Scorpio

Seismic Surveys

USER'S MANUAL

Because **the present manual** is **the only one** needed to help you operate your equipment for **seismic surveys**, you can **DISPOSE OF** the other manual provided (*Scorpio 6001/2 MK & SK User's Manual*).

(This second manual (DSNP Part No. 0311375) systematically accompanies every *Scorpio 6001/2 MK & SK* equipment leaving the factory).

0311391 Rev A

Issue : October 1998

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Appendices

1. Unpacking & Description

6001/2 MK Rover Unit

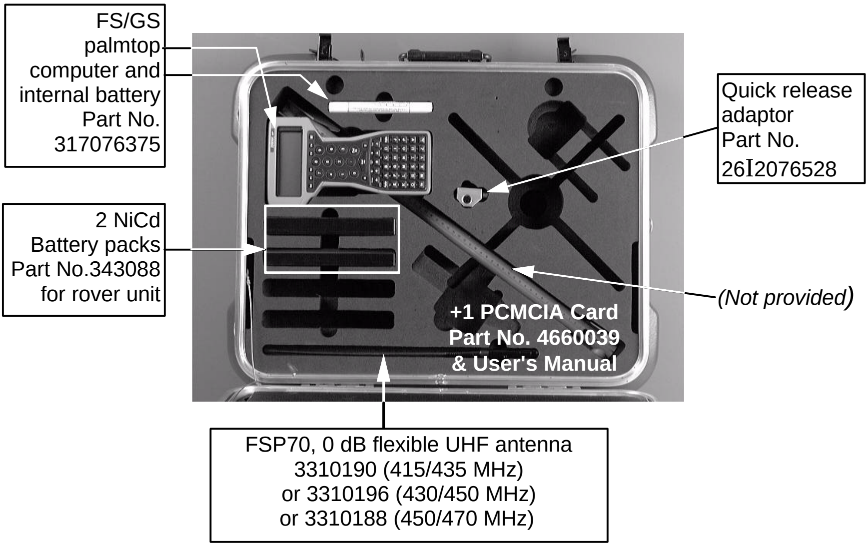
Unpacking

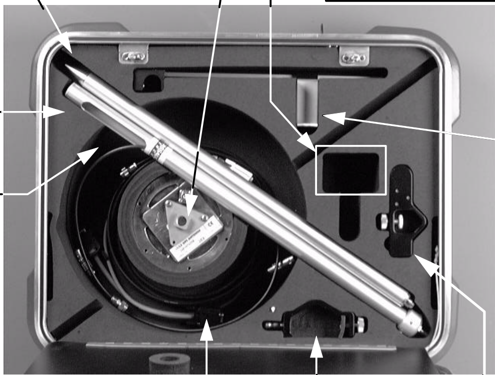
Open the accessory container. List and inspect all the parts provided. Should parts be missing or damaged when first opening the container, please contact your distributor.

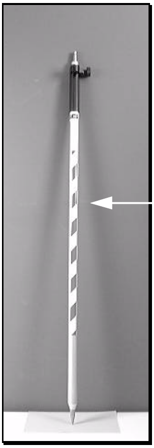
DSNP reserves the right to make changes to the standard supply described below without prior notice.

Accessory container
Part No. 790076562

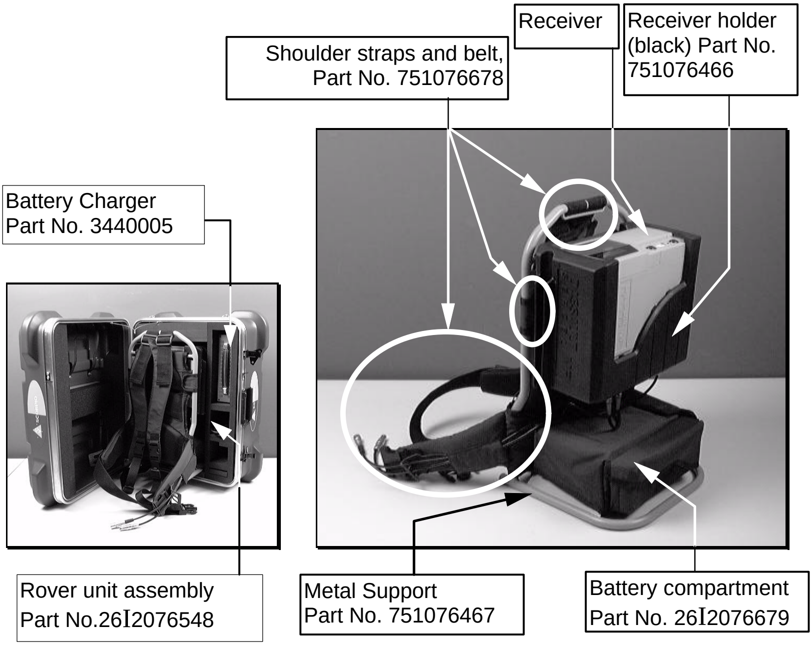
Receiver container
Part No. 790076561




GPS antenna:
NAP001 (L1) Part No.26E1076311 or
NAP002 (L1/L2) Part No. 26E1076208
with 5/8" adaptor Part No. 724076577
Mast for GPS antenna
Part No. 26I2076564
Bag of clips
Part No. 7870088
Mast for UHF antenna
26I2076840
(includes UHF coaxial cable
Part No. 505076499)
(Not provided)
FS/GS palmtop cable, pp/SubD Part No. 605076501, 1.0 m
FS/GS-PC cable, SubD9/SubD9 Part No. 605076502, 1.0 m
GPS coaxial cable (pp/TNCm) Part No. 505076500, 1.5 m
UHF coaxial cable (TNCm/TNCm) Part No. 5050227, 2.50 m
Palmtop support for telescopic pole, Part No. 7510423


Telescopic Pole 1337-L,
Part No. 3310203
(supplied separately)

Open the *Rover Unit* container. This box contains the battery charger and the rover unit assembly.



The rover unit assembly (Part No. 26I2076548) consists of the following parts:

- the 6001 receiver Part No. 26I1076437or 6002 receiver Part No. 26I2076433
- the stand, Part No. 26E1076942, which consists of the receiver holder (Part No. 751076466, black rubber), the Metal support (Part No. 751076467) and small parts (screws, washers, standoffs).
- the battery compartment, Part No. 26I2076679 (which includes 2 battery cables Part No. 605076507)

- Shoulder straps and belt, Part No. 751076678, including a serial line cable (605076509, 0.75 m) and a GPS antenna cable (605076510, 0.75 m, coaxial, 50 Ω).

Note the two cables present in the belt at delivery. Do not remove these cables from the belt as they are precisely required at this location for your field surveys.

Also, they needn't be removed before putting the rover unit assembly back into its container for transportation.

6001/2 SK Base Station

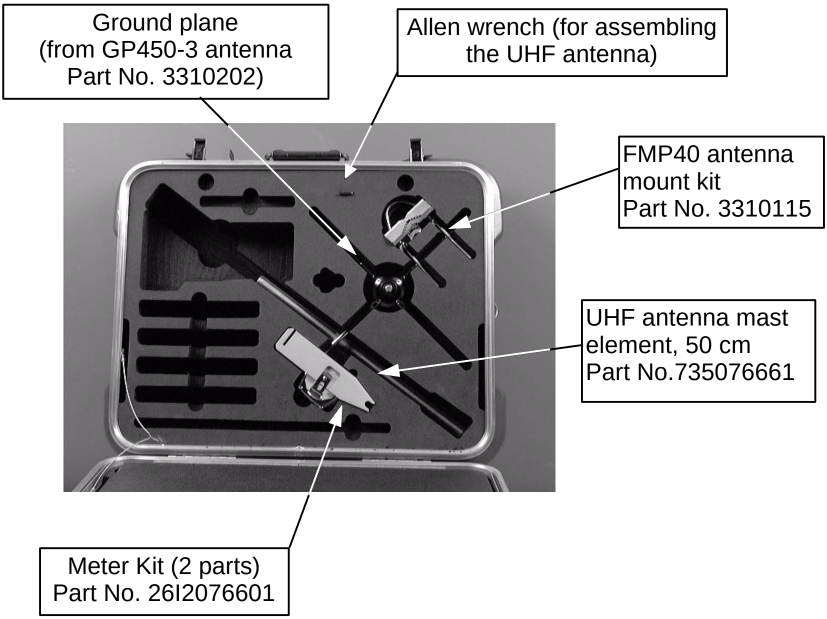
Unpacking

Open the accessory container. List and inspect all the parts provided. Should parts be missing or damaged when first opening the container, please contact your distributor.

DSNP reserves the right to make changes to the standard supply described below without prior notice.

Accessory container
Part No. 790076562

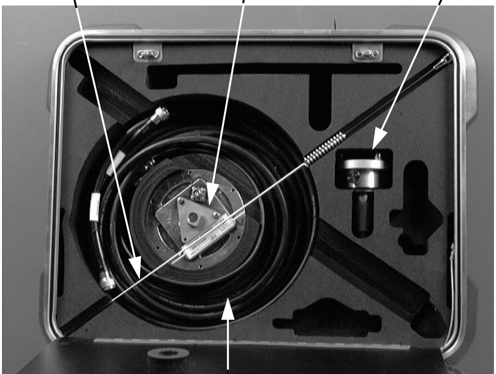
Receiver container
Part No. 790076561



GPS antenna:
NAP001 (L1) Part No.26E1076311
or
NAP002 (L1/L2) Part No. 26E1076208
with
5/8" adaptor Part No. 724076577

UHF antenna whip (from GP450-3 antenna Part No. 3310202)

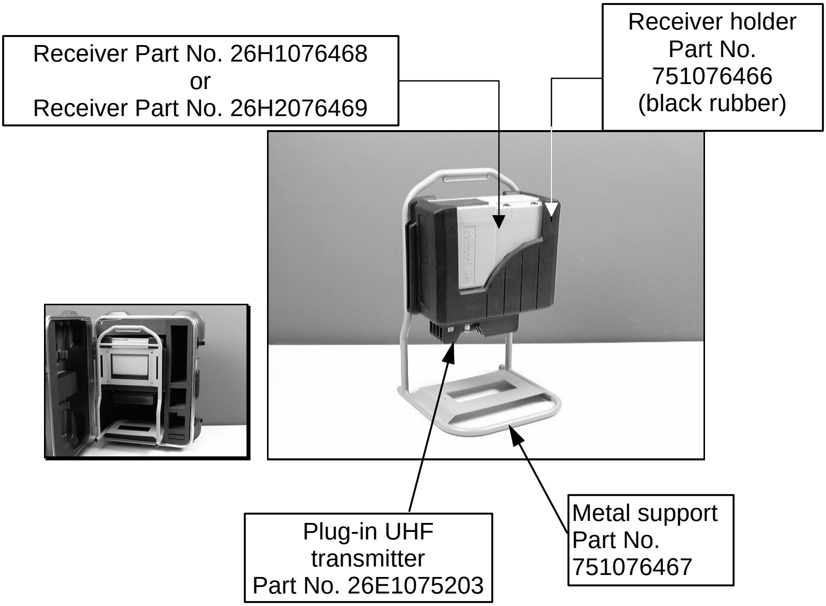
Adapter assembly composed of:
- GAW600 Tripod adapter Part No.3310205
- GAF 5/8" adapter Part No. 3310206



Set of cables:

1 power cable, 2 m	Part No. 605076503
1 RS232C cable, 2m	Part No. 605076570
1 × 10-metre GPS coaxial cable (TNC-m/TNC-m)	Part No. 5050196
1 × 6.50-metre UHF coaxial cable (N-m/N-m)	Part No. 5050197

Open the *Station* container. This box contains a single element which is the station unit secured on its holder and fitted with a plug-in UHF transmitter (on rear panel).



Station stand Part No. 26E1076942 consists of the receiver holder, the metal support and small parts (screws, washers, standoffs).

GNSS receiver description

The GNSS receiver used both at the base station and as the rover unit is fitted with the following parts on its front and rear panels.

Front Panel

- **Front panel controls**

ON/OFF pushbutton : used to turn on and off the receiver.

The indicator light nested in this button starts blinking when you press the button (if the receiver is connected to a power source). From the end of the self-tests, the light is permanently ON.

Scroll pushbutton : used to access the different data screens available from the status display.

Activates the screen light for 30 seconds whenever depressed.

A long press on the **Scroll** pushbutton allows you to return to screen No. **0**.

1

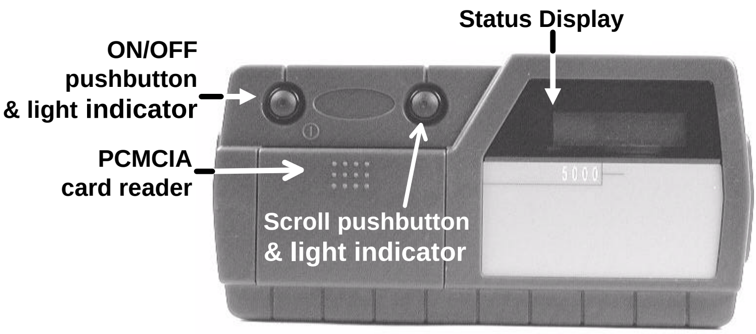
If raw data recording is planned (especially at the base station), the indicator light nested in the button provides information about this planned recording as soon as you connect the receiver to the power source:

Blinking : Recording is programmed to be run at a later time & date.

ON : A recording session is in progress. The other indicator light is necessarily ON.

OFF : No pending recording. The receiver will be powered only manually by using the ON/OFF button.

Status Display : 2-line×16-character display providing information about receiver operation (for a complete description of the displayed data, see *Appendix H*).



- **PCMCIA card reader**

  A PCMCIA card reader is located in the left-hand part of the front panel.

  This device has reader/recorder capabilities.

  The PCMCIA card is seen from the DSNP GNSS engine as a conventional serial port (port P).

Rear panel

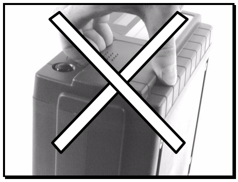
The rear panel is fitted with the following connectors:

- A GPS coaxial connector (GPS antenna input), TNC-female type
- A DGPS coaxial connector (DGPS antenna input), TNC-female type
- Two RS232 connectors (port A named "COMPUTER"; port B named "I/O")
- An RS422 connector (port D named "DGPS"), 15-C SubD-female type, used to connect the plug-in UHF transmitter (base station only)
- Two POWER connectors in parallel. This allows the receiver to be maintained in operation while you swap the power source. For example, in the case of a battery-powered receiver, you can connect the new battery before removing the low one.

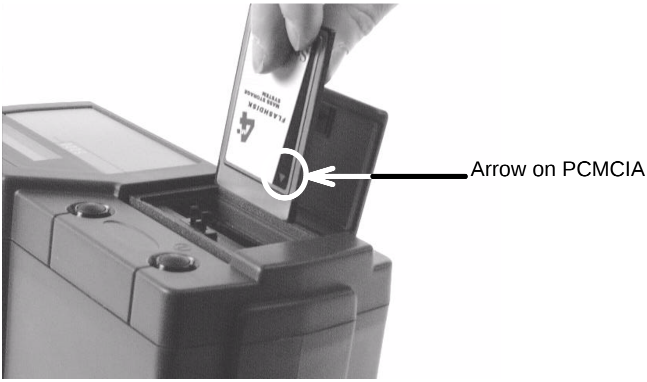
PCMCIA Drive

Inserting a PCMCIA card

- Unlock the cover by applying a finger on its upper-middle part and then by pushing it. The cover will open when you remove your finger.



- Orient the PCMCIA card as shown below.
- Insert the PCMCIA in the slot and push gently until you hear a click (indicating that the card is locked in the reader).



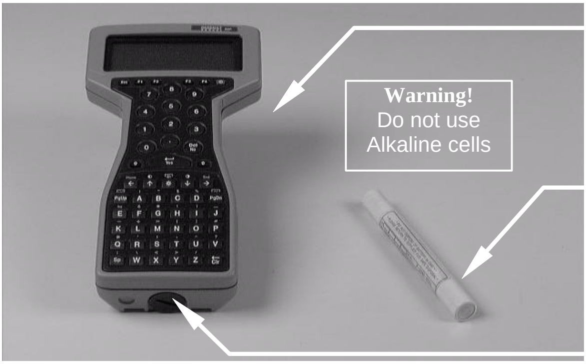
- Close the cover (a click indicates that the cover is locked) by pushing the cover, *in the same way as you did previously to open it*.

Removing a PCMCIA card

- Unlock the cover.
- With a finger, depress the black, square-shaped, knob located to the right of the reader until the card is released.

- Take the card out of the reader.

FSGS Palmtop Computer



FSGS Battery Pack

At equipment delivery, the FSGS is fitted with alkaline cells: Replace them with the NiCd battery provided separately.

The FSGS has been configured in order that battery charging can take place from a power source present on its RS232C connector.

After connecting a non-powered FSGS to an operating (powered) receiver, the "`Charging in progress`" message should appear on the FSGS display. If not so, please refer to *Appendix H*.

Warnings!

To avoid pressurisation problems inside the FSGS if it is taken on an airline trip, the battery cap has been loosened before shipment. Do not forget to lock this cap as this is required to maintain proper sealing. If you have to travel by air with your equipment, do the same (loosen the cap before take-off, lock it back after landing).

Do not charge the NiCd battery pack outside the 5 to 40° temperature range.

FSGS temperature ranges

- Operating: – 20°C to +55°C
- Storage: – 30°C to +70°C

Environment

The FSGS is designed to operate in conditions of up to 90% relative humidity. The internal humidity indicator strip, visible in the bottom-right corner of the display window, should be blue. If it takes on a pinkish color, please remove the NiCd battery and return the palmtop to the servicing department.

Trickle-charged internal battery

A trickle-charged internal battery is fitted, which provides back-up power to preserve the data on the RAM disk for at least 2 weeks if the main power source (i.e. the NiCd battery) is removed. This auxiliary battery, charged with a trickle current from the NiCd battery, does not normally need to be replaced.

Cleaning

Clean the LCD screen with a clean cloth. Do not use solvent cleaners or harsh detergents. If the case is very dirty, make sure the battery cap is tight, then wash it gently under warm running water. Leave it to dry in a warm room. Do not use forced air drying.

Long-term storage

If you intend to store the FSGS for at least 2 months, remove the NiCd battery and fit a fresh set of 3 highest quality Alkaline cells. We recommend storage at a temperature between 10°C and 35°C. Alkaline cells should be changed every 6 months.

After long-term storage

Remove the Alkaline cells and insert the NiCd battery after fully charging it.

Changing the NiCd battery

- Turn off the FSGS (press the red key, top right)
- Use a coin to undo the battery cap (turn counter-clockwise
- Remove the old battery
- Fit in a new battery, positive end first
- Take the battery cap and, with finger pressure only, press it into the battery compartment and turn it clockwise.
- Only when the thread is started, use a coin to screw the cap tightly home.

Preparing batteries for the Rover Unit

- Use NiCd batteries only.
- Approximate charging time: from 1 hour to 1 ¼ hour per battery

VERY IMPORTANT!

- A single battery pack is charged at a time.
- The battery charger first discharges the battery quickly and thoroughly before starting to charge it. Therefore the charging time will always be the same whatever the state of the battery when you insert it into the charger. ♣

2. Operating Instructions at the base station

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Station installation

Although it is rather an easy operation, you should however be very careful in every detail of the installation of a base station. Indeed, how and where you install the base station and the antennas will greatly determine the level of performance you can expect from it.

You do not need particular tool, but your usual tool box.

Choosing a location where to install a base station

Remember the station should be installed in a place clear of any devices likely to produce radiofrequency interference or multipath effects.

GPS antenna

Consider the following two requirements in the choice of a location for the GPS antenna, the first one having priority over the second:

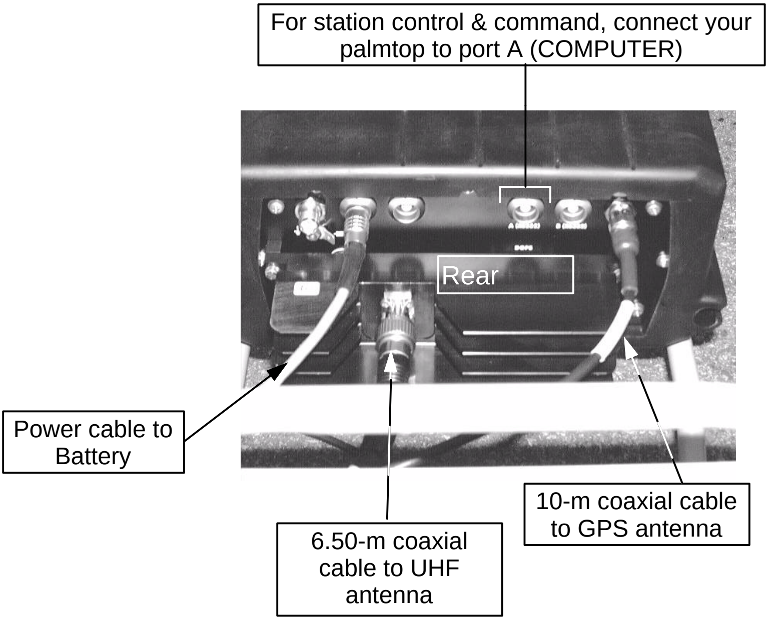
- For the best reception possible, install the GPS antenna at a safe distance from high-power antennas and radio-transmitters. Choose a place providing a 360-degree view of the horizon.
- To save time in your surveys, you should better install the GPS antenna at an accurately known location, with its coordinates expressed in the coordinate system used for the surveys. If the antenna location is not known, you will have to let the station determine this location after running it in the *Average Position mode* (see page *2-11*, *Average Position mode*).

UHF antenna

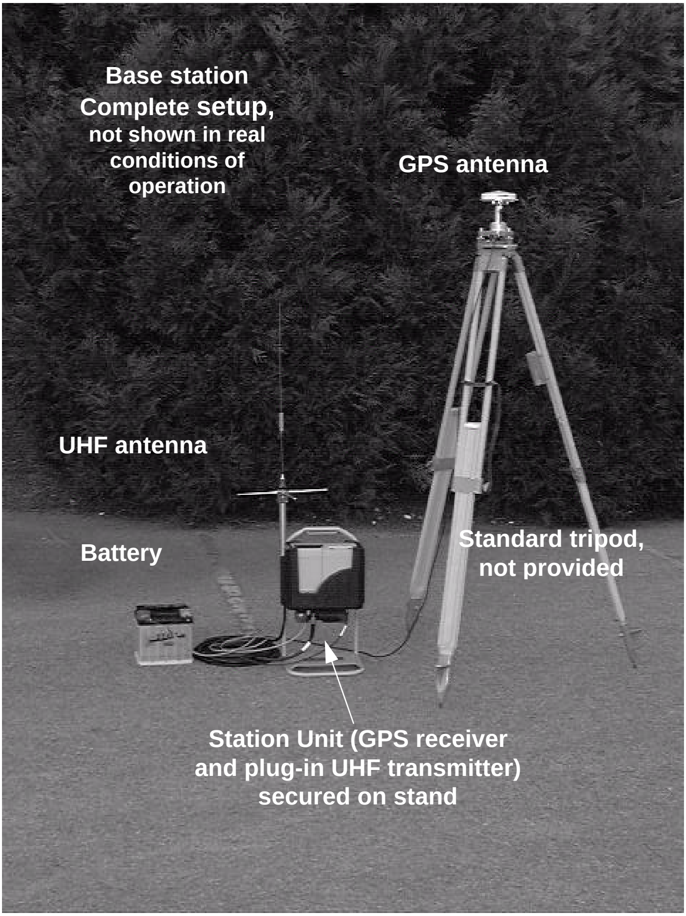
The higher the UHF antenna, the better its coverage.

Avoid mounting the UHF antenna parallel to, or in the neighborhood of other metal parts, such as masts, supporting wires, etc.

Connections and Setup



2


Base station
Complete setup,
not shown in real
conditions of
operation
GPS antenna
UHF antenna
Battery
Standard tripod,
not provided
Station Unit (GPS receiver
and plug-in UHF transmitter)
secured on stand

Measuring the GPS antenna height

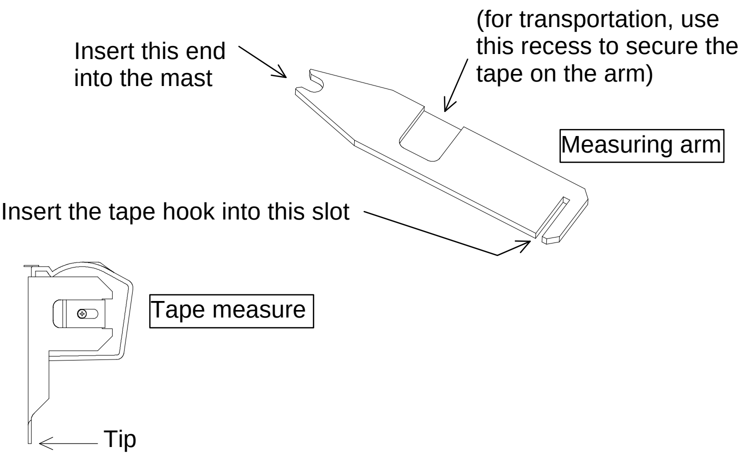
When programming the station, you will need to know the height of the GPS antenna phase center above the landmark. There are two ways of measuring this height:

DSNP measurement

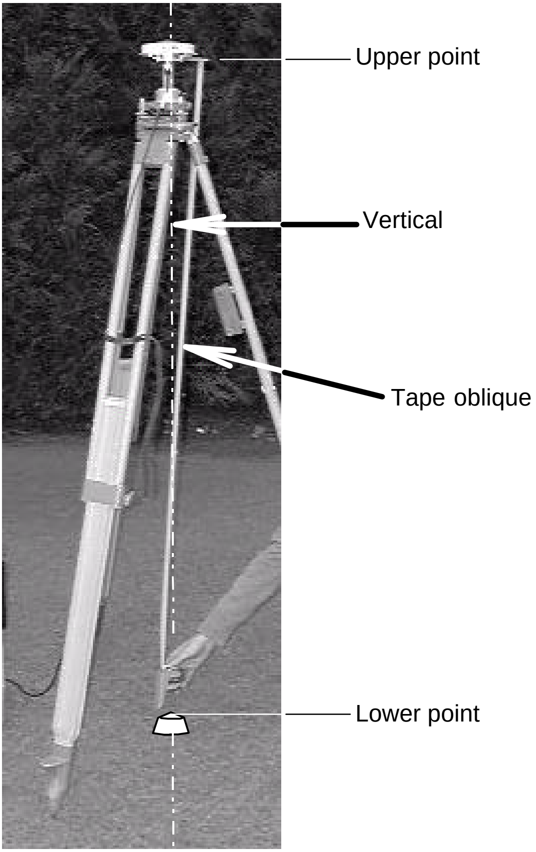
With this method, use the Meter Kit Part No. 26I2076601 as described below. The meter kit is composed of a tape measure and a measuring arm.

- Insert the measuring arm into the mast, just under the antenna base plane.

  Insert the tape hook into the measuring arm (upper point)
- Unwind the tape and place the tip onto the landmark (lower point)
- Write down the value read on the scale. This value will be entered later as the antenna height, with the DSNP measure option selected (see page *2-10*, *Entering the GPS antenna height*).



- DSNP measurement:



USER measurement

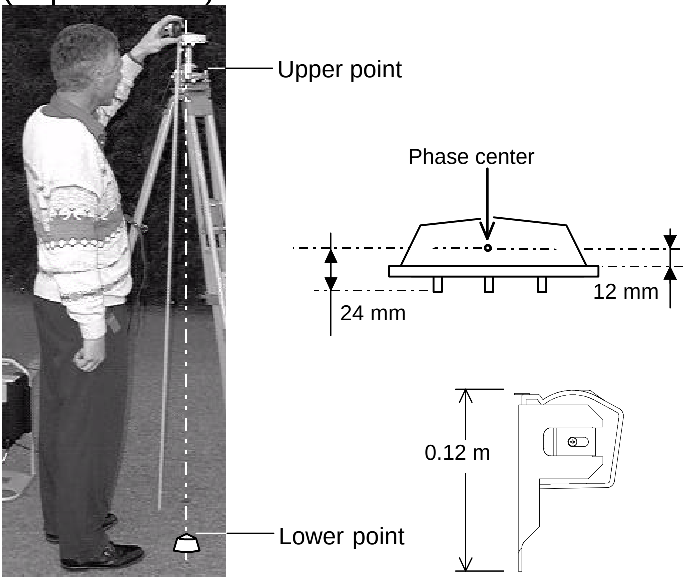
Knowing the location of the phase center in the GPS antenna, you can measure its height above the landmark with your own method:

If you find it easier, you can split the height measurement into two distinct vertical components which you measure one after the other.

For example, you can measure the height of the phase center above an arbitrary mark on the mast (1st measurement) and then measure the height of this mark above the land mark (2nd measurement).

You just need to use the tape measure for this kind of measurement.

USER measurement illustration (example)
(Tape vertical)



If, as opposed to the illustration above, the tape hook is placed on the upper point and the tape tip on the landmark, do not forget to add 0.12 m to the value you read on the scale.

2

Programming the base station (Quick Procedure)

Preamble

- If the station does not need to be programmed or re-programmed (somebody else did it for you), just press the ON/OFF pushbutton on the receiver front panel and then check that the station reaches its operational status by reading the information reported on the station's status display (screen No. 0, see *Appendix A*).
- If changes have to be made to the programming of the station, connect the palmtop and run the Palmtop software as explained hereafter.

  In this section, it is assumed that the Palmtop software has been properly installed (if required refer to *Appendix A* for software loading).

  A complete reference documentation for this software (run at the base station) is provided in *Appendix B*.

- Basically, a station can function in two different operating modes:
  - The *Average position mode*, in which the station is requested to provide a position solution of its own location at the end of a certain time, by continually averaging its position solutions collected over this period of time. This operating mode should be run only if the position of the station is unknown or insufficiently known. It should be run for some time and then the averaged position should be used to program the station in *UHF transmission mode*.
  - The *UHF transmission mode*, the normal operating mode for a base station, in which the useful data is transmitted to users through a data link operating in the UHF band.

Getting the Palmtop Software started

After pressing the ON/OFF pushbutton on the receiver front panel and after checking that the station has reached its operational status (see screen No. 0, *Appendix A*), do the following:

- Connect the FS/GS palmtop to port A on receiver rear panel, using cable part No. 605076501.
- Switch on the palmtop by depressing the red key (upper right).

- After the DOS prompt has appeared, type in "S" (not case-sensitive) and press the "Yes" key (↵).

  Let the palmtop complete its self-tests, the end of which is denoted by the test bar graph disappearing from the palmtop display. If a problem is encountered in this phase, please refer to *Appendix A*.

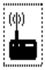
  Note that starting the Palmtop software will automatically switch the receiver on if you forgot to do that before. However in this case, the self-tests on the palmtop will be preceded by receiver booting.

Programming steps

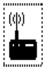
- **Loading the coordinate system from the PCMCIA**

  - Insert the PCMCIA prepared for the job into the GNSS receiver of the base station.
  - From the main menu, select  by using ← or →.
  - In the function menu which then appears select **Load coord. System** using the ↓ key.
  - Press ↵ to validate this function. The screen then indicates the name of the job contained in the PCMCIA (example: brixen00.j3d).
  - Press ↵ again to let the program load the coordinate system from that job to the base station (loading is instantaneous).
  - Press the **Esc** key to come back to the main menu

- **Entering the station position**

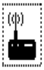
  - From the main menu, select  by using ← or →.
  - In the function menu which then appears select **Position** by using the ↓ key.
  - Press ↵ to validate this function.
  - In the new screen which then appears, enter the three coordinates of the station, expressed in the coordinate system used (indicated in top line). If they are not accurately known, enter approximate coordinates. Note that this screen also indicates the current value of antenna height with respect to ground.

- **Entering the GPS antenna height**

  - From the main menu, select  by using ← or →.
  - In the function menu which then appears select **Antenna** by using the ↓ key.
  - Press ↵ to validate this function.
  - In the new screen which then appears, press ← until the upper-right field is selected
  - Press → and from the selection menu which then appears, select **User** or **DSNP** depending on the measurement made (see page *2-4*)

- Move the cursor to the next field and enter your measurement. If you chose **User**, you may have to enter two measurements instead of one with **DSNP** (see illustration opposite the entry fields).
- Press ↵. The resulting true height of the antenna appears on the right.
- Press the **Esc** key to come back to the main menu

- **If the coordinates of the station are not accurate enough, select the Average Position mode and let the station operate in this mode for some time:**

  - From the main menu, select  using ← or →.
  - In the function menu which then appears, select **Average Position** using the ↓ key.
  - Press ↵ to validate this function.
  - Press the **R** key

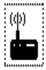
- In the edit box which then appears, type in the period of time (hhmm) during which the station should operate in the *Average Position mode*. Choose this time according to the figures given in the table below.

Operating time in *Average Position mode*	Resulting uncertainty on station's coordinates
10 min	50 meters
30 min	30 meters
1 hour	20 meters
12 hours	5 to 10 meters
24 hours	< 5 meters

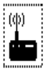
- Then press ↵. The base station then starts running in the *Average Position mode* (status in the upper-left field: **Running**)

  From this time, the coordinate fields on this screen will be updated as new solutions are available. At the end of the planned time (new status: **Stop**), they will contain the average coordinates of the station.

After the station has left the *Average Position mode*, do the following:

- Unless already done, from the main menu, select  and then select **Average Position**.
- Press the **A** key to transfer the averaged position to the **Position** function screen. The station is now ready to operate in *UHF transmission mode*.

- **Entering the transmitter characteristics, enabling the station to transmit**

    - From the main menu, select  using ← or →.
    - In the function menu which then appears, select the **Transmitter** function.
    - From the screen which then appears, enter the following parameters:
        - Station ID number: identification number of the station. This number is part of the data conveyed through the UHF link. The rover unit will test this number before validating the data received
        - Carrier frequency: within the band 400-470 MHz, necessarily a multiple of 12.5 kHz

- Transmission rate (1 to 6 seconds): the interval of time between any two consecutive transmit moments (the data update rate naturally results from this setting)
- Transmission slot (1 to 4): defines the organization of the data link if several base stations are used concurrently. If a single base station is used, choose “1” for this parameter. If several stations are used (up to 4), assign a different number to each station
- Data: choose the type of data transmitted by the base station (LRK, DSNP C P, DSNP C or RTCM)

- Press ↵ again to validate all these parameters
- Press the **E** key to enable the station to transmit (resulting status word on the screen: ON)

  (later, from this screen, you will press the **S** key to disable transmission).

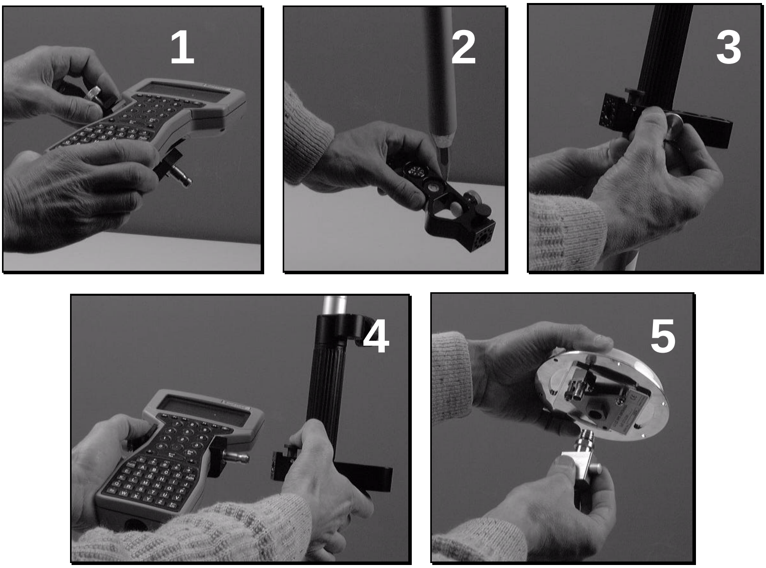
- **Programming the recording of raw data on PCMCIA, programming operating sessions**

  See *Appendix B*. ♣

3. Operating Instructions on the Rover Unit

Preparing for a field survey

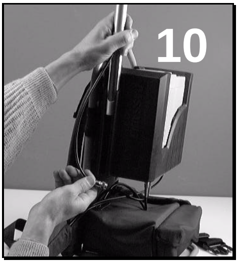
Assembling the various parts

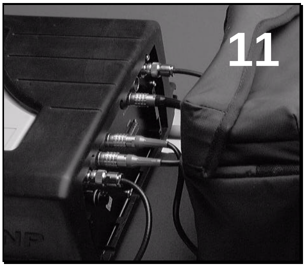


After inspecting all the parts provided in the two containers (see *Unpacking*, page *1-1*), proceed as shown above:

1. Secure the palmtop on its holder.
2. Insert the pointed end of the telescopic pole into the hole of the palmtop support.
3. Secure the support somewhere on the telescopic pole so that the palmtop be at a proper height (i.e. adapted to your own height).

4. With a thumb, depress the quick release button on the support and insert the tipped end of the palmtop holder into the support. Release the button.
5. Secure the quick release adapter in the lower part of the GPS antenna.



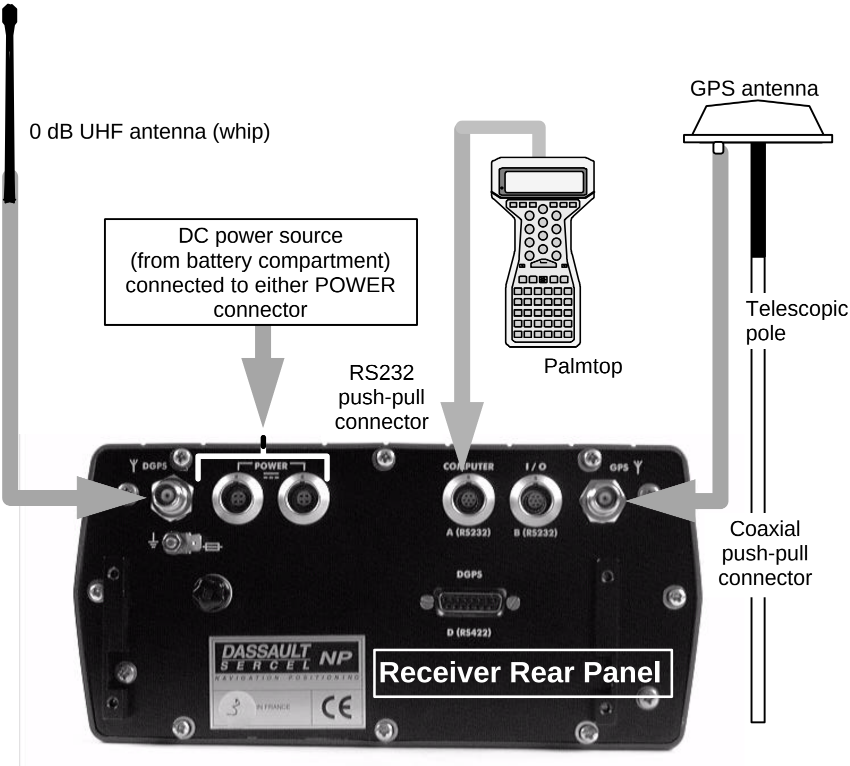


6. With a thumb, depress the button on the quick release adapter and insert the top of the pole into the adapter. Release the button.
7. Give the GPS antenna the desired height by adjusting the length of the telescopic pole.
8. Insert fresh battery packs into the battery compartment (a single way possible for battery insertion).
9. Do not forget to lock the battery compartment.

10. Screw the UHF antenna on top of the mast and insert the mast into the dedicated location on the receiver holder.
11. Make the necessary connections (described in the next page).

Connections

- Connect the end of the coaxial cable (protruding from the belt) to the GPS antenna.
- Connect the end of the serial line cable (protruding from the belt) to the palmtop.
- Make sure the palmtop is fitted with the NiCd battery pack.
- Connect the end of the coaxial cable protruding from the UHF antenna mast to the DGPS input (on receiver rear panel).


0 dB UHF antenna (whip)
DC power source
(from battery compartment)
connected to either POWER
connector
RS232
push-pull
connector
Palmtop
GPS antenna
Telescopic
pole
Coaxial
push-pull
connector
DGPS
POWER
COMPUTER
A (RS232)
I / O
B (RS232)
GPS
DGPS
D (RS422)
DASSAULT
SERCEL
NP
NAVIGATION POSITIONING
Receiver Rear Panel

Getting ready for surveying

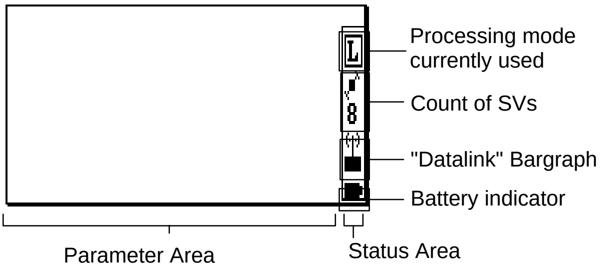
- Insert the PCMCIA containing the project into the receiver.
- Switch on the GNSS receiver by depressing the ON/OFF pushbutton.
- Put the rover unit assembly on your back
- Switch on the palmtop by depressing the red key (top right).

Operator ready for field operations

Introduction to Palmtop Software

- **Palmtop display**

All screens are divided into two distinct areas as shown below. The status area is permanently shown.



Processing mode currently used:

H : Hold (no position solution)

G : GPS

E : EDGPS (metric accuracy)

K : KART (centimetric accuracy)

L : LRK (centimetric accuracy)

Count of SVs used :

 : Blinking icon if the count of SVs drops and remains below 4

Three-level “Datalink” bargraph :

 : Blinking icon if data link is bad

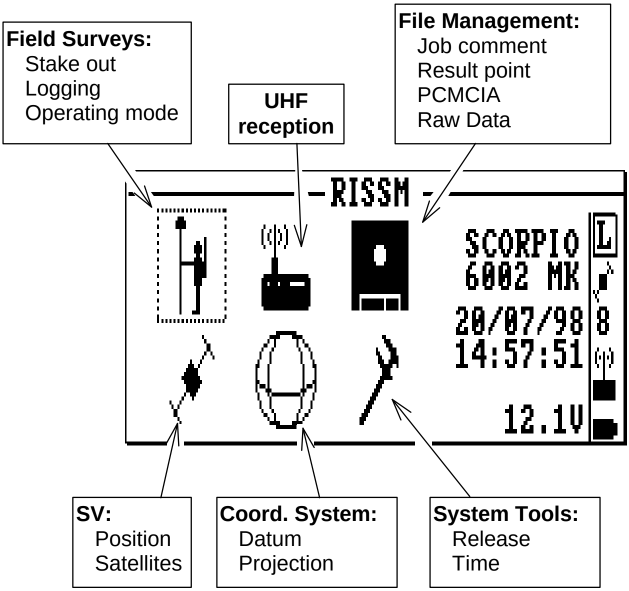
 : Respectively poor, medium and excellent data link.

- ## Keys and menus

A few keys and menu types need to be known for best use of the Palmtop Software program.

Main menu screen

The main menu shows the 6 groups of functions available in the form of icons (see below).

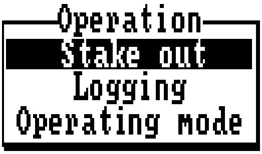


Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines. To access the main menu, refer to *Start-up sequence*, page *3-12*.

3

Function menus

They are displayed after selecting an icon in the main menu and pressing ↵. Example:



Then do the following:

- Using the vertical-arrow keys, select a function in the menu
- Press ↵ again to run this function

NOTE: The UHF reception icon has no **function** menu as this icon provides access to a single function.

Help menus

There is a **Help** menu specific to almost each function, listing all the commands available in the context of this function.

To display the **Help** menu, press the **F1** key. This causes the **Help** menu to be superimposed on the screen. Then do the following:

- Note the key-letter corresponding to the command you want to run
- Press the **Esc** key to erase the menu
- Press the key-letter to run the desired command.

For example, and as shown on the **Help** menu below, pressing the “dot” key (after removing this menu) while the system guides you to a point will invert the axis system on the palmtop display:

```
              Help
   L Longitudinal offset
   T Transverse offset
   C Reset offset
   . Invert axes
 Yes Stake out
 Clr Initialize guidance
PgUp/PgDn Zoom out/Zoom in
```

NOTE: You cannot view any **Help** menu while editing a parameter.

Other important keys

Esc

- Pressing the **Esc** key will take you back to the preceding screen, or will remove the **Help** menu from the screen, or will cancel the change you make on a parameter.

F4

- Pressing the **F4** key will allow you to quit the program. Confirm this choice by pressing ↵ (or press **Del** to cancel the request). Then a message is displayed asking you whether, in the same time, the receiver should be turned off (press the **Del** key) or not (press ↵).

F2

- Press the **F2** key when you are ready to record the position of a point.

F3

- Displays the current position.

Making changes to parameters

Depending on the size and type of the parameters that can be changed, the program will use different scenarios to let you make that change:

- If the screen contains numerical or alpha-numerical parameters, a blinking cursor will appear on the first of them.

  To change this parameter, simply type in the new value. Note that the position of the field on the screen will be shifted to the left while you edit it. If the size of the parameter is relatively long, an edit box will appear on top of the screen to show the entire field while you edit it.

  In both cases, the new value will be validated after you press ↵. Use ↓ or ↑ to access the next or previous field (respectively).

- If a parameter can only be set to some specific software-set values, then this field will be marked with a “▶”. To know the possible values and choose one of them, use ↓ or ↑ to access this field and then press →. A select box appears showing these values. Use ↓ or ↑ to choose the desired value and press ↵ to validate your choice (the select box is removed from the screen at the same time).

- **Messages and alarms:**

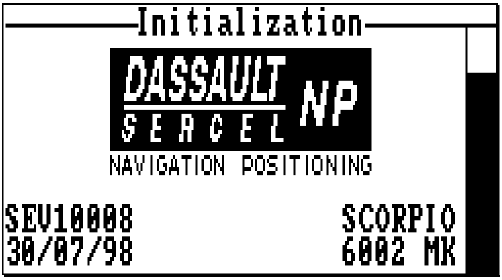
  - Alarm report:
    - Error or warning messages

  - The buzzer will sound in the following cases:
    - At the end of the initialization phase, not an alarm (beeps three times)
    - Whenever the system completes the recording of a point
    - Satellite alarm (brief 3-tone "down" sound every 6 seconds approx.)
    - Battery alarm (brief 3-tone "up" sound every 6 seconds approx.)
    - Invalid display request (brief 2-tone sound)
    - Invalid data entry (brief 2-tone sound)
    - Other errors (brief 2-tone sound).

Start-up sequence

Assuming the rover unit is now ready and you have the palmtop in hand, do the following:

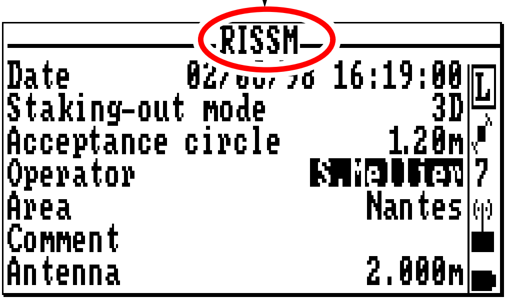
- From the DOS prompt, type in "S" or “s” and press ↵. The following screen appears denoting auto-tests in progress:



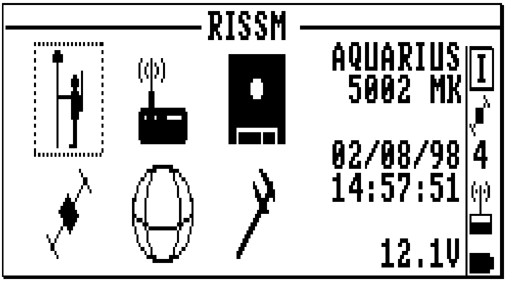
...

At the end of the auto-tests, the file (or files) relevant to the job present in the PCMCIA are transferred to the palmtop. Then the following is displayed suggesting that you should complete the header of the record file before you start the job.

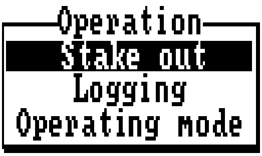
Job name appears on top of the screen



- The last 4 parameters can be changed on this screen (Operator name, Area name, comment, antenna height). Use ↑ or ↓ to access a field (the selected field is shown in inverse video). Validate each field in which changes are made by pressing ↵.
- When you agree with the content of this screen, press ↵ again. The main menu screen then appears.

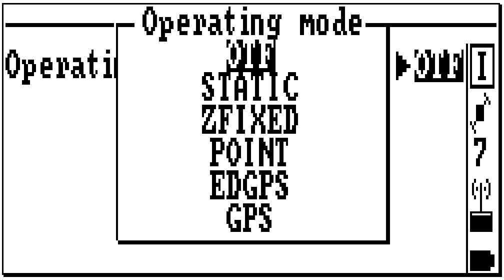


- Using ← or →, select the first icon. This icon represents an operator carrying a roving unit. When selected, this icon should be surrounded by a dotted frame (as shown above).
- Press ↵. This displays the menu window:



- Use the ↓ key to select **Operating mode** and then press ↵ again.
- As prompted by the symbol ▶ on the screen, press the → key to display the select window allowing you to select the operating mode.

- In the select window, choose **OTF**. This is the default selection (see page *3-44* for more information):



- Press ↵ to validate this choice.
- Press ↵ again to start the initialization sequence.
- When initialization is complete (this takes a few seconds), press the **Esc** key to come back to the main menu.

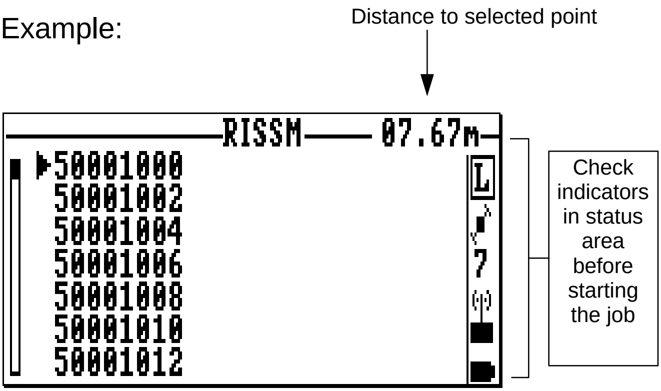
Staking Out

If the status of the data link remains bad, check the UHF parameters used (see page *3-35, Setting the data link*).

General Case

- With the first icon still selected, press ↵ and select **Stake Out**. The display now shows the list of target points you have to survey.

  Example:



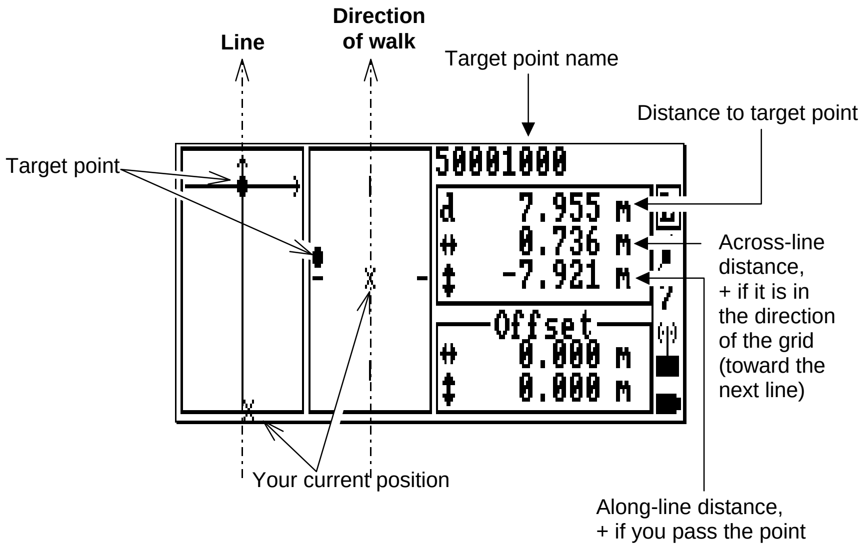
  Note that the distance to the selected point is indicated in the right-upper corner of the screen.

  Wait until the letter corresponding to the selected processing mode appears in the status bar (**L** for LRK, **K** for Kart, **E** for EDGPS, or **G** for GPS). Throughout the job, keep an eye on the status area (from bottom to top: battery voltage, data link level, count of satellites, and processing mode).

NOTE: OTF is the default initialization mode used in Kart or LRK.

3

- If required, use ↑, ↓, PgUp or PgDn to select another point.
- Press ↵ to start surveying the selected point. A guidance screen now appears to help you reach this point (see next page).
- Walk straight ahead by about 1 meter toward the presumed direction of the target point and then observe the two charts in the left-hand part of the screen.



The leftmost chart will trace your walk to the target point, starting from the position where you were (start position) when you selected that point. On this chart:

- the target point is represented by a (immobile throughout the procedure)
- Your position is represented by a

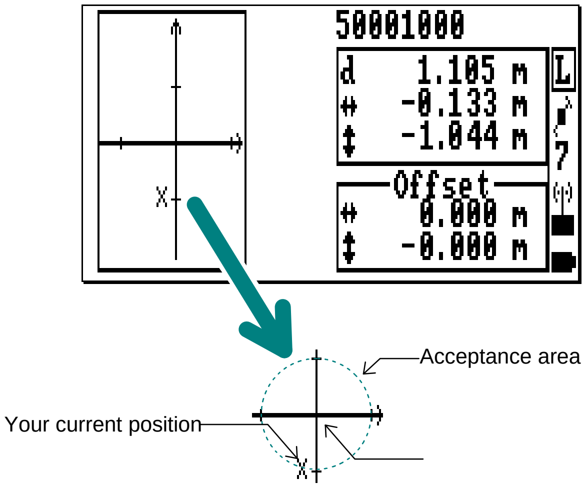
- The vertical axis represents the direction of the Line followed, if relevant. Otherwise (i.e. the target is an isolated point), this axis represents the direction defined by the target and *your* position *when you selected the target* (start position).
- The path you follow as you walk toward the target is represented by a dotted line starting from the start position.

The other chart provides visual indication on the direction to follow to reach the target. The vertical axis represents your current direction of walk. The same symbols as above are used to represent the target and your current position. The distance between the two symbols are not representative of the true distance.

- Correct your direction of walk according to these indications and then walk while continuing to read the screen for auto-correction of the path followed.
- If you realize that you cannot reach the target point, then refer to page *3-25*, *Staking Out with Offset*

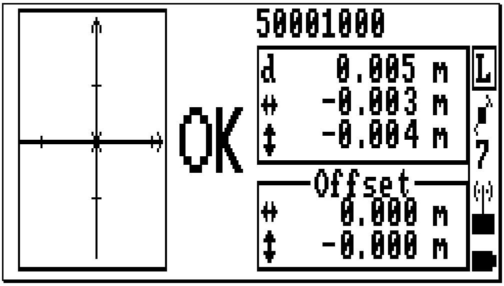
- When the distance to the target becomes less than 5 m, a new chart appears on the screen giving a magnified view of the area around the target point (± 5 m along each axis).
- When the distance to the target becomes less than 50 cm, the view is magnified a second time around the target point (± 0.5 m along each axis).

  Example in 3D (the acceptance area is a circle):

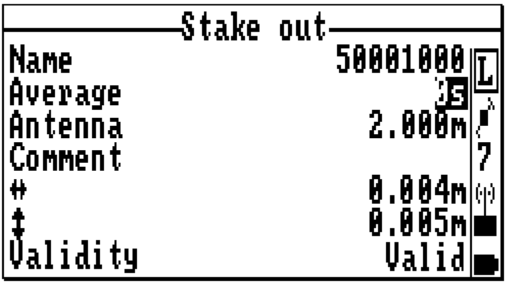


- When you enter the acceptance area, the **OK** message appears informing you that you are allowed to record the location of the point.

Before surveying the point, you can refine the GPS antenna position so that the "X" coincides accurately with the origin of the axis system, taking care to maintain the antenna mast in vertical position. As a result, the three components in the upper-right frame should be as close as possible to 0.000:



- When you are ready to record the point, press ↵. Below is the type of screen you should then obtain (example):



- The following parameters can be changed on this screen:

Average : Recording time span. The recorded position will result from the averaging of all the position solutions computed during this period of time.

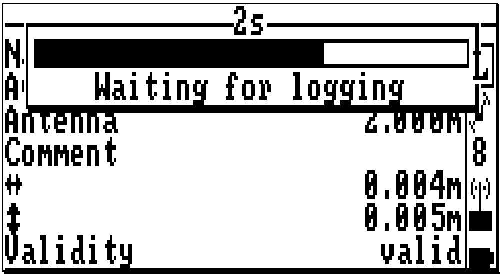
Warning! You will have to stay immobile during all this time. So do not choose it too long.

If you choose “0 s”, then the latest position solution available will be recorded as the point solution (no averaging).

Antenna : Antenna height, which for any reason, can be different from the value initially entered.

Comment : Information (text) which you want to associate with this point (optional).

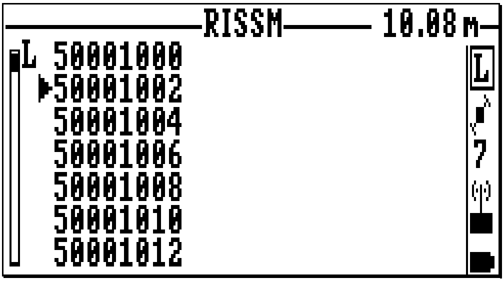
- While still maintaining the GPS antenna mast in position, press **<u>the F2 key</u>**. This starts the recording of the point. Stay immobile for the averaging time defined above. The following is displayed while the recording takes place:



The end of recording is denoted by the display of the points list on the screen. Note that the point you have just surveyed is now marked with a letter corresponding to the processing mode used (“L” for “LRK”, etc.).

The next point in the list is pre-selected to be the next point to be surveyed.

Example:



- Resume the same procedure for this point, and then for the next points in the list until the job is complete. Then press **F4** to quit the program.

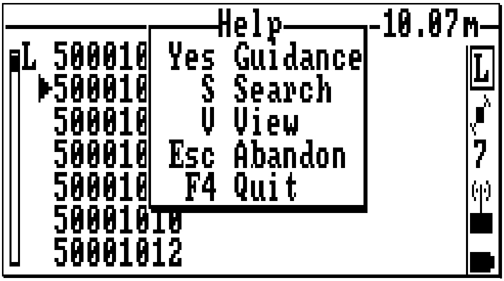
NOTES:

You can split a job into several work sessions. The palmtop software will ensure that all the results for this job are stored in the same results file, as if a single session had been performed for this job. Later, using SISS, the different sessions performed for a job can be identified by analyzing the content of the results file of this job.

You can perform logging operations while running a staking-out job

- Press the Esc key until the main menu is displayed
- With the “field operator” icon still selected, press ↵ and select **Logging** (then refer to page *3-32*).

When the points list is displayed on the palmtop, pressing F1 will display the following Help menu:



The first function, **Guidance** (Yes or ↵)**,** is in fact the function we have described earlier in this chapter. The next two functions are described below.

- **Searching for a point (S)**

  - If appropriate, press **Esc** to remove the Help menu from the screen
  - Press the **S** key. The following menu is displayed:

  - Select **nearest** if you want to find the point the closest to your current position. As a result, the name of this point will appear in the list with “ ►” preceding its name.
  - or select **by name** if you want to select a point according to name. The following edit box then appears in which you should enter the name of this point:

  - Enter this name and press ↵. As a result, the name of this point will appear in the list with “ ►” preceding its name.

NOTE: The ∗ key can be used as a “wild card”.
Examples:

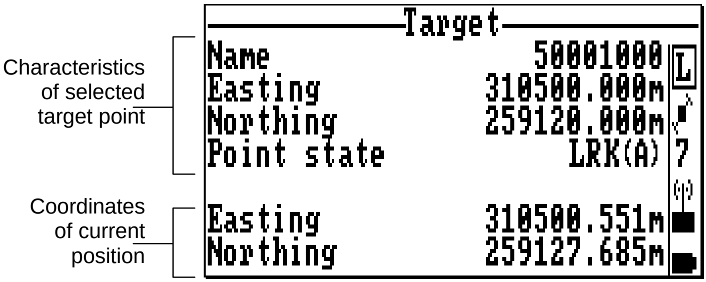
. Typing “7000∗” will result in the selection of the first point from the 7000 line (e.g.“7000 1000”).

. Typing “∗1000” will result in the selection of the first point — starting from the beginning of the file — whose name ends with “1000” (e.g.“0005 1000”).

- **Viewing the characteristics of a point (V)**

  - If appropriate, press **Esc** to remove the Help menu from the screen
  - Select any point within the list, using ↑ or ↓
  - Press the **V** key. A new screen appears providing information about this point. Your current position is also displayed in the lower part of the screen.

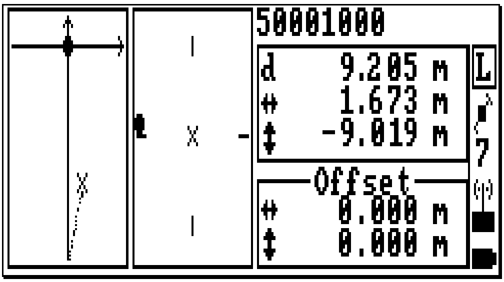
  Example:



Staking Out with Offset

You have followed the Staking Out procedure up to page *3-17* and you realize that you cannot reach the target point. In this case, you should resort to the Offset method to survey this point. This method is described below:

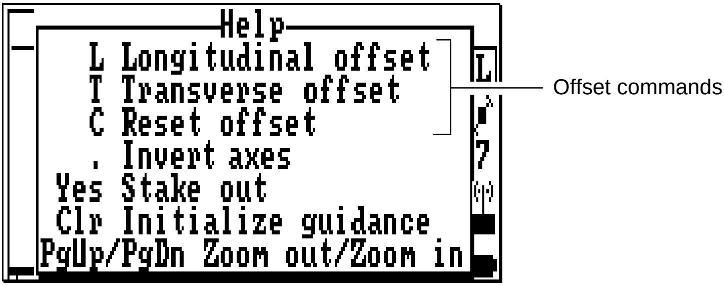
- Choose any location, in the neighbourhood of the target point, where you know point recording is possible (i.e. you check that GPS reception and the data link are good at this point)
- At this location, the screen indicates the components of the distance to the target. For example, with still the same target point as the one we surveyed in page *3-18*, we could for example obtain the following screen:



where the components of the distance to the target are:

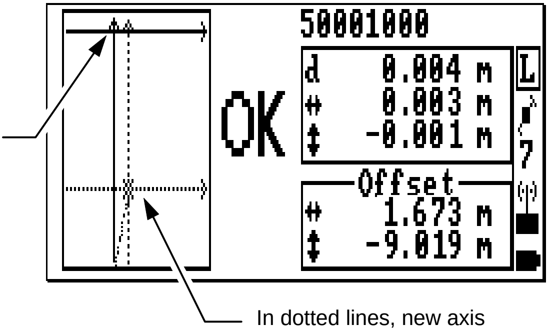
In the Offset method, you just have to complete the "Offset" area shown on the screen with these components and then record the point.

The offset method is based on the use of two commands controlled by the “T” and “L” keys. If you do not remember which letter to use, press F1 to display the context-sensitive Help menu (see below).

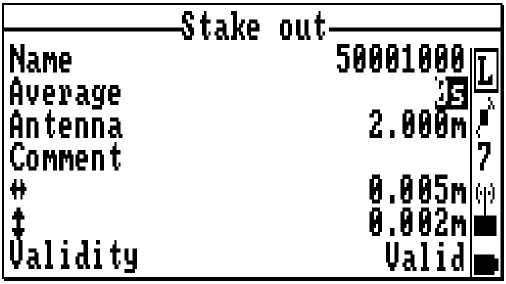


- If appropriate, press the Esc key to remove the Help menu and then press “T” to select the **Transverse offset** command.
- In the edit box which then appears, type in “1.673” and then press ↵ to validate this value.
- Press “L” to select the **Longitudinal offset** command.

In the edit box which then appears, type in “9.019” and then press ↵ to validate this value. As a result, the screen should now look like this:

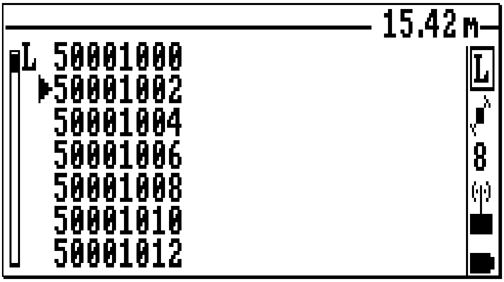


- When you are ready to record the point, press ↵. Type of screen then obtained (example):



- As in *Staking Out, General Case*, some of these parameters can be changed or completed (see page *3-20*).
- While still maintaining the GPS antenna mast in position, press **the F2 key**. This starts the recording of the point. Stay immobile for the average time defined in the preceding screen.

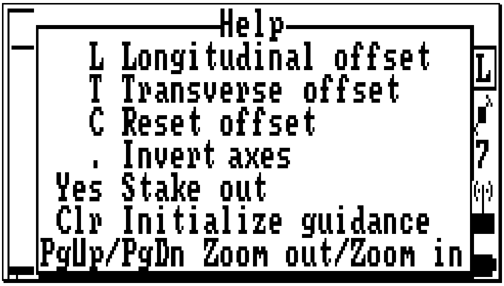
The end of recording is denoted by the display of the points list, back on the screen. Note that the point you have just surveyed is now marked with a letter corresponding to the processing mode used (“L” for “LRK”, etc.).



NOTE: After staking out a target point through the offset method, remember that the components you have defined in the offset frame will be displayed as defaults for the next point. You can clear these fields by simply pressing the C key (see Help menu below).

Staking-Out Help menu

As seen earlier (see page *3-26*), at any time during your walk to a target, when the palmtop gives you visual guidance, pressing F1 will cause the following Help menu to be superimposed on the charts:



The commands displayed in this menu are described below. Press the corresponding key (indicated at the beginning of the line) after pressing **Esc** to remove the Help menu from the screen.

Longitudinal Offset : Gives access to the "Longitudinal Offset" field (‡; see page *3-26*). Press "L".

Transverse Offset : Gives access to the "Transverse Offset" field (⇹; see page *3-26*). "Press T".

Reset Offset : Clears the above two fields. Press "C".

Invert axes : Inverts the axis system used on the left-hand guidance chart. Pressing the "dot" key will cause the orientation of the two axes to be inverted. This command operates as a toggle.

Stake Out : Will switch the palmtop to the Stake Out screen (only if **OK** is displayed beside the charts). Press ↵.

Initialize Guidance : Initializes the tracing of your walk to the target. Pressing the **Clr** key will cause the trace to be deleted and the “X” to go back to the lower part of the chart.

Zoom Out/Zoom in : Zoom commands relative to the guidance charts. Press the **PgUp** key to zoom out, or the **PgDn** key to zoom in. See also the note below

---

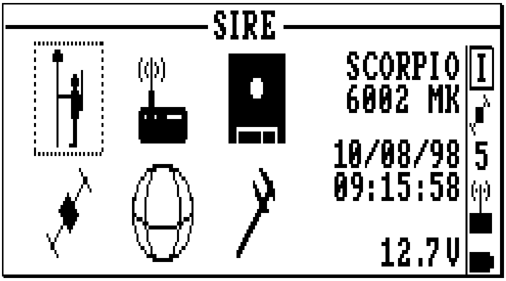
NOTE: Four different zoom settings are possible:

- Large scale (> 5m), two charts
- Medium scale (< 5 m), two charts
- Small scale (< 50 cm), a single chart
- Very small scale (<15 cm), a single chart

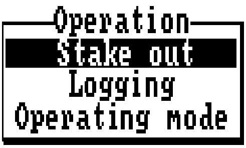
Zooming in is automatic as you approach the target whereas zooming out is manual (by pressing the **PgUp** key). If you zoom out and you are close to the target, zooming in is then also manual (by pressing the **PgDn** key).

Logging

- Select the **Main Menu** screen.

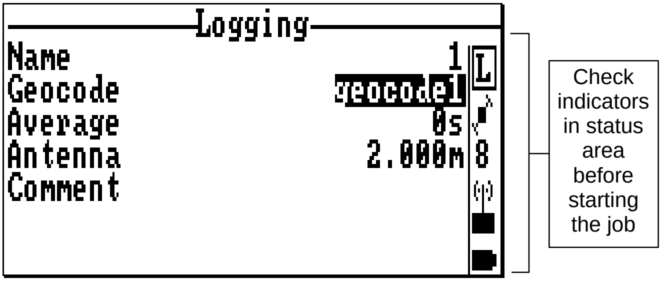


- Select the first icon.
- Press ↵. This displays the following select window:



- As described earlier (see pages *3-13* and *3-14*), choose the **Operating mode** (OTF or other) and let the receiver complete its initialization phase.

- Then from the **Main Menu** screen, with the first icon still selected, press ↵ and select **Logging**. The following screen then appears:

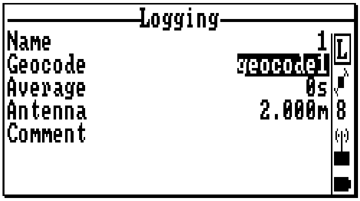


Unless **L**, **K**, **E** or **G** (according to the operating mode selected) is now displayed in the status area, wait for this letter to appear before proceeding with your work. Throughout the job, keep an eye on the status area (from bottom to top: battery voltage, data link level, count of satellites, and processing mode).

NOTE: OTF is the default initialization mode used.

- Walk to the first point you want to log.

- When you arrive at the point, complete the screen according to the instructions below.



Name : Point name. “1” by default when first logging a point in a job. If you choose this name, then “2” will be automatically prompted for the next point.

Geocode : Geocode field, 12 characters max, optional parameter.

You can define the content of this field in such a way that external software can sort out points according to the character string placed in this field.

Average : Recording time span. The recorded position will result from the averaging of all the position solutions computed during this period of time.

Warning! You will have to stay immobile during all this time. So do not choose it too long.

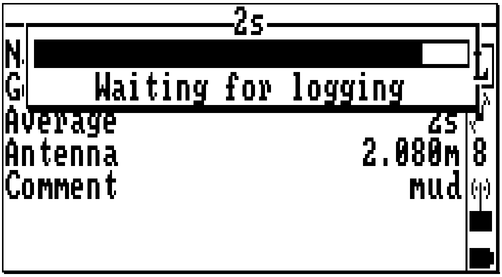
If you choose “0 s”, then the latest position solution available will be recorded as the point solution (no averaging).

3

Antenna : Antenna height, which for any reason, can be different from the value initially entered.

Comment : Information (text) which you want to associate with this point (optional).

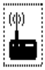
- While maintaining the GPS antenna mast in position, press **the F2 key**. This starts the recording of the point. Stay immobile for the averaging time defined above. The following is displayed while the recording takes place:

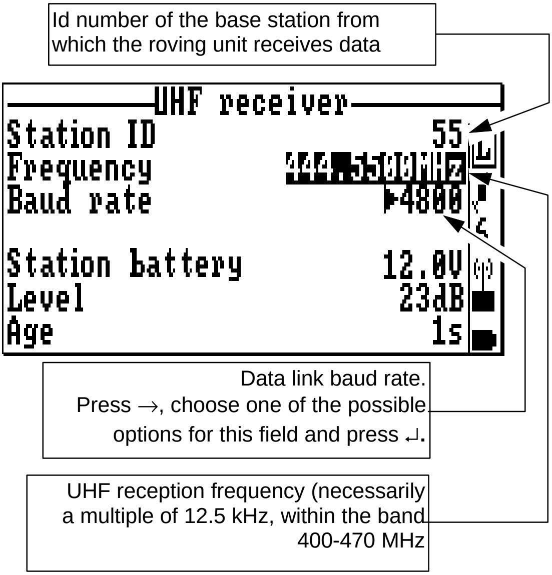


- Resume the same procedure for the next points. When the job is finished, press **F4** to quit the program.

Auxiliary functions

Setting the data link

- From the main menu, select :
- Press ↵. A new screen appears on which you can change the first three parameters (the other 3 are read-only).



3

The last 3 parameters are:

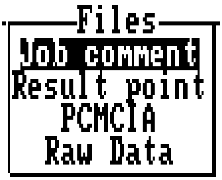
Station battery : Output voltage of the battery supplying the base station with power. This information is routed via the data link.

Level : Current UHF reception level, expressed above reference threshold

Age : Time elapsed since latest reception from base station (time expressed in seconds).

File Management

- From the main menu, select the third icon: 
- Press ↵. Four commands are then available from the function menu window which then appears:



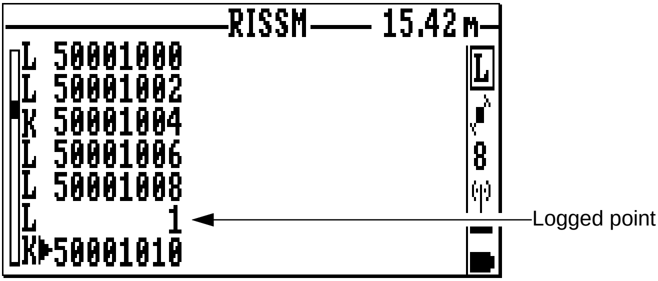
- Select the desired one and press ↵ again. The four commands are described below:

- **Job comment**

Gives access to the job file header, which you can edit as if you were starting the job (refer to *Start-up sequence*, page *3-12*).

- **Result Points List**

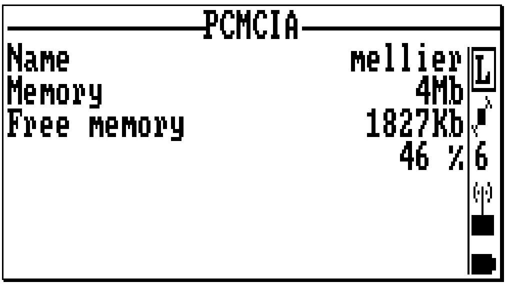
Gives access to the result points list. All surveyed points are listed whether they result from staking-out or logging.



The V key allows you to view the parameters associated with each recorded point (see page *3-22*).

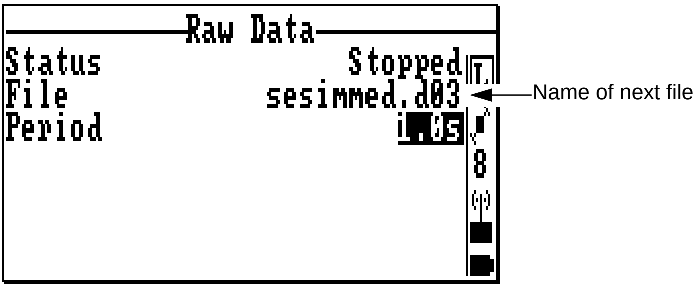
- **PCMCIA card**

This screen gives information about the PCMCIA card currently inserted into the receiver (name, nominal capacity, free memory space).

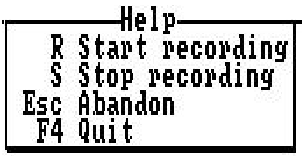


- ## Raw Data

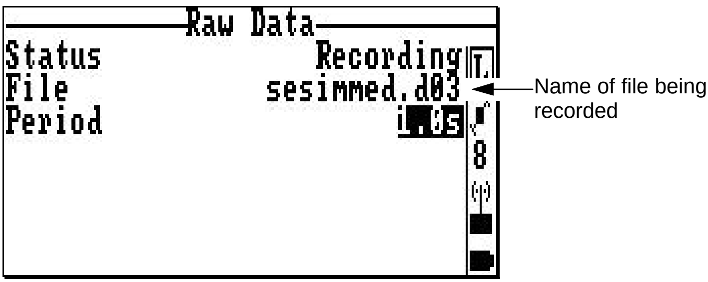
This screen allows you to control the recording of GPS raw data.



- Press F1 to display the **Help** menu:



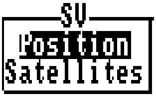
- After pressing **Esc** to remove this menu, pressing **R** will allow you to start recording GPS raw data.



Recording will take place until you come back to this function and you press **S** to stop recording. This will cause the extension of the record file to be incremented by 1, thereby making the system ready for the next data recording.

Visible GPS Constellation

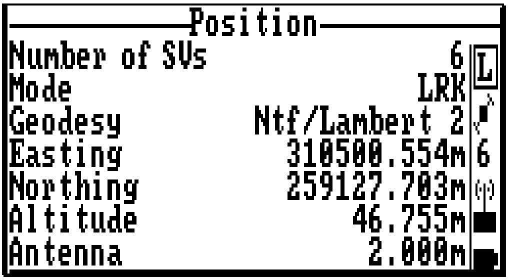
- From the main menu, select the fourth icon: 
- Press ↵. Two commands are then available from the function menu which then appears:



- Select the desired one and press ↵ again. The two commands are described below:

- **Position**

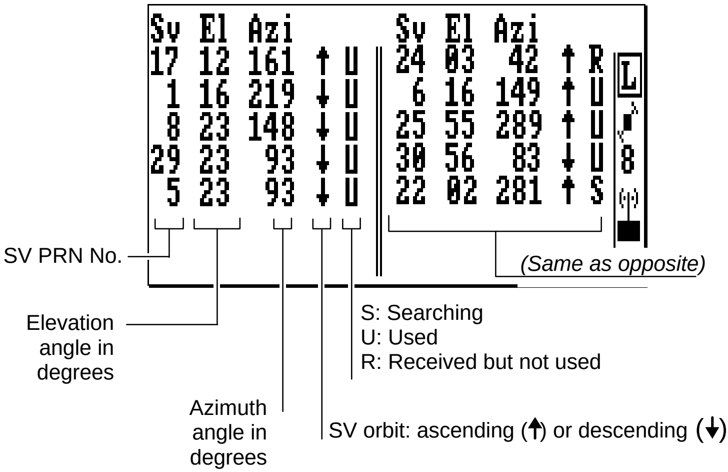
This screen gives information about your current location (count of SVs used in the current position solution, processing mode, coordinate system used, coordinates of the solution, GPS antenna height setting).



3

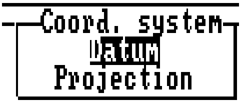
- ## Satellites

This screen gives information about the GPS constellation visible from your current location.



Coordinate System Used

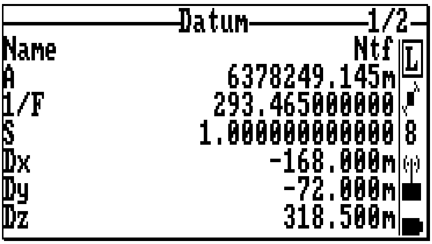
- From the main menu, select the fifth icon: 
- Press ↵. Two commands are then available from the function menu which then appears:

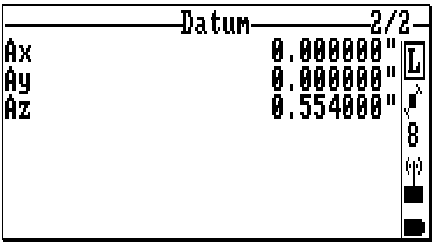


- Select the desired one and press ↵ again. The two commands are described below:

- **Datum**

This screen gives the characteristics of the datum used. As shown in the example below, this information is presented on two screens. Use the PgUp and PgDn keys to change screen.

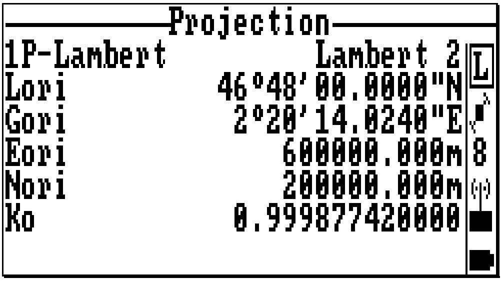




3

- **Projection**

  This screen gives the characteristics of the projection used (see example below).



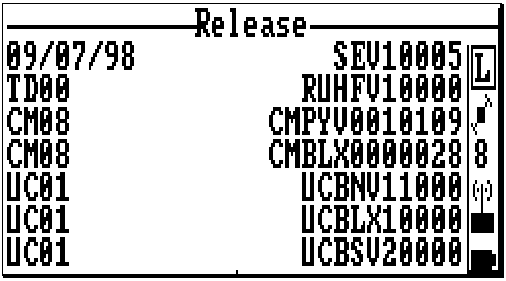
System Tools

- From the main menu, select the fifth icon: 
- Press ↵. Two commands are then available from the function menu which then appears:

- Select the desired one and press ↵ again. The two commands are described below.

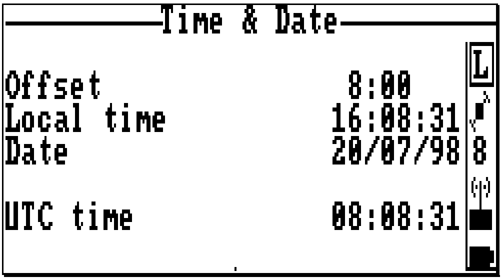
- **Release**

This screen gives information about the versions and revisions of the hardware elements composing the system.

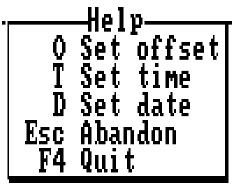


- **Time**

This screen allows you to read/change the local time.



Press **F1** to display the Help menu. Use the key-letters shown in this menu to change the time & date.



Initialization modes and processing modes

By default, the rover unit is initialized in LRK *processing mode* through the OTF *initialization mode*.

If the receiver is single-frequency (L1), the rover unit will be initialized in KART *processing mode*, also through OTF *initialization mode*. These two modes achieve centimetric accuracies.

The EDGPS *processing mode* achieves metric accuracies (this mode is used implicitly during initialization.

The use of the GPS *processing mode*, which is the least accurate of the available modes, can however be envisaged to initialize the position processing in the receiver when the data link is absent or bad.

The definitions of the different *initialization modes* possible in KART and LRK are recalled below.

- **OTF** ("On the Fly") : Initialization with rover unit in motion, start point unknown
- **STATIC** : Initialization with rover unit at a standstill (to within 1 cm) and point unknown
- **ZFIXED** : Initialization with rover unit in motion, start point unknown, but rover unit altitude remains constant throughout the initialization phase
- **POINT** : Initialization from a known point. When you select this mode, the rover unit lets you edit the coordinates of this point or choose it from a file that you select. ♣

A. Troubleshooting &Software Installation

A

GNSS Receiver Status Display

Introduction

The GNSS receiver used at the base station or as the rover unit is fitted with a 2-line $\times$ 16-character display which allows you to check its current operating status. A **Scroll** pushbutton on the front panel allows you to access the different data available from this display.

When you turn on the receiver, the following message appears on the status display until the self-tests are complete:

```
DASSAULT  SERCEL
*GNSS  RECEIVER *
```

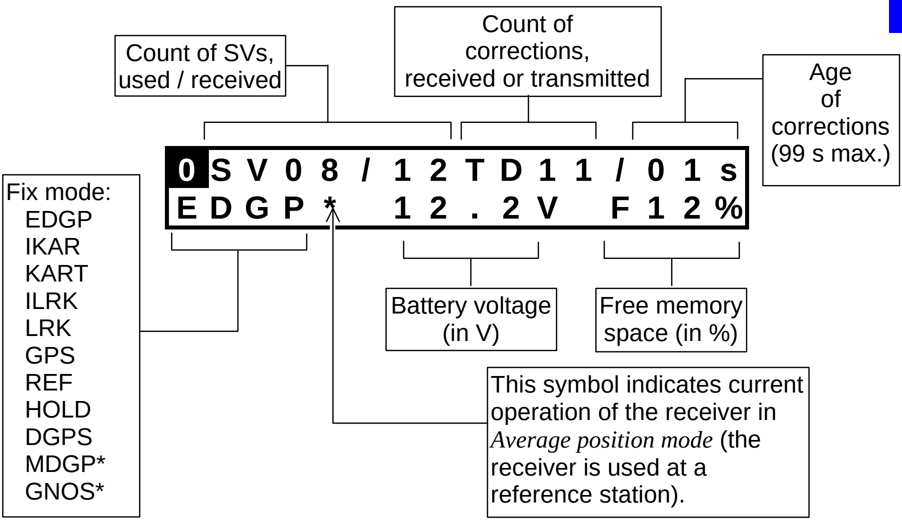
Then the status display changes as the receiver status changes. Ten different screens have been designed to describe the receiver's internal data (status, configuration, software versions). You only need to use the **Scroll** pushbutton located on the front panel to access each of these screens. A long press on this button will unconditionally take you back to screen No. 0 (the most important one at receiver start up).

Each screen is identified by a number to help you navigate through the set of screens. The screen number is located at the beginning of the upper line:

When the amount of data is too large to fit on a single screen, several "subscreens" are created for this screen. In this case, the screen number is recalled at the beginning of each subscreen. Use the same button (the **Scroll** pushbutton) to access the different subscreens (and then to access the next screen).

Screen No.0: Operating Status

At the end of the self-tests, status screen No. **0** appears. Display example:



- **Fix mode**

EDGP (EDGPS) : Enhanced DGPS
IKAR : Kinematic Application Initialization
KART : Kinematic Application Real Time
ILRK : Long-Range Kinematic Initialization
LRK : Long-Range Kinematic
GPS : "pure" or "straight" GPS
REF : User-set reference position (for a station only) (not a computed position)
HOLD : No position solution available
DGPS : Differential GPS
MDGP (MDGPS) : Multi-differential GPS (*: future use)
GNOS : Fix from geostationary SVs (*: future use)

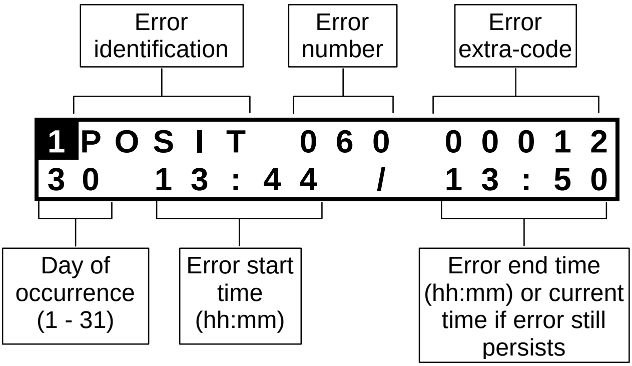
Screen No. **0** (refresh rate: 1.0 second) will be maintained on the status display until you depress the Scroll button.

If an error is detected in the receiver (anomaly, etc.), the screen number will start blinking, prompting you to have a look at screen No.1 to know more about the detected error(s). Unless the detected error still persists, it is simply acknowledged when quitting the screen reporting that error.

With screen No. 0 currently displayed, depressing the **Scroll** pushbutton repeatedly will cause new screens to appear in the order given below.

Screen No. 1: Error report

Depending on the number of errors detected (none, one or more), several subscreens for screen No. 1 may exist. Display example:



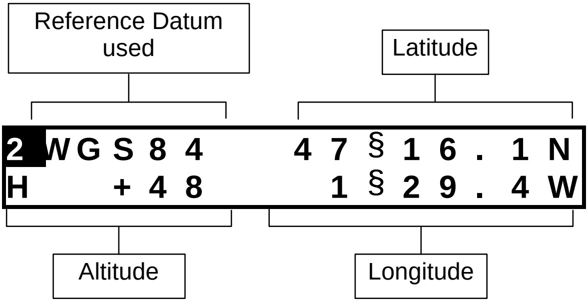
The list of all the possible errors is given in the *Error list* chapter, page *A-14*.

A

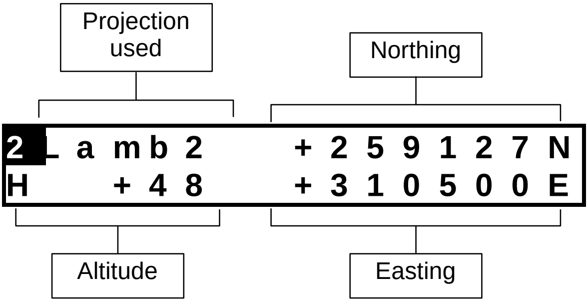
Screen No. 2: Position solution

Depending on the coordinate system used (with or without projection), this screen can be of two different types:

Without projection (example):



With projection (example):

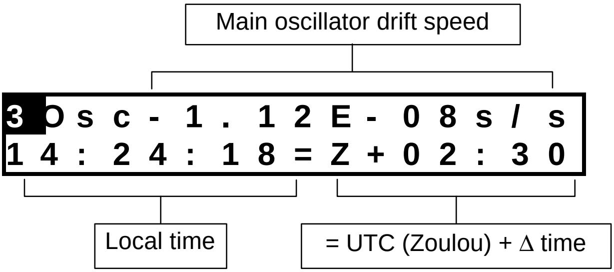


If no solution is available ("HOLD" displayed on screen No.0), this screen will display the "initial position", as defined by the configuration, or the latest position computed in case of lasting solution unavailability, due to reception loss for example.

The position displayed is not for navigation purposes. As it is only a coarse indication of the current position, it does not reflect the real degree of accuracy achieved by the position solution.

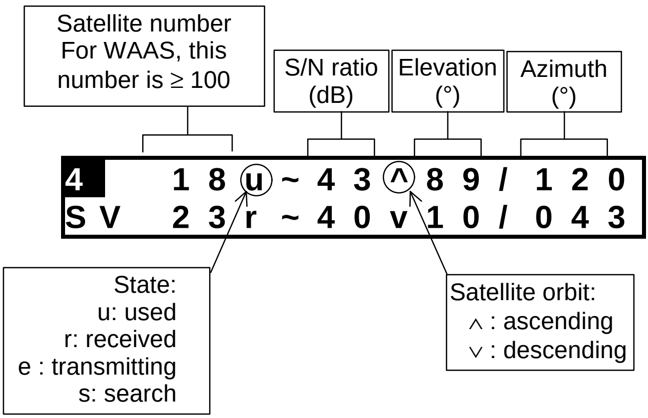
Screen No. 3: Time information

Display example:



Screen No. 4: GNSS reception status

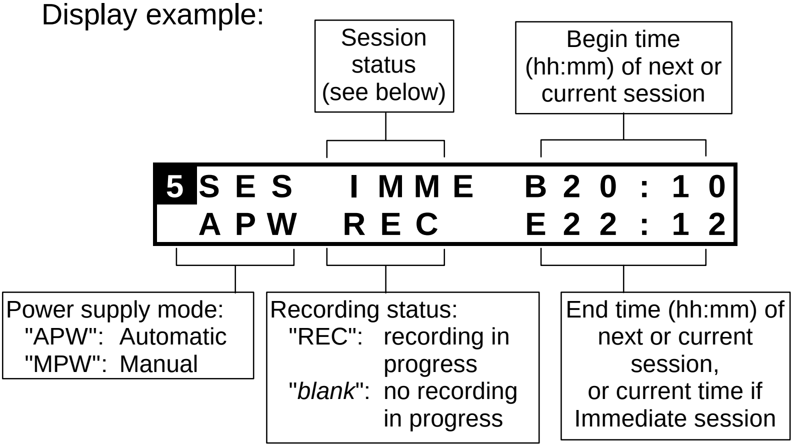
Each line describes the reception of a satellite. Hence, two satellites are shown on a subscreen and *n* subscreens will exist if *2n* (or *2n-1)* satellites are received. Display example:



Screen No. 5: Information about sessions

- **At the base station:**

The current or pending session is described on the screen. Display example:



Power supply mode:

APW : If this option is active, sessions control the power supply of the receiver. The ON/OFF pushbutton is still usable but it won't turn off the receiver if a session is in progress.

MPW : If this option is active, sessions have no control on the power supply of the receiver. Only the ON/OFF pushbutton has.

Session status:

ON : Programmed sessions are run once

CYCL : Programmed sessions will be repeated, if this may happen

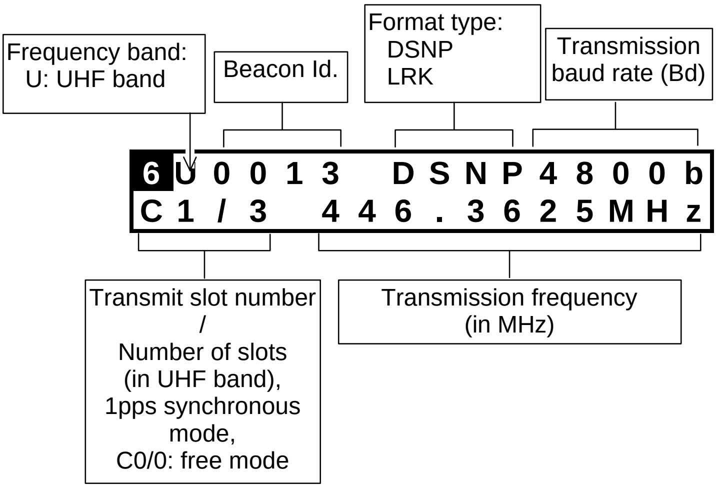
IMME : Immediate recording session in progress. Data recorded on PCMCIA (if option installed)

END : All sessions are disabled, or ends the immediate session.

Screen No. 6: Information about corrections

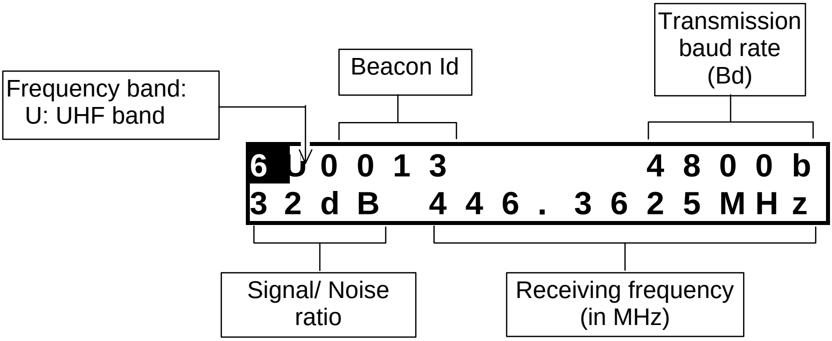
- **At the base station:**

Display example:



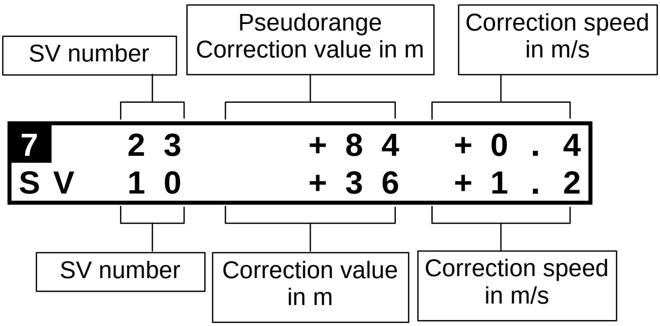
- **On the rover unit:**

  Display example:



Screen No. 7: Differential corrections

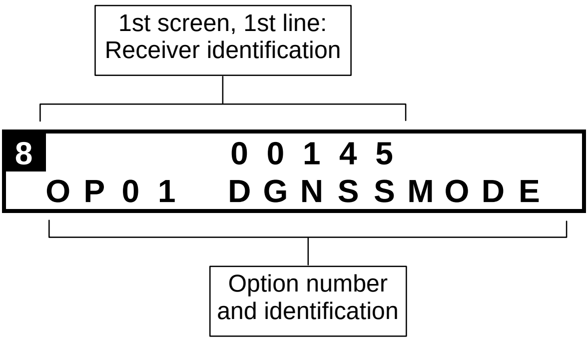
Each line describes the correction to be applied to a measurement made from the satellite specified in the line. Hence, two corrections are shown on a subscreen and *n* subscreens will exist if *2n* (or *2n-1)* corrections are computed/received. Display example:



Screen No. 8: Firmware installed

The first line indicates the serial number of the receiver. Each of the next lines identifies a firmware option installed in the receiver. The number of subscreens for screen No. 8 will depend on the number of options installed.

Display example:



- OP02 : REFSTATION (600x Sx, an option for 600x Mx)
- OP03 : KARTMODE (6002)
- OP04 : LRKMODE (6002, an option for 6001)
- OP05 : USERGEOID (not available yet)
- OP06 : RECORDING
- OP07 : QA/QC (not available yet)

Screen No. 9: Hardware and Software identification

Each subassembly in the receiver is described on a subscreen. Display examples:

Data Link:

```
9 T D 2 0   E U H F V 1 0 0 0 0
```

or

```
9 T D 0 0   R U H F V 1 0 0 0 0
```

GNSS Engine:

```
9 C M 0 8   C M B L V 0 0 0 0 1
  C M 0 8   C M P Y V 0 0 0 0 1
```

UC (CPU) board:

```
9 U C 0 0   U C B S V 1 0 0 0 0
  U C 0 0   U C B L V 1 0 0 0 0
```

```
9 U C 0 0   U C B N V 1 0 0 0 0
```

Hardware identification | Software identification

GNSS Receiver Front Panel Indicators

ON/OFF indicator	**Scroll** indicator	**Meaning**
OFF	OFF	Receiver not powered. If this status is obtained after pressing the ON/OFF pushbutton, check power supply connection (cable, connectors), power source, power voltage, rear panel fuse. If connections are okay and this status is obtained after a period of operation (status possible only at a base station), this means that the receiver has completed the programmed sessions and the receiver is now OFF due to automatic power supply control.
Flashing	OFF	Self-tests in progress (initialization phase)
ON	OFF	Operating receiver. No pending session at the base station.
ON	Flashing	At base station only: operating receiver, due to manual power supply control. Pending session.
OFF	Flashing	At base station only: receiver in standby, due to automatic power supply control. Pending session.
ON	ON	Recording on PCMCIA in progress.

GNSS Receiver Error report

Errors are reported on the status display, on Screen No.1. Each error occupies a "subscreen" (see *Screen No. 1: Error report* chapter, page *A-4*).

A

Error families

Errors are classified into families, depending on the probable origin of error. The table below summarizes the 11 different error families

Family number	Origin	Error label
00	No errors	NONE
01	Core Module	CM
02	Application Configuration	CONFG
03	DGPS	DGPS
04	Coordinate system	GEODY
05	Input/Output	I/O
06	User Interface	IHM
07	Power supply/interface	INTRF
08	Navigation	NAVIG
09	Fix processing	POSIT
10	System	SYSTM
11	Data link	TD

Error classification

Errors are classified into four categories depending on gravity:

- Simple information reported to user (code 1)
- Warnings (code 2). The receiver operates correctly but might be disturbed by the reported error.
- Serious errors (code 3). The receiver operates but delivers erroneous results.
- Fatal errors (code 4). The receiver can no longer operate correctly. You should re-initialize the receiver.

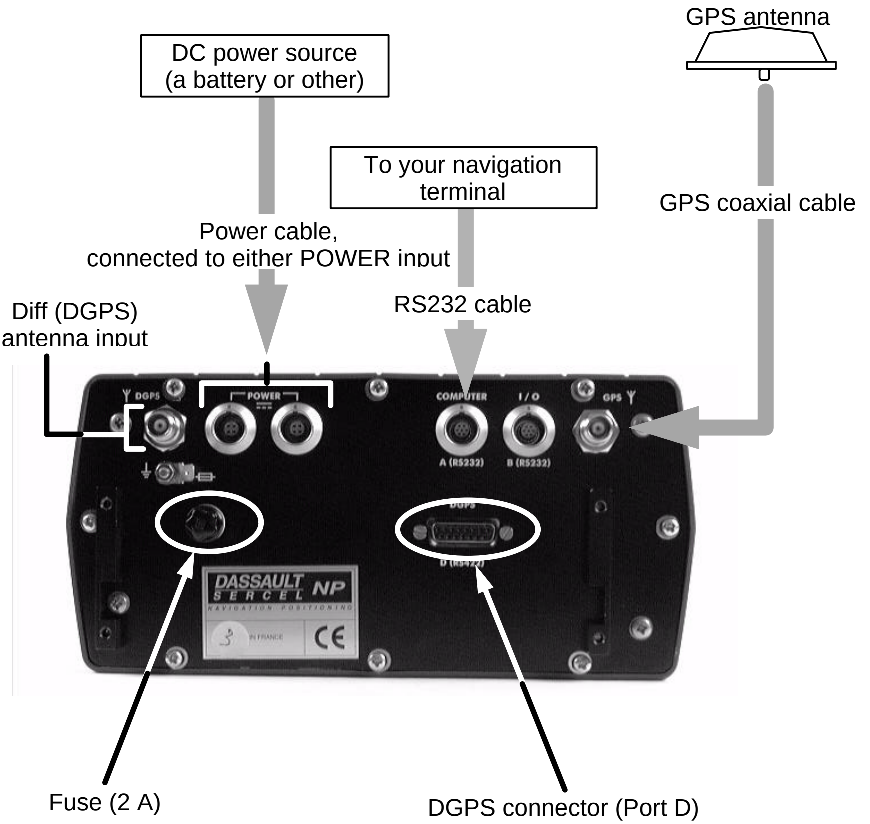
Error list

No.	Family	Gra-vity	Meaning	Error label
01	1 - CM	4	GPS not ready	GPS not ready
02	1 - CM	4	RAM error	RAM anomaly
03	1 - CM	3	Processor error	Processor anomaly
04	1 - CM	3	Timing error	Timing anomaly
05	1 - CM	3	Program memory error	Program memory anomaly
06	1 - CM	3	Data memory error	Data memory anomaly
07	1 - CM	3	Reception circuit error	Reception circuit anomaly
08	1 - CM	3	Correlation circuit error	Correlation circuit anom
09	1 - CM	4	C/A-P/YCommunication error	Communication C/A - P/Y
10	1 - CM	2	Non-used output data	Unread output datas
11	1 - CM	2	Non-identified input data	Unknown input datas
12	1 - CM	2	Non-complying input data	Bad input datas
13	1 - CM	1	GPS data error	GPS data anomaly
14	1 - CM	1	DPRAM error	DPRAM anomaly
15	1 - CM	1	Erroneous message length	Bad message length
16	1 - CM	1	EEPROM error	EEPROM anomaly
17	1 - CM	3	Trigger time-tag errorError	Datation Trigger Error
18	2 - CONFG	4	Conf integrity altered	Bad config integrity
19	2 - CONFG	3	Config parameter error	Config parameter error
20	3 - DGPS	3	No transmitting station	No sending dtation
21	3 - DGPS	3	CPU-DIFF overflow	CPU-DIFF overflow
22	4 - GEODY	3	Coordinate system error	Geodesy error
23	5 - I/O	2	Unknown remote command	Unknown telecommand
24	5 - I/O	2	Non-complying param. format	Bad parameter format
25	5 - I/O	2	Non-complying format block	Bad block format
26	5 - I/O	3	Command checksum error	Bad telecommand checksum
27	5 - I/O	3	DPR1 Input error	Input error on DPR1
30	5 - I/O	3	Non-complying LRK block	Bad LRK block on port D
31	5 - I/O	3	Port A Overflow	Overflow PortA
32	5 - I/O	3	Port B Overflow	Overflow PortB
33	5 - I/O	3	Port C Overflow	Overflow PortC
34	5 - I/O	3	Port D Overflow	Overflow PortD
35	5 - I/O	2	Format interpretation error	Format interpretation
36	5 - I/O	3	Port A Input error	Input error PortA
37	5 - I/O	3	Port B Input error	Input error PortB
38	5 - I/O	3	Port C Input error	Input error PortC
39	5 - I/O	3	Port D Input error	Input error PortD
40	6 - IHM	2	User Interface error	IHM error
41	7 - INTRF	4	Xilinx Load	Xilinx Load

42	7 - INTRF	4	Low Power Command	Low Power Command
43	7 - INTRF	3	PCMCIA overflow	PCMCIA overflow
44	7 - INTRF	3	File system full	File system full
45	7 - INTRF	2	PC board not recognized	Unknown PC card
46	7 - INTRF	4	Battery voltage too low	Battery voltage
47	7 - INTRF	3	Corrupted file system	Corrupted file system
48	7 - INTRF	4	First antenna error	First antenna error
52	7 - INTRF	3	File-opening error	File open error
53	7 - INTRF	3	File-closing error	File close error
54	7 - INTRF	3	File-writing error	File write error
55	7 - INTRF	3	File-reading error	File read error
56	8 - NAVIG	3	Navigation error	Navigation error
57	9 - POSIT	1	No differential reception	No differential reception
58	9 - POSIT	1	Too few Svs	Too few Svs
59	9 - POSIT	1	GDOP too high	GDOP too high
60	9 - POSIT	3	LPME too high	LPME too high
61	9 - POSIT	1	No fix computation	No fix computation
62	10 - SYSTM	2	Frozen display	Frozen display
63	10 - SYSTM	2	Unknown option code	Unknown option code
64	10 - SYSTM	4	C3 codes checksum error	Bad checksum codes C3
65	10 - SYSTM	2	Log checksum error	Bad log checksum
66	10 - SYSTM	4	Real-time clock	Real Time Clock
67	10 - SYSTM	4	Dual-port RAM	Dual port RAM
68	11 - SYSTM	4	Core module not ready	Core module not ready
69	10 - SYSTM	4	Program checksum error	Bad program checksum
70	10 - SYSTM	4	Data memory test	Data memory test
71	10 - SYSTM	4	Coprocessor test	Coprocessor test
72	10 - SYSTM	4	Serial port error	Error on serial port
73	10 - SYSTM	3	IDE file system mounting error	File system IDE mount err
74	10 - SYSTM	1	Option lending period has now elapsed	Option no more available
75	10 - SYSTM	4	Nb d'essai options depasse	Max option tries reached
76	10 - SYSTM	1	Journal full	Full anomalies journal
77	10 - SYSTM	3	CMOS date failed	CMOS date Failed
78	11 - TD	4	Selftest error	Autotest error
79	11 - TD	3	Erroneous blocks	Bad blocks
80	11 - TD	1	Count of restarts since selftest	Nb restart since autotest
81	10 - SYSTM	3	Mailbox overflow	Mailbox overflow
82	10 - SYSTM	3	PCMCIA removed	PCMCIA removed
83	5 - I/O	3	DPR1 Overflow	Overflow DPR1
87	10 - SYSTM	3	Line in CM file too long	Line file CM too long
88	10 - SYSTM	3	CM identification error	Identification CM error
89	10 - SYSTM	3	CM card file inconsistency	Incoherence file

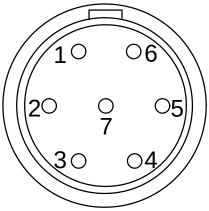
				card CM
90	10 - SYSTM	3	Flash CM clear error	Clear flash CM error
91	10 - SYSTM	3	CM program loading error	CM program file load error
92	6 - IHM	3	Kinematic mode change	Kinematic mode change
93	6 - IHM	3	No position computed	No computed position
94	7 - INTRF	4	Binary file inconsistency	Binary file incoherent
95	10 - SYSTM		RTC send error	RTC send error
96	4 - GEODY		Altimetry error	Altimetry error
97	10 - SYSTM		Applic software Re-load error	Appli soft reload error
98	10 - SYSTM	4	Protected memory error	Back memory failure
99	10 - SYSTM	4	Stack overflow	Stack overflow
100	5 - I/O	2	Error on port A in reception	Receiving error on port A
101	5 - I/O	2	Error on port B in reception	Receiving error on port B
102	5 - I/O	2	Error on port C in reception	Receiving error on port C
103	5 - I/O	2	Error on port D in reception	Receiving error on port D
104	10 - SYSTM	1	Unexpected software error	Software error

GNSS Receiver Rear panel Connectors



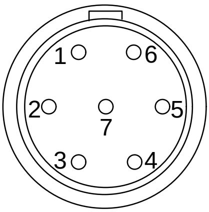
A

COMPUTER connector,
(RS232 Port A),
type: JKX FD1G 07 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



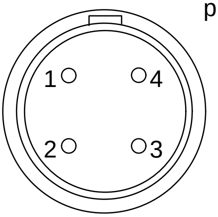
Pin	Signal	
1	+12 V	output
2	TXD	output
3	RXD	input
4	REMOTE ON	input
5	GND	
6	CTS	output
7	RTS	input

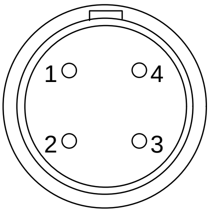
I/O connector,
(RS232 Port B),
type: JKX FD1G 07 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



Pin	Signal	
1	+12 V	output
2	TXD	output
3	RXD	input
4	Not used	
5	GND	
6	CTS	output
7	RTS	input

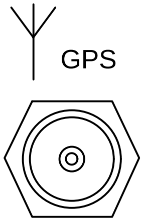
POWER connector
type: JKX FD1G 04 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



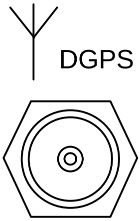


Pin	Signal
1	+ Power input
2	+ Power input
3	- Power input
4	- Power input

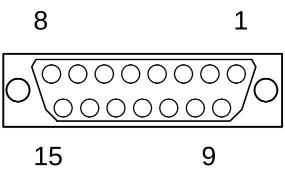
TNC-male
coaxial connector
(GNSS antenna input)



TNC-male
coaxial connector
(to/from optional DGPS
antenna)

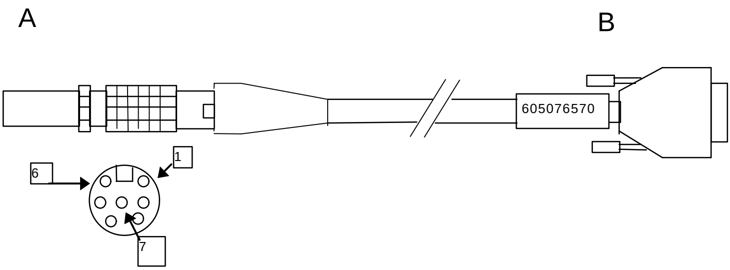


DGPS
connector
(RS422 Port D), pin view,
15-C SubD-female type.
For exclusive use by DSNP UHF
transmitter



Pin	Signal	
1	TXD+	output
2	TXD-	output
3	RXD+	input
4	RXD-	input
5	Not used	
6	GND	
7	GND	
8	+12 V	output
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Not used	

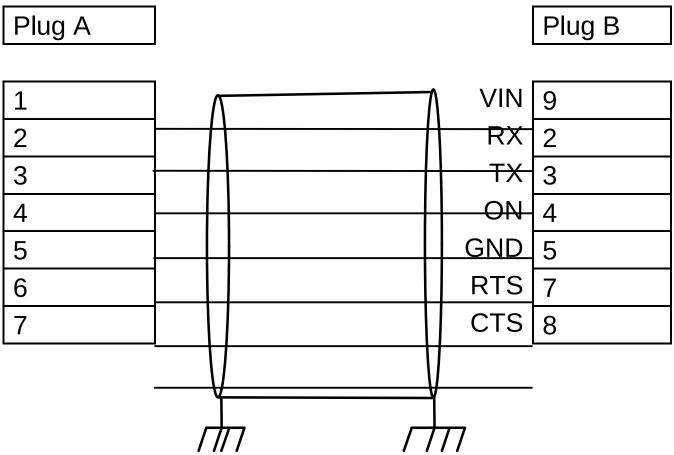
RS232 cable



A is a 7-contact JKX FD 1G 07 MSSDSM (5011253) plug with JBX1 MPN (5080359) sleeve. Manufacturer: FCI.

B is a 9-contact female subD DE-9S (5030357) connector with metal cover 8655MH09-11 (5080357). Manufacturer: FCI.

Shielded cable, 4-pair, FMA2R (6030097). Overall length 2 m.



FSGS Palmtop Computer

FSGS Palmtop Configuration

- **DOS partitioning**

In the version delivered by the manufacturer, the FSGS palmtop computer comes with 640 kbytes of memory space reserved for the DOS.

To install the Palmtop software into the palmtop, this space should be reduced to 480 kbytes. All FSGS palmtops from DSNP are shipped in that configuration.

If for any reason, the disk of a palmtop needs to be re-formatted, refer to page *A-26*, *Reformatting the disk.*

- **Battery charging**

At equipment delivery, the FSGS is fitted with alkaline cells: **<u>The first thing you have to do is to remove these cells</u>** and replace them with the NiCd battery provided separately.

The FSGS has been configured in order that battery charging can take place from a power source present on its RS232C connector.

After connecting an un-powered FSGS to an operating (powered) receiver, the `"Charging in progress"` message should appear on the FSGS display. If not so, please refer to page *A-30*, *No "charging in progress" message*.

Warning!

To avoid pressurisation problems inside the FSGS when it is taken on an airline trip, the battery cap has been loosened before shipment. Do not forget to lock this cap as this is required to maintain proper sealing.

Software loading

At equipment delivery, the FSGS palmtop is ready for use, which means that the Palmtop software is present in the palmtop.

However, in case of software upgrades or disk re-formatting, you will have to re-load the software on your own, using the procedure described below.

- **Running HCOM Communications utility**
    - Connect the palmtop to a PC-type computer using the 9-pin f/f cable provided (marked with a red sleeve)
    - On the palmtop, run HCOM by typing in "H" (or “HCOM<space>/C2” if H.BAT is not present on disk c:) and then by pressing ↵. The following should appear on the palmtop screen:

```
HUSKY File Transfer Utility
Version 1.07                20th Oct 1993
[C] Copyright Husky Computers Ltd.
press ESC to exit
```

- **Upgrading the Palmtop software (Seismic application)**

  - On the PC computer, insert the Station diskette into the drive and choose A: as the current directory (or on C:, choose as current directory the directory containing the files earlier loaded from this diskette).

    The following files should be present in the STAPALMTOP (Windows 95) or STAPAL21 (DOS) directory:

    CMDHCOM.EXE
    SEIFR.BAT
    SEIUK.BAT
    SEV10007.CFG
    SEV10008.EXE
    H.BAT
    S.BAT
    SEV100FR.LAN
    SEV100UK.LAN

  - On the PC-type computer, run the batch file SEIFR (for French language) or SEIUK (for English language). The following messages should appear successively on the palmtop:

    ```
    receiving SEISMIC.EXE
    receiving SEISMIC.LAN
    receiving SEV10007.CFG
    receiving H.BAT
    receiving S.BAT
    ```

    (Similar messages appear on the PC, in French or English, depending on the batch file used).

  - On the palmtop, press the ESC key once the "Reception Complete" message appears on the palmtop screen, denoting successful upgrading of the resident programs.

A

- **Re-loading software after formatting the palmtop disk**

In this case the procedure differs from the preceding one in the way the palmtop communications utility is run. Because H.BAT is absent, proceed as follows:

- on the palmtop, at the DOS prompt, type in "HCOM<space>/C2" and then press ↵
- run SEIFR or SEIUK, as explained in the preceding chapter.

Maintenance steps

- **Resetting the palmtop**

If for any reason the palmtop gets stuck (because of illegal operations on the keyboard for example –although this should not have such a consequence), the processor should be reset using a particular key combination, an operation similar to the well known "Ctrl+Alt+Del" on PCs. To reset the processor:

- press simultaneously the ON red key and the two ⇑ keys (on either side of the "Yes" key) until the screen turns blank
- Then release the keys and follow the instructions on the screen (type any key, confirm date and time).

- **Reformatting the disk**

  Although this should be extremely rare, you will have to re-format the disk if one of the following messages is returned by the palmtop:

  `Bad Sector in Drive C:`
  or
  `Verify failed sector: x.x`
  or
  `Data corrupted`
  or
  `Potential Data Corruption Detected`

  If the palmtop is still reactive to DOS commands (such as DIR), please skip the next paragraph "Fatal errors" and read "Util" directly.

Fatal errors

- If the RAM disk is damaged, the message "`Please contact your system provider`" will be displayed on the screen.
- In that case, key in the emergency password "`56580`", which will cause the following message to appear: "`Default disk (lose all data) Y/N?`
- Press "Y" to reformat the RAM disk, which will cause all the files to be deleted, as signaled by the following messages:

```
All data has been erased
Use UTIL to format fixed disk
```

Util

- Type in "UTIL". The main menu appears.

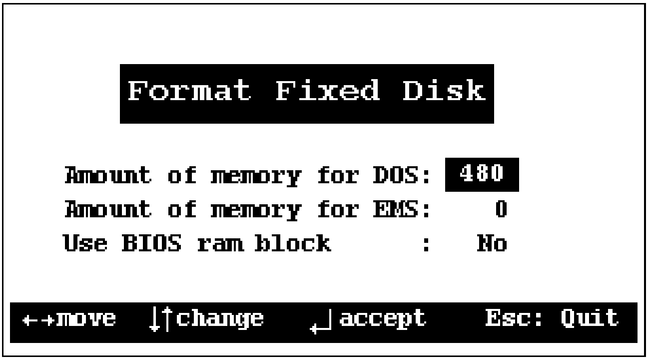
```
Field system 2 Utility                  V1.1
Set time

Set date
Format diskette
Format. Fixed Disk
Communication Port 1 Set Up
Communication Port 2 Set Up

←→move          ↲ select          Esc: Quit
```

- Using the horizontal-arrow keys, move the cursor to "Format Fixed disk"
- Press the "Yes" key. A new screen appears.

```
        Format Fixed Disk

         ***WARNING***

   This will erase all disk data!
   OK to proceed ?  No

←→move  ↓↑change   ↲accept    Esc: Quit
```

- Using the vertical-arrow keys, have "Yes" displayed in the selected field (instead of "No")

- Press the "Yes" key. A new screen appears.



- The amount of memory for DOS should be 480. If it is different, make it equal to this value using the vertical-arrow keys (increment step: 32kbytes).
- Do not change the other parameters.

- Press the "Yes" key. A new screen appears.

```
Format Fixed Disk

Track 238
Format successful
The machine will now reset

Press any key to continue
```

(Blinking)

- After loading the DOS, the palmtop asks you to update the date & time
- At the DOS prompt (C>), type in DIR. Check that 7 files are listed, leaving about 495616 bytes free.
- To load the Station and Rover Unit software, refer to page *A-23*.

- **No "charging in progress" message**

If this type of message never appears:

- Press simultaneously the "*" and "H" keys. The screen should read:

```
Charge authorisation Level: 1---4
```

- Using the horizontal arrow keys, move the cursor (inverse video) to "Power" and then press ↵. The screen should read:

```
Advanced power management (APM) Yes or
Level 1---4
```

- Using the vertical arrow keys, select "No" and then press ↵. The screen should read:

```
Advanced power management (APM)
disabled
```

Another way of disabling the APM is to remove the battery from the palmtop and then to connect a powered Scorpio receiver. The message "charging in progress" will then appear. Then you just have to put the battery back into the palmtop.

A

- **If satellite reception is difficult to achieve**

  If the equipment is moved to a very remote location (more than 500 km) compared with the valid position solution it last delivered, then the receiver may have some difficulty in finding the visible satellites and computing the corresponding dopplers, as the known initialization position is by far too wrong. In this case, use one of the procedures below to help the receiver identify the visible satellites.

  - On the Rover Unit, choose " POINT" from the Kinematic Initialization menu (screen No. 3) and enter approximate coordinates from the keyboard, expressed in the coordinate system used for the project . Check that the receiver status is HOLD (less than 4 SVs) otherwise this operation will have no effect.
  - If a PC computer is available, send the following command in terminal mode from the PC through a serial line:

    $ECGLL,DDMM,N,DDDMM,E

    where:

    DDMM,N : estimated latitude of initial position (degrees, minutes, North or South) and

    DDDMM,E : estimated longitude of initial position (degrees, minutes, West or East)

- **Re-loading the configuration**

  This occurs when the configuration used is incompatible with the palmtop. To load the correct configuration, do the following:

  - Turn off the receiver
  - Turn it on again while holding the SCROLL pushbutton depressed until the following message appears:

    `Config reset in progress` (default configuration)

  - Turn on the palmtop. The following message is reported...:

    ```
    Wrong configuration
    Do you want to reload it?
    Yes/No
    ```

    ... while the status display on the receiver front panel reads "External Config in progress".

  - Press "Yes". This causes the palmtop to go back to the DOS prompt (C>).
  - Run the Palmtop software by pressing "s" and then update the following parameters:
    - frequency
    - station number
    - data type

- **Re-starting the Kart or LRK processing method**

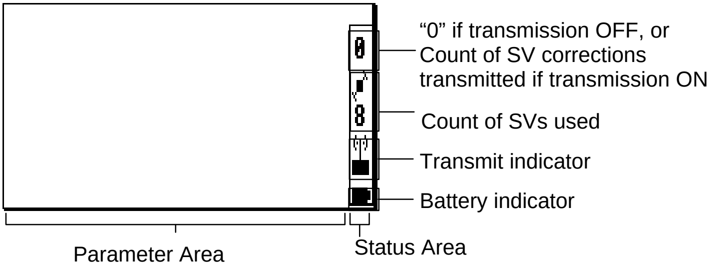
  After re-loading the SEV10007.CFG configuration, the receiver is in the default Natural GPS mode. To re-validate the mode you are using (Kart or LRK), choose the initialization type (OTF, Zfixed, etc.). ♣

B. Base Station Reference

Introduction to Palmtop Software

Palmtop display

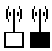
All screens are divided into two distinct areas as shown below. The status area is permanently shown.



Count of SVs used :

 : Blinking icon if the count of SVs drops and remains below 4

Transmit indicator :

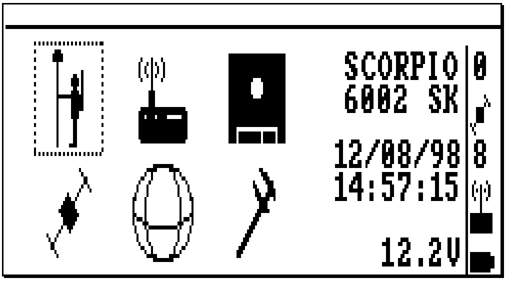
: Respectively OFF and ON.

Keys and menus

A few keys and menu types need to be known for best use of the Palmtop Software program.

- **Main menu screen**

  The main menu shows the 5 groups of functions available in the form of icons (see below).



  Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines. The main menu appears on the screen automatically after the palmtop has completed the auto-tests.

- **Function menus**

  They are displayed after selecting an icon in the main menu and pressing ↵. Example:

  Then do the following:

  - Using the vertical-arrow keys, select a function in the menu
  - Press ↵ again to run this function

NOTE: The SV icon has no **function** menu as this icon provides access to a single function. The first icon is inactive.

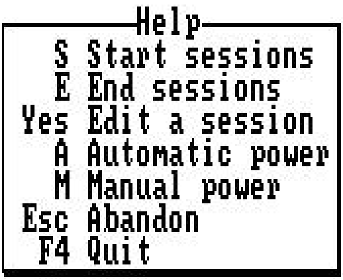
- **Help menus**

There is a **Help** menu specific to almost each function, listing all the commands available in the context of this function.

To display the **Help** menu, press the **F1** key. This causes the **Help** menu to be superimposed on the screen. Then do the following:

- Note the key-letter corresponding to the command you want to run
- Press the **Esc** key to remove the Help menu
- Press the key-letter to run the desired command.

For example, and as shown on the **Help** menu below, pressing the "↵" key (after removing this menu) will let you define the start and end times of the selected session line:



NOTE: You cannot view any **Help** menu while editing a parameter.

- **Other important keys**

Esc

- Pressing the **Esc** key will take you back to the preceding screen, or will remove the **Help** menu from the screen, or will cancel the change you make on a parameter.

F4

- Pressing the **F4** key will allow you to quit the program. Confirm this choice by pressing ↵ (or press **Del** to cancel the request). Then a message is displayed asking you whether, in the same time, the receiver should be turned off (press the **Del** key) or not (press ↵).

- **Making changes to parameters**

Depending on the size and type of the parameters that can be changed, the program will use different scenarios to let you make that change:

- If the screen contains numerical or alpha-numerical parameters, a blinking cursor will appear on the first of them.

To change this parameter, simply type in the new value. Note that the position of the field on the screen will be shifted to the left while you edit it. If the size of the parameter is relatively long, an edit box will appear on top of the screen to show the entire field while you edit it.

In both cases, the new value will be validated after you press ↵. Use ↓ or ↑ to access the next or previous field (respectively).

- If a parameter can only be set to some specific software-set values, then this field will be marked with a "▶". To know the possible values and choose one of them, use ↓ or ↑ to access this field and then press →. A select box appears showing these values. Use ↓ or ↑ to choose the desired value and press ↵ to validate your choice (the select box is removed from the screen at the same time).

- **Messages and alarms:**

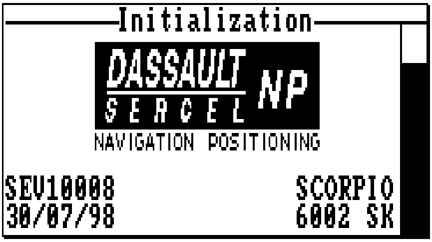
  - Alarm report:
    - Error or warning messages

  - The buzzer will sound in the following cases:
    - At the end of the initialization phase, not an alarm (beeps three times)
    - Satellite alarm (brief 3-tone "down" sound every 6 seconds approx.)
    - Battery alarm (brief 3-tone "up" sound every 6 seconds approx.)
    - Invalid display request (brief 2-tone sound)
    - Invalid data entry (brief 2-tone sound)
    - Other errors (brief 2-tone sound).

Getting started

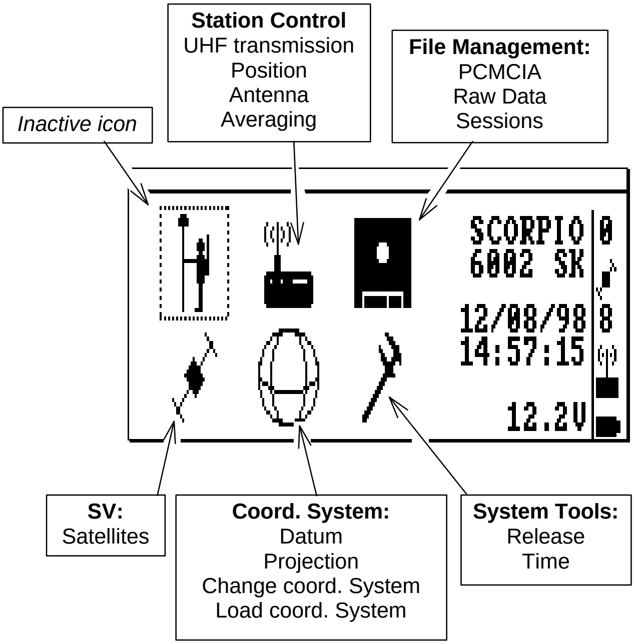
Assuming the base station is now ready and you have the palmtop in hand, do the following:

- From the DOS prompt, type in "S" or “s” and press ↵. The following screen appears denoting auto-tests in progress:



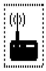
...

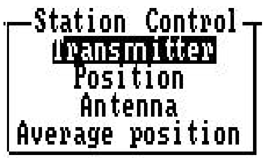
At the end of the auto-tests, the main menu appears on the screen.



- Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines.
- Press ↵ to validate your selection. In the continuation of this appendix, all functions and commands specific to the Palmtop Software are described in detail.

Station Control

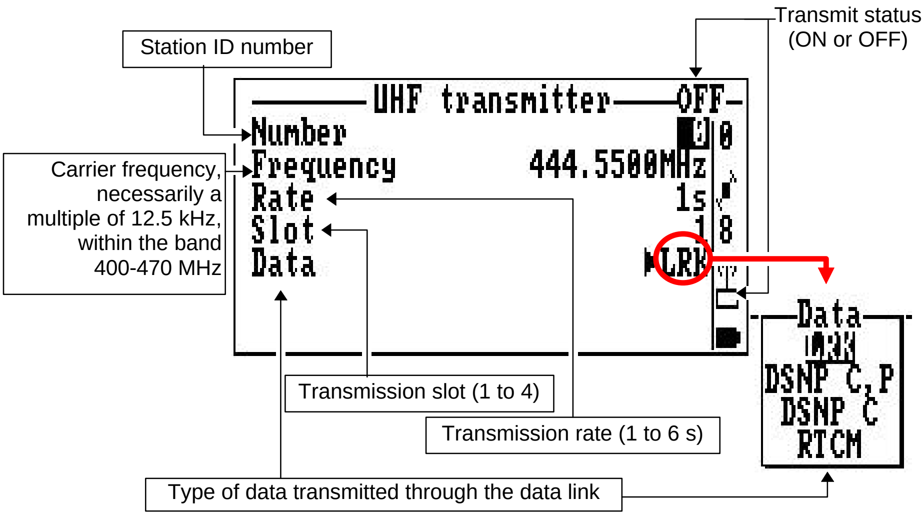
- From the main menu, select :
- Press ↵. The following function menu then appears:



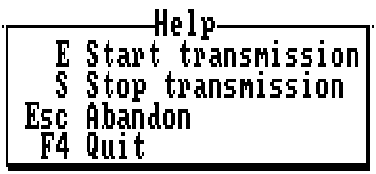
- Select a function by pressing ↓ and then press ↵. Each of the functions available from this menu are described below.

Transmitter

This function allows you to program the UHF transmitter and enable /disable UHF transmission.



Associated **Help** menu:



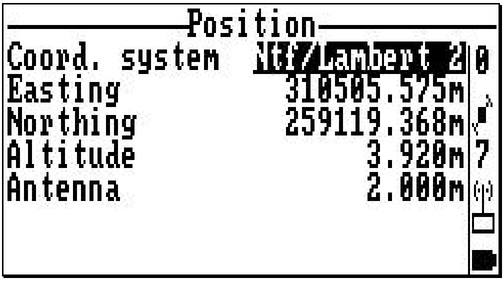
(displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **E** key to enable transmission at the station.
- or press the **S** key to disable transmission

Position

This function allows you to enter the position of the station. If it is not accurately known, enter an estimate and then run the *Average Position mode* to refine this position (see page *B-12*).



The name of the coordinate system used (top of the screen) and the height of the GPS antenna (bottom of the screen) are just displayed for your information. The coordinate system is the one requested by the PCMCIA prepared for the job, and the antenna height is the one defined using the **Antenna** function (see page *B-11*).

Antenna

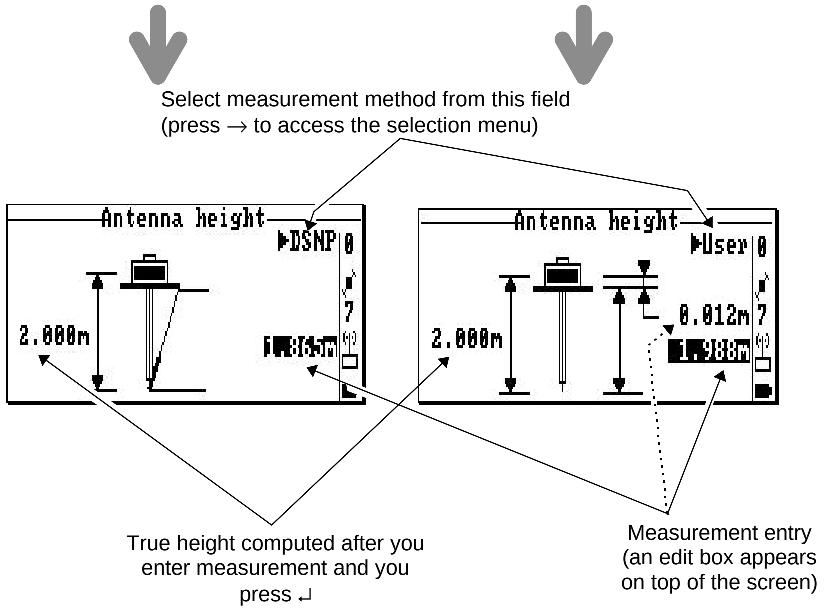
This function allows you to enter the measurement you have made after installing the GPS antenna in the field.

From this value, the program will determine the true height of this antenna with respect to the ground.

After choosing this function, press the ← key to access the field from which you can select the type of measurement made (see *section 2*) and then enter the measurement as explained in the screens below.

B

DSNP measurement **User measurement**



Average position

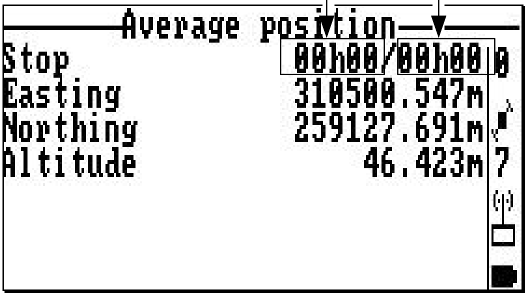
This function allows you to program the *Average Position mode* and enable/disable this mode.

Operating the base station in this mode makes it possible to refine its location if the coordinates you entered through the **Position** function (see page *B-10*) are just an estimate.

Status of the *Average Position mode* (Stop or Running)

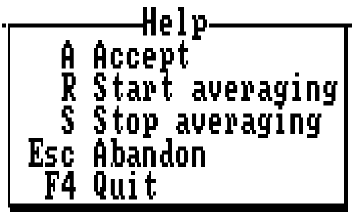
Time elapsed since you started this mode

Total time planned in this mode



First, the coordinates of the station as entered through the **Position** function, then, progressively, an averaged (refined) solution for this position, as the station keeps running in the *Average Position mode*.

Associated **Help** menu:



(displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **R** key to enable the *Average Position mode*. In the edit box which then appears, enter the time (hhmm) during which you want the station to operate in this mode:

  where hh: hours and mm: minutes

  At the end of this planned time, the status will switch to “STOP”.

- or press the **S** key to stop operating in this mode, thus causing the status to be changed to “STOP”

- or press the **A** key to transfer the displayed position as the new valid position of the station (this position will then appear on the screen of the **Position** function; see page *B-10*).

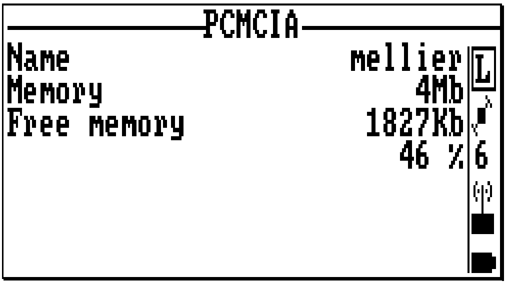
NOTE: Access to this function is denied if UHF transmission is active.

File Management

- From the main menu, select the third icon: 
- Press ↵. The following function menu then appears:

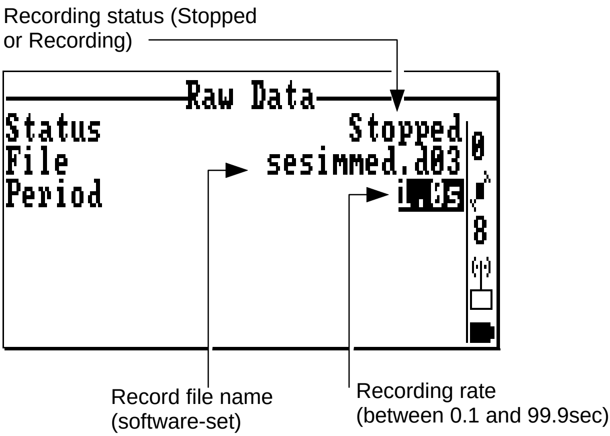
PCMCIA card

This function gives information about the PCMCIA card currently inserted into the receiver (name, nominal capacity, free memory space).

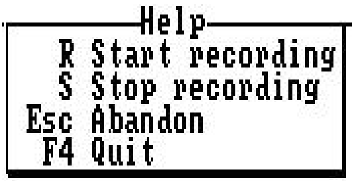


Raw Data

This function allows you to perform immediate recording of GPS raw data.



Associated **Help** menu:



According to context:

- Press the **R** key to start recording raw data on the PCMCIA.
- or press the **S** key to stop recording. As a result, the record file will be closed and the extension of the record file will be incremented by 1, thereby making the system ready for the next data recording. All record files have the same name (sesimmed).

Sessions

This function allows you to plan operating sessions for the base station.

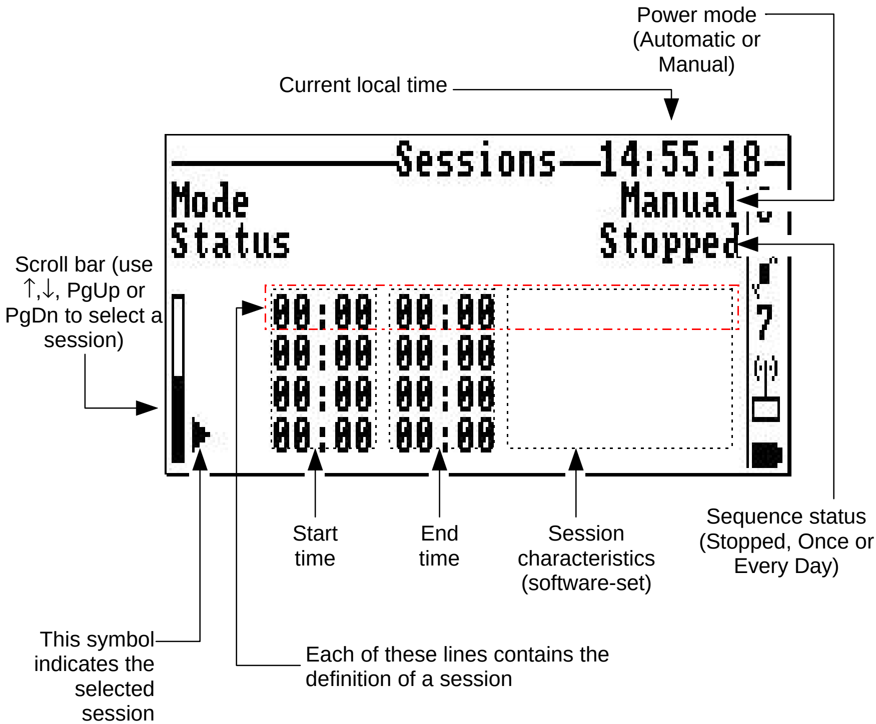
A session is an interval of time during which you wish the station to operate, combined with the possibility of having raw data recorded on the PCMCIA card.

The two underlying operating aspects of a session are the following:

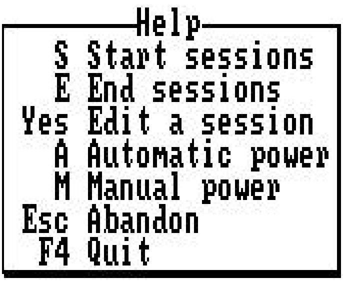
- Through a session, you can ask the station to switch on and off automatically at planned times (on a daily basis or not), thus allowing you to save energy from your batteries (this operating mode requires that you choose the **Automatic** power mode).
- Through a session, you can ask the station to perform data recording on PCMCIA during the session. Making recordings at a station may be a requirement tied to the surveying method used.

Before doing anything about sessions, please read the following :

- If you do nothing with sessions, then the station will operate on a permanent basis, with no recording on the PCMCIA, until you turn it off manually.
- Changes can be made on sessions only if the sequence of sessions has been disabled.



Associated **Help** menu:

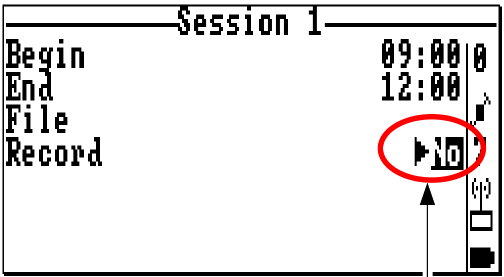


According to context:

- Press the **S** key to enable the sequence of sessions, and then specify whether the sequence must be executed once or every day:

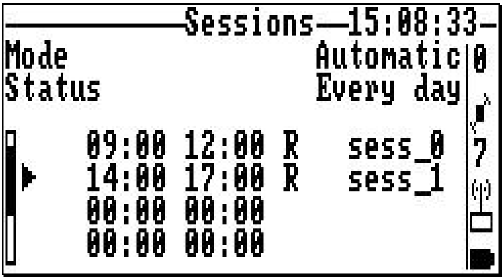
- Press the **E** key to disable the sequence of sessions.
- Press the **A** key to switch the station to **Automatic** power mode
- Press the **M** key to switch the station to **Manual** power mode.
- After selecting a session from the displayed list, press ↵ to edit its characteristics.

  Example of screen obtained when editing the characteristics of a session:



From this field, specify whether raw data must be recorded (Yes) or not (No) during the session (press → to access the selection menu.

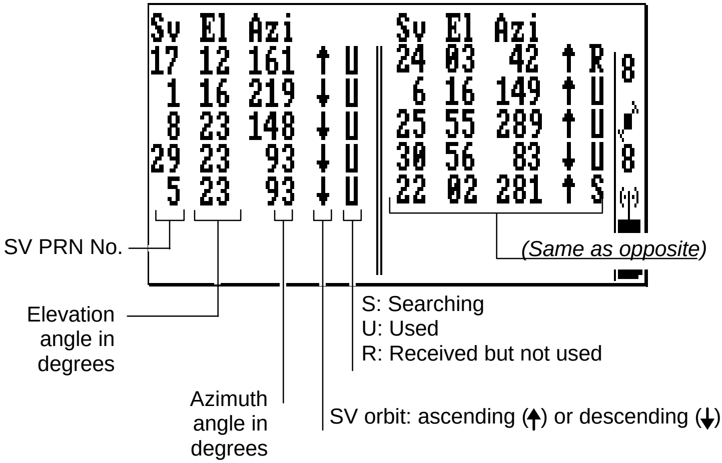
Example of screen obtained while a sequence of sessions is being executed (typical sequence in which two sessions are run every day from 9:00 to 12:00 am and from 2:00 to 5:00 pm):



Visible GPS Constellation

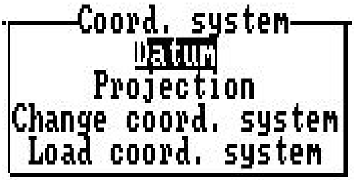
- From the main menu, select the fourth icon: 

  This function gives information about the GPS constellation visible from the base station.



Coordinate System Used

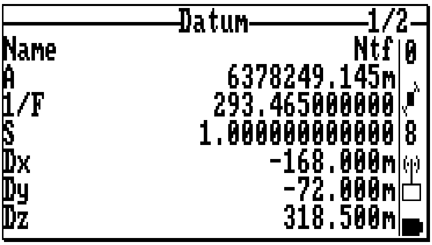
- From the main menu, select the fifth icon: 
- Press ↵. The following function menu then appears:

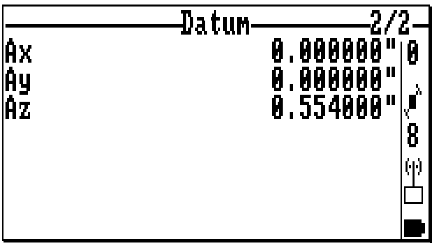


B

Datum

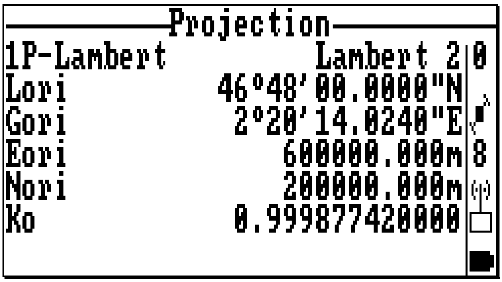
This function gives the characteristics of the datum used. As shown in the example below, this information is presented on two screens. Use the PgUp and PgDn keys to change screen.





Projection

This function gives the characteristics of the projection used (see example below).



Change Coordinate System

This function allows you to choose the coordinate system used at the station. Two choices are possible:

- the coordinate system requested for the job
- or the WGS84

Example:

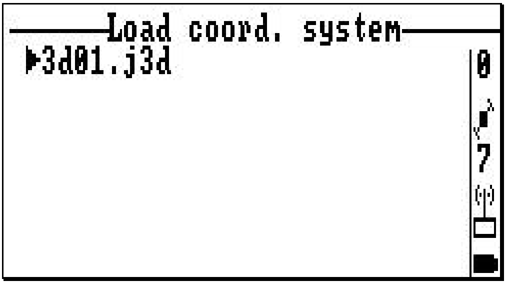
B

Load Coordinate System

This function allows you to transfer the coordinate system defined for a job to the base station.

- After inserting the PCMCIA into the GNSS receiver of the base station, select the **Load Coordinate System** function. The name of the job read from the PCMCIA appears on the screen.

  Example:



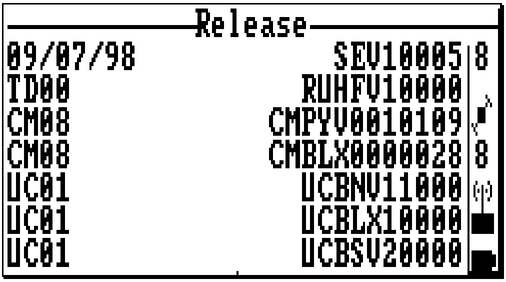
- Press ↵. This causes the coordinate system read from the PCMCIA to be instantaneously be loaded to the base station
- Press the **Esc** key to leave the function.

System Tools

- From the main menu, select the fifth icon: 
- Press ↵. The following function menu then appears:

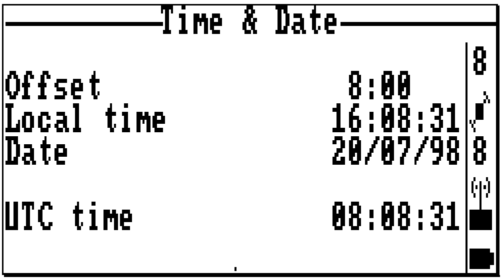
Release

This function gives information about the versions and revisions of the hardware elements composing the system.

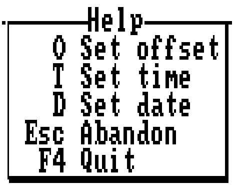


Time

This function allows you to read/change the local time.



Press **F1** to display the Help menu. Use the key-letters shown in this menu to change the time & date.



♣

C. GPS Raw Data in SBIN format

Notation Rules

- **Reserved characters**

By principle, all possible binary values in a byte are allowed. However three ASCII characters are used for message identification :

ASCII byte **FE$_h$** : denotes beginning of binary block

ASCII byte **FF$_h$** : denotes end of binary block

ASCII byte **FD$_h$** : denotes intentionally altered character

C

If between the beginning and the end of a block, the binary string initially includes such characters, then the following modifications are made to the string to avoid misinterpretation of the data at a further stage :

FD$_h$ is converted into **FD$_h$ 00$_h$**

FE$_h$ is converted into **FD$_h$ 01$_h$**

FF$_h$ is converted into **FD$_h$ 02$_h$**

NOTE : When counting bytes in a message, remember that all the "doubled" characters (i.e. FD$_h$ 00$_h$ FD$_h$ 01$_h$ and FD$_h$ 02$_h$) resulting from the encoding described above must be counted as single characters.

- **Conventions used**
  - The term "field" stands for one or more parameters.
  - The term "data" stands for a binary value occupying a byte.
  - In a byte, bit "**0**" stands for the least significant bit, bit "**7**" for the most significant bit. The most significant bit is always placed ahead.
- **Symbols used**

< >	:	denotes a field
<stb>	:	beginning of block : ASCII character **FE_h**
<blid>	:	block type: 1 ASCII character allowing identification of the data type
<long>	:	2 bytes in binary notation specifying the count of bytes in the block, from <stb> excluded up to <checksum> excluded
<checksum>	:	2 bytes (for transmission error check)
<etb>	:	end of block: ASCII character **FF_h**

- **General form**

<stb>	:	1 byte (FE_h)
<blid>	:	1 byte
<long>	:	2 bytes
<data>	:	1 to 1023 bytes
<checksum>	:	2 bytes
<etb>	:	1 byte (FE_h)

The meaning of the data in each block type is predefined

- **Error check rule**

  The message content is checked for transmission error through two "checksum" bytes the values of which result from the sum of all bytes, modulo 2^{16} , from <stb> excluded to <checksum> excluded.

- **Rule about numerals**

  Unless otherwise specified:

  - Numerals are expressed in binary, with fixed decimal point
  - The notation of signed numbers meets the rule of the 2' s complement.

C

SBIN@R : Single-frequency GPS pseudoranges in satellite time

- **General form**

<stb><**R**>	2 bytes
<long>	2 bytes
<time tagging>	5 bytes
<parameters>	1 byte
<Raw Data, 1stSV>	14 bytes
...	
<Raw Data, last SV>	14 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Time tagging**

First 2 bytes	:	GPS week number (assuming the modulo 2^{10} ambiguity is removed)
Last 3 bytes	:	GPS time in week (unit: 1/10 s). The reference time is jan 6 1980 at 0hr00.

- **Parameters**

A single byte:

Bits 0 and 1 : Code smoothed by carrier according to RTCM message No. 19

Code	Smoothing Interval
00	0 to 1 minute
01	1 to 5 minutes
10	5 to 15 minutes
11	Indefinite

Bit 2 =1

Bit 3 : =0

Bits 4 to 6 : (*reserved*)

Bit 7 : =0 (single-frequency measurements)

- **Satellite Raw Data**

1st byte : SV number

Next 4 bytes : C/A code pseudorange (unit=10^{-10} s; modulo 400 ms)

Next byte : bits 0 to 4: Level indicator

(C/No-26 dB.Hz)

bits 5 to 6 not used

bit 7=1 if phase measurement not valid

C

Next 3 bytes : $L1_{C/A}$ carrier phase (unit: 10^{-3} cycle, modulo 10^4 cycles)

Next 3 bytes : $L1_{C/A}$ carrier phase (unit 4×10^{-3} cycle/s, field ~ 32 Hz; MSB=sign; 800000_h=measurement not valid)

Next byte : $L1_{C/A}$ carrier quality indicator

Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

Last byte : C/A code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

SBIN@R : Dual-frequency GPS pseudoranges in satellite time

- **General form**

<stb><**R**>	2 bytes
<long>	2 bytes
<time tagging>	5 bytes
<parameters>	1 byte
<Raw Data, 1stSV>	14 bytes
...	
<Raw Data, last SV>	14 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Time tagging**

First 2 bytes	:	GPS week number (assuming the modulo 2^{10} ambiguity is removed)
Last 3 bytes	:	GPS time in week (unit: 1/10 s). The reference time is jan 6 1980 at 0hr00.

- **Parameters**

A single byte:

bits 0 and 1 : C/A code smoothed by carrier, complies with RTCM message No. 19

Code	Smoothing Interval
00	0 to 1 minute
01	1 to 5 minutes
10	5 to 15 minutes
11	Indefinite

Bit 2=Bit 3 : =1

Bits 4 to 6 : =0 (*reserved*)

Bit 7 : =1 (dual-frequency measurements)

- **Satellite Raw Data**

1st byte : SV number

Next 4 bytes : C/A code pseudorange (unit: 10^{-10} s modulo:0.4 s)

Next byte : bits 0 to 4: Level indicator (C/No – 26), in dB.Hz

bits 5, 6 and 7: channel status

bit 5=0 if P code; =1 if Y code

bit 6=1 if $L2_{P/Y}$ phase measurement not valid

bit 7=1 if $L1_{C/A}$ phase measurement not valid

C

Next 3 bytes : $L1_{C/A}$ carrier phase (unit=10^{-3} cycle, modulo 10^{4} cycles)

Next 3 bytes : $L1_{C/A}$ carrier phase (unit=4×10^{-3} cycles/s; field~32 kHz; MSB=sign; 800000_h=measurement not valid)

Next byte : $L1_{C/A}$ carrier quality indicator

Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

Next byte : C/A code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

Next byte	:	$L1_{P/Y} – L1_{C/A}$ carrier phase deviation, centred around zero (unit=1/256th cycle; MSB=sign; 80_h=measurement not valid)
Next 2 bytes	:	$P_{L1} – C/A_{L1}$ code deviation (unit=10^{-10} s; field~3.2 µs; MSB=sign; 8000_h=measurement not valid)
Next 2 bytes	:	$P_{L2} – C/A_{L1}$ code deviation (unit=10^{-10} s; field~3.2 µs; MSB=sign; 8000_h=measurement not valid)
Next 3 bytes	:	$L2_{P/Y}$ carrier phase (unit=10^{-3} cycles modulo 10^4 cycles of L2)
Next 3 bytes	:	$L2_{P/Y}$ carrier speed (unit=4×10^{-3} cycles/s; field~32 kHz; MSB=sign; 800000_h=measurement not valid)

C

Next byte : L2 carrier quality indicator

Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

Last byte : P/Y code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

SBIN@A: Almanac data

- **General form**

<stb><**A**>	2 bytes
<long>	2 bytes
<almanac ident.>	3 bytes
<SV almanac>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Almanac identification**

First byte	:	Number of the GPS satellite corresponding to the transmitted almanac (binary)
Last 2 bytes	:	Almanac *reference* week number (modulo 2^{10} ambiguity removed)

- **Almanac data**
  - Bits 1 to 24 from words 3 to 10 in subframes 4 or 5 (depending on SV number)

SBIN@E: Ephemeris data

- **General form**

<stb><**E**>	2 bytes
<long>	2 bytes
<ephemeris ident.>	1 byte
<SV almanac>	24 bytes
<words 3 to 10, subfr 1>	24 bytes
<words 3 to 10, subfr 2>	24 bytes
<words 3 to 10, subfr 3>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Ephemeris identification**

A single byte : Number of the GPS satellite corresponding to the transmitted ephemeris (binary)

- **Ephemeris data**
  - Bits 1 to 24 from words 3 to 10 in subframe 1
  - Bits 1 to 24 from words 3 to 10 in subframe 2
  - Bits 1 to 24 from words 3 to 10 in subframe 3

SBIN@U: Iono/UTC data

- **General form**

<stb><**U**>	2 bytes
<long>	2 bytes
<Iono/UTC data>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Iono/UTC Data**
  - Bits 1 to 24 from words 3 to 10 in subframe 4, page 18, declared valid by the GPS sensor

SBIN@S: Health & A/S data

- **General form**

<stb><**S**>	2 bytes
<long>	2 bytes
<A/S & Health data>	24 bytes
<Health data>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Health & A/S Data**

A/S & Health : Bits 1 to 24 from words 3 to 10 in subframe 4, page 25, declared valid by the GPS sensor

Health : Bits 1 to 24 from words 3 to 10 in subframe 5, page 25, declared valid by the GPS sensor

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D. Results files in ASCII SVAR format

File Header

<stx><eoln>
!L<eoln>
*1,<label11>,<label12>,<label13><eoln>
*2,<label21>,<label22><eoln>
<etx>

*1 : Header line #1

<label11>: Time when file first opened (mm/mm/yyyy hh :mm :ss)

<label12>: Operator name (20 characters max.)

<label13>: Work area Label (8 characters max.)

*2 : Header line #2

< label21 > File or Job name

< label22 > Comment (48 characters max.)

Datum

<stx><eoln>
!G, <GPS week>,<GPS time><eoln>
∗1, <datum No. "datum name"><eoln>
∗2, <"A" value>,<"1/F" value>,< "S" value>,<unit code><eoln>
∗3, <"Dx" value>,<"Dy" value>,<"Dz" value>,
<unit code><eoln>
∗4, <"Ax" value>,<"Ay" value>,<"Az" value>,
<unit code><eoln>

1st line :

Identification of the datum used. The reference is the WGS84. If it is unknown, the datum number is 0, and lines *2 to *4 are not provided.

Projection parameters

"*n*" lines are required to describe the projection parameters whose identifier is <***#n***>. Projection parameters are always preceded by the characteristics of the datum used.

The first line contains the number of the projection type. This number indicates the algorithm used. Is may be followed by a label containing the instance name for the projection type. The labels listed below are just examples.

If the projection is unknown, line #1 reads #1,0,0 and the next lines (2 and 3) are not provided.

<value1> in line **#1** qualifies the coordinate system used:

- 0: Coordinate system invalid
- 1: Standard coordinate system
- 2: Standard coordinate system from which user local grid will be determined
- 3: Standard coordinate system used with local grid

Tangent conical projection (Lambert):

#1,<**02** "Lambert 1">,<value1><eoln>
#2,<"Lori" valeur>**,**<"Gori"value>**,**<"Eori" value>**,**
<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value><eoln>

1st line: Number of projection type used, possibly followed by the name of the projection

2nd line: *Lori, Gori:* latitude and longitude of origin (angles)

Eori, Nori: projected (XY) coordinates of origin (distances)

angle unit code and distance unit code (no separator in between)

3rd line: *Ko:* Scale factor (a coefficient)

Secant conical projection (Lambert)

#**1,**<**03** "Maryland">,<value1><eoln>
#**2,**<"Lref" value>,<"Gori" value>,<"Eori" value>,
<"Nori" value>,<unit code><eoln>
#**4,**<"LatN value>,<"LatS" value>,<unit code><eoln>

1st line: Number of projection type used, possibly followed by the name of the projection

2nd line: *Lref, Gori:* latitude and longitude of origin (angles)

Eori, Nori: projected (XY) coordinates of origin (distances)

angle unit code and distance unit code (no separator in between)

3rd line: *LatN, LatS:* latitudes of 1st and 2nd parallels (scale: 1) (angles)

angle unit code

UTM projection (Universal Transverse Mercator)

#**1,**<**01** "UTM xx">,<valeur1><eoln>
#**2,**<"Lori" value>,<"Gori" value>,<"Eori" value>,
<"Nori" value>,<unit code><eoln>
#**3,**<"Ko" value><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)

Oblique cylindrical projection (Skew Orthomorphic)

#1,<**04** "Switzerland">,<valeur1><eoln>
#2,<"Lori" value> **,** <"Gori" value>**,**<"Eori" value>**,**
<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value>**,**<"Skew" value>**,**<unit code><eoln>

1st line: Number of projection type used, possibly followed by the name of the projection

2nd line: *Lori, Gori:* latitude and longitude of origin (angles)

Eori, Nori: projected (XY) coordinates of origin (distances)

angle unit code and distance unit code (no separator in between)

3rd line: *Ko:* Scale factor (a coefficient)

Skew: rotation (an angle)

angle unit code

Oblique cylindrical projection (Rectified Skew Orthomorphic)

#1,<**05** "Borneo">,<valeur1><eoln>
#2,<"Lori" value>**,**<"Gori" value>**,**<"Eori" value>**,**<"Nori" value>**,**
<unit code><eoln>
#3,<"Ko" value>**,**<"Skew" value>**,**<unit code><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)
	Skew: rotation (an angle)
	angle unit code

Oblique stereographic projection (Skew Stereographic)

#1,<**06** "Holland">,<value1><eoln>
#2,<"Lori" value> **,** <"Gori" value>**,**<"Eori" value>**,**
<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value><eoln>

1st line: Number of projection type used, possibly followed by the name of the projection

2nd line: *Lori, Gori:* latitude and longitude of origin (angles)

Eori, Nori: projected (XY) coordinates of origin (distances)

angle unit code and distance unit code (no separator in between)

3rd line: *Ko:* Scale factor (a coefficient)

D

Altimetric parameters

A *single* line is used to describe the altimetric parameters whose identifier is <**%1**>:

%1,<value1>**,**<value2>**,**<value3>**,**<altitude file name><eoln>

<value1>, <value2> and <value3> stand for the data held by the command $PDAS,ALTI interpretable by GNSS receivers:

<value1>: altitude processing mode (necessarily "2", i.e. without MSL (alti = alti $_{\text{ellipsoid}}$ – corrections – offset alt)

<value2> : Offset altitude with respect to reference surface

<value3> : *not used* ("0" necessarily)

<altitude file name>: *not used* (blank)

<etx>

Points list

<stx><eoln>
!I,<GPS week>,<GPS time><eoln>
*1,<point type>,<point number>,<label11>,<label12>,
<label13>,<label14>,<label15>,<label16>,<label 17> <eoln>
*2,<X >,<Y>,<Z>,<unit code> < eoln >
*3,<X ECEF>,<YECEF>,<ZECEF>,<unit code><eoln>
*4,<XP1>,<YP1>,<ZP1>,<DEPX>,<DEPY>,<DEPZ>,
<DXY unit code>,<DZ unit code>< eoln >
*9,<SDE>,<CEN>,<SDN>,<CEH>,<CNH>,<SDH>,<MU>,<N>,<Q>,<unit code><eoln>
*A,<Dif station number>,<XECEF>,<YECEF>
,<ZECEF><eoln>
*T,<XT>,<YT>,<ZT>,<point type>,<unit code><eoln>
<etx>

!I: point identifier, character 49_{Hex} (GPS week and time are optional)

*1 : Point description line

<Point type>:

20: staked-out target point

21: staked-out target point, modified by operator

30: logged point

<point number> : recording number (software-set)

<label11>: point name (characters 0 to 11)

<label12>: point name (characters 12 to 23)

<label13>: point name (characters 24 to 35)

<label14>: geocode of a logged point (12 characters max.)

<label15>: Count of satellites used and PDOP - format :"*%2d %9.1f*" (12 characters max.)

<label16>: comment (48 characters max.)

<label17>: recording local time ("26/11/97 13:11:59")

*2 : Line containing ground position in local coordinates

*3 : line containing ECEF position

This line contains the ECEF position of the antenna phase center when logging the point.

*4 : Offset line

<XP1><YP1><ZP1>: Theoretical ground position of offset point

<DEPX>: Longitudinal offset

<DEPY>: Transverse offset

<DEPZ>: antenna height

*9 : Qualification line

<SDE>: Easting standard deviation

<CEN>: Easting/Northing correlation

<SDN>: Northing standard deviation

<CEH>: Easting/Height correlation

<CNH>: Northing/Height correlation

<SDH>: Height standard deviation

<MU>: Weighting factor standard deviation

<N>: Count of measurements involved in qualification processing

<Q>: Origin of position solution:

- 0: blank
- 1: Natural
- 11: DGPS
- 21: EDGPS L1
- 31: KART R
- 41: KART A
- 51: EDGPS L1/L2
- 61: LRK R
- 71: LRK A

*A : line describing Differential station used

<Dif station No.>: identification number of a differential station involved in the position solution processing

<X ECEF><Y ECEF><Z ECEF>: Coordinates of a differential station involved in the position solution processing

D

<u>*T : line containing the planned position of a point to be staked out</u>

<XT><YT><YT>: planned ground position, in local coordinates, of a target point.

<point type>:
2 for 2D
3 for 3D

Unit code

ASCII character identifying the different units used in a data line, in the same order as the data, and without separator (example: 2b). The unit codes are described in the two tables below.

Length units

unit code	unit	value in metres
1	metre	1
2	US foot	0.304799999
3	imperial foot	0.304797265

Angle units

Unit code	unit	comments
a	degrees, minutes, seconds and fractions of a second	45.120952 for 45° 12' 9.52"
b	degrees and fractions of a degree	45.2026444 for 45° 12' 9.52"
c	grades	
d	radians	
e	seconds	for datum rotation

JRS file example

```
!L
*1,"15/07/98 15:52:08","BOB1.1","nantes"
*2,"3dgrid00",

!G,0,0
*1,1 "Ntf"
*2,"A"6378249.145,"1/F"293.465,"S"1,1
*3,"Dx"-168,"Dy"-72,"Dz"318.5,1
*4,"Ax"0,"Ay"0,"Az"0.554,e
#1,02"Lambert 2",1
#2,"Lori"0.816814089933346,"Gori"0.0407923394838398,"Eor
i"600000,"Nori"200000,d1
#3,"K0"0.99987742
%1,2,2,0,""

!I,966,316713.9
*1,20,1,"S1000                                        ","
500","0",,"070000001.9",,"15/07/98 15:58:18",
*2,310500.557027416,259127.681450551,46.7423079507198,1
*3,4334412.64513289,-112812.079059768,4662133.07553416,1
*4,,,,,,2,1,1
*9,0.00371601463332646,,0.00330676508412935,,,0.00569682
933643758,,1,71,1
*A,55,4334382.45,-112977.76,4662151.06
*T,310500.55,259127.68,0,2,1

!I,966,316764.6
*1,20,2,"S1000                                        ","
500","0",,"070000001.9",,"15/07/98 15:59:09",
*2,310500.445047143,259128.083978656,46.8562756089045,1
*3,4334412.42777397,-112812.204904101,4662133.42839277,1
*4,,,,,,2,1,1
*9,0.189769987318991,,0.15204122064761,,,0.1039966235742
29,,1,21,1
*A,55,4334382.45,-112977.76,4662151.06
*T,310500.55,259127.68,0,2,1

!I,966,316790.4
*1,30,3,"1",,,,"070000001.9",,"15/07/98 15:59:35",
*2,310500.433658067,259128.073141045,46.856086147106,1
*3,4334412.4357198,-112812.215963544,4662133.42053139,1
*4,,,,,,2,1,1
*9,0.189172375279052,,0.150870128633331,,,0.102321511651
014,,1,21,1
*A,55,4334382.45,-112977.76,4662151.06
```

D

```
!L
*1,"16/07/98 06:28:00","BOB.2","nantes"
*2,"3dgrid00",

!G,0,0
*1,1 "Ntf"
*2,"A"6378249.145,"1/F"293.465,"S"1,1
*3,"Dx"-168,"Dy"-72,"Dz"318.5,1
*4,"Ax"0,"Ay"0,"Az"0.554,e
#1,02"Lambert 2",1
#2,"Lori"0.816814089933346,"Gori"0.0407923394838398,"Eor
i"600000,"Nori"200000,d1
#3,"K0"0.99987742
%1,2,2,0,""

!I,966,369279.1
*1,20,4,"S1000                                       ","
500","0",,"050000002.9",,"16/07/98 06:34:24",
*2,310500.556677474,259127.683518213,46.7210161642793,1
*3,4334412.62917412,-112812.079095056,4662133.06128441,1
*4,,,,,,2,1,1
*9,0.0126973270601221,,0.0161050750784923,,,0.0197667969
594897,,1,71,1
*A,55,4334382.45,-112977.76,4662151.06
*T,310500.55,259127.68,0,2,1
```

♣

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