GPS System 500

GPS Equipment User Manual

Version 4.0
English

Leica Geosystems

GPS System 500

Congratulations on your purchase of a new Leica System GPS500.

This manual contains important safety directions (refer to chapter "Safety directions") 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.: _____

Symbols used in this manual

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 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.

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

MC500 - 12 L1, 12 L2 channels, code and phase, RTK capable

RS500 - 12 L1, 12 L2 channels, code and phase

GS50 - 12 L1 channels, carrier aided code and DGPS ability.

GS50+ - 12 L1, 12 L2 channels, code and phase, RTK capable

The SR510 utilises the AT501 Antenna. The SR520, SR530 and GS50+ typically utilise the AT502 Antenna but may also use the AT503 and AT504 Antennas. The MC500 utilises the AT502 Antenna but may also use the AT503 and AT504 Antennas for GPS Reference Station use. The RS500 utilises the AT503 or AT504 Antennas but may also use the AT502 Antenna. The GS50 may use either the AT501, RTB or RTS Antennas.

See section 8 for technical specifications.

The SR520, SR530, MC500 and RS500 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.

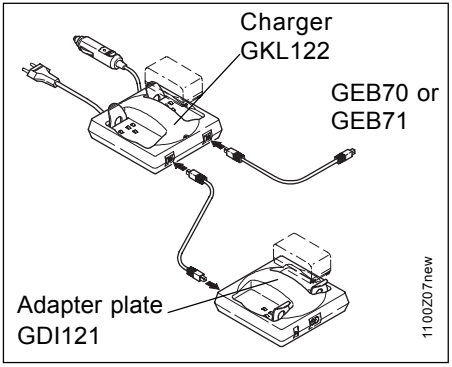
Charge the Batteries

In most cases, a short introduction in the use of the Receiver and Terminal will be provided by the local Leica 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 with the Leica 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.



WARNING:
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.

Use only the Leica batteries, chargers and accessories, or accessories recommended by Leica.

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.

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

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 externaly. 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.

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 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.

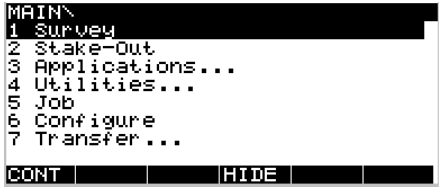
Receiver Hardware

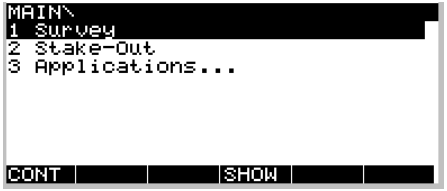
In most cases, a short introduction in the use of the Receiver and Terminal will be provided by the local Leica representative. If this is not the case proceed as outlined in the following section.

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

Step 1: Power on

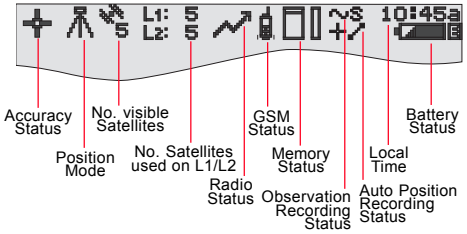
Turn on the sensor by pressing the ON-button on the terminal. One of the following two screens will appear on the display:





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.



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 and elevation mask.

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 for these numbers to start changing until they reach the number of satellites visible.

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 4 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 10 meters (with Selective Availability switched off).

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 indicates 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

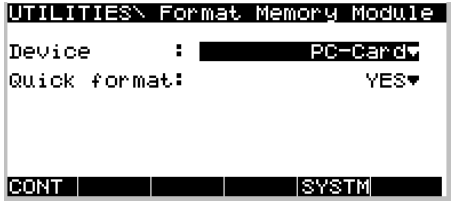
Before you start logging data you may want to (re-)format your PC-card or your internal memory.

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

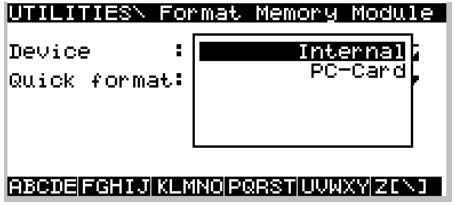
Press **4** on the terminal or use the Cursor key to highlight the line **4 Utilities**, then press **ENTER**; alternatively press **F1 CONT**.
(If only lines 1 to 3 are visible at this stage press **F4 SHOW** first).

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**.

You are now in the Utilities \ Format Memory Module panel:



If you want to format the PC-card just press **F1 CONT** to format the card. If you want to format the internal memory press **ENTER**. A list-box opens which allows you to select the internal memory.



Use the cursor key to highlight **Internal**, then press **ENTER**. Then press **F1 CONT** in order to start the formatting process of the internal memory.

By activating the format command all data will be lost! Make sure that all important data which resides on the PC-card is properly backed-up before reformatting the card. If you want to reformat the internal memory make sure that all important data is first transferred to the PC.

If you realise that you do not want to format the memory device, simply press **ESC** instead of **F1 CONT**. This key-stroke brings you always a step back into the previous panel without execution of any command.

Once the formatting of the card is completed the MAIN\ panel will appear.

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:

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 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:

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

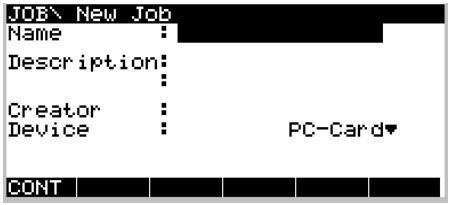
Jobs are used to organise and structure the data you collect in the field. Jobs can comprise an unlimited number of points together with all related information (raw measurements, codes, point annotation, etc.).

It is recommended that a new job is created whenever a new project is started.

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:

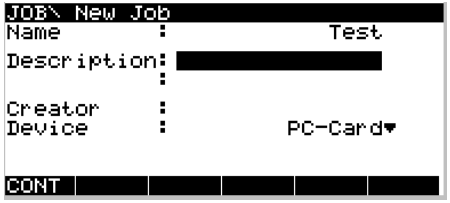
Use the cursor up or cursor down key to highlight the input field for jobs. Then press **ENTER**. The following listbox will appear:

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



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*:



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** 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 shows the job *Test*:

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

Finally you have to select the antenna type and 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:

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

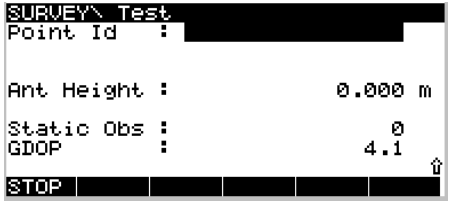
Step 5: Logging raw data

We are now within the main Survey panel. After the above configuration setup, the main Survey panel will look as follows:

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:



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 being 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**.

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 !

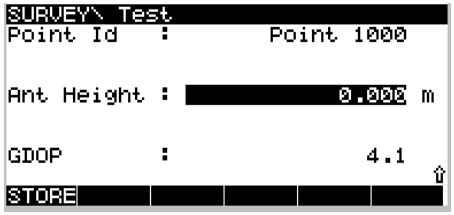
The PC-card must not be removed while in the Survey panel. If the card is taken out of the receiver all stored data might get corrupted, preventing SKI-Pro from successfully reading the data on the card.

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.

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 a 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:



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.

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 **OCUPY**.

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:

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 will become warm. This is normal.

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

- 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.

MC500 - Introduction

The MC500 is a ruggedized System 500 (SR530) which has been built for the high vibration and shock environments.

Features that are unique to the MC500 include:

- Ruggedized housing
- Standard Shock Isolators
- Higher vibration and shock specification than System 500 Survey equipment.
- Ruggedized lemo cable connectors
- External Power Source

As the MC500 is a fully compatible System 500 GPS receiver, it is capable of the full functionality of the SR530 dual frequency RTK receiver.

For example, the MC500 can be configured with the TR500 Terminal, all cables are compatible, data can be stored and processed in Ski-Pro.

Due to its rugged design, the MC500 is ideal for Machine Guidance applications.

The MC500 is a key component of the Leica Dozer 2000 Machine Guidance System from Leica.

Figure MG.01 MC500 GPS Receiver

System Configuration

The MC500 receiver can be configured and operated in two ways.

- Via the TR500 Terminal.
- Via the Outside World Interface (OWI) protocol.

These configuration options are described in the following sections.

The TR500 Terminal can be used to configure the MC500, check the status of the observations and satellites in the same way as it is used to configure the System 500 survey receivers.

When using the TR500 to configure the MC500, the MC500 must be configured from an external power source, and the TR500 connected to the Terminal Port of the MC500 via a standard Leica data cable.

A block diagram of this configuration is shown in Figure MG.02.

Please refer to the System 500 part of the User Manual fro instructions to use the TR500 to configure the MC500 receiver.

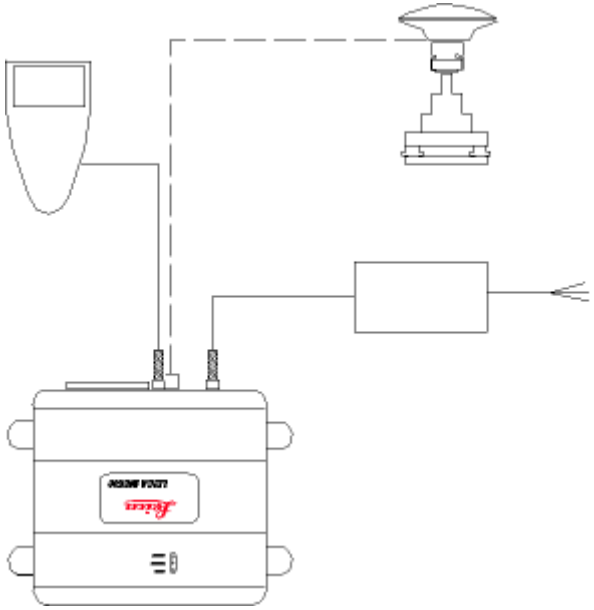


Figure MG.02 MC500 GPS Receiver configured by TR500

Configure through OWI

The MC500 can be incorporated as an OEM product into a range of positioning systems by third parties.

For example the MC500 can be incorporated into Port Control Systems, Hydrographic Survey systems and general machine guidance systems for Construction, Mining and Agriculture. Leica uses the MC500 as a critical component of the Dozer 2000 Machine Guidance product.

The MC500 can be configured using an interface protocol developed by Leica called the Outside World Interface (OWI).

Documentation on the OWI format can be supplied on request.

Figure MG.03 shows a typical configuration set up to enable configuration of the MC500 via OWI.

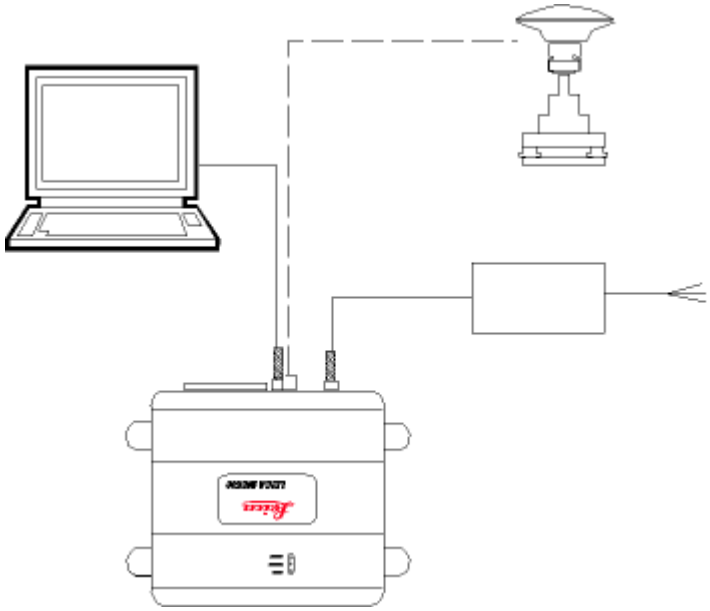


Figure MG.03 MC500 GPS Receiver configured by OWI

RS500 - Introduction

The RS500 receiver has been designed specifically for use as a reference station.

The RS500 uses the same housing and meets the same technical and environmental specifications as the SR5xx sensors. For details please refer to the Technical Specifications section of this manual.

Generally, the RS500 operates in the same manner as the SR530, but is designed to operate for specific reference station applications using remote control software, i.e. Leica Geosystems ControlStation™ software.

It supports internal logging of GPS raw data, but can also log data from external devices approved by Leica Geosystems. Both GPS raw data and external sensor data can be directly output to an external remote control software package.

With a radio modem attached, the receiver can be used to transmit data for RTK operations using proprietary as well as standard RTCM or CMR formats. The RS500 cannot receive Reference Station broadcasts and therefore cannot be used as a Real-Time rover receiver.

Standard Features
The RS500 includes the following standard features, which are not available as standard in the SR5xx sensor types:
One PPS Output port.
Two Event Input ports.
Ring Buffer logging.
Support for external sensors (Meteo/Tilt).

Data Storage
The RS500 supports all standard Leica Geosystems PCMCIA card types. The internal memory option may be installed as well. This enables data to be stored internally for post-processing.

Outside World Interface (OWI)
External control of the RS500 via remote interface is achieved through use of the Outside World Interface (OWI) command language. The ASCII/NMEA type message format from Leica as well as the compact Leica Binary 2 format can be used. Integration assistance and OWI documentation is available on request from Leica Geosystems.

Powering the RS500
The RS500 can be powered using the Leica standard internal Camcorder batteries or Leica standard external batteries for temporary use. For a more permanent setup, a universal 100V-240VAC 50-60Hz to 12VDC power converter is available. Alternative 12VDC power sources may be utilised by means of a user configurable 12VDC power cable with in-line fuse.

Turning the RS500 On/Off
The RS500 can be powered on or off by the TR500 Terminal, the sensor integrated ON/OFF button or by a remote control command (OWI).

Using the ON/OFF button will reset the receiver. All programmed outputs, data logging parameters and interface configuration options that have been set by OWI commands will be lost.

Power Failures
The RS500 will automatically power itself up and return to the previous operating mode after any temporary power failure without user (or remote control) interaction.

Cabling Connections / Options
Cable connections are identical to other System 500 receivers.

The RS500 is specifically designed as a long term GPS Reference Station. The AT502, AT503 or AT504 antenna should be mounted on a stable structure with a very clear view of the sky. SKI-Pro should be used to produce a satellite visibility plot for the location using an up to date almanac. Any potential obstructions to satellite signals should be measured by clinometer and compass and compared with the satellite visibility plot and proposed elevation mask to assess their potential impact to the usefulness of the location as a GPS Reference Station.

Mounting the GPS antenna should take into consideration environmental conditions, structural or ground movements, change in use of the property or surrounding properties and tree growth. These may impact the future performance of the GPS Reference Station.

The antenna mounting point should have a 5/8" thread and an unambiguous reference point both horizantally and vertically to which the antenna phase centre can be referenced to.

The equipment should ideally be in a secure location with a reliable power supply. An uninterruptable power supply with sufficient backup capacity for the local power conditions is recommended. The equipment should be protected against lightning or static electrical discharge as discussed further within the Safety Directions of this manual.

Connect the antenna to the sensor using the supplied antenna cable. Kinks, cut and crushed areas of the antenna cable may degrade signal quality and strength. It is recommended that the antenna cable be protected from long term damage.

Connect a 12VDC power supply to the PWR port of the RS500, or insert the internal camcorder batteries for short term operation.

For general configurations, system data transfers from/to the PC card and viewing status information attach the TR500 terminal to the sensor, either directly or via a connection cable by plugging it into the TERMINAL port on the sensor.

For configuration and operation like data logging and real time data transmission connect the sensor to a PC using the data cable (Art. No. 560 254). The PC should be running an appropriate application program such as Leica Geosystems ControlStation™.

Insert a PC-card into the sensor, if no internal memory option is installed.

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 or leave the sensor inside the shipping case. The mounting bracket (Art. No. 722 105) may be used to attach the RS500 receiver firmly to a bench, table or wall.

Your RS500 sensor is now fully ready for operation.

See Fig. RS.01 for a basic connection scheme.

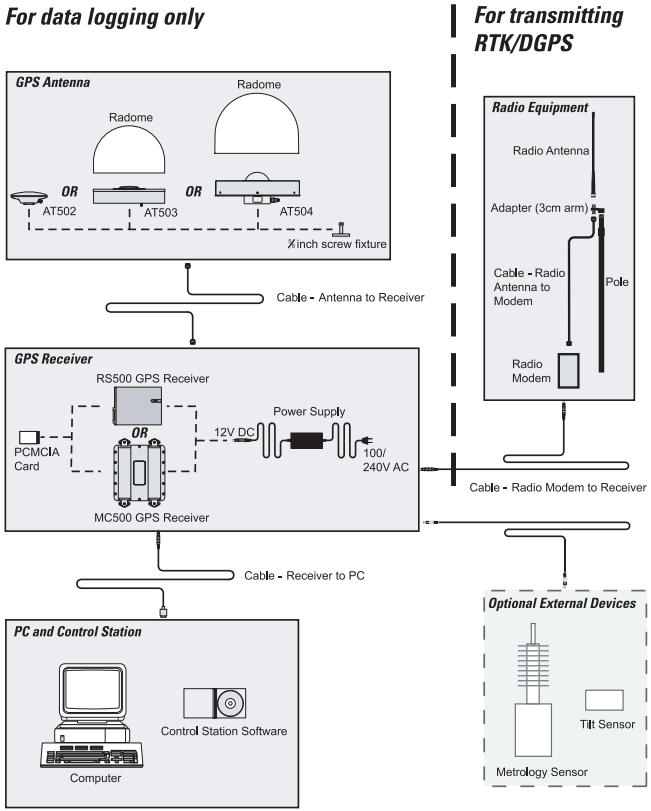
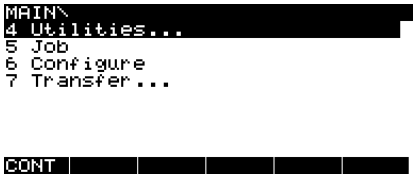


Figure RS.01 Basic connection scheme

The RS500 can be operated either with the TR500 Terminal or by remote control. However, the TR500 cannot be used for running a survey, stake-out or any of the other applications available for System 500.
Used with an RS500, the Terminal provides the general functionality to set certain operation parameters, port configurations and all transfer capabilities, including the upload of new firmware. Via the STATUS hard key all status information is available.
For the majority of applications, the RS500 has to be operated using Leica Geosystems ControlStation™ or other appropriate reference system control software.

Using the RS500 with the TR500

Step 1: Power on
Turn on the sensor by pressing the ON-button on the terminal. The following screen will appear on the display:



The RS500 has the same main menu panel as the SR5xx sensors except that the first 3 menu options are removed. It is also not possible to perform the real time configuration for the RS500. This needs to be done using remote control software. All data management, job control and sensor status operations required by an RS500 user are possible using the menu options shown above.

The RS500 **CONFIG** and **STATUS** menus do only show those options that are relevant to the operation of an RS500.

Full details on the RS500 unique operational procedures are given in the Technical Reference Manual (PDF Document), which is contained on the SKI-Pro or ControlStation™ release CD.

Step 2: Study the Icons

For a detailed description refer to **Step 2** of the chapter Getting started with the new Survey equipment - Measuring with the default configuration on pp. 11-13.

Step 3 (optional):
Format your memory card

For a detailed description refer to **Step 3** of the chapter Getting started with the new Survey equipment - Measuring with the default configuration on pp. 13-14.

Step 4:
Connecting the sensor to the PC

For normal operations the sensor will be connected to a PC using the RS232 data download cable (560254).

Connect the cable to the sensor remote control port (by default the Terminal port) and the available Com port of the PC.

Configuration of the remote port on the sensor is described in the Technical Reference Manual.

Operation of the RS500 from a PC requires one of the Leica reference station software programs which are supplied with operating instructions.

Step 5(optional):
Connecting the sensor to a Radio

The RS500 has the ability to transmit real-time GPS data out of Port 1 and Port 3 of the GPS sensor via the radio interface cable (721961) to a Leica supplied radio unit.

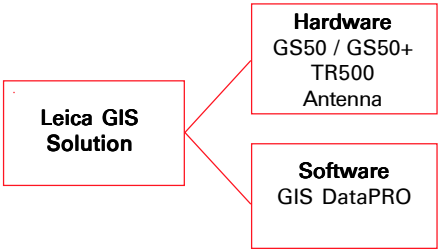
Radio installation and connection instructions are provided with Leica supplied radio units.

Unauthorised radio units should not be connected to the RS500 sensor unit.

Introduction

"Getting Started with New GIS Equipment" is designed to help get the beginning user up and running with their new Leica GS50 and GS50+. For more information about setup, features and operations of the GS50, please refer to the "Getting Started with the GS50 / GS50+ Sensor" manual.

The Leica GIS DataPRO system is composed of both hardware and software components.
The hardware consists of the GS50 sensor, TR500 terminal and antenna. This is used in the field to collect and record spatial (position) and non-spatial attributes.



The GIS DataPRO office software is comprised of a GPS post-processing system and data editing functionality which works in the native ESRI shapefile format.

GIS DataPRO Post-processing software

GIS DataPRO is used for data collection preparation and data post processing. Please refer to the "Getting Started with the GIS DataPRO Office Software" User Manual for more details.

To install the GIS DataPRO software:
1.Insert the CD-ROM into the CD drive of your PC.
2.Execute the "Setup" command.
3.Follow the instructions that appear on the screen.
Both a hardware and software user manual can be found on the CD in PDF format. The software itself contains a comprehensive online Help System.

After the data is collected in the field, the GIS DataPRO office software allows you to import, edit and export the data to your GIS. The software can also be used to design codelists which allow you to customize the field data collection process to suit your needs. To learn more about the GIS DataPRO office software, please consult the "Getting Started with the GIS DataPRO Office Software User Manual".

GS50 / GS50+ Sensor

The GS50 / GS50+ sensor consists of both a handheld terminal (TR500), and the GPS receiver itself. The GPS receiver receives the GPS signal from the NAVSTAR satellites and calculates a range to the satellites that are visible.

The GS50 is a 12-channel L1 code and phase GPS receiver. The standard GS50 does not record phase measurements for post processing purposes. Phase measurements are used internally to smooth pseudorange measurements for higher code positioning. Phase measurement recording for post processing is available as an option.

There are three antennas available with the GS50:

- AT501 – tracks L1 only (GS50).
- RTB Combined Antenna - tracks L1 and RTCM differential signal from public and private beacon infastructure.
- RTS Combined Antenna - tracks L1 and differential signals from Racal DGPS Satellite systems.

The GS50+ is a 12-channel L1, 12-channel L2 code and phase GPS receiver. The standard GS50+ records code and phase measurements for post processing and / or uses DGPS for real-time code-only positioning. RTK is available as an option.

There are three antennas available with the GS50+:

- AT502 – tracks L1 and L2. Mainly used for Rovers and References.
- AT503 – Choke Ring Antenna tracking L1 and L2. Mainly used for Reference stations.
- AT504 – JPL Design Choke Ring Antenna tracking L1 and L2. Mainly used for Reference stations.

The QuickStart Tutorial will guide you through a typical data collection session.

Each step will indicate which panel you should be viewing by displaying the menu title in brackets (i.e. MAIN\ for the main menu panel).

Step 1: Beginning GIS Data Collection (MAIN\)

Turn on the sensor by pressing the **ON**-button on the terminal. The following panel will appear:

This is the main data collection panel. Pressing ESC will take you to the main menu:

From the main menu, entering '1' on the keypad, or highlighting *GIS Data Collection* using the cursor keys and then pressing **ENTER** or **F1 CONT** will bring you back to the main data collection panel.

Upon power on you will see 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.

This number is based on the GPS almanac saved in the sensor and the last computed position. This number does not indicate the number of satellites the receiver is tracking.

Next to this symbol you'll find the "Number of Satellites used on L1" icon, indicating the number of satellites currently tracked on L1.

On initial start-up, this number will read 0 since it takes about 30 seconds to start tracking 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.

Position Fix Indication

The sensor will compute a 2D-position once 3 satellites are tracked. A 3-D position will be computed.

If the accuracy icon does not become visible even after one or two minutes then the sensor is still not tracking satellites. One reason for this is the receiver receiving signals at a location more than 500km from the startup position. If this is the case, then the receiver will download a new almanac. This will take about 15 minutes. Another reason for the receiver not tracking is a faulty antenna cable connection. Please check whether the antenna cable is connected properly to both the sensor and antenna.

If you're in an open area with no obstructions, the "number of satellites used" should correspond to the "number of visible satellites". However, in obstructed areas, such as urban canyons or forested areas, it is unlikely that the receiver will be able to track all the satellites in the sky. This is not a problem, but will degrade the accuracy of measurements slightly. Consequently, please keep monitoring the accuracy icon.

Once the Accuracy Status icon appears, data collection can begin.

Step 2: Choosing your Configuration Settings (DATA COLL \ Begin)

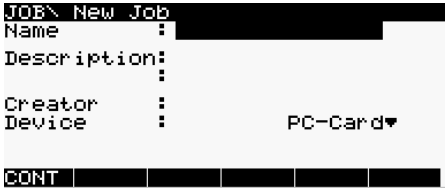
Configuration Set (Config Set) is a collection of sensor parameters needed to perform various methods of data collection. These include data recording rates, data formats, antenna types, coding methods, etc.

Several default configuration sets exist which cover standard data collection scenarios. For information on how to create configuration sets, please refer to the hardware reference manual on the GIS DataPRO software CD.

If no real time differential corrections are used (i.e. you do not have the RTCM differential beacon module attached to the sensor), you should select the GIS_PP (PP = Post Processing) configuration set.

You can make this selection either by using the “cursor left” key to toggle between all available configuration sets until PP_GIS appears or you can highlight the input field and press ENTER. Then a list box comes up showing all available sets:

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



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”:

Step 3: Choosing your codelist (DATA COLL \ Begin)

A *codelist* is simply a list of codes or features. Codes are the building blocks of the codelist and may be thought of as features.

Codelists are selected as follows: first use the cursor down key to get this input field highlighted. Then use the cursor left key to toggle among the several options until the correct one appears. Alternatively you can press the **ENTER** key to get a listbox from which the choice can be made, or a new codelist can be created.

Please note that you must select a codelist in order to collect data.

Creating a new codelist

From the codelist menu box, press F2 NEW to create a new codelist name.

The following panel appears.

As an example, we will create a codelist called ‘Electric’. Enter the word Electric in the Name input field and press **ENTER**. Press **F1** CONT to return to the codelist menu box. The *Electric* codelist now appears in the menu box. Make sure the Electric codelist is highlighted, and press **ENTER**.

Step 4: Choosing your antenna type (DATA COLL \ Begin)

Finally you have to select the antenna setup which you are using. For L1 post processing, this will normally be the AT501. For real time differential, it will normally be the RT combined antenna and for L1 + L2 post processing it will be the AT502 antenna. In this example, the selection indicates the RT combined.

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 key to toggle among the several options until the correct 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 typical data collection session are made.
The Data Coll \ Begin panel looks the following:

Pressing **F1** CONT finishes this start-up sequence.

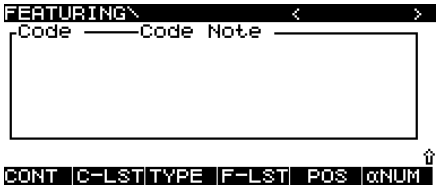
Step 5: Selecting or creating codes for data collection (FEATURING\)

You are now in the FEATURING\ panel. This panel allows you to select or create codes for data collection. Codelists can also be created using the Codelist Manager module within the GIS DataPRO software.

If in the previous step you selected an existing codelist, a number of codes appears in the codelist box. If you created a new codelist in the previous step, this listbox is empty.

Creating codes

If your codelist contains no codes, your codelist menu box looks like this:



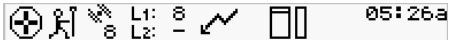
To create a new code, press **F2** C-LST. Use the right or left cursor key to select a code list. Press **F3** CODES and then **F2** NEW.

Use the right or left cursor key to choose the code type (point, line, or polygon). Enter the name of the code, and a note about the code (optional), in the appropriate input fields.

As an example, we will create a point code names Pole. We will input the following note in the note field, “Offset to road”. The note field can be used to describe the manner in which data is collected for a particular code. In this example, we are measuring the pole location from the road. Press **F1** CONT to continue.

Step 6: Logging point data (ATTRIBUTION\)

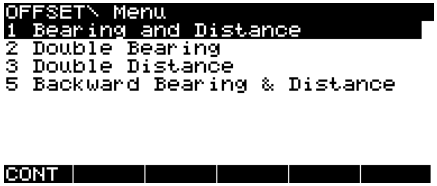
In this step, you will collect the spatial attribute (position information) for your Pole (point) code.



It is time to check again the icons on the top of the display. The position icon should be available, the position mode icon still indicates “moving”, the “number of satellites visible” icon should display a number greater or at least 4, and the number of used satellites will generally be the same as the number of visible satellites, if you are in a relatively open area.

Pressing **F4** OFFS will allow you to enter an offset to the desired point code. You can enter this offset in one of four ways:

- Bearing and Distance
- Double Bearing
- Double Distance
- Backward Bearing & Distance



The GS50 / GS50+ interfaces to a number of laser range finders that will allow you to accurately measure offset distances and angles. The following laser range finders are supported:

- Leica Disto memo (distance only)
- Leica Disto pro (distance only)
- Leica Disto™ pro⁴ (distance only)
- Leica Disto™ pro⁴ a (distance only)
- Laser Ace 300
- Criterion 400
- Criterion Compatible
- Leica Vector
- Leica Laser Locator
- Leica Laser Locator Plus

You can configure your GS50 / GS50+ to interface with your laser range finder from the CONFIGURE\OFFSET panel. Please see the technical reference manual for more information.

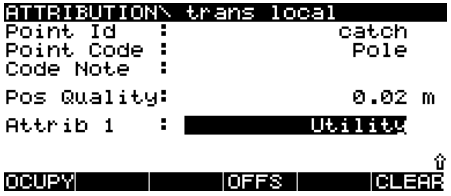
As soon as you are tracking a minimum of 4 satellites, the accuracy icon is visible (indicating good position quality), and the antenna is positioned close to the feature, you should press **F1** OCUPY.

This activates logging of raw data and the panel changes accordingly.

Notice that the position mode icon has changed to static mode, indicated by a symbol of a tripod.

During data logging, attribute information can be entered into the appropriate input fields. In this example, ‘Utility‘ has been entered for Attrib 1.

Once a sufficient amount of raw data has been collected, you can stop data collection by pressing **F1** STOP.



Data collection times will depend on the situation. If the unit is being used as a reference for post processing, then data must be continually logged until all roving receivers have stopped collecting data. If the unit is operated as a roving receiver the site occupation time depends mainly on the baseline length and your accuracy requirements.

The information shown hereon is only intended to get you up and running with your new GIS equipment. Please refer to the “Getting Started with the GS50 Sensor” and “Getting Started with GIS DataPRO” manuals for more detailed information of your new GIS system.

Transport

When dispatching the instrument, always use the complete original Leica 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.

Intended use of instrument

The following directions should enable the person responsible for the Leica Geosystems GPS, and the person who actually uses the instrument, to anticipate and avoid operational hazards.
The person responsible for the instrument must ensure that all users understand these directions and adhere to them.

Permitted uses

The Leica Geosystems GPS is 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 instrument to inform the user about hazards and how to counteract them. The Leica Geosystems GPS is not to be operated until the user has been instructed how to work with it.

Limits of use

See chapter "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.

Responsibilities

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 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 of the person in charge of the instrument:

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

Main hazards of 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 these devices, the user may receive an electric shock.

Precautions:
Use the charger only indoors, in dry rooms. Protect them from damp. If the devices are damp, do not use them.

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

- Touching live components;
- Using the devices 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 and perform the field adjustments 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 use indoors 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 in conjunction with Leica Geosystems instruments.

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 instrument, make sure that the accessories (e.g. tripod, tribrach, connecting cables) 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 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 batteries by running the instrument until they are flat.

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 External Antenna (>1kg).

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 Leica Geosystems GPS 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 Leica Geosystems GPS 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 Leica Geosystems GPS 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.

- If a Leica Geosystems GPS 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 Leica Geosystems GPS 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.

- To prevent damages due to indirect lightning strikes (voltage spikes) cables (antenna, power source, modem, ...) should be protected with appropriate protection elements (lightning arrestor). These installations must be carried out by an authorized, local specialist.

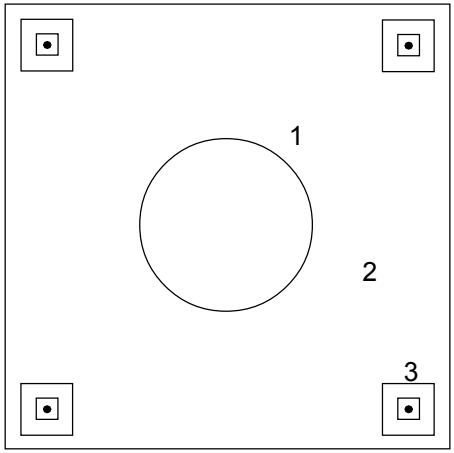
- Additional protection against lightning:
  If there is a risk of a thunderstorm, or if the equipment is to remain unused and unattended for a long period, protect your Leica Geosystems GPS additionally by unplugging all systems components and disconnecting all connecting cables and supply cables (e.g. Receiver - Antenna).

Suggestion for design of a Lightning Conductor for a GPS 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 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.

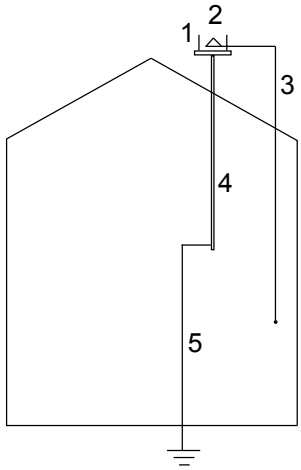
2. On metallic structures
Protection is as described for non-metallic structures, but the Air Terminals can be connected directly to the conducting structure without the need for down conductors.

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 compatability" is taken to mean the capability of the Leica Geosystems GPS 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 the Leica Geosystems GPS 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 the Leica Geosystems GPS is used in conjunction with accessories from other manufacturers, e.g. field computers, personal computers, walkie-talkies, non-standard cables, external batteries.

Precautions:
Use only the equipment and accessories recommended by Leica Geosystems. When combined with the Leica Geosystems GPS, they meet the strict requirements stipulated by the guidelines and standards. When using computers and walkie-talkies, pay attention to the information about electromagnetic compatability 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 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 may be disturbed by very intense electromagnetic radiation, e.g. near radio transmitters, walkie-talkies, diesel generators.
Check the plausibility of results obtained under these conditions.

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

Use of GPS System 500 with external Radio devices or GSM phones:

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.

Precautions:
Although the Leica Geosystems GPS meets in combination with external Radio devices or GSM phones the strict regulations and standards which are in force in this respect, Leica 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 with external Radio devices or GSM phones 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 with external Radio devices or GSM phones near to medical equipment.
- Do not operate the Leica Geosystems GPS with external Radio devices or GSM phones in aircraft.
- Do not operate the Leica Geosystems GPS with external Radio devices or GSM phones for long periods with it immediately next to your body.

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 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: SR510, SR520, SR530, RS500, GS50 and GS50+

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.

Product labeling: MC500

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 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

Note:
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.

AT504
Dorne & Margolin L1/L2 antenna element with gold anodized choke ring groundplane. Complies with IGS type 'T' antenna. Optional protective radome.

AT503
Microstrip L1/L2 antenna with choke ring groundplane. Optional protective radome.

AT502
Microstrip L1/L2 antenna with built in groundplane.

AT501
Microstrip L1 antenna with built in groundplane.

RTB
Combined GPS L1/ beacon antenna.

RTS
Combined GPS L1/ L-Band antenna.

Receivers

SR530:	1.25 kg
SR520:	1.15 kg
SR510:	1.15 kg
MC500:	3.10 kg
RS500:	1.25 kg
GS50+ :	1.25 kg
GS50 :	1.15 kg

Antennas

AT504:	4.3 kg
AT503:	2.4 kg
AT502:	0.4 kg
AT501:	0.4 kg

Power consumption

SR530:	maximum 7 Watts (excluding radio)
SR520:	maximum 5.5 Watts
SR510:	maximum 5.5 Watts
MC500:	maximum 7 Watts (excluding radio)
RS500:	maximum 7 Watts (excluding attached accessories)
GS50+:	maximum 7 Watts (excluding radio)
GS50 :	maximum 5.5 Watts

Supply Voltage

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

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
MC500	-20°C to +60°C	-40°C to +70°C
RS500	-20°C to +55°C	-40°C to +70°C
GS50+	-20°C to +55°C	-40°C to +70°C
GS50	-20°C to +55°C	-40°C to +70°C
AT501/ AT502/ AT503 AT504	-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
MC500: 100%, non-condensing

Weather:
Will withstand rain, snow, dust, sand etc.

Separation distances

SR510/SR520/SR530/GS50/GS50+ to AT502 or AT501 Antenna

Supplied cables: 1.2m or 2.8m
Optional Cable: 30m
Longer cables available on request.

MC500 to AT502 Antenna

Supplied cables: 1.2m, 2.8m or 10m
Optional Cable: 30m
Longer cables available on request.

RS500 to AT504, AT503 or AT502 Antenna

Optional Cables: 1.2m, 2.8m, 10m, 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	Static Choke Ring	Static	Rapid Static	Stop & Go	Kinematic
SR530	3mm + 0.5ppm	5mm +1ppm	5mm +1ppm	10mm +1ppm	10mm +1ppm
SR520	3mm + 0.5ppm	5mm +1ppm	5mm +1ppm	10mm +1ppm	10mm +1ppm
SR510	----------	10mm +2ppm	10mm +2ppm	20mm +2ppm	20mm +2ppm
MC500	3mm + 0.5ppm	5mm +1ppm	5mm +1ppm	10mm +1ppm	10mm +1ppm
RS500	3mm + 0.5ppm	5mm +1ppm	5mm +1ppm	10mm +1ppm	10mm +1ppm
GS50+	3mm + 0.5ppm	5mm +1ppm	5mm +1ppm	10mm +1ppm	10mm +1ppm
GS50	----------	10mm +2ppm	10mm +2ppm	20mm +2ppm	20mm +2ppm

Differential Code

Operation	SR530	SR520	SR510	MC500	RS500	GS50	GS50+
Static	30cm	30cm	30cm	30cm	30cm	30cm	30cm
Kinematic	30cm	30cm	30cm	30cm	30cm	30cm	30cm

Note:

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 agent for more information about our TQM program

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