GeoMax Zenith16/40 Series

English

Version 1.1

Introduction

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.

Product identification

The model and serial number of your product are indicated on the type plate.

Always refer to this information when you contact your agency or GeoMax authorised service workshop.

Trademarks

- Windows® is a registered trademark of Microsoft Corporation in the United States and other countries
- *Bluetooth*® is a registered trademark of Bluetooth SIG, Inc.
- microSD Logo is a trademark of SD-3C, LLC.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to:
- Zenith16 without TNC plug
- Zenith16 UHF
- Zenith40 GSM without TNC plug
- Zenith40 GSM-UHF

Table of Contents

1 Safety Directions

1.1 General Introduction

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.

1.2 Definition of Use

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)

Reasonably foreseeable misuse	• Use of the product without instruction.
	• Use outside of the intended use and limits.
	• Disabling safety systems.
	• Removal of hazard notices.
	• Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
	• Modification or conversion of the product.
	• Use after misappropriation.
	• Use of products with obvious damages or defects.
	• Use with accessories from other manufacturers without the prior explicit approval of GeoMax.
	• Inadequate safeguards at the working site.
	• Controlling of machines, moving objects or similar monitoring application 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

GeoMax AG, CH-9443 Widnau, hereinafter referred to as GeoMax, 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 it is used in accordance with the instructions
- To be familiar with local regulations relating to safety and accident prevention
- To inform GeoMax immediately if the product and the application becomes unsafe
- To ensure that the national laws, regulations and conditions for the operation of radio transmitters or lasers are respected

1.5 Hazards of Use

1.5.1 General

> ⚠ **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.

⚠ DANGER

Risk of being struck by lightning

If the product is used with accessories, for example on masts, staffs, poles, you may increase the risk of being struck by lightning. Danger from high voltages also exists near power lines. Lightning, voltage peaks, or the touching of power lines can cause damage, injury and death.

Precautions:

▸ Do not use the product in a thunderstorm as you can increase the risk of being struck by lightning.
▸ Be sure to remain at a safe distance from electrical installations. Do not use the product directly under or close to power lines. If it is essential to work in such an environment contact the safety authorities responsible for electrical installations and follow their instructions.
▸ If the product has to be permanently mounted in an exposed location, it is advisable to provide a lightning conductor system. A suggestion on how to design a lightning conductor for the product is given below. Always follow the regulations in force in your country regarding grounding antennas and masts. These installations must be carried out by an authorised specialist.
▸ To prevent damages due to indirect lightning strikes (voltage spikes) cables, for example for antenna, power source or modem should be protected with appropriate protection elements, like a lightning arrester. These installations must be carried out by an authorised specialist.
▸ If there is a risk of a thunderstorm, or if the equipment is to remain unused and unattended for a long period, protect your product additionally by unplugging all systems components and disconnecting all connecting cables and supply cables, for example, instrument - antenna.

Lightning conductors

Suggestion for design of a lightning conductor for a GNSS system:

1. On non-metallic structures
   Protection by air terminals is recommended. An air terminal is a pointed solid or tubular rod of conducting material with proper mounting and connection to a conductor. The position of four air terminals can be uniformly distributed around the antenna at a distance equal to the height of the air terminal.
   The air terminal diameter should be 12 mm for copper or 15 mm for aluminium. The height of the air terminals should be 25 cm to 50 cm. All air terminals should be connected to the down conductors. The diameter of the air terminal should be kept to a minimum to reduce GNSS signal shading.
2. On metallic structures
   Protection is as described for non-metallic structures, but the air terminals can be connected directly to the conducting structure without the need for down conductors.

Air terminal arrangement, plan view

GS_039
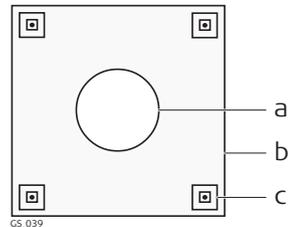
a	Antenna
b	Support structure
c	Air terminal

Grounding the instrument/antenna

GS_040
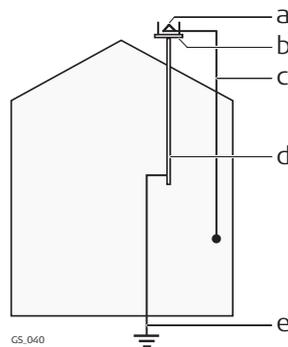
a	Antenna
b	Lightning conductor array
c	Antenna/instrument connection
d	Metallic mast
e	Connection to earth

⚠️ **WARNING**

Incorrect fastening of the external antenna

Incorrect fastening of the external antenna to vehicles or transporters poses the risk of the equipment being broken by mechanical influence, vibration or airstream. This may result in accident and physical injury.

Precautions:

▸ Attach the external antenna professionally. The external antenna must be secured additionally, for example by use of a safety cord. Ensure that the mounting device is correctly mounted and able to carry the weight of the external antenna (>1 kg) safely.

⚠ **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.

Precautions:
▸

The product must not be disposed 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 is available from GeoMax AG.

⚠ **WARNING**

Only GeoMax authorised service workshops are entitled to repair these products.

1.5.2 Charger and Batteries

⚠ **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!

⚠ **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.

⚠ **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 GeoMax 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. Do not drop or immerse batteries 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 objects.

1.6 Electromagnetic Compatibility (EMC)

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.

> ⚠️ **WARNING**
>
> **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, GeoMax 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 GeoMax.
> ‣ When combined with the product, they 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, GeoMax cannot completely exclude the possibility that 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, for example external supply cables, interface cables, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired.

Precautions:
▸ While the product is in use, connecting cables, for example product to external battery, product to computer, must be connected at both ends.

Radios or digital cellular phones

⚠ WARNING

Use of product with radio or digital cellular phone devices

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in 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, GeoMax 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 to 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.

1.7   FCC Statement, Applicable in U.S.

☞   The greyed paragraph below is only applicable for products without radio.

⚠ WARNING

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and the receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
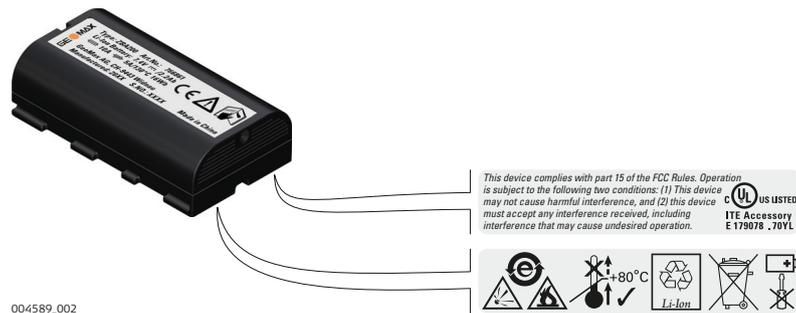• Consult the dealer or an experienced radio/TV technician for help.

⚠ CAUTION

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

Labelling GNSS receiver


```
Model:    Zenith xx xxx-xxx
Art.No.: xxxxxx   S.No.: xxxxxxx
Equip.No.: xxxxxx  Manufactured.: 2019
Power:   12V ⎓≤ 0.7A
Contains FCC ID/IC ID:
Q2331308/6850A-31308
QIPPHS8-P/7830A-PHS8P
MRBSATEL - TA23/2422A-SATELTA23
```

GeoMax AG CH-9443 Widnau, Switzerland
Developed by Hexagon Group Sweden, Made in China

This device complies with part15 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.

NovAtel ON BOARD

12574_003

Labelling internal battery

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.

C UL US LISTED
ITE Accessory
E 179078 .70YL

004589_002

1.8 ISED Statements (EN/FR), Applicable in Canada

⚠ **WARNING**

This Class (B) digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe (B) est conforme à la norme NMB-003 du Canada.

Canada Compliance Statement
This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Canada Déclaration de Conformité
L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radio Frequency (RF) Exposure Compliance Statement

The radiated RF output power of the instrument is below the Health Canada's Safety Code 6 exclusion limit for portable devices (radiated element separation distance between the radiating element and user and/or bystander is below 20 cm).

2 Description of the System

2.1 System Components

Main components

Component	Description
Receiver	A GNSS receiver with integrated communication devices.
Field controller	A multi-purpose field controller enabling the control of GeoMax instruments.
GeoMax Geo Office	An office software used for the processing of raw GNSS data.
Zenith Manager	An office software, used to manage and configure the GNSS receiver.
Zenith Manager Android	An Android based software, used to manage and configure the GNSS receiver.

2.2 Container Contents

Container part 1 of 2

a	Batteries for GNSS receiver	d	Carrier*
b	GNSS receiver	e	Measuring tape*
c	UHF radio antenna	f	Quick Guide and CD

* optional
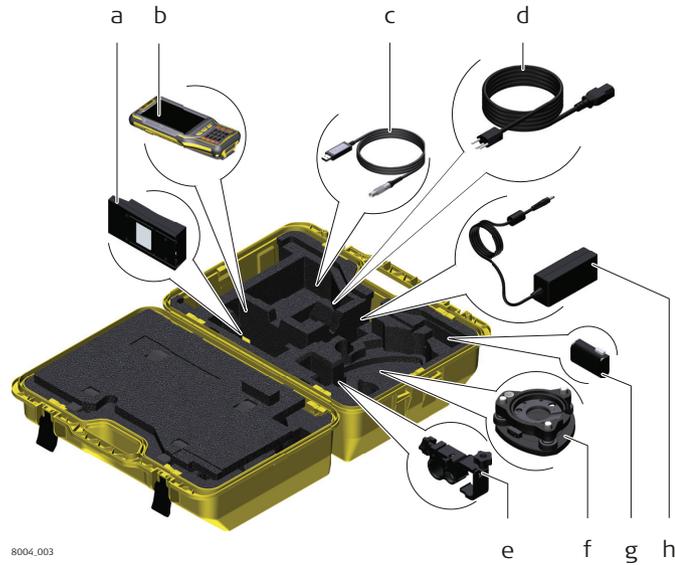
8004_003

a	Battery charger	f	Tribrach*
b	Generic slot for field controller	g	Generic slot for field controller bat-
c	USB cable		tery
d	AC adapter for battery charger	h	Generic slot for field controller AC
e	Pole holder*		adapter

*optional

2.3 System Concept

2.3.1 Software Concept

Software upload

The software can be uploaded using Zenith Manager.

☞ Ensure that a microSD card is inserted into the GNSS receiver before starting the upload. Refer to 4.6 Insert a microSD Card.

2.3.2 Power Concept

General

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

Power options

Power for the GNSS receiver can be supplied either internally or externally.

Power Supply	Description
Internal	One ZBA201 battery fitting into the GNSS receiver.
External	10.5 V to 28 V DC power supply via ZDC225 cable.

2.3.3 Data Storage Concept

Description

GNSS raw data can be recorded on the microSD card.

Memory device

The GNSS receiver has a microSD card slot fitted as standard. A microSD card can be inserted and removed.

2.4 Instrument Components

GNSS receiver components

a   TNC-connector for external UHF antenna, only for models with UHF radio
b   Battery compartment with microSD and SIM card slot
c   Keyboard with LEDs, ON/OFF button and Function button
d   Serial, USB and power port
e   Antenna Reference Plane (ARP) is where the instrument heights are measured to.

2.5 Pin Assignments

Pin assignments for serial, USB and power port

Pin	Signal Name	Function
1	USB_D+	USB data line
2	USB_D-	USB data line
3	GND	Signal ground
4	RxD	RS232, receive data
5	TxD	RS232, transmit data
6	ID	Identification pin
7	GPIO	RS232, general-purpose signal
8	PWR	Power input, 10.5 V-28 V
9	NC	Not used
10	NC	Not used

Plug type

10 pin LEMO EEG. 1B. 310. CLNP

2.6 The Antenna Reference Plane, ARP

Description

The Antenna Reference Plane:

- is where the instrument heights are measured to.
- is where the phase centre variations refer to.
- varies for different instruments.

ARP for GNSS receiver

The ARP for the GNSS receiver is shown in the diagram.

a   The Antenna Reference Plane is the underside of the thread.

3 User Interface

3.1 Keyboard

Description

a   ON/OFF button
b   Function button

17111_001
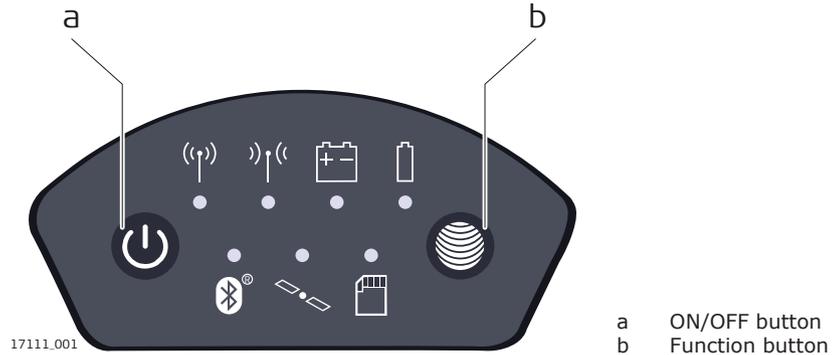
ON/OFF button

Button		Function
ON/OFF	(symbol)	If the GNSS receiver is off: Turns on the GNSS receiver when held for 2 s. ☞ While the Zenith16/40 is booting the two Power LEDs flash.
		If the GNSS receiver is already on: Turns off the GNSS receiver when held for 2 s.

Function button

☞ All functions described assume the Zenith16/40 is already on.

Button		Function
Function	(symbol)	Press and hold button for <1 s. Switches the receiver between rover or base mode.
		Press and hold button for 3 s. Updates the base position coordinates when the GNSS receiver is in base mode. The RTK base LED flashes for 2 s. When no position is available, the LED flashes red.
		Press and hold button for 5 s. Connects to the configured RTK base station or NTRIP server when the GNSS receiver is in rover mode. The RTK rover LED flashes for 2 s. No action if a rover mode is not configured.

Button combinations

Button		Function
ON/OFF	(symbol)	Press and hold buttons for 1 s.
Function	(symbol)	The current almanacs stored on the GNSS receiver are deleted, new almanacs are downloaded and the measurement engine is reset. The Position LED flashes red three times.
		Press and hold buttons for 5 s.
		The Memory LED flashes red quickly three times. The microSD card of the GNSS receiver is formatted. The Memory LED continues to flash red as the SD card is formatted.
		Press and hold buttons for 10 s.

| Button	Function
	The System RAM on the GNSS receiver is formatted. Settings of all installed software will be deleted. The Storage, RTK Base and RTK Rover LEDs flash red. The Position LED flashes yellow quickly three times. After the formatting the System RAM, the GNSS receiver is turned off.
	Press and hold buttons for 15 s.
	The registry of the GNSS receiver is deleted. Windows CE and Bluetooth communication settings will be reset to factory defaults. The Storage, RTK Base and RTK Rover LEDs flash red. The Position LED flashes yellow quickly three times. After deleting the registry, the GNSS receiver is turned off.

3.2 LED Indicators

Description

The GNSS receiver has **L**ight **E**mitting **D**iode indicators. They indicate the basic instrument status.

a   Bluetooth LED
b   RTK Base LED
c   RTK Rover LED
d   Position LED
e   Power LEDs
f   Storage LED
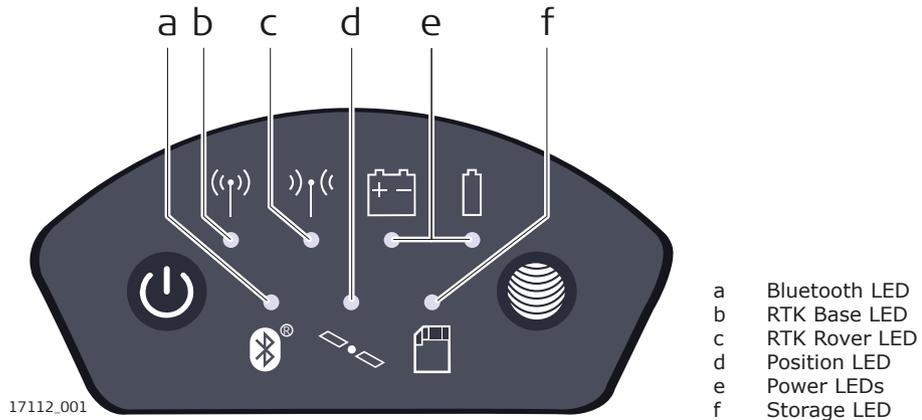
Description of the LEDs

IF the	is	THEN
Bluetooth LED	green	Bluetooth is in data mode and ready for connecting.
	blue	Bluetooth has connected.
RTK Base LED	green	the GNSS receiver is in RTK base mode. No RTK data is being passed to the interface of the communication device.
	flashing green	the GNSS receiver is in RTK base mode. Data is being passed to the interface of the communication device.
RTK Rover LED	green	GNSS receiver is in rover mode. No RTK data is being received at the interface of the communication device.
	flashing green	the GNSS receiver is in rover mode. RTK data is being received at the interface of the communication device.
Position LED	off	no satellites are tracked.
	flashing yellow	fewer than four satellites are tracked, a position is not yet available.
	yellow	a navigated position is available.
	flashing green	a code-only position is available.
	green	a fixed RTK position is available.
Power LED	off	battery is not connected, flat or the GNSS receiver is switched off.
	green	power is 20% - 100%.

IF the	is	THEN
	red	power is 5% - 20%. The remaining time for which enough power is available depends on the type of measurement, the temperature and the age of the battery.
	fast flashing red	power is low (<5%).
Storage LED	off	no microSD card is inserted.
	green	microSD card is inserted but no raw data is being logged.
	flashing green	raw data is being logged.
	flashing red	raw data is being logged but only 5% memory left.
	red	microSD card is full, no raw data is being logged or no microSD card is inserted but the GNSS receiver is configured to log raw data.

4 Operation

4.1 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 whole 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.

4.2 Equipment Setup

4.2.1 Setting up as a Real-Time Base

Use

The following equipment setup is used for real-time base stations. Raw observation data can also be collected for post-processing.

Equipment setup
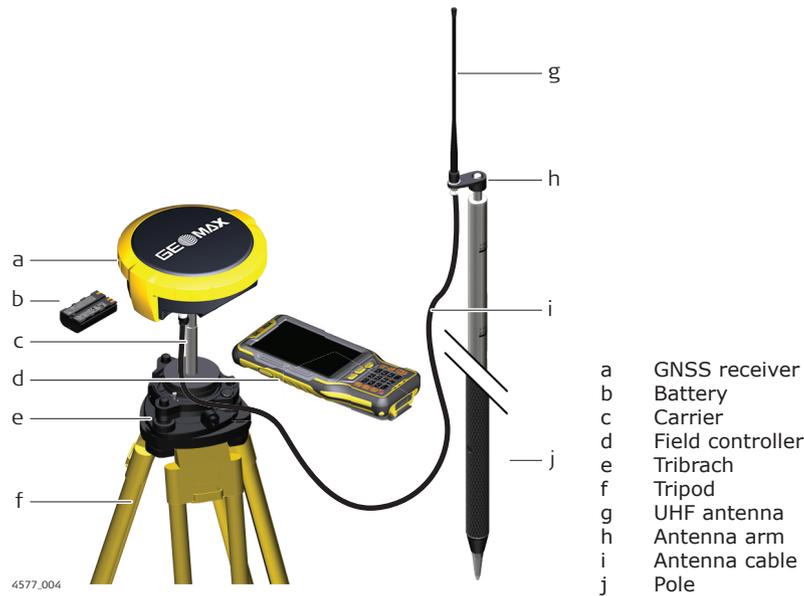
a   GNSS receiver
b   Battery
c   Carrier
d   Field controller
e   Tribrach
f   Tripod
g   UHF antenna
h   Antenna arm
i   Antenna cable
j   Pole

4577_004

Equipment setup step-by-step

1.	Set up the tripod.
2.	Mount the tribrach on the tripod.
3.	Ensure that the tribrach is over the marker.
4.	Mount and level the carrier on the tribrach.
5.	Insert the battery into the GNSS receiver.
6.	Connect the UHF antenna to the GNSS receiver using the antenna arm and the antenna cable.
7.	Press the ON/OFF button on the GNSS receiver for 2 s to switch on the GNSS receiver.
8.	Screw the GNSS receiver onto the carrier.
9.	Check that the tribrach and carrier are still level.
10.	Connect the field controller to the GNSS receiver through Bluetooth.

11. Measure the instrument height using the measuring tape. Refer to 2.6 The Antenna Reference Plane, ARP for information on the instrument height.

4.2.2   Setting up as a Post-Processing Base

Use   The following equipment setup is used for static operations over markers.

Equipment setup

4578_004

a	GNSS receiver
b	Battery
c	Carrier
d	Tribrach
e	Tripod
f	Field controller

Equipment setup step-by-step

1.	Set up the tripod.
2.	Mount the tribrach on the tripod.
3.	Ensure that the tribrach is over the marker.
4.	Mount and level the carrier on the tribrach.
5.	Insert the battery into the GNSS receiver.
6.	Press the ON/OFF button on the GNSS receiver for 2 s to switch on the GNSS receiver.
7.	Screw the GNSS receiver onto the carrier.
8.	Check that the tribrach and carrier are still level.
9.	Connect the field controller to the GNSS receiver through Bluetooth.
10.	Measure the instrument height using the measuring tape. Refer to 2.6 The Antenna Reference Plane, ARP for information on the instrument height.

4.2.3   Setting Up as a Real-Time Rover

Use   The following equipment setup is used for real-time rover.

Equipment setup

4579_004

a   GNSS receiver
b   Battery
c   UHF antenna
d   Pole
e   Holder
f   Field controller
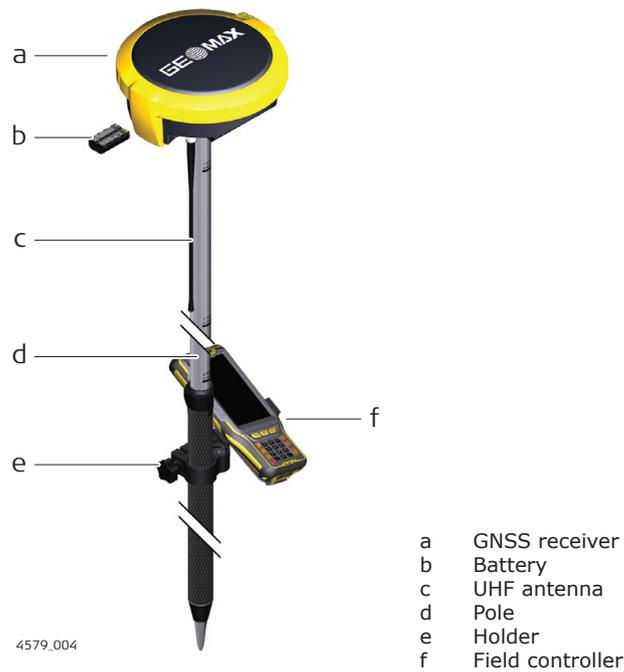
Equipment setup step-by-step

1.	Attach the field controller to the pole. Clip the field controller into the holder and lock it by tighten the screw on the holder.
2.	Turn on the field controller.
3.	Insert the battery into the GNSS receiver.
4.	Connect the UHF antenna to the GNSS receiver. The connection is only required when using the internal radio.
5.	Press ON/OFF key on the GNSS receiver for 2 s to switch on the GNSS receiver.
6.	Screw the GNSS receiver to the top of the pole.
7.	Connect the field controller to the GNSS receiver through Bluetooth. ☞ If RTK corrections are received with the field controller, the field controller must be connected to the GNSS receiver by serial cable.

4.3 Connection to a Personal Computer Using Serial or USB Cable

Description

The GNSS receiver can be connected to a personal computer using a serial cable.

Install software

1.	Start the computer.
2.	Download the Serial-to-USB cable driver from the GeoMax website.
3.	Install the cable driver on a computer using a Windows operating system.

Connect GNSS receiver to a computer step-by-step

4581_002
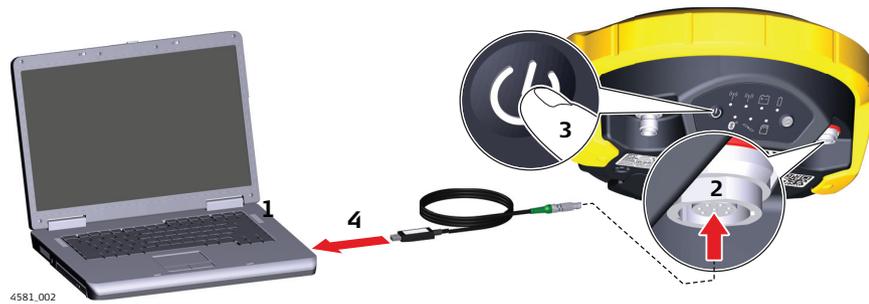
1.	Start the computer.
2.	Plug the included cable into the port of the GNSS receiver.
3.	Turn on the GNSS receiver.
4.	Plug the cable into the USB port of the computer. If Windows Hardware Wizard starts up, check **CLOSE**.

4.4 Zenith Manager

Description

The Zenith Manager software can be used to set up and configure the GNSS receiver, export data from the microSD card, enter licence keys and upload firmware.

Install software

1.	Download the Zenith Manager installation software from the GeoMax website.
2.	Install Zenith Manager on a computer using a Windows operating system.
3.	Start Zenith Manager by double-clicking the shortcut from the desktop of your computer.
4.	Connect the GNSS receiver to the computer with USB cable. Refer to 4.3 Connection to a Personal Computer Using Serial or USB Cable.
5.	Click the **Connect** button placed on the left side and select the connection type: **USB (cable)** or **Bluetooth**.

Functions

Function	Description
SETTINGS	To define the Zenith Manager language, units and precision.
INFO	To display Zenith Manager information and check if new software updates are available.
CLOSE	To stop using the Zenith Manager software.
Firmware upload	For the installation of instrument firmware. Refer to Firmware upload.
RAW data	To download raw data files from the microSD card in MDB or RINEX format.
NMEA output	To configure the NMEA output through USB port or bluetooth.
Antenna	To upload antenna offsets to the GNSS receiver.
Advanced	To upload licence key files. Refer to Upload key.

Radio settings

☞ To meet country radio licence requirements, the internal UHF radio must be set before use to legally allowed local frequencies as defined by local or governmental authorities. Use of forbidden frequencies may lead to prosecution and penalties.

At the **Configuation wizard** screen the internal radio can be configured with default channel, protocol type, channel spacing, transmission power and unit ID. Various required frequencies can be entered into the channel table and assigned to a specific channel number.

☞ When using Pacific Crest GMSK protocol between a Zenith16/40 base and Zenith16/40 rover, the **Unit ID** must be set to a different number for each receiver.

Firmware upload	The latest version of the instrument firmware is available from the GeoMax website.

To update the instrument firmware, copy the respective file to the SYSTEM directory on a microSD card and insert it into the GNSS receiver. Refer to 4.6 Insert a microSD Card.

At the **Firmware upload** menu the contents of the SYSTEM directory of the microSD card are displayed. Choose the required file and click **Upgrade** to install the firmware onto the GNSS receiver.

☞ After firmware is installed, the System RAM of the GNSS receiver must be formatted by pressing and holding the keyboard buttons for 10 s. Refer to 3.1 Keyboard.

Upload key	Optional GNSS receiver licences are activated with a key file. Before installing the licence key file onto the GNSS receiver, ensure that a microSD card is inserted it into the GNSS receiver. Refer to 4.6 Insert a microSD Card.

At the **Upload** menu browse for the key file on your computer and click **Upload**. A confirmation message is shown once the option has been activated.

4.5 Batteries

4.5.1 Operating Principles

Charging/first-time use
- The battery must be charged prior to using it for the first time because it is delivered with an energy content as low as possible.
- The permissible temperature range for charging is between 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 GeoMax, it is not possible to charge the battery if 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 only one charge/discharge cycle.
- For Li-Ion batteries, a single discharging and charging cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a GeoMax product deviates significantly form the actual battery capacity available.

Operation/discharging
- The batteries can be operated from −20 °C to +55 °C/−4 °F to +131 °F.
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery.

4.5.2 Insert and Remove the Battery

Change battery step-by-step

19101_001

☞ The battery is inserted in the bottom part of the GNSS receiver.

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.	With the battery contacts facing upwards, slide the battery into the cover of the battery compartment.
4.	Push the battery downwards so that it locks into position.

5.	Insert the cover of the battery compartment into the compartment and push the slide fastener in the direction of the arrow with the close-lock symbol.
6.	To remove a battery, push the slide fastener of the battery compartment in the direction of the arrow with the open-lock symbol and remove the cover.
7.	Push the battery slightly upwards and at the same time pull out the bottom part of the battery. This releases the battery from its fixed position.
8.	Remove the battery.

4.6 Insert a microSD 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.

Insert a microSD card step-by-step
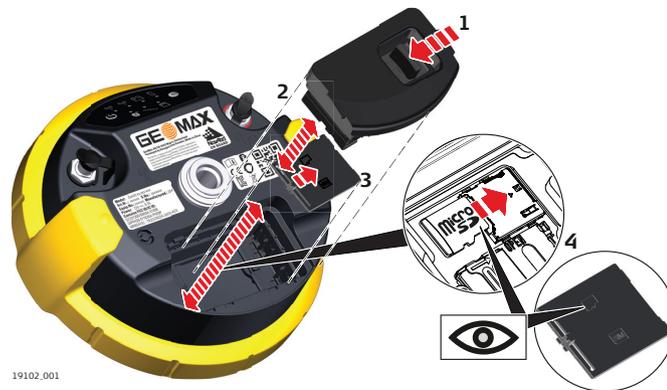
19102_001

☞	Removing the microSD card while the GNSS receiver is turned on can cause loss of data. Only remove the microSD card or unplug connecting cables when the GNSS receiver is switched off.
☞	The microSD card is inserted into a slot inside the battery compartment of the GNSS receiver.
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.	Press the latch of the SIM/microSD card cover and remove the cover.
4.	Slide the microSD card with the logo facing upwards firmly into the slot until it clicks into position.

Insert a SIM card step-by-step (if supported)
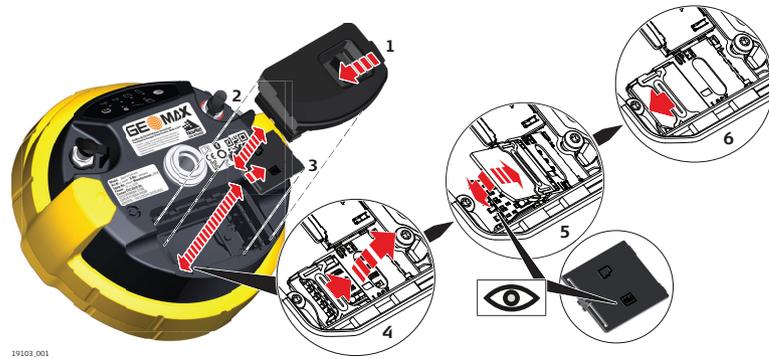
19103_001

☞	Inserting/removing the SIM card while the GNSS receiver is turned on can result in permanent damage to the card. Only insert/remove the SIM card when the GNSS receiver is switched off.
☞	The SIM card is inserted into a slot inside the battery compartment.

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 battery compartment.
3.	Press the latch of the SIM/microSD card cover and remove the cover.
4.	Push the SIM card holder in the direction of the OPEN arrow and flip it up.
5.	Place the SIM card into the SIM card holder, the chip facing the connectors inside the slot - as shown on the SIM/microSD card cover. Press the SIM card holder down.
6.	Push the SIM card holder in the direction of the LOCK arrow to close.

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.

For products for which no container is available use the original packaging or its equivalent.

Shipping

When transporting the product by rail, air or sea, always use the complete original GeoMax packaging, transport 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.

Damp products

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.
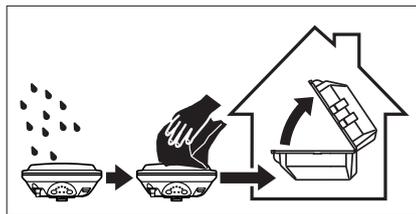
Cables and plugs

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 Technical Data

6.1.1 Tracking Characteristics

Tracking

Zenith16	Zenith40
Dual-frequency, 181 channels	Multi-frequency, 555 channels

Signals tracked

Satellite system	Zenith16	Zenith40
GPS	L1 C/A, L2P, L2C	L1 C/A, L2P, L2C, L5
GLONASS	L1 C/A, L2P, L2C	L1 C/A, L2P, L2C, L3*
BeiDou	optional; B1, B2	optional; B1, B2, B3*
Galileo	optional; E1, E5b	optional; E1, E5a, E5b, Alt-BOC, E6*
SBAS	EGNOS, WAAS, MSAS, GAGAN	EGNOS, WAAS, MSAS, GAGAN
QZSS	optional; L1, L2	optional; L1, L2, L5, LEX*

* Believed to comply, but subject to availability of BeiDou ICD and Galileo commercial service definition. GLONASS L3, BeiDou B3, QZSS LEX and Galileo E6 are foreseen to be provided through future firmware upgrade.

Initialisation:	Initialisation time typically 4 s
	Initialisation reliability >99.99%

6.1.2 Accuracy

Differential code

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

Differential phase in post-processing

Zenith16

Type	Horizontal	Vertical
Static and rapid static	5 mm + 0.5 ppm	10 mm + 0.5 ppm
Real-time-kinematic (RTK) single baseline	10 mm + 1 ppm	20 mm + 1 ppm
Real-time-kinematic (RTK), Network RTK	10 mm + 0.5 ppm	20 mm + 0.5 ppm
Static with long observations	3 mm + 0.1 ppm	3.5 mm + 0.4 ppm

Zenith40

Type	Horizontal	Vertical
Static and rapid static	3 mm + 0.5 ppm	5 mm + 0.5 ppm
Real-time-kinematic (RTK) single baseline	8 mm + 1 ppm	15 mm + 1 ppm
Real-time-kinematic (RTK), Network RTK	8 mm + 0.5 ppm	15 mm + 0.5 ppm
Static with long observations	3 mm + 0.1 ppm	3.5 mm + 0.4 ppm

☞ 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 accuracies, given as **r**oot **m**ean **s**quare, are based on measurements processed using GeoMax Geo Office and on real-time measurements.

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

6.1.3 GNSS antenna specifications

GNSS antenna specifications

Description	Value
Phase centre error	± 2 mm
LNA gain	Typically 33 dBi
Noise figure	Typically ≤ 2.5 dBi

6.1.4 Internal devices

Internal devices

Description	Value
GSM/UMTS module (only available on Zenith40)	Cinterion PHS8 Quad-Band GSM 850/900/1800/1900 MHz Penta-Band UMTS 800/850/900/1900/2100 MHz
UHF radio module	Satel M3-TR4, transceiver Transmission power 0.5 and 1.0 W Frequency range 403 to 473 MHz
Bluetooth	Class 2

6.1.5 Technical Data

Dimensions

Description	Value
Height	95 mm/3.7"
Diameter	198 mm/7.8"

Weight

Description	Value
GNSS receiver weight without battery, SIM card and SD card	Zenith16: 1.09 kg to 1.13 kg Zenith40: 1.14 kg to 1.18 kg (depeding on configuration)

Recording

GNSS raw data can be recorded on a microSD 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

Description	Value
Internal battery	Li-Ion battery 7.4 V/2.6 Ah
External power input	10.5 V to 28 V DC with ZDC225 cable
Power consumption	Typically 2.0 W without radio

Operating times

Equipment type	Operating time ZBA201
Static	7 h
Rover (radio; receive)	6 h
Rover (cellular phone)	6 h

☞ Operating times may vary depending on the temperature and battery age.

6.1.6 Environmental specifications

Environmental specifications

Description	Value			
Temperatures (°C)	GNSS receiver	-40 to +65 (operation)	-40 to +80 (storage)
	Battery	-20 to +55 (operation)	-40 to +70 (storage)
Protection	IP68 (IEC 60529) Withstands powerful jets and temporarily immersion under water. MIL-STD-810G 1 506.6 & 1 512.6 Fully dust tight MIL-STD-810G 1 510.6		
Vibration	Vibration test according to ISO 9022-36-05		
Shock	Withstands a 2 m (6.6 ft) pole topple over onto hard surface.		
Humidity	100% condensing The effects of condensation are to be effectively counteracted by periodically drying out the GNSS receiver.		

6.2 Conformity to National Regulations

Conformity to national regulations

- FCC Part 15 (applicable in US)
- Hereby, GeoMax declares that the radio equipment type Zenith16 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: https://geomax-positioning.com/partner-area.

CE Class 2 equipment according to European Directive 2014/53/EU (RED) for which following EEA Member States apply restrictions on the placing on the market or on the putting into service or require authorisation for use:
- *France*
- *Italy*
- Norway (if used in the geographical area within a radius of 20 km from the centre of Ny-Ålesund)

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, GeoMax declares that the radio equipment type Zenith40 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: https://geomax-positioning.com/partner-area.

CE Class 2 equipment according to European Directive 2014/53/EU (RED) for which following EEA Member States apply restrictions on the placing on the market or on the putting into service or require authorisation for use:
- France
- Italy
- Norway (if used in the geographical area within a radius of 20 km from the centre of Ny-Ålesund)

Frequency band

Type	Zenith16 Frequency band (MHz)	Zenith40 Frequency band (MHz)
GNSS receiver	GPS L1: 1575.42 GPS L2: 1227.60 GLONASS L1: 1602.5625 - 1611.5 GLONASS L2: 1246.4375 - 1254.3 Galileo E1: 1575.42 Galileo E5b: 1207.14 BeiDou B1: 1561.098 BeiDou B2: 1207.140	GPS L1: 1575.42 GPS L2: 1227.60 GPS L5: 1176.45 GLONASS L1: 1602.5625 - 1611.5 GLONASS L2: 1246.4375 - 1254.3 Galileo E1: 1575.42 Galileo E5a: 1176.45 Galileo E5b: 1207.14 Galileo AltBOC: 1191.795 BeiDou B1: 1561.098 BeiDou B2: 1207.140

Type	Zenith16 Frequency band (MHz)	Zenith40 Frequency band (MHz)
Bluetooth	2402 - 2480	2402 - 2480
Radio:	403 - 473	403 - 473
2G GSM	-	Quad-Band EGSM 850/900/1800/1900 GPRS multi-slot class 10
3.75 GSM/UMTS	-	Quad-Band GSM 850/900/1800/1900 Penta-Band UMTS 800/850/900/1900/2100

Output power

Type	Output Power [mW]
GNSS	Receive only
Bluetooth	5
Radio	500, 1000
2G GSM EGSM850/900	2000
2G GSM GSM1800/1900	1000
3G UMTS 800/850/900/1900/2100	250

Antenna

Type	Antenna	Gain [dBi]
GNSS	Internal GNSS antenna element (receive only)	33
Bluetooth	Internal Microstrip antenna	2 max.
UHF	Detachable λ/2 antenna	4 max.
GSM/UMTS	Integrated antenna	max.0dBi @ 800/850/900 MHz max. 3dBi @ 1800/1900/2100 MHz

6.3 Dangerous Goods Regulations

Dangerous Goods Regulations

The products of GeoMax 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 GeoMax product with Lithium batteries onboard a commercial aircraft, you must do so in accordance with the **IATA Dangerous Goods Regulations**.

☞ GeoMax has developed **Guidelines** on "How to carry GeoMax products" and "How to ship GeoMax products" with Lithium batteries. Before any transportation of a GeoMax product, we ask you to consult these guidelines on our web page (http://www.geomax-positioning.com/dgr) to ensure that you are in accordance with the IATA Dangerous Goods Regulations and that the GeoMax 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.

7   Software Licence Agreement/Warranty

Open Source Information

The software on the product may contain copyright-protected software that is licensed under various open source licences.

Copies of the corresponding licences
- can be downloaded on https://geomax-positioning.com/zenith40/opensource.

If foreseen in the corresponding open source licence, you may obtain the corresponding source code and other related data on https://geomax-positioning.com/zenith40/opensource.

874756-1.1.1en

Original text (874756-1.1.1en)

© 2021 GeoMax AG is part of Hexagon AB.
All rights reserved.