

System GPS500

Congratulations on your purchase of a new System GPS500 from Leica Geosystems.



This manual contains important safety directions (*refer to section "Safety Instructions"*) as well as instructions for setting up the product and operating it.

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

Product identification

The instrument model and the serial number of your product are indicated on the typeplate. Enter the model and serial number in your manual and always refer to this information when you need to contact your agency or authorized service workshop.

GPS Receiver (SR) Type: _____ Serial No.: _____

Terminal (TR) Type: _____ Serial No.: _____

External Antenna (AT) Type: _____ Serial No.: _____

Meanings of symbols

The symbols used in this user manual have the following meanings:



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 and/or 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.

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Leica Geosystems GPS System 500 comprises of GPS receiver hardware and PC based software for GPS Surveying and related applications.

The Main components are:

- **GPS Receiver:** Receive the satellite signals.
- **GPS Terminal:** Keyboard and Display device to steer the Receiver
- **Post-processing software:** Used to process GPS data.



All of the instructions you need in order to operate your GPS system to a basic level are contained in this user manual.

In the "Technical Reference Manual" and SKI-Pro Online Help (available in English, French and other selected languages only), there are more detailed descriptions of special software/hardware settings and software/hardware functions. These are intended for technical specialists.

The Technical Reference Manual is available as an electronic PDF document only. This document can be found on the SKI-Pro installation CD. For more information refer to the file \MANUALS\README.TXT on the SKI-Pro installation CD.

System description

GPS Receiver

The GPS Receiver receives the GPS signal from the NAVSTAR satellites and calculates a range to all visible satellites.

There are various types of Receivers available:

SR510 - 12 L1 channels, code and phase

SR520 - 12 L1, 12 L2 channels, code and phase

SR530 - 12 L1, 12 L2 channels, code and phase, RTK capable.

The AT502 Antennas are intended for use with the SR520 and SR530 Receivers. The AT501 Antenna is intended for use with the SR510 Receiver.

See section 8 for technical specifications.



The SR520 and SR530 Receivers use the GPS P code signal, which by U.S. policy is liable to be switched off without notice. Phase measurements on L2 are ensured however as these Receivers automatically switch to patented tracking techniques

Post-processing software

The Post-processing software is used to process the observations taken by the Receiver in order to compute baselines and coordinates.

SKI-Pro Static Kinematic software is the standard post-processing software for dual-frequency receivers. SKI-Pro-L1 is for single frequency receivers. The user interface for SKI-Pro and SKI-Pro - L1 software packages are identical.

SKI-Pro (SKI-Pro-L1) post-processing software

In most cases, the software will be installed by the local Leica Geosystems representative and a short introductory course will be given.

Should this not be the case, install the software as follows:

1. Insert the CD-ROM into the CD drive of your PC.
2. Select Install SKI-Pro from the menu.
3. Follow the instructions given by the installation shield.

The software contains a comprehensive Online Help System. This Help System is intended to replace the function of a printed manual. If required you may print out the entire help for use as a hard copy reference manual.

As a first step in getting familiar with the software read the booklet *Getting Started with SKI-Pro* delivered with the SKI-Pro software package.

Receiver Hardware

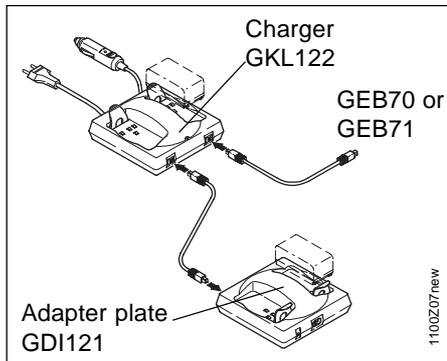
In most cases, a short introduction in the use of the Receiver and Terminal will be provided by the local Leica Geosystems representative. If this is not the case proceed as outlined in the following sections.

Alternatively refer to the *Technical Reference* PDF-manual available on the SKI-Pro Installation CD.

Charge the batteries

Charge the batteries with the Leica Geosystems battery charger provided. GEB121, GEB70 or GEB71 batteries may be used to power the GPS equipment.

The GEB121 batteries may be charged using GKL111 or GKL122 chargers.



The battery chargers are intended for indoor use only. Use a battery charger in a dry room only, never outdoors. Charge batteries only at an ambient temperature between 10°C and 30°C (50°F to 86°F). We recommend a temperature of 0°C to +20°C (32°F to 68°F) for storing the batteries.



To attain full battery capacity for new GEB121 batteries, it is essential to repeat between three and five complete charge/discharge cycles.



Use one Leica Geosystems batteries, chargers and accessories, or accessories recommended by Leica Geosystems.

The GEB70 and GEB71 batteries may be charged using GKL122 (with charging cables), GKL23 or GKL22 chargers.

Refer to the appropriate manual when using the chargers.

Set Up the Equipment

Successful GPS surveys require undisturbed satellite signal reception. This means that GPS Receivers should be set up in locations which are free of obstructions. No obstacles like trees, buildings, mountains, etc. should block the line between the GPS antenna and GPS satellites. This holds true in particular for the Receiver which serves as the reference.

For static and rapid static surveys, the antenna must be kept perfectly steady throughout the whole occupation of a point. This means that the AT501 or AT502 antenna will usually be put on a tripod.

Center and level the tripod precisely above the survey marker. Place and lock the carrier in the tribrach. Mount the antenna onto the carrier.

Connect the antenna to the sensor using the antenna cable. Plug two camcorder batteries into the backside of the sensor. Alternatively or in addition you might want to power the sensor externally. In this case connect a GEB71 battery to the PWR- port of the sensor.

Attach the TR500 terminal to the sensor, either directly or via a connection cable by plugging it into the TERMINAL-port on the sensor. Insert a PC-card into the sensor.



Lock the lid carefully after insertion of the card in order to prevent water and dust from getting inside the sensor.

Use the hook on the backside of the sensor to hang it on one of the tripod legs. Alternatively you may want to leave the sensor inside the shipping case.

Your System 500 sensor is now fully ready for operation.

Measuring with the default configuration parameters

Step 1: Power on

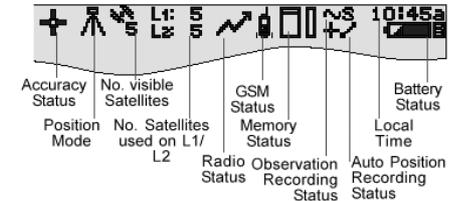
Turn on the sensor by pressing the ON-button on the terminal. One of the following two screens will appear on the display:

```
MAIN\  
1 Survey  
2 Stake-Out  
3 Applications...  
4 Utilities...  
5 Job  
6 Configure  
7 Transfer...  
CONT HIDE
```

```
MAIN\  
1 Survey  
2 Stake-Out  
3 Applications...  
CONT SHOW
```

Step 2: Study the Icons

Most important at this stage is the top part of the screen which contains several symbols (icons) which indicate the current system status.



Measuring with the default configuration parameters, continued

Upon power on you will first recognize the **Number of visible Satellites** icon, indicating the number of satellites which are theoretically visible at the current location and time. Usually this number varies between 4 and 9, depending on the satellite geometry.

Next to this symbol you find the **Number of Satellites used on L1 / L2** icon, indicating the number of satellites currently tracked either on L1 or on L2.

Upon power on you will read L1: 0, L2: 0. It will take about 30 seconds until these number will start changing and very soon reach the number of visible satellites.

Both *Number of visible satellites* and *Number of satellites used* icons will change from time to time, reflecting changes in the satellite geometry due to either the rise of new satellites or the setting of descending satellites.

Once a minimum of 3 satellites is tracked the sensor can start computing a position. As soon as a position is available it will be indicated by an icon on the far left of the status line. Since for postprocessing surveys no realtime link will be used, the icon will always indicate the availability of an autonomous position (*navigated position*) with an accuracy of about 100 meters.

As soon as the **Position Mode** icon becomes visible the sensor is in a stage where practical operation can commence.

If the *Position Mode* icon does not become visible even after one or two minutes then the sensor is still not tracking satellites. If the *Number of satellites used* is still zero, please check whether the antenna cable is connected properly to both the sensor and the antenna.

If the *Number of satellites used* differs from the *Number of visible satellites* make sure you place the antenna in an open area without obstructions, since any obstacle will block the view of satellites.

The **Battery Status** icon at the right side of the icon line shows from which source the sensor is currently powered. A and B indicate the internal batteries, E an external battery source. The symbol also indicates the voltage level of the currently used battery in 4 different stages from "full" (fully black) to 2/3 to 1/3 and "almost flat" (white colour).

The **Memory Status** icon gives several informations: whether memory for logging data is available or not. Options are either a PC-card or internal memory. If a PC card is available and configured for use then at this stage an arrow indicates the fact that it is safe to remove the PC-card from the sensor. The little bar on the right side indicates the available memory on either the PC-card or the internal memory.



You cannot proceed from here if no memory device is available. Insert a PC-card otherwise no GPS survey can be carried out.

Step 3 (optional): Format your memory card

Before you start logging data you may want to (re-)format your PC-card or your internal memory.

This step is only necessary if a completely new PC-card is used or all existing data should be deleted !

Press **4** on the terminal or use the Cursor key to highlight the line **4 Utilities**, then press **ENTER**; alternatively press **F1 CONT**.
(If only lines 1 to 3 are visible at this stage press **F4 SHOW** first).

Then press **2** to get access to the **Format Memory Module** panel, or alternatively use the cursor key to navigate to **2 Format Memory Module** and press **ENTER**; again alternatively press **F1 CONT**.

Step 4: Begin a Survey

Enter the Survey operation by either pressing 1 in the Main\ panel or by first navigating to **1 Survey** via cursor keys and then pressing **ENTER** or **F1 CONT**.

The following panel will appear:

```
SURVEY\ Begin
Config Set:      PP_STAT▼
Job             : ██████████ Default▼
Coord Sys      : WGS84 Geodetic
Antenna        : AT502 Tripod▼
CONT ██████████ ██████████ ██████████ ██████████ CSYS
```

Some basic decisions have to be made in this panel: Which configuration set should be activated, which job the raw data should be stored and which antenna set-up should be used.

A Configuration Set (Config Set) is a collection of certain sensor parameters needed to perform a certain operation, like data recording rates, point id templates, data formats, antenna types, coding methods, etc.

Several default configuration sets exist which cover standard survey scenarios. How to create new configuration sets is described in a later chapter as well as in the Technical Reference Manual.

For static survey you should select the **PP_STAT** configuration set. You can make this selection either by using the cursor left key to toggle between all available configuration sets until **PP_STAT** appears or you can highlight the input field and press **ENTER**. Then a list box comes up showing all available sets:

```
SURVEY\ Begin
CONFIG SET:
PP_KIS      Default
PP_STAT     Default
RT_REF      Default
RT_ROV      Default
TEST_PP
CONT NEW EDIT DEL INFO QNUM
```

Measuring with the default configuration parameters, continued

Now use the cursor up or cursor down key on the terminal to highlight the **PP_STAT** line. Then press **ENTER** or **F1 CONT**.

Jobs are used to organise and structure the data you collect in the field. Jobs can comprise an unlimited number of points together with all related information (raw measurements, codes, point annotation, etc.).

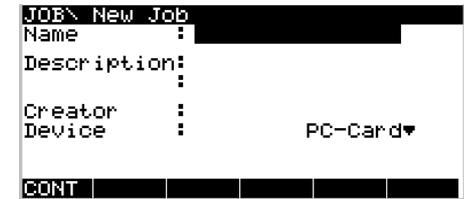
It is suggested to create a new job whenever you start a new project.

Upon formatting the memory device (i.e. PC-card or internal memory) a default job is automatically created. You can either use this job straight away or you can create your own job by doing the following:

Use the cursor up or cursor down key to highlight the input field for jobs. Then press **ENTER**. The following listbox will appear:



Now press **F2 NEW**. The following panel appears:



Measuring with the default configuration parameters, continued

You can now enter a name for a new job; press **ENTER** upon completing the input of the name. Input fields for description and creator are optional and can be left blank.

As an example we can create a new job called *Test*:

```
JOB\ New Job
Name      :          Test
Description: ██████████
Creator   :
Device    :          PC-Card▼
CONT
```

By default the new job will be assigned to the *PC-card*. If needed this can be changed to *Internal* by toggling the *Device* input field to *Internal*.

Pressing **F1 CONT** which confirms the creation of a new job name and its location. Press **ESC** if you want to leave this field without creating a new job. Pressing **F6 QUIT** has the same effect.

After pressing **F1 CONT** the list of available jobs is updated and now also shows the job *Test*:

```
SURVEY\ Begin
JOB: PC-Card
Default  < 17.04.00 >
Test     03.05.00
CONT NEW EDIT DEL DEVE#NUM
```

Measuring with the default configuration parameters, continued

Now press **F1 CONT** to confirm the selection of the newly created job.

Finally you have to select the antenna type and antenna setup which you are using. Normally this will be AT502 on tripod (or AT501 on tripod in case of a SR510 sensor).

This selection is made in the usual way: first use the cursor down key to get this input field highlighted. Then use the cursor left or right key to toggle between all available types until the right one appears. Alternatively you can press the **ENTER** key to get a listbox from which the choice can be made.

Now all required settings for a static survey are made. The Survey \ Begin panel looks as follows:

```
SURVEY\ Begin
Config Set:      PP_STAT
Job      :      Test
Coord Sys :      WGS84 Geodetic
Antenna   :      AT502 Tripod
CONT      CSYS
```

Press **F1 CONT** to finish this start-up sequence.

Step 5: Logging raw data

We are now within the main Survey panel. The way the sensor is currently configured this panel will look as follows:

```
SURVEY\ Test
Point Id :
Ant Height :      0.000 m
GDOP      :      4.1
OCUPY
```

Measuring with the default configuration parameters, continued

It is time to check again the icons on the top of the display: The *Position Mode* icon should be available, the *Position Mode* icon still indicates "moving", the *Number of visible satellites* icon should display a number greater or at least 4, and the number of used satellites should be identical to the number of visible satellites.

As soon as you are tracking a minimum of 4 satellites, the position icon is visible and the antenna is placed correctly above the survey marker, you should press **F1 OCUPY**.

This activates logging of raw data and the screen changes accordingly:

```
SURVEY\ Test
Point Id : ██████████

Ant Height :           0.000 m
Static Obs :           0
GDOP       :           4.1
STOP ██████████ ██████████ ██████████ ██████████ ██████████
```

The position mode icon has changed to static, indicated by a symbol of a tripod.

A new icon is now displayed which indicates that raw data is logged.



Raw data (containing pseudorange and phase measurements to each tracked satellite) is logged at predefined intervals (usually every 10 to 15 seconds, depending on the *Observation Recording Rate* set in your currently used configuration set):

Enter a Point Id by filling in the input field. If you make a typing error correct the mistake by pressing the **CE** key (Clear Entry). Complete the input by pressing **ENTER**.

Measuring with the default configuration parameters, continued

Now use the height hook to determine the height of the antenna above the survey marker. Insert the height hook into the carrier and measure the height between the white mark at the bottom of the height hook and the survey marker.

Enter this reading into the **Ant Height** field. Since the antenna you have selected is "AT502 Tripod" (AT501 Tripod in case of a SR510 sensor) the offset from the height hook to the phase center of the antenna is automatically taken care of.

These are the only two inputs needed for surveying a point.

The Static observation counter (Static obs) will now go up every 10 seconds (because this is the default logging interval).

The displayed GDOP value indicates the current satellite geometry; the lower the value the better.



The antenna must not be moved while data is logged, otherwise the quality of post-processed coordinates will be impaired !



The PC-card must not be removed while in the Survey panel. If the card is taken out of the receiver all stored data might get corrupted, preventing SKI-Pro from successfully reading the data on the card.

The TR500 terminal may now be disconnected. This will have no effect on the survey ! Datalogging will continue. When reconnecting the terminal the same panel will reappear.

Measuring with the default configuration parameters, continued

Datalogging should continue depending on your observation plan: a receiver used as reference has to run permanently until all rover site occupations are completed. If a unit is operated as a roving receiver the site occupation time depends mainly on the baseline length and your accuracy requirements. See *General Guide to Static and Rapid Static* for details.

Once sufficient amount of raw data has been collected the survey of the point can be completed by pressing **F1 STOP**.

The screen is altered as follows:

```
SURVEY\ Test
Point Id   :      Point 1000
Ant Height :      0.000 m
GDOP      :      4.1
STORE
```

The STORE key has become active, and you still have the chance to check and correct the entered point id and the antenna height.

Conclude the survey sequence by again pressing **F1 STORE**.

After pressing the STORE key all related information will be stored in the currently used job (point id, antenna heights, etc.)

Step 6: Ending a Survey

You can now quit the survey operation panel by pressing **SHIFT F6 QUIT**. This brings you back to the main menu.

Hint: Pressing **SHIFT F6** will always allow you to terminate the survey operation, even during a site occupation. In this case you will lose all data collected since pressing **OCCUPY**.

As soon as you are back to the main menu the PC-card may be removed. This is indicated by the PC-card icon in the status line which contains an arrow:



Processing the data in the SKI-Pro software

You can now switch off the receiver. Once power is off disconnect all cables and put all equipment back into the shipping case.

You might now move to another site and repeat the procedure outlined in this chapter. Once your fieldwork is finished you can proceed by processing the collected data in SKI-Pro in order to get accurate baseline results.



During operation of the GPS System 500 the PC-Card memory card is getting warm.

In most cases, a short introductory course to the software will have been given by the local Leica Geosystems representative.

To import and process the data proceed as follows:

- Switch on the computer, start Windows, start SKI-Pro.
- Import the data

For each sensor you must import the data into SKI-Pro

Select "Import GPS Raw Data" from the toolbar. Follow the instructions that appear on the screen.

You may wish to create a new project before storing the data on the PC.

The data is then read by SKI-Pro and copied to the project related database.

Repeat the import process for each sensor which was involved in the fieldwork of your project.

Processing the data in the SKI-Pro software, continued

- Process the data

Select the Data-Processing view of the project you want to process. The data which was previously reported appears on the screen in both a text and also graphical format.

You must tell the program which station is the Reference and which points are Rover. Click on the graphical observation bars using the right mouse button and select either Reference or Rover.

As soon as a Reference and a Rover occupation is selected the baseline between the two points can be computed. Click the "Compute" button on the tool bar to start processing the baseline.

When the computation is finished activate the "Results" view of your project and examine the information which is made available, including the logfile.

Transport

 When dispatching the instrument, always use the complete original Leica Geosystems packaging (case and cardboard box).

Never carry the instrument loose in a **road vehicle**. It can be affected by shock and vibration. Always carry it in its case and secure it.

When transporting the instrument by **rail, air or ship**, always use the complete original packaging (case and cardboard box), or its equivalent, to protect it against shock and vibration.

Storage

 **Temperature limits** (-40°C to +70°C / -40°F to +158°F) Respect the temperature limits when storing the instrument, particularly in summer if the instrument is inside a vehicle.

 **Damp instruments** must be unpacked. Dry the instrument, the case, the foam inserts and the accessories at not more than 40°C / 108°F and clean them. Do not repack until everything is completely dry.

Cleaning and drying

 Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with pure alcohol.

Use no other liquids; these may attack the polymer components.

 **Cables and plugs** Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables. Unplugging connecting cables or removing the PCMCIA card during the measurement may cause loss of data. Always switch off the instrument before removing the cables or the PCMCIA card.

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

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

Permitted uses

Leica Geosystems GPS equipment is designed and intended for the following applications:

- Measuring and computing coordinates using P-code and/or C/A-code signals from NAVSTAR GPS satellites
- Carrying out measurement tasks using various GPS measuring techniques
- Recording GPS and point related data
- Computation and evaluation by means of software.

Prohibited uses

- Use of the product without instruction
- Use outside of the intended limits
- Disabling safety systems and removal of hazard notices
- Opening the instrument using tools (screwdriver, etc.), unless this is specifically permitted for certain functions
- Modification or conversion of the instrument
- Use after misappropriation
- Use with accessories from other manufacturers without the prior express approval of Leica Geosystems
- Inadequate safeguards at the measuring station (e.g. when measuring on roads)



WARNING

Adverse use can lead to injury, malfunction and damage.

It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. Leica Geosystems GPS equipment is not to be operated until the user has been instructed how to work with it.

Refer to Section "Technical specifications"

Environment:

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

GPS Receiver (SR) and Terminal (TR):

Use in rain is permissible for limited periods.

External Antenna:

Use in rain is permissible. After long term use in this environment the External Antenna must be checked by a Leica Geosystems service technician.

- **Area of responsibility of the manufacturer of the original equipment Leica Geosystems AG, CH-9435 Heerbrugg, Switzerland (hereinafter referred to as Leica Geosystems):**

Leica Geosystems is responsible for supplying the product, including the user manual and original accessories, in a completely safe condition.

- **Responsibilities of the manufacturers of non-Leica Geosystems accessories:**



The manufacturers of non-Leica Geosystems accessories for Leica Geosystems GPS equipment are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Responsibilities, continued

- Responsibilities of the person in charge of the equipment



WARNING

The person responsible for the equipment must ensure that it is used in accordance with the instructions. This person is also accountable for the training and deployment of personnel who use the equipment and for the safety of the equipment in use.

The person in charge of the instrument has the following duties:

- To understand the safety instructions on the product and the instructions in the user manual.
- To be familiar with local regulations relating to accident prevention.
- To inform Leica Geosystems immediately if the equipment becomes unsafe.

Hazards in use

Main hazards in use



WARNING

The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial and environmental consequences.

Precautions:

All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the instrument.



WARNING

The charger must not be used under damp or inclement conditions. If moisture penetrates the charger, the user may receive an electric shock.

Precautions:

Use the charger only indoors, in dry rooms. Protect them from damp. If the charger is damp, do not use it.

Main hazards in use, continued



WARNING

If you open the charger, either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using after incorrect attempts to carry out repairs.

Precautions:

Do not open the charger yourself. Only a Leica Geosystems-approved service technician is entitled to repair it.



CAUTION:

Watch out for erroneous measurements if the product is defective or if it has been dropped or has been misused or modified.

Precautions:

Periodically carry out test measurements indicated in the user manual, particularly after the instrument has been subjected to abnormal use and before and after important measurements.



WARNING

If computers intended for indoor use are used in the field, there is a danger of electric shock.

Precautions:

Adhere to the instructions given by the computer manufacturer with regard to field use.



CAUTION:

If the accessories used with the equipment are not properly secured and the equipment is subjected to mechanical shock (e.g. blows, falling), the equipment may be damaged or people may sustain injury.

Precautions:

When setting-up the equipment, make sure that the accessories (e.g. tripod, tribrach, connecting cables etc.) are correctly adapted, fitted, secured, and locked in position. Avoid subjecting the equipment to mechanical shock.



CAUTION:

The receiver uses the GPS P-Code signal, which by U.S. policy, may be switched off without notice.



WARNING

Inadequate securing of the survey site can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

Always ensure that the survey site is adequately secured. Adhere to the regulations governing accident prevention and road traffic.



DANGER:

Because of the risk of electrocution, it is very dangerous to use reflector poles 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.



CAUTION

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

Precautions:

Before dispatching the equipment or disposing of it, discharge the battery, either by running the instrument until the batteries are flat, or by discharging them with the GKL122 charger.



WARNING

If an External Antenna is not properly fitted to the roof rack of a vehicle it can be torn off by mechanical shock, vibration or wind, possibly causing accident and injury.

Precautions:

Use nothing other than the External Antenna on the roof rack of a vehicle. Secure the External Antenna correctly to the roof rack by means of the adapter. Leica Geosystems offers the adapter as an accessory. Secure the safety cord to the External Antenna and connect the cord to the adapter in accordance with the instruction plate on the adapter. Ensure that the roof rack is correctly mounted and able to safely carry the weight of the Antenna and accessories.



WARNING

If the equipment 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 equipment 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:

Dispose of the equipment appropriately in accordance with the regulations in force in your country. Always prevent access to the equipment by unauthorised personnel.



DANGER

If the GPS Receiver Hardware is used in exposed locations (e.g. on masts, mountains or buildings), it is at risk from 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 a GPS receiver in a thunderstorm as you may increase the risk of being struck by lightning.
- Be sure to remain at a safe distance from electrical installations. Do not use the GPS Antenna directly under or in close proximity to power lines. If it is essential to work in such an environment contact the local statutory regulatory bodies responsible for electrical installations and follow their instructions.

Main hazards in use, continued

- If a GPS Antenna 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 a GPS Antenna is given below. Always follow the regulations in force in your country with regard to grounding Antennas and masts. These installations must be carried out by an authorised specialist.
- Additional protection against lightning:
If there is a risk of a thunderstorm, or if the equipment is to remain unused and unattended for a long period, protect your Leica Geosystems GPS equipment additionally by unplugging all systems components and disconnecting all connecting cables and supply cables (e.g.. Receiver - Antenna).

Suggestion for design of a Lightning Conductor for a GPS Antenna

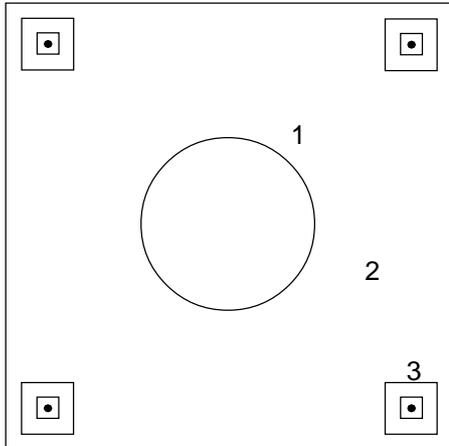
1. On non-metallic structures

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 4 Air Terminals should be uniformly distributed around the Antenna at a distance equal to the height of the Air Terminal. The Air Terminal diameter should be 12mm for copper or 15mm for aluminium. The height of the Air Terminals should be 25 to 50cm. All Air Terminals should be connected to the down conductors. The diameter of the Air Terminal should be kept to a minimum to reduce GPS signal shading.

2. On metallic structures

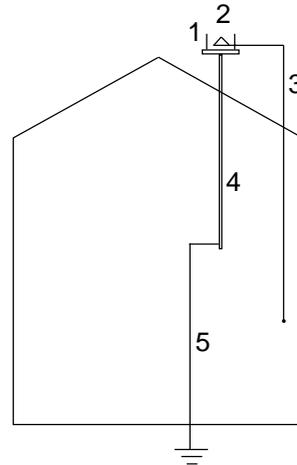
Protection is as described for non-metallic structures, but the Air Terminals can be connected directly to the conducting structure without the need for down conductors.

**Air Terminal arrangement
(plan view)**



- 1 GPS Antenna
- 2 Support-Structure
- 3 Air Terminal

Grounding the Receiver/Antenna



- 1 Lightning Conductor Array
- 2 GPS Antenna
- 3 Antenna/Receiver Connection
- 4 Metallic Mast
- 5 Connection to Earth

The term "electromagnetic acceptability" is taken to mean the capability of the Leica Geosystems GPS equipment 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 can cause disturbances in other equipment.

Although Leica Geosystems GPS equipment 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

There is a risk that disturbances may be caused in other equipment if Leica Geosystems GPS equipment is used in conjunction with accessories from other manufacturers, e.g. field computers, personal computers, radios, non-standard cables, external batteries etc.

Precautions:

Use only the equipment and accessories recommended by Leica Geosystems. When combined with GPS equipment they meet the strict requirements stipulated by the guidelines and standards. When using computers and radios, pay attention to the information about electromagnetic acceptability provided by the manufacturer.



CAUTION

Disturbances caused by electromagnetic radiation can result in the tolerance limits for measurements being exceeded.

Although the Leica Geosystems GPS equipment meets the strict regulations and standards which are in force in this connection, Leica Geosystems cannot completely exclude the possibility that the Leica Geosystems GPS equipment may be disturbed by very intense electromagnetic radiation, for instance near radio transmitters, walkie-talkies, diesel generators, power cables. Check the plausibility of results obtained under these conditions.



WARNING

If the Leica Geosystems GPS equipment is operated with connecting cables attached at only one of their two ends (e.g. external supply cables, interface cables), the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other instruments may be impaired.

Precautions:

While the Leica Geosystems GPS equipment is in use, connecting cables (e.g. instrument to external battery, instrument to computer) must be connected at both ends.

Electromagnetic acceptability, continued



Only for Leica Geosystems GPS equipment **with** integrated radio modem:



WARNING

Electromagnetic radiation can cause disturbances in other equipment, in installations (e.g. medical ones such as pacemakers or hearing aids) and in aircraft. It can also affect humans and animals.

Although the Leica Geosystems GPS equipment 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 or that humans or animals may be affected.

- Do not operate the Leica Geosystems GPS equipment in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.

- Do not operate the Leica Geosystems GPS equipment near to medical equipment.
- Do not operate the Leica Geosystems GPS equipment in aircraft.
- Do not operate the Leica Geosystems GPS equipment for long periods with it immediately next to your body.

FCC statement (applicable in U.S.)



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 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.

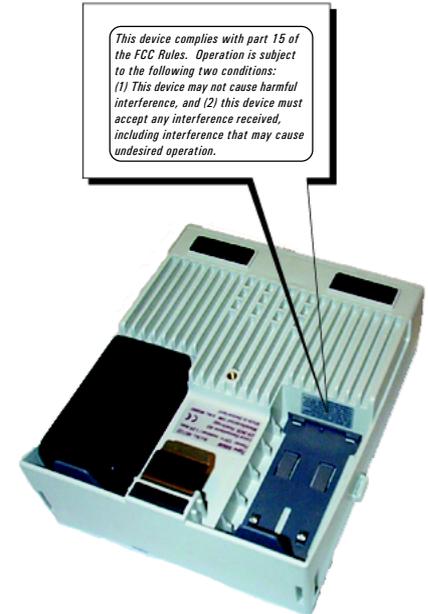


WARNING

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

Product labeling:

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.



The Technical Specifications for Leica Geosystems GPS equipment are contained on the following pages.

Satellite Reception:
Dual frequency

Receiver channels:
12 L1 continuous tracking
12 L2 continuous tracking

L1 channels:
Carrier phase, P1 code, C/A code

L2 channels:
Carrier phase, P2 code

Carrier Tracking

L1, AS on or off:

Reconstructed carrier phase via C/A code

L2, AS off:

Reconstructed carrier phase via P2 code

L2, AS on:

Switches automatically to patented P code-aided technique providing full L2 reconstructed carrier phase

Code Measurements

L1, AS off:

Carrier phase smoothed code measurements: C/A code narrow correlation, P1 code

L1, AS on:

Carrier phase smoothed code measurements: C/A code narrow correlation, patented P1 code-aided code

L2, AS off:

Carrier phase smoothed code measurements: P2 code

L1, AS on:

Carrier phase smoothed code measurements: Patented P2 code-aided code



Carrier phase and code measurements on L1 and L2 are fully independent with AS on or off.

Satellites Tracked:

Up to 12 simultaneously on L1 and L2

Time to first phase measurement typically 30 seconds.

Satellite Reception:

Single frequency

Receiver channels:

12 L1 continuous tracking

L1 channels:

Carrier phase, C/A narrow code

L1 Carrier Tracking:

Reconstructed carrier phase via C/A code

L1 Code Measurements:

Carrier phase smoothed C/A code measurements

Satellites Tracked:

Up to 12 simultaneously

Time to first phase measurement typically 30 seconds.

AT502

Microstrip L1/L2 antenna with built in groundplane.

AT501

Microstrip L1 antenna with built in groundplane.

Equipment weights

Receivers

SR530: 1.25 kg
SR520: 1.15 kg
SR510: 1.15 kg

Antennas

AT502: 0.4 kg
AT501: 0.4 kg

Power

Power consumption

SR530: maximum 7 Watts
(excluding radio)
SR520: maximum 5.5 Watts
SR510: maximum 5.5 Watts

Supply Voltage

All equipment: Nominal 12V DC
(Range 11-16V DC)

Environmental Specifications

Instrument	Operation	Storage
SR530	-20°C to +55°C	-40°C to +70°C
SR520	-20°C to +55°C	-40°C to +70°C
SR510	-20°C to +55°C	-40°C to +70°C
AT501/AT502	-40°C to +75°C	-40°C to +75°C
Leica PC-cards, all sizes.	-20°C to +75°C	-40°C to +75°C
Optional internal memory.	-20°C to +55°C	-40°C to +70°C

Humidity:

Up to 95%, non-condensing

Weather:

Will withstand rain, snow, dust, sand etc.

Separation distances

SR510/SR520/SR530 to AT502 or AT501 Antenna

Supplied cables: 1.2m or 2.8m

Optional Cable: 30m

Longer cables available on request.

Baseline precision

The following specifications are based on measurements processed using SKI-Pro software and are given as baseline rms (root mean square).

Differential Phase

Operation	SR530	SR520	SR510
Static	5mm +1ppm	5mm +1ppm	10mm +2 ppm
Rapid static	5mm +1ppm	5mm +1ppm	10mm +2 ppm
Stop & Go	10mm +1ppm	10mm +1ppm	20mm +2ppm
Kinematic	10mm +1ppm	10mm +1ppm	20mm +2 ppm

Differential Code

Operation	SR530	SR520	SR510
Static	30cm	30 cm	30 cm
Kinematic	30 cm	30 cm	30 cm



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

Leica Geosystems AG, Heerbrugg, Switzerland, has been certified as being equipped with a quality system which meets the International Standards of Quality Management and Quality Systems (ISO standard 9001) and Environmental Management Systems (ISO standard 14001).



***Total Quality Management-
Our commitment to total customer
satisfaction***

*Ask your local Leica Geosystems agent
for more information about our TQM
program*

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