This document gives an overview of the GAIA-FIELD gravity equipment.

Document Release

Version	Date	Description	Responsible
1	Feb-2026	Initial Version	A Adelekan
2	Oct-2026	Updated	J Wingate

Silicon Microgravity Limited

GAIA-FIELD 1.2 Gravity System

User Manual Overview

Document Layout

Chapter	Description
Introduction to GAIA	Overview of GAIA
Getting Started	GAIA-FIELD Components and part description
Setting up the GAIA	Setting up GAIA-FIELD for field survey
Short Operating Guide	Operating GAIA-FIELD during survey
Troubleshooting	Identifying and fixing minor faults
Maintenance and best Practices	Handling GAIA-FIELD for best performance

Symbols

⚠ *NOTE:*	This indicates essential information, descriptions, explanation, or caution that require special attention.
	This highlights a specific feature explained for the user's understanding.

Please fill out the table below for your instrument.

Use this information when contacting SMG for service and support purposes.

Product Name	
Serial Number	
Invoice Date	
Supplier	

For Silicon Microgravity Ltd contact information please visit www.smggravity.com

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General Safety
The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated.
This manual contains operating and safety instructions, which must be followed to ensure the safe operation and to maintain the equipment in a safe condition.
The instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage.

Electrical Safety
The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument. The instrument is powered by internally mounted rechargeable batteries and optional mains adapter and charger.

Repair and Maintenance
The instrument must be maintained either by the manufacturer or an accredited service agent. Visit www.smggravity.com for contact details.

1.0 Introduction to GAIA-FIELD

1.1 Overview of GAIA-FIELD



Figure 1.1: The GAIA-FIELD Gravimeter

The GAIA-FIELD gravimeter is a resonant MEMS vibrating beam technology device, designed for gravity measurement with a resolution of at least 0.01 µGal. GAIA-FIELD is able to detect minute changes in the earth's gravity caused by density variations in the subsurface.

The equipment is fitted with an internal gimbal and tilt sensor, for each measurement the sensor is adjusted to gravity maximum and tilt is continuously monitored and displayed during data acquisition. This ensures that data is collected within the allowable tilt range and enables real-time correction of remaining tilt effects.

Field measurements are taken by accessing the smart interface through a WiFi connected control unit such as a computer, phone, or tablet. The sensor can be configured to acquire repeated readings, depending on data requirements. The data is automatically stored and can be downloaded later for further use.

The equipment is compact, with the sensor, electronics, batteries, and other components integrated into a single housing. Two Li-ion rechargeable batteries (one for use and the other as a backup) provide sufficient power to operate the equipment throughout a normal survey day.

GAIA-FIELD is automatically able to compensate for temperature, pressure, instrument tilt, and tide. The instrument is designed to operate in ambient temperatures between –40 °C and +50 °C.

The GAIA-FIELD gravimeter has been developed for a broad range of gravity measurement applications such as geophysical research, civil engineering and infrastructural projects, geological exploration, environmental studies, archaeological surveys and more.

2.0 Getting Started

2.2 Unpacking the equipment

During shipment, GAIA-FIELD and all necessary accessories are securely packed either in;

- Transport Peli-Case
- Secure Packaging

Upon receiving the GAIA-FIELD unit, the batteries will be charged to 30% and either stored separately from the GAIA-FIELD or within the unit in accordance with IATA transport safety regulations. Before opening the packaging, ensure that the top is facing upward.

If using the Transport Peli-case:

- Press the release button on the lock and lift the latch to open the Peli case.



Figure 2.1: Peli-case showing the lock release buttons

If using the cardboard packing case

- Ensure the case is top up when unpacking, we recommend saving the packaging and foam for future shipments

After removing the GAIA-FIELD instrument from the packaging visually inspect it for any physical damage that may have occurred during transport. If any visible damage is found, please notify Silicon Micro gravity Limited immediately.

⚠*NOTE:* *Carefully inspect the equipment and the accompanying accessories for any visible damage immediately after delivery by the carrier.*

2.3 GAIA-FIELD Overview

The standard components of the GAIA-FIELD system supplied include:

- GAIA-FIELD Unit
- Mini-Tripod base (fixed to GAIA)
- Static Levelling Base
- 2 x Li-ion batteries (usually pre-installed)
- Smart battery charger and mains power cable
- USB-C charger and mains power cable

2.3.1 GAIA-FIELD Gravimeter

The GAIA-FIELD unit itself is permanently housed in a Peli-case and designed as a standalone system with a fitted mini-tripod. The mini-tripod provides a stable base for the GAIA-FIELD unit and can be used with the separate Static Levelling Base for course manual levelling.



Figure 2.2: GAIA-FIELD Gravimeter

2.3.2 Mini-Tripod

GAIA-FIELD is built as a single package with the **Mini-Tripod** providing stable support for the equipment during field operations. The **Mini-Tripod** has no adjustment and should be used with the **Static-Levelling Base** on uneven or soft terrain.



Figure 2.3: GAIA-FIELD and Static Levelling Base. NOTE GAIA-FIELD 1.2 has a GNSS Antenna vs the Spirit Level

2.3.3 Battery

GAIA-FIELD gravimeter is built to function on one battery; however, each unit has slots for and is supplied with two 14.4 V, 6.8 Ah Smart Li-ion batteries with capacity of 6.8 Ah / 98 Wh each. While one battery is needed to operate the equipment, the other battery acts as backup which GAIA-FIELD will automatically switch to during operation as required.

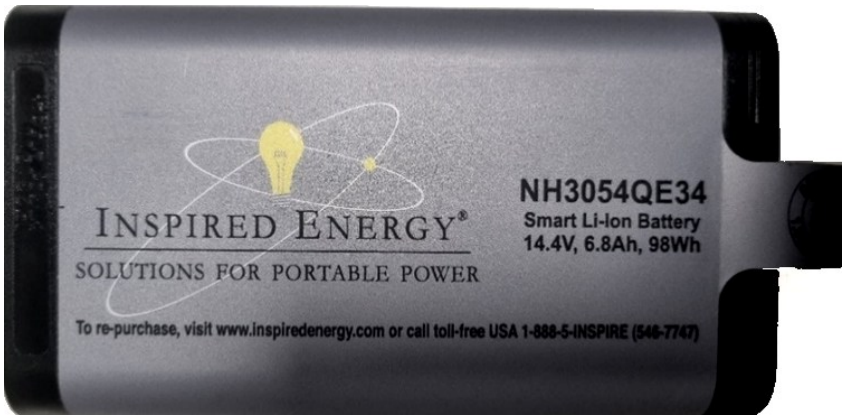


Figure 2.4: Smart Li-ion battery

Each battery provides approximately 10-12 hours operation. Battery life can be affected by temperature, equipment usage and other factors.

2.3.4 Smart Charger and USB-C Charger

Charging the batteries can be achieved by connecting the **Smart Battery Charger** supplied with the instrument to a mains power source and placing the battery on the charger, ensuring the correct terminal is securely locked into the charging port. See the Inspired Energy website for charger support.



Figure 2.5: Smart battery charger and the power cable



Figure 2.6 Dell USB-C charger

The GAIA-FIELD can also be connected directly to external power using the provided **Dell USB-C charger.** When the system is connected to the **Dell USB-C charger**, it both charges the batteries and powers the system.

⚠*NOTE: The GAIA-FIELD must be switched on with USB-C charger connected to charge the installed batteries*

2.3.5 Accessory Connection Port

The top of the GAIA-FIELD Peli-case is equipped with a standard M8 threaded port for accessories such as a target prism for a Total Station (an electronic theodolite).



Figure 2.7: Accessory Port

2.4 Overview of GAIA-FIELD Front Panel

GAIA-FIELD is built into a light weight Peli-case. The front panel can be accessed by releasing the twin catches on the lid.



Figure 2.8: GAIA-FIELD Front Panel key features

2.4.1 Power Button

The power button is located to the top left side of GAIA-FIELD front panel. It has two functions;

- Press and hold for at least 5 seconds to fully power on and fully power off the GAIA-FIELD
- Press and hold for less than 3 seconds to switch the GAIA-FIELD into standby mode (GAIA-FIELD must be powered on to enter standby mode)
- When in standby mode hold for less than 3 seconds to return the GAIA-FIELD into full operation mode

2.4.2 Battery Compartment

The battery compartments are on the front panel of the GAIA-FIELD device and can be accessed by pressing up the lock of the battery compartment to lift the lid.

2.4.3 USB Ports

Two Type-C USB port are available on the Front Panel interface:

Right Power Port: For use with an external power source to power GAIA-FIELD and charge installed batteries.

Left Data Port: For data transfer and connectivity between the GAIA-FIELD and other devices, such as computers or external storage. This allows for data backup, software updates, and troubleshooting.

3.0 Setting up GAIA-FIELD

3.1 Charging Batteries with Smart Battery Charger

The batteries are charged using either the Smart Battery Charger or by inserting them into the GAIA-FIELD and connecting the USB-C Charger to the GAIA-FIELD power port.

When charging the battery with the Smart Battery Charger, the charging LED on the Smart Charger is solid green (See the picture below), and the battery charge level indicator will blink on the battery. The battery is fully charged when the battery charge level indicator stops blinking.

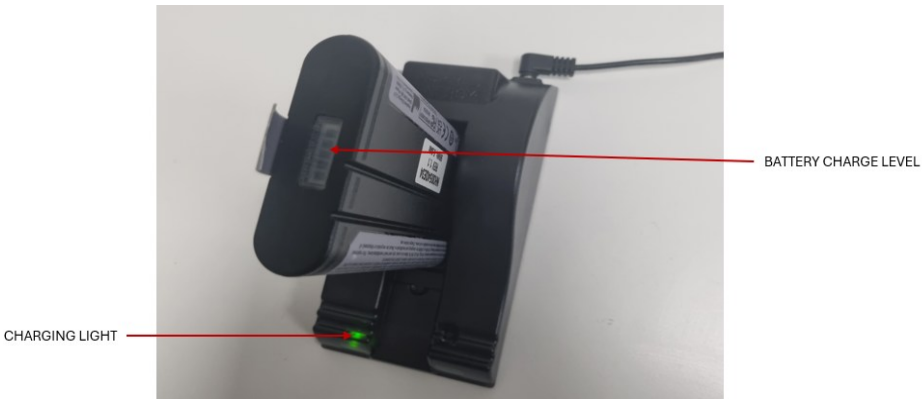


Figure 3.1: Battery charging using Smart Battery Charger

3.2 Removing the Battery Compartment Cover

The battery compartment can be accessed by lifting the lock on the compartment cover to vertical after which the cover can be removed.



Figure 3.2: Removing the battery compartment cover

3.3 Removing and Inserting Batteries

After removing the battery compartment lid, the GAIA-FIELD battery can be inserted or removed. Ensure the correct polarity and insert the batteries in the proper orientation.



Figure 3.3: Inserting battery into the GAIA

⚠ *NOTE:* *The GAIA-FIELD battery can be replaced without turning off the instrument. To do this, the device should either be connected to an external power source while the batteries are replaced or at least one battery remained installed.*

3.4 Replacing Battery Compartment Cover

Once the batteries are inserted, replace the battery compartment cover with the lock raised. After carefully positioning the cover, press down the lock to secure the battery in place.



Figure 3.4: Replacing the battery compartment cover

⚠ *NOTE:* *Care must be taken when replacing the battery compartment cover to avoid damaging the compartment and the cover.*

3.5 Powering On GAIA-FIELD

To 'Power On' the GAIA-FIELD, press and hold the power button for ~3 second. The instrument LEDs around the gimbal flash, the power LED, along with other LEDs on the front panel will illuminate. Full startup of the Wi-Fi and user interface will take 1-2 minutes.



Figure 3.5: Starting Up GAIA-FIELD



Figure 3.6: LED light illuminates on GAIA-FIELD front panel during powering up

3.5.1 Warm-up Time

After powering up GAIA-FIELD, the equipment should be allowed approximately 2 hours to warm up and ensure the sensors reach the required operating temperature.

3.5.2 Stabilisation Period

When the GAIA-FIELD equipment is received and switched ON for the first time or after it has gone through an extensive shipping. We recommend a minimum 6 hours stabilisation period. It may take about 24 hours for the GAIA-FIELD to fully stabilise after powering up. Tilt and Drift calibrations should be performed prior to first use.

3.6 Switching GAIA-FIELD off or into Standby Mode

Power Off the GAIA-FIELD by pressing and holding the power button for ~5 seconds, during this time the LEDs around the gimbal will flash and then all LEDs will switch off, confirming a complete shutdown. The GAIA does not charge batteries where switched off.

Standby Mode disables most GAIA-FIELD handling systems including Wi-Fi and USB connectivity. However the thermal control of the core remains active so that the unit does not require stabilisation time when switched back to full operation. In addition battery charging is active in standby mode if connected to USB-C power.
To switch the instrument into '**standby mode'**, briefly press the power button for <3 second. The Wi-Fi and Bluetooth lights will be disabled, power light will pulse, battery LEDs and charging function normally.

3.7 External Power Source

The GAIA-FIELD is equipped with a USB-C port for external power connection. Refer to the picture below for the location of the external power port. A 100 Watt PD USB-C charger must be used, we recommend the supplied Dell Charger is used.



Figure 3.7: Connecting GAIA-FIELD with USB-C to external power source

Connect the USB-C cable to the external power source and insert the cable into the external power port (USB charger slot) on the GAIA-FIELD.

When the instrument is connected to an external power source, the external power supply powers the unit and charges one battery at a time. The External Power LED light turns green when connected to an external power source.

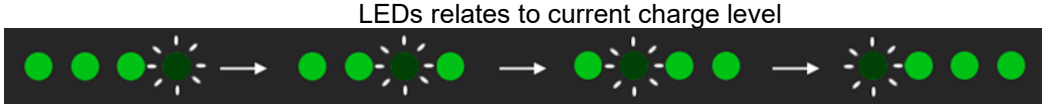
Battery Indicator Status Modes

Battery Charging. During charging a single battery LED will pulse. The specific LED and colour relates to the battery charge level.

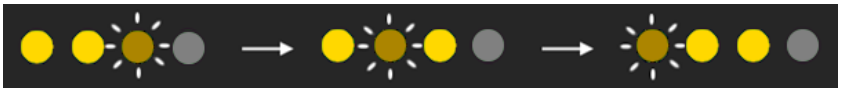


>75% CHARGED *>50% CHARGED* *>25% CHARGED* *<25% CHARGED*

Battery In Use. During dis-charge the battery status LEDs cycle right to left. The quantity and colour of LEDs relates to current charge level

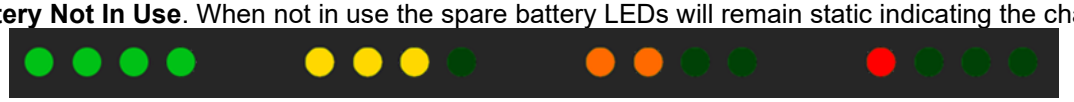


BATTERY IN USE. BATTERY AT >75% CHARGE



BATTERY IN USE. BATTERY AT >50% CHARGE

Battery Not In Use. When not in use the spare battery LEDs will remain static indicating the charge level.



>75% CHARGED *>50% CHARGED* *>25% CHARGED* *<25% CHARGED*

3.8 Connecting to your GAIA-FIELD

GAIA-FIELD is designed to be remotely operated from a connected device, such as a tablet, PC, or phone. It can connect to the device via Wi-Fi or USB-C.

To establish a connection, enable Wi-Fi on the device. Search for 'GAIA-X Wi-Fi' in your devices list of available networks.

The factory supplied Wi-Fi password is S1lic0n46

⚠ *NOTE: When connected via Wi-Fi, GAIA-FIELD connectivity may indicate 'connected without internet', see the figure below.*

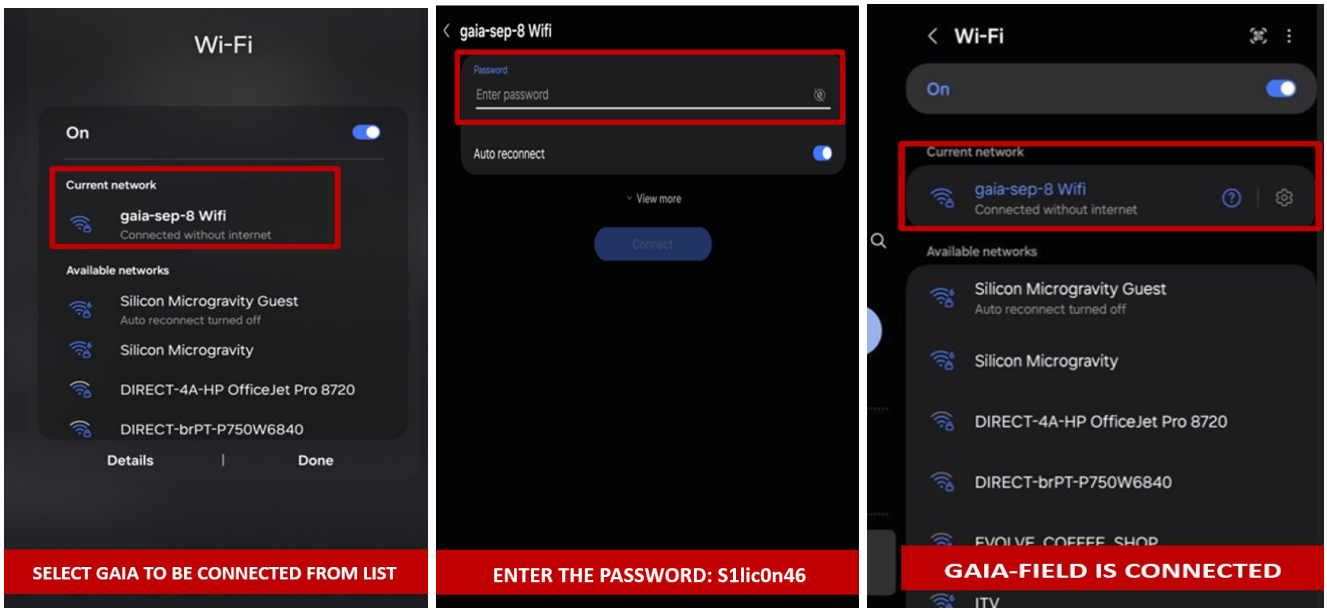


Figure 3.8: Connecting GAIA-FIELD to the Control unit

⚠ *NOTE: When GAIA-FIELD is connected to the control device via Wi-Fi, the Wi-Fi indicator on the front panel will turn green. If the connection is not established, the light will remain yellow.*

To access the user interface of the GAIA-FIELD system use the following URLs on your devices web browser;

- **Wi-Fi** http://192.168.9.1
- **USB** http://192.168.8.1

3.9 Levelling

GAIA-FIELD levelling is done in two stages:

Stage 1 Levelling is achieved using the Static-Levelling Base. Ensure the Static-Levelling base is firmly placed on the measurement surface (e.g press the unit down into soft ground to prevent movement during measurement). The GAIA-FIELD can now be placed onto the Static-Levelling Base and using the visible spirit level coarse levelling can be achieved. The Static-Levelling Base allows for suitable levelling even with ground conditions are off by up to 15°.

Stage 2 is automatically performed by the internal gimbal at the start of every reading and every repeat. The gimbal automatically carries out the fine levelling of the system when each measurement is taken. The internal gimbal has approximately 12° of range and can level to micro degree accuracy.



Figure 3.9: Mini-Tripod positioning on Static-Levelling Base

3.10 Data Storage

The GAIA-FIELD instrument is equipped with two user-accessible internal SD cards, providing a total of 32GB of storage capacity dedicated to gravity data. This dual SD card configuration enhances reliability during data acquisition by enabling simultaneous data recording on both cards. In the event of a failure on one card, the second card automatically assumes recording duties, ensuring uninterrupted data collection.

The data stored on these cards can be easily retrieved and transferred for further analysis. This redundancy feature significantly improves the reliability of the GAIA-FIELD, making it well-suited for long-duration surveys and applications where data integrity is critical.

4.0 Short Operating Guide

Full details of the GAIA-FIELD user interface and Gravity project management can be found via the GAIA-FIELD User Guides online. Below is a quick description on field data measurement.

4.1 Prepare the GAIA-FIELD for field measurements

When taking Gravity measurements we recommend keeping the GAIA-FIELD lid closed to protect the device and maintain improved thermal stability.



Figure 4.1: GAIA-FIELD

4.2 Accessing the User Interface and Creating Project

Default URLs for GAIA-FIELD 1.1

- **Wi-Fi** **http://192.168.9.1**
- **USB** **http://192.168.8.1**

To access the GAIA-FIELD logger interface on the control device, connect to the GAIA-FIELD via Wi-Fi or USB-C, open your device's browser, enter the provided GAIA-FIELD connection URL

⚠ *NOTE: Chrome browser is recommended when connecting GAIA-FIELD with your control device.*

Click on the 'Home' tab to navigate to the home page as shown below.



Figure 4.2: GAIA-FIELD project home page

On the Home screen, users can create new project, load project or close and existing project. *To create new project, or load an existing project,*

See the separate guide on "Creating and Loading Project with GAIA-FIELD"

4.3 Taking Gravity Measurements

To record station data using GAIA-FIELD, ensure that

- GAIA-FIELD is connected to the control unit
- Project has been created for the intended data reading
- The equipment positioned at the correct location
- The equipment is suitably stable and level

Navigate to the data acquisition page, by clicking on 'Measure'

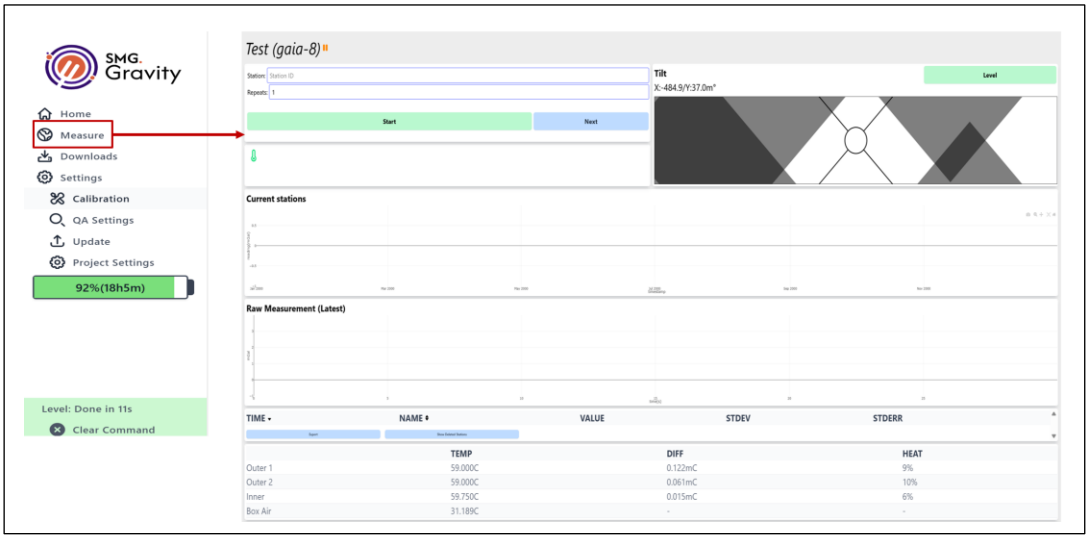


Figure 4.3: GAIA-FIELD data acquisition page

Enter the ‘Station id’ and the number of ‘Repeats’ required per station.

After GAIA-FIELD positioning and coarse level achieved, you can begin station readings by Click **‘Level’** to level the system or Click ‘**Start**’ to run the fine levelling of the GAIA-FIELD and perform the station data reading subsequently after the levelling.

For each reading the system will run fine levelling automatically until the virtual bubble is positioned within the spirit level after which it will commencing gravity readings.

See the separate guide on “Levelling, Data Reading and Data Downloading with GAIA-FIELD”

5.0 Troubleshooting

5.1 No connection with GAIA-FIELD

❖ Issue: The GAIA-FIELD instrument is not connected to the control unit

- Solution:
  1. Ensure that the Wi-Fi connection is active and properly configured.
  2. Check if the GAIA-FIELD Wi-Fi connection appears in the list of available devices on the control unit and it is properly connected.
  3. If the connection is still not established, restart both the GAIA-FIELD and the control unit, and attempt the reconnection.
  4. Ensure that the control unit is connected to the correct GAIA-FIELD network.
  5. Check the range and proximity between the GAIA-FIELD and the control unit.
  6. Ensure the GAIA-FIELD URL has been entered correctly
  7. You may also consider disabling mobile data on the device.
  8. Consider testing a wired connection via USB-C data port.

5.2 Levelling failure

❖ Issue: When GAIA-FIELD return levelling failure

⚠ *NOTE: The tilt for X or Y is supposed to give value < ± 10. Levelling is not active during a reading.*

- Solution:
  1. Ensure that the instrument is properly positioned or placed on a stable surface.
  2. Firmly drive the tripod legs into the ground to ensure stability.
  3. Position the GAIA-FIELD on the tripod approximately level.
  4. Ensure via the User Interface the Black Levelling Circle is within the white box
  5. Ensure there is not high vibration of movement that can prevent a stable tilt sensor reading
  6. Reposition the GAIA at a different angle and repeat

5.3 Instrument not powering up

❖ Issue: The GAIA-FIELD instrument fails to power on.

- Solution:
  1. Verify the batteries are sufficiently charged to allow the GAIA-FIELD to power up.
     - Battery power status can be seen on the battery LCD by removing battery lids.
     - Use the external smart charger to charge the battery if required.
  2. Ensure the power supply is an approved 100W + PD USB-C charger.
  3. Ensure the USB cable supports 100W PD power & data
  4. Leave the unit for 5 minutes with USB-C and batteries removed and retry.
  5. If the issue persists, try charging the batteries or using a different power source.
  6. Ensure you are pressing the power button for >5s to enable power up.

5.4 Inaccurate gravity readings

❖ Issue: Gravity readings are inconsistent or inaccurate.

- Solution:
    1. Ensure the GAIA-FIELD has had 6-12 hours' time to stabilise internal temperature.
    2. Ensure a Tilt calibration has been performed in a quiet and stable location
    3. Ensure that the instrument is properly levelled and placed on a stable surface.
    4. Check that the level bubble is within the spirit level and the zero tilt error is <5mDeg.
    5. Ensure that there is no interference from extreme weather conditions or vibrations e.g. wind, rain, or heat.
    6. Ensure there is not significant audible sound near the device.
    7. If performance is still not suitable consider performing device calibrations
        - Tilt calibration (~5 minutes).

6.0 Maintenance, Best Practice and Safety Information

6.1 Maintenance

Do not attempt to open or make internal adjustments without proper training on the maintenance of GAIA-FIELD instrument.

- Contact Silicon Micro Gravity in case of maintenance or any repair issue.

6.2 Best Practice

To ensure consistent and reliable gravity data, observe the following precautions:

- Do not move or disturb GAIA-FIELD during data collection.
- While the GAIA-FIELD instrument is in operation, all nearby movement or vibration should be minimized as much as possible.
- Keep GAIA-FIELD level and ensure the tilt value is <10 mdeg as displayed on the users interface. If it's above this value, re-level the system and repeat the station measurement.
- Ensure a data reading is commenced from the base / tie station and always close the survey loop by returning to the base / tie station to confirm instrument drift.
- Regularly back up data from the GAIA-FIELD system to external storage or cloud services.
- Consider routine tilt and drift calibrations to ensure tightest compensation during field work

6.3 Safety Information

General Handling and Setup:

- Though the equipment has been built to be user-friendly, ensure that all personnel operating GAIA-FIELD gravity equipment are adequately trained and understand the operation and safety protocols.
- Always read and follow the manufacturer's instructions and safety guidelines provided in the user manual.
- Before each use, inspect the equipment for any signs of damage, wear, or malfunction.
- The meter is designed for use in a variety of environmental conditions; however, care must be taken to avoid environmental noise which could arise from:
    - careless handling,
    - exposing the meter to high rainfall,
    - extreme temperatures,
    - footsteps or vibration around the unit setup, and
    - other factors that could affect equipment performance and data quality.
- The lid of the GAIA-FIELD Peli-case should remain closed during data acquisition.
- The GAIA-FIELD gravity meter should only be connected to external power source using recommended power cable. Ensure that the batteries are properly secured before use.
- When not in use, store the meter away from extreme weather, in a suitable storage area to prevent accidental damage.
- While the GAIA-FIELD unit is turned on, it should not be stored in the transport case or in a tightly enclosed space. This could likely cause the unit to overheat.
- To improve GAIA-FIELD perfomance and prevent environmental noise in data recording, careless handling, wind, rain, nearby foodsteps, heavy machinery and vibration around the equipment setup should be avoided.
- When transporting, ensure that GAIA-FIELD is securely packed and shielded from potential shocks or impacts by transporting using the transport case.

7.0 Technical Specifications

Instrument Identification	GAIA-FIELD
Sensor Type	Micro Electro Mechanical Systems (MEMS)
Reading Resolution	< 0.01 microGal
Standard Deviation of repeats	< 5 microGal @ 60-120s readings
Residual Drift Errors	Typically 20 microGal St Dev over 24 hours
Operating Temperature	-40°C to +50°C
Power Consumption	Average – 10 Watts Peak – 30 Watts
Levelling Gimble	+/- 12°
Tripod Available	Yes
Connectors	Wi-Fi USB C –Data USB C –Charge / Power
GNSS	Multi-band high-precision GNSS for <5 cm position (condition dependent) Surface-mounted multi-band active antenna RTK enabled (via suitable caster and connectivity) PPK (Rinex file download
Data Output	USB and Wi-Fi
On Board Data Storage	2 x SD Card
Sealing	IP68 Closed
Batteries	2 x 98Wh replaceable/rechargeable smart Li-ion batteries with 24-hour operation capability.
Mass	5kg
Dimension	270 mm(W) x 246 mm(L) x 180 mm(H)
Standard System Contains	GAIA-FIELD Gravity Meter GAIA-FIELD Static Levelling Base 2 x Rechargeable Smart Batteries Smart Battery Charger Power and USB-C Cable Factory Test Certificate