Specifications	Remarks
1	Control terminal	1		

		piece		
2	Pan head screw with spring and flat washers	3 pieces	M5×16	
3	Control terminal ball adapter with round plate	1 piece		Control terminal bracket assembly is provided.
4	Adapter bracket	1 piece	M6×20	
5	Hexagon nut	4 pieces	M6	
6	Bracket base	1 piece		
7	U-bolt	2 pieces		

4.1.2 Installation Steps

Step 1: Fix the bracket base. Select an appropriate position inside the cab for easy operation. Then, fix the control terminal bracket base there with U-bolts and nuts.

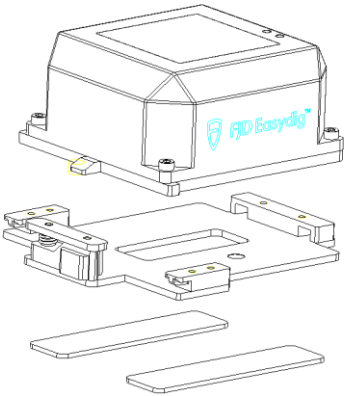


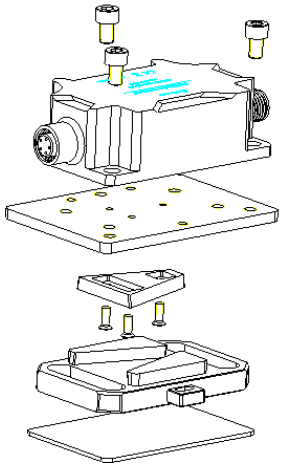
Step 2: Take out the control terminal, rotate the bracket handle counterclockwise, and then install the back ball of the control terminal into the bracket ball socket.

Step 3: Install the control terminal onto the ball of the base, and rotate the bracket handle clockwise to tighten the connection. Ensure that the control terminal is fixed firmly and will not move easily.

4.2 Install the Sensors

4.2.1 Required Materials





No.	Name	Qty.	Specifications
1	Wireless sensor	3 pieces	
2	Mounting base of wireless sensor	3 pieces	
3	3M double sided tape	6 pieces	80×20 mm
4	Body sensor	1 piece	
5	Hexagon socket head cap screw	3 pieces	M5×8
6	Mounting base of body sensor	1 piece	
7	3M double sided tape	1 piece	85×60 mm
8	Pinch plate	1 piece	

4.2.2 Installation Steps

Step 1: Install the mounting bases of the body and wireless sensors. Stick the 3M double-sided tape to the mounting bases. Install the mounting bases in the selected positions as shown below. Seen from the cab, all mounting bases of the wireless sensors are installed on the left side.

Note: It is recommended to weld the mounting base of the bucket sensor if the dogbone is of an irregular shape or uneven surface, making it impossible to attach the 3M double-sided tape.

Step 2: Install the sensors. Mount the sensors onto the body, boom, arm, and dogbone of the excavator.

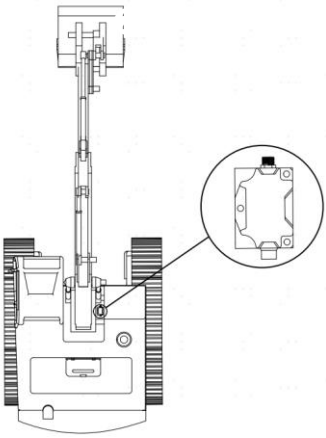
Note: A wireless sensor has the following four status during daily use:

1. Blinking super fast: An OTA update is in progress;
2. Blinking fast: The Bluetooth connection is established;
3. Blinking slowly: The Bluetooth connection is not established;
4. No blinking: The sensor is in hibernation.

When the sensor can be found in the list of Bluetooth devices but its indicator is off, the sensor is in light sleep. When the sensor cannot be found in the list of Bluetooth devices and its indicator is off, the sensor is in deep sleep or turned off.

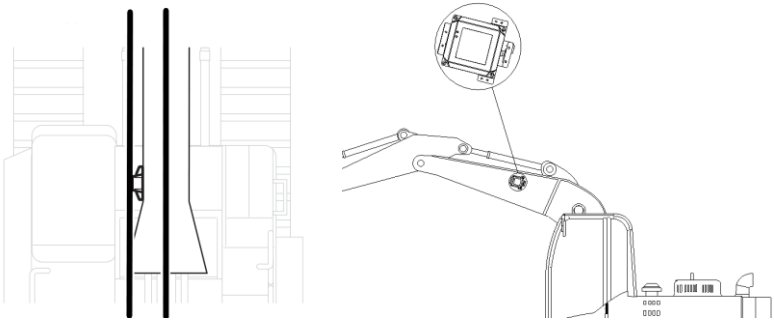
4.2.2.1. Body sensor

This sensor provides all-terrain data compensation to ensure the excavator operation accuracy on slopes, in foundation pits, and underwater.
This sensor is normally installed on the slewing platform. It may also be installed on the vehicle body or the cab bottom plate. Ensure that the sensor interface points to the bucket, the sensor is parallel to the body center line, and the mounting surface is level.



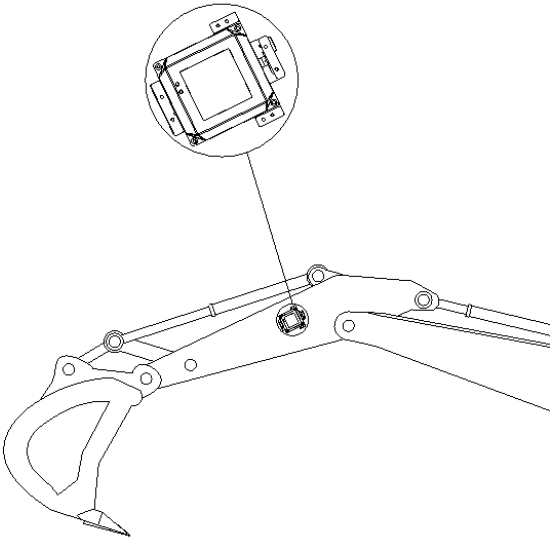
4.2.2.2. Wireless sensor (boom)

This sensor monitors and determines the boom angle in real time.
Install this sensor in parallel to the body center line and against the upper edge of the boom. To ensure accuracy, do not install it near the boom axis.
The rubber clip for quickly fixing and removing the sensor should point towards the cab as shown below.



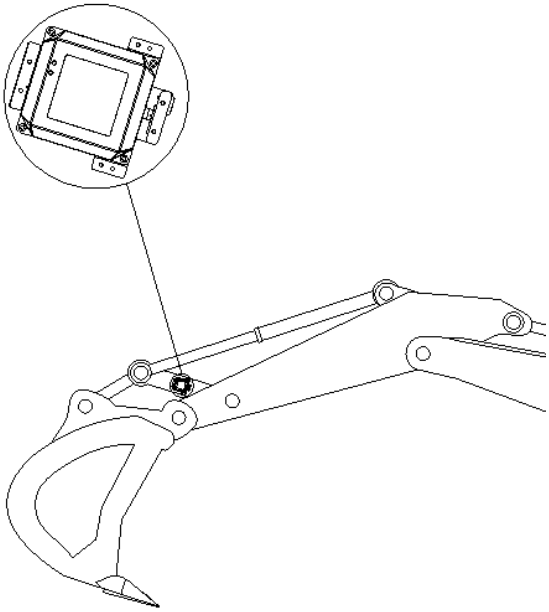
4.2.2.3. Wireless sensor (arm)

This sensor monitors and determines the arm angle in real time.
Install this sensor against the upper edge of the arm.
The rubber clip for quickly fixing and removing the sensor should point towards the cab as shown below.



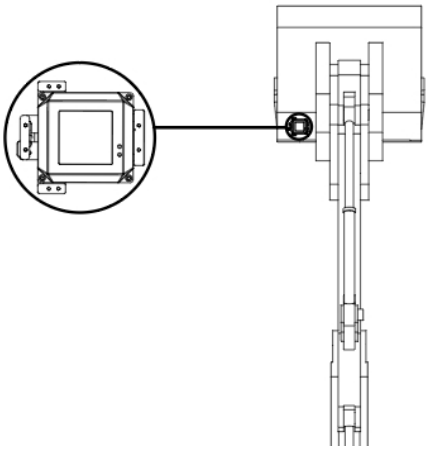
4.2.2.4. Wireless sensor (bucket)

This sensor monitors and determines the bucket angle in real time.
Install this sensor on the dogbone, and ensure that the sensor edge is flush with the dogbone edge.
The rubber clip for quickly fixing and removing the sensor should point towards the cab as shown below.

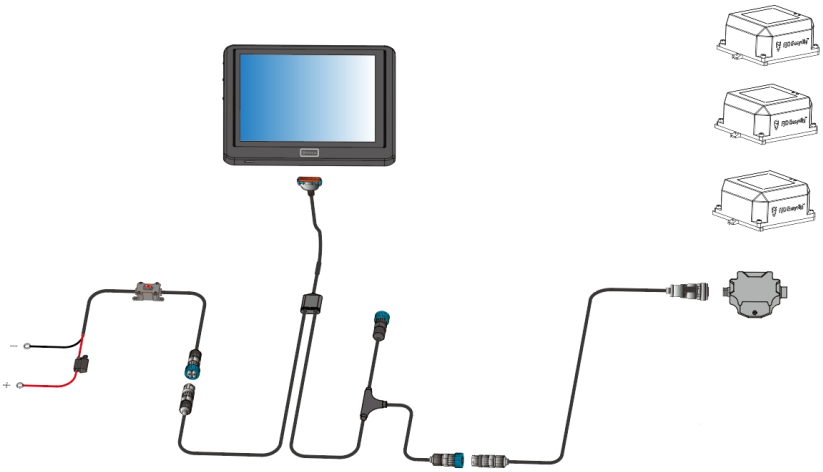


4.2.2.5 Wireless sensor (tilt bucket) (optional)

This sensor monitors and determines the angle of the tilt bucket in real time.
Install this sensor on the top of the bucket as shown below, or install it on the tilting plane.
The rubber clip for quickly fixing and removing the sensor should point towards the left side if viewed from the cab as shown below.
This sensor is not included in the standard configuration and should be purchased separately.



4.3 Install Harnesses



4.3.1 Required Materials

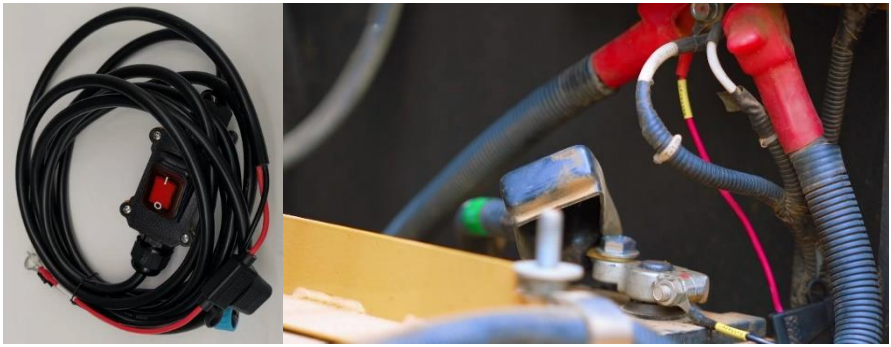
No.	Name	Qty.	Specifications
1	Main harness	1 piece	3.5 m
2	Power harness	1 piece	4 m
3	Body sensor harness	1 piece	
4	Cable tie	Several	

4.3.2 Installation Steps

1. Body sensor harness

Connect the harness to the body sensor at one end and to the main harness at the other end.

2. Power harness



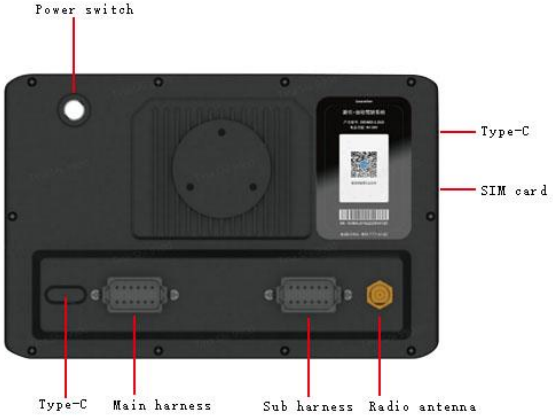
Connect the positive terminal to the normally open contact of the relay, and the negative terminal to the negative electrode of the battery or the vehicle body.

!	**Note:** Ensure that the input voltage is in the range of 9-36 V, and the main power switch is easy to reach.

3. Main harness

Wire the main harness in the cab in a concealed way to avoid affecting excavator operations. Then, connect it to the body sensor harness and power harness.

4. Control terminal ports



Connect the main harness, the body sensor, and the power harness to the corresponding ports. Then, turn on the switch on the power harness to check whether the power indicator of the control terminal is lit, and turn on the control terminal to check whether it works normally.

5. Inspection of harness installation

Check whether the power harness, the main harness, and the body sensor harness are firmly fixed, and whether the excavator pulls any harness or encounters other obstructions during operations.

4.4 Install the SIM Card

4.4.1 Required Materials

No.	Name	Qty.
1	SIM card	1 piece
2	Ejector pin	1 piece
3	Tweezers	1 piece
4	Cross screwdriver	1 piece

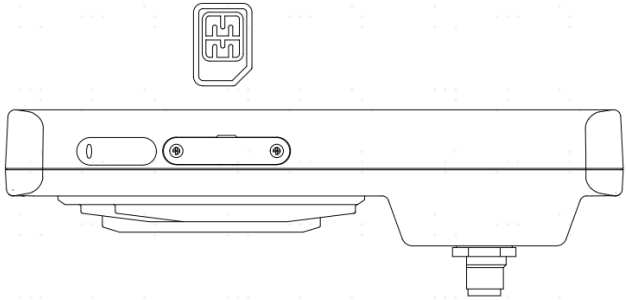
Notes:

1. Purchase a SIM card that supports the frequency bands of the 4G communication module of the control terminal. Ensure that the SIM card supports the following 4G frequency bands:
   LTE FDD: B1/B3/B5/B8
   LTE TDD: B38/B39/B40/B41
   TD-SCDMA: B34/B39
   WCDMA: B1/B8
   GSM: 900/1800 MHz
2. Ensure that the data service is enabled for the SIM card.

3. After installing the SIM card, turn on the control terminal and set the APN and network type in the Android system settings if it is required according to the SIM card manual.

4.4.2 Installation Steps

1. Use a cross screwdriver to unscrew the SIM card cover on the top of the control terminal.
2. Use an injector pin and tweezers to slowly insert the SIM card into the slot via the T3 port with the chip facing the screen side.



The hardware installation of the FJD Easydig G21 Excavator Guidance System is completed.

5. System Commissioning

5.1 Check Before Commissioning

Vehicle condition

Ensure that the excavator is in good condition and all parts work properly.

Site condition

1. Ensure that there are no high-voltage power lines within 150 m around the site.
2. The site ground should be level and no smaller than 50 m × 10 m.
3. The site should have flat concrete pavement or asphalt pavement.
4. Commissioning should be carried out on non-public roads. Ensure that no irrelevant personnel stay around the excavator during commissioning to prevent accidents.

5.2 Power-on

5.2.1 Check Before Power-on

1. Check whether the power supply is connected correctly.
2. Check whether the supply voltage is satisfactory.

5.2.2 Check After Power-on

1. Check whether the power indicator of the control terminal is lit.
2. Turn on the control terminal, and check whether the system program starts normally.

5.3 Parameter Calibration

For details, refer to the *FJD Easydig G21 Excavator Guidance System Software User Manual* provided with the machine.

6.FCC Warning

NOTE: 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
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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.
FCC RF Exposure Warning Statements:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment shall be installed and operated with minimum distance 20cm between the radiator & body.