VERTEX LASER GEO2 & LASER GEO2

Technical manual - English

Overview of the manual

This manual covers only the essential, standard functions of GEO2 units, such as hardware configurations, battery charging, or switching the application in the unit.

Haglöf Sweden AB

1 OVERVIEW

1.1 HAGLÖF SWEDEN®

Haglöf Sweden AB focuses on the development, manufacturing, and marketing of modern measurement solutions for professional forest inventories and other field measurement work.

In Haglöf Sweden's unique product range you will find the world' largest assortment of increment borers and precision calipers, a variety of height and distance meters, laser rangefinders, computer calipers and complete software systems and applications.

There are over 200 companies representing the Haglöf Sweden brands around the world. This ensures customers on all continents and on more than 100 different markets quick and qualified service and support.

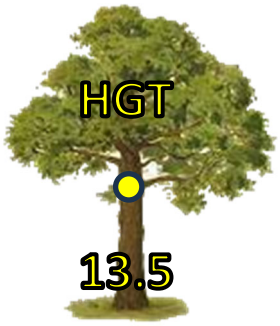
1.2 USER GUIDE

- The manual uses the term GEO2 for all the instruments. When it refers to the Vertex Laser Geo2 specifically, it calls it VLGEO2 and the Laser Geo2 as LGEO2.
- When shipped, the GEO2 is usually pre-programmed with one or more applications, depending on your purchase configuration.
- This manual describes only the basic, built-in functions found in GEO2 units, such as hardware settings, charging the battery, or changing the application in the unit.
- To learn more about the functions and menus, consult the manual of the application that is installed in the GEO2.

1.3 FEATURES

The GEO2 models offer outstanding capacity and versatility, for accurate and efficient field measurement operations in different situations, terrains, climates, and surroundings.

GEO2 has a high-tech platform that is programmable and can be adapted to the customer's needs. In addition to the user being able to choose a standard application, he can also choose other application modules to fulfill his need for functionality. Different application modules can be stored in GEO2 to be selected later in real time in the field whenever needed. The range of application modules is large and constantly growing.



The GEO2 offer long range distance measuring with high precision laser and integrated tilt- and compass sensors for accurate 3D measurements.

When measuring height, diameters can also be measured and recorded. A diameter can be measured at a particular height or alternatively, a height can be determined for a fixed diameter.

Results are presented in an integrated heads-up display and on a large external graphic LCD display.

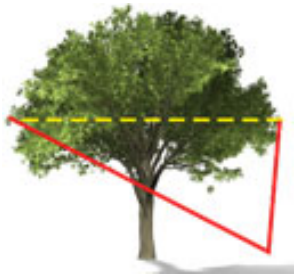
Data can be stored on the built in SSD drive with a simple key press. Saved data is ready for import to Excel as a csv file or imported to Google Earth as a KML file or any other GIS software that supports KML.

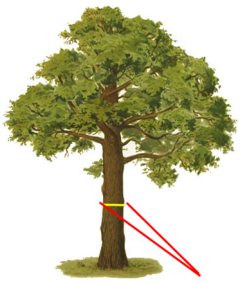
The VL GEO2 model includes built-in, proven reliable ultrasonic distance technology, optimized for measurements in dense forest and for circular sample plot work.

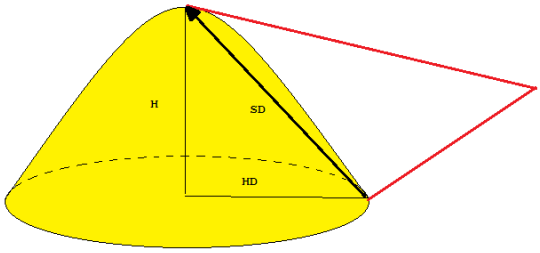
1.3.1 GPS AND MAPPING

The built in GPS-receiver and a 5-position numeric ID-attribute allow you to tag important data with coordinates with a simple key press. Your data is stored on a built in SSD drive and are immediately available to you when connecting the GEO2 standard USB 2.0 interface to any PC or Apple computer. No software installation or drivers are needed, and your field data can be opened straight in your favorite GIS- or spreadsheet application without any special converting software.

Complex operations such as area measurement, 3D mapping of targets and trail mapping have integrated functions in the GEO2. These functions are available without any external tools. The 3D Vector function allows you to measure horizontal targets such as canopy width or height of piles or heaps.







1.3.2 FORESTRY

The VL GEO2 model is especially suitable for forestry measurement applications. The use of an ultrasonic transponder helps you to quickly and accurately determine if a tree is in or out a circular sample plot. The ultrasound method is superior compared to alternative methods, as it can be used in dense forests and areas with thick understory.

1.3.3 HEIGHTS

Standard height measuring functions with laser (VL GEO2: also, ultrasound) such as 3-point, 2-point or 1 point measuring are available in the easy-to-follow menu system. The non-magnification reflex sight helps you to easier identify individual targets such as treetops in the forest.

1.3.4 UPGRADES AND CUSTOMIZATIONS

The Firmware (BIOS) in the GEO2 can be upgraded by the user. New functions and features are under constant development. New firmware is available on our website https://haglof.app as soon as it is released. An easy and quick installation ensures that you always have the latest version. Alternative application modules for user specified utilization functions can be offered at development and license costs. In addition to the user being able to choose a standard application, he can also choose other application modules to fulfill his need for functionality. Different application modules can be stored in GEO2 to be selected later in real time in the field whenever needed.

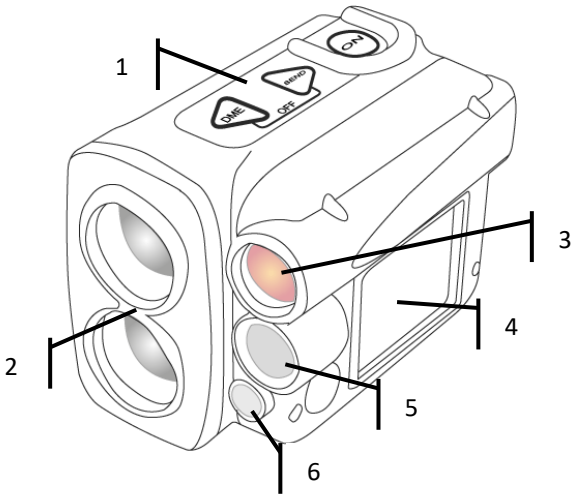
1.3.5 COMMUNICATION

The built-in, dual-mode Bluetooth BR/EDR- and BLE module, including both Bluetooth low energy V4.2 (LE) and Classic connectivity, enables long range wireless data transfer to your favorite handheld device.

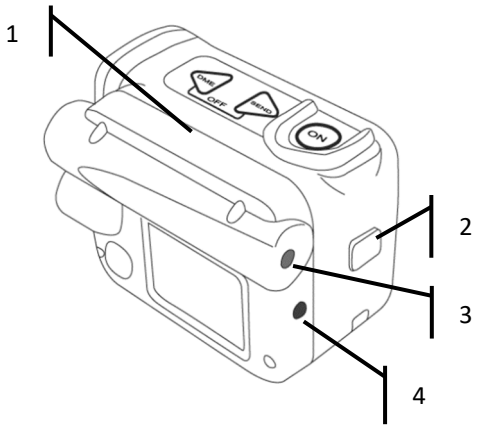
The Infrared transmitter can be used to send height data wireless to a computer caliper such as Digitech Pro II+.

The Standard USB V2.0 interface enables fast data transfer between PC and the GEO2.

2 INSTRUMENT OVERVIEW

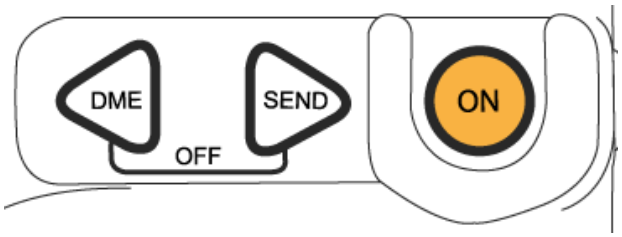


(1) Buttons
(2) Laser optics
(3) Lens for Sight and Heads up display
(4) LCD display
(5) Ultrasound transceiver (VL GEO2)
(6) Ultrasound temperature sensor (VL GEO2)



(1) Integrated
    a. Bluetooth
    b. Lithium-ion battery
    c. Integrated GPS receiver
    d. Integrated SSD drive
    e. Integrated Tilt sensor
    f. Integrated Compass sensor
(2) USB connection and protection cap
(3) Sight with HUD (Heads up display)
(4) IR transmitter

2.1 FUNCTIONS AND USE OF THE BUTTONS



The GEO2 instrument has an overlay with three buttons: the ON button and two buttons with arrow symbols that are labeled DME and SEND.

2.1.1 ON

The GEO2 instrument turns on when you press the ON button. The ON button also lets you choose a menu command or a function; confirm a choice or a value; and start measuring heights and inclination.

When you use the laser function to measure distances, you can hold down the ON button to activate a scanning function. The laser will keep scanning until it finds a target, or you let go of the button. The scanning function is very helpful to measure thin objects like power or phone lines.

2.1.2 NAVIGATION BUTTONS

Use the navigation buttons - DME and SEND - to move through the menus, and to adjust values and choices.

2.1.3 DME BUTTON

Only for VL GEO2, you can use the ultrasonic distance measuring function when the instrument is off by pushing the DME button.
The DME button also works with the Laser.

Push the DME key to temporarily switch the preset Laser mode (First-, Strongest-, Last- target), to make the laser sensor work better depending on the situation.

For instance: use mode Last to prevent the laser from hitting a target before your main target like grass or bushes.

2.1.4 SEND BUTTON

Using the SEND button, data can be transmitted with IR and Bluetooth to another device or stored in the internal memory during measurement.

Data transfer with IR or Bluetooth is not possible when data storage is turned on.

2.1.5 EXIT (DME + SEND)

Press both DME and SEND buttons at the same time to step out of a menu, to interrupt a function or to turn the instrument off.

The instrument has automatic turn off function that is activated after approximately 2 minutes of inactivity.

2.1.6 RESET

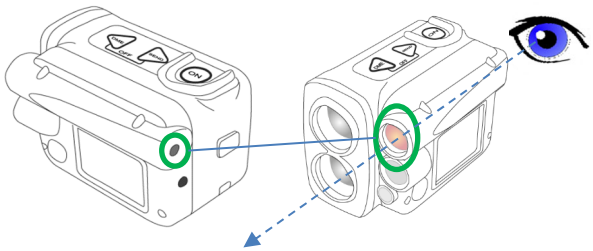
If the application in the instrument is locked, a reset can be done by pressing all keys (DME, SEND and ON).

2.1.7 TURN OFF

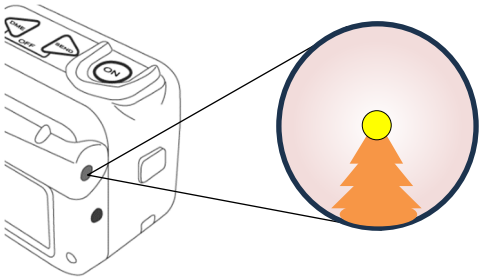
The instrument turns off after 2 minutes of inactivity. To turn off the instrument manually, press the DME- and SEND buttons at the same time (Exit) when in the main menu.

If GPS or Bluetooth is activated, the instrument will hold 18 minutes before completing turn off. This is to keep GPS or Bluetooth active and ready for new measurements within the time frame of 18 minutes.

2.2 SIGHT

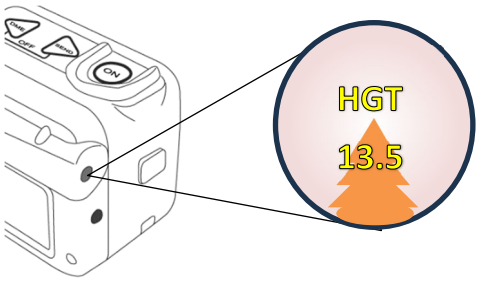


2.2.1 REFLEX SIGHT



The GEO2 have a highly intensive reflex sight. The sight has no magnification, to simplify identification of close-by objects.

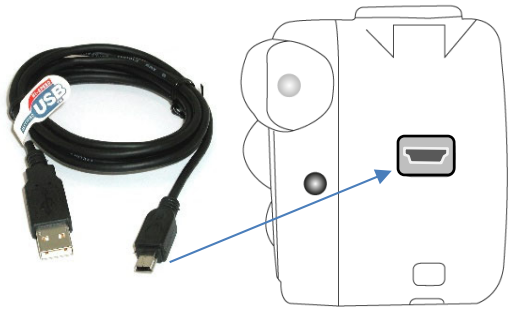
2.2.2 HUD (HEADS UP DISPLAY)



The reflex sight also works as a HUD (heads up display) where various results are presented. More details are shown on the large LCD display on the left side of the instrument.

2.3 BATTERY AND CHARGING OF BATTERY

The instrument has a Li-Ion battery inside. The display has a battery symbol with four (4) levels of battery power (100%, 75%, 50%, 0%).



To charge the battery, plug the mini-USB cable into the Mini USB port on the back of the instrument.

The charging process will stop by itself when the battery is full.

Do not power off the instrument while it is charging.

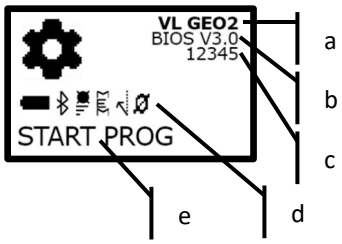
If the battery is empty, it will need about 3.5 hours to charge fully, and a full battery can support about 10,000 measurements.

> ! Please note that only an authorized service station can replace the battery, if needed.

3 BIOS/(FIRMWARE)

BIOS mode (Basic Input Output System) allows you to launch a new application or modify different hardware settings, test- and calibration routines. Most of the BIOS functions in this manual, such as SETTINGS or SELECT PROG, are usually available from the default application and you only use BIOS mode if the default application does not support them or if the application is missing or deleted.

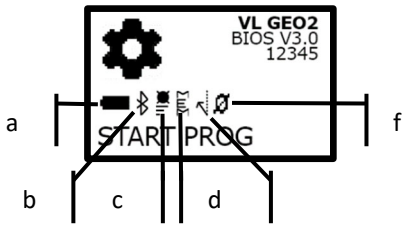
1. Push the SEND+DME buttons together from OFF mode to turn on GEO2 in BIOS mode.
2. The BIOS mode is on.



a. Instrument name: VL GEO2 or L GEO2
b. BIOS Version 3.0
c. Serial number 12345
d. Status Icons
e. Menu –" Function"

3.1 STATUS ICONS

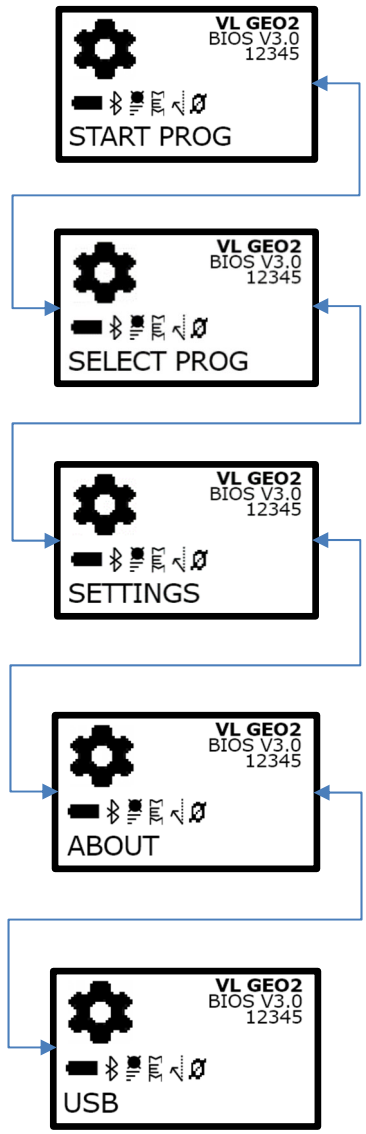
Some helpful status icons appear on the main menu screen.



a. Battery level 0%, 25%, 75%, 100% and Charging
b. Bluetooth on or connected
c. GPS enabled
d. Memory storage enabled
e. Compass declination enabled
f. Remote diameter or remote Fixed- diameter enabled

3.2 BIOS MENU SCHEME

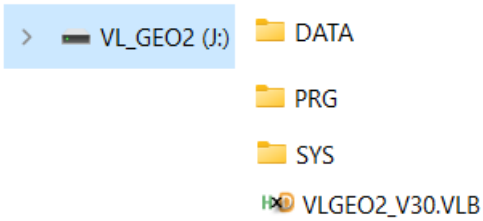
Start the BIOS menu: From OFF mode, press and hold the SEND+DME buttons.



3.3 BIOS UPGRADE

You can update the GEO2 BIOS firmware with new improvements when they are released. You should always have the newest BIOS version. You can get it from this link: https://www.haglof.app

1. To turn on the GEO2 instrument, press ON.
2. Use the mini USB cable to connect the Instrument to a computer.
    a. The instrument will switch to USB mode automatically.
    b. The Instrument will show up as a removable drive on Windows computer and as a mounted volume on Mac computers.
3. Copy the firmware file to the instrument's root library for example: "VLGEO2_V30.VLB".



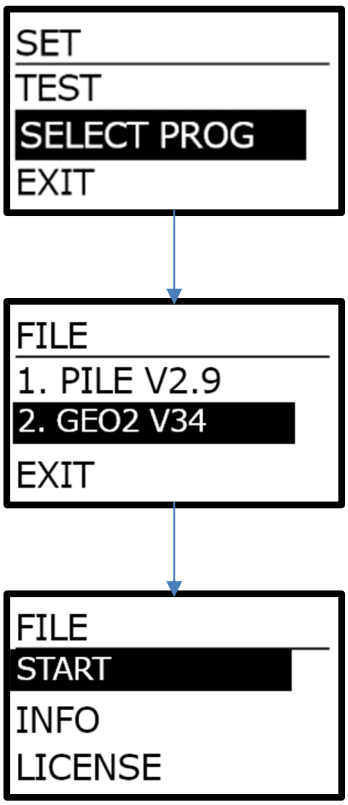
4. Disconnect the USB cable.
5. Turn the instrument off.
6. Hold the SEND button while the instrument is off and plug in the USB cable to start the upgrade. Let go of the SEND button.
7. When the upgrade is done, unplug the USB cable.

3.4 START APPLICATION

To launch the current application, select the menu option "START PROG". The current application also runs automatically when you switch on GEO2.

3.5 SELECT APPLICATION

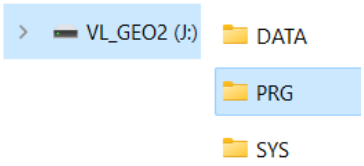
GEO2 can hold multiple applications. The menu “SELECT PROG” displays the applications that are in the GEO2. Usually there is only one default application, but a user can buy more applications if he wants to. The menu “SELECT PROG” can also be accessed from the current application in menu “SETTINGS”.



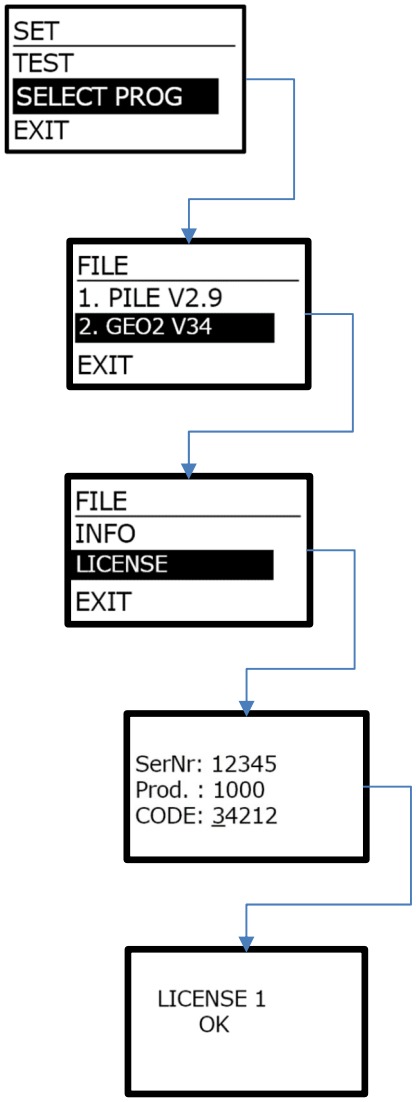
3.6 INSTALL AN APPLICATION IN GEO2

Install a new application by copying an application file ex. "**GEO2 V34.VL7**" to "**VL_GEO2:\PRG**" folder.

1. Press ON to activate the GEO2 instrument.
2. Use the mini-USB cable to connect the Instrument to a computer.
    a. The instrument will switch to USB mode automatically.
    b. The Instrument will show up as a removable drive on Windows computer and as a mounted volume on Mac computers.

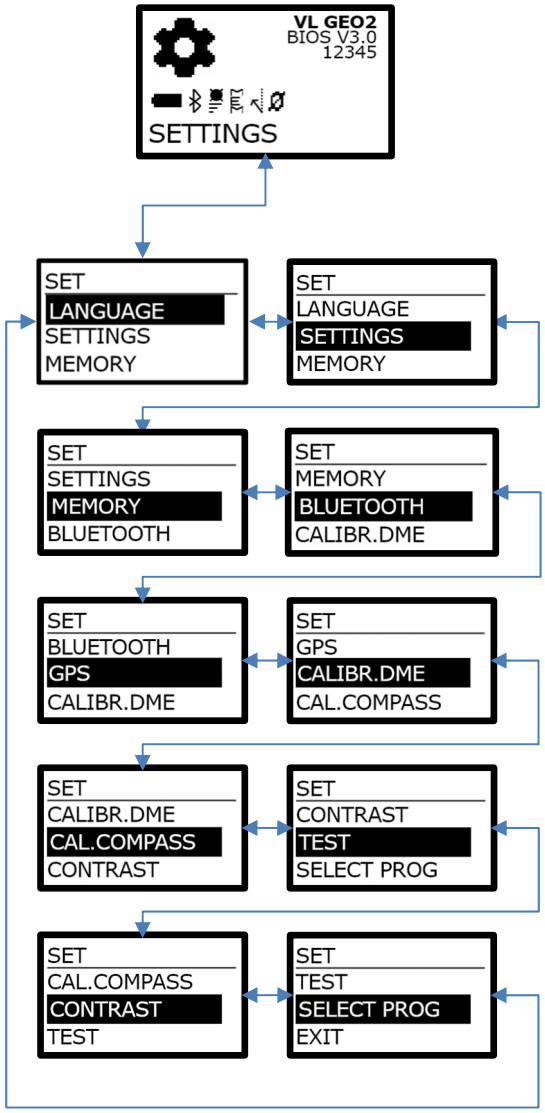


3. Unplug the USB cable.
4. Go to the menu "SETTINGS" in the application and press ENTER.
5. Choose menu "SELECT PROG" and press ENTER.
6. Pick the application from the list and press ENTER.
7. Choose "OPEN"
8. Choose "LICENSE"
9. Type in a valid License Code (from your dealer) in the CODE field.
    a. Begin with the first digit. Use DME- and SEND- button to increase/decrease the first digit.
    b. Move to the second digit with ENTER.
    c. When all digits are entered, press ENTER to save the License.
10. Select menu "**START"** to start the application.



4 SETTINGS

4.1 SETTINGS MENU SCHEME



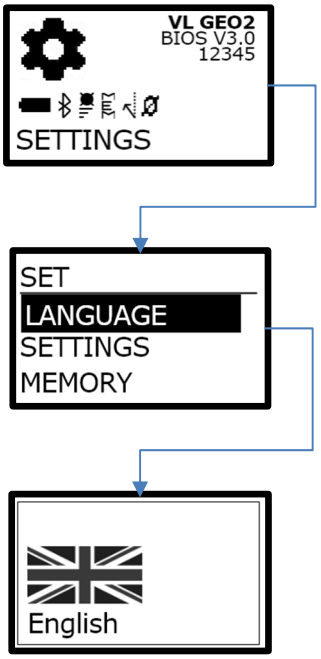
4.2 LANGUAGE

Choose the default language for GEO2. Some of the languages below may not work with the application, check the application manual for more details.

Currently following languages are supported:

English, Finnish, French, Portuguese, Russian, Spanish, Swedish, German, Czech, Danish, Estonian, Latvian, Lithuanian, Norwegian, Polish, Italian, Japanese.

Remember, language switches back to English when BIOS mode is on. (To start GEO2 in BIOS mode from OFF mode, press and keep holding the SEND+DME buttons.)



4.3 ENTERING TEXT AND NUMBER

Use the DME, SEND and ON buttons to enter text/numbers in some ID fields and several GEO2 settings. A cursor highlights the first character when you enter.

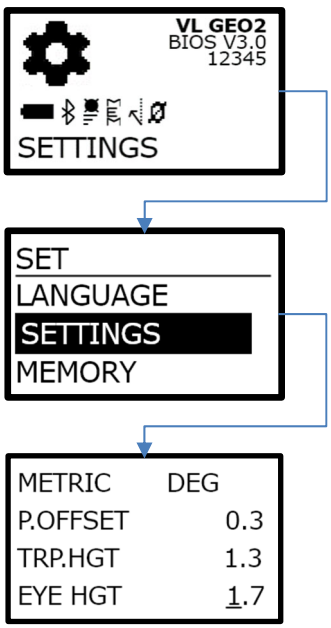
Ex: **0123.4**

To choose a different character, press SEND or DME. Keep doing this until you see the character you want. Press ON to go to the next position. When you enter the last character, the entry is done. You can cancel the entry with EXIT (DME + SEND).

4.4 SETTINGS

In the SETTINGS menu, all settings are made to measure heights, distances and angles.

1. Press ON to activate the GEO2 instrument.
2. Select **SETTINGS** and press ON to confirm. Choose **SETTINGS** in the **SET** menu and press ON.



3. Use the DME or SEND button to change values and settings. Press ON to step to the next field. Settings are saved when you have stepped through all fields. To quit, press the DME- and SEND buttons at the same time.

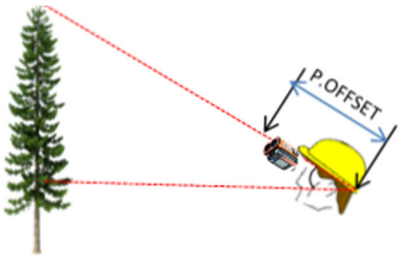
4.4.1 METRIC/FEET:

Choose between metric(m/cm) or feet(ft/") for measuring heights, diameters and distances.

4.4.2 DEG/GRAD/%:

Choose how to measure angles and slopes as DEG (degrees 0…360), GRAD (grades 0…400) or % (percentage).

4.4.3 P.OFFSET

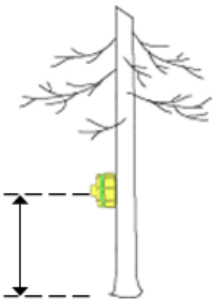


The Pivot offset is the distance between the front of the instrument and a hypothetical point where the projected aiming line from the tree and the top of the tree meet. This point is behind the operator's neck when using the instrument. The Pivot offset should normally be about 0.3m/1.0ft.

The Instrument will assume that the distance to an object is directly below the desired height of the target, so the Pivot offset should include half of the diameter value to account for the narrowing of a tree. To measure tree heights, you should add half of the average diameter in the stand/area where you are measuring now.

How to change values, See Entering text and number

4.4.4 TRP.HGT



The distance from the ground level to the transponder or other reference point should match the height of that point. Usually, the TRP.HGT value is the center of the transponder T4 or zero (0) when the reference point is at the ground level, or the lowest part of the object being measured. In menu HEIGHT DME, the height always includes the TRP.HGT value.

The standard height value for the T4 transponder is 1.3m/4.3ft, which is the Breast height on a tree.

How to change values, see 4.3 Entering text and number

4.4.5 EYE HGT

EYE HGT is the distance from ground level to the operator's eyes. This value is needed for the 1-point laser function to find out the total height from ground level.

How to change values, see 4.3 Entering text and number

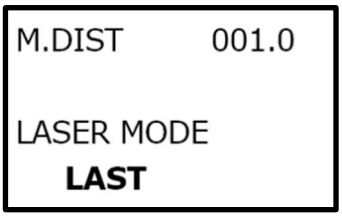
4.4.6 M.DIST

The HEIGHT DME menu allows you to enter a manual distance value if you already know the distance to the object, for example a constant distance between poles. You can use M.DIST as well if it is difficult to measure distances with ultrasound and/or laser, for example if there is a large object in the way of the object you want to measure. Note! The quality of the manual distance value affects the quality of the height result. Make sure you set the right transponder height TRP.HGT since this value is also used when you enter a manual distance value, see settings - TRP.HGT.

How to change values, See 4.3 Entering text and number

4.4.7 LASER MODE:

Set the laser to respond to the first object it hits (FIRST), the object that gives the strongest signal (STRONGEST), or to respond to and measure the last target it hits when measuring distances (LAST).



You can temporarily switch the laser mode by pressing the DME button and toggle between LAST, FIRST, and STRONGEST targets.

> ! Note that the laser returns to the default mode after a measurement.

4.4.8 BAF

BAF (Basal Area Factor) is a function in the DME menu that is usually used to measure distance with ultrasound (VL GEO). The BAF function can also be used with laser. When doing a "relascopic" measurement operation, the built-in BAF function can help to determine the minimum tree diameter 'Ø' for a plot. When using a relascope or prisms, some trees in the plot may be hard to see and to decide if they belong in the plot or not. By measuring the distance from the plot center, the Instrument can calculate the minimum diameter for the tree to be part of the plot.

Select the desired Basel area factor. It can range from 000.1 to 999.9 (m2/ha) or (ft2/acre).

Enter 000.0 to turn off the BAF function.

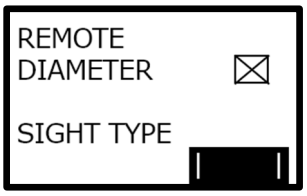
How to change values, See 4.3 Entering text and number

In sloped terrain, the VL GEO2 can adjust for the slope and compute the diameter measure. In these situations, use the ANGLE function in the menu to measure the distance and angle from the tree to the reference point (see section ANGLE in this user's guide).

To use laser instead of ultrasound, point and press ON to measure the distance with Laser.

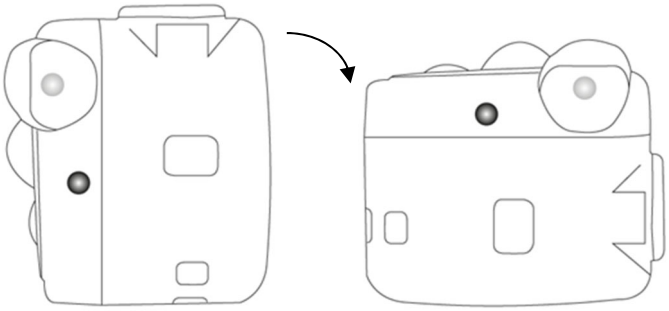
4.4.9 REMOTE DIAMETER

Diameters can also be recorded when measuring height. A diameter can either be measured at a specific height, or a height can be established for a fixed diameter. The sight and the distance to the object limit the accuracy and the largest diameter that can be measured, see Technical Specification.



To activate the Remote Diameter Function, press the KEY- or SEND button, and then press ON to confirm.

When the Remote Diameter is activated, the GEO2 will switch to Diameter Mode if the user turns the GEO2 90° to the right after measuring a distance/height.



4.4.9.1 VARIABLE REFLEX SIGHT

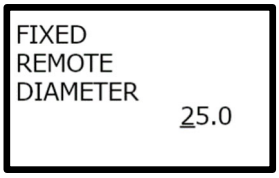
With Remote Diameter, the user has two choices of sights for measuring a diameter. Use the KEY- or SEND button to pick the Sight you prefer and press ON to confirm.

The "BAR" sight has 2 vertical lines that show the boundaries of the diameter to be measured.

The "LINE" sight has a horizontal line that goes from one end of the diameter to the other.

4.4.9.2 FIXED OR VARIABLE REMOTE DIAMETER

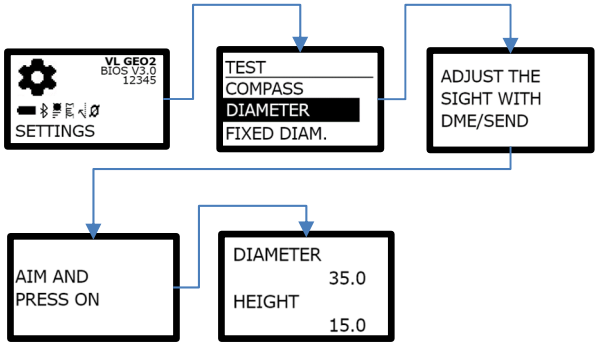
The user has to choose between fixed or variable diameter when using Remote Diameter. Fixed diameters are helpful when the user wants to find out the height at a specific diameter. GEO2 will automatically change the sight when a fixed remote diameter is set.



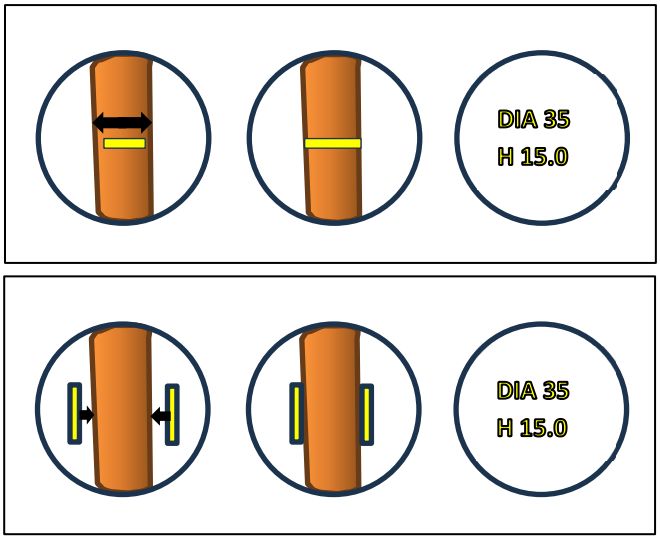
To use variable diameter instead of fixed diameter, enter 00.0. See 4.3 Entering text and number for information on entering text/numbers. When using variable diameter, the user can change the measurement with the DME- and SEND buttons. The status symbol in main menu will show whether “Remote Diameter” is on with fixed ⌀ or variable ⌀ diameter.

4.4.9.3 VARIABLE DIAMETER TEST

To test the variable remote Diameter function, go to the SETTINGS / TEST / DIAMETER menu.



1. Aim at an object through the sight and press ON to use the laser measurement.
2. Rotate GEO2 90° to the right.
3. Use the DME/SEND button to move the diameter sight until it matches the diameter. Press and hold the button to move the sight continuously.



4. Press ON to see the result.

4.4.9.4 FIXED DIAMETER TEST

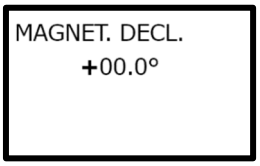
Test the variable remote Diameter function with the SETTINGS / TEST / FIXED DIAM. menu.

1. Enter a diameter.
2. Aim and press ON to start measuring using Laser.
3. Tilt GEO2 clockwise 90°.
4. GEO2 adjust the sight automatically depending on current pitch and distance.
   If user tries to adjust the sight manually with DME/SEND, a reminder "**FIX**" will show that the sight is fixed.

5. Aim for a diameter that fills the scope.
6. Press ON to get the result. If a diameter is to large for the sight, an error message "**D>MAX**" is shown in the headup display. In that case, move away from the object and try again.

4.4.10 MAGNETIC DECLINATION:

Enter the local magnetic declination for the compass between -90.0° and +90.0°.



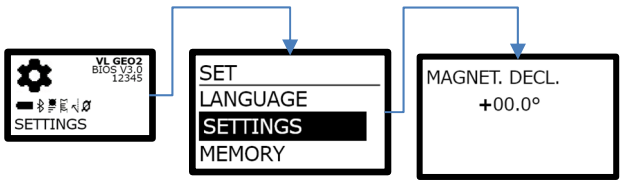
The Instrument has a default magnetic declination of 0.0. You may need to adjust the magnetic declination for your location before using the GEO2 instrument. The declination correction is (only) relevant if you will use your data in a GIS application or if you need accurate true north azimuth.

A magnetic field surrounds the Earth, and any magnetized object that is free to move, such as a North-seeking compass, will align itself with the magnetic North and South Poles. Magnetic declination (or magnetic variation) is the difference in the direction, or angle, from your position to true North (or the North Pole) and magnetic North, which is somewhere in Northern Canada. The magnetic declination changes a lot depending on where you are in the world and slightly also from year to year. You need to know the right magnetic declination for your area to make sure that the calculations your Instrument does are accurate.

4.4.10.1 ADJUST DECLINATION TO MATCH YOUR LOCATION

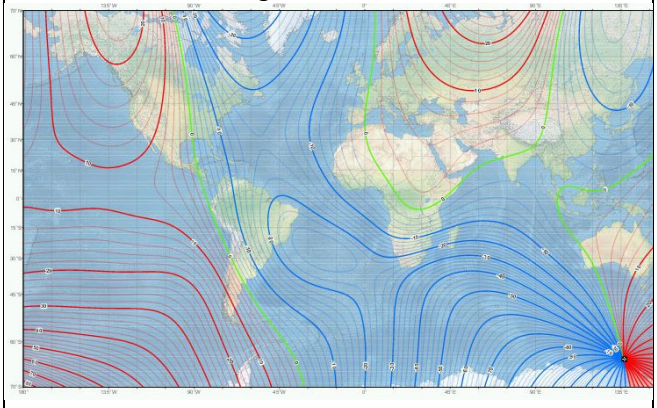
Select the SETTINGS menu to adjust the current declination for your location, which is the difference between true north and magnetic north. The Instrument will automatically correct the compass angle that it measures with the declination that you set. You can set and get a declination from -90.0° to +90.0°.

1. Press ON to start the GEO2 instrument.
2. Select SETTINGS and press ON to confirm selection. Then choose SETTINGS in the SET menu and press ON.
3. Press ON, step by step, until MAGNET. DECL is shown.
   Use the DME- or SEND button to change the sign (‘+’/’-‘), then press ON to step to next position.
4. Use the DME- or SEND button to change digit at current position (‘+’/’-‘). Press ON to go to next position.
5. Repeat step 5 above until all digits are defined.



See http://www.magnetic-declination.com/ for latest info about magnetic declination.

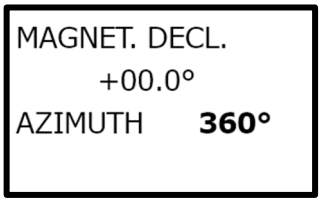
Deviations in some larger cities



Anchorage 22° Atlanta -4° Bombay -1° Boston -16° London -4° Little Rock 3° Livingston, MT 14° Munich 1° New York City -14°	Orlando -5° Oslo -2° Paris -2° Calgary -18° Chicago -3° Denver 10° Jerusalem 3° Rio de Janeiro -21°	San Francisco 15° Seattle 19° Shanghai -5° Toronto -11° Vancouver -20° Washington DC -10° Waterbury, CT -14° Stockholm 2°

4.4.11 AZIMUTH

Choose the unit for the compass as 360° (degrees 0…360)



or 400’ (grades 0…400). This setting only affects how the compass value is shown in the display. The compass values in CSV- and KML-files are always stored in 360° format.

4.4.12 MEMORY

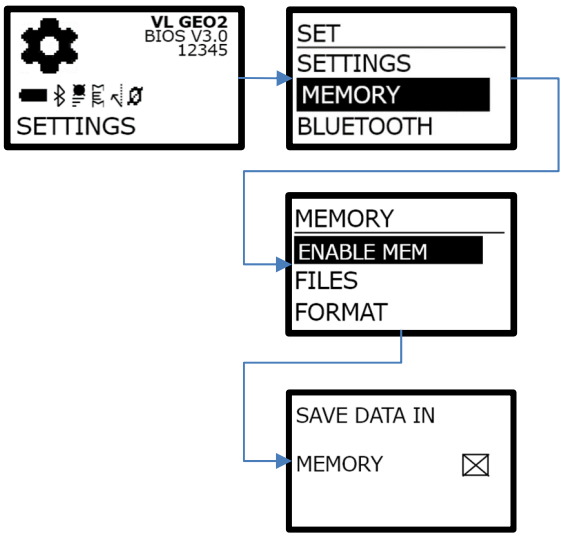
The Instrument comes with an SSD drive that can store data and results. To save data, press the SEND button, as long as the saving function is on in the MEMORY menu of the application. The memory can hold about 10000 measurement operations. When the data is stored, the display shows DATA SAVED. A measurement cannot be stored more than once.

4.4.12.1 ENABLE MEMORY

Use the memory to save results when you press SEND.

> ! Note: You can't send data by Bluetooth or IR if the memory is on.

1. Turn on the instrument by pressing ON.
2. Choose SETTINGS from the main menu and navigate to menu MEMORY. Press ON button.
3. Choose ENABLE MEM and press ON to validate this choice.
4. Tick the MEMORY box by using DME- or SEND button, then press ON to save this choice.



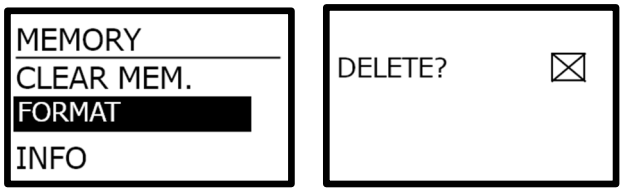
If the memory function is on, any kind of measurement data can be saved. A 5-digit numeric ID and a GPS coordinate are stored with each data set, (if the GPS function is on too).

Example:

4.4.12.2 FORMAT

To erase all the data in the GEO2 instrument, you need to format the SSD drive. Before you do that, make sure you save your data files to a folder on your computer, or you will lose them!

To select the “DELETE?” option, use the DME- or SEND button. To start the formatting and deletion process, press ON two times.

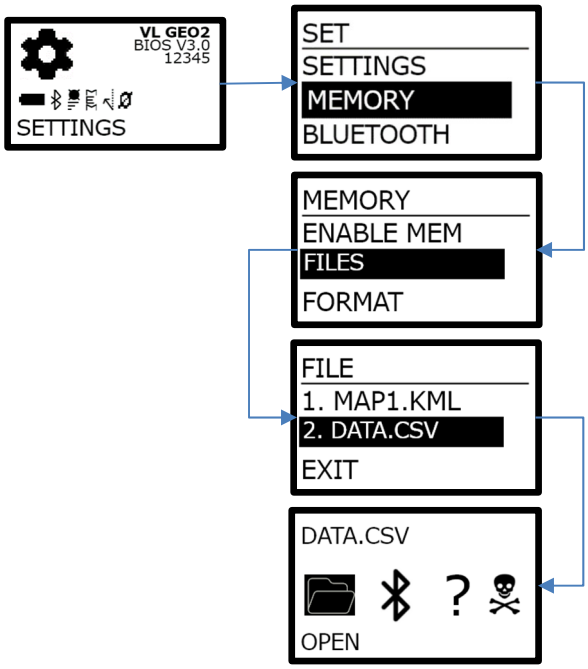


4.4.12.3 INFO

INFO tells how much memory the Instrument has used.

4.4.12.4 FILES

You can use the "FILES" menu to manage saved files. For example, you can delete single files or send them through Bluetooth to the Haglof Link app.



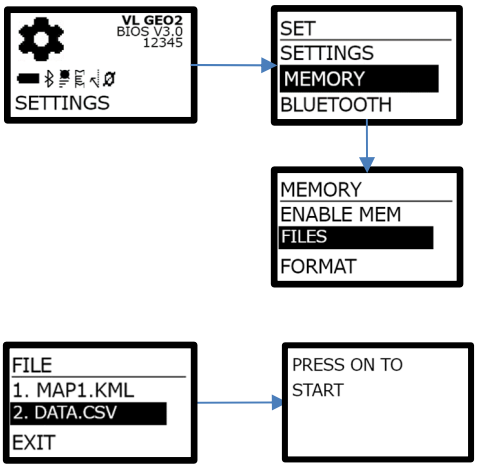
Following functions are available in “FILES” menu.

	Command	Description
	Open	Open a file (no use in BIOS menu)
	Send	Send a file via Bluetooth
?	Info	Information about a file, size etc.
	Delete	Deletes a file

4.4.12.5 SEND FILES VIA BLUETOOTH

You can send files from the GEO2 instrument to another device with BLE (Bluetooth Low Energy), like the Haglof Link app for iOS and Android or the Haglof BLE manager for Windows 10 or newer.

1. To turn on the instrument, press ON.
2. Choose menu MEMORY from the main menu or in menu SETTING and press ON.
3. Choose SEND FILES and press ON to accept this choice.
4. Tick the ALL box with the DME- or SEND button, then press ON to save this choice.
5. Start the application in the unit that will receive the files and connect it to the GEO2 instrument.
6. Press ON to begin transferring the files.



4.5 BLUETOOTH

GEO2 is compatible with both Bluetooth Classic and Bluetooth Low Energy, which enables you to connect various kinds of data collectors and mobiles or other external devices such as GPS.

> ! Note that the device you are connecting to determines whether Classic or Low Energy is used. The GEO2 Classic service shows up as "VLGEO2_XXXXX_COM" and the Low Energy service as "VLGEO2_XXXXX". When using Low Energy, you do not need to pair the devices.

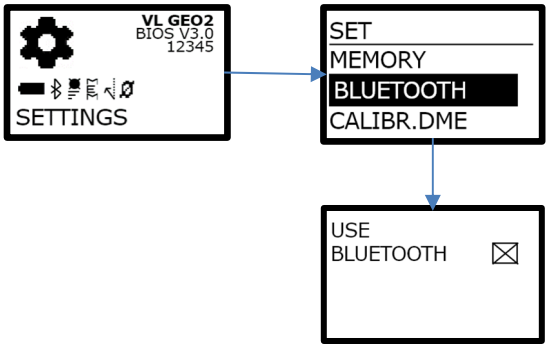
When using Bluetooth Classic, data is sent as NMEA packets and as notification packet when using Low Energy, see 9 DATA FORMAT.
Some units need a pin-code to connect. GEO2's code is 1234.

After completing a measurement, press the SEND button on the GEO2 to transmit data.

> ! Note: The memory function deactivates the option to send data through Bluetooth or IR.

4.5.1 ACTIVATE BLUETOOTH®

1. To turn on the instrument, press ON.
2. From the main menu, choose SETTINGS, go to BLUETOOTH and press ON.
3. Tick the BLUETOOTH box with the DME- or SEND button, then press ON to confirm this setting. The instrument is now ready to connect with external units.



4.6 GPS

You can add coordinates to your measurement data using the built-in GPS of the GEO2 instrument.

You can also use an external Bluetooth GPS receiver, such as the Geode or the Trimble R1, to get better precision.

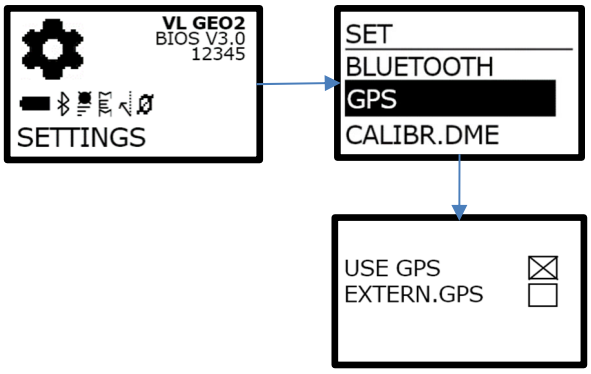
With GPS, you can use your data in a GIS application like Qgis, ArcGIS, Google Earth or similar.

> ! For higher accuracy and before saving any data with coordinates, wait for at least 10 minutes after turning on the instrument for the GPS units to settle before using the GPS function.

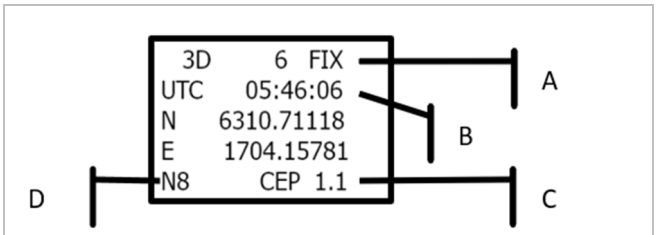
The internal GPS has a 33-channels, high sensitivity GPS receiver that can work with multiple common satellite systems such as GPS, Glonass, Galileo and GZSS at the same time. This greatly enhances positioning in complex terrain. It also offers built-in, real-time correction, free of charge, with SBAS (EGNOS, WAAS, MSAS, GAGAN) that allows for accuracy up to 2.5m CEP in open terrain. The GPS can rapidly find satellites by using built-in algorithms that forecast satellite positions for up to three days. The algorithms rely on data from the last satellite constellations that are stored in the Instrument (as long as the battery has power).

4.6.1 TURN ON THE GPS

1. To turn on the GEO2 instrument, press ON.
2. From the main menu, choose SETTINGS and then GPS. Press the ON button.
3. Tick the USE GPS box with the DME- or SEND button, then press ON to continue.
   The Instrument will remember this option even if the instrument is turned off. The Instrument will also delay its auto turn-off feature by 18 minutes when the GPS is on, to make sure the GPS is accurate.

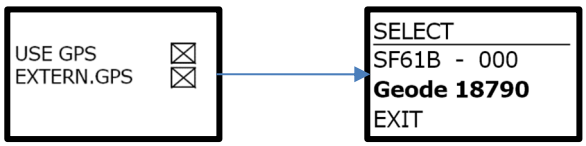


4. The GPS screen will display the current coordinates as soon as they are ready. The GPS module may take some time to get its first position – its fix – depending on how long and where it was last used. A fix usually takes a few minutes. To get a faster fix, you need a clear and open sky. For better accuracy, let the GPS run for about 10 minutes after the first fix.
   The coordinates are averaged. You can reset the average by pressing the DME Button. Press SEND button to save a coordinate (You must enable Memory in SETTINGS/MEMORY first). Press EXIT- or ON button to leave the GPS menu.



	Description
A	Number of satellites
B	Utc time
C	CEP error (m)
D	Number of samples

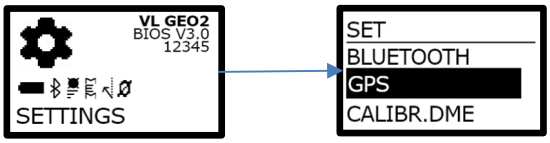
5. Check the EXTERN.GPS box if you are using an external Bluetooth GPS receiver. The GEO2 will ask you for a pin code to pair the device with the external GPS (refer to the GPS documentation for more information). The GEO2 Instrument will look for available devices, and you should turn on the external GPS before this search begins. When the search is done, select your device from the list and Press Enter to connect.



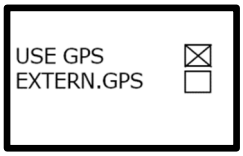
4.6.2 USE GEO2 AS AN EXTERNAL GPS

The GEO2 instrument can also be used as an external GPS and send GPS data to another unit.

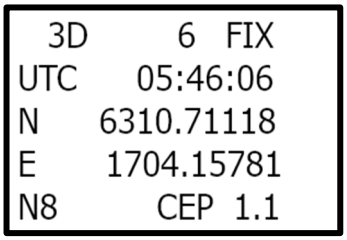
1. To start the GEO2 instrument, press ON.
2. Go to the main menu and select SETTINGS, then BLUETOOTH, to turn on Bluetooth.
3. Go back to the main menu and select SETTINGS, then GPS. Press the ON button.



4. Tick the USE GPS box with the DME- or SEND button, then press ON to proceed.
5. Leave the EXTERN.GPS box unticked and press ON.

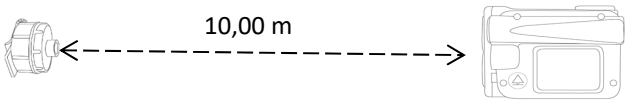


Connect the unit that will receive the GPS coordinates to the GEO2 instrument. The GEO2 instrument will begin to send GPS data.



4.7 CALIBRATING THE ULTRASOUND

1. To calibrate the VL GEO2 (Vertex Laser Geo2) device for the best ultrasound measurements, make sure it has the same temperature as the surroundings.



2. Use a tape or something similar to measure exactly 10m/32.8 feet.
3. Put the T4 transponder at the end of the 10m distance.
4. Turn off the VL GEO2.
5. Turn on the transponder, see 6.1 Activate the Transponder T4 details.
6. To turn off VL GEO2, press DME and SEND together.
7. Go to the zero point of the distance and point VL GEO2's front at the transponder.
8. Press ON to turn it on.
9. Choose SETTINGS and CALIBR. DME and press ON to verify.
10. When 10.00 appears on the screen, VL GEO2 ultrasound is calibrated.
11. Press DME and SEND together to exit the menu.

The temperature sensor needs enough time to accurately measure the surrounding temperature. If the instrument is in your pocket, you may need to wait up to 10 minutes before getting precise measurement results.

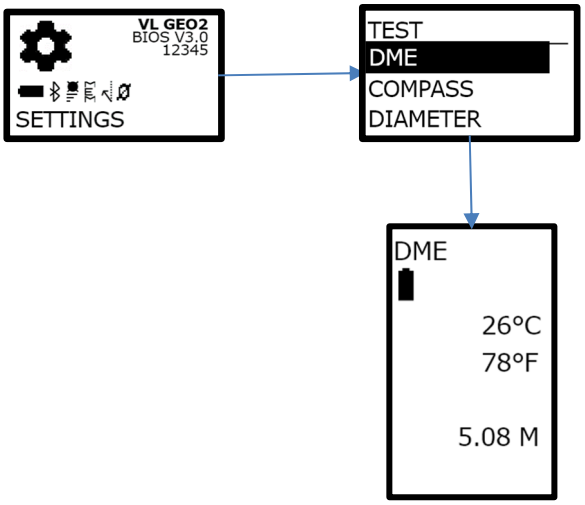
If the VL GEO2 is in a pocket with a temperature of +15C and the outside temperature is -5C, the measurement result will be 10.40m instead of the right 10.00m. The measuring error due to temperature change at 10.0m is about 2cm/°C.

The error will quickly reduce, but it might take up to 10 minutes to reach the final accuracy. Therefore, calibrating the instrument before the sensor is stable will make the error permanent. The display will show the right result for a short time, but a few minutes later, the result will be incorrect.

4.7.1 DME TEST

To test the DME (ultrasound/Laser), go to the SETTINGS / TEST / DME menu.

1. Turn on the transponder, see 6.1 Activate the Transponder T4 for details.
2. Press DME key to measure with ultrasound. Or Point and press ON to measure with Laser.

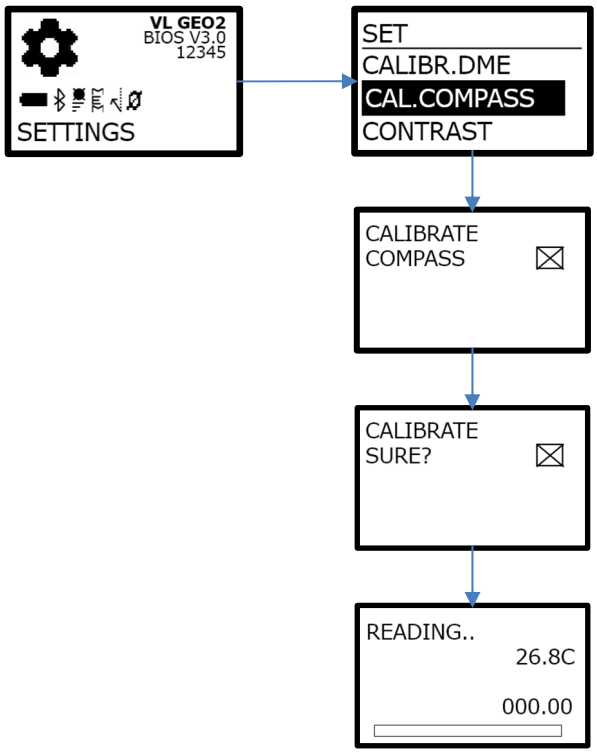


4.8 COMPASS CALIBRATION

The Instrument comes calibrated at the factory. The GEO2 instrument does not have any parts that can be taken out, and usually there is no need to recalibrate the compass. If the Instrument is near a powerful magnetic field, it is advisable to do a recalibration, and this can be done in CAL.COMPASS.

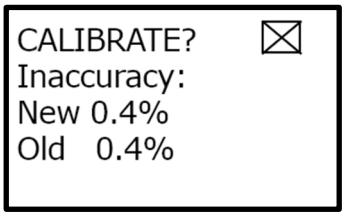
The following steps will help you calibrate the compass:

1. Go to SETTINGS in the main menu and move to CAL.COMPASS. Press ON.
2. Tick the CALIBRATE box using the DME- or SEND button. Press ON to proceed.
3. Tick the SURE box using the DME- or SEND button, then press ON to proceed.



4. Point the Instrument to north and rotate the Instrument around each axis, one by one. The rotation should be slow and steady for a more accurate calibration. The rotation should take about 30 seconds to finish. Any breaks in this motion can cause errors in the pitch and roll, as they are seen as an acceleration by the sensors.

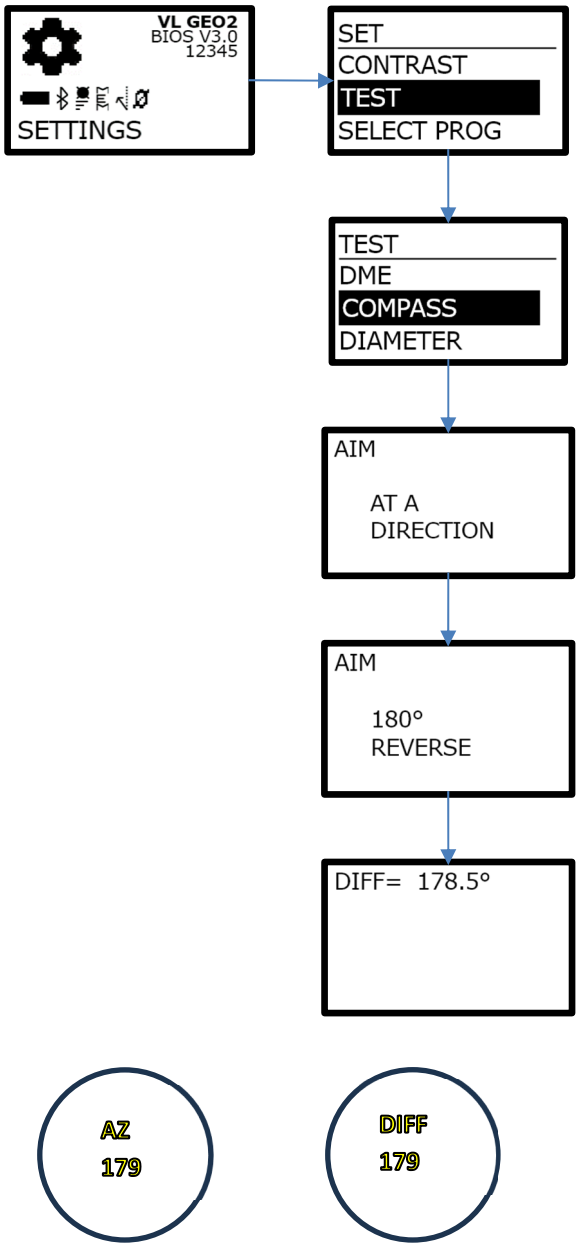
5. Press ON when done.
6. Tick the CALIBRATE box using the DME- or SEND button if inaccuracy is less than 1%. Press ON to confirm and calibrate.



4.8.1 COMPASS TEST

To test the compass, go to the SETTINGS / TEST / COMPASS menu.

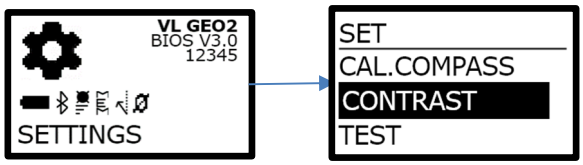
1. Aim the GEO2 instrument at an object 10m-50m away.
2. Press ON to record direction 1.
3. Walk to the object and rotate 180 degrees.
4. Aim the GEO2 instrument at your original location.
5. Press ON to record direction 2.
6. The variation DIFF between directions 1 and 2 should be 180 ° + -4 °



4.9 DISPLAY CONTRAST

Adjusting the display contrast.

1. Turn on the instrument by pressing ON.
2. Choose SETTINGS from the main menu and navigate to menu CONTRAST. Press ON button.



3. Change the display contrast by using the DME and SEND buttons. There are 24 contrast levels to choose from.
4. Press ON to save or press both DME and SEND to exit this function and menu.

5 DISTANCE MEASURING

The descriptions for the laser method apply to the LASER GEO2 instrument model.

Two methods are available for measuring distances with the VL GEO2: laser or ultrasound. The choice of method for a field operation depends on factors such as terrain type and vegetation cover. The weather conditions at the time can also affect the choice. The laser function is often used for measuring heights and long distances in open areas.

With the T4 transponder, ultrasound measuring can be used for working in circular sample plots and measuring short distances in thick terrain/forests.

5.1 LASER METHOD

Laser can be used to measure how far away objects such as trees, power lines or buildings are. Laser can also be used together with the BAF function, but the ultrasound method (VL GEO) is more often used for this purpose.

The instrument laser sensor is of high quality and provides precise results and a long measuring range. The laser sends out invisible, eye safe infrared light pulses that bounce off the chosen target back to its optical receiver. The distance is determined by comparing the return time with the speed-of-light constant and shown on the instrument display. The ability of a laser sensor to measure to a target depends on how well the target reflects the light and any obstacles between the sensor and the target, such as dust, fog, foliage or other. Reflectance is affected by color, opacity, distance and the angle of reflection as well as the amount of any ambient obstacles between the sensor and the target. A darker target is less reflective than a lighter one and heavy dust will weaken the signal more than light dust. An adjustable laser filter allows for flexible measuring, where you can choose to measure the nearest object, the furthest object or the object that gives the strongest signal.

Use the DME button to temporarily change the preset Laser mode (First-, Strongest-, Last- target) allowing the laser to work with the most suitable mode for the situation.
Example: Use Last mode to avoid that the laser sensor hits a target in front of your main target such as grass or bushes.

5.2 ULTRASOUND METHOD

VL Geo2: With the T4 transponder, ultrasound can help measure the distance to a plot center and get the sample plot radius. You can use the BAF Basal Area Function to decide if a tree belongs to a sample plot study. Ultrasound works well in dense forests, which is an advantage over other methods.

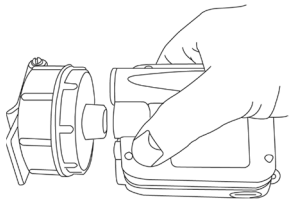
The Vertex Laser Geo2 ultrasound method uses ultrasonic signals to get a distance reading from the measuring instrument to the T4 transponder. The height is calculated trigonometrically with the measured results on distance and angle. The T4 Transponder can work in a 60° mode for direct height measuring, such as when attached to a tree stem; or in a 360° mode when placed on the monopod plot staff – useful when working in circular sample plots with the VL GEO2 ultrasound method.

Ultrasound technology can be used when the target is fully or partly covered and hard to see. The methodology is helpful in circular sample plots, and if the reference point (plot center) is hidden by understory like shrubs and bushes. When measuring the angle to the reference point, the horizontal distance can be calculated.

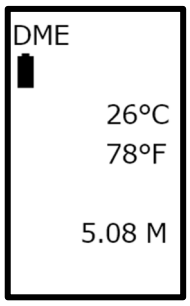
Working with factor gauges or prisms can be challenging in areas with thick underbrush, and poor visibility can affect the accuracy of diameter evaluation. With the instrument built-in BAF function (Basal Area Function), the minimum tree diameter for trees to be included in the plot can be shown, by measuring the distance from the tree to the reference point/plot center.

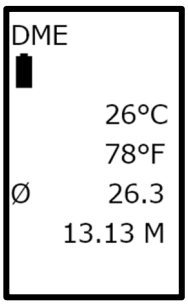
5.3 DISTANCE MEASURING USING ULTRASOUND

1. Shut down the VL GEO2.
2. To activate the T4 transponder, place the ultrasonic transceiver on the VL GEO2 device near the middle of the transponder and push the DME button on the VL GEO. Listen for two short beeps from the transponder. The T4 transponder is now ON and will remain ON until you deactivate it or it turns off automatically after about 20 minutes of no activity. To deactivate the T4 transponder (OFF), follow the same steps as above and wait for four (4) short beeps.
   You can put the T4 transponder on the monopod staff in the center of a plot (up to 20 meters or better accuracy) or attach it to a tree trunk (up to 30 meters or better accuracy).



3. Push the DME button to measure the distance to the transponder. The result is shown on the display. If the BAF function is on, the Ø min diameter is calculated and displayed (pic 2).





> ! Note that you can also use the laser in this menu, aim and press ON to measure with laser.

4. Do point 3 again to measure more distances.

Press both the DME and SEND buttons to shut down the VL GEO2 device.

The speed of ultrasonic pulses varies depending on the weather conditions, air pressure and other factors. With no obstacles between the instrument and the transponder in open terrain, ultrasound and the T4 transponder can sometimes measure distances up to 40 meters.

The ultrasound needs to be calibrated at the same temperature as the air. The VL GEO2 has a sensor that will adjust for changes in the temperature. For best measuring accuracy, it is advised to check and calibrate the instrument regularly, and ideally daily.
DISTANCE MEASURING USING ULTRASOUND

6 TRANSPONDER T4

The VL GEO2 instrument system usually comes with a transponder T4.

The transponder has an ultrasonic transceiver that interacts with the VL GEO2 instrument. The transponder can perform direct measurements and measure around a full 360° circle, which is useful when working in circular sample plots.

A monopod, and 360° adapter/spreader are used to position the transponder in the middle of the sample plot. For directed measurements the transponder is attached to the tree with a small metal hook on the backside of the transponder.

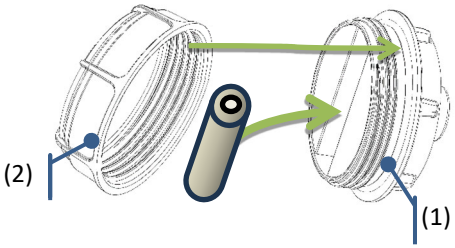
T4 is equipped with 6 bright LEDs and they perform the following function:

1. Shows when T4 is on by blinking.
2. If no blinking happens, the battery in the T4 might need changing or the T4 might not be turned on.
3. Shows when sound pulses are coming by blinking. Sound pulses usually come from the VL GEO2 when distance is measured. If sound pulses are blinking without any measurement happening, there might be a sound source nearby that is causing interference (for example, grasshoppers, waterfalls). This makes measurement hard and the user should either wait until the noise stops or move the T4 somewhere else.

! Note that a low battery in T4 can also cause unwanted blinking. Some interference is normal and does not affect the measurement.

- There is no switch for the transponder, and the VL GEO2 instrument acts as a remote control to activate and deactivate it.
- The transponder will shut down by itself after about 20 minutes of not being used.

The Transponder T4 uses a 1,5 AA alkaline battery, placed under the battery lid.



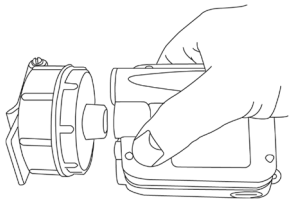
(1) Transponder housing
(2) Battery lid

! When not using the transponder, take out the battery. (This avoids battery acid leaks that can damage the device.)

! Do not screw on the battery cover too tightly.

6.1 ACTIVATE THE TRANSPONDER T4

1. Ensure that the VL GEO2 is turned off.
2. Point the VL GEO2 ultrasound transceiver at the T4 transponder ultrasound transceiver, keeping a distance of about 2 cm.

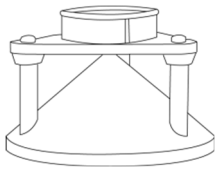


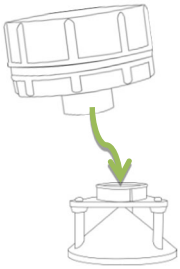
3. Press the DME button to transmit an ultrasonic pulse.
    a. The transponder will emit 2 beeps and the LEDs will flash if it is ON.
    b. It will emit 4 beeps if it is OFF.

6.2 360° ADAPTER

A VL GEO2 configuration comes with a 360° adapter and a special plot staff.

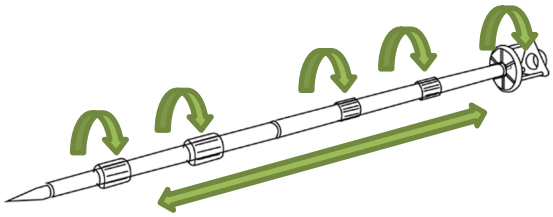
The adapter allows measuring in a complete 360° circle and is good for circular sample plot work.





6.3 MONOPOD PLOT CENTER STAFF

The user can measure with ultrasound in a full circle around the monopod, by using the adapter for the transponder and the custom plot center staff or monopod. The monopod is light weight, can change its length, and can be set at different heights.

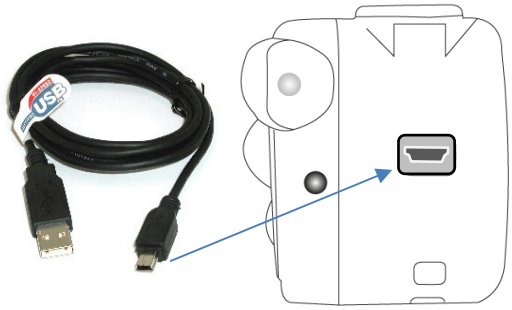


6.4 MONOPOD

You can also use a monopod, which is helpful when measuring thin objects and for more stable aiming. The GEO2 can be attached to the monopod with 1/4-20 mount. Make sure to use a non-magnetic monopod if you use one with the GEO2 instrument, otherwise you might affect the compass in the GEO2 instrument. See the Compass section in this user guide for more details.

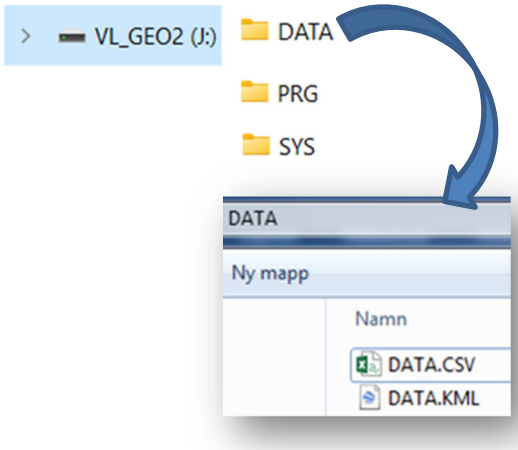
7 CONNECT TO THE COMPUTER

1. Turn on the GEO2 instrument by pressing ON.



2. Use the mini USB cable to link the Instrument to a computer. The instrument goes into USB mode by itself. On Windows computer, the instrument shows up as a removable drive. On Mac computers, it shows up as a mounted volume.

3. Locate the VL_GEO2:\DATA folder on your computer.
4. Ensure that you transfer your data files to a folder map on your computer.



5. Your height- and 3D vector data is stored in the **DATA.CSV** file (semi colon separated) and in the **DATA.KML** file (GIS file). The CSV- and KML-files can be opened directly with your favorite spreadsheet application and GIS application such as Excel and Google Earth. Trail data is stored in **TRAILXXX.CSV** and **TRAILXXX.KML** and map data is stored in **MAPXXX.CSV** and **MAPXXX.KML** or **MAPGPSXXX.CSV** and **MAPGPSXXX.KML** where XXX is the ID.

   It is recommended to free disc space by executing menu **MEM CLEAR** in the Instrument when the data files have been copied and stored to your computer.

8 IR – COMMUNICATION

The Haglöf Sweden Digitech Professional computer calipers can receive data with IR (infrared light). The instrument sends text data serially via Bluetooth or IR when the SEND button is pressed. To use IR- or Bluetooth data transfer, the data storage function (ENABLE MEM) has to be turned off first in the MEMORY menu.

1. Turn on the IR receiver of the Digitech Professional caliper (refer to the Digitech Professional user manual)
2. Align the IR port of the GEO2 instrument with the IR receiver of the Digitech Professional and press SEND.
3. If needed, do 2 again.

> ! The gap between the instrument and the IR receiver should be no more than 5 cm.

9 DATA FORMAT

9.1 IR - HAGLOF

The IR Data packet contains a total of 40 signs.

1 0000<LF><CR>
2 0000<LF><CR>
3 0000<LF><CR>
4 0000<LF><CR>
5 +000<LF><CR> (At negative angle '+'is replaced with '-')

<LF>=Linefeed (ASCII 10)

<CR>=Carriage Return (ASCII 13)

At height measuring, the following is sent

Line 1:	1:a height (dm alt. feet X 10)
Line 2:	2:a height (dm alt. feet X 10)
Line3:	3:e height (dm alt. feet X 10)
Line 4:	Horizontal distance to the object (dm alt. ft X 10)
Line 5:	Angle to object (grads X10)

At distance measuring the following is sent:

Line 1:	0000
Line 2:	0000
Line 3:	0000
Line 4:	Distance to transponder (cm alt feet X 10)
Line 5:	Angle to object (grads X10)

9.2 CLASSIC BLUETOOTH - NMEA

The NMEA format sends height, horizontal distance, angle and azimuth to the object.

$PHGF,HVV, HDvalue,units,AZvalue,units,INCvalue,units,SDvalue,units,Heigth, unit,*csum<CR><LF>

$PHGF,	is the message identifier.
HVV,	is the type of data, in this case horizontal and vertical vector.
HDvalue	Calculated Horizontal Distance. One decimal place.
Units	F=feet, M=meters
AZvalue	Measured Azimuth. One decimal place.
Units	D=Degree
INCvalue	Measured Inclination value. One decimal place.
Units	D=Degree
SDvalue	Measured Slope Distance Value. One decimal place.
Units	F=feet, M=meters
H value	Calculated Height Value. One decimal place.
Units	F=feet, M=meters
*csum	
<CR>	Carriage Return
<LF>	Line Feed

Example:

Ex: $PHGF,HVV,10.2,M,2.3,D,38.4,D,10.4,M,21.6,M,*3F

9.3 BLUETOOTH LOW ENERGY

The GEO2 instrument allows data transfer with Bluetooth Low Energy (BLE) devices, usually supported by Android and iOS. The transfer requires an App that supports the GATT service below. Data is sent by pressing the SEND button on the GEO2 instrument after a measurement.

service uuid = "9e000000-f685-4ea5-b58a-85287cb04965"
characteristic uuid = "9e010000-f685-4ea5-b58a-85287cb04965"

Total 20 bytes:

Byte 0-3	**horizontal distance**	**(m x10)**	**"0" .. "9999"**
Byte 4-7	**distance**	**(m x10)**	**"0" .. "9999"**
Byte 8-11	**height**	**(m x10)**	**"0" .. "9999"**
Byte 12-15	**vertical angle**	**(° x10)**	**"-900".. "900"**
Byte 15-19	**horizontal angle**	**(° x10)**	**"0" .. "3600"**

10 TECHNICAL SPECIFICATION

Note that this technical specification includes descriptions for ultrasound valid for the VL GEO2 model only

Physical	
Dimensions (L x W x H)	3.7x2.5x2.8”(93x63x72mm)
Weight	8.6oz(243g)
Housing and frame material	Glass filled polycarbonate
Shock/Vibration	MIL-STD-810E
Moisture	IP67, NEMA 6
Monopod/tripod mount	1/4” female thread
Operating temperature	Temperature range -20° to +45°C / -4F to 113F

Power	
Power consumption	Max 0.9W
Battery duration	Approx. 2000 measurements
Battery type	Chargeable Li-Ion 3.7V 1600mAh 5.9Wh
UN38.3 Test	Test performed and successfully passed
Charging time	Max 3.5h
Charger interface	USB mini B
Charger	Wall charger 110/220AC-5VDC, USB mini B interface
Car charger	Car Cigarette Lighter Adapter 12VDC , USB mini B interface
Cable	USB mini B Male/USB Type A Male, 0.5m

User interface	
Buttons	3 multi-functional buttons
Buzzer	Yes
Display	Graphic LCD 100x60pixel
Bluetooth	Dual-mode Bluetooth BR/EDR. Bluetooth low energy V4.2 (LE) and Classic connectivity. Spp (serial profile), pin code 1234.
Range	10-50m/32-160ft
Bluetooth classic data format	NMEA
Bluetooth BLE GATT server	Distance (dm), height (dm), pitch and yaw (® x10) in GATT database. (iOS, Android)
IR	Haglöf standard format
Sight	Heads up display, 1x magnification

Memory	
Capacity	10000 sets of data
Memory type	Non volatile
Data file	CSV, KML

USB	
Version	2.0
Device class	USB mass storage device class
Storage capacity	1000MB

Height	
Range	0-999.9 m/ft
Resolution	0.1m/ft

Vertical Angle	
Units Angle	Degrees 360^0, Grads 400^0 and %
Angle range	-90.0^0 to +90.0^0

Resolution angle	0.1⁰
Accuracy	0.1⁰

Horizontal Angle (Compass)	
Units Angle	Degrees 360⁰
Angle range	0.0⁰ to 359.9⁰
Resolution angle	0.1⁰
Accuracy	1.5⁰ RMSE

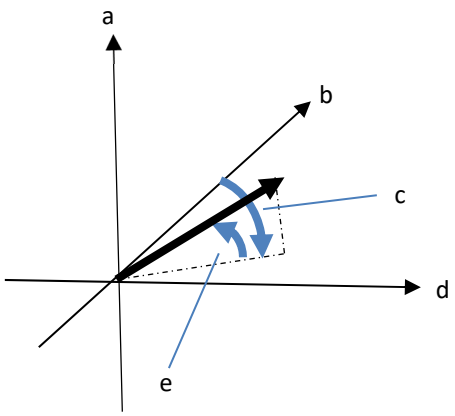
Laser	
Min range	1.5ft/46cm
Max range	2000ft/700m (depending on target)
Accuracy	0.1ft /4 cm
Resolution	0.1ft /0.1m (0.01m/0.1ft when using laser in DME mode)
Target modes	First, Last, Strongest
Wavelength	905nm
Divergence	3 mrad (1ft beam diameter @ 328ft (30cm @ 100m)
Free aperture	0.91in/23 mm
Eye safety	Class 1, 7mm (FDA, CFR21) Class 1m (IEC 60825-1:2001)

Remote diameter	
Sight range	0-46 positions
Max diameter	47” at 13yrd / 98cm at 10m
Resolution	0.1”/ 0.1cm
Accuracy	1/2” at 13yrd / 1.2cm at 10m

10.1 THE INSTRUMENT COORDINATE SYSTEM

The GEO2 use these directions of X, Y, Z axes:

a. Z=Up
b. X=North
c. Azimuth 0..360°
d. Y=East
e. Angle -90°…90°



GPS Features	
Host-based multi-global navigation satellite system:	GPS(USA)/GLONASS(Russia)/Galileo(EU)/QZSS(Japan)
SBAS Satellite-based augmentation systems:	WAAS(USA), EGNOS(EU), GAGAN(India), MSAS(Japan)
Built in self-generated orbit prediction (Faster TTFF up to 3days)	
Built in jamming removing	

GPS Interfaces	
Geodetic datum	WGS84
Protocol	NMEA
NMEA messages:	
GGA	Time, position and fix type data.
GLL	Lat, long, UTC time of position fix and status.
GSA	GNSS receiver operating mode, satellite used, DOP values.
GSV	Number of satellites in view ID numbers, elevation, azimuth and SNR values.
RMC	Time, date, position, course and speed data.
VTG	Course and speed information relative to the ground.

GPS Performance Data	
Receiver type 33tracking/99 acquisition- channel GNSS receiver	
Update rate	1Hz
Sensitivity	
Tracking:	-165 dBm
Reacquisition:	-160 dBm
Cold starts:	-147 dBm
Time-To-First-Fix	(All SV @ –130 dBm)
Cold starts:	28s up to 15min (open sky)
Warm starts:	26s (open sky)
Hot starts:	<1s (open sky, <2h since last start)

GPS Accuracy	
Automatic Position	2.5m CEP (circular error probable) (50% 24 hr static, -130dBm)
Speed	0.1m/s (50%@30m/s)*
Operation temperature:	-40℃~+85 ℃

Ultrasound	
Distance (max) to transponder T4	>30m/100ft
Distance (max) to T4 with 360° adapter	>20m/60ft
Resolution	0.01m/0.1ft
Accuracy	1% or better when calibrated

Transponder T4	
Size: Diameter	70mm / 2.8”
Weight	85g/5oz (battery included)
Battery	1x 1,5V AA Alkaline
Power consumption	9mW

Other	
Adapter/Spreader	Plastic, weight app. 30g/1oz
Monopod/plot staff	Four sections, 33-140cm, around 270g/9.5oz, aluminium/plastic. A monopod staff with a foot support and a 1/4-20 mount.
Monopod non-magnetic	Two-piece non-magnetic monopod with ¼ 20” threads for attaching to device
Case	Soft instrument carrying case. Transport case in aluminium.

11 TROUBLESHOOTING

11.1 LASER

Symptom	Check points
Laser will not start/Display will not light up	Charge battery
Distance to target not reached	Ensure that the laser beam is not blocked in the laser sensor or detector. Ensure that laser lenses are clean. If necessary, clean these parts (See section on Care, storage and maintenance, this document). Target shape and color not suitable for laser reflection. Thin and small surfaces, targets with diffuse reflection surface, targets with considerable depths, targets through glass surfaces; snow, rain, dusk, fog. Control setup laser mode in the Settings menu. First-Strongest-Last. If necessary, charge battery.
Not possible to measure close by targets	Make sure that target is not blocked
Targets outside of certain distance cannot be measured	Make sure that target is not blocked
Unstable and uncertain measuring results	Charge battery Ensure that target shape and conditions can reflect laser beam. Hold the instrument steady and press ON. Make sure that target is not blocked
Incorrect measuring results are presented	Charge battery Ensure that target shape and conditions can reflect laser beam. Make sure that target is not blocked Check laser mode settings in the Settings menu. First-last-strongest

11.2 ULTRASOUND

Symptom	Check points
No distance presented in display	Ensure that transponder is on/active. Poor battery. Repeated noise in surroundings (chain saws, highway traffic, crickets…) Use of wrong type of transponder
Measured distance values unstable	Repeated noise in surroundings (chain saws, highway traffic, crickets…) Calibrate ultrasound (VL GEO).
Red aim dot will not go out	Ensure transponder to be on/active. Poor battery. Repeated noise in surroundings (chain saws, highway traffic, crickets…) Use of wrong type of transponder Angle to object to large – increase distance to object.
VL GEO/ L GEO2 unit will not start	Poor battery, charge needed.
Transponder unit will not start	Poor battery
No presentation of measuring results	Ensure transponder to be on/active. Poor battery. Repeated noise in surroundings (chain saws, highway traffic, crickets…) Use of wrong type of transponder Angle to object to large – increase distance to object. Measuring instrument is not held steady. Instrument has not registered any horizontal distance.
Unrealistic or incorrect measuring results	Repeated noise in surroundings (chain saws, highway traffic, crickets…) Measuring instrument is not held steady

11.2.1 COMPASS

Symptom	Check points
Azimuth result is wrong	Ensure that no metallic- or magnetic objects are too close to the GEO2 instrument. Metallic framed eye wears, mobile phone, pace maker, power line etc. can affect the function. Check the declination in menu SETTINGS. Keep the VL GEO2 / L GEO2 steady during measuring. Recalibrate the compass if necessary.

12 COMPLIANCE STATEMENTS/DÉCLARATION DE CONFORMITÉ

CE	Product Origin: Sweden (EC) Declaration of Conformity: Haglöf Sweden AB hereby declare under our sole responsibility that the VL Geo2/Laser GEO2 instrument complies with the requirements of the following applicable European Directives: Electromagnetic Compatibility (EMC) Directive 2014/30/EU, Low-Voltage (Safety) Directive 2014/35/EU, RoHS Directive 2011/65/EU, Conformity is assessed in accordance to the following standards: Emission: EN 61000-6-3:2021 Immunity: EN 61000-6-2:2019, EN 61000-4-2, -3, -8 Approved Jan 26 2024, Joakim Nygren R&D Manager, Haglöf Sweden AB Report nr 24005 by Dectron AB, Thörnblads väg 6, 386 90 Färjestaden, Sweden
EU and UK	This device, The VL GEO2/LASER GEO2, BT122 conforms with the essential requirements and other relevant requirements of the Radio Equipment Directive (RED) (2014/53/EU) and of the Radio Equipment Regulations (RER) (S.I. 2017/1206).
FCC	This device, The VL GEO2/LASER GEO2, containing FCC ID 5123A-BT122, complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FCC PART 15.21 STATEMENT	Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. User modifications / changes This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
IC CANADA	This device, the VL GEO2/LASER GEO2, containing IC 5123A-BT122 complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device. Ce produit, VL/LASER GEO2, IC ID 5123A-BT122, est conforme au Chapitre 15 du Règlement FCC et le RSS du Règlement IC. L'utilisation est soumise aux deux conditions suivantes: (1) le périphérique ne peut pas causer d'interférences nuisibles et (2) l'appareil doit accepter toute interférence en réception, y compris les interferences causant un dysfonctionnement de l'appareil.
SOUTH KOREA CERTIFICATE	Certificate of broadcasting and communication equipment's no. R-R-BGT-BT122
JAPAN	This equipment contains specified radio equipment that has been certified to the technical regulation conformity certification under the radio law.  R 209-J00442 当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。

13 WARRANTY AND SERVICE INFORMATION

The VL GEO2/Laser GEO2 is covered by a one-year limited warranty. Haglöf Sweden AB warrants that this product shall be free from defects in materials and workmanship, under normal intended use, for a period of 12 months after date of shipment. The warranty excludes the batteries, the accessories and any written materials. The warranty does not apply if the product has been improperly installed, improperly calibrated or operated in a manner not in accordance with the user's guide. Warranty is also automatically expired if the product has been opposed to external force and warranty is not applicable for cosmetic defects. The one-year limited warranty time covers obvious fabrication defects. Defects in the electronic components that are impossible for the manufacturer to detect prior to assembling and shipping of the product may occur. Haglöf Sweden AB can in no case be responsible for problems of this nature and has no liability for any loss of business, profits, savings, consequential damages or other damages resulting from use of the products described. Signs of misuse, cosmetic damage, accidents or equal automatically withdraw the warranty. The warranty is valid in the country where your Haglöf product has been purchased. A product covered by warranty will be subject to exchange, service, and repair or according to special agreement between seller and buyer, within the frames of the limited warranty. Haglöf Sweden reserves the right to determine which option will be most suitable for each separate case after having examined and evaluated the product. Contact manufacturer for complete warranty and service information.

13.1 SAFETY AND OPERATION PRECAUTIONS

To avoid injury or material loss, please read this safety

and operation precautions thoroughly:

- Never look directly at the laser beam or directly at the sun when using the instrument.
- Do not use the instrument together with other optical instruments, such as binoculars and lenses. Using an optical instrument together with the instrument increases the danger of eye damage.
- Do not depress the ON button while aiming with the eye or looking into the optics from the objective side.
- Do not disassemble the instrument. Any signs of disassembling automatically withdraw any warranties and the manufacturer does not guarantee the product.
- Never place the instrument in an unstable place.
- Never look through the instrument while walking.
- If you should develop any symptoms of eye irritation or skin inflammation around the eye due to use of the instrument, consult a doctor immediately.
- If the instrument should fail to operate correctly, discontinue use and consult the manual. If you are unable to fix the problem, contact your local dealer for instructions or where to send the instrument for repair.
- The instrument has built-in Bluetooth® for data transfer to external devices. There may be local restrictions on the use of both Bluetooth® and laser technology. It is the operator's responsibility to control that the technology in the instrument is permitted to use in the area where the instrument is operated.

13.2 CARE, STORAGE AND MAINTENANCE

- Store the instrument in its soft case when carrying. Do not swing the instrument by its strap.
- The instrument is water and dust resistant, but should not be used in water and it is not waterproof.
- Use a soft, clean and dry cloth to clean the instrument if exposed to rain, water, sand and mud. Do not use alcohol, benzene, thinner or other organic agents to clean the instrument's main body! Always clean as soon as possible after the exposure, and always store the instrument in a dry, cool place and away from direct sunlight.
- Use a soft oil-free brush to remove dust from the lens surface. To remove stains or smudges (fingerprints etc.), wipe lenses gently with a soft clean cotton cloth or oil-free lens tissue. To clean a lens, moisten it with lens cleaning solution and wipe it clean with a lens cloth or lens tissue. Stubborn smudges can be removed with a small amount of pure alcohol using extra care to avoid scratching of the lens surface. The tissue should only be used one time.
- Do not expose the instrument to excessive heat or ultraviolet rays, since this may damage the unit.
- When exposed to sudden changes in temperature or high humidity, water condensation may appear on lens surfaces. Do not use the instrument until this condensation has evaporated. Dry the instrument at room temperature and store in a cool, dry place.
- Keep the instrument and any parts of and for the instrument out of reach of small children. Consult a doctor immediately if a small child has swallowed any parts of the instrument or its packing.

13.3 NOTES ON BATTERIES

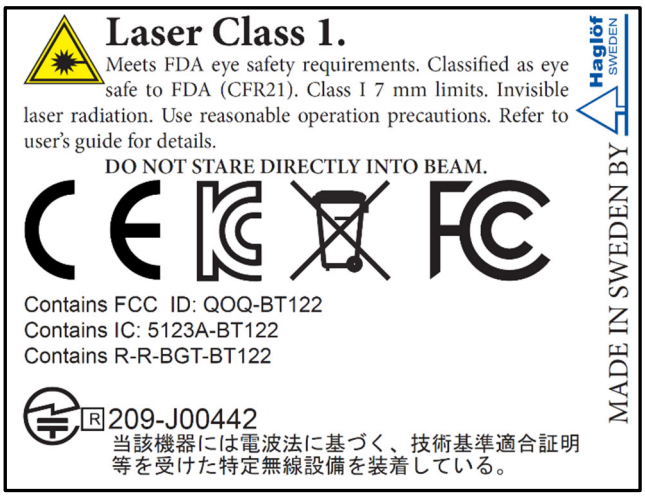
- Rinse skin or eyes well with water if exposed to any battery fluid. If swallowed, contact a doctor
- Do not short-circuit battery chamber terminals, and do not carry any batteries with keys or coins in a pocket.
- Keep away from fire and water and do not disassemble batteries.
- Avoid strong vibrations, shock, fluid or extremes in temperatures for all batteries. If handled incorrectly, batteries may rupture and leak, corroding equipment and staining clothing

13.4 APPLICATION

Haglöf Sweden and its suppliers cannot warrant the performance or results when using the firmware, application or hardware, nor the documentation. No warranties or conditions are made; neither expressed nor implied, of merchantability, suitability or special fitness for any particular purpose. If application problems appear, please contact your programmer for support. Haglöf Sweden takes no responsibility for loss of income, time, or problems and delays due to problems in soft- or hardware of products. Copyrights of all application & firmware made by Haglöf Sweden belong to Haglöf Sweden. Any lists and/or information of application for any Haglöf Sweden AB products should be considered as brief descriptions and not as a complete guide to what may and may not be available. Contact manufacturer for more information on terms and conditions.

- **Always contact your Haglöf Sweden representative/dealer where the instrument was purchased for assistance with all questions concerning service and warranty issues.**
- For a valid warranty, a copy of invoice or dated receipt of your purchase must be presented. The serial number of the returned product must be clearly stated upon return.
- The return freight to us is on buyer's expense. After warranty repair or exchange, the return freight to you is on our expense. If warranty has expired or is null and void, all freights are on buyer's expense.
- If no original invoice can be presented upon shipment, or if two years or more have passed from date of purchase, customs fees will be added by the applicable customs authorities and possibly in receiving country as well. These fees are on buyers account.
- Please do not hesitate to contact us or Haglöf Sweden AB representative for questions or comments!
- Any signs of misuse or negligence automatically withdraw our warranty commitments

13.5 LABEL



TECHNICAL MANUAL - ENGLISH

VERTEX LASER GEO2 & LASER GEO2

REVISION: 1

2024-04-30

Haglöf Sweden AB

Klockargatan 8
882 30 Långsele
Sweden

☎ +46 620 255 80
✉ info@haglofsweden.com