AlphaGeo L2 Plus
GNSS Receiver User Manual

Comprehensive Guide to Setup, Operation and Maintenance

Contents

1. Introduction

The Global Navigation Satellite System (GNSS) receiver is a device designed to determine precise geographic locations through signals from multiple satellites. GNSS technology encompasses systems such as GPS, GLONASS, Galileo, BeiDou, QZSS and SBAS. This manual provides detailed instructions for the setup, operation, and maintenance of your GNSS receiver, ensuring optimal performance and longevity.

Among the innovations shaping modern mapping and geographic measurements, the L2 Plus from Alpha GEO stands out as a prime example of cutting-edge technology. The AlphaGeo L2 Plus GNSS redefines portability and precision, combining a high-precision GNSS board, laser measurement, and IMU (Inertial Measurement Unit) in an ultra-compact body (120x61x41mm, 170g). Designed for efficiency, it delivers centimeter-level accuracy in diverse environments.

2. Key Features

GNSS receivers offer advanced features that include:

- 1408-channel GNSS engine supporting GPS, GLONASS, Galileo, BeiDou, QZSS and SBAS
- Integrated green laser (±1cm + 5mm/m accuracy, 100m range)
- 4D IMU with 120° tilt compensation (<2.5cm error)
- Bluetooth 4.0 & USB-C connectivity
- IP67 rated (-20°C to +75°C operation)

3. Components and Accessories

3.1. Device overview

Front View

Side View (Left)

L2 Plus Front View

1	Power LED
2	Bluetooth LED
3	Data LED
4	Satellite LED

L2 Plus Side View (Left)

5	Power / Laser measure button

Back view

Side View (Right)

L2 Plus Back View

6	Serial number

Bottom view

L2 Plus Bottom View

7	Green laser module
8	USB-C Port
9	Thread for ¼ adapter

4. L2 Plus GNSS receiver package

Single unit version:

10. L2 Plus Protective Storage Box – 1pcs
11. L2 Plus GNSS receiver unit – 1pcs.
12. L2 Plus ¼ GNSS pole adapter - 1pcs.
13. L2 Plus GNSS power adapter (Input: 100-240V ~50/60Hz 0.3A MAX, Output: 5.0V=3.0A)- 1pcs.
14. L2 Plus Charging cable USB → Type-C - 1pcs.

Bundle version:

10. L2 Plus Protective Storage Box – 1pcs.
11. L2 Plus GNSS receiver unit – 1pcs.
12. L2 Plus ¼ GNSS pole adapter - 1pcs.
13. L2 Plus GNSS power adapter (Input: 100-240V ~50/60Hz 0.3A MAX, Output: 5.0V=3.0A)- 1pcs.
14. L2 Plus Charging cable USB → Type-C - 2pcs.
15. Controller unit - 1pcs.
16. Controller unit power adapter (Input: 100-240V ~50/60Hz 0.3A MAX, Output: 5.0V=2.0A) -1pcs.
17. Controller holder / bracket – 1pcs.

Warning Note:

- Before proceeding with the setup, ensure that all components listed above are present.
- Store the equipment in its original packaging when not in use to prevent damage.
- Maintain a dry environment with humidity levels between 30-70%.
- Avoid exposing the components to temperature extremes, specifically below -20°C or above 60°C, to ensure optimal performance and longevity.

5. Powering On/Off the L2 Plus GNSS

5.1. Startup Process

1. **Initiation**
   - Press & hold power button (5) for **3 seconds**
2. **System Boot**
   - *Visual confirmation*:
     - All LEDs blink **2 times** (green LEDs + red battery LED)
   - *Meaning*:
     - Self-test completed
     - GNSS board initializing
3. **Operational Mode**
   - *Active status indicators*:
     - ◐ **Blinking green Bluetooth LED (2)** = Pairing mode active
     - ◐ **Blinking green Satellite LED (4)** = Acquiring GNSS signals
     - ● **Red battery LED (1)** = Shows power ON status

Note: First cold start may take longer (≤90 sec).

Normal Startup Timeline

Time After Power-On	LED State panel	System Status
0-3 sec	● ● ● ●	All LEDs are off	Power button held
3-5 sec	● ◐ ◐ ◐ x 2	Battery steady red, BT, DATA, SAT blinks	System booting
5+ sec	● ◐ ● ◐	Battery steady red, BT & SAT blinks, DATA off	Ready for pairing
5+ sec	● ● ◐ ●	Battery steady red, BT & SAT steady green, DATA blinks	GNSS sending data to controller via Bluetooth

Note: Connect to USB-C charger if red battery LED doesn't illuminate during power button press.
Minimum 20% charge required for cold starts

5.2. Shutdown Process

1. **Press & hold** power button for **3 seconds**
2. **Visual confirmation**:
   - All LEDs turn off after a single release
3. **Complete shutdown** occurs

Time After Power-Off	LED State panel	System Status
3-5 sec	● ● ● ●	All LEDs are off	Power button held

Note: The L2 Plus GNSS supports Bluetooth SPP3.0 + BLE5.0 Dual Mode for wireless communication. It **does not** support Wi-Fi or WEBUI interfaces.

6. Software Installation & Setup

Install the software provided onto your mobile device. The software will facilitate data collection and analysis.

Compatible Application

1. SurPro 6.x (Android-only)
    - Version requirement: v6.2 or later
    - Download: AlphaGeo official website

Prerequisites

- L2 Plus GNSS powered ON (see Page6: Power-On Sequence)
- Data controller (Android) with SurPro v6.x installed
- Bluetooth is enabled on both devices

7. First time Bluetooth Pairing Procedure for L2 Plus GNSS

1. Turn on L2 Plus GNSS receiver (page6).
2. Turn on the data controller.
3. Open SurPro v6.x on data controller.
4. *Fig. 1.* Tap **DEVICE** button.
5. *Fig. 2.* Tap **COMMUNICATION** button.
6. *Fig. 3.* Choose from **MODEL TYPE** menu corresponding GNSS unit (L2Plus).

Fig. 1

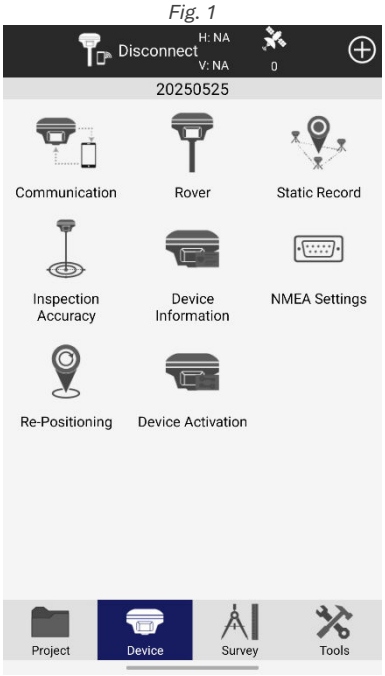


Fig. 2

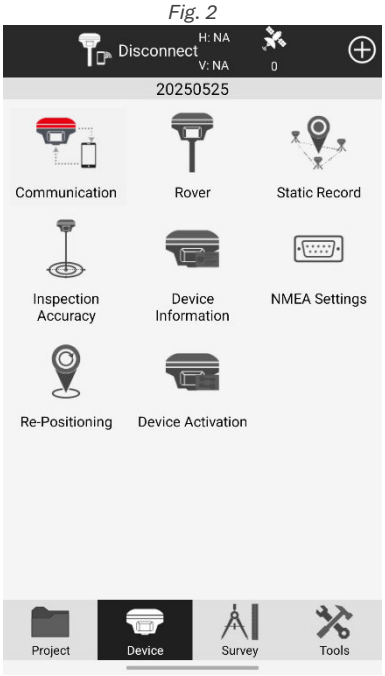
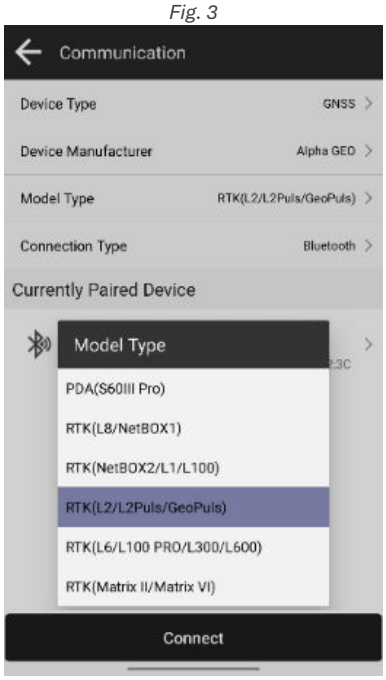


Fig. 3



7. *Fig. 4.* Goto **AVAILIABLE BLUETOOTH DEVICES**, find corresponding serial number which can be found on back side of L2 Plus (page4) of your unit.
8. *Fig. 5.* Tap **CONNECT** button, allow Bluetooth connection - popup window will appear once.
9. Wait for L2 Plus GNSS connection and controller via Bluetooth <10 sec.
10. *Fig 6.* Device connected successfully. Communication icon appears GREEN.

Fig. 4

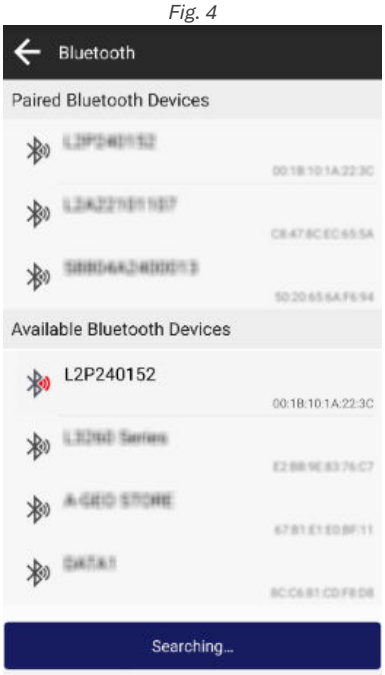


Fig. 5

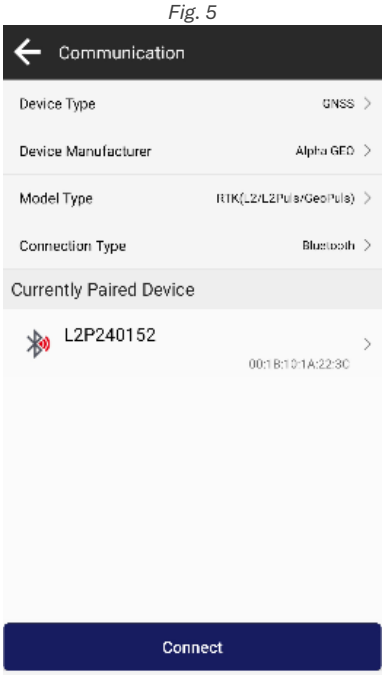


Fig. 6

Note:

- After initial pairing, L2 Plus will auto-connect to the last paired device when both are powered on.
- SurPro v6.x maintains the link unless:
  - Bluetooth is disabled
  - Device is forgotten in Android settings

Troubleshooting

Connection Issues

Symptom	Solution
L2 Plus not listed	1. Confirm Bluetooth is ON 2. Restart L2 Plus to re-enable pairing mode (◐ LED blinks)
"Connection Failed" in SurPro	1. Restart both devices 2. Delete L2 Plus from Android Saved Devices and re-pair
Intermittent Data Drops	1. Ensure devices are <10m apart 2. Avoid metal obstructions

8. Rover Mode Configuration

8.1. General Parameters

ℹ **Note:** Always press Stop Receiving RTK Corrections in SurPro before adjusting these parameters to prevent data corruption

Parameter	Description	Recommended Value	Impact
Cut-Off Angle	Minimum satellite elevation angle for positioning	**10°–15°**	Higher values reduce multipath errors but may limit satellite availability.
Diff Delay	Time threshold for accepting RTK corrections	**5–10 sec**	Shorter delays improve responsiveness but risk instability with weak signals.
Record Raw Data	Stores unprocessed GNSS observations	**Enabled for PPK**	Disabling saves storage space (~5MB/hr vs. 50MB/hr).

Configuration Workflow

1. **Pause RTK:**
   - In SurPro: Tap **Rover** > *RX Data Status* > **Stop Corrections** (Fig.7)
2. **Adjust General Parameters:**
   - Tap **General parameters** > *Change General Parameters* > Tap *"***OK***"* (Fig.8)
   - Tap **Apply** (Fig.9)
3. **Resume Workflow:**
   - Restart RTK (**Device > Re-Positioning**) after changes are saved.

Fig. 7

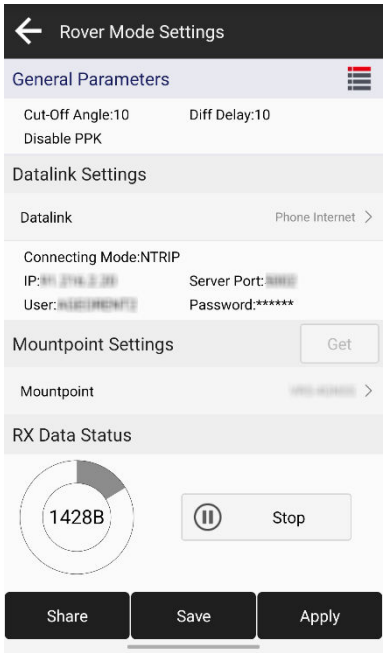


Fig. 8

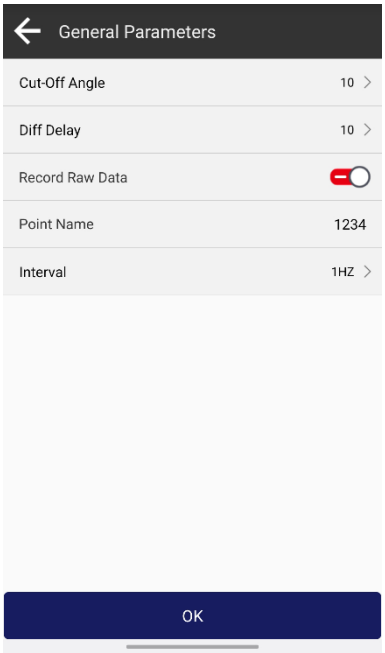
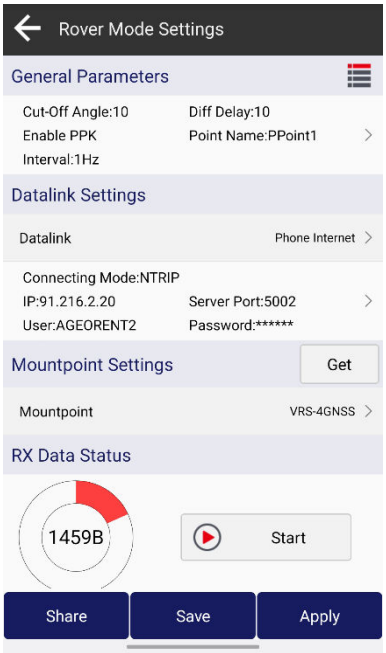


Fig. 9



🔧 **Troubleshooting**

Settings Not Applied:

- Ensure RTK corrections are stopped before editing

Frequent RTK Drops:

- Increase Diff Delay incrementally (2 sec steps)

8.2. Datalink Settings

ℹ **Note:** Not Available in L2 Plus - **Device Internet (no SIM/Wi-Fi/WEBUI)**

Available Connection Types

Type	Description	Compatibility
Phone Internet	Uses paired smartphone's cellular data via Bluetooth (NTRIP)	All Android/iOS devices with SurPro 6
PPP	Precise Point Positioning via correction streams (B2B, E6, RXN data types)	Requires external NTRIP service

Connection Mode Settings

Mode	Purpose	Configuration	Use Case
NTRIP	RTK corrections via internet	Requires: • NTRIP caster address • Port (e.g., 2101) • Mount point • Username/Password	Standard RTK surveying with cellular data
TCP Client	Direct connection to base station	Input: • Base station IP • Port (e.g., 2102) • Protocol (RTCM3.x)	Local base station setups without internet
APIS	AlphaGeo's proprietary data protocol	Auto-configured when using AlphaGeo CORS	Integrated AlphaGeo workflows

8.3. NTRIP Setup Guide

1. Select **NTRIP** Connection mode
2. Enter credentials from your correction service provider (IP, Port, User, Password) (Fig.10)
3. Tap **OK**:
4. Tap **Get** in Mountpoint Settings menu (Fig.11)
- Select Mountpoint for RTK corrections
5. Tap **Start** in RX Data Start (Fig.11)

Fig.10

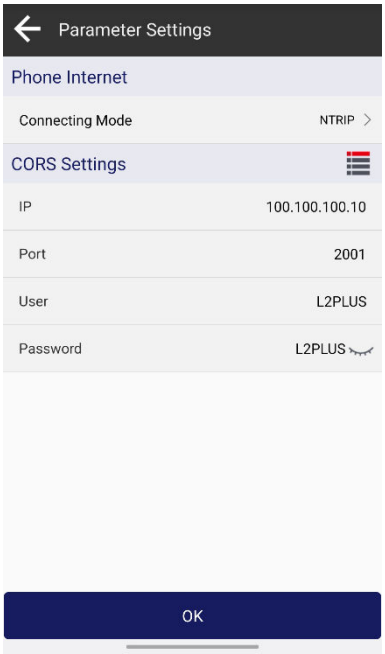
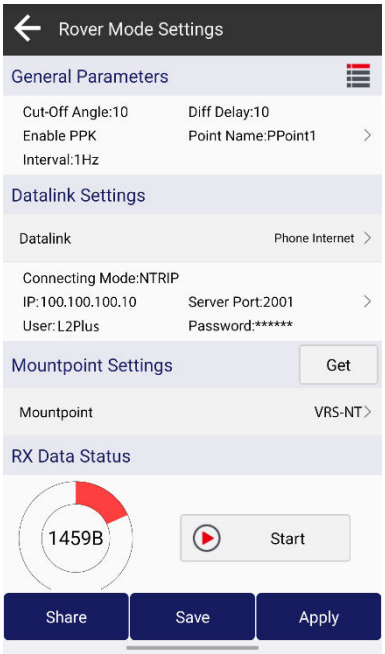


Fig.11



🔧 **Troubleshooting**

NTRIP Quick Reference

Issue Category	Symptoms	Solutions	Prevention Tips
Cellular Signal	"No Internet" error, intermittent data	• Toggle airplane mode • Switch to 4G • Relocate for better signal	Use signal booster apps
Credential Errors	"Invalid login", expired account	• Re-enter credentials • Contact provider for reset/subscription renewal	Store credentials securely (password manager)
Mountpoint Issues	"Not found" or incompatible format	• Verify exact name (case-sensitive) • Use RTCM3.2/3.3 (avoid MSM)	Bookmark preferred mountpoints
RTCM Quality	Float solution, high AR ratio	• Check baseline distance (<30km) • Increase Diff Delay to 10s	Monitor base station health logs
Occupied Credentials	"Account limit reached"	• Provider disconnects old sessions • Use unique logins per device	Enable auto-disconnect after idle
Port Blocking	Connection timeout	• Try port 443 (HTTPS) • Whitelist IP with IT admin	Pre-test at office
Time Sync	Timestamp errors in raw data	• Enable "Use Server Time" in SurPro	Regular device clock checks

8.4. TCP Client Setup Guide

Prerequisites

- Base station streaming RTCM3.x corrections
- Local network/IP radio with stable connection
- L2 Plus GNSS and base station in same subnet

Configuration Steps

1. **Configure Base Station**
   - Set output protocol: RTCM3.2 or 3.3
   - IP (e.g., 100.100.100.10)
   - Port (e.g., 5002)
2. **In SurPro 6□x**: (Fig.12)
   - IP (e.g., 100.100.100.10)
   - Port (e.g.,5002
3. Tap **OK**
4. Tap **Start** in RX Data Start (Fig.13)
5. **Verify Connection** (Fig.13)
   - SurPro status: "RTK Fixed" (after 5-60 sec)

Fig. 12

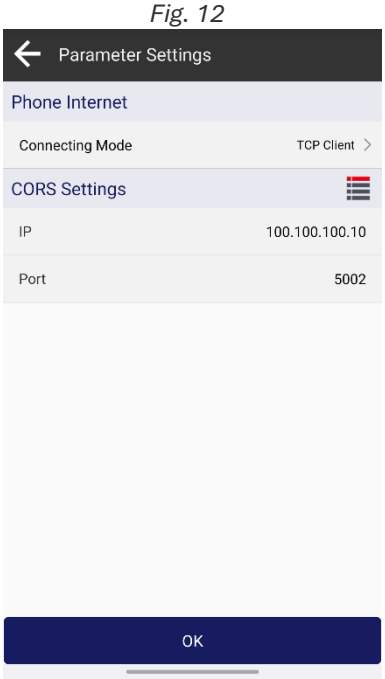
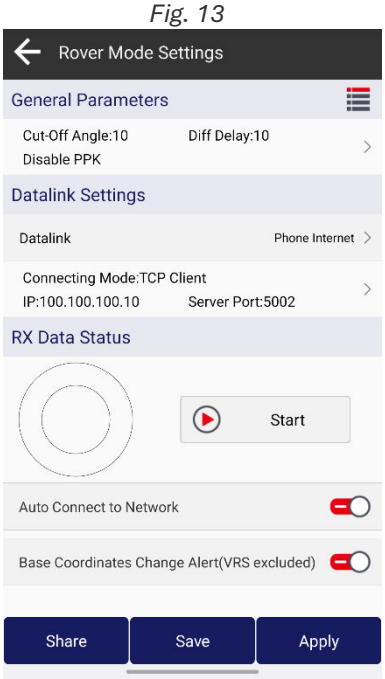


Fig. 13



🔧 Troubleshooting

Issue	Solution
"Connection refused"	1. Check base station firewall rules 2. Verify port forwarding
Intermittent data	1. Ping base station IP 2. Reduce network hops
Wrong protocol	Ensure base station outputs RTCM3.x (not CMR/CMR+)

Advanced Settings

- **Diff Delay**: Adjust (5-15 sec) for high-latency networks
- **Heartbeat Interval**: Set to 30 sec for unstable connections

ℹ **Note:** For > 30km baselines, use NTRIP instead.

8.5. PPP (Precise Point Positioning) Configuration Guide

Supported Data Types

Type	Source	Accuracy	Initialization Time
B2B	BeiDou PPP corrections	10-20cm (static)	30-45 min
E6	Galileo high precision	5-10cm (kinematic)	15-30 min
RXN	Multi-constellation blend	10-15cm	20-40 min

Configuration steps

1. Configure **PPP** service in SurPro 6.x
2. Choose **Datalink** Data type: (Fig.14)
   - B2B
   - E6
   - RXN
3. Tap **Apply**
4. **Device** window will appear (Fig.15)
5. **PPP** service **ON**

Fig. 14

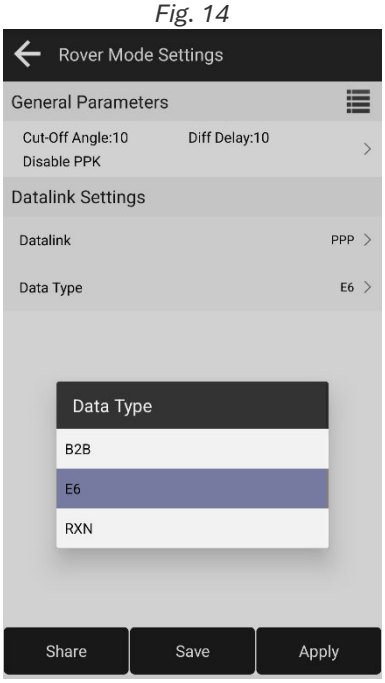
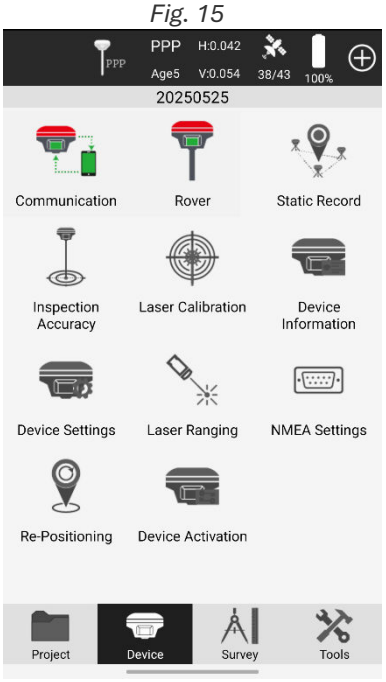


Fig. 15



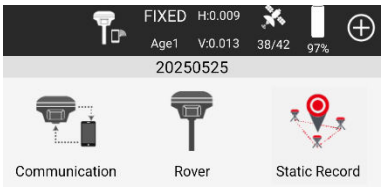
Note: Minimum Satellite Visibility: 10+ GNSS satellites (multi-constellation preferred)

Troubleshooting

Slow Convergence:

- Ensure open-sky view (>30° elevation mask)

9. Static Recording Configuration



Parameter Guide

Settings	Options	Recommendation
Path	Custom directory selection	./SurPro/Projects/[Project_Name]/
Point Name	Manual entry or auto-generate	Use site codes (e.g., BM01_A)
Cut-Off Angle	1°–45°	**10°** (balances SNR and SV count)
Interval	5Hz – 60s	**1s** for PPK **30s** for static control
Obs□Time	5min – Custom	**≥30min** for baselines <5km **≥2hrs** for >20km

Configuration Steps

1. In **SurPro**: **Device** > **Static Record**
2. Configure: (Fig.16)
   - Set **Path** (e.g., external SD card for long sessions)
   - Define **Point Name** convention
   - Adjust **Cut-Off Angle** based on environment
   - Choose **Observation Time**
3. Tap **START** (Fig.16)
4. **PPK** Observation started (Fig.17)

Fig. 16

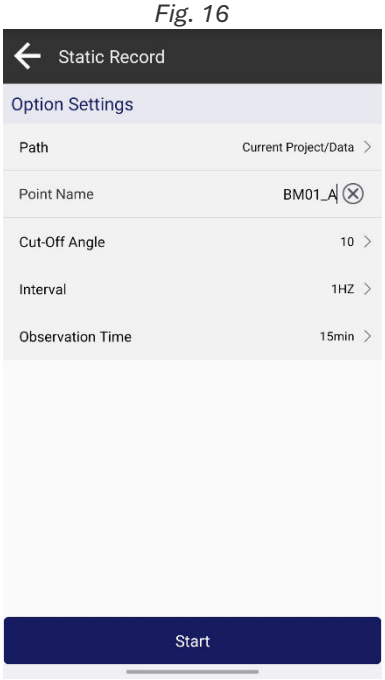
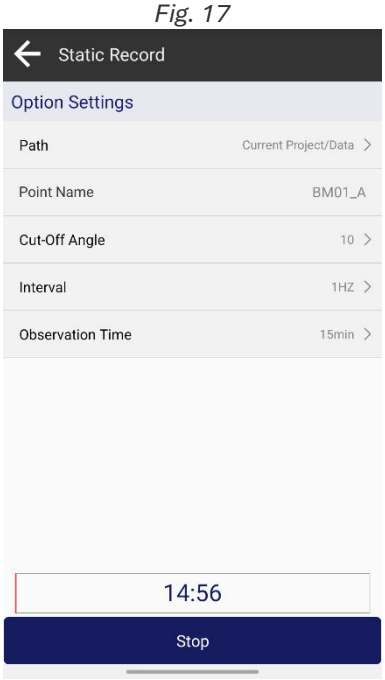


Fig. 17



🔧 **Troubleshooting**

Storage Full:

- Change path to external storage

Invalid Point Name:

- Avoid special characters (/ \ : * ?)

10. IMU Technology in AlphaGeo L2 Plus

The L2 Plus integrates a **4D MEMS IMU** for tilt-compensated measurements, delivering superior performance in challenging environments.

Key Advantages

- **Precision Tilt Compensation**:
  - Measures accurately at **0–120° tilt**
  - **<2□5cm error** within full range (industry-leading)
- **Instant Initialization**:
  - **3-second calibration** (no field recalibration needed)
  - Auto-triggers when RTK FIX is achieved
- **Magnetic Immunity**:
  - Unaffected by rebar, vehicles, or power lines (unlike magnetometer-based systems)
- **Dual Verification**:
  - Cross-validates GNSS and IMU data in real-time

10.1. IMU Configuration with SurPro v6.x

Prerequisites

- **RTK FIXED** solution
- Stable ground (no movement during calibration)
- Pole in **vertical position** (±5° tolerance)

Step-by-Step Guide

1. Goto **DEVICE** menu, tap **Inspection Accuracy** (Fig.18)
2. Set **Antenna Height** (Pole height), tap **Pole Calibration** (Fig.19)
3. **Pole Calibration** screen appears, to start **IMU** calibration tap **Start** button (Fig.20)

Fig. 18

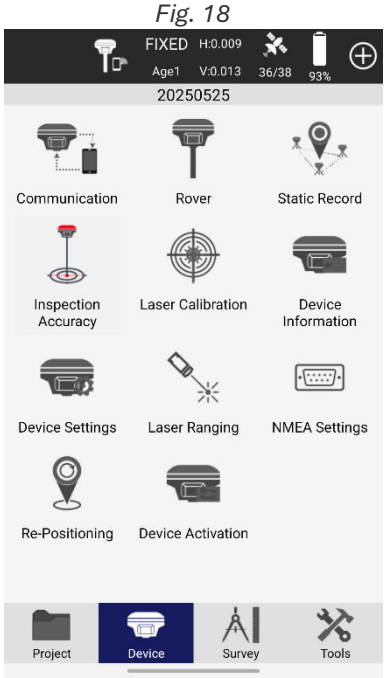


Fig. 19

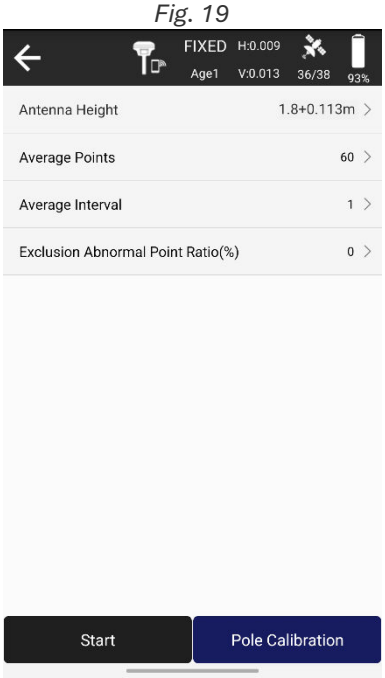
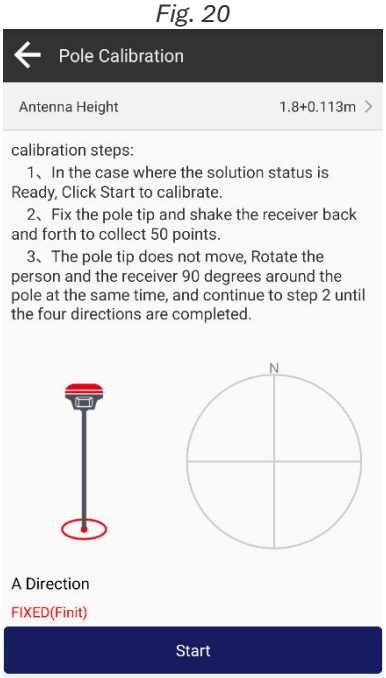


Fig. 20



4. Fix the pole tip and shake the receiver back and forth to collect **50 points** (Fig.21)
5. The pole tip does not move, rotate the person and the receiver **90 degree** around the pole at the same time, and continue to step 2 until all directions are completed (Fig.22)
6. **Remind** window will appear when **Calibration Completed**, tap **OK** (Fig.23)

Fig.21

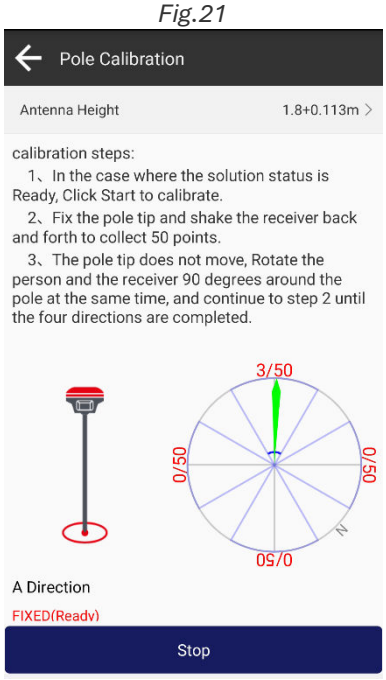


Fig.22

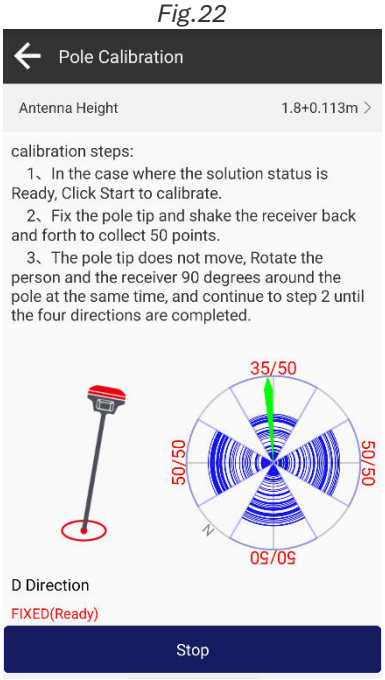
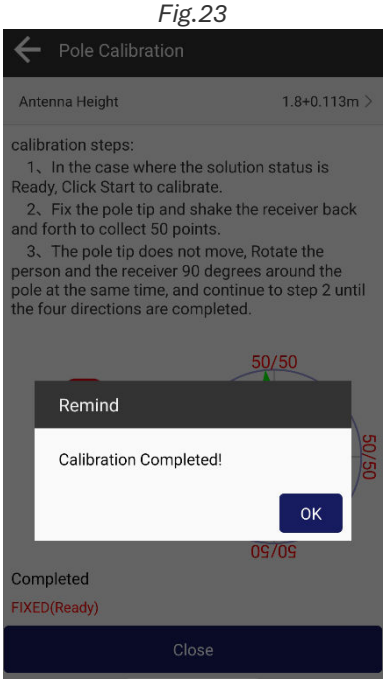


Fig.23



🔧 Troubleshooting

Issue	Solution
"RTK Lost During Calibration"	Restart calibration after re-fix
<50 Points Collected	Increase shake range/speed
Tilt Errors >2□5cm	Recalibrate on flat concrete surface
Pole Tip Movement	Use ground marker/spike for absolute fix

11. Laser Technology & Calibration for the L2 Plus

Warning Note:

- Do Not stare directly into beam or aim at reflective surfaces
- Use Caution beyond 50m – accidental eye exposure within 13m may cause injury
- Label Compliance: Ensure this symbol is visible on device: [Class 3A Laser Label]

The AlphaGeo L2 Plus integrates a high-precision Class 3A green laser (520nm) for enhanced measurement capabilities, offering superior visibility and accuracy in diverse field conditions.

Typical Use Cases

1Construction Layout

- **Feature**: Quick stakeout of **walls, columns, and foundations** without prism.
- **Advantage**: Measures **through rebar/glass** (no magnetic interference).

2Utility Mapping

- **Feature**: Safely records **power lines, manholes, and pipelines** from a distance.
- **Advantage**: No need to climb poles or enter hazardous zones.

3Topographic Surveys

- **Feature**: Captures **tree canopies, riverbanks, and steep slopes** with tilt compensation.
- **Advantage**: **Single-person operation** vs. traditional prism setups.

4Emergency Response

- **Feature**: Rapid **distance-to-hazard** assessments (e.g., wildfires, collapsed structures).
- **Advantage**: Works in **smoke/light fog** where GNSS fails.

11.1. L2 Plus Laser Calibration with SurPro v6.x

The laser module integrates with the **4D IMU** to enable tilt-compensated measurements.

Critical Precondition

IMU Calibration Required

- Laser accuracy depends on proper IMU initialization.

  (Follow steps in Section 5.2 of this manual)

How They Work Together

1. **IMU Measures Tilt** (0–120°) → Adjusts laser distance vector
2. **GNSS Provides Position** → Combines with laser data for 3D coordinates
3. **SurPro Displays**:
   - Corrected distance
   - Real-time tilt angle

Step-by-Step Guide

1. Goto **DEVICE** menu, tap **Laser Calibration** (Fig.21)
2. Mount **L2 Plus** on pole
3. Set **Antenna Height** (Fig.22)
4. Choose from the library **Known Point** or proceed direct RTK measurement for **Known Point** (Fig.22)
5. Tap Measure Button, when it green (Fig.23)

Fig. 21

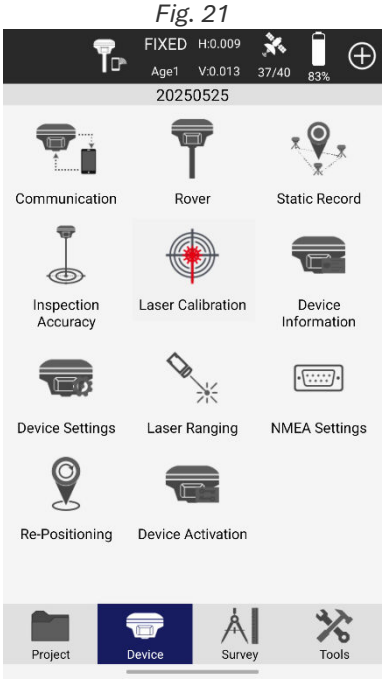


Fig. 22

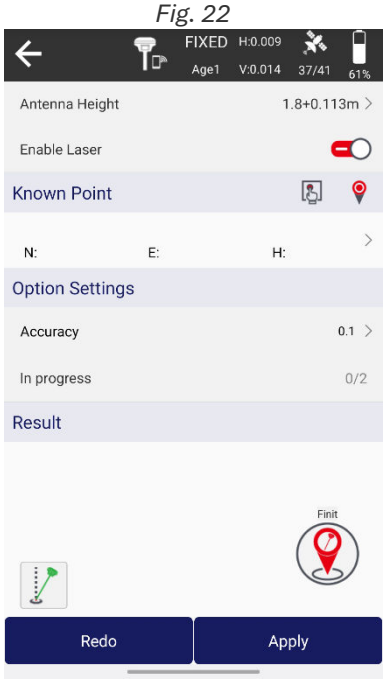
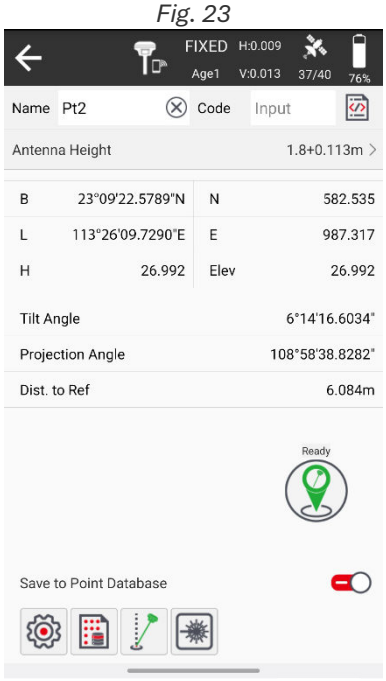


Fig. 23



6. **Enable Laser** (Fig.24)
7. Point Laser at **Known Point 1** and tap **Measure**
   Option setting shows In Progress 1/2.
8. Move to a new location (≥10m from first point), Point laser at **Known Point 1** again → Tap **Measure**
   Option setting shows In Progress 2/2.
9. Calibration **Result** will appear (Fig.25)
10. Tap **Apply** to save calibration (Fig.25)

Fig. 24

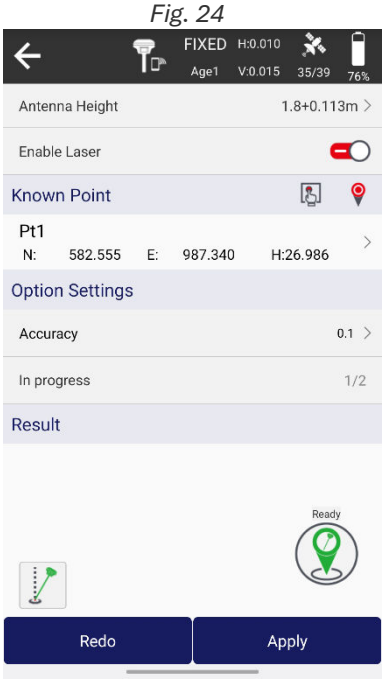
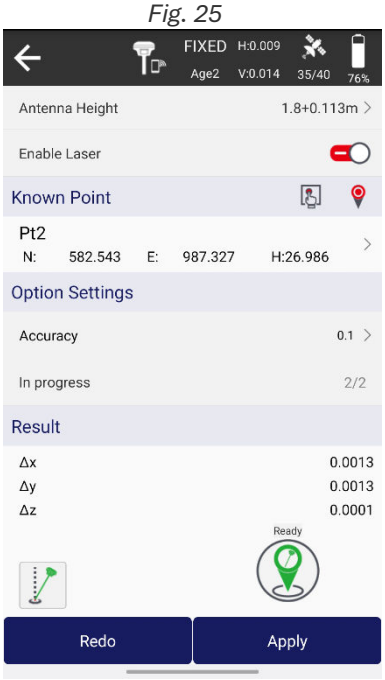


Fig. 25



🔧 Troubleshooting

Measurement Failed:

- Ensure Laser spot is steady on target
- Ensure RTK remains FIXED during calibration

12. L2 Plus GNSS Specifications

GNSS Performance	Channels	1408
	Data Format	RTCM2.X、RTCM3.X
	Signals tracking	GPS: L1C/A,L2C,L2P, L5
		GLONASS: L1,L2
		BDS: B1,B1C, B2, B2a, B2b, B3
		GALILEO: E1, E5a, E5b, E6
		QZSS: L1, L2, L5, L6
		SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM
	Cold start	<60s
	Hot start	<15s
	Positioning output rate	1Hz~50HZ
	Signal reacquisition	<1s
	RTK initialization time	<5s
	Initialization reliability	>99.99%
	Time accuracy	20ns
Positioning accuracy*	Static GNSS surveying	H:±(2.5mm+0.5ppm)
		V:±(5mm+0.5ppm)
	RTK surveying	H:±(8mm+ 1ppm)
		V:±(15mm+1ppm)
	Laser surveying	±1cmm+5mm/m
IMU	Sensor	Supported,4D lMU
		initialization in 3 seconds
	Update rate	400Hz
	Accuracy	<2.5cm within 120°
	Tilt compensation	0~120%
Communications	I/O interface	Type-C
	Bluetooth	Bluetooth V4.0
Electrical	Battery	Built-in Li-ion battery,supports external power supply
	Capacity	2000mAh
	Battery life	>12hrs
	Interface	Type-C 5V/2A
Environmental	Operating temperature	-20°C~+75°C
	Storage temperature	-40°C~+85°C
	Protection IP	IP67
	Shockproof	Survive a 2m pole drop onto concrete
	Vibration	MIL-STD-810G
	Humidity	100%Non-condensing
Physical	Dimensions	120mmx61mmx41mm
	Weight	170g
	Materials	Polymer engineering materials
	Keys	Power button
	Indicators	1*Satellite indicator
		1*Bluetooth indicator
		1*Data communication
		1*Power indicator

13. Copyrights, Warranty, and Environmental Recycling

13.1. Copyrights and Trademarks

AlphaGeo™, the **AlphaGeo**™ **logo**, and the **L2 Plus GNSS receiver** are trademarks of AlphaGeo™.
AlphaGeo SurPro™ is a trademark of AlphaGeo™.
All other trademarks are the property of their respective owners.

13.2. Release Notice

This is the **June 2024** release of the **AlphaGeo L2 Plus GNSS Receiver User Manual**.
The following limited warranties provide specific legal rights, which may vary by jurisdiction.

13.3. Standard Limited Warranty (2024 Edition)

This Limited Warranty constitutes the complete agreement between the **Customer/Dealer** and **AlphaGeo**™ for the product, superseding all prior agreements or representations.

13.4. AlphaGeo™ warrants that its products:

1. Are free from defects in materials/workmanship for **1 year** (unless otherwise specified for accessories).
2. Have been tested and calibrated before shipment.

13.5. Warranty coverage begins on the date of first purchase.

- AlphaGeo™ will, at its discretion, **repair or replace** defective products at no cost during the warranty period.
- Repairs require **30-day approval** after defect verification (excludes user-inflicted damage).
- Replaced parts carry a **30-day warranty** or the remainder of the original warranty, whichever is longer.

13.6. Exclusions:

- Damage caused by misuse, improper handling, or unauthorized modifications.
- Loss during return shipping (customer must insure shipments).

13.7. Shipping Policy

- **Customer/Dealer** pays for shipping defective products to AlphaGeo™.
- **AlphaGeo**™ covers return shipping for warranty repairs.

13.8. Dead on Arrival (DOA) Return Policy

- **7-day return window** from purchase date for full refund (less shipping).

- Products must be:
  - Unused, in original packaging.
  - Include all manuals, accessories, and undamaged boxes.
- Restocking fees may apply for special orders.

13.9. Firmware/Software Warranty

- AlphaGeo™ does not guarantee error-free operation.
- **Software fixes** are provided to address non-conformance with specifications.

13.10. Out-of-Warranty Repairs

- Customer pays for:
  - **Repair fees**.
  - **Return shipping**.

13.11. Disclaimer and Limitation of Remedy

- **Implied warranties** (merchantability/fitness) are disclaimed beyond the 1-year term.
- AlphaGeo™ is not liable for:
  - Data loss or incidental damages.
  - Damages exceeding the product's purchase price.
- **User responsibility**: Follow all instructions to avoid malfunctions or injuries.

13.12. Environmental Recycling:

13.12.1. European Union (EU)

- **Prohibited**: Disposal with urban waste.
- **Required**: Separate collection at authorized centers.
- **Symbol**: Crossed-out trash bin indicates mandatory recycling.

13.12.2. Outside EU

- Follow local e-waste regulations

14. Safety Recommendations

14.1. Warnings and Cautions

Always adhere to these safety alerts when using the AlphaGeo L2 Plus:

- **WARNING**: Risk of **personal injury** or **equipment damage** (e.g., laser exposure, battery mishandling).
- **CAUTION**: Risk of **equipment malfunction** (e.g., data loss, calibration errors).

Critical Warnings:

- **Class 3A Laser**: Do not stare directly into the 520nm beam (<13m distance).
- **Battery**: Do not puncture, incinerate, or expose to liquids.

14.2. Wireless Module Approval

- The L2 Plus uses **Bluetooth 4.0+** (no WiFi/UHF).
- **Regulatory Compliance**:
  - **FCC ID**: [Your FCC ID] (USA)
  - **CE RED**: EN 303 413 V2.1.1 (EU)
- **User Responsibility**: Verify local wireless regulations for Bluetooth devices.

14.3. Instrument Approval

- Complies with:
  - **EMC**: EN 61000-6-2 (Immunity) / EN 61000-6-3 (Emissions)
  - **Safety**: EN 62368-1
- **Modification Warning**: Unauthorized changes void approvals and warranty.

14.4. Bluetooth Safety

- **Low RF Exposure**: Output power ≤2.5mW (far below FCC/EU limits).
- **Safe Distance**: Maintain ≥20 cm from the body during use.
- **Restricted Areas**: Hospitals, aircraft (follow facility rules).

14.5. Regional Compliance

14.5.1. USA (FCC)

- Part 15B: Verified to not cause harmful interference.
- **Note**: This device complies with FCC RF exposure limits for uncontrolled environments.

14.5.2. Europe (EU)

- **RED Directive**: 2014/53/EU
- **EMC Directive**: 2014/30/EU
- **Full Details**: EU Compliance Portal

14.6. Lithium-Ion Battery Safety

WARNINGS:

- **Leaks**: Corrosive fluids—rinse skin/eyes immediately with water.
- **Damage**:
  - Do **not** expose to >60°C or open circuits.
  - Use only **5V/3A USB-C chargers** (AlphaGeo-approved).

14.7. Storage:

- Keep at 30–50% charge if unused >3 months.

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