



LG-1

Land Gravity Meter



User manual v1.2

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Introduction

LG-1 is fused quartz spring based relative gravity meter designed for land survey. The gravity sensor with relative range 10000 mGal and reading resolution 0.0001 mGal is placed in a tempered vacuum chamber. The instrument is useful for oil, gas and mineral exploration, geological mapping, water management, civil engineering and geotechnical investigations, detection of cavities, archaeological studies.

LG-1 Highlights

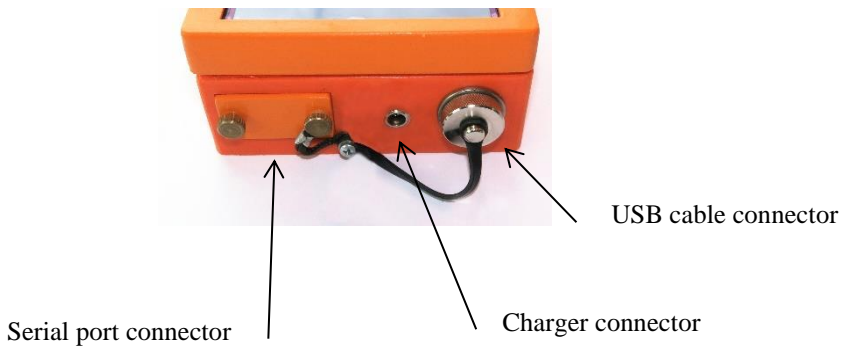
- World-wide gravity operating range
- Low drift gravity sensor
- Good resistance to mechanical shocks and vibrations
- Tide, tilt, drift and temperature corrections
- Sun-well readable LCD on the meter for simple control
- Operating range from -20 to +45°C
- Dust & light rain protection
- Hot-swappable Li-Ion cells (30 hours operation at 25°C)
- Light weight

Detachable Control Unit

- Li-Ion cells (30 hours operation at 50% LCD backlight) or 6 AA cells
- Easy control system with joy-stick, high resolution LCD, large data memory, voice recorder, firmware upgradeable via internet
- Built-in GPS
- Dust & light rain protection
- USB connection for data download

LG-1 Components

Control unit



Probe



Tripod:
The tripod upper parts must fit into the probe bottom rails

Power Supply

Control Unit

rechargeable Li-Ion battery pack (exchangeable, high capacity, low self-discharge, good temperature characteristics)

six NiCd or NiMh or single use cells size AA (in internal holder)

AC-adaptor for 100-240 V AC, 50-60 Hz, 12 W

cable for 12 V car socket



Warning: Use of a supply different from the accessories listed above or its self-made modification can damage the device, and cancel the warranty.

Probe



rechargeable Li-ion battery pack (exchangeable, high capacity, low self-discharge, good temperature characteristics)



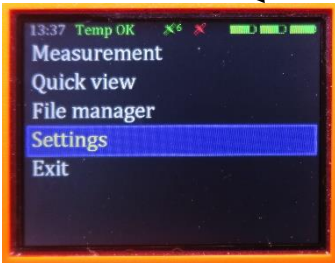
AC-adapter for 100-240 V AC, 50-60 Hz, 80 W







cable for 12 V car socket

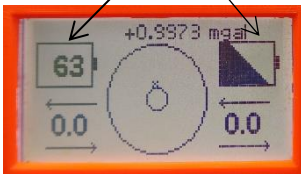
Battery Indicators

Battery indicators P1, P2 (probe), CU (control unit)



-  Fully charged
-  Partially charged
-  Discharged (intermittent sound indicates critical discharge)
-  Being charged

Battery indicators



The probe display shows either battery level (0-100%) or charging status (right battery is being charged).

Note: Both the Control unit and the Probe indicate almost discharged battery by beeping.

Battery Charging

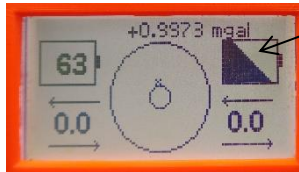
Charging automatically starts when external power source is connected (AC-adaptor or DC power source 12 V).

Yellow “Being charged” indicator  is displayed when the control unit is switched on.

“*Charging*” message is displayed when the control unit is switched off.



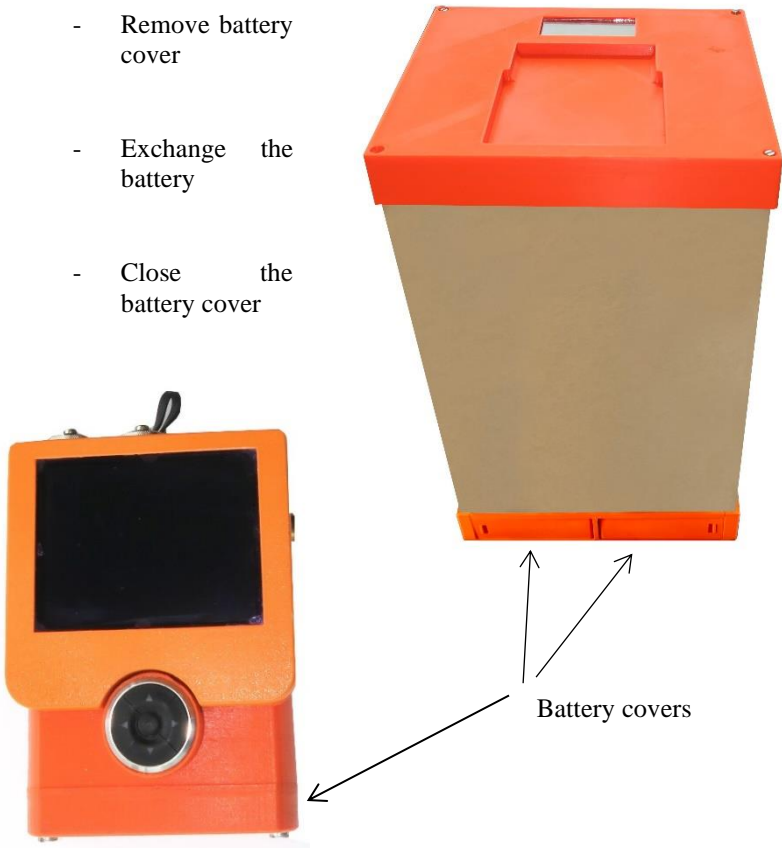
On the probe the charging is indicated with the symbol as shown on the picture.



Charging

Battery Exchange

- Remove battery cover
- Exchange the battery
- Close the battery cover



Note 1: Careful fixing of the Battery cover determines the water tightness of the battery compartment!

Note 2: The probe needs continuous supply to keep uninterrupted temperature control of the gravity sensor. For this reason, you should replace inside batteries **one by one** (not both at the same time).

Basic Operation of the Instrument

Switching ON/OFF – the Probe

The probe needs to be permanently switched on to maintain proper measurement precision. It can be switched off by a main switch if it is necessary, for example during air transport, but then it needs to be switched on at least 24 hours (48 hours recommended) before the measurement to heat the sensor and to stabilize the quartz core. Then tilt calibration may follow to eliminate a possible internal mechanical shift. More frequent measurements at the base station are recommended to determine and subtract higher drift after “switched-off” period.

Putting the Probe Into Operation After Delivery

The probe is dispatched from GF Instruments switched off. The procedure of putting into operation is:

- switch the probe on and connect the AC adapter
- level the probe
- wait at least 24 hours (48 hours recommended)
- proceed tilt calibration (see chapter *Maintenance*). Successful tilt calibration indicates that the fused quartz core inside the probe is OK.

Switching ON/OFF – the Control Unit

Press **Enter** button to switch on. At first the control unit tries to establish Bluetooth connection with the probe and then shows its serial number.

Select **Exit** from main menu to switch off.



Note: For hard reset (do not use under normal operation):

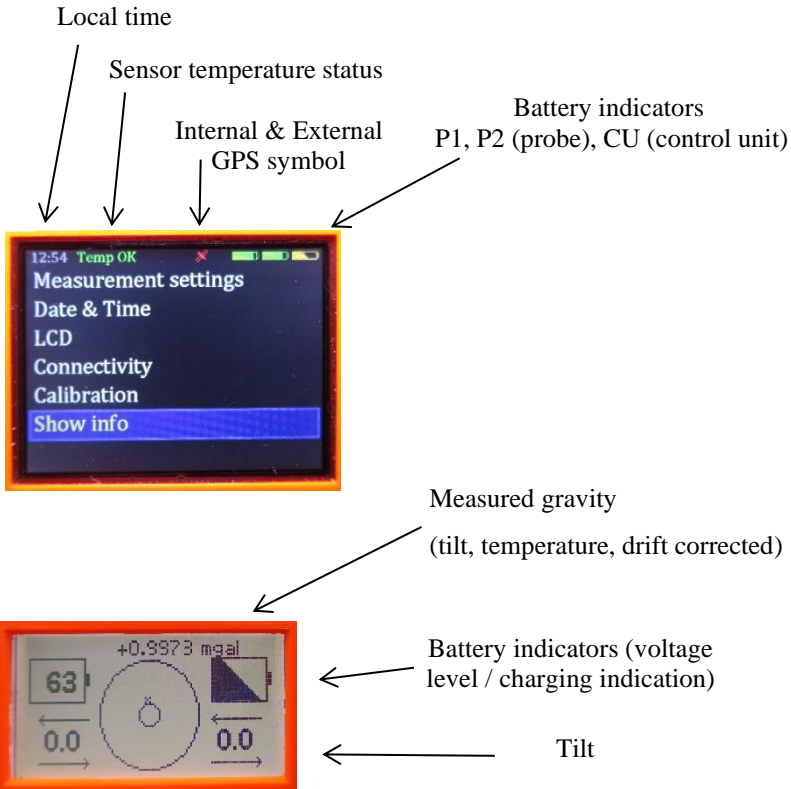
- press **Enter** button for approximately 12 s until beeping stops
or
- press all arrow buttons simultaneously

Navigation Switch (Joy-stick)

- To move cursor, use four **arrow** buttons
- To confirm chosen item, use **Enter** button or also **Right arrow** button
- To exit menu and go to parent menu, use **Left arrow** button
- To open sub-menu use **Enter** button



Status Shown on LCD

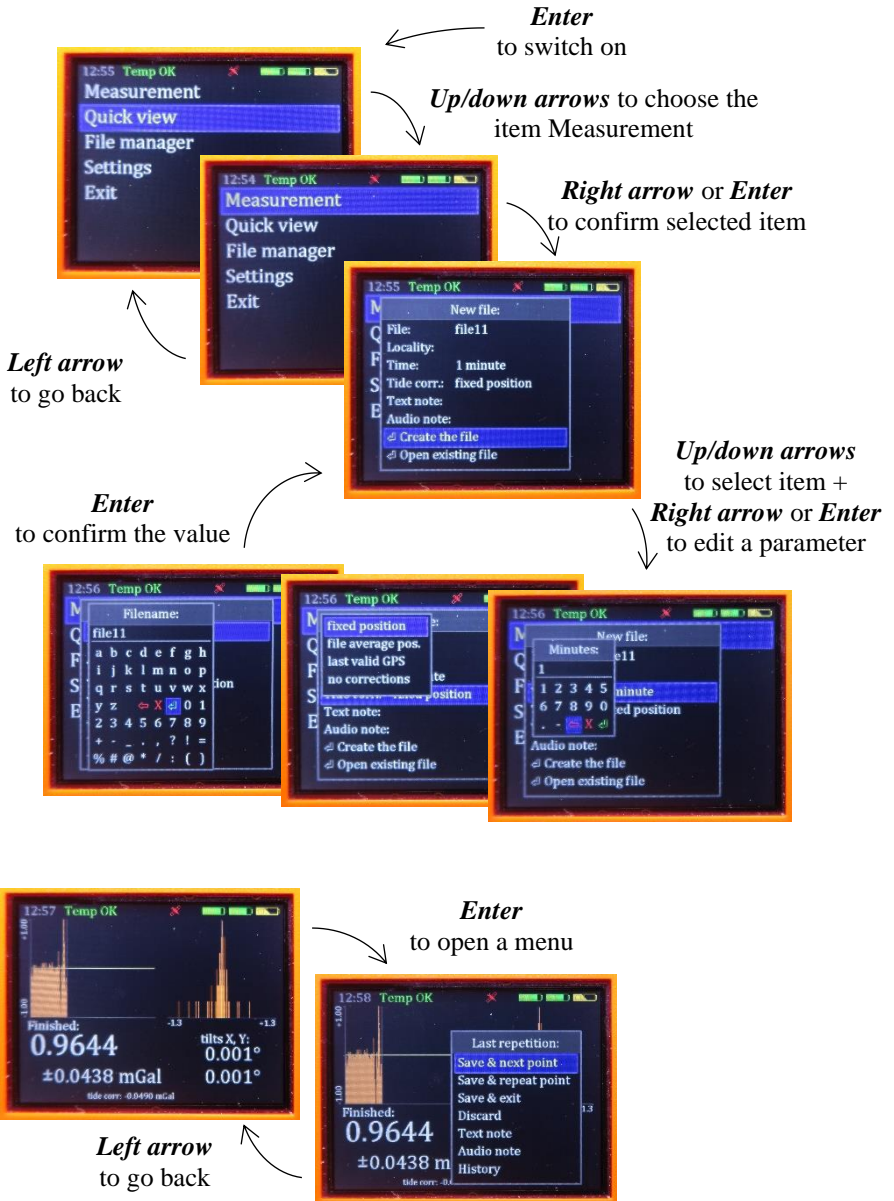


Sensor temperature status – OK / ERROR according to the sensor temperature.

Measured gravity – it is the corrected value from the sensor. There is also a thermostat temperature displayed while the probe is connected to an AC adapter.

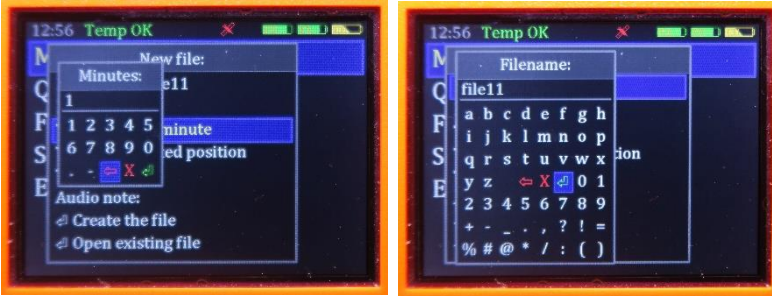
Tilt – follow the numbers and arrows as a hint how to rotate tripod's wheels to level the probe.

Examples of Menu Handling

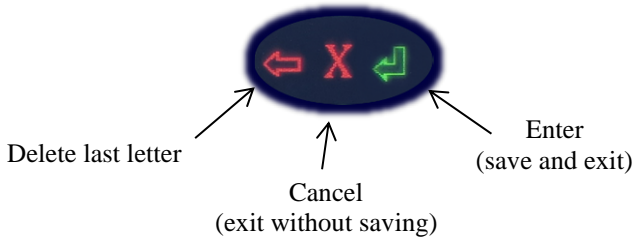


Text Input, Numerical Input

Use joy-stick to choose and confirm a symbol to be written.



Special symbols:



Audio Recording

Any data file as well as any measured point can be completed with audio note. Each audio note is stored and exported as a separate file.



Select audio note



Confirm and record a note



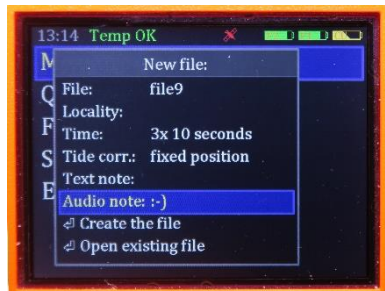
Any button stops recording



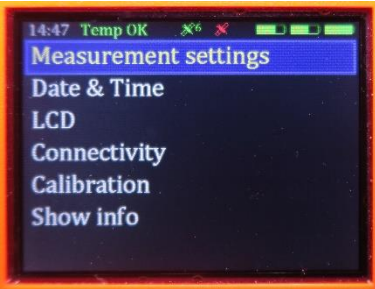
Replay note to check comprehensibility



:-) marks an existing audio note

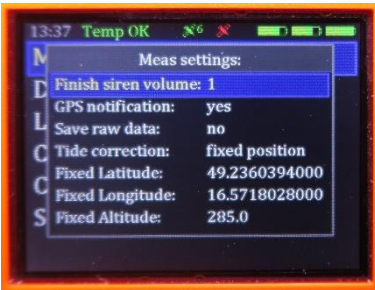


Settings



Select *Settings* from the main menu to check and set all settings.

Measurement settings



Finish siren volume – loud speaker volume when last measurement is finished.

GPS notification – allows beep sound when GPS signal appears / disappears.

Save raw data – allows to store gravity measurement waveform (10 samples per second) together with measurement results.

Tide corrections – see chapter below.

Note: raw data increase memory consumption as well as time needed for data dumping.

Measurement settings - tide correction

The Moon and Sun tide corrections are calculated according to Longman tidal formulas. For proper calculation the GMT time as well as the position on the Earth are needed. GPS coordinates can be set manually or taken from GPS receiver. External GPS is used prior to Internal GPS.

Select *Settings* from the main menu, and then *Measurement settings* to set method of tidal correction calculation.



Select *Tide correction* to choose the type of tidal calculation. This will be used for initial set of tide correction when new measurement created.

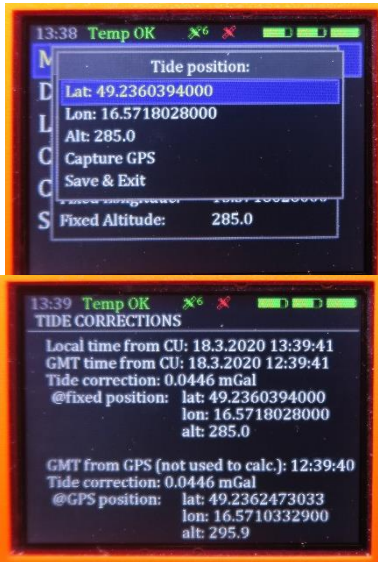


Fixed position – the position on the Earth is fixed to a constant value.

File average position – the average GPS position from all measurements in one file will be used. During measurement the current average is used for tide calculation. If the data file is displayed or downloaded to PC or flash disk then the tide correction is recalculated according to final average position.

Last valid GPS – the current GPS data are used. If no GPS data are received then the position from previous measurement will be used.

No correction – no tide correction is calculated.



To change the fixed GPS position select *Measurement / Tide corr.: / Fixed position*. The values can be changed manually or by capturing the current position from GPS receiver.

The tide correction calculated from current GPS position as well as the correction calculated from fixed position is displayed when *Show info* from the *Settings* menu is selected.

Date & Time

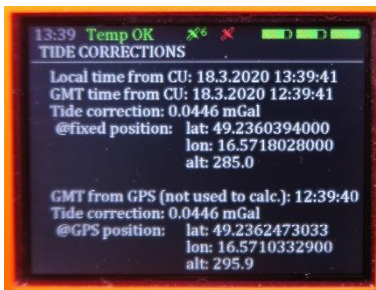


It is necessary to set proper local time. The local time is displayed on the left upper corner of the LCD as well as stored in measured data file.

Time zone is important to determine GMT time for correct calculation of the tide correction.

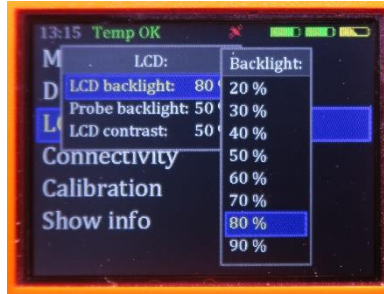
Auto update by GPS – the GPS data contains GMT time. It is used to keep valid time in the control unit when allowed.

Auto update by PC – Allows updating the time automatically from a PC when connected to download data.



To check consistency of the local time, the time zone and the GMT time coming from GPS receiver select **Show info** from the **Settings** menu.

LCD



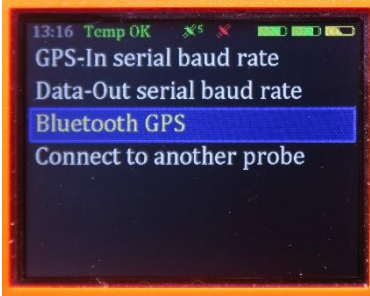
LCD backlight changes control unit backlight intensity. The backlight intensity can also be changed directly in any menu if you press **Enter** button longer than 1 second. The backlight intensity changes automatically as long as you hold the button.

Note: Display backlight of the control unit influences battery life on a single charge.

Probe backlight serves for setting of the probe display.

LCD contrast changes control unit display contrast.

Connectivity



The menu serves for setting of RS232 and Bluetooth connections.

External GPS Receiver Connection – via RS232

Set the GPS receiver to the mode for transmitting of NMEA protocol with GGA sentence, without parity.

Select *Settings* from the main menu, then *Connectivity* and finally *GPS-In Serial Baud Rate*.

Choose a Baud Rate corresponding to Baud rate of the GPS receiver.

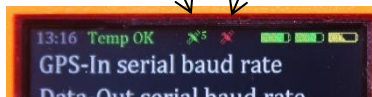


Green GPS symbol with a number of satellites is shown while external GPS data are received. No symbol means no external GPS data receiving.

According to measuring settings (*Settings / Measurement settings / GPS notification* set to „Yes“) a short beep signalizes GPS data receiving start, while long beep means no GPS data available.

External GPS symbol

Internal GPS symbol



External GPS Receiver Connection – via Bluetooth

Set the GPS receiver to the mode for transmitting of NMEA protocol with GGA sentence.

Choose **Settings** from the main menu, then **Connectivity** and **Bluetooth GPS**.

List of available Bluetooth devices is shown. Select the GPS receiver.

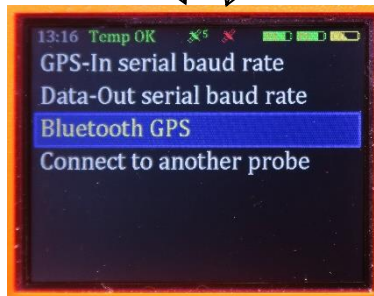


GPS data are displayed in case of successful connection.

Green GPS symbol with a number of satellites is shown while external GPS data are received. No symbol means no GPS data receiving.

According to measuring settings (**Settings / Measurement settings / GPS notification** set to „Yes“) a short beep signalsizes GPS data receiving start, while long beep means no GPS data available.

External GPS symbol Internal GPS symbol



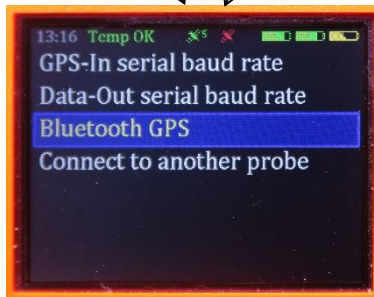
Internal GPS Receiver

It cannot be switched off. Both external and internal GPS data are stored if external receiver is connected.

Green GPS symbol with a number of satellites is shown while internal GPS data are received. Red symbol means not valid GPS data.

According to measuring settings (*Settings / Measurement settings / GPS notification* set to „Yes“) a short beep signalizes GPS data receiving start, while long beep means no GPS data available.

External GPS symbol Internal GPS symbol



Note: internal GPS receiver is based on SiRF Star IV, horizontal Position Accuracy 2.5 m CEP (SA off), position refresh rate 1 s.

Data Out Connection – via RS232

This option serves for automatic external data collection in complex systems.

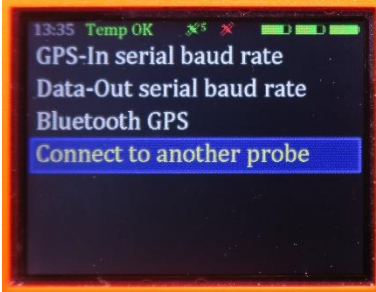
Select *Settings* from the main menu, then *Connectivity* and finally *Data-out Serial Baud Rate* to set proper Baud Rate.



For more information contact GF Instruments.

Connecting to another LG-1 Probe

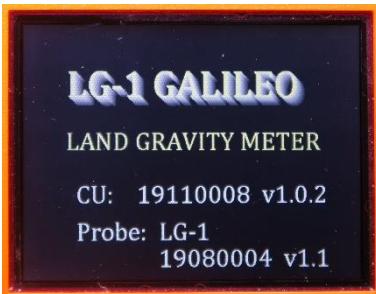
The procedure allows changing the probe connected to the control unit.



Select *Settings* from the main menu, then *Connectivity* and finally *Connect to another probe*.



Then select probe by its serial number.



Welcome screen appears when the new connection is established successfully.

Measurement Procedure

The gravity measurement on a measured site consists of gravity data collection for a given time period. The length of the period determines total precision of the measurement.

The measurements are stored in data files in the Control unit memory. The gravity measurement is completed with GPS data (internal 2.5 m GPS receiver in the Control unit for rough point positioning and also optional external GPS receiver), with manually entered position information and other data as a comment.

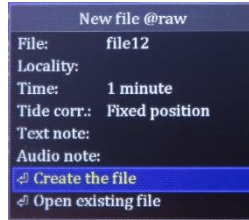
Periodic re-measurement of a base station (usually every 2 – 4 hours) serves for eliminating of a total residual Probe drift.

For the measurement the Probe is placed on the tripod, which serves for levelling. The tripod upper parts must fit into the probe bottom rails. The tripod should stay on a solid ground, or be pushed into a soft ground (up to its base). The levelling tripod can be also mounted on any bigger one using its central hole.



To start the measurement, switch the Control unit on (the LG-1 probe must be switched on permanently) and Choose ***Measurement*** from the main menu.

Edit File Parameters



If the window title indicates **@raw** then raw data are stored together with results – see *Measurement settings* menu.

File – name of new data file (automatically numbered file name is preset)

Locality – name of locality (optional)

Time – logging time of one measurement – usually 60 seconds and the number of its repetitions. 1-100 repetitions can be set, logging time can be set from 10 s to 10 min. The repeated measurements are done automatically, the immediately following values are stored.

Tide corr. – type of tide correction calculation. The value is preset according to *Measurement settings* menu.

Text note – optional text description of the file

Audio note – optional audio record. Its length is not limited.

Create the file

Open existing file – allows continuing of the previously stored measurement – list of stored files will appear; a header of selected file is displayed if the file is chosen.

Edit Point Parameters



Point – label of the measured point. Automatically increased when going to the next point (e.g. label *25a* is increased to *25b*, label *dyke59* is increased to *dyke60*).

Height – the height of the probe above the ground level. The height correction will be calculated after data download. Usually the height of the upper edge of the probe is used.

Nominal value – set absolute gravity value when a base station is measured. To set no value just confirm empty text when editing.

Text note – optional text description of the measured point.

Audio note – optional audio record. Its length is not limited.

External GPS – data capture from external GPS receiver, if connected. The position may be stored now (e.g. if the precise GPS receiver and LG-1 probe cannot be on the point simultaneously) or it will be captured automatically during measurement.

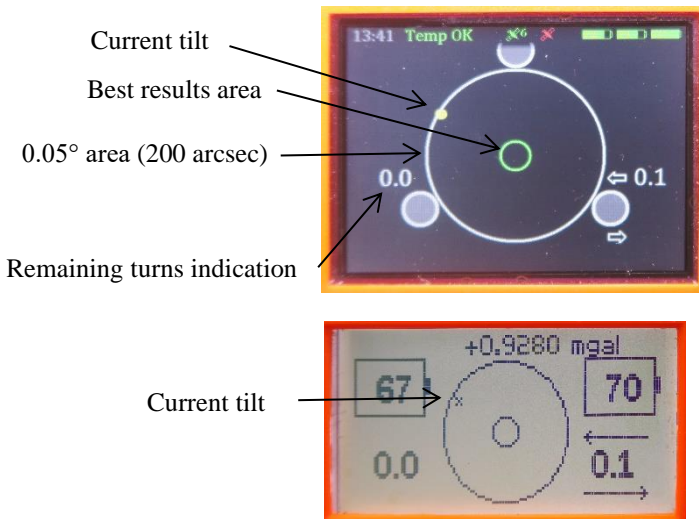
Single measurement – Start the measurement (all repetitions will be measured subsequently).

Continuous measurement – Start the measurement (regardless the set number of repetitions the measurement will be repeated until manually stopped).

Levelling

The gravity meter needs to be leveled (i.e. the sensor is exactly in horizontal position). Usually it is levelled using the Probe's display, when the instrument is placed at the measured point. The levelling screen on the Control Unit serves for verifying of the levelling status before the measurement.

Rotate the tripod's levelling wheels to move the Current tilt cursor into the Best results area.



Current tilt – the cursor should be placed in the middle of the circles by turning the tripod's levelling wheels.

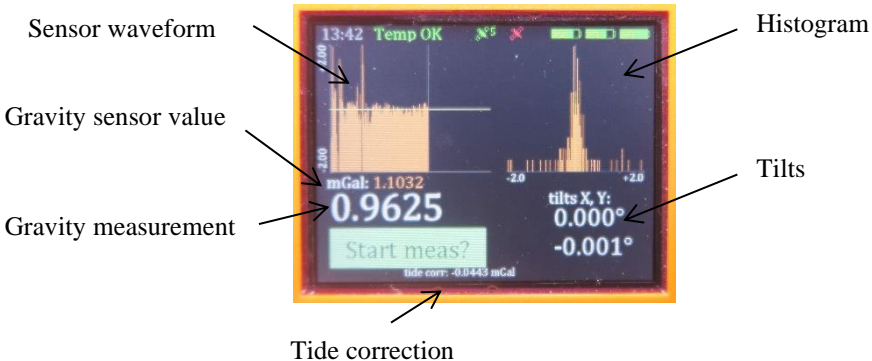
Best results area – area where the tilt should be kept for the best results, especially for microgravity measurement.

0.05° area – area of tilt under 0.05 degree (200 arcsec), where the built-in tilt correction gives accurate results.

Rem. turns indication – the direction and count of turns required for proper levelling. Turn two front wheels as indicated, or turn the rear one in the opposite direction.

To start the measurement press the **Enter** or **right button**, to escape press **left button**.

Measurement Preview



Sensor waveform – gravity measurement waveform (10 samples per second), the vertical scale is changeable by pressing **Up / Down button**. The green line shows current result of the measurement.

Gravity sensor value – current result of gravity measurement.

Gravity measurement – the result of statistical processing of the measured gravity values (all measurements from measurement preview beginning).

Histogram – graph of measured values distribution. Slimmer peak indicates lower noise level. The green line shows current result of the measurement.

Tilts – current values of tilt.

Tide correction – displayed if calculated (it allows to check whether it works correctly)

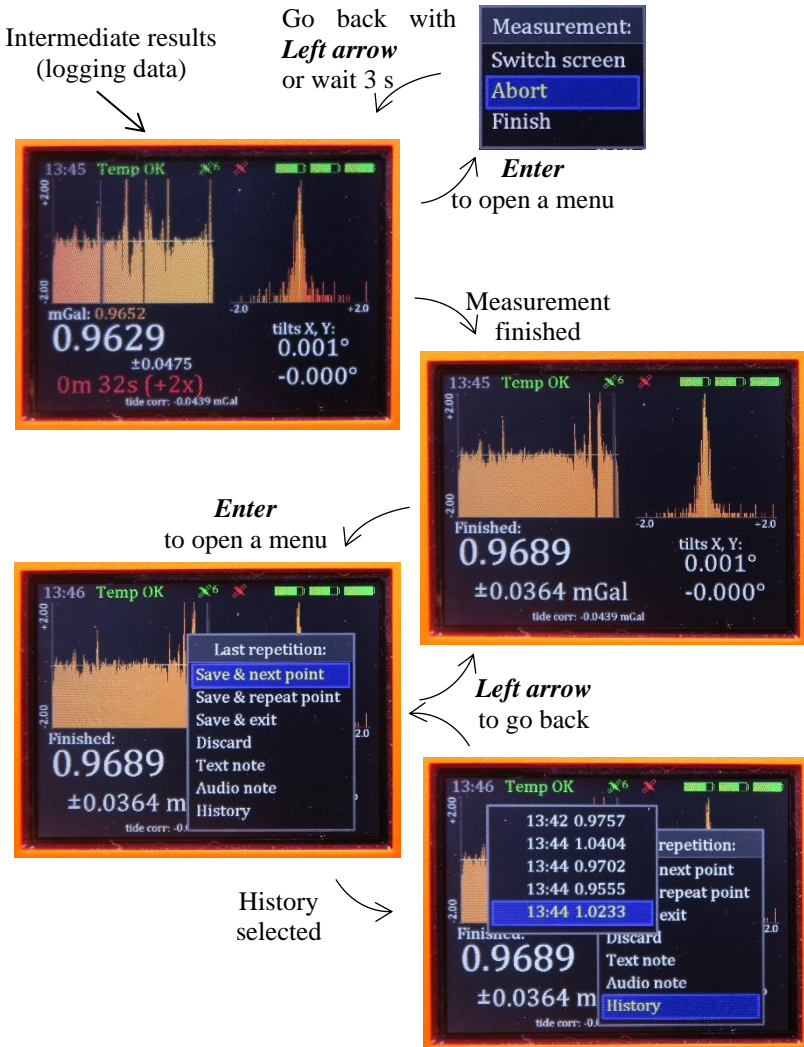
The screen serves to check the gravity signal stability. If the noise level is OK, if the average value is not changing, if tilts remains low, press **Enter** or **right button** to start gravity measurement.

To escape press **left button**.

Gravity Measurement

Gravity logging is carried out for the preset time. Then the result together with the standard deviation is displayed. The logging can be aborted or finished earlier after pressing **Enter button**.

Finishing of the measurement is signaled by the audio signal. Its volume can be adjusted in **Settings** under **Measurement** settings, item **Finish siren volume**.





Right arrow to switch between graphic screen and text screen with last 5 measurements



Switch screen – switch between graphic screen and text screen

Abort – cancels the measurement.

Finish – finishes the measurement earlier (shorter logging time) – suitable for example when a train is coming and big ground noise is expected.

Save & next – stores final data into the memory and prepares measurement of next point (increased point number).

Save & repeat – stores final data into the memory and prepares new measurement of the same point

Discard – deletes the measured data and prepares repeated measurement.

Text note – edits the text note associated with this measurement.

Audio note – edits the audio note associated with this measurement.

History – view list of the last measured values (up to 100 measurements).

Quick View

This mode allows fast measurement of gravity value without storing in the device memory. Settings of file parameters and point parameters are omitted.

Levelling (see page 33) is to be done first.

Then **Gravity measurement** (see page 34) with preset measurement time of 10 minutes is performed. Tide correction is calculated according to **Measure settings** menu. The measurement is aborted after pressing **Enter button** or **Left button**.

File Manager



File Manager allows reviewing of measured data, deleting of useless files from data memory, saving files to USB flash disk or erasing the whole instrument memory.

Choose ***File Manager*** from main menu.

View Files

At first list of stored measured files is displayed. Once one of the files is selected its header is displayed, then it is possible to go through measured data using ***right / left arrows***.

Delete Files

Select a data file from a list, and then confirm deleting the file.

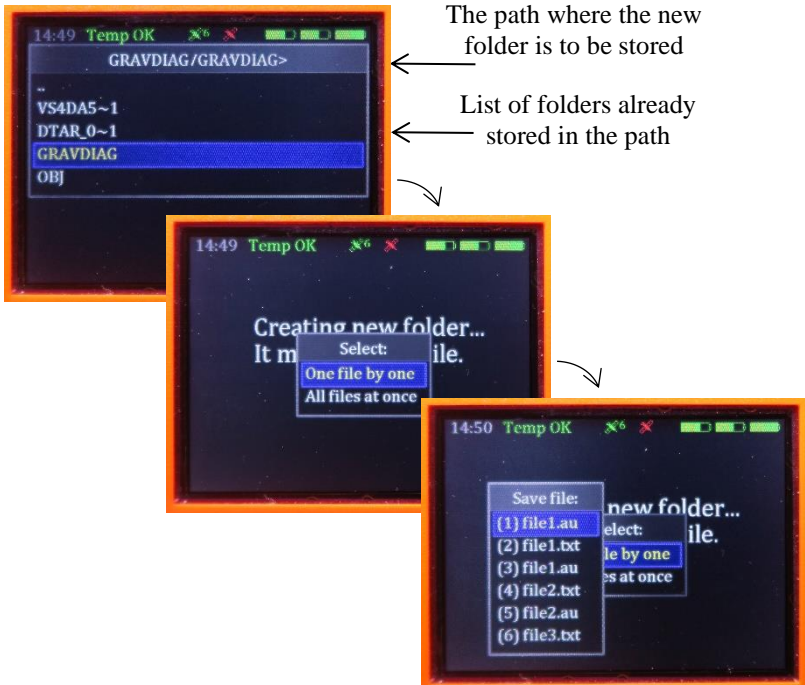
Save to USB flash

Connect the data cable from accessories to the control unit and connect your USB Flash disk (FAT12, FAT16 or FAT32 formatted) to its shorter part. The beep sound confirms successful connection.

Either all files or one by one file stored in memory will be transferred to USB flash disk into a new created folder. Select path where the new project folder will be created, the current path is displayed above the line. To go into any folder, select the folder and press **right button**, to go into a parent folder press **left button**. To confirm the path, press **Enter button**.

Finally enter a name of the new created folder.

Note: Drift correction with respect to base measurements is not calculated. A binary file is stored together with standard ASCII file. The binary file can be used in PC software **Gravimeter Downloader** for export with calculation of drift correction with the respect to base station.



Memory Format

After confirmation, all data memory is erased and formatted. It represents total data loss!

It is useful to do memory formatting from time to time for defragmentation of the data memory.

Memory space from deleted files can be used only when the whole memory is formatted.

Data Download

Files with the measured data can be transferred to PC either directly or via USB flash disk (described in chapter Save to USB flash on page 39).

Output files are ASCII and can be opened in MS Excel or in a text editor.

Files stored in binary format can be exported to ASCII format using the program *Gravimeter Downloader*.

If an audio note is made with the measurement the mark “+audio” is added to the measurement text note and the related audio file “.au” is created.

PC Software Installation (Before First Download)

Insert the installation CD Gravimeter to the PC. Connect the PC with the control unit using a cable from accessories. The control unit is switched on automatically, wait for the text “PC Control” on the control unit screen (drivers installed successfully).

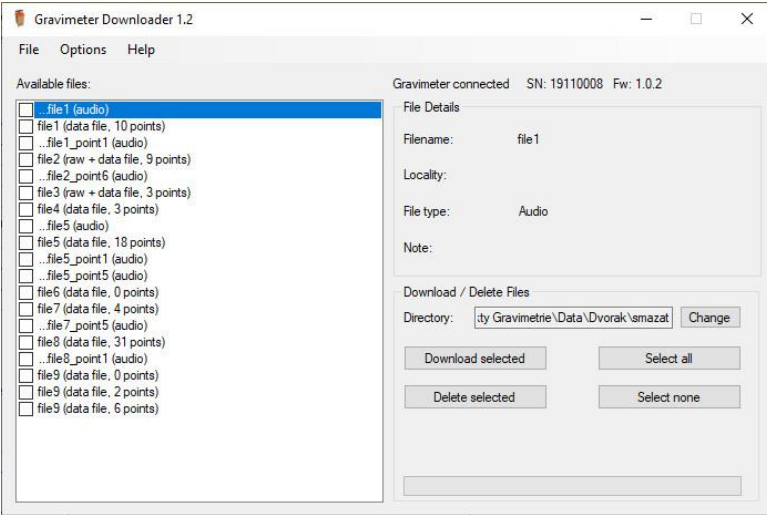
For the installation of *Gravimeter Downloader* software please run *setup.exe* from the *Gravimeter Downloader Software* folder on the CD and follow its instructions.

Further information (if necessary) can be found in *readme.pdf* on the installation CD.

Start of the PC Software

For direct data download connect your PC with the control unit using a cable from accessories. The control unit is switched on automatically, wait for the text “PC Control” on the control unit screen and start Gravimeter Downloader on PC by double click on its icon on the desktop or choose the item Gravimeter Downloader from the menu *Start | Programs | GF Instruments | Gravimeter*.

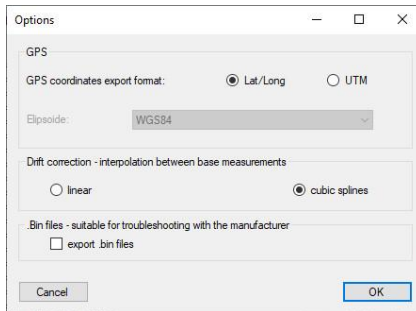
Screen like the following one will appear.



You can select files from the control unit memory for downloading/deleting. Selected files can be copied to the chosen directory then.

Relevant audio files are selected automatically if a data file is selected.

After clicking on menu **Options\Program** you can choose either Latitude/Longitude or UTM way of GPS coordinates as well as the way of calculating drift correction.

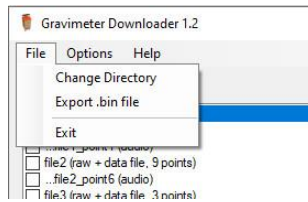


Linear drift correction – the drift correction value is interpolated linearly between each two following measurements of a base station. Calculated drift is a continuous curve with sharp breaks.

Cubic splines – the drift correction value is interpolated using a cubic spline. Calculated drift is a continuous smooth curve.

Export .bin files may be ticked to store .bin files together with exported data. The .bin file contains also some status information. The .bin file can help in case troubleshooting with the GF Instruments.

To export binary file select **Export .bin file** from **File** menu and then choose the file.



Output Data Format

The output files are ASCII files with the results. A *.txt* file contains all results of measurements. Two raw data files are exported if raw data collection was set. One, with extension *.dat*, has all the raw data from all measured points in one column, the other, with extension *table.dat*, has each measured point in separate column.

The *.txt* file consists of the header with measurement settings and the following columns:

Point point label

Date

Time

Decimal_time+date combined item

Latitude Lat(ext) for external GPS & ***Lat(int)*** for internal GPS data

Longitude Lon(ext) for external GPS & ***Lon(int)*** for internal GPS data

Altitude Alt(ext) for external GPS & ***Alt(int)*** for internal GPS data

Satellites Satellites(ext) for external GPS & ***Satellites(int)*** for internal GPS data

FixQuality FixQuality(ext) for external GPS & ***FixQuality(int)*** for internal GPS data

Sens_Temp relative temperature of sensor core

G_nominal nominal gravity when base station measured

Height probe height above ground level

Measurement gravity measurement (after Tilt, Drift, Temperature corrections)

St_deviation standard deviation of the gravity measurement

Drift&Offset_correction correction calculated from repeated base station measurements

Height_correction correction calculated from the probe height above ground level

Tide_correction calculated correction

G_corrected consists of ***Measurement*** + ***Drift&Offset_corrections*** + ***Alt_correction*** + ***Tide_corrections***

Tilt_X value of the tilt in X axis

Tilt_Y value of the tilt in Y axis

Duration period length of the measurement

Note text + audio

In the *.dat* file the following first column is included:

G_data raw output of the sensor, 10 samples per second. Tilt, drift and temperature corrected.

In the *_table.dat* file each column starts with the information about the point number, date and time of each measured point.

Gravity Corrections

Temperature correction based on precise measurement of the sensor temperature is done directly in the probe.

Tilt correction based on precise measurement of the sensor tilt is done directly in the probe. User recalibration of the tilt correction is useful after transport or switching the probe on.

Internal drift correction eliminating permanent drift of the sensor is done directly in the probe. User recalibration is possible.

Postprocessing drift correction eliminating residual drift is done after data download, with regards to repeated base-station measurements. The correction values are stored in the output data file. Two methods of calculation are available:

- Linear drift correction – the drift correction value is interpolated linearly between each two following measurements of a base station. Calculated drift is a continuous curve with sharp breaks.
- Cubic splines – the drift correction value is interpolated using a cubic spline. Calculated drift is a continuous smooth curve.

Height correction eliminates influence of variable height of the probe above the ground level. The correction $3.086 \mu\text{Gal} / 1 \text{ cm}$ is calculated after data download from the height value set by the operator during the measurement. The correction values are stored in output data file.

Tide correction is calculated according to I. M. Longman's formulas, using GPS data (position and time) and the gravimetric factor 1.1575. The correction values are stored in output data file.

Maintenance

LG-1 Land Gravity Meter does not require any special and frequent maintenance.

However, it is a sensitive and sophisticated geophysical tool that can be damaged by careless handling. Good technical and geophysical sense of user can significantly both improve the quality of measured results and prolong the life of the instrument.

Device Storage & Transportation

The storage & transportation can be short-time (during the gravity survey) and long-time (between the projects).

The Probe needs to be permanently switched on, and levelled to maintain proper measurement precision during the gravity survey.

Overnight, during the gravity survey, when you are not using the gravimeter:

- level it at a dry secure place,
- keep it switched on and connected to the AC adapter,
- the Control unit can be switched off.

It is also recommended to keep the probe switched on during a short transportation (less than 24 hours).

Switch the probe off between the projects (in the case of storage or longer transport). Avoid mechanical shocks during handling of the probe even when it is in the transport case!

Keeping Water Tightness

High degree of water tightness is kept while there is no mechanical damage of the instrument casing. It is recommended to check sealings under battery covers from time to time.

Power Supply

Rechargeable Li-Ion batteries do not require exchange during day operation. Recharging after each day work provides their reliable working time. Additional spare battery can serve for unpredictable occasions like sudden battery failure, forgotten recharging, etc.

Tripod

Threads of the leveling wheels are protected against moisture and dust by stainless steel sleeves and rubber seals. It is recommended to wind the wheel up, to clean the sleeve and lightly oil it from time to time. Assure that no dust gets in the threads!

Drift Calibration

Residual drift of the sensor is subtracted in data postprocessing using repeated base-station measurements.

The built-in drift correction can be fine-tuned using two measurements of the same place, with time interval 4-7 days between measurements with tide corrections on and valid GPS position.

Some recommendations for a time between the measurements:

- avoid mechanical stresses, for example during a transport,
- keep uninterrupted supply of the probe,
- keep the probe levelled.



Select *Settings* from the main menu, then *Calibration* and finally *Drift* to edit the calibration.

Fill in the form (two measurements + time interval between them) and select *Adjust drift*.

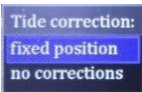


Finally confirm the drift calibration change.

Tilt Calibration

The built-in inclinometers as a crucial part of tilt corrections can be easily and precisely adjusted by three measurements on solid ground, away of potential noise sources, under different tilts.

Select **Settings** from the main menu, then **Calibration** and finally **Tilt_X** and **Tilt_Y** (in any order) to start the calibration.



Select type of tide corrections to be calculated.



Select one by one all inclinations to be measured.

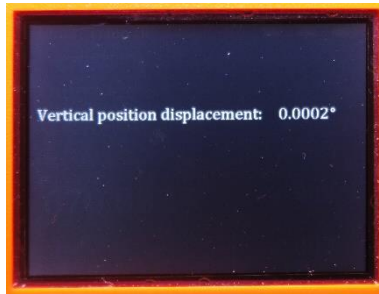


Level the probe into the green circle on the control unit's LCD. Note the probe's LCD does not indicate proper tilt at that time.



Perform gravity measurement (preset time is 3 minutes).

Individual gravity readings of different tilts should not differ much because of active tilt correction.



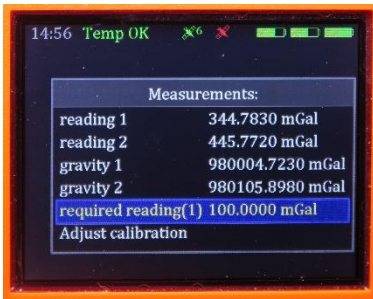
Select *Calculate displacement* and confirm the calibration change.

The calibration can be easily repeated to verify its accuracy.

Gravity Calibration

The gravity calibration can be adjusted using two gravity readings at places with different and known gravity acceleration. The difference over 100 mGal is recommended for high accuracy of the calibration.

To avoid a drift of the device as well as any other random error it is recommended to measure both places several times.



Select *Settings* from the main menu, then *Calibration* and finally *Gravity* to edit the calibration.

Fill in the form (two measurements + known gravity accelerations).

The item *required reading(1)* allows to shift the probe's reading to give a specific value on the 1st place.

Select *Adjust calibration*.

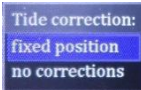


Finally confirm the gain calibration change.

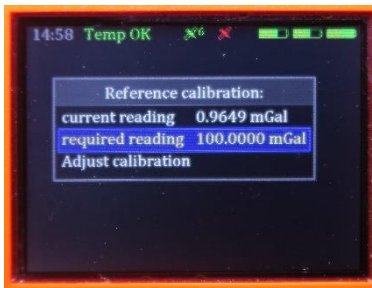
Reference calibration

The reading value can be shifted to give required reading at any place.

Select *Settings* from the main menu, then *Calibration* and finally *G reference* to start the calibration.

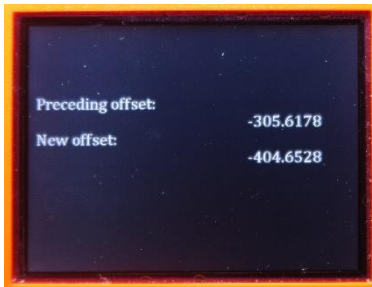


Select type of tide corrections to be calculated.



Choose option *get reading* to start gravity measurement. Once the measurement is finished the name of the item will change to *current reading*. Fill in the *required reading*.

Select *Adjust calibration*.



Finally confirm the offset change.

Firmware Upgrade

- Switch the control unit off.
- Press and hold **Down arrow** and then switch device on by pressing **Enter**. "Bootloader mode" message will appear. If the probe is in the Bluetooth vicinity than either the probe or the control unit can be selected for upgrade.
- Connect the device with PC using USB cable and start Gravimeter Downloader software.
- From **Tools** menu select **Firmware upgrade**, and choose the new firmware file.
- Upgrade process will start. When finished, click **OK** and device will be automatically turned off. The firmware upgrade is completed.

Microgravity Measurements

The following recommendations are valid generally, especially when a precise measurement is required:

The probe should be always leveled (the inclination indicator on a display inside the 0.05° circle) except the probe transportations. This is especially important for microgravity measurements. Mechanical shocks can cause sensor drift. It may need several hours to disappear then.

Do not connect the AC adapter to the probe during measurement.

Try to follow the same measuring procedure at every measured point. Performing the gravity reading in the same time period after probe is moved to another point increases precision of the measurement. If a rough handling cannot be avoided, level the probe and wait a few minutes before every reading, until a possible slight drift disappears.

Prefer solid ground (rock, concrete...) to a soft soil for the measurement, away of potential sources of vibration.

Avoid mechanical shocks during manipulation with the probe. Use soft shock absorber below the probe while transporting by a vehicle.

Under windy conditions use e.g. a windbreak tent to protect the meter from influence of wind.

Provide a base station measurement rather more often (e.g. each two hours) to minimize variable drift influence. The base station should be an easily accessible low noise place with solid ground surface.

Technical Specifications

Dimensions and Weight

Probe: 23.5cm x 21cm x 35cm / 5.8 kg (including batteries)

Tripod: 0.5 kg

Control unit: 0.6 kg (including Li-Ion battery)

Transport case: 70 cm x 36 cm x 53 cm

Ambient Conditions

Temperature from -20 to +45°C

Dust & light rain protection

Probe

Sensor: Robust fused quartz core in tempered chamber, good resistance to mechanical shocks and vibrations

Resolution: 0.1 μ Gal

Gravity operating range: 10000 mGal

Repeatability: better than 5 μ Gal

Built-in corrections: Tilts, Drift, Temperature, (tide by PC software)

Sensor sampling frequency: 10 per second

Gravity acquisition time: 10 s to 10 min

Gravity sensor position: is in the middle of the probe case, 20 cm below upper edge

Power supply: Li-Ion batteries (hot-swappable, 2 x 10.4 Ah, 30 hours at 25°C), AC adapter or 12 V car socket recharging

Control

Joy-stick user-friendly operation

LCD probe display: Sun well readable transreflective (with backlight)
B&W 128x64

LCD control unit display: Sun readable transreflective RGB 640x480

Firmware upgradeable: Both the probe and the control unit (via internet)

Data memory: 8 GB

GPS receiver: integrated SiRF Star IV technology (2.5 m accuracy) or
external receiver

Connectivity: Bluetooth (2 channels for the probe and GPS), USB (for PC
and flash disk), RS232

Power supply: Li-Ion battery (5.2 Ah, 30 hours) or 6 AA cells, AC adapter
or 12 V car socket recharging

Safety Instructions



The instrument is equipped with fused quartz sensor. Avoid strong mechanical and temperature shocks!



This device meets essential requirements and other relevant conditions of the applicable European directives. The Declaration of Conformity is delivered with the instrument. Testing reports are available on request.



If possible, dispose of the device at a recycling center. Do not dispose the device with the household waste.

For warranty or after warranty repair contact the producer at the address:
(or a service center from list on www.gfinstruments.com)

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