

# FJDynamics Autosteering Kit

## Installation Instruction



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## **Foreword**

Thanks for choosing products of FJDynamics. This Instruction provides detailed hardware installation instructions. If you have any problems during use, please contact local dealers.

## **Application**

This Instruction mainly introduces physical features of the product, and their installation steps, technical specifications, and the specifications and application rules for wiring harnesses and connectors, and is applicable to users who have understood those information, have experience in hardware installation and maintenance, and are familiar with relevant terms and concepts.

## **Technical support**

Official website: <https://www.fjdynamics.com/>

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# 1 Introduction

Launched by FJ Dynamics, FJDynamics Autosteering Kit for agricultural vehicles supports assistant straight driving and fully unmanned transformation. The kit can not only control the steering to provide driving assistance for the vehicle, but also realize the fully unmanned transformation of agricultural vehicles through the control of the vehicle's accelerator, brake, clutch, gearbox, and operation components. The kit is composed of the in-vehicle display and control terminal, GNSS high-precision positioning equipment, steering motor, angle sensor, attitude sensor, communication antenna, cable harness and so on. Among them, the in-vehicle control terminal is equipped with the auto steering driving software independently developed by FJ Dynamics.

## 2 Preparations

### 2.1 Safety Requirement

To avoid personal injury and equipment damage, please read the safety recommendations herein carefully before installation. The following safety recommendation does not cover all possible hazardous conditions.

#### Installation Safety

1. Do not install the product or perform debugging in the environment with high temperature, heavy dust, harmful gas, inflammable substances, explosive substances, electromagnetic interference (large radar station, transmitter station, substation), unstable voltage, high vibration or loud noise; otherwise, the

equipment may be unable to operate normally.

2. Do not install the equipment in places vulnerable to water accumulation, water seepage, water dripping, condensation, etc., so as to prevent the equipment from being damaged by water accumulated at the interface.

### **Removal Safety**

1. After the equipment has been installed, do not remove it frequently for fear of unexpected damage.
2. Before removal, please turn off all the power supplies and remove the battery cable to prevent damage to the equipment due to live operation.

### **Electrical Safety**

1. Carry out electrical operations in accordance with local regulations and specifications by qualified electricians.
2. Please carefully check the working area for potential hazards, such as wet floor.
3. Before installation, identify the location of the emergency power switch. In case of an accident, disconnect the power switch.
4. Always make inspections carefully when it is necessary to turn off the power supply.
5. Do not place the equipment in a humid place, and keep it away from liquids.
6. Keep it away from high power wireless equipment such as wireless transmitter,

radar transmitter, high frequency and current devices, microwave oven.

7. Prevent direct or indirect contact with high voltage power supply or mains supply for fear of fatal hazard.

## **2.2 Installation site requirements**

To ensure the normal operation of the equipment, the installation site shall meet the following requirements.

### **Installation requirements**

1. Ensure that the installation location is firm enough to support the control terminals and accessories.
2. Ensure that the installation location is big enough for the installation of the control terminal, and that the control terminal is free from other obstructions and barriers.

### **Temperature and humidity requirements**

1. In order to ensure the normal operation and service life of the equipment, the working environment shall be of natural temperature and humidity, and high humidity and temperature shall be avoided. In case of direct sunlight in the summer, it is recommended to take simple shading means, but please keep it spaced from the control terminal appropriately.
2. The equipment shall not be operated in the environment not up to the

temperature and humidity requirements for a long time, otherwise, it will be damaged.

3. If the equipment is operated in the environment with high relative humidity, insulation materials may be degraded to cause improper insulation or even electric leakage, and sometimes, the mechanical properties of materials may be changed and metal parts may become rusty.

4. If the equipment is operated in the environment with low relative humidity, the insulating strip will shrink and the static electricity will be generated, thus damaging the circuit on the equipment.

### **Cleanliness requirements**

1. The installation and operation environment of equipment also makes demands on the content of salt, acid and sulfide in the air. Some harmful substances will accelerate the corrosion of metal and the aging of certain parts. Therefore, measures shall be taken to reduce the invasion of harmful gases (such as: sulfur dioxide, hydrogen sulfide, nitrogen dioxide, chlorine).

### **Power supply requirements**

1. Voltage input: Select the steering motor according to the vehicle battery, and select the input voltage according to the voltage of the steering motor (generally, the starting voltage of the vehicle shall be met).

2. Connect the terminals of the power line to the positive and negative terminals of the battery accordingly. Avoid direct contact with the wiring harness and the high temperature object.

## 2.3 Installation tools

Before the formal installation, please prepare the following tools.

<b>Assembly Tools for FJDynamics Autosteering Kit</b>				
<b>No.</b>	<b>Tool</b>	<b>Type</b>	<b>Quantity</b>	<b>Purpose</b>
1	Phillips screwdriver	Medium size	1	Angle sensor installation
2	Slotted screwdriver	Medium size	1	Hook fastening
3	Inner hexagon wrench	3	1	Angle sensor installation
4		4	1	1. Steering wheel assembly 2. Installation of splined sleeve
5		5	1	Fixing of motor lower bracket
6		11	1	Fastening of U-bolt for fixing control terminal
7	Hexagon wrench	13	2	1. Antenna bracket installation; 2. Steering motor clamp bracket installatio
8		24	1	GNSS antenna bolt
9		12/14	2	Battery wire installation (the specification of bolts depends on the model of

				vehicle)
10		18/21	1	Removal and installation of front axle bolts (the specification of bolts depends on the type of axle)
11	Socket wrench	8/11/13/24/27	1	Removal of steering wheel bolt (lengthened socket) (the specification of socket depends on the type of steering column).
12	Utility knife	/	1	Unpacking
13	Scissors	/	1	Strap scissoring
14	Tape measure	5m	1	Measurement of body parameters

## 2.4 Unpacking and inspection

After the above tools are ready, please check the following list of goods.

No.	Name	Quantity	Remarks
<b>Support Module Box</b>			
1	Antenna Connector	1	
2	Welded casing	2	
3	GNSS Antenna Assembly	2	
4	Suction cup base	2	
5	L Sealing Bag	1	Install antenna connector
6	Hexagon bolt M5×16	4	

7	Hexagon nut M5	4	
8	Hexagon bolt M8×50	4	
9	Hexagon nut M8	4	
10	Spring washer 8	4	
11	Plain washer 8	8	
12	#1 GNSS Feeder	1	
13	#2 GNSS Feeder	1	
14	4G Antenna	1	
15	Radio Antenna	1	
16	IMU wiring harness	1	
17	Steering motor connecting cable	1	
18	Steering motor main power cable	1	
19	Intelligent Main Wiring Harness ( II )	1	
20	Control terminal bracket (type II)	1	
21	S Sealing Bag	1	Install hall angle sensor
22	Fixing bracket	1	
23	Hexagon socket head cap screws M3×6	2	
24	spring washer 3	2	
25	Plain washer 3	2	
26	Cross recessed pan head screw, single coll spring lock washer and plain washer assemblies M5×16	2	
27	Hexagon nut M5	2	
28	Cross recessed countersunk head screws M5×8	2	
29	Angle sensor wiring harness	1	

30	Hose hoop	2	
<b>Core Module Box</b>			
1	Steering wheel	1	
2	Steering motor	1	12V/24V
3	S Sealing Bag	1	Install motor and steering wheel
4	Hexagon socket head cap screws M5×12	6	
5	spring washer 5	6	
6	Plain washer 5	6	
7	spring washer 4	6	
8	Plain washer 4	6	
9	Hexagon socket head cap screws M4×14	6	
10	Hexagon socket head cap screws M6×16	1	
11	spring washer 6	1	
12	Flat washer 6	1	
13	L sealing bag	1	Sealing bag
14	Software Instructions	1	
15	Hardware Instruction	1	
16	Product Certification	1	
17	Screen Protector	2	
18	L Sealing Bag	1	Install Nameplate
19	Open flat round head blind rivets	4	
20	Nameplate	1	
21	Packing List	1	
22	Nylon strap	20	

23	L Sealing Bag	1	Parts Kit
24	Hexagon bolt M5×16	1	
25	Hexagon bolt M8×50	1	
26	Hexagon socket head cap screws M6×16	1	
27	Self-tapping screw ST4.8×25F	1	
28	Hexagon nut M5	1	
29	Hexagon nut M8	1	
30	spring washer 6	1	
31	spring washer 8	1	
32	Flat washer 6	1	
33	Flat washer 8	1	

**Note: The splined sleeve, steering motor bracket and Angle Sensor bracket are not included in this table, they are available at the dealer's premise, and the dealer will install according to the model.**

The items listed above are for general cases only, and may be different as the actual case is (subject to the order contract). Please check the received product carefully against the packing list or order contract. If you have any questions or errors, please contact the dealer.

### **3. Installation**

Please read Chapter 2 carefully and ensure that the requirements described in Chapter 2 are met.

#### **3.1 Check before installation**

Before installation, make a detailed plan for the installation location, power supply and wiring of the equipment, and confirm that:

1. The installation location is spacious enough to meet installation and cooling requirements of the product.
2. The installation site meets the temperature and humidity requirements of the equipment.
3. The installation site meets the power supply and current requirements of the equipment.
4. The selected power supply meets the power requirements of the system.
5. The installation site meets the siting requirements of the equipment.
6. For the equipment supplied to specific users, please confirm whether the equipment meets the special supply requirements before installation.

#### **3.2 Precautions during installation**

1. Do not connect the power supply to the equipment during installation.

2. Please place the equipment in a dry place.
3. Avoid placing the equipment in a high temperature environment.
4. Please keep the equipment away from high voltage cables.
5. Please keep the equipment away from the environment exposed to strong thunderstorms and strong electric fields.
6. Please power off the equipment before cleaning.
7. Please do not clean the equipment with liquids.
8. Please do not open the case.
9. Please fix the equipment firmly.

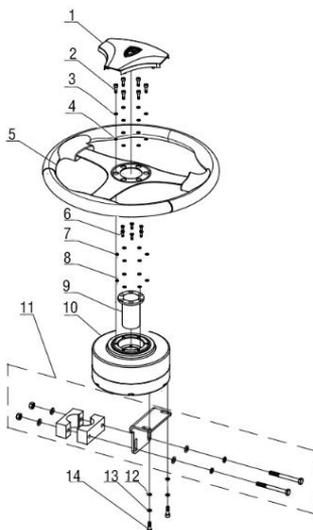
## **4. Installation steps**

### **4.1 Installation of electrical steering wheel**

#### **4.1.1 Materials required for installation of electrical steering wheel**

<b>No.</b>	<b>Name</b>	<b>Quantity</b>
1	Dust-proof Cap and Bonding Logo	1
2	Hexagon socket screw M5x12	6
3	Spring washer 5	6
4	Plain washer 5	6

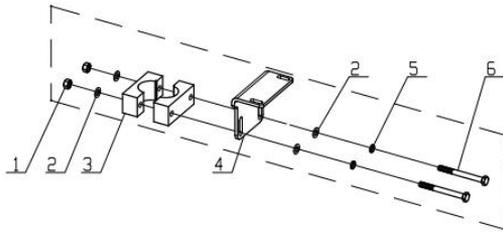
5	Steering wheel	1
6	Hexagon socket head cap screws M4×14	6
7	Spring washer 4	6
8	Plain washer 4	6
9	1# splined sleeve	1
10	Steering motor	1
11	Motor bracket 2	1
12	Plain washer 6	2
13	Spring washer 6	2
14	Hexagon socket head cap screws M6×16	2



- The list of materials involved in the installation of the motor bracket 2

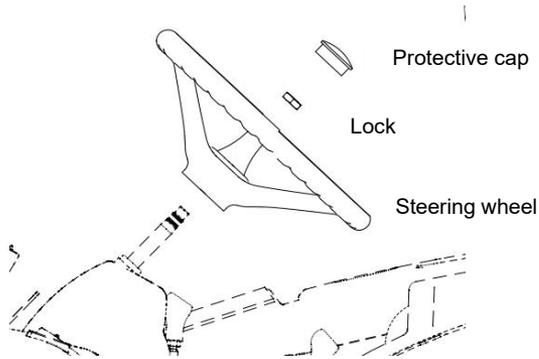
(Part 11 in the picture above):

No.	Name	Quantity
1	Hexagon nut M8	2
2	Plain washer 8	4
3	Steering hoop block	2
4	Steering motor mounting bracket	1
5	Washer 8	2
6	Hexagon bolt M8x80	2



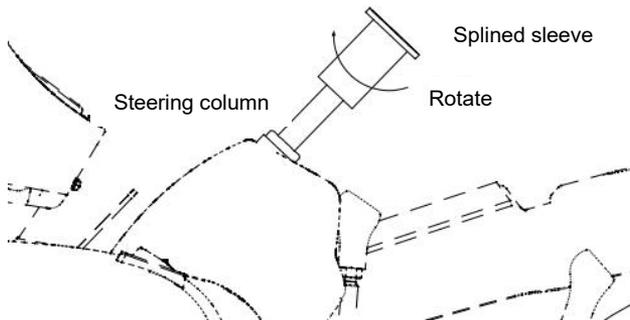
#### 4.1.2 Installation steps of electrical steering wheel

1. Remove the steering wheel of the vehicle. Remove the protective cap of the original steering wheel, and then undo the lock nut (keep the nut for later installation), and pull out the original steering wheel.

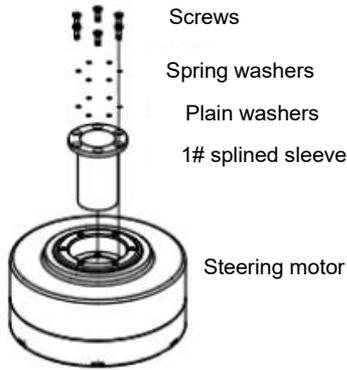


2. Select the splined sleeve according to the spline of the steering column. Install the splined sleeve on the steering column and rotate it leftwards and rightwards until no shaking and clearance is involved.

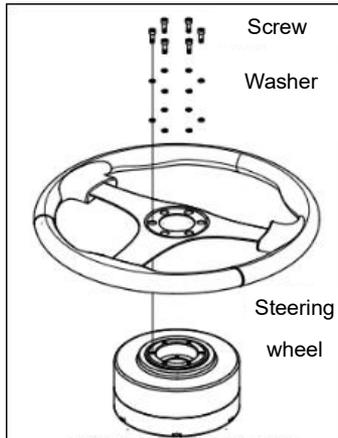
\*There is an example of installation: 1# splined sleeve.



3. Put the 1# splined sleeve into the steering motor, and fix the splined sleeve and steering motor with 6 hexagon socket head cap screws M4×14, 6 spring washers 4 and plain washers 4.



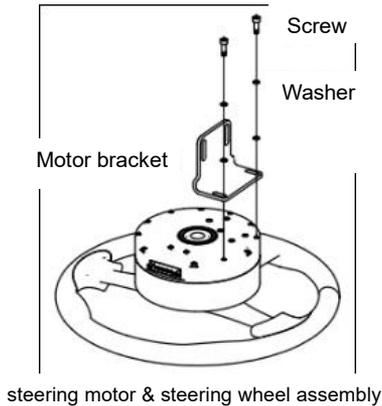
3. Install FJD steering wheel and fix the wheel and motor with 6 hexagon socket screws M5×16, spring washer 5 and plain washer 5.



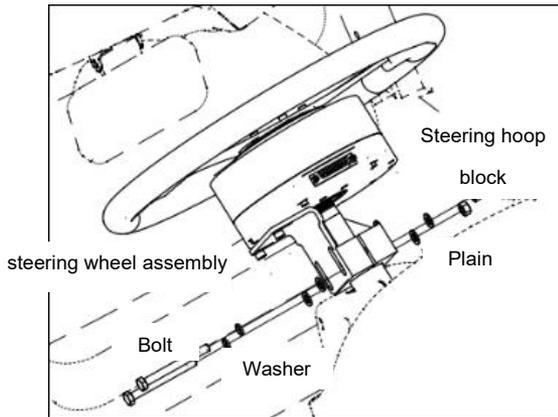
steering motor installed splined sleeve

4. Install the motor bracket. Please fix motor and its bracket with 2 hexagon socket screws M6×16 and washer 6, but do not tighten the bolts at this moment.

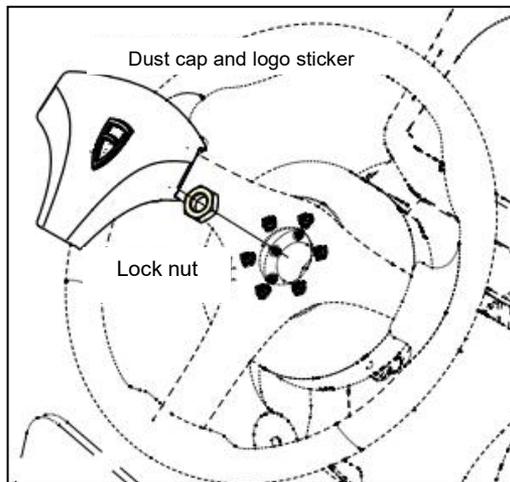
**Note: The structure of steering coloum and dashboard below the wheel is different, please select suitable motor bracket accordingly. There is an example fro instruction: the motor bracket 2.**



5. Install the steering motor & steering wheel assembly to the vehicle with steering wheel removed, adjust the motor connector to the position convenient for wiring harness connection (It is recommended to be placed in the cockpit near the gear side). Meanwhile, install the steering hoop block, adjust the position of the motor bracket, and finally tighten its parts, so as to ensure that the bracket is firmly installed and the outer motor will not rotate with it.



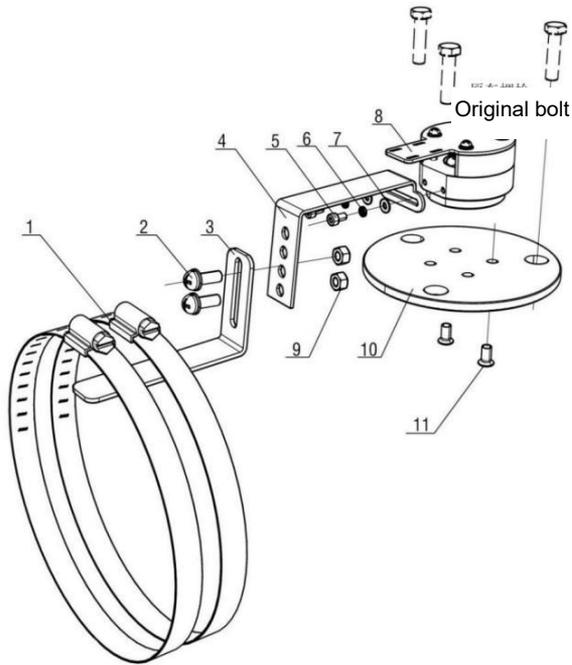
6. Install the original lock nut removed in step 1, and then install dust-proof cap and bonding logo.



## 4.2 Installation of angle sensor

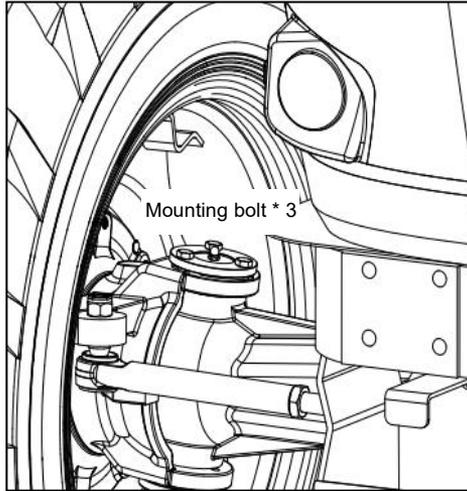
### 4.2.1 Materials required for hall angle sensor installation

No.	Name	Quantity
1	Hose hoop	2
2	Hexagon bolt M5x16	2
3	Fixing bracket	1
4	Angle sensor bracket	1
5	Hexagon socket head cap screws M3×6	2
6	Spring washer 3	2
7	Plain washer 3	2
8	Angle sensor assembly	1
9	Hexagon nut M5	2
10	Angle sensor bracket 3	1
11	Cross recessed countersunk head screws M5×8	2

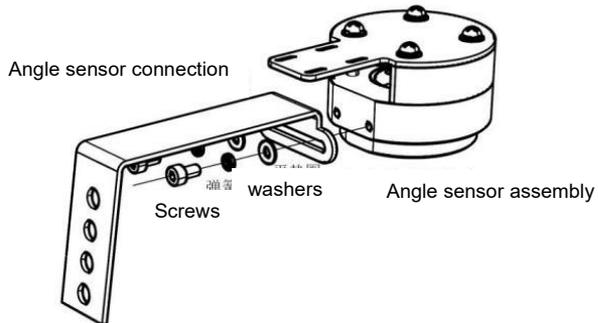


#### 4.2.2 Installation steps of Hall Angle Sensor

1. Check the structure of the front axle spindle of the vehicle's left/right wheel, and then select the suitable bracket. (The figure below shows an example of installing the angle sensor bracket 3)

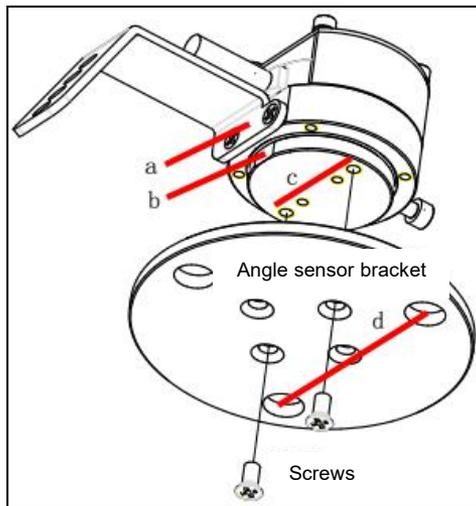


2. Install the angle sensor bracket. Please fix it with 2 Hexagon socket head cap screws M3×6 and washers.

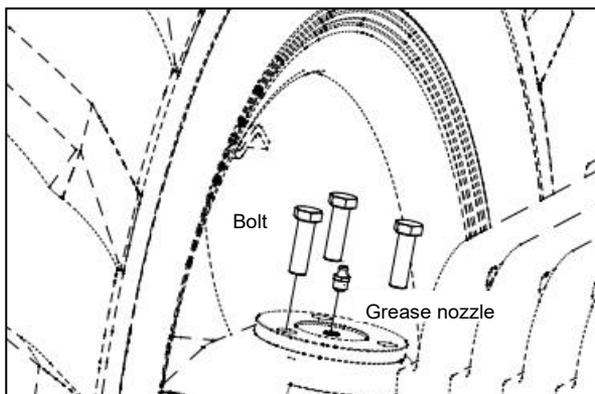


6. Install the angle sensor bracket. Please fix angle sensor assembly and its bracket with 2 cross recessed countersunk head screws M5x8.

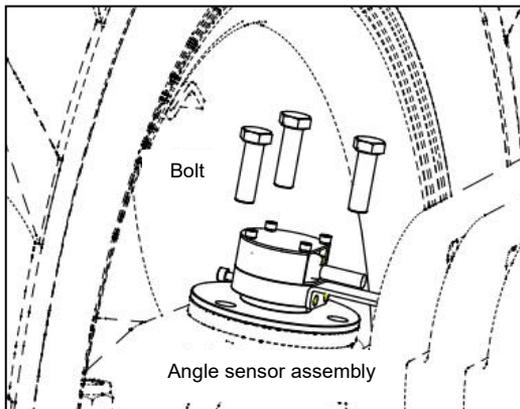
**Note: The plane a should be parallel to plane b, and line c should be parallel to line d.**



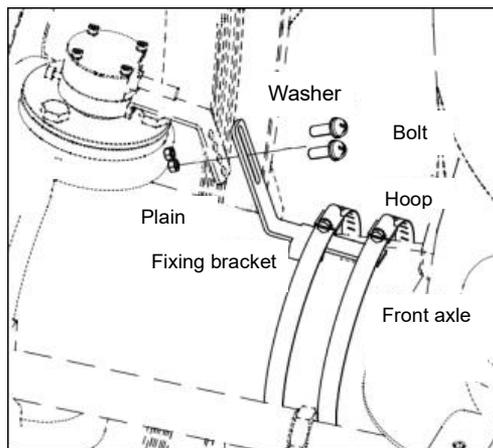
4. Remove the spindle bolts and grease nozzles of the front axle.



5. Install the angle sensor assembly. Fix the assembly with bolts removed in step 4.

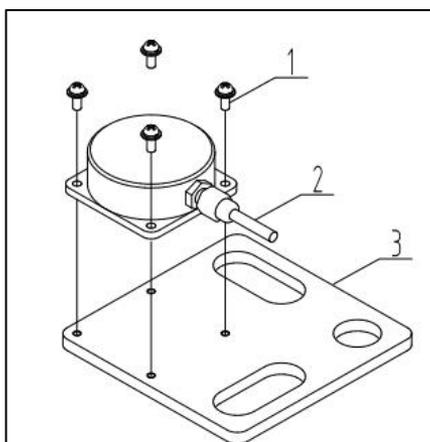


6. Install the fixing bracket. Connect the angle sensor assembly and fixing bracket with 2 hexagon bolts M5x16, hexagon nuts M5, spring washer 5 and plain washer 5, and then fix the fixing bracket with the front axle using 2 hose hoops.



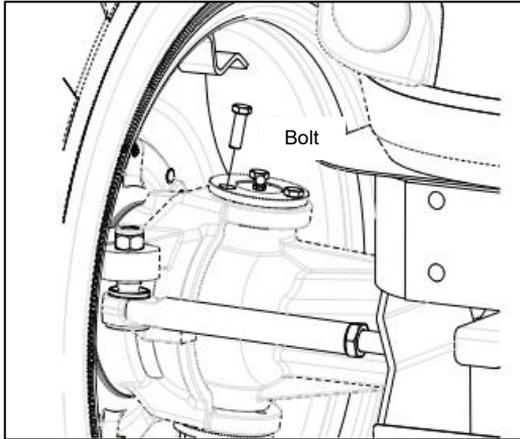
#### 4.2.3 Materials required for altitude angle sensor installation

No.	Name	Quantity
1	Bolt with elastic flat washer M3x8	4
2	Altitude Angle Sensor	1
3	Altitude Angle Sensor Bracket	1

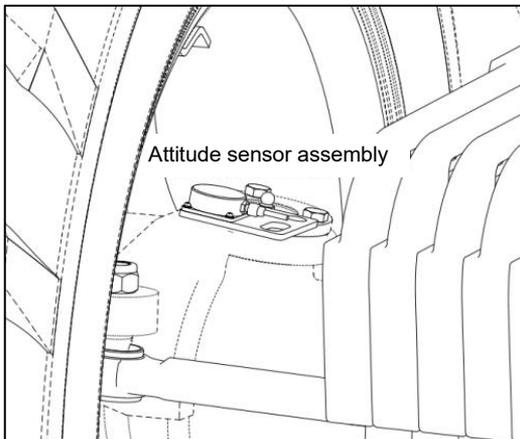


#### 4.2.4 Installation steps of Altitude Angle Sensor

1. Please remove one of the pivot bolts of the front axle.



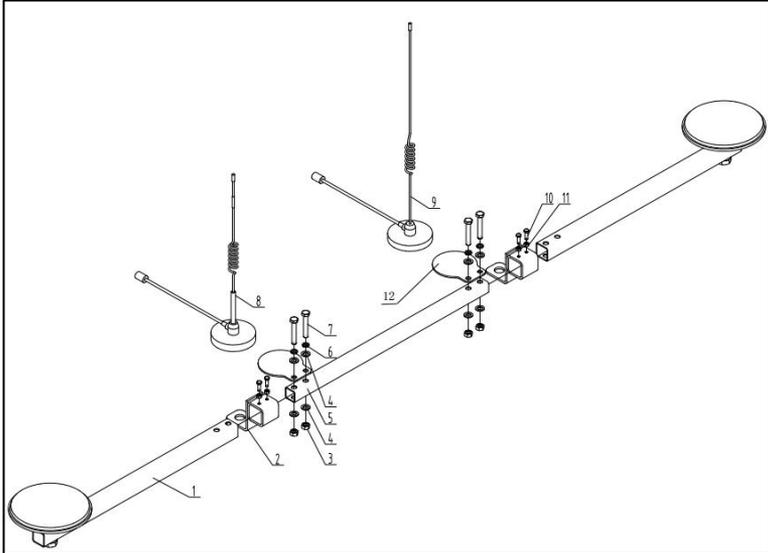
2. Install the attitude sensor assembly on the front axle. Adjust the position of the wiring harness, and then tighten the original bolts to the front axle.



### 4.3 Installation of antenna

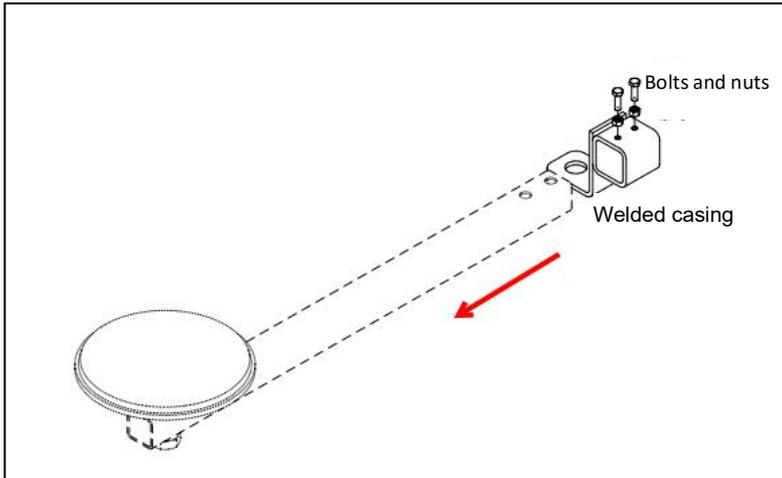
#### 4.3.1 Materials required for antenna installation (4G antenna/Radio antenna)

No.	Name	Quantity
1	GNSS Antenna Assembly	2
2	Welded casing	2
3	Hexagon nut M8	4
4	Washer 8	4
5	Antenna connector	1
6	Spring washer	4
7	Hexagon bolt M8x50	4
8	4G antenna	1
9	Radio antenna	1
10	Hexagon bolt M5x16	4
11	Hexagon nut M5	4
12	Suction cup base	2

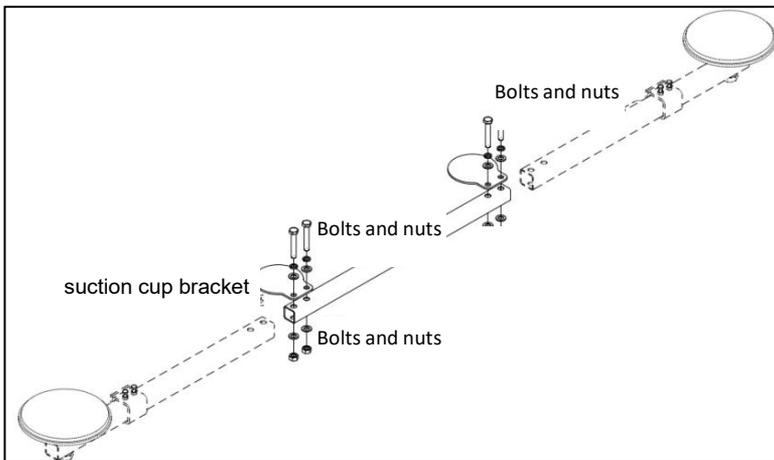


#### 4.3.2 Installation steps of antenna

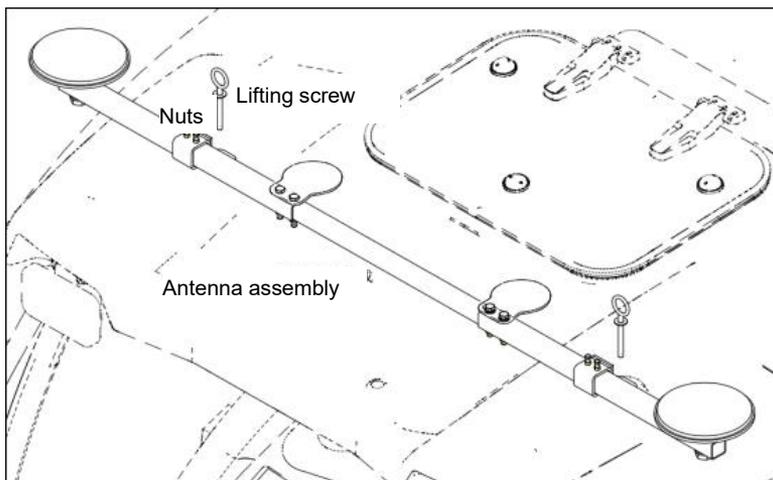
1. Weld the casing into the GNSS antenna assembly, so that the casing can be welded and moved left and right on the GNSS antenna assembly. And then install it with 4 hexagon bolts M5x16 and hexagon nuts M5, but do not tighten them at this moment.



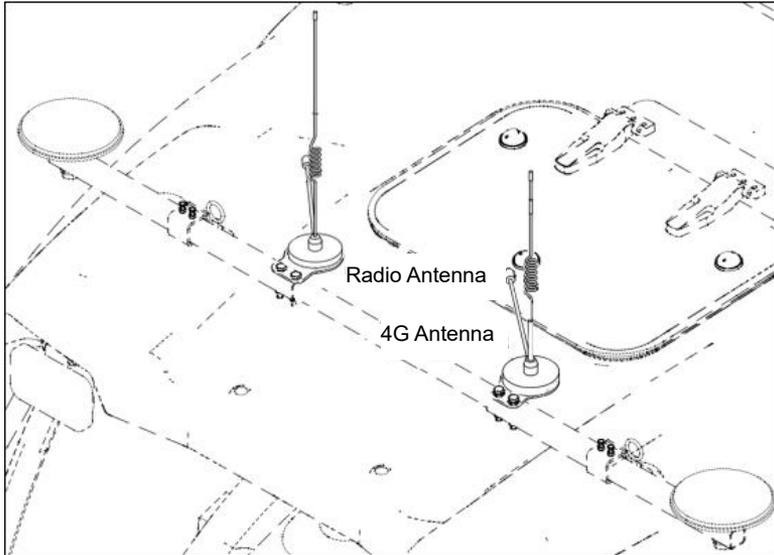
2. Assemble the antenna bracket. Insert the two GNSS antenna assembly into the antenna connector, align the four holes, and fix the suction cup bracket to the antenna assembly with 4 hexagon head bolts M8x50, spring washers 8, 8 flat washers 8 and hexagon nuts M8.



3. Install the antenna bracket assembly on the ceiling of the vehicle. Ensuring the 2 GNSS antennas are symmetrical and perpendicular to the body center of vehicle by adjusting the position of the casing weldment. After that, tighten 4 hexagon nuts M5 so that the antenna bracket assembly cannot move leftwards and rightwards, and then fix the antenna assembly through the screws on the ceiling.



4. After the antenna assembly is fixed, attach the 4G antenna and the radio antenna to the antenna connector.

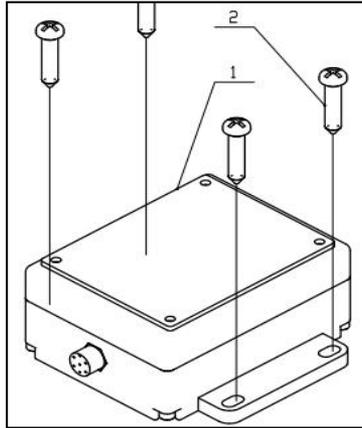


**\*The right-hand side of the vehicle forward direction should be GNSS antenna 1, the left side should be GNSS antenna 2. Please follow this instruction to connect the corresponding antenna feeder.**

#### **4.4 Installation of IMU**

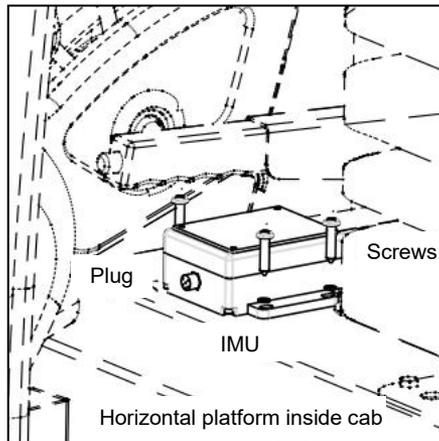
##### **4.4.1 Materials required for IMU installation**

<b>No.</b>	<b>Name</b>	<b>Quantity</b>
1	IMU	1
2	Self-tapping screw ST4.8×25	4



#### 4.4.2 Installation steps of IMU

1. Install IMU. Place IMU at a horizontal position inside the cab, and then align the connecting plug with the forward direction of the vehicle, and fix IMU with 4 self-tapping screws.

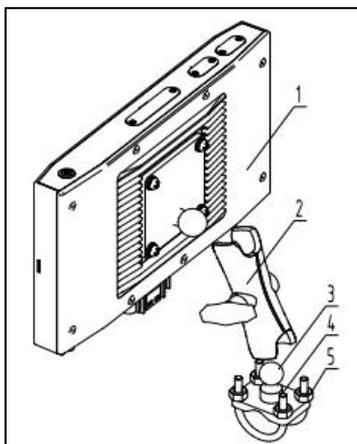


**Note:** The IMU shall be placed horizontally, with the plug in the direction same as the traveling direction of the vehicle.

## 4.5 Installation of control terminal

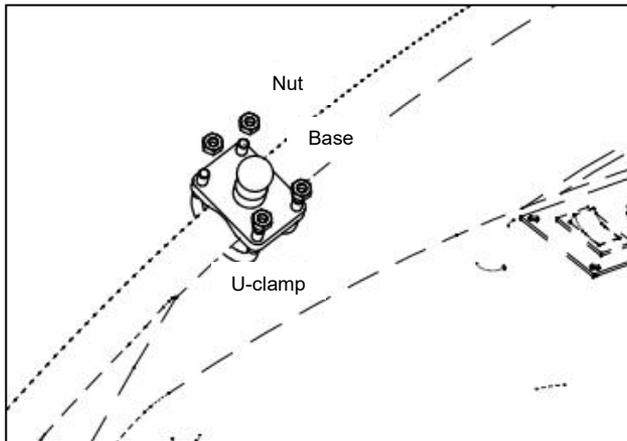
### 4.5.1 Materials required for control terminal installation

No.	Name	Quantity	Remarks
1	Control terminal	1	
2	Connecting base	1	Provided with the control terminal assembly
3	Mounting bracket	1	
4	Nut	4	
5	U-hook	2	

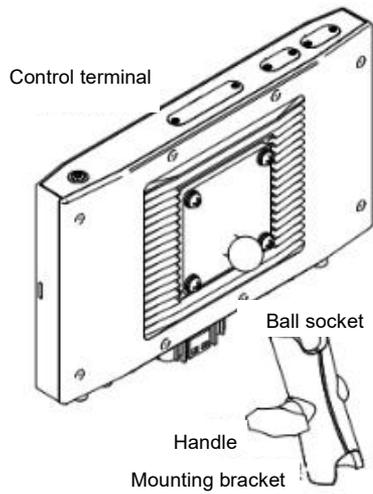


#### 4.5.2 Installation steps of control terminal

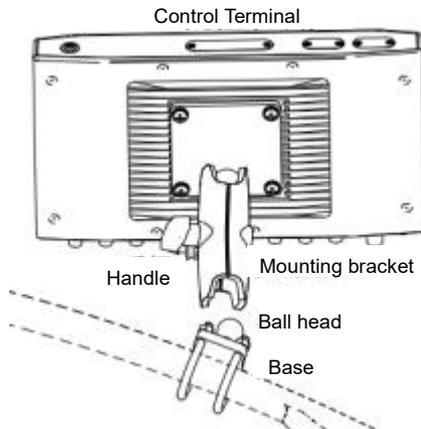
1. Fix the base. Select proper round steel handle position on the right door (at the control lever-side door), and then fix it with U-bolts.



2. Rotate the mounting bracket handle counterclockwise and install the control terminal into the ball socket of the mounting bracket.



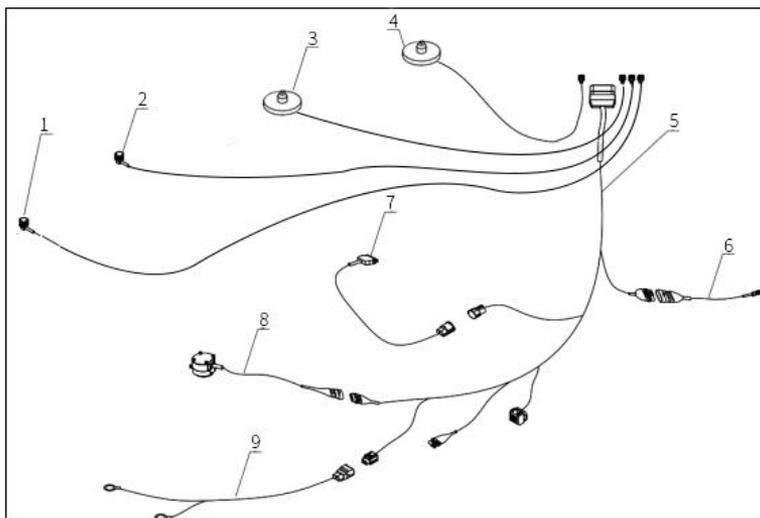
3. Install control terminal installed in step 3 onto the base ball head and rotate it clockwise to ensure that the control terminal is fixed firmly without shaking.



## 4.6 Installation of cable harness

### 4.6.1 Materials required for installation of cable harness

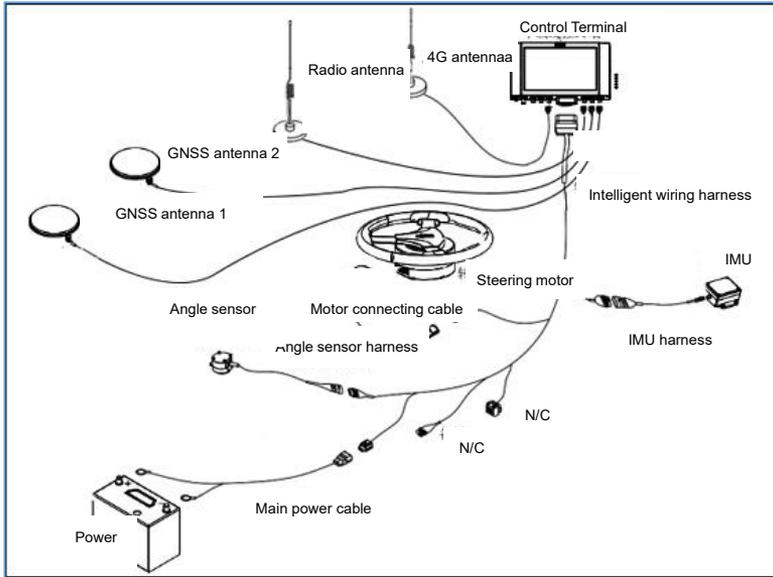
No.	Name	Quantity
1	#1 GNSS Feeder	1
2	#2 GNSS Feeder	1
3	Radio antenna connecting cable	1
4	4G antenna connecting cable	1
5	Intelligent Main Wiring Harness ( II )	1
6	IMU wiring harness	1
7	Steering motor connecting cable	1
8	Angle sensor wiring harness	1
9	Steering motor main power cable	1



#### 4.6.2 Installation steps of cable harness

Please connect the cable plugs accordingly as shown below.

**Note: Connect the main power cable to the negative terminal of the power supply, and then to the positive terminal, and finally, connect other plugs.**



## 4.7 Installation of SIM card

### 4.7.1 Materials required for installation of SIM card

No.	Name	Quantity
1	SIM Card	1
2	Thimble	1
3	tweezers	1
4	Phillips screwdriver	1

**SIM Card Note:**

1. Please buy a SIM card that supports the frequency bands of our 4G module in control terminal. The 4G module currently used in FJDynamics Autosteering Kit is EC25-G, which supports the following frequency bands. Please confirm that with the SIM card supplier.

LTE FDD: B1/B2/B3/B4B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28.

LTE TDD: B38/B39/B40/B41

UMTS: B1/B2/B4/B5/B6/B8/B19

GSM: B2/B3/B5/B8

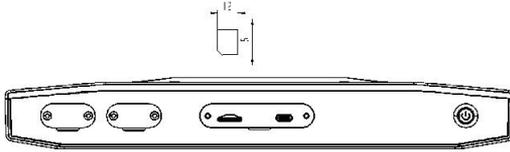
2. Please make sure that the dataflow service of the SIM card you purchased has been activated.

3. After installing SIM card, please confirm whether the APN and network type needs to be set according to the Instructions. If necessary, please turn on control terminal and complete the network configuration in the built-in Android system.

**4.7.2 Installation of SIM card**

1. Please use Phillips screwdriver to unscrew the T3 cover of the top control box of the control terminal to expose the SIM card insertion interface.

2. With the SIM card chip facing up, use thimble and tweezers to slowly insert the SIM card into the proper position of the SIM card slot in the top T3 interface.



Above all, the installation of the FJDynamics autosteering kit has been completed.

## 5. System debugging

### 5.1 Debugging site requirements

1. The agricultural machinery shall be in good conditions and all parts shall work normally.
2. The agricultural machinery shall not be attached with accessories.
3. The agricultural machinery shall be balanced by counterweights.
3. There shall be no tall trees, buildings and other obstacles affecting the satellite signal around the debugging site.
4. There shall be no high voltage wire within 150m around the debugging site.
5. The debugging site shall be horizontal, with a length not less than 50m and a width not less than 10m.
6. The floor of debugging site shall be paved with cement or asphalt.
7. The debugging site shall not be on a public road. During the debugging, there

shall be no irrelevant personnel around the agricultural machinery to prevent personal injuries.

## **5.2 Power-on and Startup**

### **5.2.1 Inspection before power-on**

1. Check whether the power connection is correct
2. Check whether the power supply voltage is consistent with the requirements

### **5.2.2 Inspection after power-on**

1. Check whether the control terminal power light is on after power-on.
2. Check whether the control terminal program can be started normally after its power switch is pressed.

## **5.3 Parameter Calibration**

For details on parameter calibration, please refer to the Software User Manual of FJDynamics Autosteering Kit.

## 6. Appendix

### 6.1 Main Hardware and its Specifications

No.	Assembly	Components	Specifications
1	Control Terminal	Control Terminal	<p>Size: 300×190×43mm;</p> <p>10.1-inch capacitive touch screen, LED backlight, 1280*800 pixels, 700cd/m<sup>2</sup> LCD; Dual speaker;</p> <p>2G RAM, 8G ROM;</p> <p>Various digital and analog output interfaces, etc.</p> <p>Power supply: 10-30V;</p> <p>RF signal, Positioning satellite and 4G signal etc.;</p> <p>Operating temperature: -30℃~+70℃;</p> <p>Storage temperature: -40℃~+85℃;</p> <p>IP rating: IP65;</p> <p>Relative Humidity: 0% to 95%, @40℃ (non-condensation)</p> <p>WIFI specification: 2.4GHz frequency band, frequency range: 2.4GHz-2.5GHz, output power:</p>

			14dB±1.5dB
2	Antenna Assembly	GNSS Antenna	Frequency range: GPS L1/L2, GLONASS L1/L2, BDS B1/B2/B3; Operating voltage: 3.3~12VCD; Operating current: ≤45mA; Size: 152*63mm
3		4G Antenna	Suction cup antenna: Frequency range: B1/B2/B3/B5/B8/B38/B39/B40/B41; VSWR: ≤2.0; Gain (dBi): 2±0.5; Impedance (Ω): 50; Polarization: Linear, Vertical; Antenna size: Φ370*82mm; Operating temperature: -20℃~+60℃
4		Radio Antenna	Suction cup antenna: Frequency range: 433/470MHz; VSWR: ≤2.0; Gain(dBi): 1±0.5; Impedance (Ω): 50; Polarization: Linear, Vertical; Antenna size: Φ490*82mm; Operating temperature: -20℃~+60℃

5	IMU	IMU	<p>Power input: 5V;</p> <p>Acceleration accuracy: 0.09mg;</p> <p>Gyroscope accuracy: 0.004°/s;</p> <p>Heading angle accuracy: 1°;</p> <p>Roll and pitch angle: 0.5°</p>
6	Angle Sensor	Angle Sensor	<p>Power supply: 5V;</p> <p>Update frequency: typical 3.4KHz;</p> <p>Resolution: &lt; 0.1°;</p> <p>IP rating: IP67;</p> <p>Operating temperature: -40°C~+85°C</p>
7	Electric Steering Wheel	Steering Wheel	<p>Power supply: 12V/24V;</p> <p>Peak torque: 20Nm (12V); 30Nm (24V);</p> <p>IP rating: IP65</p>
8		Steering Motor (12V /24V)	<p>Power supply: 12V/24V;</p> <p>Peak torque: 20Nm (12V); 30Nm (24V);</p> <p>IP rating: IP65</p>
9		Splined Sleeve	<p>Power supply: 12V/24V;</p> <p>Peak torque: 20Nm (12V); 30Nm (24V);</p> <p>IP rating: IP65</p>





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