GPS - System 300

Getting Started

GPS Sensors
SR260, SR261
SR299, SR399,
SR9400
SR9500

GPS Controllers
CR333, CR344

Version 3.40 and higher

Leica Geosystems Inc., GPS, CH-9435 Heerbrugg (Switzerland)
Phone +41 71 727 31 31, Fax +41 71 727 46 73, www.leica.com

Leica

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ADVISORY NOTICE

This receiver uses the GPS P–code signal, which, by U.S. Policy, may be switched off without notice.

Phase measurements on L2 are ensured, however, as the receiver switches automatically to code-aided tracking.

1 Introduction

This booklet explains (by means of practical examples) some of the basic concepts and functions of the Leica GPS–System 300.

The three main component parts of Leica GPS–System 300 are as follows:

I. Leica GPS Sensor
II. Leica GPS Controller
III. SKI Static Kinematic Software

The booklet has been designed to be useful as both a learning tool and a short reference manual for the Sensor and Controller. The best way to learn the system is to work through the exercises presented here. Note that the booklet is written primarily for use with the CR333 Controller and SR399 Sensor although it can also be used in conjunction with other combinations of Leica/WILD GPS equipment.

The booklet also explains some of the common functionality of the Controller and is suitable for use as a "field manual." If more detailed information is required the reader should refer to the Technical Reference Help.

2 Before switching the Controller ON

This booklet does not explain the workings of GPS. If you would like an explanation of the fundamentals of GPS we recommend you read some of the many texts available on the subject. You will find that you will automatically learn more about GPS as you use the System to collect and process data.

The most important thing to understand is that GPS requires differential observations that are collected at both an assigned "reference" station and a "roving" station. The data at these stations should be collected at the same rate and at the same time. The data from these stations is then processed using the SKI software to produce a final result.

System 300 is designed for static, rapid static, reoccupation, stop and go, and kinematic surveys. Each of these operation modes is also referred to in the Controller Technical Reference Help and in the SKI Help.

Before starting the exercises in this booklet it is helpful to understand the meaning of project, mission, and operation type and how data is managed in the Controller

2.1 Missions

A mission describes the way that the Controller has been configured to carry out a survey. Each mission has an associated mission configuration file which contains a set of parameters including the initial point coordinates, satellite tracking parameters, operation type, data tracking characteristics, and point–identification conventions. Each mission configuration file is uniquely identified by a six character mission code in the Controller.

When you receive the equipment there will always be one mission — called Static Survey DEFAULT — set in the Controller. The exercises in this booklet explain how to use this mission as a template for creating your own missions.

2.2 Operation Types

One of the most important observation parameters that makes up the mission configuration file is the operation type. The operation type varies according to the needs of the survey. There are five operation types: Four for surveying — static survey, stop and go survey, kinematic survey and kinematic on the fly survey — and one for navigation.

You can use several missions in one project. You can use different operation types in a mission. The operation type chosen depends on the requirements of the survey.

When observations take place between at least two stationary receivers the survey type is termed as a static survey. Static surveying is ideal over long distances with four or more satellites. You should observe for at least one hour – preferably 2 hours or more on long lines – to ensure an accurate result.

On short lines, when there are sufficient satellites available with good geometry, it is possible to get high accuracy with relatively short observation times. The speed of measurement and increase in productivity are due to advanced processing algorithms in SKI software and have lead to the term rapid static surveys.

Reoccupation surveys are also static surveys but require that a point is occupied more than once. All data that is collected at the point, whether it be on the same day, or on a completely different day, can be combined to get one solution in SKI. If 4 satellites are observed during the first occupation, and 4 different satellites during the second, the reoccupation mode in SKI will process the data as if 8 satellites had been observed at that point.

Stop and go surveys enable many points to be observed quickly. Initially, the roving receiver must occupy the first point until sufficient data have been collected for the ambiguities to be resolved (this is known as the initialisation period). The rover can then move from point to point whilst maintaining lock on the satellites. The stop and go technique is ideally suited to small areas where the points are close together and where there are no obstructions to the satellite signals.

Kinematic surveys are used to calculate differential point positions at a pre–set time interval. The roving receiver can be on a moving platform. The survey technique is similar to that of stop and go. Kinematic surveys are ideal for tracking moving vehicles (say for road profiling), tracking boats, offshore platforms etc.

Kinematic On the Fly surveys are used to obtain the same results as Kinematic surveys, the difference being that no static initialisation is required. This type of survey may only be successfully utilised if the AROF option for SKI has been purchased.

The Sensor and Controller can also be used as a navigation receiver. The WGS84 point position is displayed and may be recorded. The Controller is also able to steer to targets and display coordinates in local grid format.

2.3 Data Management

Data stored in the Controller is organised into a database called the GEODB. The GEODB consists of Projects, Jobs, Code Lists, Transformation sets, Points and Lines.

Raw GPS data and Real Time points are record in a Job. The Job is defined before any measuring commences. The Job is linked to a Project which may contain any number of Jobs. Other miscellaneous (non-essential) data may be defined for the Job such as operator, field party etc.

As stated above, each Job is linked to a Project. The Project contains links to other components of the GEODB. The Project defines which Transformation Set and which Codelist (if any) will be used with a Job.

Codelists may be defined in the Codelist Manager and downloaded to the Controller. Codelists contain descriptions of points and may be attached to points during the time that the measurements are taken. More information on Codelists is available in the Codelist Manager Help.

Transformation Sets may be defined either in the Controller itself or in SKI and subsequently downloaded to the Controller. Transformation sets will mostly be used by Real-Time users. Further information is available in the SKI Help, the Technical Reference Help and in the Guidelines to Real Time Surveying Using RT-SKI.

Points refer to either user entered points or points recorded using Real Time GPS. They will mostly be used by Real Time users and will not concern users who are recording GPS data for post-processing. Lines are defined from Points are likewise only likely to concern Real Time users. Further information about Points and Lines is contained in the Technical Reference Help and in the Guidelines to Real Time Surveying using RT-SKI.

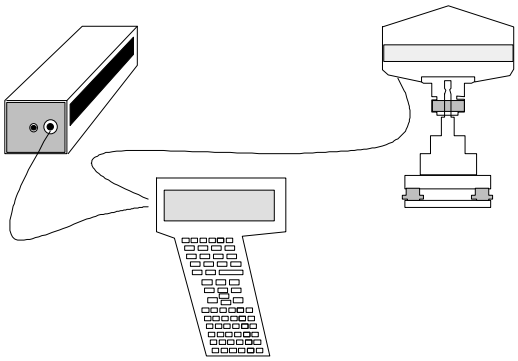
3 Setting Up the Equipment

To work through the exercises in this booklet set up the equipment outside when at least 4 satellites with good GDOP are available. Choose an open area with no obstructions. For survey work there is normally a reference station that observes throughout the satellite window and a roving receiver that moves from point to point.

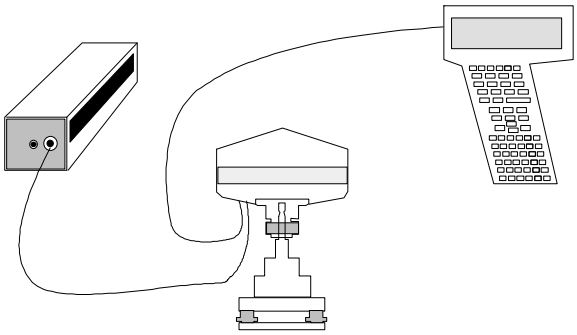
For the exercises you should set up two receivers a few metres apart. This will give you the opportunity to configure both a reference and a roving receiver.

Note that you must also insert a battery into a memory card before using the card for the first time. Instructions are provided with the card.

To set up the Sensors use either the stop/go kinematic pole plus quickstand, or tripods. Use the 1.8m cable to connect the battery to the Sensor or Controller. Use the 2.8m cable to connect the Controller to the Sensor.



Battery connected to Controller



Battery connected to Sensor

For further information See section 7.

You are now ready to commence observations.

4 Learning to use the equipment for surveying

The following exercises are designed to lead you quickly through the Controller and to familiarise you with the most important commands, displays, features, and settings.

For maximum benefit set up two sets of equipment a few metres apart. Use fully charged batteries. Work through the exercises exactly as presented using only the suggested keystrokes. In this way you will quickly learn how to use the equipment.

Although the exercises were designed primarily for the SR399 Sensor and CR333 Controller, they can also be used in conjunction with the SR260/SR261/SR9400/SR9500/SR399E Sensors and the CR344 Controller. The user should note however that small differences with the presented exercises will occur.

EXERCISE 1: Switch ON, format memory card, input time zone, configure keyboard, data logging and sensor type

Insert a memory card into each Controller.

Panel	*Action / Display*	*Key*
	Switch ON Leica GPS Testing hardware All hardware tests passed GPS System 200 (v3.30)	*ON* *ENTER*
Main Menu [0000]	Use arrow keys Toggle to AUXILIARY	 *CONT (F1)*
Auxiliary [0500]	Format memory card/module	*CONT (F1)*
Format Memory Card/ Inter Memory [0540]	Enter a label, e.g. Card 1 Note that F3 switches between MCARD and MMODULe Do you really want to format ? (Y/N) Formatting done. Format another ? (Y/N)	*CONT (F1)* *Y (Yes)* *N (no)*
Main Menu [0000]	Returned to main menu Toggle to Configuration	 *CONT (F1)*
Configuration [0200]	Toggle to Date, Time, Zone	*CONT (F1)*
Configuration Date, Time, Zone [0230]	Input your local time zone e.g., +3 or –7 etc. Do NOT change GPS Date and Time	*SET (F2)* *CONT (F1)*
Main Menu [0000]	Returned to Main Menu Toggle to Configuration	 *CONT (F1)*
Configuration [0200]	Toggle to Keyboard & Display	*CONT (F1)*
Configuration Keyboard/Display [0250]	Vertical arrows toggle from field to field Horizontal arrows toggle within field Toggle to and set: Keyclick OFF level MEDIUM Audio alarm ON level MEDIUM Illumination OFF level MEDIUM Illumination timeout 030 sec (min 5)	 *CONT (F1)*
Main Menu [0000]	Returned to Main Menu Toggle to Configuration	 *CONT (F1)*

Configuration [0200]	Toggle to Data Logging	*CONT (F1)*
Configuration Data Logging [0270]	Toggle using horizontal arrows Select MEMORY CARD (or INTERNAL MEMORY MODULE)	*CONT (F1)*
Main Menu [0000]	Returned to Main Menu Toggle to Configuration	*CONT (F1)*
Configuration [0200]	Toggle to Coordinate Type	*CONT (F1)*
Configuration Coordinate Type [0280]	Select WGS 84 GEODETIC	*CONT (F1)*
Main Menu [0000]	Returned to Main Menu Toggle to Configuration	*CONT (F1)*
Configuration [0200]	Toggle to Sensor Type	*CONT (F1)*
Configuration Sensor Type [0290]	Select the Sensor and Antenna according to which Sensor is connected	*CONT (F1)*
Main Menu [0000]	Returned to Main Menu Switch off	*OFF*

Notes:

A memory card must be formatted before using it for the first time. The optional 1MB internal memory module will normally be formatted when you receive the equipment.

Input your time zone. Local times will now be shown correctly.

The Date and Time shown in panel [0230] are in the GPS reference time frame. Do NOT change. Under normal circumstances the GPS Date and Time should always be correct.

- Chose keyclick ON or OFF as you prefer.
- Set illumination OFF during day to preserve battery power.
- Set illumination ON at night (the display becomes illuminated when any key is touched).
- Illumination goes out XX seconds after last keystroke.

The correct Sensor type must be configured. If the wrong Sensor type is configured, warning messages will appear during the mission start up sequence and when the mission is started, there will be no communication between Sensor and Controller.

Run through exercise 1 with each set of equipment.

EXERCISE 2: Running the Static Survey Default mission

A mission is comprised of a set of parameters and commands. When a mission is run the Controller steers the Sensor and sets the equipment to observe and record in a specified manner.

When you receive the equipment there will be one stored mission, Static Survey Default. This mission is a factory–set (default) mission and cannot be deleted.

Before starting this exercise determine the latitude and longitude of your position to within approximately 2°. Also find out your height above sea level to about 1000 m.

Panel	*Action / Display*	*Key*
	Switch On GPS System 300	*ON* *ENTER*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to STSDEF Static Survey DEFAULT STS (If this is the only mission it will be highlighted)	*RUN/F1*
Current Mission [1000]	Displays information about selected mission	*CONT (F1)*
	"Please Wait" flashes	
Select Project/Job [1002]	Accept Default Project and Default Job	*CONT (F1)*
Set Operation [1021]	Horizontal arrows toggle between operation types Toggle to STATIC	*CONT (F1)*
Set Initial Position [1005]	Vertical arrows toggle from field to field Horizontal arrows toggle within field i.e., Last fix/User input, N/S, E/W Toggle Use to USER INPUT Input approx.Lat, Lon,Hgt	*CONT (F1)*

Set Satellite Tracking Control [1006]	Vertical arrows toggle from field to field Hz arrows toggle Health/L2 mode to AUTO<>USER Toggle Health/L2 mode to AUTO Accept minimum elevation 15°	*CONT (F1)*
Set Data Collection Parameters [1101]	Vertical arrows toggle from field to field Horizontal arrows toggle within field Toggle to COMPACTED Min sats for recording: input 4 Obs. rec.–rate stat.: toggle to 15secs	*CONT (F1)*
Set Stop–Go Parameters [1103]	Accept the default settings: Baseline length approx. 10 km Stop at 100% NO Maximum recording time 60 min Stop at maximum time NO These setting have no influence on the observations	*CONT (F1)*
Set Point Id Parameters [1104]	Accept the default settings. These setting have no influence on the observations	*CONT (F1)*
"Please Wait" flashes		
Survey [1110]	You are now in the main surveying panel Press MEAS to start observations	*MEAS (F1)*
Message: "Measuring– check your input" is displayed		

You have now been through the complete start up sequence on the Controller. The equipment should start to track satellites within a minute or so. All of the observation parameters have been viewed and set. You will see how many satellites are being tracked, the number of measurement epochs that have been recorded, and the current GDOP.

Wait until the equipment is tracking all available satellites. This is shown in the Status Field, e.g., 3 of 3, 4 of 4, 5 of 5 etc. Let it track for about 5 minutes and study the main Surveying panel [1110]. The title line displays the selected mission code. You can toggle to edit and input point identification, height reading and antenna offset, and point attributes while observations are in progress. Try entering values in the appropriate input fields. These options will be fully discussed later in this booklet.

After you have let the Sensor track for a few minutes and after you have finished editing the Survey panel press STOP (F1). A message asks if you want to "Stop measuring ? (Y/N)". Confirm with Y (yes). The observations will stop, and you have a final chance to edit the point identification, height reading and antenna offset, and point attributes. Now press REC–PT(F1) to record the point information in the panel.

Finally press EXIT–M (F2) to exit the mission. The message "Exit mission ? Sure ? (Y/N)" appears. Confirm with Y (yes). You are back in the Main Menu. Switch OFF.

Run through exercise 2 with each set of equipment.

Note that with a CR344 Controller, Real Time Messages and NMEA messages can be configured. These are specialised settings for Real Time Surveying, details of which are contained within the Technical Reference Help and the Guidelines to Surveying using RT-SKI. For the exercises presented here simply accept the default values for these panels.

EXERCISE 3: Copying a mission

Exercise 2 showed how the Static Survey Default mission could be used for static survey observations. You had to view each panel and edit the initial position, data collection parameters etc. Many of the panels did not need editing and merely served to slow down the start–up procedure.

To speed up the procedure you can configure your own missions. This is done by taking a mission as a "template," copying it, and editing it.

In this exercise you will copy the Static Survey Default mission

Panel	*Action / Display*	*Key*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to: STSDEF Static Survey DEFAULT STS	*COPY (F3)*
Copy Mission [0130]	You will be presented with the following information: Source: STSDEF Type: STS Name: Static Survey DEFAULT Vertical arrows toggle from field to field Horizontal toggle type: STS/SGS/KIS/NAV/KOF (Note: CAP = capitals, SPC = space) Type in the following information: Target: STSTRY Type: STS Name: Static Survey Trial	*CONT (F1)*
Missions [0100]	STSTRY Static Survey Trial STS displayed in mission list	*ESC*
Main Menu [0000]	Returned to main menu	

Run through exercise 3 on the other equipment.
In exercise 4 you will edit Static Survey Trial.

EXERCISE 4: Editing a mission

When running Static Survey Default in exercise 2, you viewed each observation parameter and panel. Through mission editing you can set the observation parameters to your requirements and decide which panels should be displayed. In this exercise you will edit Static Survey Trial.

Panel	*Action / Display*	*Key*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to STSTRY Static Survey Trial STS Sensor Connected? (Y/N)	 *EDIT (F4)* *N (No)*
	"Please Wait" flashes	
Current Mission [1000]	Displays information about Static Survey Trial. Some information about the current mission will be displayed. You can ignore this for now. Configuration: Display panel Toggle to YES This panel will be displayed when mission is run.	 *CONT (F1)* *CONT (F1)*
Select Project/Job [1002]	Accept Default Project and Default Job	*CONT (F1)*
Set Operation [1021]	Horizontal arrows toggle between operation types Toggle to STATIC Toggle display panel to YES	 *CONT (F1)* *CONT (F1)*
Set Initial Position [1005]	Toggle to USER INPUT Input approx.Lat, Lon,Hgt Toggle display panel to YES	 *CONT (F1)* *CONT (F1)*

Set Satellite Tracking Control [1006]	Health and L2 mode: Toggle to AUTO Minimum elevation 15° Toggle display panel to NO This panel will not be displayed when mission is run	 *CONT (F1)* *CONT (F1)*
Set Data Collection Parameters [1101]	COMPACTED Toggle Obs. rec.–rate stat. to 15 secs Display panel to YES	 *CONT (F1)* *CONT (F1)*
Set Stop–Go Parameters [1103]	Input the following settings: Baseline length approx: 5 km Stop at 100% NO Maximum recording time: 60 min Stop at maximum time: NO Display panel to NO	 *CONT (F1)* *CONT (F1)*
Set Point Id Parameters [1104]	Accept default settings Display panel to NO Message: "Store new mission parameters ? (Y/N)"	*CONT (F1)* *CONT (F1)* *Y = Yes*
Missions [0100]	Returned to MISSIONS menu	*ESC*
Main Menu [0000]	Returned to MAIN MENU	

You have opted to display only the CURRENT MISSION, the SELECT/ENTER Project/Job, the SET Operation, the SET Initial Position, and the SET Data Collection Parameters panels. You set the minimum number of satellites for recording to 4. You also set the Health and L2 mode to AUTO. This is the recommended setting for all measurements (selecting USER allows override of satellite health and L2 settings but is not recommended).

Repeat exercise 4 with the other equipment, i.e., receiver No. 2. But at SET Initial Position toggle to Last Fix instead of User Input. i.e.,

SET Initial Position [1005]	Toggle to LAST FIX Display panel to YES	*CONT (F1)* *CONT (F1)*

You have already measured with receiver 2 in exercise 2. The sensor stored its last computed position. Thus it already has the initial position. Therefore you can use Last Fix.

EXERCISE 5: Running a mission in manual mode (RUN)

In exercise 4 you edited a mission named Static Survey Trial. Now run Static Survey Trialin manual mode with receiver 1.

Panel	*Action / Display*	*Key*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to STSTRY Static Survey Trial STS	*RUN (F1)*
Current Mission [1000]	Displays information about Static Survey Trial	*CONT (F1)*
"Please Wait" flashes		
Select Project/Job [1002]	Accept Default Project and Default Job	*CONT (F1)*
SET Operation [1021]	Type: STATIC	*CONT (F1)*
SET Initial Position [1005]	USER INPUT Check /inputapprox Lat, Long,Hgt	*CONT (F1)*
SET Data Collection Parameters [1101]	Compacted or sampled : COMPACTED Min. sats start recording : 4 Obs. rec.–ratestat. : 15 secs	*CONT (F1)*
"Please Wait" flashes		
Survey [1110]	You are now in main surveying panel Press MEAS to start observations	*MEAS (F1)*
Message: "Measuring – check your input"		

The equipment should start to track satellites within a minute or so. Note that it will only start recording data if at least 4 satellites are being tracked. Note how easy it was to run the mission. You had only to verify/edit the Project/Job, initial position, the operation type, and the data collection parameters.

Let the equipment track satellites. Enter the height reading and antenna offset. Try changing the point number. Press STATUS/F5 to see the satellite status, then return to the main surveying panel with ESC. Do not try anything else at the moment.

After tracking for a few minutes press STOP/F1.
Message "Stop measuring (Y/N)" appears.
Confirm with Y (yes).
Press REC–PT (F1) to record the point information in the panel.
Press EXIT–M (F2) to exit mission.
Message "Exit mission ? Sure ? (Y/N) " appears.
Confirm with Y (yes).
You are back in MAIN MENU [0000].
Switch OFF.

Repeat exercise 5 with receiver No. 2. Note that Initial Position [1005] is set to LAST FIX. Leave at LAST FIX and press CONT (F1). i.e.,

Set Initial Position [1005]	LAST FIX	CONT (F1)

You measured with receiver 2 in exercise 2. The Sensor stored its last position. Thus it has the initial position. Therefore you can use LASTFIX.

Notes on initial position

Use LAST FIX when working in the same area. The Sensor will start in fast–acquisition mode.

Use USER INPUT after moving several hundred kilometres or more to a new area. The Sensor will start in normal–acquisition mode.

If you select USER INPUT and the difference between LAST FIX and USER INPUT is less than 100 km the Sensor will once again start in fast acquisition mode. Otherwise, if this difference is greater than 100 km the Sensor will start in normal acquisition mode.

EXERCISE 6: Running a mission in automatic mode (AUTO)

In exercise 5 you ran the mission Static Survey Trial in manual mode. If you are sure that all parameters are correct you can simplify the procedure still further by running the mission in automatic mode. All observation parameters are automatically accepted and only the main surveying panel is displayed.

Panel	*Action / Display*	*Key*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to STSTRY Static Survey Trial STS	*AUTO (F2)*
"Please wait" flashes		
Survey [1110]	You are now in main surveying panel Press MEAS to start observations	*MEAS (F1)*
Message: "Measuring – check your input" is displayed		

Running a mission in automatic mode by–passes all panels. All pre–set observation parameters are accepted.

Repeat exercise 6 with receiver 2.

Finally:

After tracking for a few minutes press STOP/F1.
Message "Stop measuring (Y/N)" appears.
Confirm with Y (yes).
Press REC–PT/F1 to record the point information in the panel.
Press EXIT–M/F2 to exit mission.
Message "Exit mission ? Sure ? (Y/N) " appears.
Confirm with Y (yes).
You are back in MAIN MENU [0000].
Switch OFF.

EXERCISE 7: Deleting a mission

You can delete a mission as follows.

Panel	*Action / Display*	*Key*
Main Menu [0000]	Toggle to MISSIONS	*CONT (F1)*
Missions [0100]	Toggle to STSTRY Static Survey Trial STS Message appears: Delete mission ? Sure ? (Y/N) As you will need Static Survey Trial again, do NOT delete it now. Press N Press ESC	*DELETE (F5)* *N (No)* *ESC*
Main Menu [0000]	Returned to MAIN MENU	

Note that you cannot delete the mission STSDEF Static Survey Default.

Note that you cannot delete a mission that you have chosen as the start–up mission. (See Technical Reference Help.)

EXERCISE 8: Viewing the Survey panel and entering information whilst measuring

Switch ON.
Run Static Survey Trial in either manual or automatic mode.
Press MEAS/F1 in panel [1110] Survey to start measuring.

Inspect panel [1110] Survey

Title line:

[1110]	SURVEY: STS ↓ Operation type	P[test] ↓ Project	M[STSTRY] ↓ Mission

Enter Point id: e.g. 123456abc
Up to 16 alphanumeric characters can be entered.

Enter Code: If Codelist has been downloaded from Codelist Manager.
Press CODE (F3)
Select Code from list.
Press CONT (F1)

Enter height reading and antenna offset:

If sensor is on tripod/tribrach/carrier
Ht. reading = Height hook reading at white line e.g., 1.435m
Ant. offset = 0.441m

If sensor is on 1.5m pole plus quickstand
Ht. reading = 1.500m
Ant. offset = 0.091m

See also Section 5.8

GDOP/PDOP: Strength of current satellite constellation given.

Status: [X of Y] sats
Y = number of satellites above minimum elevation angle
X = Number of satellites tracked

Epochs: Number of epochs recorded. Note: As you set min. sats. for recording to 4 in Static Survey Trial, the Controller will only record if 4 or more satellites are tracked.

INS key: Toggles from Insert to Overtype mode for alphanumeric input

EXERCISE 9: Viewing panel [1451] STATUS Satellites whilst measuring

You are in Survey panel [1110]. The equipment is measuring. Press STATUS/F5 to view panel [1451] and display the status of the satellites.

[1451] STATUS Satellites

Sat : Satellite number
S/N1 : Signal–to–noise ratio on L1 frequency
S/N2 : Signal–to–noise ratio on L2 frequency
Azi : Azimuth of satellite
Ele : Elevation of satellite

Press ESC or CONT(F1) to return to Survey panel [1110].

Note that with SR260/SR261 Sensors, only the L1 frequency is tracked. In addition to this, the SR260/SR261 will never track more than 6 satellites at any one time.

EXERCISE 10: Stepping through Surveying Menu whilst measuring

You are in the Survey panel [1110]. The equipment is measuring. Press MENU/F6 to enter [1310] SURVEYING MENU.

[1310]	SURVEYING MENU
	SET ENTER DISPLAY STATUS

Toggle to select , then press CONT(F1) to continue to sub–menu.
Toggle to select in sub–menu, then press CONT(F1) to continue.
Finally, press CONT(F1) to return directly to Survey panel [1110].
Or press ESC to step back one level/panel at a time.

CONFIG	Communication Port Keyboard and Display Units Sensor and Antenna Coding System	Allow you to check and edithe Controller setupwhilst in a mission. Certain parameterscan be changed whilst measuring if necessary.

SET	Sat. Track. Control Data Collect. Par. Stop–Go Parameters Point Id Parameters	Allow you to check and edit parameters whilst in a mission. Can be changed whilst measuring if necessary.

SELECT /ENTER	Project Job Point Line	Allow you to edit chosen Project/Job and edit/add existing/new points/lines whilst in a mission.
	Target Filter	(for Real Time Users). Allows you to filter Target points by coordinate system and/or Job. Can also filter out Lines from target list.
	Point Offset	Offsets to required point. Required point computed in SKI. Rarely required.

DISPLAY	Navigated Position	Local date, time and time zone Latitude, Longitude, Height (ellipsoidal) GDOP or PDOP
	Target Course	Target Id and Code (if any). Bearing (with respect to geo north), distance and height diff to target.
	Course	Current bearing, speed, distance and time between GPS fixes.
	Date, Time, Zone.	Time zone (set in configuration), Local date and time, GPS date and time.
	Sat Health	Satellite number and health

STATUS	Satellites	See exercise 9	
	Tracking	Chan: Sat: Mode: S/No: Q.I.: Key L1/L2/F3 Key SATS	Channel 01 to 09 Satellite number SH = search SY = synchronization TD = taking L1 data TC = taking L2 data via code CO = coasting/lost signal Signal–to–noise ratio Signal quality indicator Toggles display L1 to L2 Toggles to STATUS Satellites
	Data Logging	Device: Bytes total: free: Obs. mode: Rec. rate: Epochs	Memory card/internal memory Total capacity (KB) Free space (KB) COMPACTED/SAMPLED Recording rate (1 to 60 sec) Number of epochs recorded
	Stop–Go Indicator		See exercise 11
	Battery / Voltage		Displays battery voltage levels Low ********* High
	Sensor Settings		Sensor info. / factory settings

Signal–to–noise ratio	S/N1 (L1)	S/N2 (L2) code
Sat elevation > 70°	about 48 to 50	about 46 to 48
Sat elevation 15° to 20°	about 35 to 40	about 33 to 40

Signal Quality Indicator
Should be 80 to 99. If < 80 cycle slips are likely

Note that the SR260/SR261/SR9400 Sensor will display L1 information only and that the Stop Go Indicator is not available.

EXERCISE 11: The Stop–Go Indicator

The Stop - Go Indicator is only available with the SR299/E, SR399/E and the SR9500. If the SR260/SR261/SR9400 Sensor is being used, the Stop/Go Indicator will not be available.

In static survey mode two or more receivers track the same 4 or more satellites simultaneously. It is often convenient to have one receiver – the reference – observing continuously while the other(s) – the rover(s) – moves from point to point.

On short lines, with at least four satellites and good GDOP, it is possible to achieve high accuracy (resolve ambiguities) with only 5 to 10 minutes of observations. The term Rapid Static is used to describe short observation times with the rover moving quickly from point to point.

Section 5.2 provides a guide to measuring times for baselines of different lengths under different satellite constellations.

The Stop–Go Indicator in the Controller provides the operator of the roving receiver with an approximate guide to measuring times. It indicates when sufficient observations should have been taken for successful post–processing (ambiguity resolution) to be successful.

To try the Stop–Go Indicator choose a time when at least 4 satellites with GDOP <8 are available. Then try the following exercise:

EXERCISE: Stop–Go Indicator

Switch ON. Run Static Survey Trial in either manual or automatic mode. Do NOT press MEAS yet! See below.

Panel	*Action / Display*	*Key*
Survey [1110]	Survey panel Do NOT press MEAS yet!	*MENU (F6)*
Survey Menu [1310]	Toggle to SET	*CONT (F1)*
Set [1311]	Toggle to Stop–Go Parameters	*CONT (F1)*
Set Stop–Go Parameters [1103]	Check parameters that were set in exercise 4 when editing Static Survey Trial. Baseline length approx. : 5 km Stop at 100 % : NO Maximum recording time 60 min Stop at maximum time : NO	*CONT (F1)*
Survey [1110]	Returned to Survey panel Now press MEAS to start recording Press MENU for SURVEYING MENU	*MEAS (F1)* *MENU (F6)*
Survey Menu [1310]	Toggle to STATUS	*CONT (F1)*
Status [1314]	Toggle to Stop–Go Indicator	*CONT (F1)*
Status Stop–Go Indicator [1455]	Inspect panel as equipment measures. Amount completed Increases to 100%. Stop : NO Time to go : Decreases to 0 Time elapsed : Total obs. time mm:ss Max.rec.time set : mm:ss Stop : NO Wait until Done ≥ 100 % and Time to go = 0:00 min. Sufficient obs. now taken.	*CONT (F1)*
Survey [1110]	Returned to Survey panel Stop measuring ? (Y/N) Stop and Record Exit mission ? Sure ? (Y/N)	*STOP/F1* *Y (Yes)* *REC–PT (F1)* *EXIT–M (F2)* *Y (Yes)*
Main Menu [0000]	Returned to MAIN MENU	

Note that the Stop-Go Indicator may be also accessed by selecting STATUS (F5) from the Survey Panel [1110] and then SG-IND (F5) in panel [1451].

Explanation of Stop and Go Indicator

The Stop–Go parameters in panel [1103] can be entered/edited in several different ways:

1)When editing a mission (exercise 4);
2)When RUNning a mission (exercise 2); or
3)Via the Survey Menu (exercise 11).

The following four Stop–Go Indicator parameters can then be set :

Stop–Go Indicator Parameter	Action / Explanation
Baseline lengthapprox	Enter 5 for lines between 0 and 5 km in length. Enter 10 for lines between 5 and 10 km in length. Does not apply for lines > 10 km.

Stop at 100 %	Toggle between YES and NO.
	If you answer YES – when 100 % is reached you are returned to the main survey panel [1110] – measurements are stopped automatically.
	If you answer NO – when 100 % is reached the equipment will continue to measure. – no message is issued.

Maximum recording time	You can enter any integer number between 1 and 999 minutes. Alarm will sound and message appears when max recording time reached. Measurements continue until STOP is pressed.

Stop at maximum time	Toggle between YES and NO.
	If you answer YES – when 100 % is reached you are returned to the main survey panel [1110] – measurements are stopped automatically.
	If you answer NO – the equipment will continue to measure. – the message "Maximum recording time reached" will be displayed.

Panel [1455] STATUS Stop–Go Indicator

The Stop–Go Indicator involves two information panels. When you first enter the Stop–Go Indicator you go directly into the first panel. To access the second panel you press NEXT (F5). Subsequent pressing of F5 toggles you between the two panels.

Type	STS POINT Static Survey point SGS INITIAL POINT Stop & Go Survey initial point SGS MOVING Stop & Go while moving SGS SUBSEQUENT POINT Stop Go subsequent point KIS INITIAL POINT Kinematic Survey initial point KIS MOVING Kinematic survey while moving (SGS/KIS: only apply for Stop and Go and Kinematic operations)
Amount completed	Increases from 0 % to 100%. When 100% reached, sufficient observations should have been taken for an accurate result (ambiguity resolution).
Time to go	Time to go (in minutes and seconds) until Amount completed = 100 %.
Time elapsed	The time (in minutes and seconds) for which observations have currently been recorded. Increases continuously.
Max.rec. time set	The maximum recording time that was set by the user (will be ignored if Stop = NO).
No. of sats L1/l2	The number of satellites on L1 at the current epoch. The number of satellites on L2 at the current epoch.
Cycle slips L1/L2	Total number of cycle slips on L1 up to current epoch. Total number of cycle slips on L2 up to current epoch.

Current GDOP	The GDOP at the current epoch.
Limit	GDOP limit = 8. Fixed value. Calculations for "Amount completed" and "Time to go" are only performed when the current GDOP ≤ 8.
Obs. rec.–rate	The rate at which observations are being recorded (in seconds). See exercises 2 and 4.
Epochs recorded	The total number of epochs recorded. Increases continuously.

The Stop–Go Indicator estimates the required time for sufficient data to be collected for an accurate result (ambiguity resolution) to be obtained during post–processing. The estimate is based on the number of satellites, the GDOP, the baseline length, and the recording rate. The following table provides an approximate guide to the Stop–Go Indicator's estimate.

Input in panel [1103]	Baseline length in km	Number of satellites	GDOP max = 8	Time required for "Amount completed=100%" at 10 sec rec rate
5	0 to 5	5	max 8	5 minutes
5	0 to 5	4	max 8	> 5 minutes
5	0 to 5	6	max 8	< 5 minutes
10	5 to 10	5	max 8	10 minutes
10	5 to 10	4	max 8	> 10 minutes
10	5 to 10	6	max 8	< 10 minutes

Estimates are calculated for two baseline ranges only — 0 to 5 km and 5 to 10 km. Thus enter only 5 or 10 in panel [1103].

Estimates are not calculated for baselines over 10 km.

Estimates are not calculated when the GDOP exceeds 8.

Note that the Stop–Go Indicator only provides an estimate of recommended measuring times for the SR399/E and SR9500. It is a guide. The equipment does not stop measuring when "Amount completed = 100 %" (unless you have set the "Stop at 100 %" option to YES). You can continue measuring or you can stop and record.

EXERCISE 12: Point Identifier (point number)

Up to 16 alphanumeric characters can be entered for the point identifier. You can enter the point id. in the Survey panel [1110] whilst the equipment measures. You can define a numeric part of up to 9 digits. This numeric part can be set to increment automatically.

For static and rapid static surveys you may not need to define a special template for the point id. You will probably enter the required point id. for each point.

However, and particularly for Stop and Go or Kinematic surveys, you may find it useful to define a template with an automatically incrementing numeric part for the point id.

You can define the point id. parameters from several different locations in the Controller

1) When editing a mission (exercise 4);
2) When running a mission in manual mode (exercise 2); or
3) From the surveying menu (exercise 11).

Run the mission Static Survey Default in manual mode (RUN) exactly as in exercise 2. Inspect panel [1104] Set Point Id Parameters.

Panel	*Action / Display*	*Key*
Set Point Id Parameters [1104]	Point Id template: NNNNNN********** (N = numerical part, incrementing) (* = alphanumeric part, non–incrementing) Point number start position Point number increment: 1 Use auto increment: YES Cursor start position: 1	
Continue to run the mission		*CONT (F1)*

Survey [1110]	The 6–figure incrementing part of the point id. is set to start at 000001. You can enter another value e.g., 000123 The six–figure part will increment. For more details see section 5.3, exercise 13.	

Remaining functions and panels

Exercises 1 to 12 took you through the Controller's main functions and panels. You should now be able to use the equipment for normal survey purposes.

Many of the remaining functions and panels are self explanatory. For full details refer to the Technical Reference Help.

ALT–Key Combinations

The following short–cut key combinations are available. They can be very useful at times as they allow rapid access to several useful functions. There is no need to remember all of the alt–key combinations. If you can only remember Alt–h (which is the alt–key help panel) you will be able to view all available alt–key combinations.

Key	*Explanation*
ALT – H	Help for alt–keys
ALT – A	Audio alarm on/off
ALT – B	Battery status
ALT - G	Switches between coordinate systems (if transformation defined)
ALT – I	Illumination on/off
ALT – K	Keyclick on/off
ALT – L	Lock keyboard (when leaving equipment unattended)
ALT – U	Unlock keyboard
ALT – M	Message history (displays the last ten messages)
ALT – W	Warnings help (displays explanations of the more important warning messages)
ALT – +	Increases display contrast
ALT – –	Reduces display contrast

5 Notes on GPS Surveying

GPS surveying is a differential technique. Two receivers measure simultaneously and track the same satellites. Results are obtained by post processing with SKI. For convenience, one receiver is termed the reference and the other the rover. In SKI, baselines are computed from the reference to the rover.

The observation recording rate should be set to the same value at both the reference and the rover. It is advisable to set both the reference and the rover to either compacted or sampled.

5.1 Static and Rapid–Static Surveys

Both the reference and the roving receiver remain stationary until sufficient data has been collected for successful post–processing.

Static Surveys: This is the classical GPS survey method and is used on long lines. Observations may continue for several hours.

Rapid Static: On short lines, provided certain conditions with the Sensor are met, measuring times can be reduced to as little as 5 to 10 minutes. This has led to the term Rapid Static. In Rapid Static, the reference receiver will usually observe continuously through the observation window whilst the rover is moved from point to point.

Recommended observation parameters for both the reference and roving receiver for static and rapid–static surveys

	Static Surveys	Rapid–Static Surveys
	Long lines - 1 hour or more of observations	Short lines - 5 to 30 minutes of observations
	Reference and Rover	Reference and Rover
Health/L2 mode	AUTO	AUTO
Minimum elevation	15°	15°
Operation type	Static	Static
Compacted/Sampled	Compacted	Compacted
Obs. rec.–rate static	15, 30 or 60 secs	10 or 15 secs

The missions Static Survey Default and Static Survey Trial are suitable for static and rapid–static surveys. You can also create your own missions. After working through exercises in this booklet you should be well prepared for static and rapid-static observations.

5.2 Baseline lengths and times for Static and Rapid–static

The observation time required for an accurate result in post–processing depends on several factors: baseline length, number of satellites, satellite geometry (GDOP), the ionosphere etc. Ionospheric disturbances vary with time and with location on the earth's surface.

With the SR299, two minutes is the minimum observation time for rapid static with 5 or more satellites, rapid recording rates, and GDOP ≤ 8. This can suffice for very short lines. However, due to the levels of ionospheric disturbance, longer observation times will usually be required.

Note: Unless one is extremely restrictive, it is impossible to quote observation times that can be fully guaranteed. The following table provides a guide for the SR399/E and SR9500. It is based on our own experience in mid–latitudes under current levels of ionospheric disturbance.

No. of sats. GDOP ≤ 8	*Approximate baseline*	*Approximate observation time*	
		By day	*By night*
RAPID STATIC			
4 or 5	Up to 5 km	5 to 10 minutes	5 minutes
4 or 5	5 to 10 km	10 to 20 mins	5 to 10 mins
4 or 5	10 to 15 km	Over 20 mins	5 to 20 mins
STATIC			
4 or 5	15 to 30 km	1 to 2 hours	1 hour
4 or 5	Over 30 km	2 to 3 hours	2 hours

The Stop–Go Indicator also provides the operator of the roving receiver with a guide to measuring times.

Guidelines to observation times with the SR261 are given in the booklet "Notes on using the SR261 GPS Sensor and SKI-L1 software". Similar

guidelines for the SR9400 are available in the booklet "Notes on the SR9400".

Caution

Rapid fluctuations in the ionosphere can reach very high levels and are the main external factor limiting successful GPS surveying. The ionosphere's influence is 3 to 4 times more severe by day than by night and increases with the length of the line. The influence of the ionosphere also varies with time and with position on the earth's surface. Ionospheric disturbances can cause systematic errors in the phase measurements that can lead to results outside quoted specifications. The only way to counter ionospheric disturbances is to observe for sufficient time for successful post–processing to be possible.

On long lines over about 15 km observe for as long as possible (minimum 1 to 2 hours). It can be advantageous to observe long lines at night when ionospheric disturbances are less severe.

Note that these remarks apply to GPS surveying in general and not only to Leica GPS equipment.

5.3 Stop and Go surveys

In rapid–static surveys the rover occupies a point for about 5 to 10 minutes. It is then switched off and moved to the next point.

In Stop and Go surveys the rover remains switched on and lock to the satellites must be maintained whilst moving from point to point.

A Stop and Go chain comprises:

1) An initial rapid–static fix (for ambiguity resolution); and
2) A series of Stop and Go points (or subsequent points).

Recommended observation parameters for Stop and Go surveys

The reference receiver must be set to STATIC, the rover to STOP and GO. Both should be set to COMPACTED. The observation recording rate has to be the same at both receivers. Chose a recording rate of 3, 4, or 5 seconds.

	Reference	*Rover*
Health/L2 mode	AUTO	AUTO
Minimum elevation	15°	15°
Operation type	Static	Stop and Go
Compacted/Sampled	Compacted	Compacted
Min. sats. for recording	4	4
Obs. rec.–rate static	4 secs	4 secs

EXERCISE 13: Stop and Go survey

Choose a window with at least 4 satellites and good GDOP. Set up one sensor on a tripod/tribrach/carrier as a reference. Mount the other sensor on the 1.9 m Stop and Go pole as the rover. Use the mission Static Survey Trial.

Reference: Start the reference receiver by running Static Survey Trial in manual mode (RUN) as in exercise 5. Confirm that the following settings are correct. If they are not then edit them accordingly.

Panel	*Action / Display*	*Key*
Current Mission [1000]	Displays some information about the current mission. Ignore this panel.	*CONT (F1)*
"Please wait" flashes		
Select Project/Job [1002]	Accept Default Project and Default Job	*CONT (F1)*
Set Operation [1021]	STATIC	*CONT (F1)*
Set Initial Position [1005]	Confirm that the initial position approximately matches your actual location. Edit if necessary. See exercise 4.	*CONT (F1)*
Set Data Collection Parameters [1101]	Compacted or sampled : COMPACTED Obs. rec.–ratestat. : 4 secs	*CONT (F1)*
"Please wait" flashes		
Survey [1110]	Press MEAS to start observations Enter point id.: e.g., ref123 Enter height hook reading: e.g., 1.456m Enter antenna offset: 0.441m Let the reference continue to measure	*MEAS (F1)*

Rover: Put the pole in the quickstand or hold it firmly against an object such as a wall or a fence post. Start the rover by running Static Survey Trial in manual mode (RUN) as in exercise 5. Confirm that the following settings are correct. If they are not then edit them accordingly.

Panel	Action / Display	Key
Current Mission [1000]	Displays some information about the current mission. Ignore this panel.	CONT (F1)
	"Please wait" flashes	
Select Project/Job [1002]	Accept Default Project and Default Job	CONT (F1)
Set Operation [1021]	Toggle toSTOP-GO	CONT (F1)
Set Initial Position [1005]	Confirm that the initial position approximately matches your actual location. Edit if necessary. See exercise 4.	CONT (F1)
Set Data Collection Parameters [1101]	Compacted or sampled : COMPACTED Obs. rec.–rate static : 4 secs	CONT (F1)
	"Please wait" flashes	
Survey [1110]	Press MEAS to start observations. Note that the point id. is 000001 Enter the height of pole: 1.900 m Enter the antenna offset: 0.091 m Measure until you have enough observations for a rapid–static fix. See table in 5.2. Refer to Stop–Go Indicator. Stop measuring. Record. Point id. increments to 000002 Do NOT exit mission. Move to next point holding pole vertical, avoiding obstructions, maintaining lock on satellites. Place pole on next point. Press MEAS The point id. is 000002 Ht = 1.900 Ant offset = 0.091 m Wait for at least 2 epochs, i.e., 8secs Then stop and record. Move to next point, 000003. Continue in this way.	MEAS (F1) STOP (F1) REC–PT (F1) MEAS (F1) STOP (F1) REC–PT (F1)

Loss of lock: If a loss of lock message appears and as a result you are tracking less than 4 satellites, you must start a new chain.

Stop–Go Indicator: You can refer to panel [1455] STATUS Stop–Go Indicator for guidance (see Exercise 11). It shows:

1) SGS INITIAL POINT
2) SGS MOVING
3) SGS SUBSEQUENT POINT

Configuring your own missions: You used Static Survey Trial for both the reference and the rover. You may find it convenient to define two special missions: Stop and Go Reference, and Stop and Go Rover.

For more information, refer to the booklet "Guidelines to Stop and Go and Kinematic GPS Surveying".

5.4 Kinematic Surveys

In kinematic surveys the roving receiver is usually mounted on a moving platform such as a car. Kinematic surveys are similar to Stop and Go surveys except that after the initial rapid–static fix the rover moves continuously. In kinematic surveys, measurements are related to specific epochs. In Stop and Go surveys measurements are related to points.

For trial purposes you could again use the mission Static Survey Trial and simply set the required observation parameters. Alternatively you could define missions for Kinematic Reference and Kinematic Rover.

Recommended observation parameters for kinematic surveys:

	Reference	*Rover*
Health/L2 mode	AUTO	AUTO
Minimum elevation	15°	15°
Operation type	Static	Kinematic
Compacted/Sampled	Sampled	Sampled
Min. sats. for recording	4	4
Obs. rec.–rate static	1 sec	1 sec
Obs. rec.–rate moving	Does not apply	1 sec

Note that panel [1101] has an additional parameter for kinematic surveys.

Panel	Action / Display		Key
Set Data Collection Parameters [1101]	Compacted or sampled Min. sats start recording Obs. rec.–rate stat .ic Obs. rec.–rate moving	: SAMPLED : 4 : 1 secs : 1 secs	*CONT (F1)*

Obs rec–rate static is used for the initial rapid–static fix of the roving receiver. Obs rec–rate moving applies to the kinematic measurements and defines the interval at which recordings are made once the roving receiver is moving.

One could use 15 secs obs. rec.–rate stat. at the reference and the rover for the initial rapid–static fix. Once the rover starts to move one would have to reset obs. rec.–rate stat. at the reference to 1 sec to match the 1 sec obs rec–rate moving at the rover. The most convenient method is to set the same value, e.g., 1 sec, for obs rec–rate static at the reference and rover andobs rec–rate moving at the rover.

For more information, refer to the booklet "Guidelines to Stop and Go and KinematicGPS Surveying".

5.5 Kinematic On the Fly Surveys

Kinematic On the Fly surveys are used to achieve the same results as Kinematic surveys. The difference is that with a Kinematic On the Fly survey, the user does not have to occupy an initialisation point. It is possible to begin the Kinematic chain immediately upon acquisition of 5 or more satellites.

The procedure for activating a KOF mission is the same as for a Kinematic mission except of course that no static initialisation period is required. As soon as the MEAS button has been pressed, moving can commence.

Remember, SKI will only process KOF data if the AROF option is present within SKI. This is an extra option.

EXERCISE 14: Kinematic survey

Reference: Start the reference as in 5.3 (Stop and Go survey) but modify the observation parameters.

Rover: Start the rover as in 5.3 (Stop and Go survey) but modify the observation parameters. The rover must remain stationary for the initial rapid–static fix.

Panel	*Action / Display*	*Key*
Survey:KIS [1110]	Press MEAS for rapid–static fix. Check Stop– Go Indicator. After sufficient obs. have been taken STOP. Message appears "Stop measuring ? (Y/N) ?" RECORD the point. Point id shows "Ready for move!" Do NOT exit mission. Press MEAS to start kinematic chain. Point id shows "---- Moving ----" The rover/vehicle can now move. Recordings will be made every 1 sec. Stop the kinematic chain. Message appears "Stop measuring ? (Y/N) ?" RECORD the chain. Exit the mission. Turn off the equipment.	*MEAS (F1)* *STOP (F1)* *Y (Yes)* *REC–PT (F1)* *MEAS (F1)* *STOP (F1)* *Y (Yes)* *REC–PT (F1)* *EXIT–M (F2)* *OFF*

Loss of lock: If a loss of lock message appears and as a result you are tracking less than 4 satellites, you must start a new kinematic chain.

Stop and Go Indicator: You can refer to panel [1455] Status Stop and Go Indicator for guidance (see Exercise 11). It shows:

1) KIS INITIAL POINT
2) KIS MOVING

5.6 Compacted or Sampled?

The Sensor takes code and phase measurements every 0.1 second. If you set COMPACTED, the 10 measurements taken during a 1 second interval are compacted to form one measurement. Imagine that you set COMPACTED and a 15 secs observation recording rate: one compacted measurement will be recorded every 15 seconds.

If you set SAMPLED only one 0.1 second measurement will be recorded every 1 sec (if you have selected a 1 second recording rate).

The accuracy of a compacted measurement is slightly higher than that of a sampled measurement.

For static, rapid static, and Stop and Go surveys always use compacted measurements. For kinematic surveys, particularly if the vehicle accelerates, use sampled measurements. Compacted can be used for slow, constant movement.

5.7 Notes on the Reference Receiver

In GPS surveying all baselines are computed from the reference to the rover. Thus the reference receiver must function reliably.

Take extra care when choosing the site for the reference receiver:
- No obstructions above 15°;
- No radio transmitters in the vicinity; and
- Site free ofmultipath conditions.

Reliable 12V power supply must be guaranteed:
- Use a fully charged battery;
- Connect two batteries if necessary;
- Consider using a car battery; or
- Use a transformer (12V / 1A) connected to the mains power supply.

Sufficient recording capacity must be available:
- Use a newly formatted memory card;
- Use a controller with 1MB internal memory; or
- Consider using a PC with SPCS orMultistationsoftware.

5.8 Sensor height = height reading + antenna offset

The height of the Sensor above the survey point consists of the antenna offset and height reading. Both of these values are entered by the operator in the survey panel [1110]. The diagrams show the antenna offset and height reading for various standard set–ups.

Antenna offset

The antenna offset is the height of the antenna phase center above the point to which the height reading is made. It comprises the following:

1) Height of antenna phase center above base of Sensor;
2) Plus an amount attributed to one or more of the following; adapter, carrier, height hook.

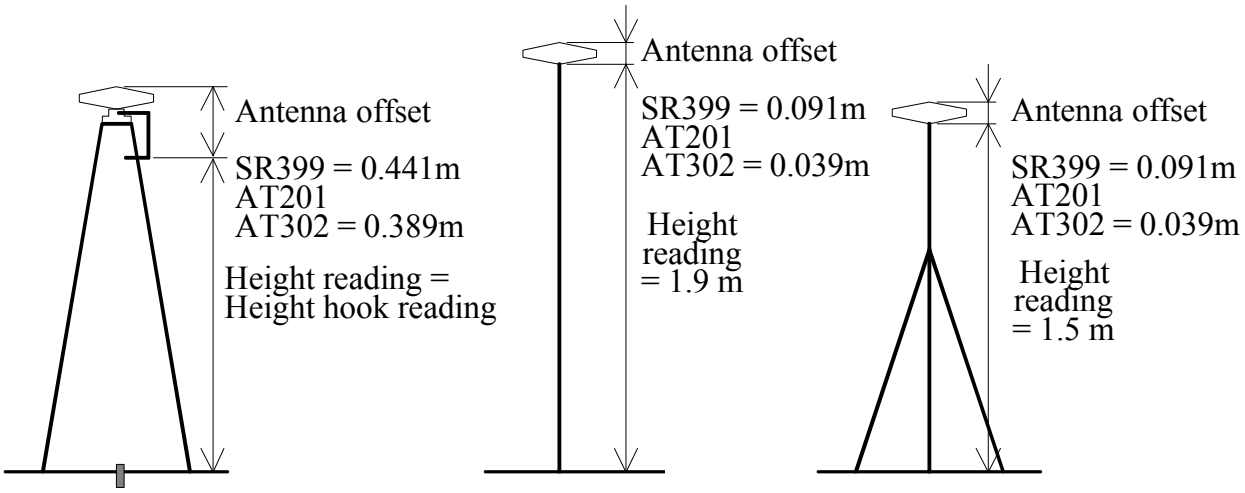
Provided the same type of set up is used at each point the antenna offset will be the same for each point.

Height reading

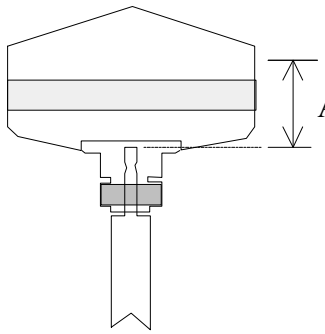
When the Sensor/Antenna is set up on a tripod, a tribrach, or a carrier, the height reading is the tape reading to the white line on the height hook.

When the Sensor/Antenna is mounted on a stop/go pole the height reading is the height of the pole (1.5 m or 1.9 m).

When the Sensor/Antenna is set–up on a pillar using a tribrach and carrier the height reading is the height from the pillar to the ledge of the carrier.



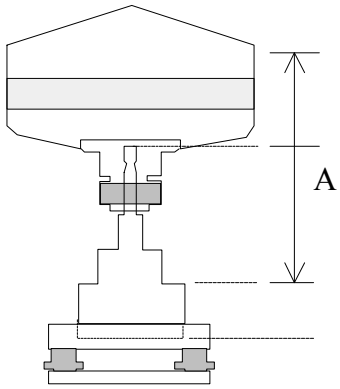
SR399, POLE, AND GRT44 MOUNT



Sensor mounted on stop/go kinematic pole.

Antenna offset A = 0.091 m

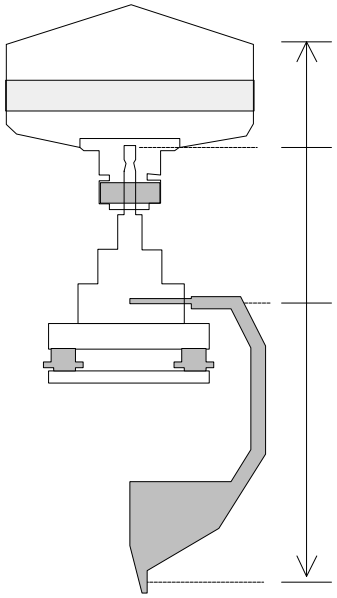
Height reading B = Height of pole (1.5m or 1.9m)



Sensor mounted on GRT44 carrier, for pillar measurement

Antenna offset A = 0.191

Height reading B = Height from GRT44 ledge to pillar

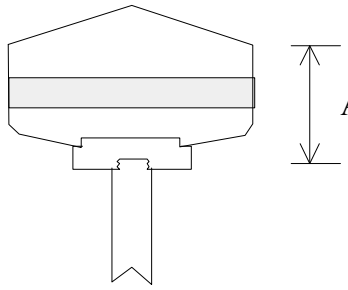


Sensor mounted on GRT44 for tripod set-up

Antenna offset A = 0.441

Height reading B = Height Hook reading

ADAPTER WITH 5/8 " THREAD

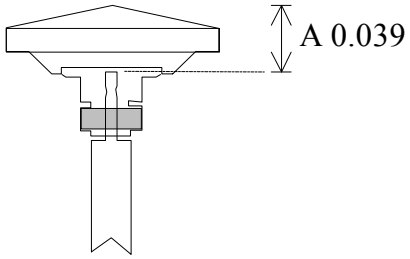


Sensor mounted on ranging pole.

Antenna offset A = 0.103

Height reading B = Height of pole

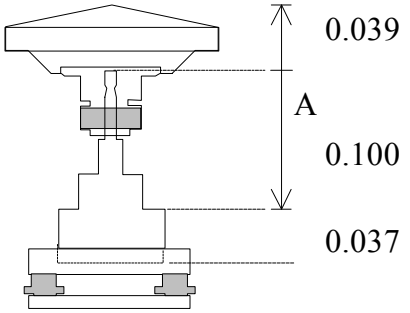
AT201/AT302, POLE, AND GRT44 MOUNT



Sensor mounted on stop/go kinematic pole.

Antenna offset A = 0.039 m

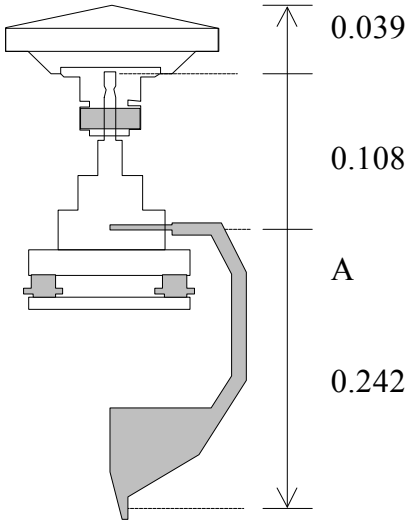
Height reading B = Height of pole (1.5m or 1.9m)



Sensor mounted on GRT44 carrier, for pillar measurement

Antenna offset A = 0.139

Height reading B = Height from GRT44 ledge to pillar

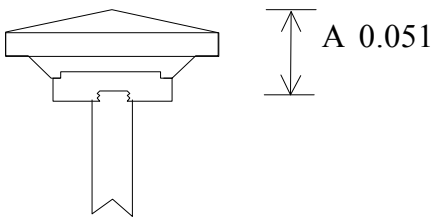


Sensor mounted on GRT44 for tripod set-up

Antenna offset A = 0.389

Height reading B = Height Hook reading

ADAPTER WITH 5/8 " THREAD



Sensor mounted on ranging pole.

Antenna offset A = 0.051

Height reading B = Height of pole

6 Navigation

Although the System 300 Sensors and Controllers are used mainly as survey receivers they can also be used for navigation. You can display navigated positions via the surveying menu whilst using the equipment in surveying mode

EXERCISE 15: Display navigated position via the surveying menu

Run the Static Survey Trial mission in manual or auto mode as in exercise 5 or 6.

Panel	*Action / Display*	*Key*
Survey [1110]	You are in the main surveying panel. Press MENU.	 *MENU (F6)*
Surveying Menu [1310]	Toggle to DISPLAY	*CONT (F1)*
Display [1313]	Toggle to "Navigated Position"	*CONT (F1)*
Navigated Position [1213]	Time loc. : date, local time, and time zone Latitude : latitude Longitude : longitude Height : ellipsoidal height DOP : GDOP or PDOP GDOP is displayed if 4 sats available. PDOP is displayed if 3 sats available. If GDOP exceeds 23, PDOP is displayed. The navigated position updates every second.	 *CONT (F1)*
Survey [1110]	Returned to main surveying panel.	

Note that the Target Course and Course can also be displayed by following the same procedure.

7 Notes on equipment

For full details, see appropriate equipment list.

7.1 Batteries, Chargers, and Battery Connections

Use the appropriate Leica 12v NiCd battery and corresponding charger. It should be possible to simultaneously connect two batteries to any particular combination of System 300 equipment at any one time. This will double the amount of time the user can utilise the equipment.

ChargingNiCd batterieswith GKL12/14 Charger

Set charger to 110V–115V or to 220V–240V according to mains / line supply.

A flat battery should be charged for 14 hours. Charge at ambient temperatures between 10°C and 30°C. Do not overcharge.

Press the red button on the GKL12/12–1 to start 14 hours charging time.

Use a timer with the GKL14 (commonly from electrical and DIY stores) to control the charging time.

ChargingNICd batteries with GKL23 Charger:

Newer GEB70 and GEB71 batteries with the appropriate 5 pin charging sockets (do not confuse with 5 pin Lemo socket for connecting to instrument) may be charged using the GKL23 charger. The charger automatically charges the battery for the correct length of time. See the charger instruction booklet for details.

Battery Connections:

Both the SR399 Sensor and CR333 Controller have two identical sockets. Any socket can be used when connecting a battery to the Sensor or to the Controller.The SR9500 is connected in a similar fashion.

For the SR260/SR261 sensor refer to the booklet "Notes on using the SR261 and SKI-L1". For the SR9400 refer to the booklet "Notes on using the SR9400."

The battery can be connected to either the Sensor or the Controller. Two batteries can be connected when observing for long periods — one at the Sensor and one at the Controller.

To change the battery without interrupting the power supply simply connect a fully–charged battery to the unused socket on either the Controller or the Sensor and then remove the used battery.

7.2 Attaching the Sensor to a Tripod or a Stop–Go Pole

For static and rapid–static surveys the sensor will normally be set up using either:

1)a tripod, a tribrach, and a GRT44 carrier; or
2)a 1.5 m or 1.9 m stop and go pole and a quickstand.

Attach the Sensor to the carrier or pole. Press the black button on the adapter and ensure that the Sensor falls securely into position. Release the black button. Tighten the black locking ring for extra security.

7.3 Orientation of the Sensor

Sensor orientation is not critical for normal survey work (when an accuracy of 1 to 2 cm suffices).

You need only orient the Sensor for precise control surveys and deformation surveys of the highest accuracy (5mm + 1ppm).

For this reason there are vertical alignment marks on both the Sensor and Antenna.

7.5 Memory cards

This section applies to Leica PCMCIA cards only.

Each memory card is supplied with a battery. Insert a battery before using the card for the first time. Instructions are supplied with the card.

To insert a battery

1) Place battery in holder with + (plus) side uppermost;
2) Insert holder into card;
3) Switch Battery lock to ON
4) Write the date on the card.

The memory card battery will last at least 6 months. The battery supports the memory — if it goes flat all data on the card will be lost.

Transfer any data from the card before changing the battery. Deactivate the battery lock, remove the holder, and change the battery.

If necessary, you can change the battery when there is data on the card by using the following procedure:

1)Insert the card into the Controller or the memory–card reader. Switch on the Controller or the reader. The card is now powered from the Controller or the reader;
2)Deactivate the battery lock and pull out the holder whilst keeping the card in the Controller or the reader; and finally
3)Change the battery as described above.

Formatting: The card must be formatted before using it for the first time.

Write/Protect Switch: The card has a write/protect switch located next to the battery lock. When set to ON, no data can be written to or erased from the card

Inserting card: Insert under the flap at the rear of the Controller. Keep the red arrow uppermost.

8 Checking the Controller Firmware Version

Firmware version 3.40 is the version implemented at the current time. Check the firmware version in the Controller as follows:

Panel	*Action / Display*	*Key*
Main Menu[0000]	Toggle to CONTROLLER SERVICE	*CONT (F1)*
Controller Service [0700]	Toggle to Factory settings	*CONT (F1)*
Controller Factory Settings [0711/0712]	Information about Controller hardware and software. Toggle forward and back with NEXT and PREV. Panel [0711] will show: Boot software Vers. No. X.XX System software Vers. No. X.XX Controller firmware Vers. No. X.XX Exit panel with CONT or ESC.	*CONT (F1)*

The system software is the internal operating software in the Controller.

The Controller firmware controls the user interface, i.e., the panels you see and the commands you use when operating the Controller.

From time–to–time new versions of the Controller firmware will be released. You can load a new firmware version from SKI. Installation instructions are in the SKIhelp.

9 Additional Precautions:

1)Do not change the memory card during measurements.
EXIT–Mission and then change the card.

2)Always EXIT–Mission correctly, i.e., wait until the display returns to the Main Menu [0000], before disconnecting the Controller from the Sensor.

By exiting the mission correctly you ensure that the equipment is properly initialised for the next start, next operation, or next mission. EXIT–Mission also switches off the Sensor.

10 Notes on Leica GPS Sensors

The Sensor can be steered by a Controller or by a PC running Leica's SPCS or WILD Base software.

The Sensor will normally start tracking satellites within 1 to 2 minutes.

If after 5 minutes the Sensor has not started to track satellites, check the GPS date and time (DISPLAY Date, Time, Zone), and the initial position (DISPLAY Navigated Position). Correct if necessary.

Leica Geosystems Inc.
GPS
CH-9435 Heerbrugg
(Switzerland)
www.leica.com

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