Getting Started with Real-Time Surveys

Version 2.0
English

Leica

MADE TO MEASURE

System GPS500

**Congratulations on your purchase of a
new Leica System GPS500.**

Contents

Introduction to this book

This book is designed to help the System 500 user to get started quickly with real-time GPS surveying. It is also a general guide to centimetre-accuracy real-time surveying and to sub-meter DGPS surveys.

The book contains several exercises. By carrying out these exercises you will learn the most important aspects of real time with System 500 easily and quickly.

Once you can work confidently with real time, you will find that you will be able to explore the more advanced features of the system by yourself and to study the Technical Reference Manual for full details.

This book is written primarily for centimeter-accuracy RTK with the Leica SR530 receiver. For centimeter accuracies, carrier-phase measurements are used and ambiguities must be resolved.

This book can also be used as a guide to sub-meter work using code-only real-time surveying or DGPS with RTCM code corrections. Positional accuracies as high as 30cm rms are achievable. In order to work with code-only real-time surveying or DGPS with RTCM, certain settings have to be changed at the reference and/or rover. Once the required settings are made, operation is essentially the same as for centimeter-accuracy real time.

- The SR530 can be used for code-only real-time surveying and for DGPS with RTCM.
- The SR520 and SR510 receivers require the DGPS/RTCM option.

The equipment

This book assumes that you have two sets of equipment, one for a real-time reference and one for a real-time rover. Setting up the equipment is easy. If necessary refer to section 2 of the Technical Reference Manual and/or to the Equipment List.

Charge the batteries.

Set up the real-time reference on a tripod as shown in the diagram.

1. GPS antenna
2. Carrier
3. Tribrach
4. GPS receiver
5. Terminal
6. Cable to GPS antenna
7. Tripod
8. Radio antenna
9. Arm for radio antenna
10. Cable to radio antenna
11. Height hook
12. Radio modem in housing
13. PCMCIA flash card
14. Two plug-in batteries
15. Container
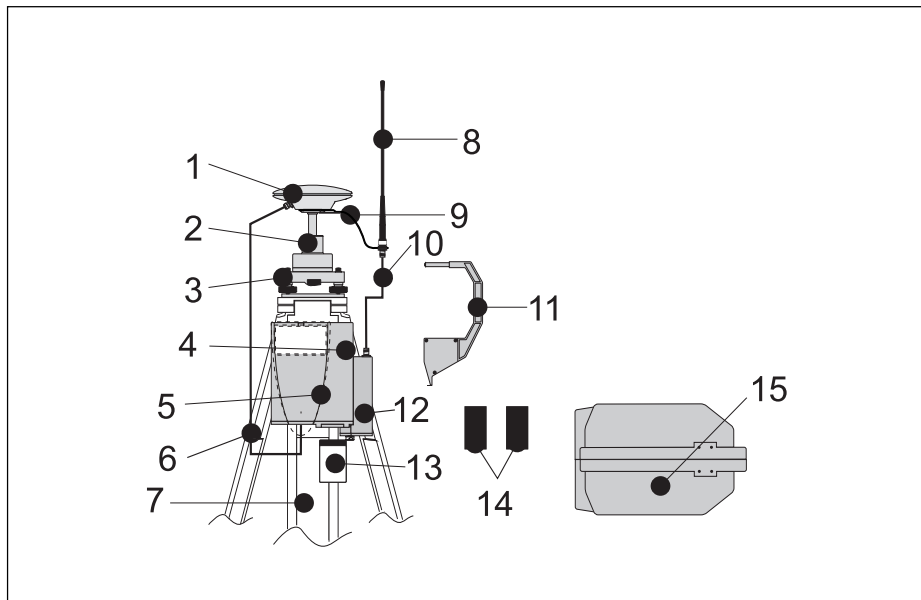
Real-time rover

Set up the real-time rover either using the mini-pack or all-on-the-pole.

Real-time rover with mini-pack

Set up the real-time rover with mini-pack as shown in the diagram.

1. GPS antenna
2. Pole upper part
3. Grip for pole
4. Holder for terminal
5. Pole lower part
6. 1.2m cable to GPS antenna
7. 1.6m extension cable
8. Terminal
9. Plug-in batteries
10. GPS receiver
11. Radio modem in housing
12. PCMCIA flash card
13. Cable receiver to terminal
14. 1.2m cable to radio antenna
15. Radio antenna
16. 3cm arm for radio antenna
17. Telescopic rod
18. Mini-pack
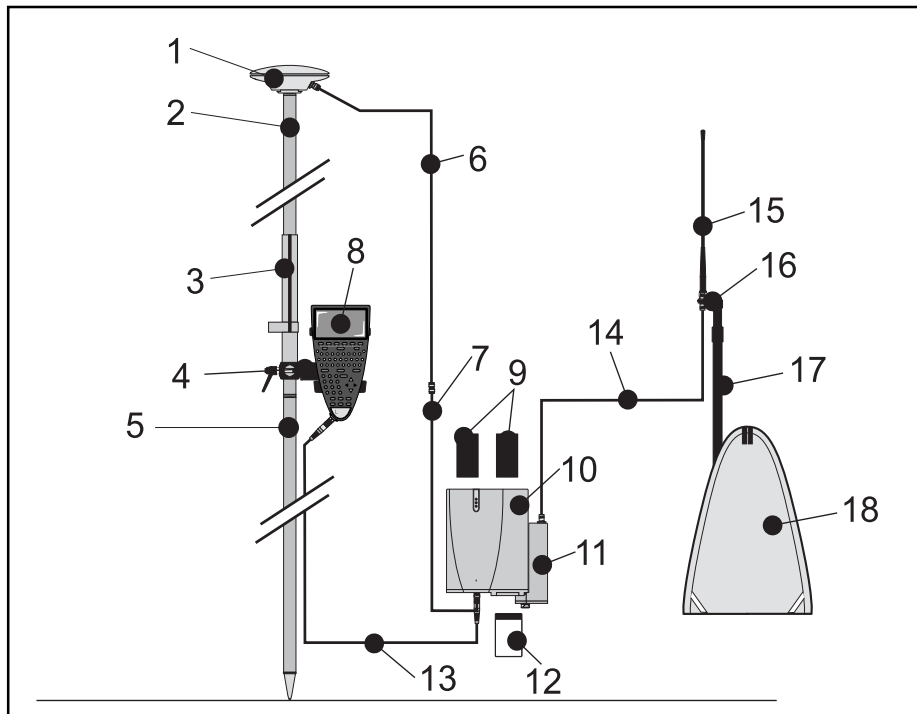
Set up the real-time rover all-on-the-pole as shown in the diagram.

1. GPS antenna
2. Pole upper part
3. Grip for pole
4. Holder for GPS receiver
5. Pole lower part
6. Radio antenna
7. Arm for radio antenna
8. 1.2m cable to radio antenna
9. Plug-in batteries
10. Terminal
11. GPS receiver
12. Radio modem in housing
13. PCMCIA flash card
14. 1.2m cable to GPS antenna
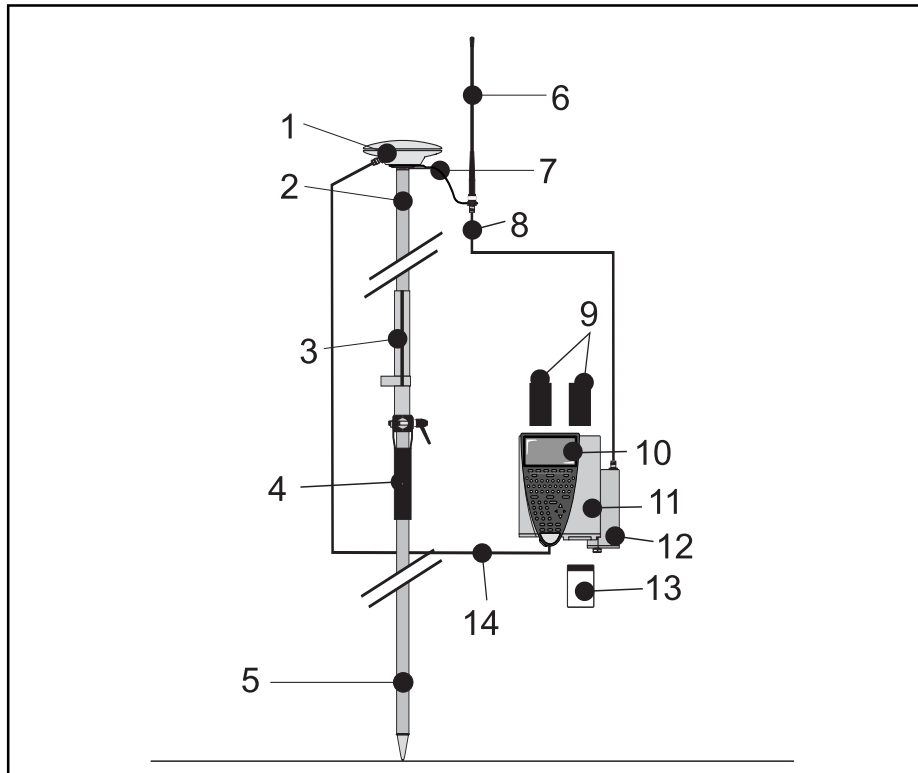
Getting to know the terminal

This section provides a short introduction to the terminal. For full details see section 4 of the Technical Reference Manual.

Keyboard and display

Plug the terminal and two charged batteries into the receiver. Insert a PCMCIA card into the slot in the receiver and close the door. Switch **ON**. The Main Menu appears.

```
⊕ ⏃ ⤢ L1: 8        ▣▯       13:25
      ⏃   L2: 7     ▼
MAIN\
1 Survey
2 Stake-Out
3 Applications...
4 Utilities...
5 Job
6 Configure
7 Transfer...

CONT            HIDE
```

```
⊕ ⏃ ⤢ L1: 8        ▣▯       13:41
      ⏃   L2: 7     ▼
MAIN\
1 Survey
2 Stake-Out
3 Applications...




CONT            SHOW
```

Touch **F4 HIDE/SHOW** to hide and recall main-menu selections 4 to 7.

Note the following:

- **F1 to F6** are softkeys
- **SHIFT + F1** = HELP
- **SHIFT + F6** exits to main menu
- **ESC** steps back one screen
- **CE** clears last character entered
- **ENTER** confirms an entry
- **STATUS** accesses the status menu

Note the following although you will not need them initially:

- **CONFIG** allows you to change configurations
- **F7 to F10** are user definable keys

- Additional softkeys arrow: ↑

Arrow in bottom right-hand corner of display indicates that additional softkey options are available. Touch SHIFT to view additional softkey options. Touch SHIFT again to revert to original softkey options.

- Use up and down arrows to scroll through menus and list boxes to required item.

Status icons
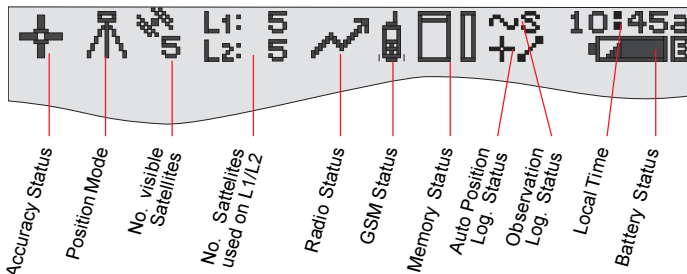
Accuracy Status

⊕ High Precision Navigation (cm level)

⊕ Precision Navigation (0.5 - 5m level)

⊕ Navigation (<100m)

Position Mode

⚹ Static - the GPS Antenna should be held stationary.

⚹ Moving - The GPS Antenna may move.

Radio Status

⤴ Radio Transmitting (blinks)

⤴ Radio Receiving (blinks)

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

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

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

Auto Position Recording Status

+✓ Positions are being recorded according to distance.

+⊙ Positions are being recorded according to time.

Battery Status

▰ Battery Voltage OK

▰ Battery supplying 2/3 peak voltage

▱ Battery supplying 1/3 peak voltage

▱ Battery empty

List boxes

When using the terminal you will find two types of list boxes, full-screen list boxes and drop-down list boxes.

Full-screen list boxes

Use the up and down arrow keys to highlight your selection then press ENTER. A scroll bar at the right of the display indicates that there are more lines (selections) than fit on the screen. Scroll with the up and down arrow keys.

Drop-down list boxes

A small arrow at the right of an input field indicates that there is a drop-down list box. Press ENTER to access the list box. Use the arrow keys to highlight your selection then press ENTER.

Configuration - setting the receiver for the radio modem

Your receiver will have been delivered with a radio modem. Your Leica representative should have defined two CONFIGURATION SETS, one for a real-time reference and one for a real-time rover. Assume that these are called:

- MY-R-REF "My real-time reference"
- MY-R-ROV "My real-time rover"

To see the configuration sets defined in your receiver:
ON > Main Menu
Press the **CONFIG** key
Press **CONF F5**
Panel CONFIG SET lists the configuration sets in receiver
Press **ESC** to return one panel
Press **ESC** to return to Main Menu
Switch **OFF**

```
CONFIG SET\          <        >
 CNF ──── Description ────
 MY-R-REF
 MY-R-ROV
 PP_KIS   Default
 PP_STAT  Default
 RT_REF   Default

CONT │ NEW │EDIT │ DEL │INFO │αNUM
```

Only view the list of configuration sets. Please do not carry out any manipulations on configuration sets at this stage.

MY-R-REF should be a copy of the factory-default configuration RT_REF but modified to make your SR530 operate with your radio modem as a real-time reference in standard mode.

MY-R-ROV should be a copy of the factory-default configuration RT_ROV but modified to make your SR530 operate with your radio modem as a real-time rover in standard mode.

If your representative has not defined the required configuration sets for a real-time reference and real-time rover for your radio modem, ask him to do so.

Otherwise, you will have to define the two configuration sets yourself as explained sections 5.3 and 5.4 of the Technical Reference Manual. The configuration sets should be defined before you use real time and continue further with this book.

Prepare an exercise field

Select a small, open area such as a parking lot, sports field, park or flat roof. Mark ten points. Call them REF and 1, 2, 3 … to 9. The points need not be more than about 10m apart.

Preparing the equipment

Formatting PCMCIA cards

Plug two fully-charged batteries into each receiver. Insert a PCMCIA card into the PCMCIA slot of each receiver and close the door. When starting with the equipment it is easiest if there is no data on the cards.

Format the cards as follows:

ON > Main Menu
4 Utilities
CONT F1
Panel UTILITIES\ Menu
2 Format Memory Module
CONT F1
Panel UTILITIES\ Format Memory Module
Device: PC-Card   Quick format: YES
CONT F1 > Main Menu
Card is formatted. Switch **OFF**.

Setting time zone and initial position

When you receive the receiver it should have the correct GPS date and time. You have to input the time zone so that it displays local date and time.

Setting the time zone

ON > Main Menu
Press the **CONFIG** key
3 General
CONT F1
4 Time and Initial Position
CONT F1
Panel CONFIGURE\ Time & Initial Pos
Scroll to Time Zone. Press ENTER to open box. Scroll to select time zone, e.g -3. Press ENTER.
CONT F1 > Main Menu
Time zone is set. Switch **OFF**.

```
CONFIGURE\ Time & Initial Pos
Local Time :          18:59:58
Time Zone  :                 0
Local Date :          05.12.99

Local E    :          1857.459 m
Local N    :          1336.769 m
Ortho Hgt  :            32.742 m

CONT  COORD
```

Initial position: using the receiver for the first time

The receiver always stores its last position as an initial position. The initial position helps the receiver to acquire satellites very quickly.

If you move a very long distance (1000km or more) to another location, the initial position will be wrong and the receiver may take longer to acquire satellites and calculate a new position. If the initial position is totally wrong (other side of world) it may need up to about 5 minutes.

When you use the receiver for the very first time, remember that it may have a wrong initial position (possibly Switzerland) and that you may have to wait for a few minutes for it to acquire satellites.

Setting the units for the display

You can determine in which units information is displayed.
To set the units

ON > Main Menu
Press the **CONFI**G key.
3 General
CONT F1
1 Units
CONT F1
Panel CONFIGURE \ Units
Toggle with up and down arrows
Set required units. Example:
   Angle: Press ENTER to open box.
   Select ”360° ’ ” ”. Press ENTER.
   Press *ANGLE F6*
   Panel CONFIGURE \ Angle Formats
   Direction Ref: Press ENTER to open box.
   Select ”North Azimuth”. Press ENTER.
   Direction Base: Press ENTER to open box.
   Select ”True”. Press ENTER.
   CONT F1
Panel CONFIGURE \ Units
CONT F1 > Main Menu

CONFIGURE\ Units	
Distance:	Metres▼
Angle :	360° ’ ”▼
Velocity:	km/h▼
Date :	dd.mm.yy▼
Time :	24 hours▼
Temp :	Celsius °C▼
Pressure:	millibar (mbar)▼

CONT					ANGLE

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

CONT					

Starting the real-time reference

Set up the real-time reference at point REF as shown in section "Real-time reference".
Centre and level up.

Switch **ON > Main Menu**
Select **1 Survey**
Press **CONT F1**

```
SURVEY\ Begin
Config Set:            MY-R-REF▼

Job       :           Default▼
Coord Sys :      WGS84 Geodetic

Antenna   :       AT502 Tripod▼

CONT                      CSYS
```

Panel SURVEY\Begin
Config set: Press ENTER to open list box.
Select config set "MY-R-REF". Press ENTER.
Job: Press ENTER to open list box.
Select job "Default". Press ENTER.
Coord sys: "WGS84 Geodetic", cannot change.
Antenna: "AT502 Tripod". Correct, do not change.
Press **CONT F1.**

```
⊕ ⱽₐ L1: 8 ⌁     □□         18:47
    8 L2: 7
SURVEY\ Default
Point Id    :         REF

Ant Height :       1.335 m

Static Obs :            1
GDOP       :          8.5
                        ⇧
STOP
```

Panel SURVEY\Default (default is job)
You now have to input point id, antenna height and coordinates. Do this in the following order:
Ant. Height: Input height hook reading, e.g. 1.335. ENTER.
Lat, Lon, EHgt: Press **HERE F4**. Last navigation position coordinates are accepted.
Point Id: Type in REF. Press ENTER.
Press **STORE F1**.
Press **CONT F1**.

You have now started the real-time reference. The panel shows:

```
SURVEY\ Default
Point Id    :              REF▼

Ant Height :          1.335  m

WGS84 Lat  :    47°24'32.0411"  N
WGS84 Lon  :     9°37'01.8650"  E
WGS84 EHgt :          459.601  m

CONT COORD      HERE        SPP
```

Navigation position icon	⊕
Static mode icon	𓊍
Number of satellites tracked	ⱽₐ L1: 8 / L2: 7
Radio-transmitting arrow, blinking	⌁

Point Id: REF
Ant Height: 1.335m
Static Obs: 0 (not recording)
GDOP: Will usually be <5

The real-time reference will continue transmitting until you press STOP. However, as you want to work with the real-time reference, please do NOT press STOP now!

Note on antenna height

In panel SURVEY\Begin the antenna is defined as AT502 on Tripod. You have only to input the height hook reading, e.g. 1.335m. The vertical offset 0.360m from the white line of the height hook to the mechanical reference plane (bottom of antenna mount) will be added automatically. Thus the total height of the antenna above the ground will be 1.335 + 0.360 = 1.695m. For more details see section 2.11 of the Technical Reference Manual.

The STATUS key

Press the STATUS key to explore the status panels while the reference is transmitting. The status panels provide information only. You can look through them without affecting the real-time reference.

Press the STATUS key.
Toggle with the up and down arrows.
Use CONT F1 to continue.
Use ESC to step back one panel.
Use SHIFT + F6 to return to the SURVEY\Default panel.

STATUS panels

1 **Survey**
   1 **Real Time**: information on real-time output.
   2 **Stop & Go Indicator**: not required for real-time reference. For rover and rapid static.
   3 **Position**: navigation position.
   4 **Logging**: you are not logging data.
   5 **Satellite**: satellite status, note SKY plot.

2 **Logs**
   1 **Point Log**: Information on points.
   2 **Code Log**: you are not using codes.
   3 **Message Log**: list of messages.

3 **General**
   1 **Memory/Battery**: memory and battery status.
   2 **Sensor**: information on receiver.
   3 **Software Version**: information on firmware.

4 **Interfaces**
   Lists all interfaces and devices.

The CONFIG key

Do not use at this stage!

Configuration sets can be changed via the CONFIG key. Configuration set MY-R-REF is set to make your SR530 operate with your radio modem as a real-time reference. Do not change it.

Removing the terminal

You can remove the terminal and attach it again while the receiver is operating. You do not need to switch off and on.

The real-time reference is transmitting. If you have only one terminal, remove it from the reference for use with the rover. The SR530 will continue to operate and transmit as a real-time reference.

Set up the real-time rover as shown in section "Real-time rover". Hold the pole in your hand.

Switch **ON** > Main Menu
Select **5 Job**
CONT F1
Panel JOB \ PC-Card lists jobs
Press **NEW F2** for new job
Panel JOB \ New Job
Name: input name "JOB 1". Press ENTER
(Ignore Description and Creator)
CONT F1 (JOB 1 now in list)
CONT F1 > Main Menu

You have created a new job.

Main Menu
Select **1 Survey**
CONT F1

```
SURVEY\ Begin
Config Set:             RT_ROV▼
Job      :              JOB 1▼
Coord Sys :     WGS84 Geodetic
Antenna  :        AT502 Pole▼
CONT                         CSYS
```

Panel SURVEY\Begin
Config set: Press ENTER to open list box.
Select config set "MY-R-ROV". Press ENTER.
Job: Press ENTER to open list box.
Select job "JOB 1". Press ENTER.
Coord sys: "WGS84 Geodetic", cannot change.
Antenna: "AT502 Pole". Correct, do not change.
CONT F1

You are now in panel **SURVEY \ JOB 1**. You have started the real-time rover. The antenna height is set automatically to 2.000m.

```
  ✛  ⚐ ☊  L1: 8  ⟋            18:51
      8 L2: 7
SURVEY\ Default
Point Id   :
Ant Height :              2.000 m
Positions  :                   1
Quality    :               0.04 m
STOP
```

The panel shows:

Number of satellites   Radio receiving arrow, blinks   Moving mode icon

Wait for a minute or so. The position mode icon will change from:

Navigation   to   Precise Navigation   to   High Precision

When the high precision icon appears, the coordinate **Quality** should be between 0.01 and 0.05m. You can now start centimeter-accuracy real-time surveying. Proceed as follows:

Hold pole steady on point 1:
Panel **SURVEY \ JOB 1**
Point Id: Input   **1**. ENTER
Press **OCUPY F1**
Wait for about 5 seconds
STOP F1
STORE F1
You have recorded real-time WGS coordinates of point 1.

Hold pole steady on point 2:
Point Id: Input   **2.** ENTER
OCUPY F1
Wait for about 5 seconds
STOP F1
STORE F1

Measure the other points 3, 4, … to 9 in the same way.

Note the sequence at each point:
- Input Point Identifier
- OCUPY > STOP > STORE
Number of positions between OCUPY and STOP is shown .

When you press OCUPY the icon changes to "static".
You should hold the pole steady on the point.

When you press STOP the icon changes to "moving".
You can move.

As the position update rate is set to 1 second in configuration set MY-R-ROV, you must stay on a point for at least 1 second between OCUPY and STOP. If you stay longer on a point, the result (recorded coordinates) will be the mean of all real-time positions between OCUPY and STOP.

Now measure points 1, 2, 3, 4 again

Use exactly the same point identifiers: 1, 2, 3, 4.
After measuring a point twice, the message **"2 measurements on point"** appears.This shows that the two results agree to within set threshold values (0.05m in position and 0.07m in height in configuration set MY-R-ROV).

Take a third measurement to point 4 but place the pole about 20cm from the point. A box **"MANAGE \ Average"** appears showing the three results, e.g.

Time	Date	DPos	Dheight	Use
14:26	03.01	0.203	-0.008	N *
14:20	03.01	0.008	-0.007	Y
14:10	03.01	0.008	+0.007	Y

Two measurements are flagged Y = use. One measurement is flagged N = do not use. (You can override with USE F5). Press CONT F1 to accept the two Y measurements. The N measurement is not accepted.

Summary: if you measure a point two or more times the system will check that the results agree. Average coordinates are calculated.

Note on Quality

The CQ Coordinate Quality of the position is displayed, e.g. 0.02m. On pressing STORE, the coordinates are recorded provided that the Quality value does not exceed a set threshold (0.05m in configuration set MY-R-ROV).

If the Quality exceeds the threshold value a warning message is displayed. You are given the option to store or not to store.

To change the threshold values

Press key CONFIG.
1 Survey
CONT F1
6 Point…
CONT F1
Panel CONFIGURE \ Point
1 Threshold Settings
CONT F1
Panel CONFIGURE \ Threshold Settings
   You could now change the threshold settings.
   But do **NOT** do so at this stage.
   The values set are suitable for learning the system.
CONT F1

```
⊕⋏ ⟋⟍ L1: 8  ⌁ ▢▢      18:53
      8 L2: 7
CONFIGURE\ Threshold Settings

Avg. Limits Pos:      0.050 m
Avg. Limits Hgt:      0.070 m

Monitor CQ      :          YES▾
Quality         :      0.050 m


CONT
```

Note on the CONFIG key

Configuration sets can be changed via the CONFIG key. Configuration set MY-R-ROV is set to make your SR530 operate with your radio modem as a real-time rover. Do not change change settings via the CONFIG key at this stage.

Note on antenna height

In panel SURVEY\Begin the antenna is defined as AT502 on Pole. The antenna height is set automatically to the correct height of 2.000m. For details see section 2.11, Technical Reference Manual.

Hidden features

Press the SHIFT key.
Press GRAPH F3.
Plot of measured points recorded in JOB 1.
Try the other keys.
Press ESC to return to panel SURVEY \ JOB 1.

Look at the STATUS panels

1 Survey

1 Real Time: real-time input and rover status.
2 Stop & Go Indicator: not used.
3 Position: real-time position.
4 Logging: number of points occupied (positions recorded)
5 Satellite: satellite status

2 Logs – look at the point log

1 Point Log
CONT F1
Panel STATUS \ Point Log
List of measured points, scroll through.
Press **INFO F5**

Shows time, coordinate source, CQ quality, class.
MEAS = 1 measurement. AVRG = averaged.

CONT F1 > return to SURVEY panel

Return to Main Menu

SHIFT + F6 to return to Main Menu
Switch **OFF**

The real-time reference should continue to operate. In section "Introduction to surveying with the real-time rover" you surveyed with the real-time rover. Now try to stake out.

ON > Main Menu
Select **5 Job**
CONT F1
NEW F2 for new job
Create new job ”JOB 2”. ENTER
CONT F1
CONT F1 > Main Menu

Main Menu
Select **2 Stake-Out**
CONT F1

```
STAKE-OUT\ Begin
Config Set:              MY-R-ROV▼
Stake Pts :                  Job1▼
Store Pts :                  Job2▼
Stake Type:                 Point▼

Antenna   :            AT502 Pole▼
Ant Height:               2.000 m

CONT |       | LOG|ASCII|   |CSYS
```

Panel STAKE-OUT \ Begin
Config Set: Press ENTER to open box.
Select ”MY-R-ROV”. Press ENTER.
Stake Pts: Press ENTER to open box.
Select job ”JOB 1”. Press ENTER.
Store Pts: Press ENTER to open box.
Select job ”JOB 2”. Press ENTER.
Stake Type: Press ENTER to open box.
Select ”Point”. Press ENTER.
Antenna: AT502 Pole
Ant Height: 2.000m
CONT F1

Stake Pts: JOB 1 >The points that you want to navigate to for stake out are in JOB 1.
Store Pts: JOB 2 > If you record during stake out, the coordinates will be recorded in JOB 2.
Stake Type: Point > Stake out individual points (not on a defined slope or grid)

Panel STAKE-OUT \ JOB 1
Orient: Press ENTER to open box.
Select "Known Pt". Press ENTER.
Down 1 line. ENTER to open box.
Select "REF" . Press ENTER.
Down 1 line. ENTER to open box.
Select "1" . Press ENTER.

You have selected:
Point REF as the orientation for stake out.
Point 1 as the target (point to be staked out).

In the graphical display:

⌃ Is the orientation mark

◯ Is the target (where you want to go)

✛ Is your current position

Use ORTHO/POLAR F2 to toggle between:

Polar (direction and distance)	Orthogonal (distance and offset)
Dist: Distance to target	In: Distance towards orientation point Out: Distance away from orientation point
Direct: Direction to target	Left/Right: Distance left or right
Cut/Fill: Cut (down) and fill (up)	Cut/Fill: Cut (down) and fill (up)
Quality: Position quality	Quality: Position quality

Stake out (navigate to) point 1

Orient terminal towards REF.
Toggle with F2 to POLAR.
Note distance and direction.
Move towards target.
Scale of graphics changes with distance to target.
Toggle to ORTHO when close to target.
Move carefully until exactly on target
(In/Out and Left/Right within about 0.02m)

To record staked-out position of point 1

Assume that you would now mark the point (place a marker)
Set up on mark
Press OCUPY > STOP > STORE
Coordinates are recorded in JOB2

Stake out point 2

Target has changed automatically to 2.
Stake out point 2
OCUPY > STOP > STORE

Stake out other points

Open target box to select points.
Try different orientations: North, Sun, Last Point.

Hidden features

Press the SHIFT key.
Press GRAPH F3.
Plot of staked-out points recorded in JOB 2.
Try other keys.
Press ESC to return to panel STAKE-OUT \ JOB 1.

Look at the point log

Main Menu
5 Job
CONT F1
Select JOB 1
CONT F1
Main Menu

Press STATUS key
2 Logs
CONT F1
1 Point Log
CONT F1
List of points in JOB 1
CONT F1
Main Menu

Similarly, look at point log for JOB 2.

Switch OFF.

Exit stake out

SHIFT + F6 to exit to Main Menu

Stop the real-time reference

You can now STOP and switch OFF the real-time reference.

Summary of exercise 1

In exercise 1 you did the following:

- Worked in WGS84.
- Started a real-time reference with HERE (single navigation position).
- Created jobs.
- Surveyed with a real-time rover.
- Saw how threshold values work for two or more measurements to a point.
- Saw how the threshold value works for coordinate quality.
- Staked out points with a real-time rover.
- Noted the various icons.
- Noted how the antenna height is set.
- Used the STATUS key to look at various status displays.
- Looked at some hidden features

You can now operate the real-time system at a basic level.

Real-time surveying in local coordinates

Imagine that you have to do a job on a construction site. You are given a list of control points and points to be set out in local coordinates. You have to survey detail and topographic features and stake out points. Results have to be in local coordinates. Exercise 2 illustrates how to do this.

Local coordinates of exercise field

For exercise 2, you need the coordinates of points 1 to 9 on a local grid. For convenience and clarity, choose the origin such that the East coordinates are positive with values of about 2000m and the North coordinates are positive with values of about 1000m. Take the approximate height above sea level as the height datum.

Measure points 1 to 9 with a total station. Obtain the coordinates and heights to an accuracy of about 0.02m.

e.g.	PT	E	N	Ht
	1	2060.252m	1055.324m	430.242m

Fast access in menus and list boxes

In exercise 1 section 6, all operations were given as:
- Scroll with arrow keys to item
- Then press CONT or ENTER

In Menus, instead of scrolling and pressing CONT, simply press the appropriate number key for fast access to the menu item. Example:

ScrollingON > Main Menu	**Fast access**
Toggle down	ON > Main Menu
Select 5 Job	5 Job
CONT F1	Panel JOB list
Panel JOB list	

In list boxes there is a search field with a blinking cursor at the top right of the list box. Type in the first letter(s) of the item you need. The highlight will spring to the item. (Case sensitive!).

In the remainder of this book, examples will be based on fast access.

Starting the real-time reference

Set up the real-time reference again at point REF. Use the same receiver and PCMCIA card. Do NOT format the card. This time you will use the SPP (Single Point Position) key instead of the HERE key to obtain coordinates for the reference. Enter the point id. as REF SP.

ON > Main Menu
1 Survey
Panel SURVEY\ Begin
Config Set: MY-R-REF
Job: Default
Coord Sys.: WGS84 Geodetic
Antenna: AT502 Tipod
CONT

Panel SURVEY\ Default
Input information as follows:
Ant Height: Height hook reading. ENTER.
Press **SPP F6**
Panel SURVEY\ Single Pt Position
Point Id: (Random number shown)
Type in REF SP. ENTER.
(Note: will not accept REF)
Time: Input 10. ENTER.

```
SURVEY\ Single Pt Position

Point Id :          REF SP
Time     :          10min




OCUPY
```

OCUPY F1
Panel SURVEY\ Single Pt Position
Point Id: REF SP
Time at Pt: Still to go out of 10mins.

After 10 minutes **Panel SURVEY\ Default** appears. You have started the real-time reference. The radio transmitting arrow blinks.

Note: The receiver would not accept REF as the point id. because a point REF with coordinates already exists in the data base. Thus you had to input REF SP.

Note: A single-point position SSP is calculated over a period of time (10 mins). This is more accurate than a navigation position obtained with HERE.

Format the card

As this is a learning exercise, first format the card as explained in section "Formatting PCMCIA cards". This will prevent any confusion with old jobs and data.

Create a job

Create a new job " **JOB A LOCCDS**" for the local coordinates.

ON >. Main Menu
5 Job
NEW F2
Name: Input "JOB A LOCCDS". ENTER.
CONT > List of jobs
CONT > Main Menu

Input the local coordinates

Input the local coordinates with point identifiers PT01, PT02, ….to PTO9.

Main Menu
3 Applications
02 Point Management

Panel: **MANAGE\ JOB A LOCCDS**
NEW F2
Panel: MANAGE \ New Point
Point Id.: Input "PT01".ENTER
Toggle with **COORD F2** to *E, N, Hgt*
Input E coordinate. ENTER.
N coord. ENTER. Hgt ENTER.
STORE F1 > PT01 in list

```
⊕ ℍ ⅋ ℓ  L¹:   8          22:10
         8  L²:  7
MANAGE\ New Point
Point Id    :              PT01


Local E     :         2060.252  m
Local N     :         1055.324  m
Local OHgt  :          430.242  m

STORE COORD
```

NEW
Point Id.: Input "PT02".ENTER
Input E, N, Hgt. ENTER.
STORE > PT02 in list

Input coordinates for PT03 to PT09
After all points are entered
CONT F1 > Main Menu

Measuring control points with the real-time rover and computing transformation parameters

Measuring the control points

Create a job

Create a new job "**JOB B MEASD**" for the measured points.

Measure four control points

Measure 4 of the points on the outside of the area, e.g. 1, 3, 7 and 9.

REF   ①   2   ③

       4   5   6

        ⑦   8   ⑨
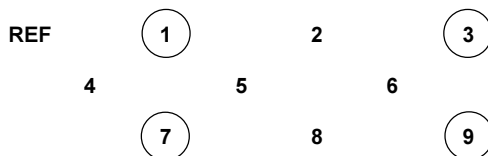
Use the same point ids.

Use exactly the same point ids - PT01, PT03, PT07, PT09 - as you used when entering local coordinates (section "Entering the local coordinates into the real-time rover"). Point ids. are case sensitive. Thus if you used capital letters (or lower case) for point ids. when entering local coordinates, please make sure that you also use capital letters (or lower case) when measuring.

Measuring the four control points:

Main Menu
1 Survey
Panel: SURVEY\ Begin
Config Set: "MY-R-ROV". ENTER.
Job: "JOB B MEASD". ENTER.
Coord Sys : "WGS 84 Geodetic"
Antenna: "AT502 Pole"
CONT

Panel: SURVEY\ JOB B MEASD
At each point
Input *Point Id*.(PT01, PT03, PT07, PT09)
OCUPY > STOP > STORE

The WGS84 coordinates of the 4 points are recorded in "JOB B MEASD".

Computing transformation parameters between WGS84 and local coordinates

"JOB A LOCCDS" contains the local coordinates of PT01 to PT09. "JOB B MEASD" contains the WGS84 coordinates of four of these points, e.g. PT01, PT03, PT07 and PT09. Transformation parameters between the WGS84 and local coordinates can now be calculated.

You have to enter two names, one for the Coordinate System and one for the Transformation. Always use meaningful names that you will understand later. For this exercise use the following names:
- "CS1 ONE STEP" for the Coordinate System.
- "TS1 ONE STEP" for the Transformation

Main Menu
3 Applications
01 Determine Coord System

```
COORDSYS\ Determination Begin

Coord Sys :      CS1 ONE STEP

WGS84 Pts :       JOB B MEASD▼
Local Pts :       JOB A LOCCDS▼


CONT  |      |   LOCAL|   CSYS
```

Panel: COORDSYS\ Determination Begin
Coord Sys: Input "CS1 ONE STEP". ENTER.
WGS84 Pts: Press ENTER to open box.
Select "JOB B MEASD".ENTER.
Local Pts: Press **LOCAL F4.**

```
COORDSYS\ Local Point Format

Local Pts :            Job
                 ASCII File
```

Panel: COORDSYS\ Local Point Format
Local Pts: Press ENTER to open box
Choice of Job or ASCII. Select "Job". ENTER.
CONT

Panel: COORDSYS\ Determination Begin
Local Pts: : Press ENTER to open box.
Select "JOB A LOCCDS".ENTER.
Panel now shows
   Coord Sys: "CS1 ONE STEP"
   WGS84 PTS: "JOB B MEASD"
   Local Pts: "JOB A LOCCDS"
CONT

```
COORDSYS\ Type Selection
Coord Sys  :       CS1 ONE STEP

Transform  :       TS1 ONE STEP▼
Trans Type :           1-Step▼

Geoid Model:             ------▼

CONT  |      |      |      |
```

```
COORDSYS\ Type Selection
Coord Sys  :
                   Classical
Transform  :         1-Step
Trans Type :

Projection :
Geoid Model:
```

Panel COORDSYS\ Type Selection
Coord Sys: "CS1 ONE STEP"
Transform: Input "TS1 ONE STEP". ENTER.
Trans Type: Press ENTER to open box.
Select "1-Step". ENTER.
Geoid Model: Ignore, leave blank.
CONT

```
COORDSYS\ Determine 1-Step
  WGS84 ----- Local ----- Match
 PT09         PT09         P+H
 PT07         PT07         P+H
 PT03         PT03         P+H
 PT01         PT01         P+H
                                ⇧

CONT | NEW |EDIT | DEL |MATCH|
```

Panel COORDSYS\ Determine 1-Step
The points will be matched automatically for Position and Height if you numbered them correctly. (If not use EDIT F3 to match points).
CONT

Panel COORDSYS\ Residuals
Use **INFO F5** for N, E, Hgt residuals
Use **RESLT F3** and **RMS F5** for results
Panel COORD SYS\ Parameters
CONT
CONT
Panel COORDSYS\ Residuals
CONT

Panel COORDSYS\ Save Coord System
Coord Sys: "CS1 ONE STEP"
Information on coordinate system shown
CONT to save (store) coordinate system

Main Menu

You have computed a one-step transformation and stored a coordinate system.

To see the active coordinate system
In section "Computing transformation parameters between WGS84 and local coordinates" you determined a coordinate system "CS1 ONE STEP" for local coordinates. As "CS1 ONE STEP" is the last determined coordinate system, it automatically becomes the active coordinate system and will be used by the configuration set MY-R-ROV that you use for surveying and setting out. You can now work in local coordinates and the terminal can display in local coordinates.

The active coordinate system is used by the active configuration set and is attached to the active job. To look at the various coordinate systems and to see which one is active do the following:

Press the **CONFIG** key
1 Survey
1 Position

Panel: CONFIGURE\ Position
Update rate: 1.0s. Do not change.
Coord Sys: "CS1 ONE STEP" shown.
This is the active coord. system.
Press ENTER for list of systems.
Select CS1 ONE STEP.
(Do not select another system)
ENTER
CONT > Main Menu

Surveying new points

Measure about 10 new points as if you would be doing a detail or topo survey. Any random points will do.

ON > Main Menu

Main Menu
1 Survey

Panel SURVEY\Begin
Config set: "MY-R-ROV"
Job: ENTER to open box.
Select "JOB B MEASD". ENTER.
Coord sys: "CS1 ONE STEP".
(The active coordinate system)
Antenna: "AT502 Pole
CONT

You are now in panel **SURVEY \ JOB B MEASD**.
Point ID: Input "PT51". ENTER.

The antenna height is set to 2.000m. When the high precision icon appears and the quality shows between 0.01 and 0.05, you can start centimeter-accuracy surveying.

Hold pole on first point.

```
✛ ⺆⺄ ⣿ L1: 8  ∿  ▯▯        14:27
       8 L2: 7
SURVEY\ JOB B MEASD
Point Id   :              PT51

Ant Height :          2.000  m

Quality    :          0.03  m
                               ⇧
OCUPY
```

Point Id: Input "PT51". ENTER.
OCUPY > STOP > STORE

Note how the point id. increments automatically. Second point PT 52
OCUPY > STOP > STORE

Third point PT 53
OCUPY > STOP > STORE

Measure about 10 new points as if you would be doing a detail or topo survey. Any random points will do.

Look at the displayed position

Press the **STATUS** key
1 Survey
3 Position

Panel STATUS \ Position
Press **COORD F2** to see:

E N Hgt / Lat Lon Hgt / X Y Z

```
 ✛ 🛰 ⚡     L1: 8  ⌇⌇        11:44
   🛰     8 L2: 7 ⌇⌇
STATUS\ Position
Local Time :11:44:50.1 (0.00)
Local E    :          998.949 m
Local N    :         1007.552 m
Local OHgt :          472.728 m
Pos Qlty   :            0.02  m
Hgt Qlty   :            0.02  m
CONT  COORD BLINE VELCY      TARGT
```

SHIFT + F6 to quit
Main Menu

Look at the recorded points

Main Menu
3 Applications
02 Point Management
Panel\ JOB B MEASD

```
MANAGE\ JOB B MEASD<           >
Point Id ——————CQ ——Class——
PT51                   0.03 MEAS
PT52                   0.03 MEAS
PT53                   0.03 MEAS

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

List of points in JOB B MEASD
EDIT F3 to view coordinates

COORD F2 to see
E N Hgt / Lat Lon Hgt / X Y Z

SHIFT + F6 to quit
Main Menu

Staking out from local coordinates

When working through section "Entering the local coordinates into the real-time rover", you input the local coordinates of PT01, PT02 … to PT09 into "JOB A LOCCDS". You should now navigate to and stake out these points.

Main Menu
2 Stake-Out

```
STAKE-OUT\ Begin
Config Set:          MY-R-ROV▼
Stake Pts :    JOB A LOCCDS▼
Store Pts :    JOB C STORE SO▼
Stake Type:         Point▼

Antenna   :       AT502 Pole▼
Ant Height:           2.008 m

CONT
```

Panel STAKE-OUT \ Begin
Config Set "MY-R-ROV"
Stake Pts: ENTER to open box.
Select job "JOB A LOCCDS". ENTER.
Store Pts: ENTER to open box.
Press **NEW F2**

Panel JOB \ New JOB
Name: Input "JOB C STORE SO". ENTER.
CONT

```
STAKE-OUT\ Begin
JOB: PC-Card        <         >
JOB A LOCCDS        17.01.99
JOB B MEASD         18.01.99
JOB C STORE SO      22.01.99
```

Panel STAKE-OUT \ Begin
List of jobs shown
Select "JOB C STORE SO". ENTER.

Panel STAKE-OUT \ Begin
Stake Type: "Point".
Antenna: "AT502 Pole"
Ant Height: 2.000m
CONT

```
STAKE-OUT\ Begin
JOB: PC-Card        <         >
JOB A LOCCDS        17.01.99
JOB B MEASD         18.01.99
JOB C STORE SO      22.01.99
```

Panel STAKE-OUT \ JOB A LOCCDS
You are now in the stake out panel.
You can navigate to and stake out points.

Note:
Stake Pts: The points that you want to navigate to for stake out are in "JOB A LOCCDS".
Store Pts: If you record during stake out, the coordinates will be recorded in "JOB C STORE SO".

```
+  ░░ ⚡ L1:  8  ⌐         14:22
     ░  L2:  7⌐
STAKE-OUT\JOB 1
Orient :Known Pt▼
              REF▼
                1▼
Dist  :      6.839 m        ○
Direct:     59°58'       +
Cut   :      0.464 m
Quality:     0.03 m

OCUPY ORTHO    REDRW
```

Panel STAKE-OUT \ JOB A LOCCDS
Orient: ENTER to open box.
Select "North". ENTER.
Down 2 lines. ENTER to open box.
Select PT01 as target. ENTER.
Stake out point PT01

Navigate to target.
When exactly on point.
OCUPY > **STOP** > **STORE**
Coordinates are recorded in "JOB C STORE SO".

Stake out point PT02
Target changes to next point PT02
OCUPY > **STOP**
Press **DIFF F2** to see differences between position and required coordinates.
STORE

Stake out the other points PT03 to PT09

Note that:

* You can change the orientation
* Target changes automatically to next point
* Press DIFF to see differences between position and required coordinates.
* Press SHIFT then GRAPH to see plot of staked-out points recorded in "JOB C STORE SO".

SHIFT + F6 to quit
Main Menu

To look at recorded points

3 Applications
02 Point Management
List of points recorded in "JOB C STORE SO".

In exercise 2 you did the following:
* Started the real-time reference with SSP Single Point Position.
* Entered local coordinates manually.
* Created a coordinate system containing a one-step transformation between WGS84 and local grid.
* Viewed the list of coordinate systems and noted which coordinate system is active.
* Set the point id. template.
* Surveyed new points in local coordinates.
* Looked at the position display.
* Used Point Management to view the recorded points.
* Staked out points from local coordinates.
* Saw the difference between "required" and "staked-out" coordinates.

In exercise 2 you entered coordinates manually. For production work, you will usually transfer coordinates and other data digitally as follows:
* On an ASCII file from the PC to the card.
* In a job from SKI-Pro software to the card.

In exercise 2 you created a coordinate system with a one-step transformation.
* You can also create coordinate systems with ellipsoids, projections, 7-parameter Helmert transformations, and geoidal models.

You now know the system in more detail and can carry out a survey or stake-out job in local coordinates.

System 500 operating system

Introduction

System 500 is very easy to use for surveying and stake-out work yet it is also extremely powerful with a huge range of features and functions. These special features, functions and operations are necessary to meet the individual requirements of users carrying out all types of applications all over the world.

Most users will use System 500 real time for surveying and stake out. Although a user may need some of the special features, it is very unlikely that any user will need them all.

The receiver can be configured (set) to operate in any way. Settings and outputs can be selected and functions activated or deactivated as required. Once configured (set), the receiver is very easy to use.

This book has been written to help the user to get started as quickly as possible with real time. It covers only those features and operations that most users are likely to need. After working through the exercises in this book, you will find that you can explore the system further by yourself and study the Technical Reference Manual.

Sections "Introduction" to "Summary of System 500 operating system" provide an introduction to the operating system.

Main Menu

You have already used many of the main functions and operations. At this stage you only need to understand the general concept of the operating system and the structure of the main menu and sub-menus. Browse through the menus but do not attempt to look at every function and operation in detail.

The following short forms indicate the essential functions and operations that all users will need, and the functions and operations that a user may or may not need.

ESNL   **Essential** functions and operations. Needed by all users.
SF   Standard functions and operations.
        May or may not be needed.
OP   Optional application programs.
        Only active if purchased. Not needed by all users.
Info   Information only. No functions or operations.

Main Menu		
1 Survey	ESNL	Main operating mode.
2 Stake-Out	ESNL	Main operating mode.
3 Applications …		Contains sub-menu. See below.
4 Utilities …		Contains sub-menu. See below.
5 Job	ESNL	Job management.
6 Configure		Configure receiver. See section 8.3.
7 Transfer …		Contains sub-menu. See below.

3 Applications …		
01 Determine Coord System	**ESNL**	Ellipsoids, projections, geoidal models, transformations.
02 Point Management	**ESNL**	View and edit recorded points. Create new points.
03 Calculator	SF	Calculator similar to HP. Reversed Polish Notation.
04 Wake-up Sessions	SF	Start and stop receiver automatically at pre-set times.
05 COGO	SF	Various coordinate geometry calculations.
06 Area	SF	Area calculation. Uses points in data base.
07 DTM Stakeout	OP	Stake out digital terrain model. Must be purchased.
08 QuickSlope	OP	Stake out slopes. Must be purchased.
09 RoadPlus	OP	Stake out road alignments. (USA). Must be purchased.
10 RoadX	OP	Stake out road alignments. (Scandinavia). Must be purchased.
11 Multipiste	OP	Stake out road alignments. (France). Must be purchased.
12 GIS Data Collection	OP	GS50 GIS data collection. Must be purchased.
13 GIS Navigation/Update	OP	GS50 GIS navigation software Must be purchased.

4 Utilities …		
1 Directory of Memory Device	Info	Directory information.
2 Format Memory Module	**ESNL**	Format card/internal memory.
3 Enter Security Code	OP	Activates optional application programs. Must be purchased.
4 Self Test	SF	Self test memory devices

7 Transfer …		
01 Job	SF	Transfer a job from card to internal memory or vice versa.
02 Config Set	SF	Transfer a configuration set from card to system RAM or vice versa.
03 Coordinate System	SF	Transfer a coordinate system from card to system RAM or vice versa.
04 Antenna Info	SF	Transfer antenna information from card to system RAM or vice versa.
05 Code list	SF	Transfer a code list from card to system RAM or vice versa.
06 ASCII/GSI8 to Job	SF	Transfer an ASCII or GSI8 file to a job.
07 GSI/User File	SF	To create GSI, or user-defined data-exchange files on card. Also to transfer format files from card to system RAM.
08 Geoid Field File	SF	To transfer geoidal-model file from card to system RAM or vice versa.
09 Any File Type	SF	Transfer a file from card to internal memory or vice versa.
10 Firmware	SF	Transfer receiver firmware from card to system RAM.
11 Firmware TR500	SF	Transfer terminal firmware from card to system RAM to terminal.
12 Language Version	SF	Transfer language-version text (for receiver operation) from card to system RAM.
13 Application Text	SF	Transfer text for COGO, Area, optional Application Programs etc. from card to system RAM. For language versions.
14 Almanac	SF	Transfer almanac from card to system RAM or vice versa.

Configuration sets

A configuration set is a series of commands, parameters and settings that makes the receiver operate, display, output, record, receive and transmit in a defined manner. A configuration set may also cause certain functions to be active or not active.

The receiver is delivered with four (4) factory-default configuration sets.

* PP_STAT - for static and rapid-static post-processing operation.
* PP_KIS - for kinematic post-processing operation.
* RT_REF - for real-time reference operation.
* RT_ROV - for real-time rover operation.

If RT_REF and RT_ROV cannot be used directly with your radio modem, your Leica representative should have defined two additional configuration sets, MY-R-REF and MY-R-ROV.

MY-R-REF should be a copy of the factory-default configuration RT_REF but modified to make your SR530 operate with your radio modem as a real-time reference in standard mode.

MY-R-ROV should be a copy of the factory-default configuration RT_ROV but modified to make your SR530 operate with your radio modem as a real-time rover in standard mode.

When starting with System 500, you should find it sufficient to use MY-R-REF and MY-R-ROV for real-time work, and PP_STAT and PP_KIS for post-processing applications.

When starting with System 500 it should not be necessary for you to define new configuration sets.

Exercise 3 - Create a new configuration set to use when browsing through panels

When starting to work with System 500, use the configuration sets that are provided with the receiver. Do NOT modify or delete these configuration sets.

As you may want to browse through the various menus and panels when reading sections "Exercise 3 - create a new configuration set to use when browsing through panels" to "The difference between "Main Menu > 6 Configure" and the CONFIG key", create a new configuration set "BROWSING" that you can use for exercise purposes. Do this as follows:

Press **CONFIG** key
Panel CONFIGURE\ xxxxx.cnf
Press **CONFG F5**
Panel: CONFIG SET\
List of configuration sets
Press **NEW F2**


```
CONFIGURE\ New Configuration Set

Name       :              BROWSING
Description:▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓


Creator    :

                              C
CONT ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓
```

Panel: CONFIGURE\ New Configuration Set
*Name***:** Input "BROWSING". ENTER.
CONT F1
List of configuration sets
Select "BROWSING"
CONT F1

```
CONFIG SET\
CNF ────Description────
BROWSING
MY-R-REF
MY-R-ROV
PP-KIS   Default
PP-STAT  Default

CONT │ NEW │     │ DEL │INFO │αNUM
```

List of configuration sets
Select "BROWSING"
CONT F1

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



CONT │     │STORE│     │CONFG│
```

Panel: CONFIGURE\ Browsing.cnf
BROWSING is now the active configuration set

Press **ESC**
Main Menu

Use "BROWSING" when trying out any of the possibilities described in sections "Main Menu > 6 Configure" to "The difference between "Main Menu > 6 Configure" and the CONFIG key". This will ensure that you do not change any of the configuration sets supplied with the receiver.

Main Menu > 6 Configure

By using **6 Configur**e of the **Main Menu** you can:
• Define new configuration sets
• Change user-defined configuration sets
• Delete user-defined configuration sets.
• View the settings in configuration sets.

Note that only user-defined configuration sets can be changed and deleted. The four factory-default configuration sets cannot be changed and deleted.

When starting to work with System 500, use the configuration sets that are provided with the receiver. Do **NOT** modify or delete these configuration sets.

If you browse through the panels under **6 Configure**, make sure that you select configuration set "BROWSING".

The CONFIG key

Press the **CONFIG** key:
• **1 Survey**
• **2 Operation**
• **3 General**
• **4 Interfaces**

If you browse through these menus, make sure that "BROWSING" is the active configuration set.

Press **CONFIG** key
Press **CONFG F5**
Select "BROWSING"
CONT
"BROWSING" is now active. `CONFIGURE\ Browsing.cnf`

The CONFIG key

(If you browse through these menus, make sure that "BROWSING" is the active configuration set)

1 Survey		Important settings. Form part of configuration set. Can also be set via Main Menu 6 Configure.
	1 Position	Settings for displayed position.
	2 Satellites	Set elevation mask and satellite health
	3 Coding	Select coding system. Allows manual entry of codes.
	4 Stake-Out	Settings for stake out.
	5 Id Templates	Define point id. templates
	6 Point...	**1 Threshold settings** > For averaging and quality. **2 Hidden point** > Settings for hidden point routine. **3 Seismic** > Seismic record (For seismic/USA only)
2 Operation		Important settings. Form part of configuration set. Can also be set via Main Menu 6 Configure.
	1 Operation Mode	Select Standard or Advanced operation
	2 Occupation Settings	Settings for occupying points
	3 Logging	Settings for logging data
	4 Formats	Settings for coordinates, quality, point-occupy counter
	5 Antenna	Antenna management. Settings for offset and height

3 General		Settings that are less likely to be changed. Form part of a configuration set. But can only be set via the CONFIG key. Cannot be set via Main Menu 6 Configure.
	1 Units	Settings for display and inputs
	2 Language	Language selection
	3 Hot-Keys	Assign functions to keys F7, F8, F9, F10
	4 Time & Initial Position	Set time, time zone, and initial position
	5 Start-Up	Select panel in which receiver starts at ON
	6 TR500	Settings for terminal: illumination, alarm, keyclick, alphabet
	7 Sensor Identification	Serial number
4 Interfaces		Important settings. Some form part of configuration set and may also be set via Main Menu 6 Configure.
	No further menus	Settings for all interfaces, ports and devices. Configure real-time, hidden point, NMEA output, remote operation, PPS and event input devices.

Standard and Advanced Operation Mode

- With Operation Mode set to Standard you will see the functions and settings that most users will need.
- With Operation Mode set to Advanced you will have access to additional functions and settings.
- MY-R-REF, MY-R-ROV and the four factory-default configuration sets are all set for Standard mode.
- When starting with System 500 real-time, use MY-R-REF and MY-R-ROV in standard mode.
- Once you have used and are familiar with System 500, you may want to define your own configuration sets and to use Advanced mode.

The difference between "Main Menu > 6 Configure" and the CONFIG key

A configuration set makes the receiver operate in a defined way. When surveying or setting out, you select the required configuration set in the first panel, SURVEY\ Begin or STAKE-OUT\ Begin. The selected configuration set is then active.

Main Menu > 6 Configure is used to define new configuration sets, as well as to change, delete and view configuration sets. Any changes are stored.

The **CONFIG key** is used mainly to make temporary changes to the active configuration set while surveying or setting out. The changes will not be stored, i.e. they will be lost on switching OFF or changing to another configuration set.

Example: While surveying in real-time, you will often need to change the point id. template. Simply press CONFIG and change the settings.

To make temporary changes to a configuration set using the CONFIG key

If you try to do this, make sure that you select configuration set "BROWSING".

Press **CONFIG** key
Active configuration set is shown in panel title bar.
Press **CONFG F5**
List of configuration sets.
Select "BROWSING".
CONT

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



CONT        STORE        CONFG
```

"BROWSING" is now active.
Make the required changes.
Then press **CONT**

Main Menu

To store changes made to a configuration set using the CONFIG key

Although the CONFIG key is used mainly to make temporary changes to a configuration set, it is possible to store these changes so that the new settings will not be lost on switching OFF or changing to another configuration set.

If you try to do this, make sure that you select configuration set "BROWSING".

Press **CONFIG** key again
Active configuration set is shown in panel title bar.
Press **CONFG F5**
List of configuration sets.
Select "BROWSING".
CONT
"BROWSING" is now active.
Press **STORE F3** to store any changes made.
Main Menu

Using **CONFIG** key > **3 General** > **3 Hot-Keys**, you can assign CONFIGURE functions, STATUS displays, SURVEY operations, and APPLICATION programs directly to keys **F7, F8, F9 and F10**.

This allows fast, direct access without stepping through menus.

Once you have worked with System 500 for some time, you will find it very convenient to be able to assign those operations and functions that you need often to the four hot keys.

When working with configuration set MY-R-ROV, you will probably find that the hot keys have been assigned as follows:

F7   STATUS\ Satellites
F8   APPLICATION\ Point Management
F9   STATUS\ Position
F10   CONFIGURE\ Hot-Keys

Summary of System 500 operating system

Section "System 500 operating system" provided an introduction to the operating system.

System 500 real time is extremely powerful with many functions, operations and settings. This huge range of possibilities is necessary to meet the requirements of users carrying out all types of applications all over the world.

Most users will use System 500 real time for surveying and stake out. Although a user may need some of the special functions, it is very unlikely that any one user will need them all.

The receiver can be configured (set) to operate, display, output, record, receive and transmit in almost any way. Once it is set (configured) it is extremely easy to use.

Operating the real-time rover is very easy and almost a one-key operation. Even relatively unskilled operators can be used.

Most users will not need to define configuration sets, at least not initially. Most users will find it sufficient to use MY-R-REF and MY-R-ROV when starting with real-time surveying.

Once you are familiar with the system, you can define your own configuration sets if you need to and even switch to advanced mode for more demanding applications. For detailed information on configuring the receiver, see sections 5 and 9 of the Technical Reference Manual.

When getting started, it is not necessary to try to understand every detail of the operating system. The system is intuitive, and as you work, you will soon become familiar with it. Full details are in Technical Reference Manual.

Summary:

- **The receiver is extremely powerful.**

- **It can be set to operate in any way.**

- **Once set (configured), it is very easy to use.**

Transferring coordinates from the PC to the receiver

In exercise 2, section "Entering the local coordinates into the real-time rover", you input local coordinates by hand into the receiver. In production work, you will normally transfer coordinate lists from the PC to the card. This can be done in two ways:

- In a coordinate set or project from SKI-Pro to the card.

- In an ASCII file or text file from the PC to the card.

Transferring coordinates from SKI-Pro to the card

Transferring a list of coordinates in a coordinate set or project from SKI-Pro to a card is straightforward. A job with the coordinate list is created automatically on the card.

When staking out with the receiver, you have to specify that will "stake out from a job". You did stake out from a job in exercise 2, section "Staking out from local coordinates".

When determining a coordinate system / transformation with the receiver, you have to specify that the "local coordinates are in a job". You did this in exercise 2, section "Computing transformation parameters between WGS84 and local coordinates".
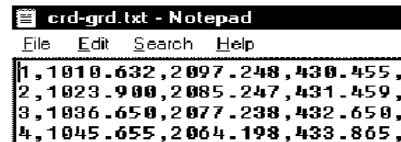
Exercise 4 - Transferring coordinates directly from the PC to the card

This section explains how to transfer coordinates in a file directly from the PC to the card. Local coordinates on a card are used for stake-out work and for determining a coordinate system / transformation.

On the PC

In exercise 2, section "Local coordinates of exercise field", you determined local coordinates with a total station. Use Notepad to create a text file with these coordinates. Enter in the sequence Point Id, Northing, Easting, Height . Use commas as separating characters. Save the file under a suitable name, e.g. "crd-grd.txt" or "crd-grd.asc" (the filetype does not matter).

Example:

Insert a card that has been used or formatted in the receiver into the PC. Copy the file "crd-grd.txt" from the PC into the directory DATA on the card.
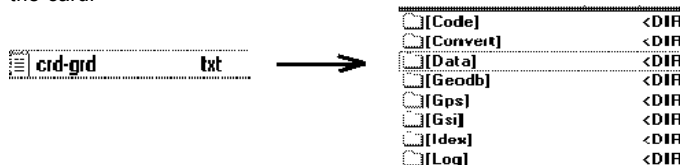
On the receiver - Example for stake out

Press the **CONFIG** key
CONFG F5
List of configuration sets
Select "MY-R-ROV"
CONT
 "MY-R-ROV" now active.

Press the **CONFIG** key
1 Survey
4 Stakeout
Panel: CONFIGURE\ Stake-Out
Stake from: Press ENTER to open box.

```
CONFIGURE\ Stake-Out
Stake from  :
                        Job
            ASCII File▼
Show Path   :
Def. Orient :
Use Beep    :
Dist from Pt:               m
```

Select "ASCII file". ENTER.
Press **ASCII F4**

```
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
```

Panel: CONFIGURE\ Pt ASCII Format
(You have to set for file "crd-grd.txt")
Delimeter: Comma
Id Pos: 1
East Pos: ENTER to open box.
Select 3. ENTER.
North Pos: ENTER to open box.
Select 2. ENTER.
Height Pos: 4
(You have set mask for "crd-grd.txt")
CONT

```
CONFIGURE\ Stake-Out
Stake from  :        ASCII File▼
STORE -> Job:              NO▼
Show Path   :              NO▼
Def. Orient :           North▼
Use Beep    :             YES▼
Dist from Pt:          0.500 m


CONT          ASCII
```

Panel: CONFIGURE\ Stake-Out
(Other settings should be in order)
(See below for STORE > Job) ***
CONT

Main Menu

Press CONFIG again
Panel: CONFIGURE\ My-R-ROV.cnf
MY-R-ROV is active
STORE F3
Main Menu

You can now switch **OFF**. The settings that you have just made will be retained.

*** Note on STORE > Job

As explained in section "Introduction to stake out with the real-time rover", you can record the coordinates of the "staked-out points" in a job.

If you select STORE > JOB NO, only the coordinates of the "staked-out points" will be recorded in a job.

If you select STORE > JOB YES, the coordinates of the "staked-out points" plus the "coordinates to-be-staked out" (from ASCII file) will be recorded in a job.

Stake out from ASCII file

Now repeat the stake-out exercise described in section "Staking out from local coordinates".

Main Menu
2 Stake-Out

```
STAKE-OUT\ Begin
Config Set:              MY-R-ROV▼
Stake Pts :        Crd-grid.txt▼
Store Pts :        JOB D SO ASC▼
Stake Type:              Point▼

Antenna   :          AT502 Pole▼
Ant Height:             2.000 m

CONT
```

Panel STAKE-OUT\ Begin
Config Set: "MY-R-ROV"
Stake Pts: "Crd-grd.txt"
Store Pts: Create a new job
"JOB D SO ASC"
Stake Type: "Point"
Antenna: "AT502 Pole"
Ant Height: "2.000"
CONT

Panel STAKE-OUT\ Crd-grd.txt
You can now stake out the points in file "crd-grd.txt".

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

TQM
ISO 9001 / ISO 14001

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Our commitment to total customer satisfaction*

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

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Leica

*Leica Geosystems AG
Geodesy
CH-9435 Heerbrugg
(Switzerland)
Phone +41 71 727 31 31
Fax +41 71 727 46 73
www.leica-geosystems.com*