

# EG10 High-Precision Excavator Guidance System Manual

**Core Summary:** The EG10 High-Precision Excavator Guidance System integrates **GNSS high-precision positioning, external IMU attitude sensing, and CAD design data** to visualize design results in real-time on the excavator operation screen, achieving **construction processes without manual stakeout, with high-precision guidance**. This system is specifically designed for earthwork operations such as slope trimming, trenching, and leveling, effectively solving traditional construction problems that rely on manual measurement and have difficulty ensuring precision, thereby improving construction efficiency and quality.

## Product Overview

The EG10 High-Precision Excavator Guidance System is an intelligent construction solution specifically designed for engineering machinery. By integrating **centimeter-level GNSS positioning, high-precision IMU attitude sensing, and professional construction guidance software**, the system maps design drawings in real-time to the excavator operation interface, allowing operators to intuitively and precisely control bucket position, achieving **stakeout-free construction with what-you-see-is-what-you-get** effects.

### Core Advantages of EG10 System:

- **High-precision construction:** Centimeter-level positioning accuracy ensures construction quality
- **Efficiency improvement:** Reduces manual stakeout time, increases construction efficiency
- **Easy operation:** Intuitive graphical interface reduces reliance on skilled operators
- **Wide applicability:** Suitable for various earthwork operations including slope trimming, trenching, leveling, foundation pit excavation

This system is applicable to various earthwork scenarios, including but not limited to **slope trimming, trenching, leveling, foundation pit excavation**, etc., significantly improving construction accuracy, reducing rework, and decreasing reliance on skilled operators.

# Appearance Illustration and Structure Introduction

## Overall System Appearance Layout

The EG10 system hardware consists of four core components that work together to achieve high-precision guidance functions. The typical installation positions of each component on the excavator are as follows:

- External IMU: Installed on the excavator bucket, serving as the core attitude sensor of the system
- Mounting bracket: Used to secure IMU, receiver and other equipment, providing a firm installation foundation
- V10a receiver: Typically installed on the cab roof or boom open area, providing positioning reference
- T10 tablet: Installed in the driver's cab, serving as the human-machine interface



External IMU Device Appearance

## External IMU Detailed Structure

The external IMU is the key component for the EG10 system to achieve **high-precision bucket attitude sensing**, with its structural design fully considering the harsh operating environment of engineering machinery.

### Core Structural Features:

- **Sensor configuration:** Uses **industrial-grade 6-axis** sensors (3-axis accelerometer + 3-axis gyroscope), capable of precisely measuring bucket **pitch**

## angle and roll angle

- **Connection method:** Equipped with **quick-detachable** "dog bone" connectors, supporting **welding-free installation**, greatly simplifying deployment process
- **Protection rating:** Housing uses high-strength engineering plastic, interfaces equipped with **waterproof and dustproof sealing rings**, adapting to dusty, humid construction site environments
- **Installation flexibility:** Can adapt to different types of mounting brackets through adapter seats, meeting various excavator installation requirements

### Diagram Annotation Description:

- Status indicator light: Multi-color LED indicator light, displaying device working status
- Waterproof data interface: Used to connect power and data transmission cables
- "Dog bone" connector: Key component for quick installation and removal
- Device fixed housing: High-strength shell protecting internal precision sensors

## Indicator Light Status Detailed Explanation

The indicator lights of the EG10 system are important for judging device working status, with both external IMU and V10a receiver equipped with multi-status indicator lights.

### Power and Working Status Indication

- **Green steady light:** Device powered normally, in standby or stable working state
- **Red steady light:** Power fault or voltage abnormality, need to immediately check power supply circuit
- **Indicator light not lit:** Device not powered or power connection fault
- **Green slow flash** (approximately 1 second per flash): Device starting up or initializing
- **Green fast flash** (approximately 3 flashes per second): Device attempting to establish data connection (such as IMU pairing with receiver/tablet)
- **Blue steady or slow flash:** Data connection stable, normally transmitting sensor data
- **Yellow flashing:** Sensor data abnormal or system prompting need for calibration
- **Red-green alternating flash:** System detecting serious error, need to restart device or contact technical support

## Hardware Components

## Core Hardware Priority

According to functional importance in the system, EG10 hardware components are ranked by the following priority:

### 1. External IMU (Core Sensing Unit)

As the **eyes** of the system, the external IMU directly measures the spatial attitude of the bucket, with its measurement accuracy and stability **directly determining** the final construction guidance accuracy. Any installation looseness or calibration deviation will cause guidance error.

### 2. Mounting Bracket (Physical Foundation)

Provides **physical stability** for device installation. The firmness of the bracket directly affects IMU data reliability. The system provides **magnetic fixation** and **welding fixation** methods, users should choose according to actual working conditions.

#### Mounting Bracket Component Description:

- **Bracket body:** Main support structure
- **Ring magnet:** Strong magnetic suction disk for magnetic fixation method
- **Threaded connectors:** Used to connect IMU or other devices
- **Adapter seat:** Adapts to different device interfaces

## Mounting Bracket Fixation Method Detailed Explanation

### Magnetic Fixation Method

- **Working principle:** Adsorbs onto excavator metal surface through strong magnetic suction disk
- **Installation requirements:** Installation surface must be **clean, dry, flat**, free from oil stains, rust or peeling paint
- **Advantages:** Quick installation and removal, no damage to original excavator structure
- **Applicable scenarios:** Temporary engineering, equipment needing frequent changes, or when excavator surface conditions are good
- **Precautions:** Under strongly vibrating working conditions, need secondary reinforcement with binding straps

### Welding Fixation Method

- **Installation requirements:** Professional welder **fully welds** bracket base to appropriate position on excavator boom
- **Advantages:** **Extremely firm** connection, no loosening risk, suitable for long-term high-intensity vibration conditions
- **Applicable scenarios:** Fixed-site long-term operations, uneven excavator surface or heavy oil contamination preventing magnetic fixation
- **Precautions:** Clean welding slag after welding, apply anti-rust treatment

**Selection recommendation:** For most construction scenarios, especially those with strong vibration, **strongly recommend using welding fixation method** to obtain optimal long-term stability and data reliability.

## Installation Instructions

**Safety Warning:** All installation or removal operations must be performed with the excavator **engine completely shut off**, equipment **parked on flat, solid ground**, and ensuring all moving parts (boom, bucket, etc.) are properly secured. Installation operations are strictly prohibited while the excavator is running or without taking safety measures.

## Pre-installation Preparation

- Equipment inspection: Unbox and check all hardware (IMU, bracket, receiver, tablet, cables) for completeness and no visual damage
- Site preparation: Park excavator on flat, solid ground, perform safety operations such as shutdown, parking brake
- Surface treatment: Plan installation positions (outer side of boom, cab roof), thoroughly clean surface oil stains, mud and surface rust with sandpaper and cleaner

## Step-by-Step Installation Process

### Step 1: Mounting Bracket Fixation

#### Magnetic method operation:

- Press magnetic suction disk against cleaned installation surface
- Apply force to ensure firm adsorption, check for no shaking
- Can perform secondary reinforcement with binding straps if needed

#### Welding method operation:

- Professional welder welds bracket base to specified position
- Ensure welding is firm and flat

- Allow cooling after welding, clean welding slag

## Step 2: External IMU Installation

- Insert IMU's "dog bone" connector into adapter seat at end of bracket, hearing "click" sound indicating locking
- Adjust IMU angle so arrow on housing roughly points toward excavator forward direction
- Tighten fixing screws, ensure IMU has no shaking
- Connect IMU power and data cables, ensure interfaces are fully inserted and waterproof screw caps are tightened

## Step 3: V10a Receiver Installation

- Install receiver onto bracket on cab roof or boom upper area
- Ensure antenna faces sky, with unobstructed view (away from large metal structures)
- Connect cables and ensure firm connection

## Step 4: T10 Tablet Installation

- Fix tablet bracket inside cab at position convenient for operator observation and not prone to collision
- Place tablet into bracket slot, adjust to suitable viewing angle
- Connect power cable

## Step 5: Wiring Connection and Cable Management

- Connect all cables (power, data) between devices according to system connection diagram
- Use cable ties to **neatly bundle** cables
- Route cables along existing excavator wire harness or structural components, avoid suspension or being squeezed, scraped by moving parts

## Post-installation Checklist

After installation completion, please check the following items in sequence, only power on after confirming all are correct:

- All devices (IMU, receiver, bracket) firmly fixed, no shaking when forcefully rocked
- All waterproof interfaces tightened
- Cable routing safe, no sharp bends, stretching or wear risk

- Receiver installation position meets open, unobstructed requirement
- IMU installation direction roughly correct (arrow pointing forward)
- Tablet installation position convenient for operator observation and safe

## Calibration Operations

Calibration is the key step to establish an accurate mathematical model between excavator **physical dimensions, joint motion relationships** and **sensor data**. **All calibration operations must be performed on level, solid ground.**

### Boom Calibration

This step is used to calibrate excavator boom and arm geometric parameters, establishing mechanical arm motion model.

#### Pre-calibration preparation:

- Ensure excavator parked on **level, solid** ground
- Confirm IMU installation firm, no looseness
- Prepare measuring tape for measurements

#### Calibration steps:

##### Input basic parameters

- Accurately input excavator **boom length** in T10 tablet software
- This value should be pin center to pin center distance, must match excavator model specifications

##### Bucket ground contact position calibration

- Place bucket flat, **completely pressed against** ground
- Confirm this position as reference zero point in software

##### Boom motion range calibration

- Retract boom inward to **mechanical limit position** (cannot move further inward)
- Confirm this position in software
- Extend boom outward to **mechanical limit position** (cannot move further outward)
- Confirm this position in software

##### Vertical position calibration

- Operate boom so line connecting bucket pin center and excavator swing center is **perpendicular to ground**
- Can use simple plumb bob to assist in judging verticality

- Confirm this position in software

**Calibration success indication:** Software interface displays "Boom calibration successful", providing accuracy evaluation value. If display fails, check if all positions are accurately calibrated.

## Bucket Calibration

This step is used to calibrate bucket geometric dimensions, especially critical **D-I value** (straight-line distance from bucket pin center to tooth tip).

### Calibration steps:

#### Select bucket model

- Select bucket template in software accessory library that **exactly matches** actual bucket model
- If no corresponding model in library, select closest matching template

#### Move to limit positions

- Operate bucket to **fully closed** limit position
- Confirm this position in software
- Operate bucket to **fully open** limit position
- Confirm this position in software

#### Measure and input D-I value

- Using measuring tape, **precisely measure** straight-line distance from bucket pin center to tooth tip when bucket is fully open
- **Accurately input** measured value into software specified field
- Recommend measuring three times and taking average to ensure accuracy

#### Complete calibration

- Follow remaining software prompts to complete steps
- Until "Bucket calibration successful" displayed

## Calibration Verification and Troubleshooting

### Verification method:

- After calibration completion, slowly operate excavator various movements (boom up/down, arm extend/retract, bucket rotate)
- Observe whether bucket icon movement on tablet screen is **continuous, synchronized, without jumps** with real bucket movement
- If significant deviation found, need to recalibrate

### Common failure causes and countermeasures:

Problem Phenomenon	Possible Cause	Solution Measures
Boom calibration failure	Ground not level	Move excavator to level ground and retry
Boom calibration cannot complete	Boom not moved to true mechanical limit	Ensure movement reaches limit position, mechanical stop reached
Parameter error prompt	Input boom length does not match actual	Verify excavator model specifications, input correct parameters
Bucket D-I value abnormal	Measurement taken when bucket not at fully open limit position	Re-operate bucket to limit position then measure
Large deviation after calibration during operation	IMU installation position shifted after calibration	Check and tighten IMU installation, recalibrate
System prompts need recalibration	Equipment reinstalled after removal or construction site changed	Execute complete calibration process

**Important reminder: Every time construction site changed, or any hardware reinstalled or removed, must re-execute complete boom and bucket calibration process.**

## Usage Precautions

### Daily Usage Precautions

#### Power management

- Check device battery level before startup, **below 20% should charge promptly**
- Avoid operation interruption and data loss due to battery depletion
- Use device **original charger** for charging

#### Device operation

- Avoid using sharp objects to operate tablet touchscreen
- During device operation, **strictly prohibit hot-plugging** any data or power

interfaces

- If displayed positioning deviation on tablet **suddenly and continuously increases**, immediately stop operation, check device connections

### **Environmental adaptability**

- Device operating temperature typically  $-20^{\circ}\text{C}$ ~ $60^{\circ}\text{C}$ , avoid prolonged exposure to extreme temperatures or direct sunlight
- Prevent device contact with large amounts of water or mud, clean with dry cloth
- **Prohibit direct water flushing** of core components (IMU, receiver)

### **Electromagnetic environment**

- Devices should be **kept away** from strong electromagnetic interference sources such as large generators, welding machines
- Avoid prolonged operation under high-voltage power lines

## **Regular Maintenance Points**

### **Cleaning maintenance**

- Regularly clean device housing, screen and **magnetic suction disk surface** with dry cloth
- Remove dust, oil stains, keep equipment clean
- Check waterproof interface sealing rings for integrity

### **Tightness inspection**

- Weekly or every 50 operating hours, check **all brackets, connectors** for tightness
- Pay special attention to IMU installation firmness, prevent loosening due to vibration
- Check cables for wear, aging signs

### **Long-term storage**

- If equipment long-term idle, maintain battery level at **50%-70%**
- Perform supplemental charging every 2-3 months, prevent battery over-discharge
- Store in dry, cool place, avoid high temperature, high humidity environments

## **Safety Operation Specifications**

### **Pre-operation inspection**

- Check equipment installation firmness before each operation
- Confirm indicator light status normal

- Verify system positioning accuracy meets requirements

### **Operation monitoring**

- Maintain attention to information displayed on tablet
- If abnormal prompts or accuracy decrease found, timely pause operation for troubleshooting
- Avoid forcing operation under abnormal system status

### **Equipment disposal**

- **Prohibit users from self-disassembling, modifying** device internal structure
- Any faults please directly contact FJDynamics official after-sales service
- Discarded equipment should be disposed according to electronic waste processing specifications

## **Common Problem Solutions**

### **Installation Problems**

#### **Problem 1: Bracket magnetic suction not firm, easily loosens during operation**

##### **Possible causes:**

- Installation surface has oil stains, rust or paint layer
- Magnetic components demagnetized due to long-term use or impact
- Installation surface uneven, insufficient contact area

##### **Solution measures:**

- Use sandpaper and cleaner to **thoroughly clean** oil stains, rust from installation surface
- If magnetic force significantly weakened, contact after-sales service to replace new magnetic accessories
- Consider switching to welding fixation method, especially for long-term high-intensity operation scenarios

#### **Problem 2: After external IMU installation, software shows no IMU signal**

##### **Possible causes:**

- IMU data interface not fully inserted or waterproof screw cap not tightened
- Data cable connecting IMU damaged or poor contact
- IMU device not powered or power supply fault

##### **Solution measures:**

- Check and re-insert all IMU interfaces firmly, ensure waterproof screw caps

tightened

- Replace data cable for testing, troubleshoot cable problems
- Check IMU power connection, confirm power supply normal

## Calibration Problems

### **Problem 3: Boom calibration failure or cannot complete calibration process**

#### **Possible causes:**

- Calibration ground uneven, causing reference position error
- During calibration, boom not moved to true mechanical limit position
- Input boom length parameters don't match actual excavator dimensions

#### **Solution measures:**

- Move excavator to **level, solid** ground and recalibrate
- During operation ensure boom reaches mechanical limit, cannot move further
- Verify excavator model specifications, input correct boom length parameters

### **Problem 4: Bucket D-I value measurement abnormal or no change after calibration**

#### **Possible causes:**

- Measurement taken when bucket not at fully open limit position
- Measuring tool inaccurate or measurement method incorrect
- Wrong bucket model selected

#### **Solution measures:**

- Re-operate bucket to fully open limit position then measure
- Use standard measuring tape, measure straight-line distance from pin center to tooth tip precisely
- Re-select correct bucket model in software accessory library

### **Problem 5: After calibration success, find large guidance deviation during actual operation**

#### **Possible causes:**

- IMU installation position accidentally shifted after calibration completion
- Calibration steps performed incorrectly, need recalibration
- Construction ground slope differs significantly from calibration ground

#### **Solution measures:**

- Immediately stop operation, check IMU installation firmness, retighten
- On level ground, re-execute complete boom and bucket calibration

- If construction ground has slope, need to set corresponding ground reference in software

## Signal and Connection Problems

### Problem 6: V10a receiver has no GNSS signal or weak signal

#### Possible causes:

- Receiver installation position obstructed (such as close to cab, under trees)
- Local satellite signal conditions poor (canyons, high-rise areas)
- Receiver antenna connection fault

#### Solution measures:

- Move receiver to **more open position**, ensure antenna faces sky
- Wait for satellite signal conditions improvement, or change operation time
- Check antenna connection firmness, re-plug if necessary

### Problem 7: IMU data transmission unstable, intermittent

#### Possible causes:

- Data cable connecting IMU damaged or excessively bent
- Device power supply unstable, voltage fluctuations large
- Wireless transmission subject to strong interference

#### Solution measures:

- Check and organize cables, avoid sharp bends, replace data cable if necessary
- Check excavator power system, ensure stable power supply
- Investigate surrounding strong interference sources, adjust device position if necessary

### Problem 8: Tablet cannot search or connect to IMU/receiver

#### Possible causes:

- IMU or receiver Bluetooth/Wi-Fi not enabled or not in pairing mode
- Distance between devices too far, exceeding wireless transmission range
- Tablet software not granted Bluetooth/Wi-Fi connection permissions

#### Solution measures:

- Confirm IMU/receiver powered on and in pairing mode (indicator fast flashing)
- Shorten distance between devices, ensure within effective transmission range
- Check tablet system settings, ensure software granted necessary connection permissions

## **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.

Any 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.

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.