What's New! - Sensor Firmware Release v4.00

Important Notice!

Please find on the enclosed CD the installation files for the new Sensor firmware v4.00. The new Sensor firmware should be installed on all your Sensors immediately. This will ensure your System 500 is kept up to date.

Thursday, May 16, 2002 *Total no. of pages: 48*

1. About this release

What's New…

The System 500 Firmware v4.00 contains the following:



- Many exciting new features
- Additional functionality
- Improved and extended functionality
- And much more…

This firmware should be used with all Sensors in the System 500 product line. For details please refer to Section 2 of this document. Take your time to read the document carefully, there are a lot of new features!

Remember, this one firmware is for all Sensors – SR510, SR520, SR530 and RS500. Ensure you update all your Sensors with the new firmware!



Before installing the firmware, carefully read the instructions given in the Section 3 of this document on how to upload the new firmware.

Particularly take care to load the files in the correct order.

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About this release (continued)

A Summary of all the New Features…

The following features and improvements are present in this v4.00 firmware.

RTK Formats and Devices – New Functionality and Support for New Devices

- **Timeslicing**
- **SCAN- Functionality**
- **Reading the Radio Channel Direct from the Radio Modem**
- **Additional Radio Modem Device Supported**
- **Additional GSM Devices Supported**
- **Select the Closest GSM Reference station**

RTK Performance

- **CMR+ RTK Format**
- **RTK – Output Rate up to 10Hz**
- **Height Smoothing**

Auto Logged Points - New Functionality

- **Point Annotations for Auto logged Points**
- **Point Annotations for Auto logged Point via ASCII Input from any 3rd Party External Device**

Survey – New Functionality

- **Timed Start of Point Occupation**
- **Absolute Difference Check in addition to the Average check**
- **NEAR-key functionality - helps to find the closest point**
- **Enter a Vertical Offset, a Slope Distance and an Elevation Angle for Calculation of Hidden Points**
- **Enter a New Attribute to Attribute Choice List when Coding**

Stake-Out – New Functionality

- **NEAR-key Functionality - Find the Closest Point to Stake**
- **Remain in Stake-Out Application and continue Survey Work**

Point Manager – Improvement

- **Editing Point ID of Previously Measured Points**

Co-ordinate Systems – New Functionality

- **Use of Geoid Models and CSCS Models directly from PC-Card**
- **New Default Projection and US State Plane Zones**
- **New Default Ellipsoid ATS 77**
- **Distribution of Residuals during Determination of Co-ordinate System**
- **New Country Specific Co-ordinate Systems supported**
- **New Geoid Model Supported**

Data Transfer – New Functionality and Improvements

- **Transfer GSM Reference Station Data (Dial up numbers and positions) between Sensors**
- **Transfer of complete System RAM between Sensors**
- **Additional External Devices Supported**
- **Transfer ASCII/GSI to Job Improvements**

New Application and Application Improvements

- **New RoadPlus Editor Application**
- **RoadPlus Improvements**
- **RoadX Application Improvements**
- **COGO Improvements**

Miscellaneous

- **Improved Configuration Set Definitions**
- **Key to switch the Background Illumination on and off**
- **Define Reference Radio Channel via Hotkeys**
- **Activate or Deactivate the "Loss of Lock" beep**
- **New Power Fail Options**
- **New Interface: ASCII Remote**
- **Receive Leica, CMR (CMR+) messages on a GS50, SR510 and SR520**

2. New Functionality / Improvements

RTK Formats and Devices – New Functionality and Support for New Devices

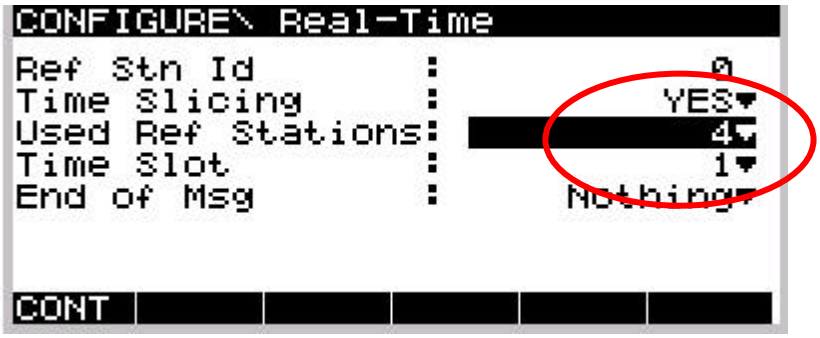
Timeslicing

New timeslicing functionality means that it is now possible to use up to 4 reference stations on the same radio channel at the same time. This is possible with all RTK data formats and all devices.

Simply define the number of reference stations to be used during the survey and assign a timeslot as to when that reference station should send the RTK message.

In order to access the new timeslicing functionality, the **Operation Mode** has to be set to **Advanced** (CONFIG and then 2 Operation and then 1 Operation Mode).

In the **CONFIGURE\ Real-Time** panel (CONFIG and then **4 Interfaces** and then **F3(EDIT)** the **Real-Time** interfaces), configure the sensor to be a reference and then press **F6(REF)** to access the panel shown below.



Select the **Time Slicing** field to be **Yes**.

Note, a different **Ref Stn ID** must also be entered for each reference station being used.

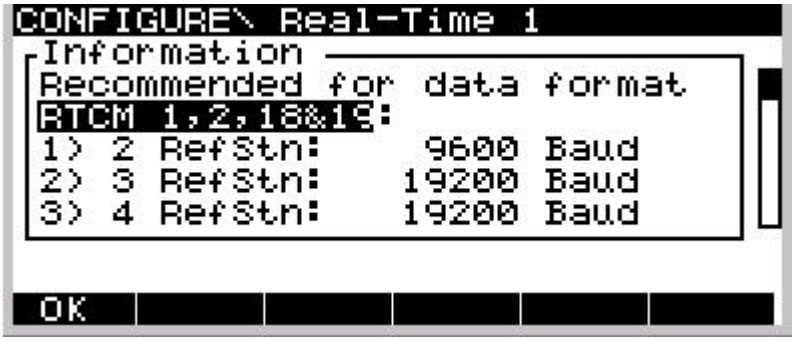
It is now possible to enter the number of reference stations to be used (up to 4 can be used) in the **Used Ref Stations** field.

The number of available **Time Slots** depends on the number of reference stations being used. As shown in the table below, the chosen time slot then determines the delay with which the RTK message is sent.

Used Ref. Stations	Timeslots	Time delay
2	1	0,00 sec
	2	0,50 sec
3	1	0,00 sec
	2	0,33 sec
	3	0,66 sec
4	1	0,00 sec
	2	0,25 sec
	3	0,50 sec
	4	0,75 sec

The use of the time slicing functionality is restricted depending on which RTK format is used and the baud rate with which the radio is transmitting RTK messages.

If an "illegal" time slicing configuration is defined, the sensor indicates to the user what configurations are allowed as shown below.



Refer to **Chapter 5.3.1** in the **v4.00 Technical reference** manual for a complete description!

On the rover the user must then choose from which reference station to receive RTK messages.

Access the **CONFIGURE\ Radio Channel** panel **(CONFIG** and then **4 Interfaces** and then **F5(CTRL)**) as shown below.



Here the **Ref Stn ID** of the reference station to be used can be entered. Obviously ensure that the rover is on the same radio channel as the reference station.

Refer to **Chapter 5.3.1** in the **v4.00 Technical reference** manual for a complete description!

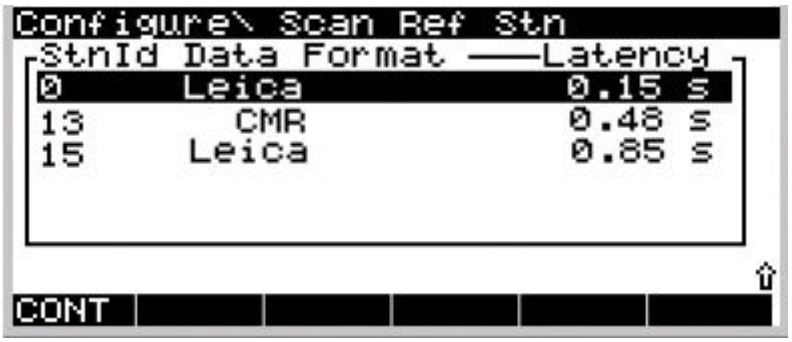
SCAN - Functionality

The new **SCAN** functionality provides a simple way to find out what reference stations are operating in the surrounding area.

Any reference stations operating on the **same** channel as the channel currently being used by the user's radio are detected. The Ref Stn Id, the format and latency of the transmitted RTK-message is shown to the user.

This new SCAN button is always available and can be used any time to check, what reference stations are being used in the area.

Activate the SCAN functionality by pressing **F5(SCAN)** in the **CONFIGURE\ Radio Channel** panel (compare previous picture). The radio channel currently being used is then scanned to determine what reference stations are being used in the area.



It is then possible to arrow up and down and to choose the reference station with which you wish to communicate. **F1(CONT)** then selects this reference station to be used, returns to the **CONFIGURE\ Radio Channel** panel and copies the selected Reference Station ID into the corresponding field.

Refer to **Appendix H** in the **v4.00** Technical Reference manual for a complete description!

Reading the Radio Channel direct from the Radio Modem

When accessing the **CONFIGURE\ Radio Channel** panel the sensor now interrogates the attached radio device and displays the radio channel to which the radio is currently configured.



This functionality is only possible for Satelline 3AS radio device, Pacific Crest RFM96W and PDL radio devices, and the Teledesign TS4000 radio device.

For other radios, as before, the channel displayed does not necessarily coincide with the actual radio channel.

Additional Radio Modem Device Supported

The following additional radio modem device is now supported. This device may be used with Real-Time, Remote, NMEA, ASCII Input or GSI/User Out Interfaces:

- **Teledesign TS4000**

This radio is not available directly from Leica and is not supported by a housing. Contact your local distributor for more information about this radio device.

Refer to **Appendix H** in the **v.4.00** Technical Reference manual for a complete list of supported Radio Modem Devices!

Additional GSM Device Supported

The following additional GSM Devices are now supported. These devices may be used with Real-Time, Remote, NMEA, ASCII Input or GSI/User Out Interfaces:

- **Siemens TC35**
- **Wavecom M1200 Series**

The Siemens TC35 GSM module (900/1800Mhz dual band) will replace the Siemens M20 during the next few months – the M20 is no longer

being produced by Siemens.

The new TC35 device can be connected via an external cable or can be purchased already integrated into a housing.

The article number for ordering a TC35 GSM module, integrated into a fitting housing, will soon be available.

The Wavecom M1200 Series is identical to the already existing WMOD2 model.

The M1200A should be purchased to be used in a 900/1800 MHz GSM networks whereas the M1210A should be purchased to be used in a 900/1900 MHz GSM network.

A housing for these new Wavecom models which fits to the Leica System 500 receiver can be ordered by the Article No.: **724643**.

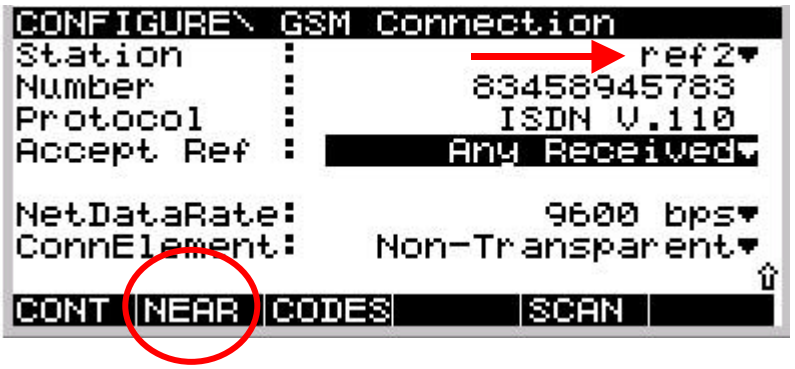
Refer to **Appendix H** in the **v.4.00** Technical Reference manual for a complete list of supported GSM Devices!

Select the Closest GSM Reference Station with which to connect

More and more countries now have an increasing number of permanent reference stations using GSM as the RTK data link. Normally, any of these reference stations can be dialled by a rover to receive RTK corrections.

However, it may not always be obvious to the user, which of the available reference stations is closest to the users current location. New functionality means that the sensor will help the user to choose the closest reference station.

In the **CONFIGURE\ GSM Connection** panel (**CONFIG** and then **4 Interfaces** and then **F5(CTRL)**) a new **F2 (NEAR)** key is available.

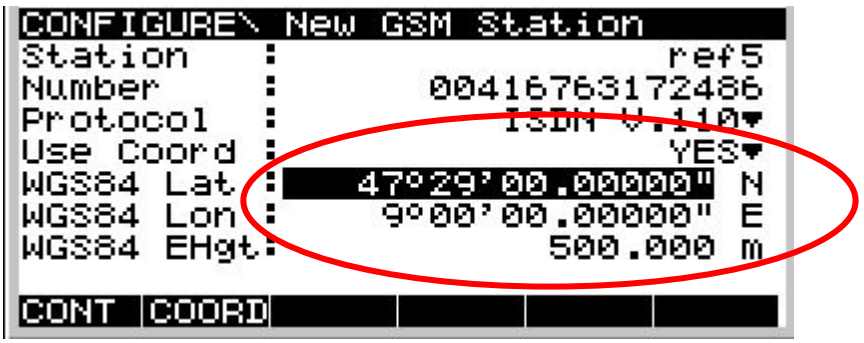


When this button is pressed the sensor chooses the closest reference station from the list of previously entered reference stations.

The name, number and protocol of the chosen reference station is then displayed.

To use this functionality, the user must have previously entered the WGS84 or local co-ordinates of the reference stations when entering the other information of the GSM reference station (the station name, number and protocol).

As with previous firmware, to enter and/or edit the GSM reference stations, press the **Enter** key on the **Station** line. A list of previously entered GSM reference stations is then displayed. In this panel, press **F2(NEW)** or **F3(EDIT)** to create a new or edit an existing GSM reference station.



With v4.00 firmware it is now also possible to enter the WGS 84 or local co-ordinates of the reference station.

Refer to **Appendix H** in the **v4.00 Technical Reference** manual for a complete description!

RTK-Performance

CMR+ RTK Format

It is now possible to receive and transmit the **CMR+** data format. This means an SR530 can be used in all combinations as a RTK reference station or RTK Rover with most other 3rd party GPS systems.

RTK Output Rate up to 10 Hz

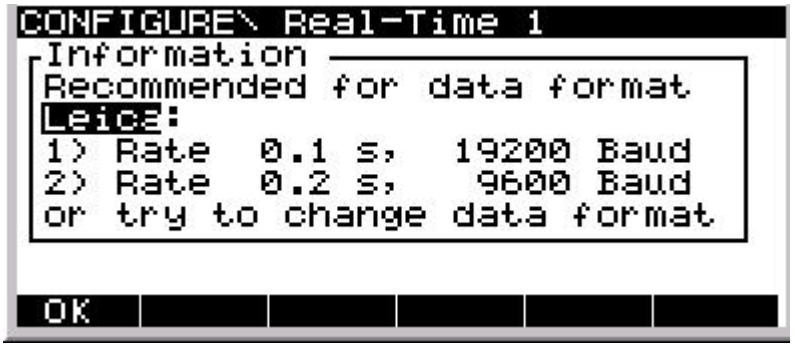
It is now possible to set the real-time data output rate on a reference up to 10 Hz (10Hz, 5Hz and 2Hz is now also possible). All RTK message types can be transmitted at these faster data rates. It was previously only possible to transmit RTK messages up to 1Hz.



Increasing the real-time data output rate may slightly increase the accuracy of positions computed on the rover.

On the rover it is recommended to maintain the use of prediction activated to maximum positional availability.

Depending on the baud rate of the device being used and the RTK message type being transmitted, it may not be possible to transmit RTK messages at data rates faster than 1Hz. The sensor will warn the user if an "illegal" data rate is selected.



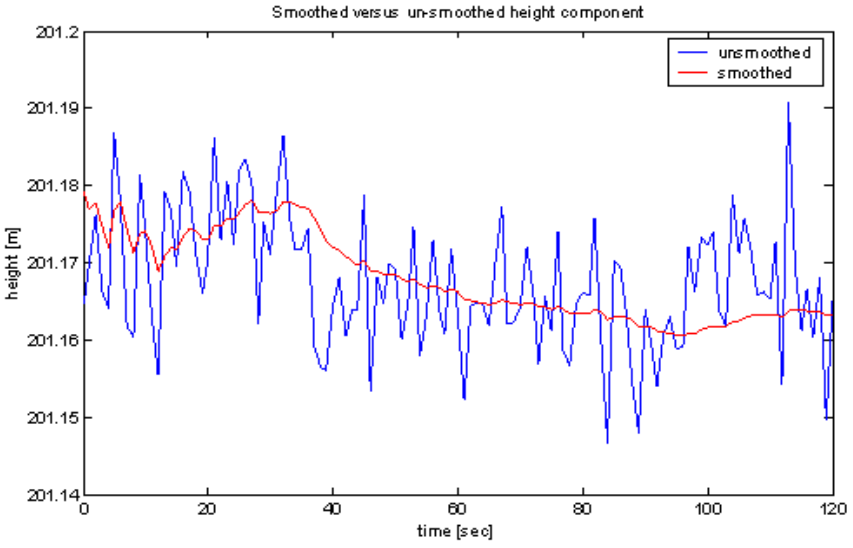
Note, increasing the rate at which RTK data is transmitted will increases the power consumption of the reference station.

Height Smoothing

As is well known, the height component of GPS computed positions is not as accurate as the horizontal component (refer to newsletter 00/16).

For some RTK applications such as machine control, it may be beneficial to use a more "stabilised" height, that is to apply some smoothing to the computed heights.

In the plot below, the blue (more "jagged" curve) shows "normal" or non-smoothed computed heights. The red (less "jagged" curve) shows the computed heights when "height smoothing" is activated.



With v4.00 firmware it is now possible to activate such height smoothing if required. Ensure the sensor is configured as a real time rover and working in **Advanced** operation mode.

In the **CONFIGURE\ Position** panel (**CONFIG** and then **1 Survey** and then **1 Position**) the **SHIFT F4(FILT)** button is available.



Press this button to access the **CONFIGURE\ Filter** panel.



In this panel it is then possible to activate the height smoothing filter.

If activated, height smoothing is then applied to all computed heights (WGS84 heights, local heights and NMEA output).

Refer to **Chapter 5.4.1** in the **v4.00 Technical Reference** manual for a complete description!

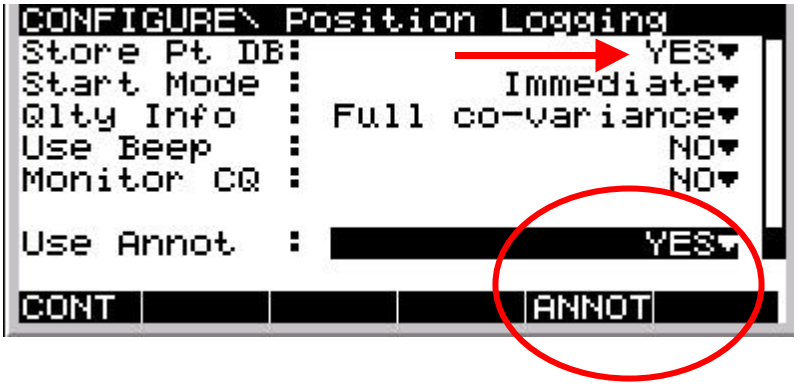
Auto Logged Points – New Functionality

Point Annotations for Auto Logged Points

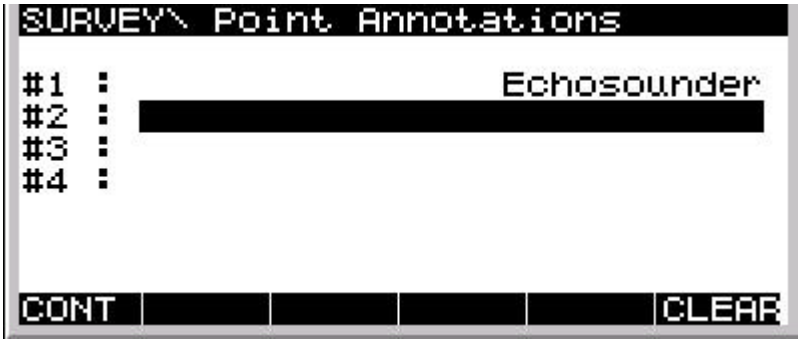
With v4.00 firmware it is now possible to store Point Annotations also for Automatic Logged Positions (with previous firmware it is only possible to store annotations for "normally occupied points").

In the **CONFIGURE\ Position Logging** panel (**CONFIG** and then **2 Operation** and then **3 Logging**) ensure to set **Store Pt DB** to **Yes.**

An additional line is then available to choose whether to store annotations with the auto logged points. If **Use Annot** is set to **Yes** then a new **F5(ANNOT)** button is available.



Pressing **F5(ANNOT)** accesses the **SURVEY\ Point Annotations** panel.



The annotations can be entered here which should be stored with each auto logged point.

All auto logged points which are now recored during the survey will have the same annotation until changed.

Note, point annotations which are entered as usual via the **F5(ADD)** button during the survey are only recorded the "normally" occupied points (this is the same behaviour as exisiting functionality)

Refer to **Chapter 5.4** in the **v4.00 Technical reference** manual for a complete description!

Point Annotations for Auto logged Points via ASCII Input from any 3rd Party External Device

In v3 firmware, it was possible to attach a 3d party device to the sensor and record the ASCII data sent from this device as a point annotation.

This was particularly useful for example to survey a lake by attaching a depth sounder to the sensor. It was then possible to measure points across the lake and at the same time measure the

depth of the lake at these positions with the depth sounder. The depth reading was then automatically stored as an annotation to this point. However, this required the user to repeatedly press **F1(OCUPY)** in order to measure points.





It is now possible to store these depth sound readings (or any other ASCII data coming from any other device) to auto logged points – the user no longer has to repeatedly press **F1(OCUPY)**.

To store ASCII data from a 3rd party device as annotations to auto logged points, the **Use Annot** line in the **CONFIGURE\ Position Logging** panel should be set to **Yes** as described above.

In addition, the **ASCII Input** functionality should be configured as described in the v3 firmware release notes or as described in the Technical Reference Manual.

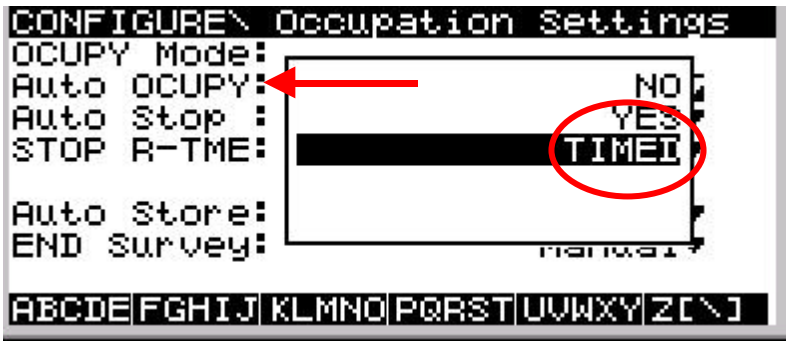
Refer to **Chapter 9.12** in the **v4.00 Technical Reference** manual for a complete description!

Survey – New Functionality

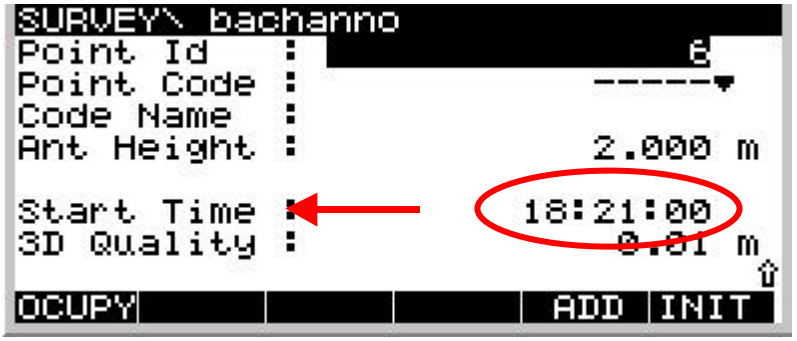
Timed Start of Point Occupation

Some local survey procedures require that the occupation of certain points should begin at specific times. With v4.00 firmware this now is possible (note this is in addition to the existing Wake Up functionality).

In the **CONFIGURE\ Occupation Settings** panel (**CONFIG** and then **2 Operation** and then **2 Occupation Settings**) select the new option **TIMED** as the **Auto OCUPY** mode to activate the new functionality.



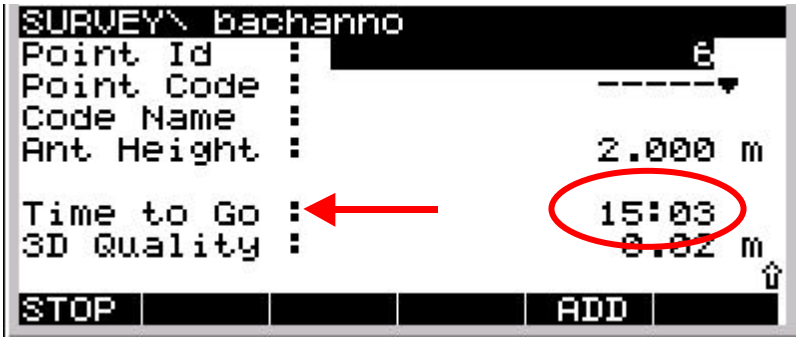
Within the normal **SURVEY\ Job Name** panel survey a new line appears – **Start Time** and the current local time is diplayed.



It is now possible to enter the specific time at which the point occupation should start.

Then press **F1(OCUPY)** in order to start the countdown towards the point occupation.

The time to go until the point occupation begins is now displayed.



Once the required time is reached (the counter is at zero), then the point occupation begins and the **Time at Point ID** line indicates for how long the point has been occupied.



Once the point is stored, the **F1(OCUPY)** button is again available and the **Start Time** line is shown again. The time for the next point occupation can then be entered.

Refer to **Chapter 7** in the **v4.00 Technical Reference** manual for a complete description!

Absolute Difference Check in addition to the Average check

In addition to the existing Average Difference check functionality (when a point is measured twice or more with the same point ID a check is made on the co-ordinate difference between these points and the average of these points), it is now also possible to check the absolute co-ordinate difference between two GPS measured points.

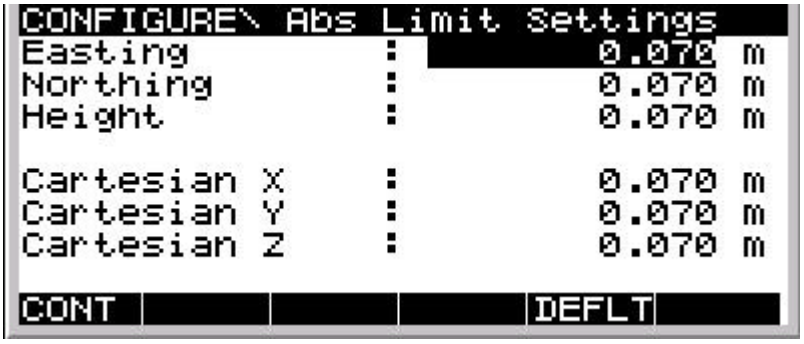
Similar to the Average Difference check it is possible to enter threshold values for the Absolute Difference check. When the second point is measured and stored, a check is made to see if the difference in co-ordinates exceeds the threshold limits.

In the **CONFIGURE\ Threshold Settings** panel (**CONFIG** and then **1 Survey** and then **6 Point…** and then **1 Threshold Settings**) a new line allows the user to select if the **Average** or **Absolute** difference mode should be activated.



If the **Abs** difference check mode is chosen then a new **F6(ABS)** is available.

Pressing **F6(ABS)** accesses the **CONFIGURE\ Abs Limit Settings** panel.



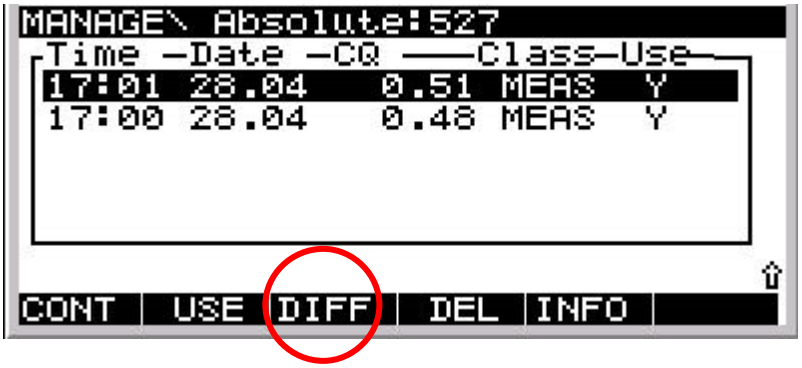
Here the absolute difference threshold limits can be entered (both WGS84 Cartesian and local grid absolute differences can be checked). **F5(DEFLT)** resets all limits to 70mm.

Note, it is still possible at any time during the survey to switch between the absolute and average difference check modes.

When any point is occupied and given the same point ID as a previously measured point a check of the absolute differences between the coordinates of the two points is made.

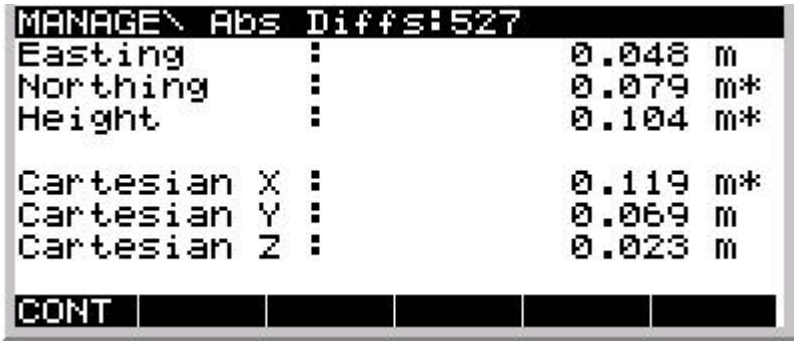
If the co-ordinate differences are less than the threshold settings then the usual message **"2 measurements on point"** is displayed. Additionally the new **F2(ABS)** button is available – pressing this button accesses the **MANAGE\ Absolute: Point ID** panel (described below).

If any of the co-ordinate differences are greater than the threshold settings then the usual message **"Point out of absolute limit"** is displayed and the **MANAGE\ Absolute: Point ID** panel is automatically accessed.



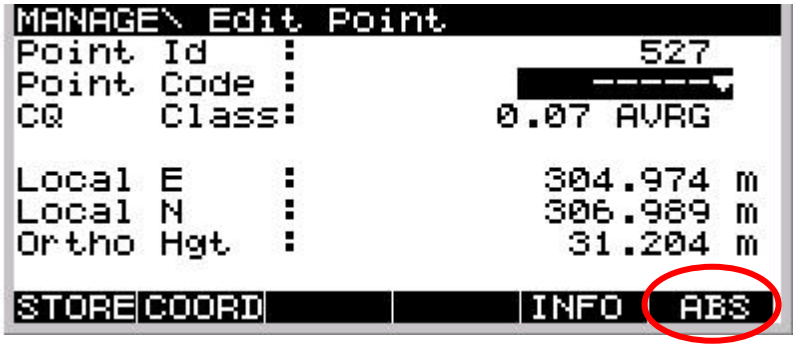
This panel is very similar to the existing **MANAGE\ Average: Point ID** panel where the individual measured points can be turned on or off or can be deleted.

If the **USE** status of two points is set to **YES** then a new **F3(DIFF)** button is available. Pressing this button leads to the co-ordinate differences panel.



The co-ordinate differences, exceeding the configured threshold limits, are flagged by an asterisk.

Note, the **MANAGE\ Absolute: PointID** panel also can be accessed through the point manager functionality when editing the point which has been measured more than once by pressing the **F6(ABS)** button.



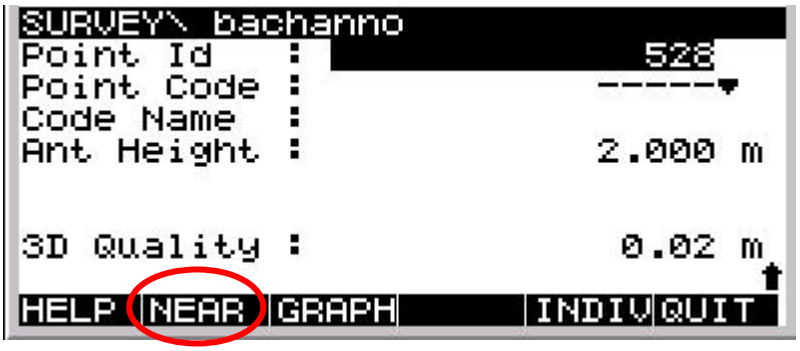
Refer to the **Chapters 5.4, 7.4.6**, and **11.6** in the **v4.00 Technical Reference** manual for a complete description!

NEAR-Key Functionality

During a survey, it can be quite common to re-measure a previously measured point, or to re-survey a control point already stored in the active job.

You wish to re-measure the point and give it the same point ID as the previously measured point or control point but cannot remember the name of the point.

With v4.00 firmware the new **SHIFT F2(NEAR)** button in the Survey panel compares the users current position with the co-ordinates of all points stored in the currently active job. Once the point closest to the users current position is found, the point ID of this point is copied into the **Point ID** field in the survey panel.

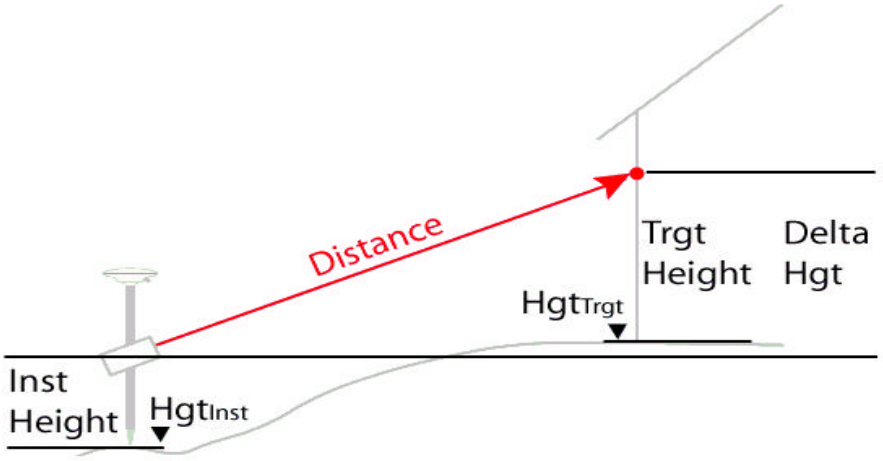


Refer to **Chapter 7.4.10** in the **v4.00 Technical reference** manual for a complete description!

Ability to Enter a Vertical Offset, Slope Distance and Elevation Angle for calculation of Hidden Points

With previous firmware, when hidden points are measured with an external device (such as the Leica Laser Locator) it was assumed that the height of the device above the ground was zero.

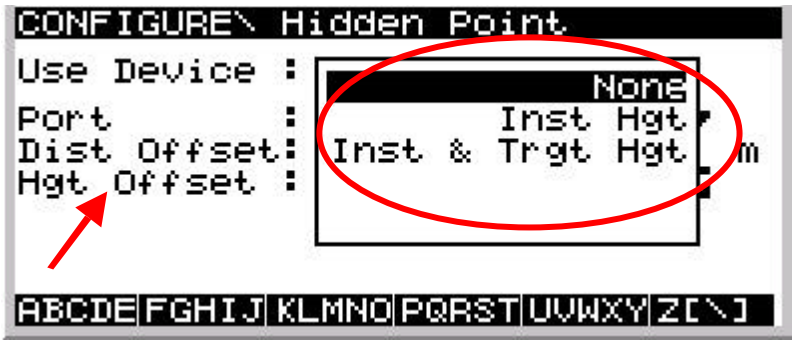
With v4.00 firmware it is now possible to enter the true height of the device above the ground (the instrument height) and the height of the target (the target height) above the ground. This then allows the true height of the hidden point being measured to be computed.



where,

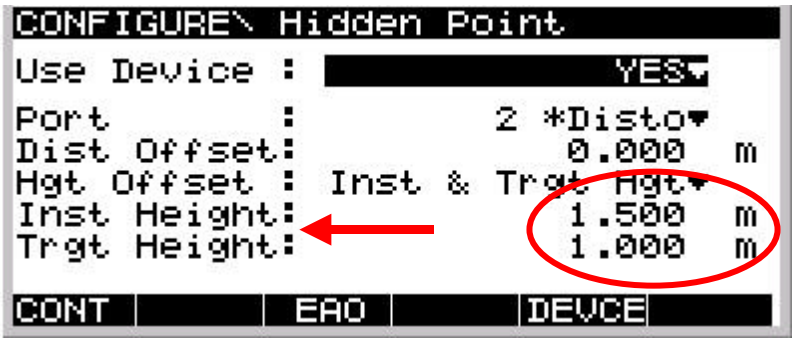
$$Hgt_{Trgt} = Hgt_{Inst} + Inst.Height + Delta\ Hgt - Trgt.Height$$

It is possible to enter instrument and target heights if the **Include Hgt** functionality is activated in the **CONFIGURE\ Hidden Point** panel (**CONFIG** and then **1 Survey** and then **6 Point…** and then **2 Hidden Point**).



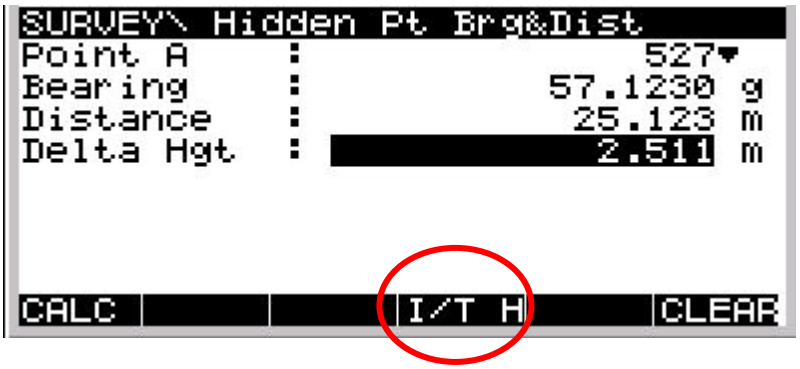
It is possible to choose between entering just the instrument height or both the instrument height and the target height.

Depending on what is chosen, default values for the vertical offsets can be entered.

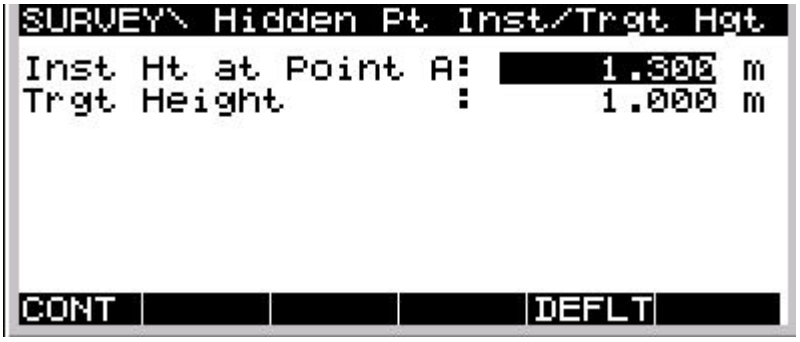


In the above example, it is expected that most hidden points will be measured with the external device at an approximate height of 1.50m above the ground (possibly eye height). Additionally, it is expected that the most hidden points will be measured at a height of approximate height of 1.00m above the ground**.**

Note, that during the survey of the hidden points, it is possible at any time to change the values for the instrument and target heights using a new **F4(I/T H)** button in **SUREVY\ Hidden Point Method** panel.



Pressing **F4(I/T H)** accesses the **SURVEY\ Hidden Pt Inst/Trgt Hgt** panel.

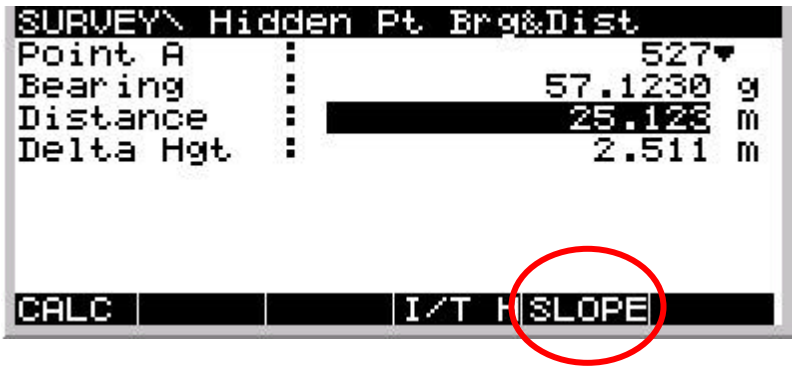


Here a new instrument and target height can be entered.

Note, that the measured height value displayed in the **Delta Hgt** line once the device has been used to measure the hidden point does not inlcude these vertical offsets (Intr Hgt and Trg Hgt). This value is received directly with the external device. The entered instrument and target heights are of course included to compute the height of the hidden point.

In addition to the vertical offset, with new v4.00 firmware allows the user to enter a slope distance and an elevation angle to compute the horizontal distance:

In all Hidden Point applications, as soon the focus is on the Distance field, an new button **F5(Slope)** is available.



With this button, the user has the possibility to enter a slope distance (manual or by external device) and in addition the elevation angle or the slope in percentage can be entered. Pressing the **F1(CONT**) button computes the horizontal distance and copies the value into the distance field.



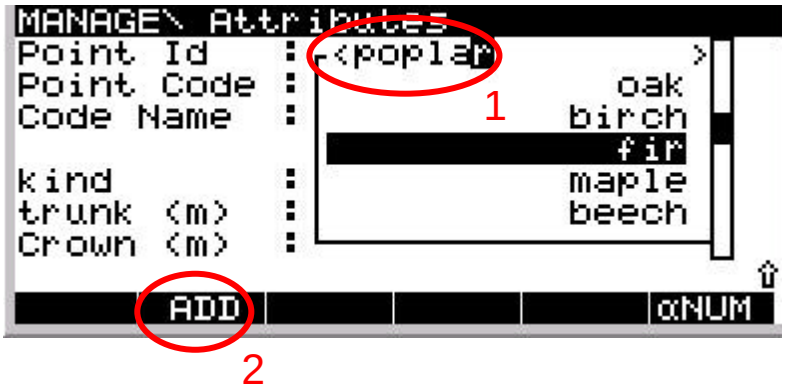
Refer to **Chapter 5.4, 7.4.9**, and **Appendix H** in the **v4.00 Technical Reference** manual for a complete description!

During Coding – enter a New Attribute to a Choice List

It has always been possible to code points where the codes have attributes and the attributes may use a choice list of options. For example, when surveying a tree, an attribute choice list may contain the attribute values "Oak", "Birch", "Fir" and other kinds of trees, but the kind "Poplar", needed in that example, is missing.

It is now possible to add additional attribute value to this choice list.

To add a new attribute values to the choice list, enter the new attribute value and then press the **F2(ADD)** button.



The new attribute is selected and added to the choice list.

Refer to **Chapter 8.1.4** in the **v4.00 Technical Reference** manual for a complete description!

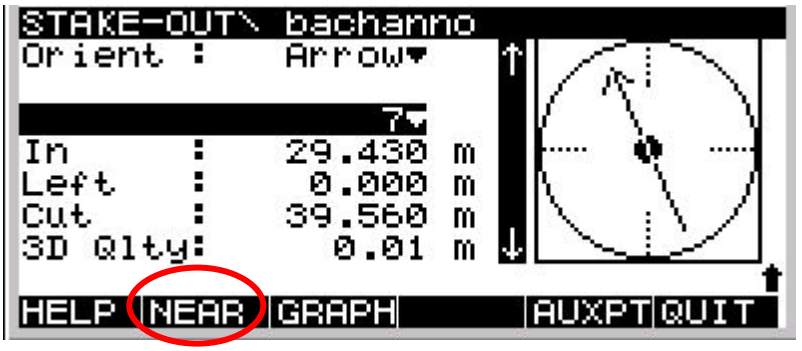
Stake-Out – New Functionality

NEAR – Key Functionality

As previously described, the **F2(NEAR)** button is available during survey.

A **F2(NEAR)** key is also available in the stake out application.

Pressing this button during stake out automatically selects the point closest to the users current position to be staked out.



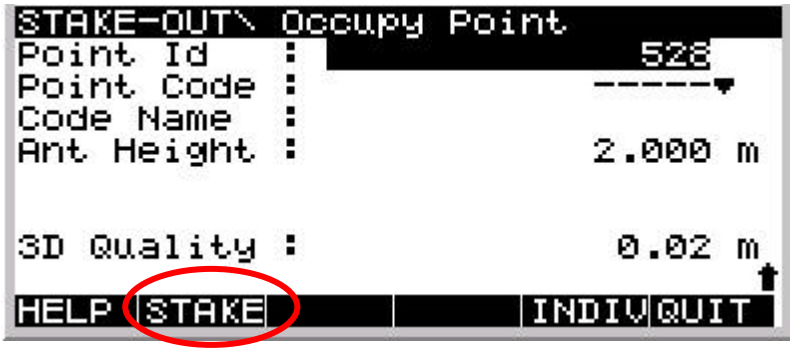
After staking out and measuring this point, the **F2(NEAR)** button can again be pressed to use the next closest point to be staked out.

Refer to **Chapter 7.5.10** in the **v4.00 Technical Reference** manual for a complete description!

Continue your Survey during Stake-Out application

With previous firmware versions, after pressing **F5(PCKUP)** in the main stake out panel and surveying a point, the user was immediately returned to the stake out panel.

In v4.00 firmware, the user now remains in the survey panel after a point has been surveyed. In this panel, a new **Shift F2(STAKE)** button is available. Pressing this button then returns the user to the stake out panel.



Refer to **Chapter 7.5.8**. in the **v4.00 Technical Reference** manual for a complete description!

Point Manager Improvement

Editing the Point Ids of Points already stored

With v4.00 firmware, it is now possible to rename already stored points.

Within point manager, set the focus on that point you wish to rename and press **F3(EDIT)**. It is now possible to edit the point ID.

Note that it is NOT possible to edit the point ID of an automatic logged point.

Refer to **Chapter 11.3** in the **v4.00 Technical Reference** manual for a complete description!

Co-ordinate Systems – New Functionality

Use Geoid Models and CSCS Models directly from the PC-Card

With v4.00 firmware it is now possible to use geoid field files and CSCS field files directly from the PC-Card. With previous firmware it was necessary to transfer the field file from the PC-Card to the system RAM of the sensor (this is still possible).

The advantage of using geoid field files and CSCS field files directly from the PC-Card is that it is now possible to use field files covering much larger areas (possibly even country wide if the PC card is big enough). With the system RAM, it is only possible to use field files up to 0.5MB – this is usually large enough for most users, but not for countrywide field files. Note, if the PC card is formatted, the field files will of course be lost.

In order to use geoid field files and CSCS field files directly from the PC-Card it is necessary to use the new **F2(PCARD)** button in the **CONFIGURE\ Edit Coord Systm** panel (**CONFIG** and then **1 SURVEY** and then **1 Position**). Any geoid field files or CSCS field files stored on the PC-Card are then displayed and available to be selected.



Additional information related to the field file (such as date and time of creation, the storage source) can be displayed using the **F5(INFO)** button.

Note, as with previous firmwares, geoid field files must be stored in the **Data/GPS/Geoid** directory on the PC card and CSCS field files must be stored in the **Data/GPS/CSCS** directory on the PC card.

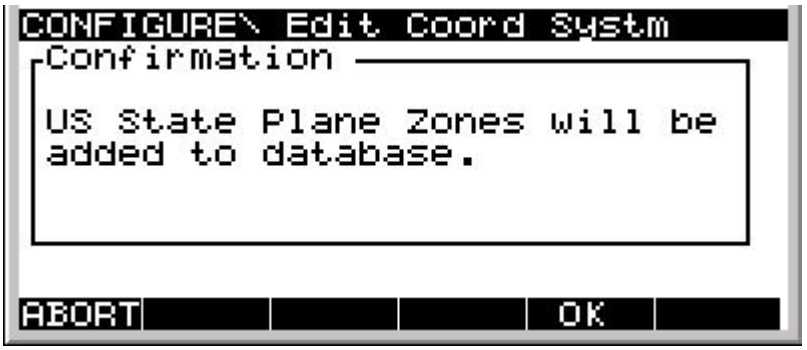
Refer to **Chapter 11.1.** in the **v4.00 Technical Reference** manual for a complete description!

New Default Projection and US State Plane Zones

V4.00 firmware now supports the **Romania Stereo 70** map projection. This is a "default" projection and can be "installed" as described below.

Additionally, it is possible to obtain US State Plane Zones directly on the sensor.

In the panel listing the projections available on the sensor (access this panel by editing an existing or creating a new co-ordinate system), press the **F5(DEFLT)** button. This will "install" all default projections (including the new Romania Stereo 70 projection). The user is asked, if the US State Plane Zones should also be installed.



F1(ABORT) adds only the default projections. **F5(OK)** additionally installs all US State Plane Zones.

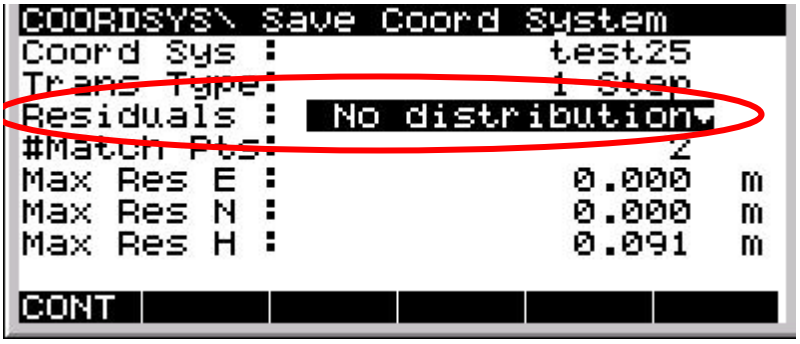
Refer to **Chapter 11.1**. in the **v4.00 Technical Reference** manual for a complete description and a complete list of the supported default projections!

New Default Ellipsoid

With v4.00 firmware the **ATS-77 ellipsoid** is now installed as a default ellipsoid. This ellipsoid is used for certain provinces in Canada.

Distribution of Residuals during Determination of Co-ordinate System

With v4.00 firmware it is now possible to choose the residual distribution method during the determination of the co-ordinate system process.



A distribution of residuals is used to disperse any strains in the transformation. Residuals can be distributed by a variety of methods including 1/Dist, By $1/Dist^2$, $1/Dist^{3/2}$ or by using a multiquadratic interpolation method (Multiquadratic).

Refer to **Chapter 11.1.** in the **v4.00 Technical Reference** manual for a complete description!

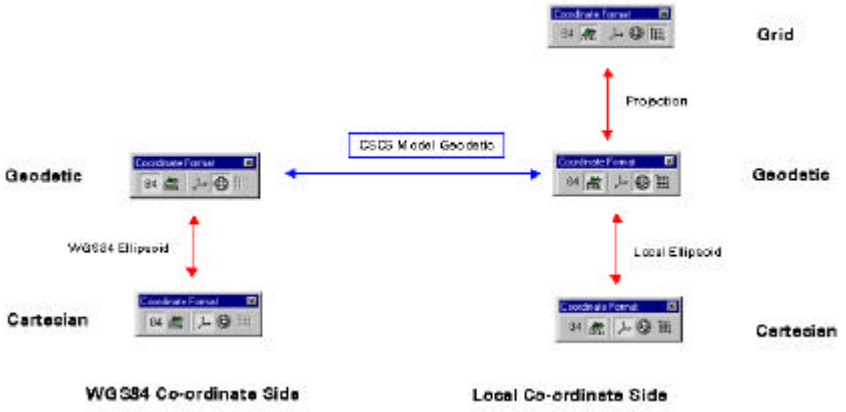
New Country Specific Co-ordinate System Models Supported

CSCS Models have already been introduced with SKI-Pro v2.1 and Sensor firmware v3.0x. CSCS models are tables of conversion factors to directly convert between GPS measured coordinates (WGS84) and the corresponding local mapping coordinates, taking the distortions of the local mapping system into account. CSCS models are based on grid files, which can be considered as a look-up table for the corrections.

In addition to the Cartesian and the Grid method, which were already supported with firmware v3.0x, firmware v4.00 now also fully supports the **Geodetic conversion method**. When converting from WGS84 to Local a correction in latitude and longitude is interpolated from the file and applied to get the local geodetic co-ordinates, into which the local map projection can be applied. Any suitable geoid model can be combined with a Geodetic CSCS Model.

Note, transformations cannot be used in a co-ordinate system which is using a Geodetic CSCS model (this makes no sense).

Principal:



To use CSCS Models on the System 500 Sensor, field files have to be generated in SKI-Pro version 2.5 (or higher).

All CSCS models use interpolation algorithms to interpolate the correction for a point in the grid file. The **bi-quadratic interpolation** technique has been added with Ski-Pro version 2.5 and is supported with new firmware v4.00. This method is used e.g. by the Swiss CSCS Model, which uses the Grid conversion method and is available through your local Leica representative.

New Geoid Model Supported

The **DFHBF geoid model** available for Germany is also supported by the new v4.00 firmware.

With the DFHBF approach, a scale factor is additionally applied to the point's height when converting to local orthometric heights. SKI-Pro v2.5 or higher must be used to create a field-file for this Geoid Model use.

Data Transfer – New Functionality and Improvements

Transfer GSM/Modem Reference Station Data between Sensors

With v4.00 firmware it is now possible to transfer GSM reference station information from one sensor to another.

This is very useful in a country where many GSM reference stations can be accessed. It is no longer needed to repeatedly enter this station information into new sensors – the information can be copied from one sensor to another.

To download all the station information, choose **18 Modem/GSM Station List** in the **TRANSFER\ Menu** panel. The system creates a binary file (station.bin), where all that station information (Station name, GSM data number, Position of stations) is included.

This file can then be uploaded to a second sensor, again via the **TRANSFER\ Menu** item **18 Modem/GSM Station List**.

Refer to **Chapter 13.18** in the **v4.00 Technical Reference** manual for a complete description!

Transfer of Complete System RAM between Sensors

With v4.00 firmware it is now possible to transfer the complete contents of the system RAM between sensors.

In the **TRANSFER\ Menu** panel choose **19 System**. The file sysram.sys can then be transferred to or from the PC card. The following information is stored in this file –

- All configuration sets (all settings, Id templates, all user defined devices, all defined ports, all antenna information etc)
- All co-ordinate systems (ellipsoids, geoid models, CSCS models, projections, transformations etc)
- Format files
- Codelists
- Language files
- Application text
- Almanac
- Telemax account files
- CFC log mask Files
- Beacon station list
- GSM station list

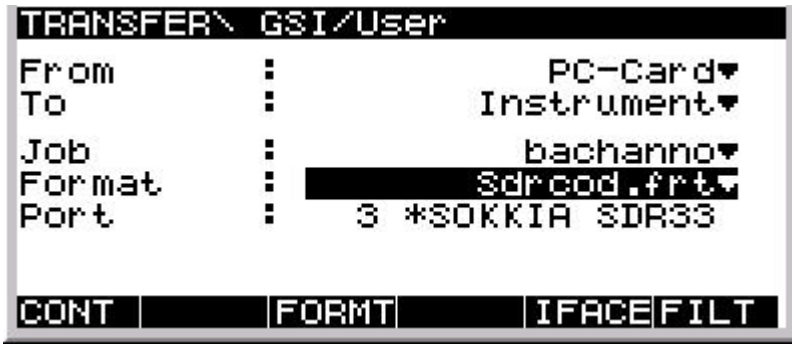
Refer to **Chapter 13.19** in the **v4.00 Technical Reference** manual for a complete description!

Additional External Devices Supported

With v3.00 firmware it was possible to download points stored within a job from the sensor to a Geodimeter and Zeiss Rec500 devices.

It is now also possible to transfer data to the **Sokkia SDR33** and Leica **TPS300/700** devices.

Functionality is as described in the v3.00 firmware release notes.



Ensure that your external device is set into a receive mode to receive all the data from System500.

Additionally, the correct format file suitable for the device to where the data will be transferred must be used. Some example format files are included on the v4.00 firmware CD.

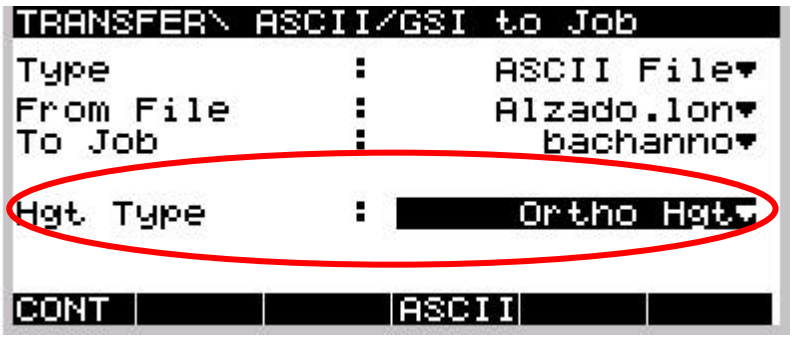
Refer to **Chapter 13.7** in the **v4.00 Technical Reference** manual for a complete description!

Transfer ASCII/GIS to Job Improvements

When importing data from a GSI file to a job on the sensor, any point code information contained in the GSI file is now also imported into the job (previously, any code information was ignored).

This is very useful when passing data on PC cards between the GPS sensor and TPS1100 instruments.

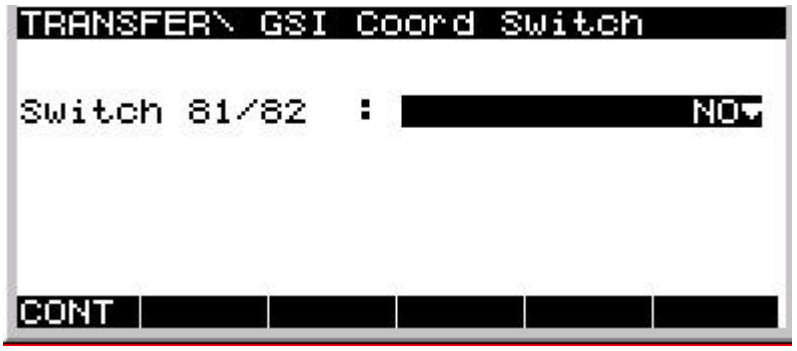
It is also now possible to define if the heights of points should be imported with orthometric or ellipsoidal heights.



Note, it is only possible to choose the height types of points being imported in the **Advanced** operation mode. In **Standard Operation** mode all heights are imported as orthometric heights.

In some countries "left handed" co-ordinate systems are used. For such co-ordinate systems, it is necessary during the transfer of GSI data to a job to allow the WI81 value (normally the easting value) to be imported as the northing and the WI82 value (normally the northing value) to be imported as the easting co-ordinate.

This is now possible with v4.00 firmware. Access the **TRANSFER\ GSI Coord Switch** panel by pressing the **SHIFT F3(LHS)** button in the **TRANSFER\ ASCII/GSI to Job** panel (choose **06 ASCII/GSI to Job** in the **TRANSFER\ Menu** panel)



Refer to **Chapter 13.6** in the **v4.00 Technical Reference** manual for a complete description!

New Application and Application Improvements

New RoadPlus Editor Application

A new application is available – the RoadPlus Onboard Editor (Article no.: **730 872**) allows the creation of road alignment files in the field.

With the RoadPlus Editor the user has the possibility to design GSI Files for

- Horizontal Alignments

  The horizontal alignment component allows the editing and deletion of the following geometric elements:

  Start Point

  Straight (Tangent)

  Circular Curve (Arc)

  Spiral In

  Spiral Out

  Spiral Curve In

  Spiral Curve Out

- Vertical Alignment

  The vertical alignment component allows the creation, editing and deleting of the following geometric elements:

  Start Point

  Straight (Tangent)

  Circular Curve (Arc)

  Parabola

- Cross Sections

  The cross sections component allows the creation, editing and deletion of the following:

Cross Section Templates:

- Defined by Delta Distances or by Cross Slopes
- Closing Slope

- Cross Section Assignment

  The cross section assignment component allows the creation, editing and deletion of cross section assignment files

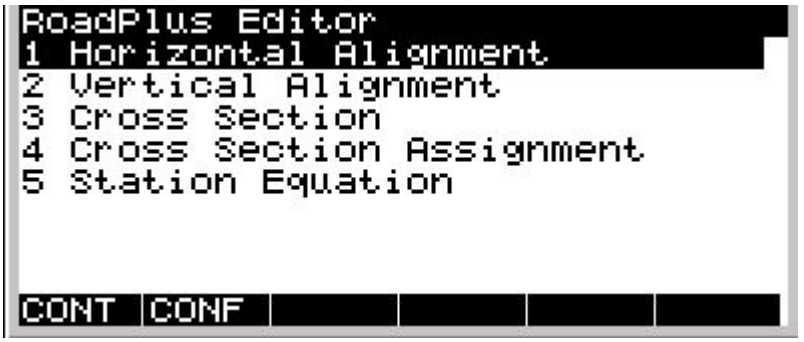
- Station Equation

  Station Equations define adjustments for the stationing values in the Horizontal Alignment file.

  The Station Equation component allows the creation, editing and deletion of Station Ahead and Station Back definitions.

Access the new application via the **APPLICATION\ Menu**





The road alignment files created in the RoadPlus Editor can be used in both the RoadPlus application and the RoadX application.

Refer to the new **Road Plus Editor** manual which is included on the v4.00 firmware CD for a complete and detailed description!

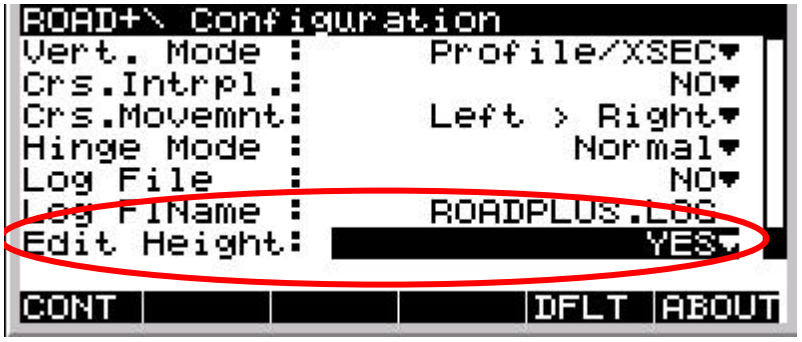
RoadPlus Improvements

With v4.00 firmware it is now possible to edit the elevation of a selected station.

This means that it is now possible to stake-out the horizontal position of points in relation to the horizontal alignment of a road but with a height independent of the road alignment.

This may be useful when staking out the positions of manholes which are co-ordinated relative to the road alignment, but the height of these manholes have individual heights not related to the road alignment.

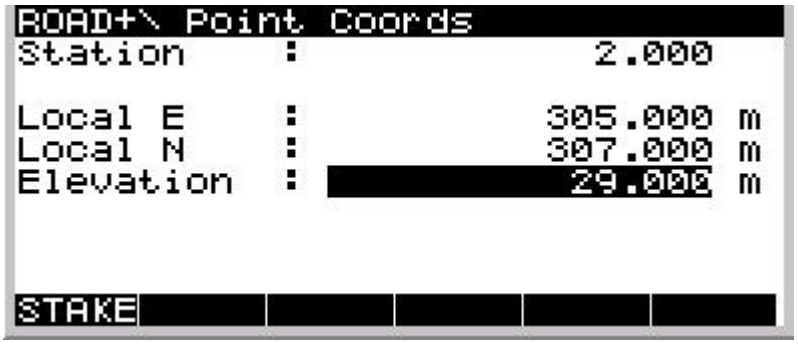
In the **ROAD+\ Configuration** panel, set **Edit Height** to **YES.**



Then as usual, in the **ROAD+\ Station & Offset** panel define the position of the manhole in relation to the horizontal alignment.

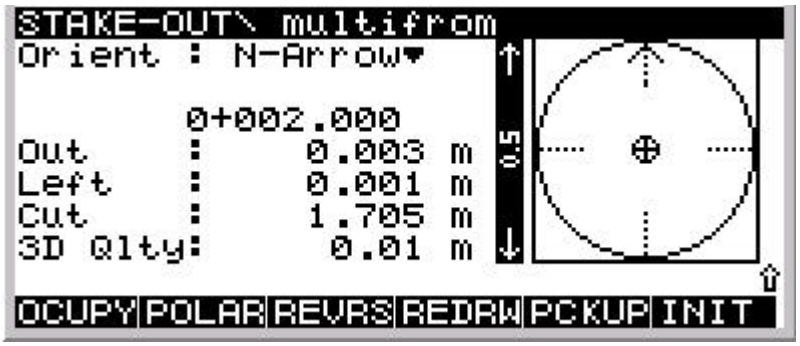


Pressing **F1(CONT**) calculates the co-ordinates of the manhole with the elevation being computed from the Vertical Alignment.



If you have set the **Edit Heights** to **YES**, then it is now possible to edit the height of the point to set out.

Enter here the required height and press **F1(STAKE)** to stake out the point.

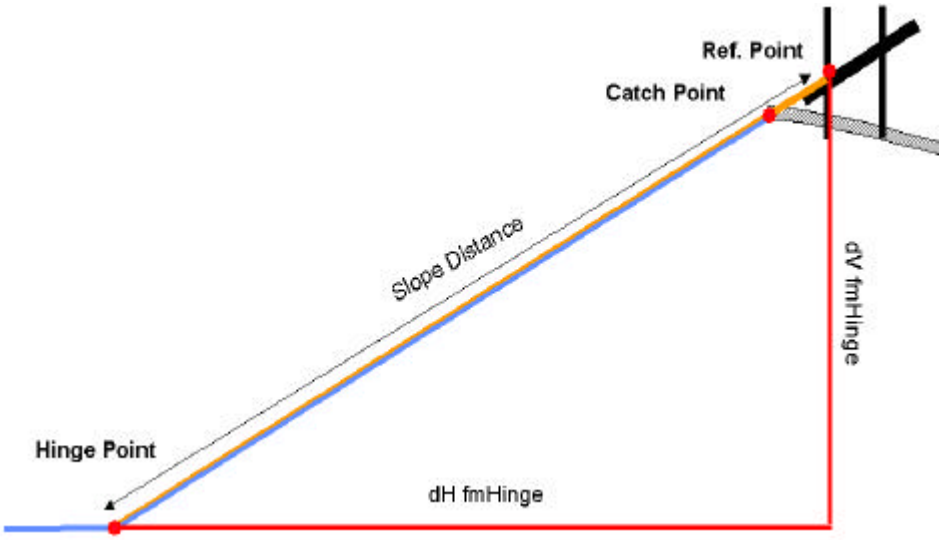


The height now being staked out is the entered height.

Another Road Plus Improvement is the onboard calculation of the Slope Distance.

During the setting out of a road, it is common that the slope distance needs to be computed to inform the operator how deep to cut (or fill). The calculation now is made by the Road Plus application.

The slope distance is defined as the following:



In the **ROAD+\ Catch Point** panel and in the **ROAD+\ Reference Point** panel a new line displays the computed slope distance.



Refer to the **v4.00 Road Plus** manual which is included on the v4.00 firmware CD for a complete and detailed description!

RoadX Application Improvements

With v4.00 firmware, many improvements have been made to the RoadX application.

A point can immediately be stored after setting out the point by using the **F3 (STORE)** button available in all four RoadX "applications".

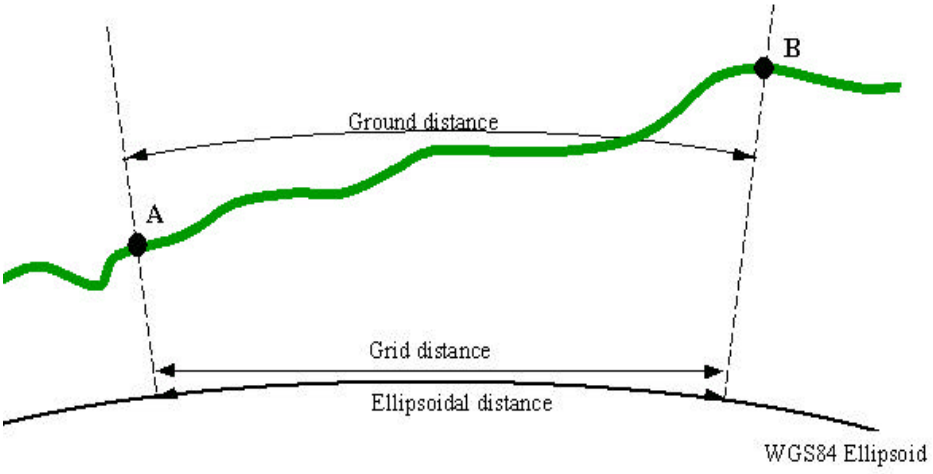
Additionally, points being stored can be given a code if required.



It is also now possible to create a comprehensive log file allowing the user to document his fieldwork.

COGO Improvements – Inverse Function

Within the COGO Inverse computation, it is now possible to compute the geodetic azimuth, the ellipsoidal distance on the WGS84 Ellipsoid and the ground distance on the mean level between two Points.

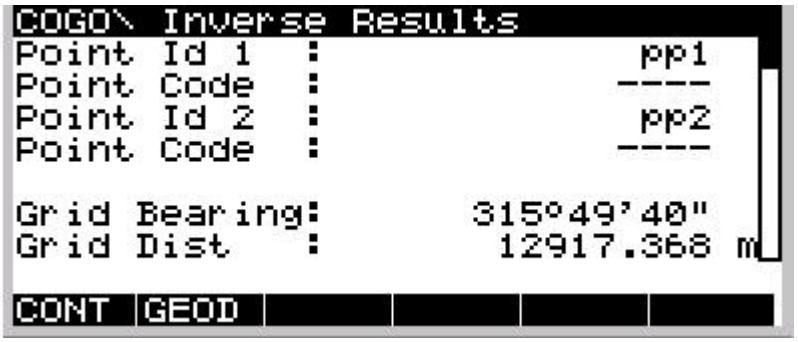


Grid distance: defined as the distance between the two sets of two-dimensional grid co-ordinates

Ellipsoidal distance: horizontal ellipsoidal distance on the WGS84 ellipsoid

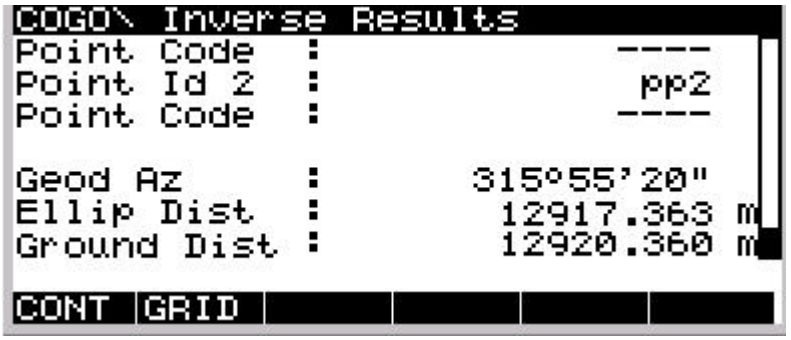
Ground distance: horizontal distance computed between two points at the mean elevation of the two points parallel to the WGS84 ellipsoid

Access the **COGO\ Inverse** application and select two available points from which to compute the Azimuth and Distance:



If a local co-ordinate system is being used then a new **F2(GEOD) / F2(GRID)** button is available.

Pressing this button toggles between viewing the grid bearing and the grid distance and the geodetic azimuth, the ellipsoidal distance and the ground distance.



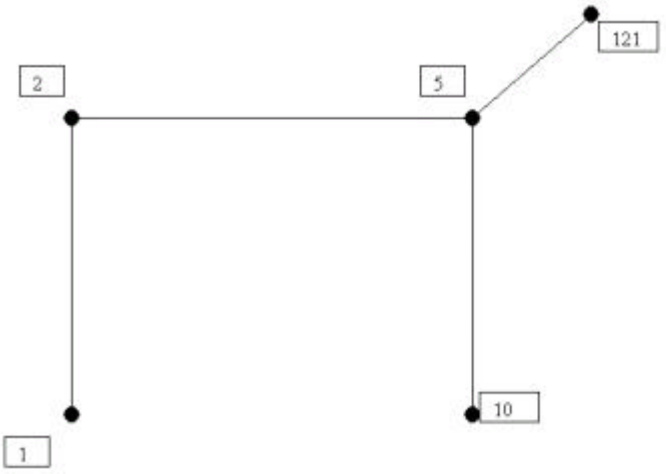
If no local coordinate system is being used it is still possible to compute the geodetic azimuth, the ellipsoidal distance and the ground distance between measured points, always relating to the WGS84 ellipsoid. It is of course not then possible to toggle to view the grid bearing and distance.

COGO Improvements – Traverse Function

New Traverse functionality allows the user to enter a traverse sequentially which retains the correct point numbering sequence of the traverse.

It is additionally possible to enter "sideshot" calculations.

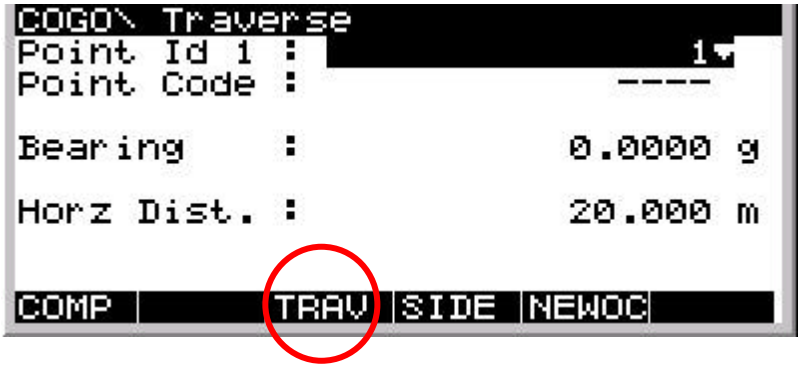
Example: The user wants to compute a Traverse with the following design:



v4.00 firmware now makes the computation of this traverse much easier.

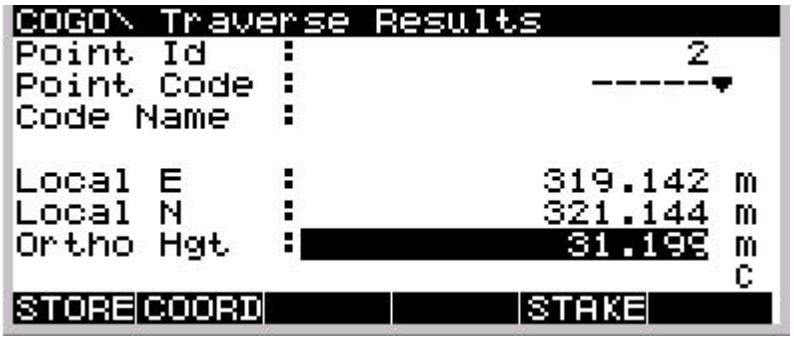
In the **COGO\ Traverse** panel select the point (here point 1) with which to start the traverse (alternatively, measure the start point using **F5(NEWOC**).

Now enter the bearing and distance to compute the next traverse point (here point 2). To compute this point press the new **F3(TRAV)** button.



This tells the system that the computed point will be an element of the designed traverse.

After pressing the **F3(TRAV)** button, the system computes the point and allows the user to enter a point Id and if required, a code.

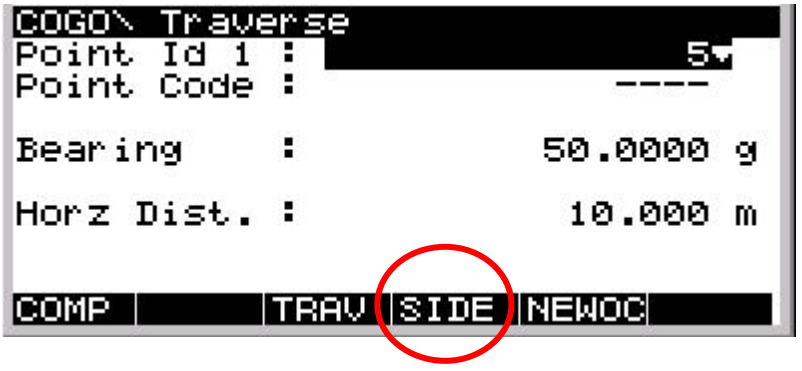


As usual, store the point using **F1(STORE)** or stake out the point immediately with **F5(STAKE).**

The system then returns to the **COGO\ Traverse** panel and automatically selects the last stored point (here point 2) as the next starting point.



For the computation of point 2 he continues for the next traverse element (point 5)



At the next step, point 121 should be computed, but this point is not an element of the traverse – point 121 is a side shot made from point 5.

The user again enters the calculation parameters **Bearing** and **Horz Dist** but this time presses **F4(SIDE)** to indicate that the computed point is to be a side shot.

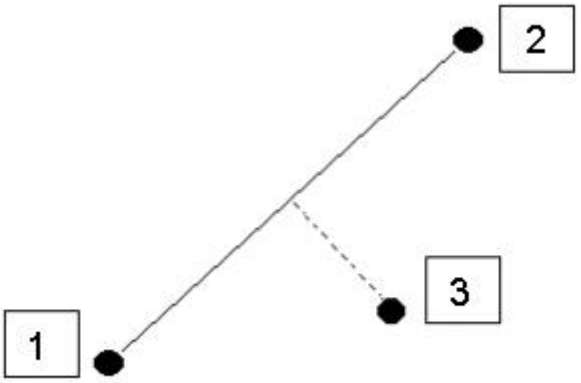
Again the **COGO\ Traverse Results** panel appears and the side shot point can be stored.

In the **COGO\Traverse** panel point 5 is still shown as the last element of the traverse to be the next start point for the following elements. It is now simple to finish the traverse computation.

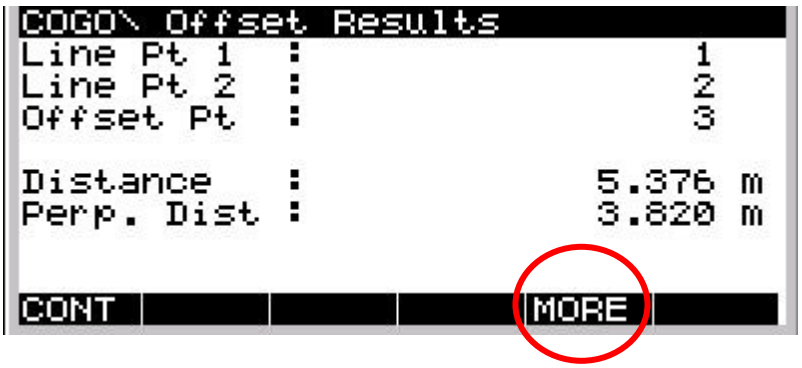
COGO Improvements – Distance-Offset Function

Another improvement in COGO has been made in the **Offset: Distance-Offset** application.

As an example: the scenario would be that the user chooses a line defined by Points 1 and 2 with the offset point being point 3.



F1(COMP) in the **COGO\ Offset** panel computes and displays the results of the the offset computation – the distance from point 1 to the Intersection (**Distance**) and the offset from point 3 to the Line 12 (**Perp. Dist**)



In addition, more inforation can now be displayed via the new **F5(MORE)** button:



The bearing of the baseline 1-2 is displayed (**Bearing 1-2**).

The distance of the baseline 1-2 is displayed (**Dist. 1-2**).

The position of the offset point in relation to the baseline is displayed (**Offset Pt**).

The bearing of the offset point toward the baseline is displayed (**Offset Brng**).

Refer to **Chapter 11.6** in the **v4.00 Technical Reference** manual for a complete description of all these COGO improvements!

Miscellaneous – New Functionality and Improvements

Improved Configuration Set Definition

The sequential configuration (**6 Configure** from the main menu) allows configuration sets to be easily created in a logical sequential manner.

It can however be a long process if the user wants to change only a few settings. It is now possible to select individual panels from the sequential process from a list of available panels.

This list can be accessed from the first screen of the sequential flow using the new **LIST (F6)** button.



F1(CONT) leads through the sequential configuration as usual.

F6(LIST) displays the list of configuration panels that would be accessed during the sequential configuration process. It is now possible to select these panels and directly access the panel.



As usual, the **F3 (STORE)** button permanently stores any changes that have been made to the configuration set and exits the **CONFIGURE\ Job** panel.

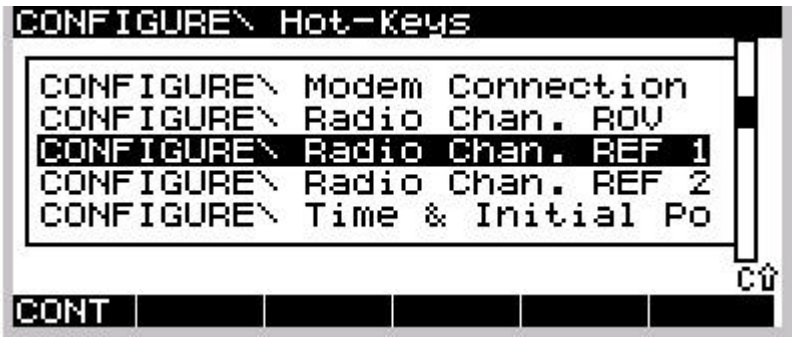
Refer to **Chapter 5** in the **v4.00 Technical Reference** manual for a complete description!

Key to switch the Background Illumination ON/OFF

Press the keys **ALT B** on the terminal to turn ON and OFF the terminal background illumination.

Define a Reference Radio Channel via Hot Keys

With v4.00 firmware it is now possible to define function keys (hot keys) which enable the radio channel to be easily changed of both the reference and rover (it was previously only possible for the rover).



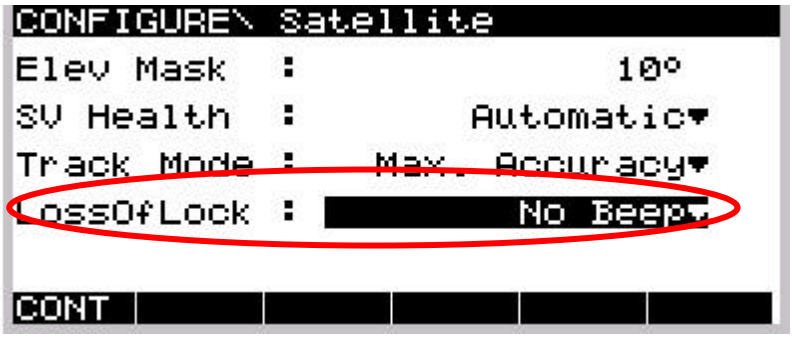
Obviously, these function key will only work if the sensor is configured to be a reference.

Refer to **Chapter 9.4** in the **v4.00 Technical Reference** manual for a complete description!

Activate or Deactivate "Loss of Lock" beep

v4.00 firmware provides a possibility to switch on or off the "loss of lock" beep which indicates a loss of satellite signals due to satellite shading caused by trees, buildings or other obstacles.

Configure this setting in the **CONFIGURE\ Satellite** panel (**CONFIG** and then **1 Survey** and then **2 Satellite**).



New Power Fail Options

With v4.00 firmware it is now possible to choose between two different automatic power up scenario after a power failure event.

In the **CONFIGURE\ Start-Up** panel **(CONFIG** and then **3 General** and then **5 Start-Up**), the new **AutoOn** prompt allows to select two different modes.



Power Fail (the default setting) means that the system restarts after re-connecting power only after an abrupt power fail – such as after a short circuit. Recommended for normal field survey and whenever using battery power.

ExtPowerLow/PowerFail means that the system restarts after re-connecting power after an abrupt power fail or after a slow drop in voltage which lead to the sensor powering down. Select this option only if the system is powered by with mains electricity, e.g. an external main AC/DC power supply, but not by batteries. This is typically the case on permanent reference stations.

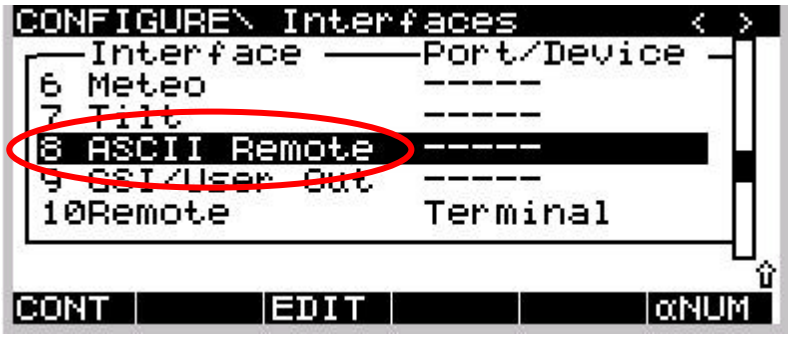
Note that the option **ExtPowerLow/PowerFail** is not recommended if you power your system with batteries. This option could then cause a deep discharge on the battery and so damage or destroy the battery.

To prevent users from unknowingly using this option with batteries, it cannot be permanently stored in the configuration. After manual power off with either TR500, sensor power button or by OWI command the AutoOn will always be reset to **PowerFail**.

Chose the option that best suits your application.

New Interface: ASCII Remote

With v4.00 firmware a new interface **ASCII Remote** is available which allows the direct control of an external device via OWI commands.



An example: For a real time data link it is wished to use a modem which is not directly supported by system 500 (e.g channel switch is not possible). This external device is attached on port 3 of the sensor.

On port 2 the "Remote Station" (e.g laptop) is connected. Now it is possible to send a command from the laptop via the sensor to the modem, the channel switch will be executed and the modem will send back a message to the laptop, which can be interpreted there.

V4.00 firmware allows to send commands from the "Remote Sation" to the interface port, which steers the device connected on that port.



Receive Leica and CMR (CMR+) messages on a GS50, SR510,and SR520

With v4.00 firmware it is now possible for GS50, SR510 or SR520 sensors to receive and use Leica, CMR and CMR+ RTK messages to compute a real-time code only solution.

An RTK reference station can now be set up to send real time messages in Leica RTK data format. One user can work with a SR530 as a rover and now, additional GS50, SR510 and SR520 users can compute real-time code only solutions from the same reference station.

3. Upload of new firmware v4.00

Upload from the PC card or serial transfer with SKI-Pro

The firmware of the Sensor consists of 2 files, the Sensor System Firmware itself and the Measurement Engine Firmware.

On the CD you will find a directory called "**SensorFW**". In this directory there are 2 files:

- 5_sysme.fw
- 5_syssen.fw

Both of the files can be uploaded using one of the 2 methods:

1. You can transfer directly from PC card to Sensor System. No additional software is necessary. See Method 1a below.
2. Or you can use SKI-Pro and transfer the firmware by means of the serial data transfer cable. See Method 2 below.

We recommend the first method, it is faster and easier but requires a PC card reader.

Additionally, on the CD is one more file :

- 5_system.fw

This is the above two files combined together as one file. This file can only be transferred to the sensor if you have a 8MB PC card or greater. See Method 1b below.

Method 1a: Transfer directly from PC card with 4MB Leica PC Card

If you have a PC card reader you can transfer the firmware directly from PC card to the system of the receiver.

If you have only a 4MB Leica PC card then you must load the firmware using 2 individual files.

Follow the steps below.

1. Format the PC card on a System 500 Sensor. As ever we recommend you to only use Leica PC cards for transfer. Copy the file **5_sysme.fw** to the GPS/PROG directory of the memory card.
2. Put the PC card into PC card slot of the Sensor, switch the Sensor on and select **7 TRANSFER** menu.
3. Choose menu item **10 Firmware**.
4. Select **GPS500 (SYSTEM ME)** from the list box and press **F1 (CONT)**. The upload process starts automatically. The complete transfer lasts 2-3 minutes. The system will end up in the main menu.
5. After successful upload of the first part, take the PC card out, delete the file in the GPS/PROG directory and replace it with the **file 5_syssen.fw**.

6. Put the PC card back into PC card slot of Sensor, make sure that Sensor is still switched on and select **7 TRANSFER** menu.
7. Choose item **10 Firmware**. Choose **GPS500 (SYSTEM SEN)** from the listbox. Press **F1 (CONT)**. This transfer lasts about 3-4 minutes.

You have now updated the Sensor firmware.

Note: It is absolutely essential that you first load 5_sysme.fw! If the previous firmware on your sensor was version 1.30 and you get the upload order wrong you will get an error message :

"Please contact service

Quote error number: 00058030"

It is not necessary to contact service. Just start the above procedure again, this time uploading **5_sysme.fw** first!

Method 1b: Transfer directly from PC card with 10MB Leica PC Card

If you have a PC card reader you can transfer the firmware directly from PC card to the system of the receiver. If you have a 10MB Leica PC card or larger then you can load the firmware using just 1 file.

Follow the steps below.

1. Format the PC card on a System 500 Sensor. As ever we recommend you to only use Leica PC cards for transfer. Copy the file **5_system.fw** to the GPS/PROG directory of the memory card.
2. Put the PC card into PC card slot of the Sensor, switch the Sensor on and select **7 TRANSFER** menu.
3. Choose menu item **10 Firmware**.
4. Select **GPS500 (SYSTEM)** out of the list box and press **F1 (CONT)**. The upload process starts automatically. The complete transfer lasts 6-8 minutes. The system will end up in the main menu.

You have now updated the Sensor firmware.

Method 2: Serial Transfer using the Sensor Transfer Component of SKI-Pro

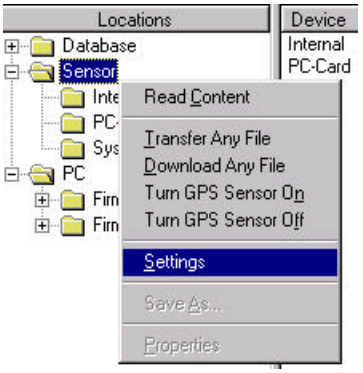
If you wish to upload v4.00 Firmware to the sensor with serial transfer using SKI-Pro, you must firstly make a few simple checks on the sensor

- Ensure that the **Remote** interface is assigned to the **Terminal** port. This can be checked by pressing **CONFIG** and then choosing **4 Interfaces**. This will show you if the **Remote** interface is assigned to the **Terminal** port. If it is not, then press **F3(EDIT)** to access the **CONFIGURE\ Remote Control** panel and select the **Terminal Port**.
- Ensure no port is assigned to a GSM device.
- Disconnect all external devices from the sensor (radio modems etc)

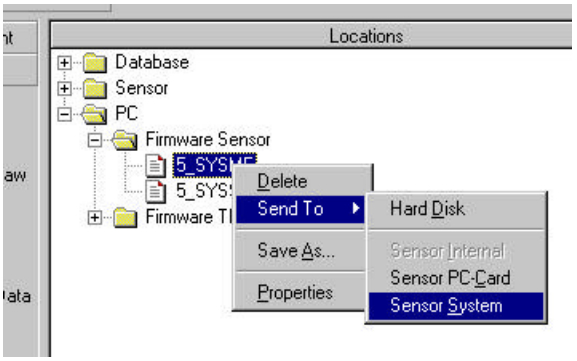
- Remove the PC card
- Make sure you have fully charged batteries in the sensor

Once you have completed these checks, proceed as follows:

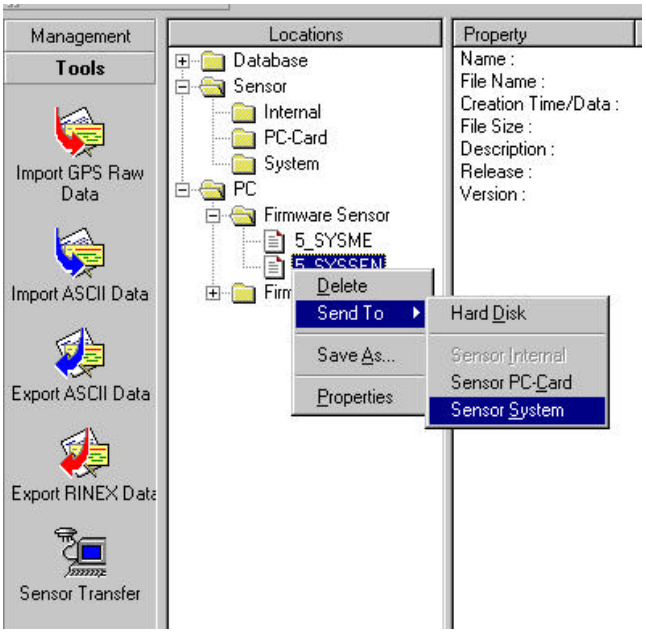
1. Connect the Sensor to the PC with the Leica Serial port data transfer cable. Connect the cable to an RS232 port of your computer (normally COM1) and connect it to the TERMINAL port of the Sensor.
2. Please note that you have to connect the cable directly to the Sensor's terminal port and NOT to the terminal itself. Remove the terminal off the Sensor! You do not need the terminal for Sensor firmware upload.
3. Your Sensor should be switched off. Check that the LEDs are not on.
4. Launch SKI-Pro. Ensure you are using either SKI-Pro Version 1.1, SKI-Pro v2.0 , SKI-Pro v2.1 or SKI-Pro v2.5.
5. Select Tools – Sensor Transfer. In the tree view, click with the right mouse button on the folder Sensor. Use the context menu item "Settings" to specify the used COM port of your computer and set a baud rate according the performance of your computer.



6. You may wish to test your Sensor-PC connection by turning the Sensor on and off, using the commands "Turn GPS Sensor On" and "Turn GPS Sensor Off".
7. After the "Turn GPS Sensor On" command the LED labelled Power and Memory should be green. Make sure that the Sensor is turned on before you transfer the first file.
8. Having correctly connected the Sensor to the PC, open the PC folder, then open the folder Firmware Sensor. Ensure you have previously copied the new v4.00 firmware to the directory on your PC where you keep firmware files. This is normally \Program Files\Leica Geosystems\SkiPro\TransferObjects\...
9. First click with the right mouse button on the item **"5_syssme"**.
10. Choose "Send to: Sensor System" from the context menu.



11. Depending on the selected baudrate the transfer can last between 10-30 minutes. **During the transfer, DO NOT activate or use any other software on the PC.**
12. As soon as the progress indicator window disappears, you can start to upload the second part of the firmware.
13. In the folder Firmware Sensor, click on "**5_syssen"** with the right mouse button and select "Send to:" "Sensor System" from the context menu.



14. Depending on the selected baud rate the transfer will last 15-60 minutes. **During the transfer, DO NOT activate or use any other software on the PC.**
15. The Sensor can now be turned off using the command "Turn GPS Sensor off" (right mouse-click on Sensor folder). Alternatively you could press the ON/OFF button of the Sensor itself.

Turn the Sensor on and the system will now start up, showing V4.00 in the "Leica Geosystems" start up screen.

Check Sensor Firmware Status

Whatever method you have used to upload the firmware, you can now check the Sensor firmware versions by selecting:

STATUS/ 3 General/ 3 Software Versions.

The correct versions are:

Firmware: 4.00

Boot: 1.62

Measurement engine: 1.39

Meas Eng Boot: 1.03

Navigation: 2.12

Communication: 1.50

Keyboard/Disp: 2.10

4. Closing Remark

The new enhancements are described in full detail in the updated v4.00 Technical Reference manual, which is available on the CD-ROM under "Manuals".

These new and improved features continue our policy of continual development of Leica GPS System 500. We are sure these new features and improvements will further enhance your productivity using System 500.

Leica Geosystems AG

GPS Product Management
S & E Division

CH-9435 Heerbrugg, Switzerland

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).

TQM
ISO 9001 / ISO 14001

Total Quality Management- Our commitment to total customer satisfaction.

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