



Leica GS18

User Manual

English
Version 4.2



Introduction

Purchase

Congratulations on the purchase of the Leica GS18.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to [1 Safety Directions](#) for further information.

Read carefully through the User Manual before you switch on the product.



The content of this document is subject to change without prior notice. Ensure that the product is used in accordance with the latest version of this document.

Updated versions are available for download at the following Internet address:
<https://myworld-portal.leica-geosystems.com/> > myDownloads

Product identification

The model and serial number of your product are indicated on the type label. Always refer to this information when contacting your agency or Leica Geosystems authorised service centre.

Trademarks

- *Bluetooth®* is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to all models of the Leica GS18 GNSS instrument. Where there are differences between the various instruments they are clearly described.

Available documentation

Name	Description/Format		
GS18 Quick Guide	Provides an overview of the product together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
GS18 User Manual	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	-	✓

Name	Description/Format		
Captivate Technical Reference Manual	Overall comprehensive guide to the product and apps. Included are detailed descriptions of special software/hardware settings and software/hardware functions intended for technical specialists.	-	✓

Refer to the following resources for documentation/software:

- the Leica Captivate USB documentation card
- <https://myworld-portal.leica-geosystems.com/>

<https://myworld-portal.leica-geosystems.com/> offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

The availability of services depends on the instrument model.

Service	Description
My Products	Register all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep up-to-date with the latest documentation.
My Service	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
My Support	Create new support requests for your products that will be answered by your local Leica Geosystems support team. View your complete support history and view detailed information on all your support requests.
Knowledge	Enter key words and start searching in our knowledge base. You can find FAQs (Frequently asked questions) as well as Knowledge articles for Leica Geosystems products.
Downloads	Downloads of software, manuals, tools, training material and news for Leica Geosystems products. Download the latest documentation and software to keep yourself and your products up-to-date. You can access downloads of software, manuals, tools, and training material.
Online Learning	Welcome to the home of Leica Geosystems online learning! There are numerous online courses – available to all customers with products that have valid CCPs (Customer Care Packages).
My SmartNet	Add and view your Hexagon SmartNet subscriptions and user information. Hexagon SmartNet delivers high-precision and high-availability GNSS network correction services in real-time and around the globe. The Hexagon SmartNet Global family offers Network RTK with RTK bridging and Precise Point Positioning (PPP) services. These services work exclusively with Leica Geosystems GS smart antennas and receivers, providing the highest accuracy. Combined, they ensure Hexagon SmartNet coverage everywhere.
My Trusted Services	Leica Geosystems Trusted Services offer you increased productivity while at the same time providing maximum security. New software services and state-of-the-art IT infrastructure offer a vast potential to optimise your workflow and increase your efficiency and productivity, both now and in the future.
My Security	Leica Geosystems Security delivers you total peace-of-mind in knowing that if your instrument is ever stolen, a locking mechanism is available to ensure that the instrument is disabled and can no longer be used.

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Description

The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

About warning messages

Warning messages are an essential part of the safety concept of the instrument. They appear wherever hazards or hazardous situations can occur.

Warning messages...

- make the user alert about direct and indirect hazards concerning the use of the product.
- contain general rules of behaviour.

For the users' safety, all safety instructions and safety messages shall be strictly observed and followed! Therefore, the manual must always be available to all persons performing any tasks described here.

DANGER, WARNING, CAUTION and NOTICE are standardised signal words for identifying levels of hazards and risks related to personal injury and property damage. For your safety, it is important to read and fully understand the following table with the different signal words and their definitions! Supplementary safety information symbols may be placed within a warning message as well as supplementary text.

Type	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Intended use

- Computing with software
- Recording measurements
- Carrying out measurement tasks using various GNSS measuring techniques
- Recording GNSS and point related data
- Remote control of product
- Data communication with external appliances

- Measuring raw data and computing coordinates using carrier phase and code signal from GNSS satellites (GNSS systems)
- Capturing image groups and computing 3D coordinates of points using images

Reasonably foreseeable misuse

- Use of the product without instructions
- Use outside of the intended use and limits
- Disabling of safety systems
- Removal of hazard notices
- Opening the product using tools, for example a screwdriver, unless this is permitted for certain functions
- Modification or conversion of the product
- Use after misappropriation
- Use of products with recognisable damage or defects
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems
- Inadequate safeguards at the working site
- Controlling of machines, moving objects or similar monitoring applications without additional control and safety installations

1.3

Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation. Not suitable for use in aggressive or explosive environments.

WARNING

Working in hazardous areas or close to electrical installations or similar situations

Life Risk.

Precautions:

- ▶ Local safety authorities and safety experts must be contacted by the person responsible for the product before working in such conditions.

1.4

Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the User Manual and original accessories, in a safe condition.

Person responsible for the product

The person responsible for the product has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual
- To ensure that the product is used in accordance with the instructions
- To be familiar with local regulations relating to safety and accident prevention
- To stop operating the system and inform Leica Geosystems immediately if the product and the application become unsafe
- To ensure that the national laws, regulations and conditions for the operation of the product are respected
- To ensure that radio modems are not operated without the permission of the local authorities on frequencies and/or output power levels other than those specifically reserved and intended for use without a specific permit. The internal and external radio modems have been designed to operate on frequency ranges and output power ranges, the exact use of which differs from one region and/or country to another.

- This product must be installed on building and construction machinery only by an appropriately trained and qualified specialist.

1.5

Hazards of Use

DANGER

Risk of electrocution

Because of the risk of electrocution, it is dangerous to use poles, levelling staffs and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:

- ▶ Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.



WARNING

Distraction/loss of attention

During dynamic applications, for example stakeout procedures, there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:

- ▶ The person responsible for the product must make all users fully aware of the existing dangers.

WARNING

Inadequate securing of the working site

This can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

- ▶ Always ensure that the working site is adequately secured.
- ▶ Adhere to the regulations governing safety, accident prevention and road traffic.

CAUTION

Not properly secured accessories

If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people can sustain injury.

Precautions:

- ▶ When setting up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
- ▶ Avoid subjecting the product to mechanical stress.

WARNING

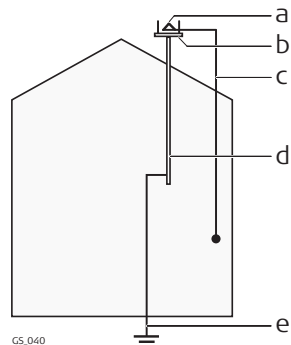
Lightning strike

If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.

Precautions:

- ▶ Do not use the product in a thunderstorm.

Grounding the instrument/antenna



- a Antenna
- b Lightning conductor array
- c Antenna/instrument connection
- d Metallic mast
- e Connection to earth

For the AC/DC power supply:

WARNING

Electric shock due to missing ground connection

If unit is not connected to ground, death or serious injury can occur.

Precautions:

- ▶ The power cable and power outlet must be grounded!



For the AC/DC power supply:

WARNING

Electric shock due to use under wet and severe conditions

If unit becomes wet it may cause you to receive an electric shock.

Precautions:

- ▶ If the product becomes humid, it must not be used!
- ▶ Use the product only in dry environments, for example in buildings or vehicles.



- ▶ Protect the product against humidity.

For the AC/DC power supply:

 WARNING

Unauthorised opening of the product

Either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs.

Precautions:

- ▶ Do not open the product!
- ▶ Only Leica Geosystems authorised service centres are entitled to repair these products.

 WARNING

Inappropriate mechanical influences to batteries

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:

- ▶ Before shipping the product or disposing it, discharge the batteries by the product until they are flat.
- ▶ When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed.
- ▶ Before transportation or shipping, contact your local passenger or freight transport company.

 WARNING

Exposure of batteries to high mechanical stress, high ambient temperatures or immersion into fluids

This can cause leakage, fire or explosion of the batteries.

Precautions:

- ▶ Protect the batteries from mechanical influences and high ambient temperatures.
- ▶ Consider the product's IP class restrictions in chapter [6 Technical Data](#).
- ▶ Do not drop or immerse the product into fluids.

 WARNING

Short circuit of battery terminals

If battery terminals are short circuited e.g. by coming in contact with jewellery, keys, metallised paper or other metals, the battery can overheat and cause injury or fire, for example by storing or transporting in pockets.

Precautions:

- ▶ Make sure that the battery terminals do not come into contact with metallic/conductive objects.

WARNING

Damaged battery housing

There is a risk of fire. In case skin or eyes have come into direct contact with electrolytes leaking from the battery, rinse them thoroughly with clear water. Immediately contact a doctor.

Precautions:

- ▶ Stop using the battery.
- ▶ Turn off any charging in action.
- ▶ If any electrolytes should leak from a damaged battery, avoid skin contact and direct inhalation of gases.

WARNING

Improper battery handling

Risk of fire, explosion or burn.

Precautions:

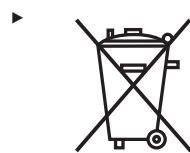
- ▶ Only replace battery with supported type.
- ▶ Prevent heating the battery above 70 °C.
- ▶ Never throw battery into fire.
- ▶ Do not disassemble, crush, or modify the battery.

WARNING

If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- The product includes parts of Beryllium inside. Any modification of some internal parts can release dust or fragments, creating health hazard.

Precautions:



The product must not be disposed of with household waste.

Dispose of the product appropriately in accordance with the national regulations in force in your country.

Always prevent access to the product by unauthorised personnel.

Product-specific treatment and waste management information can be received from your Leica Geosystems distributor.

WARNING

Improperly repaired equipment

Risk of injuries to users and equipment destruction due to lack of repair knowledge.

Precautions:

- ▶ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

Description

The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

 CAUTION**Electromagnetic radiation**

Electromagnetic radiation can cause disturbances in other equipment.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

 CAUTION**Use of the product with accessories from other manufacturers. For example, field computers, personal computers or other electronic equipment, non-standard cables or external batteries**

This may cause disturbances in other equipment.

Precautions:

- ▶ Use only the equipment and accessories recommended by Leica Geosystems.
- ▶ When combined with the product, other accessories must meet the strict requirements stipulated by the guidelines and standards.
- ▶ When using computers, two-way radios or other electronic equipment, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

 CAUTION**Intense electromagnetic radiation. For example, near radio transmitters, transponders, two-way radios or diesel generators**

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that the function of the product may be disturbed in such an electromagnetic environment.

Precautions:

- ▶ Check the plausibility of results obtained under these conditions.

 CAUTION**Electromagnetic radiation due to improper connection of cables**

If the product is operated with connecting cables, attached at only one of their two ends, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired. For example, external supply cables or interface cables.

Precautions:

- ▶ While the product is in use, connecting cables, for example product to external battery or product to computer, must be connected at both ends.

CAUTION

Exceeding the RF radiation exposure limits for general population

Health risk

Precautions:

- ▶ The antennas used for this transmitter must be installed such that a minimum separation distance of at least 23 cm is always maintained between the radiator (antenna) and all persons.
 - ▶ The antennas used for this transmitter must not be co-located or operated with any other antenna or transmitter.
-

WARNING

Use of product with radio or digital cellular phone devices

Electromagnetic fields can cause disturbances in other equipment, installations, medical devices, for example pacemakers or hearing aids, and aircrafts. Electromagnetic fields can also affect humans and animals.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.
 - ▶ Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
 - ▶ Do not operate the product with radio or digital cellular phone devices near medical equipment.
 - ▶ Do not operate the product with radio or digital cellular phone devices in aircrafts.
 - ▶ Do not operate the product with radio or digital cellular phone devices for long periods with the product immediately next to your body.
-

2 Description of the System

2.1 System Components

Main components	Component	Description
	Instrument	To calculate a position from the computed ranges to all visible GNSS (Global Navigation Satellite System) satellites. To estimate a tilt compensated pole tip position by combining the GNSS position with attitude information from an Inertial Measurement Unit (IMU). To capture image groups with the camera and to use those captured images to calculate the 3D coordinates of points.
	Web server	Web-based tool to preprogram the GNSS instrument.
	Antenna	To receive the satellite signals from the GNSS satellites.
	Leica Infinity	The office software including a series of help programs which support working with Leica instruments.

Instrument	Instrument	Description
	GS18	GPS, GLONASS, BeiDou and Galileo GNSS receiver, QZSS, NavIC L5, SBAS (EGNOS, WAAS, MSAS, GAGAN), L-band, multi-frequency, code and phase, real-time capable, internal memory, integrated Inertial Measurement Unit and camera.

2.2 System Concept

2.2.1 Software Concept

Description All instruments use the same software concept.

Software for all GS GNSS instruments	Software type	Description
	GS firmware (GS_xx.fw)	This software covers all functions of the instrument. The Web server application is integrated into the firmware and cannot be deleted. The English language is integrated into the firmware and cannot be deleted.
	Language software (WEB_LANG.sxx)	Numerous languages are available for the Web server application. The English language is the default language. One language is chosen as the active language.

Software upload  Uploading GS firmware can take some time. Ensure that the battery is at least 75% full before beginning the upload, and do not remove the battery during the upload process.

Software for	Description
All GS models	The software can be uploaded using the Leica Web server application or myWorld@Leica Geosystems.

Software for	Description
	Ensure that a Leica SD card is inserted into the GS instrument before starting the upload. Refer to 4.3 Working with the SD Card and micro SIM Card .

2.2.2

Power Concept

General

Use the batteries, chargers and accessories recommended by Leica Geosystems to ensure the correct functionality of the instrument.

Power options

Power for the instrument can be supplied either internally or externally.

Model	Power supply
Internally	One battery (GEB334) fits into the instrument.
Externally	GEB373 battery connected via a cable, or Car battery connected via a converter cable supplied by Leica Geosystems, or 10.5 V-28 V DC power supply via a converter cable supplied by Leica Geosystems, or 110 V/240 V AC to 12 V DC power supply unit, supplied by Leica Geosystems.



For permanent operations use **Uninterruptible Power Supply** units as a back-up in a main power failure.

2.2.3

Data Storage Concept

Description

Data (Leica GNSS raw data and RINEX data) can be recorded on the internal memory or on the SD card.

Memory device

Internal memory:	The GS18 GNSS instrument has an internal memory. Available capacity: Up to 4 GB
SD card:	The GS18 GNSS instrument has an SD card slot fitted as standard. An SD card can be inserted and removed. Available capacity: 1 GB, 8 GB



While other SD cards can be used, Leica Geosystems recommends to only use Leica industrial grade SD cards and is not responsible for data loss or any other error that can occur while using a non-Leica card.



Unplugging connecting cables, removing the data storage device or interrupting the power supply during the measurement can cause loss of data. Only remove the data storage device, unplug connecting cables or interrupt the power supply when the GS GNSS instrument is switched off.

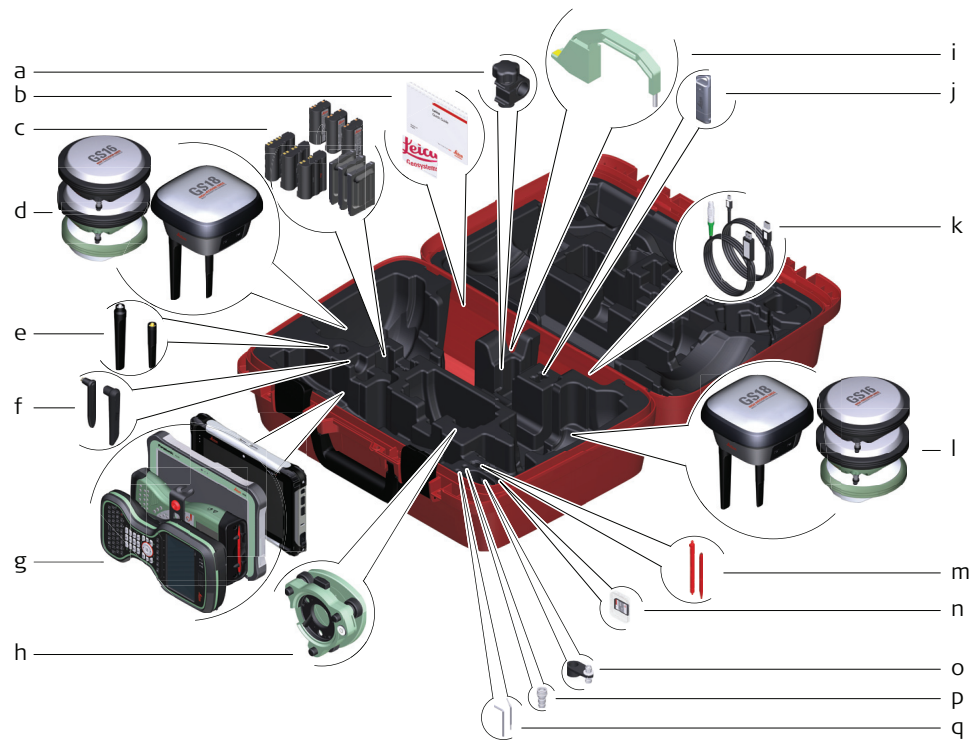


SD cards can directly be used in an OMNI drive as supplied by Leica Geosystems. Other PC card drives can require an adaptor.

2.3

Container Contents

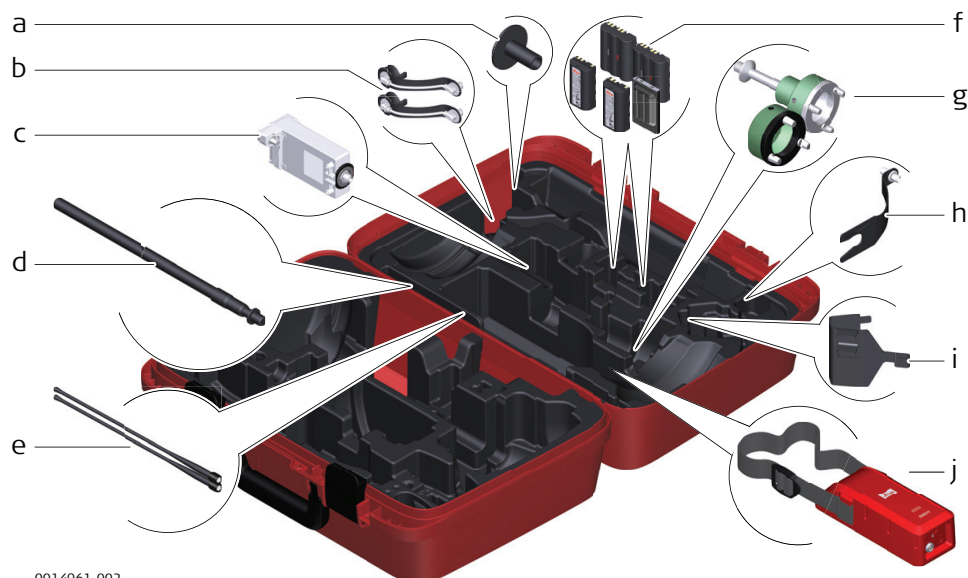
Container for GS instrument and accessories 1/2



0021683_002

- a GHT63 clamp
- b Manuals and USB documentation card
- c GEB212, GEB260 (spare battery for CS20) or GEB334 batteries
- d Antenna
- e GAT18, GAT27 or GAT28 mobile antenna
- f GAT21, GAT25 or GAT26 radio antenna
- g Field controller with holder or tablet
- h Tribrach
- i Height hook
- j USB stick
- k Cables
- l Antenna
- m Stylus
- n SD cards
- o GAD34 arm 3 cm
- p TNC QN-adapter
- q Allen key and adjustment tool

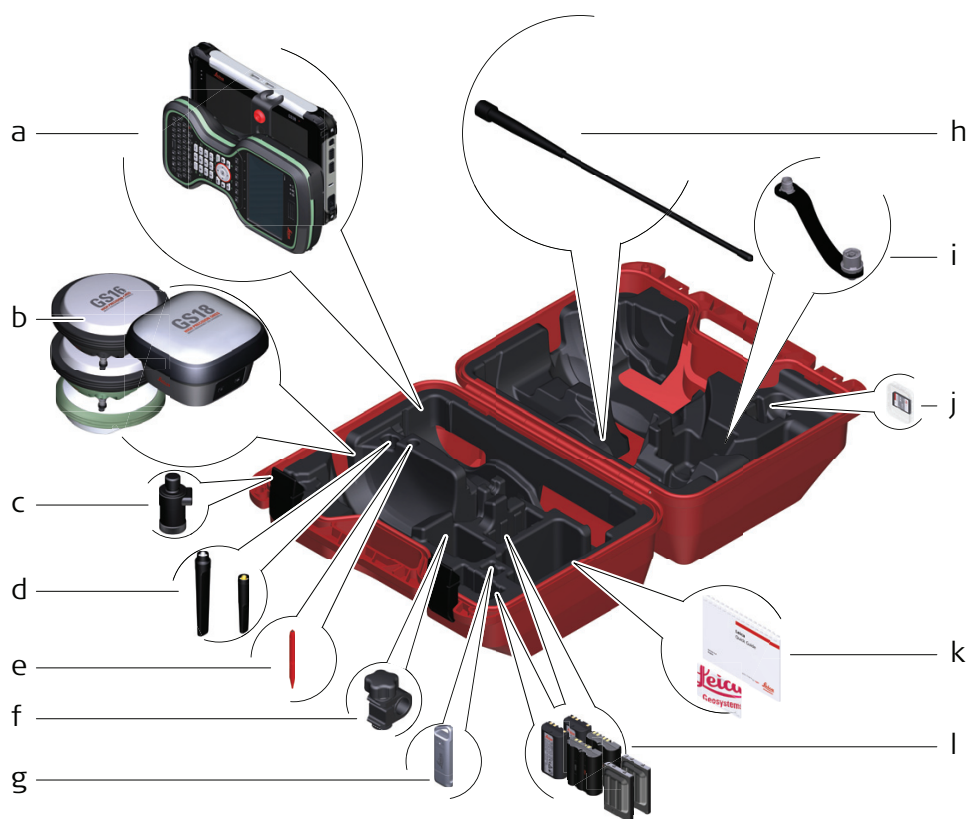
Container for GS instrument and accessories 2/2



0014961_002

- a GHT36 base for telescopic rod
- b Antenna arm
- c GFU RTK modem
- d GAD32 telescopic rod
- e GAT1 or GAT2 radio antennas
- f GEB212, GEB260 (spare battery for CS30) or GEB334 batteries
- g GRT146 or GRT247 carrier
- h GAD33 arm
- i GHT58 tripod bracket for GFU
- j External battery

Container for GS instrument and accessories



0022597_001

- a Field controller with holder
- b Antenna
- c CRP15, quick release adaptor for quick mounting and demounting the GS18 to the pole without screwing
- d GAT25, GAT26, GAT27 or GAT28 antenna
- e Stylus
- f GHT63 clamp
- g USB stick
- h GAT1 or GAT2 radio antennas
- i Antenna arm
- j microSD card including adapter or SD card
- k Manual & USB documentation card
- l GEB212, GEB260 (spare battery for CS30) or GEB334 batteries

2.4

Instrument Components



The instrument can be preprogrammed using the Web server application running from the instrument on a web browser of a Windows device. Connect the instrument to a computer using a cable. Turn on the instrument by holding down the Power key for 2 s. A green blinking light at the connectivity and the storage LED indicates that the instrument powers up.

GS18 components



- a SMB-connector for external UHF antenna, only for models with UHF radio
- b SMB-connector for external LTE antenna
- c LEDs, ON/OFF button and Function button
- d Battery compartment with SD card and micro SIM card slot
- e LEMO port, serial, USB and external power
- f Antenna Reference Plane (ARP)



- a Camera (GS18 I)

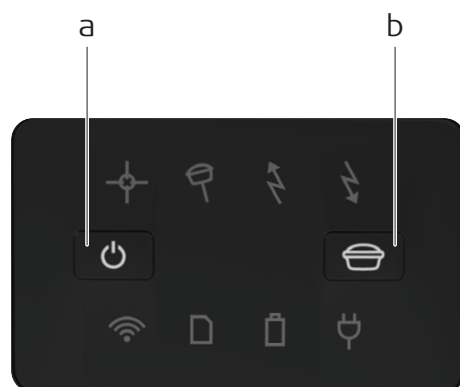


A Bluetooth port is included inside all GS GNSS instruments enabling connectivity to the field controller.

3 User Interface

3.1 Keyboard

Keyboard GS18



0014280_001

- a ON/OFF button
b Function button

ON/OFF button

Button	Function
ON/OFF	 If GS18 already off: Turns on GS18 when held for 2 s.  While the GS18 is booting the Connectivity and Storage LED are flashing green. The Battery and or Power LEDs shine green or red depending on the power source and the battery status.
	If GS18 already on: Turns off GS18 when held for 2 s.  The Position LED shines orange. The Tilt and the Storage LEDs shine red. RTK Base and RTK Rover LEDs shine green. The Connectivity LED shines blue or green, depending on the connectivity. The Battery and Power LEDs shine green or red depending on the battery status.

Function button

 All functions following described assume the GS18 is already on.

Button	Function
Function	 Press and hold button for <1 s. If the GS18 is in: - base mode: The GS18 switches to be in rover mode. - rover mode and in static mode: No action. - rover mode and in kinematic mode: The GS18 switches to be in base mode.

Press and hold button for 3 s.

If the GS18 is in:

Button	Function
	- base mode and a position is available, RTK OUT is configured: The RTK base LED flashes green for 2 s. The GS18 takes the next available position and updates the coordinates of the currently stored RTK base position. - base mode and no position is available, no RTK OUT is configured: No action. - rover mode: No action.
Press and hold button for 5 s.	
If the GS18 is in:	
	- base mode: No action. - rover mode and RTK IN via Internet is configured: The RTK rover LED flashes green for 2 s. The GS18 will connect to the RTK base station or the Ntrip server configured. - rover mode and RTK IN active and data being received via Internet: The RTK rover LED flashes green for 2 s. The GS18 will stop the RTK stream and disconnect to the RTK base station or (Ntrip) server. - rover mode but RTK in not configured: No action.

Button combinations

Button	Function
ON/OFF 	
+ 	
Function 	
Press and hold both buttons, release after 1 s. The current almanacs stored on the GNSS instrument are deleted and new almanacs are downloaded. The Position LED flashes orange quickly three times.	
Press and hold buttons for 5 s. The Memory LED flashes red quickly three times. If no SD card is inserted, the internal memory of the GNSS instrument is formatted. If inserted, the SD card of the GNSS instrument is formatted. The Memory LED continues to flash red as the internal memory or SD card is formatted.	
Press and hold buttons for 10 s. The System RAM on the GNSS instrument is formatted. Settings of all installed software will be deleted. After the formatting the System RAM, the GNSS instrument is turned off. Following LEDs flash simultaneously three times: - Position LED: Orange - Tilt LED: Red - RTK Base and RTK Rover LEDs: Green	

Button	Function
	Press and hold buttons for 15 s. The registry of the GNSS instrument is deleted. Windows CE and communication settings will be reset to factory defaults. After deleting the registry, the GNSS instrument is turned off. Following LEDs flash simultaneously three times: • Position LED: Orange • Tilt and Storage LED: Red • Connectivity LED: Blue • All other LEDs: Green
	Press and hold buttons for >15 s. The GNSS instrument switches back to last operation mode.

3.2

Operating Principles

Operating the instrument

The GS18 GNSS instrument is operated either by pressing its buttons (ON/OFF button, function button) or by the field controller.

Operation by buttons

The GS18 GNSS instrument is operated by pressing its buttons. Refer to [3.1 Keyboard](#) for a detailed description of the buttons and their function.

Operation by field controller

The GS18 GNSS instrument is operated by the field controller using the Captivate software. Refer to the User Manual of the field controller for a detailed description of the keys and their function.

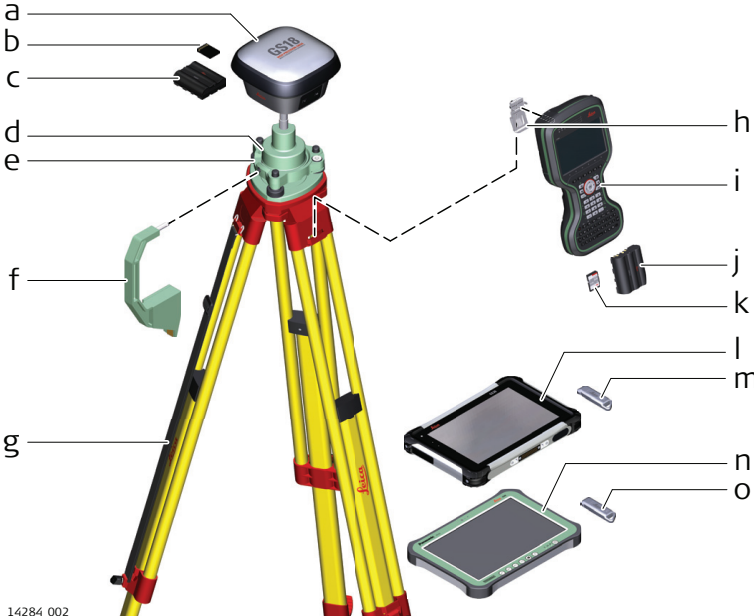
Turn on GS18

To turn on the instrument press and hold the Power button for 2 s.

Turn off GS18

To turn off the instrument:

- press and hold the ON/OFF button for 2 s
- confirm to power down the instrument when exiting the software on the field controller

4	Operation																																
4.1	Equipment Setup																																
4.1.1	Setting up as a Post-Processing Base																																
Use	The equipment setup described is used for static operations over markers.																																
Description	The instrument can be programmed with the field controller before use which can then be omitted from the setup. - The antenna is mounted directly using screw fitting. If using stub and adapter, procedures can vary slightly. - When using the adapter and carrier, ensure that the antenna and the adapter assembly slide down the full length of the carrier stub. An incorrectly mounted antenna will have a direct effect on the results. Use an external battery such as GEB373 to ensure operation for a full day.																																
Equipment setup	 14284_002 <table><tr><td>a</td><td>GS instrument</td><td>i</td><td>CS20 field controller</td></tr><tr><td>b</td><td>SD card</td><td>j</td><td>GEB334 battery</td></tr><tr><td>c</td><td>GEB334 battery</td><td>k</td><td>SD card</td></tr><tr><td>d</td><td>GRT146 carrier</td><td>l</td><td>CS30 tablet</td></tr><tr><td>e</td><td>Tribrach</td><td>m</td><td>USB stick</td></tr><tr><td>f</td><td>Height hook</td><td>n</td><td>CS35 tablet</td></tr><tr><td>g</td><td>Tripod</td><td>o</td><td>USB stick</td></tr><tr><td>h</td><td>Utility hook</td><td></td><td></td></tr></table>	a	GS instrument	i	CS20 field controller	b	SD card	j	GEB334 battery	c	GEB334 battery	k	SD card	d	GRT146 carrier	l	CS30 tablet	e	Tribrach	m	USB stick	f	Height hook	n	CS35 tablet	g	Tripod	o	USB stick	h	Utility hook		
a	GS instrument	i	CS20 field controller																														
b	SD card	j	GEB334 battery																														
c	GEB334 battery	k	SD card																														
d	GRT146 carrier	l	CS30 tablet																														
e	Tribrach	m	USB stick																														
f	Height hook	n	CS35 tablet																														
g	Tripod	o	USB stick																														
h	Utility hook																																
Equipment setup step-by-step	- Set up the tripod. - Mount and level the tribrach on the tripod. - Ensure that the tribrach is over the marker. - Place and lock the carrier in the tribrach. - Insert the data storage device and the batteries into the GS. - Screw the GS onto the carrier. - Check that the tribrach is still level.																																

8. Insert the data storage device and the battery into the field controller.
9. Switch on the field controller and connect it to the instrument if necessary.
10. To hang the field controller on the tripod leg, use the hook on the hand strap or use the utility hook. Refer to the User Manual of the field controller.
11. Insert the height hook into the carrier.
12. Measure the antenna height using the height hook.
13. Press the ON/OFF button on the instrument for at least 2 s to switch on the instrument.

4.1.2

Setting up as a Real-Time Base

Use

The equipment setup described is used for real-time base stations with the need of optimal radio coverage. Raw observation data can also be collected for post-processing.

Description

The GS18 instrument can be programmed with the field controller before use which can then be omitted from the setup.

The connection between GS18 and the field controller is made via Bluetooth or WLAN.

The radio antenna (GAT28) is directly mounted downwards facing at the GNSS antenna. Alternatively, the radio antenna (GAT1/GAT2) can be mounted on the antenna arm (CA41) which clips to the GNSS antenna.

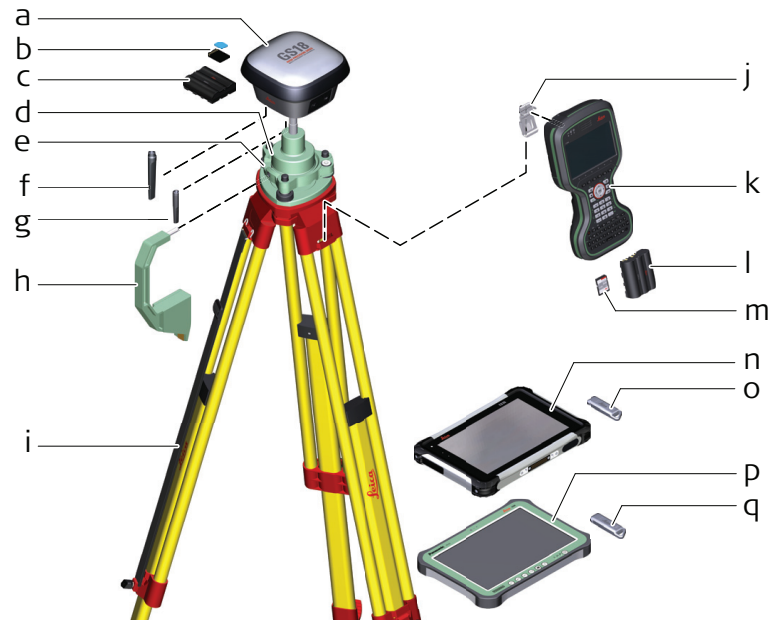


- The GNSS antenna is mounted directly using screw fitting. If using stub and adapter, procedures can vary slightly.
- When using the adapter and carrier, ensure that the antenna and the adapter assembly slide down the full length of the carrier stub. An incorrectly mounted antenna will have a direct effect on the results.
- Standard radio is used throughout the instructions. Digital cellular phones can also be used but the setup can differ slightly.



Use an external battery such as GEB373 to ensure operation for a full day.

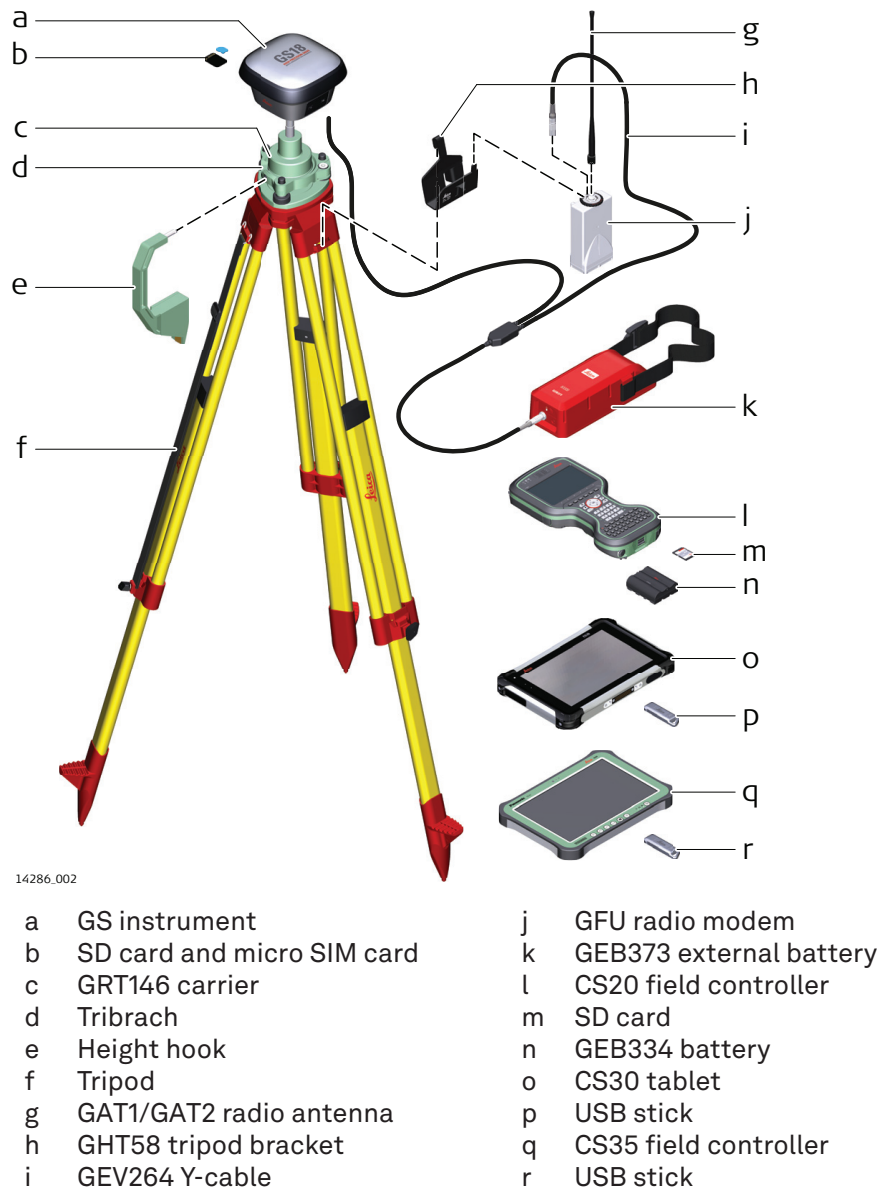
Equipment setup - GS18 cellular or GS18 UHF



14285_002

- | | | | |
|---|--|---|-----------------------|
| a | GS instrument with integrated cellular modem or UHF (transmit) modem | h | Height hook |
| b | SD card and micro SIM card | i | Tripod |
| c | GEB334 battery | j | Utility hook |
| d | GRT146 carrier | k | CS20 field controller |
| e | Tribrach | l | GEB334 battery |
| f | GAT28 radio antenna, for UHF use only | m | SD card |
| g | GAT27 LTE antenna | n | CS30 tablet |
| | | o | USB stick |
| | | p | CS35 tablet |
| | | q | USB stick |

Equipment setup



Equipment setup step-by-step

1.	Set up the tripod.	
2.	Mount and level the tribrach on the tripod.	
3.	Ensure that the tribrach is over the marker.	
4.	Place and lock the carrier in the tribrach.	
	GS18	GS with external RTK device
5.	Insert the data storage device and the batteries into the GS18.	
6.	Screw the GS18 onto the carrier.	
7.	Check that the tribrach is still level.	
8.	-	Hang the external battery onto a tripod leg.
9.	-	Hang the tripod bracket onto a tripod leg and attach the radio housing onto the tripod bracket.
10.	Connect the UHF or LTE antenna to the GS18.	Connect the GEV264 cable to the GS18, to the external battery and to the radio housing.

11. Insert the data storage device and the battery into the field controller.
12. Connect the field controller to the instrument if necessary.
13. To hang the field controller on the tripod leg, use the hook on the hand strap or use the utility hook. Refer to the User Manual of the field controller.
14. Insert the height hook into the carrier.
15. Measure the antenna height using the height hook.
16. Press the ON/OFF button on the instrument for at least 2 s to switch on the instrument.

4.1.3

Setting up as a Real-Time Rover

Use

The equipment setup is used for real-time rover with extended periods of use in the field.

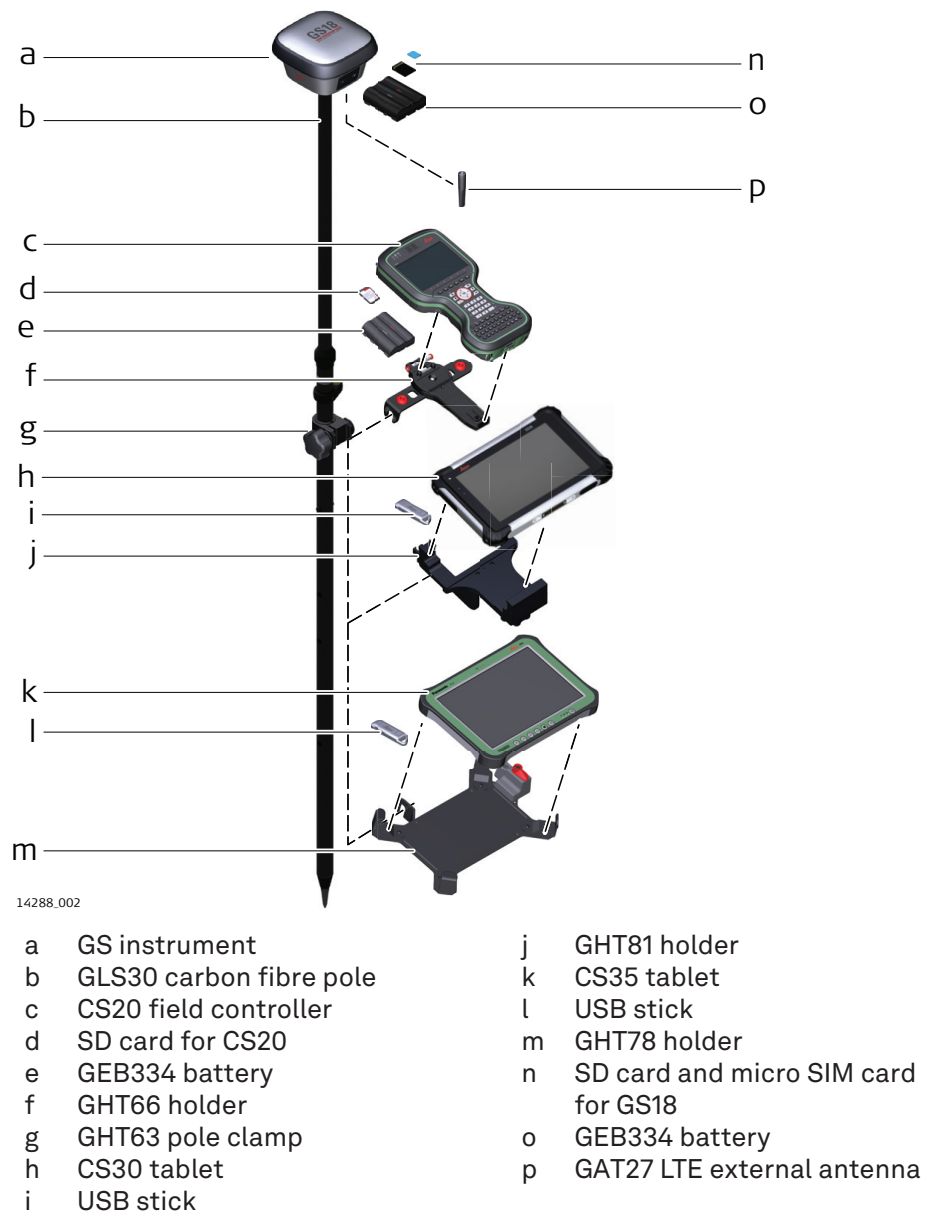
Description

Connections are made to the GNSS antenna, radio antenna and field controller. The field controller is fixed to the pole with the GHT63. Connection between the GS18 instrument and the field controller is made through Bluetooth.

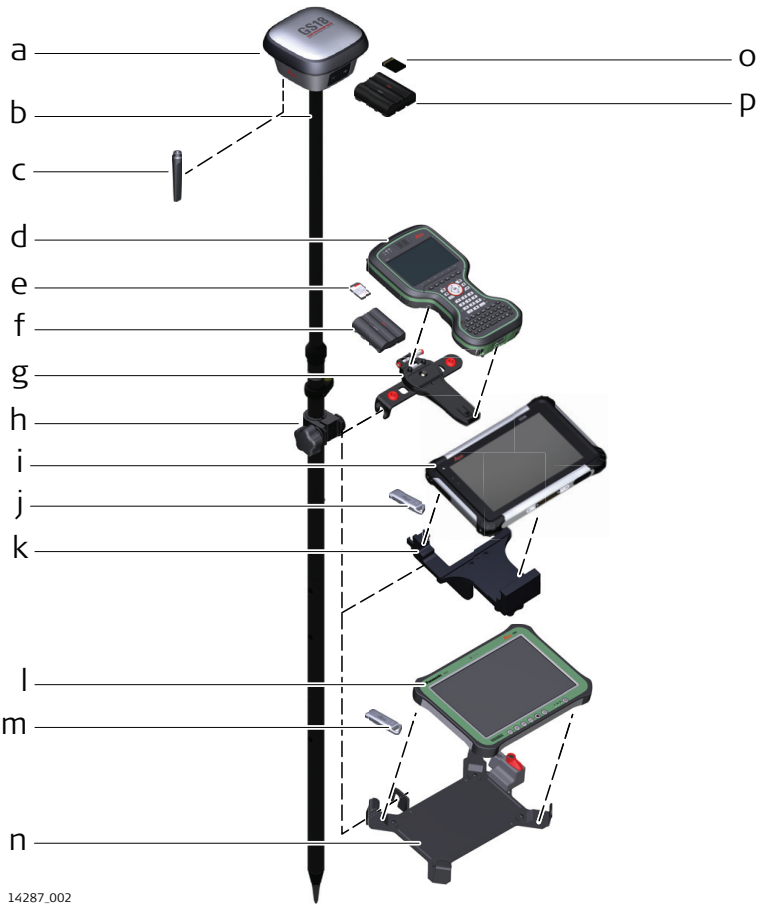


- The antenna is mounted directly using screw fitting. If using stub and adapter, procedures can vary slightly.
- When using the pole with stub, ensure that the antenna and the screw-to-stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted antenna will have a direct effect on the results.
- Carbon fibre poles are used since they are recommended for automatic tilt compensated measurements. For applications without tilt compensation, they can be replaced with their aluminium equivalent without any changes to these instructions.
- Standard radio is used throughout the instructions. Digital cellular phones can also be used but the setup can differ slightly.

Equipment setup - GS18 LTE



Equipment setup - GS18
UHF



14287.002

- | | | | |
|---|---|---|------------------|
| a | GS instrument with integrated UHF radio modem | i | CS30 tablet |
| b | GLS30 carbon fibre pole | j | USB stick |
| c | GAT28 radio antenna | k | GHT81 holder |
| d | CS20 field controller | l | CS35 tablet |
| e | SD card for CS20 | m | USB stick |
| f | GEB334 battery | n | GHT78 holder |
| g | GHT66 holder | o | SD card for GS18 |
| h | GHT63 pole clamp | p | GEB334 battery |

Equipment setup step-
by-step

1. Attach the GHT66 for CS20 holder to the pole.
2. Insert the data storage device and the battery into the field controller.
3. Clip the field controller into the holder and lock it by pushing the locking pin into the locked position.
4. Press ON/OFF button on the field controller to switch on.
5. Insert the data storage device and the batteries into the GS18.
6. Press ON/OFF button on the GS18 to switch on.
7. Screw the GS18 to the top of the pole.
8. The field controller and GS18 are connected via Bluetooth.

4.1.4

Fixing the Field Controller to a Holder and Pole



Refer to the User Manual of the field controller.

Description

Leica USB drivers support Windows 7, Windows 8 (8.1) and Windows 10 operating systems.

Cables

Leica USB drivers support:

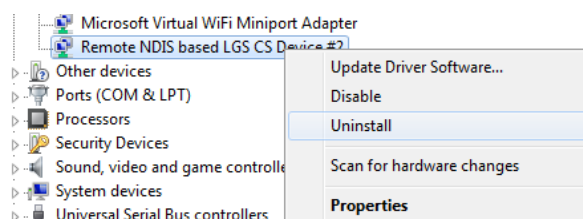
Name	Description
GEV234	USB data cable, 1.65 m, connects CS to GS or CS to PC (USB)
GEV261	Y-cable, 1.8 m, connects instrument to PC – battery

Uninstalling the previous drivers

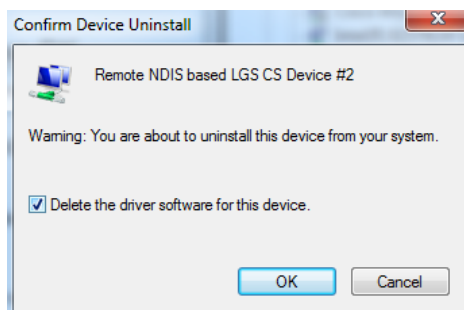
Skip the following steps if you have never installed Leica USB drivers before.

If older drivers were previously installed on the PC, follow the instructions to uninstall the drivers prior the installation of the new drivers.

1. Connect your instrument to the PC via cable.
2. On your PC, select to **Control Panel > Device Manager**.
3. In **Network Adapters**, right-click on **Remote NDIS based LGS....**
4. Click on **Uninstall**.



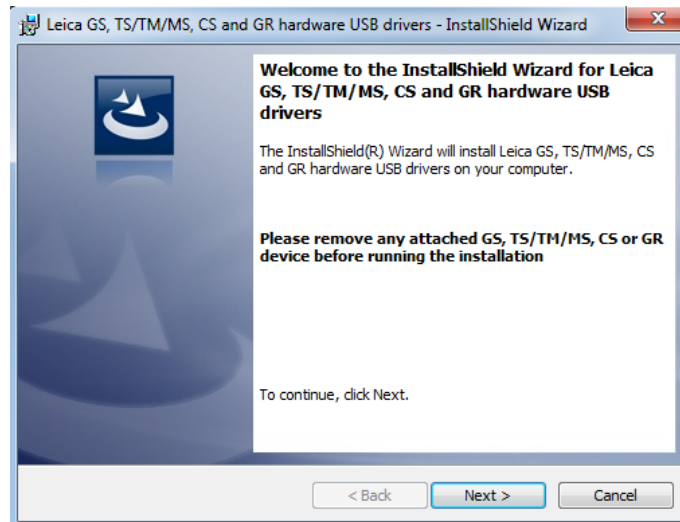
5. Set **Delete the driver...** as checked. Press **OK**.

**Install Leica USB drivers**

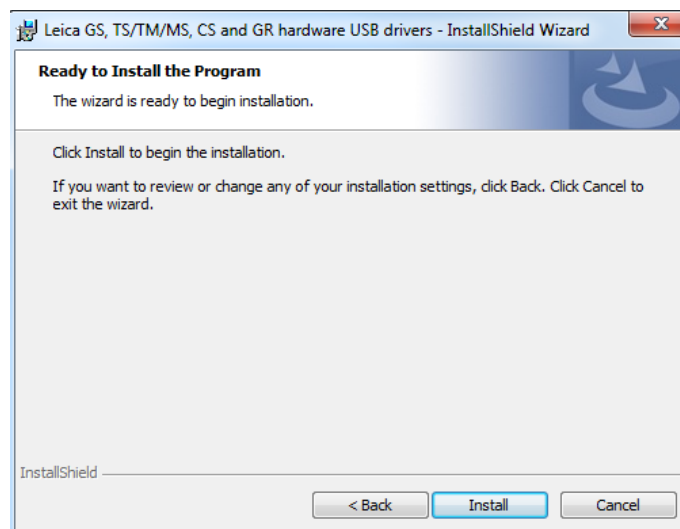
1. Start the PC.
 2. Run the **Setup_Leica_USB_XXbit.exe** to install the drivers necessary for Leica devices. Depending on the version (32bit or 64bit) of the operating system on your PC, you have to select between the three setup files following:
 - Setup_Leica_USB_32bit.exe
 - Setup_Leica_USB_64bit.exe
 - Setup_Leica_USB_64bit_itanium.exe
- To check the version of your operating system, go to **Control Panel > System > System type**.
- The setup requires administrative privileges.
- The setup has to be run only once for all Leica devices.

3. The **Welcome to InstallShield Wizard for Leica GS, TS/TM/MS, CS and GR USB drivers** window appears.

☞ Ensure that all Leica devices are disconnected from your PC before you continue!



4. Click **Next>**.
5. The **Ready to Install the Program** window appears.



6. Click **Install**. The drivers will be installed on your PC.
7. The **InstallShield Wizard Completed** window appears.
8. Click **Finish** to exit the wizard.

Connect to PC via USB cable step-by-step

1. Start the PC.
2. Plug the cable into the instrument.
3. Turn on the instrument.
4. Plug the cable into the USB port of the PC.
5. Press the Windows Start button at the bottom left corner of the screen.
6. Type the IP address of the device into the search field.
 - \\192.168.254.1\ for field controller
7. Press **Enter**.

A file browser opens. You can now browse within the folders on the instrument.

4.1.6

Connecting to the Web Server

Description

The Web server is a web-based tool to view the status of and configure the GNSS instruments. The Web server application is integrated into the GS firmware and cannot be deleted.

Accessing the Web server via cable step-by-step

1. Start the PC and turn on the GS instrument.
 Instead of connecting to your PC, you can connect your GS instrument to the field controller.
2. Connect the GS instrument with the GEV234 cable to the PC. Refer to [4.1.5 Connecting to a Personal Computer](#).
3. Double-Click the **Configure GS connection** shortcut from the desktop of your PC. The GS network adapter is configured with IP address: 192.168.254.1. A DOS window appears when the configuration was successful. Press any key to exit the DOS window. The **Configure GS connection** shortcut disappears from the desktop.
4. Start the web browser of your PC.
5. Type in **http://192.168.254.2** and press enter to access the web server of GS instrument.

Accessing the Web server via Bluetooth step-by-step

To access the Web server the tasks following have to be done:

- Configure the PC's Bluetooth device
- Establish a Bluetooth connection between PC and GS
- Accessing the Web server

Configuring the PC's Bluetooth device

Action

1. Start your PC.
2. Activate the Bluetooth device of your PC.
3. Go **Start⇒Settings⇒Network Connections**.
4. Double-click **Bluetooth** from the **LAN or High-Speed Internet** device list. The **Bluetooth Properties** windows is started.
5. In the **General** page, select **Internet Protocol (TCP/IP)** from the list and click **Properties**. The **Internet Protocol (TCP/IP) properties** windows is started.



This procedure has to be done only once.

Establishing a Bluetooth connection between PC and GS instrument

Action

1. Start the PC and turn on the GS instrument.
 Instead of connecting to your PC, you can connect your GS instrument to the field controller. In this case, turn on the field controller, start Captivate and establish a Bluetooth connection to the GS instrument.
2. Run the Bluetooth software and start the **Bluetooth Setup Wizard**.
3. Click **Next**. The **Bluetooth Device Selection** will be started and an automatic search will be done.

Action	
4.	Select the shown GS instrument and click Next . The Bluetooth Security Setup is started.
5.	Type in 0000 as Bluetooth security code and click Pair Now . The pairing procedure will be done and the Bluetooth Service Selection is started.
6.	Highlight Personal Ad-hoc Network and check the checkbox for Personal Ad-hoc Network.  Do not select Serial Port as service.
7.	Click Next . The Bluetooth Setup Wizard Completion Page is started.
8.	Type in a name for your GS instrument and click Finish to complete the Bluetooth Setup Wizard .
	This procedure has to be repeated for every GS instrument you want to connect to.

Accessing the Web server

Action	
1.	Start the web browser on your PC/field controller.  Ensure that your GS instrument is still running and the Bluetooth connection between PC/field controller and GS is established.
2.	Type in 192.168.253.2 . The Web server is started. You will see the home functions following: • Go to Work! • Wake-up sessions are not supported for GS18. • Current Status • To access GNSS information of the GS as well as the instrument firmware. • Instrument • To access configuration settings for the GS. • User • To upload and activate firmware, licence keys and languages.

4.2

Batteries

4.2.1

Operating Principles

First-time use/ charging batteries

- The battery must be charged before using it the first time, because it is delivered with an energy content as low as possible or might be in sleep mode.
- The permissible temperature range for charging is from 0 °C to +40 °C/ +32 °F to +104 °F. For optimal charging, we recommend charging the batteries at a low ambient temperature of +10 °C to +20 °C/+50 °F to +68 °F if possible
- It is normal for the battery to become warm during charging. Using the chargers recommended by Leica Geosystems, it is not possible to charge the battery once the temperature is too high
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make a discharge/charge cycle
- For Li-Ion batteries, a single discharge/charge cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a Leica Geosystems product deviates significantly from the actual battery capacity available.

Operation/discharging

- The batteries can be operated from $-20\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$ / $-4\text{ }^{\circ}\text{F}$ to $+131\text{ }^{\circ}\text{F}$
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery

4.2.2

Battery for GS18

Change battery step-by-step



1. Push the slide fastener of the battery compartment in the direction of the arrow with the open-lock symbol. Remove the cover.
2. To remove the battery, push the retaining clip upwards. This releases the battery from its fixed position.
3. Remove the battery.
4. To insert the battery, slide the battery into the battery compartment with the battery contacts facing downwards. Push the battery into the compartment so that it locks into position.
5. Insert the cover of the battery compartment into the compartment.
6. Push the slide fastener in the direction of the arrow with the close-lock symbol.

4.3

Working with the SD Card and micro SIM Card



- Keep the card dry.
- Use it only within the specified temperature range.
- Do not bend the card.
- Protect the card from direct impacts.



Failure to follow these instructions could result in data loss and/or permanent damage to the card.



The SIM card size must be a micro SIM (3FF) .

The SIM card must be inserted in the correct way as depicted on the GS18 housing.

Using a SIM card adapter might damage the SIM card tray of the GS18.

Insert a SD card and
micro SIM card step-by-
step



14293_002



Removing the SD card or micro SIM card while the GS18 is turned on can cause loss of data. Only remove the SD card or micro SIM card or unplug connecting cables when the GS18 is switched off.



The SD card and micro SIM card are inserted into a slot inside the battery compartment of the instrument.

1. Push the slide fastener of the battery compartment in the direction of the arrow with the open-lock symbol.
2. Remove the cover from the battery compartment.
3. Slide the SD card and micro SIM card with the logo facing upwards firmly into the slot until it clicks into position.
4. Insert the cover of the battery compartment into the compartment.
5. Push the slide fastener in the direction of the arrow with the close-lock symbol.

4.4

Working with the Tilt Compensation

Description

The pole can be held in a slanting position over the point to be measured without checking the circular bubble on the pole.

Measurements are reliable and accurate even if the pole is not levelled as the tilt values are calculated by an Inertial Measurement Unit. Tilt values contain information about the 3D position of the pole.

The measurements are immune to magnetic disturbances as there is no magnetometer used.

Tilt compensation also works with Navigated and Code solutions. High accuracy positions are recommended to speed up the tilt compensation initialization.

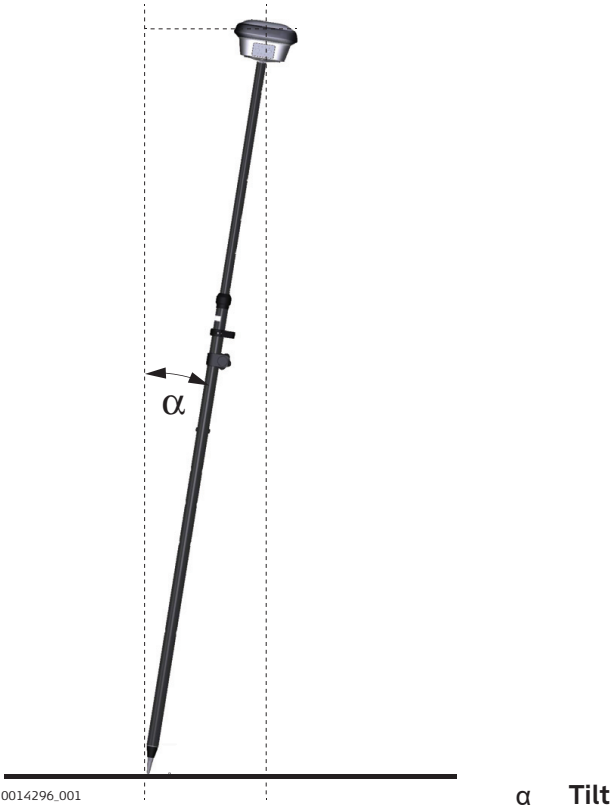
Tilt compensation is turned off when RINEX logging is on.

When measuring a point, the pole tip must be stable on the point while the pole should be in slight movement. Tilt compensation is indicated by an icon and the Tilt LED and is maintained by natural pole movement, for example while moving to the next point to be measured.

Advantages:

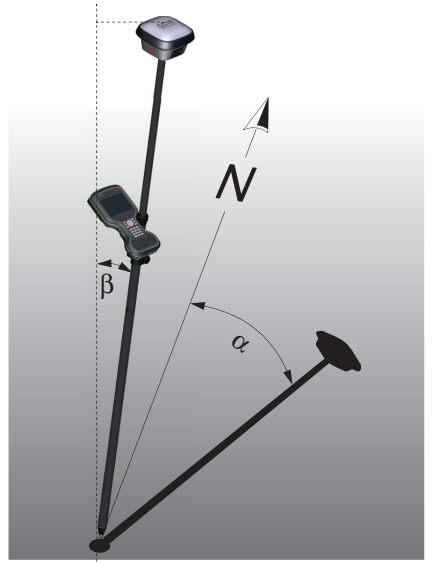
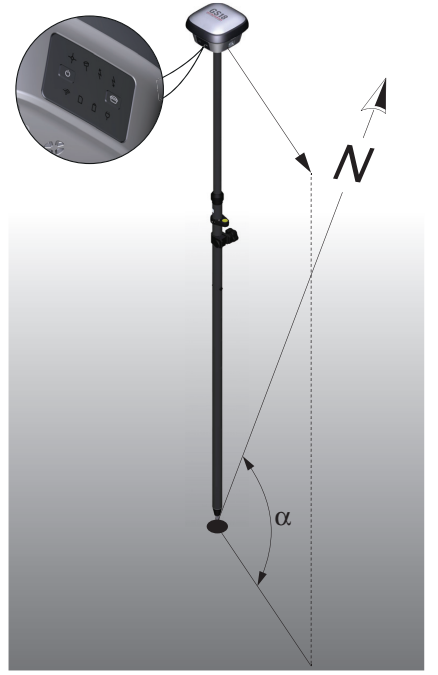
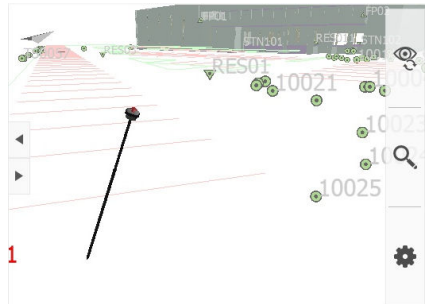
- No need to level the pole
- Faster surveying procedure

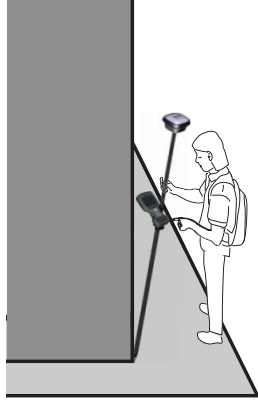
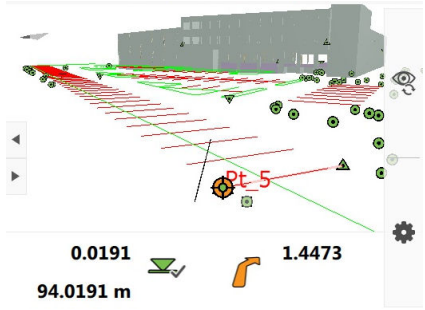
Diagram



Tilt compensation step-by-step

Action	Result
 A GS18 must be configured as real-time rover and connected to a CS20, CS30 or CS35.	
1. Leica Captivate - Home: Settings\GS sensor\Tilt compensation	
2. Tilt Compensation Use tilt compensation: Check box checked. Set Use tilt compensator to: Compensate & store tilt.	
3. OK	
 Move the antenna for initialisation. Walking to the survey mark is sufficient. A message and a voice prompt indicate that the tilt compensation is being applied.	
 The LEDs on the GS18 and the green background of the position icon on the CS20, CS30 or CS35 indicate when a tilt compensated measurement is possible. Refer to 4.6 LED Indicators on GS18 .	
4. For an overview of the current position in the survey area Click the GS position icon. Select Current position .	

Action	Result
5. Current GS position, Tiltpage The fields are updated according to the setting for GS position update rate in Screen, Audio & Text Input.	 0014298_002 α Direction of tilt β Tilt  0014307_001 α GS heading
6. For an overview of the current position in the survey area Use the 3D viewer with dxf data or a background image:	

Action	Result
7. Measure points Leica Captivate - Home: Measure The position of the tilted GS18 is shown in the 3D viewer. Measure Stop Store Application example:	  0014297_001
8. Stake points Leica Captivate - Home: Stake points The position of the tilted GS18 is shown in the 3D viewer.	
9. Stake out the point. The values are valid for the tip of the pole.	

4.5

Working with the GS imaging App

Description

The camera can be used to capture images of an object of interest.

In respect to the user, the camera needs to be directed toward the left or the right side, so that it always faces the object of interest while walking along it.

To assure a good visual overlap of the images, the system captures the images with a rate of 2 Hz.

In order to get the best accuracy of point coordinates computed from the images, the images within one sequence should be captured along a U-shaped trajectory.

The images captured within one sequence will be stored as an image group.

The coordinates of any characteristic point captured in the images can be computed right away. One point needs to be picked manually in one image.

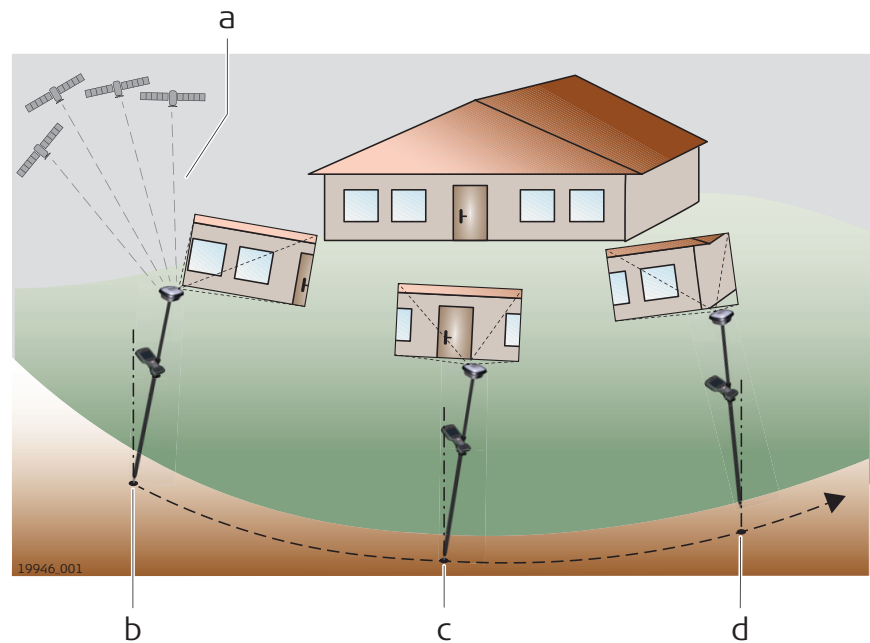
The algorithm will automatically find the picked point in other images from the

image group. The algorithm will select and use the images that are the most optimal for the calculation of the 3D position of the point.

Advantages:

- No need to measure each point individually with the pole tip of the GS sensor
- No need to physically access the points
- Capture images of the areas with weak or no satellite signal

Diagram



- a GNSS signal
- b Position of captured image i
- c Position of captured image i+1
- d Position of captured image i+2

Capturing an image group step-by-step

- ☞ GS18 I is ready to capture an image group when all of the following conditions are fulfilled:
- The GS18 I must be configured as real-time rover and connected to a CS20 LTE, CS20 BASIC, CS30 or CS35 via cable or WLAN.
 - The live video stream is visible.
 - The tilt compensation is initialised.
 - The 3D coordinate quality value is better than 10 cm.

Action	Result
1. Leica Captivate - Home: GS imaging\Capture image group	
2. Start	
Walk along the object of interest while the camera is directed toward the left or the right side in respect to the user.	
Stop	
Wait until the image processing has been finished.	
Store	

Action	Result
Capturing time The value indicates how much time has passed since the capturing of images was started. The capturing time is limited to 60 seconds.	The capturing time increases constantly during the capturing. After 60 seconds, the capturing stops automatically.
Number of images The value indicates the number of images that were captured within the image group	The number of images will be shown after the capturing is stopped.
3. Image group quality The value indicates the expected quality of a point measurement inside the image group	The quality will be shown after the capturing is stopped.

Measuring in images step-by-step

Action	Result
 At least one image group must be stored within the active job.	
1. Leica Captivate - Home: GS imaging\Measure in images.	
2. Select an image group.	
3. Pick a characteristic point in the image. The picked point will be marked with the symbol  in the image.	
 The snapping tool option can be used to automatically snap the point to the closest corner point.	
4. Measure	
For editing a measurement	
 If an image was used for the calculation of the 3D coordinates of the picked point, the symbol  will appear in the selected image.	

Action	Result
 If an image was not used for the calculation of the 3D coordinates of the picked point, the symbol  will appear in the selected image. The symbol marks the approximate position of the measured point in the selected image.	
5. To remove an image from the measurement, select the image with Previous or Next and press Remove .	The coordinates and its CQ values will be re-calculated automatically after the image has been removed from the measurement.
6. To add an image to the measurement, select the image with Previous or Next . Pick the point in this image and press Add . The image will be added to the measurements.	The coordinates and its CQ values will be re-calculated automatically after the image has been added to the measurement.
7. Store When the point is stored, the point symbol appears in all images of the image group.	

4.6

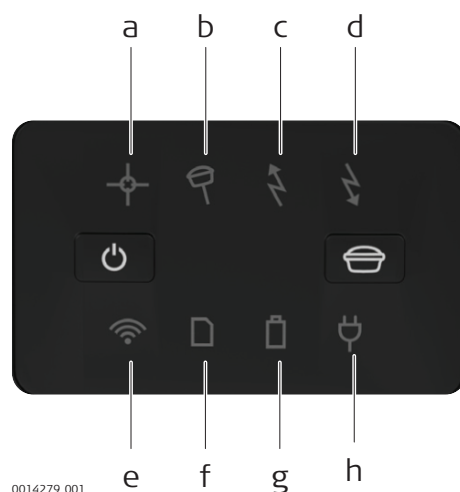
LED Indicators on GS18

LED indicators

Description

The GS18 instrument has Light Emitting Diode indicators. They indicate the basic instrument status.

Diagram



- a Position LED
- b Tilt LED
- c RTK Base LED
- d RTK Rover LED
- e Connectivity LED
- f Storage LED
- g Battery LED
- h Power LED

0014279_001

Description of the LEDs

LED	LED Status	Status of the Instrument
Position LED	off	No satellites are tracked or GS18 is switched off.
	flashing orange	Satellites are tracked, a position is not yet available.
	orange	A navigated position is available.
	flashing green	A code-only position is available. PPP is converging. SBAS correction is used.
	green	A fixed RTK position is available, including xRTK. PPP has converged.
Tilt LED	off	GS18 is not powered. Tilt functionality is unavailable or switched off.
	green	Tilt compensation is activated, compensation values are stored. Tilt compensation is being applied.
	red	Tilt compensation is activated, but currently not being applied
	flashing red	Undefined problem with tilt compensation
RTK Base LED	off	GS18 is in RTK rover mode or GS18 is switched off.
	green	GS18 is in base mode, no RTK data is transmitted
	flashing green	GS18 is in base mode, RTK data is transmitted to the selected port. Rate according to RTK base setting.
RTK Rover LED	off	GS18 is in RTK base mode or GS18 is switched off.
	green	GS18 is in rover mode, no RTK data is received via selected port.
	flashing green	GS18 is in rover mode, RTK data is received via selected port. Rate according to received correction data.
Connectivity LED	off	GS18 is not powered or module is not ready.
	green	Bluetooth is in data mode and ready for connecting.
	blue	Bluetooth has connected.
Storage LED	off	GS18 is switched off or no SD card is inserted or internal memory has more than 50 MB or no raw data is being logged.
	green	SD card is inserted but no raw data is being logged.

LED	LED Status	Status of the Instrument
	flashing green	SD card is inserted, raw data is being logged on the SD card and more than 50 MB of memory space is available on the SD card. OR SD card is inserted, raw data is being logged on the internal memory and more than 50 MB of the memory space is available on the internal memory. OR No SD card is inserted, raw data is being logged on the internal memory and more than 50 MB of memory space is available on the internal memory.
	red	SD card is inserted, no raw data is being logged and less than 50 MB of the memory space is available on the SD card. OR No SD card is inserted, no raw data is being logged and less than 50 MB of memory space is available on the internal memory.
	flashing red	SD card is inserted, raw data is being logged on SD card and less than 50 MB of memory space is available on the SD card. OR SD card is inserted, raw data is being logged on the internal memory and less than 50 MB of memory space is available on the internal memory. OR No SD card is inserted, raw data is being logged on the internal memory and less than 50 MB of memory space is available on the internal memory.
	fast flashing red	SD card is inserted, raw data logging is configured to be saved on the SD card, but the SD card is full and no raw data can be logged to SD card. OR SD card is inserted, raw data logging is configured to be saved on the internal memory, but the internal memory is full and no raw data can be logged to the internal memory. OR No SD card is inserted, raw data logging is configured to be saved on the internal memory, but the internal memory is full and no raw data can be logged to internal memory.
Battery LED	off	Battery is not connected, flat or GS18 is switched off.
	green	Power is 21% - 100%.
	flashing green	Battery is inserted. External power is connected.

LED	LED Status	Status of the Instrument
	red	Power is 20% - 11%. The remaining time for which enough power is available depends on the type of survey, the temperature and the age of the battery.
	flashing red	Battery is inserted with less than 20% power remaining. External power is connected.
	fast flashing red	Power is low (<10%).
Power LED	off	External battery is not connected or flat or no external power supply is connected or GS18 is switched off.
	green	External power is 21% - 100%.
	red	External power is 20% - 11%.
	flashing red	External power is low (<10%).

4.7

Guidelines for Correct Results with GNSS Surveys

Undisturbed satellite signal reception

Successful GNSS surveys require undisturbed satellite signal reception, especially at the instrument which serves as a base. Set up the instrument in locations which are free of obstructions such as trees, buildings or mountains.

Steady instrument for static surveys

For static surveys, the instrument must be kept perfectly steady throughout the entire occupation of a point. Place the instrument on a tripod or pillar.

Centred and levelled instrument

Centre and level the instrument precisely over the marker.

Tilt compensation for kinematic surveys

If tilt compensation is available and activated then tilt compensation is applied for stakeout and surveys with instantaneous point measurement, auto points or point measurements with short occupation time. The pole tip can be placed on the marker, while the antenna does not have to remain levelled and steady. The status of the tilt compensation is indicated by an icon and the Tilt LED.

5 Care and Transport

5.1 Transport

Transport in the field

When transporting the equipment in the field, always make sure that you

- either carry the product in its original container,
- or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.

Transport in a road vehicle

Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its container and secure it.

Shipping

When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, container and cardboard box, or its equivalent, to protect against shock and vibration.

Shipping, transport of batteries

When transporting or shipping batteries, the person responsible for the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.

5.2 Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to [6 Technical Data](#) for information about temperature limits.

Li-Ion batteries

- Refer to [6 Technical Data](#) for information about storage temperature range
- Remove batteries from the product and the charger before storing
- After storage recharge batteries before using
- Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use
- A storage temperature range of 0 °C to +30 °C / +32 °F to +86 °F in a dry environment is recommended to minimize self-discharging of the battery
- At the recommended storage temperature range, batteries containing a 40% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged

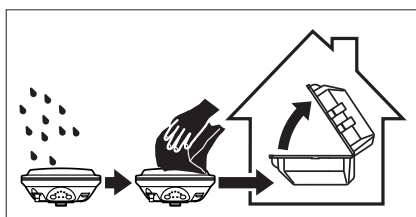
5.3 Cleaning and Drying

Product and accessories

- Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.

Cleaning and drying

Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 40 °C [104 °F] and clean them. Remove the battery cover and dry the battery compartment. Do not repack until everything is dry. Always close the transport container when using in the field.



Cables and plugs

Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Connectors with dust caps

Wet connectors must be dry before attaching the dust cap.

6 Technical Data

6.1 GS18 Technical Data

6.1.1 Tracking Characteristics

Satellite reception Multi-frequency

Instrument channels  Depending on the satellite systems and signals configured, a maximum number of 555 channels is allocated.

Supported signals

System	Signal
GPS	L1, L2, L2C, L5
GLONASS	L1, L2, L2C, L3
Galileo	E1, E5a, E5b, AltBOC, E6
BeiDou	B1I, B1C, B2I, B2A, B3I
QZSS	L1, L2C, L5, L6*
NavIC	L5*
SBAS (WAAS, EGNOS, MSAS, GAGAN)	L1, L5*
Terrastar	L-band

* QZSS L6 and SBAS L5 will be provided through future firmware upgrade.
Support of NavIC is incorporated and will be provided through future firmware upgrade.

 Carrier phase and code measurements on L1, L2 and L5 (GPS) are fully independent with AS on or off.

6.1.2 Accuracy

 Accuracy is dependent upon various factors including the number of satellites tracked, constellation geometry, observation time, ephemeris accuracy, ionospheric disturbance, multipath and resolved ambiguities.

The following accuracies, given as root mean square, are based on measurements processed using Leica Infinity and on real-time measurements.

The use of multiple GNSS systems can increase accuracy by up to 30% relative to GPS only.

Differential code

The baseline precision of a differential code solution for static and kinematic surveys is 25 cm.

Differential phase in post-processing

Type	Horizontal	Vertical
Static and rapid static	3 mm + 0.5 ppm	5 mm + 0.5 ppm
Kinematic	8 mm + 1 ppm	15 mm + 1 ppm
Static with long observations	3 mm + 0.1 ppm	3.5 mm + 0.4 ppm

Differential phase in real-time	Type		Horizontal		Vertical	
	Single Baseline (<30 km)		8 mm + 1 ppm		15 mm + 1 ppm	
	Network RTK		8 mm + 0.5 ppm		15 mm + 0.5 ppm	
Tilt	Tilt compensated in real-time Additional Hz pole tip uncertainty: Typically less than 2 mm + 0.3 mm/° tilt down to 30° tilt for topographic points (not for static control points)					
Imaging	Typically 2 cm to 4 cm (2D) within the distance of 2 m to 10 m between the camera and the object The accuracy depends on the prevailing GNSS accuracy and the type of the trajectory. A curve in the trajectory increases the accuracy of an image point measurement.					
6.1.3	Technical Data					
Dimensions	Height:		0.109 m			
	Length:		0.173 m			
	Width:		0.173 m			
Weight	Instrument weight without battery, SIM card and SD card:					
	Type		Weight [kg]/[lbs]			
	GS18 I		1.25/2.75			
	GS18 T		1.23/2.71			
	GS18		1.20/2.65			
Recording	Data (Leica GNSS raw data and RINEX data) can be recorded on the internal memory or on the SD card. 1 GB is sufficient for over 1 year of raw data logging based on logging every 15 s from an average of 15 satellites.					
Power	Power consumption:		Radio excluded: 3.5 W typically, 300 mA (with external battery), 320 mA (with internal battery)			
	External supply voltage:		Nominal 12 V DC (≡, GEV71 car battery cable to a 12 V car battery), voltage range 12 V-24 V DC			
Internal battery	Type	Battery	Voltage	Capacity	Operating time, typical*	
	GEB334	Li-Ion	11.1 V	2.8 Ah	8 h	
* Operating time depends on use of wireless communication devices.						
External battery	Type	Battery	Voltage	Capacity		
	GEB373	Li-Ion	13 V	16.8 Ah		
Operating times	The given operating times are valid for					

- GS18: instrument; one fully charged GEB334 battery.
- Room temperature; operating times will be shorter when working in cold weather.

Type		Operating time
Static		8 h continuously
Rover	with cellular modem	6 h continuously
	with radio modem	7 h continuously
Base	with cellular modem	6 h continuously
	with radio modem	5 h continuously

Electrical data

GNSS Signal	Frequency	GS18
GPS L5	1176.4500 MHz	✓
Galileo E5a		
BeiDou B2a		
Galileo AltBOC	1191.7950 MHz	✓
GLONASS L3	1202.0250 MHz	✓
Galileo E5b	1207.1400 MHz	✓
BeiDou B2I		
GPS L2	1227.6000 MHz	✓
GLONASS L2	1242.9375 - 1248.6250 MHz	✓
BeiDou B3I	1268.5200 MHz	✓
Galileo E6	1278.7500 MHz	✓
QZSS L6		
BeiDou B1I	1561.0980 MHz	✓
GPS L1 C/A	1575.4200 MHz	✓
GPS L1C		
Galileo E1		
BeiDou B1C		
GLONASS L1	1598.0625 - 1605.3750 MHz	✓
Terrastar	1545.8250 - 1545.9050 MHz	✓
Gain (LNA)		Typically 22 dB
Noise Figure		Typically < 2 dB

Environmental specifications

Temperature

Type	Operating temperature [°C]	Storage temperature [°C]
GS18 I	-30 to +50	-40 to +85
GS18 T	-40 to +65	-40 to +85
GS18		
Leica SD cards	-40 to +85	-40 to +100
GEB334	-30 to +60	-40 to +70

Protection against water, dust and sand

Type	Protection
GS18 I	IP66 & IP68 (IEC 60529)
GS18 T	
GS18	
GEB334	IP54 (IEC60529)

Pollution degree

Type	Pollution degree
GS18 I GS18 T GS18 GEB334	4 Electrical equipment for indoor and outdoor use. Electrical equipment for usage in industrial environment.
Leica SD cards	2 Electrical equipment for office environment.

Humidity

Protection
Up to 95%
The effects of condensation are to be effectively counteracted by periodically drying out the instrument.

Altitude

Type	Range
All instruments	Unrestricted

Sound level

Type	Value
All instruments	No sound emitted or no physical moving parts

6.2

Conformity to National Regulations

6.2.1

GS18

Labelling GS18



GS18 I
Model: GS18 I P/N: 1234567 E/N: 12345678
S/N: 1234567
Leica Geosystems AG, CH 9435 Heerbrugg
Manufactured: YYYY, Made in Switzerland
Power: 12V nominal / 0.9A max.
IMEI: XX XXXXXX XXXXXX X

UK CA GB Importer: Leica Geosystems Ltd.
Hexagon House, Michigan Drive,
Tongwell, Milton Keynes, MK15 8HT

CE **IP66**
IP68

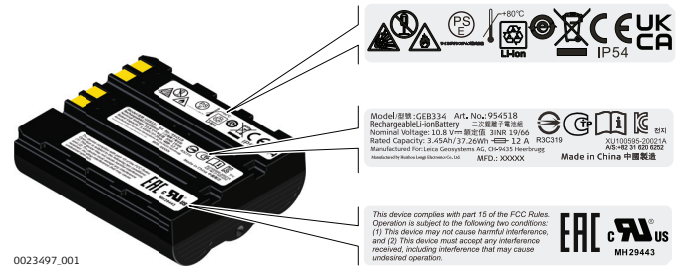
25 209-J00157 **R** 217-210086 **T** ADF220664217
003-210121

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received,
including interference that may cause undesired operation.

Contains FCC ID: RFD-BTWC0 Contains IC: 3177A-BTWC0
Contains FCC ID: QIPPLS63-W Contains IC: 7830A-PLS63W
Contains FCC ID: MRBSATEL-TA40 Contains IC: 2422A-SATELTA40

14277_002

Labelling GEB334



EU

CE Hereby, Leica Geosystems AG declares that the radio equipment type GS18 is in compliance with Directive 2014/53/EU and other applicable European Directives.
The full text of the EU declaration of conformity is available at the following Internet address: <http://www.leica-geosystems.com/ce>.

The low band 5.15 - 5.35 GHz is for indoor use only.

CE **!** AT, BE, BG, CH, CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IS, IT, LI, LT, LU, LV, MT, NL, PL, PT, RO, SE, SI, SK, TR, UK

Europe
USA
Canada

WARNING

RF exposure compliance requirements in Europe, USA and Canada
RF Exposure!

- Precautions:**
- ▶ Maximum antenna gain is 14 dBi.
 - ▶ Maintain the separation distance listed in the table between the antenna of this device and all persons.
 - ▶ Do not colocate or operate this device with any other antenna or transmitter.

Antenna gain [dBi]	Separation distance [cm]
0	23
4	36
6	45
8	56
10	71
12	89
14	112

USA

Type	Serial number < 5480000 Contains FCC ID:	Serial number ≥ 5480000 Contains FCC ID:
WLAN Bluetooth	RFD-BTWC0 Part 15B	RFD-BTWC0 Part 15B
400 MHz UHF	MRBSATEL-TA40 Part 15B, 90	MRBSATEL-TA40 Part 15B, 90
900 MHz UHF	MRBSATEL-TA31 Part 15B, 90	MRBSATEL-TA31 Part 15B, 90
LTE (PLS8X)	QIPPLS8-X Part 15B, 22, 24, 27	-

Type	Serial number < 5480000 Contains FCC ID:	Serial number ≥ 5480000 Contains FCC ID:
LTE (PLS63-W)	-	QIPPLS63-W Part 15B, 22, 24, 27

USA

WARNING

Allocation of the frequency band 406.0 – 406.1 MHz for government use only

Frequency band without a proper permit is strictly forbidden.

Precautions:

- To use the SATEL-TR4+ radio transceiver module in North America on this frequency band a proper permit is required.

Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Canada

Type	Serial number < 5480000 CAN ICES-003(B) NMB-003(B) Contains IC:	Serial number ≥ 5480000 CAN ICES-003(B) NMB-003(B) Contains IC:
WLAN Bluetooth	3177A-BTWC0	3177A-BTWC0
400 MHz UHF	2422A-SATELTA40	2422A-SATELTA40
900 MHz UHF	2422A-SATELTA31	2422A-SATELTA31
LTE (PLS8X)	7830A-PSL8X	-
LTE (PLS63-W)	-	7830A-PLS63W

Frequency band

Type	Frequency band [MHz]
GS18, GNSS	1176.45 1191.795 1202.025 1207.14 1227.60 1243.375 – 1248.625 1268.52 1278.75 1561.098 1575.42 1598.625 – 1605.375
GS18, Bluetooth	2401 – 2481
GS18, WLAN	2401 – 2473
GS18, Radio	403 – 473 902 – 928
GS18, Cellular phone	Serial number < 5480000 Dual-Band GSM 900 / 1800 & Tri-Band UMTS 900 / 1800 / 2100 & Penta-Band LTE 800 (B20) / 900 (B8) / 1800 (B3) / 2100 B(7) / 2600 (B1)

Type	Frequency band [MHz]
	Serial number ≥ 5480000 Quad-Band GSM 850 / 900 / 1800 / 1900 & Eight-Band UMTS 1, 3, 2, 4, 5, 6, 8, 19 & 15 Band FDD-LTE 1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 66 & 3 Band TD-LTE 38, 40, 41
GS18, Cellular phone (NAFTA)	Quad-Band GSM 850 / 900 / 1800 / 1900 & Tri-Band UMTS 850 / AWS 1700/2100 / 1900 & Penta-Band LTE 700 (B13) / 700 (B17) / 850 (B5) / AWS 1700/2100 (B4) / 1900 (B2)
GS18, Cellular phone (Japan)	Tri-Band UMTS 800 B6 / 800 B19 / 2100 B1 & Tri-Band LTE 800 (B19) / 1800 (B3) / 2100 (B1)

Output power

Type	Output power [mW]
GNSS	Receive only
Bluetooth	10
Radio	1000
WLAN	100
GS18 GSM	1000 / 2000
GS18 UMTS	250
GS18 LTE	200

Antenna

Type	Antenna	Gain [dBi]
GNSS	Internal GNSS antenna element (receive only)	-
UHF	External antenna	0
WLAN Bluetooth	Internal Patch antenna	2
GSM/UMTS/LTE	External antenna	2

Others

The conformity for countries with other national regulations has to be approved prior to use and operation.

6.2.2

Dangerous Goods Regulations

Dangerous Goods Regulations

Many products of Leica Geosystems are powered by Lithium batteries.

Lithium batteries can be dangerous under certain conditions and can pose a safety hazard. In certain conditions, Lithium batteries can overheat and ignite.



When carrying or shipping your Leica product with Lithium batteries onboard a commercial aircraft, you must do so in accordance with the **IATA Dangerous Goods Regulations**.



There are guidelines on **How to carry** and **How to ship** products with Lithium batteries. Before any transportation of a Leica product, we ask you to consult the guidelines on the web page ([IATA Lithium Batteries](#)) to ensure that you are in accordance with the IATA Dangerous Goods Regulations and that the Leica products can be transported correctly.



Damaged or defective batteries are prohibited from being carried or transported onboard any aircraft. Therefore, ensure that the condition of any battery is safe for transportation.

Software Licence Agreement

This product contains software that is preinstalled on the product, or that is supplied to you on a data carrier medium, or that can be downloaded by you online according to prior authorisation from Leica Geosystems. Such software is protected by copyright and other laws and its use is defined and regulated by the Leica Geosystems Software Licence Agreement, which covers aspects such as, but not limited to, Scope of the Licence, Warranty, Intellectual Property Rights, Limitation of Liability, Exclusion of other Assurances, Governing Law and Place of Jurisdiction. Please make sure, that at any time you fully comply with the terms and conditions of the Leica Geosystems Software Licence Agreement.

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Appendix A

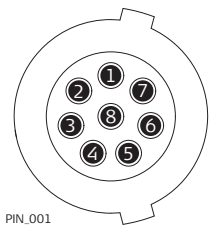
Pin Assignments and Sockets

Description

Some applications require knowledge of the pin assignments for the instrument ports.

In this chapter, the pin assignments and sockets for the instrument ports are explained.

Pin assignments for port P1



Pin	Signal Name	Function	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 10.5 V-28 V	In
8	GPIO	RS232, general-purpose signal	In or out



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