GPS System 500

Technical Reference Manual

Version 4.0
English

Leica Geosystems

Congratulations on your purchase of Leica System 500

To use equipment in the permitted manner, please refer to the detailed safety instructions in the User Manual.

Technical Support

Technical Support is provided by Leica Geosystem's worldwide network of representatives. We are represented in almost every country in the world. A representative directory is available at:

www.leica-geosystems.com

Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

View of chapters

Contents

1. Introduction

System 500 is used to receive signals from GPS satellites which are then processed to obtain a position on the earth's surface.

It can be used in many applications, the main ones being Land Survey, Stakeout and Hydrographic Survey.

The main components of System 500 are the GPS Antenna and GPS Receiver. Ancilliary components are the Terminal, Batteries, PC Cards and cables.

SKI-Pro, a PC based software is also used in conjunction with the hardware listed above for post-processing GPS data and for downloading coordinates recorded in the field. Instructions for using SKI-Pro can be found in the accompanying printed guides and on-line help.

System 500 - main hardware components

1.1 The GPS Antenna

There are several System 500 GPS Antennas available. These are:

- AT501 Single Frequency Antenna.
- AT502 Dual Frequency Antenna.
- AT503 Dual Frequency Choke Ring Antenna.
- AT504 JPL Design Dual Frequency Choke Ring Antenna.
- Single Frequency Choke Ring Antenna.

The GPS Antenna is selected for use based upon the application. The vast majority of applications will require the AT501 or AT502 Antenna.

The AT501 is a L1 single frequency antenna. Use it with the SR510 Receiver. The AT502 is a dual frequency antenna. Use it with the SR520 or SR530 Receiver.

The Choke Ring Antennas are designed for use where the utmost precision is required. Typical applications include Static Surveys of long baselines, Tectonic Plate monitoring, Reference Stations, etc.

Use the AT503 and AT504 with the SR520 or SR530 Receiver. Use the Single Frequency Choke Ring with the SR510 Receiver.

Also available is a combined GPS/ RTB or GPS/ RTS antenna. Refer to Appendix K for further information.

AT502 Antenna

AT504 Antenna

1.2 The GPS Receiver

The GPS Receiver is the instrument that processes the GPS signals received by the GPS Antenna.

There are six different models of GPS receiver in System 500. The model number is printed on the PC card lid.

See the detailed descriptions of each of these receivers given down below.

SR510 - Tracks the L1 C/A code and uses it to reconstruct the carrier phase. Data can be stored for post-processing in SKI-Pro. Baselines can be calculated with a precision of up to about 5-10mm +2ppm.

With a radio modem attached the receiver can be used for real-time measurements accepting RTCM code corrections. Coordinates can be calculated with a precision of up to about 0.5m.

SR520 - Tracks the L1 C/A code and L2 P-code to reconstruct the carrier phase. When Anti-Spoofing (A-S) is activated, the receiver switches to a patented P-code aided tracking technique that provides full L2 carrier measurements and L2 pseudoranges. Data can be stored for post-processing. Baselines can be calculated with a precision of up to about 3-10mm +1ppm.

With a radio modem attached the receiver can be used for real-time measurements accepting RTCM code corrections. Coordinates can be calculated with a precision of up to about 0.5m.

SR530 - Tracks the L1 C/A code and L2 P-code to reconstruct the carrier phase. When Anti-Spoofing (A-S) is activated, the receiver switches to a patented P-code aided tracking technique that provides full L2 carrier measurements and L2 pseudoranges. A radio modem attaches and the receiver can be used for RTK operations. Coordinates can be calculated with a precision of up to about 1cm

Data can also be stored for post-processing. Baselines can be calculated with a precision of up to about 3-10mm +1ppm.

System 500 GPS Receivers can be operated with or without the TR500 Terminal (see section 1.3). The TR500 is used for field data acquisition and for configuring the receiver.

Details of using the Receiver without a Terminal are given in Chapter 3.

MC500 - A ruggedized version of the SR530 designed specifically for Machine Control. Can also be utilised as a dedicated GPS Reference Station. Please refer to Appendix I for specific details.

RS500 - A dedicated GPS Reference Sation receiver designed for permanent installation. Please refer to Appendix J for specific details.

GS50 - This receiver has been specifically designed for GIS applications. Please refer to Appendix K for more information that is specific to the GS50 and the corresponding PC-software GIS DataPRO.

1.3 The TR500 Terminal

The TR500 Terminal provides a full user interface to all System 500 GPS Receivers.

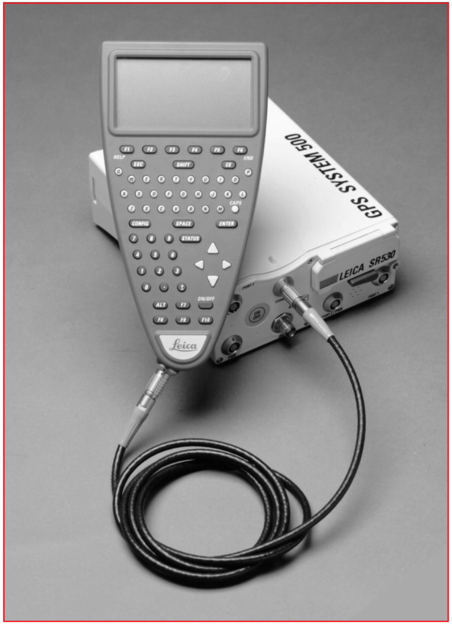
It can be used to set parameters in the receiver and to steer the GPS measurement operation.

The TR500 can be used to set and store parameters in one GPS receiver and then removed and used to set parameters in another System 500 receiver. The receiver can then be used in the field without the TR500 attached. Note that whilst this is possible when measuring in any mode, for a Reference or Rover, it is recommended that the Receiver only be used without a TR500 at Reference stations or with Static/Rapid Static Rovers.

The TR500 is connected either directly to the receiver or via a cable.

Data input is via a fully alphanumeric QWERTY keyboard and an LCD display of 32 x 12 characters which may be illuminated.

TR500 mounted on the Receiver



TR500 connected using the cable

1.4 Data Storage

Data is stored on either an Internal Memory or PC Card. The PC Card is the preferred data storage medium. The Internal Memory is an option.

The PC Card is inserted into the slot on the front of the GPS Receiver. PC Cards are available from Leica with varying capacities. Note that whilst other PC Cards may be used, Leica recommend Leica PC cards only and cannot be held responsible for data loss or any other error that may occur whilst using a non-Leica card.

To insert the PC Card in the GPS Receiver, open the card slot door, with the Leica Logo uppermost and facing you, slide the card into the slot firmly until it clicks into position. Press the eject button at the side of the card to remove it.

The Internal Memory is available in 8MB or 16MB capacities and resides in the Receiver. When data has to be downloaded to SKI-Pro, connection is made between port 2 on the Receiver and a serial port on the PC.

The memory device is checked before starting a survey. If it is more than 80% full, an information message appears.

Follow the care instructions shown on the rear of the card. Keep the card dry, only use within the specified temperature range, do not bend the card and protect it from direct shock. Failure to follow these instructions could result in data loss and/or permanent damage to the card.

The card can become very hot during use. Avoid touching the metal parts of the card after prolonged use.

Inserting the PC Card

PC Card versus Internal Memory
The PC Card is the preferred data storage medium as it has the following advantages over internal memory:

- **Faster download times.** A PC Card download using a PC Card Reader or PCMCIA port is virtually instantaneous. Internal memory has to download through a serial connection and can take time.

- **Flexibility / no downtime of GPS Receiver.** A PC Card can be removed from a receiver when it is full and replaced with a spare. The Receiver does not have to be taken back to the office for downloading.

Using an Internal Memory means however that the data has less chance of being misplaced or lost. This can happen when multiple PC Cards are used for the same project.

If you are not sure about which type of memory to use, try using a PC card but don't remove it from the Receiver. You can still download as if it were Internal Memory through any port.

1.5 Batteries/Power Supply

System 500 will normally be powered by two GEB121 camcorder type batteries. which plug into the underside of the GPS receiver.

Two batteries, fully charged, will power the SR510 and TR500 for about 7.5 hours continuously and the SR520/530 for about 6 hours continuously.

Operating times will be shorter when working in cold weather and when a radio modem is connected.

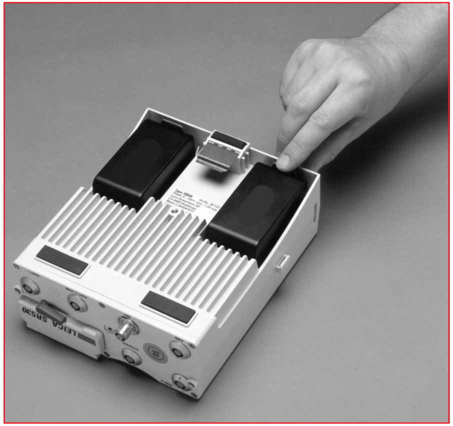
Plug in and remove the GEB121 batteries as shown opposite.

System 500 can also be powered by the GEB71 7Ah battery or any 12V DC power supply via either power port, on the front face of the receiver using an appropriate cable.

Connecting a GEB121 Battery

With the Receiver upside down and the Leica logo on the battery facing you, locate one end into the battery bay. Press the opposite end of the battery down until it audibly clicks into place.

Removing a GEB121 Battery



Pull and hold the battery catch. Withdraw the battery with the other hand.

The battery contains toxic material and must be disposed of in an environmentally friendly manner. Do not dispose of the battery in normal household or office waste.

GEB121 Batteries

GEB121 Batteries can be charged using the GKL122 or GKL111 battery chargers. The preferred model is the GKL122.

GEB71 Batteries

GEB71 Batteries can be charged using the GKL122 battery charger only.

Chargers

The GKL122 is an intelligent charger. It will charge the batteries by the exact amount required. This maximizes battery life. The GKL122 can charge up to 2 GEB121 batteries at once. The GDI121 extension plate enables a further two batteries to be charged from the same charger at the same time.

Additionally, the GKL122 can charge up to two GEB71 batteries.

The GKL111 battery charger is a simple charger. It will charge one GEB121 battery at a time. It will charge the batteries by the exact amount required. This maximizes battery life.

The batteries are delivered from the factory totally discharged. They will require a full charging cycle before the equipment can be used. For full instructions on battery charging, refer to the manual accompanying the charger you are using.

2. Equipment Set Up and Connection

The type of equipment set up that is used will vary with the type of site occupation and the measuring mode. This also applies to the way in which the various components are connected together. There are optimal solutions for setting up the equipment on a tripod, in a backpack and on the pole.

Set up on Tripod

Set up on Unipole

Set up on pole with Minipack

2.1 GPS Receiver ports

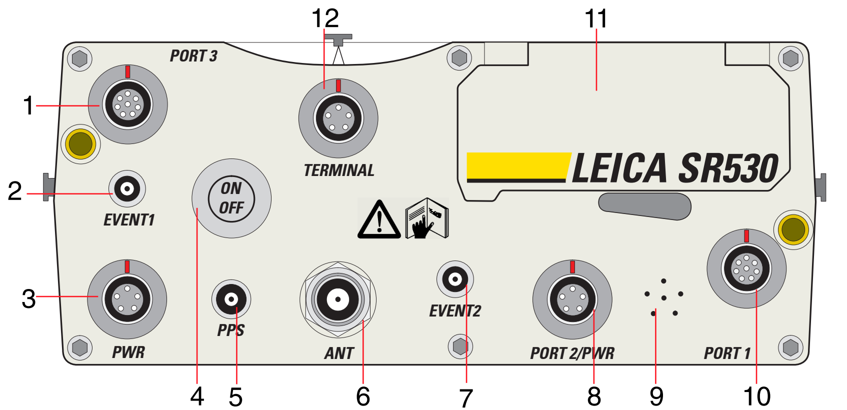
All other components of System 500 connect to the GPS Receiver.

The TR500 Terminal fits either directly on the Receiver or can be connected to the Terminal port using a cable.

A Radio Modem in a housing can also be fitted directly to the Receiver. Alternatively, if the housing is not being used, the radio modem can be connected to Port 1 or Port 3 using a cable.

The Antenna is connected to the Receiver via the ANT Port.

External power can be connected via a cable through Port 2.



1. Port 3. 8 pin Lemo.Power/data in/out
2. Event Input 1 (Optional)
3. 5 pin Lemo. Power
4. Power ON/OFF
5. PPS Output (Optional)
6. GPS Antenna in
7. Event Input 2 (Optional)
8. Port 2. 5 pin Lemo. Power/data in/out.
9. Pressure equalisation vent.
10. Port 1. 8 pin Lemo. Power/data in/out.
11. PC Card door.
12. Terminal in/out or Remote Interface in/out.

SR530 Receiver, front panel

Use

Static/Rapid Static operations or as Reference for Kinematic.

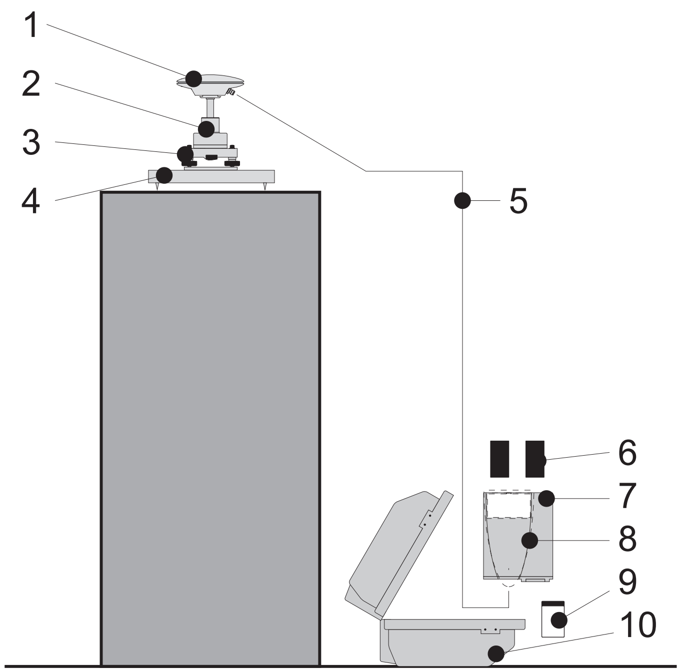
The Receiver and TR500 (if used) can be assembled to make one unit. One connection is made to the GPS Antenna which is mounted on the Pillar. The Receiver and TR500 can be kept in the case. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. GPS Antennas are AT501 or AT502. Procedures/setup may vary if AT503, 504 or single frequency choke ring are used.

Equipment Checklist

1. GPS Antenna AT501, 502, 503, 504 or 505
2. GRT146 Carrier
3. GDF122 or GDF112 Tribrach
4. Pillar Plate (if required)
5. GEV120 2.8m Antenna Cable
6. 2, GEB121 Batteries
7. SR510/520/530 GPS Receiver
8. TR500 Terminal (if required)
9. MCF XMB-3 PC Flash Card.
10. GVP602 System 500 Transport Case.



Procedure

1. If a pillar plate is being used, locate it on the pillar.
2. Screw the tribrach to the pillar plate or the pillar. Level the tribrach.
3. Place and lock the GRT146 Carrier in the Tribrach.
4. Screw the Antenna onto the Carrier.
5. Check that the Tribrach is still level.
6. Connect the GPS Receiver to the Antenna using the GEV120 Antenna cable.
7. Plug the GEB121 batteries into the GPS Receiver.
8. Attach the TR500 Terminal to the Receiver if required.
9. Insert the PCMCIA Flash Card into the Receiver.
10. Switch on the system using the ON/OFF button.
11. The Receiver can be placed in the Transport Case for additional protection.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is not being used, further guidance is available in Chapter 3.

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ When Using the GAD31 adapter and GRT144 carrier, ensure that the Antenna and GAD31 assembly slide down the full length of the GRT144 stub. An incorrectly mounted Antenna will have a direct effect on your results.

☞ In wet conditions the Receiver can be placed in the transport case during use for extra protection. Try to shut the case as completely as possible.

☞ If the Receiver is left in the case during use in temperatures exceeding 25°C, the lid should be left open. Refer to Appendix A for operating and storage temperatures.

☞ Use an external battery such as GEB71 to extend the operating time past 6 hours.

2.3 Equipment Setup - Post Processed Static/Rapid Static/Reference on Tripod

Use

Static/Rapid Static operations or as Reference for Kinematic.

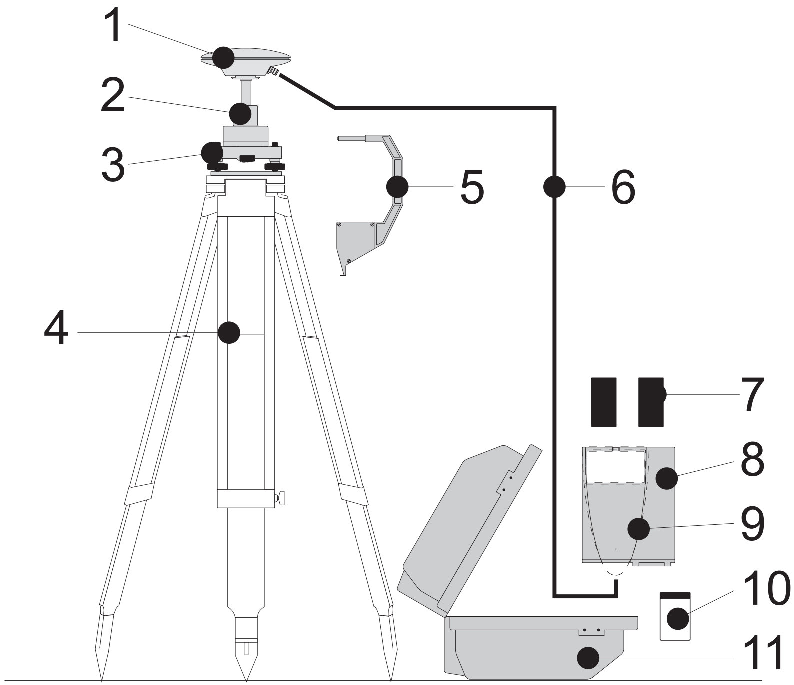
The Receiver and TR500 (if used) can be assembled to make one unit. This clips to the tripod leg or is placed in the transport container. One connection is made to the Antenna. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. GPS Antennas are AT501 or AT502. Procedures/setup may vary if AT503, 504 or single frequency choke ring are used.

Equipment Checklist

1. GPS Antenna AT501 or AT502
2. GRT146 Carrier
3. GDF122 or GDF112 Tribrach
4. GST20, GST05 or GST05L Tripod
5. GZS4 Height Hook
6. GEV120 2.8m Antenna Cable
7. 2, GEB121 Batteries
8. SR510/520/530 GPS Receiver
9. TR500 Terminal (if required)
10. MCF XMB-3 PCMCIA Flash Card.
11. GVP602 System 500 Transport Case.



Procedure

1. Set up the tripod.
2. Mount and level the tribrach on the tripod.
3. Place and lock the GRT146 Carrier in the Tribrach.
4. Screw the Antenna onto the Carrier.
5. Check that the Tribrach is still level.
5. Insert the Height Hook into the Carrier.
6. Connect the GPS Receiver to the Antenna using the GEV120 Antenna cable.
7. Plug the GEB121 batteries into the GPS Receiver.
8. Attach the TR500 Terminal to the Receiver if required.
9. Insert the PCMCIA Flash Card into the Receiver.
10. Using the hook on the rear of the unit, hang it on the Tripod leg or place it in the box.
11. Switch on the system using the ON/OFF button on the Receiver.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is not being used, further guidance is available in Chapter 3.

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

When Using the GAD31 adapter and GRT144 carrier, ensure that the Antenna and GAD31 assembly slide down the full length of the GRT144 stub. An incorrectly mounted Antenna will have a direct effect on your results.

In wet conditions the Receiver can be placed in the transport case during use for extra protection. Try to shut the case as completely as possible.

If the Receiver is left in the case during use in temperatures exceeding 25°C, the lid should be left open. Refer to Appendix A for operating and storage temperatures.

Use an external battery such as GEB71 to extend the operating time past 6 hours.

2.4 Equipment Setup - Post Processed Kinematic, Minipack and Pole

Use

Post Processed Kinematic Rover.

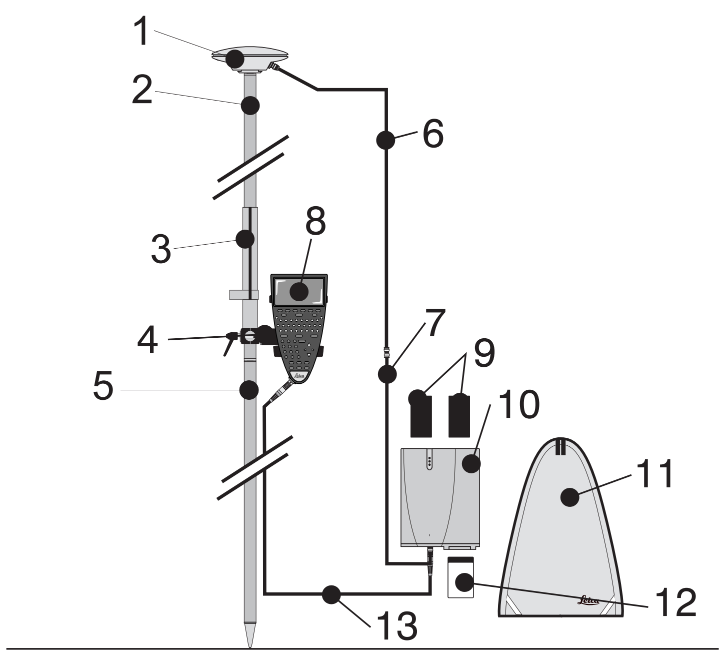
The Receiver is placed in the Minipack. Connections are made to the Antenna and TR500. Recommended for extended periods of use in the field.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

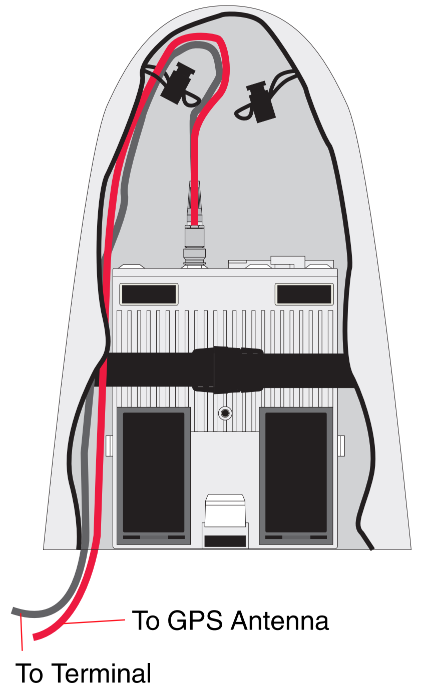
Equipment Checklist

1. GPS Antenna AT501 or 502
2. GLS21 Upper half aluminium pole with screw
3. GHT25 Grip for pole
4. GHT27 Holder for TR500
5. GLS20 Lower half aluminium pole
6. GEV141 1.2m Antenna cable
7. GEV142 1.6m Antenna cable
8. TR500 Terminal
9. 2, GEB121 Batteries
10. SR510, 520 or 530 GPS Receiver
11. GVP603 Minipack
12. MCF XMB-3 PCMCIA flash card
13. GEV97 1.8m, 5pin Lemo cable



How to set up the equipment

1. Screw the two halves of the pole together.
2. Slide the grip onto the pole. Attach the TR500 holder and tighten the screw.
3. Screw the GPS Antenna to the top of the pole.
4. Slide the TR500 into the holder until it clicks into place.
5. Insert the PC Card into the Receiver and plug in the GEB121 batteries.
6. Place the Receiver front panel up in the Minipack with the batteries facing outwards. Fasten the strap around the Receiver
7. Connect the GPS Antenna to the Receiver using the two Antenna cables. Connect the longest cable to the Receiver, pass the cable through the cable brake and down through the opening in the bottom corner of the Minipack flap. Draw the required amount of cable out of the Minipack and tighten the cable brake. Refer to the diagram.
8. Connect the TR500 to the port labelled “Terminal” on the Receiver using the 1.8m cable. Pass it through the opening in the bottom of the Minipack flap, down through a cable brake and then plug into the Receiver. Refer to the diagram.
10. Switch on the system using the ON/OFF button on the Receiver.



Connecting the TR500 Terminal and GPS Antenna in the Minipack

The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ Ensure a **dry** plastic weather protection cap is fitted to the socket on the TR500 that is not connected to the sensor.

☞ If moisture or water should appear in the socket that is not used on the TR500, allow the socket and plastic weather protection cap to dry naturally.

☞ When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

☞ Advice on using the Minipack is given in Section 2.14.

2.5 Equipment Setup - Post Processed Kinematic, All on Pole, Direct Clip of TR500 on to Sensor

Use

Post-processed Kinematic Rover.

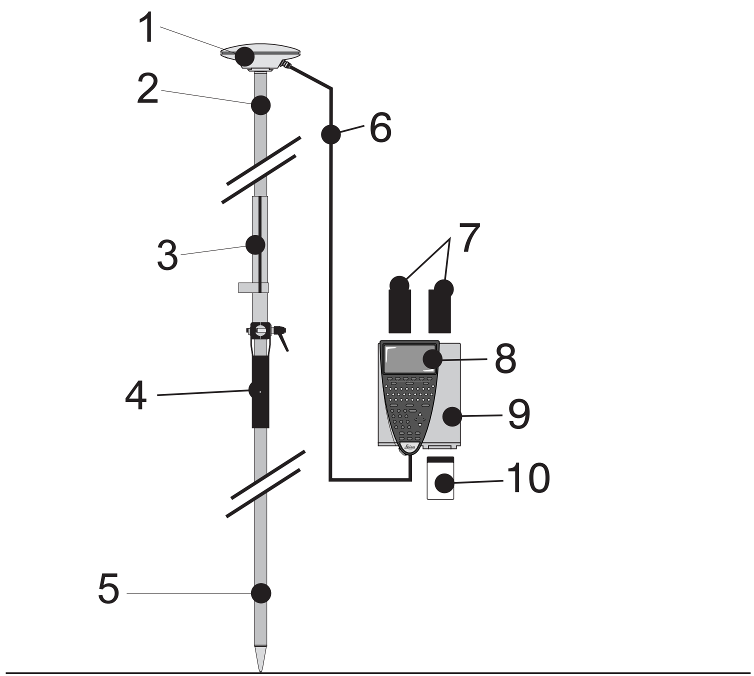
The TR500 is mounted on the Receiver which is screwed onto the pole grip. One connection is made from the Receiver to the Antenna. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

Equipment Checklist

1. GPS Antenna AT501 or 502
2. GLS18 Upper half aluminium pole with screw
3. GHT25 Grip for pole
4. GHT26 Holder for GPS Receiver
5. GLS17 Lower half aluminium pole
6. GEV141 1.2m Antenna cable
7. 2, GEB121 Batteries
8. TR500 Terminal
9. SR510, 520 or 530 GPS Receiver
10. MCF XMB-3 PCMCIA flash card



How to set up the equipment

1. Screw the two halves of the pole together.
2. Slide the grip onto the pole. Attach the GPS Receiver holder and tighten the screw.
3. Screw the GPS Antenna onto the top of the pole.
4. Attach the TR500 to the GPS Receiver. Screw the GPS Receiver to the GPS Receiver holder.
5. Insert the PC Card into the Receiver and plug in the GEB121 batteries.
6. Connect the GPS Antenna to the Receiver using the 1.2m antenna cable.
7. Switch on the system using the ON/OFF button on the TR500.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

2.6 Equipment Setup - Post Processed Kinematic, All on Pole, TR500 and Sensor separated

Use

Post-processed Kinematic Rover.

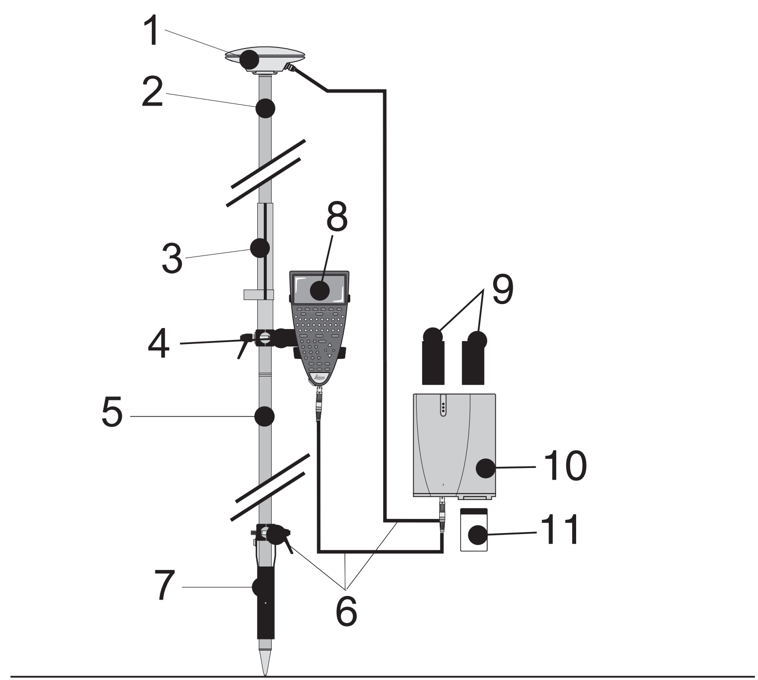
The TR500 is fixed to the pole grip with a holder. With another metallic holder and a holder piece, the receiver is fixed to the pole. One connection is made from the Receiver to the Antenna. Another connection is made from the Receiver to the TR500. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

Equipment Checklist

1. GPS Antenna AT501 or 502
2. GLS18 Upper half aluminium pole with screw
3. GHT25 Grip for pole
4. GHT27 Holder for TR500
5. GLS17 Lower half aluminium pole
6. GHT37 Holder piece for GPS Receiver with antenna cable and 5pin Lemo cable
7. GHT26 Holder for GPS Receiver
8. TR500 Terminal
9. 2, GEB121 Batteries
10. SR510, 520 or 530 GPS Receiver
11. MCF XMB-3 PCMCIA flash card



How to set up the equipment

1. Screw the two halves of the pole together.
2. Slide the grip onto the pole. Attach the TR500 holder to the grip and tighten the screw.
3. Slide the holder piece for the GPS Receiver onto the pole. Attach the GPS Receiver holder and tighten the screw.
4. Screw the GPS Antenna onto the top of the pole.
5. Slide the TR500 into the holder until it clicks into place.
6. Screw the GPS Receiver to the GPS Receiver holder.
7. Insert the PC Card into the Receiver and plug in the GEB121 batteries.
8. Connect the GPS Antenna to the Receiver using the antenna cable supplied with the GPS receiver holder piece.
9. Connect the TR500 to the port labelled "Terminal" on the Receiver using the 5 pin Lemo cable.
10. Switch on the system using the ON/OFF button on the TR500.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

2.7 Equipment Setup - Real Time Reference, single tripod

Use

Real Time Reference Station. May also collect raw observation data for post-processing.

The Receiver and TR500 (if used) can be assembled to make one unit. This clips to the tripod leg. Connections are made to the GPS and Radio Antenna. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

The Radio Antenna is mounted on the Antenna Arm which clips to the GPS Antenna.

The SR510 and SR520 can only be used as a DGPS reference station if they are fitted with the DGPS option. They cannot be used as a Real-Time Reference station.

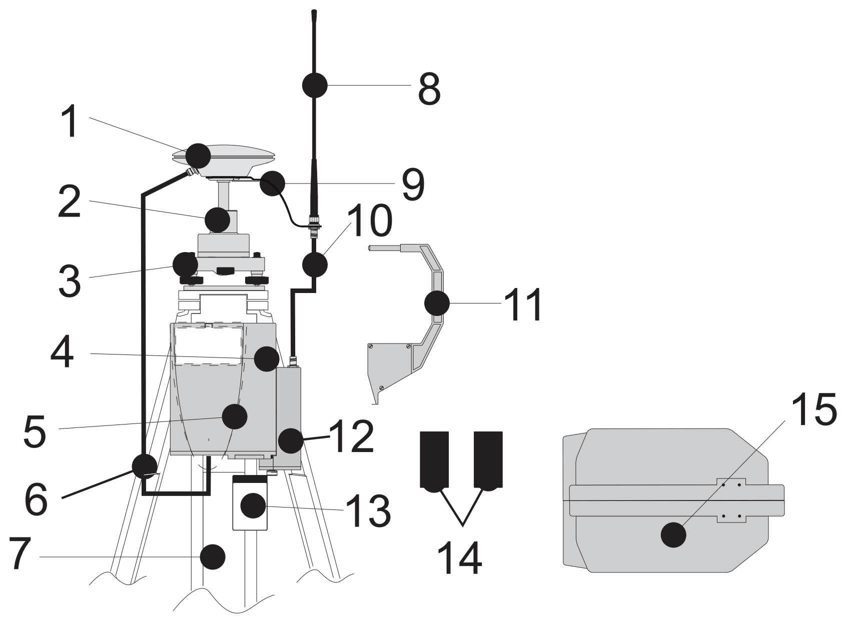
The SR530 can be used as either a DGPS or Real-Time reference station. Real-Time and DGPS are fitted as standard on the SR530.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Standard Radio modem is used. (Mounted in Radio Housing).

Equipment Checklist

1. GPS Antenna AT501, 502
2. GRT146 Carrier
3. GDF122 or GDF112 Tribrach
4. SR510/520/530 GPS Receiver
5. TR500 Terminal (if required)
6. GEV141 1.2m Antenna Cable
7. GST20/GST05/05L Tripod
8. GAT1/GAT2 Radio Antenna
9. GAD33 Radio Antenna Arm
10. GEV141 1.2m Antenna Cable
11. GZS4 Height Hook
12. Radio Modem in GFU 5/6 Housing
13. MCF XMB-3 PC card
14. 2, GEB121 Batteries
15. GVP602 Transport Case



How to set up the equipment

Follow steps 1-10 as described in section 2.3.

11. Clip the Antenna Arm to the GPS Antenna. Screw the Radio Antenna onto the Arm.
12. Attach the Radio Modem in its housing to the GPS Receiver.
13. Connect the Radio Antenna to the Radio Modem using the 1.2m Antenna Cable.
14. Switch the System On using the On/Off button on the Receiver.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is not being used, further guidance is available in Chapter 3.

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

When Using the GAD31 adapter and GRT144 carrier, ensure that the Antenna and GAD31 assembly slide down the full length of the GRT144 stub. An incorrectly mounted Antenna will have a direct effect on your results.

In wet conditions the Receiver can be placed in the transport case during use for extra protection. Try to shut the case as completely as possible.

If the Receiver is left in the case during use in temperatures exceeding 25°C, the lid should be left open. Refer to Appendix A for operating and storage temperatures.

Use an external battery such as GEB71 to extend the operating time past 6 hours.

Use

The Receiver and TR500 (if used) can be assembled to make one unit. This clips to the tripod leg. Connections are made to the GPS and Radio Antenna. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

The Radio Antenna is mounted on the second tripod. This increases the height of the Radio Antenna and therefore maximizes radio coverage.

The SR510 and SR520 can only be used as a DGPS reference station if they are fitted with the DGPS option. They cannot be used as a Real-Time Reference station.

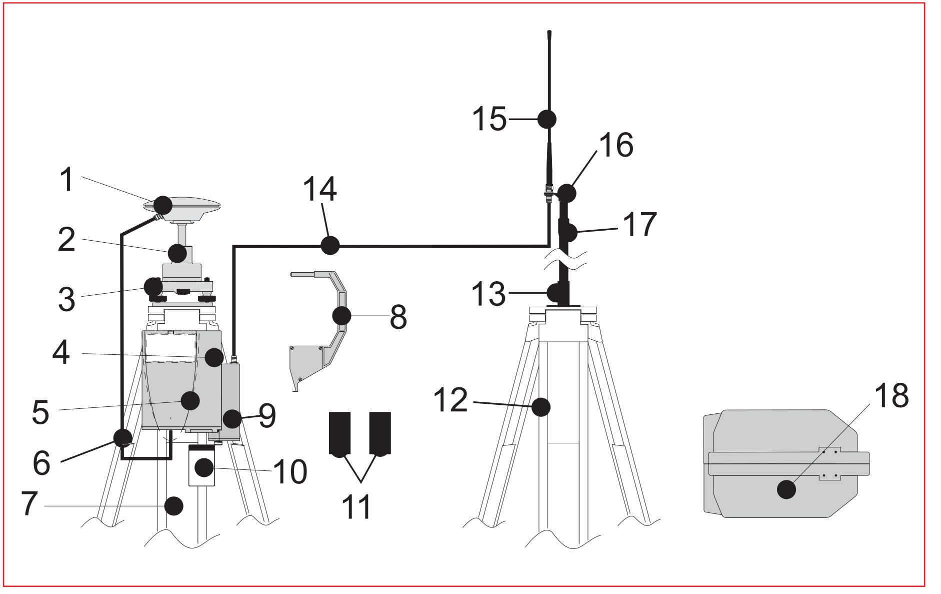
The SR530 can be used as either a DGPS or Real-Time reference station. Real-Time and DGPS are fitted as standard on the SR530.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Standard Radio modem is used. (Mounted in Radio Housing).

Equipment Checklist

1. GPS Antenna AT501/502
2. GRT146 Carrier
3. GDF122 or GDF112 Tribrach
4. SR510/520/530 GPS Receiver
5. TR500 Terminal (if required)
6. GEV141 1.2m Antenna Cable
7. GST20\GST05\05L Tripod
8. GZS4 Height Hook
9. Radio Modem in GFU5/6 Housing
10. MCF XMB-3 PC Card
11. GEB121 Batteries
12. GST20\GST05\05L Tripod
13. GHT36 Base for Telescopic Rod
14. GEV120 2.8m Antenna Cable
15. GAT1\GAT2 Radio Antenna
16. GAD34 Short Antenna Arm
17. GAD32 Telescopic Rod
18. GVP602 Transport Case



How to set up the equipment

Follow steps 1-10 as described in section 2.3.

11. Attach the Radio Modem in its housing to the GPS Receiver.
12. Set up the second Tripod nearby. Screw the Base onto the Tripod. Push the Telescopic Rod into the Base.
13. Screw the Short Antenna Arm onto the telescopic Rod. Screw the Radio Antenna onto the Arm.
14. Connect the Radio modem to the Radio Antenna using the 2.8m Antenna cable.
15. Switch the System On using the On/Off button on the Receiver or Terminal.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is not being used, further guidance is available in Chapter 3.

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ When Using the GAD31 adapter and GRT144 carrier, ensure that the Antenna and GAD31 assembly slide down the full length of the GRT144 stub. An incorrectly mounted Antenna will have a direct effect on your results.

☞ In wet conditions the Receiver can be placed in the transport case during use for extra protection. Try to shut the case as completely as possible.

☞ If the Receiver is left in the case during use in temperatures exceeding 25°C, the lid should be left open. Refer to Appendix A for operating and storage.

2.9 Equipment Setup - Real-Time Rover, Pole and Minipack

Use

The Radio Modem attaches to the Receiver and is placed in the Minipack. Connections are made to the GPS Antenna, Radio Antenna and TR500. Recommended for extended periods of use in the field.

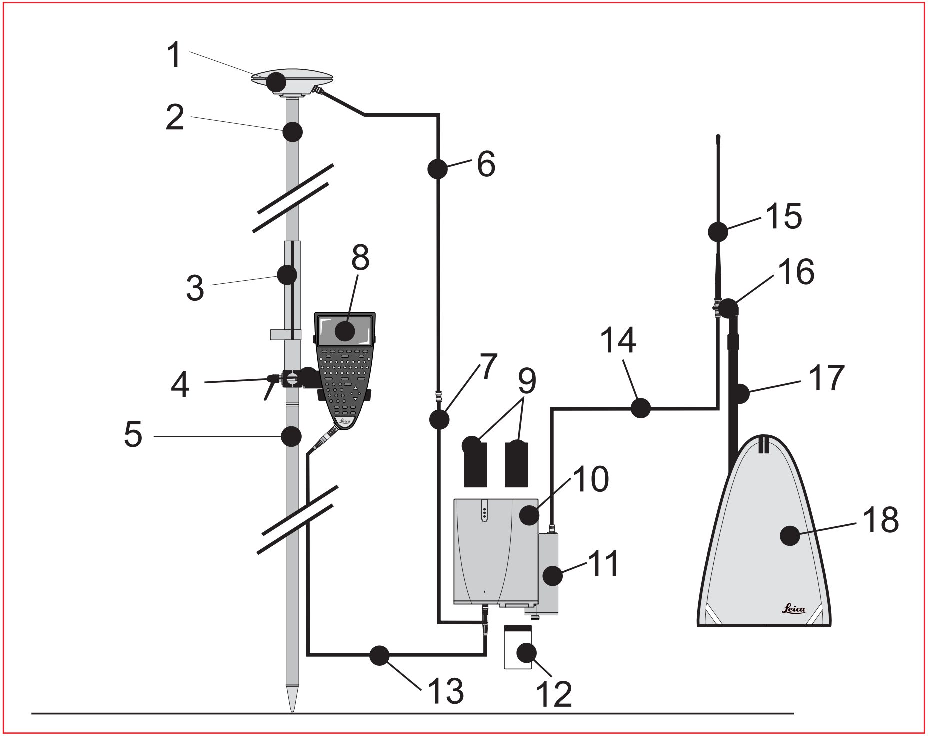
The cables coming from the Minipack can be disconnected in the event that an obstacle (E.g. a fence) has to be crossed.

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

Equipment Checklist

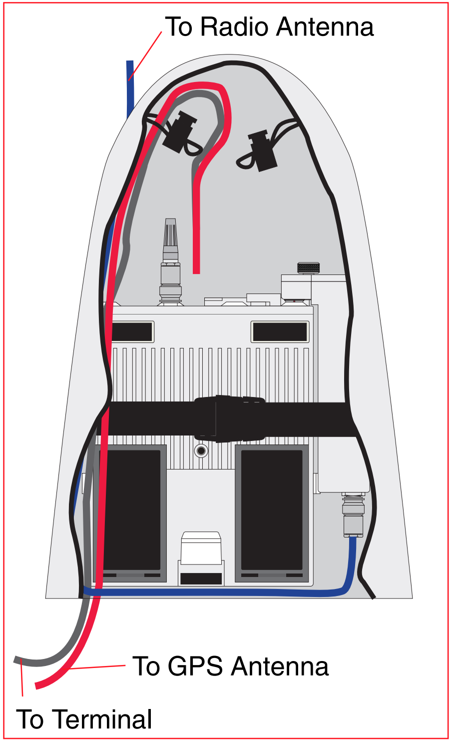
1. GPS Antenna AT501 or 502
2. GLS21 Upper half aluminium pole with screw or stub
3. GHT25 Grip for pole
4. GHT27 Holder for TR500
5. GLS20 Lower half aluminium pole
6. GEV141 1.2m Antenna cable
7. GEV142 1.6m Antenna cable
8. TR500 Terminal
9. 2, GEB121 Batteries
10. SR510, 520 or 530 GPS Receiver
11. Radio Modem in GFU5/6 Housing
12. MCF XMB-3 PCMCIA flash card
13. GEV97 1.8m, 5pin Lemo cable
14. GEV141 1.2m Antenna cable
15. GAT1/GAT2 Radio Antenna
16. GAD34 Small Antenna Arm
17. GAD32 Telescopic Rod
18. GVP603 Minipack



How to set up the equipment

Follow steps 1-5 as described in section 2.4.

6. Attach the Radio Modem Housing containing the Radio Modem to the GPS Receiver.
7. Place the GPS Receiver front panel up in the Minipack with the batteries facing outwards. Fasten the strap around the Receiver (refer to diagram)
8. Push the Telescopic Rod through the slit in the top of the Minipack. Ensure it is located in the sleeve inside the Minipack and push it all the way to the bottom. Adjust the height of the Telescopic Rod to suit.
9. Screw the Short Antenna Arm onto the Telescopic Rod. Screw the Radio Antenna onto the Short Antenna Arm.
10. Connect the Radio Modem to the Radio Antenna using a 1.2m Antenna Cable. The cable should pass down underneath the Receiver and then up through the slit in the top of the Minipack.
11. Connect the GPS Antenna to the Receiver using the two Antenna Cables. The longest Cable should be connected to the Receiver. Pass this cable through a cable brake and down through the slit under one of the reflective strips at the bottom of the Minipack. Draw the required amount of cable out of the Minipack and tighten the cable brake. Refer to the diagram.
12. Connect the TR500 to the port labelled “Terminal”on the Receiver using the 1.8m cable.Pass it through the opening under one of the reflective strips at the bottom of the Minipack, up through a cable brake and then plug into the Receiver. Refer to the diagram.
13. Switch the System ON using the ON/OFF key on the Terminal.



The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ Ensure a **dry** plastic weather protection cap is fitted to the socket on the TR500 that is not connected to the sensor.

☞ If moisture or water should appear in the socket that is not used on the TR500, allow the socket and plastic weather protection cap to dry naturally.

☞ When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

☞ Advice on using the Minipack is given in Section 2.14.

2.10 Equipment Setup - Real-Time Rover, All on Pole, direct clip of TR500 on to Sensor

Use

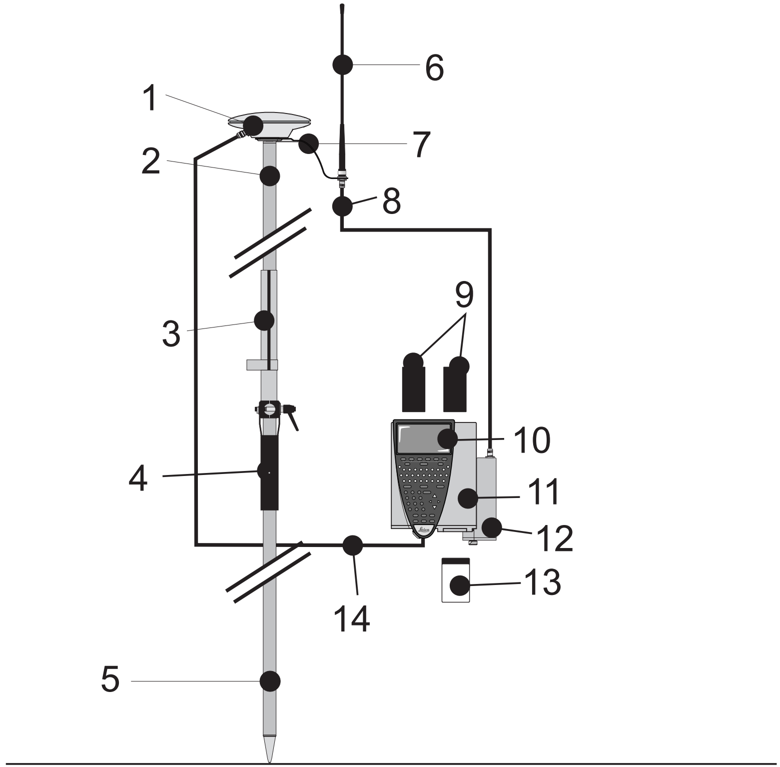
The TR500 is mounted on the Receiver which is clipped to the grip. Connections are made from the Receiver to the GPS and Radio Antennas. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

Equipment Checklist

1. GPS Antenna AT501 or 502
2. GLS21 Upper half aluminium pole with screw or stub
3. GHT25 Grip for pole
4. GHT27 Holder for GPS Receiver
5. GLS17 Lower half aluminium pole
6. GAT1/GAT2 Radio Antenna
7. GAD33 Antenna Arm
8. GEV141 1.2m Antenna Cable
9. 2, GEB121 Batteries
10. TR500 Terminal
11. SR510/520/530 GPS Receiver
12. Radio Modem in GFU5/6 Housing
13. MCF XMB-3 PC Card
14. GEV141 1.2m Antenna Cable



How to set up the equipment

Follow steps 1-6 described in section 2.5.

7. Clip the Antenna Arm to the GPS Antenna. Screw the Radio Antenna onto the Arm.
8. Attach the Radio Modem in its housing to the GPS Receiver.
9. Connect the Radio Antenna to the Radio Modem using a 1.2m Antenna Cable.
10. Switch the System ON using the ON/OFF key on the Terminal.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

☞ The Radio Antenna may also be connected directly to the Radio Housing. Note however that range and quality of signal received may be affected.

2.11 Equipment Setup - Real-Time Rover, All on Pole, TR500 and Sensor separated

Use

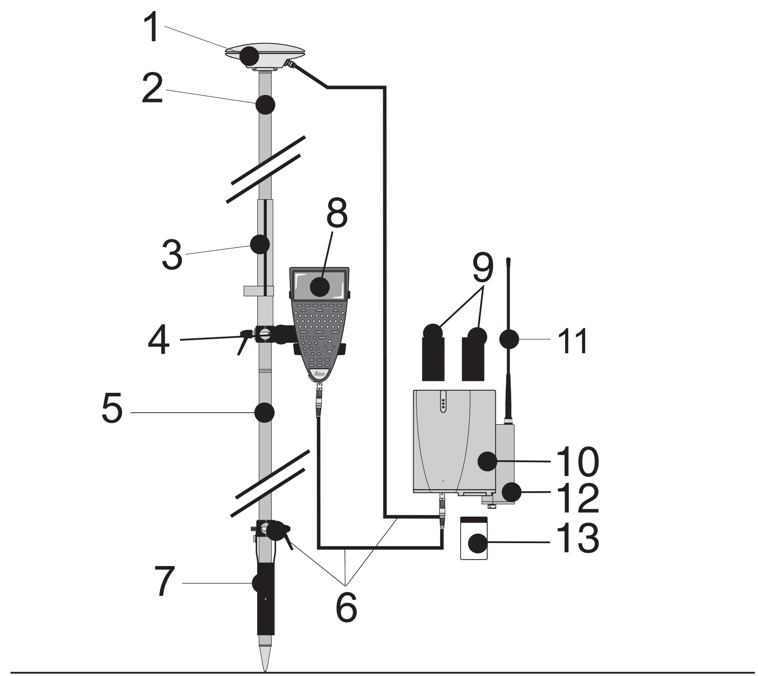
The TR500 is fixed to the pole grip with a holder. With another metallic holder and a holder piece, the receiver is fixed to the pole. The Radio Modem plus radio antenna attaches to the Receiver. One connection is made from the Receiver to the Antenna. Another connection is made from the Receiver to the TR500. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

Assumptions

1. GPS Antenna is mounted directly using screw fitting. If using stub and GAD 31 adapter, procedures may vary slightly.
2. Aluminium poles are used. You may replace them with their Carbon Fiber equivalents without any change to these instructions.

Equipment Checklist

1. GPS Antenna AT501 or 502
2. GLS18 Upper half aluminium pole with screw
3. GHT25 Grip for pole
4. GHT27 Holder for TR500
5. GLS17 Lower half aluminium pole
6. GHT37 Holder piece for GPS Receiver with antenna cable and 5pin Lemo cable
7. GHT26 Holder for GPS Receiver
8. TR500 Terminal
9. 2, GEB121 Batteries
10. SR510, 520 or 530 GPS Receiver
11. GAT1/GAT2 Radio Antenna
12. Radio Modem in GFU5/6 Housing
13. MCF XMB-3 PCMCIA flash card



How to set up the equipment

Follow steps 1-9 described in section 2.6.

10. Attach the Radio Modem in its housing to the GPS Receiver.

11. Screw the Radio Antenna onto the housing.

12. Switch on the system using the ON/OFF button on the TR500.

The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

☞ When using the upper pole halves with stub, ensure that the Antenna and GAD31 screw/stub adapter slide down the full length of the stub before tightening the locking ring. An incorrectly mounted Antenna will have a direct effect on your results.

Use

The TR500 is held in the hand with the hand pouch. Connections are made from the Receiver to the GPS (or if being used the combined GPS/DGPS antenna). Recommended for long periods of use, for mainly GIS type data collection surveys.

The setup described in the following pages assumes an RTB or RTS module is being used (see also Appendix K for further information on GIS applications).

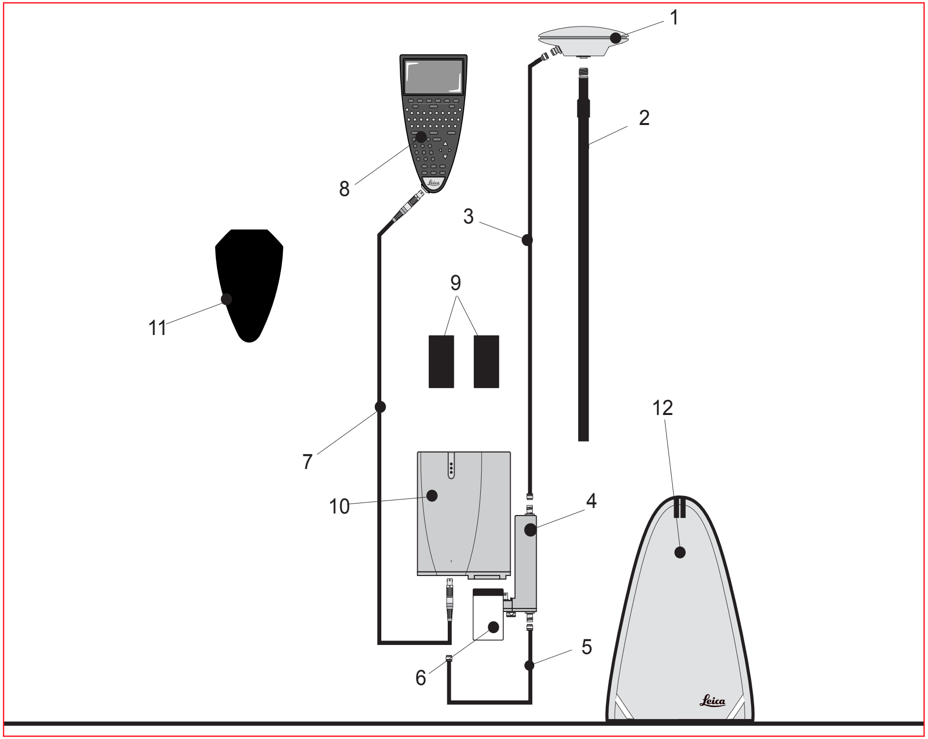
You may also use the Real-Time GIS Rover setup with a standard radio device but note the following differences:

1. With a standard radio device being used you will need a separate radio antenna: attach the GAT1/GAT2 Radio Antenna to the pole using the GAD33 Antenna Arm (see the RT-Rover, All on Pole chapter for further illustration).

2. The RTB/ RTS module cable will not be needed then: Connect the Radio antenna to the Radio modem housing using the GEV141 1.2m Antenna Cable (see the RT-Rover, Pole and Minipack chapter for further illustration).

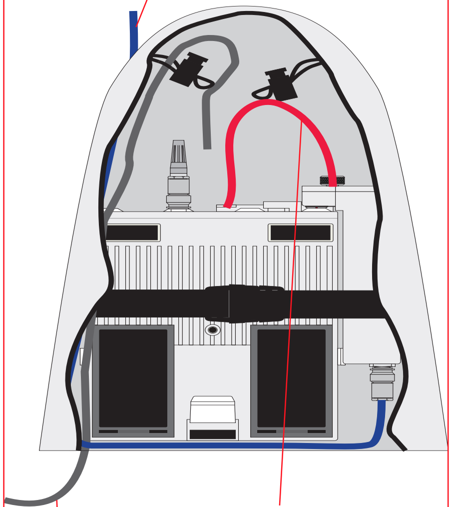
Equipment Checklist

1. Combined RTB (or RTS)/GPS antenna
2. GAD32 Telescopic Rod
3. GEV141 1.2m Antenna Cable
4. RTB (or RTS) differential receiver module
5. 0.3m GPS receiver to RTB (or RTS) module cable
6. MCF XMB-3 PC Card
7. GEV97 1.8m, 5pin Lemo cable
8. TR500 Terminal
9. 2, GEB121 Batteries
10. GS50 GPS Receiver
11. Handstrap with beltclip for TR500 Terminal
12. GVP603 Minipack



How to set up the equipment

1. Insert the PC Card into the Receiver and plug in the GEB121 batteries.
2. Place the Receiver front panel up in the Minipack with the batteries facing outwards. Fasten the strap around the Receiver
3. Connect the RTB/GPS Antenna to the Receiver using the Antenna cables. Connect the cable to the RTB/RTS module and route the cable around the bottom of the Receiver and up to to the GPS antenna. Refer to the diagram.
4. Connect the TR500 to the port labelled “Terminal” on the Receiver using the 1.8m cable. Pass it through the opening in the bottom of the Minipack flap, down through a cable brake and then plug into the Receiver. Refer to the diagram.
5. Connect the RTB/RTS module to the Receiver GPS antenna port using the 30 cm antenna cable.
6. Switch on the system using the ON/OFF button on the Receiver.



The Next Steps

If the Receiver has been pre-programmed and the TR500 is being used, further guidance is available in Chapter 7.

If the Receiver requires programming with the TR500, further guidance is available in Chapter 5.

Ensure a **dry** plastic weather protection cap is fitted to the socket on the TR500 that is not connected to the sensor.

If moisture or water should appear in the socket that is not used on the TR500, allow the socket and plastic weather protection cap to dry naturally.

Advice on using the Minipack is given in Section 2.14.

Use

The repeater box attaches to a tripod and the radio modem to the repeater box. An external battery also attaches to the tripod. The Radio Antenna is mounted on the tripod. One connection is made from the battery to the repeater box. Another connection is made from the radio to the radio antenna.

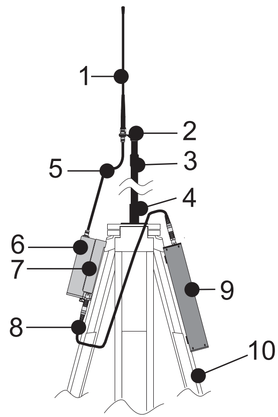
For more information on repeaters and the repeater box see Appendix H.

Assumptions

1. A RTK reference is set up, pre-programmed according to chapter 5.3 and running according to chapter 7.3.
2. A RTK rover is prepared and pre-programmed according to chapter 5.4.
3. The same type of radios are used on reference, repeater and rover station.
4. The radio modem at the repeater station is programmed to repeater mode.
5. All radio modems at reference, repeater and rover operate on the same frequency.
6. The reference and rover receivers run standard firmware 3.00 or higher.

Equipment Checklist

1. GAT1\GAT2 Radio Antenna
2. GAD34 Short Antenna Arm
3. GAD32 Telescopic Rod
4. GHT36 Base for Telescopic Rod
5. GEV120 2.8m Antenna Cable
6. Radio Modem in GFU5/6 Housing
7. GHT38 Repeater Box
8. 1.8 m Connection cable for external battery
9. GEB71 Battery
10. GST20\GST05\05L Tripod



How to set up the equipment

1. Set up the tripod.
2. Screw the Base for the Telescopic Rod onto the Tripod. Push the Telescopic Rod into the Base.
3. Screw the Short Antenna Arm onto the Telescopic Rod. Screw the Radio Antenna onto the Arm.
4. Connect the Radio Modem to the Repeater Box. Attach the Repeater Box to the tripod.
5. Connect the Radio Modem to the Radio Antenna using the 2.8m Antenna Cable.
6. Connect the Repeater Box to the GEB71 battery.

The Next Steps

As soon as the Repeater Box is connected to the battery, it is ready to receive and broadcast data.

Start surveying or a staking-out with the rover. Further guidance is available in Chapter 7.4 and 7.5.

2.14 Using the Minipack

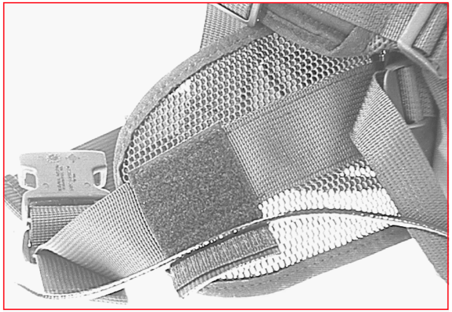
The Minipack has several features which may not be readily apparent at first. These features help to make using System 500 more comfortable.

1. Antenna Pole Strap
Ensures the Antenna Pole does not sway around and remains as upright as possible.

Pass the strap around the pole and fasten using the clip as shown in the photograph.

2. Hip Belt
The Hip Belt transfers most of the weight from the shoulders to the hips when properly adjusted.

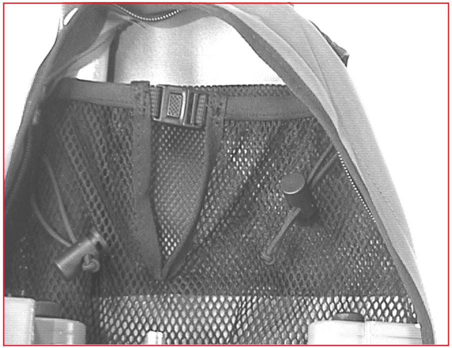
It also contains velcro attachments through which cables can be passed.



Use the attachments as shown in the photograph.

3. Internal Net Pouch

The Backpack has an internal net pouch designed for carrying an AT501 or AT502 Antenna when not in use. It can also be used for storing coiled cables or carrying a nonstandard radio modem.



4. Using the Minipack in high temperatures

In high temperatures it is desirable to increase air flow around the Receiver. Therefore the backpack can be kept half or even fully open when in use.

Open the Minipack halfway. Tuck the flap inside. Secure it with the velcro pad.

Open the Minipack flap fully and fold the flap under the Receiver during use in extremely hot temperatures.

2.15 Measuring Antenna Heights

The height of the GPS Antenna above the point consists of several components - the Height Reading, the Vertical Offset and the Phase Center Eccentricities. When a standard System 500 Antenna mounted on standard System 500 accessories is selected, the only measurement you will have to input is the Vertical Height (shown as VR in the following section). When a pole is used, even this value is automatically suggested by the Receiver as 2.00m (the height of the System 500 pole).

This means that for most operations, you will only need to input the height measurement from the height hook or use the default height measurement of 2.00m for the pole.

However, there may be cases when you need to calculate the height components, such as when using non-Leica accessories or Antennas or when not using a tripod or pole.

It is also important to realize where the Antenna Heights are measured to. This Datum is referred to as the Mechanical Reference Plane. This varies for different Antennas. It is also the datum from which the Phase Center Eccentricities are calculated.

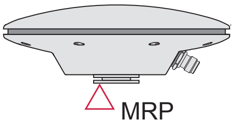
Phase Center Eccentricities of Leica Antennas are handled automatically by System 500. They will have to be entered manually when using non-Leica Antennas. Advice on how to create a new Antenna Type for non-Leica Antennas is given in the Online Help of SKI-Pro (Antenna Management).

Finally, the Antenna Height is sometimes calculated by taking a slope distance from the point on the ground to the outside edge of the Antenna. In this case, the Vertical Height must be calculated using the Slope Height and a Horizontal Offset.

Special care must be taken when using System 300 GPS Antennas with a System 500 Receiver or when using the AT501/502 GPS Antenna on the System 300 pole.

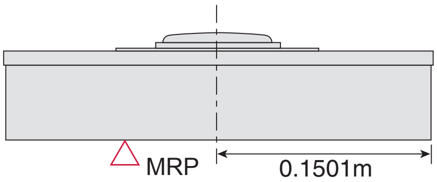
The Mechanical Reference Plane or datum to which the Antenna Height is measured and from which the Phase Center Eccentricities are calculated is shown for each Leica System 500 Antenna.

AT501 and AT502



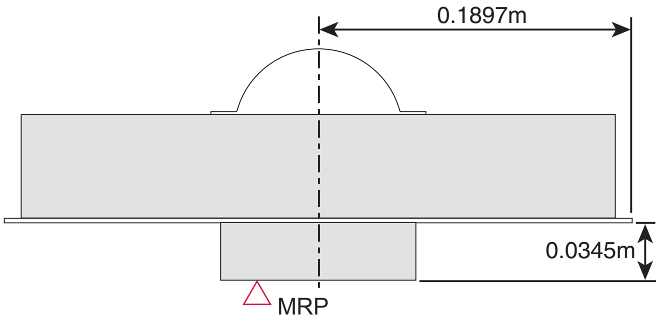
The Mechanical Reference Plane is the underside of the threaded metal insert.

AT503



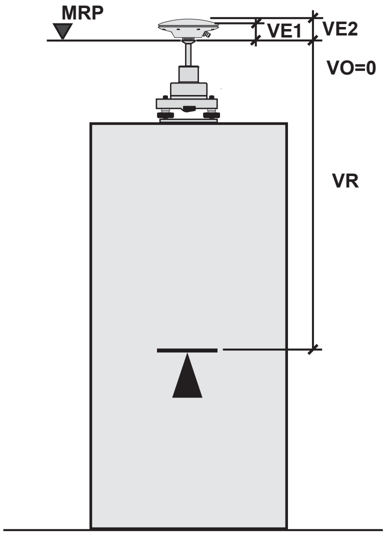
The Mechanical Reference Plane is the underside of the Antenna itself.

AT504



The Mechanical Reference Plane is the underside of the Preamplifier Housing. The AT504 is built to a JPL design specified by the IGS for Reference Stations. The Mechanical Reference Plane is always referred to as the Bottom of Preamplifier or BPA by the IGS.

1. Pillar Setup



VO Vertical Offset
VR Vertical Height Reading
VE1 Vertical Phase Center Eccentricity for L1.
VE2 Vertical Phase Center Eccentricity for L2
MRP Mechanical Reference Plane

Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

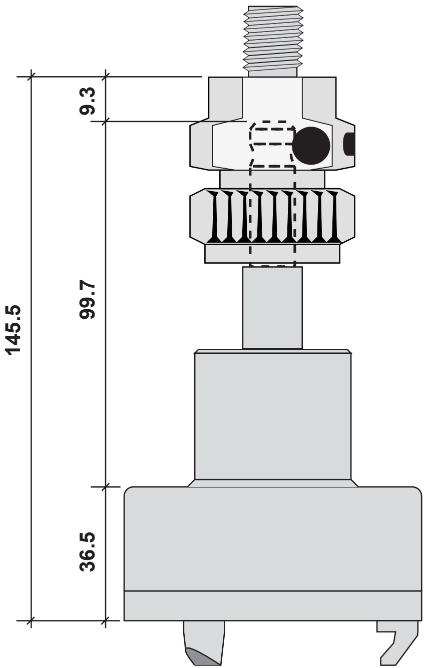
The Vertical Height (VR) value is measured from the pillar benchmark to the Mechanical Reference Plane of the Antenna. As there is no accessory available to measure the Vertical Height in this case, it is usually obtained through levelling. Refer to the details on the next page for help in measuring the Vertical Height.

The Vertical Offset is not required in this case and therefore is input as zero.

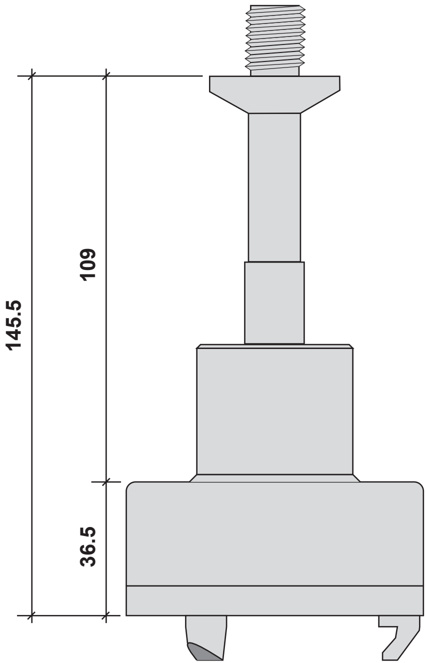
The Vertical Phase Center Eccentricities are stored in the Receiver for all Leica System 500 Antennas and any non-Leica Antenna that you define. As long as the correct antenna is chosen there is no need to enter any value into the Receiver. These values do need to be calculated when a new type of Antenna that does not exist in the Antenna Setup Records is used.

Pillar Setup II - Carrier and Adapter dimensions

All dimensions are shown in millimeters and may be required when determining the Vertical Height Reading on a pillar or other nonstandard setup. They allow you to determine the height to a surface on the carrier (which is probably easier than determining it to the Mechanical Reference Plane), and then add the remaining value to the Mechanical Reference Plane.

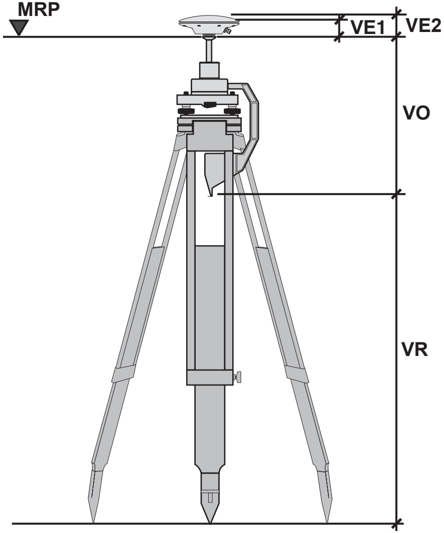


GRT44 Carrier with GAD31 Stub to Screw Adapter



GRT46 Carrier

2. Tripod Setup



VO Vertical Offset
VR Vertical Height Reading
VE1 Vertical Phase Center Eccentricity for L1.
VE2 Vertical Phase Center Eccentricity for L2
MRP Mechanical Reference Plane

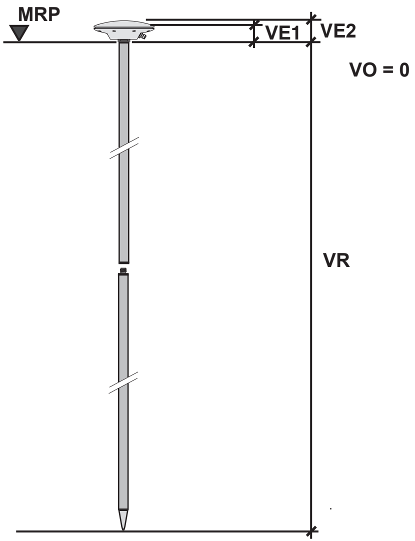
Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

The Vertical Height Reading (VR) value is measured using the Height Hook.

The Vertical Offset (VO) value is stored in the Antenna Setup record and for a Tripod Setup with the Height Hook as shown is 0.36m. This will need to be measured if you are entering a new Antenna Setup Record without using the Height Hook. There are two methods for mounting Leica Antennas - using a GRT46 with a 5/8 inch screw or using a GRT44 with stub and a GAD31 stub to screw adapter. The VO value remains constant whichever setup is used.

The Vertical Phase Center Eccentricities are stored in the Receiver for all Leica System 500 Antennas and any non-Leica Antenna that you define. As long as the correct antenna is chosen there is no need to enter any value into the Receiver. These values do need to be calculated when a new type of Antenna that does not exist in the Antenna Setup Records is used.

3. Pole Setup



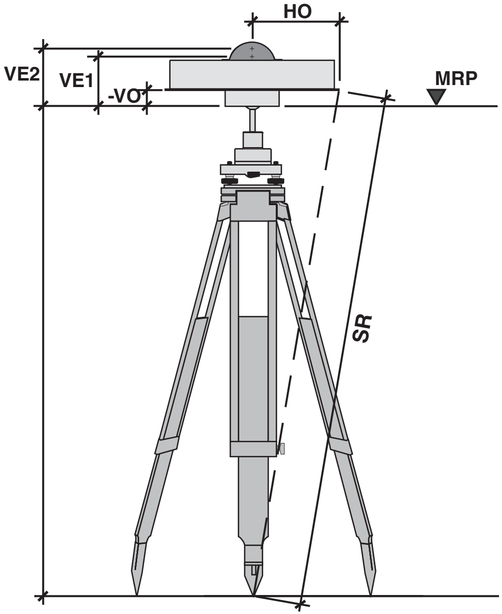
VO Vertical Offset
VR Vertical Height Reading
VE1 Vertical Phase Center Eccentricity for L1.
VE2 Vertical Phase Center Eccentricity for L2
MRP Mechanical Reference Plane

Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

The Vertical Height Reading (VR) value fixed at the height of the pole. With a standard Leica System 500 pole this is 2.0m. There are two System 500 upper pole halves. One has a 5/8 inch screw - the Antenna screws on directly. The other has a stub and uses a GAD31 stub to screw adapter. Whichever pole type is used, the height remains at 2.00m. Additional 1.00 m pole sections maybe easily added or subtracted. In some special cases where the lower half of the pole alone is used, the height will be 1.00m.

The Vertical Offset (VO) value is zero in this case.

The Vertical Phase Center Eccentricities are stored in the Receiver for all Leica System 500 Antennas and any non-Leica Antenna that you define. As long as the correct Antenna is chosen there is no need to enter any value into the Receiver. These values do need to be calculated when a new type of Antenna that does not exist in the Antenna Setup Records is used.



VO Vertical Offset
HO Horizontal Offset
SR Slope Height Reading
VE1 Vertical Phase Center Eccentricity for L1.
VE2 Vertical Phase Center Eccentricity for L2
MRP Mechanical Reference Plane

If you are using the Slope Height Reading the antenna height is calculated as follows:

$$\textbf{Antenna Height} = \sqrt{(SR^2 - HO^2)} \pm VO$$

If the Offset Point on the antenna is above the Mechanical Reference Plane MRP, the Vertical Offset VO is negative.

The Slope Height Reading is measured from the point on the ground to the outside edge of the antenna. The Antenna used for this example is a Dorne Margolin T (Leica AT504) as specified by the IGS. The Mechanical Reference Plane will differ depending on the Antenna type used.

3. Using System 500 without a Terminal

The SR510, 520 and 530 receivers can be used without the TR500 attached.

Applications and set ups most suited to this type of configuration are Reference Stations for Post-Processing and Real-Time and Static/Rapid Static measurements.

The receiver can be programmed in the office using the TR500. This greatly reduces the knowledge required to operate the instrument in the field.

Full instructions on how to program the receiver are given in Chapter 5.

3.1 Setting up the Equipment

The Receiver and Antenna will usually be mounted on a tripod or pillar. Refer to Chapter 2 for details of equipment set up and connections.

Measure the Antenna Height using the Height Hook. Note this value down. You will need to enter it into SKI-Pro when you get back to the office. You should also note the Point Id and start and stop times.

A suggested form for recording necessary data is given in section 3.5.

The Receiver needs to be configured correctly before it will work. The parameters that are especially important for working without a Terminal are in Occupation Settings. Full details are given in Chapter 5.

3.2 Operation

Once the equipment is set up, switch it on using the ON/OFF switch on the Receiver.

The equipment will automatically begin to acquire and track satellites and record data as set up in the Receiver configuration.

Wait at the point for the required time. Note that the required observation time does not begin until the Satellite Status LED is constant green (see next section). A list of approximate observation times for Rapid Static and Static baseline measurements is given in Appendix B.

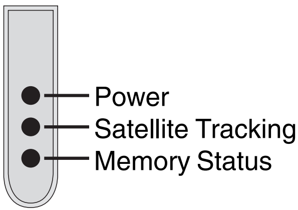
3.3 Shut Down

To shut down the equipment press and hold the ON/OFF button for 3 seconds. The LED indicators will not be lit when the equipment is switched off.

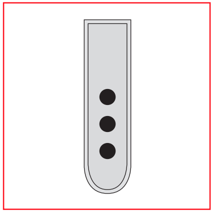
3.4 LED Indicators

Every System 500 Receiver has three LED indicators that inform the operator of basic Receiver status. The LED indicators are located at the top of the Receiver and are only visible when the TR500 Terminal is not attached.

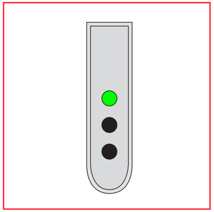
The top LED gives power information, the middle gives satellite tracking information and the lower gives memory status.



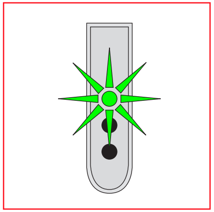
3.4.1 Power LED



Power LED off - No Power

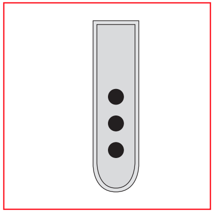


Power LED green - Power OK

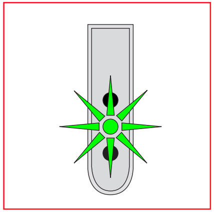


Power LED Flashing Green - Power Low

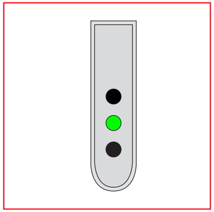
3.4.2 Satellite Status LED



Satellite Status LED off - No Satellites tracked

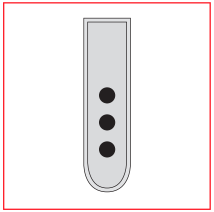


Satellite Status LED flashing green - first satellite tracked, position not yet available

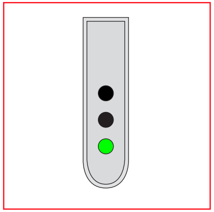


Satellite Status LED Green - Enough satellites tracked to compute position

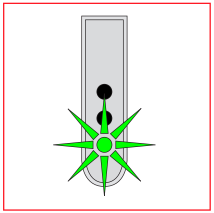
3.4.3 Memory Status LED



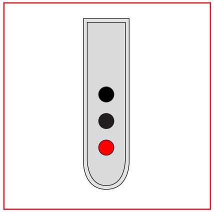
Memory Status LED off - Memory Device not available (PC Card not inserted or Internal Memory not fitted).



Memory Status LED Green - Memory capacity OK on selected device



Memory Status LED flashing green - Memory capacity 75% full on selected device



Memory Status LED red - Memory full on selected device

3.5 Field Record Sheet

Field Record - Static/Rapid Static Survey point

Operator Name: ____________________

Start time (Local): ____________________

Stop Time (Local): ____________________

Point ID: ____________________

Antenna Height: ____________________

Receiver Serial No.: ____________________

Date: ____________________

4. TR500 Terminal Overview

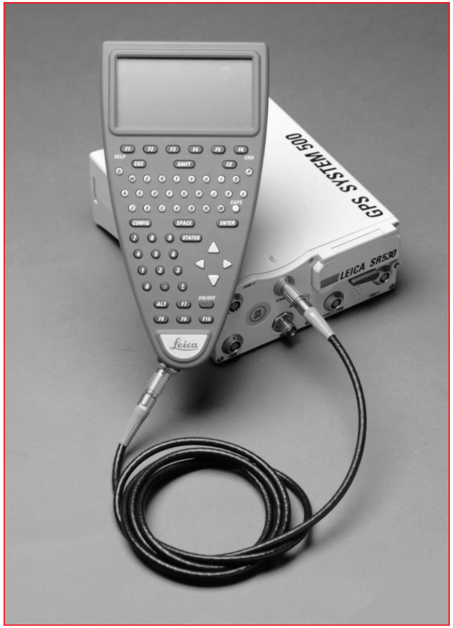
The TR500 Terminal performs three main functions:

1. Program the GPS Receiver
2. Enable input of information to the GPS Receiver
3. Display information from the GPS Receiver

The Terminal must be connected to the GPS Receiver to function. It can be connected using a cable or mounted directly onto the receiver.

Once connected, the Terminal and Receiver can be switched on using the ON/OFF key on the Terminal.

A GHT28 handstrap/beltclip is available which fits on the rear of the Terminal. This improves handling of the Terminal in applications where it is held constantly in the hand. (E.g. GIS applications).



TR500 Terminal attached to GPS Receiver with cable

4.1 Screen Layout

When activated for the first time, the Terminal runs through several boot up screens and then the Main Menu appears.

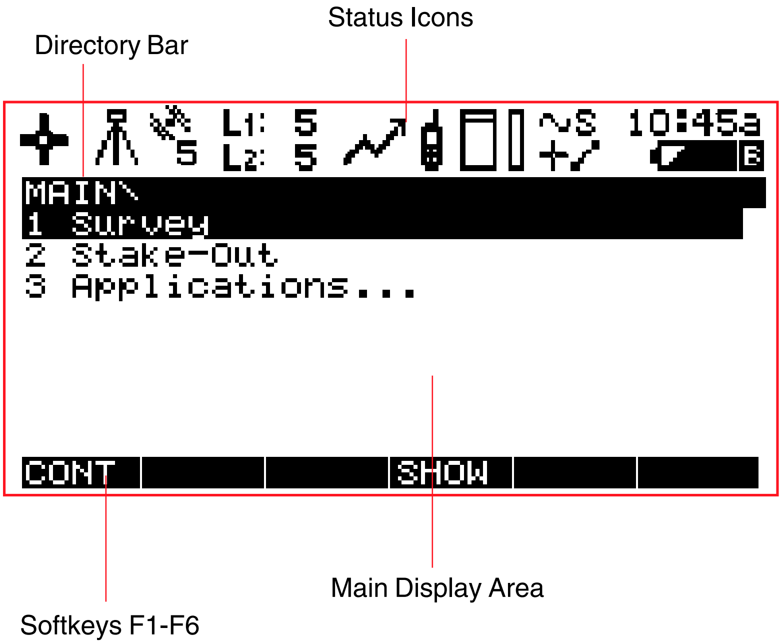
The basic layout consists of a row of status icons over a main display area with a row of six softkeys (F1-F6) at the bottom.

The Status Icons provide information related to basic Receiver functions.

The Directory Bar gives your location within the menu structure.

The Main Display Area shows information regarding the receiver and/or ongoing survey operation.

The Softkeys (F1-F6) indicate which command may be executed by pressing the relevant key.



On certain screens a shift symbol will appear in the bottom right corner above the softkey. It indicates that further choices are available on the softkeys.

At this time, the shift key appears so:

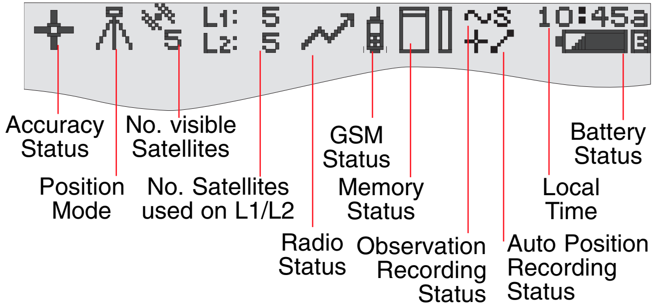
When it is pressed, it appears so:

Pressing it again will toggle back to the original softkeys.

When a function is being carried out that will take a significant amount of time, the hourglass symbol (shown below) will appear.

This indicates that the system is busy.

4.2 Status Icons



Note that the icons that appear depend upon which System 500 Receiver you are using, the options set on it and the configuration that you are using.

Accuracy Status

 High Precision Navigation (cm level)

 Precision Navigation (0.5 - 5m level)

 Navigation (<100m)

When no position is available, no icon is shown.

Position Mode

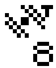
Static - the GPS Antenna should be held stationary.

Moving - The GPS Antenna may move.

The Position Mode is governed by the type of operation defined in the Configuration.

No. Visible Satellites

The number of theoretically visible satellites according to the current almanac are displayed.



When the Track Mode is set to MaxTrak this will be indicated with a little “T” being added to the icon.

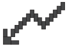
No. Satellites used on L1/L2

When an Accuracy Status icon is displayed the number of satellites currently used for the position computation are shown. Satellites that are tracked but with a poor signal quality are not shown.

When no Accuracy Status icon is displayed the number of tracked satellites are shown, irrespective of the signal quality.

Radio Status

 Radio Transmitting (blinks)

 Radio Receiving (blinks)

If two radio modems are being used simultaneaously, the icon will alternate between each modem.

GSM Status

 The GSM phone is connected to the network.

If this icon blinks, the GSM phone is either trying to connect to or disconnect from the network.

Memory Status

 Internal Memory selected

 PC-Card selected

 Safe to remove PC-Card

 Memory level Indicator. Has 12 levels between:

 Memory Empty and

 Memory Full

Observation Recording Status

The Receiver is recording raw GPS observations in Stationary mode. The Receiver should be held stationary.

The Receiver is recording raw GPS observations in Moving mode. The Receiver may move.

Auto Position Recording Status

Will appear when Auto Position Recording has been activated in the Configuration Set.

Positions are being recorded according to distance.

Positions are being recorded according to time.

Local Time

The local date can be set to display either 12 or 24 hour clock.

Battery Status


Battery Voltage OK


Battery supplying 2/3 peak voltage


Battery supplying 1/3 peak voltage


Battery empty

The battery being used is denoted by the letter next to it. A and B are the plug-in camcorder batteries, E is the external battery.

This example shows that an external battery is fully charged and is being used to power the system.

The system will always use the battery with the highest voltage level.

Due to the discharge characteristics of the batteries, the lengths of time between the four voltage level icons may not be consistent. The voltage level will decrease more quickly the lower it gets.

4.3 Keyboard

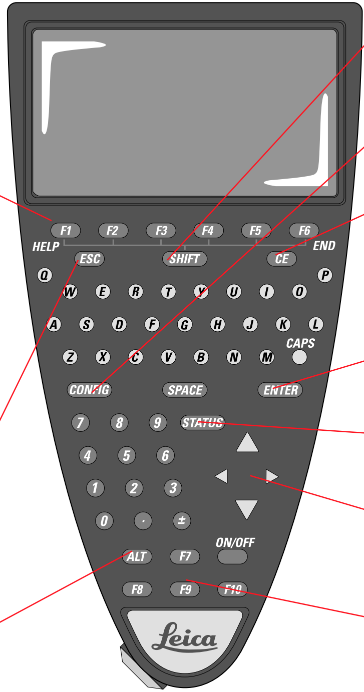
The Terminal keyboard is a QWERTY layout designed for use in temperture extremes and also for gloved hands if necessary.

The six keys **F1-F6** at the top of the keyboard correspond to the six softkeys that appear on the screen when the Terminal is activated.

Pressing **Shift** followed by **F1** will always activate the Help screen. Pressing **Shift** followed by **F6** will quit the Help and return you to the screen you were on.
Alternatively, pressing **Shift** followed by **F6** will quit Survey, Stake Out or Application.

Use the **Esc** key to step back to the previous screen at any time.

Use the key combination Alt + L to lock and unlock the terminal.
Use the key combination Alt + B to switch the screen illumination on and off.



Use the **Shift** key when the Shift symbol is displayed to reveal further choices on the softkeys F1-F6.

Use the **CONFIG** key to enter the Configuration menus at any time.

The **CE** key is used to clear the last character entered when entering names, numbers etc. into the Re-ceiver.

Use the **ENTER** key to confirm an entry into the system.

Use the **STATUS** key to access status information at any time.

Use the Cursor keys to move around the screen.

The keys **F7-F10** are user definable function keys. They can be defined to execute commands or access any screen of your choosing. See section 9.4.

4.4 General Operating Principles

There are several conventions used in the user interface of System 500.

1. Function Keys
F1-F6 function keys appear below six bars on the screen. These bars will appear with commands in them on each screen. To execute the command, press the corresponding function key.

2. Entering Data
At times you will have to enter Point Ids, Names etc. Enter the data using the keyboard and press the Enter key.

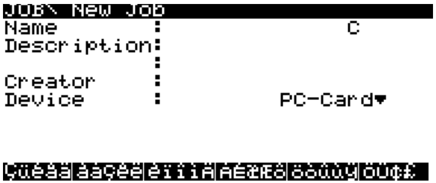
Special characters such as ä, á, ç etc. can be entered using the alphanumeric input. When the character you wish to input is not on the keyboard, press the Enter key. The F1-F6 keys will then contain 5 characters on each. Press the key that contains the character you require. The F1-F6 keys will then contain one of each of the five that you selected. Use the up and down cursor keys to scroll through all the possible characters. Press the key that corresponds to the character you require.This will then be entered. The extra characters that are available for use can be configured in the Configure menu.

Working Example

Application - Entering a special character.

Technique - N/A

Requirement - You need to enter the Job name “Cézanne”. All the characters are contained on the keyboard except “é”.



Field Procedure - The “C” is entered. To select the “é”, press **F1**. The function keys will then change as follows:

Press **F3** to select the “é”.

3. Selecting items from list boxes

At times you will have to select an item from a list box. This could be a point Id, Job, code etc. There are two types of list boxes.

1. The list box appears as the whole screen.
2. An item appears with an arrow next to it indicating a drop down list box.

When a list box appears on the whole screen, a search field will appear in the directory line with a blinking cursor. If you know the name of the item you are search for you may type in the first few letters. The item(s) that match what you type will be automatically highlighted. This is case sensitive. List boxes that contain more lines than is possible to fit on the screen have a scroll bar at the side. This indicates your position within the list.

Alternatively you can move down the list item by item using the cursor keys.

Pressing Shift will reveal **HOME** (**F2**), **END** (**F3**), **PG UP** (**F4**) (Page Up) and **PG DN** (**F5**) (Page Down) keys. You may also use these keys to scroll up and down the list.

When a drop down list box is available, a small arrow appears next to the selected item, as with **Ant Name** shown below.

Press the right or left cursor key to cycle through the choices or press **ENTER** to make the drop down box appear.

A search field will appear at the top of the list box with a blinking cursor. If you know the name of the item you are search for you may type in the first few letters. The item(s) that match what you type will be automatically highlighted. This is case sensitive.

Alternatively you can move down the list item by item using the cursor keys.

Pressing **SHIFT** will reveal **HOME** (**F2**), **END** (**F3**), **PG UP** (**F4**) (Page Up) and **PG DN** (**F5**) (Page Down) keys. You may also use these keys to scroll up and down the list.

5. Configuring the Receiver

The receiver has numerous parameters and functions which can be configured by the user.

Different Configuration Sets are used for different measuring techniques. Several default Configuration Sets are programmed into the receiver before delivery. These default files should cover the majority of applications.

However, you also have the opportunity to define your own Configuration Sets. You may define several Configuration Sets to cover every type of operation that you are likely to carry out. This can be done using the TR500 Terminal.

There are two methods for defining the Configuration. You can select **Configure** from the Main Menu or press the **CONFIG** key.

Selecting **Configure** from the Main Menu enables a sequential configuration. Parameters can either be defined one after each other or explicitly selected from a list. These parameters are saved permanently in the Configuration Set and will be used as defaults each time the Configuration Set is used.

Pressing the **CONFIG** key enters a menu from which you can choose the parameter you wish to define. Certain infrequently used parameters are only available through the **CONFIG** key and are not contained in the sequential configuration.

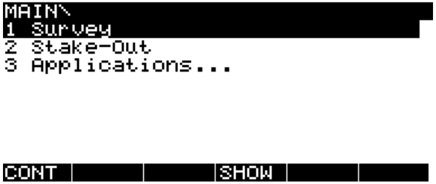
It is recommended that the **CONFIG** key is only used when you are already measuring and realize that you need to change a parameter temporarily (for the duration of the current survey), or need to configure a parameter not contained in the sequential configuration.

When **Configure** is selected from the Main Menu there are two configuration levels available, **Standard** and **Advanced**. **Standard** is recommended for most users. **Advanced** enables definition of parameters required for specialized applications.

To start defining a Configuration Set, attach the Terminal to the Receiver directly or connect it using a Lemo cable.

Switch on the Receiver and Terminal by pressing the **ON/OFF** key.

The following screen will appear the first time you switch on.



The most frequently used functions are displayed. Use **SHOW/HIDE** (**F4**) to reveal/hide all of the functions.

This chapter covers configuration using the sequential configuration (**Configure**) from the Main Menu. Details about configuration using the **CONFIG** key can be found in Chapter 9.
Select **Configure** from the Main Menu. Press **CONT** (**F1**).

The following screen will appear:

You can select a Configuration Set by moving up and down the list and pressing **CONT** (**F1**) or entering the name of the Configuration Set. Press **EDIT** (**F3**) to edit it. Changes in default Configuration Sets are only temporary until the sensor is turned of. Permanent changes, require the creation of a new Configuration Set.

To enter a new Configuration Set press **NEW** (**F2**).
To delete a Configuration Set press **DEL** (**F4**). You will be asked for confirmation before the Configuration Set is deleted.

Pressing **INFO** (**F5**) toggles between the date of creation, creator and description of the Configuration Sets.

Entering a new Configuration Set
After **NEW** (**F2**) has been selected, the following screen will appear.

Enter the **Name** and, if required a **Description** and **Creator**. Press the **ENTER** key after each entry. Press **CONT** (**F1**) when you are finished.

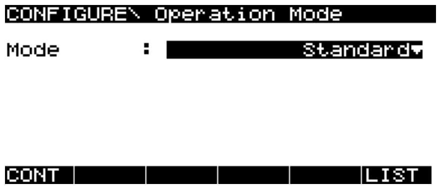
If you create a new Configuration Set a copy of the highlighted Configuration Set will be created.

This section covers configuration of the receiver for post-processed Static, Rapid Static or Kinematic Reference operations.

Highlight the Configuration Set you wish to edit and press **EDIT** (**F3**). Note that you cannot edit default Configuration Sets. You have to create a new Set and then edit it.

Operation Mode
Select the Operation Mode that you require. The Operation Mode defines which Configuration screens will be available to you.

You may choose between **Standard** and **Advanced**. **Standard** is recommended for most users. **Advanced** enables definition of parameters required for specialized applications.



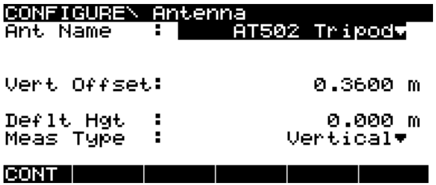
When you have made your selection press **CONT** (**F1**) to go through the fixed order of parameter panels.

Or press **LIST (F6)** to get a listing of the available parameter panels which can then be accessed individually with **CONT (F1)**. Changes are automatically stored at the end of the list. Changes in individual parameter panels can be stored with **STORE (F3)** without the need to go to the end of the list.

The Standard Operation Mode is described from here on. The extra configurable features available when Advanced is selected are described in section 5.1.1.

Antenna

Select the Antenna configuration that you are using.



Ant. Name - Displays and selects the currently selected antenna setup.

Vert Offset - Displays the vertical offset defined in the Antenna setup (**Ant Name**).

Deflt Hgt - Displays a default height for the Antenna setup. This is of little use for Static or Rapid Static applications where the Antenna height differs with each setup.

Meas Type - Also, enter the means by which the Antenna height was measured. For the majority of GPS Antennas (including all Leica antennas), this will be **Vertical**. The height of some non-Leica GPS antennas can only be measured by taking the slope distance to the outer edge of the Antenna. If this is the case, select **Slope** and enter the averaged value. You will then be required to enter a **Horizontal Offset** also. See Section 2.15.3 for more details on measuring slope height.

To select an antenna setup, highlight **Ant. Name** and press **ENTER** to open the drop down box. All of the existing antenna setups are listed.

You may select from this list or enter your own Antenna configuration by pressing the **NEW** (**F2**) key. Note that the settings from the currently highlighted antenna setup are taken over as suggested default values.

Most Static and Rapid Static Surveys or Reference Stations are carried out using a tripod or pillar setup.

When a factory default tripod setup is chosen, the Vertical Offset is automatically set at 0.36m. You will only need to measure the height with the height hook when setting up over a point.

Note that factory default antenna setups contain an elevation dependent correction model. This is not seen by the user. When setting up your own configuration with the Receiver, this model is not taken over. This model is required for real-time rover operations. If you need to input your own antenna setup and it requires an antenna correction model, use SKI Pro to configure the antenna setup and transfer it to the Receiver.

Advice on calculating Antenna heights and offsets for Leica and non-Leica Antennas is given in Chapter 2.15.
Use the **EDIT** (**F3**) key to edit the highlighted Antenna configuration. Note that factory default Antenna configurations can only be viewed and not edited.

Use the **DEL** (**F4**) key to delete an Antenna configuration.

Use the **DEFLT** (**F5**) key to reveal factory default Antenna configurations with current System 500 GPS Antennas. This will then change to **ALL**. Use **ALL** (**F5**) to reveal System 300 Antenna configurations also. You can pick out the Antenna configurations that you will use the most and delete the rest. All possible factory default Antenna configurations may still be accessed in the future by using the **DEFLT** and **ALL** keys.

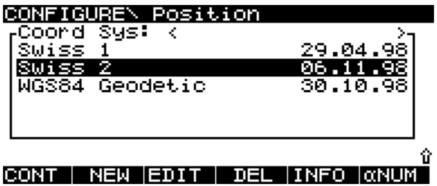
Position
This screen defines the way in which position is displayed. These settings are mostly used for Real-Time Rover setups.

Update Rate - Defines the rate at which the position will be updated on the display.

Coord Sys - You may select a coordinate system which will be used to display the positions. The WGS84 coordinate system will always be available and should be sufficient for Static/Rapid Static work. You may determine other coordinate systems in SKI Pro and upload them or you may determine other coordinate systems in the field using **Applications\Determine Coord System** (see section 11.1).

Further options are available on this screen in Advanced mode. See section 5.1.1 for details.

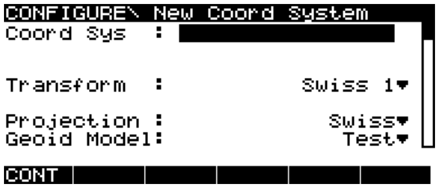
Highlight **Coord Sys** and press **ENTER** to reveal the list of coordinate systems currently available.



Select the coordinate system that you wish to use.

Use **NEW** (**F2**) to define a new coordinate system. Use **EDIT** (**F3**) to edit a coordinate system. Use **DEL** (**F4**) to delete the selected coordinate system and **INFO** (**F5**) to reveal the type of transformation used.

When **NEW** (**F2**) is pressed, the following screen appears.



Coord Sys - Defines the name of the new coordinate system.

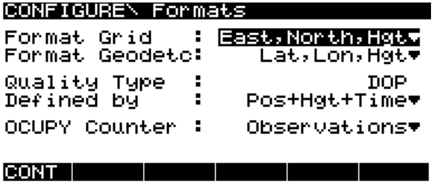
Further advice on Coordinate Systems is given in Section 11.

When you have set the parameters press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

When using **EDIT** (**F3**) the same descriptions apply.

Press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

Formats



You can configure the way in which information is presented when surveying.

Format Grid - The format of grid coordinates if they are being used.

Format Geodetic - The format of geodetic coordinates if they are being used.

Quality Type - The way in which the quality of a position is displayed in the Main Survey screen. This is Hard-wired to **DOP** for Static/Rapid Static Configurations. It will display a Dilution of Precision according to the components defined.

Defined by - Defines the components used to calculate the **DOP**. The definitions of the **DOP** are as follows:

Height - VDOP
Pos - HDOP
Pos + Hgt - PDOP
Pos + Hgt + Time - GDOP

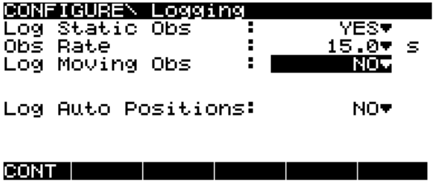
OCUPY Counter - Defines how the length of time spent occupying a point is displayed. Select from **Time** - normal time or **Observations** - the number of observations recorded.

Coding
If you wish to select a coding system press **ENTER** and choose from Thematical or Free coding. Complete descriptions of the coding systems used by System 500 are given in Chapter 8.

Press **CODES** (**F3**) to review the codes in the chosen codelist. You may also edit the codelist here.

Real-Time
For Static or Rapid Static post-processing operations select **None** and press **CONT (F1)**.

Logging



Log Static Obs - Switches logging on or off when the Receiver is in Static mode. The receiver has to be stationary.

Obs Rate - The rate at which observations will be logged. For Static observations over long baselines and long periods of time 15-30 seconds is a reasonable rate. For Rapid Static applications, 10-15 seconds is normally used. For Reference stations for post-processed and real-time kinematic rovers, the rate should be set the same as at the Rover.

Log Moving Obs - Only available when **Log Static Obs** = **YES**. Sets the observation rate when the receiver is in Moving mode. This is only used in Real-Time kinematic and Post-Processed kinematic operations.

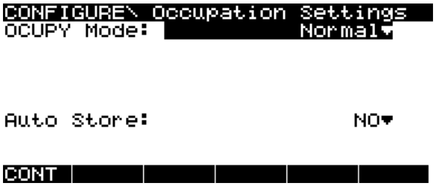
Log Auto Positions - Will automatically log positions at a specified rate. This is mostly used for real-time rover operations. See section 5.4 for details.

Press **CONT** (**F1**) to continue to the next screen.

Further options are available on this screen in Advanced mode. See section 5.1.1 for details.

Occupation Settings

These settings control the way in which points are occupied and recorded.



OCUPY Mode - Sets the way in which coordinates will be recorded for a point. For Static, Rapid Static and Post-processed Reference Station applications **Normal** only will be available.
This means that observations will be recorded until the **STOP** key is pressed. The last observation that is recorded is the one that expired directly before **STOP** was pressed.

Auto Store - Allows you to automatically store a point after the **STOP** key has been pressed.

Further options are available on this screen in Advanced mode. See section 5.1.1 for details.

Id Templates

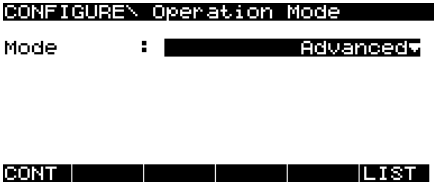
An Id template is used to pre-define a Point Id. This feature is mainly used in post-processed and real-time kinematic operations where many points are collected quickly. For Static, Rapid Static and Real-Time Reference operations, set all fields to **No template used**.

Further options are available on this screen in Advanced mode. See section 5.1.1 for details.

Press **CONT** (**F1**) to complete the configuration. You will return to the Main Menu.

The Advanced Mode contains extra configurable parameters that may be required for certain specialized applications.

Select Advanced in **CONFIGURE\Operation Mode**.



Only the screens that differ from those seen in Standard Mode are described here.

Position
In addition to the functionality given in Standard mode, details about the chosen coordinate system are given.

Residuals - Available when editing a coordinate system. The method by which residuals will be distributed throughout the transformation area is displayed.
This may help the transformation result be more realistic and help disperse any strains in the transformation. **1/Dist**, **1/Dist^2** and **1/ Dist$^{3/2}$** distributes the residuals of the control points according to the distance between each control point and the newly transformed point.

Multiquadratic distributes the residuals using a multiquadratic interpolation approach.

Transform - The name of the transformation set used is displayed.
Ellipsoid - The name of the local ellipsoid is displayed.
Projection -The name of the projection used is displayed.
Geoid Model - The name of the geoid model used is displayed.
CSCS Model - The name of the CSCS model used is displayed.

Note that the details that are displayed depend upon the type of transformation used. Certain types of transformation do not use all of the described parameters to calculate local coordinates.

Logging

In addition to the functionality given in Standard mode, you can also specify the observables to be recorded and access further functionality via the **FILES** (**F6**) key.

```
CONFIGURE\ Logging
Log Static Obs     :      YES▾
Obs Rate           :     15.0▾ s
Log Moving Obs     :       NO▾

Observables        :   Normal▾
Log Auto Positions:        NO▾

CONT                        FILES
```

Observables - Defines what is recorded in the raw GPS data. **Extended** records extra observables including the Doppler observable.

Pressing the **FILES** (**F6**) key enables you to configure further options.

```
CONFIGURE\ Log Files

Log File Segments :   1 File▾

Auto Del Log Files:      Never▾


CONT
```

Log File Segments - Will split up the recorded data into files of a specific time-based length unless **1 File** is selected. If a time is selected the option **Split Tracks** will become available. Select **No** will only record data into a new file if the time is reached and a new track is observed.

Auto Del Log Files - Will delete the recorded data after the specified length of time unless **Never** is selected.

Press **CONT** (**F1**) to return to CONFIGURE\Logging.

Occupation Settings

Additional functionality available in this panel over Standard mode is **Auto OCUPY**, **Auto Stop**, **STOP P-PRC** and **END Survey**.

```
CONFIGURE\ Occupation Settings
OCUPY Mode:                Normal▾
Auto OCUPY:                   YES▾
Auto Stop :                    NO▾

STOP P-PRC:                  Time▾
Auto Store:                    NO▾
END Survey:             Automatic▾

CONT                   P-PRC
```

Auto OCUPY - will automatically occupy the point as soon as the survey is started. **Timed** is chosen for automatic point occupations at a certain time. The time is specified in the SURVEY panel.

Auto Stop - will automatically stop the measurements according to the setting in the **STOP P-PRC** function. The measurements stop when the criteria for the setting reach 100%.

STOP P-PRC - Defines the method used for Auto Stop when Auto Stop is set to **YES**.
When Auto Stop is set to **NO** a percentage value will be displayed next to the Time or Epochs in the Main Survey screen. This indicates how much of the Auto Stop criteria has elapsed. The Auto Stop criteria is defined using the **P-PRC** (**F5**) key (see below).

END Survey - Defines how the survey will be ended. **Manual** lets you exit the survey yourself. **Automatic** will exit the survey automatically. **Auto & Shut-down** will exit the survey and turn the sensor off.

When one of the **STOP P-PRC** options is selected the **P-PRC** (**F5**) key will become available. Pressing this key will enable you to configure the option you have selected.

When:

Time is selected, set the required observation time for each point. The time starts counting when **OCUPY** is pressed. The Receiver stops recording when the set length of time is reached.

STOP&GO Indicator is selected, set the baseline range. When measuring, an observation time will be calculated based on the selected baseline range, the number of available satellites and the GDOP. This is displayed as a percentage value.

Observations is selected, set the number of epochs that should be recorded at each point.

# of Sats is selected, set the length of time to observe depending on the number of satellites available. You may edit the value for each number of satellites. Should the number of available satellites change during observations, the observations already recorded will be taken into account. Should the number of satellites decrease, more time will be added. Should the number of satellites increase, time will be subtracted. The Receiver stops recording when the time limit is reached.

Press **CONT** (**F1**) to return to CONFIGURE\Occupation Settings.

Working Example

Application - Post Processed Rapid Static Observation Recording

Technique - Rapid Static

Requirement - You wish to view the Stop and Go Indicator on the Main Survey screen but do not want to automatically stop the survey.

Settings -

```
CONFIGURE\ Occupation Settings
OCUPY Mode:              Normal▾
Auto OCUPY:                  NO▾
Auto Stop :                  NO▾

STOP P-PRC: STOP&GOIndicator▾
Auto Store:                  NO▾
END Survey:              Manual▾

CONT                P-PRC
```

Other Settings - Use **P-PRC** (**F5**) to set the **Baseline Length**.

Field Procedure - After pressing **OCUPY** the time or epoch counter will start. The Stop and Go Indicator percentage value will be shown in brackets next to this. It will run until **STOP** is pressed. The observations will not stop being recorded at 100% automatically. Further information regarding the STOP & GO indicator is available in STATUS\SURVEY\STOP&GO Indicator.

Id Templates

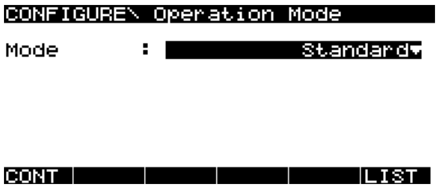
Id Templates are not normally of use for Static, Rapid Static or Kinematic Reference Stations and should be set to **No Template Used**.

However, should you wish to use them, you will find you may also configure Id Templates for Auxiliary Points in exactly the same way as for normal points.

This section covers configuration of the receiver for Post-Processed Kinematic operations.

Operation Mode
Select the Operation Mode that you require. The Operation Mode defines which Configuration screens will be available to you.

You may choose between **Standard** and **Advanced**. **Standard** is recommended for most users. **Advanced** enables definition of parameters required for specialized applications.



When you have made your selection press **CONT** (**F1**) to go through the fixed order of parameter panels.

Or press **LIST (F6)** to get a listing of the available parameter panels which can then be accessed individually with **CONT (F1)**. Changes are automatically stored at the end of the list. Changes in individual parameter panels can be stored with **STORE (F3)** without the need to go to the end of the list.

The Standard operation mode is described from here on. The extra configurable features available when Advanced is selected are described in Section 5.2.1.

Antenna

Select the Antenna configuration that you are using.

Ant. Name - Displays and selects the currently selected antenna setup.

Vert Offset - Displays the vertical offset defined in the Antenna setup (**Ant Name**).

Deflt Hgt - Displays a default height for the Antenna setup. If the antenna will always be mounted at a fixed height (E.g. on a pole or always at the same fixed location), enter the value. You will also get a chance to enter the height for each set up during survey operations.

Meas Type - Also, enter the means by which the Antenna height was measured. For kinematic measurements using a pole, this will be **Vertical**.

To select an antenna setup, highlight **Ant. Name** and press **ENTER** to open the drop down box. All of the existing antenna configurations are listed.

You may select from this list or enter your own antenna configuration by pressing the **New** (**F2**) key and entering the required information.

Most Post-Processed Kinematic Surveys are carried out using the System 500 pole. When a factory default pole setup is selected, (**AT501 Pole**/**AT502 Pole**) the **Vertical Offset** is set automatically at zero and the **Deflt Hgt** at 2.00m. Note that the settings from the currently highlighted antenna setup are taken over as suggested default values.

Advice on calculating Antenna Heights and offsets for Leica and non-Leica Antennas is given in Chapter 2.15.

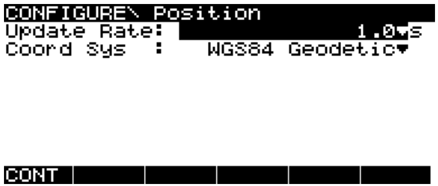
Use the **Edit** (**F3**) key to edit the highlighted Antenna configuration. Use the **DEL** (**F4**) key to delete an Antenna configuration.

Use the **DEFLT** (**F5**) key to reveal default antenna configurations with current System 500 GPS antennas. This will then change to **ALL**.

Use **ALL** (**F5**) to reveal System 300 antenna configurations also. You can pick out the antenna configurations that you will use the most and delete the rest. All possible antenna configurations may still be accessed in the future by using the **DEFLT** and **ALL** keys.

Position

This screen defines the way in which position is displayed. These settings are mostly used for Real-Time Rover setups.



Update Rate - Defines the rate at which the position will be updated on the display.

Coord Sys - You may also select a coordinate system which will be used to display the positions. The WGS84 coordinate system will always be available and should be sufficient for post-processed kinematic work. You may define other coordinate systems in **Applications** in **Determine Coord System** (see section 11.1).

Further options are available on this screen in Advanced mode. See section 5.2.1 for details.

Highlight **Coord Sys** and press **ENTER** to reveal the list of coordinate systems currently available.

Select the coordinate system that you wish to use.

Use **NEW** (**F2**) to define a new coordinate system. Use **EDIT** (**F3**) to edit a coordinate system. Use **DEL** (**F4**) to delete the selected coordinate system and **INFO** (**F5**) to reveal the type of transformation used.

When **NEW** (**F2**) is pressed, the following screen appears.

```
CONFIGURE\ New Coord System
Coord Sys  :

Transform  :        Swiss 1▼

Projection :         Swiss▼
Geoid Model:          Test▼

CONT
```

Coord Sys - Defines the name of the new coordinate system.

Further information about Coordinate Systems is given in Chapter 11.

When you have set the parameters press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

When using **EDIT** (**F3**) the same descriptions apply.

Press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

Formats

```
CONFIGURE\ Formats
Format Grid    : East,North,Hgt▼
Format Geodetc:     Lat,Lon,Hgt▼
Quality Type   :            DOP
Defined by     :   Pos+Hgt+Time▼
OCUPY Counter  :   Observations▼

CONT
```

You can configure the way in which information is presented when surveying.

Format Grid - The format of grid coordinates if they are being used.

Format Geodetic - The format of geodetic coordinates if they are being used.

Quality Type - The way in which the quality of a position is displayed in the Main Survey screen. This is Hard-wired to **DOP** for Post-processed Kinematic Configurations.

It will display a Dilution of Precision according to the components defined.

Defined by - Defines the components used to calculate the **DOP**. The definitions of the **DOP** are as follows:

Height - VDOP
Pos - HDOP
Pos + Hgt - PDOP
Pos + Hgt + Time - GDOP

OCUPY Counter - Defines how the length of time spent occupying a point is displayed. Select from **Time** - normal time or **Observations** - the number of observations recorded.

Coding
If you wish to select a coding system press **ENTER** and choose from Thematical or Free coding. Complete descriptions of the coding systems used by System 500 are given in Chapter 8.

Press **CODES** (**F3**) to review the codes in the chosen codelist. You may also edit the codelist here.

Real-Time
For Static or Rapid Static postprocessing operations select **None** and press **CONT (F1)**.

Logging

```
CONFIGURE\ Logging
Log Static Obs      :        YES▼
Obs Rate            :        1.0▼  s
Log Moving Obs      :        YES▼
Static Init         :         NO▼

Log Auto Positions:           NO▼
Moving Ant Height :       0.000    m

CONT
```

Log Static Obs - Switches logging on or off when the Receiver is in Static mode. The receiver has to be stationary. This is used when performing Static Initializations or when occupying distinct points in a kinematic chain.

Obs Rate - The rate at which observations will be logged when the receiver is stationary or when it is moving. For Static intializations or occupying distinct points in a kinematic chain, the rate should be set at between 0.1-2 seconds.

Log Moving Obs - Only available when **Log Static Obs** = **YES**. Activates observation recording when the receiver is in moving mode. The rate is set in **Obs Rate**.

Static Init - Sets whether a Static Initialization will be performed at the beginning of a kinematic chain. When using the SR510 set this option to **YES**.

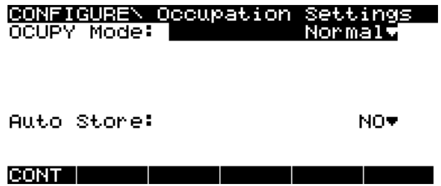
Log Auto Positions - Will automatically log positions at a specified rate. This is mostly used for real-time operations. See section 5.4 for details.

Moving Ant Height - Sets the Antenna Height when the receiver is in moving mode. When a standard System 500 pole setup is used, the suggested default will be 2.00m.

Press **CONT** (**F1**) to continue to the next screen.

Further options are available on this screen in Advanced mode. See section 5.2.1 for details.

Occupation Settings
These settings control the way in which points are occupied and recorded.



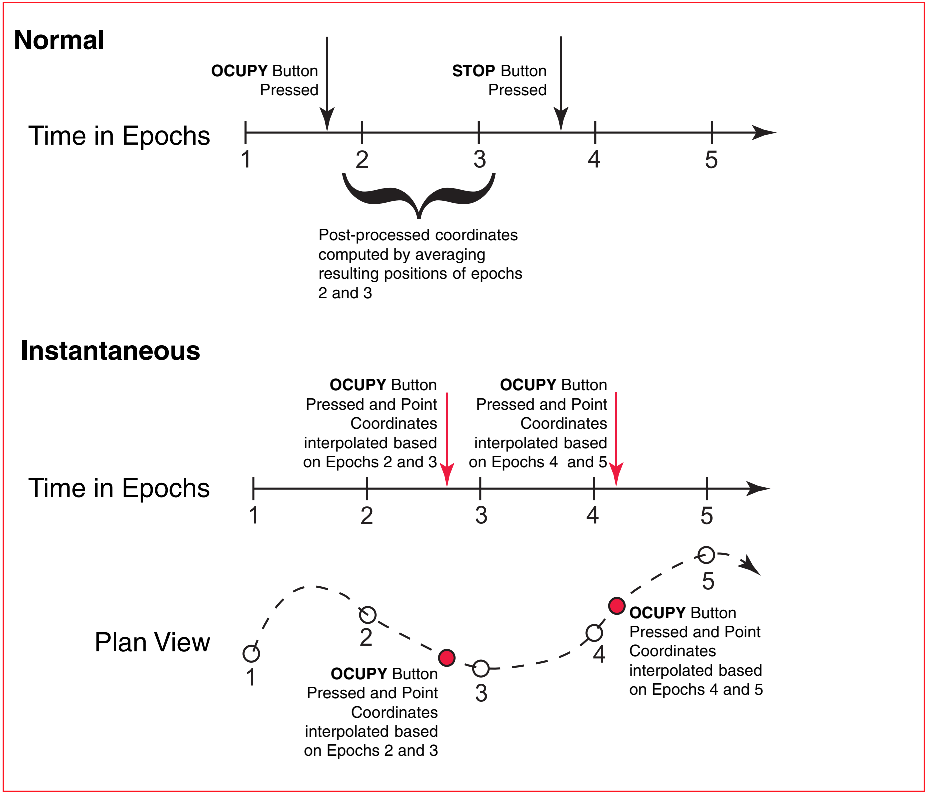
OCUPY Mode - Sets the way in which coordinates will be recorded for a point.
Normal means that the observations will be recorded when the **STOP** key is pressed. A type of averaging is performed on the measurements observed over the time spent on the point. This helps filter out effects of slight movement. (E.g. trembling hands).
Instantaneous means that a time tag will be recorded when the **OCUPY**

key is pressed. During post-processing, A coordinate will be interpolated between the positions at the neighboring two epochs.

For post-processed kinematic surveys, it is possible to use either of the settings.

Auto Store - Allows you to automatically store a point after the **STOP** key has been pressed.

Further options are available on this screen in Advanced mode. See section 5.2.1 for details.



Overview of Normal and Instantaneous settings

Id Templates

An Id template is used to pre-define a Point Id. This feature is mainly used in post-processed kinematic and real-time kinematic operations where many points are collected quickly. When set up correctly it will save you having to type in the Point Id at each point.

```
CONFIGURE\ Id Templates

OCUPY Pts    : Point      ######▼
Auto Log Pos : Auto Pos   ######▼



CONT
```

OCUPY Pts - Displays the Id template selected for use with manually recorded points.
Auto Log Pos - Displays the Id template selected for use with automatically recorded points.

Select the template that you wish to use. Press **ENTER** to reveal the list of available templates.

```
CONFIGURE\ Id Templates
 Point Template  —Inc  —Crsr
 No Template Used
 Time and Date
 Point       ###### 1     1     →


CONT  NEW  EDIT  DEL
```

In this panel two default templates are displayed and also a template that a user has previously defined.
Inc stands for Increment and denotes the amount by which any specified number will increment at each point.
Crsr stands for Cursor and denotes the character number at which the cursor will be automatically placed.

The arrow → means that this template is set to operate in the **Remain Running** mode.

No Template Used - if this option is selected the last Point Id entered in the Survey panel will be displayed. The Point Id will be automatically incremented if that Point Id contains any numerical characters.
If you overtype this Point Id the auto increment will start from the new Point Id.

Time and Date - will automatically use the current local time and date as the Point Id.

Point ###### - automatically writes the word “Point” followed by an automatically incrementing 5 figure number (denoted by #).

To define your own Id Template press **NEW** (**F2**).

```
CONFIGURE\ OCUPY Pts
PtId. Mode   :  Remain Running▾
Id           : Point       ######
Num Start    :                 11
Num End      :                 16
Auto Inc     :               YES▾
Num Inc      :                  1
Cursor Pos   :                16▾

CONT
```

Pt Id. Mode - Is the Mode how the Pt Template will be used. If you select **Remain Running** and you enter a different Point Id manually in the Survey panel the new Point Id will be used as the new Id Template. The following Point Id's will then be based on this new Template. If you select **Change to Indiv.** and then enter a Point Id manually in the Survey panel the Point Id will return to the Id Template as it is defined.

Id - Displays the way in which the template is currently configured. You may also enter any standard text here that you would like to see in the Id Template. (In this example the standard text is the word "Point". The # symbols indicate automatically incrementing numbers).
Note that leading spaces cannot be accepted.

Num Start - Defines the start position of any automatically incrementing number.

Num End - Defines the end position of any automatically incrementing number.

Auto Inc - Defines whether the number will increment automatically at subsequent points.

Num Inc - Defines the amount by which any automatically incrementing number will increment.You may enter a negative increment if required.

Cursor Pos - Defines the position at which the cursor will start at.

Press **CONT** (**F1**) until you return to the CONFIGURE\ Id Templates screen.

To edit an existing Id Template press **EDIT** (**F3**).

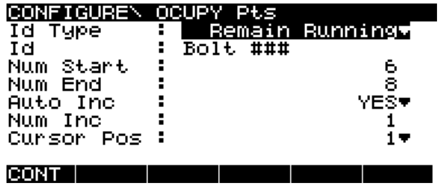
To delete an existing Id Template press **DEL** (**F4**).

Further options are available on this screen in Advanced mode. See section 5.2.1 for details.

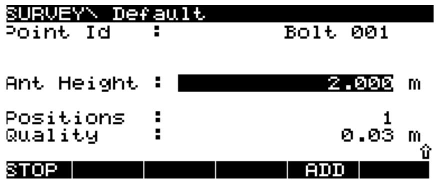
Working Example 1

Requirement - You are completing a survey where you will require many different point IDs. Most point IDs will need an incrementing number behind the text. The first points you measure will need the point ID "**Bolt ###**".

Settings - In CONFIG\ OCUPY Pts set up a point ID template as shown here.
Note that the Id type is set to "**Remain Running**".



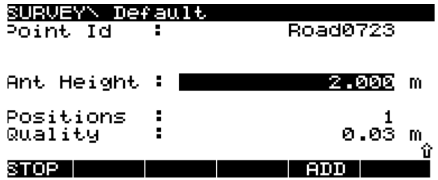
Field Proc - Within the Survey panel, the first point will automatically show the Point Id "**Bolt 001**" upon pressing **STORE**, the next Point Id will automatically show "**Bolt 002**".



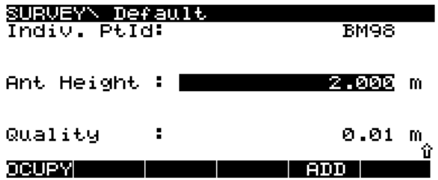
Working Example 1 (cont)

Field Proc (cont) -

You now wish to survey points with the Id “**Road####**” starting with Id “**Road0723**”. Enter this point Id into Survey panel. The next point Id will automatically be “**Road0724**”.



You now wish to survey one individual point and give it the point ID “**BM98**”. In the Survey panel, press **SHIFT** and then **INDIV (F5)** and enter this point Id.

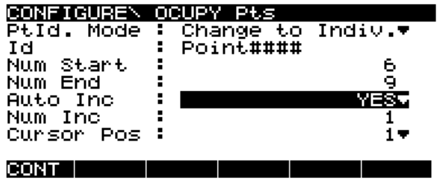


Survey this point and upon pressing STORE, the next point Id will revert back to “**Road0724**”.

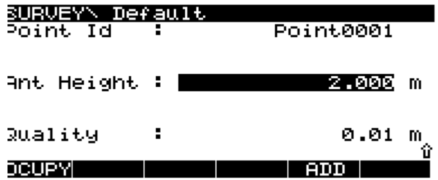
Note: Should you wish to store any new point Id as a template into the “library” then access the CONFIGURE\ ID Templates panel (CONFIG, 1 Survey, 5 Point Id Templates) and then press **CONT (F1)**. The point Id currently in use is now stored as a template.

Working Example 2

Requirement - You are completing a survey where you need only one point ID that needs an incrementing number behind the text. These points will need the point ID "**Point####**". However you will also survey some individual points that will need unique point Ids.



Settings - In CONFIG\ OCUPY Pts set up a point ID template as shown here.
Note that the Id type is set to "**Change to Indiv.**".

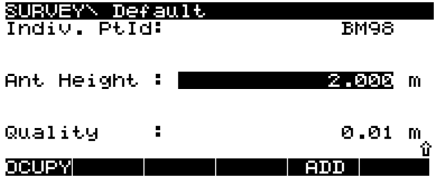


Field Proc - Within the Survey panel, the first point will automatically show the Point Id "**Point0001**". Upon pressing **STORE**, the next Point Id will automatically show "**Point0002**".

Working Example 2 (cont)

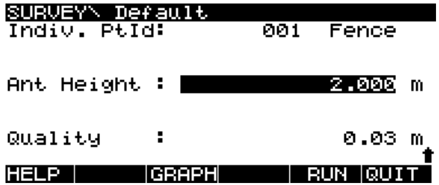
Field Proc (cont) -

You now wish to survey one individual point and give it the point ID “**BM98**”. In the Survey panel, enter this point ID. Survey this point and upon pressing STORE, the next point Id will revert back to “**Point0002**”.



Note - When entering the individual point Id “BM98” you did not need to press **SHIFT INDIV (F5)** as in Working Example 1. This is because the “**Point####**” template is operating in the **Change to Individual** mode.

Suppose you do now wish to survey points using a new point Id “**###Fence**” and you wish this template to operate in the **Remain Running** mode.



Enter the point Id **“001Fence**” and then press **SHIFT RUN (F5)**. Occupy and store this point. The next point Id will be **“002Fence**”

Note: Numerical characters in front of any text will also increment. This allows any type of incrementing point Ids to be created.

The Advanced Mode contains certain extra configurable options that may be required for specialized applications.

Select Advanced in **CONFIGURE\Operation Mode**.

```
CONFIGURE\ Operation Mode

Mode         :          Advanced▾




CONT |    |    |    |    |LIST
```

Only the screens that differ from those seen in Standard Mode are described here.

Position
In addition to the functionality given in Standard mode, details about the chosen coordinate system are given.

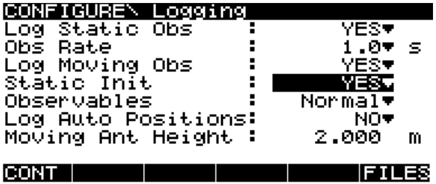
```
CONFIGURE\ Position
Update Rate:              1.0▾s
Coord Sys  :             UTM30▾
Residuals  :   No distribution
Transform  :              Test
Ellipsoid  :          WGS 1984
Projection :            UTM 30
Geoid Model:             -----

CONT |    |    |    |    |
```

Residuals - The method by which residuals will be distributed throughout the transformation area is displayed.
Transform - The name of the transformation set used is displayed.
Ellipsoid - The name of the local ellipsoid is displayed.
Projection -The name of the projection used is displayed.
Geoid Model - The name of the geoid model used is displayed.
CSCS Model - The name of the CSCS model used is displayed.

Note that the details that are displayed depend upon the type of transformation used. Certain types of transformation do not use all of the described parameters to calculate local coordinates.

Logging

In addition to the functionality given in Standard mode, you can also specify the observables to be recorded and access further functionality via the **FILES** (**F6**) key (not on the GS50/ GS50+).



Observables - Defines what is recorded in the raw GPS data. Extended records extra observables including the Doppler observable. Full details of what is recorded in each mode is given in Appendix D.

Pressing the **FILES** (**F6**) key enables you to configure further options.

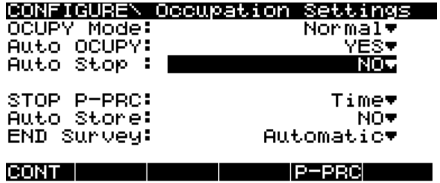
Log File Segments will split up the recorded data into files of a specific length unless **1 File** is selected. If a time is selected the option **Split Tracks** will become available. Select **No** will only record data into a new file if the time is reached and a new track is observed.

Auto Del Log Files will delete the recorded data after the specified length of time unless **Never** is se-lected.

Press **CONT** (**F1**) to return to CONFIGURE\Logging.

Occupation Settings

Additional functionality available in this panel over Standard mode is **Auto OCUPY**, **Auto Stop**, **STOP P-PRC** and **END Survey**.



Auto OCUPY - will automatically occupy the point as soon as the survey is started. **Timed** is chosen for automatic point occupations at a certain time. The time is specified in the SURVEY panel.

Auto Stop - will automatically stop the measurements according to the setting in the **STOP P-PRC** function. The measurements stop when the criteria for the setting reach 100%.

STOP P-PRC - Defines the method used for Auto Stop when Auto Stop is set to **YES**.
When Auto Stop is set to **NO** a percentage value will be displayed next to the Time or Epochs in the Main Survey screen. This indicates how much of the Auto Stop criteria has elapsed. The Auto Stop criteria is defined using the **P-PRC** (**F5**) key (see below).

END Survey - Defines how the survey will be ended. **Manual** lets you exit the survey yourself. **Automatic** will exit the survey automatically. **Auto & Shut-down** will exit the survey and turn the sensor off.

When one of the **STOP P-PRC** options is selected the **P-PRC** (**F5**) key will become available. Pressing this key will enable you to configure the option you have selected.

When:

Time is selected, set the required observation time for each point. The time starts counting when **OCUPY** is pressed. The Receiver stops recording when the set length of time is reached.

STOP&GOIndicator is selected, set the baseline range. When measuring, an observation time will be calculated based on the selected baseline range, the number of available satellites and the GDOP. This is displayed as a percentage value. The Receiver stops recording as soon as 100% is reached.

Observations is selected, set the number of epochs that should be recorded at each point. This setting is recommended for post-processed kinematic surveys.

# of Sats is selected, set the length of time to observe depending on the number of satellites available. You may edit the value for each number of satellites. Should the number of available satellites change during observations, the observations already recorded will be taken into account. Should the number of satellites decrease, more time will be added. Should the number of satellites increase, time will be subtracted. The Receiver stops recording when the time limit is reached.

Press **CONT** (**F1**) to return to CONFIGURE\Occupation Settings.

Working Example

Application - Picking up distinct points in a Kinematic chain

Technique - Post-Processed Kinematic on the Fly. (Not possible with SR510).

Requirement - You wish to automatically stop recording and store each point after pressing **OCUPY**.

Settings -

```
CONFIGURE\ Occupation Settings
OCUPY Mode:              Normal▼
Auto OCUPY:                  NO▼
Auto Stop :                 YES▼

STOP P-PRC:        Observations▼
Auto Store:                 YES▼
END Survey:              Manual▼

CONT |    |    |    |P-PRC|
```

Other Settings - Use **P-PRC** (**F5**) to set the **Observations** to **1** or **2**.

Field Procedure - At the point you wish to measure, place and level the pole on the point. Press **OCUPY**. The point will be recorded and stored automatically as soon as the set number of observations are recorded. Note that the Point Id must be correctly defined and any code (if required) selected BEFORE **OCUPY** is pressed due to **Auto Store** being set to **YES**.

Id Templates

You may also configure Id Templates for Auxiliary Points in exactly the same way as for normal points.

5.3 Configuring the Receiver for Real-Time Reference Operations

This section covers configuration of the receiver for Real-Time Reference Operations. Note that Real Time Reference Operations are only possible with an SR530 (Real-Time to centimeter level) or an SR510 or 520 that has the RTCM 2.x option activated (DGPS to 0.5 - 5m level).

Highlight the Configuration Set you wish to edit and press **CONT** (**F1**). Note that you cannot edit default Configuration Sets. You have to create a new one and then edit it.

Operation Mode
Select the Operation Mode that you require. The Operation Mode defines which Configuration screens will be available to you.

You may choose between Standard and Advanced. Standard is recommended for most users. Advanced enables definition of parameters required for scientific research and other specialized applications.

```
CONFIGURE\ Operation Mode
Mode          :           Standard▼



CONT                            LIST
```

When you have made your selection press **CONT** (**F1**) to go through the fixed order of parameter panels.

Or press **LIST (F6)** to get a listing of the available parameter panels which can then be accessed individually with **CONT (F1)**. Changes are automatically stored at the end of the list. Changes in individual parameter panels can be stored with **STORE (F3)** without the need to go to the end of the list.

The Standard Operation mode is described from here on. The extra configurable features available when Advanced is selected are described in the next section.

Antenna
Select the Antenna configuration that you are using.

Ant. Name - Displays and selects the currently selected antenna setup.

Vert Offset - Displays the vertical offset defined in the Antenna setup (**Ant Name**).

Deflt Hgt - Displays a default height for the Antenna configuration. This is of little use for Real-Time Reference stations where the Antenna height differs with each setup.

Meas Type - Also, enter the means by which the Antenna height was measured. For the majority of GPS Antennas (including all Leica antennas), this will be **Vertical**. The height of some non-Leica GPS antennas can only be measured by taking the slope distance to the outer edge of the Antenna. If this is the case, select **Slope** and enter the value. You will then be required to enter a **Horizontal Offset** also. See Section 2.15.3 for more details on measuring slope height. Note that the settings from the currently highlighted antenna setup are taken over as suggested default values.

To select an antenna setup, highlight **Ant. Name** and press **ENTER** to open the drop down box. All of the existing antenna configurations are listed.

Most Real-Time Reference Stations are setup on a tripod or pillar.

You may select from this list or enter your own Antenna configuration by pressing the **NEW** (**F2**) key. Note that the settings from the currently highlighted antenna setup are taken over as suggested default values.

When a factory default tripod setup is chosen, the Vertical Offset is automatically set at 0.36m. You will need to measure the Antenna Height with the height hook when setting up.

Setting up on a pillar will require that you use the default pillar setup.

Advice on calculating Antenna heights and offsets for Leica and non-Leica Antennas is given in Chapter 2.15.

Use the **EDIT** (**F3**) key to edit the highlighted Antenna configuration. Note that factory default Antenna configurations can only be viewed and not edited.

Use the **DEL** (**F4**) key to delete an Antenna configuration.

Use the **DEFLT** (**F5**) key to reveal factory default Antenna configurations with current Leica GPS Antennas. This will then change to **ALL**.

Use **ALL** (**F5**) to reveal System 300 Antenna configurations also. You can pick out the Antenna configurations that you will use the most and delete the rest.

All possible factory default Antenna configurations may still be accessed in the future by using the **DEFLT** and **ALL** keys.

Position

This screen defines the way in which position is displayed.

Update Rate - Defines the rate at which the position will be updated on the display.

Coord Sys - You may also select a coordinate system which will be used to display the positions. The WGS84 coordinate system will always be available. You may define other coordinate systems in **Applications** in **Determine Coord System** (see section 11.1).

Further options are available on this screen in Advanced mode. See section 5.3.1 for details.

It is especially important to define a local coordinate system for a Real-Time Reference Station if you intend to use a known local grid coordinate at the Reference Point. The Receiver must be able to calculate an equivalent coordinate in the WGS84 coordinate system for transmission to the Rover(s).

Highlight **Coord Sys** and press **ENTER** to reveal the list of coordinate systems currently available.

```
CONFIGURE\ Position
 Coord Sys: <                 >
 Swiss 1               29.04.98
 Swiss 2               06.11.98
 WGS84 Geodetic        30.10.98

                                ⇧
CONT | NEW |EDIT | DEL |INFO |αNUM
```

Select the coordinate system that you wish to use.

Use **NEW** (**F2**) to define a new coordinate system. Use **EDIT** (**F3**) to edit a coordinate system. Use **DEL** (**F4**) to delete the selected coordinate system and **INFO** (**F5**) to reveal the type of transformation used.

When **NEW** (**F2**) is pressed, the following screen appears.

```
CONFIGURE\ New Coord System
Coord Sys   :

Transform   :          Swiss 1▼

Projection  :           Swiss▼
Geoid Model :            Test▼

CONT |     |     |     |     |
```

Coord Sys - Defines the name of the new coordinate system.

Further advice on Coordinate Systems is given in Section 11.

When you have set the parameters press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

When using **EDIT** (**F3**) the same descriptions apply.

Press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

Formats

```
CONFIGURE\ Formats
Format Grid    : East,North,Hgt▾
Format Geodetc:     Lat,Lon,Hgt▾
Quality Type   :             DOP
Defined by     :  Pos+Hgt+Time▾
OCUPY Counter  :  Observations▾

CONT
```

You can configure the way in which information is presented when surveying.

Format Grid - The format of grid coordinates if they are being used.

Format Geodetic - The format of geodetic coordinates if they are being used.

Quality Type - The way in which the quality of a position is displayed in the Main Survey screen. This is Hard-wired to **DOP** for Real-Time Reference Configurations. It will display a Dilution of Precision according to the components defined.

Defined by - Defines the components used to calculate the **DOP**. The definitions of the **DOP** are as follows:

Height - VDOP
Pos - HDOP
Pos + Hgt - PDOP
Pos + Hgt + Time - GDOP

OCUPY Counter - Defines how the length of time spent occupying a point is displayed. Select from **Time** - the normal time or **Observations** - the number of computed navigation solutions recorded.

Coding
Normally, when setting up a Real-Time Reference Station, the Reference Point will be selected from a predefined point list. These points will have been measured previously and any required code already assigned. Therefore a Coding System is not usually required.

If you still wish to select a coding system press **ENTER** and choose from Thematical or Free coding. Complete descriptions of the coding systems used by System 500 are given in Section 8.

Press **CODES** (**F3**) to review the codes in the chosen codelist. You may also edit the codelist here.

Real-Time 1/2
Configures the parameters used for Real-Time operations. If needed, it is possible to configure two real-time interfaces.

R-Time Data - defines the operation mode of the receiver. Select **Reference** to broadcast real-time data.

Data Format - Defines the format used to broadcast the real-time data.

Port - defines the port to which the Real-Time data will be sent. Normally a radio modem or GSM phone will be connected to the port. When the radio modem is a Satelline, Pacific Crest or GSM phone it will be mounted in the radio housing box and attached to either Port 3 or Port 1.
You may also attach a radio modem or phone via a cable to any port.

Use the right or left cursor keys to select a port for transmission of real-time data. The device that is currently assigned to this port will be displayed.

Rate - Set the rate at which you wish to output messages. System 500 supports rates of 0.1 to 60 seconds.

To define the Data Format, highlight the **Data Format** field and press **ENTER**.

Leica is the proprietary Leica real-time GPS data format. This is the best format to use when working exclusively with Leica System 500 Rover units.

CMR and **CMR+** are compacted formats used to broadcast data for third party receivers.

RTCM is for use when Rover units from a different manufacturer will be used. RTCM message 3 is always generated irrespective of which other message types are chosen.
RTCM 18, 19 - Uncorrected Carrier phase and pseudorange. Use for RTK operations where the ambiguities will be resolved at the Rover (RTK). An accuracy of around 1-5cm (rms) can be expected after a successful ambiguity resolution.
RTCM 20, 21 - RTK Carrier phase corrections and high-accuracy pseudorange corrections. Use for RTK operations. There is little or no difference in the accuracy obtained using these messages as compared to messages 18 and 19.
RTCM 1, 2 - Differential and Delta Differential GPS corrections. Use for DGPS applications. An accuracy of 0.5-5m rms can be expected at the Rover.

Pressing the **DEVCE** (**F5**) key lets you configure and assign a device to the selected port.

```
CONFIGURE\ Devices and Ports
Device
*Satelline 2ASx
*Satelline 2ASxE
*Satelline 3AS/3ASd
*Siemens M1
*Siemens M20

CONT | NEW |EDIT | DEL |DEFLT
```

Select the device you wish to assign to the port. If no default devices are displayed press **DEFLT** (**F5**) to reveal them. Default devices have an asterisk before the device name.

Select a device from the list. To view the configuration of your chosen device, press **EDIT** (**F3**). If the device you wish to use requires a different configuration, select **Unknown Radio** and press **NEW** (**F2**) and enter the Name and Port Settings for the device.
A complete list of all available devices is given in Appendix H.

Press **CONT** (**F1**) to return to CONFIGURE\ Real-Time1.

Pressing **REF** (**F6**) enables you to configure further options concerning the broadcast messages from the reference station.

```
CONFIGURE\ Real-Time
Ref Stn Id          :          0


End of Msg          :    Nothing▾
RTCM Versn          :        2.2▾

CONT
```

You may define a number for the reference station ID, select a carriage return at the end of each message and, if RTCM format has been selected, choose the RTCM Version to output. Note that the Reference and Rover must use the same RTCM version.

You will need to define a Ref Stn Id if:
1. You intend to work with 2 reference stations simultaneously, broadcasting on different frequency channels and use frequency switching at the rover.
or
2. The Reference is being moved from one point to another.

If it is required to configure the second real-time interface press **SHIFT R-T 2** (**F2**) in the CONFIGURE\ Real-Time 1 panel.

```
CONFIGURE\ Real-Time 1
R-Time Data:      Reference▾
Data Format:          Leica▾
Port       :1 *Satelline 2A▾
Rate       :           1.0▾ s

HELP |R-T 2|     |     |     |QUIT
```

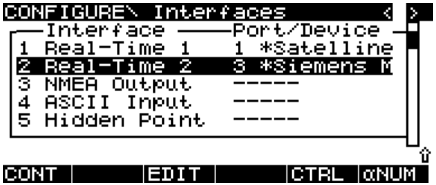
Configure the parameters for the Real-Time 2 interface as described above. The second Real-Time 2 interface is completely independent to the Real-Time 1 interface so that a different **Data Format** and **Rate** may be selected.

Note that a different port must be selected to that used for the Real-Time 1 interface.

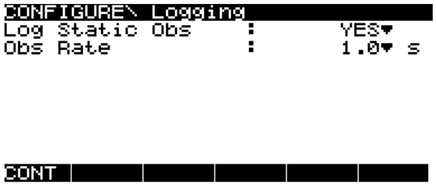
Use **SHIFT R-T 1** (**F2**) to accept the configuration settings and return to Real-Time 1.

Use **CONT** (**F1**) to return to the CONFIGURE\ Interface panel.

The **Port/ Device** configured for both real-time interfaces is now visible.



Logging
If required, you may log the raw observations. This may be used if there are problems with the data reception at the Rover and a Real-Time position could not be calculated. The observation data can be post-processed when back in the office to fill in any gaps in the Real-Time positions. Of course, observations must be logged at the Rover also.



Log Static Obs - Switches logging on or off when the Receiver is in Static mode.

Obs Rate - The rate at which observations will be logged.

For Real-Time Reference stations the rate should be set the same as the Position Update Rate at the Rover. This will normally be between 0.1-2s.

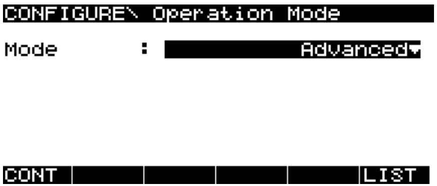
Press **CONT** (**F1**) to continue to the next screen.

Further options are available on this screen in Advanced mode. See section 5.3.1 for details.

Press **CONT** (**F1**) to complete the configuration.

The Advanced Mode contains extra configurable parameters that may be required for certain specialized applications.

Select Advanced in **CONFIGURE\Operation Mode**.



Only the screens that differ from those seen in Standard Mode are described here.

Position
In addition to the functionality given in Standard mode, details about the chosen coordinate system are given.

Residuals - The method by which residuals will be distributed throughout the transformation area is displayed.
Transform - The name of the transformation set used is displayed.
Ellipsoid - The name of the local ellipsoid is displayed.
Projection -The name of the projection used is displayed.
Geoid Model - The name of the geoid model used is displayed.
CSCS Model - The name of the CSCS model used is displayed.

Note that the details that are displayed depend upon the type of transformation used. Certain types of transformation do not use all of the described parameters to calculate local coordinates.

Real-Time 1/2
Configures parameters used for Real-Time operations.

Data Format - There are two extra formats available for RTCM. You have the possibility to output both Code corrections together with raw GPS data or high-precision phase corrections by selecting the options **RTCM 1, 2, 18, 19** or **RTCM 1, 2, 20, 21**.

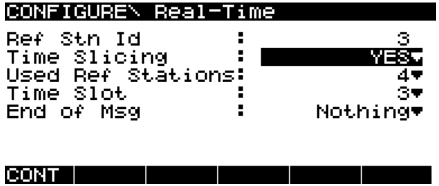
Also, the extra key **RATES** (**F3**) is available.

RATES enables different messages to be output at different rates.

If **RTCM** is selected as the Data Format, you may select different rates for the various message types. E.g. Message 3 is always output regardless of which RTCM messages are selected. As this message does not usually have to be constantly output, you may select a lower rate for it.

If **Leica** Data Format is selected, you may select different rates for the raw data transmission (**Data Rate**), the rate at which the reference coordinates are output (**Coord Rate**) and the rate at which Reference Station information (Point Id, etc.) is output (**Info Rate**).

In addition to the configuration options in the standard mode, pressing **REF** (**F6**) enables you to configure **Time Slicing**. Time Slicing is the possibility to send RTK messages delayed. This is required when RTK messages from different reference stations are sent on the same radio channel. Time Slicing on System500 works for radios, GSM and the RS232 interface.



Time Slicing - Activates time slicing. If set to **Yes**, two more lines become available.

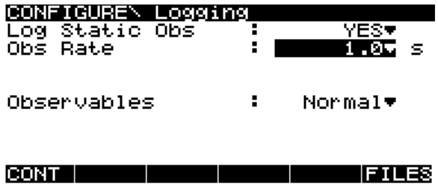
Used Ref Stations - Set the number of reference stations in use. You can have up to 4 reference stations from where RTK messages are sent.

Time Slot - The time slot represents the actual time delay. The number of time slots is the number of reference stations in use. The time delay equals 1 sec devided by the total number of reference stations. If two reference stations are used, the number of time delay is 0.50.

Therefore, the time slots are at 0.00 sec and at 0.50 sec. With three reference stations, the time delay is 0.33. The time slots are at 0.00, 0.33 and 0.66 sec.

The second Real-Time 2 interface is completely independent to the Real-Time 1 interface so that the number of reference stations and time slots can be configured differently.

Logging
In addition to the functionality given in Standard mode, you can also specify the observables to be recorded and access further functionality via the **FILES** (**F6**) key.



Observables - Defines what is recorded in the raw GPS data. Extended records extra observables including the Doppler observable.

Pressing the **FILES** (**F6**) key enables you to configure further options.

Log File Segments - Will split up the recorded data into files of a specific length unless **1 File** is selected.
If a time is selected the option **Split Tracks** will become available. Select **No** will only record data into a new file if the time is reached and a new track is observed.

Auto Del Log Files - Will delete the recorded data after the specified length of time unless **Never** is selected.

Press **CONT** (**F1**) to return to CONFIGURE\Logging.

5.4 Configuring the Receiver for Real-Time Rover Operations

This section covers configuration of the receiver for Real-Time Rover Operations. Note that Real Time Rover Operations are only possible with an SR530 (Real-Time to centimeter level) or an SR510 or 520 that has the RTCM 2.0 option activated (DGPS to 0.5 - 5m level).

Highlight the Configuration Set you wish to edit and press **EDIT** (**F3**). Note that you cannot edit default Configuration Sets. You have to create a new Set and then edit it. If the only existing Configuration Sets are default Sets, highlight the Set that corresponds to the type of operation you wish to configure (in this case, RT_ROV), and press **NEW** (**F2**). After entering the Name, etc., select the new Configuration Set and press **EDIT** (**F3**).

Operation Mode
Select the Operation Mode that you require. The Operation Mode defines which Configuration screens will be available to you.

You may choose between **Standard** and **Advanced**. **Standard** is recommended for most users. **Advanced** enables definition of parameters required for scientific research and other specialized applications.

```
CONFIGURE\ Operation Mode
Mode          :            Standard▾



CONT                                LIST
```

When you have made your selection press **CONT** (**F1**) to go through the fixed order of parameter panels.

Or press **LIST (F6)** to get a listing of the available parameter panels which can then be accessed individually with **CONT (F1)**. Changes are automatically stored at the end of the list. Changes in individual parameter panels can be stored with **STORE (F3)** without the need to go to the end of the list.

The Standard Operation mode is described from here on. The extra configurable features available when Advanced is selected are described in the next section.

Antenna

Select the Antenna configuration that you are using.

Ant. Name - Displays and selects the currently selected antenna setup. This will normally be **AT502 Pole** for real-time Rover operations.

Vert Offset - Displays the vertical offset defined in the Antenna setup (**Ant Name**).

Deflt Hgt - Displays a default height for the Antenna configuration. If the antenna will always be mounted at a fixed height (E.g. on a pole or always at the same fixed location), enter the value. This will normally be 2.00m for Real-Time Rover operations. You will also get a chance to enter the height for each set up during survey operations.

Meas Type - Also, enter the means by which the Antenna height was measured. For Real-Time Rover operations this will usually be **Vertical**.

To select an antenna setup, highlight **Ant. Name** and press **ENTER** to open the drop down box. All of the existing antenna configurations are listed.

You may select from this list or enter your own antenna configuration by pressing the **NEW** (**F2**) key and entering the required information.

Most Real-Time Rover Surveys are carried out using the System 500 pole. When a factory default pole setup is selected, (**AT501 Pole**/**AT502 Pole**) the **Vertical Offset** is set automatically at zero and the **Deflt Hgt** at 2.00m. Note that the settings from the currently highlighted antenna setup are taken over as suggested default values.

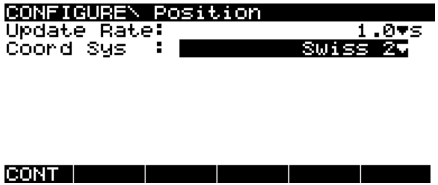
Advice on calculating Antenna Heights and offsets for Leica and non-Leica Antennas is given in Chapter 2.15.

Use the **EDIT** (**F3**) key to edit the highlighted Antenna configuration. Use the **DEL** (**F4**) key to delete an Antenna configuration.

Use the **DEFLT** (**F5**) key to reveal default antenna configurations with current Leica GPS antennas. This will then change to **ALL**. Use **ALL** (**F5**) to reveal System 300 antenna configurations also. You can pick out the antenna configurations that you will use the most and delete the rest. All possible antenna configurations may still be accessed in the future by using the **DEFLT** and **ALL** keys.

Position

This screen defines the rate for and the way in which position is displayed. If you wish to work in local coordinates, you MUST define the coordinate system here.



Update Rate - Defines the rate at which the position will be updated on the display.

Coord Sys - You may also select a coordinate system which will be used to display the positions. The WGS84 coordinate system will always be available. You may define other coordinate systems in **Applications** in **Determine Coord System** (see section 11.1).

Highlight **Coord Sys** and press **ENTER** to reveal the list of coordinate systems currently available.

Select the coordinate system that you wish to use.

Use **NEW** (**F2**) to define a new coordinate system. Use **EDIT** (**F3**) to edit a coordinate system. Use **DEL** (**F4**) to delete the selected coordinate system and **INFO** (**F5**) to reveal the type of transformation used.

When **NEW** (**F2**) is pressed, the following screen appears.

```
CONFIGURE\ New Coord System
Coord Sys   :

Transform   :         Swiss 1▼

Projection  :          Swiss▼
Geoid Model :           Test▼

CONT
```

Coord Sys - Defines the name of the new coordinate system.

When you have set the parameters press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

When using **EDIT** (**F3**) the same descriptions apply.

Press **CONT** (**F1**) to return to the CONFIGURE\Position screen.

Further options are available on this screen in Advanced mode. See section 5.4.1 for details.

Formats

```
CONFIGURE\ Formats
Format Grid    : East,North,Hgt▼
Format Geodetc:     Lat,Lon,Hgt▼
Quality Type   :            DOP▼
Defined by     :  Pos+Hgt+Time▼
OCUPY Counter  :      Positions▼

CONT
```

You can configure the way in which information is presented when surveying.

Format Grid - The format of grid coordinates if they are being used.

Format Geodetic - The format of geodetic coordinates if they are being used.

Quality type - For real-time rover, select Quality. This will display a Coordinate Quality in cm within which the position lies. This is calculated using the standard deviations of the coordinate components.

Defined by - Defines the components used to calculate the Quality.

Height - 1D Height Quality
Pos - 2D Position Quality
Pos + Hgt - 3D Position Quality
Pos + Hgt + Time - 3D Position Quality

OCUPY Counter - Defines how the length of time spent occupying a point is displayed. Select from **Time** - normal time or **Positions** - the number of position calculations.

Coding

If you wish to select a coding system press **ENTER** and choose from Thematical or Free coding. Complete descriptions of the coding systems used by System 500 are given in Chapter 8.

Press **CODES** (**F3**) to review the codes in the chosen codelist. You may also edit the codelist here.

Real-Time

```
CONFIGURE\ Real-Time
R-Time Data:              Rover▾
Data Format:              Leica▾
Port       :1 *Satelline 2A▾
Ref Sensor :             SR530▾
Ref Antenna:      AT502 Tripod▾
Use Phase  :               YES▾
Radio Down : Don't Log Obs▾
                                 ⇧
CONT                    DEVCE
```

R-Time Data - defines the operation mode of the Receiver. Select **Rover** to receive real-time data.

Data Format - Defines the format used to broadcast the real-time data.

Port - defines the port to where the Real-Time receive device will be connected. Normally this will be a radio modem or GSM phone. When the radio modem is a Satelline 1AS/ 2ASx/2ASxE, Pacific Crest RFM96(W) or GSM phone it will be mounted in a housing and attached to either Port 3 or Port 1. You may also attach a radio modem or phone without a housing via a cable to any port.

Use the right or left cursor keys to select a port for transmission of real-time data. The device that is currently assigned to this port will be displayed.

Ref Sensor - Select the Receiver type used at the Reference Station. If this is not a Leica Receiver select **Unknown**.

Ref Antenna - select the Antenna used at the reference station. All Antennas in the current antenna list are available. If you do not know which Antenna is being used at the reference or an Antenna is being used which is not in the list, select **Unknown**. If the reference data is corrected by absolute antenna calibration values and you want to use Leica standard antenna models on the rover side, select **ADVNULLANTENNA**.

Use Phase - Set to **NO** if only a code solution is required.

Radio Down - Raw observations can be logged for post-processing in case of radio link interuption.

To define the Data Format received, highlight the **Data Format** field and press **ENTER**.

Leica is the proprietary Leica real-time GPS data format. This is the best format to use when working exclusively with Leica System 500 Rover units.
CMR and **CMR+** are compacted formats used for receiving data from third party receivers.
RTCM is used for receiving data from a non-System 500 Reference Station. RTCM Message 3 will always be received by default.
RTCM 18, 19 - Uncorrected Carrier phase and pseudorange. Use for RTK operations where the ambiguities will be resolved at the Rover (RTK). An accuracy of around 1-5cm (rms) can be expected after a successful ambiguity resolution.
RTCM 20, 21 - RTK Carrier phase corrections and high-accuracy pseudorange corrections. Use for RTK operations. There is little or no difference in the accuracy obtained using these messages as compared to messages 18 and 19.
RTCM 1, 2 - Differential and Delta Differential GPS corrections. Use for DGPS applications. An accuracy of 0.5-5m rms can be expected at the Rover.
RTCM 9, 2 - GPS Partial Correction Set and Delta Differential GPS Corrections. Use for DGPS applications. An accuracy of 0.5-5m rms can be expected at the Rover. Use this when a slow data link is being used in the presence of interference.

Pressing the **DEVCE** (**F5**) key lets you configure and assign a device to the selected port.

Select the device you wish to assign to the port. If no default devices are displayed press **DEFLT** (**F5**) to reveal them.

A complete description of all available devices and detailed configurations and uses is given in Appendix H.

Press **CONT** (**F1**) to return to the CONFIGURE\Real-Time screen.

Press **CONT** (**F1**) again. The next screen will depend on the device that has just been chosen. For example, if the chosen device is the Pacific Crest radio, the user will be able to choose the radio channel. If the chosen device is a GSM device, the user will be able to configure parameters for use with a GSM device such as PIN code.

A complete description of the different screens is given in Appendix H.

Press **SHIFT** and then **PRED (F3)** to activate and deactivate **Prediction** on the rover.

```
CONFIGURE\ Prediction

Prediction    :                YES

CONT
```

If an SR530 is being used as the RTK reference station, then the **Leica** data format should always be used. In this case **Prediction** should always be set to **YES.**

If however, the reference is transmitting a 3rd party data format such as RTCM, CMR or CRM+, then prediction on the rover may be turned on or off. Prediction is only of use in RTK cm accuracy surveys.

The default setting is that prediction will be activated.

There are two advantages in using prediction:

1. Update rate: Prediction allows RT positions to be computed on the rover at a rate greater than the transmission rate of the data from the reference station. This means RT positions can be computed on the rover at a rate up to 10Hz, regardless of the rate at which data is transmitted from the reference station.

2. Reduced latency: Positions computed with prediction will have a latency of around 30 to 40ms.

However, should the RTK messages transmitted from the reference station be effected by latency, then the accuracy of the positions computed using prediction may be reduced. In these circumstances, it may be necessary to deactivate positions computed by prediction. In this case **Prediction** should be set to **NO.**

However deactivating prediction would mean:

1. Update rate: Positions can only be computed at the rate at which data is transmitted from the reference station.

2. Increased latency: Computed positions would have an increased latency.

In all RTK surveys where the reference station is not an SR530 and the RTK message is not Leica format, it is up to the user to decide if the performance of the rover is better with prediction activated or deactivated.

Press **CONT (F1)** to continue.

Logging

If required, you may log the raw observations. This may be used if there are problems with the real-time data reception at the Rover and a Real-Time position could not be calculated, or if you wish to be able to check your work back in the office. Observations must be logged at the Reference also.

Another alternative for post-processing infill is to use the **Radio Down** option. This is available in Advanced mode in CONFIGURE\Real-Time. (See section 5.4.1).

```
CONFIGURE\ Logging
Log Static Obs     :      YES
Obs Rate           :      2.0  s
Log Moving Obs     :      YES
Static Init        :       NO

Log Auto Positions:       NO
Moving Ant Height  :    2.000  m

CONT
```

Log Static Obs - Switches logging on or off when the Receiver is in Static mode. The receiver has to be stationary. This is used when occupying distinct points in a kinematic chain.

Obs Rate - The rate at which observations will be logged when the receiver is stationary or when it is moving. For Static intializations or occupying distinct points in a kinematic chain, the rate should be set at between 0.1-2 seconds.

Log Moving Obs - Only available when **Log Static Obs** = **YES**. Activates observation recording when the receiver is in moving mode. The rate is set in **Obs Rate**.

Static Init - Available when **Log Moving Obs** = **YES**. Defines whether or not a static initialization will be performed at the beginning of each kinematic chain.

Log Auto Positions - Will automatically log positions at a specified rate.

Moving Ant Height - Sets the Antenna Height when the receiver is in moving mode. When a standard System 500 pole setup is used, the suggested default will be 2.00m.

Press **CONT** (**F1**) to continue to the next screen.

Further options are available on this screen in Advanced mode. See section 5.4.1 for details.

When **Log Auto Positions** is set to **YES**, the **POS** (**F3**) key becomes available. Use this key to define the criteria for automatic position recording.

```
CONFIGURE\ Position Logging
Log Pos by  :          Time▾
Pos Rate    :           1.0 s
Log Factor  :             1▾
Log every   :           1.0 s
Store Pt DB:             YES▾
Start Mode  :     Controlled▾
Qlty Info   :        Only CQ▾

CONT
```

Log Pos by - Defines the criteria by which an automatic position will be logged.
When **Time** is selected, the **Position Rate** defined in Configure\Position is displayed. This may be multiplied by the **Log Factor** to give a position logging rate displayed in the **Log Every** line.

Store Pt DB – If this parameter is set to **YES** the Auto-Points will be stored to the GeoDB. This is the setting that is needed if it is intended to store codes with Auto-Points. Auto-Points stored to the GeoDB may additionally be viewed and edited in the **Point Management**, they may be output with an .FRT file, they may be staked out or viewed in the Graph panel.

Note, if it is chosen to store Auto-Points to the GeoDB, the maximum recording rate is 1Hz.

Start Mode – You may select from either **Immediate** or **Controlled**. If you select **Immediate** the system will automatically start with logging Auto-Points as soon as you start the survey. If you select **Controlled** you will decide when you start the logging of Auto-Points. Press the **AUTO** key in the main Survey panel to enter the mode for measuring Auto-Positions. In the **AUTO-POS** panel the **START (F6)** key will be available to you.

```
CONFIGURE\ Position Logging
Log every   :           1.0 s
Store Pt DB:             YES▾
Start Mode  :     Controlled▾
Qlty Info   :        Only CQ▾
Use Beep    :            YES▾
Monitor CQ  :            YES▾
3D Quality  :         5.000 m

CONT
```

Quality Info - Defines which quality information should be recorded with the position. You may select from the **Full covariance** information or just the coordinate quality (**CQ only**).

Use Beep - If **YES,** the terminal will beep when an automatic position is logged.

Monitor CQ - If **YES,** the CQ of the automatic position will be monitored and the point will only be recorded if less than the specified quality. When **YES** is chosen an additional line appears below **Monitor CQ** to enter the specified quality.

Use Annot - This line is visible, if Store Pt DB is set to YES. If **YES**, point annotations will be stored in the GeoDB with each auto logged point, too. **Point Annotations** may be used as an electronic notepad where events, notes etc. may be written. They are then taken with the point Id information into SKI-Pro.

Point annotations for auto logged points are independant from point annotations for manually occupied points.

```
CONFIGURE\ Position Logging
Store Pt DB:             YES▼
Start Mode :       Immediate▼
Qlty Info  :         Only CQ▼
Use Beep   :             NO▼
Monitor CQ :             YES▼
3D Quality :          5.000 m
Use Annot  :             YES▼

CONT                ANNOT
```

An **ANNOT (F5)** key becomes available.

```
SURVEY\ Point Annotations

#1 :            Chased by Dog
#2 :           Tree fell on head
#3 :         Couldn't find point
#4 :     Packed up and went home

CONT                        CLEAR
```

You may type in 4 notes with up to 26 characters in each note.

Press **CLEAR** (**F6**) to delete the content of all input fields and **CONT** (**F1**) to leave the panel.

After doing so and reentering the panel SURVEY\Point Annotations with **ANNOT (F5)**, the keys **LAST (F3)** and **LAST# (F5)** will be active. # stands for the numbers 1 to 4 of the point annotations and changes with the cursor position. **LAST (F3)** reactivates all previous four point annotations. **LAST# (F5)** only reactivates the previous annotation of the last line.

Annotations are ignored when entering point annotations first and then changing **USE ANNOT** to **NO**. With setting **USE ANNOT** to **YES** again, the last annotations are remembered.
Point Annotations are remembered until the system is turned off.

Point annotations can be viewed in Point Management. See chapter 11.3.

The logging of Auto-Positions may also be configured from inside the **AUTO-POS** panel. See chapter **7.4.7 Using the AUTO key** for more information.

When **Distance** is selected, a position will be recorded every time the distance from the previously recorded point matches the value set in the **Log Every** line. You can also define the **Quality Info** recorded with the point in the same way as when **Time** is selected.

When **Height** is selected, a position will be recorded every time the height difference from the previously recorded point matches the value set in the **Log Every** line. You can also define the **Quality Info** recorded with the point in the same way as when **Time** is selected.

Press **CONT** (**F1**) to return to the CONFIGURE\Logging screen.

Press **CONT** (**F1**) to continue to the next screen.

Occupation Settings

```
CONFIGURE\ Occupation Settings
OCUPY Mode:              Normal▾


Auto Store:                  NO▾

CONT
```

OCUPY Mode - Sets the way in which coordinates will be recorded for a point.
Normal means that the coordinates will be recorded using an average of the positions calculated between pressing **OCUPY** and **STOP**. This helps filter out effects of slight movement. (E.g. trembling hands).

Instantaneous means that a time tag will be recorded when the **OCUPY** key is pressed. A coordinate will be interpolated between the positions at the neighbouring two epochs.

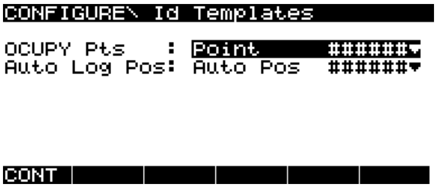
More details about Normal and Instantaneous occupy modes are given in section 5.2.

Auto Store - Allows you to automatically store a point after the **STOP** key has been pressed.

Further options are available on this screen in Advanced mode. See section 5.4.1 for details.

Id Templates

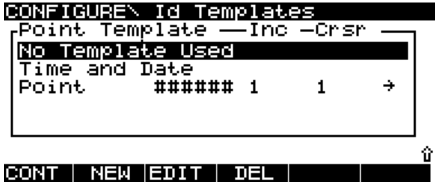
An Id template is used to pre-define a Point Id. This feature is mainly used in post-processed kinematic and real-time kinematic operations where many points are collected quickly. When set up correctly it will save you having to type in the point Id at each point.



OCUPY Pts - Displays the Id template selected for use with manually recorded points.
Auto Log Pos - Displays the Id template selected for use with automatically recorded points.

Select the template that you wish to use.

Press **ENTER** to reveal the list of available templates.



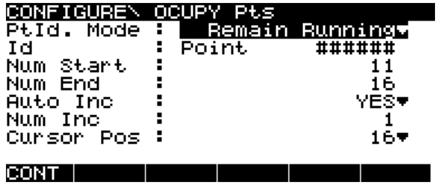
Inc stands for Increment and denotes the amount by which any specified number will increment at each point. **Crsr** stands for Cursor and denotes the character number at which the cursor will be automatically placed.

The arrow → means that this template is set to operate in the **Remain Running** mode.

No Template Used - if this option is selected an automatically incremented Point Id of the last entered Point Id will be displayed in the Survey panel. If you overtype this Point Id the auto increment will start from the new Point Id.

Time and Date - will automatically use the current local time and date as the Point Id.

To define your own Id Template press **NEW** (**F2**).



Pt Id. Mode - Is the Mode how the Pt Template will be used. If you select **Remain Running** and you enter a Point Id manually in the Survey panel the new Point Id will be used as the new Id Template and the following Point Id's will be based on this new Template. If you select **Change to Indiv.** and then enter a Point Id manually in the Survey panel the Point Id will return to the Id Template as it is defined.

Id - Displays the way in which the template is currently configured. You may also enter any standard text here that you would like to see in the Id Template. (In this example the standard text is the word “Point”. The # symbols indicate automatically incrementing numbers).

Num Start - Defines the start position of any automatically incrementing number.

Num End - Defines the end position of any automatically incrementing numbers.

Auto Inc - Defines whether the number will increment automatically at subsequent points.

Num Inc defines the amount by which any automatically incrementing number will increment.

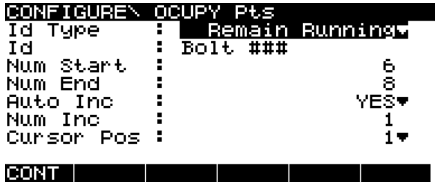
Cursor Pos - Defines the position at which the cursor will start at.
Press **CONT** (**F1**) until you return to the CONFIGURE\ Id Templates screen.

Further options are available on this screen in Advanced mode. See section 5.4.1 for details.

Working Example 1

Requirement - You are completing a survey where you will require many different point IDs. Most point IDs will need an incrementing number behind the text. The first points you measure will need the point ID "**Bolt ###**".

Settings - In CONFIG\ OCUPY Pts set up a point ID template as shown here.
Note that the Id type is set to "**Remain Running**".

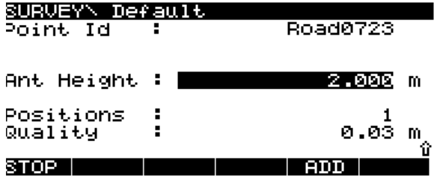


Field Proc - Within the Survey panel, the first point will automatically show the Point Id "**Bolt 001**" upon pressing **STORE**, the next Point Id will automatically show "**Bolt 002**".

Working Example 1 (cont)

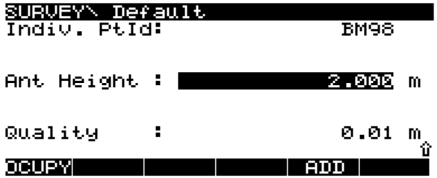
Field Proc (cont) -

You now wish to survey points with the Id "**Road####**" starting with Id "**Road0723**". Enter this point Id into Survey panel. The next point Id will automatically be "**Road0724**".



You now wish to survey one individual point and give it the point ID "**BM98**". In the Survey panel, press **SHIFT** and then **INDIV (F5)** and enter this point Id.

Survey this point and upon pressing STORE, the next point Id will revert back to "**Road0724**".

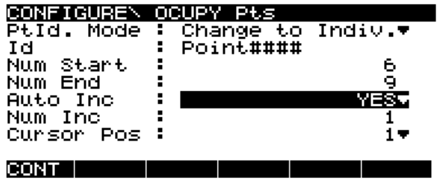


Note: Should you wish to store any new point Id as a template into the "library" then access the CONFIGURE\ ID Templates panel (CONFIG, 1 Survey, 5 Point Id Templates) and then press **CONT (F1)**. The point Id currently in use is now stored as a template.

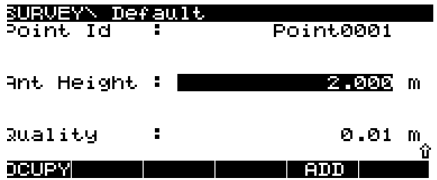
Working Example 2

Requirement - You are completing a survey where you need only one point ID that needs an incrementing number behind the text. These points will need the point ID “**Point####**”. However you will also survey some individual points that will need unique point Ids.

Settings - In CONFIG\ OCUPY Pts set up a point ID template as shown here.
Note that the Id type is set to “**Change to Indiv.**”.



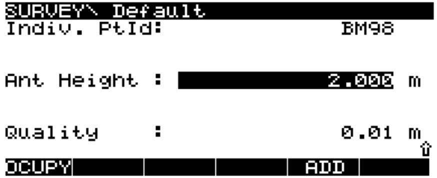
Field Proc - Within the Survey panel, the first point will automatically show the Point Id “**Point0001**”. Upon pressing **STORE**, the next Point Id will automatically show “**Point0002**”.



Working Example 2 (cont)

Field Proc (cont) -

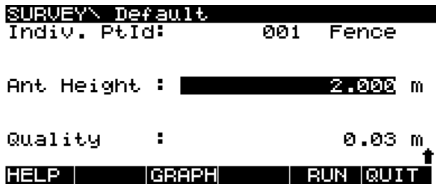
You now wish to survey one individual point and give it the point ID "**BM98**". In the Survey panel, enter this point ID. Survey this point and upon pressing STORE, the next point Id will revert back to "**Point0002**".



Note - When entering the individual point Id "BM98" you did not need to press **SHIFT INDIV (F5)** as in Working Example 1. This is because the "**Point####**" template is operating in the **Change to Individual** mode.

Suppose you do now wish to survey points using a new point Id "**###Fence**" and you wish this template to operate in the **Remain Running** mode.

Enter the point Id **"001Fence**" and then press **SHIFT RUN (F5)**. Occupy and store this point. The next point Id will be **"002Fence**"



Note: Numerical characters in front of any text will also increment. This allows any type of incrementing point Ids to be created.

Threshold Settings

These settings are used as checks if more than one set of measured coordinates are recorded for the same point.

```
CONFIGURE\ Threshold Settings
Avg/Abs Diffs  :          Avg▼
Avg. Limits Pos:       0.050 m
Avg. Limits Hgt:       0.070 m
Monitor CQ     : Pos + Height▼
Quality        :       0.050 m


CONT
```

Avg/Abs Diffs - A check can either be defined as an averaging functionality or as an absolute coordinate difference for X, Y, Z and E, N, H (with local coordinate system). **Avg** is the default option. When selecting **Abs**, the average position is still calculated.

Regardless of whether **Avg** or **Abs** is selected, points with more than one associated measured point will still be shown as average in Point Management.

Avg. Limits Pos - Only available if **Avg** is selected. Sets the averaging limit for position. When two or more coordinates are recorded for the same point, the system will compute an average for the positions and check that each position does not differ from the average by more than the defined amount. If they do differ by more than the defined amount, you will be alerted and can then decide whether to raise the averaging limits and record the coordinates or to ignore the coordinates.

Avg. Limits Height. - Only available if **Avg** is selected. Sets the averaging limit for height. The system will compute an average for the heights and check that each height does not differ from the average by more than the defined amount. If they do differ by more than the defined amount, you will be alerted and can then decide whether to raise the averaging limits and record the coordinates or to ignore the coordinates.

Monitor CQ - Allows to check the quality (CQ) of a point before it is stored. It is possible to choose to set a **Pos only**, **Height only**, **Pos + Height** CQ limit or no limit at all (**None**).

Quality - Sets the value for **Monitor CQ**.

If **Abs** is chosen then the **Avg. Limits Pos** and **Avg. Limits Height** are not shown but the **ABS (F6)** key becomes available.

```
CONFIGURE\ Threshold Settings
Avg/Abs Diffs   :         Abs▾


Monitor CQ      : Pos + Height▾
Quality         :      0.050 m



CONT                       ABS
```

Press **ABS (F6)** to set the limits for the absolute position difference in E, N, H and X, Y, Z.

```
CONFIGURE\ Abs Limit Settings
Easting         :      0.070 m
Northing        :      0.070 m
Height          :      0.070 m

Cartesian X     :      0.070 m
Cartesian Y     :      0.070 m
Cartesian Z     :      0.070 m

CONT                 DEFLT
```

Press **DEFLT (F5)** to set the default value of 0.07 m in all lines.

Press **CONT (F1)** to continue.

Stakeout

```
CONFIGURE\ Stake-Out
Stake from   :     ASCII File▾
STORE -> Job:            YES▾
Show Path    :             NO▾
Def. Orient  :          North▾
Use Beep     :            YES▾
Dist from Pt:         0.500 m
Diff Check   :       Pos + Hgt▾

CONT               ASCII
```

Stake from - Sets the source from which target points will be taken. **Job** means that the Rover will look for target points from a Job that you use. **ASCII File** means that you can stake out using an ASCII file. The ASCII file may be uploaded to the Receiver using SKI Pro or by copying the ASCII file onto a PC Card and using the Transfer function. Alternatively use the ASCII / GSI to Job converter and use Stake from Job. See section 13.6 for more information.

Store → Job - Appears when **ASCII File** is selected in **Stake from**. This parameter takes the original ASCII coordinate and stores it in the Job, together with the staked point. This is useful when comparing design points to actually staked points.

Show Path - Will display a track on the graphics screen of your previous positions when set to **Yes**.

Def. Orient - Defines the default orientation direction for stake out. This is the direction from which bearings or offsets will be taken. Note that this is the default orientation. A different orientation may always be defined when running Stakeout.

The options are:
North - orient towards north.
Sun - the sun is used as the orientation direction. System 500 can calculate the position of the sun for any time and location on the earth's surface.

Last Point - Use the last recorded point.
Known Point - Use any point in the job. The point can be defined when running Stakeout.
Line - Orient parallel to any line defined in the current job. The line can be defined when running Stake-out.
Arrow - Shows an arrow on the graphical side of the stake-out panel. Simply walk in the direction of this arrow to find the point to be staked out.

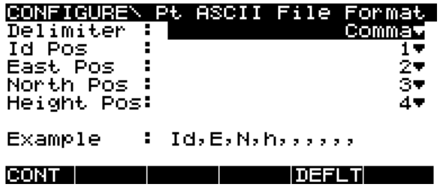
Use Beep - Will make the system beep whenever you are within the distance of the chosen target point set in **Dist from Pt**.

Diff Check - Possible options to check the difference between the design coordinates and the staked coordinates are by **Height** only, **Position** only, **Pos + Hgt** or not to check the difference at all (**None**).

This functionality will make the system automatically display the differences if the defined **Limit** is exceeded.

Use DTM - Appears when the DTM Stakeout option has been purchased and enables you to use a Digital Terrain Model as the height datum and will show cut and fill values relative to the DTM. DTMs are stored on the PC card or sensor internal memory.

When **ASCII File** is selected in **Stake from**, the **ASCII** (**F4**) key becomes available. Use this to define the format of the ASCII file.



Delimiter - Sets the character used to separate the various point compo-nents. Choose from **Comma** (,), **Line Feed** (new line), **Semicolon** (;), and **Space** (blank).

ID Pos - Sets the position of the Point Id.

East Pos - Sets the position of the easting.

North Pos - Sets the position of the northing.

Height Pos - Sets the position of the height.

An example of what is selected is displayed. Use the **DEFLT** (**F5**) key to reset the format to its original values. Define the delimiter used to separate the information for each point and then define the position of each component of each point. An example of what you have defined is given at the bottom of the screen.

Press **CONT** (**F1**) to return to the CONFIGURE\Stakeout screen and **CONT** (**F1**) again to complete the configuration.

The Advanced Mode contains extra configurable parameters that may be required for certain specialized applications.

Select Advanced in **CONFIGURE\Operation Mode**.

```
CONFIGURE\ Operation Mode

Mode        :          Advanced▾




CONT                          LIST
```

Only the screens that differ from those seen in Standard Mode are described here.

Position
In addition to the functionality given in Standard mode, details about the chosen coordinate system are given.

```
CONFIGURE\ Position
Update Rate:               1.0▾s
Coord Sys  :              UTM30▾
Residuals  :     No distribution
Transform  :                Test
Ellipsoid  :            WGS 1984
Projection :              UTM 30
Geoid Model:               -----

CONT
```

Residuals - The method by which residuals will be distributed throughout the transformation area is displayed.

Transform - The name of the transformation set used is displayed.

Ellipsoid - The name of the local ellipsoid is displayed.

Projection -The name of the projection used is displayed.

Geoid Model - The name of the geoid model used is displayed.

CSCS Model - The name of the CSCS model used is displayed.

Note that the details that are displayed depend upon the type of transformation used. Certain types of transformation do not use all of the described parameters to calculate local coordinates.

Pressing **Shift** followed by **FILT (F4)** will access the panel **CONFIGURE\ Filter**.

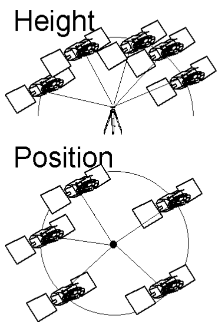
Height Smoothing - Enables you to activate or deactivate the height smoothing filter. With **YES**, smoothing is applied to all heights measured in the WGS84 or in a local coordinate system or output via NMEA. The filter defaults are best suited for high dynamic variations in height up to 1 m/s as carried out by graders.

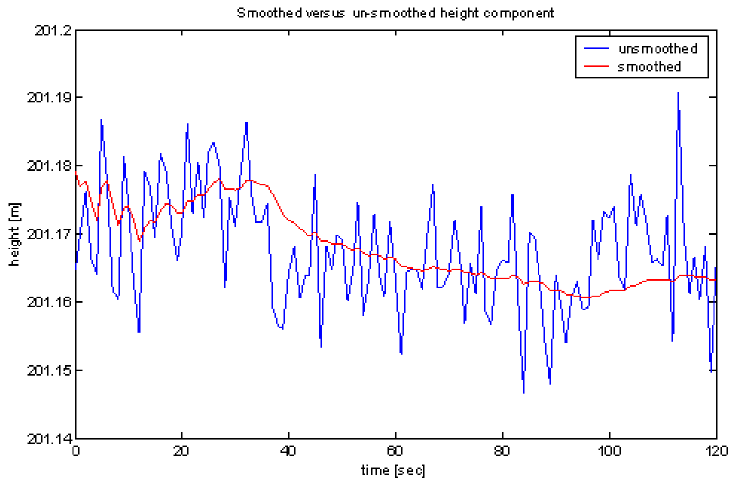
Height Smoothing and Filter techniques with kinematic GPS

Due to the nature of GPS, the height is the weakest part in GPS measurements. Height information can only be received from satellites above the antenna. Signals from the satellites of the other half of the orbits are blocked off by the earth.
Therefore, the GPS heights are less "stabilised" than the positions where information all around the horizon is available.

In kinematic surveys, this fact results in height variations of a few centimeters as shown in the blue curve.
Some GPS monitoring applications, however, require a stabilised height.

By applying the filter, the height variations are smoothed and most of the noise in height component is eliminated. In the diagram below, smoothed heights are shown in red.





Real-Time

```
CONFIGURE\ Real-Time
R-Time Data:               Rover▼
Data Format:               Leica▼
Port       :3 *Satelline 2A▼
Ref Sensor :              SR530▼
Ref Antenna:      AT502 Tripod▼
Use Phase  :                YES▼
Radio Down :     Don't Log Obs▼

CONT                  DEVCE
```

Use Phase - Enables you to define whether or not to use the phase data broadcast from the reference station. For normal centimeter level Real-Time surveying this will be set to **YES**.

When MaxTrak is selected **Use Phase** will automatically be set to NO and the ability to edit the **Use Phase** option is disabled. For further information on **MaxTrak** refer to chapter 9.1 Survey - Satellite.

Radio Down - Enables you to log raw GPS data in the event that radio contact is lost to the reference station.

The observation rate is fixed at 1 second. When **Radio Down** is set to **Log Obs**, two further options appear.

Log After - Defines the length of time that should elapse without radio contact before logging commences.

For minimum - Defines the length of time that GPS raw data will be logged for after an interruption is detected. Even if radio contact is re-established, raw data logging will continue for the specified time.

If radio contact is lost again, these two options will be used to log raw data again automatically.

If the chosen **Data Format** is RTCM, the **RTCM (F6)** button is available.

```
CONFIGURE\ Real-Time
RTCM Versn :               2.1▼
#Bits/Byte :                 6▼
Ref Net    :               YES▼
Telemax    :               YES▼
Accountfile:       account.tmx▼

CONT
```

RTCM Versn - Choose between RTCM v2.1 and v2.2.

#Bits/Byte - Choose between 6 and 8 bits per byte.

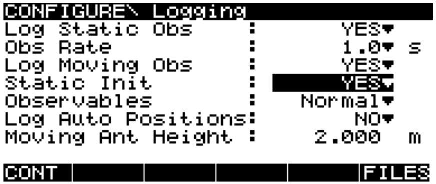
Change **Ref Net** to **YES** if corrections for a virtual reference shall be used.

Telemax - To make use of the German SAPOS reference station service via Telemax, set to **YES**. For more information see Appendix H.

Accountfile - Only available if Telemax = **YES**. Select the appropriate Accountfile, which you have transferred to the receiver before.

Logging

In addition to the functionality given in Standard mode, you can also specify the observables to be recorded and access further functionality via the **FILES** (**F6**) key.



Observables - Defines what is recorded in the raw GPS data. **Extended** records extra observables including the Doppler observable.

Pressing the **FILES** (**F6**) key enables you to configure further options.

Log File Segments will split up the recorded data into files of a specific length unless **1 File** is selected. If a time is selected the option **Split Tracks** will become available. Select **No** will only record data into a new file if the time is reached and a new track is observed.

Auto Del Log Files will delete the recorded data after the specified length of time unless **Never** is selected.

Press **CONT** (**F1**) to return to CONFIGURE\Logging.

Occupation Settings

Additional functionality available in this panel over Standard mode is **Auto OCUPY**, **Auto Stop**, **STOP R-TME** and **END Survey**.

Auto OCUPY - will automatically occupy the point as soon as the survey is started. **Timed** is chosen for automatic point occupations at a certain time. The time is specified in the SURVEY panel.

Auto Stop - will automatically stop the measurements according to the setting in the **STOP R-TME** function. The measurements stop when the criteria for the setting reach 100%.

STOP R-TME - Defines the method used for Auto Stop when Auto Stop is set to **YES**.
When Auto Stop is set to **NO** a percentage value will be displayed next to the Time or Epochs in the Main Survey screen. This indicates how much of the Auto Stop criteria has elapsed. The Auto Stop criteria is defined using the **R-TME** (**F3**) key (see below).

The criteria available to automatically stop a real-time Rover are:
Accuracy -Stop when a specified accuracy is reached.
Positions - Stop after a set number of positions have been calculated. Note that these are positions (position recording rate) and not raw observations.
STOP&GOIndicator - Stop when the Stop and Go Indicator has reached 100%.

Auto Store - Will automatically store the point information and GPS data when the survey is stopped.

END Survey - Sets how the Survey operation will be ended. **Manual** lets you exit the survey yourself. **Automatic** will exit the survey automatically. **Auto & Shut-down** will exit the survey and turn the sensor off.

Id Templates
You may also configure Id Templates for Auxiliary Points in exactly the same way as for normal points.

Threshold Settings

In addition to the functionality given in Standard mode you can also specify a DOP limit. If the limit is exceeded no position will be recorded.

```
CONFIGURE\ Threshold Settings
Avg/Abs Diffs  :            Avg▾
Avg. Limits Pos:         0.050 m
Avg. Limits Hgt:         0.070 m
Monitor CQ     : Pos + Height▾
Quality        :         0.050 m

CONT |     | DOP |     |     |
```

Press **DOP** (**F3**).

```
CONFIGURE\ DOP Limit

Limit          :           GDOP▾
DOP            :              8

CONT |     |     |     |     |
```

Limit - Select the type of DOP limit. If no limit shall be active select **None**.

DOP - Enter the DOP limit value.

Press **CONT** (**F1**) to continue.

Hidden Point

A hidden point is defined as a point that cannot be measured by GPS but by an external device. This is usually due to satellite shading. Satellite shading can be caused by the close proximity of tall buildings, trees etc.

```
CONFIGURE\ Hidden Point
Include Hgt:              YES▾
Pos Qlty   :            0.300   m
Hgt Qlty   :            0.400   m

CONT |     |     |     |IFACE|
```

Include Hgt - Will compute a height for a hidden point and include a quality component for height difference.

Pos Qlty - The position quality defined here has to come from your own knowledge or experience with the device you are using. System 500 will not check any recorded measurements against the position and height qualities. It will however be used in any least squares adjustment that may be carried out later.

Hgt Qlty - The height quality defined here has to come from your own knowledge or experience with the device you are using. System 500 will not check any recorded measurements against the position and height qualities. It will however be used in any least squares adjustment that may be carried out later.

Press **IFACE** (**F5**) and then select **YES** for **Use Device** to choose the port and device to be used.

```
CONFIGURE\ Hidden Point
Use Device :                 YES▾
Port       :          2 *Disto▾
Dist Offset:             0.000   m
Hgt Offset : Inst & Trgt Hgt▾
Inst Height:             0.000   m
Trgt Height:             0.000   m
CONT |     | EAO |     |DEVCE|
```

Port - Use the right or left cursor keys to select the port to where the device will be connected. This will normally be port 2.

Pressing **DEVCE** (**F5**) allows the device to be chosen.

System 500 supports several devices such as Leica Disto memo, Disto pro, Disto™ pro⁴ and Disto™ pro⁴ a. All of them are hand held lasermeter that can be used to record otherwise inaccessible points. You may also use a simple tape to measure to such points and input the measurements manually.

Press **CONT** (**F1**) to return to the previous panel.

Dist Offset - Enter a distance offset if necessary. Refer to Appendix H for more information.

Hgt Offset - Available if **Include Hgt** in the previous panel and **Use Device** in the current panel are set to **YES**. The options are:

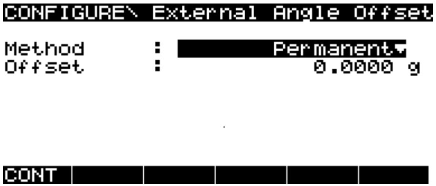
None - Neither instrument nor target height is considered. The result is the delta height between the center of the external device and the aimed point. This delta height can be measured, estimated or left as zero.

Inst Height - The instrument height is considered. If the delta height between the center of the external device and the aimed point is measured or estimated, the result is the height difference between the rover point on the ground and the aimed point. Enter the instrument height into the corresponding new line.

Inst Height & Trgt Height - Instrument as well as target height to be considered. If the delta height between the center of the external device and the aimed point is measured or estimated, the result is the ground height difference between rover and aimed point. Enter the values in the corresponding two new lines.

Refer to Appendix H for a complete list of all supported Hidden Point devices, their configurations, sketches and more information on hidden points.

EAO (**F3**) allows the default method to be set that will be used to enter an **External Angle Offset** when measuring hidden points using a device that measures azimuths.



The options are **None**, **Permanent** or **New For Each Point**. If permanent is chosen a default **EAO** can also be entered.

If **None** is chosen it will not be possible to enter an EAO during the measurement of hidden points.

Press **CONT** (**F1**) to continue.

Seismic
You can set whether or not to store a seismic record with each point. If **Use Seismic Record** is set to **YES**, the seismic records for manually occupied points are stored in point annotation #4. The same holds true for auto logged points as long as **Store Pt DB** and **Use Annot** in panel CONFIGURE\ Position Logging are set to **YES**. For detailed information see section 5.4.

The format for seismic records is given in Appendix C.

Press **CONT** (**F1**) to complete the configuration.

6. Jobs and Points

6.1 Management of Jobs

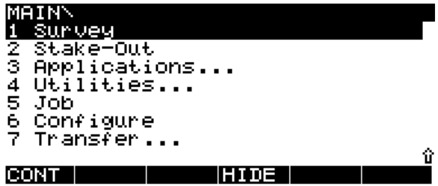
Jobs exist in order for you to be able to structure and organize your work. They define a common location within the System 500 file system for points.

All points that are recorded will be stored within a particular Job. This Job may cover a whole project or part of a larger project. It may cover certain classes of points for a project such as control points, detail points etc.

Whole Jobs can then be downloaded to and uploaded from SKI Pro. Jobs are downloaded to SKI Pro for post-processing operations or for data transfer to a further program (such as a GIS). Points contained within Jobs that are uploaded can be used for Real-Time Stakeout operations.

A copy of the Coordinate System that was used with the last active Job will also be stored.

Jobs are managed from the **Job** option in the Main Menu. Press **SHOW** (**F4**) to reveal all of the Main Menu choices.



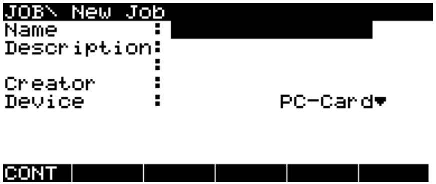
Select **Job** and press **ENTER**.

The currently available Jobs are displayed together with the date they were created or last edited.

Keys to help you navigate through the list are available by pressing **SHIFT**.

Creating a New Job

Press **NEW** (**F2**) to create a new Job.



Name - Defines the Job name. The name may be up to 16 characters long and may include spaces.

Description - A description of the job can be entered. This could be for example, work to be performed or the type/class of points contained in the job. (Optional)

Creator -The name of the person that created the job may be entered. (Optional).

Device - Sets the device upon which the Job is stored. Note that Internal Memory is not fitted as standard and therefore may not be an option.

Press **CONT** (**F1**) to confirm the entry and return to JOB\PC-Card or JOB\Internal.

Editing a Job

To edit an existing Job press **EDIT** (**F3**). The Job **Name**, **Description**, **Creator** and **Device** are displayed and are available for editing.

Deleting a Job

To delete a Job, select the Job and press the **DEL** (**F4**) key. You will be asked for confirmation before the Job is deleted. All points and data contained in the Job will be lost.

Selecting the Device

Jobs may be stored on the PC-Card or the Internal Memory if fitted. To change the device viewed, press the **DEVCE** (**F5**) key.

The use of System 500 with the most common techniques of measurement are described.

The correct Receiver must be used for the technique chosen. An overview is given below.

Application	Post-Processed Static/R. Static Post-Processed Kinematic Reference	Post-Processed Kinematic (Static Initialisation)	Post-Processed Kinematic on the Fly	Real-Time DGPS (1-5 m)	Real-Time RTK (1-5cm)
SR510	✓	✓			
SR520	✓	✓	✓		
SR510 with RTCM2.0 option	✓	✓		✓	
SR520 with RTCM2.0 option	✓	✓	✓	✓	
SR530	✓	✓	✓	✓	✓

7.1 Static and Rapid Static Survey, Post-Processed Kinematic Reference

Set up the equipment as described in Chapter 2. Attach the Terminal.

Switch on. The Main Menu will be displayed. The system will automatically start searching for satellites.

Select **Survey** and press **CONT** (**F1**).

```
SURVEY\ Begin
Config Set:              PP_STAT▾

Job         :           Default▾
Coord Sys   :      WGS84 Geodetic

Antenna     :        AT502 Tripod▾

CONT |     |     |     |     |CSYS
```

Config Set - Defines the Configuration Set to be used. The last Configuration Set used or created will be taken by default although any other Configuration Set may be selected.

Job - Defines the Job to be used. This is the Job where any point and observation data will be stored.

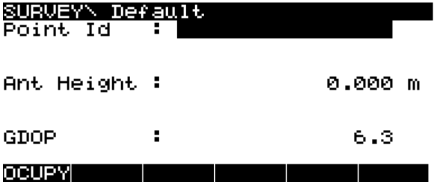
Coord Sys - Displays the coordinate system that will be used for the display of coordinates. For post-processed work, this will normally be WGS84

Antenna - Defines the Antenna setup to be used. The Setup defined in the Configuration Set will be taken by default although any other setup may be selected. For post-processed Static/Rapid Static or Kinematic Reference work, this will normally be **AT501/502 Tripod**.

Press **CONT** (**F1**) when you have made your selection.

7.1.1 Overview of Procedure

The Main Survey Panel appears.



From here you can add **Point Id**, and **Antenna Height** and observe the DOP.

If configured, you will also be able to add a Code.

If configured, you will also be able to enter a start time for the point occupation.

As soon as the receiver has enough information, the **DOP** will be displayed.

The Moving Icon is displayed at this point. This indicates that the Antenna can be moved around and that no Static Observations are being recorded.

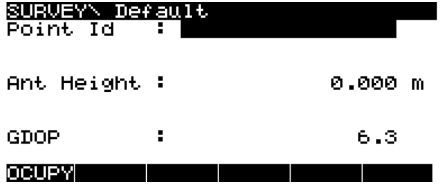
Use the **OCUPY** (**F1**) key to start data recording. The icon changes to a tripod, indicating that the Receiver should remain stationary.

Press **STOP** (**F1**) when you have enough data and **STORE** (**F1**) to record the point information.

The **ADD** (**F5**) key is available in Advanced mode and is explained in section 7.1.7.

Further details about this procedure are given in the sections that follow.

7.1.2 Adding the Point Id



The **Point Id** is an identifier for a particular point. It also collates all measurements made on that point and all other associated data such as codes, point annotations and meteorological data.

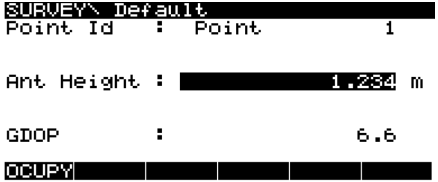
If a point Id template has been configured in the Configuration Set, a Point Id will be suggested. You can overwrite this with a different Id if required.

If no point Id is suggested then enter a point Id. By default if the point Id contains any numerical values, these will be incremented by 1.

To break the auto numbering press **Shift INDIV (F5)** and enter an individual Point Id. After this point has been stored it will return to the previously suggested Point Id.

If you define a Point Id Template in the Configuration Set you have even more flexibility to automatically define your Point Id's.

Further information about Point Id Templates and two working examples are given in Chapter 5.2.



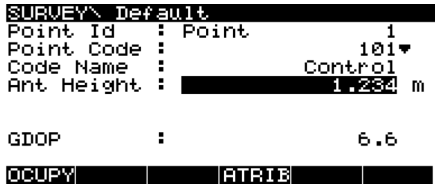
Measure the Antenna Height. When using a Tripod this will be measured using the Height Hook. When mounted on a pillar, you must use some other way of measuring the height. Enter the value in **Ant Height**.

Further details on measuring the Antenna height can be found in section 2.15.

It will be possible to add a code to a point if a coding system has been defined for use in the Configuration Set.

System 500 supports two coding methods; Thematical Coding and Free Coding. Both methods of coding are explained in Chapter 8.

Thematical Coding



The fields **Point Code** and **Code Name** will be displayed as above. Highlight the **Point Code** and either:

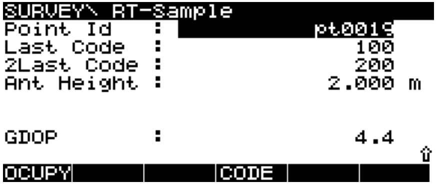
1. Use the left or right cursor keys to cycle through the code list.
or

2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.

The **Code Name** will be displayed for the **Point Code** that you have chosen. Enter any attributes for the code using the **ATRIB** (**F4**) key.

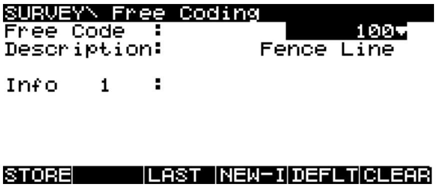
The code is stored along with the Point Id information.

Free Coding



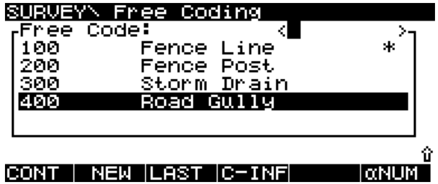
The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE** (**F4**) key will be available. Press this key to access the codelist.



To select the code:
1. Use the left or right cursor keys to cycle through the code list.

or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.



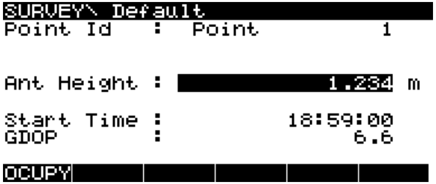
An asterisk next to a code indicates that it has attributes.

Press **CONT** (**F1**) to select the code.

Further information about Coding Systems is available in Section 8.

7.1.5 Adding a Starting Time

It will be possible to add a starting time for a point occupation if auto occupy has been set to Timed in the Occupation Settings of the Configuration Set.



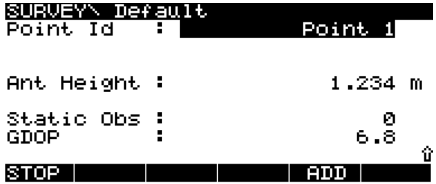
Initially, the time displayed in **Start Time** is the current time with the seconds rounded to zero.

Enter the time in **Start Time** in hours:minutes:seconds.

7.1.6 Measuring procedure

Measuring procedure without starting time

Press the **OCUPY** (**F1**) key to begin recording observations. The icon changes to a tripod, indicating that the Receiver should remain stationary.



Static Obs/Time - The method by which you have selected to count time will be shown. In Advanced mode, you may select to display the amount of data required according to one of four criteria. If this has been set, a percentage value will be shown next to the expired Epochs/Time.

This percentage value is the amount of data recorded with 100% being the amount required. If Auto Stop was selected, the recording of observations will automatically stop when 100% is reached.

The **ADD** (**F5**) key is available. Further information is available in the next section.

Further information about the Stop and Go indicator, satellites tracked, data logged etc. can be accessed through the STATUS key. More information about this key is given in Chapter 10.

When the required length of time has passed, press the **STOP** (**F1**) key to stop raw observation recording. If Auto Stop has been set in the Configuration, this will happen automatically.

Press **STORE** (**F1**) to store the Point Id and any Thematical Code that you may have assigned. If Auto Store has been set in the Configuration, this will happen automatically.

Leave the survey by pressing **SHIFT** followed by **QUIT** (**F6**). To switch off, press the **ON/OFF** key on the terminal.

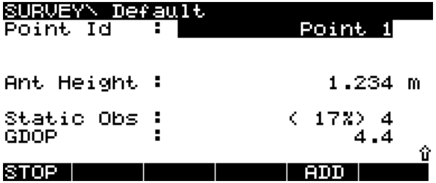
Measuring procedure with starting time

After entering a point ID, the antenna height and a start time, press the **OCUPY** (**F1**) key.

```
SURVEY\ Default
Point Id      :          Point 1

Ant Height    :          1.234 m

Time to Go    :           0:45
GDOP          :            4.4
STOP                  ADD
```

The line **Start Time** changes to **Time to go**. The time before the measurement starts automatically is displayed in hours:minutes:seconds and is counted down.

Once the entered start time is reached, the measurement beginns. The icon changes to a tripod, indicating that the Receiver should remain stationary.



The line **Time to go** changes to Static Obs/Time.

Static Obs/Time - The method by which you have selected to count time will be shown. In Advanced mode, you may select to display the amount of data required according to one of four criteria. If this has been set, a percentage value will be shown next to the expired Epochs/Time. This percentage value is the amount of data recorded with 100% being the amount required. If Auto Stop was selected, the recording of observations will automatically stop when 100% is reached.

The **ADD** (**F5**) key is available. Further information is available in the next section.

Further information about the Stop and Go indicator, satellites tracked, data logged etc. can be accessed through the STATUS key. More information about this key is given in Chapter 10.

When the required length of time has passed, press the **STOP** (**F1**) key to stop raw observation recording. If Auto Stop has been set in the Configuration, this will happen automatically.

Press **STORE** (**F1**) to store the Point Id and any Thematical Code that you may have assigned. If Auto Store has been set in the Configuration, this will happen automatically.

Once the point is stored, again the **OCUPY (F1)** key becomes available and the start time line is shown with the current time and the seconds rounded to zero. To start a new occupation enter the next start time. Then press **OCUPY (F1)**.

Leave the survey by pressing **SHIFT** followed by **QUIT** (**F6**). To switch off, press the **ON/OFF** key on the terminal.

When the Advanced Mode is selected, the **ADD** (**F5**) key is available.

This key can be used to add Point Annotations, and Meteorological Data.

```
SURVEY\ Default
Point Id    : Point           1

Ant Height  :           1.234 m

GDOP        :             6.8
OCUPY|    |    |    | ADD |
```

Press **ADD** (**F5**)

```
SURVEY\ Add Menu
1 Point Annotations
2 Metereological Data
3 Hidden Point...



CONT|    |    |    |    |
```

Adding Point Annotations
Point Annotations may be used as an electronic notepad where events, notes etc. may be written. They are then taken with the Point Id information into SKI-Pro.

To add Point Annotations, select **Point Annotations** from the list and press **CONT** (**F1**).

```
SURVEY\ Point Annotations

#1 :              Chased by Dog
#2 :            Tree fell on head
#3 :          Couldn't find point
#4 :      Packed up and went home


CONT|    |    |    |    |CLEAR
```

You may type in 4 notes with up to 26 characters in each note. Press **CONT** (**F1**) when you are finished.

Press **CLEAR (F6)** to delete the content of all fields.

Adding Meteorological Data
Meteorological data may be required when very precise work is being carried out or when very different weather conditions exist between the Rover and Reference. This data will not be used by SKI-Pro but may be exported in RINEX format from SKI-Pro and used in a scientific processing software that accepts meteorological data for tropospheric modelling.

Select **Meteorological Data** from the list and press **CONT** (**F1**).

```
SURVEY\ Metereological Data

Temp Dry    :           20.00   °C
Temp Wet    :           20.00   °C

Atmos Pres  :         1013.00 mbar
Rel Humid   :          100.00    %


STORE|    |    |    |    |
```

Enter the data and press **STORE** (**F1**). The data will be stored with a time tag. During long observation periods you may need to store several sets of meteorological data as the weather changes.

Set up the equipment as described in Chapter 2. Attach the Terminal.

Switch on. The Main Menu will be displayed. The system will automatically start searching for satellites.

Select **Survey** and press **CONT** (**F1**).

Config Set - Defines the Configuration Set to be used. The last Configuration Set used or created will be taken by default although any other Configuration Set may be selected.

Job - Defines the Job to be used. This is the Job where any point and observation data will be stored.

Coord Sys - Displays the coordinate system that will be used for the display of coordinates. For post-processed work, this will normally be WGS84.

Antenna - Defines the Antenna setup to be used. The Setup defined in the Configuration Set will be taken by default although any other setup may be selected. For post-processed Kinematic work, this will normally be **AT501/502 Pole**.

Press **CONT** (**F1**) when you have made your selection.

The Main Survey screen appears.

```
SURVEY\ Default
Point Id    :

Ant Height  :           0.000 m

GDOP        :             6.3
OCUPY
```

From here you can add **Point Id**, **Code**, **Antenna Height** and observe the DOP.

If configured, you will also be able to enter a start time for the point occupation.

As soon as the receiver has enough information, the **DOP** will be displayed.

The PP_KIS default post-processed kinematic configuration set is defined such that you must perform a static initialization.

This will always be the case when using a SR510. SR520 and SR530 users may set the static initialization parameter to NO and perform initialization on the fly.

Further details about this procedure are given in the sections that follow.

7.2.2 Adding the Point Id

```
SURVEY\ Default
Point Id    :

Ant Height  :           0.000 m

GDOP        :             6.3
OCUPY
```

The **Point Id** is an identifier for a particular point. It also collates all measurements made on that point and all other associated data such as codes, point annotations and meteorological data.

If a point Id template has been configured in the Configuration Set, a Point Id will be suggested. You can overwrite this with a different Id if required.

If no point Id is suggested then enter a point Id. By default if the point Id contains any numerical values, these will be incremented by 1.

To break the auto numbering press **Shift INDIV (F5)** and enter an individual Point Id. After this point has been stored it will return to the previously suggested Point Id.

If you define a Point Id Template in the Configuration Set you have even more flexibility to automatically define your Point Id's.

Further information about Point Id Templates and two working examples are given in Chapter 5.2.

```
SURVEY\ Default
Point Id    : Point           1

Ant Height  :           2.000 m

GDOP        :               6.6

OCUPY
```

Usually, in post-processed kinematic surveys the Antenna will be mounted on a pole and therefore the height will remain constant. When an AT501/502 Antenna is used together with a System 500 pole, the Antenna Height is 2.00m. This may have been specified as the default height in the Configuration Set.

Otherwise, measure the Antenna height and enter it.

The only time when the Antenna height will not remain constant is when a Static Initialization is carried out on a Tripod and the Antenna is then transferred onto a pole. In this case, measure the Antenna height on the Tripod, add the offset (with a height hook this is 0.36m) and enter it. Then, after pressing **STOP** (**F1**) to finish the initialization, the Moving Antenna height specified in the Configuration Set will be used for the moving part of the Kinematic chain.

It will be possible to add a code to a point if a coding system has been defined for use in the Configuration Set.

System 500 supports two coding methods; Thematical Coding and Free Coding. The principles of both methods of coding are explained in Chapter 8.

Thematical Coding

```
SURVEY\ Default
Point Id    : Point          1
Point Code  :              101▾
Code Name   :           Control
Ant Height  :             1.234 m

GDOP        :               6.6
OCUPY|     |     |ATRIB|     |
```

The fields **Point Code** and **Code Name** will be displayed as above. Highlight the **Point Code** and either:

1. Use the left or right cursor keys to cycle through the code list.

or

2. Press **ENTER** and select the code from the list.

or

3. Type in the first few characters of the code until the desired code is displayed.

The **Code Name** will be displayed for the **Point Code** that you have chosen. Enter any attributes for the code using the **ATRIB** (**F4**) key.

The code is stored along with the Point Id information.

Free Coding

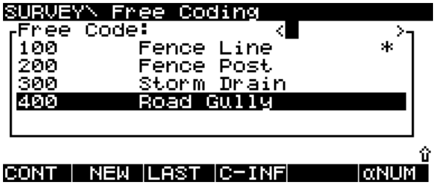
```
SURVEY\ RT-Sample
Point Id    :            pt0019
Last Code   :               100
2Last Code  :               200
Ant Height  :             2.000 m

GDOP        :               4.4
                                ⇧
OCUPY|     |     |CODE |     |
```

The Last Code and second last code (**2Last Code**) that were used are shown.

The **CODE** (**F4**) key will be available. Press this key to access the codelist.

```
SURVEY\ Free Coding
Free Code  :             100▾
Description:       Fence Line

Info    1  :


STORE|     |LAST |NEW-I|DEFLT|CLEAR
```

To select the code:
1. Use the left or right cursor keys to cycle through the code list.
or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.

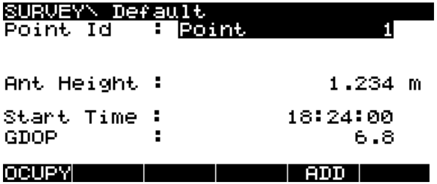


An asterisk next to a code indicates that it has attributes.

Press **CONT** (**F1**) to select the code.

Further information about Coding Systems is available in Section 8.

It will be possible to add a starting time for a point occupation if auto occupy has been set to Timed in the Occupation Settings of the Configuration Set.



Initially, the time displayed in **Start Time** is the current time with the seconds rounded to zero.

Enter the time in **Start Time** in hours:minutes:seconds.

The exact measuring procedure varies depending upon which Receiver you are using and the Configuration Set.

When using an SR510, you must perform a Static Initialization before commencing the moving part of the survey. The option to do this is activated in the Configuration Set. When using a SR520 or SR530, you may also perform a Static Initialization if required although there is not strictly any need to do so. When using the SR520 and SR530, the normal way to work will be to initialize on the fly. No Static Initialization is then required.

Measuring with Static Initialization without starting time

If you have selected to perform a static initialization, press **OCUPY** (**F1**) as soon as you are ready. The static initialization will begin. The Receiver needs to be kept perfectly steady during this time. For this reason, it is advised to use a quickstand or to mount the sensor on a tripod for the initialization period.

The initialization may be thought of as a Rapid Static point. You will need to measure for several minutes, the exact time being determined by the baseline length (distance between rover and reference). The exact time required may be shown using the Stop and Go Indicator.

You may configure this to be shown in the Main Survey panel and may also access it through the **STATUS** key. The moving part of the chain will not begin until you have completed the initialization and pressed **STOP** (**F1**).

As soon as this key is pressed the moving part of the chain will begin and observations recorded at the predefined rate. You may move along the course you wish to record.

When carrying out a post-processed kinematic survey where a static initialization has been performed, the Receiver will automatically monitor the number of satellites tracked. If at any time this number falls below 4, observation recording will stop and a message will show on the screen informing you that the satellite count has fallen below 4 and you must reinitialize. You must then perform the static initialization again.

Initialization on the Fly without starting time

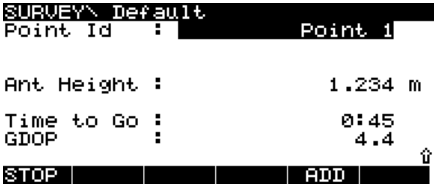
This is the method that will be preferred by SR520 and SR530 users. No Static Initialization is required. Observations will be recorded as soon as **CONT** (**F1**) in the SURVEY\Begin screen is pressed.

Recording Distinct Points without starting time

To record distinct points within the moving part of the kinematic chain (whether a static initialization has been performed or not), occupy the point, level the pole and press **OCUPY** (**F1**). The point will be recorded in accordance with what has been defined in the Configuration Set. Check the Point Id and Antenna Height. Add a code if required. Press **STOP** (**F1**) followed by **STORE** (**F1**) to store the point.

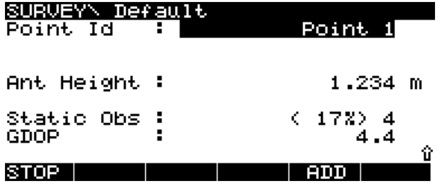
Initialization and point recording with starting time

After entering a point ID, the antenna height and a start time, press the **OCUPY** (**F1**) key.



The line **Start Time** changes to **Time to go**. The time before the measurement starts automatically is displayed in hours:minutes:seconds and is counted down.

Once the entered start time is reached, the measurement beginns.



The line **Time to go** changes to Static Obs/Time.

When the required length of time has passed, press the **STOP** (**F1**) key to stop raw observation recording. If Auto Stop has been set in the Configuration, this will happen automatically.

Press **STORE** (**F1**) to store the Point Id and any Thematical Code that you may have assigned. If Auto Store has been set in the Configuration, this will happen automatically.

Once the point is stored, again the **OCUPY (F1)** key becomes available and the start time line is shown with the current time and the seconds rounded to zero.

To start a new occupation - either the first point recording after initialization or a subsequent point recording - enter the next start time. Then press **OCUPY (F1)**.

7.2.7 Using the AUTO key

If **Log Auto Positions** is set to **YES** in the CONFIGURE\ Logging screen the **Auto** (**F3**) key is available in the main Survey screen.

```
SURVEY\ Default
Point Id    :              pt0020

Ant Height  :             2.000 m

GDOP        :                4.4
OCUPY     AUTO       ADD
```

Auto (**F3**) can be used to switch to the mode for measuring Auto-Positions in the Auto-Pos panel.

This functionality is mostly used in Real-Time Rover operations. For details on measuring Auto-Positions refer to chapter 7.4.7 Using the AUTO key in Real-Time Rover measurement procedures.

7.2.8 Using the ADD key

When the Advanced Mode is selected, the **ADD** (**F5**) key is available.

```
SURVEY\ Default
Point Id    : Point           1

Ant Height  :             1.234 m

GDOP        :               6.8
OCUPY                  ADD
```

This key can be used to add Point Annotations, Meteorological Data and Hidden Points.

Press **ADD** (**F5**).

```
SURVEY\ Add Menu
1 Point Annotations
2 Metereological Data
3 Hidden Point...



CONT
```

Adding Point Annotations

Point Annotations may be used as an electronic notepad where events, notes etc. may be written. They are then taken with the Point Id information into SKI-Pro. Point Annotations may only be added when a distinct point is being recorded.

To add Point Annotations, select **Point Annotations** from the list and press **CONT** (**F1**).

```
SURVEY\ Point Annotations

#1 :             Chased by Dog
#2 :          Tree fell on head
#3 :        Couldn't find point
#4 :     Packed up and went home

CONT                       CLEAR
```

You may type in 4 notes with up to 26 characters in each note. Press **CONT** (**F1**) when you are finished.

Press **CLEAR (F6)** to delete the content of all fields.

Adding Meteorological Data

Meteorological data may be required when very precise work is being carried out or when very different weather conditions exist between the Rover and Reference. When carrying out post-processed kinematic work, it only makes sense to input meteorological data at distinct points, (not during the moving parts). This data will not be used by SKI-Pro but may be exported in RINEX format from SKI-Pro and used in a scientific processing software that accepts meteorological data for tropospheric modelling.

Select **Meteorological Data** from the list and press **CONT** (**F1**).

```
SURVEY\ Metereological Data

Temp Dry    :          20.00  °C
Temp Wet    :          20.00  °C

Atmos Pres  :        1013.00 mbar
Rel Humid   :         100.00   %

STORE
```

Enter the data and press **STORE** (**F1**). The data will be stored with a time tag. During long observation periods you may need to store several sets of meteorological data as the weather changes.

This chapter assumes that you will use the default Real-Time Reference File.

Set up the equipment as described in Chapter 2. Attach the Terminal, but only attach the radio modem if you are sure that the port is correctly configured. Attaching a radio modem to an incorrectly configured port may result in damage to the radio modem.

Switch on. The Main Menu will be displayed. The system will automatically start searching for satellites.

Select **Survey** and press **CONT** (**F1**).

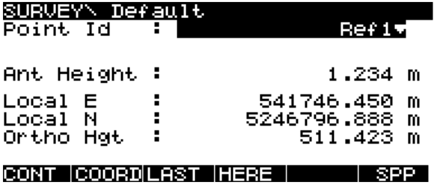
Config Set - Defines the Configuration Set to be used. The last Configuration Set used or created will be taken by default although any other Configuration Set may be selected.

Job - Defines the Job to be used. This is the Job where any point and observation data will be stored.

Coord Sys - Displays the coordinate system that will be used for the display of coordinates. This coordinate system is attached to the selected Job. Press **CSYS (F6)** to change the Coordinate System. Information on determining the coordinate system is given in section 11.1.

Antenna - Defines the Antenna setup to be used. The Setup defined in the Configuration Set will be taken by default although any other setup may be selected. For Real-Time Reference Stations, this will normally be **AT501/502 Tripod**.

Press **CONT** (**F1**) when you have made your selection.



You will need to select the way in which you define the reference point. You may select either a known point from the drop down list or use the **LAST (F3)** key to use the coordinates that were used when the sensor was last used as a reference station. Alternatively, use the **HERE** (**F4**) key to select the present navigation position or use the Single Point Positioning **SPP** (**F6**) feature to determine the reference point.

Using a known point
Select a point from the drop down list box. This point will have been previously entered into the database manually, from SKI Pro, or may be a point resulting from a previous real-time rover measurement.

Use the **COORD** (**F2**) key to switch display between coordinate systems.

Measure and input the Antenna Height (**Ant Height**). When using a Tripod this will be measured using the Height Hook.

Further details on measuring the Antenna height can be found in section 2.15.

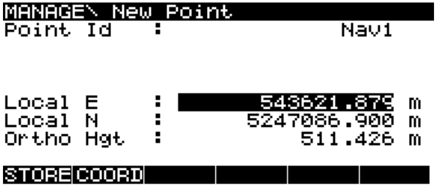
Using the last used Reference Station coordinates
To use the same coordinates that were used when the sensor was last used as a reference station, choose **LAST** (**F3**).

When a sensor is used as a reference station and is turned off, the reference station coordinates are stored within the System RAM. They can then be used again the next time the sensor is used as a reference station.

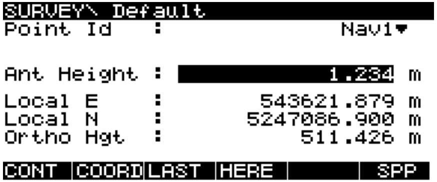
This means that even if the PC card that previously contained the reference station coordinates is formatted, the last used coordinates can still be used.

Using the current Navigation Position

To use the current navigation position as the coordinates for the reference point, press the **HERE** (**F4**) key.



The current navigation position will be taken. Input the Point Id and press **STORE** (**F1**). The point will be added to the database and will be taken over into the Main Survey screen.



Measure and input the Antenna Height (**Ant Height**). When using a Tripod this will be measured using the Height Hook.

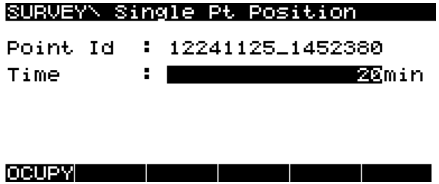
Further details on measuring the Antenna height can be found in section 2.15.

The navigated position is normally used in preference to the Single Point Position (SPP) if there is no previously measured point available and the baseline between Reference and Rover is 5km or less. In situations where the baseline is greater than 10km, it is probably better to use SPP.

Using Single Point Position (SPP)

A SPP is where the GPS code observations for a single point are collected over a period of time and refined into a position that is generally more accurate than a navigated position.

To activate the Single Point positioning, press **SPP** (**F6**).



The suggested Point Id is automatically created based on the Time and Date Point Id Template. It may if required be overwritten. The Time and Date Point Id Template follows the following format:

RRRRMMDD_HHMMSSS

Where:

RRRR = last four numbers of Receiver serial number.
MM = month
DD = Day
HH = Hour
MM = Minutes
SSS = seconds to 1 decimal place.

Input the length of time over which the single point should be processed. The longer the time, the more accurate the single point. A good compromise is 20 minutes.

Press **OCUPY** (**F1**) to begin the single point occupation.

```
SURVEY\ Single Pt Position

Point Id  : 12241125_1452380
Time at Pt:              0:04


STOP
```

The occupation will run for the length of time specified. After this time, the point will be automatically recorded and the Main Survey screen will be shown. Alternatively, if you wish to cut the single point processing short, press **STOP** (**F1**).

As soon as the Main Survey screen is shown, observation data will be broadcast. Up to this point, only Point Id and battery status etc. will be broadcast.

Single Point Processing is generally used in preference to the navigation position as a means of defining reference station coordinates when either there is no previously measured point available and the baseline distance from the reference to the rover exceeds 10km.

The HERE and SPP methods are only suitable for use at the start of a project. On subsequent days, reference station coordinates should be the results of the previous days work!

When the reference point has been defined and the Main Survey panel is shown, there is little more to be done. Data will be transmitted and, if so configured, will also be recorded.

If working in Advanced mode, you may use the **ADD** (**F5**) key to add Point Annotations or Meteorological data.

To shut the Receiver down, press **STOP** (**F1**) and then switch **OFF**. The store function is executed automatically.

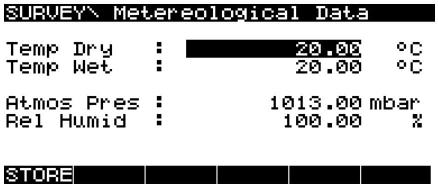
When the Advanced Mode is selected, the **ADD** (**F5**) key is available.

This key can be used to add Meteorological Data.

Press **ADD** (**F5**), followed by **CONT** (**F1**)

Meteorological data may be required when very precise work is being carried out and/or when very different weather conditions exist between the Rover and Reference. This should only be used when recording data for post-processing. This data will not be used by SKI-Pro but may be exported in RINEX format from SKI-Pro and used in a scientific processing software that accepts meteorological data for tropospheric modelling.

Select **Meteorological Data** from the list and press **CONT** (**F1**).



Enter the data and press **STORE** (**F1**). The data will be stored with a time tag. During long observation periods you may need to store several sets of meteorological data as the weather changes.

7.4 Real-Time Rover, Surveying New Points

Set up the equipment as described in Chapter 2. Attach the Terminal.

Switch on. The Main Menu will be displayed. The system will automatically start searching for satellites.

Select **Survey** and press **CONT** (**F1**).

Config Set - Defines the Configuration Set to be used. The last Configuration Set used or created will be taken by default although any other Configuration Set may be selected.

Job - Defines the Job to be used. This is the Job where any point and observation data will be stored.

Coord Sys - Displays the coordinate system that will be used for the display of coordinates. For this type of work, a local coordinate system should be used although this is not strictly essential. Press **CSYS (F6)** to change the Coordinate System. Information on determining the coordinate system is given in section 11.1.

Antenna - Defines the Antenna setup to be used. The Setup defined in the Configuration Set will be taken by default although any other setup may be selected. For Real-Time Rover work, this will normally be **AT501/502 Pole**.

Press **CONT** (**F1**) when you have made your selection.

7.4.1 Overview of Procedure

As soon as data is received from the Reference, and the Rover itself is tracking sufficient satellites, the ambiguity resolution process will begin. This processes the data and calculates the baseline from Reference to Rover to within 1-5 cm.

When the ambiguities are resolved, the Accuracy Status Icon will show the position to be between 1 and 5cm.

Additionally, the Coordinate Quality (Quality) in the Main Survey screen should show between 0.01 and 0.05.

To record a point, place and level the pole, Input the Point Id and Code (if required). If configured, you will also be able to enter a start time for the point occupation. If working in Advanced mode, use the **ADD** key to add point annotations and/or hidden points.

Then press the **OCUPY** (**F1**) key.

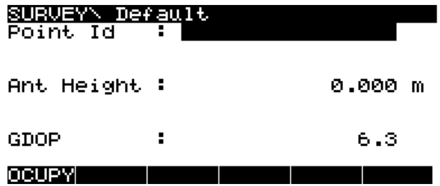
Then according to what has been set in the Occupation Settings, press **STOP** (**F1**) and **STORE** (**F1**).

When working with DGPS (code only) corrections, the accuracy will be around 0.5-5m. Ambiguity resolution will not be attempted. The Accuracy Status Icon will show between 0.5 and 5m

The Coordinate Quality (Quality) in the Main Survey screen should show between 0.5 and 5.0.

Raw GPS observation data may be logged during the Real-Time survey with no change to the procedure.

7.4.2 Adding the Point Id



The **Point Id** is an identifier for a particular point. It also collates all measurements made on that point and all other associated data such as codes, point annotations and meteorological data.

If a point Id template has been configured in the Configuration Set, a Point Id will be suggested. You can overwrite this with a different Id if required.

If no point Id is suggested then enter a point Id. By default if the point Id contains any numerical values, these will be incremented by 1.

To break the auto numbering press **Shift INDIV (F5)** and enter an individual Point Id. After this point has been stored it will return to the previously suggested Point Id.

If you define a Point Id Template in the Configuration Set you have even more flexibility to automatically define your Point Id's.

Further information about Point Id Templates and two working examples are given in Chapter 5.2.

```
SURVEY\ Default
Point Id     :          POINT 1

Ant Height   :            2.000 m

Quality      :             0.12 m

OCUPY                   ADD  INIT
```

Usually, in Real-Time Rover surveys the Antenna will be mounted on a pole and therefore will remain constant. When an AT501/502 Antenna is used together with a System 500 pole, the Antenna Height is 2.00m. This may have been specified as the default height in the Configuration Set.

Otherwise, measure the Antenna height and enter it.

The only time when the Antenna height will not remain constant is when a Static Initialization is carried out on a Tripod and the Antenna is then transferred onto a pole.

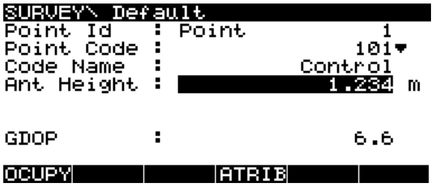
In this case, measure the Antenna height on the Tripod and enter it. Then, after pressing **STOP** (**F1**) to finish the initialization, the Moving Antenna height specified in the Configuration Set will be used for the moving part of the Real-Time Rover work.

It will be possible to add a code if a coding system has been defined in the Configuration Set.

It will be possible to add a code to a point if a coding system has been defined for use in the Configuration Set.

System 500 supports two coding methods; Thematical Coding and Free Coding. The principles of both methods of coding are explained in Chapter 8.

Thematical Coding



The fields **Point Code** and **Code Name** will be displayed as above. Highlight the **Point Code** and either:

1. Use the left or right cursor keys to cycle through the code list.
or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.

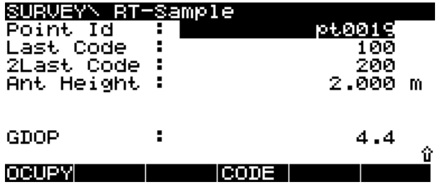
The **Code Name** will be displayed for the **Point Code** that you have chosen. Enter any attributes for the code using the **ATRIB** (**F4**) key.

The code is stored then along with the Point Id information.

Auto-logged points may also be coded if a coding system has been defined. The procedure will be the same as with Occupy Points described above.

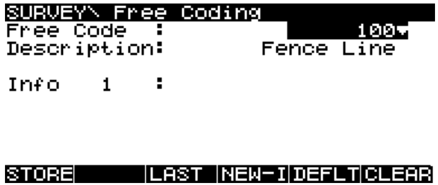
For further information on how to use codes with Auto-logged Points refer to chapter 7.4.7 Using the AUTO key.

Free Coding

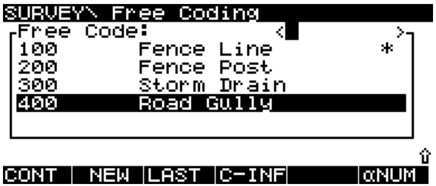


The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE** (**F4**) key will be available. Press this key to access the codelist.



To select the code:
1. Use the left or right cursor keys to cycle through the code list.
or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.



An asterisk next to a code indicates that it has attributes.

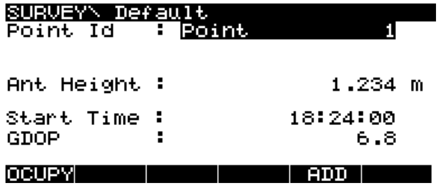
Press **CONT** (**F1**) to select the code.

Further information about Coding Systems is available in Section 8.

Auto-logged points may also be free-coded if a corresponding coding system has been defined. The procedure will be the same as with Occupy Points described above.

For further information on how to free-code Auto-logged points refer to chapter 7.4.7 Using the AUTO key.

It will be possible to add a starting time for a point occupation if auto occupy has been set to Timed in the Occupation Settings of the Configuration Set.



Initially, the time displayed in **Start Time** is the current time with the seconds rounded to zero.

Enter the time in **Start Time** in hours:minutes:seconds.

Measuring procedure without starting time

Switch on the instrument. Select Survey. Select a Real-Time Rover Configuration Set in which auto occupy has **not** been set to Timed in the Occupation Settings.

During this time, the unit should acquire satellites and should pick up the signal from the Reference.

When enough of the same satellites are tracked simultaneously at the Rover and Reference and the signal from the Reference is received, the Receiver will automatically start the ambiguity resolution process.

Note that if code only measurements are being used, the ambiguity resolution process is not required and therefore will not start.

The ambiguity resolution process will run. When the ambiguities are resolved, the baseline from the Reference to the Rover is calculated to between 1-5cm.

The Accuracy Status Icon will be displayed as follows:

Additionally, the Coordinate Quality should show between 0.01 and 0.05.

To record a point, place and level the pole. Input information such as Point Id and Code (if required). If working in Advanced mode, use the **ADD** (**F5**) key to add point annotations. Press the **OCUPY** (**F1**) key.

Then, according to what has been set in Occupation Settings, press **STOP** (**F1**) and **STORE** (**F1**).

Measuring procedure with starting time

Switch on the instrument. Select Survey. Select a Real-Time Rover Configuration Set in which auto occupy has been set to Timed in the Occupation Settings.

During this time, the unit should acquire satellites and should pick up the signal from the Reference.

When enough of the same satellites are tracked simultaneously at the Rover and Reference and the signal from the Reference is received, the Receiver will automatically start the ambiguity resolution process.

Note that if code only measurements are being used, the ambiguity resolution process is not required and therefore will not start.

The ambiguity resolution process will run. When the ambiguities are resolved, the baseline from the Reference to the Rover is calculated to between 1-5cm.

The Accuracy Status Icon will be displayed as follows:

Additionally, the Coordinate Quality should show between 0.01 and 0.05. To record a point, place and level the pole. Input information such as Point Id, Code (if required) and start time. If working in Advanced mode, use the **ADD** (**F5**) key to add point annotations. Press the **OCUPY** (**F1**) key.

```
SURVEY\ Default
Point Id    :          POINT 1

Ant Height  :          2.000 m

Start Time  :        16:58:00
3D Quality  :           0.04 m

OCUPY|    |    |    | ADD |INIT
```

The line **Start Time** changes to **Time to go**.

The time before the measurement starts automatically is displayed in hours:minutes:seconds and is counted down.

Once the entered start time is reached, the measurement beginns. The icon changes to a tripod, indicating that the Receiver should remain stationary.

```
SURVEY\ Default
Point Id    :          POINT 1

Ant Height  :          2.000 m

Positions   :              7
3D Quality  :           0.01 m

STOP |    |    |    | ADD |
```

The line **Time to go** changes to depending to the OCCUPY counter set Positions / Time at point.

Then, according to what has been set in Occupation Settings, press **STOP** (**F1**) and **STORE** (**F1**).

Once the point is stored, again the **OCUPY (F1)** key becomes available and the start time line is shown with the current time and the seconds rounded to zero. To start a new occupation enter the next start time. Then press **OCUPY (F1)**.

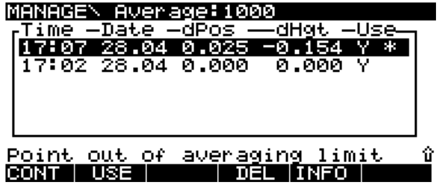
Averaging Procedure
Whenever more than one coordinate for the same point is recorded, the system does the following:

In any case, it carries out an averaging procedure.

Depending on the Threshhold Settings, either the difference between the average and the individual point coordinates or the absolute coordinate differences between two points in X, Y, Z and E, N, H (with local coordinate system) can be displayed. Limits for the averaging procedure as well as for the absolute coordinate differences are also set in Threshold Settings.

Should a point fall within these threshold settings and the system is set to the averaging functionality, you may press **AVRG (F2)** to display the differences between the average and the individual point coordinates.

The intervals are displayed with time when they were recorded, and the differences in position and height.

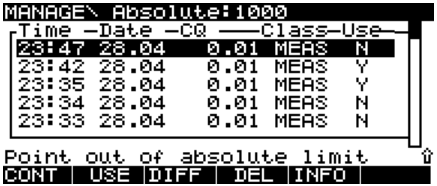


Should a point fall outside of these threshold settings, this panel will be accessed automatically. The asterisk marks the measurement exceeding the threshold settings. Common reasons for this happening are an incorrect antenna height or a wrong point Id.

You may either:
Press **ESC** to return to the survey screen, check and correct the antenna height or point Id, then rerecord the interval. Your previous, incorrect interval will be deleted.

or
Highlight the interval that is incorrect and press **USE** (**F2**) to deselect the interval. Then press **CONT (F1)** to return to the survey screen.
or
Highlight the interval that is incorrect and press **DEL** (**F4**) to delete the interval.Then press **CONT (F1)** to return to the survey screen.
or
With **INFO** (**F5**) toggle between different information for each interval.

Should a point fall within the threshold settings and the system is set to absolute coordinate differences, you may press **ABS (F2)**.



The intervals are displayed with time when they were recorded, and the coordinate quality and class.

Should a point fall outside of these threshold settings, this panel will be accessed automatically. Common reasons for this happening are an incorrect antenna height or a wrong point Id. The use flag for this point is then set to N for no.

You may either:
Press **ESC** to return to the survey screen, check and correct the antenna height or point Id, then rerecord the interval. Your previous, incorrect interval will be deleted.
or
Highlight an interval that is incorrect and press **DEL** (**F4**) to delete the interval. Then press **CONT (F1)** to return to the survey screen.
or
With **INFO** (**F5**) toggle between different information for each interval.
or
Highlight an interval and press **USE** (**F2**) to include or exclude a measurement from calculating the absolute coordinate difference. An absolute coordinate difference can only be calculated between two measurements. After having set the use flag for two measurements to Y, press **DIFF (F3)** to display the absolute coordinate differences.

```
MANAGE\ Abs Diffs:1000
Easting      :          0.001 m
Northing     :          0.000 m
Height       :          1.999 m*

Cartesian X :          1.334 m*
Cartesian Y :          0.225 m*
Cartesian Z :          1.472 m*

CONT
```

The absolute differences for Easting, Northing and Height can only be displayed if the survey is carried out in a local coordinate system.

An asterisk identifies those which exceed the threshold settings.

CONT (F1) returns you to the survey screen.

If **Log Auto Positions** is set to **YES** in the CONFIGURE\ Logging screen the **Auto** (**F3**) key is available in the main Survey screen.

```
SURVEY\ Default
Point Id    :             pt0017

Ant Height  :             2.000 m

3D Quality  :              0.01 m

OCUPY      AUTO       ADD  INIT
```

Auto (**F3**) can be used to switch to the mode for measuring Auto-Positions in the Auto-Pos panel.

```
AUTO-POS\ Default
Auto Pt Id  :     Time and Date

Mov Ant Hgt:             2.000 m

3D Quality  :              0.01 m

           SURV       POS START
```

AutoPt Id – If no **Auto Log Pos** Point Id template has been chosen the default template **Time and Date** will be used. Alternatively a Point Id template may be defined (see chapter 5.4. Configuring the Receiver for Real-Time Rover Operations).

Mov Ant Hgt – Sets the Antenna Height when the receiver is in moving mode. When a standard System 500 pole setup is used, the suggested default will be 2.00m.

Quality – Displays the quality of your current position.

If a coding system has been defined for use in the Configuration Set it will be possible to add a code to the auto-logged point. This may be either a **thematical** code or a **free** code.

Note that adding a code is only possible if **Store Pt DB** is set to **YES** in the CONFIGURE\ Position Logging screen (see chapter 5.4).
It is also only possible to change the code for auto-logged points when no auto-logged points are being measured.

Thematical Coding with auto-logged points

The procedure of thematically coding auto-logged points is very similar to the thematical coding of Occupy Points. For further information on coding Occupy Points see chapter 7.4.4 Adding a Code.

```
AUTO-POS\ Default
Auto Pt Id :     Time and Date
Auto Pt Cod:              CB▼
Code Name  : CENTRE-LINE BITU
Mov Ant Hgt:           2.000 m

3D Quality :            0.02 m
            SURV ATRIB POS START
```

The fields **AutoPt Code** and **Code Name** will be displayed as above.

Highlighting the **AutoPt Code** you may either select a code from the given codelist or enter a new code. The **Code Name** will be displayed for the **AutoPt Code** that you have chosen.Using the **ATRIB** (**F4**) key you may enter up to three attribute values for the code.

The code is stored then along with the **AutoPt Id** information.

Free Coding with auto-logged points

The procedure of free-coding auto-logged points is very similar to the free-coding of Occupy Points. For further information on coding Occupy Points see chapter 7.4.4 Adding a Code.

```
AUTO-POS\ Default
Auto Pt Id :     Time and Date
Last Code  :               200
2Last Code :               100
Mov Ant Hgt:           2.000 m

Positions  :                30
3D Quality :            0.02 m
            SURV CODE POS STOP
```

The **Last Code** and the second last code (**2Last Code**) that were used are shown.

To access the codelist and enter a different or new code press the **CODE** (**F4**) key.

```
SURVEY\ Free Coding
Free Code   :            POND▼
Description:      Edge of Water

1 Op code   :         27 <pre>▼
2 String    :       Lake Louise
Info     3  :             ------

STORE      LAST  NEW-I DEFLT CLEAR
```

The fields **Free Code** and **Description** will be displayed as above.

Highlighting the **Free Code** you may either select a code from the given codelist or enter a new code. The **Description** will be displayed for the selected **Free Code**. Using the **NEW-I** (**F4**) key you may enter up to 20 attributes (Infos) for the code.

Press **STORE** (**F1**) to record the code.

To start the logging of Auto-Points press the **Start** (**F6**) key.

```
AUTO-POS\ Default
Auto Pt Id :     Time and Date


Mov Ant Hgt:           2.000 m


3D Quality :            0.01 m
                               ⇧
            SURV       POS START
```

To view or change the configuration of the Auto-Position logging press the **POS** (**F5**) key, which accesses the CONFIGURE\ Position Logging panel. For further information on how to configure the logging of Auto-Positions see chapter 5.4 Cofiguring the Receiver for Real-Time Rover Operations.

If you also wish to measure “normal” Occupy Points whilst still recording auto-logged points press the **SURV** (**F3**) key to move back to the main Survey panel.

Note that the storing of Auto-Positions stops as soon as **OCUPY** (**F1**) is pressed. When **STOP** (**F1**) is pressed to stop the measurement on the Occupy Point the system will start again with storing Auto-Positions. As soon as **STORE** (**F1**) is pressed the **AUTO** (**F3**) key becomes visible again to enter the AUTO-POS panel.

While Auto-Positions are collected the number of **Positions** already measured will be displayed.

```
AUTO-POS\ Default
Auto Pt Id :     Time and Date


Mov Ant Hgt:           2.000 m

Positions  :              15
3D Quality :            0.02 m
                               ⇧
            SURV       POS STOP
```

Press **STOP** (**F6**) to terminate the logging of Auto-Points.

The **INIT** (**F6**) key shows in the main survey screen and is available in Advanced Mode.

```
SURVEY\ Default
Point Id     :          POINT 1

Ant Height   :          2.000 m

3D Quality   :           0.04 m
OCUPY                  ADD  INIT
```

When a Real-Time Rover Configuration Set is chosen, the Receiver will automatically start the initialization process as On-the-Fly as soon as the conditions are right.

INIT (**F6**) can be used to select the initialization method and also to force a new initialization. Ensure that the correct Antenna height has been entered before starting the initialization.

```
SURVEY\ Initialisation
1 Static
2 Known Point
3 On-The-Fly




CONT
```

Static - Initializes using Static. The Antenna should be mounted either on the pole with a quickstand or on a tripod. This method may be used if for some reason it is proving difficult to initialize on the fly and no known point is available.

Known Point - Initializes on a known point. If you have a point, the coordinates of which are already accurately known in position and height, you may use it to initialize. This method is used when it is proving difficult to initialize on the fly.

On-The-Fly - Initializes as you are moving with the Antenna. This is the most common and useful method and is used automatically by default. It may be used again here after a successful initialization on the fly as a quality check.

Select the method you wish to use and press **CONT** (**F1**).

When **Static** and **On-the-Fly** have been chosen, the initialization procedure will begin immediately.

When **Known Point** has been chosen you will be prompted to select the point you wish to use to initialize on. This point must be contained in the Job you are working in.

When the Advanced Mode is selected, the **ADD** (**F5**) key is available.

```
SURVEY\ Default
Point Id     : Point            1

Ant Height   :           1.234 m

GDOP         :             6.8
OCUPY                    ADD
```

This key can be used to add Point Annotations, Meteorological Data and Hidden Points.

Press **ADD** (**F5**)

```
SURVEY\ Add Menu
1 Point Annotations
2 Metereological Data
3 Hidden Point...



CONT
```

Adding Point Annotations

Point Annotations may be used as an electronic notepad where events, notes etc. may be written. They are then taken with the Point Id information into SKI Pro.

To add Point Annotations, select **Point Annotations** from the list and press **CONT** (**F1**).

```
SURVEY\ Point Annotations

#1 :               Chased by Dog
#2 :           Tree fell on head
#3 :         Couldn't find point
#4 :     Packed up and went home


CONT                         CLEAR
```

You may type in 4 notes with up to 26 characters in each note. Press **CONT** (**F1**) when you are finished.

Press **CLEAR (F6)** to delete the content of all fields.

Adding Meteorological Data

Meteorological data may be required when very precise work is being carried out or when very different weather conditions exist between the Rover and Reference. When carrying out Real-Time Rover work, it only makes sense to input meteorological data when recording data for post-processing as well as recording points in real-time. The meteorological data should be entered at distinct points, (not during the moving parts). This data will not be used by SKI-Pro but may be exported in RINEX format from SKI-Pro and used in a scientific processing software that accepts meteorological data for tropospheric modelling.

Select **Meteorological Data** from the list and press **CONT** (**F1**).

```
SURVEY\ Metereological Data

Temp Dry   :       20.00   °C
Temp Wet   :       20.00   °C

Atmos Pres :     1013.00 mbar
Rel Humid  :      100.00    %

STORE
```

Enter the data and press **STORE** (**F1**). The data will be stored with a time tag. During long observation periods you may need to store several sets of meteorological data as the weather changes.

Hidden Points

A hidden point is a point that cannot be measured by GPS. This is normally due to satellite shading caused by trees overhead, the close proximity of buildings etc. This feature is used by Real-Time Rovers only.

There are two possibilities for inputting hidden point data. You may attach a Hidden Point device such as Leica Disto memo, Disto pro, Disto™ pro⁴ or Disto™ pro⁴ a. Or you may measure to the hidden point using a tape.

When using a Hidden Point device, remember to set the correct Port parameters. For details refer to Appendix H.

Having selected Hidden Point from the **ADD** menu, you have 5 choices.

```
SURVEY\ Hidden Point
1 Bearing and Distance
2 Double Bearing
3 Double Distance
4 Chainage and Offset
5 Backward Bearing & Distance

CONT
```

Bearing and Distance, height excluded

```
SURVEY\ Hidden Pt Brg&Dist
Point A      :           A1▼
Bearing      :       0.0000 g
Distance     :        0.000 m




ABORT                NEWOC
```

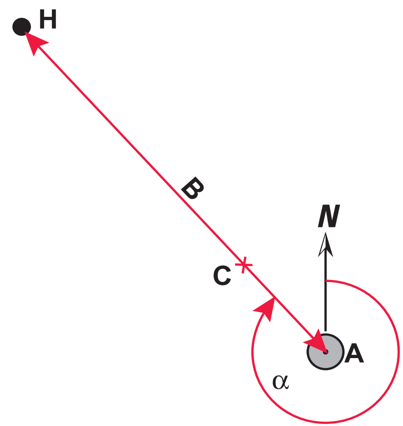
Point A - GPS point on which bearing α is measured.
Bearing - Bearing Angle to the Hidden Point in units configured.
Distance - Horizontal distance from **Point A** to the Hidden Point in units configured.

Use **ABORT** (**F1**) to abort the procedure. When **Point A** is highlighted, use **NEWOC** (**F5**) to occupy that point before you start measuring the hidden point.

When **Bearing** is highlighted, the **BRNG** (**F6**) key is available. This function may be used if you do not know or have no device for determining the bearing. Select a point that lies on the line AH (see diagram). Occupy the point and press **BRNG** (**F6**).

```
SURVEY\ Occupy Auxiliary Point
Point Id     :             Aux1
Direction    :          Toward▼

Ant Height   :          2.000 m

3D Quality   :           0.02 m
                                ⇧
OCUPY                  ADD  INIT
```

Input a **Point Id** and the **Direction** (**Toward** or **Away** from the hidden point). Then press **OCUPY** (**F1**) and **STOP** (**F1**), **STORE** (**F1**) according to the Occupation Settings. The **Bearing** towards point H will be calculated using the auxiliary point and Point A.



A - GPS point on which bearing α is measured
B - Measured **Distance** from A to H
C - Auxiliary Point (optional)
H - Hidden point
α - Measured **Bearing** from A to H

Bearing and Distance, height included

If the height computation for a hidden point has been enabled within the configuration, the following options apply in addition to those on the previous page.

```
SURVEY\ Hidden Pt Brg&Dist
Point A      :           A1▼
Bearing      :        0.0000 g
Distance     :         0.000 m
Delta Hgt    :        ------ m

ABORT|    |    |I/T H|SLOPE|
```

Delta Hgt - Height difference between the center of the external device and the aimed point. Devices with inclinometer like the Laser Locator will transfer the measured height difference automatically into this field as long as Include Hgt in the panel CONFIGURE\ Hidden Point is set to YES.

When working with devices without inclinometer the height difference can be estimated and typed in manuallly.

Use the **I/T H (F4)** key to check or enter the instrument height at the standpoint and target height.

```
SURVEY\ Hidden Pt Inst/Trgt Hgt
Inst Ht at Point A:    1.614 m
Trgt Height       :    1.237 m

CONT|    |    |    |DEFLT|
```

The default values as defined in the configuration are displayed but can be edited. Use the **DEFLT (F5)** key to reveal the default values again.

Trgt Height will only be available if the settings have been done accordingly in the configuration. Otherwise, only the instrument height will be taken into account.

CONT (F1) to return to the previous panel.

When **Distance** is highlighted, use **SLOPE (F5)** to enter a slope distance and either an elevation angle or a grade in %. External devices work here as well.

```
SURVEY\ Slope Dist

Slope Dist :          25.000 m
Elev Angle :         10.0000 g
Grade (%)  :            15.8 %

CONT|    |    |    |    |
```

CONT (F1) returns to the previous panel and displays the calculated horizontal distance and height difference.

For further information on the Hidden Point application and configuration refer to Appendix H as well as chapter 5.4.1.

Double Bearing, height excluded

```
SURVEY\ Hidden Pt Brg&Brg
Point A    :            A1▼
Bearing A  :       0.0000 g

Point B    :            B1▼
Bearing B  :       0.0000 g


ABORT                 NEWOC
```

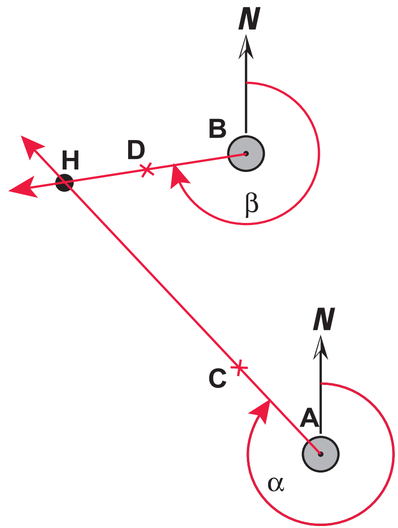
Point A - The point from which Bearing A is measured.
Bearing A - Bearing Angle α to Hidden Point in units configured.
Point B - The point from which Bearing B is measured
Bearing B - Bearing Angle β to Hidden Point in units configured.

Use **ABORT** (**F1**) to abort the procedure. When **Pt from** is highlighted, use **NEWOC** (**F5**) to occupy the point you are currently at before the hidden point is measured.

When **Bearing** is highlighted, the **BRNG** (**F6**) key is available. This function may be used if you do not know or have no means of calculating the bearing. Select a point that lies on the line AH (see diagram). Occupy the point and press **BRNG** (**F6**).

```
SURVEY\ Occupy Auxiliary Point
Point Id   :            Aux1
Direction  :          Toward▼

Ant Height :         2.000 m

3D Quality :          0.02 m
                              ⇧
OCUPY                ADD  INIT
```

Input a **Point Id** and the **Direction** (**Toward** or **Away** from the hidden point). Then press **OCUPY** (**F1**) and **STOP** (**F1**), **STORE** (**F1**) according to the Occupation Settings. The **Bearing** will be calculated using this point and the point you are measuring from.



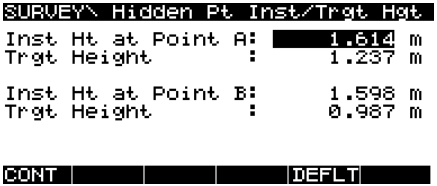
A - Point from which Bearing A is measured
B - Point from which Bearing B is measured
C - Auxiliary Point (optional)
D - Auxiliary Point (optional)
H - Hidden Point
α - Measured **Bearing** from A
β - Measured **Bearing** from B

Double Bearing, height included

If the height computation for a hidden point has been enabled within the configuration, the following options apply in addition to those on the previous page.

Delta Hgt - Height difference between the center of the external device and the aimed point. Devices with inclinometer like the Laser Locator will transfer the measured height difference automatically into this field as long as Include Hgt in the panel CONFIGURE\ Hidden Point is set to YES. When working with devices without inclinometer the height difference can be estimated and typed in manuallly.

Use the **I/T H (F4)** key to check or enter the instrument height at the standpoints A and B and target heights.



The default values as defined in the configuration are displayed but can be edited. Use the **DEFLT (F5)** key to reveal the default values again.

Trgt Height will only be available if the settings have been done accordingly in the configuration. Otherwise, only the instrument height will be taken into account.

CONT (F1) to return to the previous panel and continue with the calculation of the hidden point.

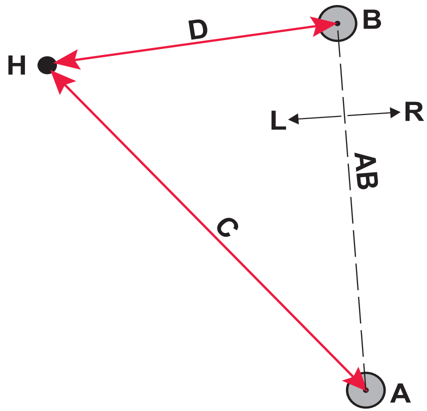
For further information on the Hidden Point application and configuration refer to Appendix H as well as chapter 5.4.1.

Double Distance, height excluded

```
SURVEY\ Hidden Pt Dist&Dist
Point A     :              A1▼
Distance A  :           0.000 m

Point B     :              B1▼
Distance B  :           0.000 m

Location    :  Left of Line AB▼

ABORT                   NEWOC
```

Use **ABORT** (**F1**) to abort the procedure. Use **NEWOC** (**F5**) to occupy the point you are currently at before the hidden point is measured.

Point A - Point from which **Distance A** is measured.
Distance A - Horizontal distance from Point A to the hidden point in units configured.
Point B - Point from which **Distance B** is measured.
Distance B - Horizontal distance from Point B to the hidden point in units configured.
Location - Locates hidden point to left or right of Line AB.



A - Point from which **Distance A** is measured.
B - Point from which **Distance B** is measured.
C - **Distance A**
D - **Distance B**
AB - Line AB
L - Left of Line AB
R - Right of Line AB

Double Distance, height included

If the height computation for a hidden point has been enabled within the configuration, the following options apply in addition to those on the previous page.

```
SURVEY\ Hidden Pt Dist&Dist
Point A      :             A1▾
Distance A   :          0.000 m
Delta Hgt    :          ----- m
Point B      :             B1▾
Distance B   :          0.000 m
Delta Hgt    :          ----- m
Location     : Right of Line AB▾

ABORT|    |    |I/T H|SLOPE|
```

Delta Hgt - Height difference between the center of the external device and the aimed point. Devices with inclinometer like the Laser Locator will transfer the measured height difference automatically into this field as long as Include Hgt in the panel CONFIGURE\ Hidden Point is set to YES.

When working with devices without inclinometer the height difference can be estimated and typed in manuallly.

Use the **I/T H (F4)** key to check or enter the instrument height at the standpoints A and B and target heights.

```
SURVEY\ Hidden Pt Inst/Trgt Hgt
Inst Ht at Point A:     1.614 m
Trgt Height       :     1.237 m

Inst Ht at Point B:     1.598 m
Trgt Height       :     0.987 m


CONT|    |    |    |DEFLT|
```

The default values as defined in the configuration are displayed but can be edited. Use the **DEFLT (F5)** key to reveal the default values again.

Trgt Height will only be available if the settings have been done accordingly in the configuration. Otherwise, only the instrument height will be taken into account.

CONT (F1) to return to the previous panel.

When **Distance A** or **Distance B** is highlighted**,** use **SLOPE (F5)** to enter a slope distance and either an elevation angle or a grade in %.

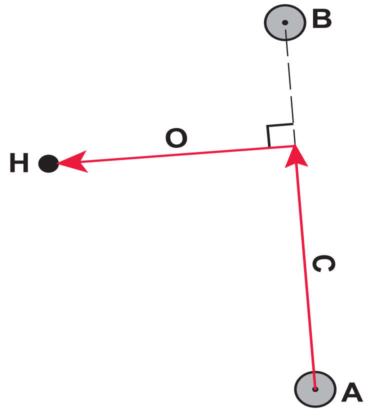
```
SURVEY\ Slope Dist

Slope Dist  :        25.000 m
Elev Angle  :       10.0000 g
Grade (%)   :          15.8 %



CONT|    |    |    |    |
```

External devices work here as well. **CONT (F1)** returns to the previous panel and displays the calculated horizontal distances and height differences.

For further information on the Hidden Point application and configuration refer to Appendix H as well as chapter 5.4.1.

Chainage and Offset, height excluded

```
SURVEY\ Hidden Pt Chng&Off
Point A      :              A1▼

Point B      :              A1▼

Chnge from   :         Point A▼
Chainage     :          0.000 m
Offset       :          0.000 m

ABORT                NEWOC
```



Point A - Point A on line.
Point B - Point B on line.
Chnge from - Point from which chainage starts.
Chainage - Distance along line
Offset - Offset from line to hidden point. Negative value = left of line, Positive value = right of line.

Use **ABORT** (**F1**) to abort the procedure. Use **NEWOC** (**F5**) to occupy the point you are currently at before the hidden point is measured.

A - GPS **Point A**
B - GPS **Point B**
C - **Chainage**
O - **Offset**
H - Hidden point

Chainage and Offset, height excluded

If the height computation for a hidden point has been enabled within the configuration, the following options apply in addition to those on the previous page.

```
SURVEY\ Hidden Pt Chng&Off
Point A     :            A1▼
Delta Hgt   :         ------ m
Point B     :            B1▼
Delta Hgt   :         ------ m
Chnge from  :       Point A▼
Chainage    :          0.000 m
Offset      :          0.000 m

CALC |    |    |I/T H|NEWOC|
```

Delta Hgt - Height difference between the center of the external device and the aimed point. Devices with inclinometer like the Laser Locator will transfer the measured height difference automatically into this field as long as Include Hgt in the panel CONFIGURE\ Hidden Point is set to YES.

When working with devices without inclinometer the height difference can be estimated and typed in manuallly.

Use the **I/T H (F4)** key to check or enter the instrument height at the standpoints A and B and target heights.

```
SURVEY\ Hidden Pt Inst/Trgt Hgt
Inst Ht at Point A:   1.614 m
Trgt Height       :   1.237 m

Inst Ht at Point B:   1.598 m
Trgt Height       :   0.987 m

CONT |    |    |    |DEFLT|
```

The default values as defined in the configuration are displayed but can be edited. Use the **DEFLT (F5)** key to reveal the default values again.

Trgt Height will only be available if the settings have been done accordingly in the configuration. Otherwise, only the instrument height will be taken into account.

CONT (F1) to return to the previous panel and continue with the calculation of the hidden point.

For further information on the Hidden Point application and configuration refer to Appendix H as well as chapter 5.4.1.

Backward Bearing & Distance, height excluded

```
SURVEY\ Hidden Pt Brg&Dist
Point A    :             A1▾
Bearing    :          0.0000 g
Distance   :           0.000 m



ABORT                NEWOC
```

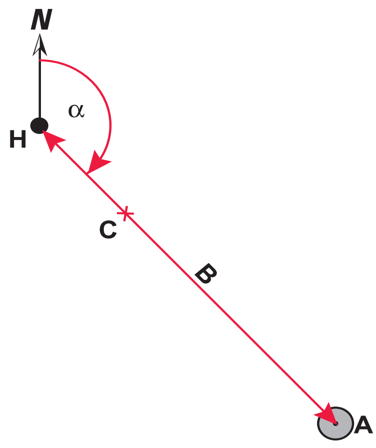
Point A - GPS point towards which bearing α is measured.
Bearing - Bearing Angle to **Point A** in units configured.
Distance - Horizontal distance from the Hidden Point to **Point A** in units configured.

Use **ABORT** (**F1**) to abort the procedure. When **Point A** is highlighted, use **NEWOC** (**F5**) to occupy that point.

Go to the Hidden Point. When **Bearing** is highlighted, the **BRNG** (**F6**) key is available. This function may be used if you do not know or have no device for determining the bearing. Select a point that lies on the line HA (see diagram). Occupy the point and press **BRNG** (**F6**).

```
SURVEY\ Occupy Auxiliary Point
Point Id   :              Aux1
Direction  :           Toward▾

Ant Height :           2.000 m

3D Quality :            0.02 m
OCUPY                ADD  INIT
```

Input a **Point Id** and the **Direction** (**Toward** or **Away** from Point A). Then press **OCUPY** (**F1**) and **STOP** (**F1**), **STORE** (**F1**) according to the Occupation Settings. The **Bearing** towards Point A will be calculated using the auxiliary point and Point A.



A - GPS point towards which bearing α is measured
B - Measured **Distance** from H to A
C - Auxiliary Point (optional)
H - Hidden point
α - Measured **Bearing** from H to A

Backward Bearing & Distance, height included

If the height computation for a hidden point has been enabled within the configuration, the following options apply in addition to those on the previous page.

```
SURVEY\ Hidden Pt Brg&Dist
Point A      :              A1▼
Bearing      :           0.0000 g
Distance     :            0.000 m
Delta Hgt    :           ------ m

ABORT |      |      | I/T H | SLOPE |
```

Delta Hgt - Height difference between the center of the external device and the aimed point. Devices with inclinometer like the Laser Locator will transfer the measured height difference automatically into this field as long as Include Hgt in the panel CONFIGURE\ Hidden Point is set to YES.

When working with devices without inclinometer the height difference can be estimated and typed in manuallly.

Use the **I/T H (F4)** key to check or enter the instrument height at the standpoint and target height.

```
SURVEY\ Hidden Pt Inst/Trgt Hgt
Inst Ht at Point A:      1.614 m
Trgt Height       :      1.237 m

CONT |      |      |      | DEFLT |
```

The default values as defined in the configuration are displayed but can be edited. Use the **DEFLT (F5)** key to reveal the default values again.

Trgt Height will only be available if the settings have been done accordingly in the configuration. Otherwise, only the instrument height will be taken into account.

CONT (F1) to return to the previous panel.

When **Distance** is highlighted**,** use **SLOPE (F5)** to enter a slope distance and either an elevation angle or a grade in %. External devices work here as well.

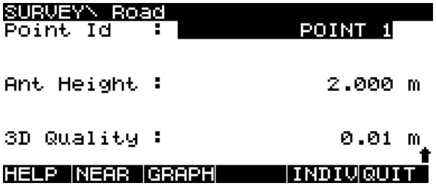
```
SURVEY\ Slope Dist

Slope Dist :            25.000 m
Elev Angle :           10.0000 g
Grade (%)  :              15.8 %

CONT |      |      |      |      |
```

CONT (F1) returns to the previous panel and displays the calculated horizontal distance and height difference.

For further information on the Hidden Point application and configuration refer to Appendix H as well as chapter 5.4.1.

7.4.10 Using the NEAR key

Search for the nearest point to the current sensor position by pressing **SHIFT** and then **NEAR** (**F2**). The current sensor position is the position at the time when the NEAR key is pressed.



Stop the search with **ABORT (F1)**.

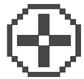
Once the nearest point has been found, its point ID is automatically copied into the Point ID field. This can be helpful when it is necessary to make a second measurement of a previously measured point. It saves having to remember and then type in the point ID.

Survey the point as usual.

7.4.11 Radio Down Infill

Radio Down Infill is used when contact between the Reference and Rover is lost and a Real-Time position cannot be calculated. This option is set in the Configuration Set.

When contact is lost, the ambiguities will also be lost after a few seconds. The Accuracy Status Icon will display a navigated position (<100m).



The Quality will be low, (a large number).

Raw GPS data logging will automatically commence at a rate of 1 second after the length of time specified in the Configuration Set.

Then one of three scenarios can ensue:

1. Contact with the Reference is reestablished within the minimum logging time specified in the Configuration Set. Logging will carry on for this minimum time and then stop.

2. Contact with the Reference is reestablished after the minimum logging time specified in the Configuration Set. Logging will stop.

3. Contact with the Reference is not reestablished. Logging will continue until the survey is ended or contact with the Reference Station is reestablished.

When using Post-Processing Infill it is useful to note the following points:

1. The Reference Station must also be logging data at the same rate or higher than the Rover.

2. The data is logged as a kinematic chain. Distinct points within the chain may be logged as in a post-processed kinematic survey.

3. The data has to be downloaded and processed using SKI-Pro. All of the data (Real-Time points and raw data), will be imported into the same SKI-Pro Project.

Stake-Out is the staking out of predetermined points. These points may have been surveyed earlier and uploaded through SKI Pro, may already exist in a Job on the Receiver or may have been uploaded in an ASCII file.

System 500 offers the possibility to stake out points, slopes and grids.

Stakeout must always be performed in Real-Time, normally using a SR530 in order that centimeter level accuracies can be achieved. Therefore, a Real-Time Rover type Configuration Set should always be used.

Set up the equipment as described in Chapter 2. Attach the Terminal.

Switch on. The Main Menu will be displayed. The system will automatically start searching for satellites. If the Receiver is already configured as a Real-Time Rover and a signal is available from a reference station, the Receiver will also automatically start the ambiguity resolution process.

From the Main Menu, select **Stake-Out**.

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

CONT |    |    |HIDE|    |
```

The following screen will then appear:

```
STAKE-OUT\ Begin
Config Set:                RT_ROV▾
Stake Pts :               Default▾
Store Pts :               Default▾
Stake Type:                 Point▾

Antenna   :            AT502 Pole▾
Ant Height:               2.000 m

CONT |    | LOG|ASCII|    |CSYS
```

Config Set - The Configuration Set used for the stakeout.
Stake Pts - The Job or ASCII file used as the source for the points to be staked. The source type can be configured in CONFIG\Survey\Stakeout.

Store Pts - The Job where the staked points are stored.
Stake Type - The type of Stake-Out operation to be performed.
Antenna - The Antenna setup used, defined in the Configuration Set. You may select a different one if required.
Ant Height - The default Antenna Height defined in the Configuration Set. You may enter a different height if required.

Use **LOG (F3)** if you want to generate a report file of the staked out points. Select between **Short**, **Long** or **None**. A report log-file will be stored on the PC Card or Internal memory in the ‘Log’ sub-directory.
A **Long** log file will contain the design and “as staked” co-ordinates, the differences in easting, northing and height between the design and staked points and the antenna height.

A **Short** log file will contain the design co-ordinates, the “as staked” height coordinate and the differences in height between the design and staked points.

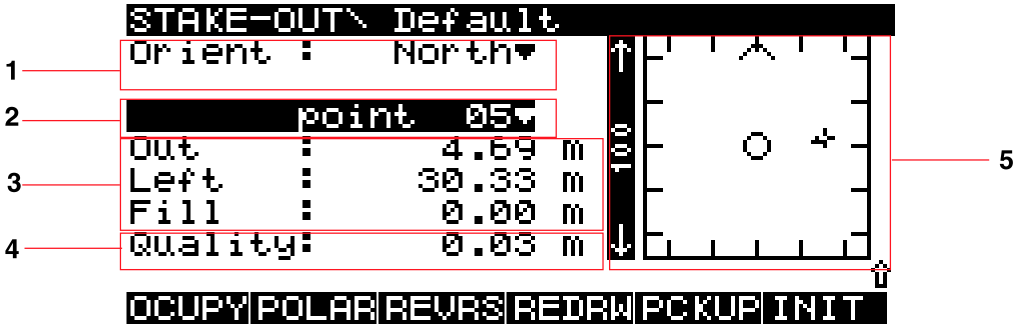
Use **ASCII (F4)** - to select whether you want to stakeout from an ASCII file or from a Job.
For more information on staking out from an ASCII file see section 5.4.

1. Point
Simple point stakeout. Points are defined as targets and staked from a predefined list. The distance in/out and left/right or distance and bearing are given to the target, together with the cut/fill. Orientation can be made in a variety of ways including orientation parallel to a line.

2. Slope
Stake points along a slope. Line is selected as orientation (no points are available as orientation). The cut and fill are relative to the slope of the line.

3. Grid
Stake points in the form of a grid based on lines. A reference line is defined and the grid built up using increments along the line and offsets.

When Stake-Out has been started, the following screen appears:



1. Orientation - Defines the direction on which the Range Information (3) is based.

2. Target Point - The current point for which the Range Information (3) is shown.

3. Range Information - The range to the currently selected point. May be one of two formats:

Orthogonal - Range In/Out and Offset Left/Right plus Cut/Fill.
Polar - Range In/Out and Bearing plus Cut/Fill.

4. Quality - The quality of your current position.

5. Graphics panel - Shows your current position (a cross) relative to the Target Point (central circle). The scale changes depending on your proximity to the target.

The Orientation defines a reference direction from which all measurements to target points are made.

The orientation is defined by a point or a line.

To select a method of Orientation, highlight the Orient field and use the left or right cursor keys to cycle through the options or press Enter to open a window containing all the options.

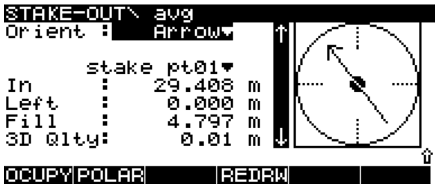
North - The reference direction from which all measurements are displayed to Target points is north in the active coordinate system.

Sun - The reference direction from which all measurements are displayed to Target points is the sun. The Receiver contains an almanac and can calculate the position of the sun irrespective of local time or position.

Last Pt - The reference direction from which all measurements are displayed to Target points is the Last Point that was recorded.

Known Pt - The reference direction from which all measurements are displayed to Target points is a point contained within the current “Stake from” Job. Select the point from the list that is presented when this option is chosen.

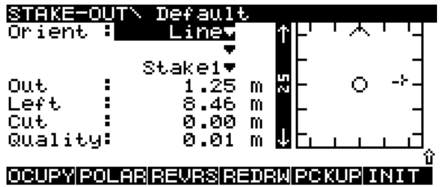
Arrow - If Arrow has been selected the graphical display will show a moving arrow pointing in the direction of the point to be staked.



Line - The reference direction is parallel to the selected line. Lines may be defined based on points in the Job.

Defining a new Line for Orientation
A new line for orientation may be defined between any two points that exist in the current Job used.

In the **Orient** field selected **Line**.



A new entry field will appear below **Orient**. This field will be empty if no lines are defined. Move to this field and press **ENTER** to access the line list box.

```
STAKE-OUT\ Default
Line: STK_Line.TXT <          >

CONT | NEW |EDIT |DEL-A|     |αNUM
```

The list of lines is displayed. If the list is empty then there are no lines defined! Use **CONT** (**F1**) to select the highlighted line, **New** (**F2**) to define a new line, **EDIT** (**F3**) to edit an existing line and **DEL-A** (**F4**) to delete all the lines in the list.

Lines are always stored in an ASCII file, it is not possible to store lines in a Job.

Lines are stored in local grid format. It is however still possible to define a line with WGS84 Geodetic or Cartesian coordinates even when only the WGS84 coordinate system is being used. The sensor will automatically use a standard UTM projection to compute the necessary grid coordinates.

The ASCII file is always defined as STK_Line.txt and is stored on the PC Card or Internal memory in the Data sub-directory. You may write your own line file on the PC and then transfer it to the PC Card or internal memory. The file format is given in Appendix D.

To define a new line, press **NEW** (F2).

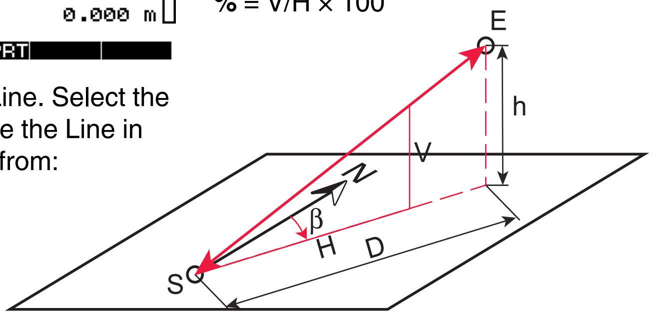
```
STAKE-OUT\ Line Definition
Name       :          Line 1
Type       :    Start+Endpoint▾

Local E    :          0.000 m
Local N    :          0.000 m
Ortho Hgt  :          0.000 m

Local E    :          0.000 m

CONT |     |     |IMPRT|     |
```

Input a **Name** for the Line. Select the method to use to define the Line in **Type**. You may select from:

Start+Endpoint
Start+Dst+Bg+%
Start+Dst+Bg+H/V
Start+Dst+Bg+V/H
Start+Dst+Bg+Hgt

S - **Start** - Start point
E - **Endpoint** - End point
D - **Dst** - Horizontal Distance
β - **Brg** - Bearing
H - **H** - Horizontal component
V - **V** - Vertical component
h - **Hgt** - Height difference

% = V/H × 100



Start+Endpoint
The Line is defined between two points.

Either:

1. Enter the coordinates and height of each point.

or

2. Use the **IMPRT** (**F3**) key to import any point contained in the Job you are using. Make sure that one of the entry fields for the point (start or end point) you wish to define is highlighted, press **IMPRT** (**F3**), select the point from the list and press **CONT** (**F1**).

Start+Dst+Bg+%
The line is defined by a start point, a horizontal distance and bearing from the start point and a percentage slope value.

Enter/Select **LocalE**, **Local N** and **Ortho Hgt** for the start point as described in **Start+Endpoint**.

Enter the horizontal **Distance** to the end point. This end point will be an artificial point. If no value other than zero is given, a default of 100m will be taken.

Enter the horizontal **Bearing** to the end point, through which the line passes.

Enter the **Slope** percentage value. This is defined as described in the diagram.

Start+Dst+Bg+H/V
The line is defined by a start point, a horizontal distance and bearing from the start point and the ratio of horizontal increment over vertical increment.

Enter/Select **LocalE**, **Local N** and **Ortho Hgt** for the start point as described in **Start+Endpoint**.

Enter the horizontal **Distance** to the end point. This end point will be an artificial point. If no value other than zero is given, a default of 100m will be taken.

Enter the horizontal **Bearing** to the end point, through which the line passes.

Enter the **Slope H/V** values. These are defined as described in the diagram.

Start+Dst+Bg+V/H
The line is defined by a start point, a horizontal distance and bearing from the start point and the ratio of vertical increment over horizontal increment.

Enter/Select **LocalE**, **Local N** and **Ortho Hgt** for the start point as described in **Start+Endpoint**.

Enter the horizontal **Distance** to the end point. This end point will be an artificial point. If no value other than zero is given, a default of 100m will be taken.

Enter the horizontal **Bearing** to the end point, through which the line passes.

Enter the **Slope V/H** values. These are defined as described in the diagram.

Start+Dist+Bg+Hgt
The line is defined by a start point, a horizontal distance and bearing from the start point and the height difference between the start point and artificial end point.

Enter/Select **LocalE**, **Local N** and **Ortho Hgt** for the start point as described in **Start+Endpoint**.

Enter the horizontal **Distance** to the end point. This end point will be an artificial point. If no value other than zero is given, a default of 100m will be taken.

Enter the horizontal **Bearing** to the end point, through which the line passes.

Enter the Height Difference (**Hgt Diff**) between the start point and the artificial end point.

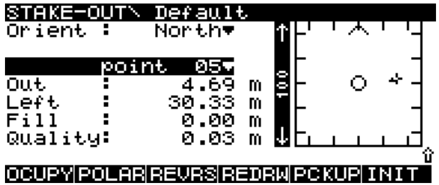
When you have entered the method by which you wish to define the line and the necessary parameters, press **CONT** (**F1**) to continue.

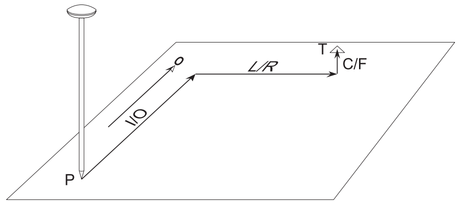
The new line is displayed. Press **CONT** (**F1**) to select the line for orientation.

There are two methods which you can use to find your way to a point. These are Polar and Orthogonal. Use the F2 key to switch between the two methods.

Orthogonal

The Orthogonal method gives you a distance In/Out to the point, a distance left/right to the point and a cut/fill.

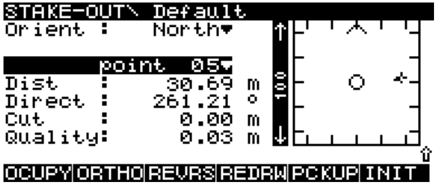


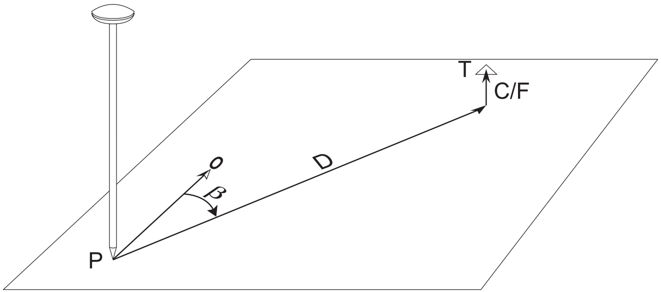


O - Orientation direction (**Orient**)
P - Current Position
I/O - Horizontal Distance (**In**/**Out**)
L/R - Horizontal Distance (**Left**/**Right**)
C/F - Vertical Distance (**Cut**/**Fill**)
T - Target Point

Note: In - from current position to target along the orientation direction.
Out - from current position to target 180° from orientation direction
Left/right - looking along orientation direction, distance left/right to target point.

Polar
The Polar Method gives you a Bearing from the orientation reference, a horizontal distance and a cut/fill to the point.





O - Orientation Direction (**Orient**)
P - Current Position
D - Horizontal Distance (**Dist**) to Target

β - Bearing (**Direct**) to Target
C/F - Vertical Distance (**Cut**/**Fill**)
T - Target Point

The reverse function is available in Advanced mode and switches the orientation by 180°. It is used when the Target lies behind you and you would effectively have to walk backwards to reach it.

Press **REVRS** (**F3**). The orientation is turned through 180°. You can also now turn through 180° yourself so that you are facing the direction in which you need to walk.

7.5.7 Using the Redraw function

The redraw function is used when Show Path has been chosen in the configuration and the path that you have followed is shown on the graphical area of the display.

When moving around in the same area, this graphical area may not refresh. The path may build up obscuring the display.

Press **REDRW** (**F4**) to refresh the display and erase the displayed path.

7.5.8 Picking up a new point

This function is available in Advanced mode. If you are staking out and need to measure new points, you may do so by pressing the **PCKUP** (**F5**) key. This brings you into survey mode.

```
STAKE-OUT\ Occupy Point
Point Id    :             A1

Ant Height  :        2.000 m

3D Quality  :         0.01 m
OCUPY                ADD  INIT
```

Measure the points and/or hidden points as described in sections 7.4.6 and 7.4.9.

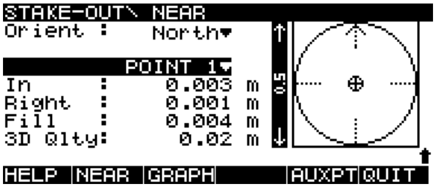
Press **SHIFT** and then **STAKE (F2)** to return to Stake-Out. Returning to Stake-Out is possible before a point occupation or after storing the point.

7.5.9 Using the INIT key

The **INIT** (**F6**) key is available in Advanced mode and is used to select and force a new initialization.

In Stake-Out, the initialization will always be on-the-fly. More details about using the INIT key and initialization on the fly can be found in section 7.4.8.

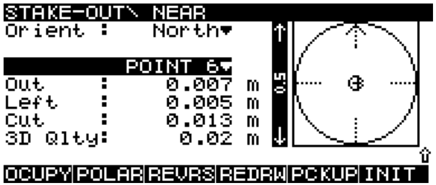
The nearest point to the current sensor position for staking out can be found by pressing **SHIFT** and then **NEAR** (**F2**). The current sensor position is the position at the time when the NEAR key is pressed.



It may also help when using this key to set the stake out filter to Points to Stake. See chapter 11.3 for more information about the filter.

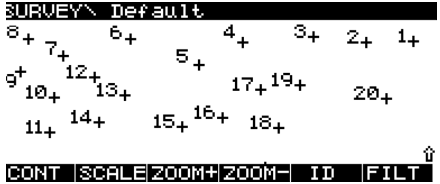
Stop the search with **ABORT (F1)**.

Once the nearest point has been found, its point ID is automatically copied into the field of the Target Point.



Stake out the point as usual.

A map of the 30 last measured points can be displayed by pressing **SHIFT** and then **GRAPH** (**F3**). Each point is given a temporary ID between 1 and 30.



SCALE (**F2**) displays a linear scale consistent with the current zoom level.

The map is displayed. Use **ZOOM+** (**F3**) and **ZOOM-** (**F4**) to zoom in and out.

ID (**F5**) reveals a list with the temporary point IDs and the “real” point IDs.

FILT (F6) allows to change the filter settings for the currently selected Job. More information about filter settings can be found in section 11.3.

Press **SHIFT** to reveal **REDRW** (**F4**). This redraws the map to the original scale.

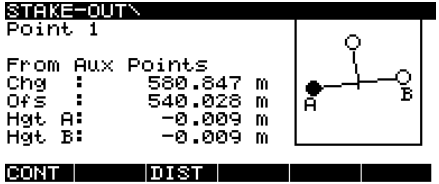
You may also scroll the map left/right, up/down by using the cursor keys.

Auxiliary points are used as aids when trying to find a stake out point. Two auxiliary points are recorded to form start and end points of a line. The chainage and offset or distance from each auxiliary point to the target point is then displayed together with a sketch.

The auxiliary points can have codes assigned to them and can also be downloaded into SKI Pro.

To start the auxiliary point routine, press **SHIFT** and then **AUXPT** (**F5**).

Enter a point Id for Point A and record the auxiliary point in exactly the same way that you would record any other point in real-time. Then carry out the same operation for point B. After pressing **STORE** (**F1**) the following screen will appear.



The line AB is displayed together with the location of the target point.

Chg - The chainage along the line AB to the target point.
Ofs - The Offset from line AB to the target point. Negative value = left, positive value = right.
Hgt A/Hgt B - Height difference between auxiliary point A/B and the target point.

Press **DIST** (**F3**) to display the distance from each auxiliary point to the target point instead of the chainage and offset.

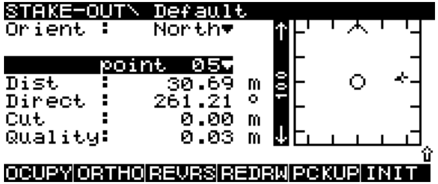
Press **CONT** (**F1**) to return to the stake out screen.

Point is selected as the **Stake Type** when entering Stake-Out.

The list of Target points are those contained in the Job or ASCII File.

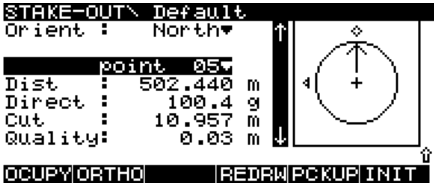
The “as staked” points will always be stored in the Job. You may also choose to store the Target points defined in the ASCII File in the Job. In this way you have the Target points and the “as staked” points in one Job.

To stake out a point, select it from the Target Point List. Press **Enter** to expose a list of all points in the Job. See section 11.3 for a description of the useful filters and sorting methods which may be helpful when staking a lot of points. A particularly useful filter maybe to filter by **Points to Stake.**



The measurement to the point will be displayed as Orthogonal or Polar. Use the **F2** key to switch between the methods.

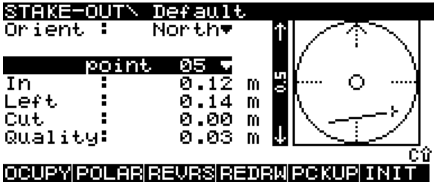
If you are a 500 meter (or feet) away from the target point, the graphical display will look as follows:



The cross and arrow indicate your current position and direction of moving. The rectangle points to the target point and the triangle to the orientation point. The display is only updated if you are moving faster than 50cm/sec. If the rectangle is in one line with the arrow you are heading towards the target point.

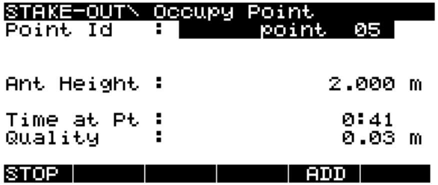
If you are closer than 500 m to the target point your position with respect to the Target point is shown in another graphical display. The scale shown on the left side of the display will change as you get closer to the point. The stages are 500m, 100m, 25m, 5m, 1m and 0.5m. Note that the orientation direction is denoted by the arrow at the top center. When the Reverse function is activated, this arrow will appear bottom center of the graphical display.

The graphical display is a square until the 0.5m level is reached. At this stage it will turn into a circle.



When you are at the point to be staked, the measurements to the point must be at or nearly zero. Make sure that the pole is level and press **OCUPY** (**F1**). If you had to level the pole, ensure that the measurements to the point are still good before pressing OCUPY.

Depending upon what has been set in the configuration, the following screen may appear.



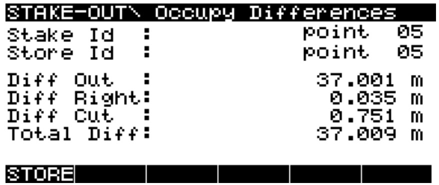
The Point Id of the Target Point will be taken by default. If you wish to enter a new point Id you may, but remember that this will then be considered a separate point. If you simply wish to add aditional text to the suggested point Id, press **Enter.** The point Id in the display remains and the cursor will be in the position defined in the current Point Id template.

If required, you may also add a code (if a coding system has been configured). Details on adding codes are given in section 7.4.4.

When you are satisfied with the input, press **STOP** (**F1**).

The **DIFF** (**F2**) key is available.

Pressing this key gives the differences between the design coordinates and staked coordinates of the point.



If **Diff Check** has been set to either **Position** only, **Height** only or **Pos + Hgt** in the CONFIGURE\ Stake-Out screen then the STAKE-OUT\ Occupy Differences panel will be displayed automatically if the differences exceed the defined **Limit**.

Diff In/Out - Horizontal distance In/ Out to the Target Point.
Diff Left/Right - Horizontal distance Left/Right to the Target Point.
Diff Cut/Fill - Vertical distance to the Target Point.
Total Diff - Length of vector from Target Point to measured point.

If you have chosen to record a **LONG** log file these values will also be stored in the log file.

Press **STORE** (**F1**)

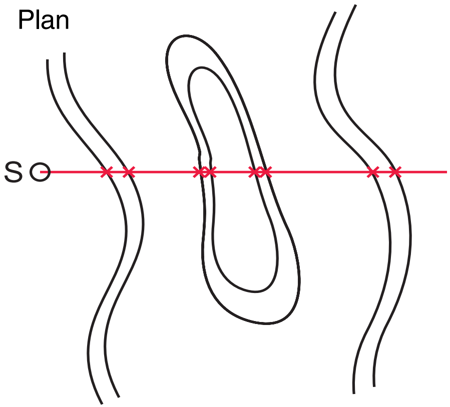
A check will be performed according to the Required Coordinate Quality set in the Configuration. If the point is within the Required CQ, it will be stored and no special messages will appear.

If however the point is outside the Required CQ, it may warrant further investigation.

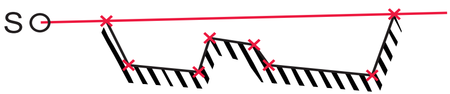
Slope Stake-Out has two main applications.

1. Measurement/Stakeout of transition points of slopes for cross-sections.

Plan



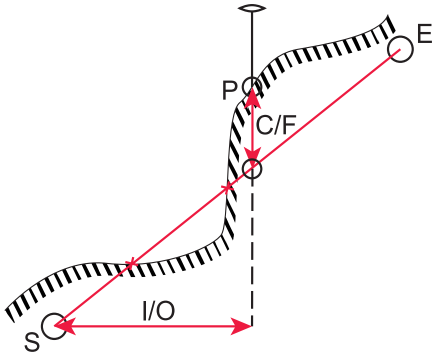
Section



S - Startpoint of slope
× - Transition point to be measured/ staked

The Line is defined as the section line through the terrain. You ensure that you follow this line by observing the Left/Right value and keeping it at or near zero. When you arrive at a point where the level of the terrain begins to change, record the point. You can also stake this point for future reference.

2. Staking out of slope intercepts. (points where design slopes and terrain intersect).



S - Startpoint of Slope Line
E - Endpoint of Slope Line
P - Current Position
I/O - Horizontal Distance In/Out to Start Point
C/F - Vertical Distance Cut/Fill to Slope Line
+ - Slope Intercept

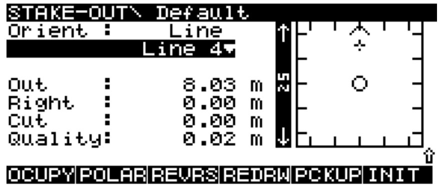
The Slope Line is defined and selected. Proceed along the line. You can ensure that you keep on the line by observing the Left/Right value and keeping it at or near zero. Observe the Cut/Fill value. At the intercept(s) it will be zero. When you arrive at such a point, stake it and record it.

Procedure

Slope is selected as the **Stake Type** when entering Stake-Out.

The “as staked” points will always be stored in the **Store Pts** Job. If staking from an ASCII file, you may also choose to store the Target points defined there in the Job. In this way you have the Target points and the “as staked” points in one Job.

To start Slope Stake-Out, press **CONT** (**F1**).

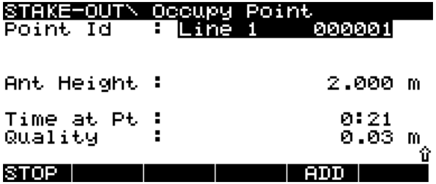


Stake-Out starts. **Orient** is along the Slope Line only . Details about using Lines as orientation are given in section 7.5.4.

The measurements **In**/**Out**, **Right**/ **Left** and **Cut**/**Fill** are given with respect to the start point of the line.

When you reach the required point place the stake.

To record the point, press **OCUPY** (**F1**).



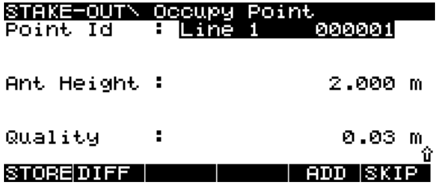
A default **Point Id** is suggested. This comprises of the Line Id followed by any incrementing numbers that you have defined in the Occupy template.

Alternatively, you may press **SHIFT** and then **PT ID (F3)** to use the Point ID currently defined in the Occupy template.

If you simply wish to add aditional text to the suggested point Id, press **Enter.** The point Id in the display remains and the cursor will be in the position defined in the current Point Id template.

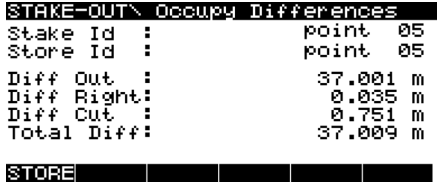
You may also enter a completely different Point Id if required.

Press **STOP** (**F1**).



If a codelist has been defined you may select a code. Details on adding codes are given in section 7.4.4.

The **DIFF** (**F2**) key is available. Pressing this key gives the differ-ences between the startpoint of the line and the staked point.

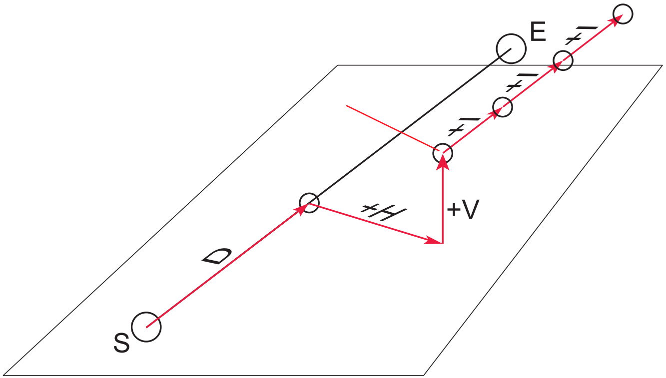


Diff In/Out - Horizontal distance In/ Out to the startpoint
Diff Left/Right - Horizontal distance Left/Right to the startpoint.
Diff Cut/Fill - Vertical distance to the startpoint of line.
Total Diff - Length of vector from startpoint to measured point.

If you have chosen to record a **LONG** log file these values will also be stored in the log file.

Press **STORE** (**F1**) to store the point.

Grid Stake-Out can be used to stake out grids relative to a defined reference line.



SE - Defined Reference Line
D - Distance to Station Begin
H - Horizontal Offset
V - Vertical Offset
I - Increment

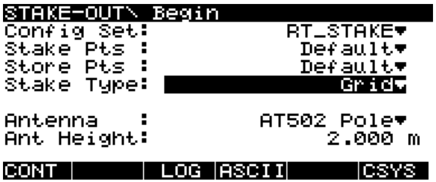
The Reference Line is selected or defined. Define the distance to the first station along the Reference Line, the Horizontal and Vertical Offsets from the Reference Line. Define the amount by which the Receiver should increment.

The first Target Point is the first point in the grid. Proceed to this point and record it. After this point is recorded, the next Target point will be shown. Carry on in this fashion until you reach the end of the row.

You may then create a new row by redefining the Horizontal Offset and switching the Increment to the negative value. Follow this row back in the direction from which you came, recording the grid points as you go. Alternatively, you can redefine the horizontal offset and start the next row in the same direction, next to the first grid point.

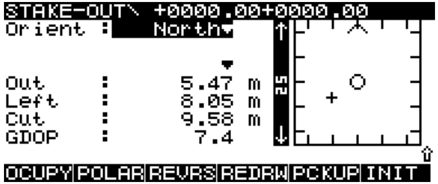
Procedure

Grid is selected as the **Stake Type** when entering Stake-Out.



The “as staked” points will always be stored in the Job. If staking from an ASCII file, you may also choose to store the Target points defined there in the Job. In this way you have the Target points and the “as staked” points in one Job.

To start Grid Stake-Out, press **CONT** (**F1**).



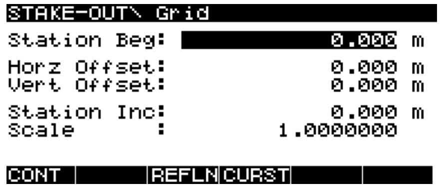
Stake-Out starts. Select the orientation.

Then move to the Target field (shown empty here). You must select a line as the target. Press **ENTER**.

You may select the line from this panel. If no lines are defined (as here), press **NEW** (**F2**) to define one.

Descriptions of how to define lines are given in section 7.5.4 (Although this section is concerned with orientation, the principles of defining lines are exactly the same).

When you have selected/defined a line, use the **PARAM** (**F5**) key to define the grid parameters.

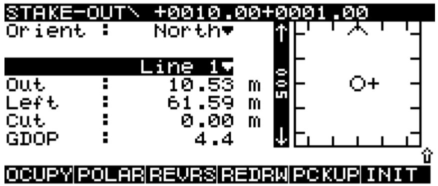


Station Beg - The distance along the Reference Line to the first grid point.
Horz Offset - The Horizontal Offset from the Reference Line to the first grid point.
Vert Offset - The Vertical Offset from the Reference Line to the first grid point.

Station Inc - The distance between each grid point in the direction of the Reference Line.
Scale - Depending on the transformation method used and the stake out design criteria, you may specify a scale factor to be applied to the increment value within the map projection plane. This is only used when staking out grids over large areas (tens of kilometers) and otherwise should be left at the default value of 1.00.

Refer to the diagrams at the start of this section for more details of each parameter.

Press **CONT** (**F1**) to continue.



The first point in the grid is automatically selected as the target point and measurements to that point are given.

Information about the point you are looking for is given in the Directory Bar.

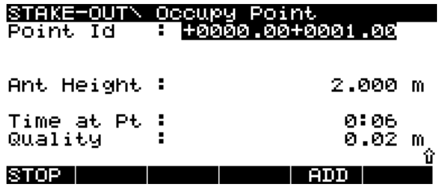
The point is given as:

+XXXX.XX+YYYY.YY

Where

- **X** is the distance along the Reference Line.
- **Y** is the Horizontal Offset from the Reference Line.

Move to the point and record/stake it. Press **OCUPY** (**F1**).



The Point Id is automatically chosen according to the format explained previously.

Alternatively, you may press **SHIFT** and then **PT ID (F3)** to toggle between using the Point ID currently defined in the Occupy template and the suggested Line Id as described in section 7.5.13.

If you simply wish to add aditional text to the suggested point Id, press **Enter.** The point Id in the display remains and the cursor will be in the position defined in the current Point Id template.

You may also enter a completely different Point Id if required.

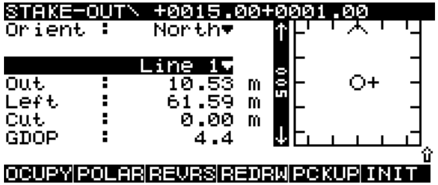
Add a code if required. Coding is explained in Chapter 8.

Use the **ADD** (**F5**) key to add a Hidden Point and/or Point Annotations.

When you have the pole level, press **STOP** (**F1**).

The **DIFF** (**F2**) key is available. Pressing this key reveals the differences between the design grid point and the as staked grid point. If you have chosen to record a **LONG** log file these values will also be stored in the log file.

Press **STORE** (**F1**) to store the point.

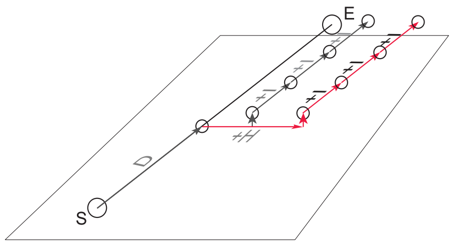


The next target is automatically selected according to the increment value. The value given in the Directory Bar also shows this.

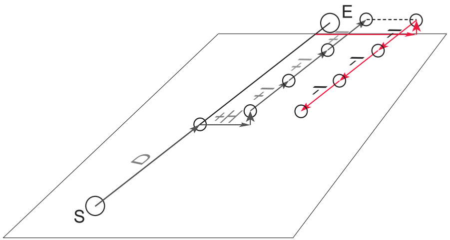
Carry on staking and recording points in this way until you reach the end of the row.

You can then choose the way in which you wish to proceed to the next row:

1. Increase the offset and start the next row in either direction from the last recorded grid point.



2. Increase the offset and start the next row in either direction adjacent to the first grid point.



To use option 1, highlight the Line and press **ENTER**. Press **PARAM** (**F5**) to enter the Grid parameters.

```
STAKE-OUT\ Grid
Station Beg:              10.000 m
Horz Offset:               4.000 m
Vert Offset:               0.000 m
Station Inc:              -5.000 m
Scale      :           1.0000000
CONT |     |REFLN|CURST|     |
```

Input the new Horizontal Offset (**Horz Offset**). Give the Increment (**Station Inc**) a negative value. Press **CURST** (**F4**) (current station).

The next target point will be displayed.

To use option 2, highlight the Line and press **ENTER**. Press **PARAM** (**F5**) to enter the Grid parameters.

```
STAKE-OUT\ Grid
Station Beg:              10.000 m
Horz Offset:               4.000 m
Vert Offset:               0.000 m
Station Inc:               5.000 m
Scale      :           1.0000000
CONT |     |REFLN|CURST|     |
```

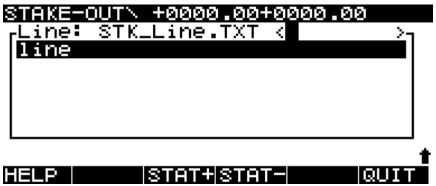
Input the new Horizontal Offset (**Horz Offset**). Press **CONT** (**F1**).

The next target point will be displayed.

The **REFLN** (**F3**) key is used to automatically set the start point of the reference line as the target. If this is pressed and the start point has already been recorded, the end point will be selected.

If a point within the grid is obstructed (E.g. a car is parked over it or it is heavily shaded by trees), there is a function that allows you to skip that point and carry on to the next one.

Enter the Line definition screen.



Press **SHIFT** to reveal **STAT+** (**F3**) and **STAT-** (**F4**). **STAT+** (**F3**) will increment to the next point. **STAT-** (**F4**) returns to the previous point.

8.1 Thematical Coding

There are two types of Coding System available on System 500 - Thematical Coding and Free Coding.

Thematical Codes are point-based information recorded together with the other point information.

Free Codes are time-based information, independent of the points. A time stamp is recorded with each free code, allowing the subsequent export of points and codes in chronological order. This information can then be used in third-party mapping software.

Thematical Coding is point-based information recorded at the point you are occupying. Thematical Codelists consist of Layers, Codes and Attributes.

The **Layer** is the primary block of the codelist and describes a group of related codes. For example, the Layer Vegetation could describe the Codes Tree, Grass, Shrub etc.

The **Code** is the secondary block and usually describes a single object.

A Code may have one or more **Attributes** attached to it. **Attributes** describe properties of the Code. For example, the Code Tree could have the Attributes Type, Height, Age, Girth, Spread etc.

Although it is possible to create a new, empty Codelist on the Receiver and then create new Layers, Codes and it is far more practical to create the complete Codelist in SKI-Pro Codelist Manager and upload it to the Receiver.

Codelists can be transferred to the PC Card or Internal Memory using the Transfer function in SKI-Pro. Codelists on the PC Card or Internal Memory must then be transferred to the Receiver using the Transfer function.

The Codelist is then selected for use in Configuration.

```
CONFIGURE\ Coding

Coding Type    :     Thematical▼

Codelist       :     Codelist 1▼



CONT |      |CODES|     |LAYER|
```

Coding Type - Choose **Thematical**.
Codelist - Select the codelist from the list or, to define a new codelist, press **ENTER**.

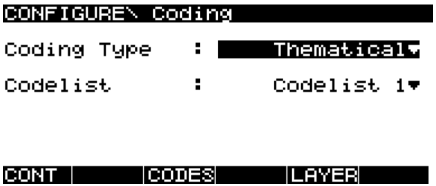
```
CONFIGURE\ Coding
 Codelist: <                    >
 Codelist 1
 Free Codelist



                                 ⇧
CONT | NEW |     | DEL |     |αNUM
```

The Codelists on the Receiver are displayed. To create a new, empty Codelist press **NEW** (**F2**).

```
CONFIGURE\ Codelist

Name        :
Creator     :



CONT |     |     |     |     |
```

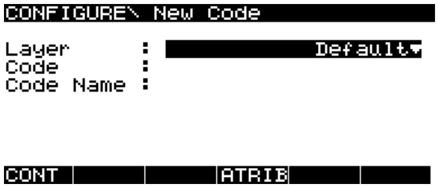
Enter the **Name** of the new Codelist and if required the name of the **Creator**. Press **CONT** (**F1**).

Layers, Codes and Attributes can be added to a Codelist. When a Thematical Codelist has been selected, the **CODES** (**F3**) and **LAYER** (**F5**) keys will be available.



To create new Codes and Attributes press **CODES** (**F3**).

The list of existing codes is given. Press **NEW** (**F2**) to create a new code.



Select the Layer on which the code will exist. To add a new Layer, press **ENTER** and **NEW** (**F2**). Refer to the next section for details.

Enter the new **Code** and its **Code Name**.

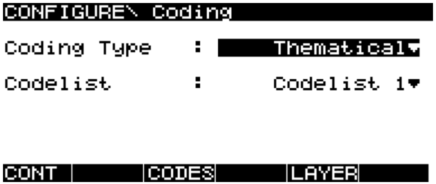
To add or edit attributes, press **ATRIB (F4)**.

Enter a meaningful name for the Attribute.

Move to the next field with the cursor. You may enter a default value for the Attribute.

Press **NEW** (**F2**) to add another new attribute. Press **CONT** (**F1**) to continue.

Layers, Codes and Attributes can be added to a Codelist. When a Thematical Codelist has been selected, the **CODES** (**F3**) and **LAYER** (**F5**) keys will be available.



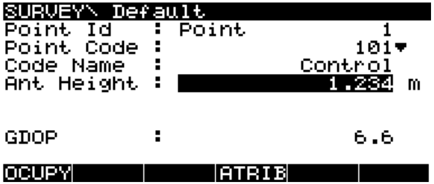
To create a new Layer or activate/ deactivate an existing Layer press **LAYER** (**F5**).

Press **NEW** (**F2**) to create a new layer. Input the Layer name and press **CONT** (**F1**).

To activate/deactivate individual Layers, select the Layer and press **USE** (**F4**) to toggle the Layer on/off.

To deactivate all Layers, press **NONE** (**F5**). This key then changes to **ALL** (**F5**). Use this to activate all the Layers.

When a Thematical Codelist has been selected for use within a Configuration Set, it will be possible to add a Thematical Code to a point when measuring.



The fields **Point Code** and **Code Name** will be displayed as above. Highlight the **Point Code** and either:

1. Use the left or right cursor keys to cycle through the code list.
or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.

The **Code Name** will be displayed for the **Point Code** that you have chosen. Enter any attributes for the code using the **ATRIB** (**F4**) key.

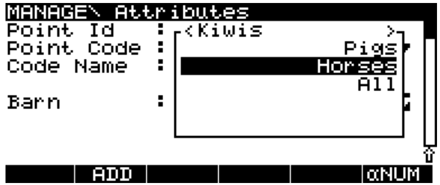
The code is stored along with the Point Id information.

When the Point Code list box is open there are several other operations that you may carry out.

CONT (**F1**) selects the code and returns to the survey screen.
NEW (**F2**) lets you define a new code.
LAST (**F3**) jumps to the code log and displays the codes that were last assigned in order.

ATRIB (**F4**) - lets you define attributes for the selected code and add attribute values to the choicelist of an attribute.

To add an attribute value to a choicelist, highlight the line of the according attribute and press ENTER.



Type in the new attribute value, then press **ADD (F2)**.

STORE (**F1**) records the code and returns to the Main Survey panel.

Free Coding is time-based information, independent of any recorded points.

Free Coding can be used to generate virtually any type of code. Exporting of the codes through an Output Mask converts them for use in any type of third party surveying software.

Output Masks are defined in SKI-Pro using Format Manager. Some standard Output masks exist, (E.g. for exporting to GSI format), but you are also free to define whichever output mask best suits the format that you usually work with.

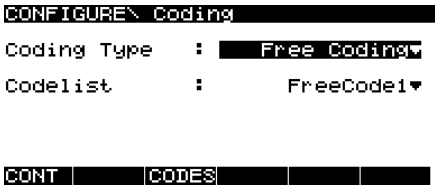
A Free Code consists of a Code Name, a Description and then up to 20 Information Blocks which may contain any data you wish to write in them.

The Output Mask defines how this data will then be translated when it is downloaded.

Although it is possible to create a new, empty Codelist on the Receiver and then create new Layers, Codes and Attributes, it is far more practical to create the complete Codelist in SKI-Pro Codelist Manager and upload it to the Receiver.

Codelists can be transferred to the PC Card or Internal Memory using the Transfer function in SKI-Pro. Codelists on the PC Card or Internal Memory must then be transferred to the Receiver using the Transfer function.

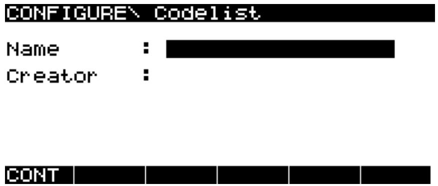
The Codelist is then selected for use in Configuration.



Coding Type - Choose **Free Coding**.

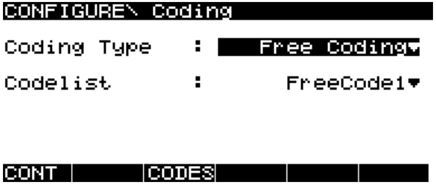
Codelist - Select the codelist from the list or, to define a new codelist, press **ENTER**.

The Codelists on the Receiver are displayed. To create a new, empty Codelist press **NEW** (**F2**).



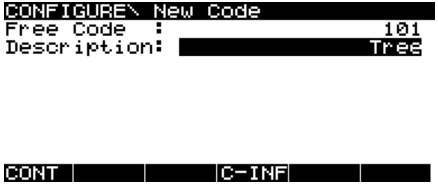
Enter the **Name** of the new Codelist and if required the name of the **Creator**. Press **CONT** (**F1**).

Codes can be added to a Codelist. When Free Coding has been selected, the **CODES** (**F3**) key will be available.



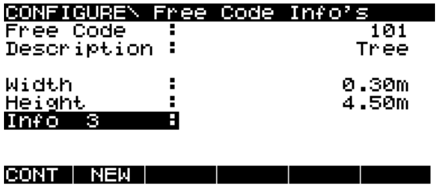
To create new Codes press **CODES** (**F3**).

Press **NEW** (**F2**).



Free Code - Input the identifier
Description - Input the description of the Indentifier.

Press **C-INF** (**F4**) to add information blocks for the code.



Enter a meaningful name for the info block. Then move to the adjacent field to enter a default value.

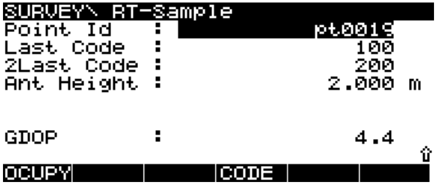
Use the **NEW** (**F2**) key to add more information blocks.

Press **CONT** (**F1**) to continue.

The new code is displayed in the list. An asterisk at the end of the line indicates that the codes has information blocks defined. Press **C-INF** (**F4**) to view and if required add information blocks.

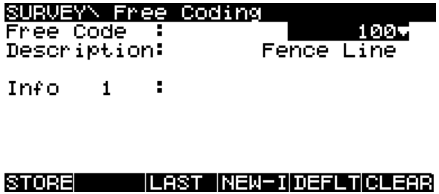
Press **CONT** (**F1**) to continue.

When a Free Codelist has been selected for use within a Configuration Set, it will be possible to record a Free Code when measuring.

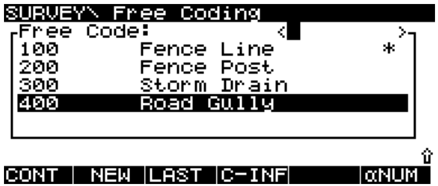


The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE** (**F4**) key will be available. Press this key to access the codelist.



To select the code:
1. Use the left or right cursor keys to cycle through the code list.
or
2. Press **ENTER** and select the code from the list.
or
3. Type in the first few characters of the code until the desired code is displayed.



An asterisk next to a code indicates that it has attributes.

NEW (**F2**) lets you add a new code.

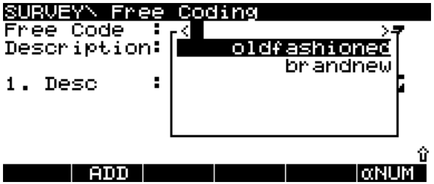
LAST (**F3**) jumps to the code log and displays the codes that were last assigned in order.

C-INF (**F4**) lets you assign new information blocks to the selected code.

Press **CONT** (**F1**) to select a code from the list.

Type in the attribute or add a new attribute with **NEW-I (F4)**.

To add an attribute value to an existing choicelist of an attribute, highlight the line of the according attribute and press ENTER.



Type in the new attribute value, then press **ADD (F2)**.

STORE (**F1**) records the code and returns to the Main Survey screen.

9. The CONFIG Key

The **CONFIG** key can be used at any time to make temporary alterations to any parameter in the Configuration Set.

There are some configurable parameters that can only be accessed through the **CONFIG** key and are not contained in the sequential Configuration. Nevertheless, they are part of the Configuration Set.

The other parameters that are available through the Sequential Configuration are described in Chapter 5.

Press **CONFIG**.

You can configure any parameter for the current Configuration Set. You may make changes to any configurable option contained in items 1-4. After making the change, you will press **CONT** (**F1**). You will return to whichever screen you were in previously. The changes will be temporary unless, after making the change, you press the **CONFIG** key again and press **STORE** (**F3**).

To choose a different Configuration Set, press **CONFG** (**F5**).

You may select any Configuration Set in the list and press **CONT** (**F1**) or add a new one using the **NEW** (**F2**) key. Press **ESC** to return to the CONFIGURE screen.

Enables you to define the Satellite Elevation Mask and also automatic tracking of healthy satellites.

```
CONFIGURE\ Satellite
Elev Mask    :                 10°
SV Health    :          Automatic▾
Track Mode   :      Max. Accuracy▾
LossOfLock   :            No Beep▾

CONT
```

Elev Mask - The elevation mask or elevation below which satellite data will not be recorded and below which satellites will not be shown to be tracked. For RT applications the **Elev Mask** should be set to 10°. For post processing only applications, the **Elev Mask** should be set to 15°. These are the default mask angles used in the System Default Configurations.

SV Health - Can be set to **Automatic** or **User**. When set to **Automatic**, the receiver monitors the incoming satellite signal and if the signal is flagged as unhealthy, will not record data from it or use data from it in a real-time computation.

When set to **User**, you may define which satellites are used and which not. The satellites are defined using the **HELTH** (**F4**) key.

For the vast majority of applications there should be no reason to set SV Health to User.

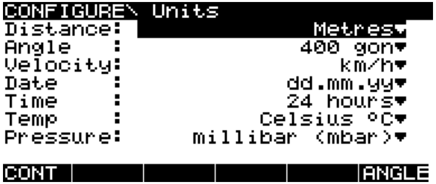
Track Mode - The sensor may also be configured to operate in one of two **Track Modes.**
Max. Accuracy should be chosen for normal survey applications.
MaxTrak is suitable for GIS applications where a lower accuracy may be acceptable but it is desirable to track satellites under noisier conditions (trees, built up areas).

Only a code solution is possible if **MaxTrak** mode is selected. However, when the **Track Mode** is set back to **Max Accuracy**, RTK phase solutions will again be computed.

Additionally, it is not possible to import phase data into SKI-Pro that has been collected when the **MaxTrak** mode was selected. Only code solutions can then be computed in SKI-Pro.

LossOf Lock - When losing all satellite signals for example due to satellite shading caused by tall buildings, trees, etc. a message “Complete loss of lock” appears. The sensor may be configured to beep with this loss of lock message or not.

Enables you to configure units for all types of measurement data displayed and recorded by the receiver.



Distance - Select from **Meters**, **Int. Feet** (International Feet), **Int. Feet 1/8 in** (International Feet to 1/8 inch), **US feet**, **US feet 1/8 in** (US feet to 1/8 inch), **Kilometres** or **Int. Miles** (International Miles).

Angle - Select from **400gon**, **360° decimal**, **360° ' "**, or **6400mil**. Use **ANGLE** (**F6**) to define further options for this unit.

Velocity - Select from **km/h** (kilometers per hour), **mph** (miles per hour), or **knots**.

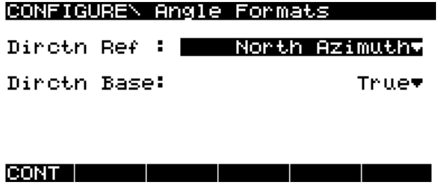
Date - Select the date format from **dd.mm.yy**, **mm/dd/yy** or **yy/mm/dd**, where **dd** = day, **mm** = month and **yy** = year.

Time - Select the time format from **12 hours** or **24 hours**.

Temp - Select the units used for temperature from **Celcius °C** or **Fahrenheit °F**.

Pressure - Select the units used for atmospheric pressure from **millibar (mbar)**, **mm merc (mm Hg)**, **inch merc (inch HG)**, **hectopascal (hPa)** or **pounds / in² (psi)**.

Use the **ANGLE** (**F6**) key to configure the direction reference and direction base for angular measurements.



Dirctn Ref - Defines the direction reference or the direction from which angles are measured.

Dirctn Base - Defines the Direction Base as either **True** or **Magnetic**. When **Magnetic** is chosen, input the current deviation of Magnetic North from True North.

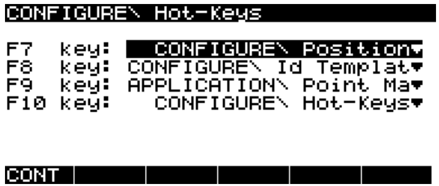
9.3 General - Language

Select the Language in which you wish the Terminal Interface to be displayed. The language is associated with the Configuration Set.

The Receiver can hold up to two languages.Use the **DEL** (**F4**) key to delete any languages that are not required.

9.4 General - Hot Keys

You may assign a particular screen to each of the keys F7 - F10 so that when one of these keys is pressed, that screen is displayed.



Select the key you wish to configure and press **ENTER**. A list of all available screens is displayed. Select the screen and press **ENTER**.

Note that you can also configure the function keys F1 - F6 to the hot keys or select ‘NEXT Dialog Call’ to switch between all previously opened screens.

9.5 General - Time and Initial Position

It is important that the local time, date and initial position are approximately correct in order for the Receiver to quickly locate and track satellites.

```
CONFIGURE\ Time & Initial Pos
Local Time :          13:52:17
Time Zone  :                0▾
Local Date :          16.12.98

Local E    :       544744.503 m
Local N    :      5247260.800 m
Local EHgt :          511.627 m

CONT  COORD                 NAV
```

Check that the **Local Time** is approximately correct. This will be updated every time GPS satellites are tracked. Check also the **Time Zone** for your current location and **Local Date**.

Then check your local position. If you have a local Coordinate System defined, this will be available in grid coordinates as well as WGS84 Geodetic and WGS84 Cartesian. Use the **COORD** (**F2**) key to switch between coordinate systems.

The **NAV** (**F6**) key enables you to activate or deactivate the navigated height solution. For most applications this will be deactivated as it enables a navigated position calculation with only 3 satellites.

Certain aerial applications may need to switch this to **NO**, thereby activating the navigated height solution.

9.6 General - Start-Up

Defines the screen that will be displayed when the Receiver is switched on and the behaviour after power failure.

```
CONFIGURE\ Start-Up

Panel  :           MAIN\ Menu▾

AutoOn :            PowerFail▾



CONT
```

Panel - Select the screen you wish to be displayed upon switching the Receiver on.

AutoOn - **PowerFail** should be selected for system restarts after an abrupt power failure like a short circuit or unplugging batteries by mistake. **ExtPowerLow/PowerFail** should only be selected when the system is powered by an external main AC/DC as is the case with reference stations power supply but not by batteries.

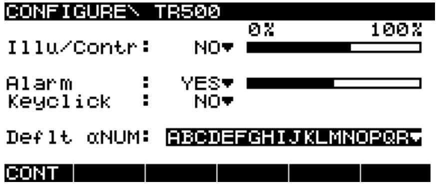
It is recommended for possible slow drop in voltage or an abrupt power failure.

The option **ExtPowerLow/ PowerFail** is not recommend for systems running with batteries! This option could then effect a deep discharge on the battery and could destroy the battery!

The **ExtPowerLow/ PowerFail** option can only be set temporary. After manual turn off and on again, the option is always reset to **PowerFail** to protect the batteries from deep discharging.

Start-Up is particularly useful for operations without the TR500 Terminal. Ensure that you start up in SURVEY\ MAIN and not in SURVEY\ Begin.
For further details on how to configure the Sensor to automatically start up and occupy a point, refer to Chapter 5, Configuring the Receiver.

Enables you to configure some general features of the Terminal.



Illu/Contr - Switches the screen illumination on or off and sets the contrast level. Alternatively, use the key combination Alt + B for switching the screen illumination on or off.

Alarm - Switches the alarm on or off and also controls the volume. The alarm sounds when an important event occurs (such as an error message appearing).

When Illu/Contr or Alarm are selected, you can adjust the Illumination Level or Contrast and Sound Level by using the **-10%** (**F4**) and **+10%** (**F5**) keys.

Keyclick - Switches the Keyclick on or off.

Deflt αNUM - defines the set of extra characters available through the αNUM key or on the F1-F6 function keys whenever you type in an entry.

9.8 General - Identification

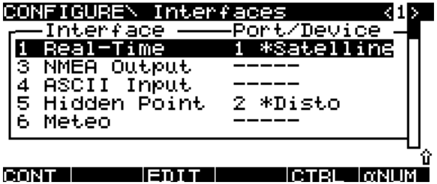
The Sensor Identification can be defined. By default the last four numbers of the serial number are used. Type in any other four character Id if required. The Sensor Id is displayed in the automatic point template, log files etc. and defines which instrument was used for certain measurements.

Use the **DEFLT** (**F5**) key to automatically redefine the Sensor Identification as the last four figures of the serial number.

9.9 Interfaces

Gives an overview of all interfaces and the port and device currently assigned for that interface.

For example, a sensor is being used as a real time rover with a Satelline radio attached to port 1 and hidden points are being collected using a DISTO connected to port 2.



For this type of operation, the Interfaces panel would look as shown above.

A more detailed description on the interfaces is given in the following sections.

For further details on the interfaces **Tilt** and **Meteo** see App. J.

9.10 Interfaces - Real-Time

The **Real-Time** interface enables you to configure the Real-Time parameters, the port and the device used for Real-Time data communication. The port (1,2 or 3) and the device are displayed. If both real-time interfaces are configured, both will be displayed in the CONFIGURE\ Interfaces panel as **Real-Time 1** and **Real-Time 2**.

Set the focus on Real-Time and press **EDIT (F3)** to modify the Real-Time device and parameters.

Certain devices allow you to set additional parameters e.g. channel switch. This parameters can be accessed by pressing **CTRL (F5)**. For information about all supported Real-Time devices refer to Appendix H.

For information about Real-Time Reference parameters refer to section
5.3 Configuring the Receiver for Real-Time Reference Operations.

For information about Real-Time Rover parameters refer to section 5.4 Con-figuring the Receiver for Real-Time Rover Operations.

The **NMEA Output** interface enables you to configure which NMEA messages to output through which port using which device.

Set the focus on NMEA Output and press **EDIT (F3)** to select the NMEA messages to be output.

```
CONFIGURE\ NMEA Message Output
Use Device:                 YES▾

Port       : 3 *Satelline 2AS▾
Messages   : GGA,ZDA



CONT |     |MESGS| ID  |DEVCE|
```

Select the port to which the NMEA messages should be sent. Use the **DEVCE** (**F5**) key to configure the device itself. Refer to Appendix H for a complete list of all supported devices.

Use the **ID** (**F4**) key to define the talker ID that appears at the beginning of each message. This will normally remain at the default **GP** for GPS.

Use the **MESGS** (**F3**) key to display the messages that can be output, the rates and the output timing method.

```
Message  —Rate  —Use  —Output
GGA        1.0    YES   Epoch
GLL        1.0    NO    Epoch
GNS        1.0    NO    Epoch
VTG        1.0    NO    Epoch
ZDA        5.0    YES   Epoch

CONT |     |EDIT | USE | ALL |
```

Highlight the message that is to be output and press **F3 (EDIT)** to configure how a particular message is sent.

```
CONFIGURE\ Message to Send
Message     :           GGA
Rate        :           1.0▾  s
Use         :           YES▾
Output Time:      At Epoch▾

Output Dela:           0.00   s

CONT |     |     |     |     |
```

Rate - Choose a rate between 0.1 and 3600s at which the message should be sent.

Use - Choose **Yes** to output the message.

Output Time - A message may be sent either at an exact epoch or immediately.
At Epoch means that the message will be sent at the exact epoch as defined by the **Rate**.
Immediately means that the message is sent as soon as it is available

Output Delay - If the message is sent **At Epoch,** then additionaly the message may be delayed before it is output through the chosen port. The time of delay can be a value up to the rate at which the message is output. This may be useful if 2 or more sensors are being used to monitor the position of an object. The position of each sensor is being output as a NMEA message back to a master control station. The control station may not be able to cope with all the positional data messages if all sensors were sending their position message back at exactly the same time (as would be the case with **Immediately**). In this case the second and third sensor could delay their output so the control station receives the message from each sensor at a slightly different time.

A full description of each NMEA message is given in Appendix E.

The ASCII Input interface enables you to configure port and device, from which you want to receive and store ASCII strings from external devices such as depth sounders, barometers, digital cameras, pipe detectors, Geiger counters etc.

The ASCII strings are stored as point annotations together with the next point measured. Point annotations for auto logged points are only stored when Store Pt DB and Use Annot in panel CONFIGURE\ Position Logging are set to YES. For detailed information see section 5.4.

The port (1, 2 or 3) and the device are displayed. Set the focus on ASCII Input and press **EDIT** (**F3**) to modify the ASCII Input device.

```
CONFIGURE\ ASCII Input
Use Device    :              YES▾
Port          :          1 *RS232▾
End of Msg    :           CR + LF▾
Annot #1      :      Depth Sounder
Annot #2      :
Annot #3      :
Annot #4      :

CONT          ANNOT          DEVCE
```

If you want to use an external device for ASCII input set **Use Device** to YES. Select the **Port** to which the device is connected. Use the **DEVCE** (**F5**) key to configure the device itself.

End of Msg - Select the delimiter to be used to identify the end of the incoming ASCII string. This may be either CR, LF or CR + LF.

Press the **ANNOT** (**F3**) key to define which of the incoming ASCII strings should be stored as a point annotation and how. You may identify up to four different message types (**Annotation #1** to **#4**).

```
CONFIGURE\ ASCII Input
Annotation  :                 #1▾
User defined:                YES▾
Description :      Depth Sounder
Message Id  :
Data prefix :   @<Description>@▾
Reply       :                GGA▾
CONT
```

Set **User defined** to **YES.** Enter a description to identify the annotation (e.g. depth sounder).

Message Id - This can be used to identify particular data within the incoming ASCII string. See Working Example 2 for an example.

Data prefix - To more easily identify the annotations registered with a point it is possible to couple them with the above given description. The description will then be stored together with the ASCII string.

Reply - As a reaction of the sensor to an incoming ASCII string an NMEA message may be sent back to the external device. In case of a camera, for example, this may allow you to have the position being integrated into the photograph afterwards.

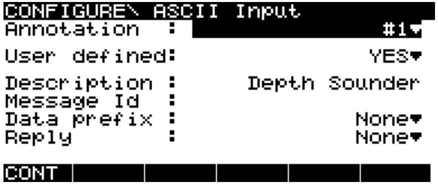
Press **CONT** (**F1**) to return to the CONFIGURE\ ASCII Input panel.

Working Example 1

You need to complete a survey on a small lake and wish to record the depth of the lake that is measured by a 3rd party depth sounder at certain locations. This depth sounder constantly streams data at a rate of 1Hz and sends the depth it has measured in the following format:

27.234<CR>
27.345<CR>
27.232<CR>
.....

The **ASCII Input** interface needs to be configured such that when a position is measured, the depth measurement will be stored as annotation 1 with that point. To do this, in the **CONFIGURE\ ASCII Input** panel, press **ANNOT** (**F3**) and configure **Annotation #1** to accept the incoming ASCII data as shown below.



Note that because the depth sounder is streaming data, the depth measurement that is stored with the point will be the last measurement received by the sensor before the point is stored (the point can be stored either by pressing **STORE** (**F1**) or using Auto Store functionality).

The co-ordinates of points can now be measured over the lake and additionally, the depth of the lake at that point is also recorded as an annotation.

Working Example 2

You need to complete a survey on contaminated waste land and using a gas analyser, you wish to measure the level of different gasses at various locations. When a button is pressed on the gas analyser, it will measure the level of 4 different gasses and outputs the results as an ASCII string. This ASCII string has the following format:

$GS1 2.786<CR/LF>
$GS2 0.034<CR/LF>
$GS3 1.395<CR/LF>
$GS4 0.025<CR/LF>

where $GS1 to $GS4 is the Message ID for the 4 different gasses followed by the gas reading itself in ppm.

You wish that when a point is surveyed, this ASCII string is split and that each individual gas reading is recorded as a separate annotation such that annotation 1 would contain the value 2.786, annotation 2 would contain the value 0.034 etc.
To achieve this, each annotation should be configured to accept only one particular gas reading. The Message ID line is used to “search” the input for that particular gas reading.

```
CONFIGURE\ ASCII Input
Annotation   :            #1▾
User defined:             YES▾
Description :           Gas 1
Message Id  :            $GS1
Data prefix :            None▾
Reply       :            None▾
CONT
```

When each annotation is configured for each particular gas reading the CONFIGURE\ ASCII Input panel should look as follows.

```
CONFIGURE\ ASCII Input
Use Device   :            YES▾
Port         :       2 *RS232▾
End of Msg   :        CR + LF▾
Annot #1     :          Gas 1
Annot #2     :          Gas 2
Annot #3     :          Gas 3
Annot #4     :          Gas 4
CONT      ANNOT     DEVCE
```

The waste land site can now be surveyed. The co-ordinates of any points can be measured and before storing this point, the gas analyser is activated to take a gas reading at this point. The point can then be stored and the 4 gas readings are stored as individual annotations along with this point.

9.13 Interfaces - Hidden Point

The **Hidden Point** interface enables you to configure the port and device used for Hidden Point measurements. The port (1,2 or 3) and the device are displayed. Set the focus on Hidden Point and press **EDIT (F3)** to modify the Hidden Point device.

If you want to use an external device set **Use Device** to **YES**.

Select the port to which the device is connected. Use the **DEVCE** (**F5**) key to configure the device itself. For information about all supported Hidden Point devices refer to Appendix H.

If no device is connected the Hidden Point measurement may also be entered manually. The parameters for Hidden Point measurements can be configured in CONFIGURE\ Survey, Point..., Hidden Point. Refer to Chapter 5 for further details.

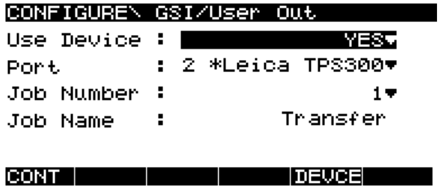
9.14 Interfaces - GSI/User Out

The **GSI/User Out** interface enables you to export a job with a format file through a port on the sensor to a total station or any other device.
The port (1, 2 or 3) and the device are displayed. Set the focus on GSI/ User Out and press **EDIT** (**F3**) to modify the GSI/ User Out port and device.

If you want to use a GSI/User Out device set **Use Device** to **YES**.
Select the port to which the device is connected. Use the **DEVCE** (**F5**) key to configure the device itself.

Leica TPS300/700, Geodimeter and Zeiss REC500 total stations as well as the SOKKIA SDR33 datalogger are currently supported.

When Leica TPS300/700 is selected and connected to the GPS receiver, select the **Job Number** to which job the data should be sent. The **Job Name** of existing jobs in the TPS instrument is displayed. For a new job, type in a name.



If data is being transferred to a Geodimeter total station, then the total station must be in a mode ready to receive data.

SOKKIA devices can only handle numeric point IDs. If **Renumber** is set to **YES,** all points are transfered but renumbered starting from 1. If **NO** is selected, only points with numeric point IDs are transfered and point IDs are shortened to 4 digits, truncating from the right.

```
CONFIGURE\ GSI/User Out
Use Device :          YES▾
Port       : 3 *SOKKIA SDR33▾
Renumber   :          YES▾

CONT              DEVCE
```

For more information on exporting ASCII files using a Format file template refer to chapter 13.7 Transfer GSI/ User.

The **Remote** interface enables you to configure the Remote control mode and the device connected to the sensor. In most of the cases the sensor will be controlled via the TR500 connected to the Terminal port. Alternatively a remote computer can be used to steer the sensor.

If the Remote mode is set to Terminal and a command is sent to the sensor via any serial port the sensor automatically turns on and switches to remote mode.

If the sensor is to be remotely controlled, highlight the Remote interface and select the **Port.** Press **DEVCE (F5)** to select the appropraite device from the list. Normally this will be RS232.

For more information about devices refer to Appendix H.

Sensor Transfer with SKI-Pro

Using the Remote interface it is possible to download data directly from the memory device of the sensor into SKI-Pro through the serial port of the PC without having to remove the TR500 from the Terminal port.

Configure the Remote interface to the appropriate port and device as described above. This would normally be Port 2 and RS232 device using the standard System 500 download cable.

Connect the sensor to the PC. Data can now be downloaded to the PC using the Sensor Transfer component in SKI-Pro in the normal manner.

9.16 Interfaces - PPS Out

The **PPS Out** interface enables you to configure the PPS (Pulse Per Second) output port and parameters. This function is available only if the necessary hardware exists.

Select **PPS Out** and press **EDIT (F3)**.

Set **PPS Out** to Yes.

Set the **PPS Rate** at which the pulse shall be output. Select between 0.1 - 20 seconds.

If an external device is connected to the sensor an OWI or LB2 message can be transmitted at the time the PPS is output. Change **Notify msg** to ASCII (OWI) or Binary (LB2) and press **NPORT (F5)** to select the port and device through which the message shall be transmitted.

The ASCII message takes the following format:

$PLEIR,HPT,sssssssss,nnnn*hh<CR><LF>

Format	**Content**
$PLEIR,	Header
HPT,	Message identifier (High Precision Time)
sssssssss,	GPS time of week of next PPS pulse (in msec)
nnnn	GPS week number
*hh	Check sum
<CR>	Carriage return
<LF>	Line feed

The message will be sent at least 0.5 seconds prior to the next pulse. For this reason messages are only sent when the PPS rate is greater than 1sec.

The **Limit Error** is the time limit within which PPS shall be generated. If the time accuracy exceed this value no PPS output is generated. Change Limit Error to **YES** and enter a value in nanoseconds.

The following technical details provide pulse characteristics and cable connectivity.

The time pulse has a 3.3V peak (= High) on a 50 ohm resistance. The pulse length is 25 usec with the leading edge coinciding with the beginning of each epoch.

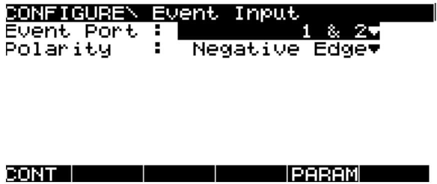
The cable should be matched with an appropriate resistance of 50 ohm. The connector Type is: Huber & Suhner FFA.0S.CTAC32Z.

The **Event Input** interface enables you to configure the Event Input ports and parameters. This function is available only if the necessary hardware exists.

The Event Input port allows direct connection to an external device (e.g. aerial camera). When this device operates (e.g. the shutter opens), the time that the event occurred will be recorded in the GPS measurements. These records can later be superimposed on the processed kinematic data and the positions where the events took place can be interpolated in SKI-Pro.

In adition to the time stamps, the user can also log positions, velocity and quality. Events logged during real time operations can also be exported to an ASCII file using an appropriate Format File and the Sensor Transfer functionality. Refer to Chapter 13 for further details.

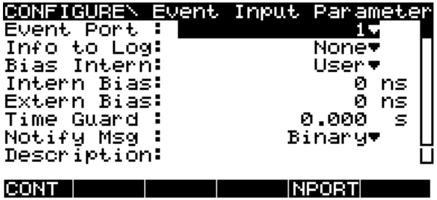
Select **Event Input** and press **EDIT (F3)**.



Select Port **1** or **2** or if you want to use both at the same time **1 & 2**.

Select the **Polarity** according to the external device you are using. The polarity selected effects both ports in the same way.

Press **PARAM (F5)** to modify additional parameters.



If both event input ports are used select the **Event Port** number and set the parameters for each.

Info to Log - Select the information that shall be logged with the Event record.

Bias Intern - Set to **User,** for setting your own calibaration value for a particular sensor. **Factory** uses default settings.
Intern Bias - When Bias Intern is set to User, set a calibration value here for a particular sensor.

Extern Bias - Enables you to define a calibration value according to the external event device and cable used.

Time Guard - If two or more events take place during the time (in seconds) defined, only the first event will be recorded. Enter 0 to accept all events. The shortest recording time is 1 second, however all events will be counted.

If an external device is connected to the sensor an OWI or LB2 message can be transmitted at the time the event takes place.

To enable messages, change **Notify Msg** to ASCII (OWI) or Binary (LB2) and press **NPORT (F5)** to select the port and device through which the message shall be transmitted.

Scroll down and enter a **Description**. This description will be recorded with the event record. This is particularly useful if two event input ports are used at the same time in order to differentiate between the two event records.

The technical specification for the Event Input port are as follows:

Pulse type: TTL, positive or negative going pulse
Pulse Length: Minimum 125 nsecs
Voltage: TTL level (~5V, min. 3.3V)
Pin definition: Center = signal, case = ground
SR530 Connector type:
Huber & Suhner Lemo Typ II
FFA.00.250.CTAC327

The ASCII message takes the following format:

$PLEIR,EIX,ssssssss,tttttttt,nnnn,cccc,dddd*hh<CR><LF>

Format	**Content**
$PLEIR,	Header
EIX,	Message identifier = event input “1” or “2”
sssssssss,	GPS time of week of event (in msec)
tttttttt,	GPS time of week of event (sub msec in nsec)
nnnn	GPS week number
cccc	Event count
dddd	Event pulse count[1]
*hh	Check sum
<CR>	Carriage return
<LF>	Line feed

[1]This is the count of all pulses including those violating the specified time guard boundary conditions. This allows determination of missed events.

10.1 Real-Time Input Status

The Status of all Receiver functions can be accessed through the **STATUS** key at any time.

```
STATUS\ Menu
1 Survey
2 Logs
3 General
4 Interfaces



CONT
```

Status is divided into 4 main sub menus.

1 Survey - Status of survey related functions.
2 Logs - Logfiles of what has been recorded.
3 General - Status of hardware and firmware.
4 Interfaces - Status of the interfaces, ports and external devices.

Real-Time Status is available when a Real-Time reference or Real-Time rover is being used. The information available differs with the operation mode.

The panels below describe what would be seen when an RTK reference or rover is being used with Leica data format. Different data would be seen if RTCM corrections were being used or code only data was being transmitted and received.

1. Real-Time Rover

```
STATUS\ Real-Time Input
Data Format:          Leica

Sats L1/L2 :           7/ 7
Last recvd :             1 s
% recvd    :            99


CONT      DATA AMBIG     REF
```

Data Format - The data format being received.
Sats L1/L2 - The number of satellites on L1/L2 being used in the computation.
Last recvd - The amount of time since the last message was received from the reference station.
% recvd - The Receiver compares the amount of data received through the GPS Antenna with the amount received from the reference station and displays this as a percentage.

Press **DATA** (**F3**) for information about the data being received from the satellites.

```
STATUS\ Real-Time Input
Sat --    :            -----
Phase L1  :            ----- cyc
Phase L2  :            ----- cyc
Code L1   :            ----- m
Code L2   :            ----- m
CONT           SAT+
```

Sat - The number of the chosen satellite
Phase L1 - The number of phase cycles from the Antenna to the satellite on L1.
Phase L2 - The number of phase cycles from the Antenna to the satellite on L2.
Code L1 - The pseudorange to the satellite from L1 data.
Code L2 - The pseudorange to the satellite from L2 data.

Press **AMBIG** (**F4**) for information about the ambiguity resolution process.

```
STATUS\ Ambiguity
Sat :   --  --  --  --  --  --
L1  :   --  --  --  --  --  --
L2  :   --  --  --  --  --  --

Sat :   --  --  --  --  --  --
L1  :   --  --  --  --  --  --
L2  :   --  --  --  --  --  --
CONT
```

Each Satellite used in the real-time computation is displayed with the ambiguity status on each frequency. **YES** indicates a fixed ambiguity, **NO** that the ambiguity is not yet fixed.

Press **REF** (**F6**) for information about the Reference Station.

```
STATUS\ Reference Stn Coords
Point Id     :         New 1
Ant Height   :       2.000 m
Marker       :
Local E      :  542388.025 m
Local N      : 5246896.029 m
Local EHgt   :     509.584 m
CONT COORD
```

The **Point Id** and Antenna Height (**Ant Height**) of the reference point are displayed.

Then either **Marker** or **Antenna** is displayed, indicating from where the coordinate is given.

Press **COORD** (**F2**) to view the coordinates in WGS84 Geodetic and Cartesian formats and local grid coordinates if a Coordinate System is being used.

2. Real-Time Reference

```
STATUS\ Real-Time Output
Data Format:           Leica

Sats L1/L2 :            7/ 7
Last Sent  :               1 s



CONT |    |DATA |    |    | REF
```

Data Format - The data format being sent.
Sats L1/L2 - The number of satellites on L1/L2 being used in the computation.
Last sent - The amount of time since the last message was sent.

The **DATA** (**F3**) and **REF** (**F6**) keys are available. The information displayed there is exactly the same as with a Real-Time Rover.

The Stop & Go Indicator gives information regarding the amount of time spent on a point and the amount of time required at a point.

The information displayed differs, depending on whether you are in static or moving mode.

Static Mode

```
STATUS\ STOP&GO Indicator
Completed         :          0 %
Time to Go        :         0:00
Time at Pt        :         0:00
Cycle Slips       :    L1: 0 L2: 0
GDOP              :   <max = 7> 3.4
Obs Rec Rate      :          1.0 s
Static Obs        :            0

CONT |    |    |    |    |
```

Completed - A percentage value indicating how much data is required for successful processing (100%) and how much has been collected. The criteria used to display this value depend on what has been set in the Configuration Set. See explanation below.

Time to Go - If set, a timer showing how much time is left before you can cease observations for this point.

Time at Pt - The amount of time spent recording at the point.

Cycle Slips - The number of cycle slips that have occurred on L1/L2 since recording commenced on the current point.

GDOP - The current calculated value for PDOP or GDOP.

Obs Rec Rate - The Observation Recording Rate currently set.

Static Obs - The number of Static Observations (epochs) recorded at this point.

Completed Criteria - If no special settings have been made in the Configuration Set, the percentage is a conservative estimate based on a 10-15km baseline. This is also the default setting for Real-Time Reference Stations.

In a Post-Processed Survey, where Auto Stop and/or STOP P-PRC have been set, the value may be displayed according to:
Time - A minimum time is specified.
Observations - A certain number of observations have been specified.
Stop and Go Indicator - A baseline length is selected and a percentage calculated using the baseline length, number of satellites and GDOP.
No. Sats - A length of time is specified that varies with the number of satellites available.

In a Real-Time Rover Survey, where Auto Stop and/or STOP R-TME have been set, the value may be displayed according to:
Accuracy - when the specified accuracy is reached, measurement will stop. This is impossible to predict in percentage terms and so the default Stop and Go indicator (10-15km) is displayed.

Positions - The number of real time positions required on each point are specified.

Stop and Go Indicator - A baseline length is selected and a percentage calculated using the baseline length, number of satellites and GDOP.
No. Sats - A length of time is specified that varies with the number of satellites available.

Moving Mode

```
STATUS\ STOP&GO Indicator
5 Sat's since   :        0:00

PDOP            : (max = 7) 3.6
Obs Rec Rate    :         1.0 s
Moving Obs      :             0
CONT
```

5 Sats since - The length of time that 5 satellites have been observed for. In Kinematic on the Fly operations, it is important to observe 5 satellites for about three minutes or so without interruption at the beginning of the chain.

GDOP - The current calculated value for PDOP or GDOP.

Obs Rec Rate - The Observation Recording Rate currently set.

Moving Obs - The number of Moving Observations (epochs) recorded in this interval.

```
STATUS\ Position
Local Time :08:55:22.1 (0.00)
Local E    :      542063.475 m
Local N    :     5246845.867 m
Local EHgt :         509.644 m
HDOP       :             1.4
VDOP       :             3.6
CONT COORD      VELCY      TARGT
```

Local Time - The local time is displayed followed by the time latency to UTC in brackets.

The position is then given. Use the **COORD** (**F2**) key to switch between WGS84 geodetic/Cartesian and local coordinates. Note that local coordinates are only available if a local coordinate set has been defined.

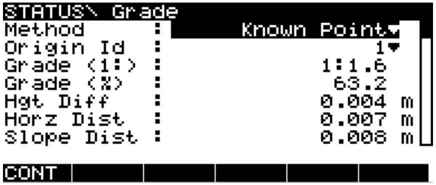
Accuracy indicators for the current position in horizontal and vertical components are given.

Press **VELCY** (**F4**) to view velocity information. Your velocity in the horizontal and vertical directions is given together with the bearing for the horizontal direction.

Press **TARGT** (**F6**) to define and navigate to a target. All functions are available as in Real Time Point Stakeout except for the fact that positions cannot be recorded.

When working in advanced rover mode, you may use the **BLINE (F3)** key to see information about the baseline. Baseline information, however, can only be displayed if the reference coordinate is sent as part of the data format used for broad-casting.

In the rover advanced mode, you may also use the **GRADE (F5)** key. In the subsequent panel STATUS\ Grade, information about the grade between an origin point and the current rover position is displayed based on four different methods.



According to the update rate, the individual values are updated automatically. Note that the highest update rate in this panel is 1 second even though the general update rate might be set to a value < 1 second.

To define the method, highlight the **Method** field and press **ENTER**.

Known Point - The origin point of the grade is a selected known point.
Last Point - The origin point of the grade is the last measured point.
Distance - The origin point of the grade is not a fixed point as it is the case with the Known Point or Last Point method. It is updated with the current rover position after the rover has been moved over a certain distance. The application starts when a distance has been entered. The rover position at that time is taken as the first origin from where the grade is calculated.
Time - The origin point of the grade is not a fixed point as it is the case with the Known Point or Last Point method. It is updated with the current rover position after a certain time interval. The application starts when a time has been entered. The rover position at that time is taken as the first origin from where the grade is calculated.

Origin Id - Available for the methods Known Point and Last Point. This is from where the grade is calculated. With Known Point, select from the list of known points in the current job. With Last Point, the point ID of the last measured point is automatically displayed.

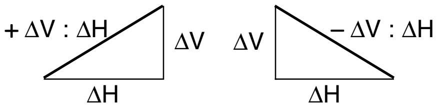
Distance - Available for the method Distance. Set a distance in meters after which the position of origin is updated.

Time - Available for the method Time. Set a time intervall in seconds after which the position of origin is updated.

Grade <1:> - Grade between the first point and the current rover position.

grade = 1 : slope = $\Delta V : \Delta H$

positive for cut slopes
negative for fill slopes



cut slope **fill slope**

Grade <%> - Grade between the first point and the current rover position in percent.

Hgt Diff - Orthometric height difference between the origin point and the current rover position. If the orthometric heights are unavailabel, the height difference refers to the local ellipsoid. Should this not be available either, the WGS84 ellipsoidal is used instead.

Horz Dist - Horizontal grid distance between the origin point and the current rover position. If local grid coordinates are unavailable, thehorizontal distance refers to the local ellipsoid. Should this not be available wither, the WGS84 ellipsoid is used instead.

Slope Dist - Slope distance between the origin point and the current rover position in local grid. If local grid is unavailable, local ellipsoidal coordinates are used instead. Should those not be available either, the WGS84 ellipsoidal coordinates are used.

Bearing - Bearing between the origin point and the current rover position. Displayed if the method is Known Point or Last Point.

Information about the raw GPS data logging is given.

```
STATUS\ Logging
Logging          :        YES
Moving Obs       :         34

All Static Obs   :          7
All Moving Obs   :         36

# DB Pts         :         87
# Auto Pts       :          7

CONT          FILES       REF
```

Logging - Indicates whether raw GPS data logging is active or not.

StaticObs/Moving Obs - The number of Static or Moving observations (epochs) recorded in this interval. Static or Moving Obs are displayed depending on the current measuring mode.

All Static Obs - The total number of static observations (epochs) recorded in the current Job.

All Moving Obs - The total number of moving observations (epochs) recorded in the current Job.

 # DB Pts - Total number of points contained in the Job's database, i.e. manually recorded points as well as Auto-Points.

 # AUTO Pts - The number of points that have been recorded automatically in the current track, i.e. the current START-STOP sequence.

Use the **FILES** (**F4**) key to view information about the logged data files.

```
STATUS\ Logged data files
Current Job  :          Default
# / Size Pts:   12 /      15 KB
Size Obs     :              9 KB
Total Size   :             30 KB

Other Jobs   :            -----
Memory Free  :           1.9 MB

CONT
```

Current Job - The name of the currently selected Job.

 # / Size Pts - The number of and memory occupied by the points in the current Job.

Size Obs - The memory occupied by the raw GPS data in the current Job.

Total Size - The memory occupied by the current Job.

Other Jobs - The memory occupied by all other jobs on the current memory device.

Memory Free - The amount of free memory on the current memory device.

The **REF** (**F6**) key is available when the Receiver is configured as a real-time rover.

Pressing this key gives information about the logging status on the Reference station.

Information about the satellites is given.

STATUS\ Satellite

Sat	Elev	Azi	SN1	SN2	QI1	QI2
13	↑ 80	3	51	51	99	99
27	↑ 79	188	51	51	99	99
10	↑ 65	283	50	51	99	99
19	↓ 52	61	49	50	99	99
18	↓ 25	92	45	47	99	92
24	↓ 24	233	44	46	99	92

CONT | TRACK | | HELTH | SKY | REF

Sat - The PRN number of each observed satellite is given.

Elev - The elevation of the satellite above the horizon is given together with the direction in which it is moving (rising or setting).

Azi - The azimuth of the satellite is given.

SN1 & **SN2** - The signal to noise ratio on L1 (SN1) and L2 (SN2) is given.

QI1 & **QI2** - The quality indicator of the phase measurement reconstruction is given for L1 (QI1) and L2 (QI2).

TRACK (**F2**)

Allows toggling between elevation/ azimuth and tracking/searching information.

STATUS\ Satellite

Sat	L1	L2	SN1	SN2	QI1	QI2
13	TR	TR	51	51	99	99
27	TR	TR	51	51	99	99
10	TR	TR	50	51	99	99
19	TR	TR	49	50	99	99
18	TR	TR	45	47	99	92
24	TR	TR	44	46	99	92

CONT | EL/AZ | | HELTH | SKY | REF

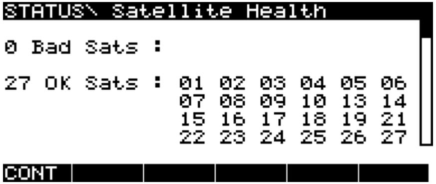
Sat - The PRN number of each observed satellite is given.

L1 & **L2** - The tracking status of each satellite. **TR** = Tracking, **SH** = searching.

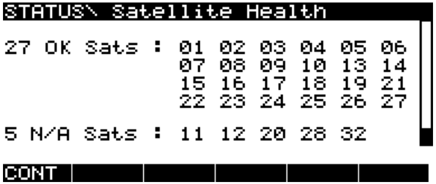
SN1 & **SN2** - The signal to noise ratio on L1 (SN1) and L2 (SN2) is given.

QI1 & **QI2** - The quality indicator of the phase measurement reconstruction is given for L1 (QI1) and L2 (QI2).

HELTH (**F4**)

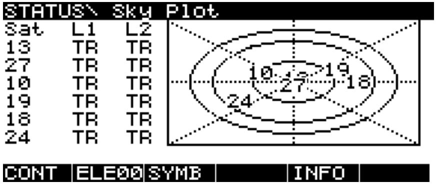


Press cursor down key.



The PRN numbers of Bad (unhealthy) satellites, OK (healthy) satellites and satellites for which no data is available are listed.

SKY (**F5**)



Displays a sky plot showing positions of the satellites and related information of the highest 6 satellites.

On the graphic, north/south corresponds the central vertical line. The rings show the elevations of 15, 30 and 60° from the outside to the inside. The satellites are shown in their relative positions.

ELE00 (**F2**) - Sets the elevation mask to 0 for this panel only in order that you may view the satellites below the cutoff mask. This key then changes to **ELExx** which enables you to set the elevation mask back to its original value.

SYMB (**F3**) - Toggles the display of the satellites in the graphic to satellite symbols.

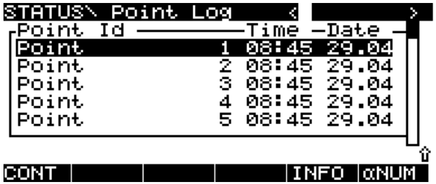
INFO (**F5**) - Toggles the displayed satellite information between tracking information, Signal to Noise Ratio and Quality Indicator Information.

REF (**F6**)

This key is available when the Receiver is configured as a real-time rover.

Pressing this key gives information about the satellites being tracked at the Reference station.

A log of all points in the currently selected job is displayed in order of time.



Further information is available by pressing the **INFO** (**F5**) key.

The column **Crd Source** appears and displays the source of the coordinates for each point.

Calculated - calculated from other sets of coordinates. E.g. via COGO routines or averaged.
GPS Navigtd - GPS navigated position.
PPRC Code - Post processed GPS code only.
PPRC flt ph - Post processed GPS phase float position (ambiguities not resolved).
PPRC fix ph - Post processed GPS phase. Ambiguities fixed.
RTME Code - Real Time GPS position code only.
RTME fix ph - Real-Time GPS phase position. Ambiguities fixed.
GPS RTCM - Real Time GPS position from RTCM code corrections.
Unknown - Unknown source.
User enterd - coordinate entered by user.

Pressing **INFO** (**F5**) again reveals the **CQ** (coordinate quality) in and the coordinate class. The coordinate class may be either:

MEAS - Point measured once
AVRG - Point measured more than once and coordinates averaged.
CTRL - Point user entered or held fixed with no accuracy matrix.

10.7 Code Log Status

The last 5 codes that have been used from the current codelist are displayed. Should you select a different codelist for use, this log will be cleared.

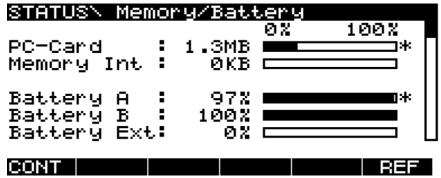
Pressing **INFO** (**F5**) reveals the time at which the code was recorded.

10.8 Message Log Status

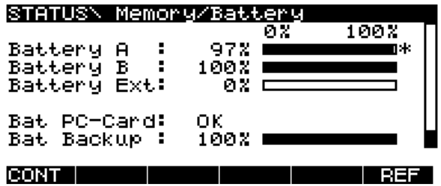
The last 100 messages displayed on the terminal are listed in order of time (most recent first). This log can only be deleted by pressing **DEL-A** (**F4**).

Pressing **INFO** (**F5**) reveals the time and date that the message appeared.

10.9 Memory/Battery Status



Press cursor down.



PC-Card - Amount of memory remaining on the PC-card.
Memory Int - Amount of memory remaining on the internal memory.

Battery A - amount of charge remaining in internal battery A.

Battery B - Amount of charge remaining in internal battery B.

Battery Ext - Amount of charge remaining in the external battery.

Bat PC-Card - Battery status of the SRAM PC Card battery. The three status levels are **OK**, **Low** and **Error**. Note that you should change the PC-Card Battery when it becomes Low. Failure to do so may result in loss of data. Ensure that any data on the card is backed up before changing the battery. PC Flash Cards do not use a battery.

Bat Backup - Receiver system backup battery. When this battery becomes low, contact your Leica representative to arrange replacement.

In case of a Real-Time Rover you may press **REF (F6)** to display the Memory and Battery Status of the Reference Station.

10.10 Sensor Status

```
STATUS\ General
Sensor Type   :        SR530
Sensor Serial#:     19981224
Control Mode  :        TR500
Primary Port  :     Terminal
PPS           :          YES
Event Input   :          YES
CONT
```

The Receiver model used and its serial number are displayed.

Control Mode- Displays the device that is used to control the sensor. Normally this the TR500.

Additionally it indicates whether the **PPS** output and the **Event Input** ports are available.

10.11 Software Version Status

Displays the **Firmware** version, the **Boot** software of the sensor, **Measurment Engine** software, **Measurement Engine Boo**t software and the Firmware for the **Keyboard / Display** (TR500) currently installed.

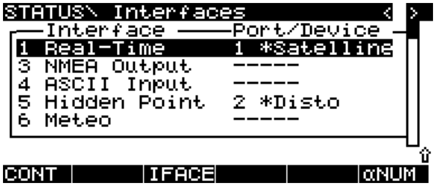
MORE (F6) provides information on special software settings.

10.12 Interfaces Status

Gives an overview of all interfaces and the port and device currently assigned for that interface.

For example, a sensor is being used as a real time rover with a Satelline radio attached to port 1 and hidden points are being collected using a DISTO connected to port 2.

The NMEA output and the ASCII Input are not currently configured.



For this type of operation, the Interfaces panel would look as shown above.

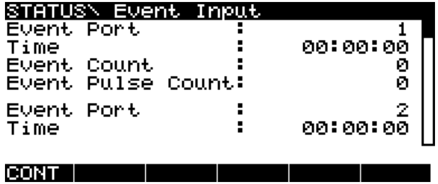
To get detailed information on the status of single interfaces press the **IFACE** (**F3**) button. Specific status information is available for the following interfaces.

Real-Time - Pressing **IFACE** (**F3**) allows you to view the Real-Time Input status. For details see chapter 10.1.

ASCII Input - Pressing **IFACE** (**F3**) allows you to view the ASCII Input status.

For each annotation you may either view the given description or the last received ASCII string specified by the Message Id. Toggle between both views by pressing **DATA**/**DESCR** (**F3**).

Event Input - Pressing **IFACE** (**F3**) allows you to view the Time, Event Count and Event Pulse Count for the selected port(s).



For further details about Status information for the different devices please refer to Appendix H.

11.1 Determining a Coordinate System

Applications contains a number of miscellaneous functions that are not necessarily related.

From within this menu item you may determine coordinate systems, carry out point management functions, access an on-board calculator, define wake-up sessions and access any of the standard and/or optional application programs (assuming the security code has been entered).

For further description of the optional Application programs please refer to the appropriate manuals.

GPS gives coordinates relative to a global datum known as WGS84. This coordinate datum is however relatively new in terms of the length of time that people have been giving specific points coordinates. The WGS84 datum is therefore not used as the datum for coordinates in the vast majority of countries around the world.

As surveying developed through the centuries, individual countries adopted datums that best suited their individual requirements.

Therefore when surveying with GPS, coordinates are first obtained relative to the WGS84 datum. These coordinates then have to be transformed into the local coordinate system.

There are several methods by which this can be done. One is the Helmert approach where the coordinates are transformed from the WGS84 Datum to the local ellipsoidal datum and then a map projection is applied to obtain grid coordinates. Other methods involve transforming the coordinates directly from WGS84 into a local grid.

System 500 receivers contain three different methods: the Helmert method, the 1-Step method and the 2-Step method. The method used depends on the results required and the quality and extent of known points.

Which method to use?
This question largely depends on local conditions and information.
If you wish to keep the GPS measurements totally homogenous and the information about the local map projection is available, the Classical 3D approach would be the most suitable.

For cases where there is no information regarding the ellipsoid and/or map projection and/or you wish to force the GPS measurements to tie in with local existing control then the One Step approach may be the most suitable.

The 2-Step approach takes the local ellipsoid and map projection into account and can therefore be used for larger areas than 1-Step trans-formations. Compared to the Classical 3D approach it treats position and height information separately, which allows for position only control points to be used as well.

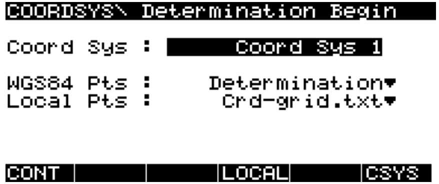
In order to determine a Coordinate System, you will require the coordinates of points in both the WGS84 and local coordinate system. Depending on the type of transformation you wish to use, you may also need details of the map projection, local ellipsoid and a local geoidal model program.

1. 3D Helmert Transformation: Ellipsoid and Projection must be known, Geoid information is optional.

2. 1-Step Transformation: Geoid information is optional, no other information is required.

3. 2-Step Transformation: Ellipsoid, Projection and a Pre-transformation must be known, Geoid information is optional.

From the Application Menu, select **Determine Coord System** and press **CONT** (**F1**).

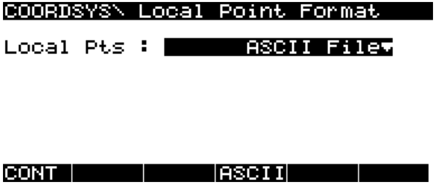


Coord Sys - Type in a new name for the new coordinate system.

WGS84 Pts - Select the Job from which the points with WGS84 coordinates will be taken.

Local Pts - Select the Job or ASCII file from which the points with local coordinates will be taken.

Use **LOCAL** (**F4**) to define the source of the local coordinates (from Job or ASCII).



When ASCII is selected, the **ASCII** (**F4**) key is available. Use this key to define the format of the ASCII file.

When you have selected the source for the local points Press CONT (F1) until you return to the COORDSYS\ Determination Begin screen.

Use the **CSYS** (**F6**) key to view the list of current Coordinate Systems.

Use **NEW** (**F2**) to define a new coordinate system. Note the difference between define and determine. Here you can define a Coordinate System using an existing transformation. When you determine a Coordinate System you also determine a new transformation using point data.

If you have known parameters for the Coordinate System, you may enter them directly in CONFIG\Survey\Position.

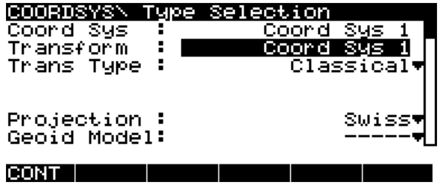
Use **EDIT** (**F3**) to edit the selected Coordinate System.

Use **DEL** (**F4**) to delete the selected Coordinate System.

Use **INFO** (**F5**) to display the date when each coordinate system was created.

Press **CONT** (**F1**) to return to the COORDSYS\ Determination Begin screen.

Press **CONT** (**F1**) to proceed with the Coordinate System Determination.



Coord Sys - The name of the Coordinate System is displayed.

Transform - Define the name of the Transformation. By default the same name as the Coordinate System will be suggested. Type in a new one if required.

Trans Type - Select the type of transformation to be determined. Classical is the 3D Helmert type transformation, One Step is a transformation type where no information about local ellipsoid or map projection is required.

2-Step is a transformation type where information about the local ellipsoid, map projection and a pre-transformation is required.

Pre-Transf - Available only if a 2-Step transformation type is selected. It is a preliminary 3D transformation which is used together with the selected projection to obtain preliminary grid coordinates to be used for a final 2D transformation. Select a pre-transformation from the list or open the list and enter a new transformation by pressing **NEW** (**F2**).

Ellipsoid - Available if a classical or a 2-Step transformation and a standard projection type is defined. Select the ellipsoid on which your local coordinates are based. Open the list and press **DEFLT** (**F5**) to reveal all of the available ellipsoids. If your ellipsoid is not listed, you may add it to the list by pressing **NEW** (**F2**) and entering the parameters.

Press **CONT** (**F1**) to return to COORDSYS\Type Selection.

Projection - Available if a Classical or a 2-Step Transformation Type is selected. Select the Map Projection from the list or open the list and input the parameters for your local map projection, (see box over). When used for the first time, this list will contain only non-standard map projections.

Non - standard map projections available include:
Czech and Slovak
Danish Bornholm
Danish Jylland
Danish Sjelland
Dutch RD Stereographic
Finnish KKJ
Hungarian
Malaysian
New Zealand
Romania Stereo 70
Swiss
Swiss 95

Geoid Model - If a Geoid Model is to be applied, press **ENTER** and select it from this list.

Geoid Model Field Files can be exported from SKI-Pro onto the PC-card or internal memory in the Data\GPS\Geoid sub-directory. They can either be transfered to the System RAM or be read directly from the PC- card.

Use **PCARD (F2)** to update the list with Geoid Model Field Files existing on the PC-card.

To edit the name of the Geoid Model press **EDIT (F3)**.

Use **INFO (F5)** to see where the geoid model is stored, which ellipsoid the model is based on and the date and time of creation.

Use **SHIFT + PARAM (F5)** to view the parameters defining the Geoid Model Field File.

Press **CONT** (**F1**) to return to COORDSYS\Type Selection.

For detailed information on Geoid Models, please refer to the SKI-Pro Online Help.

CSCS Model - If a CSCS Model is to be applied, press ENTER and select it from this list.

CSCS Model Field Files can be exported from SKI-Pro onto the PC-card or internal memory in the Data\GPS\CSCS sub-directory.They can either be transfered to the System RAM or be read directly from the PC- card.

Use **PCARD (F2)** to update the list with CSCS Model Field Files existing on the PC-card.

Use **INFO (F5)** to see where the CSCS model is stored and the date and time of creation.

Use **SHIFT + PARAM (F5)** to view the parameters defining the CSCS Model Field File.

Press **CONT** (**F1**) to return to COORDSYS\Type Selection.

For detailed information on CSCS Models, please refer to the SKI-Pro Online Help.

Press **CONT** (**F1**) to proceed.

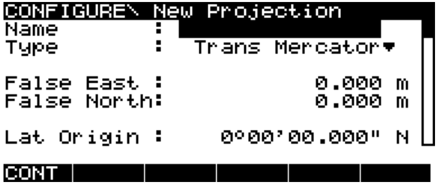
Defining a map projection

Most map projections conform to a standard type and will need to be defined before being used for the first time.

From the COORDSYS\ Type Selection screen, open the **Projection** list.

Press **DEFLT** (**F5**) to reveal all of the available default projections and US State Plane Zones.

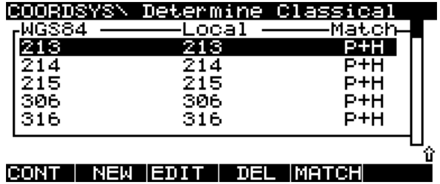
Select **NEW** (**F2**) to enter a new projection set.



Enter the name of your projection and select the type of projection. Although the majority of projections are Transverse Mercator, UTM or Lambert, a variety are available.

Input the parameters of your projection, not forgetting to scroll down the complete list and enter all parameters.

Press **CONT** (**F1**) to continue. The next step in the process is to match the common points.



Points from the two systems with the same point Id will be suggested for matching by default.

If you do not wish to match two points, highlight the point pair concerned and press **MATCH** (**F5**). This key is also used when determining a 1-Step or a 2-Step transformation and you wish to match the points in height or position only.

To match a new coordinate pair, press **NEW** (**F2**) and select the WGS84 and local point to be matched.

New WGS84 points may be measured from here using **NEWOC** (**F5**). Press **CONT** (**F1**) to return to this panel.

To edit an existing coordinate pair, select the pair and press **EDIT** (**F3**). Make any necessary adjustments and press **CONT** (**F1**) to return to this panel.

Use **DEL** (**F4**) to unmatch the selected coordinate pair.

When a Classical type transformation is being selected, the **PARAM** (**F5**) key is available after pressing **SHIFT**.

This enables you to define the type of transformation model and the parameters for the transformation.

Trans-model - Select the type of transformation model you wish to use. In practice, you will only see minimal differences in the transformed coordinates between each model. In principle **Molodensky - Badekas** is more numerically stable due to the fact that it takes its rotation origin from the center of gravity of the WGS84 coordinates. **Bursa - Wolf** takes its centre of gravity from the origin of the WGS84 datum.

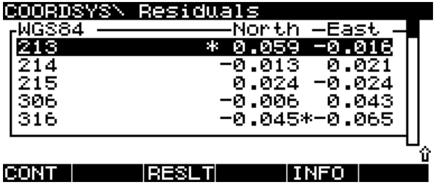
You may then (if required) either enter known values for certain parameters and hold them fixed at those values or set the values to 0. Parameters that have the **-----** displayed will be calculated.

To hold a parameter fixed, highlight it. The **FIX** (**F4**) key will become available. Type in the fixed value. In order that the parameter is simply not calculated, enter 0.

To reset a fixed parameter, in order that it will be calculated, select the parameter and press **ADJST** (**F4**).

Press **CONT** (**F1**) to return to the previous screen.

Press **CONT** (**F1**) to execute the transformation calculation.



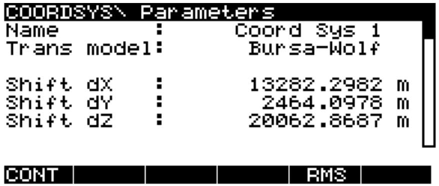
The residuals of the transformation are displayed. This is the difference between the transformed WGS84 coordinates and the original coordinates in the local system.

Values that are marked with a star indicate where the highest residuals lie.

Use **INFO** (**F5**) to view the height residuals.

Use **RESLT** (**F3**) to view the transformation calculation result (the calculated transformation parameters). The information given will differ with the type of transformation performed.

Classical Transformation Results



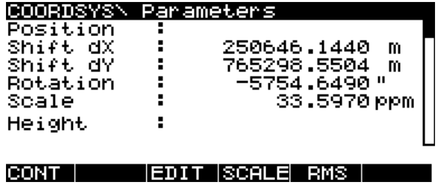
The **Name** and Trans formation Model (**Trans model**) used are displayed.

Then the calculated translation parameters are displayed.

Shift dX, **dY**, **dZ** - Shift along X, Y and Z axes.

Rotation X, **Y**, **Z** - Rotations about X, Y and Z axes.
Scale - Scale factor between the two datums.

1-STEP/ 2-STEP Transformation Results



The transformation is split into a 2D Helmert transformation for position and a Height Interpolation.

For a 1-Step transformation the center of gravity of the points on the WGS84 Datum is calculated. A temporary central meridian is then constructed through this center of gravity and a Transverse Mercator projection applied.

continued...

For a 2-Step transformation first the pre-transformation is applied to obtain auxiliary cartesian coordinates. Then the specified map projection is applied on the given ellipsoid.
For both methods this results in a temporary auxiliary grid. A 2D Helmert transformation is then performed between the auxiliary grid and the given local system.

The position transformation results are given first.

Shift dX, **dY** - Shift along the X and Y axes.
Rotation - Rotation about the Z axis.
Scale - Scale factor between the two datums.

Then the Height transformation information is given.

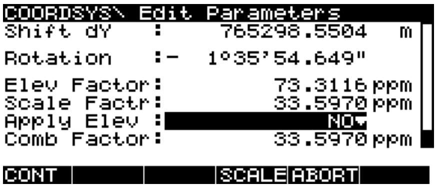
Slope dH/dX / dH/dY - Slope of the height interpolation plane when looking along the X or Y axis.

Shift H0 - Height of the interpolation plane at the point it intersects the Z axis.
Origin X0, **Y0** - Coordinates of the center of gravity of points in the auxiliary local grid.

Use the **RMS** (**F5**) key to display calculated accuracies for each of the transformation parameters.

Use the **SCALE**/ **ppm** (**F4**) key to switch between ppm and scale factor values.

Use the **EDIT** (**F3**) key if you wish to edit the previously calculated 1-Step or 2-Step parameters.



Shift dX, dY, Rotation, Scale Factr - The position transformation results can be edited if required. This may be necessary in some circumstances where you have computed a One Step transformation, but still wish to use a specific scale or rotation for example.

Elev Factor - Displays the elevation factor calculated from the ellipsoidal height(s) of the common point(s).

Apply Elev - If set to YES the **Comb Factor** will be calculated as **Scale Factor** x **Elev Factor.** If set to NO the **Comb Factor** will be equal to the **Scale Factor** of the original calculation.

In COORDSYS\ Edit Parameters press **ABORT** (**F5**) to go back without any changes or press **CONT** (**F1**) to accept the Comb Factor and the other 1-Step/ 2-Step parameters you have changed.

In COORDSYS\ Parameters press **CONT** (**F1**) to proceed.

```
COORDSYS\ Save Coord System
Coord Sys :      Coord Sys 1
Trans Type:        Classical
Residuals :       By 1/Dist▼
#Match Pts:                7
Max Res E :            0.049  m
Max Res N :            0.057  m
Max Res H :            0.123  m

CONT
```

An overview of the Coordinate System is given.

Coord Sys - The Coordinate System name.

Trans Type - The type of transformation used.

Residuals - The method by which residuals will be distributed throughout the transformation area is displayed.
This may help the transformation result be more realistic and help disperse any strains in the transformation. **1/Dist**, **1/Dist**^{2} and **1/Dist**$^{3/2}$ distributes the residuals of the control points according to the distance between each control point and the newly transformed point.
Multiquadratic distributes the residuals using a multiquadratic interpolation approach.
The method of distribution is stored with the new coordinate system.

#Match Pts - The number of matched points used in the transformation calculation.

Max Res E, **N**, **H** - The largest residual in East, North and Height.

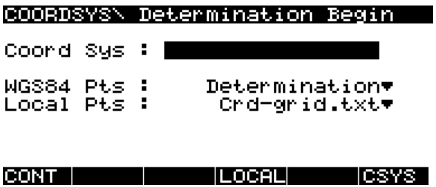
Press **CONT** (**F1**) to save the Coordinate System and return to the Application menu.

11.2 Adding Points to Existing Coordinate Systems

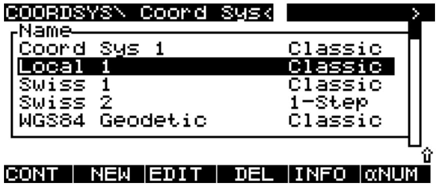
Points may be added to existing Coordinate Systems. This is useful if you have to measure outside of an existing transformation area and therefore need to extend the area by measuring the WGS84 coordinates of a point known in the local system that lies outside of the existing transformation area.

Measure the new point(s) in the same job as the other existing points used to determine the Coordinate System.

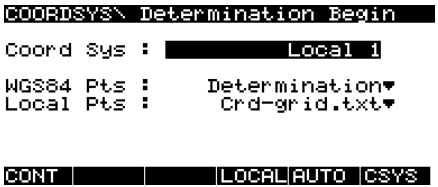
From Applications select Determine Coordinate System.



Press **CSYS** (**F6**) to list the Coordinate Systems available.



Select the Coordinate System that you wish to include new points in. Press **CONT** (**F1**).

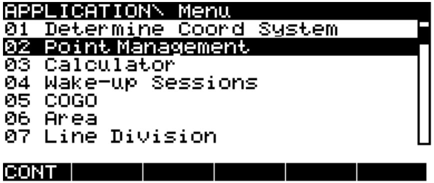


Now you have two choices. You may either automatically match the new points and calculate the new parameters by pressing **AUTO** (**F5**). Alternatively, you may proceed manually through the Coordinate Determination as described in the last section.

When adding new points manually, the points matched in the previous parameter calculation are recalled and used again, even if they did not have matching point Ids. The new point(s) have to be selected by you using the **NEW** (**F2**) key.

When **AUTO** (**F5**) is pressed, the coordinates that were matched in the previous parameter calculation are recalled and used again, even if they did not have matching point Ids. The new point(s) that have identical point Ids will be matched and included in the computation. You are then presented with the results. Press **CONT** (**F1**) to accept them or, if there is a problem, press **ESC** to return to the Determination Begin screen and recompute manually.

Enables you to manage the points contained in the currently selected Job. You may also set a point filter according to varying criteria.



Select **Point Management** and press **CONT** (**F1**).

Each point is displayed with the time and date on which it was recorded. Note that automatically recorded points will only be displayed if **Store Pt Db** is set to **YES** in the CONFIGURE\ Position Logging panel (see chapter 5.4 for details). Coordinates for the same point recorded on different datums are displayed separately. Each point is displayed with its highest Point Class only.

Press **INFO** (**F5**) to reveal the Crd Source - the source from which the coordinates were generated.

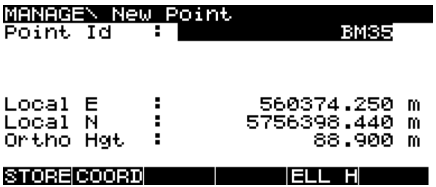
Calculated - calculated (WGS84) from other sets of coordinates.

Calc (Grid) - calculated (Grid) from other sets of Coordinates. E.g. via COGO routines.
GPS Navigtd - GPS navigated position.
PPRC Code - Post processed GPS code only.
PPRC flt ph - Post processed GPS phase float position (ambiguities not resolved).
PPRC fix ph - Post processed GPS phase. Ambiguities fixed.
RTME Code - Real Time GPS position code only.
RTME fix ph - Real-Time GPS phase position. Ambiguities fixed.
GPS RTCM - Real Time GPS position from RTCM code corrections.
Unknown - Unknown source.
User enterd - WGS84-coordinate entered by user.
User (Grid) - Grid coordinates entered by user.

Pressing **INFO** (**F5**) again reveals the **CQ** (coordinate quality) and the coordinate class. The coordinate class in ascending order may be:

MEAS - Point measured once
AVRG - Point measured more than once and coordinates averaged. Regardless of whether **Avg** or **Abs** is selected in the Threshold settings, points with more than one associated measured point will still be shown as average here.
CTRL - Point user entered or held fixed with no accuracy matrix.

Use **NEW** (**F2**) to enter a new point. Enter the new point Id and the coordinates. Use the **COORD** (**F2**) key to switch between Coordinate Systems.



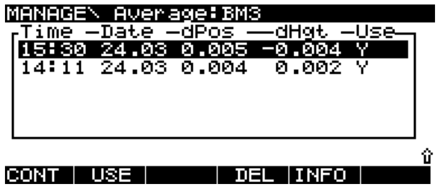
If the panel shows local grid coordinates you may use the **ELL H**/ **ORTHO** (**F5**) key to switch between entering orthometric or local ellipsoidal heights.
When you have entered the point details press **STORE** (**F1**) to store the point and return to the previous screen.

Use **EDIT** (**F3**) to view the coordinates and point annotations of a selected point or to edit the point ID. Unless set otherwise, the coordinate displayed is that which corresponds to the highest coordinate class available.

Use the **COORD** (**F2**) key to switch between Coordinate Systems.

Use the **INFO** (**F5**) key in the same way as in the MANAGE screen to switch the information displayed about the point.

Additionally, when a Configuration Set is being used where Advanced mode is set, the averaging functionality in Threshold Settings is set to **Avg** and the point contains more than one measurement, the **AVRG** (**F6**) key is available.

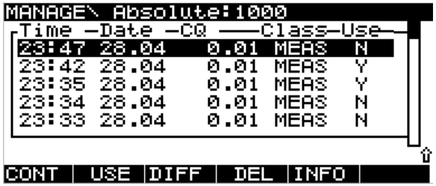


Press **USE** (**F2**) to either select or deselect measurements from the averaged coordinate.

Press **DEL** (**F4**) to delete single measurements.

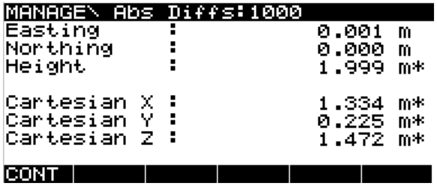
When you have finished editing the coordinates, press **STORE** (**F1**) to store the point and return to the list of points of the current job.

When a Configuration Set is being used where Advanced mode is set, the averaging functionality in Threshold Settings is set to **Abs** and the point contains more than one measurement, then the **ABS** (**F6**) key is available.



Press **USE** (**F2**) to include or exclude a measurement from calculating the absolute coordinate difference. An absolute coordinate difference can only be calculated between two measurements.

Press **DIFF (F3)** after having set the use flag for two measurements, to display the absolute coordinate differences.



The absolute differences for Easting, Northing and Height can only be displayed if the survey is carried out in a local coordinate system.

An asterisk identifies those which exceed the threshold settings.

CONT (F1) returns you to the previous screen.

Press **DEL** (**F4**) to delete single measurements.

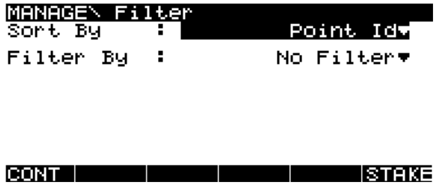
CONT (F1) to return to Edit Point screen.

CONT (F1) returns to the listing of points of the current job.

When **SHIFT** is pressed the **JOB (F3)** key enables you to change the current job. Note - this function is not available if you access Point Management with a Hot-Key.

When **SHIFT** is pressed the **FILT** (**F6**) key is available along with the standard **HOME**, **END**, **PG UP** and **PG DN** keys.

Use **FILT** (**F6**) to order the points and to apply a filter to the points.



Sort By - Sets the method by which the points are ordered. **Point Id** sorts alphabetically, **Time** by the time the point was calculated and **Internal Index** by the order in which they are stored on the memory device.

Filter By - Sets a filter on the points contained in the Job. Used if you only want to display points belonging to a specific subset. Note that when set, the filter also applies to every screen on the list where you can access the point list.

No Filter - No filter set. The occupation with the highest class that exists for each point is displayed. (Class is in following descending order: CTRL, AVRG, MEAS).

Radius from Pt - Enables you to filter by selecting a point and all points within a defined radius from it.

Closest Pt - Used in Stakeout. When selected, finds the closest point to your current position, then finds the closest point to that and so on. The points are then ordered thus so that in Stakeout you are always sure that you are taking the most efficient route.

Range of Pt Id's - Define a start and end Point Id. Only points that fall either alphabetically or numerically within this range will be available.

Pt Id Wildcard - Specify a wildcard that you wish the point Id to contain. E.g. ***NT will look for all points with 5 characters ending in NT.

Only points that contain this wildcard will then be available.

Time - Specify a start and end date and a start and end time. Points that were recorded outside of this time window will not be available.

Class - Select a point class. All points that are not in this class will not be available. Note that when class MEAS is selected, points with class AVRG will be split into their MEAS components and be displayed separately.

Coordinate Type - Select the type of coordinates you wish to make available - WGS84 only, Local only or WGS84 and Local.

Code - Select the Code(s) for the points that you wish to make available. All points that do not have those codes attached will not be available. Press **CODES (F3)** to toggle the use status of individual Codes to YES or NO.

Layer - Select the Layer(s) for the points that you wish to make available. All points that do not have those Layers attached will not be available. Press **LAYERS (F5)** to toggle the use status of individual Layers to YES or NO.

By pressing **STAKE (F6)** you may select an additonal stake out filter. The options No Filter, Points to Stake and Staked Points are available.

When you have set the required Filter press **CONT** (**F1**) to continue.

11.4 Calculator

The Calculator functions according to the RPN principle. This has the advantage that complicated calculations require less keystrokes. It is available for any calculation you wish to make.

11.5 Wake-up Sessions

You may program the Receiver to automatically start, measure and then shut down again without any interaction from an operator. You may define several Wake-Up Sessions in order that the Receiver will make several measurements automatically one after the other.

```
APPLICATION\ Menu
01 Determine Coord System
02 Point Management
03 Calculator
04 Wake-up Sessions
05 COGO
06 Area
07 Line Division

CONT
```

Select **Wake-up Sessions** from the APPLICATION menu.

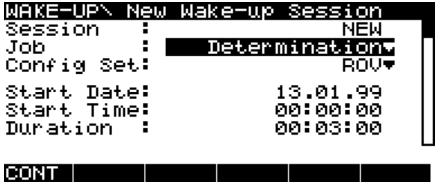
Any existing Wake-up Sessions are displayed.

Use **NEW** (**F2**) to enter a new Wake-up Session.

Use **EDIT** (**F3**) to edit an existing Wake-up Session.

Use **DEL** (**F4**) to delete an existing Wake-up session.

When **NEW** (**F2**) is pressed the following screen appears.



Job - Select the job which should be used to record the point(s)/data.

Config Set - Select the Configuration Set which should be used.

Start Date - Enter the date when the Session should start.

Start Time - Enter the Start Time when the Session should start.

Duration - Enter the duration of the Session.

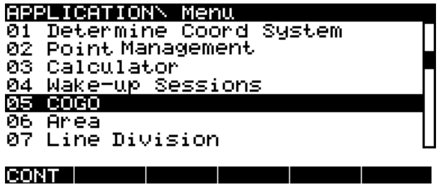
Point Id - If the wake-up session will be carried out on a known point, select it from the listbox. If it will be carried out on an unknown point, leave it set at **---**. Define a Point Id template in the Configuration Set. Define a name alone, without any automatic increment if you always wish the point to have the same point ID. Define a name with an automatic increment if you wish the point to have a different Point ID for each wake-up session.

Ant Height - Enter the height of the Antenna above the point.

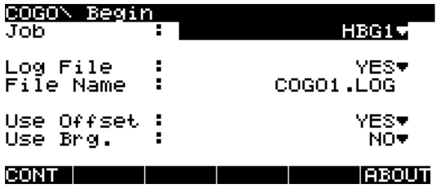
 # Execute - The number of times that you wish to repeat this Wake-Up session.

Interval - Appears when **# Execute** is set to a value greater than 1. Defines the time interval that must elapse between start times of the different executions of the Session.

The COGO functions enable you to calculate new points using existing data. This existing data may be existing coordinates of points, existing known distances or existing known angles. Instead of using existing points from the Job database, points can be measured on the spot and used for computation.
In order to use the COGO functions local grid coordinates must be available i.e. a local coordinate system must be defined. Only the COGO function ‘Inverse’ can also handle coordinate systems that would not allow the computation of grid coordinates.



Select **COGO** from the APPLICATION menu.



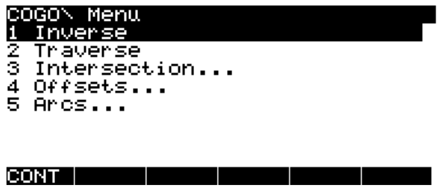
Job - Change the current Job if necessary.

Change **Log File** to YES and enter a **File Name** if you want to generate a log file of all the calculations. The file will be written in the \LOG subdirectory of the PC card or internal memory.

Use Offset - Enables you to activate an additional entry field for a parallel offset whenever a line is to be defined.

Use Brg. - Enables you to enter and display bearings in the four quadrants NorthEast, SouthEast, SouthWest and NorthWest. If this option is set to YES and a bearing needs to be entered the function key QUAD (F6) enables you to switch between the quadrants.

Press **CONT (F1)** will bring you to the COGO menu.



Inverse

This function enables you to calculate the inverse between two grid or two geodetic points. All coordinates used in the program can be entered manually, selected from the database or measured.

```
COGO\ Inverse
Line Pt 1   :            A▼

Line Pt 2   :            B▼




COMP                NEWOC
```

Enter the start point and the end point of the line or press **NEWOC (F5)** to measure new points.

Press **COMP (F1)** to start the computation.

Local coordinate system attached:

```
COGO\ Inverse Results
Point Code   :           ----
Point Id 2   :              B
Point Code   :           ----

Grid Bearing:      156°10'28"
Grid Dist    :         12.520 m
Hgt Diff     :         21.261 m

CONT  GEOD
```

The Grid Bearing (Azimuth), Grid Distance and the Height Difference are displayed.

To display Geodetic Azimuth and Ellipsoidal Distance press **GEOD (F2)**.

```
COGO\ Inverse Results
Point Code   :           ----
Point Id 2   :              B
Point Code   :           ----

Geod Az      :     156°37'19"
Ellip Dist   :         12.527 m
Hgt Diff     :         21.261 m

CONT  GRID
```

To get back to Grid Bearing and Grid Distance then press **GRID (F2)**.

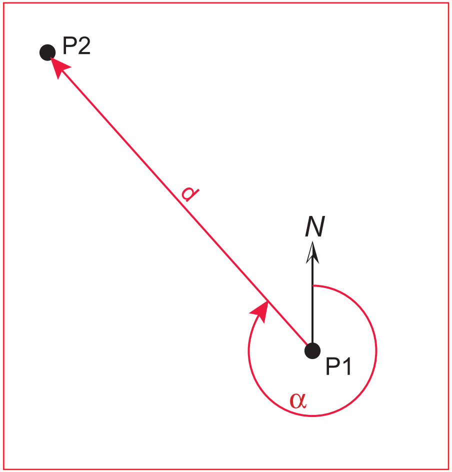
Press **CONT (F1)** to return to the COGO\ Menu.

No local coordinate system attached:

```
COGO\ Inverse Results
Point Code   :           ----
Point Id 2   :              B
Point Code   :           ----

Geod Az      :     156°37'19"
Ellip Dist   :         12.527 m
Hgt Diff     :         21.261 m

CONT
```

The Geodetic Azimuth, Ellipsoidal Distance and the Height Difference are displayed.

Press **CONT (F1)** to return to the COGO\ Menu.



Input:

P1 - Start point of line (E, N, h / Lat, Long, h)

P2 - End point of line (E, N, h / Lat, Long, h)

Output:

α - Grid Bearing / Geodetic Azimuth

d - Grid Distance / Ellipsoidal Distance

- Height Difference

Traverse

This function enables you to calculate one or more new points by defining a start point and entering its distance and azimuth from the start point.

```
COGO\ Traverse
Point Id 1 :                  A▾

Bearing    :          60°06'04"
Parall OS  :            0.000 m
Horz Dist. :           46.141 m

COMP | INV |TRAV |SIDE |     |
```

Enter the start point of the line or press **NEWOC (F5)** to measure a new point. Enter the Bearing (Azimuth), the optional Parallel Offset and the Horizontal Distance. Instead of entering these values manually you may calculate them from two existing points by pressing **INV (F2)**.

Single point computation:

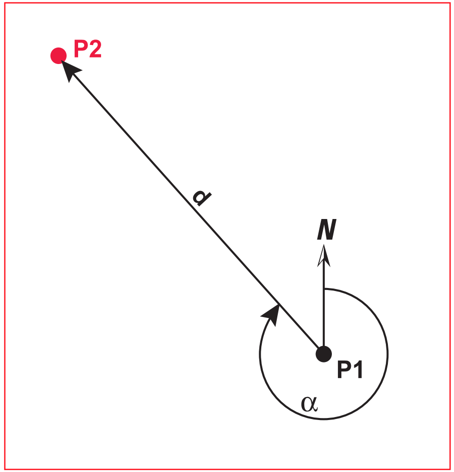
Press **COMP (F1)** to start the computation.

```
COGO\ Traverse Results
Point Id   :                002

Local E    :         6057.101 m
Local N    :         2069.985 m
Ortho Hgt  :          403.754 m

STORE|COORD|     |     |STAKE|
```

Easting, Northing and Height of the new point are displayed.

Enter a Point Id, change the Height if neccessary. Press **STORE (F1)** will bring you back to the COGO\ Menu.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - Start point of line (E, N, h)
α - Bearing (Azimuth)
d - Horizontal Distance

Output:
P2 - End point of line (E, N, h)

Multiple point computation:

Press **TRAV (F3)** to start a sequential traverse.

```
COGO\ Traverse Results
Point Id    :            002

Local E     :     6057.101 m
Local N     :     2069.985 m
Ortho Hgt   :      403.754 m
STORE COORD            STAKE
```

Easting, Northing and Height of the first new point are displayed.

Press **COORD (F2)** to toggle between coordinate types.

Press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.

Alternatively, enter a Point Id and change the Height if neccessary. Press **STORE (F1)** to store the point and continue with the traverse.

The point stored is associated with a traverse execution. Therefore, it is suggested as next start point.

```
COGO\ Traverse
Point Id 1 :            002▼

Bearing    :      90°00'00"
Parall OS  :        0.000 m
Horz Dist. :       25.000 m
COMP  INV  TRAV SIDE
```

Enter the Bearing (Azimuth), the optional Parallel Offset and the Horizontal Distance. Instead of entering these values manually you may calculate them from two existing points by pressing **INV (F2)**.

Pressing **TRAV (F3)** displays the results in the **COGO\ Traverse Results** panel. There, press **STORE (F1)**.

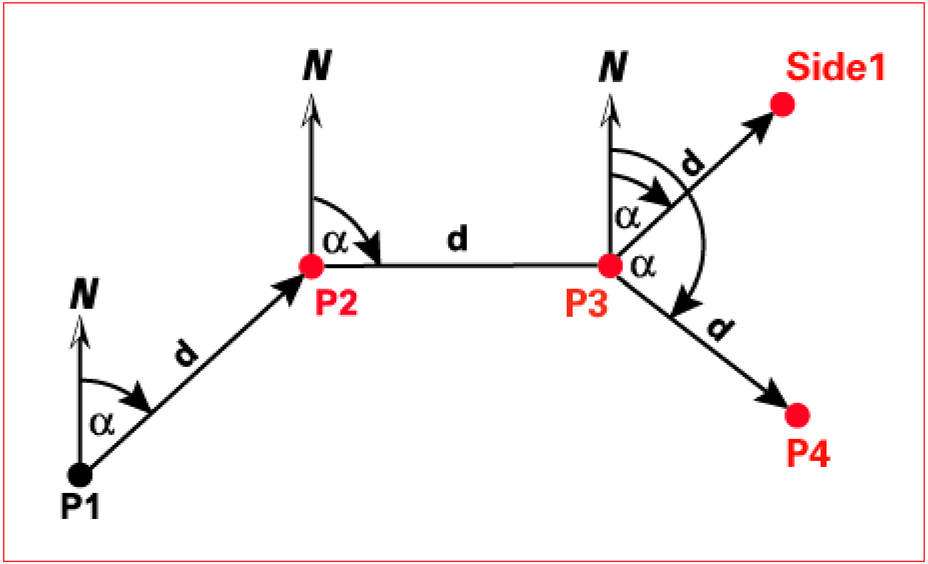
This leads again to the **COGO\ Traverse** panel. Enter another Bearing (Azimuth), the optional Parallel Offset and the Horizontal Distance. Press **TRAV (F3)** to continue the traverse or **SIDE (F4)** for a single side shot.

```
COGO\ Traverse Results
Point Id    :          side1

Local E     :     6104.101 m
Local N     :     2108.090 m
Ortho Hgt   :      403.754 m
STORE COORD            STAKE
```

In the **COGO\ Traverse Results** panel, Easting, Northing and Height of the side shot are displayed. Enter a meaningful point ID and press **STORE (F1)**. Again, this leads to the **COGO\ Traverse** panel.

To add another traverse point or side shot follow the instructions above.

To finish the traverse enter the Bearing (Azimuth), the optional Parallel Offset and the Horizontal Distance for the end point. Press **COMP (F1)** followed by **STORE (F1)** to return to the COGO\ Menu.

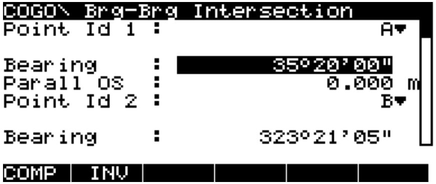


Input:
P1 - Start point of line (E, N, h)
α - Bearings (Azimuths)
d - Horizontal Distances

Output:
P2 - First traverse point (E, N, h)
P3 - Second traverse point (E, N, h)
P4 - Third traverse point (E, N, h)
...
Side1 - Side point (E, N, h)

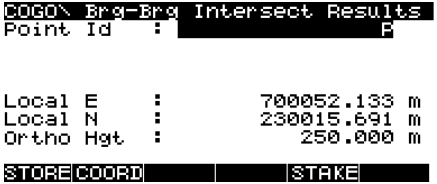
Intersection: Bearing - Bearing

This function enables you to calculate the intersection point of two lines. The lines may be defined by a point and a bearing (azimuth).



Enter the start point of the first line or press **NEWOC (F5)** to measure a new point. Enter the Bearing (Azimuth) and the optional Parallel Offset. Enter the start point of the second line together with the Bearing and Parallel Offset.
Instead of entering these values manually you may calculate them from two existing points by pressing **INV (F2)**.

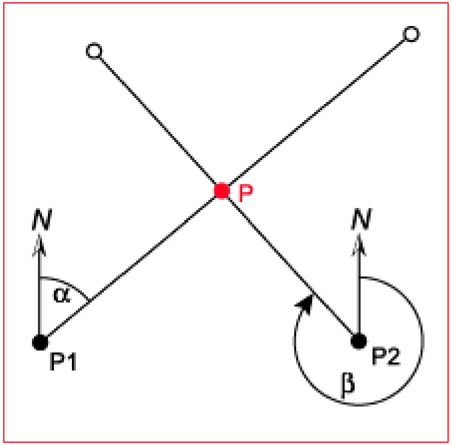
Press **COMP (F1)** to start the computation.



Easting, Northing and Height of the intersection point are displayed.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to COGO\ Intersection.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - Start point of first line (E, N, h)
α - Bearing (Azimuth)
P2 - Start point of second line (E,N,h)
β - Bearing (Azimuth)

Output:
P - Intersection point (E, N, h)

Intersection: Bearing - Distance

This function enables you to calculate the intersection point(s) of a line and a circle. The line is defined by a point and a bearing (azimuth) and the circle by the centre point and the radius.

```
COGO\ Brg-DistIntersection
Point Id 1 :                 A▼

Bearing    :          35°20'00"
Parall OS  :            0.000 m
Point Id 2 :                 B▼

Distance   :           20.000 m

COMP | INV |    |    |    |
```

Enter the start point 1 of the line or press **NEWOC (F5)** to measure a new point. Enter the Bearing (Azimuth) and the optional Parallel Offset. Enter the centre point 2 and the radius (Distance) of the circle. Instead of entering the values manually you may calculate them from two existing points by pressing **INV (F2)**.

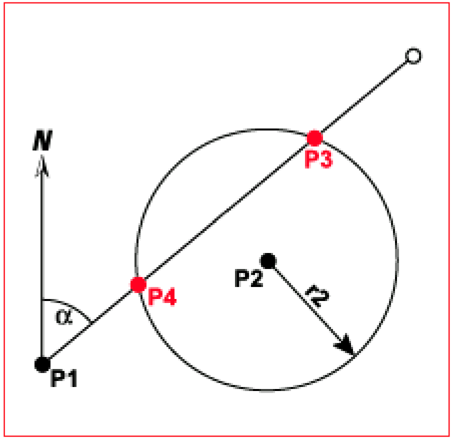
Press **COMP (F1)** to start the computation.

```
COGO\ Brg-Dist  Inters. Results
Point Id   :                  P


Local E    :       700052.133 m
Local N    :       230015.691 m
Ortho Hgt  :          250.000 m

STORE|COORD|OTHER|     |STAKE|
```

Easting, Northing and Height of the first intersection point are displayed. To display the second intersection point press **OTHER (F3)**.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to COGO\ Intersection.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - Start point of first line (E, N, h)
α - Bearing (Azimuth)
P2 - Centre point of circle (E, N, h)
r2 - Radius

Output:
P3 - 1. Intersection point (E, N, h)
P4 - 2. Intersection point (E, N, h)

Intersection: Distance - Distance

This function enables you to calculate the intersection point(s) of two circles. The circles are defined by a the centre point and the radius.

```
COGO\ Dist-Dist Intersection
Point Id 1 :                  A▼

Distance   :             20.000 m
Point Id 2 :                  B▼

Distance   :             30.000 m


COMP | INV |     |     |     |
```

Enter the point 1 of the first circle or press **NEWOC (F5)** to measure a new point. Enter the optional Parallel Offset and the radius (Distance). Enter the values for the second circle. Instead of entering the values manually you may calculate them from two existing points by pressing **INV (F2)**.

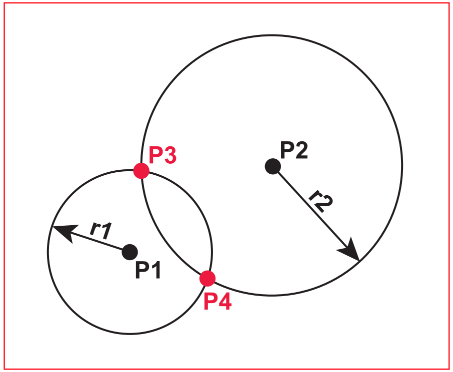
Press **COMP (F1)** to start the computation.

```
COGO\ Dist-Dist Insters. Results
Point Id   :                  P3


Local E    :        700069.384 m
Local N    :        230038.050 m
Ortho Hgt  :           250.000 m

STORE|COORD|OTHER|     |STAKE|
```

Easting, Northing and Height of the first intersection point are displayed. The first intersection point is the point left of the line P1-P2. To display the second intersection point press **OTHER (F3)**.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to the COGO\ Intersection menu.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - Centre point of 1. circle (E, N, h)
r1 - Radius
P2 - Centre point of 2. circle (E, N, h)
r2 - Radius

Output:
P3 - 1. Intersection point (E, N, h)
P4 - 2. Intersection point (E, N, h)

Distance -- Offset

This function enables you to calculate the distance and offset values of an offset point from a line defined by two points, the bearing and distance of the baseline, the location of the offset point in relation to the baseline and the bearing from the offset point to the baseline.

```
COGO\ Offsets
Line Pt 1   :                A▾
Line Pt 2   :                B▾
Offset Pt   :                C▾

COMP |     |     |     |NEWOC|
```

Enter the start and end point of the line or press **NEWOC (F5)** to measure new points. Enter the offset point.

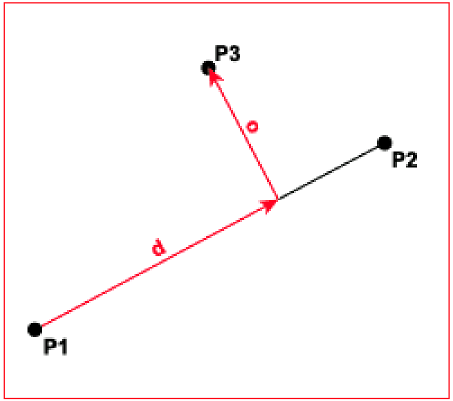
Press **COMP (F1)** to start the computation.

```
COGO\ Offset Results
Line Pt 1   :                A
Line Pt 2   :                B
Offset Pt   :                C

Distance    :         28.749 m
Perp. Dist  :        -17.684 m

CONT |     |     |     |MORE |
```

The Distance along the line and the Perpendicular Distance (Offset) are displayed.
A negative Perp. Dist (Offset) indicates that the point lies on the left hand side of the line P1-P2.
A negative Distance indicates that the point lies behind the start point of the line P1-P2.

Press **MORE (F5)** to display the bearing and the distance from the start point to the end point of the baseline, the location of the offset point in relation to the baseline and the bearing from the offset point to the baseline.

Press **CONT (F1)** to return to the COGO\ Offsets menu.



Input:
P1 - Start point of line (E, N, h)
P2 - End point of line (E, N, h)
P3 - Offset point (E, N, h)

Output:
d - Distance
o - Offset (Perpendicular Distance)

Set Point by Distance -- Offset

This function enables you to calculate a point by using the distance (chainage) and offset values from a line. The line is defined by two points.

```
COGO\ Offset
Point Id 1 :                 A▾

Point Id 2 :                 B▾

Distance   :           46.255 m
Perp. Dist :          -15.230 m

COMP | INV |    |    |    |
```

Enter the first and the second point of the line or press **NEWOC (F5)** to measure new points. Enter the Distance along the line and the Perpendicular Distance (Offset).
Enter a negative Distance if the point lies behind the start point of the line P1-P2.
Enter a negative Perp. Dist (Offset) if the point lies on the left hand side of the line P1-P2.

Instead of entering the values manually you may calculate them from two existing points by pressing **INV (F2)**.

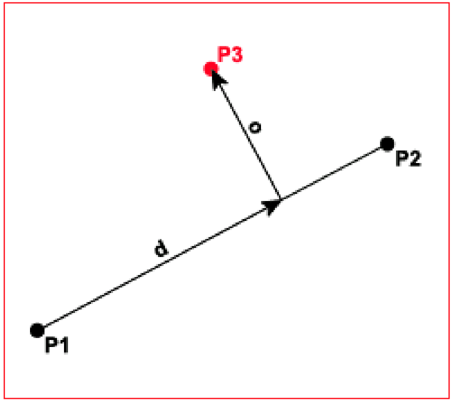
Press **COMP (F1)** to start the computation.

```
COGO\ Offset Results
Point Id    :                P3


Local E     :      700047.493 m
Local N     :      230018.740 m
Ortho Hgt   :         250.000 m

STORE|COORD|     |     |STAKE|
```

Easting, Northing and Height of the offset point are displayed.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to the COGO\ Offset menu.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - Start point of line (E, N, h)
P2 - End point of line (E, N, h)
d - Distance (Chainage)
o - Offset (Perpendicular Distance)

Output:
P3 - Offset point (E, N, h)

3 Point Arc

This function enables you to calculate the centre point and the radius of an arc defined by three points

```
COGO\ 3 Point Arc
Arc Pt 1    :                    A▾

Arc Pt 2    :                    B▾

Arc Pt 3    :                    C▾


COMP |    |    |    |NEWOC|
```

Enter the three points on the arc or press **NEWOC (F5)** to measure new points.

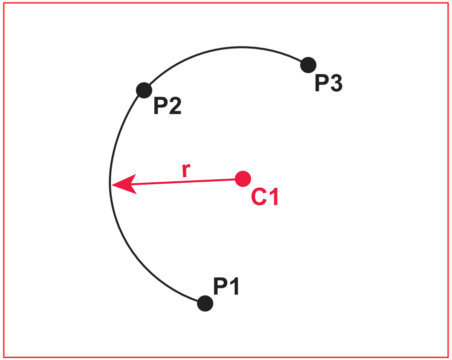
Press **COMP (F1)** to start the computation.

```
COGO\ 3 Pt. Arc Results
Point Id    :                 C1


Local E     :       708681.574 m
Local N     :       215049.457 m
Ortho Hgt   :          250.000 m

STORE|COORD|    |    |STAKE|MORE
```

Easting, Northing and Height of the centre point are displayed. To display the Radius press **MORE (F6)**.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to the COGO\ Arcs menu.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.



Input:
P1 - First point on arc (E, N, h)
P2 - Second point on arc (E, N, h)
P3 - Third point on arc (E, N, h)

Output:
C1 - Centre point of arc (E, N, h)
r - Radius

Distance on Arc

This function enables you to calculate a point on an arc defined by three points and based on the arc distance.

```
COGO\ Distance on Arc
Arc Pt 1    :           A▾
Arc Pt 2    :           B▾
Arc Pt 3    :           C▾
Arc Dist    :      3.500 m
COMP                NEWOC
```

Enter the three points on the arc or press **NEWOC (F5)** to measure new points. Enter the Arc Distance starting from the first point.

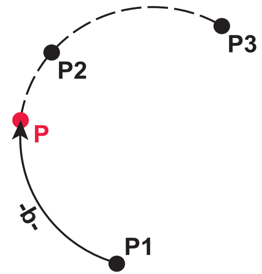
Press **COMP (F1)** to start the computation.

```
COGO\ Dist on Arc Results
Point Id    :                P

Local E     :     708681.574 m
Local N     :     215049.457 m
Ortho Hgt   :        250.000 m
STORE COORD          STAKE
```

Easting, Northing and Height of the new point on the arc are displayed.

Enter a Point Id, change the Height if neccessary and press **STORE (F1)** will bring you back to the COGO\ Arcs menu.

Alternatively press **STAKE (F5)** to switch to the stakeout screen and use the coordinates directly for stakeout.

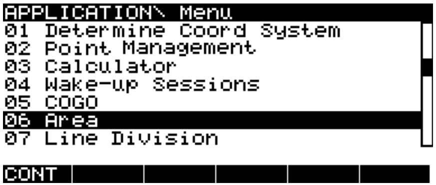


Input:
P1 - First point on arc (E, N, h)
P2 - Second point on arc (E, N, h)
P3 - Third point on arc (E, N, h)
b - Distance on Arc

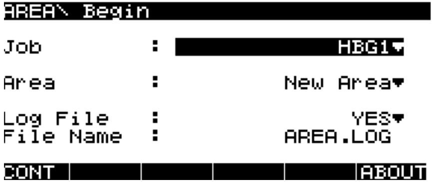
Output:
P - New point on arc (E, N, h)

11.7 Area

The Area function enables you to calculate an area based upon points in the database. The area segments may be defined as lines or arcs. The nodes along the perimeter of the area must be defined clockwise.
In order to use the area function, local grid coordinates must be available i.e. a local coordinate system must be defined.



Select **Area** from the APPLICATION menu.



Job - Change the current Job if necessary.

Area - Select between defining a New Area or modify the Last Area. By default the last area definition will always be retained allowing you to modify it.

Change **Log File** to YES and enter a **File Name** if you want to generate a log file of the area calculation. The file will be written in the \LOG subdirectory of the PC card or internal memory.

Press **CONT (F1)** will bring you to the Create Area screen.

To define the segments of a new area or to add additional segments to an already existing area press **NEW (F2)**. Select the points from the list and press **ADD (F2)** after each Node (point) or click **ARC (F3)** to define an arc. Arcs can be defined by two points and a radius or by three points. Alter-natively you may press **NEWOC (F5)** to measure new points. When all segments of the area are defined press **CONT (F3)**.

To modify the Id of a Node (point) or to change the arc definitions set the focus on that segment and press **EDIT (F3)**.

Press **DEL (F4)** to delete an segment.

To finish the area definition and start the calculation press **CALC (F1)**. The last point is automatically joined with the first point of the definition and the result is displayed.

```
AREA\ Calculation Results

No. of Segs:              9
Area       :         58.798 m²
Hectares   :          0.006
Perimeter  :         36.103 m

CONT |     |LIST |     |PLOT |
```

The units as set in CONFIGURE \General\Units are used to display the results.

Press **LIST (F3)** or ESC to return to the Create Area screen and modify the area definition.

PLOT (F5) displays a praphical screen showing the outline of the defined area.

Press **CONT (F1)** to return to the APPLICATION\ Menu.

This application allows a line to be created and then this line can be segmented creating any number of points along this line. These points can then be staked out if required.

Access the Line Division application from the Application menu.

```
APPLICATION\ Menu
01 Determine Coord System
02 Point Management
03 Calculator
04 Wake-up Sessions
05 COGO
06 Area
07 Line Division

CONT |
```

Choosing this application leads to the LINE DIV\ Begin panel.

```
LINE DIV\ Begin
Job         :      RT-Sample▼
Type        :  Start+Endpoint▼
Start Point:            9030▼
End Point   :            9055▼
Height Def  :           Slope▼
Method      :     By Interval▼
Interval    :          20.0 m

CONT |
```

Job – Allows access to the standard JOB\ panel with full functionality.The job that is shown on entering this panel is the currently active job. Select the job containing the points from which the line will be created.

Type - Allows the selection between the two ways in which a line may be defined. The two choices are **Start + Endpoint** and **Start + Dst + Bg** (Startpoint + Distance + Bearing). Depending on your selection different menu items become available.

Start + Endpoint means that a **Start Point** and an **End Point** have to be given to define the line. Select two points from the list or enter NEW points.

Start + Dst + Bg means that a **Start Point** as well as an **Azimuth** and a **Length** have to be given to define the line. Select a start point from the list or enter a NEW point.

Height Def - Allows the definition of how the heights of the points that will be created are computed. The two choices are **Slope** and **Use Start Pnt Ht**.

Use Start Pnt Ht means all created points are given the same height as the start point in the chosen line.

If **Type Start + Endpoint** has been selected, **Slope** means that all created points are given a height that is interpolated between the heights of the start and the end point for the chosen line.

If **Type Start + Dst + Bg** has been selected, **Slope** means that the height of the interpolated points is determined by the entered **Zenith** angle of the line.

Method - Allows a choice between **By Segments** and **By Interval** and defines how the chosen line is segmented.

By Segments means that the number of segments by which the line will be divided can be entered.

If **By Segments** is chosen, the next line in the panel reads **Num of Segs** and a positive integer value may be entered.

By Interval means that the interval at which the new points are created along the line can be entered.

If **By Interval** is chosen, the next line in the panel reads **Interval** and a positive integer value may be entered.

Strt Pnt Id - Allows a point ID to be entered from which all subsequently created points from this line division will be assigned.

PtIDInc/Dec - Allows to enter a positive or negative integer value which will be used to create the point Ids that the newly created points will be assigned.

The new points will be stored in the chosen job as user entered grid points and can then be staked out using the usual stake-out routines.

12.1 Directory of Memory Device

The Utilities menu item is revealed by pressing **SHOW** (**F4**) from the Main Menu.

```
UTILITIES\ Menu
1 Directory of Memory Device
2 Format Memory Module
3 Enter Security Code
4 SelfTest



CONT
```

Utilities contains file, memory and security utilities.

The directory of the currently selected memory device is displayed.

```
PC-Card:\

CODE          02.09.99 09:16
CONVERT       02.09.99 09:16
DATA          02.09.99 09:16
DTM           22.09.99 06:19
GEODB         02.09.99 09:16

CONT                    DEVCE
```

If an internal memory is fitted, **DEVCE** (**F5**) will be available. Use this to access the directory of the internal memory.

To enter a directory, highlight it and press **ENTER**. To move up a level out of a sub-directory, highlight the double points and press **ENTER**.

CODE - Contains all codelist files.

CONVERT - Contains all format files defined in Format Manager.

DTM - Contains any **DTM** stakeout file to be used with this application.

DATA - Contains user defined ASCII files including the line definition file STK_Line.txt as well as the sub-directory **GPS**. **GPS** contains any almanac files that have been transferred from the Receiver as well as the **GEOID**, the **CSCS** and the **RINGBUF** sub-directory. **GEOID** contains any Geoidal Model files, **CSCS** contains any CSCS Field Files and **RINGBUF** contains any Ring Buffer Data files.

GEODB - Contains all Job files including GPS raw data and point information.

GPS - Contains any coordinate system files transferred from the Receiver as well as the sub-directories **CONF** and **PROG**. **CONF** contains any configuration set files transferred from the Receiver. **PROG** contains Receiver firmware and text files.

GSI - Contains any GSI files created through the Transfer command on the Receiver.

IDEX - Contains any IDEX files created through the Transfer command on the Receiver.

LOG - Contains any log files generated from the optional application programs.

See Appendix G for further details on the directory structure of the memory device.

Enables you to reformat a memory device. All data will be erased and a fresh directory structure created.

```
UTILITIES\ Format Memory Module
Device       :        PC-Card▾
Quick format:             YES▾


CONT                SYSTM
```

Device - Select the memory device you wish to format. **Internal** is available when an internal memory module is fitted.

Quick format - Selects the way in which the formatting is carried out. When set to **YES** the data will not be visible any more but in reality still exists on the memory device. It will be overwritten as and when required. When set to **NO** all data is really deleted.

If you want to format the Sensor System RAM press **SYSTM (F5)** and confirm twice by pressing **(F5)**.

If you format the System RAM all system data such as Almanac, User defined Configuraton Sets, User defined Antennas, Codelists, Geoid Model Field Files and CSCS Model Field Files will be lost.

12.3 Enter Security Code

The security code is required to activate optional application programs.

Select the application program you wish to activate and then enter the security code supplied by Leica Geosystems when you purchased the option.

Instructions on how to use each optional application program are contained in a separate manual accompanying the security code.

12.4 Self Test

A memory self test can be performed on both the PC card and the internal memory device (if fitted).

The self test will test the chosen memory device for bad sectors or corrupted data and report on the result.

13. Transfer

Transfer enables you to transfer all types of data between different data devices on the Receiver. Transfer of data to SKI-Pro is carried out from within SKI-Pro.

Select **Transfer** from the Main Menu.

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

The following screen appears.

```
TRANSFER\ Menu
01 Job
02 Config Set
03 Coordinate System
04 Antenna Info
05 Codelist
06 ASCII/GSI to Job
07 GSI/User
CONT
```

13.1 Job

Enables you to Transfer a Job between PC Card and Internal Memory.

```
TRANSFER\ Job
From      :          PC-Card▼
To        :          Internal
Job       :     Determination▼

CONT      ALL          MORE
```

Select **From** where you wish to transfer the Job. The device **To** which the Job will be transferred will automatically selected.

Job - Select the Job to be transferred. Press **ALL** (**F3**) to select all the Jobs.

MORE (**F6**) enables you to define which data to transfer. Select from **Points and Obs**, **Points only** or **Obs only**.

13.2 Config Set

Enables you to transfer Configuration Sets between Sensors and PC Cards.

```
TRANSFER\ Config Set
From        :         Sensor▼
To          :        PC-Card
Config Set:         Pp_kis.cnf▼

CONT      ALL
```

Select **From** where you wish to transfer the Configuration Set. The device **To** which the Configuration Set will be transferred will be automatically selected.

Config Set - Select the Configuration Set to be transferred. Press **ALL** (**F3**) to select all the Configuration Sets.

13.3 Coordinate System

Enables you to transfer Coordinate Systems between Sensors and PC Cards.

```
TRANSFER\ Coordinate System
From      :           PC-Card▾
To        :            Sensor
Coord Sys :                  ▾

CONT |    | ALL |    |    |
```

Select **From** where you wish to transfer the Coordinate System. The device **To** which the Coordinate System will be transferred will be automatically selected.

Coord Sys - Select the Coordinate System to be transferred. Press **ALL** (**F3**) to select all the Coordinate Systems.

13.4 Antenna Info

Enables you to transfer Antenna Info Records between Sensors and PC Cards.

```
TRANSFER\ Antenna Info
From      :           PC-Card▾
To        :            Sensor
Antenna   :                  ▾

CONT |    | ALL |    |    |
```

Select **From** where you wish to transfer the Antenna Info Record. The device **To** which the Antenna Info Record will be transferred will be automatically selected.

Antenna - Select the Antenna Info Record. Press **ALL** (**F3**) to select all the Antenna Info Records.

13.5 Codelist

Enables you to transfer Codelists between Sensors and PC Cards.

```
TRANSFER\ Codelist
From      :           PC-Card▾
To        :            Sensor
Codelist  :                  ▾

CONT |    | ALL |    |    |
```

Select **From** where you wish to transfer the Codelist. The device **To** which the Codelist will be transferred will be automatically selected.

Codelist - Select the Codelist. Press **ALL** (**F3**) to select all the Codelists.

Enables you to convert an ASCII file into a Job.

The reason to convert an ASCII file to a job is mainly for Stake Out. When staking points there are many advantages to stake out points stored in a job rather than staking from an ASCII file. For example, points stored in a job can be filtered and sorted, individual points can be found more quickly and so on.

Example for an ASCII file in GSI8 format:

```
110001+00000015 81..00+64340360 82..00+52962354 83..00+00000689 71....+000sheep
72....+000black 73....+0000DEAD 74....+23102001 75....+0011h02m
```

The ASCII file may be in a simple Format (e.g. Pt Id, East, North, Height) or in GSI8 or GSI16 format (e.g. Pt Id, East, North, Height, Code, Attributes). In all cases, the imported height can be selected to be orthometric or ellipsoidal. Codes and attributes can be imported with GSI8 and GSI 16. This is restricted to thematical coding, which uses WI71 for code IDs and WI72 to 79 for attribute values.

The converted points will be added to the Job database. Points are always imported with the point class controll. If a point already exists in the database with the point class controll, the program will prompt you to overwrite it or not. If a point already exists in the database with the point class measured, the program will prompt you to add the point that is to be imported as controll point. If this is answered with yes and codes and possibly attributes are attached to the point in the GSI file, the program then performs a subsequent check. It prompts when a code or attribute value is different.

```
TRANSFER\ ASCII/GSI to Job
Type        :      ASCII File▼
From File   :        Lokal.txt▼
To Job      :             HBG2▼

Hgt Type    :        Ortho Hgt▼

CONT |    |    |ASCII|    |
```

Select the file **Type** of the source file. GSI File or ASCII File. The file must be located in the \GSI directory for GSI files and in the \DATA directory for ASCII files.

Select the file **From** which you want to convert and the Job **To** which the points shall be added.

Hgt Type - Visible in Advanced mode only. Allows the point to be imported as either height type **Ortho** or **Ellipsoidal**. Ortho is the default option. If Ellipsoidal has been selected then this setting is remembered until the sensor is turned off.

When **ASCII File** is selected, the **ASCII** (**F4**) key becomes available. Use this to define the format of the ASCII file.

```
CONFIGURE\ Pt ASCII File Format
Delimiter :               Comma▼
Id Pos    :                   1▼
East Pos  :                   2▼
North Pos :                   3▼
Height Pos:                   4▼

Example   : Id,E,N,h,,,,,,

CONT |    |    |    |DEFLT|
```

Delimiter - Sets the character used to separate the various point components. Choose from **Comma** (,), **Line Feed** (new line), **Semicolon** (;), and **Space** (blank).

ID Pos - Sets the position of the Point Id.

East Pos - Sets the position of the easting.

North Pos - Sets the position of the northing.

Height Pos - Sets the position of the height.

Use the **DEFLT** (**F5**) key to reset the format to its original values.
Define the delimiter used to separate the information for each point and then define the position of each component of each point. An example of what you have defined is given at the bottom of the screen.

Press **CONT** (**F1**) to return to the previous screen.

When **GSI File** is selected, a GSI coordinate switch may be defined. This is necessary in case of "left handed" coordinate systems. The WI81 value (normally the easting value) is then imported as the northing and the WI82 value (normally the northing value) as the easting.

```
TRANSFER\ ASCII/GSI to Job
Type           :        GSI File▼
From File      :    Alnexamp.gsi▼
To Job         :           HBG2▼

Hgt Type       :       Ortho Hgt▼

HELP |    | LHS |    |    |QUIT
```

Use **SHIFT** - **LHS** (**F3**) to define the GSI coordinate switch.
Switch 81/82 - **YES** activates the coordinate switch.

```
TRANSFER\ GSI Coord Switch

Switch 81/82   :            YES▼



CONT |    |    |    |    |
```

Press **CONT** (**F1**) to return to the previous screen.

Enables you to convert a Job into an ASCII file using a Format file. Format files define the format of the final ASCII file and are created using Leica Format Manager software.

```
TRANSFER\ Write file
From           :         PC-Card▼
To             :         PC-Card▼
Job            :     Determination▼
Format         :        Gsi16.frt▼
Destinatn      :        GSI File▼
File           :        GSI21.TXT
CONT |    |FORMT|    |    |FILT
```

Select **From** which device you wish to select a Job and **To** which device you wish to store the ASCII file.

The ASCII file can either be written to the PC-card/ Internal Memory or, alternatively, to another device via a serial port.

Job - Select the Job from which you wish to write the data.

Format - Select the Format File that you wish to use.

Format Files need to be stored in the System RAM of the sensor. Press **FORMT (F3)** to transfer them from the directory \CONVERT of the PC Card or internal memory to the System RAM or vice versa.

If PC-card or Internal has been selected as the desired device you have to specify the Destination and the File name:

Destinatn - Select the type of file that will be written. This specifies where the file will be written.

File - Specify the file name and extension.

If **To** Instrument has been chosen you have to specify the Port and the Device.

```
TRANSFER\ GSI/User
From        :              PC-Card▼
To          :           Instrument▼
Job         :        Determination▼
Format      :          Example.frt▼
Port        : 2 *Leica TPS300/7
CONT |     |FORMT|     |IFACE|FILT
```

Press **IFACE** (**F5**) and set **Use Device** to **YES**.

```
CONFIGURE\ GSI/User Out
Use Device :                 YES▼
Port       : 2 *Leica TPS300▼
Job Number :                   1▼
Job Name   :          Transfer
CONT |     |     |     |DEVCE|
```

Select the port to which the device is connected. Use the **DEVCE** (**F5**) key in the CONFIGURE\ GSI/User Out panel to configure the device itself.

Leica TPS300/700, Geodimeter and Zeiss REC500 total stations as well as the SOKKIA SDR33 datalogger are currently supported.

When Leica TPS300/700 is selected and connected to the GPS receiver, select the **Job Number** to which job the data should be sent. The **Job Name** of existing jobs in the TPS instrument is displayed. For a new job, type in a name. When transfering into an existing TPS job, all fixpoints in that job are deleted during transfer.

If data is being transferred to a Geodimeter total station, then the total station must be in a mode ready to receive data.

SOKKIA devices can only handle 4 digit numeric point IDs. If **Renumber** is set to **YES,** all points are transfered but renumbered starting from 1. If **NO** is selected, only points with numeric point IDs are transfered and point IDs are shortened to 4 digits, truncating from the right.

```
CONFIGURE\ GSI/User Out
Use Device :                YES▼
Port       : 3 *SOKKIA SDR33▼
Renumber   :                YES▼
CONT |     |     |     |DEVCE|
```

The SDR33 must be ready to receive data before starting the transfer on System500. Jobs are transfered with the same name as on System500.

It is necessary to use the correct format file when transferring data to a total station.

Press **FILT (F6)** if you wish to transfer a selection of points only. For more information about the filter settings please refer to 11.3 Point Management.

Press **CONT** (**F1**) to transfer the file. The number of exported points will then be displayed.

13.8 Geoid Field File

Enables you to transfer Geoid Field Files between Sensors and PC Cards.

```
TRANSFER\ Geoid Field File
From      :           PC-Card▼
To        :            Sensor
Geoid File:                  ▼

CONT      ALL
```

Select **From** where you wish to transfer the Geoid Field File. The device **To** which the Geoid Field File will be transferred will be automatically selected.

If you transfer a Geoid Field File **From** the PC-Card **To** the Sensor then a Geoid model will be automatically created.

Geoid File - Select the Geoid Field File. Press **ALL** (**F3**) to select all the Geoid Field Files.

13.9 CSCS Field File

Enables you to transfer CSCS Field Files between Sensors and PC Cards.

```
TRANSFER\ CSCS Field File
From      :           PC-Card▼
To        :            Sensor
CSCS File :                  ▼

CONT      ALL
```

Select **From** where you wish to transfer the CSCS Field File. The device **To** which the CSCS Field File will be transferred will be automatically selected.

If you transfer a CSCS Field File **From** the PC-Card **To** the Sensor then a CSCS model will be automatically created.

CSCS File - Select the CSCS Field File. Press **ALL** (**F3**) to select all the CSCS Field Files.

13.10 Firmware

Enables you to transfer Receiver firmware from the PC Card to the Sensor.

```
TRANSFER\ Firmware
From      :           PC-Card
To        :            Sensor
Version   :                  ▼

CONT
```

Version - Select the firmware version that you wish to transfer.

Note that for PC Card capacity reasons, the firmware is available in separate sections as well as one file.

This enables different sections to be uploaded via the PC Card if the complete file will not fit on the PC Card.

13.11 Firmware TR500

Enables you to transfer Terminal firmware from the PC Card through the Sensor to the Terminal.

```
TRANSFER\ Firmware TR500
From        :             PC-Card
To          :              Sensor
Version     :

CONT
```

Version - Select the firmware version that you wish to transfer.

13.12 Language Version

Enables you to transfer Local Language files of the system software to the Sensor from a PC Card.

```
TRANSFER\ Language
From        :             PC-Card
To          :              Sensor
Version     : DEUTSCH       (3.02)

CONT
```

Version - Select the language version that you wish to transfer.

13.13 Application Text

Enables you to transfer a language file for the optional Application programs from the PC Card to the Sensor.

```
TRANSFER\ Application Text
From        :             PC-Card
To          :              Sensor
Version     :

CONT
```

Version - Select the Language File for the optional Application program.

13.14 Almanac

Enables you to transfer GPS Satellite Almanac Files to the Sensor from a PC Card.

```
TRANSFER\ Almanac
From          :        PC-Card▾
To            :         Sensor
Almanac       :                ▾

CONT |     |     |     |     |
```

Almanac - Select the Almanac that you wish to transfer.

13.15 Account File

Enables you to transfer a Telemax Account File between PC Card and Sensor.

```
TRANSFER\ Telemax Account File
From          :          PC-Card▾
To            :           Sensor
File          :    Leicamun.tmx▾

CONT |     | ALL |     |     |
```

Select **From** where you wish to transfer the Account file. The device **To** which the Account file will be transferred will automatically be selected.

File – Select the Account file to be transferred. Up to two files may be selected on each sensor. Since Account files are sensor specific only the appropriate files will be indicated to you for selection. Press **ALL** (**F3**) to select both files at once.

13.16 CFC Log Mask File

Enables you to transfer a **C**ultivated **F**ield **C**ontrol Log Mask File between PC Card and Sensor.

```
TRANSFER\ CFC Log Mask File
From          :          PC-Card▾
To            :           Sensor
Log Mask      :                 ▾

CONT |     | ALL |     |     |
```

Select **From** where you wish to transfer the CFC Log Mask File. The device **To** which the CFC Log Mask File will be transferred will be automatically selected.

Log Mask - Select the Log Mask. Press **ALL** (**F3**) to select all the Log Mask Files available.

13.17 Beacon Station List

Enables you to transfer a Beacon Station List between PC Card and Sensor.

```
TRANSFER\ Beacon Station List
From        :         PC-Card▾
To          :          Sensor
File        :                ▾

CONT      ALL
```

Select **From** where you wish to transfer the Beacon Station List. The device **To** which the Beacon Station List will be transferred will be automatically selected.

File - Select the **beacon.txt** file.

13.18 Modem/GSM Station List

Enables you to transfer Modem/GSM Station details between PC Card and Sensor.

```
TRANSFER\ Modem/GSM Station List
From        :         PC-Card▾
To          :          Sensor
File        :    Stations.bin▾

CONT
```

Select **From** where you wish to transfer the Modem/GSM Station List. The device **To** which the Modem/ GSM Station List will be transferred will be automatically selected.

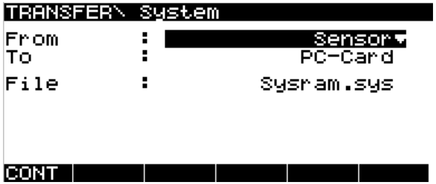
File - Select the **Stations.bin** file.

13.19 System

Enables you to transfer the complete System RAM between PC Card and Sensor in a file called Sysram.sys. This includes:

- All information from the Config Sets
- Coordinate Systems
- Format Files
- Codelists
- Language Files
- Application Text Files
- Almanac
- Telemax Account Files
- CFC Log Mask Files
- Beacon Station List

When uploading a Sysram.sys file to a receiver, all existing settings on the receiver will be overwritten.



Select **From** where you wish to transfer the file. The device **To** which the file will be transferred will be selected automatically.

File - Other namings than **Sysram.sys** are not allowed.

Enables you to transfer any file between the DATA directories on the memory devices.

Select **From** where you wish to transfer the File. The device **To** which the File will be transferred will be automatically selected.

File - Select the File. Press **ALL** (**F3**) to select all the Files.

Appendix A - Operating and Storage Temperatures

Component	Operation	Storage
Receiver	-20°C to +55°C	-40°C to +70°C
Terminal	-20°C to +55°C	-40°C to +70°C
Antenna	-40°C to +75°C	-40°C to +75°C
PC Flash Cards	-20°C to +75°C	-40°C to +75°C
Internal Memory	-20°C to +55°C	-40°C to +70°C

Appendix B - Observation Times

Obs. Method	No. sats. GDOP< 8	Baseline Length	Approximate observation time By day	By night
Rapid Static	4 or more	Up to 5 km	5 to 10 mins	5 mins
	4 or more	5 to 10 km	10 to 20 mins	5 to 10 mins
	5 or more	10 to 15 km	Over 20 mins	5 to 20 mins
Static	4 or more	15 to 30 km	1 to 2 hours	1 hour
	4 or more	Over 30 km	2 to 3 hours	2 hours

Appendix C - Seismic Record Format

Seismic records may be generated and saved along with the point information. They take the following format:

```
@,GSE,V,M,gg.g,pp.p,hh.h,vv.v,aaa.aaa,ss,eee,ii,REC,RSN
```

Example

```
@GSE12 4.0 0.0 0.0 0.0 1.220 5 1 2SR530 001899
```

Record Content	Description
`@`	Record Flag. @ = Automatically stored (not user entered).
`GSE`	Record Type. GSE = **G**PS **SE**ismic.
`Version`	Version number of this record.
`M`	Position type. Range 0,1,2,3,4. Default if none available - 0 0 - position not available 1 - navigated position 2 - differential code position 3 - differential phase, float solution 4 - differential phase, fixed solution
`gg.g`	GDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
`pp.p`	PDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
`hh.h`	HDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
`vv.v`	VDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
`aaa.aaa`	Antenna Height - sum of instrument height and antenna offset. Range -99.9 to 999.99. Default if not available - 0.0.
`ss`	Number of satellites used for solution. Range 0 to 12. Default if not available - 0.
`eee`	Number of epochs spent on point. Range 0 to 999. Default if not available - 0. Default if not available-0.
`ii`	Length of interval between epochs (seconds). Range 0, 1, 2, 3, 4, 5, 6, 10, 12, 15, 30, 60. Default if not available - 0.
`REC`	Receiver type. Range SR299, SR399, SR299E, SR399E, SR9400, SR9500, SR510, SR520, SR530, GS50
`RSN`	Receiver serial number. Range 0 - 999999. Value if unavailable - 0.

Appendix D - Defined Line File Format

Lines that have been defined in Stakeout are stored in the file STK_Line.txt in the data directory of the memory device. Up to 100 lines may be stored in this file.

Line records take the following format, separator is a space, but no space after @< and @>. The linear unit is Meter and the angular unit is Gon.

```
@<ID xxxxx.xxx yyyyy.yyy hhh.hhh
@>LD LDD
```

$\overbrace{\texttt{@<}}^{1}\ \overbrace{\texttt{ID}}^{2}\ \overbrace{\texttt{xxxxx.xxx}}^{3}\ \overbrace{\texttt{yyyyy.yyy}}^{4}\ \overbrace{\texttt{hhh.hhh}}^{5}$

$\underbrace{\texttt{@>}}_{6}\ \underbrace{\texttt{LD}}_{7}\ \underbrace{\texttt{LDD}}_{8}$

Record Format	Description
`@<`	Start of first line of record
`ID`	Line ID, 16 characters
`xxxxx.xxx`	Start Point Easting
`yyyyy.yyy`	Start Point Northing
`hhh.hhh`	Start Point Orthometric Height
`@>`	Start of second line of record
`LD`	Line definition type: 1 - Endpoint Easting, Northing, Height 2 - Distance, Bearing, %V 3 - Distance, Bearing, H/V 4 - Distance, Bearing, V/H 5 - Distance, Bearing, Hgt Diff
`LDD`	Line definition values. Depend on LD, as shown above.

The Receiver can output a variety of NMEA messages. These can be set using the CONFIG key or may be steered from a connected device using a query message.

Note that a Talker ID appears at the beginning of the header. This is normally GP for GPS but may be set by the user in CONFIG\NMEA.

The query message format is the same for every NMEA message apart from the message identifier.

Format	Content
`$PLEIQ,`	Header, message sent from *Outside World*.
`XXX,`	Message Identifier[1]
`x,`	Port[2]
`x`	Output Rate[3]
`*hh`	Checksum
`<CR>`	Carriage Return
`<LF>`	Line Feed

[1] Message Identifiers are:
GGA - Global Positioning System Fix Data
GGK - Real-Time Position with DOP
GGK (PT) - Real-Time Position with DOP
GGQ - Real-Time Position with CQ
GLL - Geodetic Position - Latitude/Longitude
GNS - GNSS Fix Data
GSA - GPS DOP and Active Satellites
GSV - GPS Satellites in View
LLK - Leica Local Position and GDOP
LLQ - Leica Local Position and Quality
VTG - Course Over Ground and Ground Speed
ZDA - Time and Date

[2] Port from which NMEA message is requested:
1 - Port 1
2 - Port 2
3 - Port 3

[3] Output rate of NMEA Message

0 - Output off	11 - 12 s	21 - 10 min
1 - 0.1 s (10Hz)	12 - 15 s	22 - 12 min
2 - 0.2 s (5Hz)	13 - 20 s	23 - 15 min
3 - 0.5 s (2Hz)	14 - 30 s	24 - 20 min
4 - 1 s	15 - 1 min	25 - 30 min
5 - 2 s	16 - 2 min	26 - 1 h
6 - 3 s	17 - 3 min	200 - Output immediately
7 - 4 s	18 - 4 min	
8 - 5 s	19 - 5 min	
9 - 6 s	20 - 6 min	
10 - 10 s		

In the listing of NMEA messages, certain symbols are used as identifier for the field types. They are:

Special Format Fields

A	Status	Single character field: A = Yes, Data Valid, Warning Flag Clear V = No, Data Invalid, Warning Flag Set
llll.ll	Latitude	Fixed / Variable length field: degreesminutes.decimal - 2 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length.
yyyyy.yy	Longitude	Fixed / Variable length field: degeesminutes.decimal - 3 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length.
eeeeee.eee	Grid Easting	Fixed length field: At the most 6 fixed digits for meters and 3 fixed digits for decimal fractions of meters.
nnnnnn.nnn	Grid Northing	Fixed length field: At the most 6 fixed digits for meters and 3 fixed digits for decimal fractions of meters.
hhmmss.ss	Time	Fixed / Variable length field: hoursminutesseconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and a variable number of digits for decimal-fraction of seconds. Leading zeros are always included for hours, minutes and seconds to maintain fixed length.
mmddyy	Date	Fixed length field: monthdayyear - 2 fixed digits for month, 2 fixed digits of day, 2 fixed digits of year. Leading zeros always included for month, day and year to maintain fixed length.
	Defined Field	Some fields are specified to contain pre-defined constants, most often alpha characters. Such a field is indicated by the presence of one or more valid characters. Excluded from the list of allowable characters are the following that are used to indicate other field types: A, a, c, x, hh, hhmmss.ss, llll.ll, yyyyy.yy.

Numeric Value Fields

x.x	Variable numbers	Varaible length integer or floating numeric field. Optional leading and trailing zeros. (example: 73.10 = 73.1 = 073.1 = 73)
hh_	Fixed HEX field	Fixed length HEX numbers only

Information Fields

c--c	Variable text	Variable length valid character field
aa_	Fixed alpha field	Fixed length field of upper-case or lower-case alpha characters
xx_	Fixed number field	Fixed length field of valid characters

Format	Content
`$GPGGA,`	Header, incl. Talker ID, message sent from Receiver
`hhmmss.ss,`	UTC time of Position
`llll.ll,`	Latitude
`a,`	Hemisphere “N”/“S”
`yyyyy.yy,`	Longitude
`a,`	“E”/“W”
`x,`	GPS Quality Indicator 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 not existing 4 = Realtime position, ambiguities fixed
`xx,`	Number of satellites in use, 00-12
`x.x,`	HDOP
`x.x,`	Antenna altitude above/below mean sea level. Note, if no orthometric height is available the local ell. height will be exported. If the local ell. height is not available either, the WGS84 ell. height will be exported.
`M,`	Units of altitude meters (fixed text “M”)
`x.x,`	Geoidal separation
`M,`	Units of geoidal separation meters (fixed text “M”).
`x.x,`	Age of differential GPS data, null when DGPS not used
`xxxx`	Differential Reference Station ID, 0000-1023
`*hh`	Checksum
`<CR>`	Carriage Return
`<LF>`	Line Feed

GGK - Real-Time Position with DOP

Format	Content
$GPGGK,	Header, incl. Talker ID,message sent from Receiver GGK Sentence Formatter
hhmmss.ss,	UTC of Position Fix
mmddyy,	UTC date
llll.ll,	Latitude
a,	Hemisphere “N”/“S”
yyyyy.yy,	Longitude
a,	“E”/“W”
x,	GPS Quality Indicator 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 = Realtime position, ambiguities fixed
xx,	Number of Satellites in Use (Common satellites between ref and rover, Values between 00 to 12, may be different from the number in view)
x.x,	GDOP
EHT	Ellipsoidal height
x.x,	Antenna altitude above/below mean sea level. Note, if no orthometric height is available the local ell. height will be exported. If the local ell. height is not available either, the WGS84 ell. height will be exported.
M	Units of altitude meters (fixed text “M”)
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

GGK(PT) - Real-Time Position with DOP

This message type is Trimble proprietary.

Format	Content
$PTNL,GGK,	$ Start of sentence delimiter — TALKER ID, fixed with PTNL GGK Sentence Formatter
hhmmss.ss,	UTC of Position Fix
mmddyy,	UTC date
llll.ll,	Latitude
a,	Hemisphere “N”/“S”
yyyyy.yy,	Longitude
a,	“E”/“W”
x,	GPS Quality Indicator 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 = Realtime position, ambiguities fixed
xx,	Number of Satellites in Use (Common satellites between ref and rover, Values between 00 to 12, may be different from the number in view)
x.x,	PDOP
EHT	Ellipsoidal height
x.x,	Altitude above/below mean sea level for position of marker. Note, if no orthometric height is available the local ell. height will be exported.
M	Units of altitude meters (fixed text “M”)
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Format	Content
$GPGGQ,	Header, incl. Talker ID,message sent from Receiver
	GGQ Sentence Formatter
hhmmss.ss,	UTC of Position Fix
mmddyy,	UTC date
llll.ll,	Latitude
a,	Hemisphere “N”/“S”
yyyyy.yy,	Longitude
a,	“E”/“W”
x,	GPS Quality Indicator 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 = Realtime position, ambiguities fixed
xx,	Number of Satellites in Use (Common satellites between ref and rover, Values between 00 to 12, may be different from the number in view)
x.x,	Coordinate Quality
EHT	Ellipsoidal height
x.x,	Antenna altitude above/below mean sea level. Note, if no orthometric height is available the local ell. height will be exported. If the local ell. height is not available either, the WGS84 ell. height will be exported.
M	Units of altitude meters (fixed text “M”)
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Format	Content
$GPGLL,	Header, incl. Talker ID,message sent from Receiver
llll.ll,	Latitude
a,	Hemisphere “N”/“S”
yyyyy.yy,	Longitude
a,	“E”/“W”
hhmmss.ss,	UTC time of position
A,	Status[1] A = Data valid V = Data not valid
a	Mode Indicator[1] A = Autonomous mode D = Differential mode N = Data not valid
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

[1]The Mode Indicator field supplements the Status field. The Status field is set to A for the Mode Indicators A and D. The Status field is set to V for the Mode Indicator N.

GNS - GNSS Fix Data

Format	Content
$XXGNS,	Header, message sent from Receiver. XX=GP - GPS only, XX=GL - GLONASS only, XX=GN- Combined GPS/GLONASS
hhmmss.ss,	UTC time of position
llll.ll,	Latitude
a,	Hemisphere “N”/“S”
yyyyy.yy,	Longitude
a,	“E”/“W”
c--c,	Mode Indicator
	N = No Fix
	A = Autonomous. GPS Nav Fix
	D = Differential. DGPS Fix
	P = Precise Nav (no deliberate degradation such as SA)
	R = Real Time Kinematic. RTK Fix
	F = Float RTK.
xx,	Number of satellites in use, 00-99
x.x,	HDOP of all satellites used in computation
x.x,	Antenna altitude above/below mean sea level, meters. Note, if no orthometric height is available the local ell. height will be exported. If the local ell. height is not available either, the WGS84 ell. height will be exported.
x.x,	Geoidal separation, meters
x.x,	Age of Differential GPS Data, null when GPS not used.
xxxx	Differential reference station ID, 0000-1023
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

GSA - GPS DOP and Active Satellites

Format[1]	Content
$GPGSA,	Header, incl. Talker ID,message sent from Receiver
a,	Mode
	M = Manual, forced to operate in 2D or 3D mode
	A = Automatic, allowed to automatically switch 2D/ 3D
x,	Mode
	1 = Fix not available
	2 = 2D
	3 = 3D
xx,	PRN numbers of satellites used in solution (this format is repeated 12 times and null for unused fields)
x.x,	PDOP
x.x,	HDOP
x.x	VDOP
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

[1] Example:

```
$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,
x.x,x.x,x.x*hh<CR><LF>
```

GSV - GPS Satellites in View

Format	Content
$GPGSV,	Header, incl. Talker ID, message sent from Receiver
x,	Total number of messages, 1 to 3
x,	Message number, 1 to 3
xx,	Total number of satellites in view
xx,	Satellite PRN number
xx,	Elevation, degrees, 90° maximum
xxx,	Azimuth, degrees True, 000 to 359
xx	SNR (C/No) 00-99 dB, null when not tracking
.....,	2nd-3rd SV
xx,	
xx,	4th SV
xxx,	
xx	
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Note
- Satellite information may require the transmission of multiple messages. The first field specifies the total number of messages, minimum value 1. The second field identifies the order of this message (message number), minimum value 1.
- A variable number of "PRN-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per message. Null fields are not required for unused sets when less than four sets are transmitted.

LLK - Leica Local Position and GDOP

Format	Content
$GPLLK,	Header, incl. Talker ID,message sent from Receiver
hhmmss.ss,	UTC time of position
mmddyy,	UTC date
eeeeee.eee,	Grid Easting, meters
M,	Meter (fixed text "M")
nnnnnn.nnn,	Grid Northing, meters
M,	Meter (fixed text "M")
x,	GPS Quality 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 = Realtime position, ambiguities fixed
xx,	Number of satellites used in computation
x.x,	GDOP
x.x,	Altitude above/below mean sea level for position of marker. Note, if no orthometric height is available the local ell. height will be exported.
M	Meter (fixed text "M")
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

LLQ - Leica Local Position and Quality

Format	Content
`$GPLLQ,`	Header, incl. Talker ID,message sent from Receiver
`hhmmss.ss,`	UTC time of position
`mmddyy,`	UTC date
`eeeeee.eee,`	Grid Easting, meters
`M,`	Meter (fixed text “M”)
`nnnnnn.nnn,`	Grid Northing, meters
`M,`	Meter (fixed text “M”)
`x,`	GPS Quality 0 = fix not available or invalid 1 = No Realtime position, navigation fix 2 = Realtime position, ambiguities not fixed 3 = Realtime position, ambiguities fixed
`xx,`	Number of satellites used in computation
`x.x,`	Coordinate Quality
`x.x,`	Altitude above/below mean sea level for position of marker. Note, if no orthometric height is available the local ell. height will be exported.
`M`	Meter (fixed text “M”)
`*hh`	Checksum
`<CR>`	Carriage Return
`<LF>`	Line Feed

VTG - Course Over Ground and Ground Speed

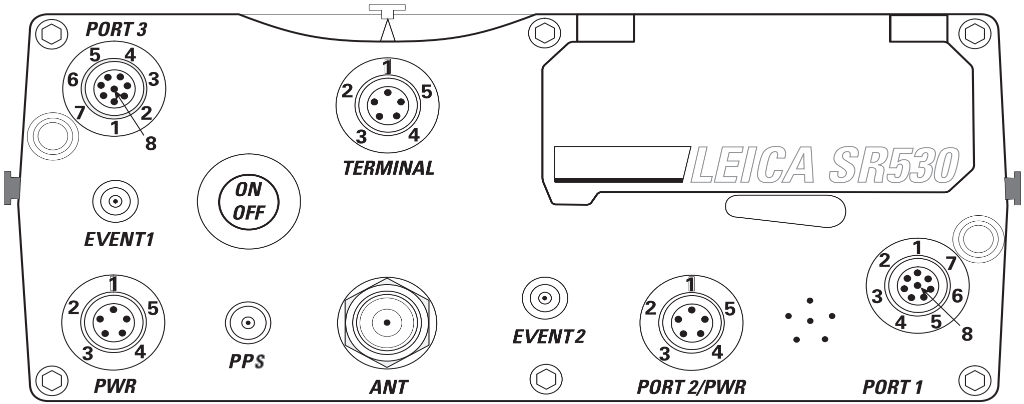
Format	Content
`$GPVTG`	Header, incl. Talker ID,message sent from Receiver
`x.x,`	Course over ground, degrees (0.0° to 359.9°)
`T,`	True (fixed text “T”)
`x.x,`	Course over ground, degrees (0.0° to 359.9°)
`M,`	Magnetic (fixed text “M”)
`x.x,`	Speed over ground
`N,`	Knots (fixed text “N”)
`x.x`	Speed over ground
`K,`	Km/h (fixed text “K”)
`a`	Mode Indicator A = Autonomous mode D = Differential mode N = Data not valid
`*hh`	Checksum
`<CR>`	Carriage Return
`<LF>`	Line Feed

Note - The Magnetic declination is set in the Receiver using the CONFIG key.

ZDA - Time and Date

Format	Content
`$GPZDA,`	Header, incl. Talker ID,message sent from Receiver
`hhmmss.ss,`	UTC time
`xx,`	UTC Day, 01 to 31
`xx,`	UTC Month, 01 to 12
`xxxx,`	UTC Year, 1997 to ...
`xx,`	Local zone description, hours (-13 to 13) (±)
`xx`	Local zone description, minutes (00 to 59)
`*hh`	Checksum
`<CR>`	Carriage Return
`<LF>`	Line Feed

Note - This message is given high priority and is output as soon as it is created. Latency is therefore reduced to a minimum.



Port 1

Pin	Function
1	RTS
2	CTS
3	GND
4	Rx
5	Tx
6	Vmod
7	Bat[1)]
8	+12V[2)]

Port2/PWR

Pin	Function
1	Bat[1)]
2	+12V[2)]
3	GND
4	Rx
5	Tx

Port 3

Pin	Function
1	RTS
2	CTS
3	GND
4	Rx
5	Tx
6	Vmod
7	Bat[1)]
8	+12V[2)]

Terminal

Pin	Function
1	KDU_ON
2	KDU_PWR
3	GND
4	Rx
5	Tx

PWR

Pin	Function
1	Bat[1)]
2	+12V[2)]
3	GND
4	---
5	---

1) Input into sensor
2) Output out from sensor

Sockets

Port 1 and 3:
Lemo FGA.1B.308.CLCD.x2Z

Port 2, PWR:
Lemo FGG.1B.305.CLCx.xxZ

Event:
Lemo ERN.0S.250.CTL

PPS:
Lemo HGP.00.250.CTL

Appendix G - Data Device Directory Structure

The following structure refers to PC Cards and Internal Memory. It shows where files are stored for transfer to and from the System RAM and where data is stored.

- **CODE**
  - All Codelists
- **CONVERT**
  - All Format files from Format Manager
  - Cultivated Field Control Log Mask File
- **DATA**
  - User-defined ASCII files
  - STK_Line.txt (Line Definition File)
  - Point Files
  - **GPS**
    - Alamanac files
    - **GEOID**
      - Geoid Model Field files
    - **CSCS**
      - CSCS Field Files
    - **RINGBUF**
      - Ring Buffer Files (RS500)
- **DTM**
  - DTM Stakeout file
- **GEODB**
  - All Jobs
  - Coordinate System Files

- **GPS** — Antenna Info Record Files
  beacon.txt (Beacon Station List)
  Stations.bin (Modem / GSM Station List)
  - **CONF** — Configuration Sets
  - **PROG** — Firmware Files
    Language Files
    Sysram.sys (System RAM file)
  - **SERVICES** — Telemax Accountfiles
- **GSI** — GSI Files
- **IDEX** — IDEX Files
- **LOG** — Log Files from Application Programs

Interfaces
An interface should be considered as a function of the sensor. For example, Real-Time is one function that can be activated on the sensor, Hidden Point is another function and so on.

System 500 supports the following interfaces:

Real - Time Input/Output
NMEA Output
ASCII Input
Hidden Point Input
Meteo
Tilt
GSI/ User Out
Remote Control
PPS Output
Event Input

Each interface may be controlled by one or more **Devices.**

For further details on the interfaces **Tilt** and **Meteo** see App. J.

Devices
A device should be considered as both the hardware which is used in connection with an interface and the parameters that allow the hardware to communicate with the sensor.

The devices that are supported by the sensor can be divided into the following groups:

RS232
Radio modem devices
GSM
Modem devices
RTB Module (CSI)
RTS Module (Racal)
SAPOS
Hidden Point devices

Certain devices may be used with one or more interfaces. For example, a radio modem can be used to receive Real-Time Reference data but a second radio modem could also be used to simultaneously output NMEA messages.

Note:
The PPS Output and the Event Input are optional interfaces that require special hardware (ports) and devices which are not described here. Please refer to the respective chapters in section 9 of this manual.

Port 1, 2 and 3 of the Sensor are standard RS232 interfaces. If you are using an external device that is not directly supported you may use the default RS232 configuration.

By default a standard RS232 device is available in the list.

RS232 - Standard parameters with 9600 baud rate.

To create a new standard RS232 device highlight **RS232** and select **NEW (F2)**.

Enter a name and change the parameters according to the specification of your external device.

Press **CONT (F1)** to store the device.

Radio devices are normally used to transmit or receive Real-Time data. Additionally a Radio device may also be used to steer and communicate with the Sensor e.g. to download raw data from a remote location etc.

The following radio devices are supported with System 500:

Satelline 1AS/2AS
Satelline 2ASx
Satelline 2ASxE
Satelline 3AS/3ASd
Pacific Crest RFM96W
Pacific Crest PDL
AT-RXM500 (Akasaka Tech)
Dataradio T-96S (Australia only)
Teledesign TS4000 (USA only)

The Teledesign TS4000 requires a specific housing to be purchased from Leica USA.

Configuring the Radio

From CONFIGURE\ Interfaces highlight the interface (e.g. Real-Time) you want to use with the Radio and press **EDIT** (**F3**).

Press **DEVCE (F5)** to access the device list.

Certain localised versions of the above radios may require extra configuration before use with System 500. In this case, highlight the radio model used and press **NEW** (**F2**). Enter a name (e.g. Satelline Italy) and enter the applicable device parameters.

To configure a third party radio highlight **Unknown Radio** and press **NEW** (**F2**). Enter a name (e.g. Radio-XY) and enter the applicable device parameters.

The port settings are the parameters used for the communication between the Sensor and the radio. If required, edit them to suit the radio settings or change the radio settings.

Radio Modems and Channel Switching

Channel switching is supported with Satelline 2ASx, 2ASxE, 3AS/3ASd and Pacific Crest RFM96 modems. It offers you the ability to set the channel on the radio modem.

This changes the frequency at which the radio operates by a small amount. This can be used in the following situations:

Case 1
Two Real-Time Reference stations are set up at two locations, each broadcasting on two different channels. This gives the Rover two advantages:

1. If the signal from one reference station is blocked, you can switch channels and try the other one.
2. You can obtain two separate fixes for each point, providing redundancy for future least squares adjustment operations.

Case 2
One Real-Time Reference and one Real-Time Rover are being used. If the signal is blocked due to radio interference, you can switch the channel at the Reference and Rover to try a slightly different frequency.

Note that when using channel switching, the Ref Stn Id at the Reference should be set to a different Id for each reference site.

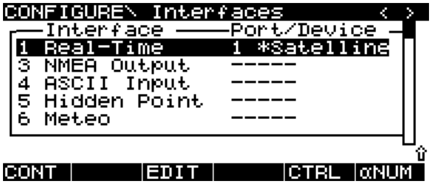
The number of channels available and the frequency spacing between channels will depend on the radio modem used.

Channel switching on Pacific Crest Radio Modems must be activated by a Pacific Crest dealer and may require a special license.

Satelline Radio Modems must be in *Programming* mode. This can be set by a Satelline dealer. Channel switching may contravene radio broadcasting regulations in certain countries.

Make yourself aware of the regulations in force in the area in which you are operating.

Channel switching is available via CONFIGURE\ Interfaces.



Highlight the device to switch channels and press **CTRL (F5)**.

For the radio modems Satelline 3AS, Pacific Crest RFM96W and Pacific Crest PDL, the channel to which the radio is set is checked and displayed. For other radios than those, a similar check is technically impossible. Therefore, the channel displayed does not necessarily coincide with the actual radio channel.

Enter a **Channel** number and confirm with **CONT (F1)**.

Additionally if you are using the device for a Real-Time Rover sensor you may set the following parameter:

Accept Ref - Defines which reference station to accept real-time data from. Choose from the following:
Any Received means that the sensor will accept data from any reference station from which it receives data.
1st Received means that data will be received and used from the first reference station that is recognised by the rover. If you wish to force the system to try to establish a new connection with a different reference station press **1st (F6).**
User defined enables you to define which reference station data will be received from according to its **Ref Stn Id**. This is necessary when several reference stations send RTK messages delayed on the same frequency **(Time Slicing)** and you wish to switch from one reference station to another.

```
CONFIGURE\ Radio Channel
Radio Type :    Satelline 2ASxE

Channel     :                  5
Accept Ref  :       User defined▾
Ref Stn Id  :                  0


CONT |    |    |    |SCAN |
```

With **User defined** you may press **SCAN (F5)** to access a list of refer-ence stations transmitting on the particular channel. The list shows the reference station IDs, the RTK format used for transmitting and the latency (time delay) with which the messages are sent. This SCAN functionality is independant from time slicing and can therefore always be used to check the RTK format of the refer-ence.

```
Configure\ Scan Ref Stn
 StnId Data Format ——Latency
 0      Leica         0.15 s




                             ⇧
CONT |    |    |    |    |
```

Highlight the reference station you wish to use. **CONT (F1)** returns to the previous panel. The number of the selected reference station is taken over into the **Ref Stn Id** line.

Note that setting Ref Stn Ids is only possible without a survey or stakeout operation running.

Repeaters and Repeater Box

Firmware 3.00 and higher supports the use of repeaters.

A repeater is a radio, which is set up for repeater mode. A repeater receives data from the reference and broadcasts the data further to the rover. Consequently, the range increases. The total range depends on the set up of reference, repeater and rover.

Since not all radio modems are suitable as repeaters, we recommend the Satelline 3AS(d) and all Pacific Crest RFM96 and PDL Models.

A radio, which is programmed as a repeater, can still be used for refer-ence and rover applications. How-ever, this is not recommended for power consumption reasons.

It is important that all radio modems at reference, repeater and rover operate on the same frequency. For a channel switch, the repeater requires connection to the sensor.

The GHT38 is a repeater box for the Leica housings for radio modems. By using this box, the housings can be fixed to a tripod. The power supply for the modem is enabled with an exter-nal battery and a power cable.

For more information on how to set up a repeater with a repeater box see section 2.13.

GSM devices are normally used to transmit or receive Real-Time data. Additionally a GSM device may also be used to steer and communicate with the Sensor e.g. to download raw data from a remote location etc. The following standard GSM models are directly supported with System 500 and fit into a Radio Housing:

Siemens M1
Siemens M20
Siemens TC35
Wavecom WMOD2
Wavecom M1200 Series

The following GSM models are also supported but do not fit into a housing:

Bosch 908/909
Sagem MC850
Siemens S25/S35i

Before using GSM phones for data transmission make sure your network operator supports data transmission.

If you are using a third party GSM phone make sure it supports AT command language.

Configuring the GSM Phone

```
CONFIGURE\ Interfaces          < >
 Interface        Port/Device
1 Real-Time        ------
3 NMEA Output      ------
4 ASCII Input      ------
5 Hidden Point     ------
6 Meteo            ------

CONT |     |EDIT |     |     |αNUM
```

From CONFIGURE\ Interfaces highlight the interface (e.g. Real-Time) you want to use with a GSM phone and press **EDIT** (**F3**).

Press **DEVCE (F5)** to access the device list.

```
CONFIGURE\ Devices and Ports
 Device
*Siemens M1
*Siemens M20
*Siemens TC35
*Unknown Radio
*Wavecom WMOD2

CONT | NEW |EDIT | DEL |DEFLT|
```

Select a standard GSM phone from the list.

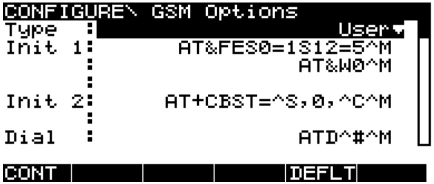
To select the Bosch 908/909, the Sagem MC850 or the Siemens S25/S35i, highlight **GSM** and press **EDIT (F3)**. Press **OPT (F4)**. Under **Type** select the equivalent GSM.

To define any other GSM device, highlight **GSM** and press **NEW** (**F2**). Enter a name (e.g. GSM-XY) and enter the applicable device parameters.

```
CONFIGURE\ New Port Settings
Name        :            GSM-XY

Baud Rate   :            19200▼
Parity      :             None▼
Data Bits   :                8▼
Stop Bits   :                1▼
Flow Contrl :          RTS/CTS▼

CONT |     |     | OPT |     |
```

The port settings are the parameters used for the communication between the Sensor and the GSM phone. If required, edit them to suit the GSM phone.

Press the **OPT** (**F4**) key to access the GSM options. The GSM options enable you to define the AT commands used for communiction between the sensor and the GSM phone.



Under **Type** select **User** and modify the remaining parameters. Alternatively select a standard GSM phone type from the list and press **SET-U (F5)** to turn these parameters into user parameters and then modify them.

Init 1 and **Init 2** - This is the initialisation sequence to initialise the phone. Between Init1 and Init 2, a check for the PIN is inbuilt.

Dial - This is the dialing string used to dial the phone number. A placeholder shall be used to insert the phone number as defined in GSM Connection.

Hangup - This is the hangup sequence used to end the network connection.

Escape - This is the escape sequence used to switch to the command mode before using the hangup sequence.

The characters below may be used to define the AT commands:

^M	Inserts a carriage return and send command
^#	Inserts the phone number as defined in GSM Connection
^S	Bearer Service: Speed (Protocol and NetDataRate)
^C	Bearer Service: Connection Element
~	Inserts a delay of 1/4 second
^^	Insert character **^**

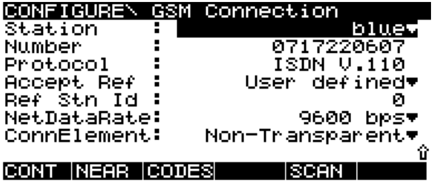
Please refer to the instruction manual of your GSM phone for information about which AT commands to use.

Using the GSM Phone

The way in which GSM phones are used for Real-Time GPS differs from radios. The Rover contacts the Reference. The Reference phone just has to be switched on. One Rover can then dial in to the Reference Station phone. As soon as the Reference is contacted, it sends the data to the Rover that has called it.

Therefore you can pre-define several GSM Connections and use them to switch between different Reference Stations.

In CONFIGURE\ Interfaces highlight the device to switch stations and press **CTRL (F5)**.



Select the **Station** to contact. The phone **Number** of the Station (Reference) and the type of **Protocol** to be used are displayed.

Accept Ref - Defines which reference station to accept real-time data from. Choose from the following:
Any Received means that the sensor will accept data from any reference station from which it receives data.
1st Received means that data will be received and used from the first reference station that is recognised by the rover. If you wish to force the system to try to establish a new connection with a different reference station press **1st (F6).**

User defined enables you to define which reference station data will be received from according to its **Ref Stn Id**.

Ref Stn Id - The Id of the Reference Station to be used. Note that setting Ref Stn Ids is only possible without a survey or stakeout operation running.

NetDataRate - Some GSMs are capable of automatic searching for the network baud rate. In this case **Autobauding** can be set. Otherwise, one of the predefined network baud rates must be selected.

ConnElement - Choose **Non-Transparent** for a GSM working with RLP (Radio Link Protocol) and **Transparent** for a GSM working without RLP. Please refer to the GSM manual to see if the GSM uses RLP. Before RLP can be used with a GSM, it must be support by the network. Check with the network provider.

Search for the nearest GSM Reference Station to the current sensor position by pressing **NEAR** (**F2**). The current sensor position is the position at the time when the NEAR key is pressed. A GSM station is only included in the search when **Use Coord** in panel CONFIGURE\ GSM Station is set to **YES**.

Once the nearest GSM Reference Station has been found, the Station field is updated accordingly.

The SCAN functionality can be used to check the data format of a GSM reference. Pressing **SCAN (F5)** establishes a connection to the GSM reference. The reference station id, the data format used for transmitting and the latency (time delay) of the GSM reference station is displayed.

```
Configure\ Scan Ref Stn
 StnId Data Format      Latency
 0      Leica           0.15 s

CONT
```

CONT (F1) cuts the GSM connection and returns to the previous panel. The station id of the highlighted reference station is taken over into the **Ref Stn Id** line, if **Accept Ref** is set to **User defined**.

To enter a new GSM station, highlight **Station** in panel CONFIGURE\ GSM Station and press **ENTER**.

```
CONFIGURE\ GSM Connection
 Station
 REF 1

                                C
CONT  NEW  EDIT  DEL
```

All existing stations are listed. To edit a station, highlight it and press **EDIT** (**F3**). To delete a station, highlight it and press **DEL** (**F4**). To enter a new station, press **NEW** (**F2**).

```
CONFIGURE\ New GSM Station
Station    :            blue
Number     :      0717220607
Protocol   :      ISDN V.110
Use Coord  :             YES
WGS84 X    :   4263868.298 m
WGS84 Y    :    722516.283 m
WGS84 Z    :   4673007.134 m

CONT COORD
```

Enter the **Station** name, telephone **Number** and the type of GSM **Protocol** (**Analog**, **ISDN V.110** or **ISDN V.120**). ISDN V.110 is equivalent to the UDI (Unrestricted Digital Information) mode found in firmware versions earlier than V4.0.

Use COORD - Set to **YES** to include a GSM station in the search for the nearest GSM reference station. If **YES** is set, coordinates can be entered and **COORD (F2)** can be used to switch between coordinate systems.

Press **CONT** (**F1**) to accept the settings and return to the station list and **CONT** (**F1**) a second time to return to panel CONFIGURE\ GSM Station.

Change the **NetDataRate** (Network baud rate) if necessary.

Press the **CODES** (**F3**) key to input your **PIN code**.

```
CONFIGURE\ GSM Codes

PIN Code    :          ********
PUK Code    :


CONT             DEL
```

If for some reason the PIN code is blocked (E.g. the wrong PIN was entered) input the **PUK Code** to be able to access the PIN.

DEL (F4) will delete both the existing PIN and PUK code.

Press **CONT** (**F1**) to return to previous screen.

Press **Shift** and then **CMD** (**F4**) to **SEND** (**F3**) an AT command to the GSM.

Note that this functionality can only be employed in Advanced Mode.

Press **CONT** (**F1**) in the CONFIGURE\ GSM Connection panel to return to CONFIGURE\ Interfaces.

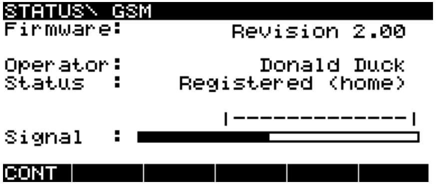
When a GSM Phone is configured a softkey **CONEC (F4)** or **DISCO (F4)** becomes available upon pressing **SHIFT** in the MAIN, SURVEY and STAKEOUT screen.

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

HELP             CONEC
```

This enables you to quickly connect to the selected Station or disconnect immediately after the survey is completed in order to save air time.

Status of the GSM phone

To access the GSM status press STATUS /Interfaces, highlight the GSM device and press **VIEW (F3)**.



Information about the connected GSM phone is displayed.

Firmware - Current firmware release.

Operator - GSM network operator.

Status - Registration status.

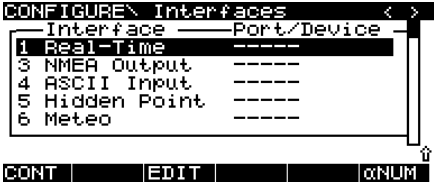
Signal Level - Indication of received signal strength on the GSM network.

A Modem device is normally used to communicate with the Sensor e.g. to download data or to transmit NMEA messages etc.
The following modem communication settings are as standard included with System 500:

U.S. Robotics 56K
Sprint PCS Motorola Timeport P8167

If you are using a third party modem make sure it supports AT command language.

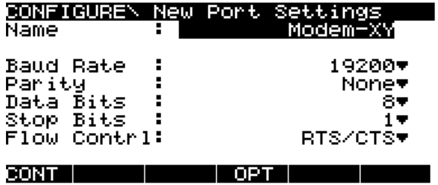
Configuring the Modem



From CONFIGURE\ Interfaces highlight the interface (e.g. Prim. Remote) you want to use with a modem and press **EDIT** (**F3**).

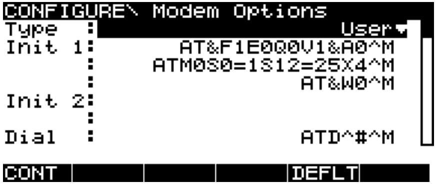
Press **DEVCE (F5)** to access the device list.

Highlight **Modem** from the list and press **NEW** (**F2**). Enter a name (E.g. ModemXY) and enter the applicable device parameters.



The port settings are the parameters used for the communication between the Sensor and the modem. If required edit them to suit the modem.

Press the **OPT** (**F4**) key to access the modem options. The modem options enable you to define the AT commands used for communiction between the sensor and the modem.



Under **Type** select User and modify the remaining parameters. Alternatively select a standard modem type from the list and press **SET-U (F5)** to turn this parameters into user parameters and then modify them.

Init 1 and **Init 2** - This is the initialisation sequenze to initialise the modem.

Dial - This is the dialing string used to dial the phone number. A placeholder shall be used to insert the phone number as defined in Modem Connection.

Hangup - This is the hangup sequence used to end the network connection.

Escape - This is the escape sequence used to switch to the command mode before using the hangup sequence.

The characters below may be used to define the AT commands:

^M	Inserts a carriage return and send command
^#	Inserts the phone number as defined in GSM Connection
^S	Bearer Service: Speed (Protocol and NetDataRate)
^C	Bearer Service: Connection Element
~	Inserts a delay of 1/4 second
^^	Insert character ^

Please refer to the instruction manual of your modem for information about which AT commands to use.

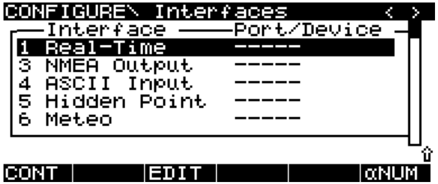
Using the Modem

The way a modem is used is very similar to a GSM phone. Please refere to the section GSM on how to use a modem.

The RTB (Real Time Beacon) Module receives DGPS corrections from U.S. Coast Guard or other differential correction beacons.

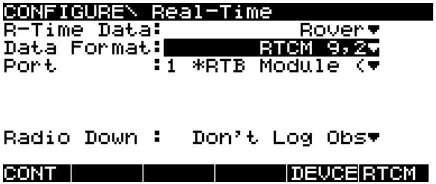
It is used for Real-Time applications in the meter or submeter accuracy range. The module consists of a combined GPS/Beacon antenna and a radio module that is available in a detachable housing.

Configuration



From CONFIGURE\ Interfaces highlight Real-Time press **EDIT** (**F3**).

Press **DEVCE (F5)** to access the device list. Select RTB Module (CSI) and press **CONT (F1)** to confirm.

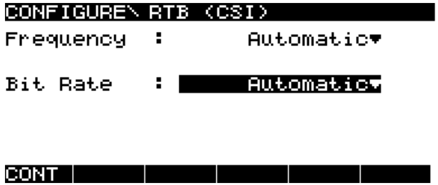


Ensure that the **Data Format** is set to RTCM 9,2.

Press **RTCM (F6)** to set the RTCM version and the number of bits/byte.

Press **CONT (F1)** to continue.

In CONFIGURE\ Interfaces press **CTRL (F5)**.



At certain locations it is possible that several beacon signals can be received at the same time. If **Frequency** is set to Automatic the strongest signal available will be used.

This is not necessarily the closest. If you know the frequency of the closest beacon select **User defined** and enter the frequency.

```
CONFIGURE\ RTB (CSI)
Frequency    :   User defined▾
                    300.0  kHz
Bit Rate     :      Automatic▾

CONT |    |    |RSTN |    |
```

Use the **RSTN** (**F4**) key to display the Beacon Stations available on the Sensor.
Note that the Beacon Station list has to be **transferred** to the Sensor before.

```
UTILITIES\ Beacon
 287.5 650 Hoek van Holland
 293.5 680 St Catherines
 299.0 689 Nash Point
 299.5 650 Ameland
 302.5 687 Flamborough Head

CONT |    |    |    |    |
```

Depending on the beacon station the **Bit Rate** may vary. Select Auto will detect the bitrate automatically. Select User defined and enter a value according to the Beacon station.

Press **CONT (F1)** to close the control panel.

Status of the RTB Module (CSI)

To access the RTB Module status press STATUS /Interfaces, highlight the RTB device and press **VIEW (F3)**.

```
STATUS\ RTB (CSI)
Signal       :          25
SN Ratio     :           0   dB
Frequency    :       204.0  kHz
Bit Rate     :         100

CONT |    |    |    |    |
```

Information about the connected RTB Module is displayed

Signal - Strength of the incoming signal in µV/m.

SN Ratio - Signal to noise ratio in dB.

>25	Excellent
20 to 25	Very good
15 to 20	Stable to Good
10 to 15	Intermittent to Stable
7 to 10	Intermittent
<7	No lock

Frequency - The frequency on which the RTB module is currently operating.

Bit Rate - The bit rate on which the TB module is currently operating.

The RTS Module (Racal) receives DGPS corrections from RACAL LandStar satellites. It is used for Real-Time applications in the meter or submeter accuracy range.

The module consists of a combined GPS/LandStar antenna and a DGPS radio receiver that is available in a detachable housing.

To receive DGPS corrections from the LandStar satellites a corresponding license must be available.

Configuration

```
CONFIGURE\ Interfaces                  < >
 -Interface ---------Port/Device -
 1 Real-Time          ------
 3 NMEA Output        ------
 4 ASCII Input        ------
 5 Hidden Point       ------
 6 Meteo              ------

CONT |    |EDIT |    |    |αNUM
```

From CONFIGURE\ Interfaces highlight Real-Time and press **EDIT** (**F3**).

Press **DEVCE (F5)** to access the device list. Select RTS Module (Racal) and press **CONT (F1)** to confirm.

```
CONFIGURE\ Real-Time
R-Time Data:              Rover▾
Data Format:          RTCM 1,2▾
Port       :1 *RTS Module <▾


Radio Down :  Don't Log Obs▾

CONT |    |    |    |DEVCE|RTCM
```

Ensure that the **Data Format** is set to RTCM 1, 2.

Press **RTCM (F6)** to set the RTCM version and the number of bits/byte.

Press **CONT (F1)** to continue.

In CONFIGURE\ Interfaces highlight Real-Time and press **CTRL (F5)**.

```
CONFIGURE\ Racal
Ref Stn Id :          Automatic▾

Channel    :          Automatic▾



CONT |    |    |    |    |
```

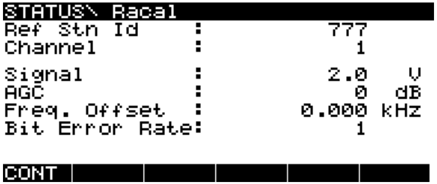
DGPS corrections can be received from different RACAL ground stations via different satellites. Each satellite sends this corrections by different beams (Channels).

If **Ref Stn ID** is set to **Automatic** it will search the closest ground station according to your current position. If it is set to **User defined** you may enter an Id manually or press **RSTN (F4)** to request a list of all ground stations available.

If **Channel** is set to Auto it will select an appropriate spot beam from the nearest satellite. If it is set to User defined you may enter a Channel number manually.

Press **CONT (F1)** to close the control panel.

Status of the RTS Module (Racal)
To access the RTS Module status press STATUS /Interfaces, highlight the RTB device and press **VIEW (F3)**.



Information about the connected Racal module is displayed.

Ref Stn ID - 3 digit Racal reference station ID. If **-1** is displayed the necessary license is not available.

Channel - Demodulator channel number.

Signal - Strength of signal. For good reception a signal of 1.5V or higher is recommended.

AGC - Automatic Gain Control indicating the voltage being fed to the variable gain amplifier on the de-modulator.

Freq. Offset - The difference be-tween the occupied carrier frequency and the entered frequency.

Bit Error Rate - The bit error rate between 0 and 7.

SAPOS is a reference station service available for Germany.

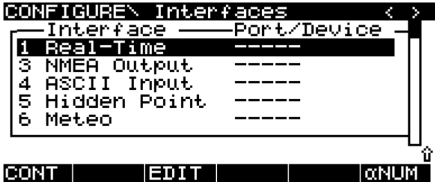
To make use of this service there are three different options:

1. **SAPOS** reference decoder box.

2. **SMARTgate** box.

3. **Telemax** Service.

Configuration



From CONFIGURE\ Interfaces highlight Real-Time and press **EDIT** (**F3**).

Press **DEVCE (F5)** to access the device list. Select SAPOS-Box and press **CONT (F1)** to confirm.

Select one of the following **Data Formats** : RTCM 1,2, RTCM 18,19 or RTCM 20,21.

Two different services are available. RTCM corrections from the closest reference can be received or your own position can be sent to the device which then receives corrections based on a virtual reference station.

In CONFIGURE\ Interfaces highlight the Real-Time and press **CTRL (F5)**.

Change **Ref Net** to Yes if corrections for a virtual reference shall be used.

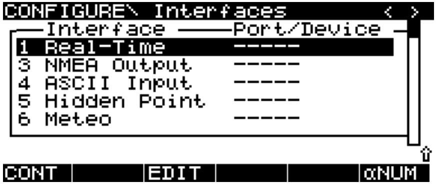
Press **CONT (F1)** to close the control panel.

SMARTgate is a device which has GSM and Radio as well as the functionality of the SAPOS-Box integrated (see www.navsys.de). The device is connected to the sensor in the Leica radio housing.

To operate this device special user-profiles have to be transferred to the SMARTgate box. Such a user-profile contains information on the kind of communication, the service em-ployed, the account used, a list of reference stations, an acceptable minimum distance etc.

The parameters of the user-profiles are neither deletable or editable nor may they be copied to the sensor. You may select from differently configured profiles on the sensor, though.

Configuration

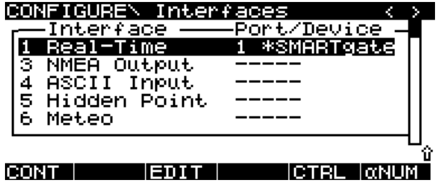


In the CONFIGURE\ Interfaces panel highlight Real-Time and press **EDIT** (**F3**).

Set **R-Time Data** to **Rover** and set the **Data Format** to either **RTCM 1,2** or **RTCM 20,21**.

Press **DEVCE** (**F5**) to access the device list. Select SMARTgate and press **CONT** (**F1**).

Press **CONT** (**F1**) to return to the CONFIGURE\ Interfaces panel.



Press **CTRL** (**F5**) to access the CONFIGURE\ SMARTgate panel.

Profile - Select one of the User Profiles stored in the SMARTgate box.

Profile No - Displays the number of the selected profile.

Ref Select - Choose the criterion by which the Reference Station shall be selected.
Choose **Profile** to select the reference station according to the given profile.

Choose **Frequency** to select the reference station according to a frequency different to the given profile. The **Frequency** has to be manually specified.

Choose **Phone No** to select the reference station according to a phone number different to the given profile. The **Phone No** has to be manually specified.

Choose **Station No** to select the reference station according to a station number different to the given profile. The **Station No** has to be manually specified.

Viewing the Status of SMARTgate

To access the SMARTgate status press STATUS /Interfaces, highlight the SMARTgate device and press **DEVCE** (**F5**).

```
STATUS\ SMARTgate
Profile    :
Profile No:                0

Medium     :            None
Error Rate:               99

CONT |    |ACCNT|VERS|    |
```

Profile - Displays the selected User Profiles.

Profile No - Displays the number of the selected profile.

Medium - Displays the currently used medium. This may be either **GSM**, **2m Radio** or **None**.

Error Rate - Displays the error rate of the currently active medium (0...99%).

Press **ACCNT** (**F3**) to display the currently used **Account**, its **Provider**, the currently used **Service** (e.g. EPS or HEPS) and the **Credit Unit** and **Credit Time**.

CreditUnit - Displays the remaining credit units.
CreditTime - Displays the time remaining according to the credit units.

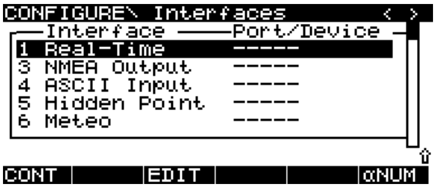
Press **VERS** (**F4**) to display the **Type** and the **Serial No.** of the SMARTgate box, the **Software Version** and its **Software Date**.

Using the SMARTgate box

Once you have set the configuration for the SMARTgate box the connection to the SAPOS station can be established by pressing **SHIFT-CONEC** (**F4**) in the MAIN, SURVEY or STAKE-OUT panel. To disconnect again press **SHIFT-DISCO** (**F4**).

To make use of the Telemax service you first have to transfer the sensor specific Account file to your sensor. A maximum of two Account files may be transferred to each sensor, e.g. one for private and one for non-private use.
For details on how to transfer such Account Files refer to chapter 13.15 Transfer Telemax Account File.

Configuration



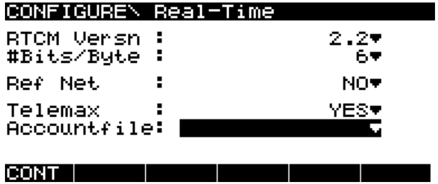
In the CONFIGURE\ Interfaces panel highlight Real-Time and press **EDIT** (**F3**).

Set a R-Time Data to **Rover** and set the **Data Format** to either **RTCM 1,2** or **RTCM 20,21**.

Press **DEVCE** (**F5**) to access the device list. Select the GSM or Modem attached to your sensor from the list or define a **NEW** (**F2**) one. For details on how to configure and use a GSM phone or Modem refer to the sub-chapters GSM and Modem in the Appendix H.

Press **CONT** (**F1**) to confirm your selection and return to the CONFIG-URE\ Real-Time panel.

Press the **RTCM** (**F6**) key to select the Telemax service in setting **Telemax** to YES. Select the appro-priate **Accountfile**, which you have transferred to the sensor before.



With the Data Format being set to RTCM two different services are available. Either RTCM corrections from the closest reference can be received or your own position can be sent via the selected device which then receives corrections based upon a virtual reference station.

Change **Ref Net** to YES if corrections for a virtual reference shall be used.

Press **CONT** (**F1**) to confirm.

Using Telemax

Once you have set the configuration for your GSM phone or the Modem and selected the Telemax service you can establish the connection to the SAPOS station by pressing **SHIFT-CONEC** (**F4**) in the MAIN, SURVEY or STAKE-OUT panel.

Based upon the Account file the Telemax software checks if you have the right to receive uncoded RTCM corrections from the SAPOS station. To disconnect again press **SHIFT-DISCO** (**F4**) in the MAIN, SURVEY or STAKE-OUT panel.

Hidden Point devices are special devices to measure distances, angles and azimuths to points which are not accessible by means of GPS e.g. house corners or trees. These measurements can be used to feed the Hidden Point application which is accessible in the Survey and Stake-out screen when the operation mode is set to Advanced. The following devices are supported:

Leica **Disto memo** (distance only)
Leica **Disto pro** (distance only)
Leica **Disto™ pro^{4}** (distance only)
Leica **Disto™ pro^{4} a** (distance only)
Laser Ace 300
Criterion 400
Criterion Compatible
Leica Vector
Leica Laser Locator
Leica Laser Locator Plus

All devices support reflectorless distance measurements using laser technology.

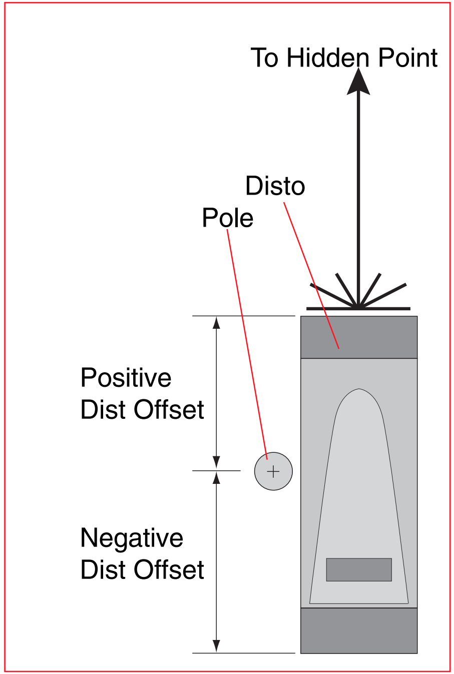
Configuration

From CONFIGURE\ Interfaces highlight Hidden Point and press **EDIT** (**F3**).

```
CONFIGURE\ Hidden Point
Use Device :              YES▾
Port       :          2 *Disto▾
Dist Offset:            0.000  m
Hgt Offset : Inst & Trgt Hgt▾
Inst Height:            0.000  m
Trgt Height:            0.000  m

CONT       EAO       DEVCE
```

Set **Use Device** to **YES**. If NO is set the Hidden Point measurements need to be entered manually. **Press DEVCE (F5)** to access the device list. Select a Hidden Point device form the list. For the Disto memo or Disto pro, select **Disto**. When using a Disto™ pro^{4} or Disto™ pro^{4} a select **Disto 4**. Press **CONT (F1)** to confirm.

Enter a distance **Dist Offset** if necessary. A negative offset means the distance measured will be reduced by the offset.



Measuring Offsets when using the Disto

Hgt Offset - Available if **Use Device** in the current panel and **Include Hgt** in the panel CONFIGURE\ Hidden Point in the current configuration set (see chapter 5.4.1.) are set to **YES**. The options are:

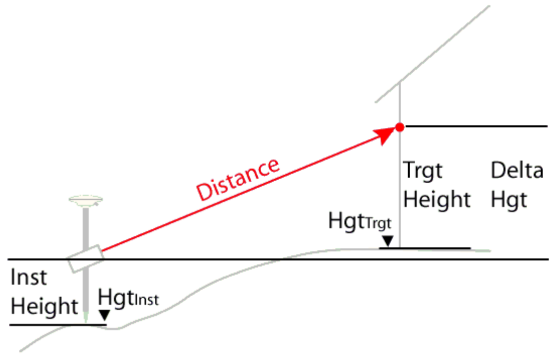
None - Neither instrument nor target height is considered. The result is the delta height between the center of the external device and the aimed point. This delta height can be measured, estimated or left as zero.

Inst Height - The instrument height is considered. If the delta height between the center of the external device and the aimed point is measured or estimated, the result is the height difference between the rover point on the ground and the aimed point. Enter the instrument height into the corresponding new line.

Inst Height & Trgt Height - Instrument as well as target height to be considered. If the delta height between the center of the external device and the aimed point is measured or estimated, the result is the ground height difference between rover and aimed point. Enter the values in the corresponding two new lines.

The instrument height is the distance from the ground to the center of the external device.

The target height is the distance from the ground to the aimed point.



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

If you are using a device that measures azimuths press **EAO (F3)** to enter an external angle offset. Select the **Method** Permanent and enter a value or select New for each Point and the program will prompt for a value during each Hidden Point measurement.

Press **CONT (F1)** to confirm.

In order to connect a device to the receiver use only the cable delivered with the device.

Introduction

The MC500 is an OEM GPS receiver, that can be integrated into complete positioning systems.

The MC500 receiver has a rugged housing that meets high shock and vibration environmental specifications. This makes the receiver ideal for use in high vibration and other difficult environments - such as Machine Control. Details of these specifications can be found in the MC500 User Manual.

The receiver and measurement performance of the MC500 are the same as the SR530. The MC500 tracks the L1 C/A code and L2 P-code to reconstruct the carrier phase. When Anti-Spoofing (A-S) is activated, the receiver switches to a patented P-code aided tracking technique that provides full L2 carrier measurements and L2 pseudoranges.

MC500 GPS receiver

The MC500 also includes the data logging features of the RS500 (see Appendix J) and is suitable for reference station applications in severe environments

With a radio modem attached the receiver can be used for RTK operations. Coordinates can be calculated with a precision of up to about 1cm.

Standard Features

The MC500 includes as standard the following features:

PPS Output functionality installed.
Event Input functionality installed.
Met / Tilt Interface.
Ring Buffer Functionality.
Ground Stud.
Environmental shock absorbers.
Dust caps for external ports.

Data Storage

The MC500 also comes as standard with a PCMCIA card. This card enables data to be stored for post-processing. This card is installed behind the protective cover. This cover should only be removed by an approved Leica technician.

Outside World Interface (OWI)

External control of the MC500 is achieved through use of the Outside World Interface (OWI) message format from Leica.

Integration assistance and OWI documentation is available on request from Leica.

Powering the MC500

The MC500 requires 12VDC power to be supplied externally, as there is no option to connect standard Camcorder batteries.

Turning the MC500 On/Off

Due to the ruggedised housing of the MC500, there is no on/off switch on the front of the sensor.

The MC500 can be powered on or off by the TR500 Terminal or by a remote control command (OWI).

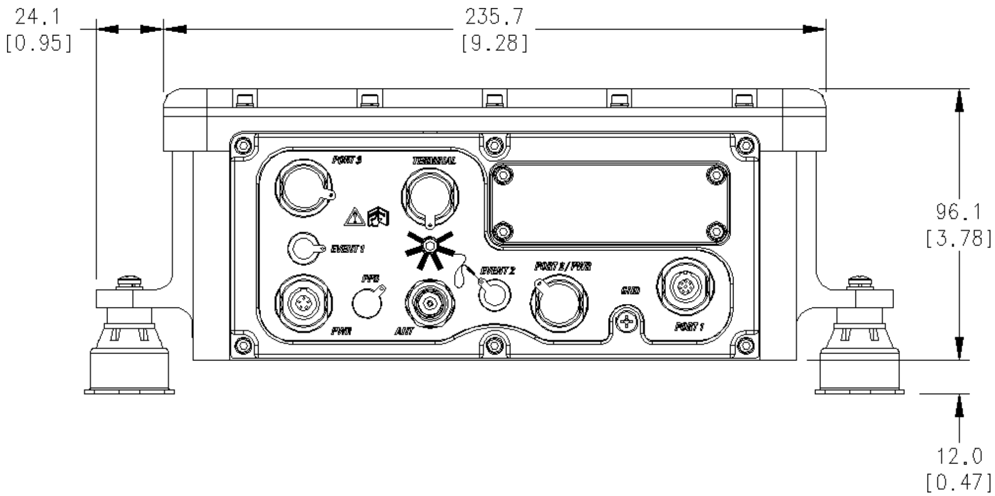
Like the Sr5xx sensors, the MC500 will automatically power itself up and return to the previous operating mode after any temporary power failure.

Cabling Connections / Options

Cable connections are identical to other System 500 receivers.

Refer to MC500 Equipment list, Dozer 2000 Installation and Maintenance Guide for cabling options.

Please see Front Panel Diagram for cable connection information.



Port 1

Pin	Function
1	RTS
2	CTS
3	GND
4	Rx
5	Tx
6	Vmod
7	Bat
8	+12V

Port2/PWR

Pin	Function
1	Bat
2	+12V
3	GND
4	Rx
5	Tx

Port 3

Pin	Function
1	RTS
2	CTS
3	GND
4	Rx
5	Tx
6	Vmod
7	Bat
8	+12V

Terminal

Pin	Function
1	KDU_ON
2	KDU_PWR
3	GND
4	Rx
5	Tx

PWR

Pin	Function
1	Bat
2	+12V
3	GND
4	---
5	---

Operating and Storage Temperatures

The range of the operating and storage temperatures of the MC500 is greater than that of the SR5xx sensors:

Operating temp: -20°C to +60°C
Storage temp: -40°C to +70°C

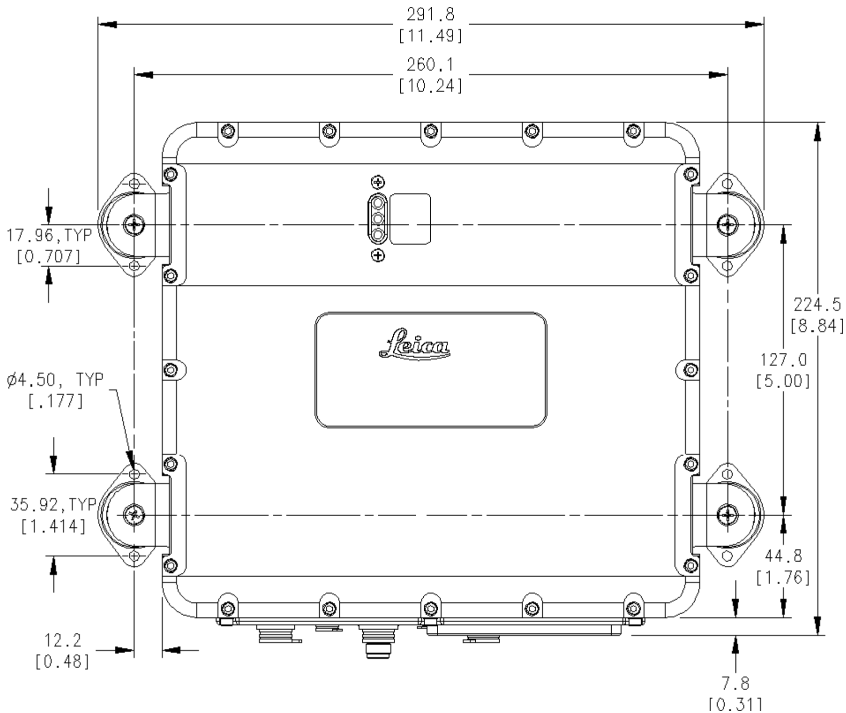
The operating and storage temperatures of all other MC500 components are the same as detailed in Appendix A.

Shock and Vibration Specifications

Exceeds MIL-STD-810C, Proc VIII. Equip Cat F for Tracked Vehicles

Mounting Diagram

The attached diagram shows the dimensions for mounting the MC500.



MC500 GPS receiver - Mounting Dimensions

Documentation Packages
Please see the following documentation to learn more about the MC500

MC500 User manual

OWI Manual

Dozer 2000 Installation and Maintenance Manual

Dozer 2000 User Manual

Dozer 2000 Equipment List

Introduction

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

The RS500 uses the same housing and meets the same environmental specifications as the SR5xx sensors, which are detailed in Appendix A. Generally, the RS500 operates in the same manner as the SR530, but is designed to operate for specific reference station applications using remote control software, i.e. Leica Geosystems ControlStation™ software.

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

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

The receiver and measurement performance is the same as with the SR530. The RS500 tracks the L1 C/A code and L2 P-code to reconstruct the carrier phase. When Anti-Spoofing (A-S) is activated, the receiver switches to a patented P-code aided tracking technique that provides full L2 carrier measurements and L2 pseudoranges.

Standard Features

The RS500 includes the following standard features, which are not available in the SR5xx sensor types:

One PPS Output port.
Two Event Input ports.
Ring Buffer logging.
Support for external sensors (Meteo/Tilt).

Data Storage

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

Outside World Interface (OWI)

External control of the RS500 via remote interface is achieved through use of the **O**utside **W**orld **I**nterface (OWI) command language. The ASCII/NMEA-type message format from Leica as well as the compact Leica Binary 2 format can be used. Integration assistance and OWI documentation is available on request from Leica Geosystems.

Powering the RS500

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

Turning the RS500 On/Off

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

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

Like the Sr5xx sensors, the RS500 will automatically power itself up and return to the previous operating mode after any temporary power failure.

Cabling Connections / Options

Cable connections are identical to other System 500 receivers.

Operation of the RS500

Like the SR5xx sensors, the RS500 can be operated either with the TR500 Terminal or by remote control. However, the TR500 cannot be used for running a survey, stakeout or any of the other applications available for System 500. Used with an RS500, the Terminal provides the basic functionality to set certain operation parameters, port configurations and all transfer capabilities, including the upload of new firmware. Via the STATUS hard key all status information is available.

For the majority of applications, the RS500 has to be operated using Leica Geosystems ControlStation™ or other appropriate reference system control software.

Using the TR500 with the RS500

When the RS500 is turned on using the TR500, the following screen will appear.

```
MAIN\
4 Utilities...
5 Job
6 Configure
7 Transfer...

CONT
```

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

The RS500 also has reduced **CONFIG** and **STATUS** options. Only the options that are relevant to operating an RS500 are available. Full details on the **CONFIG** and **STATUS** menu options available are described in the main body of this manual. TR500 configuration options unique to the RS500 sensor are described in the following sections.

Ring Buffer Functionality

The RS500 is supplied as standard with ring buffer functionality. The ring buffer allows a second set of GPS raw data to be recorded at a different observation rate as is defined within the standard/primary logging configuration.

The user can define the time period for storing data into the ring buffer. For example, if the user chooses to store 1 hour of data into a ring buffer then the last one hour of stored data will always be available. Data that is older than 1 hour is automatically over-written by the data currently being logged. When the logging into a ring buffer is activated a check will be made that there is enough free space on the PC Card or internal memory to log the data with the desired logging rate and duration.

This required space will be reserved, so that it cannot be used by other applications e.g. standard / primary logging.

Ring buffer functionality is primarily designed to be configured using remote control commands from external software and this is how most users will control the ring buffers. However, it is also possible to configure ring buffers by using the TR500 terminal.

Configuring the Ring Buffer

Press the **CONFIG** button and then choose **2 Operation** and then **6 Ring Buffer**.

```
CONFIGURE\ Ring Buffer
Ring Buffer No:              0▾

Status        :        Inactive

Obs Rate      :            0.1▾ s
Data Interval :        10 mins▾
Flag Obs      :         Static▾
Device        :        PC-Card▾

CONT   START
```

Ring Buffer No - Select a ring buffer to configure. It is possible to configure up to 10 ring buffers. Only one buffer can be running at one time.

Status - Indicates if the currently chosen ring buffer is **ACTIVE** (logging) or **INACTIVE** (not logging).

Obs Rate - The rate at which observations will be logged to the chosen ring buffer. Choose between 0.1s to 60s.

Data Interval - The size of the ring buffer. This sets the duration for how long data should be recorded to the ring buffer before newly observed data is recorded over the oldest data.

Flag Obs – Defines the dynamic mode for the selected Ring Buffer. Choose between **Static** and **Moving.**

Device - If the sensor has internal memory installed then the data recorded to the ring buffer can be stored on the sensor internal memory or the PC-Card.

Starting the Ring Buffer

Once the chosen ring buffer has been configured, pressing **START (F3)** activates logging to the ring buffer.

```
CONFIGURE\ Ring Buffer
Ring Buffer No:                 0▾
Status          :         Inactive
Obs Rate        :             0.1▾ s
Data Interval   :         10 mins▾
Flag Obs        :          Static▾
Device          :         PC-Card▾
CONT |     |START|DEL |    |    |
```

Note that if there is insufficient memory available on the chosen device for the ring buffer, then it will not become active. Either the ring buffer configuration is reduced in size by choosing a different interval or shorter period or the memory available on the chosen device is increased by erasing data from the card.

Once the chosen ring buffer is active, the **STOP (F3)** button then becomes available to stop logging to the ring buffer.

```
CONFIGURE\ Ring Buffer
Ring Buffer No:                 0▾
Status          :           Active
Obs Rate        :             0.1▾ s
Data Interval   :         10 mins▾
Flag Obs        :          Static▾
Device          :         PC-Card▾
CONT |     |STOP |    |    |    |
```

Note, that it is not possible to activate more than one Ring Buffer at a time. To log data to another ring buffer with a different configuration requires the currently active ring buffer to be stopped before starting the new one.

Once data has been logged to a ring buffer and logging has been stopped then the data in this ring buffer can be deleted by pressing **DEL (F4)**.

Pressing **START (F3)** restarts logging.

It is not possible to change the configuration parameters of a ring buffer once data has been recorded to the buffer. Only after deleting the recorded data stored in that buffer, can the configuration parameters be edited.

A ring buffer does consist of several files sharing the same file name with incrementing file extension. The number of files a ring buffer consists of depends on the data interval specified and is automatically determined. For example, a one hour interval will consist of 6 files each of 10 minutes length and a seventh file which is currently logged data to when the ring buffer is active. The ring buffer consists only of MDB (**M**easurement **D**ata**B**ase) files. No additional job (GeoDB) files will be created.

The ring buffer data will be stored on the chosen memory device in the following directory:

\DATA\GPS\RINGBUF

The static point which is stored into the ring buffer has the following point Id automatically assigned:

RBxxxxff

where:
xxxx - 4 character sensor ID (by default serial number of the sensor, last 4 digits)
ff - 2 character ring buffer number (00, 01 , … 09)

Additional External Devices

The RS500 supports additional external devices, which may be required for GPS reference stations serving special applications. Currently supported devices are:

- Meteorological Data Sensors
  - Paroscientific, Inc.: Met3A Fan-Aspirated Pressure, Temperature and Humidity Sensing System
  - Paroscientific, Inc.: Met3 Pressure, Temperature and Humidity Sensing System
  - Vaisala : PTU200GPS (must be programmed to mimic MET3 data string)

- Tilt Data Sensors
  - Applied Geomechanics, Inc.: MD900-T Digital/Analog Clinometer

Data received from all of these sensor types can be logged along with the GPS raw data onto the sensor PC card or internal memory if installed. The data will be logged into the same raw measurement files as the GPS raw data. External application software such as ControlStation™ is required to convert this data to ASCII readable formats, e.g. RINEX.
It is further possible to directly pass this data through the sensor and output it directly via the remote communication port to the controlling application software. This is possible in addition or instead of direct logging this data internally.

The above external devices can be connected to Ports 1, 2 or 3 of the RS500. Specific interface cables are available from your Leica Geosystems representative, which provide power to the external sensors from the RS500 thus creating a much neater Reference System installation.

Configuring Meteo Devices

Press the **CONFIG** button and then choose **4 Interfaces** and then **6 Meteo**.

```
CONFIGURE\ Meteo
Use Device :                YES▾
Port       :          1 *RS232▾
Data Rate  :               1.0▾ s
Log to File:                 NO▾
Notify Msg :               None▾

CONT                   DEVCE
```

Use Device – Set to YES, to activate using a Meteo device and access the configuration options.

Port - defines the port to where the Meteo device will be connected.

Data Rate – Defines the rate at which data will be requested from the Meteo device. Select between 0.1 to 3600 seconds. Note, the maximum rate possible also depends on the type of Meteo device attached.

If the rate is set higher than the device is able to deliver data, it may happen that no complete data sets can be received at all or the data will not have changed from the previous measurement. Please refer to the documentation related to the attached device.

Log to File – Select YES to activate direct logging of the Meteo data to a file. Data will be logged always into the same file/job where the GPS raw data is being logged to. No data will be logged, unless raw data logging is active. Data will also be logged to ring buffer raw data files if ring buffer logging is active.

Notify Msg – Select BINARY, to directly output the Meteo data to external application software via a selected communication port. Press **NPORT (F4)** to select the remote port and configure the device through which the message shall be transmit-ted.

The output message format is Leica Binary V2 (LB2) message type “Meteorological and Inclination Data (ID 10_{16})”. Documentation for the LB2 Interface Control is available on request from your Leica Geosystems representative.

Press **DEVCE (F5)** to access the device list. Select a Meteo device from the list and press **CONT (F1)** to confirm. To interface to the Vaisala PTU200GPS, choose the MET3 interface but make sure the Vaisala system has been programmed to mimic the MET3 data string (details will be supplied with Vaisala PTU200GPS when purchased via Leica Geosystems).

Configuring Tilt Devices

Press the **CONFIG** button and then choose **4 Interfaces** and then **7 Tilt**.

```
CONFIGURE\ Tilt
Use Device :              YES▾
Port       :          1 *RS232▾
Data Rate  :               1.0▾ s
Log to File:               NO▾
Notify Msg :             None▾

CONT                DEVCE
```

Use Device – Set to YES, to activate using a Tilt device and access the configuration options.

Port - defines the port to where the Tilt device will be connected.

Data Rate – Defines the rate at which data will be requested from the Tilt device. Select between 0.1 to 3600 seconds. Note, the maximum rate possible also depends on the type of Tilt device attached.

If the rate is set higher than the device is able to deliver data, if may happen that no complete data sets can be received at all or the data will not have changed from the previous measurement. Please refer to the documentation related to the attached device.

Log to File – Select YES to activate direct logging of the Tilt data to a file. Data will be logged always into the same file/job where the GPS raw data is being logged to. No data will be logged, unless raw data logging is active. Data will also be logged to ring buffer raw data files if ring buffer logging is active.

Notify Msg – Select BINARY, to directly output the Tilt data to external application software via a selected communication port. Press **NPORT (F4)** to select the remote port and configure the device through which the message shall be transmitted.

The output message format is Leica Binary V2 (LB2) message type “Meteorological and Inclination Data (ID 10_{16})”. Documentation for the LB2 Interface Control is available on request from your Leica Geosystems representative.

Press **DEVCE (F5)** to access the device list. Select a Tilt device from the list and press **CONT (F1)** to confirm.

Power Failures

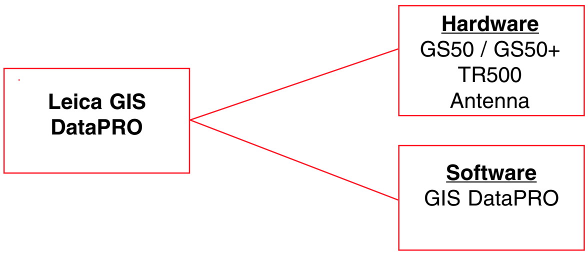
Like the SR5xx sensors, the RS500 will automatically power itself up and return to the previous operating mode after any temporary power failure. After a power failure the ring buffer configuration will be restored. A ring buffer, which was running at the time of the power failure, will be restarted automatically without user (or remote control) interaction.

Introduction

This appendix describes the operation and data collection techniques specific to the GS50 / GS50+ and GIS data collection methods.

This Appendix should be read in parallel with the main body of this Technical Reference Manual to which the chapters described below refer.

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



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

GIS DataPRO Post-processing software

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

1. Insert the CD-ROM into the CD drive of your PC.
2. Execute the "Setup" command.
3. Follow the instructions that appear on the screen.

Both a hardware and software user manual can be found on the CD in PDF format. The software itself contains a comprehensive online Help System.

The GS50 Receiver

The GS50 tracks the L1 C/A code and uses it to reconstruct the carrier phase. Data can be stored for post-processing in SKI-PRO or GIS DataPRO. Baselines can be calculated up to a precision of 10-20mm +/-2ppm.
With a radio modem or other DGPS source the receiver can be used for real-time measurements accepting RTCM code corrections. Coordinates can be calculated with a precision of up to about 0.4 meters.

The GS50+ Receiver

The GS50+ is a 12 channel L1, 12 channel L2 code and phase GPS receiver. The standard GS50+ records phase measurements for post processing and RTK purposes. Data can be stored for post-processing in SKI-Pro or GIS DataPro. Baselines can be calculated to a precision of 5-10 mm +/-1 ppm.
With a radio modem the receiver can be used for RTK measurements. Coordinates can be calculated with a precision of up to about 1 m.

Hardware Configurations and Specifications

The following pages contain different possible combinations for connecting the GS50 / GS50+ sensor with various accessories.

Centimeter level accuracy can be obtained by using two GS50+ receivers, one as reference and one as rover. For real time applications, a radio modem is needed to transfer the correction signal from the reference to the rover.

The following solutions will allow the user to obtain sub-meter positional accuracy using the Leica GS50.
With post-processing it is typical to obtain positional accuracies of 30cm using 2 GS50s (one as a reference and the other as a rover.) No additional options are necessary for a post-processing arrangement.

One Unit Operation

It is possible to use only one GS50 as a rover by downloading and post-processing RINEX data from the Internet or Public FTP server. The quality obtained cannot generally be estimated because it depends on the quality of public data and the baseline length[1]. In theory, it should be possible to obtain 30cm accuracy with reasonable baseline length[1] and quality reference data.
Along with the GIS DataPRO software, the equipment shown in the chapter “Equipment Setup: Real-Time Rover, GIS Rover” is sufficient for this type of application. The same equipment would also be sufficient for simple navigation, yielding accuracies of 2-3 meters.

DGPS

For real-time DGPS positioning, the standard equipment employs either public coastguard beacon or satellite differential signal provided by Racal-Landstar for differential corrections. Both equipment set-ups are shown to you in the Equipment Setup chapter: Real Time Rover, GIS Rover. Both require the use of GIS DataPRO software. While the Racal-Landstar signal provides global coverage (except in the Polar Regions,) beacon stations only broadcast the public signal in certain areas.[2] With either option, a typical accuracy of 40cm to 70cm can be expected, but is dependent upon location.
Other DGPS sources are also available depending on your location. In most countries, one or more sources of public signal should be available. The GS50 / GS50+ is able to work with any of these sources, provided there is a radio or modem capability to transmit the data in a standard RTCM data format.

The GS50 / GS50+ is also capable of transmitting standard RTCM corrections in real-time.

[1]Reasonable baseline length for best quality is about 100km, depending on the atmosphereic conditions. The measurement range for the baseline length is >1000km.

[2]For additional information on locations and information please visit http://www.csi-dgps.com

RACAL/LANDSTAR RTS

In addition to the standard features previously listed, additional accesories can be used in conjunction with the GS50 to enhance data collection methods. The Racal-Landstar satellite differental module and antenna can be used for Real Time corrections where beacon or reference data is not available. The Racal module and antenna attach to the GS50 in the same configuration as the RTB module and antenna (see chapter Equipment Setup - Real Time Rover, GIS Rover). Because of the nature of the satellite differential, signal coverage is global (except in the polar regions.)

Racal RTS Module Type 90952/3/90 /GFU10
and LandStar Mk4 Antenna Type 90952/3/30,
Racal Tracs Ltd. Surrey, England

Because the RACAL signal correction is porprietary in nature, it is necessary to obtain a subscription to the service.

LASER RANGEFINDERS AND DISTANCE METERS

When objects cannot be occupied directly, a variety of choices are available for offset location and can be interfaced via port 2 on the GS50 / GS50+.

The **LEICA Disto** (Below). The Disto™ pro^4 and Disto™ pro^4 a are capable of visible light measurement with a range of 100 meters and subcentimer accuracy. For more information on the Disto family of products, please visit http://www.leica-geosystems.com.

(Above)
The **Laser Ace** is a laser rangefinder from MDL in the UK. It has a range up to 300 meters with an accuracy of 10cm. For more information on the Laser Ace, visit http://www.mdl-laser.com.

(Right) **The Impulse**, by Laser Technology is a laser rangefinder from Laser Technology with a range up to 500 meters with an accuracy of about 15cm. For more information on The Impulse, please visit http://Lasertech.com.

(Above)
The **LEICA Laser Locator** and **Laser Locator Plus** are modern high-performance binocular. They combine the functions of four instruments in one compact, handheld unit: binocular observation, distance measurement, northfinding and inclinometer. For more information on the Vector family of products, please visit http://www.leica-geosystems.com.

Sensor Transfer with SKI-Pro/GIS DataPRO

Using the Remote interface it is possible to download data directly from the memory device of the sensor into SKI-Pro or GIS DataPRO through the serial port of the PC without having to remove the TR500 from the Terminal port.

Configure the Remote interface to the appropriate port and device as described in chapter 9.15 “Interfaces-Remote”. This should normally be Port 2 and RS232 device using the standard System 500 download cable.

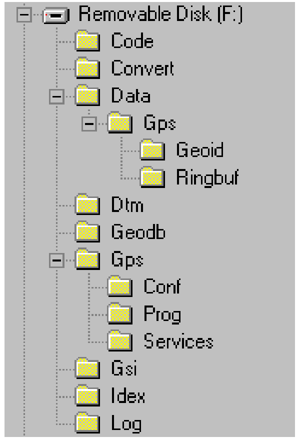
Connect the sensor to the PC. Data can now be downloaded to the PC, in the normal manner, using the Sensor Transfer component in SKI-Pro.

Compact Flash - Directory Structure and Transfer

Using the standard default for external PCMCIA Flash memory, Firmware, Rawdata and Configuration information can easily be transferred to and from the GIS DataPRO software.

Using Windows Explorer to transfer data

To transfer data from the PCMCIA card to your PC, for use by the GIS DataPRO software, you must first understand the directory/storing structure of the GS50 / GS50+ sensor.



If the PCMCIA card has been formatted on the sensor (Please refer to the H/W user manual), then the following directory structure should appear on the card.

Real Time Beacon Stations

It is possible to select a beacon service from a list that can be placed on the PCMCIA card. The file must be called beacon.txt, saved in the GPS directory and finally be transferred to the sensor.

The frequency of the beacon service should be placed on the left, with the description on the right, seperated by a space as (shown right).

228.0 Daiohzaki
292.0 Cape Mendocino
313.0 Helgoland

The GS50 / GS50+ Receiver

The GS50 and GS50 + receivers are specifically designed for GIS data collection. It uses a different approach, measure coordinates in a topological format, relating attribute information to geographic location. Like all GIS systems, the GS50 / GS50+ collect three types of features: Points, Lines and Areas.

Because these sensors are configured for GIS use, the main programs Survey and Stakeout which are found on the SR510, SR520, SR530 are replaced by the GIS Data Collection and the GIS Navigation/ Update program.

```
MAIN\
1 GIS Data Collection
2 GIS Navigation/Update
3 Applications...
4 Utilities...
5 Job
6 Configure
7 Transfer...

CONT        HIDE
```

If the sensor is configured as a reference station, there is no difference between the GIS Data Collection and the SR5xx Survey program. Additionally both GIS programs are situated on the SR510/20/30 in the application menu and are available as a paid upgrade option to the survey program.

Additional applications:

On board the GS50 / GS50+, the applications **Determine Coord Sys**, **Point Management**, **Calculator**, **COGO** and **CFC** are available and identical to those running on the SR510/20/30.

```
APPLICATION\ Menu
1 Determine Coord System
2 Point/Line/Area Management
3 Calculator
4 COGO
5 Cultivated Field Control

CONT
```

Point Management is located under a submenu **Point/Line/Area Management** of the main application menu.

```
MANAGE\ Menu
1 Point
2 Line
3 Area

CONT             PLOT
```

The menu **Point** leads to the point list which is identical to the point management. The menus **Line** and **Area** lead to lists containing measured lines and areas.

PLOT (F4) shows a graph of the points, lines or areas.

Described below are the changes that apply to the use of the **CONFIG** key in the GS50 and GS50+.

For example, the main configuration menu uses the wording **GIS Data Collection** instead of **Survey.**

```
CONFIGURE\ Test.cnf
1 Data Collection
2 Operation
3 General
4 Interfaces

CONT          STORE          CONFG
```

Configuration: Satellite

The Satellite configuration option uses an additional choice for the track mode. The default choice is **Max. Accuracy**, the additional choice on GS50 / GS50+ is **MaxTrak™**.

```
CONFIGURE\ Satellite
Elev Mask    :              10°
SV Health    :        Automatic▾
Track Mode   :    Max. Accuracy▾
LossOfLock   :          No Beep▾

CONT
```

With the MaxTrak™ option, satellite tracking is much more stable under poor GPS conditions. For long-time static measurements under good conditions, the accuracy of the default Max. Accuracy setting is higher than with the MaxTrak™ setting.

The MaxTrak™ should be used when no GPS measurement would normally be possible.

Track Mode as well as the **SV Health** configurations options are visible in Advanced mode only.

LossOf Lock - When losing all satellite signals for example due to satellite shading caused by tall buildings, trees, etc. a message “Complete loss of lock” appears. The sensor may be configured to beep with this loss of lock message or not.

Configuration: Coding

The GS50 / GS50+ only allows thematical coding.

For this reason, the panel cannot be exited with **CONT (F1)** if no codelist is available. You can define a new codelist or load a configuration file from the PC-Card.

This change applies from chapter 5.1 to 5.4.

Configuration: Stake-Out

The Stake-Out Configuration is available under the name **Navigation**.

The **STORE -> Job** configuration option when staking from an ASCII file stake points is not available.This applies to chapter 5.4.

Configuration: Point Template User Mask

The configuration of the **Cursor Pos** is not used in the GIS Data Collection program, although it can be configured on the GS50 / GS50+.

This change applies to chapters 5.2 and 5.4.

The use of the Point Template mask differs for the GIS Data Collection program and the Survey program. For this reason, the working examples given in chapters 5.2 and 5.4 do not apply to GS50 / GS50+.

Time and Date templates can be configured with **EDIT (F3)** to use either the Code or the Sensor ID as the prefix for the Point ID.

If a user defined point template mask is used on GS50 / GS50+, for example “Point ###” with an increment value 1, the Point Id is shown in the first line of the attribution panel.

Assume the last measured point was **“Point 202”**, then the next proposed id is **“Point 203”**. The Point Id cannot be overwritten manually.

Nevertheless the enumeration value **203** is changeable. During GIS point data collection, **Shift ENUM (F5)** leads to the following panel.

```
ATTRIBUTION\ Pnt Id Enumeration

PtId. Mode : Change to Indiv.
Enumeration:                203

CONT
```

Entering a different enumeration and **CONT (F1)** changes the Id enumeration immediately.

Configuration: Occupation settings

The configuration option **Auto STORE** is not available for GIS Data collection. This is because the GS50 / GS50+ always stores automatically.

This change applies to chapters 5.1, 5.2 and 5.4.

In Advanced mode, the **End Survey** option is also not available. This is because the GIS Data Collection can only be exited manually. Additionally, the **Auto OCUPY** option is not available because occupation always starts manually.

To configure the number of averaged positions for nodes, press **NODES (F4)** in the Configure\ Occupation Settings panel.

This change applies to chapters 5.1.1, 5.2.1 and 5.4.1.

Configuration: Logging

The configuration of logging for **auto logged positions** is not available for GIS Data Collection. This is because the autologged positions are not connected to any topology.

The GIS Data Collection program employs a different method to collect points automatically which is more suited to GIS data collection.

For post-processing of lines and areas measured in stream mode (START-STOP), it is mandatory to set Log Static **and** Log Moving to YES.

This change applies to chapters 5.1, 5.2 and 5.4.

Configuration: Formats

The line for configuration of **OCUPY** counter used in the SR510/20/30 survey program is removed. This is because there is no such counter in the GIS Data Collection Program.

This change applies from chapter 5.1 to 5.4.

```
CONFIGURE\ Formats
Format Grid     : East,North,Hgt▾
Format Geodetc:     Lat,Lon,Hgt▾
Quality Type    :            DOP▾
Defined by      :   Pos+Hgt+Time▾

CONT
```

Configuration: Start-up

The Start-up Configuration allows configuration of the sensor to either create a daily job or to create a job manually. Enter the configuration Start-Up with the CONFIG key.

```
CONFIGURE\ Start-Up
Panel   :              Manual
AutoOn  :     New Job per day
New Job:

ABCDE FGHIJ KLMNO PQRST UVWXY Z[\]
```

Configuration: Real-Time

The GS50 is a L1 code-only DGPS receiver. It uses RTCM data messages 1,2 or 9,2 only for data exchange. The GS50+ uses all RTCM formats as the SR530.

The standard settings allow communication with public DGPS sources. For example, coast guard world-wide differential signals use the RTCM 9,2 messages, whereas the satellite differential service - RACAL Landstar - uses the RTCM 1,2 message.

If a pair of GS50 / GS50+ receivers are communicating with each other then any of the realtime formats can be used on both receivers, as long as those recievers are using matching formats.

This applies to chapters 5.3 and 5.4.

Configuration: Hidden Point

The full Hidden Point Configuration is available under the different name **Offset**.

This applies to chapters 5.4.1 and 9.13.

Described below are the changes that refer to the use of the **STATUS** key.

The main status menu uses the wording **GIS Data Collection** instead of **Survey**.

This difference applies to chapter 10.

Described below are the changes that refer to data collection with the GS50 / GS50+.

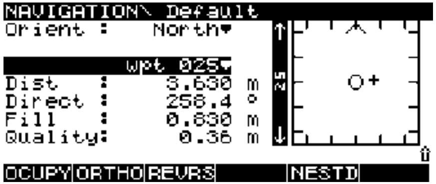
Due to the different measurement program, the chapters 7.1, 7.2 and 7.4 are not applicable at all on a GS50 / GS50+.

The manual **“Getting Started with GS50 / GS50+”** is available describing the GS50 / GS50+ main programs in detail.

Chapter 7.3 describing realtime reference station operations is fully applicable.

GIS Navigation/Update:

Chapter 7.5, describing Staking Out, is similar for most operations. The small differences are described here.



The **PCKUP** button is replaced by the **NESTD** button, which is also used in the GIS Data Collection program. It simply leads to a new data collection procedure. After data collection is complete, navigation is continued.

OCUPY differentiates if the target point is taken from a job or from an ASCII file.
For an **ASCII file** target point having no topological information, point data collection is started to measure the coordinates and to enter new code and attribute values.
For a **job** target point, **OCUPY** replaces the old point coordinates with the new measured coordinates.

SHIFT AUXPT(F5) leading to auxiliary point stake-out is not available on GIS Navigation program.

Codelist administration on GS50:

From chapter 8, Coding, only the chapters up to 8.1.2 apply to the GS50 / GS50+.

The GIS thematical coding does not use layers, but differentiates coding types for points, lines and areas. Therefore defining a new code on the GS50 / GS50+ allows entering of the new code with the choice of the type.

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

712646-4.0.0en

Leica Geosystems

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