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GPS System 500



Technical Reference Manual

***Version 2.0
English***

Leica

MADE TO MEASURE

Congratulations on your purchase of Leica System 500



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

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

The symbols used in this User's Manual have the following meanings:



DANGER:

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING:

Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.



CAUTION:

Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and / or appreciable material, financial and environmental damage.



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

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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. Ancillary 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.



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

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.

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 4MB or 10MB 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.

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 port 2.

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.

1.5.1 Charging the Batteries

GEB121 Batteries

GEB121 Batteries can be charged using the GKL121 or GKL111 battery chargers. The preferred model is the GKL121.

GEB71 Batteries

GEB71 Batteries can be charged using the GKL121 battery charger only.

Chargers

The GKL121 is an intelligent charger. It will charge the batteries by the exact amount required. This maximizes battery life. The GKL121 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 GKL121 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

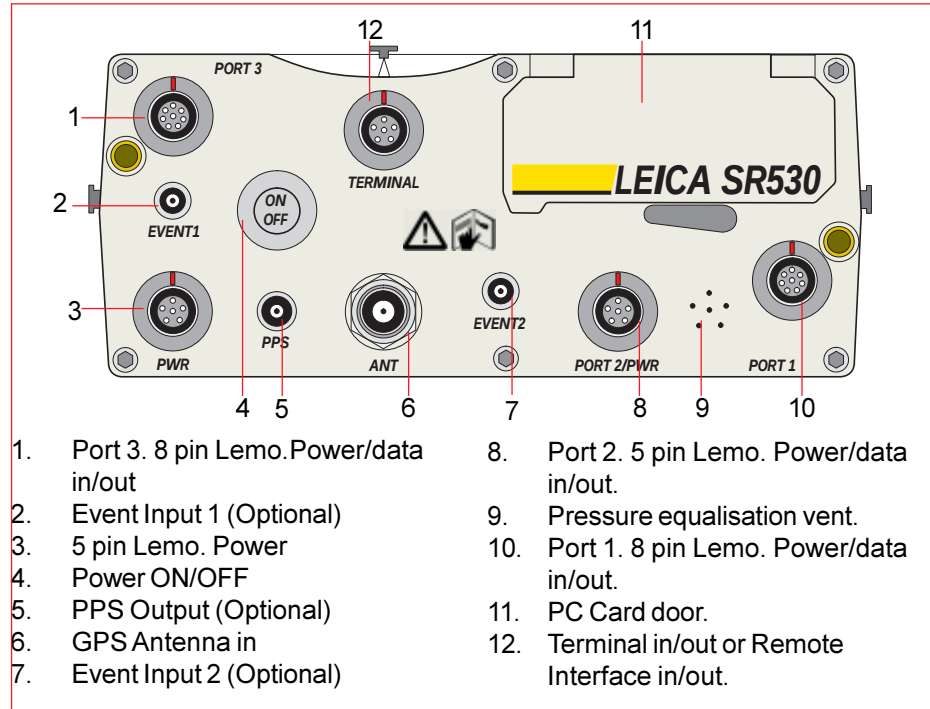
All other components of System 500 connect to the GPS Receiver.

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.



SR530 Receiver, front panel

2.2 Equipment Setup - Post Processed Static/Rapid Static/Reference on Pillar

Use

Static/Rapid Static operations or as Reference for Kinematic.

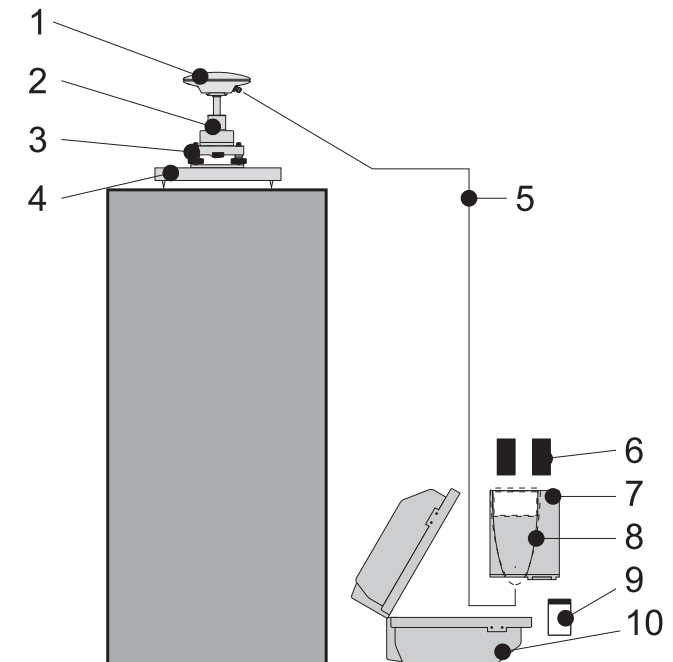
The Receiver and TR500 (if used) can be assembled to make one unit. One connection is made to the GPS Antenna which is mounted on the Pillar. The Receiver and TR500 can be kept in the case. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

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.

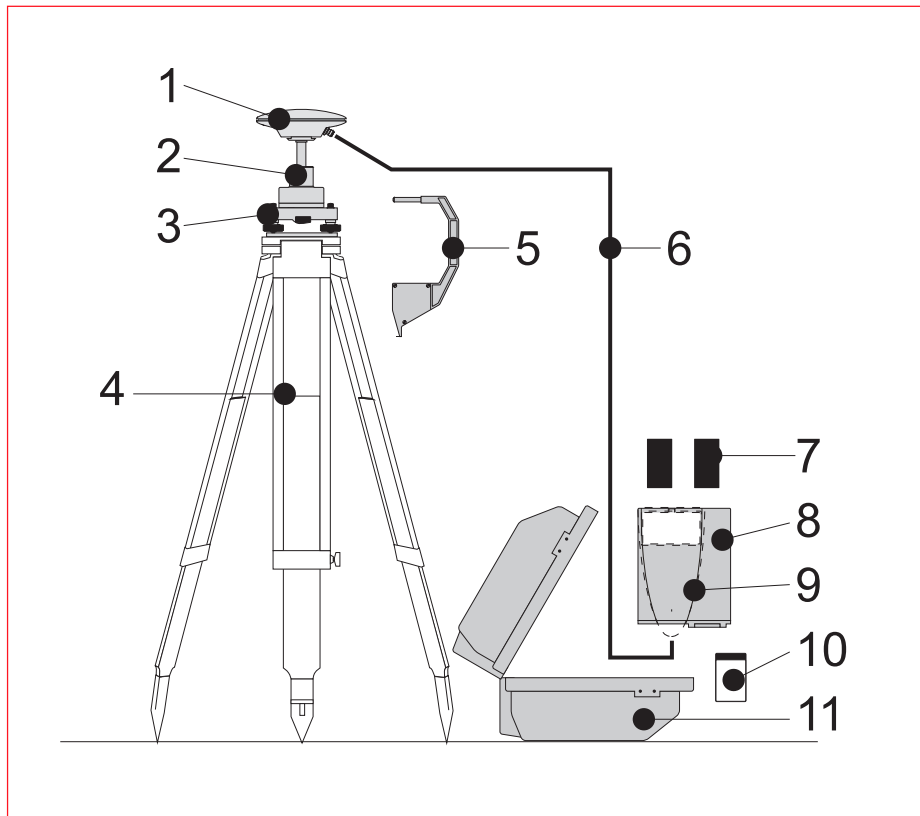
The Receiver and TR500 (if used) can be assembled to make one unit. This clips to the tripod leg or is placed in the transport container. One connection is made to the Antenna. Note that the Receiver can be programmed with the TR500 prior to use which can then be omitted from the set up.

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.

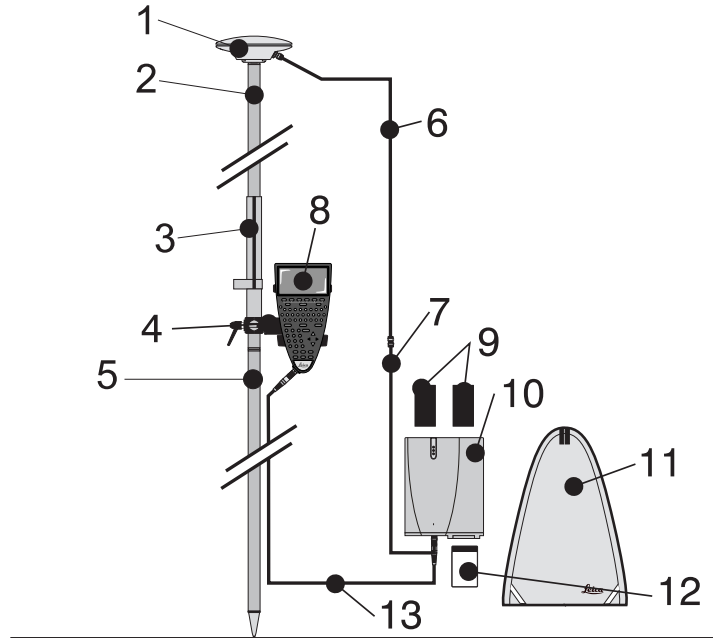
The Receiver is placed in the Minipack. Connections are made to the Antenna and TR500. Recommended for extended periods of use in the field.

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

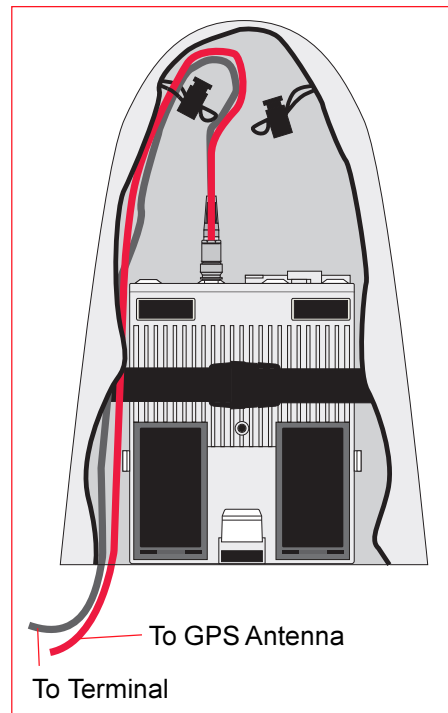


How to set up the equipment

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 2.10.

2.5 Equipment Setup - Post Processed Kinematic, All on Pole

Use

Post-processed Kinematic Rover.

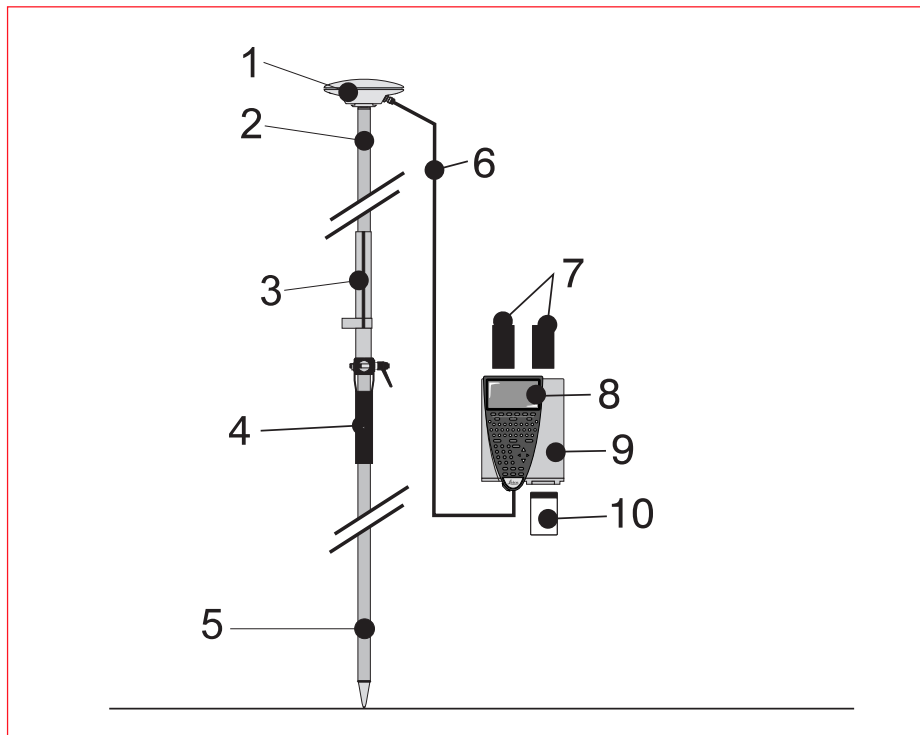
The TR500 is mounted on the Receiver which is screwed onto the pole grip. One connection is made from the Receiver to the Antenna. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

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 - 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.

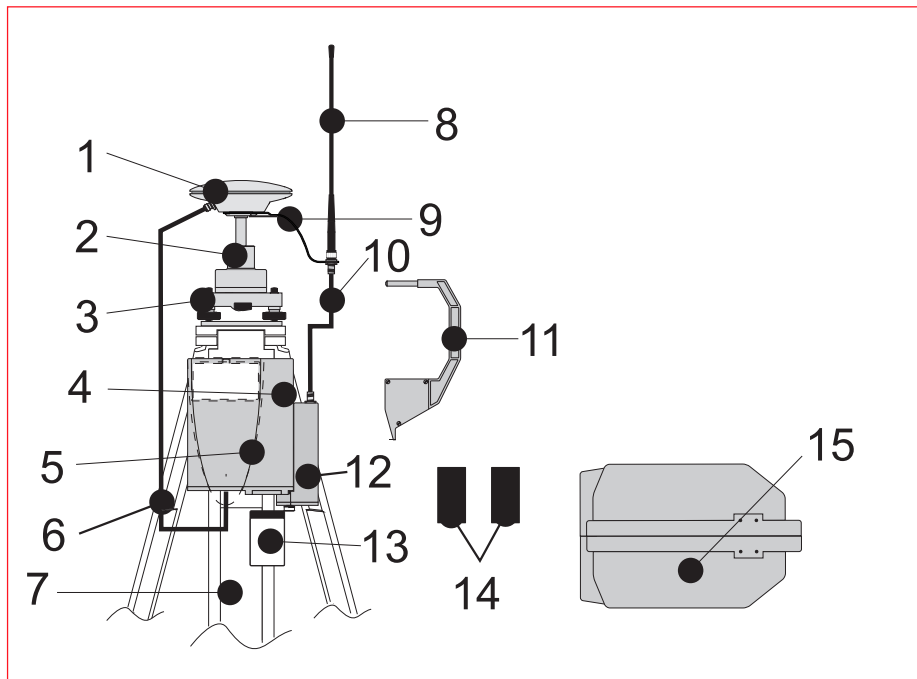
The SR530 can be used as either a DGPS or Real-Time reference station. Real-Time and DGPS are fitted as standard on the SR530.

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 Housing
13. MCF XMB-3 PC card
14. 2, GEB121 Batteries
15. GVP602 Transport Case



Procedure

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.

2.7 Equipment Setup - Real-Time Reference, Two Tripods

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.

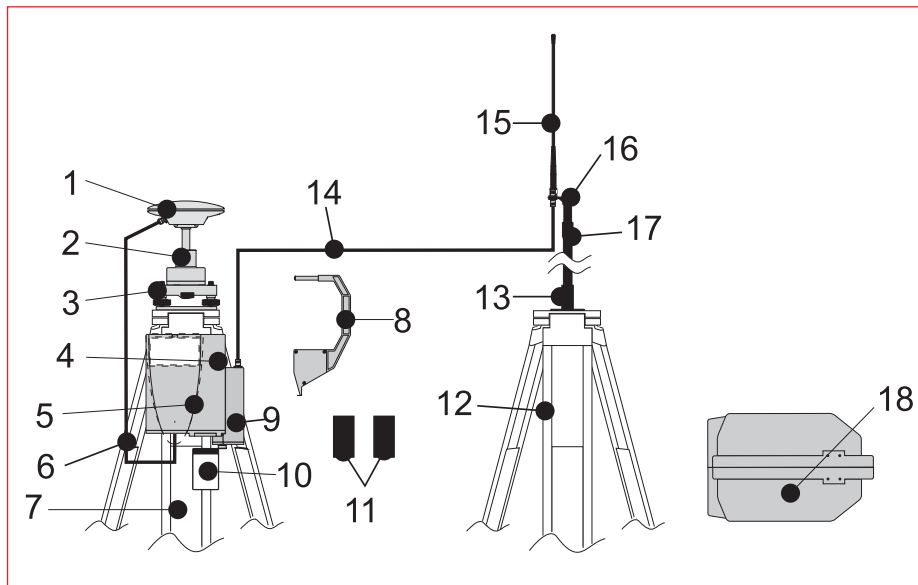
The SR530 can be used as either a DGPS or Real-Time reference station. Real-Time and DGPS are fitted as standard on the SR530.

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 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



Procedure

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

2.8 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.

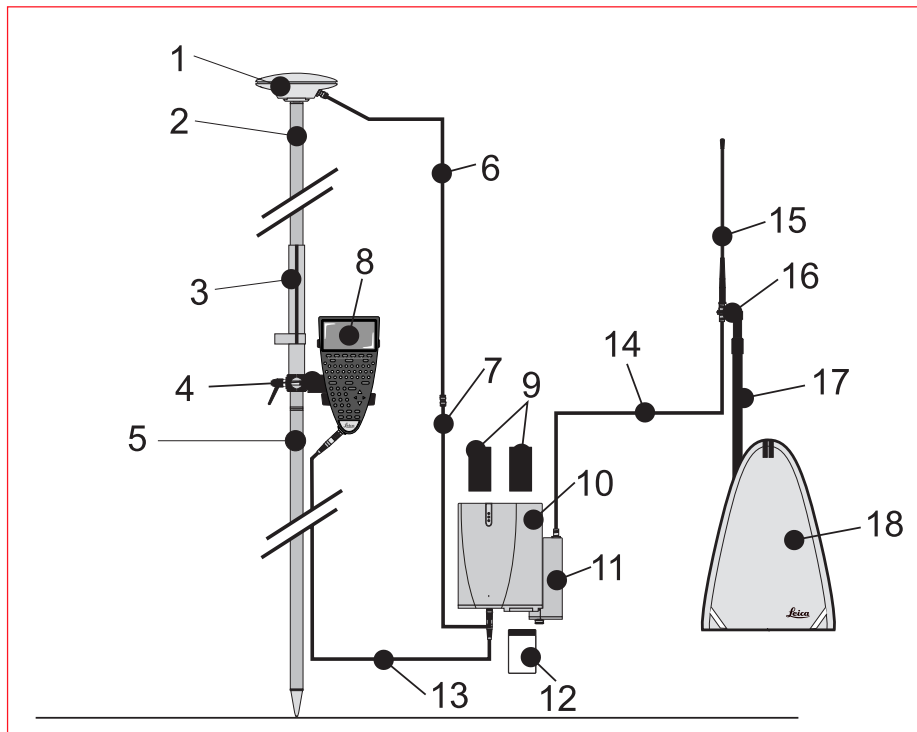
The cables coming from the Minipack can be disconnected in the event that an obstacle (E.g. a fence) has to be crossed.

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



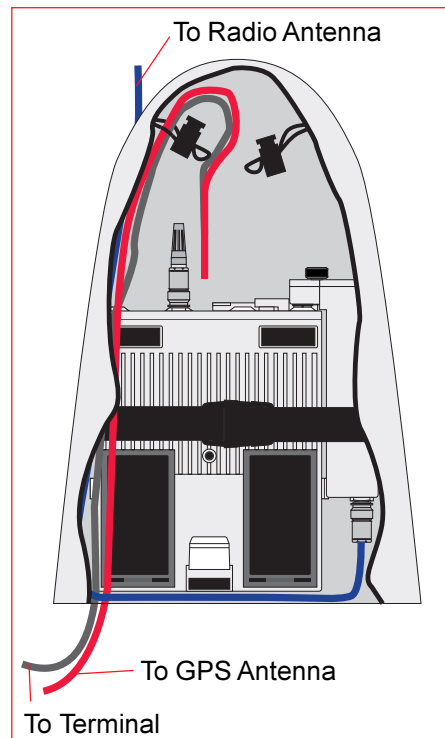
Procedure

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 2.10.

2.9 Equipment Setup - Real-Time Rover, All on Pole

Use

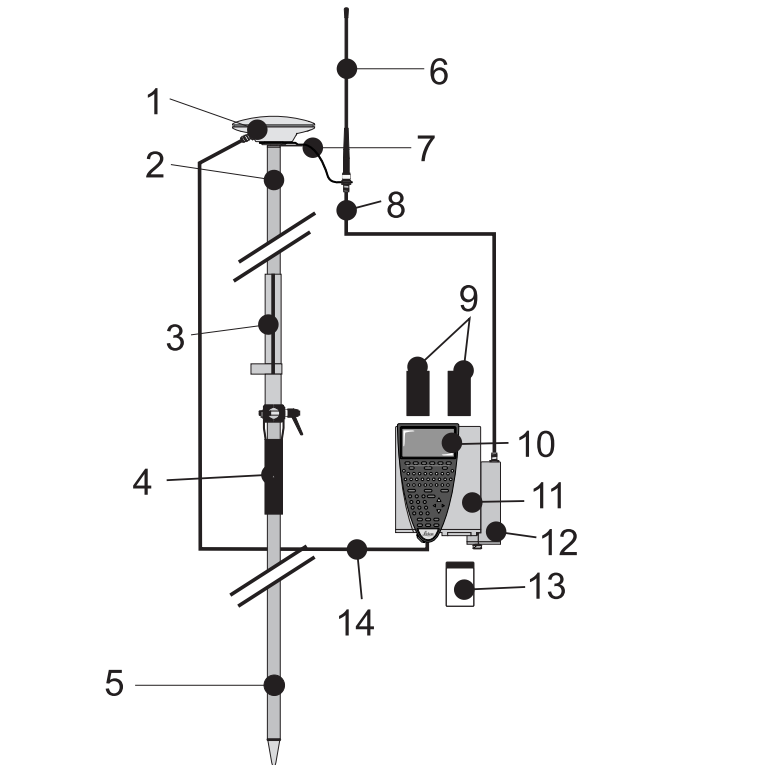
The TR500 is mounted on the Receiver which is clipped to the grip. Connections are made from the Receiver to the GPS and Radio Antennas. Recommended for short periods of use, especially where there are many obstacles (fences etc.).

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



Procedure

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.

2.10 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.

2.11 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).

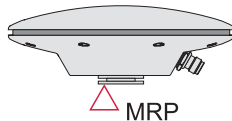
Finally, the Antenna Height is sometimes calculated by taking a slope distance from the point on the ground to the outside edge of the Antenna. In this case, the Vertical Height must be calculated using the Slope Height and a Horizontal Offset.

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.

2.11.1 Mechanical Reference Planes

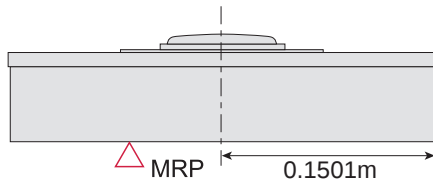
The Mechanical Reference Plane or datum to which the Antenna Height is measured and from which the Phase Center Eccentricities are calculated is shown for each Leica System 500 Antenna.

AT501 and AT502



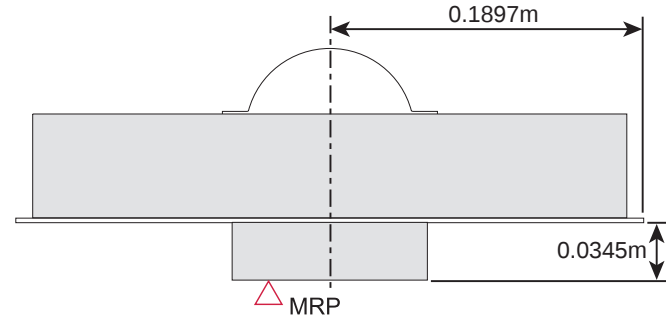
The Mechanical Reference Plane is the underside of the threaded metal insert.

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.

2.11.2 Antenna Height components

1. Pillar Setup

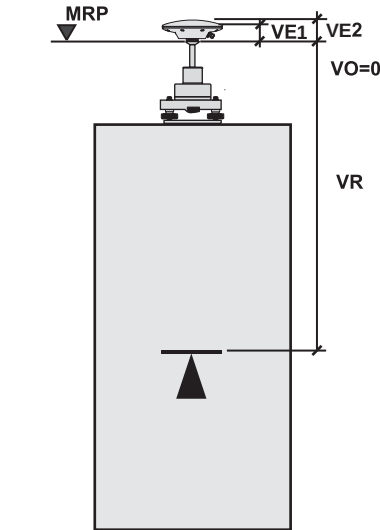
VO Vertical Offset

VR Vertical Height Reading

VE1 Vertical Phase Center Eccentricity for L1.

VE2 Vertical Phase Center Eccentricity for L2

MRP Mechanical Reference Plane



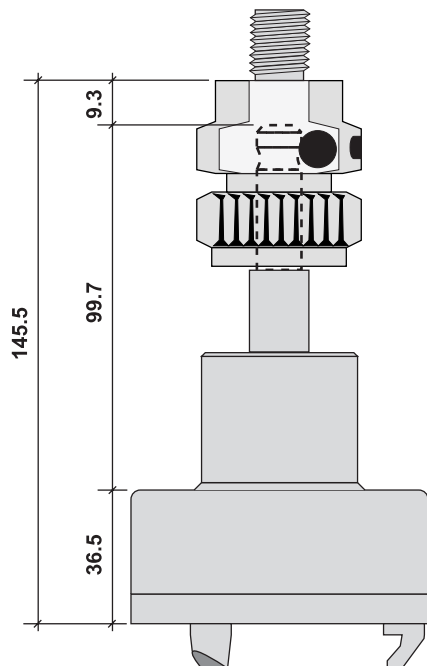
Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

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.

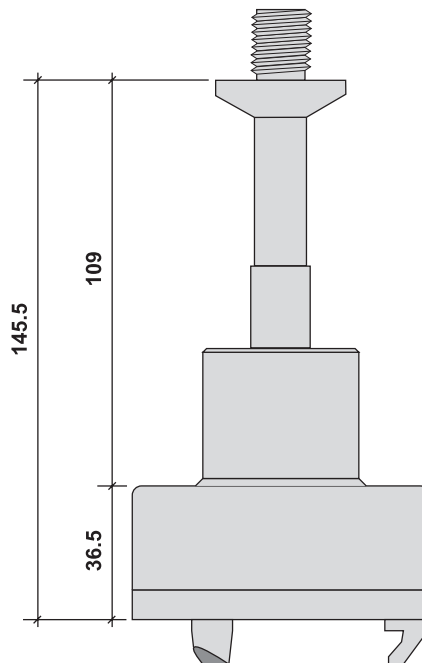
The Vertical Offset is not required in this case and therefore is input as zero.

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



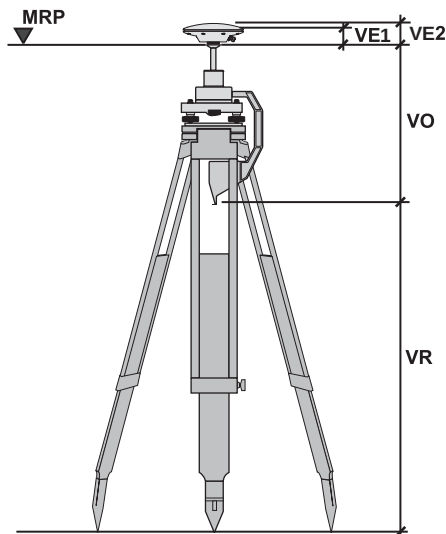
GRT44 Carrier with GAD31 Stub to Screw Adapter



GRT46 Carrier

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.

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

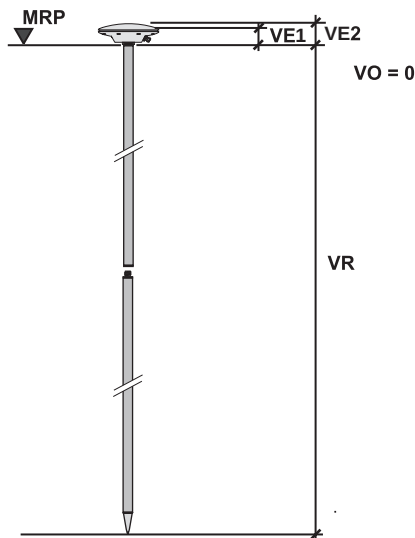
Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

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

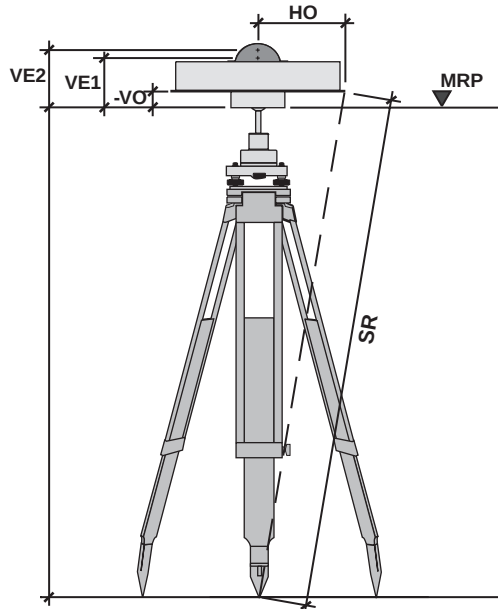
Although an AT501/502 Antenna is shown, the same principles apply to the AT504 and AT303.

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.

2.11.3 Measuring Slope Heights



- 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:

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

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.

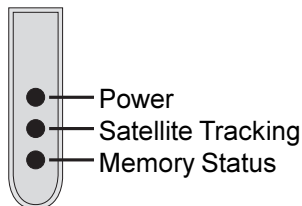
3.3 Shut Down

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.

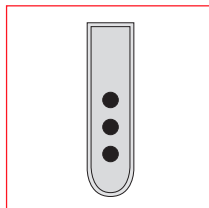
3.4 LED Indicators

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.

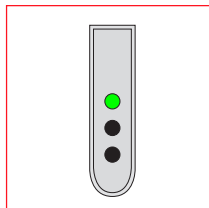
The top LED gives power information, the middle gives satellite tracking information and the lower gives memory status.



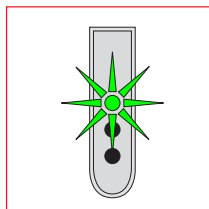
3.4.1 Power LED



Power LED off -
No Power

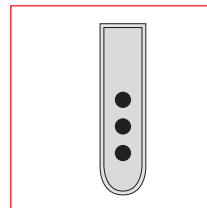


Power LED
green - Power
OK

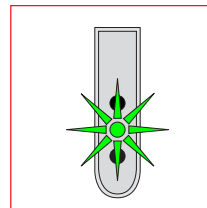


Power LED
Flashing Green -
Power Low

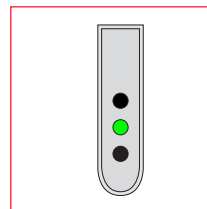
3.4.2 Satellite Status LED



Satellite Status
LED off - No
Satellites tracked

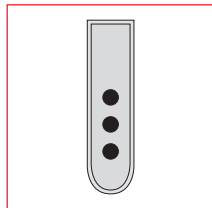


Satellite Status
LED flashing
green - first
satellite tracked,
position not yet
available

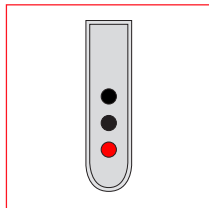


Satellite Status
LED Green -
Enough satellites
tracked to com-
pute position

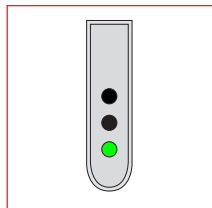
3.4.3 Memory Status LED



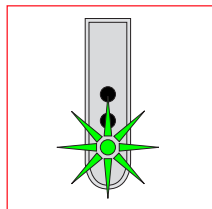
Memory Status
LED off - Memory
Device not
available (PC
Card not inserted
or Internal
Memory not
fitted).



Memory Status
LED red -
Memory full on
selected device



Memory Status
LED Green -
Memory capacity
OK on selected
device



Memory Status
LED flashing
green - Memory
capacity 75% 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.

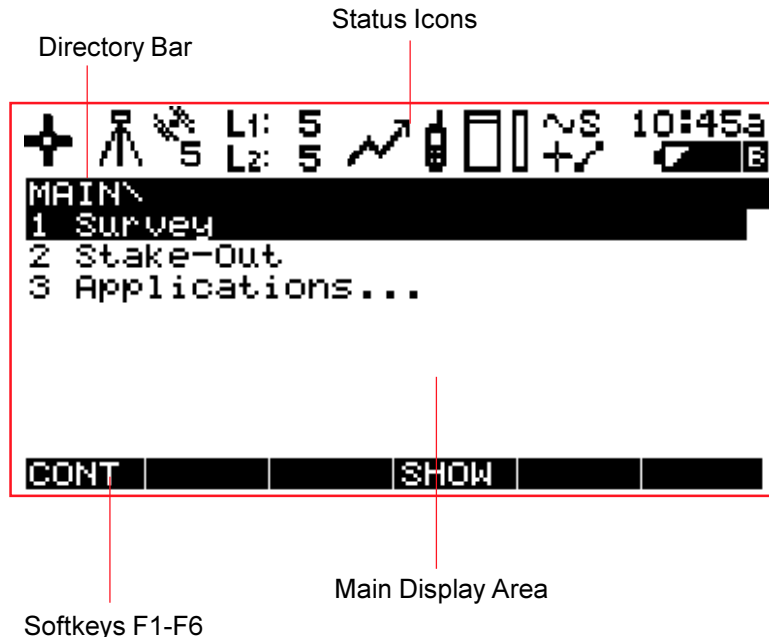
The basic layout consists of a row of status icons over a main display area with a row of six softkeys (F1-F6) at the bottom.

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:



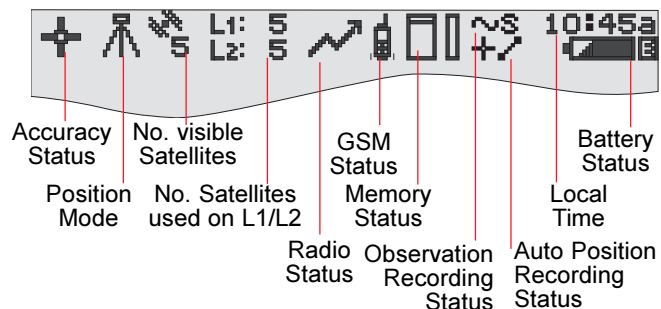
Pressing it again will toggle back to the original softkeys.

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

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 simultaneously, 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 temperature extremes and also for gloved hands if necessary.

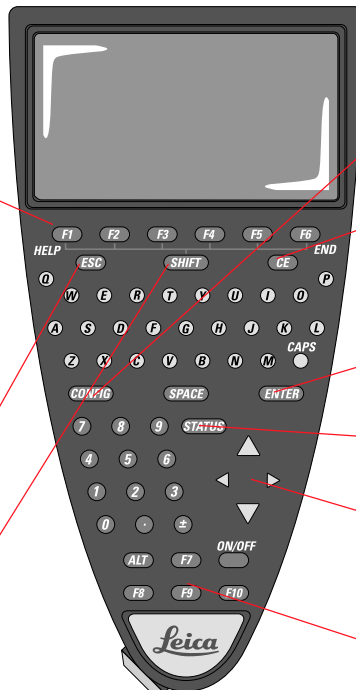
The six keys **F1-F6** at the top of the keyboard correspond to the six softkeys that appear on the screen when the Terminal is activated.

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 **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 Receiver.

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 9.3.

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 alpha-numeric 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.


```

CONFIG SET\ < >
CNF Description
PP_KIS Default
PP_STAT Default
RT_REF Default
RT_ROW Default

```

CONT NEW EDIT DEL INFO αNUM ↑

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.

```

CONFIGURE\ Antenna
Ant Name : AT502 Tripod▼

```

Vert Offset: 0.3600 m

Deflt Hgt : 0.000 m

Meas Type : Vertical▼

CONT

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

```

CONFIGURE\ Antenna
Antenna Name: < >
AT501 Pole
AT501 Tripod
AT502 Pole
AT502 Tripod
AT503 Tripod

```

CONT NEW EDIT DEL DEFLT αNUM ↑

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. Each parameter must be defined one after the other. 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.

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

```
CONT  SHOW
```

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:

```
CONFIG SET\
CNF Description
PP_KIS Default
PP_STAT Default
RT_REF Default
RT_ROV Default
```

```
CONT NEW EDIT DEL INFO NUM
```

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.

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.

```
CONFIGURE\ New Configuration Set
```

```
Name :
Description:
```

```
Creator :
```

```
CONT
```

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.

5.1 Configuring the Receiver for Static and Rapid Static Operations

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.

```
CONFIGURE\ Operation Mode
Mode      : Standard
```

```
CONT
```

When you have made your selection press **CONT (F1)**.

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.

```
CONFIGURE\ Antenna
Ant Name   : AT502 Tripod▼

Vert Offset: 0.3600 m
Deflt Hgt  : 0.000 m
Meas Type  : Vertical▼

CONT
```

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 2.4.3 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.

```
CONFIGURE\ Antenna
Antenna Name: <
AT501 Pole
AT501 Tripod
AT502 Pole
AT502 Tripod
AT503 Tripod

CONT NEW EDIT DEL DEFLT NUM
```

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. 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.

```
CONFIGURE\ Position
Update Rate: 1.0ms
Coord Sys : WGS84 Geodetic
```

```
CONT
```

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.

```
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 Geodetic : 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 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

```
CONFIGURE\ Logging
Log Static Obs : YES▼
Obs Rate : 15.0▼ S
Log Moving Obs : NO▼
Log Auto Positions: NO▼
```

```
CONT [ ] [ ] [ ] [ ] [ ] [ ]
```

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.

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.

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

Auto Store: NO▼

CONT [] [] [] [] []

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.

5.1.1 Advanced Operation Mode for Static and Rapid Static.

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
```

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:      1.0s
Coord Sys :      UTM 30
Residuals :      No distribution
Transform :
Ellipsoid :      WGS 1984
Projection :      UTM 30
Geoid Model:
```

```
CONT
```

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/Dist²** 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.

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.

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.

5.2 Configuring the Receiver for Post-Processed Kinematic Operations

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.

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.

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

```
CONFIGURE\ Operation Mode
Mode      : Standard
```

```
CONT
```

When you have made your selection press **CONT (F1)**.

Antenna

Select the Antenna configuration that you are using.

```
CONFIGURE\ Antenna
Ant Name : AT502 Pole▼

Vert Offset: 0.0000 m
Deflt Hgt : 2.000 m
Meas Type : Vertical▼

CONT
```

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.

```
CONFIGURE\ Antenna
Antenna Name: < >
AT501 Pole
AT501 Tripod
AT502 Pole
AT502 Tripod
AT503 Tripod

CONT NEW EDIT DEL DEFLT NUM
```

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.

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.

```
CONFIGURE\ Position
Update Rate: 1.0s
Coord Sys : WGS84 Geodetic
```

```
CONT
```

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.

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

```
CONT NEW EDIT DEL INFO <NUM
```

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 Geodetic: Lat, Lon, Hgt▼
Quality Type :      DOP
Defined by : Post+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 post-processing 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 initializations 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.

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.

```
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 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**

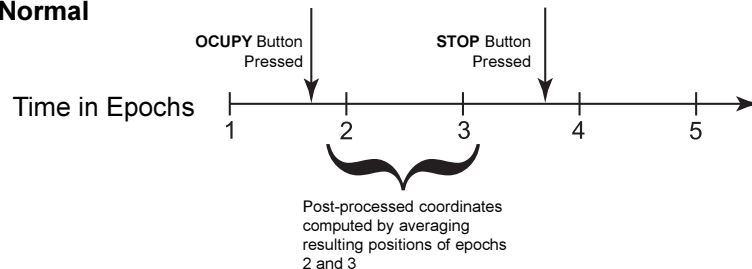
key is pressed. During post-processing, A coordinate will be interpolated between the positions at the neighboring two epochs.

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

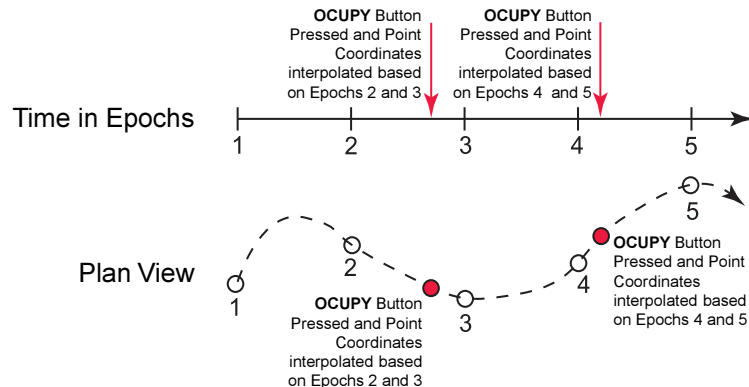
Auto Store - Allows you to automatically store a point after the **STOP** key has been pressed.

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

Normal



Instantaneous



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
```

```
OCCUPY Pts : Point #####  
Auto Log Pos: Auto Pos #####
```

```
CONT
```

OCCUPY 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"**.

```
CONFIGURE\ OCUPY Pts
Id Type      : Remain Running
Id           : Bolt ###
Num Start    : 6
Num End      : 8
Auto Inc     : YES
Num Inc      : 1
Cursor Pos   : 1
CONT
```

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"**.

```
SURVEY\ Default
Point Id     : Bolt 001

Ant Height   : 2.000 m
Positions    : 1
Quality      : 0.03 m
STOP
```

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**”.

```
SURVEY\ Default
Point Id      :      Road0723

Ant Height   :      2.000 m
Positions    :      1
Quality      :      0.03 m
STOP [ ] [ ] [ ] [ ] ADD [ ]
```

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\ Default
Indiv. PId:    BM98

Ant Height   :      2.000 m
Quality      :      0.01 m
OCUPY [ ] [ ] [ ] [ ] ADD [ ]
```

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.**”.

```
CONFIGURE\ OCUPY Pts
PtId. Mode : Change to Indiv.▼
Id          : Point####
Num Start   : 6
Num End     : 9
Auto Inc    : YES▼
Num Inc     : 1
Cursor Pos  : 1▼

CONT
```

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**”.

```
SURVEY\ Default
Point Id    : Point0001

Ant Height  : 2.000 m

Quality     : 0.01 m
            ↑

OCUPY
```

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.

```
SURVEY\ Default
Indiv. Ptid:      BM98

Ant Height :      2.000 m

Quality :          0.01 m
                ↑
OCCUPY          ADD
```

```
SURVEY\ Default
Indiv. Ptid:      001 Fence

Ant Height :      2.000 m

Quality :          0.03 m
                ↑
HELP  GRAPH  RUN  QUIT
```

5.2.1 Advanced Operation Mode for Post-Processed Kinematic

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
```

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:      1.0s
Coord Sys :      UTM 30
Residuals :      No distribution
Transform :
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.

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 : 1.0▼ s
Log Moving Obs : YES▼
Static Init : YES▼
Observables : Normal▼
Log Auto Positions : NO▼
Moving Ant Height : 2.000 m
CONT [ ] [ ] [ ] [ ] FILES
```

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.

```
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 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.

Auto Stop - will automatically stop the measurements according to the criteria set in the **STOP P-PRC** functions. 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
OCCUPY Mode: Normal▼
Auto OCCUPY: 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 2.0 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 [ ] [ ] [ ] [ ] [ ]
```

When you have made your selection press **CONT (F1)**.

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.

```
CONFIGURE\ Antenna
Ant Name   : AT502 Tripod

Vert Offset: 0.3600 m
Deflt Hgt  : 0.000 m
Meas Type  : Vertical

CONT
```

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 2.4.3 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.

```
CONFIGURE\ Antenna
Antenna Name: <
AT501 Pole
AT501 Tripod
AT502 Pole
AT502 Tripod
AT503 Tripod

CONT NEW EDIT DEL DEFALT NUM
```

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.

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.

```
CONFIGURE\ Position
Update Rate: 1.0ms
Coord Sys : WGS84 Geodetic
```

```
CONT
```

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 Geodetic : 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** - 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 pre-defined 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.

Configures parameters used for Real-Time operations

```

CONFIGURE\ Real-Time
R-Time Data: Reference▼
Data Format: Leica▼
Port : 1 *RS232▼
Rate : 1.0▼ s

```

CONT				DEVICE
------	--	--	--	--------

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 Satellite, 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 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 is a compacted format 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 **DEVICE (F5)** key lets you configure and assign a device to the selected port.

```
CONFIGURE\ Devices and Ports
Device
*Satellite 2ASx
*Satellite 2ASxE
*Satellite 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-Time.

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.

```
CONFIGURE\ Logging
Log Static Obs : YES▼
Obs Rate : 1.0▼ s
```

```
CONT
```

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.

5.3.1 Advanced Operation Mode for Real Time Reference Stations

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
```

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:      1.0s
Coord Sys :      UTM 30
Residuals :      No distribution
Transform :
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.

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

Configures parameters used for Real-Time operations.

```
CONFIGURE\ Real-Time
R-Time Data: Reference▼
Data Format: Leica▼
Port : 1 *RS232▼
Rate : 1.0▼ s
```

```
CONT | RATES | DEVICE REF
```

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 keys **RATES (F3)** and **REF (F6)** are 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**).

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.

Note that 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.

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        : 1.0▼ s
Observables      : Normal▼
```

```
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 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
```

When you have made your selection press **CONT (F1)**.

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.

```
CONFIGURE\ Antenna
Ant Name : AT502 Pole▼

Vert Offset: 0.0000 m
Deflt Hgt : 2.000 m
Meas Type : Vertical▼

CONT
```

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.

```
CONFIGURE\ Antenna
Antenna Name: < >
AT501 Pole
AT501 Tripod
AT502 Pole
AT502 Tripod
AT503 Tripod
CONT NEW EDIT DEL DEFLT NUM
```

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.

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.

```
CONFIGURE\ Position
Update Rate:      1.0↵s
Coord Sys :      Swiss 2↵
```

```
CONT | | | | |
```

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.

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

```
CONT | NEW | EDIT | DEL | INFO | NUM ↵
```

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 Syste
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 Geodetic: 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 - 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.

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.

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

```

CONFIGURE\ Real-Time
R-Time Data: Rover▼
Data Format: Leica▼
Port: 2 *Satellite 2A▼
Ref Sensor: SR530▼
Ref Antenna: AT502 Tripod▼

```

CONT				DEVICE
------	--	--	--	--------

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 Satellite 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**.

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 is a compacted format 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 **DEVICE (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 or CMR 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 initializations 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.

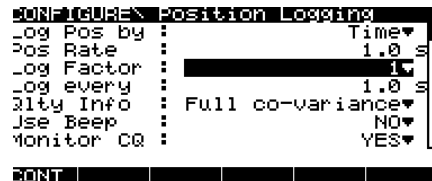
Log Auto Positions - Will automatically log positions at a specified rate.

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.



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.

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.

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 information recorded with the point and offset(s) to 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 information recorded with the point and offset(s) to 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.

```
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
```

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)**.

```
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 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"**.

```
CONFIGURE\ OCUPY Pts
Id Type      : Remain Running
Id           : Bolt ###
Num Start    : 6
Num End      : 8
Auto Inc     : YES
Num Inc      : 1
Cursor Pos   : 1
CONT
```

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"**.

```
SURVEY\ Default
Point Id     : Bolt 001

Ant Height   : 2.000 m
Positions    : 1
Quality      : 0.03 m
STOP
```

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**”.

```
SURVEY\ Default
Point Id : Road0723

Ant Height : 2.000 m
Positions : 1
Quality : 0.03 m
STOP ADD
```

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\ Default
Indiv. PtId: BM98

Ant Height : 2.000 m
Quality : 0.01 m
OCCUPY ADD
```

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.**".

```
CONFIGURE\ OCUPY Pts
PtId. Mode : Change to Indiv.▼
Id          : Point####
Num Start   : 6
Num End     : 9
Auto Inc    : YES▼
Num Inc     : 1
Cursor Pos  : 1▼

CONT
```

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**".

```
SURVEY\ Default
Point Id : Point0001

Ant Height : 2.000 m

Quality : 0.01 m
          ↑

OCUPY ADD
```

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.

```
SURVEY\ Default
Indiv. Ptid:      BM98

Ant Height :      2.000 m

Quality :          0.01 m
                ↑
OCCUPY          ADD
```

```
SURVEY\ Default
Indiv. Ptid:      001 Fence

Ant Height :      2.000 m

Quality :          0.03 m
                ↑
HELP          GRAPH          RUN  QUIT
```

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. Limits Pos:      0.030 m
Avg. Limits Hgt:      0.070 m
Required CQ      :  YES
Quality          :  0.030 m
CONT
```

Avg. Limits Pos - 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. - 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 - When set to **YES**, switches on the CQ limit defined in **Quality**, above which a point cannot be recorded.

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

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
```

```
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 /GSI8 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 Stakeout.

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

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.

```
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.

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.

5.4.1 Advanced Operation Mode for Real Time Rover

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
```

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
Coord Sys :      UTM 30
Residuals :      No distribution
Transform :      -----
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.

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

```

CONFIGURE> Real-Time
3-Time Data: Rover▼
Data Format: Leica▼
Port: 3 *Satellite 2A▼
Ref Sensor: SR530▼
Ref Antenna: AT502 Tripod▼
Use Phase: YES▼
Radio Down: Don't Log Obs▼

```

CONT				DEUCE
------	--	--	--	-------

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**.

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▼
Data Module: None▼
```

CONT					
------	--	--	--	--	--

RTCM Versn - Choose between
RTCM v2.1 and v2.2.

#Bits/Byte - Choose between 6 and 8 bits per byte.

Data Module - allows to switch to a RTCM based correction service called Ref Net available in Germany only.

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           : 1.0▼ s
Log Moving Obs     : YES▼
Static Init        : YES▼
Observables        : Normal▼
Log Auto Positions : NO▼
Moving Ant Height  : 2.000 m

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 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**.

```
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.

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.

Hidden Point

A hidden point is defined as a point that cannot be measured by GPS. 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 the **Used Device** to choose the port and device to be used.

```
CONFIGURE\ Hidden Point
Used Device: YES
Port : 2 *Disto
Offset : 0.000 m
```

```
CONT [ ] EAO [ ] DEVICE
```

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 **DEVICE (F5)** allows the device to be chosen

System 500 supports several devices such as Leica Disto Memo or Pro 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.

Refer to Appendix H for a complete list of all supported Hidden Point devices and their configurations.

EAO (F3) allows the default method to be set that will be used to enter an **External Angle Offset** when measuring hidden points.

CONFIGURE\ External Angle Offset

Method : Permanent
Offset : 0.0000 g

CONT

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.

Seismic

You can set whether or not to store a seismic record with each point. The format for seismic records is given in Appendix E.

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.

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

Select **Job** and press **ENTER**.

```
JOB\ PC-Card
Name      Date
Determination  14.04.98
CONT  NEW  EDIT  DEL  DEVICE α NUM
```

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.

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

```
CONT [ ][ ][ ][ ][ ][ ]
```

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 **DEVICE (F5)** key.

7. Measuring with System 500

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 Initialization)	Post Processed Kinematic on the Fly	Real-Time DGPS (1-5m)	Real-Time RTK (1-5cm)
SR510	✓	✓			
SR520	✓	✓	✓		
SR510 with RTCM 2.0 option	✓	✓		✓	
SR520 with RTCM 2.0 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.

7.1.3 Adding the Antenna Height

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 : 1.234 m

GDOP       : 6.6

OCCUPY
```

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 2.4.

7.1.4 Adding a Code

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

```
SURVEY\ Default
Point Id   : Point      1
Point Code : 101
Code Name  : Control
Ant Height : 1.234 m

GDOP       : 6.6

OCCUPY
```

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 (F3)** key.

The code is stored along with the Point Id information.

Free Coding

```
SURVEY\ Default
Point Id   : Point      1
Last Code  :           100
2Last Code :           200
Ant Height :           1.234 m
```

```
GDOP      :           6.6
```

```
OCCUPY    CODE
```

The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE (F3)** 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-IDEFLT 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.

```
SURVEY\ Free Coding
Free Code: < >
100 Fence Line *
200 Fence Post
300 Storm Drain
400 Road Gully
↑
CONT NEW LAST C-INF αNUM
```

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 Measuring procedure

Press the **OCUPY (F1)** key to begin recording observations. The icon changes to a tripod, indicating that the Receiver should remain stationary.

```
SURVEY\ Default
Point Id : Point 1

Ant Height : 1.234 m
Static Obs : 0
GDOP : 6.8
STOP ADD
```

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.

7.1.6 Using the ADD key

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

OCCUPY ADD
```

Press **ADD (F5)**

```
SURVEY\ Add Menu
1 Point Annotations
2 Meteorological 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\ Meteorological 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.

7.2 Post-processed Kinematic Survey (Rover)

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_KIS
Job      :      Default▼
Coord Sys :      UTM 32

Antenna   :      AT502 Pole▼
CONT      █      █      █      █      █      █      █      █      █      █
```

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.

7.2.1 Overview of Procedure

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.

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 wish to 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.

7.2.3 Adding the Antenna Height

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

OCCUPY
```

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.

7.2.4 Adding a Code

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 (F3)** key.

The code is stored along with the Point Id information.

Free Coding

```
SURVEY\ Default
Point Id   : Point      1
Last Code  : 100
2Last Code : 200
Ant Height : 1.234 m
```

```
GDOP      : 6.6
```

```
OCUPY     | CODE |      |      |
```

The Last Code and second last code (**2Last Code**) that were used are shown.

The **CODE (F3)** key will be available. Press this key to access the codelist.

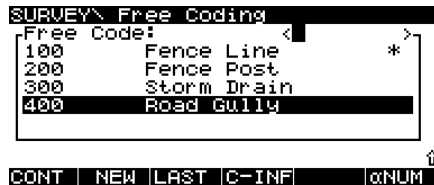
```
SURVEY\ Free Coding
Free Code  : 100
Description: Fence Line
Info 1    :
```

```
STORE | LAST | NEW-I | DEFLT | CLEAR
```

7.2.5 Measuring Procedure

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.

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 an 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

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

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

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 **OCCUPY (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.

7.2.6 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

OCCUPY 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 Meteorological 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\ Meteorological 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.

7.3 Real-Time Reference Stations

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)**.

```
SURVEY\ Begin
Config Set:      RT_REF
Job      :      Default
Coord Sys :      UTM 32

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. 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.

7.3.1 Measuring procedure

```
SURVEY\ Default
Point Id : Ref1
Ant Height : 1.234 m
Local E : 541746.450 m
Local N : 5246796.888 m
Ortho Hgt : 511.423 m
CONT COORDLAST HERE SPP
```

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 2.4.

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.

```
MANAGE\ New Point
Point Id : Nav1

Local E : 543621.879 m
Local N : 5247086.900 m
Ortho Hgt : 511.426 m

STORECOORD
```

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.

```
SURVEY\ Default
Point Id : Nav1

Ant Height : 1.234 m
Local E : 543621.879 m
Local N : 5247086.900 m
Ortho Hgt : 511.426 m

CONT COORDLAST HERE SPP
```

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 2.4.

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)**.

```
SURVEY\ Single Pt Position
Point Id : 12241125_1452380
Time : 23min
```

```
OCCUPY
```

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 accu-
rate the single point. A good compro-
mise 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, refer-
ence 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 automati-
cally.

7.3.2 Using the ADD key

When the Advanced Mode is selected, the **ADD (F5)** key is available.

```
SURVEY\ Default
Point Id   :                Ref1

Ant Height :                1.234 m

Time at Pt :                0:16
GDOP       :                7.2

STOP      ADD
```

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)**.

```
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.

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)**.

```
SURVEY\ Begin
Config Set:      RT-ROV
Job      :      Default▼
Coord Sys :      UTM 32

Antenna   :      AT502 Pole▼

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 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 working in Advanced mode, use the **ADD** key to add point annotations and/or hidden points. Then press the **OCUPY (F1)** key.

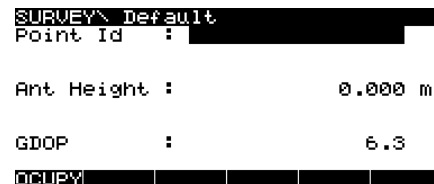
Then according to what has been set in the Occupation Settings, press **STOP (F1)** and **STORE (F1)**.

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 screenshot shows the SURVEY screen with the following fields: Point Id (with a blacked-out value), Ant Height (0.000 m), GDOP (6.3), and OCUPY (with a blacked-out value).

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.

7.4.3 Adding the Antenna Height

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

OCCUPY     [ ] [ ] [ ] [ ] 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.

7.4.4 Adding a Code

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 CODE 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 (F3)** key.

The code is stored when along with the Point Id information.

Free Coding

```
SURVEY\ Default
Point Id : Point 1
Last Code : 100
2Last Code : 200
Ant Height : 1.234 m

GDOP : 6.6

OCUPY CODE
```

The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE (F3)** 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-IDEFLT CLEAR
```

- To select the code:
1. Use the left or right cursor keys to

7.4.5 Measurement Procedure

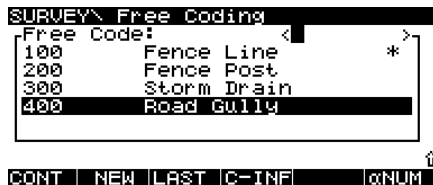
cycle through the code list.

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.

Switch on the instrument. Select Survey. Select a Real-Time Rover Configuration Set.

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 (**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)**.

Averaging Procedure

Whenever more than one coordinate for the same point is recorded, the system carries out an averaging procedure. Limits for the averaging procedure are set in Threshold Settings. Should a point fall within these threshold you may press **SHIFT** and then **AVRG (F2)** to display the differences between each occupation.

Should a point fall outside of these threshold settings, it will be brought to your attention thus.

```
MANAGE\ Average:Point1
Time -Date -dPos -dHgt -Use
09:59 29.01 999.9 -0.037 Y *
15:09 12.01 999.9 0.130 Y *

Point out of averaging limit
CONT USE INFO
```

The two intervals are displayed with time they were recorded, and the differences in position and height.

INFO (F5) toggles between different information for each interval.

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 (F4)** to deselect the interval.

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

Quality : 0.04 m

OCCUPY 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 Meteorological 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.

```
SURVEY\ Hidden Point
1 Bearing and Distance
2 Double Bearing
3 Double Distance
4 Chainage and Offset
```

```
CONT [ ][ ][ ][ ][ ]
```

There are two possibilities for inputting hidden point data. You may attach a Hidden Point device such as Leica Disto Memo or Disto Pro, 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 4 choices.

Bearing and Distance

```
SURVEY\ Hidden Pt Brg&Dist
Pt from      :      Ref1
Bearing      :      0.0000 g
Distance     :      0.000 m
```

ABORT **NEWOC**

Pt from - The point from which you are measuring.

Bearing - Bearing Angle to hidden point in units configured.

Distance - Distance 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)**.

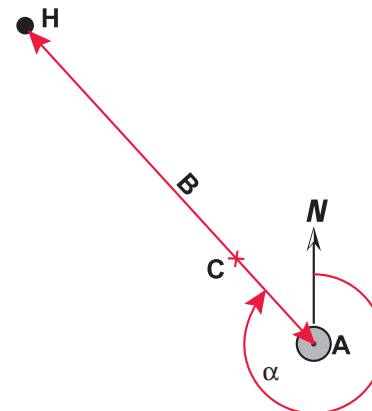
```
SURVEY\ Occupy Auxiliary Point
Point Id     :      Aux 1
Direction    :      Toward
```

Ant Height : 2.000 m

Quality : 0.01 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 you are measuring

B - Measured **Distance**

C - Auxiliary Point (optional)

H - Hidden point

α - Measured **Bearing**

Double Bearing

```

SURVEY\ Hidden Pt Brg&Brg
Pt from A : Ref1
Bearing A : 0.0000 g

Pt from B : Nav1
Bearing B : 0.0000 g
    
```

```

ABORT NEWOC
    
```

Pt from A - The point from which Bearing A is measured.

Bearing A - Bearing Angle A to hidden point in units configured.

Pt from B - The point from which Bearing B is measured

Bearing B - Bearing Angle B 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

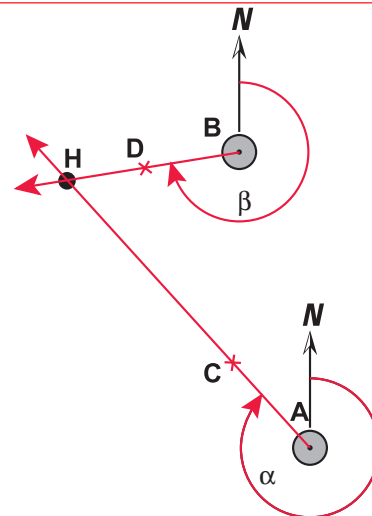
BRNG (F6) key is available. This function may be used if you do not know or have no means of calculating the bearing. Select a point that lies on the line AH (see diagram). Occupy the point and press **BRNG (F6)**.

```

SURVEY\ Occupy Auxiliary Point
Point Id : Aux 1
Direction : Toward
Ant Height : 2.000 m

Quality : 0.01 m
OCCUPY ADD INIT
    
```

Input a **Point Id** and the **Direction** (**Toward** or **Away** from the hidden point). Then press **OCCUPY (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 Distance

```
SURVEY\ Hidden Pt Dist&Dist
Pt from A : Ref1
Distance A : 0.000 m
Pt from B : Nav1
Distance B : 0.000 m
Location : Left of Line AB
ABORT NEWOC
```

Pt from A - Point from which **Distance A** is measured.

Distance A - Distance from Point A to the hidden point in units configured.

Pt from B - Point from which **Distance B** is measured.

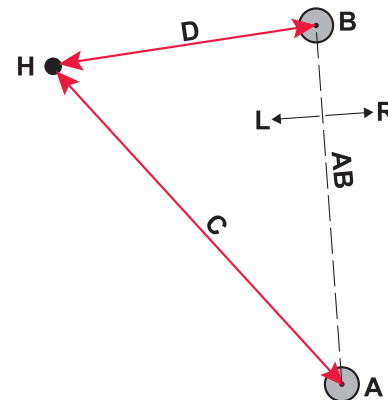
Distance B - Distance from Point B to the hidden point in units configured.

Location - Locates hidden point to left or right of Line AB.

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 - 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

Chainage and Offset

```
SURVEY\ Hidden Pt Chng&Off
Pt from A : Ref1
Pt from B : Nav1
Chnge from : Point A
Chainage : 0.000 m
Offset : 0.000 m
ABORT NEWOC
```

Pt from A - Point A on line.

Pt from 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.

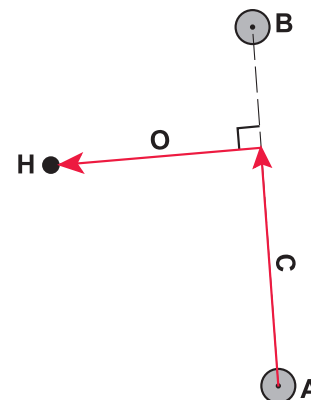
A - Pt from A

B - Pt from B

C - Chainage

O - Offset

H - Hidden point



7.4.8 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.

7.5 Real-Time Rover, Staking Out

Stake-Out is the staking out of pre-determined 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.

7.5.1 Entering Stakeout

From the Main Menu, select **Stake-Out**.

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

CONT
```

The following screen will then appear:

```
STAKE-OUT\ Begin
Config Set: RT_ROW
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

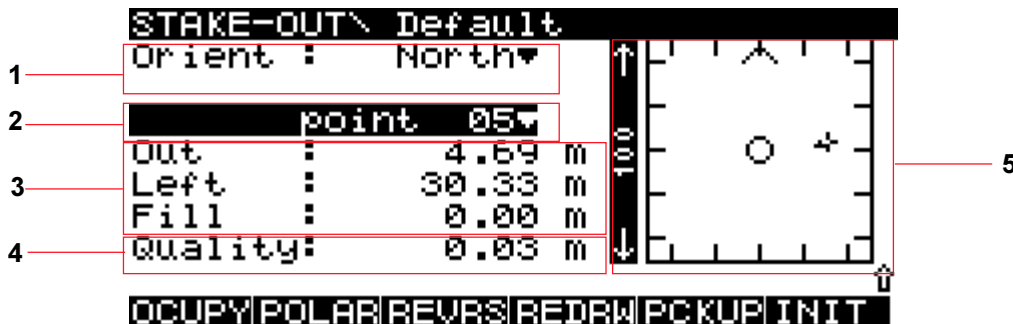
Stake points along a slope. Line is selected as orientation (no points are available as orientation). The cut and fill are relative to the slope of the line.

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.

7.5.3 The Stake-Out Screen

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.

7.5.4 Orientation

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.

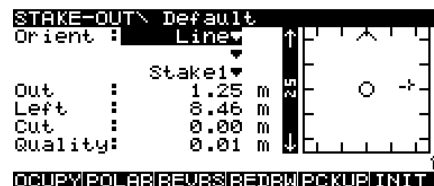
Known Pt - The reference direction from which all measurements are displayed to Target points is a point contained within the current "Stake from" Job. Select the point from the list that is presented when this option is chosen.

Line - The reference direction is parallel to the selected line. Lines may be defined based on points in the Job.

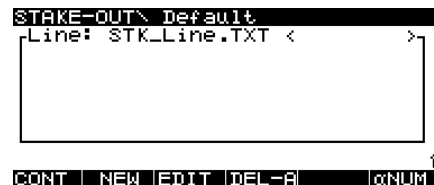
Defining a new Line for Orientation

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.



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

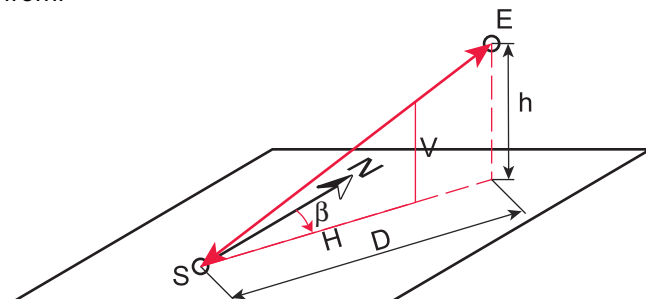
CONT IMPRT

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

$$\% = V/H \times 100$$



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 **Local E**, **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.

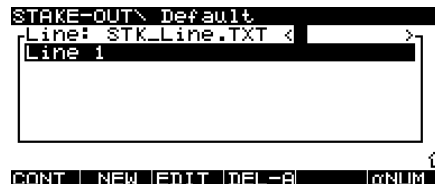
Enter/Select **Local E**, **Local N** and **Ortho Hgt** for the start point as described in **Start+Endpoint**.

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.

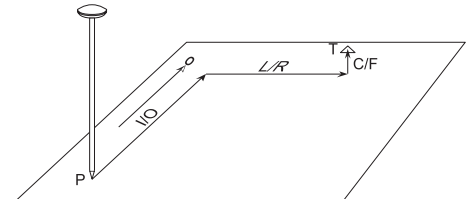
7.5.5 Polar and Orthogonal

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.

```
STAKE-OUT\ Default
Orient : North
point 05
Out : 4.69 m
Left : 30.33 m
Fill : 0.00 m
Quality: 0.03 m
OCCUPY POLAR REVERS REDRAW PICKUP INIT
```



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**)

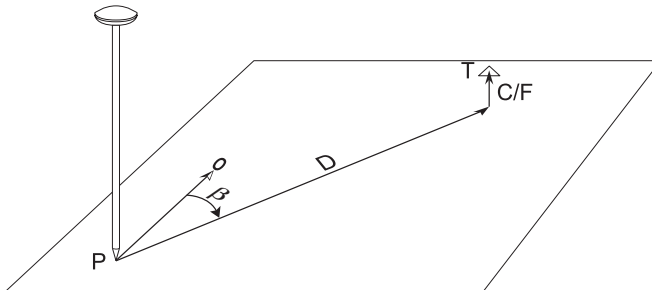
T - Target Point

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.

```
STAKE-OUT\ Default
Orient : North
point 05
Dist : 30.69 m
Direct : 261.21 °
Cut : 0.00 m
Quality: 0.03 m
OCOPY ORTHO REVERS REDRAW PICKUP INIT
```



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 **REVERS (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 a new point, you may do so by pressing the **PCKUP (F5)** key.

This brings you into survey mode. Measure the point and/or hidden point as described in sections 7.4.5 and 7.4.7

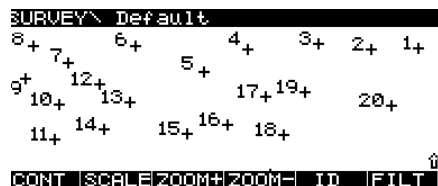
7.5.9 Using the INIT key

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 7.4.6.

7.5.10 Graph

A map of the 20 last measured points can be displayed by pressing **SHIFT** and then **GRAPH (F3)**. Each point is given a temporary ID between 1 and 20.



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.

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.

You may also scroll the map left/right, up/down by using the cursor keys.

7.5.11 Aux Pt

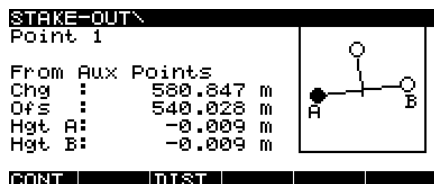
Auxiliary points are used as aids when trying to find a stake out point. Two auxiliary points are recorded to form start and end points of a line. The chainage and offset or distance from each auxiliary point to the target point is then displayed together with a sketch.

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.

7.5.12 Point Stake-Out - Procedure



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.

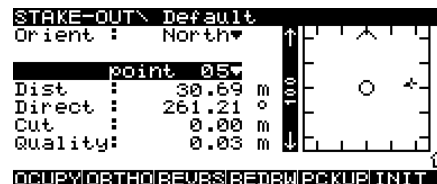
Press **CONT (F1)** to return to the stake out screen.

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.

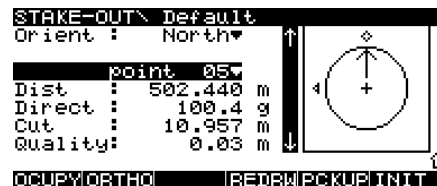
The “as staked” points will always be stored in the Job. You may also choose to store the Target points defined in the ASCII File in the Job. In this way you have the Target points and the “as staked” points in one Job.

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.

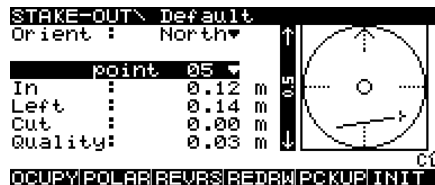
If you are a 500 meter (or feet) away from the target point, the graphical display will look as follows:



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.

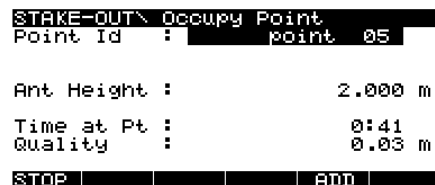
If you are closer than 500 m to the target point your position with respect to the Target point is shown in another graphical display. The scale shown on the left side of the display will change as you get closer to the point. The stages are 500m, 100m, 25m, 5m, 1m and 0.5m. Note that the orientation 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 additional 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.

```
STAKE-OUT\ Occupancy Differences
Stake Id : point 05
Store Id : point 05
Diff Out : 37.001 m
Diff Right: 0.035 m
Diff Cut : 0.751 m
Total Diff: 37.009 m

STORE
```

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.

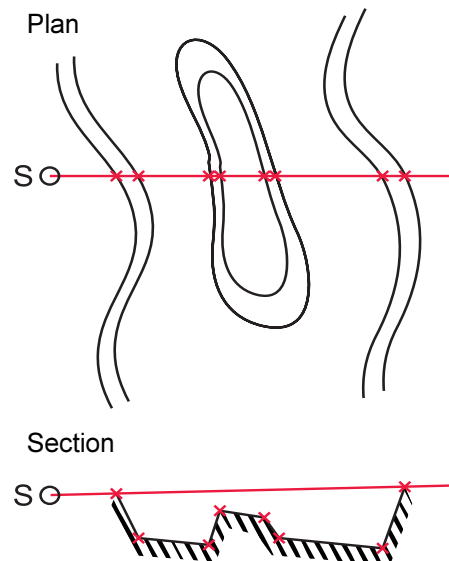
If however the point is outside the Required CQ, it may warrant further investigation.

7.5.13 Slope Stake-Out - Procedure

Slope Stake-Out has two main applications.

1. Measurement/Stakeout of transition points of slopes for cross-sections.

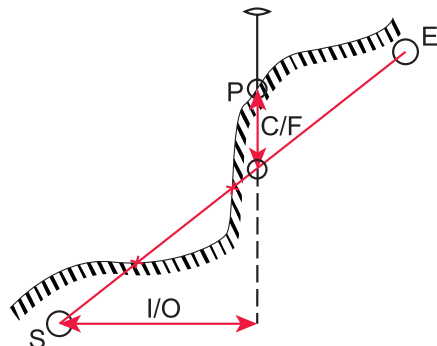
The Line is defined as the section line through the terrain. You ensure that you follow this line by observing the Left/Right value and keeping it at or near zero. When you arrive at a point where the level of the terrain begins to change, record the point. You can also stake this point for future reference.



S - Startpoint of slope

x - Transition point to be measured/
staked

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.

```
STAKE-OUT\ Begin
Config Set:      RTSTAKE▼
Stake Pts :      Default▼
Store Pts :      Default▼
Stake Type:      Slope▼
Antenna :        AT502 Pole▼
Ant Height:      2.000 m
CONT LOG ASCII CSYS
```

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\ Default
Orient : Line
Line 4
Out : 8.03 m
Right : 0.00 m
Cut : 0.00 m
Quality : 0.02 m
OCUPY POLAR REVS REDRAW PICKUP INIT

```

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)**.

```

STAKE-OUT\ Occupy Point
Point Id : Line 1 000001
Ant Height : 2.000 m
Time at Pt : 0:21
Quality : 0.03 m
STOP ADD

```

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 additional 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)**.

```

STAKE-OUT\ Occupy Point
Point Id : Line 1 000001
Ant Height : 2.000 m
Quality : 0.03 m
STORE DIFF ADD SKIP

```

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 differences between the startpoint of the line and the staked point.

```
STAKE-OUT\ Occupancy Differences
Stake Id : point 05
Store Id : point 05
Diff Out : 37.001 m
Diff Right: 0.035 m
Diff Cut : 0.751 m
Total Diff: 37.009 m

STORE
```

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.

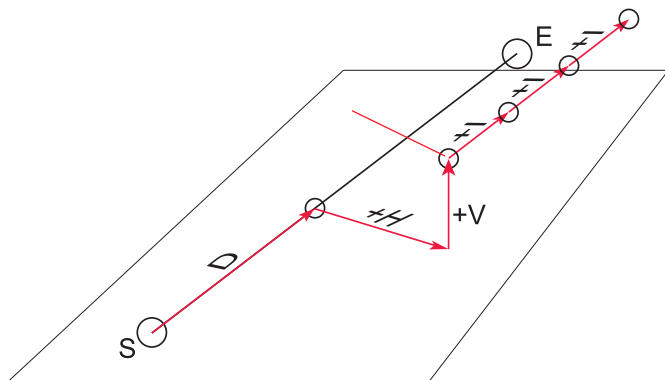
Total Diff - Length of vector from
startpoint to measured point.

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.

7.5.14 Grid Stake-Out - Procedure

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.

```
STAKE-OUT\ Begin
Config Set:      RT_STAKE
Stake Pts :      Default
Store Pts :      Default
Stake Type:      Grid
Antenna :        AT502 Pole
Ant Height:      2.000 m
CONT LOG ASCII CSYS
```

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\ +0000.00+0000.00
Orient : North
Out : 5.47 m
Left : 8.05 m
Cut : 9.58 m
GDOP : 7.4
OCCUPOLARIREVRS REDRAW PICKUP INIT
```

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**.

```
STAKE-OUT\ +0000.00+0000.00
Line: STK_Line.TXT
CONT NEW EDIT DEL-APARAM &NUM
```

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.

```
STAKE-OUT\ Grid
Station Beg: 0.000 m
Horz Offset: 0.000 m
Vert Offset: 0.000 m
Station Inc: 0.000 m
Scale : 1.0000000
CONT REFLN CURST
```

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

```
STAKE-OUT\ +0010.00+0001.00
Orient : North
Line 1
Out : 10.53 m
Left : 61.59 m
Cut : 0.00 m
GDOP : 4.4
OCUPY POLAR REVS REDRAW PICKUP INIT
```

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.

```
STAKE-OUT\ +0010.00+0001.00
```

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)**.

```
STAKE-OUT\ Occupy Point
Point Id : +0000.00+0001.00

Ant Height : 2.000 m
Time at Pt : 0:06
Quality : 0.02 m
STOP ADD
```

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 additional 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.

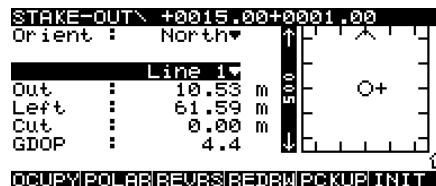
Add a code if required. Coding is explained in Chapter 8.

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.

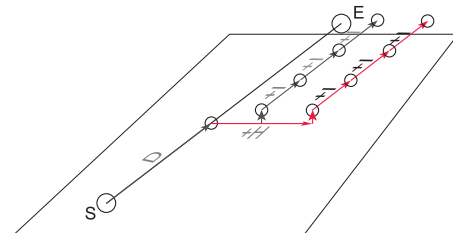


The next target is automatically selected according to the increment value. The value given in the Directory Bar also shows this.

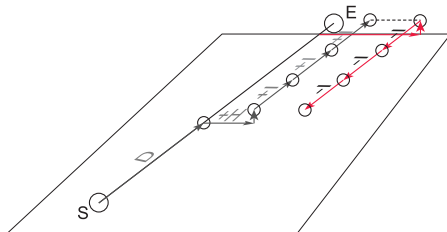
Carry on staking and recording points in this way until you reach the end of the row.

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:            1.000000
```

```
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:            1.000000
```

```
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.



```
STAKE-OUT\ +0000.00+0000.00
Line: STK_Line.TXT < >
line
[Empty box]
HELP | STAT+STAT- | QUIT ↑
```

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 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.

8.1 Thematical Coding

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 Attributes, it is far more practical to create the complete Codelist in SKI-Pro Codelist Manager and upload it to the Receiver.

8.1.1 Importing, Selecting and Defining a Thematic Codelist

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
Codelist: <
Codelist 1
Free Codelist

```

The Codelists on the Receiver are displayed. To create a new, empty Codelist press **NEW (F2)**.

CONFIGURE\ Coding

Coding Type : Thematical

Codelist : Codelist 1

```
CONFIGURE\ Codelist
Name      : 
Creator   :
```

CONT	CODES	LAYER
------	-------	-------

CONT					
------	--	--	--	--	--

Coding Type - Choose **Thematical**.
Codelist - Select the codelist from the list or, to define a new codelist, press **ENTER**.

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.

CONT	CODES	LAYER
------	-------	-------

```
CODE\      <      >  
Code _____ Code Name _____  
  
_____  
  
_____ ↑  
CONT NEW ATTRIB INFO QNUM
```

The list of existing codes is given. Press **NEW (F2)** to create a new code.

CONT			ATBIB		
------	--	--	-------	--	--

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).

CONT	NEW				
------	-----	--	--	--	--

Enter a meaningful name for the Attribute.

CONT	NEW				
------	-----	--	--	--	--

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.

8.1.4 Adding a Thematical Code to a Point

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.

```
SURVEY\ Default
Point Id : Point 1
Point Code : 101
Code Name : Control
Ant Height : 1.234 m

GDOP : 6.6

OCCUPY 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.

When the Point Code list box is open there are several other operations that you may carry out.

```
SURVEY\ Default
Point Code:
-----
ca Canyon *
cr Crossing
dt Dwarf town
dv Dwarf village

CONT NEW LAST ATRIB INFO xNUM
```

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.

8.2 Free Coding

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


```
CONFIGURE\ New Code
Free Code : 101
Description: Tree
```

Use the **NEW (F2)** key to add more information blocks.

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

```
CONT | | | C-INF | |
```

Free Code - Input the identifier

Description - Input the description of the Identifier.

Press **C-INF (F4)** to add information blocks for the code.

```
CONFIGURE\ Free Code Info's
Free Code : 101
Description : Tree
Width : 0.30m
Height : 4.50m
Info 3 :
```

```
CODE\ < | >
Code Description
101 Tree *
```

```
CONT | NEW | | C-INF | | αNUM ↑
```

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.

Enter a meaningful name for the info block. Then move to the adjacent field to enter a default value.

8.2.4 Adding a Free Code

When a Free Codelist has been selected for use within a Configuration Set, it will be possible to record a Free Code when measuring.

```
SURVEY\ Default
Point Id : 
Last Code : 
2Last Code : 
Ant Height : 0.000 m
Static Obs : 0
GDOP : 6.1
STOP CODE
```

The **Last Code** and second last code (**2Last Code**) that were used are shown.

The **CODE (F3)** 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-IDEFLT 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.

```
SURVEY\ Free Coding
Free Code: < >
100 Fence Line *
200 Fence Post
300 Storm Drain
400 Road Gully
CONT NEW LAST C-INF αNUM
```

An asterisk next to a code indicates that it has attributes.

STORE (F1) records the code and returns to the Main Survey screen.

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.

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**.

```
CONFIGURE\ Rt_rov.cnf
1 Survey
2 Operation
3 General
4 Interfaces
```

```
CONT | STORE | 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 **CONF (F5)**.

```
CONFIG SET\ < >
CNF Description
PP_KIS Default
PP_STAT Default
RT_REF Default
RT_ROV Default
```

```
CONT | NEW | EDIT | DEL | INFO | NUM ↑
```

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.

9.1 Survey - Satellite

Enables you to define the Satellite Elevation Mask and also automatic tracking of healthy satellites.

```
CONFIGURE\ Satellite
Elev Mask : 10°
SV Health : Automatic▼

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 **HEALTH (F4)** key.

For the vast majority of applications there should be no reason to set SV Health to User.

The SR510 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).

9.2 General - Units

Enables you to configure units for all types of measurement data displayed and recorded by the receiver.

```
CONFIGURE\ Units
Distance: Metres▼
Angle : 400 gon▼
Velocity: km/h▼
Date : dd.mm.yy▼
Time : 24 hours▼
Temp : Celsius °C▼
Pressure: millibar (mbar)▼

CONT [ ] [ ] [ ] [ ] [ ] ANGLE
```

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**.

9.3 General - Language

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 **Celsius °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.

```
CONFIGURE\ Angle Formats
Dirctn Ref : North Azimuth
Dirctn Base: True
```

```
CONT
```

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.

Select the Language in which you wish the Terminal Interface to be displayed. The language is associated with the Configuration Set.

```
CONFIGURE\ Language
ENGLISH
CONT DEL
```

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.

```
CONFIGURE\ Hot-Keys
F7 key: CONFIGURE\ Position
F8 key: CONFIGURE\ Id Template
F9 key: APPLICATION\ Point Map
F10 key: CONFIGURE\ Hot-Keys
```

```
CONT
```

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
```

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.

```
CONFIGURE\ Start-Up
Panel : MAIN\ Menu
CONT
```

Select the screen you wish to be displayed upon switching the Receiver on from the list.

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.

9.7 General - TR500

Enables you to configure some general features of the Terminal.

```
CONFIGURE\ TR500
Illu/Contr: NO 0% 100%
Alarm : YES
Keyclick : NO
Deflt αNUM: ABCDEFGHIJKLMNOPQR
CONT
```

Illu/Contr - Switches the screen illumination on or off and sets the contrast level.

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.

9.10 Interfaces - Real-Time

9.11 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 select **Use Device** to **YES**.

Select the port to which the device is connected. Use the **DEVICE (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.

9.12 Interfaces - NMEA Output

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

Port      : 3 *Satellite ZAS
Messages  : GGA,ZDA

CONT  MSGS ID  DEVICE
```

Select the port to which the NMEA messages should be sent. Use the **DEVICE (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 Delay: 0.00 s

CONT

Rate - Choose a rate between 0.1 and 60s 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 additionally 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 sen-

sors 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.

9.13 Interfaces - Remote

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 **DEVICE (F5)** to select the appropriate 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.

9.14 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,ssssssss,nnnn*hh<CR><LF>
```

Format	Content
\$PLEIR,	Header
HPT,	Message identifier (High Precision Time)
ssssssss,	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.

9.15 Interfaces - Event Input

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.

Additionally, positions and events can be directly logged when operating in real time. Events logged during real time operations can be 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)**.

```
CONFIGURE\ Event Input
Event Port : 1 & 2
Polarity : Negative Edge
```

CONT				PARAM	
------	--	--	--	-------	--

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.

Press **PARAM (F5)** to modify additional parameters.

```

CONFIGURE\ Event Input Parameter
Event Port : 1
Info to Log : None
Bias Intern : User
Intern Bias : 0 ns
Extern Bias : 0 ns
Time Guard : 0.000 s
Notify Msg : Binary
Description:
CONT      NPORT

```

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 - Enables to set a calibration value 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.

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.

The ASCII message takes the following format:

\$PLEIR,EIX,ssssssss,ttttttt,nnnn,cccc,dddd*hh<CR><LF>

Format	Content
\$PLEIR,	Header
EIX,	Message identifier = event input "1" or "2"
ssssssss,	GPS time of week of event (in msec)
ttttttt,	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

¹This is the count of all pulses including those violating the specified time guard boundary conditions. This allows determination of missed events.

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

10 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.

10.1 Real-Time Input Status

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.

10.2 Stop and Go Indicator

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.

10.3 Position

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 [ ] TARGET [ ]
```

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 **TARGET (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.

10.5 Satellite Status

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 HEALTH 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 HEALTH 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).

HEALTH (F4)

```
STATUS\ Satellite Health
0 Bad Sats :
27 OK Sats : 01 02 03 04 05 06
              07 08 09 10 13 14
              15 16 17 18 19 21
              22 23 24 25 26 27
CONT
```

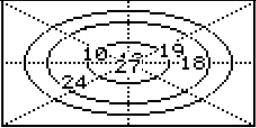
Press cursor down key.

```
STATUS\ Satellite Health
27 OK Sats : 01 02 03 04 05 06
              07 08 09 10 13 14
              15 16 17 18 19 21
              22 23 24 25 26 27
5 N/A Sats : 11 12 20 28 32
CONT
```

The PRN numbers of Bad (unhealthy) satellites, OK (healthy) satellites and satellites for which no data is available are listed.

SKY (F5)

```
STATUS\ Sky Plot
Sat  L1  L2
13   TR  TR
27   TR  TR
10   TR  TR
19   TR  TR
18   TR  TR
24   TR  TR
```



```
CONT ELE00 SYMB INFO
```

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.

10.6 Point Log Status

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.

STATUS\ Point Log			
Point Id	Time	Date	
Point 1	08:45	29.04	
Point 2	08:45	29.04	
Point 3	08:45	29.04	
Point 4	08:45	29.04	
Point 5	08:45	29.04	

CONT INFO <NUM

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

AVG - 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

STATUS\ Memory\Battery			
PC-Card	: 1.3MB	0% 100%	*
Memory Int	: 0KB		
Battery A	: 97%		*
Battery B	: 100%		
Battery Ext	: 0%		
CONT			REF

Press cursor down.

STATUS\ Memory\Battery			
Battery A	: 97%	0% 100%	*
Battery B	: 100%		
Battery Ext	: 0%		
Bat PC-Card	: OK		
Bat Backup	: 100%		
CONT			REF

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.

10.10 Sensor Status

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.

```
STATUS\ General
Sensor Type      : SR530
Sensor Serial#   : 19981224
Control Mode     : TR500
Primary Port     : Terminal
PPS              : YES
Event Input      : YES
```

The Receiver model used and its serial number are displayed.

Control Mode- Displays the device that is used to control the sensor. Normally this is 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 Boot** software and the Firmware for the **Keyboard / Display** (TR500) currently installed.

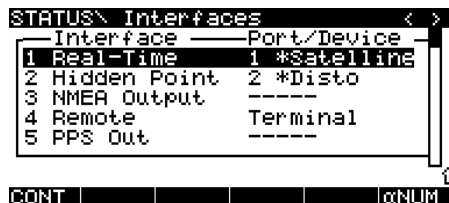
10.12 Interfaces Status

Gives an overview of all interfaces and the port and device currently assigned for that interface.

For further details about Status information for the different devices please refer to Appendix H.

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 PPS Output are not currently configured.



The screenshot shows a terminal window titled "STATUS\ Interfaces" with a table of interface configurations. The table has two columns: "Interface" and "Port/Device". The rows are numbered 1 through 5. Row 1 shows "Real-Time" connected to "1 *Satelline". Row 2 shows "Hidden Point" connected to "2 *Disto". Row 3 shows "NMEA Output" with a dashed line. Row 4 shows "Remote" connected to "Terminal". Row 5 shows "PPS Out" with a dashed line. Below the table, there are buttons for "CONT" and "QNUM".

Interface	Port/Device
1 Real-Time	1 *Satelline
2 Hidden Point	2 *Disto
3 NMEA Output	-----
4 Remote	Terminal
5 PPS Out	-----

CONT QNUM

For this type of operation, the Interfaces panel would look as shown above.

11. Applications

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.

11.1 Determining a Coordinate System

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. There are two main groups. 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. The other group of methods involves transforming the coordinates directly from WGS84 into a local grid.

System 500 receivers contain both the Helmert method and the 1-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.

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.

In System 500, you may use one of two types of coordinate system-

1. 3D Helmert Transformation, Ellipsoid, Projection and Geoid (optional).

or

2. 1-Step Transformation and Geoid (optional).

```
APPLICATION\ Menu
01 Determine Coord System
02 Point Management
03 Calculator
04 Wake-up Sessions
05 COGO
06 Area
07 DTM Stakeout

CONT
```

From the Application Menu, select **Determine Coord System** and press **CONT (F1)**.

```
COORDSYS\ Determination Begin

Coord Sys : Coord Sys 1

WGS84 Pts : Determination▼
Local Pts : Crd-grid.txt▼
```

```
CONT LOCAL CSYS
```

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).

```
COORDSYS\ Local Point Format

Local Pts : ASCII File▼
```

```
CONT 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.

```
COORDSYS\ Coord Sys< >
Name
Swiss 1      Classic
Swiss 2      1-Step
WGS84 Geodetic Classic
CONT NEW EDIT DEL INFO αNUM
```

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.

```
COORDSYS\ Type Selection
Coord Sys :      Coord Sys 1
Transform :      Coord Sys 1
Trans Type :      Classical▼
Projection :      Swiss▼
Geoid Model:      -----▼
CONT
```

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.

Ellipsoid - Available if a classical 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 the Classical Transformation Type is selected. Select the Map Projection from this 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 nonstandard map projections.

Non - standard map projections available include:

Czech and Slovak
Danish Jylland
Danish Sjælland
Dutch RD Stereographic
Finnish KKJ
Hungarian
Malaysian
New Zealand
Swiss
Swiss 95

Geoid Model - If a Geoid Model is to be applied, 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 must then be transferred to the System RAM.

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.

```
COORDSYS\ Type Selection
Projection: <
Swiss
UTM 32
CONT NEW EDIT DEL DEFLT&NUM
```

Select **NEW (F2)** to enter a new projection set.

```
CONFIGURE\ New Projection
Name :
Type : Trans Mercator▼
False East : 0.000 m
False North: 0.000 m
Lat Origin : 0°00'00.000" N
CONT
```

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.

```
COORDSYS\ Determine Classical
WGS84 Local Match
213 213 P+H
214 214 P+H
215 215 P+H
306 306 P+H
316 316 P+H
CONT NEW EDIT DEL MATCH
```

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 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 unmatched 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.

```
COORDSYS\
Name      : Coord Sys 1
Trans model: Bursa-Wolf
Shift dx  : ----- m
Shift dy  : ----- m
Shift dz  : ----- m

CONT
```

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 **ADJUST (F4)**.

Press **CONT (F1)** to return to the previous screen.

Press **CONT (F1)** to execute the transformation calculation.

COORDSYS\ Residuals		
WGS84	North	East
213	* 0.059	-0.018
214	-0.013	0.021
215	0.024	-0.024
306	-0.006	0.043
316	-0.045*	-0.065

CONT	RESLT	INFO
------	-------	------

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

COORDSYS\ Parameters	
Name	: Coord Sys 1
Trans model	: Bursa-Wolf
Shift dX	: 13282.2982 m
Shift dY	: 2464.0978 m
Shift dZ	: 20062.8687 m

CONT				RMS
------	--	--	--	-----

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 Transformation Results

COORDSYS\ Parameters	
Position	:
Shift dX	: 250646.1440 m
Shift dY	: 765298.5504 m
Rotation	: -5754.6490 "
Scale	: 33.5970 ppm
Height	:

CONT				RMS
------	--	--	--	-----

The transformation is split into a 2D Helmert transformation for position and a Height Interpolation.

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 an Transverse Mercator projection applied. This results in a temporary auxiliary grid for the WGS84 coordinates. A 2D Helmert transformation is then performed

continued...

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.

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

```
COORDSYS\ Save Coord System
Coord Sys : Coord Sys 1
Trans Type: 1-Step

#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.

#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.

```
COORDSYS\ Determination Begin
Coord Sys : 
WGS84 Pts : Determination▼
Local Pts : Crd-grid.txt▼

CONT LOCAL CSYS
```

Press **CSYS (F6)** to list the Coordinate Systems available.

```
COORDSYS\ Coord Sys
Name
Coord Sys 1 Classic
Local 1 Classic
Swiss 1 Classic
Swiss 2 1-Step
WGS84 Geodetic Classic

CONT NEW EDIT DEL INFO QNUM
```

Select the Coordinate System that you wish to include new points in. Press **CONT (F1)**.

```
COORDSYS\ Determination Begin
Coord Sys : Local 1
WGS84 Pts : Determination▼
Local Pts : Crd-grid.txt▼

CONT LOCAL AUTO LIST
```

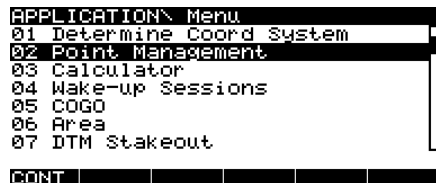
Now you have two choices. You may either automatically match the new points and calculate the new parameters by pressing **AUTO (F5)**. Alternatively, you may proceed manually through the Coordinate Determination as described in the last section.

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.

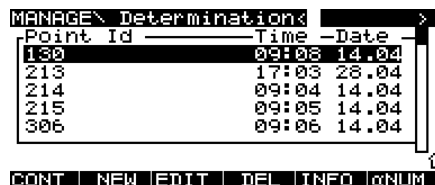
When **AUTO (F5)** is pressed, the coordinates that were matched in the previous parameter calculation are recalled and used again, even if they did not have matching point Ids. The new point(s) that have identical point Ids will be matched and included in the computation. You are then presented with 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.

11.3 Point Management

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 are not displayed and 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

AVG - Point measured more than once and coordinates averaged.

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. When you have entered the point details press **STORE (F1)** to store the point and return to the previous screen.

Use **EDIT (F3)** to edit the coordinates of a selected point. 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 and the point contains more than one measurement, the **AVRG (F6)** key is available. Use this to select or deselect measurements from the averaged coordinate. When you have finished editing the coordinates, press **STORE (F1)** to store the point and return to the previous screen.

Use the **DEL (F4)** key to delete the selected point.

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.

```
MANAGE\ Filter
Sort By      :      Point Id▼
Filter By    :      No Filter▼
```

```
CONT  STAKE
```

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 additional 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 DTM Stakeout

CONT
```

Select **Wake-up Sessions** from the APPLICATION menu.

```
Wake-up Sessions
# Date Duration
01 13.01.99 12:05 -> 12:08
02 13.01.99 12:30 -> 12:33

CONT NEW EDIT DEL INFO
```

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.

```

WAKE-UP\ New Wake-up Session
Session : NEW
Job : Determination
Config Set: ROV
Start Date: 13.01.99
Start Time: 00:00:00
Duration : 00:03:00

```

CONT

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.

11.6 COGO

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.

```
APPLICATION\ Menu
01 Determine Coord System
02 Point/Line/Area Management
03 Calculator
04 Wake-up Sessions
05 COGO
06 Area
07 DTM Stakeout

CONT
```

Select **COGO** from the APPLICATION menu.

```
COGO\ Begin
Job      : HBG1
Log File : YES
File Name : COG01.LOG
Use Offset : YES
Use Brg.  : NO

CONT
```

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.

```
COGO\ Menu
1 Inverse
2 Traverse
3 Intersection...
4 Offsets...
5 Arcs...
```

```
CONT
```

Inverse

This function enables you to calculate the inverse between two grid points. All coordinates used in the program can be entered manually or selected from the database.

```
COGO\ Inverse
Line Pt 1 :            A▼
Line Pt 2 :            B▼

COMP                                             NEWOC
```

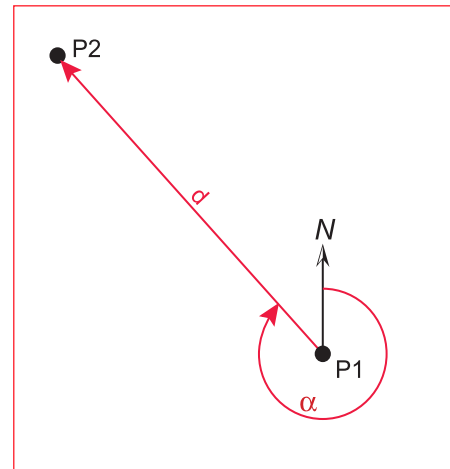
Enter the start point and the end point of the line or press **NEWOC (F5)** to measure new points.

Press **COMP (F1)** to start the computation.

```
COGO\ Inverse Results
Point Id 2 :            B
Bearing    : 240°06'04"
Horz Dist. : 46.141 m
Hgt Diff   : 50.000 m
CONT                                                       
```

The Bearing (Azimuth), Horizontal 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)

P2 - End point of line (E, N, h)

Output:

α - Bearing (Azimuth)

d - Horizontal Distance

- Height Difference

Traverse

This function enables you to calculate a new point by defining a start point and entering its distance and azimuth to the new point.

```
COGO\ Traverse
Point Id 1 :      A▼

Bearing    :      60°06'04"
Parall OS  :      0.000 m
Horz Dist. :      46.141 m

COMP  INV  [ ]  [ ]  [ ]  [ ]
```

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)**.

Press **COMP (F1)** to start the computation.

```
COGO\ Traverse Results
Point Id :      New

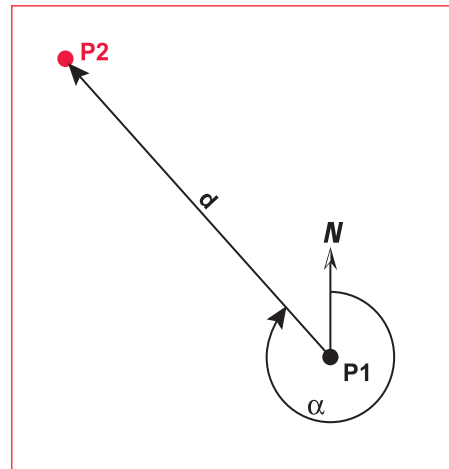
Local E   :      700120.000 m
Local N   :      230078.000 m
Ortho Hgt :      250.000 m

STORECOORD  STAKE
```

Easting, Northing and Height of the new point are displayed.

Enter a Point Id, change the Height if necessary and 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)

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).

```
COGO\ Brg-Brg Intersection
Point Id 1 : A
Bearing : 35°20'00"
Parall Off : 0.000 m
Point Id 2 : B
Bearing : 323°21'05"
COMP INV
```

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.

```
COGO\ Brg-Brg Intersect Results
Point Id : P
```

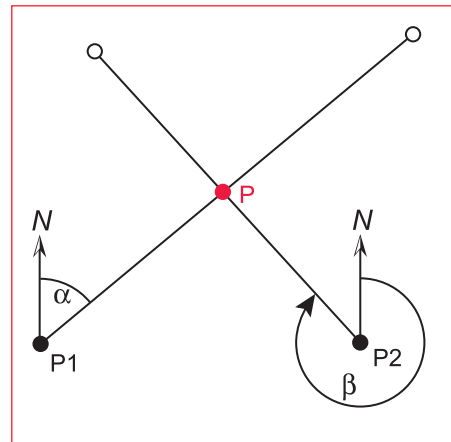
```
Local E : 700052.133 m
Local N : 230015.691 m
Ortho Hgt : 250.000 m
```

```
STORE COORD STAKE
```

Easting, Northing and Height of the intersection point are displayed.

Enter a Point Id, change the Height if necessary 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\ Bra-Dist Intersection
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)**.

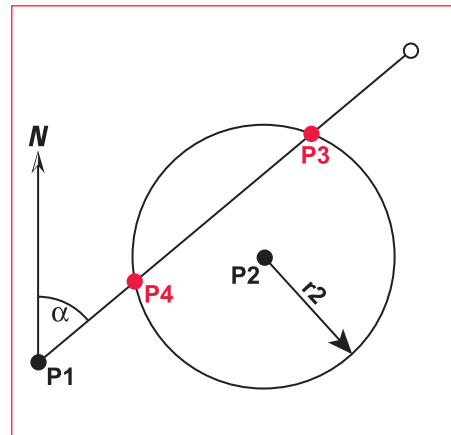
Press **COMP (F1)** to start the computation.

```
COGO\ Bra-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 necessary 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 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)**.

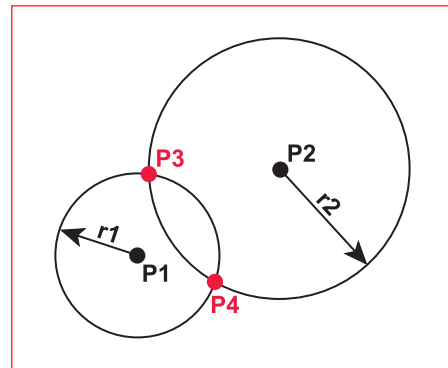
Press **COMP (F1)** to start the computation.

```
COGO\ Dist-Dist Insters. Results
Point Id : P3
Local E : 700069.384 m
Local N : 230038.050 m
Ortho Hgt : 250.000 m
STORECOORDOTHER 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 necessary 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.

```
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

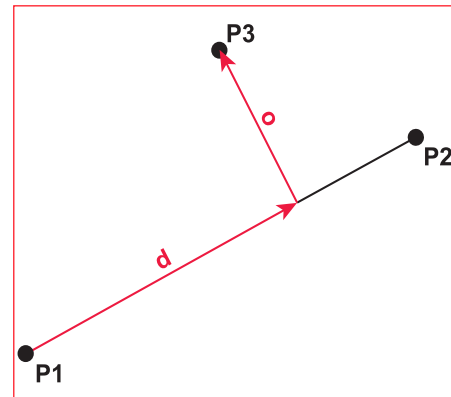
CONT
```

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 **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

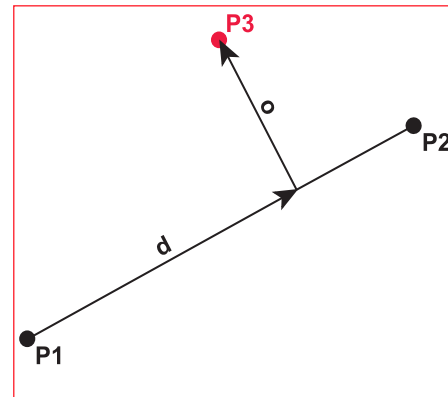
Local E   :      700047.493 m
Local N   :      230018.740 m
Ortho Hgt :      250.000 m

STORE\COORD [ ]  [ ]  [ ]  [ ]  [ ]  [ ]
STAKE [ ]  [ ]  [ ]  [ ]  [ ]  [ ]
```

Easting, Northing and Height of the offset point are displayed.

Enter a Point Id, change the Height if necessary 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

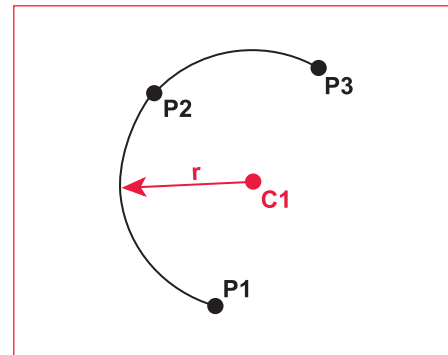
Local E   : 708681.574 m
Local N   : 215049.457 m
Ortho Hgt : 250.000 m

STORECOORD  STAKEMORE
```

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 necessary 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.

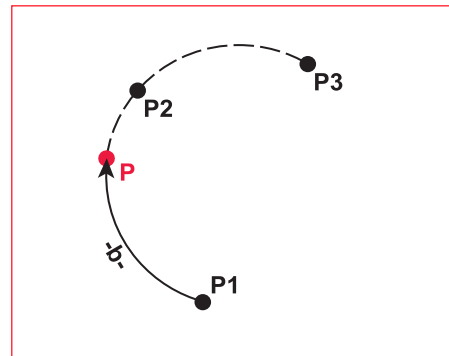
Press **COMP (F1)** to start the computation.

```
COGO\ Dist on Arc Results
Point Id : P
Local E   : 708681.574 m
Local N   : 215049.457 m
Ortho Hgt : 250.000 m
STORECOORD STAKE
```

Easting, Northing and Height of the new point on the arc are displayed.

Enter a Point Id, change the Height if necessary 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.

```
APPLICATION\ Menu
31 Determine Coord System
32 Point/Line/Area Management
33 Calculator
34 Wake-up Sessions
35 COGO
36 Area
37 DTM Stakeout

CONT
```

Select **Area** from the APPLICATION menu.

```
AREA\ Begin
Job       : HBG1
Area      : New Area
Log File  : YES
File Name : AREA.LOG

CONT
```

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.

```
AREA\ Create Area
Point Id  Area Segment
A         Node
B         BegArc  1.7
C         EndArc  1.7
D         Node
E         Node

CALC NEW EDIT DEL PLOT
```

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. Alternatively 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 displayd.

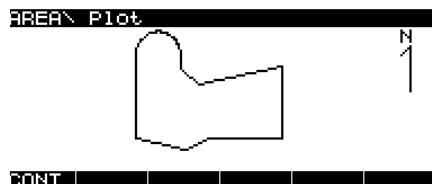
AREA\ Calculation Results

No. of Segs:	9
Area :	58.798 m ²
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 graphical screen showing the outline of the defined area.

Press **CONT (F1)** to return to the APPLICATION\ Menu.

12 Utilities

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.

12.1 Directory of Memory Device

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      DEVE
```

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** sub-directory. **GEOID** contains any Geoidal Model 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.

12.2 Format Memory Module

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 SYSTEM

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 **SYSTEM (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 and Geoid 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.

12.3 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/GSI8 to Job
07 GSI/ User File
CONT
```

13.1 Transfer 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 be 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 Transfer 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 Transfer 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 Transfer 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 Transfer 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.

13.6 Transfer ASCII/GSI to Job

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.

The ASCII file may be in a simple Format (e.g. Pt Id, East, North, Height) or in GSI format. The converted points will be added to the Job database. If a point already exists in the database the program will prompt you to overwrite it or not.

```
TRANSFER\ ASCII\GSI to Job
Type       : ASCII File▼
From       : Local.txt▼
To         : HBG2▼
```

```
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.

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.

13.7 Transfer GSI / User File

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.

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      | FORMAT      | FILTER
```

Select **From** which device you wish to select a Job and **To** which device you wish to store the ASCII file.

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.

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.

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.

13.8 Transfer 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.

Geoid File - Select the Geoid Field File. Press **ALL (F3)** to select all the Geoid Field Files.

13.9 Transfer Any File Type

Enables you to transfer any file between the DATA directories on the memory devices.

```
TRANSFER\ Any File Type
From      : PC-Card
To        : Internal
File      : Cnd-grid.txt ▼
```

```
CONT  ALL
```

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.

13.10 Transfer Firmware

Enables you to transfer Receiver firmware from the PC Card to the Receiver.

```
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 Transfer Firmware TR500

Enables you to transfer Terminal firmware from the PC Card through the Receiver 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 Transfer Language Version

Enables you to transfer Local Language files of the system software to the Receiver from a PC Card.

```
TRANSFER\ Language
From      : PC-Card
To        : Sensor
Version   : DEUTSCH <S.02>
```

```
CONT 
```

Version - Select the language version that you wish to transfer.

13.13 Transfer 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 Transfer Almanac

Enables you to transfer GPS Satellite Almanac Files to the Receiver from a PC Card.

```
TRANSFER\ Almanac
From      :          PC-Card▼
To        :          Sensor
Almanac   :  [REDACTED]▼
```

```
CONT [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
```

Almanac - Select the Almanac that you wish to transfer.

Appendix A - Operating and Storage Temperatures

Component	Operation	Storage
Receiver	-20°C to +55°C	-40°C to +75°C
Terminal	-20°C to +55°C	-40°C to +75°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 +75°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:

¹@, ²GSE, ³V, ⁴M, ⁵gg, ⁶g, ⁷pp, ⁸p, ⁹hh, ¹⁰h, ¹¹vv, ¹²v, ¹³aaa, ¹⁴aaa, ¹⁵ss, ¹⁶eee, ¹⁷ii, ¹⁸REC, ¹⁹RSN

Example

@GSE12 4.0 0.0 0.0 0.0 1.220 5 1 2SR530 001899

Record Content	Description
1 @	Record Flag. @ = Automatically stored (not user entered).
2 GSE	Record Type. GSE = GPS SEismic.
3 Version	Version number of this record.
4 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
5 gg.g	GDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
6 pp.p	PDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
7 hh.h	HDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
8 vv.v	VDOP value. Range 0.0 to 99.9. Default if not available - 0.0.
9 aaa.aaa	Antenna Height - sum of instrument height and antenna offset. Range -99.9 to 999.99. Default if not available - 0.0.
10 ss	Number of satellites used for solution. Range 0 to 12. Default if not available - 0.
11 eee	Number of epochs spent on point. Range 0 to 999. Default if not available - 0. Default if not available-0.
12 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.
13 REC	Receiver type. Range SR299, SR399, SR299E, SR399E, SR9400, SR9500, SR510, SR520, SR530
14 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 40 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.

$$\begin{array}{ccccccc} \overset{1}{@}< & \overset{2}{ID} & \overset{3}{xxxxx.xxx} & \overset{4}{yyyyy.yyy} & \overset{5}{hhh.hhh} \\ \overset{6}{@}> & \overset{7}{LD} & \overset{8}{LDD} \end{array}$$

Record Format

1	@<	Start of first line of record
2	ID	Line ID, 16 characters
3	xxxxxx.xxx	Start Point Easting
4	yyyyyy.yyy	Start Point Northing
5	hhh.hhh	Start Point Orthometric Height
6	@>	Start of second line of record
7	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
8	LDD	Line definition values. Depend on LD, as shown above.

Appendix E - NMEA Message Formats

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 <i>Outside World</i> .
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

GLL - Geodetic Position - Latitude/Longitude

GNS - GNSS Fix Data

VTG - Course Over Ground and Ground Speed

ZDA - Time and Date

LLK - Leica Local Position and GDOP

LLQ - Leica Local Position and Quality

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		

GGA - Global Positioning System Fix Data

GLL - Geodetic Position - Latitude, Longitude

Format	Content
\$GPGGA,	Header, incl. Talker ID, message sent from Receiver
hhmmss.ss,	UTC time of Position
llll.ll,	Latitude
a,	Hemisphere "N"/"S"
yyyy.yy,	Longitude
a,	"E"/"W"
x,	GPS Quality, 0=not valid, 1=GPS Nav Fix, 2=DGPS Fix, 3= RTK Fix
x,	Number of satellites in use, 00-12
xx.xx,	HDOP
xxxx.xxxx,	Antenna altitude above/below mean sea level
M,	Units of altitude meters (fixed text "M")
xx.xx,	Geoidal separation
M,	Units of geoidal separation meters (fixed text "M").
xx.xx,	Age of differential GPS data, null when DGPS not used
xx	Differential Reference Station ID, 0000-1023
*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"
yyyy.yy,	Longitude
a,	"E"/"W"
hhmmss.ss,	UTC time of position
A	Status: "A" = Data valid, "V" = Data not valid
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

GNS - GNSS Fix Data

VTG - Course Over Ground and Ground Speed

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,	"N"/"S"
yyyy.yy,	Longitude
a,	"E"/"W"
C--C,	Mode Indicator ¹
x,	Number of satellites in use, 00-99
xx.xx,	HDOP of all satellites used in computation
xxxx.xxxx,	Antenna altitude above/below mean sea level, meters
xx.xx,	Geoidal separation, meters
xx.xx,	Age of Differential GPS Data, null when GPS not used.
xx	Differential reference station ID, 0000-1023
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Format	Content
\$GPVTG	Header, incl. Talker ID,message sent from Receiver
xx.xx,	Course, degrees (0.0° to 359.9°)
T,	True (fixed text "T")
xx.xx,	Course, degrees (0.0° to 359.9°)
M,	Magnetic (fixed text "M")
xx.xx,	Speed
N,	Knots (fixed text "N")
xx.xx	Speed Over Ground (SOG)
K	Km/h (fixed text "K")
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Note - The Magnetic declination is set in the Receiver using the CONFIG key.

¹ 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 Real Time Kinematic

ZDA - Time and Date

Format	Content
\$GPZDA,	Header, incl. Talker ID,message sent from Receiver
hhmmss.ss,	UTC time
x,	UTC Day, 01 to 31
x,	UTC Month, 01 to 12
xx,	UTC Year, 1997 to ...
x,	Local zone description, hours (-13 to 13) (±)
x	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.

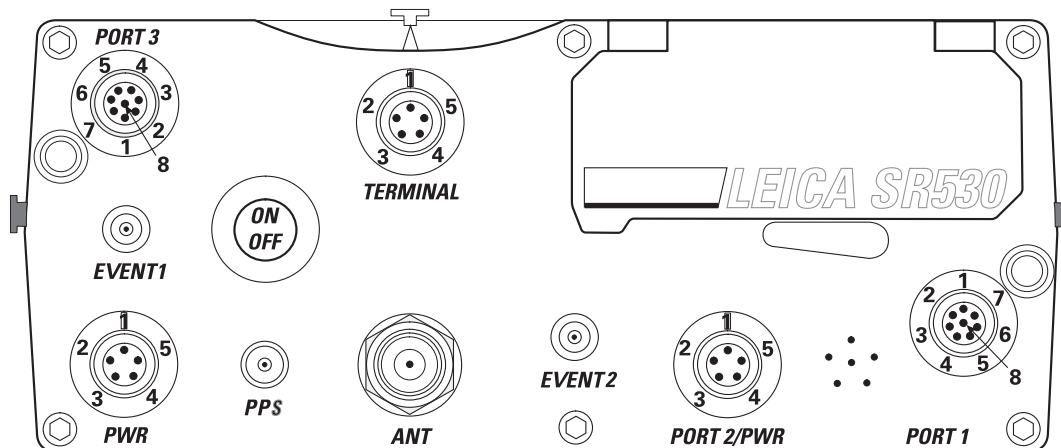
LLK - Leica Local Position and GDOP

Format	Content
\$GPLLK	Header, incl. Talker ID,message sent from Receiver
hhmmss.ss,	UTC time of position
ddmmyy,	UTC date
xxxx.xxxx,	Grid Easting, meters
M,	Meter (fixed text "M")
xxxx.xxxx,	Grid Northing, meters
M,	Meter (fixed text "M")
x,	GPS Quality, "0" = not valid, "1"=GPS Nav Fix, "2"=DGPS Fix, "3"=RTK Fix
x,	Number of satellites used in computation
xx.xx,	GDOP
xxxx.xxxx,	Height, meters
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
ddmmyy,	UTC date
xxxx.xxxx	Grid Easting, meters
M,	Meter (fixed text "M")
xxxx.xxxx,	Grid Northing, meters
M,	Meter (fixed text "M")
x,	GPS Quality, "0" = not valid, "1"=GPS Nav Fix, "2"=DGPS Fix, "3"= RTK Fix
x,	Number of satellites used in computation
xx.xx,	Position Quality, meters
xxxx.xxxx,	Height, meters
M	Meter (fixed text "M")
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Appendix F - Pin Assignments



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

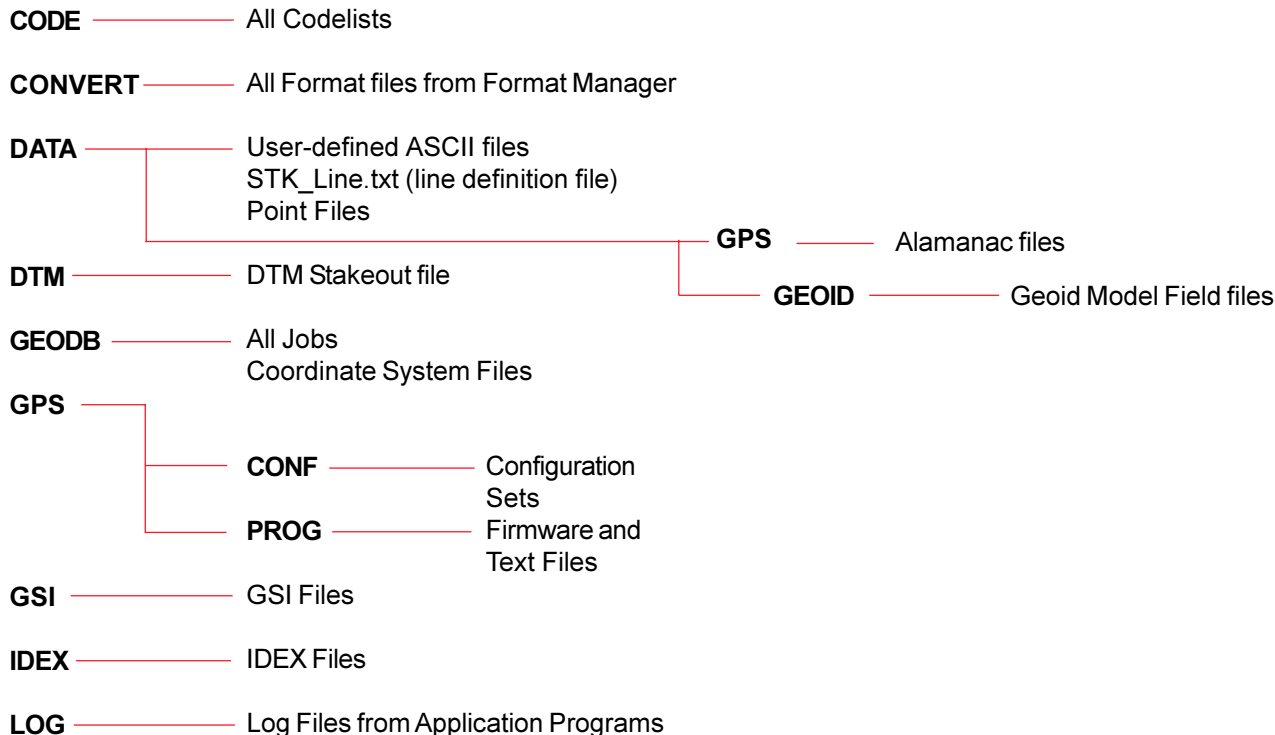
Pin	Function
1	KDU_ON
2	KDU_PWR
3	GND
4	Rx
5	Tx

PWR

Pin	Function
1	Bat
2	+12V
3	GND
4	---
5	---

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.



Appendix H - External Devices

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
- Hidden Point Input
- NMEA Output
- Remote Control
- PPS Output
- Event Input

Each interface may be controlled by one or more **Devices**.

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.

RS232

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)**.

```
CONFIGURE\ Devices and Ports
Device
*Dataradio T-96S
*GSM
*Modem
*Pacific Crest RFM96W
*RS232
CONT NEW EDIT DEL DEFLT
```

Enter a name and change the parameters according to the specification of your external device.

```
CONFIGURE\ New Port Settings
Name :
Baud Rate : 9600▼
Parity : None▼
Data Bits : 8▼
Stop Bits : 1▼
Flow Contrl: None▼
CONT
```

Press **CONT (F1)** to store the device.

Radio

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:

Satellite 1AS/2AS

Satellite 2ASx

Satellite 2ASxE

Satellite 3AS/3ASd

Pacific Crest RFM96W

Dataradio T-96S (Australia only)

Configuring the Radio

```
CONFIGURE\ Rt_Prov.cnf
1 Survey
2 Operation
3 General
4 Interfaces
```

```
CONT | STORE | CONFIG
```

From CONFIGURE\ Interfaces highlight the interface (e.g. Real-Time) you want to use with the Radio and press **EDIT (F3)**.

```
CONFIGURE\ Real-Time
R-Time Data: Rover▼
Data Format: Leica▼
Port: 1 *Satellite 2A▼
Ref Sensor: Unknown▼
Ref Antenna: Unknown▼
Use Phase: NO▼
Radio Down: Don't Log Obs▼
```

```
CONT | | | DEVICE
```

Press **DEVICE (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. Satellline 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.

```
CONFIGURE\ New Port Settings
Name: Radio-XY
Baud Rate: 9600▼
Parity: None▼
Data Bits: 8▼
Stop Bits: 1▼
Flow Contr1: None▼
```

```
CONT | | | | |
```

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 Sateline 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.

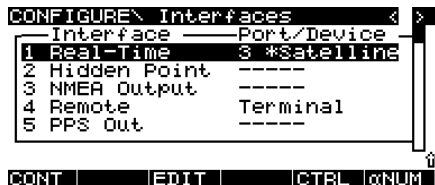
The number of channels available and the frequency spacing between channels will depend on the radio modem used.

Channel switching on Pacific Crest Radio Modems must be activated by a Pacific Crest dealer and may require a special license.

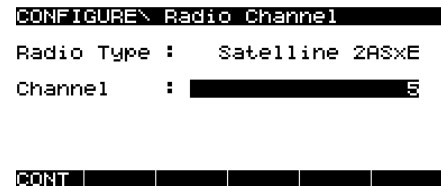
Sateline Radio Modems must be in *Programming* mode. This can be set by a Sateline dealer. Channel switching may contravene radio broadcasting regulations in certain countries.

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)**.



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 recognized 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 Id number.

GSM

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:

Siemens M1 Siemens M20

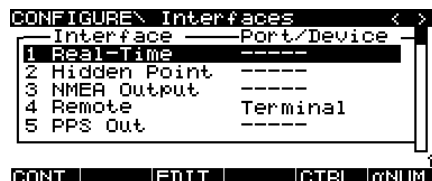


Before using GSM phones for data transmission make sure your network operator supports data transmission.



If you are using a third party GSM phone make sure it supports AT command language.

Configuring the GSM Phone



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.



Select a standard GSM phone from the list or highlight **GSM** and press **NEW (F2)**. Enter a name (E.g. GSM-XY) and enter the applicable device parameters.



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 communication between the sensor and the GSM phone.

```

CONFIGURE\ GSM Options
Type : User
Init : AT+FE000V1X430=1^M
      AT+CMEE=0^M
      AT&W0^M
Dial : ATD^#^M
Hangup: ATH^M
Escape: ~~~~~+++

CONT DEFLT

```

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 - This is the initialization sequence to initialize the phone.

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
- ^#** Inserts the phone number as defined in GSM Connection
- ~** Inserts a delay of 1/4 second

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)**.

```

CONFIGURE\ GSM Connection
Station   : REF1
Number    : 0041552803581
Modem     : UDI
Accept Ref : Any Received

Net Baud   : 9600

CONT  CODES

```

Select the **Station** to contact. The phone **Number** of the Station (Reference) the type of **Modem** used there and the Network baud rate are displayed.

To enter a new station, highlight **Station** and press **ENTER**.

```

CONFIGURE\ GSM Connection
Station
REF 1

```

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   : REF1
Number    : 0717273456
Modem     : UDI

```

CONT

Enter the **Station** name, telephone **Number** and the type of GSM **Modem** (**UDI**-Unrestricted Digital Information or analog) used there. Typically, **UDI** will be chosen if the reference is GSM compatible.

Press **CONT** (**F1**) to accept the settings and return to the station list.

Change the **Net Baud** (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 **CONT** (**F1**) 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)**.

```
STATUS\ GSM
Firmware:      Revision 2.00
Operator:      Donald Duck
Status :       Registered (home)

Signal :       |-----|
CONT
```

Information about the connected GSM phone is displayed.

Firmware - Current firmware release.

Operator - GSM network operator.

Status - Registration status.

Signal Level - Measure of signal quality on the GSM network.

Modem

A Modem device is normally used to communicate with the Sensor e.g. to download data or the transmitt NMEA messages etc.

The following modem communication settings are as standard included with System 500:

U.S. Robotics 56K



If you are using a third party modem make sure it supports AT command language.

Configuring the Modem

```
CONFIGURE\ Interfaces
Interface      Port/Device
1 Real-Time    -----
2 Hidden Point -----
3 NMEA Output   -----
4 Remote       Terminal
5 PPS Out      -----
```

CONT EDIT CTRL NUM

From CONFIGURE\ Interfaces highlight the interface (e.g. Prim. Remote) you want to use with a modem and press **EDIT (F3)**.

Press **DEVICE (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.

```
CONFIGURE\ New Port Settings
Name      : Modem-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 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 communication between the sensor and the modem.

```
CONFIGURE\ GSM Options
Type : User
Init : AT+FE0000V1X430=1^M
      AT+CMEE=0^M
      AT&W0^M
Dial : ATD^#^M
Hangup: ATH^M
Escape: ~~~~~+++

CONT DEFLT
```

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 - This is the initialization sequence to initialize the phone.

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
- ^#** Inserts the phone number as defined in Modem Connection
- ~** Inserts a delay of 1/4 second

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 refer to the section GSM on how to use a modem.

RTB Module (CSI)

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

```
CONFIGURE\ Interfaces
Interface      Port/Device
1 Real-Time    -----
2 Hidden Point -----
3 NMEA Output  -----
4 Remote       Terminal
5 PPS Out      -----
CONT EDIT      αNUM
```

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.

```
CONFIGURE\ Real-Time
R-Time Data: Rover▼
Data Format:  RTCM 9.2▼
Port        : 1 *RTB Module (▼)
```

Radio Down : Don't Log Obs▼

```
CONT DEVCERTCM
```

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)**.

```
CONFIGURE\ RTB (CSI)
Frequency : Automatic▼
Bit Rate  : Automatic▼
```

```
CONT
```

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.

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 dBuV/m.

SN Ratio - Signal to noise ratio in dB.

Frequency - The frequency on which the RTB module is currently operating.

Bit Rate - The bit rate on which the TB module is currently operating.

RTS Module (Racal)

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.

Configuration

```
CONFIGURE\ Interfaces
Interface  Port/Device
1 Real-Time  -----
2 Hidden Point  -----
3 NMEA Output  -----
4 Remote      Terminal
5 PPS Out      -----
CONT EDIT NUM
```

From CONFIGURE\ Interfaces highlight Real-Time and press **EDIT (F3)**.

Press **DEVICE (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 DEVC 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)**.

```
STATUS\ Racal
Ref Stn Id   :      777
Channel      :        1
Signal       :      2.0  V
AGC          :        0  dB
Freq. Offset :    0.000 kHz
Bit Error Rate:        1
```

CONT [] [] [] [] [] []

Information about the connected Racal module is displayed.

Ref Stn ID - 3 digit Racal reference station ID.

Channel - Demodulator channel number.

Signal - Strength of signal.

AGC - Automatic Gain Control indicating the voltage being fed to the variable gain amplifier on the demodulator.

Freq. Offset - The difference between 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. The device connected to the sensor is a SAPOS reference decoder box.

Configuration

```
CONFIGURE\ Interfaces
Interface      Port/Device
1 Real-Time    -----
2 Hidden Point -----
3 NMEA Output  -----
4 Remote       Terminal
5 PPS Out      -----
CONT          EDIT          <NUM>
```

From CONFIGURE\ Interfaces highlight Real-Time and press **EDIT (F3)**.

Press **DEVICE (F5)** to access the device list. Select SAPOS and press **CONT (F1)** to confirm.

```
CONFIGURE\ Real-Time
R-Time Data:      Rover▼
Data Format:      RTCM 18,19▼
Port:             1 *SAPOS-Box▼
Ref Sensor:       Unknown▼
Ref Antenna:      Unknown▼
Use Phase:        NO▼
Radio Down:       Don't Log Obs▼
CONT             DEVCERTCM
```

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 a position can be sent to the device which calculates corrections based on a virtual reference station.

In CONFIGURE\ Interfaces highlight the Real-Time and press **CTRL (F5)**.

```
CONFIGURE\ SAPOS-Box
Ref Net      : YES▼
```

```
CONT
```

Change **Ref Net** to Yes if corrections for a virtual reference shall be used.

Press **CONT (F1)** to close the control panel.

Hidden Point

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 Stakeout screen. The following devices are supported:

Leica **Disto** (distance only)

Laser Ace 300

Criterion 400

Criterion Compact

All devices support reflectorless distance measurements using laser technology.

Configuration

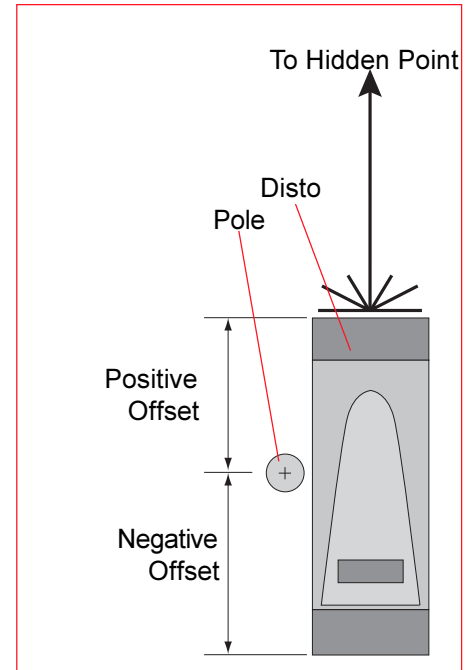
From CONFIGURE\Interfaces highlight Hidden Point and press **EDIT (F3)**.

```
CONFIGURE\ Hidden Point
Use Device : ☒ YES
Port       : 2*Disto
Offset     : 0.000 m
```

```
CONT | EAD | DEVICE
```

Set **Use Device** to YES. If NO is set the Hidden Point measurements need to be entered manually. **(F5)** to access the device list. Select a Hidden Point device from the list and press **CONT (F1)** to confirm.

Enter a distance **Offset** if necessary. A negative offset means the distance measured will be reduced by the offset.



Measuring Offsets when using the Disto

If you are using a device that measures azimuths press **EA0 (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.

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



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

*Ask your local Leica agent for more
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