



Aquarius

5000 Series

USER'S MANUAL

Notice:

The accuracy of this receiver is not only dependent on its performance but also on various external factors (installation and environmental conditions, handling, use, etc.).

Therefore, it should be used as an aid to navigation rather than a substitute for a navigator's skill and judgment.

This DSNP receiver is a reliable shipmate that will help you to make vital decisions in critical situations, but don't let them allow yourself to believe this relieves you of customary prudence and navigational care.

FCC statement (USA)

The United States Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of users of this product:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference

will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interferences by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user may find the following booklet, prepared by the Federal Communications Commission, helpful: How to identify and Resolve Radio/TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, DC. 20402 , Stock No. 004-000-00345-4. Use of a shielded cable is required to comply within Class B limits of Part 15 of FCC Rules. Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this equipment not expressly approved by DSNP may cause harmful interference and void the FCC authorization to operate this equipment.

DSNP makes no warranty of any kind with regard to this equipment, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. DSNP shall not be liable for errors contained herein or for incidental consequential damages in connection with the furnishing, performance, or use of this equipment

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The information contained in this manual is subject to change without notice.

How to use this Manual

This manual is designed to encompass the whole *5000 series* of DSNP *Aquarius* products and therefore reflects the modular design of the series.

We deliberately made the choice of extending the modular concept of the *Aquarius* series up to its documentation for we think this is the best way to preserve the consistency of the whole set of technical information proper to this series of products.

As a consequence, you may not need to read all the manual if your purchase does not include the options described from section 2 to section 6.

This user's manual is made up of the following sections and appendices:

- Section 1, *Basic operating instructions for the 5000 series*, should be read first as this section covers the whole installation procedure and the first-level operating instructions.

For most cases of use, only the reading of the first two chapters of section 1 (*Unpacking & installation, Getting started*) is required.

For users who wish to know more about their receivers, a second level of operating instructions is provided in section 1, involving the use of a control computer and DSNP proprietary commands.

Section 1 also includes a brief description of the receiver front and rear panels and a troubleshooting guide. Section 1 is common to all the *Aquarius* products.

- Section 2, *Processing options*, contains the necessary information to operate your receiver in the desired processing method (DGNSS, WADGPS, KART, LRK). It is assumed that the receiver has reached the operational status described in section 1. In fact only the KART and LRK methods are options as the DGNSS and WADGPS methods are available in all the receivers of the 5000 series.
- Section 3, *DGNSS Data link option*, describes the hardware required for a DGNSS Data link and how to operate this option.
- Section 4, *Extended I/O option*, describes the hardware required to give the receiver new I/O capabilities (1pps, RS422 port, 10-MHz clock input, external event).
- Section 5, *Station firmware option*, provides all the information needed to implement and use this option.
- Section 6, *Station Installation Kit option*, tells you how to install a base station using this optional kit.
- *Appendix A* is a short introduction to the GNSS system.
- *Appendix B* reviews all the products of the 5000 series, from the simplest equipment up to the most sophisticated one.
- *Appendix C* provides a complete description of all the DSNP NMEA0183-compliant proprietary commands.
- *Appendices D* and *E* describe the GPS raw data issued by the receiver, respectively in the SVAR format and SBIN format. *Appendix F* describes the default messages of computed data
- *Appendix G* presents the *DSetPack* software, including the *Win Comm* communication software.

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Basic Operating Instructions for the 5000 Series

1

1. Basic operating instructions for the 5000 series



Introductory Notes

In this section, you will learn how to install and start your GNSS receiver:

- The 1st chapter is the present introduction.
- The 2nd chapter covers equipment unpacking and installation.
- The 3rd chapter provides a brief description of the receiver. The front and rear panels are presented.
- In the 4th chapter (page *1-10, Getting your equipment started*), it is assumed that the receiver has been properly installed and contains the appropriate configuration. This chapter will give you all the basic instructions to start your receiver.
- The 5th chapter (page *1-19, Work sessions*) introduces the notion of session and provides instructions on how to program sessions in the receiver.
- The 6th chapter (page *1-26*) describes the usual changes you can make to an operating receiver from the control computer.
- The 7th chapter deals with the PCMCIA card reader (page *1-34, PCMCIA reader*). The usual operations relevant to this card are presented.

- The 8th chapter (page 1-39, *Checking receiver operation from the Status Display*) provides a comprehensive description of the different screens available on the status display.
- The 9th chapter (page 1-51, *Rear panel Connectors*) contains technical information on connectors. The identification and pinout of each connector is provided.
- The 10th chapter (page 1-55, *Troubleshooting*) should help you fix up some problems you might encounter when starting operating the receiver.

Unpacking and installation

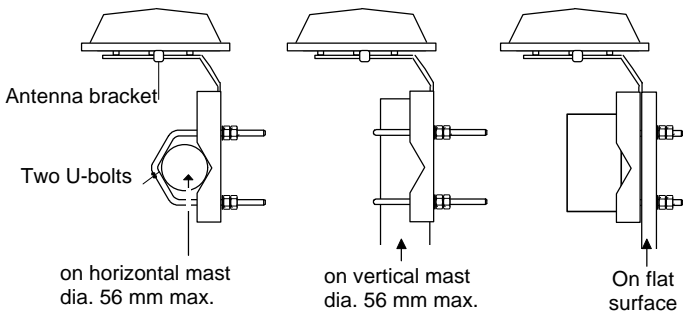
Unpacking

- Remove the different parts from the container.
- Keep the container away in a safe place as you may need it at a later date (for return shipment, transit transportation or storage).
- Inspect each of the parts. If a part has been damaged during transportation, please inform your retailer.
- The main elements part of the shipment are (non-exhaustive list):
 - Receiver unit
 - GPS Antenna
 - RS232 cable
 - Power cable
 - GPS coaxial cable
 - User's Manual

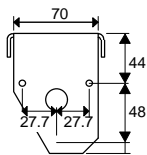
GPS antenna installation

The antenna should not be installed within the reach of any source of radio interference.

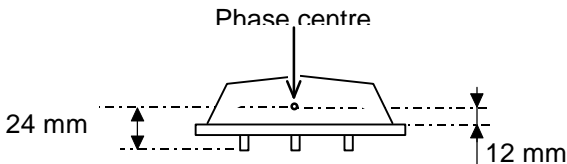
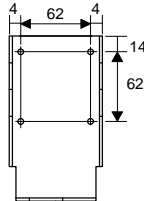
The antenna should not be exposed to smoke (whenever possible). It should be overlooking any superstructure and clear of any large metal surface.



Mount dimensions of
antenna bracket



Mount dimensions
for U-bolts



Good connections contribute a lot to the quality of signals received and therefore to the performance of the receiver. See that contacts are clean and connectors securely tightened. Coaxial connectors should be watertight.

In any case, clearance from superstructures and other antennas is essential.

Whenever possible, the coaxial cable should not be routed along any cable carrying heavy currents : starters, alternators, connections to echo sounder, radar, etc.

The antenna downlead should be attached to the mast (using adhesive or clamps) to preclude any stress on the connectors.

If you are installing a GPS antenna for a reference station (see *DGNSS Data Link* option, section 3), Remember that the GPS antenna location should be known with the best accuracy as the accuracy on the DGNSS processing will rely on it.

Receiver installation

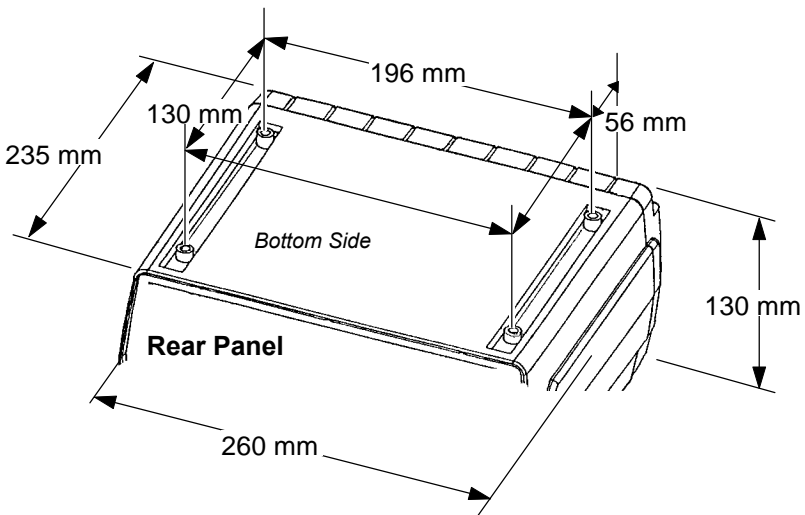
The receiver is designed to withstand a marine environment (waterproof case), resist dripping water and operate from – 20° to +55°C. Subject to these conditions, the receiver does not require any special precaution.

However, it is advisable to install the receiver clear of any moving device and away from splashes of lubricant or water.

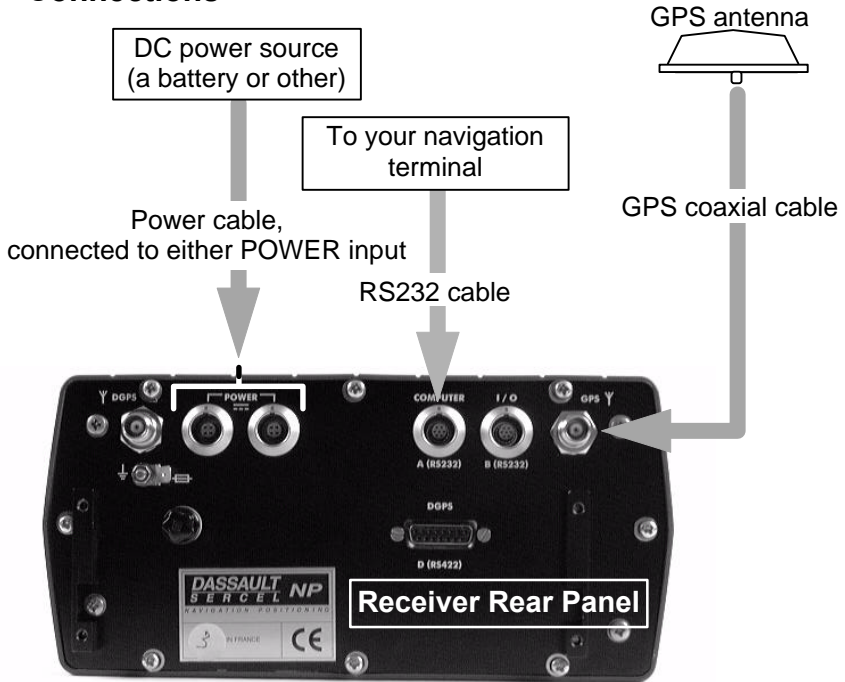
Also, direct exposure to excessive heat should be avoided.

The status display screen should be kept away from direct sun light for better legibility.

The receiver should be secured from below the case using the four tapped holes (see dimensions below, receiver case shown upside down). Use M4 screws and choose a length for these screws compatible with the 6-mm max. insertion length allowed in these holes.



Connections



Receiver description

1

Front Panel

Your receiver is fitted with the following parts on its front and rear panels.

- **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**.

The indicator light nested in the button provides information about the possible planned sessions or session in progress as soon as you connect the receiver to the power source:

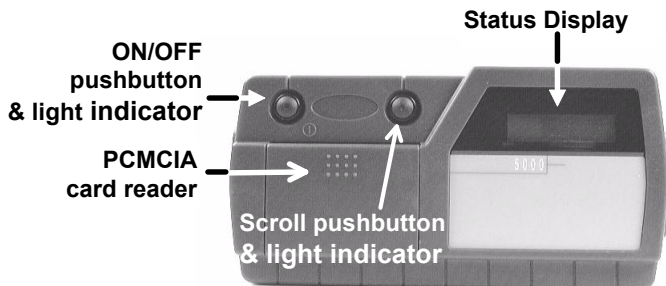
Blinking : A session is programmed to be run at a later time & date.

A few minutes before starting the session, the receiver will be automatically turned on, unless meanwhile this is made manually by the operator (who presses the ON/OFF button) or unless the power supply control mode has been set to "MPW" (refer to page I-46, *Screen No. 5: Information about sessions* for more information about this parameter).

ON : An operating or recording session is in progress. The other indicator light is necessarily ON.

OFF : No pending session. 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 page I-39, *Checking receiver operation from the Status Display*)





- **PCMCIA card reader**

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

In the basic version, this device is a card reader only. With optional software, it can be used as a recorder too.

The PCMCIA reader is seen from the DSNP GNSS engine as a conventional I/O port (port P). See page 1-34.

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 (for optional DGNSS UHF data link), 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 optional plug-in UHF transmitter (available from DSNP)
- 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.
- With the extended I/O option, four other connectors are present on the rear panel (see *Extended I/O option* in page 4-1).

Getting your equipment started

Basic connections

See precedent chapter, page 1-2, *Unpacking and installation*. These connections are briefly reviewed below:

- Use the power cable supplied to connect either of the two power inputs (or both) to the DC source. Make sure the DC voltage delivered is within the allowed range (10 to 15 V for a station, 10 to 36 V for a mobile) and the source can deliver the required power.

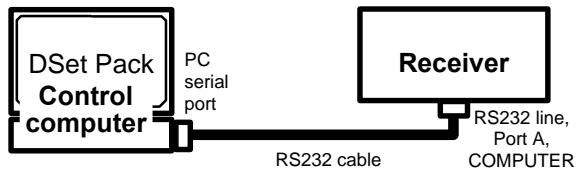
Mind the polarity of the source (the power input is protected from polarity reversal by a fuse).

- Use the TNC-TNC GPS coaxial cable supplied to connect the GPS input to the GPS antenna.
- If your receiver is fitted with an optional built-in UHF receiver, use the TNC-TNC UHF coaxial cable supplied to connect the DGPS input to the UHF antenna (see *section 3, DGNSS Data Link*, for more information about that particular point).
- Use a serial cable to connect port A (COMPUTER) or port B (I/O) to your usual navigation terminal.

PC connection

- Your receiver has been configured earlier to fulfill the specific function required by your application. This operation was performed using the *DSet Pack* or *ConfPack* software.

- If you encounter one of the problems described later when getting the receiver started (see page 1-13) you will have to use the *Win Comm* tool from the *DSet Pack* software.
- To use this tool, you will need to run *DSet Pack* from a control computer attached to the receiver (see diagram below).



(See *Appendix G* to know how to install and use *DSet Pack*).

Getting started

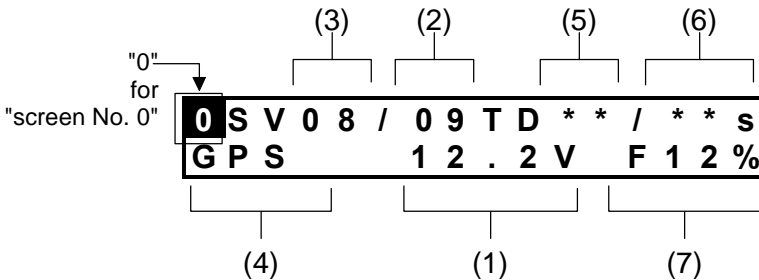
After making the necessary connections (see page 1-10, *Basic connections*), just press the **ON/OFF** pushbutton to get the receiver started.

What your receiver is then busy to is reported on the status display.

Follow the instructions below, based essentially on the observation and use of the status display, to be certain that your receiver reaches its operational status (for a complete description of that display, see page 1-39, *Checking receiver operation from the Status Display*).

- When you press the ON/OFF button, a welcome message is displayed until the receiver completes all its self-tests (this may take a few seconds).
- Then a new display appears gathering the essential information you need at that time (Screen No. 0).

Example of screen No. 0:



- Check the power voltage (1), which should be within the expected voltage range (otherwise change the source or adjust it or, if the battery used is low, replace it).

Power voltage range:

10 to 36 V dc, floating : all the 5000 series, except for the 500x SD or 500x SK station

or 10 to 15 V dc : 500x SD or 500x SK station.

- Check that both the count of received satellites (2), and the count of satellites used (3), increase with time. The count of received satellites should finally reflect the currently visible satellite constellation from the considered point.

- When the count of satellites used reaches 4, check that a position solution is available, denoted by the parameter (4) changing from "HOLD" to a mode tied to the configuration of your receiver.

For example, in the case of a "straight" or "natural" GPS receiver, this parameter will change from "HOLD" to "GPS". If DGPS corrections are received, the parameter will change to "DGPS". All the possible values of this parameter are listed in page *1-41, Screen No.0: Operating Status*).

If corrections are processed in the receiver, you will probably be interested in knowing the values of the parameters annotated (5) and (6) in our screen example above (respectively count of corrections, received or transmitted, and age of corrections).

If you do not remember the options installed in your receiver, press the **Scroll** pushbutton repeatedly until you reach screen No. 8. After reading this screen, depress this button again (and keep it depressed for a longer time) to come back to screen No. 0.

- Now that a solution is available, go to screen No. 2 by pressing the **Scroll** pushbutton. Check that the displayed position is the expected one.
- Press the **Scroll** pushbutton once more to access screen No. 3. Check that the local time displayed (beginning of lower line) is correct.

If you have reached this operational stage without any problem, then you can now let the receiver operate on its own, even forget it, and proceed with your work.
If you encounter a problem, please read what follows.

A common problem which may be encountered when first starting up the equipment is the incapability for the receiver to fix the position whereas the count of satellites used is sufficient to perform this operation (a minimum of 4 satellites is required).

This state is reported on Screen No. 0, where "HOLD" keeps on being displayed while the count of satellites has been 4 or more for a certain time.

To solve this problem:

- first check the estimated position on Screen No.2 and the local time on Screen No. 3.
- If either of these parameters (or both) are incorrect, you will need to make the necessary corrections (see *Editing the estimated position*, page 1-15 or/and *Editing the receiver time & date*, page 1-16).

These corrections require the connection of the control computer to the A port, as described earlier (see page 1-10, *PC connection*) and the use of *Win Comm* from *DSet Pack* running on this computer (see *Appendix G* to know how to send commands from *Win Comm*).

- If the two parameters are correct, or if you are facing any other kind of problem, please refer to page 1-55, *Troubleshooting*).

Editing the estimated position

You may need to use this command if the receiver cannot start functioning because of a too distant estimated position (> 200 km).

The current estimated position (which then becomes the position solution when the receiver reaches operational status) is visible on the status display, on Screen No. 2.

- From the control computer, send the following command to read the coordinates of the estimated position:

```
$ECGPQ, GLL<cr><lf>
```

The receiver will return a reply of this type:

```
$GPGLL,4716.091395,N,00129.463318,W,180449.00,A*14
```

- To change the estimated coordinates of your current position (for example, they should be *lat: 39°40.00' N* and *long: 4°15.00' E*), send the following command:

```
$ECGLL,3940,N,00415,E<cr><lf>
```

Changing the coordinates of the estimated position will re-initialize the position processing. If the new coordinates are correct, the receiver will reach operational status in no time.

A detailed description of the commands used above is provided in *Appendix C*.

After entering an estimated position, select screen No. 2 to check the new coordinates of this position. For example, screen No. 2 would look like this after sending the \$ECGLL command above :

2	W	G	S	8	4	3	9	§	4	0	.	0	N
H	+			4	6	4	§	1	5	.	0	E	

Editing the receiver time & date

You may need to use this command if the receiver cannot start functioning because of a too different local time compared with the receiver time.

The current local time is visible on the status display, on Screen No. 3.

- From the control computer, send the following command to read the local date & time:

\$ECGPQ,ZDA<cr><lf>

The receiver will return a reply of this type:

\$GPZDA,180919.00,17,2,1998,+00,00*78

- To change the local time (for example, it should be *08hr 21min, dec18 1997, offset: -1hr*), send the following command:

\$ECZDA,082100,18,12,1997,-1,00<cr><lf>

Changing the local time will re-initialize the position processing. If the local time is now correct, the receiver will reach operational status in no time.

A detailed description of the commands used above is provided in *Appendix C*.

After entering a local time, select screen No. 3 to check your entry. For example, screen No. 3 would look like this after sending the \$ECZDA command above :

3	O	s	c	-	1	.	0	0	E	+	0	0	s	/	s
0	8	:	2	1	:	0	0	=	Z	-	0	1	:	0	0

Checking the fix mode used

Screen No. 0 shows the fix mode in which the receiver operates (see parameter (4) in the display example of page I-11). If for any reason, you need to change that mode, use the FIXMOD command as explained below:

- From the control computer, send the following command to read the fix mode currently used:

```
$PDAS, FIXMOD<cr><lf>
```

If the receiver is operating in the "straight" GPS mode, the reply will be:

```
$PDAS, FIXMOD, 3, 1*39
```

- To change that mode (for example, you want to work in single-station DGPS with reference station No. 801), send the following command:

```
$PDAS, FIXMOD, 4, 1, 801<cr><lf>
```

- Check the new fix mode used by sending the following command:

```
$PDAS, FIXMOD<cr><lf>
```

The receiver should return:

```
$PDAS, FIXMOD, 4, 1, 801*2B
```

Changing the fix mode will re-initialize the position processing.

A detailed description of the command used above is provided in *Appendix C*.

Checking the type of position solution used for navigation

The type of position solution on which to base your navigation should be distinguished from the fix mode used.

In a kinematic fix mode for example (KART or LRK), three different types of position solutions are available for your navigation: EDGPS, KART A/LRK A (A for "Accurate 1-Hz rate") or KART R/LRK R (R for "Real-time 10-Hz rate"). In these cases of use, you will have to specify the desired type of position solution otherwise the receiver will deliver the default position type, which is "straight" GPS, or conventional DGPS (if available).

If you need to change the type of position solution used for navigation, use the NAVSEL command as explained below.

- From the control computer, send the following command to read the type of position solution used for navigation:

```
$PDAS,NAVSEL<cr><lf>
```

If the receiver is operating in the "straight" GPS or conventional DGPS mode, the reply will be:

```
$PDAS,NAVSEL,1,1*29
```

- To change that selection (for example, you want to select the KART A/LRK A fix), send the following command:

```
$PDAS,NAVSEL,3,1<cr><lf>
```

- Check the new selection by sending the following command:

```
$PDAS,NAVSEL<cr><lf>
```

The receiver should return:

\$PDAS,NAVSEL,3,1*2B

A detailed description of the command used above is provided in *Appendix C*.

1

Work sessions

Theory of operation

Work sessions constitute a fundamental operating aspect of your receiver. You need to know everything about sessions if you do not want, in some particular cases, to be surprised by the behavior of the receiver.

A work session is defined as a period of time during which you want a receiver to operate. The rest of the time, power will be removed from the receiver (only the session-managing circuit will remain powered).

There are two good reasons for you to use the concept of session:

- you want to limit the daily operating time of the receiver to save battery power (at a station for example).
- If you use the PCMCIA recording capability, you want to precisely define the recording time spans for best management of the PCMCIA memory space.

Indeed, if the *PCMCIA recording capability* option is installed, defining a programmed session with *recording bit =1*, or an immediate session, *and* programming a data output (or data outputs) on port P will result in the recording of the data on the PCMCIA card during the whole session.

Whatever the use you make of sessions, you have to decide on the value to give to the option controlling the receiver power supply. Two values are possible for that option (see also the \$PDAS,EXPSES command):

- Either you give full control of the power supply to the session-managing circuit (choose "AUTPW").
Warning! Providing a user with a receiver configured with this option active and no pending session may get this user into trouble if no further explanation is provided. Indeed, the receiver will unconditionally switch off after 30 seconds of operation if nothing else is done in the meantime!
- or you still allow an operator to turn on and off the receiver outside the session times (choose "MANPW"). Programmed sessions however, if any, will continue to have priority in the management of the power supply. If there is no programmed session and this option is used, the receiver will operate on a permanent basis, with power only controlled by the ON/OFF pushbutton.

There are two kinds of sessions:

- *programmed* session
- *immediate* session



- **Programmed session**

A *programmed* session is defined by:

- a start time
- an end time
- a recording indicator (0: without recording; 1: with recording)
- a session label (8 characters max.)

Unless the desired programmed sessions are present in the receiver configuration—in which case you have nothing else to do but use these sessions—you can still define, re-define or delete a programmed session using the \$PDAS,SESSN and \$PDAS,DELSES commands.

Programmed sessions can be run once (ON) or several times (CYCLE) if you give the receiver enough time to do so.

- **Immediate session**

An *immediate* session starts when the appropriate \$PDAS,EXPSES command (\$PDAS,EXPSES,IMMED) is run in the receiver:

- If the command is in the receiver configuration, the immediate session will start when you depress the ON/OFF pushbutton.
- If you send this command from the control computer, the immediate session will start when the command is processed in the receiver.

There is a single way of ending an immediate session:

- by sending the \$PDAS,EXPSES,END command.

- **Recovering permanent operation**

Permanent operation of the receiver is obtained by rejecting all the programmed sessions, if any, or by programming a single session from 0hr 00 to 24hr 00.

A few programming examples

- The session type and power supply control parameters are grouped in the \$PDAS,EXPSES command.
- All the parameters defining a programmed session are grouped in the \$PDAS,SESSN command.
- Programmed sessions can be deleted using the \$PDAS,DELSES command

For more information about these commands, see *Appendix C*.

- **Listing and validating programmed sessions**

- From the control computer, send the following command:

```
$PDAS,SESSN<cr><lf>
```

Receiver reply (example):

```
$PDAS,SESSN,1,111500,140000,0,*5E  
$PDAS,SESSN,2,154500,173000,0,*5C
```

Interpreting the receiver reply:

1st line: session 1, from 11hr15 to 14hr00, without data recording.

2nd line: session 2, from 15hr45 to 17hr30, without data recording.



- From the control computer, send the following command to validate these sessions (run order: 2 then 1 for example, sessions repeated) and to select automatic power supply control:

\$PDAS,EXPSES,CYCLE,AUTPW,2,1<cr><lf>

- Check the changes made by sending the following command:

\$PDAS,EXPSES<cr><lf>

Expected receiver reply :

\$PDAS,EXPSES,CYCLE,AUTPW,2,1*36

- **Running/ending an immediate session with data recording on PCMCIA**

(requires PCMCIA recording capability option).

- For example, from the control computer, define a GPS pseudo-range output...:

\$PDAS,PRANGE,1,P,1,10,4<cr><lf>

Check the definition of this output by sending the following command:

\$PDAS,PRANGE<cr><lf>

\$PDAS,PRANGE,1,P,1,10,4,0,0,0*70

\$PDAS,PRANGE,2,N*59

- ...and define a raw data output:

\$PDAS,GPSDAT,1,P,3,3,3,3<cr><lf>

Check the definition of this output by sending the following command:

```
$PDAS,GPSDAT<cr><lf>  
$PDAS,GPSDAT,1,P,3,3,3,3*5E  
$PDAS,GPSDAT,2,N*43
```

- From the control computer, send the following command to start the immediate session:

```
$PDAS,EXPSES,IMMED<cr><lf>
```

Check that a session is now in progress by sending the following command:

```
$PDAS,EXPSES<cr><lf>  
$PDAS,EXPSES,IMMED,MANPW*2F
```

- To end the immediate session, send the following command:

```
$PDAS,EXPSES,END<cr><lf>
```

Check that there is no more session in progress by sending the following command:

```
$PDAS,EXPSES<cr><lf>  
$PDAS,EXPSES,END,MANPW*28
```



- **Selecting Manual control for the power supply and disabling all programmed sessions**

- From the control computer, send the following:

\$PDAS,EXPSES,END,MANPW<cr><lf>

(No receiver reply)

Information about sessions is reported on the receiver status display by selecting screen No. 5. Display example:

5	S E S : I M M E B 8 : 1 8
	M P W R E C E 8 : 2 4

Usual changes made to the receiver configuration from the Control computer

While using your receiver, you will probably need to make some changes to the receiver configuration, more particularly regarding its data outputs.

This chapter discusses the usual changes you can make from the control computer (see page 1-10, *PC connection*).

Other changes can be made (see *Appendix C* in which all the possible commands are presented).

Enabling/disabling all data outputs

You may be interested in disabling *all* the active data outputs (raw-data and computed-data outputs), for example in order to facilitate maintenance steps on the attached peripheral equipment. This is simply achieved through a single command:

- From the control computer, send the following command:

```
$PDAS,OUTOFF<cr><lf>
```

(No receiver reply)

- The inverse operation is also very simple. Just send the following command to re-enable all the data outputs:

```
$PDAS,OUTON<cr><lf>
```

(No receiver reply).

The syntax of the above commands is detailed in *Appendix C*.

1

Editing the settings of a serial port

You may want to change the settings of a serial port on the receiver in order to allow communications with your peripheral equipment.

- From the control computer, send the following command to list the settings of all the receiver serial ports:

```
$PDAS,HARDRS<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,HARDRS,4,1,A,9600,8,1.0,N*0A
$PDAS,HARDRS,4,2,B,9600,8,1.0,N*0A
$PDAS,HARDRS,4,3,C,9600,8,2.0,N*09
$PDAS,HARDRS,4,4,D,19200,8,1.0,N*3F
```

- For example, to change the settings of port B to 19200 Bd, 7 data bits, Odd parity, send this command:

```
$PDAS,HARDRS,,,B,19200,7,1,O<cr><lf>
```

Check the new settings for port B by sending the following command:

```
$PDAS,HARDRS<cr><lf>
```

```
$PDAS,HARDRS,4,1,A,9600,8,1.0,N*0A
$PDAS,HARDRS,4,2,B,19200,7,1.0,O*31
$PDAS,HARDRS,4,3,C,9600,8,2.0,N*09
$PDAS,HARDRS,4,4,D,19200,8,1.0,N*3F
```

- If you change the settings of the serial port on the receiver, do not forget to make the same changes on the concerned serial port of the control computer !!

Refer to *Appendix C* for more information on the **\$PDAS,HARDRS** command.

Editing/adding the definition of a computed data output

The definition of each of the computed-data outputs generated according to the receiver configuration can be modified through the following steps:

- From the control computer, send the following command to list all the data outputs:

```
$PDAS,OUTMES<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,OUTMES,1,A,-1,10,1,5,7,8,9,10,20*4F  
$PDAS,OUTMES,2,A,-1,10,2,7,8,5,11,20*5B  
$PDAS,OUTMES,3,A,-1,10,12,20*51  
$PDAS,OUTMES,4,A,-1,10,13,20*57  
$PDAS,OUTMES,5,A,-1,10,3,5,6,20*64
```

...



- For example, to enable output #2 on port B in 1pps mode, type the following command:

\$PDAS,OUTMES,2,B,4<cr><lf>

- Check the changes made to output 2:

\$PDAS,OUTMES,2<cr><lf>

\$PDAS,OUTMES,2,B,4,10,2,7,8,5,11,20*70

- To disable an output (output #2 for example), send one of the following commands:

\$PDAS,OUTMES,2,B,0<cr><lf>

(but you lose the initial trigger information relevant to this output by using "0" as the 3rd parameter in the command)

or

\$PDAS,OUTMES,2,B,-4<cr><lf>

(you preserve the initial trigger information by placing "-" before the 3rd parameter in the command)

Refer to *Appendix C* for more information on the **\$PDAS,OUTMES** command.

Editing the definition of a GPS raw data output

The definition of each of the raw-data outputs generated according to the receiver configuration can be modified through the following steps:

- From the control computer, send the following command to list all the generated data outputs:

```
$PDAS,GPSDAT<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,GPSDAT,1,B,-3,-3,-3,-3*4C
$PDAS,GPSDAT,2,N*43
```

- For example, to change the definition of output #1 (described in the 1st reply line), send a command of this type:

```
$PDAS,GPSDAT,1,A,3,3,3,3<cr><lf>
```

Check the changes made:

```
$PDAS,GPSDAT<cr><lf>
$PDAS,GPSDAT,1,A,3,3,3,3*4F
$PDAS,GPSDAT,2,N*43
```

Refer to *Appendix C* for more information on the **\$PDAS,GPSDAT** command.

Editing the definition of a pseudorange-data output



The definition of each of the pseudorange-data outputs generated according to the receiver configuration can be modified through the following steps:

- From the control computer, send the following command to list all the generated data outputs:

```
$PDAS,PRANGE<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,PRANGE,1,B,-1,10,4,0,0,0*4F
$PDAS,PRANGE,2,N*59
```

- For example, to change the definition of output #1 (described in the 1st reply line), send a command of this type:

```
$PDAS,PRANGE,1,A,1<cr><lf>
```

Check the changes made:

```
$PDAS,PRANGE<cr><lf>
$PDAS,PRANGE,1,A,1,10,4,0,0,0*61
$PDAS,PRANGE,2,N*59
```

Refer to *Appendix C* for more information on the **\$PDAS,PRANGE** command.

Editing the navigation mode currently selected

You may want to change the navigation mode due to new or unexpected navigation conditions:

- From the control computer, send the following command to check the currently selected navigation mode:

```
$PDAS,NAVSEL<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,NAVSEL,1,1*29
```

(DGPS solution (1), Position mode (1))

- For example, to select the EDGPS solution to be used in navigation, send this command:

```
$PDAS,NAVSEL,2<cr><lf>
```

Check the changes made:

```
$PDAS,NAVSEL<cr><lf>  
$PDAS,NAVSEL,2,1*2A
```

Refer to *Appendix C* for more information on the **\$PDAS,NAVSEL** command.

Editing the filtering time constant applied to speed

You may want to change the filtering time constant applied to the *speed* parameter, due to new or unexpected navigation conditions:

- From the control computer, send the following command to check the currently selected filtering time constant:

```
$PDAS,FILTER<cr><lf>
```

The receiver will return a reply of this type:

```
$PDAS,FILTER,6*30
```

(speed filtering time constant: 6 seconds)

- To change the speed filtering time constant to 32 seconds for example, send this command:

```
$PDAS,FILTER,32<cr><lf>
```

Check the changes made:

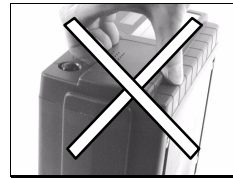
```
$PDAS,FILTER<cr><lf>  
$PDAS,FILTER,32*07
```

Refer to *Appendix C* for more information on the syntax of the **\$PDAS,FILTER** command.

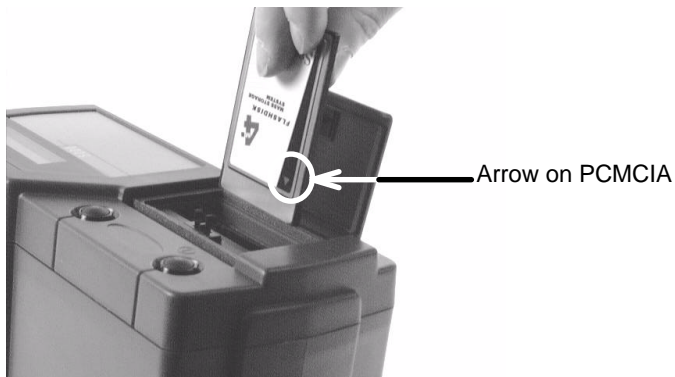
PCMCIA reader

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.

PCMCIA file organization

- All the files are stored in the PCMCIA root directory. No subdirectories can be created on a PCMCIA card.

PCMCIA control

- You need a computer attached to the receiver's port A to perform the usual operations described in the continuation of this chapter. Use *DSet Pack* or *Win Comm* to send the required commands.

- If your receiver is fitted with the *PCMCIA recording capability* option, see *Work sessions*, page 1-19, to know how to write on the PCMCIA.

Reading the amount of free memory

- From the control computer, send the following command:

```
$PDAS,MEMORY<cr><lf>
```

- The receiver will return a reply of this type:

```
$PDAS,MEMORY,DIR,1,1,,122880,3858432,0
```

The percentage of free memory on the PCMCIA card is indicated in Screen No. 0 on the status display.

Display example:

0	S	V	0	9	/	1	2	T	D	1	1	/	0	1	s
E	D	G	P	*		1	2	.	1	V		F	4	5	%

Free memory percentage

Listing all the files present on a card

- From the control computer, send the following command:

```
$PDAS,MEMORY,DIR<cr><lf>
```

- The receiver will return a reply of this type:

```
$PDAS,MEMORY,DIR,3,1,,122880,3858432,2
```

```
$PDAS,MEMORY,DIR,3,2,sesimmed.d00,694  
44,18,02,1998,092034.0
```

```
$PDAS,MEMORY,DIR,3,3,sesimmed.d01,303  
04,18,02,1998,092230.0
```

1

Loading a configuration from a card

For successful completion of this load operation, a configuration file named "CONFIG.CFG" should be stored on the PCMCIA card. Typically, this type of file is created using the DSNP *ConfPack* Software.

The configuration file currently used by the receiver can be identified using the \$PDAS,COMMNT command.

Typical procedure:

- From the control computer, send this series of commands:

```
$PDAS,COMMNT<cr><lf>
```

(for identification of the default configuration)

```
$PDAS,COMMNT,2,1,AQUARIUS  
5000 SERIES*14
```

```
$PDAS,COMMNT,2,2,DEFAULT  
CONFIGURATION*2B
```

```
$PDAS,CONFIG,LOAD<cr><lf>
```

```
$PDAS,COMMNT<cr><lf>
```

(for identification of the configuration
you've just loaded)

```
$PDAS,COMMNT,1,1,CONFIG PALMTOP*61
```


Checking receiver operation from the Status Display



Your receiver is fitted with a 2-line × 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:

```
D A S S A U L T   S E R C E L
* G N S S   R E C E I V E R *
```

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, options, 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).

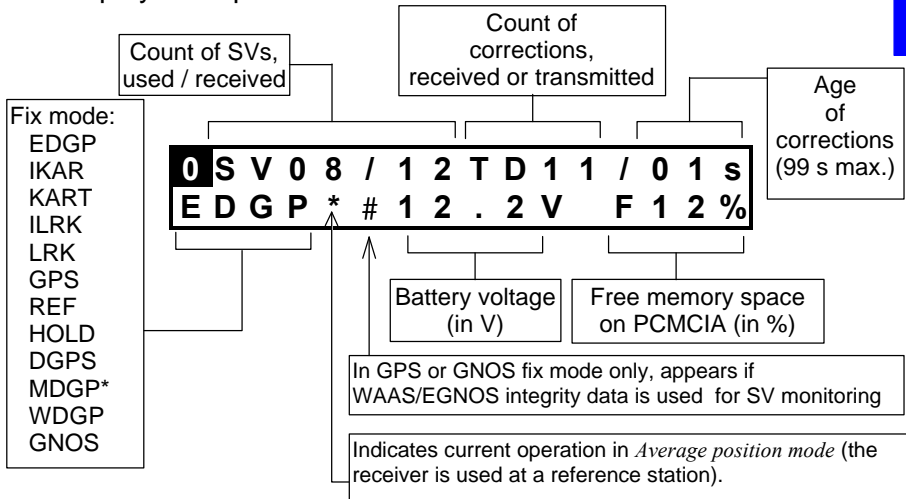
Each screen is identified by a number to help you navigate through the set of screens. The screen number is located at the beginning of the upper line:



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

WDGP : Differential GPS using WADGPS corrections and integrity control from GEO, and possibly WAAS/EGNOS pseudoranges

GNOS : Same as GPS except that WAAS/EGNOS pseudoranges are involved in the position processing.

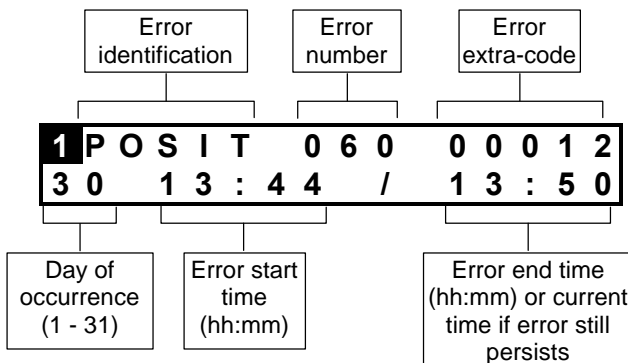
Screen No. 0 (refresh rate: 1.0 second) will be maintained on the status display until you depress the Scroll button.

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 sub-screens for screen No. 1 may exist. Display example:



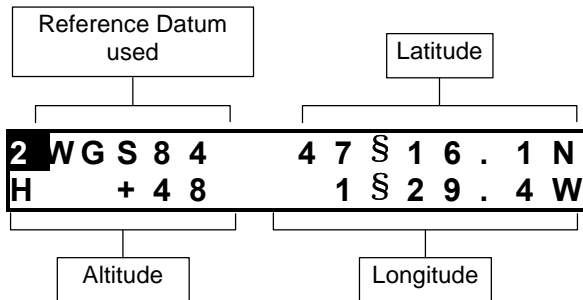
The list of all the possible errors is given in the *Troubleshooting* chapter, page 1-55.



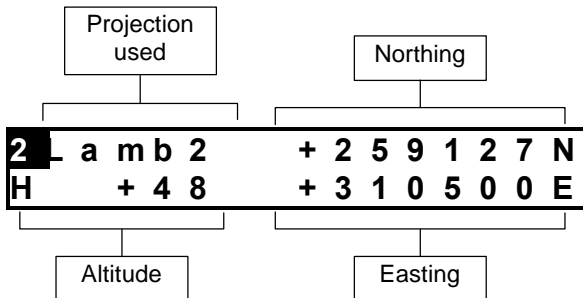
Screen No. 2: Position solution

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

Without projection (example):



With projection (example):

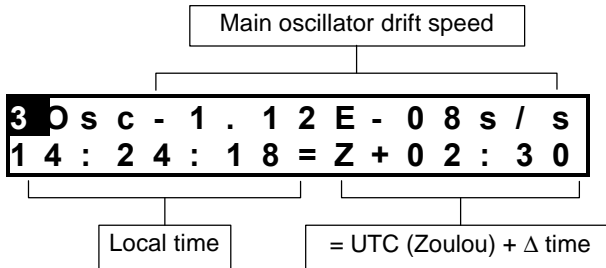


If no solution is available ("HOLD" displayed on screen No.0), this screen will display the "initial position", as defined by the configuration, or the latest position computed in case of lasting solution unavailability, due to reception loss for example.

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:

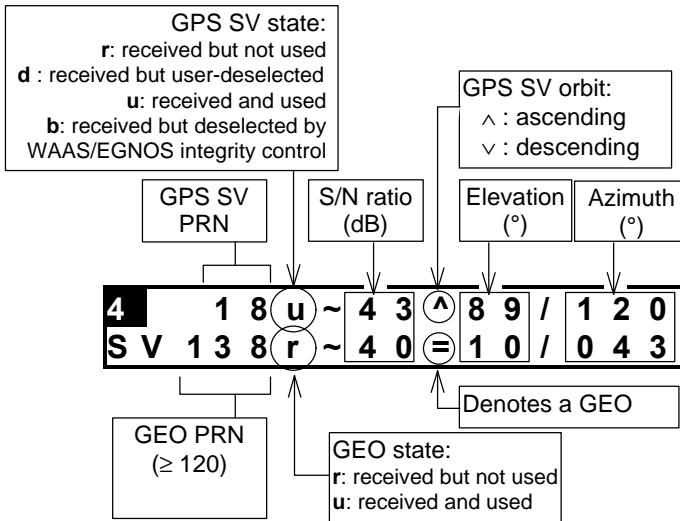




Screen No. 4: GNSS reception status

Each line describes the reception of a satellite. Hence, two satellites are shown on a sub-screen and n sub-screens will exist if $2n$ (or $2n-1$) satellites are received. In WADGPS mode, the selected GEO appears in the lower line of the last sub-screen No. 4.

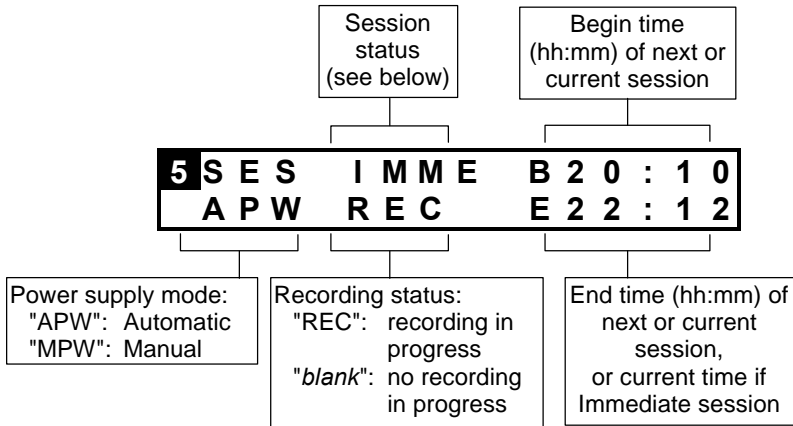
Display example with GPS SV PRN 18 and GEO PRN 138:



In the lower line containing the description of a GEO, the elevation and azimuth will be reported as equal to “000” if no ephemeris data is available to compute these angles.

Screen No. 5: Information about sessions

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)

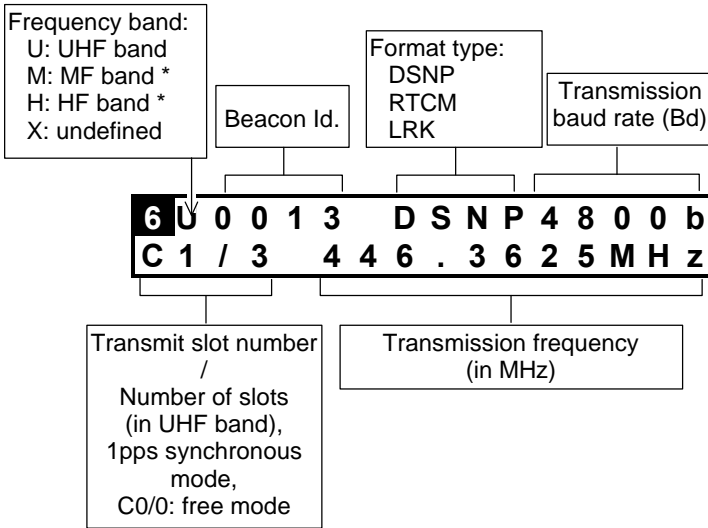
END : All sessions are disabled, or ends the immediate session.



Screen No. 6: Information about corrections

- If the equipment is connected to a transmitting beacon:

Display example:



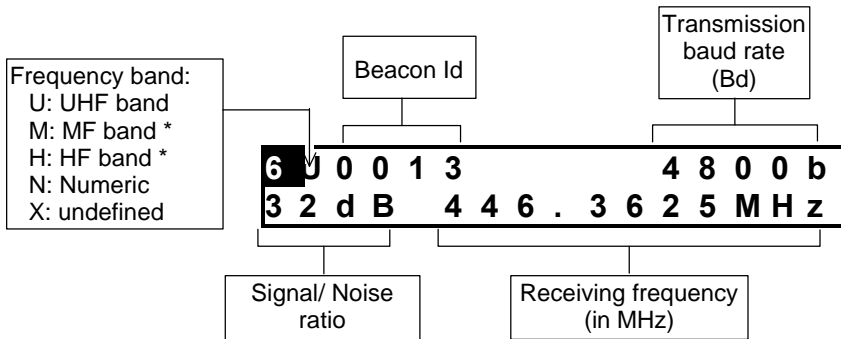
Screen obtained with no programming performed in the UHF Data Link module:

```
6 X * * * * x x x x * * * * b
    * * * . * * * * M H z
```

*: Future use

- if the equipment is a corrections receiver:

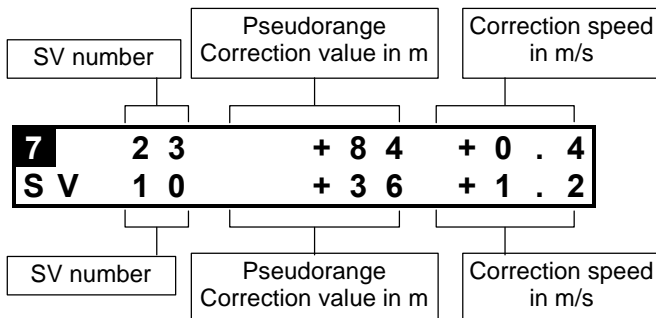
Display example:



(*: Future use)

Screen No. 7: Differential corrections

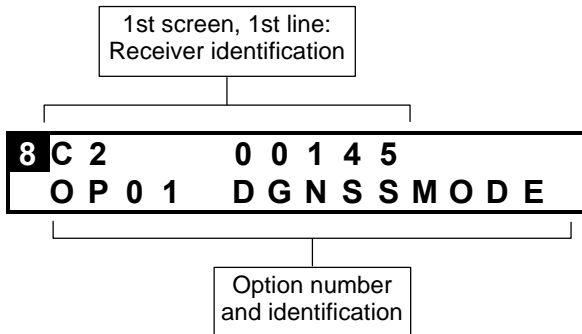
Each line describes the correction to be applied to a measurement made from the satellite specified in the line. Hence, two corrections are shown on a sub-screen and n sub-screens will exist if $2n$ (or $2n-1$) corrections are computed/received. Display example:



Screen No. 8: Firmware Options 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 sub-screens for screen No. 8 will depend on the number of options installed.

Display example:



- OP01 : DGNSSMODE
- OP02 : REFSTATION
- OP03 : KARTMODE
- OP04 : LRKMODE
- OP05 : USERGEOID
- OP06 : RECORDING
- OP07 : QA/QC

Screen No. 9: Hardware and Software identification

Each subassembly in the receiver is described on a sub-screen. Display examples:

Data Link:

```
9 T D 2 0   E U H F V 1 0 3 0 0
```

or

```
9 T D 0 0   R U H F V 1 0 3 0 0
```

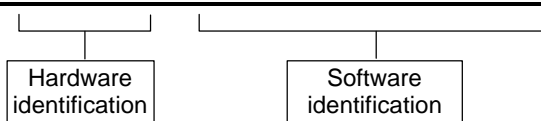
GNSS Engine:

```
9 C M 0 8   C M B L V 0 0 1 0 9
  C M 0 8   C M P Y V 0 0 2 0 4
```

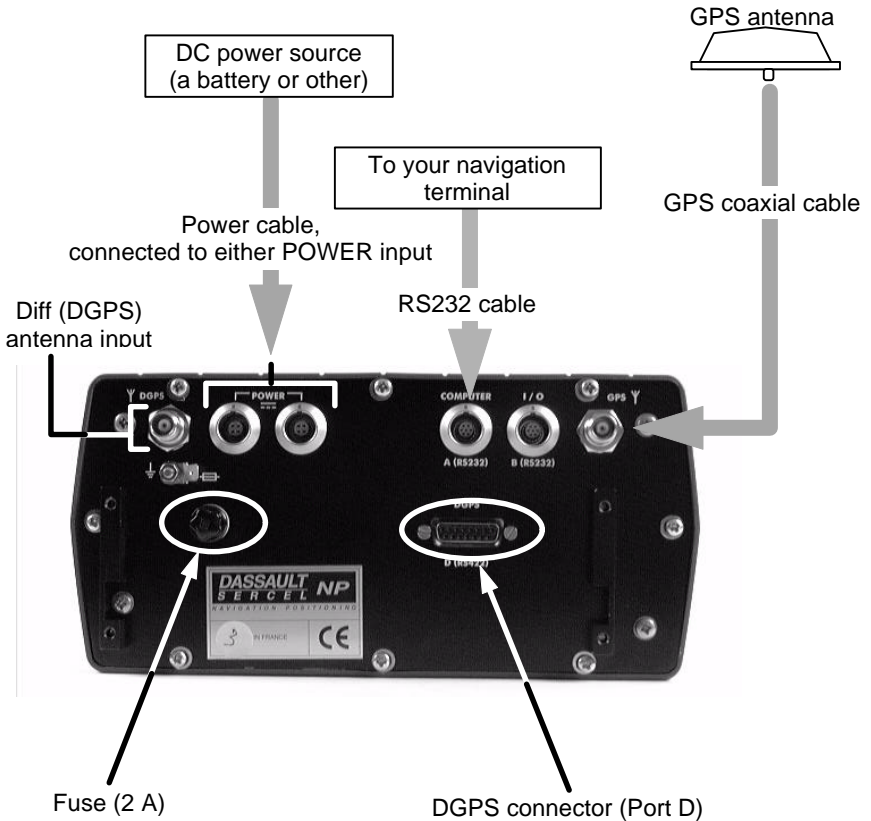
UC (CPU) board:

```
9 U C 0 1   U C B S V 2 0 0 0 0
  U C 0 1   U C B L V 1 0 0 0 0
```

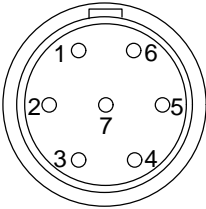
```
9 U C 0 1   U C B N V 2 0 2 0 4
```



Rear panel Connectors

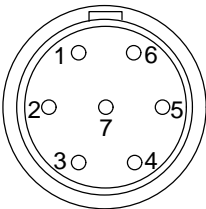


COMPUTER connector,
(RS232 Port A),
type: JKX FD1G 07 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



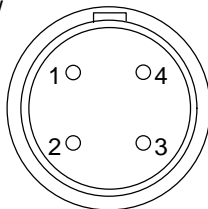
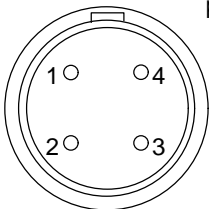
Pin	Signal	
1	+12 V	output
2	TXD	output
3	RXD	input
4	REMOTE ON	input
5	GND	
6	CTS	output
7	RTS	input

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



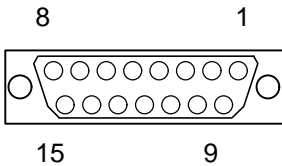
TNC-male
coaxial connector
(GNSS antenna input)



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

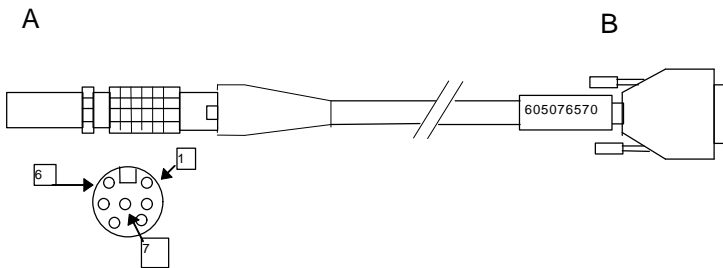


DGPS
connector
(RS422 Port D), pin view,
15-C SubD-female type.
For exclusive use by DSNP UHF
transmitter



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	

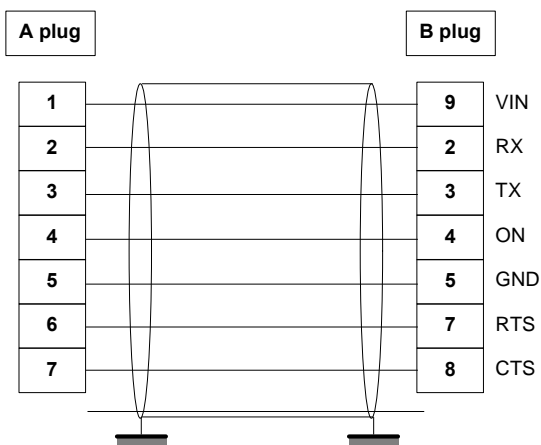
RS232 cable



A is a 7-contact JDX 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.



Troubleshooting

Front Panel Indicators



ON/OFF indicator	Scroll indicator	Meaning
OFF	OFF	Receiver not powered. If this status is obtained after pressing the ON/OFF push-button, check power supply connection (cable, connectors), power source, power voltage, rear panel fuse. If this status is obtained after a period of operation, 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 (initialisation phase)
ON	OFF	Operating receiver. No pending session.
ON	Flashing	Operating receiver, due to manual power supply control. Pending session.
OFF	Flashing	Receiver in standby, due to automatic power supply control. Pending session.
ON	ON	Operating receiver. Recording on PCMCIA in progress.

Error report

Errors are reported in two different ways:

- On the status display, on Screen No.1. Each error occupies a "sub-screen" (see *Screen No. 1: Error report* chapter, page 1-42).
- As a receiver reply to the \$PDAS,DEFLT command (see this command in *Appendix C*).

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	CONFIG
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	SYSTEM
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.

1

Error list

No.	Family	Gravity	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 error	Datation Trigger Error
18	2 - CONFG	4	Config 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	Max number of tries reached	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
86	POSIT	3	Kinematic initialization	Kinematic initialization
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



Processing Options

NOTICE:

In the first part of this section, the differential processing methods are described (conventional DGNS, WADGPS, complete with QC). All users should read this part as these methods are implemented in all receivers from the Aquarius 5000 Series.

In the second part, the optional KART/LRK methods are presented. This part may be skipped unless you are the user of one of these options.

2. Processing options

DGNSS

Introduction

DGNSS is a processing mode used to refine the GPS position computed in a GNSS receiver, using pseudo-range corrections generated at a stationary point by a *reference station*.

To operate in DGNSS, you can use DGPS pseudo-range corrections in the RTCM format delivered by an external equipment attached to your receiver via a serial port, or use a specific data link from the reference station to each receiver. A UHF hardware option is available from DSNP (see section 3) to implement this kind of data link.

This section assumes that you are familiar with the basic DGPS techniques. A few additional key elements are required however to understand all the DGNSS capabilities offered by your receiver. This is discussed in the next pages.

Software installation

As the DGNSS processing mode is part of any equipment from the *5000 Series*, no prior installation phase is required to use this functionality.

Implementation Procedures

- Terminology used

Reference station : a stationary GPS receiver, with accurately known location, whose function is to generate DGPS corrections and data.

The *identification number* of a *reference station* is user-defined through the \$PDAS,UNIT command. In DGNSS processing mode, your receiver will read this identification number from the DGPS messages received to identify the source of corrections and data.

Beacon A transmitting unit connected to one or more reference stations. The beacon is used to transmit DGPS corrections to users.

A beacon is identified by a specific identification number, called *Beacon Id*, complying with the beacon numbering rule defined by the RTCM.

It is important to note that a *reference station* and the *beacon* to which it is attached may have different *identification numbers*.

When defining a beacon, you will be asked to enter its geographical coordinates. Remember that these coordinates do not need to be very precise as they are just used by navigators to select the corrections transmitter the closest to their positions. Conversely, the coordinates of a reference station must be known with the best possible accuracy as they are essential in the computing of DGPS corrections.

Navigator receiver : Mobile receiver providing position or navigation data.

- **Reference station programming outlines**

The following DSNP proprietary commands are used to implement the DGNSS processing in a *reference station*:

- \$PDAS,DGPS,MODE is used to:
 - define your receiver as a corrections generator
 - specify the associated beacon and its transmission rate
- \$PDAS,DGPS,STATION is used to let the *reference station* know the transmission specifications (carrier, modulation type, encryption) of the attached beacon.
- \$PDAS,DGPDAT is used to specify the type of corrections which the *reference station* will generate.

- \$PDAS,UNIT is used to assign an identification number to the *reference station*.
- \$PDAS,FIXMOD allows you to specify the fix computing mode used at the *reference station*.
- \$PDAS,PREFLL or \$PDAS,PREFNE allows you to enter the precise coordinates of the *reference station*.

- *Navigator receiver programming outlines*

The following DSNP proprietary commands are used to implement the DGNS processing in a *navigator receiver*:

- \$PDAS,DGPS,MODE is used to:
 - define your receiver as a corrections "consumer"
 - specify the beacon which should be received.

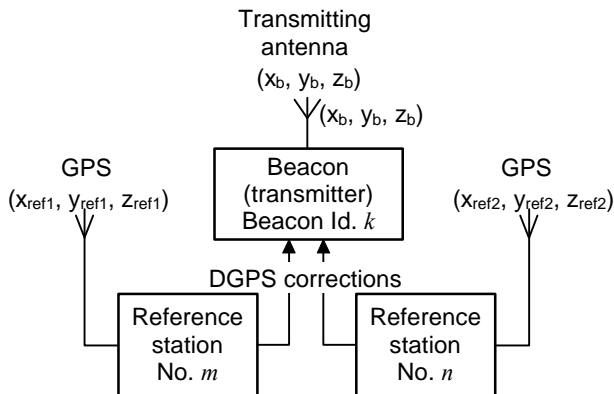
If no beacon id. is specified, then corrections are assumed to be delivered by a third equipment (Inmarsat decoder for example) attached to one of the receiver's serial ports.
 - specify the *reference station(s)* from which corrections are acquired.
- \$PDAS,DGPS,STATION is used to let the receiver know the transmission specifications (carrier, modulation type, encryption) of each of the potentially usable beacons.
- \$PDAS,FIXMOD allows you to select the DGPS computation mode and the reference station to be used.



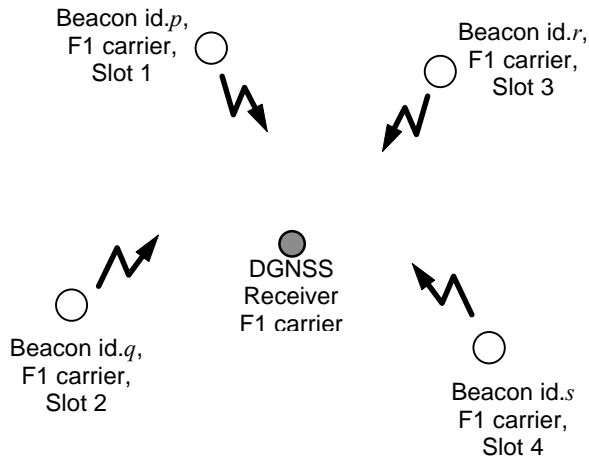
- In the navigator receiver, \$PDAS,DGPDAT is used only to define the output of DGPS corrections and so has no fundamental role in the programming of the DGNSS processing.
- If the DGNSS processing used provides several position solutions, \$PDAS,NAVSEL lets you choose the type of position solution you want to use for your navigation application.

• **Particular cases of DGPS networks usable with the 5000 series**

1. A number of reference stations can use the same beacon to transmit their corrections (USCG beacon, INMARSAT transmission):



2. In UHF band, up to 6 beacons can use the same carrier frequency. In this case, a specific transmit time slot is assigned to each beacon so that corrections from each beacon can be transmitted and received in sequence.



Corrections will be received on the same reception frequency. The receiver will be able to sort out the corrections as a function of the source by analyzing the identification number of the reference station contained in the corrections messages.

With a navigator receiver from the Aquarius 5000 series, up to 4 different sets of DGPS data can be received concurrently, one of which being chosen to be involved in the fix processing.

This "time sharing" scheme is not recommended if you work with the high-accuracy KART or LRK method.

Typical programming example

The example below describes a DGNSS system using the DSNP UHF data link. Proceed in the order given below.

- **Configuring the UHF reference station**

1. Enter the definition of the beacon (i.e. the DSNP UHF transmitter) by sending the following command to the GNSS receiver that will be used as the reference station:

```
$PDAS,DGPS,STATION,1012,BLIXERD,3845.45,S,01021.00,E,UHF,421000000,50,,,1200,DN
```

- Beacon Id.: 1012
 - Beacon name: BLIXERD
 - Beacon coordinates: 38°45.45'S - 10°21'E
 - Band and carrier: UHF, 421 MHz
 - Beacon range: 50 km
 - (two empty fields)
 - Baud rate 1200 Bd
 - Modulation type: DQPSK
 - No encryption
2. Send the following command to define this receiver as the reference station:

```
$PDAS,DGPS,MODE,1,D,E,1012,0
```

- Command line: 1
- Port: D (serial port of the DSNP UHF transmitter)

- Receiver defined as DGPS corrections generator: E
 - Beacon Id. (a DSNP UHF transmitter): 1012
 - Transmission mode: free (0)
3. Send the following command to select the processing mode used at the reference station:

\$PDAS,FIXMOD,1,1

- Residuals computation in transmitting reference station mode: 1
 - DGPS reference station: 1
4. Send the following command to enter the position of the reference station (in this example: Lat 38°45.448532'S, Lon 10°20 993478'E and H: 93.833 m):

**\$PDAS,PREFLL,0,3845.448532,S,01020.993478
,E,93.833**

5. Send the following command to define the identification number of the reference station (in this example, station id: 13):

\$PDAS,UNIT,13

6. Send a command of this type to define the DGPS corrections generated by the reference station:

\$PDAS,DGPDAT,1,D,1,10,3,1

In this example:

- Command line: 1
- DGPS corrections output on port D (to UHF transmitter) in time mode
- output rate 1 second
- Data type: DSNP UHF, UHF stations only
- Data description: code corrections

- **Configuring a UHF mobile**

1. Send the same command as you did for the reference station to tell the navigator receiver which UHF transmitter to work with:

\$PDAS,DGPS,STATION,1012,BLIXERD,3845.45,S,01021.00,E,UHF,421000000,50,,,1200,DN

- Beacon Id.: 1012
- Beacon name: BLIXERD
- Beacon coordinates: 38°45.45'S - 10°21'E
- Band and carrier: UHF, 421 MHz
- Beacon range: 50 km
- (two empty fields)
- Baud rate 1200 Bd
- Modulation type: DQPSK
- No encryption

2. Send the following command to define the GNSS receiver as a corrections receiver (the navigator receiver):

\$PDAS,DGPS,MODE,1,D,R,1012,,,13

- Command line: 1
- Port: D (serial port of the DSNP UHF transmitter)
- Receiver defined as DGPS corrections receiver: R
- Beacon Id. (the received DSNP UHF transmitter): 1012
- Identification number of the reference station received: 13

3. Send the following command to select the DGNSS mode in the navigator receiver:

\$PDAS,FIXMOD,4,1,13

- Single-station DGPS fix mode: 4
- DGPS reference station: 1
- Identification of the DGPS reference station: 13

4. Send the following command to select the DGPS solution as the position solution used in navigation:

\$PDAS,NAVSEL,1,1

- DGPS fix used for navigation: 1
- Navigation mode: none → 1

Implementing Conventional DGNS

• Introduction

With the basic version of the Aquarius 5001 or 5002 receiver, conventional DGPS can be implemented using DGPS RTCM-SC104 data in the "6 of 8" character format.

In this operating case, the required data will be generated by an external receiver/demodulator (a device receiving data from an MF radio-beacon or an INMARSAT demodulator for example) and applied to the receiver through one of its serial ports.

With the integration, into the receiver, of a UHF Datalink reception module, and the use of a suitable UHF reference station, conventional DGPS can also be implemented using one of the following formats:

- DGPS RTCM-SC104 data in the "6 of 8" character format, transmitted through the UHF Datalink at 1200 or 4800 Bd
- Pseudorange corrections, in the DSNP format, transmitted through the UHF Datalink at 1200 Bd

To date, conventional DGPS cannot be implemented using the data received in the LRK format, through the UHF Datalink operated at 4800 Bd.

The receiver can decode concurrently the correction data sets received from 4 different stations. However, the receiver will process only one of these correction data sets.

- **Example of programming steps letting the receiver use RTCM-SC104 corrections received on its serial port**

1. Use the following command to configure the serial port. This will let the receiver acquire and decode the DGPS data received from station No. 710 via its B port:

\$PDAS,DGPS,MODE,1,B,R,,,710

2. Use the following command to choose the fix mode in which the DGPS corrections received will be involved:

\$PDAS,FIXMOD,4,1,710

3. To choose the DGPS solution as the position solution used for your navigation applications, send the following command:

\$PDAS,NAVSEL,1,1

4. To enter "40 seconds" as the maximum age not to be exceeded by the DGPS corrections received, send the following command:

\$PDAS,AGECOR,40

When the DGPS corrections are received and involved in the position processing, Screen No. 0 on the Status display should look like this:

0	S	V	0	8	/	1	0	T	D	0	8	/	0	1	s
D	G	P	S			1	2	.	1	V			F	*	* %



In this screen example:

- 8 DGPS corrections are received, aged 1 second on average
- DGPS position solution delivered by the receiver; of the 10 pseudoranges received, 8 are corrected.

The DGPS corrections received can be viewed by selecting Screen No. 7 on the Status display.

- **Example of programming steps letting the receiver use RTCM-SC104 or DSNP UHF corrections acquired by the built-in UHF receiver**

1. Enter the definition of the station transmitting corrections in the DSNP UHF format by using the command below (carrier frequency: 444.55 MHz, 1200 Bd, DQPSK modulation).

**\$PDAS,DGPS,STATION,8,DSNP,4716,N,00129
 ,W,UHF,444550000,30,,,1200,DN**

- Use the following command to configure the built-in UHF receiver in order to let the receiver acquire and decode the DGPS data received from the reference station used (in this example, station No. 14 used):

\$PDAS,DGPS,MODE,1,D,R,8,,,14

- Use the following command to choose the fix mode in which the DGPS corrections received will be involved:

\$PDAS,FIXMOD,4,1,14

- To choose the DGPS solution as the position solution used for your navigation applications, send the following command:

\$PDAS,NAVSEL,1,1

- Select Screen No. 6 on the Status display to check the new settings of the built-in UHF receiver. In this example, the screen should look like this:

6	U 0 0 0 8	1 2 0 0 b
4 5 d B	4 4 4 . 5 5 0 0 M H z	



- **Particular case in which the RTCM-SC104 DGPS data received are transmitted by a UHF NDS100 MkII reference station**
 - This kind of data is transmitted systematically with "1" as the station number, which is therefore different from the true station number contained in the header of the RTCM message.
 - The programming steps provided below will let the receiver acquire and decode DGPS RTCM-SC104 data received from station No. 715, this data being transmitted by a UHF NDS100 MkII station at the carrier frequency of 436.125 MHz.

```
$PDAS,DGPS,STATION,4,RTCM,3812,N,0042  
7,E,UHF,436125000,30,,,1200,DN  
$PDAS,DGPS,MODE,1,D,R,4,,,1,715  
$PDAS,FIXMOD,4,1,715  
$PDAS,NAVSEL,1,1
```

- **Programming data outputs to a serial port or to the PCMCIA**

The DGPS digital information received on a serial port or by the UHF Datalink can be routed to a serial port or recorded on a PCMCIA (if the *PCMCIA recording capability* option has been activated) for archive or post-processing purposes.

Three output formats are available:

Acquisition format	Possible output formats		
	RTCM-SC104	DSNP UHF	SVAR!D
RTCM-SC104	✓		✓
DSNP UHF		✓	✓

- For example, to let the receiver output DGPS data on its A port, in time mode every 10 seconds, and in the SVAR!D format, use the following command:

\$PDAS,DGPDAT,1,A,1,100,4

- For example, to allow the receiver to start an immediate session with data recording on PCMCIA (PCMCIA recording capability option is required), send the two commands below. In this example, data in the DSNP UHF format will be recorded.

\$PDAS,EXPSES,IMMED,MANPW

\$PDAS,DGPDAT,2,P,3,,3,1

Use the following command to stop the data recording and end the immediate session:

\$PDAS,EXPSES,END,MANPW

WADGPS

Introduction

WADGPS (Wide Area DGPS) is a processing mode used to refine the GPS position computed by the *Aquarius* receiver, using the WADGPS corrections, and possibly the WAAS/EGNOS pseudo-ranges, broadcast by a geostationary satellite (GEO) of the WAAS or EGNOS system. Please, refer to *Appendix A* for more information about these systems.

When only pseudoranges are used in the position processing, then “GNOS” is reported as the fix mode currently used by the receiver (see Screen No. 0 in page 1-41). When WADGPS corrections and possibly WAAS/EGNOS pseudoranges are used, “WDGP” is reported on that screen.

Software Installation

As the WADGPS processing mode is part of any equipment from the *5000 Series*, no prior installation phase is required to use it.

To allow an *Aquarius* receiver to operate in this mode, one (or two) of its reception channels must be given the function of receiving and decoding the information broadcast by a GEO.

Two channels in the *Aquarius* receiver are usable for this purpose. However for the time being, we recommend that a single channel be used for WADGPS operation.

Implementation Procedure

The following DSNP proprietary commands are used to implement the WADGPS processing mode in the *Aquarius* receiver:

- \$PDAS,GNOS is used to choose either automatic or manual selection of the GEO to be received. If manual selection is chosen, this command must also include the PRN of the GEO to be received.
- \$PDAS,FIXMOD is used to enable the use of the WAAS/EGNOS in the position processing
- \$PDAS,GEODAT is used to configure outputs of WAAS or EGNOS data
- \$PDAS,DGPDAT is used to configure outputs of DGPS data
- \$PDAS,QC is used to select the type of quality control used.

The first two commands are essential in the implementation of the WADGPS processing mode. The use of these two commands is illustrated with the two examples below.

For the other commands, please refer to *Appendix C*.

- **WADGPS with INMARSAT III F5 GEO**

1. Enable the tracking of the WAAS or EGNOS system by specifying the PRN number of the GEO used and choosing a selection mode (Auto or Manual). Example:

\$PDAS,GNOS,2,138

where:

2: enables the tracking of WAAS/EGNOS and requests manual selection of a GEO

138: is the GEO PRN

Running this command will cause a WAAS/EGNOS-reserved channel in the *Aquarius* receiver to be allocated to SV PRN 138.

2. Enable the receiver to use the received WAAS/EGNOS data in the position processing:

\$PDAS,FIXMOD,4,2,138

where:

4: selects “single-station DGPS” as the current GPS fix mode

2: selects WAAS/EGNOS to be the source of corrections (hence WADGPS) but pseudoranges from this system will not be used

138: is the PRN of the GEO used

2

Later, once the GEO is received and used, screen No. 4 (see also page *I-44*) should look like this:

4		3	2	u	~	4	3	^	8	9	/	1	2	0	
S	V	1	3	8	r	~	5	8	=	2	5	/	1	1	6

The GEO will then be described in the lower line (the “=” symbol means that the satellite is geostationary, as opposed to ^ and v used to depict the orbit of a GPS satellite).

- **WADGPS with EURIDIS GEO (when operational)**

1. Enable the tracking of the WAAS or EGNOS system by specifying the PRN number of the GEO used and choosing a selection mode (Auto or Manual). Example:

\$PDAS,GNOS,2,120

where:

2: enables the tracking of WAAS/EGNOS and asks for manual selection of a GEO

120: is the GEO PRN

2. Enable the receiver to use the received WAAS/EGNOS data in the position processing:

\$PDAS, FIXMOD, 4, 12, 120

where:

4: selects “single-station DGPS” as the current GPS fix mode

12: selects WAAS/EGNOS to be the source of DGPS corrections (hence WADGPS) and pseudoranges from this system will be used

120: is the PRN of the GEO used

IMPORTANT: When you decide to use the WAAS/EGNOS system to enhance your navigation, do not forget to issue the corresponding position solution (i.e. DGNSS) by running the following command:

\$PDAS, NAVSEL, 1, 1

2

QA/QC

Introduction

Two types of Quality Control can be used in the *Aquarius* receiver:

1. *Autonomous Quality Control* whose main features are summarized below:
 - Operates in standalone, without resorting to information from external equipment.
 - Consists of a simplified UKOOA control in which suspect pseudoranges are simply detected, not eliminated from the position processing
 - QC results are not reported on the front panel status display but instead, stored as internal variables which can be issued from the receiver by defining and enabling appropriate computed-data output (see page 2-26).
 - As of today, is only available in Straight GNSS, conventional DGPS or WADGPS
2. *External Quality Control* whose main features are summarized below:
 - Uses implicitly integrity information from a WASS/EGNOS GEO when the WADGPS processing mode is used
 - Monitors SV states. The state of any SV rejected by the WAAS/EGNOS integrity control will be reported as “b” (for “bad”) on Screen No. 4.

- Integrity results are stored as internal variables which can be issued from the receiver by defining and enabling appropriate computed-data output (see page 2-26)
- As of today, is only available in Straight GNSS or WADGPS.

NOTE: The two types of Quality Control can be used concurrently.

2

Software Installation

The use of the *Autonomous Quality Control* requires the installation of the QA/QC software option.

The use of the *External Quality Control* does not require any additional software or hardware option.

Implementation Procedures

The implementation of the Quality Control, whether autonomous or external, is not automatic as this requires the use of the **\$PDAS,QC** command, as explained in the example below.

- **Autonomous and External QC performed concurrently**

- Run a command of this type:

\$PDAS,QC,1,1,138

where:

1: Requests Autonomous QC (UKOOA)

1: Requests External QC (from WAAS/EGNOS)

138: Provider of external integrity information (GEO PRN 138)

- **WAAS/EGNOS pseudorange output on a serial port**

- Use the same command (PRANGE) as you would for GPS pseudoranges. Example:

\$PDAS,PRANGE,1,A,1,100,2,0,0,0

where:

1: Output number

A: Output port identification

1: Output mode (time)

100: Output rate (every 10 seconds)

2: Data type (SBIN@R)

0,0,0: No filtering on carrier/code for GPS, WAAS and pseudolite.

The WAAS/EGNOS pseudorange will be issued in a separate data block.

- **WAAS/EGNOS data output on a serial port**

- Run the GEODAT command in which you specify the type of data to be output. The WAAS/EGNOS data comes in two possible formats: SBIN@W or SVAR!W.

Example:

```
$PDAS,GEODAT,1,A,1
```

where:

1: Output number

A: Output port identification

1: WAAS/EGNOS data in SBIN@W format

- **WADGPS corrections output on a serial port**

- Run the DGPDAT command in which you specify "RTCM" as the type of corrections to be output.

Example:

```
$PDAS,DGPDAT,1,B,1,200,1,1,9,2
```

where:

1: Output number

B: Output port identification

1: Time output mode

200: Output rate every 20 seconds

1: Data type: RTCM-SC104

1,9: Corrections

2: Deltas of corrections

Internal Variables containing QC results

As explained earlier, QC results are stored in the receiver as variables (see lists below).

- **Autonomous QC**

- NM2DM : Max. 2D MDE (**M**ean **D**etectable **E**rror) on fix (in meters)
- NSV2D : PRN of SV responsible for Max. 2D MDE
- NM3DM : Max. 3D MDE on fix (meters)
- NSV3D : PRN of SV responsible for Max. 3D MDE
- NFVAL : Instantaneous value of F Test performed on fix solution
- NFMEA : Average value of F Test performed on fix solution
- NFTST : F Test result
- WT[i] : F Test result performed on pseudorange residuals (i: channel number 1 to 16)
- MDE[i] : 2D MDE on pseudoranges (in meters) (i: channel number 1 to 16)

- **External QC**

INTEGAP : External QC in progress? (Yes/No)

INTEGID : PRN of the GEO from which external QC is performed (120 to 138) (or -1 if information not available)

INTEGS[1...16] : WAAS/EGNOS external QC status for each channel

0: Unmonitored **1**: Unhealthy **2**: Healthy

UDRE[1...16] : Current value of UDRE (User Differential Range Error), in meters, provided by WAAS/EGNOS external QC for each channel (-1 if information not available).

2

KART/LRK

KART

- **Theory of operation**

Typically, the algorithms used to determine the values of ambiguous terms go through the following steps:

- Defining a search volume, built on the basis of the approximate position, according to its uncertainty (covariance),
- Computing all possible solutions in the search volume,
- Choosing the best possible solution (minimum variance),
- Validating the solution (through comparison with the second best solution).

Some conditions and tests are applied at different levels so that a priori inconsistent solutions can be rejected.

This scheme can be used for dual-frequency receivers because the number of possible solutions remains relatively low within the search volume. In single-frequency receivers, it is not reasonably applicable (in real time) due to the large number of possible solutions.

This is why the scheme used in the KART system is radically different:

- Recursive computation of an approximate solution, using the phase and pseudo-ranges triple difference. The solution tends towards the actual solution over time.

- On each measurement epoch, computation of a double-difference solution, with a fixed value for ambiguous terms (integers). The solution results from successive updatings, starting from the approximate solution, first fixing the integers for the satellite pair less sensitive to the initial position error and finishing with the most sensitive pair.
- Validation of these solutions with fixed ambiguous terms (traditional test on residuals, complemented by a test for their changes over time).
- Check for the repeatability of the solution over a given period.

This scheme dramatically differs from the traditional methods. The following differences can be pointed out:

- No search volume is required, meaning that the method does not rely on any hypothesis on the quality of the approximate solution, so the actual solution does not risk being left outside a search volume that may be improperly estimated.
- No statistical analysis on multiple solutions.
- No Kalman filter or statistical analysis. More generally, no stochastic models or statistical distributions need to be a priori determined.

The methods based on statistical tests are naturally attractive, but they are only efficient on condition that the stochastic models can be determined properly. Unfortunately, it is very difficult to determine precise models for the errors affecting the GPS measurements. The multipath effects or the propagation errors, to name but a few, are not easy to evaluate. As a result, the so-called 'optimal' methods are not so optimal in practice, as they are too much dependent on the a priori models.

- **Characteristics**

The maximum range and the initialization time are the main two aspects to be considered in order to achieve the best possible results with a real-time kinematic system.

The maximum range is defined as the maximum distance from the reference station within which the user will fully benefit from the performance of the system. Two major factors may affect the maximum range:

- Physical phenomena: in the case of KART, just like in any single-frequency system, the maximum range is mostly limited by the uncorrelation of ionospheric errors. This phenomenon is significant at distances in excess of 10 to 15 km (for a medium latitude). Generally such distances can be covered with the KART even though longer initialization times are required.
- Data transmission and the techniques implemented to provide a reliable link from the reference station to the mobile. The traditional UHF DGPS systems from DSNP have a long record of field-proven reliability in excess of the requirements of the KART.

To sum up, it is advisable to install both the GPS and UHF antennas of the reference station at a location clear of any obstructions and high enough to cover the area of interest and preclude any multipath effects that otherwise might affect the performance of the system. Even if the UHF link allows operations over longer ranges, initializations should be performed within no more than 10 to 15 km of the reference station.

LRK

The advantages of using the two GPS frequencies lie in that this makes it possible to cover longer ranges and cut down the initialization time while increasing the reliability of the initialization process.

- As far as maximum range is concerned, the uncorrelation of ionospheric errors no longer prohibits operations more than 15 km away from the reference station.

We can compensate for uncorrelation by combining the measurements taken on L1 and L2 (ionospheric delays are inversely proportional to the squared frequency).

Then the remaining limitations arise from the uncorrelation of tropospheric errors and from the errors on the broadcast ephemerides, but those errors have a much smaller impact in terms of amplitude. As a result, the only practical limitation is dependent on the quality of the radio link (several tens kilometers in the case of the DSNP UHF link).

- When it comes to solving for the ambiguous terms in carrier phase measurements, resorting to two frequency is still more beneficial. Combining the two frequencies makes it possible to get a wavelength of 86 cm (L2-L1), which decreases the number of solutions that may be retained around the approximate position and increases the separation between any two possible solutions. All those features allow the initialization time to be substantially reduced, and they significantly increase the reliability of the solution.

As many tests have been conducted that reveal the merits of the technique used in the KART system, the same processes can be used for the LRK with the following enhancements:

- Recursive computation of the approximate solution: in addition to the pseudo-ranges (C/A code) and phase triple difference on L1, a triple difference is computed on the phase of L2 and on L1/L2 pseudo-ranges (P/Y code). This leads to a faster convergence towards the actual solution.
- On each epoch, computation of a double-difference solution —only one— with resolved integers. With the LRK method, however, the position solution is computed in two steps. Starting from the approximate solution, in the first step, a «coarse» solution is computed through a linear combination of the measurements made on L1 and L2 (86 cm integer ambiguity instead of 19 cm), on wide windows. The solution, more accurate —albeit coarse— than the approximate position, is used to solve for integers in the second step with higher accuracy.
- Final computation of the position: over long distances, using the two frequencies compensates for ionospheric delays and increases the covered area.
- Solution validation: testing the residuals on L1 and L2.
- The checking for the repeatability of the fitting solution is used only in the case of critical conditions (e. g. only four satellites received).

To sum up, the LRK system can be used farther from the reference station than the KART and allows shorter initialization times to be achieved, meaning that it can be used in critical environments (forests, urban areas, harbours, etc.). However, this does not relieve the user of the necessity of installing the reference station antenna in an open area, high enough to cover the desired range.

Implementing the KART and LRK processing modes

- **Intoduction**

Unless your initial delivery includes a *UHF Datalink reception module* (also named *UHF built-in receiver*), you need to install this hardware option to be able to implement the KART or LRK processing mode in your *Aquarius* mobile receiver. You also need the presence of a suitable UHF reference station transmitting code & phase data within your work area.

Two data formats are usable:

- Pseudorange corrections and L1 phase measurements, in a DSNP format and transmitted through the UHF Datalink at 1200 Bd, should be chosen to let the receiver compute a *KART position solution*.
- Pseudorange and phase measurements, in the LRK format, transmitted through the UHF Datalink at 4800 Bd, should be chosen to let the receiver compute a *"high-rate" KART position solution* (with L1 only) or a *LRK position solution* (with L1 and L2).

To date, the RTCM-SC104 data in the "6 of 8" character format transmitted through the UHF Datalink at 1200 or 4800 Bd, does not allow the receiver to issue a KART or LRK position solution (this functionality should be the object of a future extension).

In addition, the mobile receiver should be fitted with the appropriate firmware and GNSS engine:

- *KARTMODE firmware* and L1 GNSS engine for KART processing mode
- *LRKMODE firmware* and L1/L2 GNSS engine for LRK processing mode

To reduce the initialization time (especially with the KART), and depending on the application, different initialization modes are possible, which you can select by using the \$PDAS, FIXMOD command:

- OTF** ("On the Fly") : Initialization with receiver in motion, start point unknown
- STATIC** : Initialization with receiver at a standstill, but point unknown
- Z-FIXED** : Initialization with receiver in motion, start point unknown, but receiver altitude remains constant throughout the initialization phase
- POSIT** : Initialization from a known point

The **POSIT** initialization mode requires the prior entry of a reference position using the \$PDAS,PREFLL or \$PDAS,PREFNE command.

With the KART or LRK processing mode, three distinct position solutions are available:

EDGPS : (for "Enhanced" DGPS) Precise DGPS position, computed every 0.1 second, available on reception of DGPS data from the reference station, without having to wait for the end of the KART or LRK initialization phase

KART-A or LRK-A : (A for "Accurate") Accurate KART or LRK kinematic position, computed every time DGPS data from the reference station is received (every 1.0 second in general)

KART-R or LRK-R : (R for "Real Time") KART or LRK kinematic position, computed from extrapolated DGPS data, available every 0.1 second.

To choose one of these position solutions to be used as the input information for your navigation needs, use the \$PDAS,NAVSEL command.

- **Example of programming steps letting the mobile receiver process DGPS Data received by the built-in UHF receiver (data in the DSNP UHF format)**

1. Send the command below to let the receiver know the characteristics of the station transmitting the corrections in the DSNP UHF format (carrier: 444.55 MHz, transmission rate: 1200 Bd, modulation type: DQPSK):

```
$PDAS,DGPS,STATION,8,DSNP,4716,N,00129  
,W,UHF,444550000,30,,1200,DN
```

2. Send the command below to configure the built-in UHF receiver so that it can receive and decode the DGPS data from this reference station (station No. 14):

```
$PDAS,DGPS,MODE,1,D,R,8,,14
```

3. Send the command below to enter a reference position for a KART initialization at a known point (centimetric accuracy demanded):

```
$PDAS,PREFLL,0,4716.1043533,N,00129.45430  
00,W,48.752
```

4. Send the command below to select and initialize the KART processing mode from a known point, using the DGPS data received:

```
$PDAS,FIXMOD,10,1,14
```

5. Send the command below to choose the KART-R position solution for your navigation needs:

\$PDAS,NAVSEL,4,1

6. Select Screen No. 6 on the Status display to check the new settings of the built-in UHF receiver and the current reception level. In this example, the screen should look like this:

6	U	0	0	0	8					1	2	0	0	b	
4	5	d	B		4	4	4	.	5	5	0	0	M	H	z

When the DGPS corrections are received and involved in the position processing, Screen No. 0 on the Status display should look like this:

0	S	V	0	8	/	1	0	T	D	0	8	/	0	1	s
K	A	R	T			1	2	.	1	V		F	*	*	%

This field successively changes from "GPS" to "IKAR" (during the initialization phase) and finally to "KART" when initialization is complete.



- **Example of programming steps letting the mobile receiver process the dual-frequency DGPS data received by the built-in UHF receiver (DGPS data in LRK format)**

1. Send the command below to let the receiver know the characteristics of the station transmitting the corrections in the LRK format (carrier: 444.55 MHz, transmission rate: 4800 Bd, modulation type: GMSK):

```
$PDAS,DGPS,STATION,12,LRK,4716,N,00129  
,W,UHF,444550000,30,,4800,GN
```

2. Send the command below to configure the built-in UHF receiver so that it can receive and decode the DGPS data from this reference station (station No. 72):

```
$PDAS,DGPS,MODE,1,D,R,12,,72
```

3. Send the command below to select the LRK processing mode and the OTF initialization, using the DGPS data received:

```
$PDAS,FIXMOD,7,1,72
```

4. Send the command below to choose the KART-A position solution for your navigation needs:

```
$PDAS,NAVSEL,3,1
```


When the DGPS corrections are received and involved in the position processing, Screen No. 0 on the Status display should look like this:

```

0 S V 0 8 / 1 0 T D 0 8 / 0 1 s
L R K      1 2 . 1 V F * * %
  
```

This field successively changes from "GPS" to "ILRK" (during the initialization phase) and finally to "LRK" when initialization is complete.



- **Programming data outputs to a serial port or to the PCMCIA**

The DGPS digital information received on a serial port or by the UHF Datalink can be routed to a serial port or recorded on a PCMCIA (if the PCMCIA recording capability option has been activated) for archive or post-processing purposes.

Three output formats are available:

Acquisition format	Possible output formats		
	DSNP UHF	LRK	SVAR!D
DSNP UHF	✓		✓ (1)
LRK		✓	

⁽¹⁾: Only pseudorange corrections are available in this format.

- For example, to let the receiver output DGPS data on its B port, in Immediate mode, and in the LRK format, use the following command:

\$PDAS,DGPDAT,1,B,3,,2 ♣

Data Link Options

NOTICE:

The Data Link hardware is marketed as an option.

This section may be skipped unless you are the user of one of these options.

WARNING!

Each country maintains its own rules and regulations with respect to the operation of radio equipment. It is the user's responsibility to assure that proper licensing procedures are followed in accordance with the laws of each country. DSNP may provide licensing assistance for operation of the UHF transmitter.

Operating an unlicensed radio transmitter is a violation of the law. You may be subject to fines or other penalties if you operate a radio transmitter without proper licensing.

3. Data Link options

UHF Data link option

Introduction

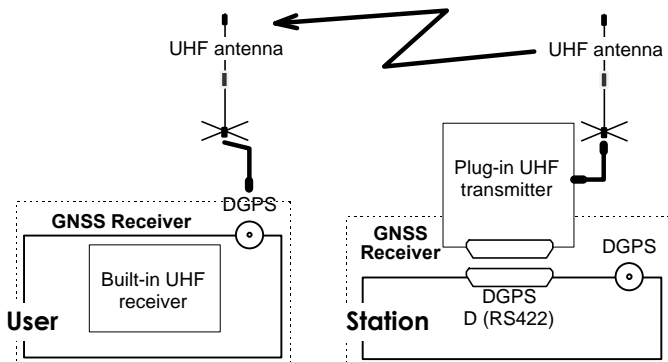
The UHF data link allows operations in the UHF, RTCM-SC104 DGNSS, the KART or the LRK® format.

The UHF data link comes as a hardware option, unless you have an Aquarius 5002 SK/MK or Aquarius 5001 SD/MD receiver, in which case the UHF data link is part of your purchase.

If your initial purchase does not include this option and you buy it later, you will have to make it installed by your usual retailer as this operation requires some technical skills.

The UHF data link consists of a UHF transmitter and a UHF receiver. Typically, the transmitter is installed in a reference station, the receiver in a mobile.

The UHF transmitter or receiver communicates with a DSNP GNSS receiver through a serial RS422 line operating at 19200 Bd max. (transmitter plugged on that port; see SubD connector on the GNSS receiver rear panel).



Data link specifications

- **UHF transmitter**

Radiated power : Factory-set, at user's request:

4 W (36 dBm)

2 W (33 dBm)

0.5 W (27 dBm)

or 0.1 W (20 dBm)

Frequency band : 410-470 MHz (4801 channels, 12.5 kHz apart)

Modulation types : DQPSK (Differential Quadrature Phase Shift Keying), 1200 bits/s, 1200-Hz subcarrier

GMSK (Gaussian Minimum Shift Keying), 4800 bits/s in base band

Data transmission rate : on data reception or synchronous with the 1pps (optional output)

Data input mode : differential (RS422), 1200, 4800, 9600 or 19200 bits

Message type : C (DSNP corrections)

P (L1 phase, C/A code KART format)

R (RTCM)

T (L1 or L1/L2 LRK format)

Power supply : 10 to 16 V DC, non-floating/15 W, from the receiver to which the transmitter is attached

Operating temperature : -20 to +55°C

Dimensions (L×W×H) : 198×66×60 mm

Waterproofing : IP65

Magnetic compatibility : complying with ETS 300-279 and ETS 300-113

- **UHF receiver**

Sensitivity : Analog: -118 dBm typical, for signal-to-noise and distortion added of 12 dB

Digital: -118 dBm typical, for a bit error rate of 1×10^{-5} in DQPSK or GMSK

Frequency band : 410-470 MHz (4801 channels, 12.5 kHz apart)

3-dB bandwidth : 6 MHz typical at 410 MHz, 8 MHz typical at 470 MHz

Modulation types : DQPSK (Differential Quadrature Phase Shift Keying), 1200 bits/s, 1200-Hz sub-carrier

GMSK (Gaussian Minimum Shift Keying), 4800 bits/s in base band

Message type : C (DSNP corrections)

P (L1 phase, C/A code KART format)

R (RTCM)

T (L1 or L1/L2 LRK format)

X (Relay 1 or 2)

Installation

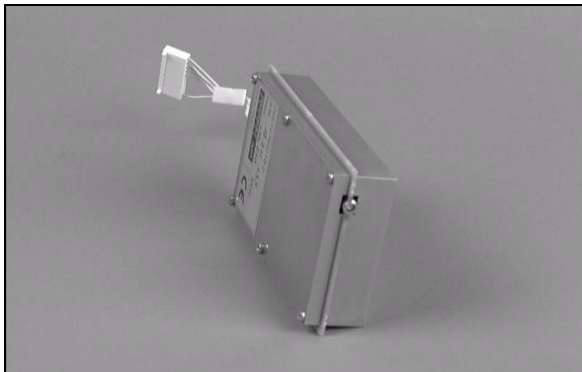
- **UHF transmitter**

Installed at the reference station, it is simply plugged onto the SubD 15-C connector located on the rear panel of your receiver (port D, RS422, DGPS). The UHF transmitter is secured on the rear panel by four screws. See photo below.

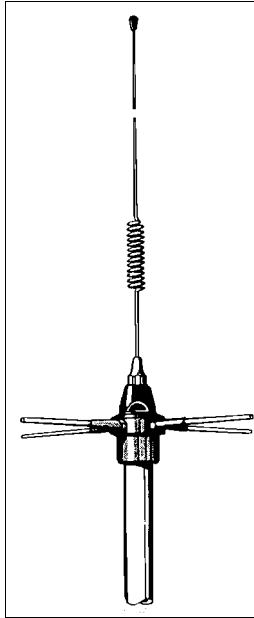


- **UHF receiver**

Only trained personnel can perform this operation as this requires the opening of the receiver case. For your information, a photo of the UHF receiver board is provided below.



- UHF antenna



3

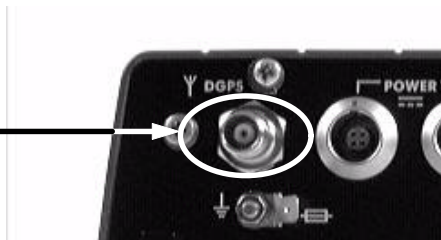
A Procom GP450-3 whip antenna is used both at the reference station and on user receivers. The accessory kit consists of:

- A coaxial cable (6.50 m for reference station, 30 m for user receiver)
- An N-TNC adaptor
- An antenna mast
- A stainless bracket ref. 33100115
- Allen wrenches, provided to secure the antenna base on the mast.

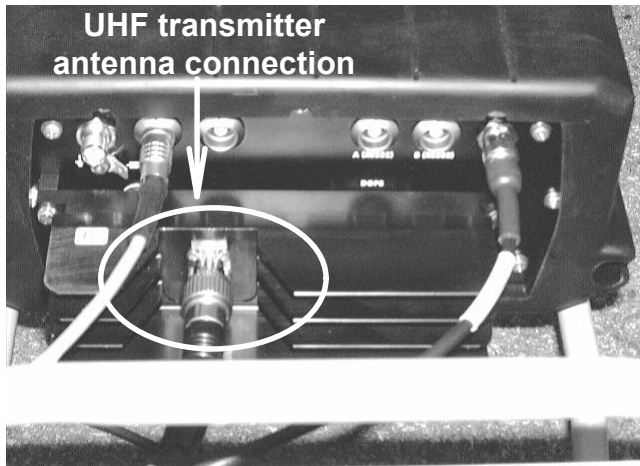
For the installation of this antenna, you should take the same precautions as with the GPS antenna (see page 1-3, *GPS antenna installation*). As said elsewhere, the geographical location of the UHF antenna is not of prime importance for the DGNS processing as such.

- Assemble the Procom antenna
- Insert the hollow mast provided into the coaxial cable and then plug the coaxial cable to the connector located in the base of the antenna
- Move the mast along the cable to insert it into the base of the antenna
- Tighten the screws, using one of the Allen wrenches provided, to secure the antenna on the mast
- Using the bracket provided, secure the assembly on the main mast (not provided)
- Connect the other end of the coaxial cable:
 - ◇ to the DGPS input (on rear panel), through the N-TNC adaptor provided, if you are installing the data link on the user receiver.

Connect UHF
receiving
antenna here



- ◇ to the N receptacle of the UHF transmitter if you are installing the data link at the reference station



3

Warning!

For single-frequency reference stations, allow for a safe distance of at least 1.5 m between the GPS antenna and the 3-dB UHF antenna whatever the UHF frequency used.

For dual-frequency reference stations, the minimum distance required between these two antennas is a function of the UHF frequency used, namely:

- 4.20 m at 410 MHz
- 2.10 m at 415 MHz
- 1.5 m from 420 to 470 MHz.

For any other frequency, please consult DSNP.

Typical programming steps

- **Defining the data link**

At the reference station and in the user receiver(s), use the \$PDAS,DGPS,STATION command to define the DGPS corrections transmitter (or beacon) which here is the attached UHF transmitter:

- Beacon Id
- Beacon name
- Antenna coordinates (2D)
- Frequency band
- Carrier frequency
- Baud rate
- Modulation type

- **Setting the UHF transmitter as the beacon attached to the reference station**

At the reference station, use the \$PDAS,DGPS,MODE command to declare the attached UHF transmitter as the beacon used to transmit DGPS corrections

- **Defining the data transmitted through the data link**

The transmitted data depends on the processing used (DGNSS, KART, LRK). See page 2-1, *Processing options*.

- **Setting the UHF receiver**

Use the \$PDAS,DGPS,MODE command to perform this operation.

- **Checking the software version and device identification**

Use the \$PDAS,IDENT command or select screen No. 8 on the integrated status display (see page 1-49, *Screen No. 8: Firmware Options*).

- **Monitoring the UHF data link**

Select screen No.6 on the integrated status display (see page 1-47, *Screen No. 6: Information about corrections*).

UHF Datalink Programming Examples

- **Transmitting/receiving DGPS Data (in the RTCM-SC104 format) compatible with the NDS100 Mk II station**

The characteristics of the UHF station are the following:

Station Id number : 712

WGS84 Reference Position : 47°16.1043533'N, 1°
29.4543'W, Altitude 48.752m

Beacon Id : 3

Frequency : UHF band, 444.55 MHz

Modulation : 1200 Bd, DQPSK

Transmission programming : Free mode, every 1.0 second

Format : RTCM-SC104

Messages : Type 1 (PRC's) and type 3
(Reference ECEF)

5001SD or 5002SK Station (using *REFSTATION* firmware):

\$PDAS,UNIT,712

**\$PDAS,PREFLL,0,4716.1043533,N,00129.45430
00,W,48.752**

\$PDAS,FIXMOD,1,1

**\$PDAS,DGPS,STATION,3,RTCM-
3,4716,N,00129,W,UHF,444550000,30,,1200,DN**

\$PDAS,DGPS,MODE,1,D,E,3,0

\$PDAS,DGPDAT,1,D,1,10,1,1,3

5001MD or 5002MK Mobile:

**\$PDAS,DGPS,STATION,3,RTCM-
3,4716,N,00129,W,UHF,444550000,30,,,1200,DN**

\$PDAS,DGPS,MODE,1,D,R,3,,,712

\$PDAS,FIXMOD,4,1,712

\$PDAS,NAVSEL,1,1

3

- **Transmitting/receiving DGPS Data (in the DSNP format) compatible with the NDS100 and NDS100 Mk II stations**

The characteristics of the UHF station are the following:

Station Id number : 14

WGS84 Reference Position : 47°16.1043533'N, 1°
29.4543'W, Altitude 48.752m

Beacon Id : 18

Frequency : UHF band, 444.55 MHz

Modulation : 1200 Bd, DQPSK

Transmission programming : 1PPS synchronous mode,
during 1st second of a 3-
second cycle

Format : DSNP

Messages : Pseudorange corrections

5001SD or 5002SK Station (using *REFSTATION* firmware):

\$PDAS,UNIT,14

**\$PDAS,PREFLL,0,4716.1043533,N,00129.45430
00,W,48.752**

\$PDAS,FIXMOD,1,1

**\$PDAS,DGPS,STATION,18,DSNP-
18,4716,N,00129,W,UHF,444550000,30,,,1200,DN**

\$PDAS,DGPS,MODE,1,D,E,18,3,1

\$PDAS,DGPDAT,1,D,2,3,3,1

5001MD or 5002MK Mobile:

**\$PDAS,DGPS,STATION,18,DSNP-
18,4716,N,00129,W,UHF,444550000,30,,,1200,D
N**

\$PDAS,DGPS,MODE,1,D,R,18,,,14

\$PDAS,FIXMOD,4,1,14

\$PDAS,NAVSEL,1,1

3

- **Transmitting/receiving DGPS Data (in the DSNP format) compatible with the NDS100 Mk II station**

The characteristics of the UHF station are the following:

Station Id number : 15

WGS84 Reference Position : 47°16.1043533'N, 1°
29.4543'W, Altitude 48.752m

Beacon Id : 15

Frequency : UHF band, 444.55 MHz

Modulation : 1200 Bd, DQPSK

Transmission programming : Free mode every 1 second

Format : DSNP

Messages : Pseudorange corrections and
phase measurements

5001SD or 5002SK Station (using *REFSTATION* firmware and *KARTMODE* or *LRKMODE* firmware):

\$PDAS,UNIT,15

**\$PDAS,PREFLL,0,4716.1043533,N,00129.45430
00,W,48.752**

\$PDAS,FIXMOD,1,1

**\$PDAS,DGPS,STATION,15,KART-
15,4716,N,00129,W,UHF,444550000,30,,,1200,DN**

\$PDAS,DGPS,MODE,1,D,E,15,0

\$PDAS,DGPDAT,1,D,1,10,3,1,2

5001MD or 5002MK Mobile:

**\$PDAS,DGPS,STATION,15,KART-
15,4716,N,00129,W,UHF,444550000,30,,,1200,D
N**

\$PDAS,DGPS,MODE,1,D,R,15,,,15

\$PDAS,FIXMOD,4,1,15 (Conventional DGPS)

\$PDAS,NAVSEL,1,1

3

5001MD or 5002MK Mobile (using *KARTMODE* or *LRKMODE* firmware):

**\$PDAS,DGPS,STATION,15,KART-
15,4716,N,00129,W,UHF,444550000,30,,,1200,DN**

\$PDAS,DGPS,MODE,1,D,R,15,,,15

\$PDAS,FIXMOD,7,1,14 (KART with OTF
initialization)

\$PDAS,NAVSEL,4,1 (Navigation from Real-
Time KART position
solution)

- **Transmitting/receiving DGPS Data (in the LRK format)**

The characteristics of the UHF station are the following:

Station Id number : 22

WGS84 Reference Position : 47°16.1043533'N, 1°
29.4543'W, Altitude 48.752m

Beacon Id : 30

Frequency : UHF band, 444.55 MHz

Modulation : 4800 Bd, GMSK

Transmission programming : Free mode every 1 second

Format : LRK

Messages : Pseudorange corrections and
phase measurements

5002SK Station (using *REFSTATION* firmware and
LRKMODE firmware):

\$PDAS,UNIT,22

**\$PDAS,PREFLL,0,4716.1043533,N,00129.45430
00,W,48.752**

\$PDAS,FIXMOD,1,1

**\$PDAS,DGPS,STATION,30,LRK-
30,4716,N,00129,W,UHF,444550000,30,,,4200,GN**

\$PDAS,DGPS,MODE,1,D,E,30,0

\$PDAS,DGPDAT,1,D,1,10,2

5001MD Mobile (using *KARTMODE* firmware):

**\$PDAS,DGPS,STATION,30,LRK-
30,4716,N,00129,W,UHF,444550000,30,,,4200,GN**

\$PDAS,DGPS,MODE,1,D,R,30,,,22

\$PDAS,FIXMOD,7,1,22 ("High Rate" KART with
OTF initialization)

\$PDAS,NAVSEL,4,1 (Navigation from Real-
Time KART position
solution)

3

5002MK Mobile (using *LRKMODE* firmware):

**\$PDAS,DGPS,STATION,30,LRK-
30,4716,N,00129,W,UHF,444550000,30,,,4200,GN**

\$PDAS,DGPS,MODE,1,D,R,30,,,22

\$PDAS,FIXMOD,7,1,22 (LRK with OTF
initialization)

\$PDAS,NAVSEL,3,1 (Navigation from Accurate
LRK position solution)

Transmitted Data Blocks

The syntax used for these blocks is described below:

- 1st byte: **02** Beginning of block ([stx] in ASCII notation)
- 2nd byte: **XX** Message identifier (an alphabetical character in ASCII notation):
- C: DSNP pseudo-range corrections (same code corrections as those generated by an NDS100 MkII station)
 - P: L1 phase, C/A code (same phase corrections as those generated by an NDS100 MkII station)
 - R: RTCM
 - T: L1 or L1/L2 LRK format
- 3rd byte: **XX** Reference station number (in BCD notation) (00 to 99). If greater than 99 (which will be the case with an RTCM-SC104), the reference station number will be encoded modulus 100 the "station identification number", as entered using the \$PDAS,UNIT command.
- then:
- YYYYYYYYYY: Corrections message. Format tied to identifier (see below)
- Last byte **03** End of block ([etx] in ASCII notation)

- Corrections message Type C

1st byte:		Message length measured from "02" to "03" inclusive (in BCD notation, from 00 to 99)
2nd byte		Transmission rate in seconds (in BCD notation, from 01 to 99)
Next 3 bytes	ZZ ZZ ZZ	Z counter output, modulo 49152, in 0.1-second units (in BCD notation)
Next n×4 bytes	SV CR CR CR	(n: count of SVs, max 10) SV (in BCD): $SV\ number + 80_{hex}$ if correction < 0 or $SV\ number + 40_{hex}$ if ephemeris change CR (in BCD): correction value in cm, max. 999 999 cm
Last 2 bytes	XX XX	Checksum (binary sum) from [stx]

- **Corrections message Type P**

1st byte:		Message length measured from "02" to "03" inclusive (in BCD notation, from 00 to 99)
2nd byte		Transmission rate in seconds (in BCD notation, from 01 to 99)
Next 3 bytes	<i>ZZ ZZ ZZ</i>	Z counter output, modulo 49152, in 0.1-second units (in BCD notation)
Next n×5 bytes	<i>sv ph ph ph cq</i>	(n: count of SVs, max 10) <i>sv</i> (in BCD): SV number <i>ph</i> (in BCD): phase value, modulo 10 000 cycles, in 1/100th of a cycle <i>c</i> : continuity indicator (4 bits from 0 to F) incremented by one every time the status of phase measurement is different from 0 <i>q</i> : 0 (phase quality indicator not operational in this version)

Next 15 bytes

XXXXXX
YYYYYY
ZZZZZ

XYZ position (in BCD notation) of the station, on ECEF (same as RTCM #3)

For each parameter,

field= $\pm 2\,147\,483\,647$ (in BCD), unit: 0.01 m, sign placed in the most significant bit of the 1st byte ($\delta\theta_{\text{hex}} = -$)

Last 2 bytes

XX XX

Checksum (binary sum) from [stx]

3

- **Corrections message Type R**

		Message length measured from "02" to "03" inclusive (in binary notation, from 1 to 255)
2nd byte		Transmission rate in seconds (in BCD notation, from 01 to 99)
Next n×bytes	XXXXXXXXXX	<p>RTCM message in the 6×8 characters format. All values less than 80_{hex}</p> <p>A 30-bit RTCM word is transformed into 5 bytes.</p> <p>At the transmission input, n will depend on the UHF baud rate (1200 or 4800 bits/s for a transmission duration of 900 ms max.)</p>
Last 2 bytes	XX XX	Checksum (binary sum) from [stx]

- RTCM-SC104 messages are described in the document referenced "RTCM RECOMMENDED STANDARDS FOR DIFFERENTIAL GNSS - RTCM SPECIAL COMMITTEE No. 104, MARCH 1 1996"
- The UHF reference stations from the Aquarius 5000 series can transmit the following types of RTCM messages, depending on the choice made using the \$PDAS,DGPDAT command:
 - 1 or 9 : PRC's corrections
 - 2 : Delta PRC's corrections
 - 3 : Reference station position
 - 5 : Constellation Health
 - 16 : User message

• Corrections message Type T

First 2 bytes:		Message length measured from "02" to "03" inclusive (in binary notation, from 1 to 65535)
Next byte		Transmission rate in seconds (in BCD notation, from 01 to 99)
Next 3 bytes	XX XX XX	Time tagging: GPS time in week, in 1/10 seconds
Next byte	pp	C/A & P/Y & L1/L2 filtering indicator ⁽¹⁾
Next n×14 or 27 bytes	XXXXXXXXXX	Satellite raw data on L1 C/A or L1/L2 P/Y ⁽¹⁾
Next 15 bytes	XXXXXX YYYYY ZZZZ	XYZ position (in BCD notation) of the station, on ECEF (same as RTCM #3) For each parameter, field= ± 2 147 483 647 (in BCD), unit: 0.01 m, sign placed in the most significant bit of the 1st byte (80 _{hex} = -)
Next 2 bytes	XX XX	Station battery output voltage (in BCD notation), unit: 10 ⁻¹ V
Last 2 bytes	XX XX	Checksum (binary sum) from [stx]

⁽¹⁾ Data complying with the same data in SBIN@R format, single- and dual-frequency.



In L1 C/A, transmission capability: up to 16 channels (254 bytes at 4800 Bd \Rightarrow 529 ms)

In L1/L2, transmission capability: up to 14 channels (408 bytes at 4800 Bd \Rightarrow 850 ms)

- **Corrections message Type X**

First 2 bytes:		Message length measured from "02" to "03" inclusive (in binary notation, from 0 to 65536)
Next byte		Transmission rate in seconds (in BCD notation, from 01 to 99)
Next n×bytes	XXXXXXXXXX	User message n depends on the baud rate n=68 for 1200 Bd or 405 for 4800 Bd
Last 2 bytes	XX XX	Checksum (binary sum) from [stx] ♣

Extended I/O Option

NOTICE:

The extended I/O board is marketed as an option.

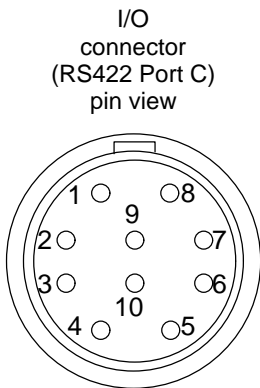
This section may be skipped unless you are the user of this option.

4. Extended I/O option

Installation

Only trained personnel can perform the installation of the optional I/O board as this requires the opening of the receiver case.

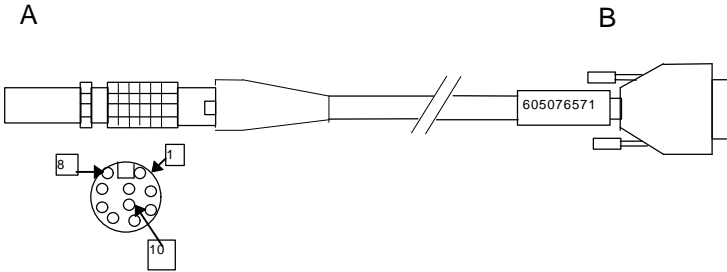
RS422 port (port C)



Pin	Signal	
1	+12 V	output
2	RXD -	input
3	RXD+	input
4	TXD+	output
5	TXD -	output
6	CTS -	input
7	CTS+	input
8	RTS -	output
9	RTS+	output
10	GND	

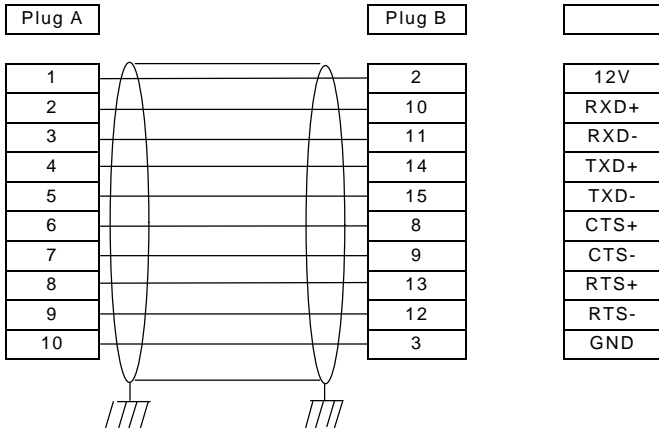
4

RS422 Cable Part number: 26E1076571



A is a 10-contact FGG-1K-310.CTAK (5011265) plug.
Manufacturer: LEMO

B is a 15-contact female subD DA-15S (5010832) connector
with metal cover DA121073-150 and 250-8501-013(2)
(5080329). Manufacturer: CANNON.



10 MHz external oscillator input

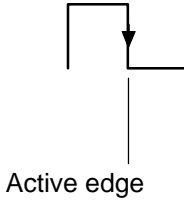
- Any sine wave, with amplitude level between 0 and 10 dBm, frequency $10 \text{ MHz} \pm 10^{-6}$ @ 0 dBm, and input impedance : 50 Ω .
- Automatic switching between external and internal master oscillator.
- Changing the master oscillator while the receiver is in operation is not recommended as this can result in GPS signal loss
- BNC connector

1 pps output

- 1 Hz square wave form (0-5 V amplitude)
- Falling edge synchronized onto UTC time
- Accurate to within $\pm 100 \text{ ns}$ (not including the SA-induced error) if the 30-metre antenna cable is used.
- Settling time : less than 30 seconds after the first fix is available.
- Subject to frequency oscillator drift once no more fix is available
- BNC connector

External Event input

- Accurate to within ± 100 ns + SA, with GPS fix effective
- CMOS input with 10 k Ω pull-up resistor to + 5 V DC
- BNC connector
- Falling edge active:



Station Firmware Option

NOTICE:

The Station Firmware is marketed as an option.

This section may be skipped unless you are the user of this option.

5. Station Firmware option

Foreword

The *Station Firmware* option allows you to operate your receiver as a DGNSS corrections generator.

No instructions are provided in this section concerning the installation of the *Station Firmware* option as such. As a matter of fact, this option can only be installed by DSNP before delivery (if your initial purchase includes this option) or by your distributor (if you ordered this option separately at a later date).

The *Station Firmware* option also includes a 3½" diskette or a CD-ROM containing the *Station Control software*. This section tells you everything you should know to install and use this program.

The *Station Control software* is required to configure the DGNSS corrections generator from an external computer. Typically, this program should be installed and run on a palmtop computer, such as the FS/GS available from the DSNP catalogue.

Alternately, the programming of the DGNSS corrections generator can be performed using the *DSet Pack* software.

Installation

Equipment required

- Your palmtop
- a PC-type computer fitted with a 3½" diskette drive and an RS232 port
- An RS232 serial line cable
- The 3½" diskette (or CD-ROM) supplied containing all the files of the Station Control software.

Program files

The diskette supplied contains the following files:

- t.bat : Batch file allowing you to run the Station Control software by simply typing in "t" then "↵" on the palmtop keyboard
- tov201fr.lan
- tov201uk.lan : Text files containing all the program menus, displays, messages and other, in French and in English
- tov20100.exe : Program file (to be run from the palmtop)
- topofr.bat
- topouk.bat : Batch files run from the PC to download the program to the palmtop
- h.bat : Batch file run from the palmtop through which the "Waiting for transfer" state is selected in the palmtop.
- tov20100.cfg : Station configuration file intended for the receiver unit (might be required if the receiver configuration was incompatible with the palmtop)

Installation instructions

The procedure given below is for a DSNP FS/GS palmtop:

- Boot the PC
- Insert the diskette supplied into the PC drive
- After checking that the palmtop is off, connect its RS232 port to an RS232 port of the PC using the serial cable supplied
- Turn on the palmtop
- On the palmtop, type in "hcom\c2\ " (or simply "h" if h.bat is already present in the root directory) and then press ↵
- On the PC, run "topouk.bat" or "topofr.bat" from the diskette. This launches the installation procedure. Wait for the end of installation.
- Once installation is complete, press the esc key on the palmtop.

If you use another palmtop, refer to the manufacturer's documentation to know how to transfer files to this palmtop. Through this procedure you should download the following files to the root directory:

- topo.exe
- topo.lan
- t.bat
- tov20100.cfg

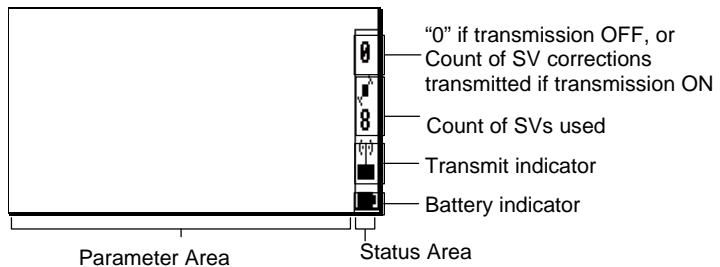
Introduction to operating Instructions

- 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 (more particularly screen No. 0 and screen No. 6; see pages *I-41* and *I-47*).
- If changes have to be made to the programming of the station, you will need to connect your palmtop and use the Station Control software.
- 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 not sufficiently known. It should be run for some time (typically 24 hours) and then the averaged position should be used to program the station in *UHF transmission mode*.
 - The *transmission mode*, the normal operating mode for a station, in which corrections computed by the station are transmitted to users through a data link.


Introduction to the Station Control 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.

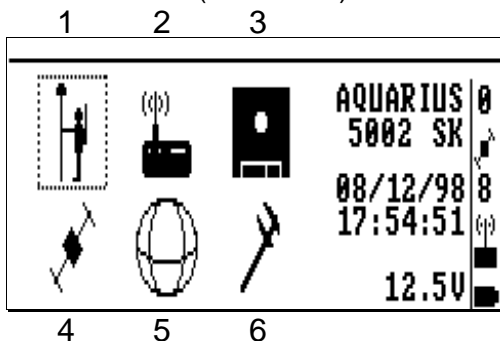
Keys and menus

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 6 groups of functions available in the form of icons (see below).



Use the vertical- or horizontal-arrow keys (\uparrow , \downarrow , \rightarrow , \leftarrow) to select an icon. The selected icon is surrounded by dotted lines. Then press \downarrow to enter the corresponding function. Alternately, you can directly enter a function by pressing the corresponding numeral key (see figures 1 to 6 in the screen example above)

- **Function menus**

They are displayed after selecting an icon in the main menu and pressing \downarrow . Function menu example:



- Using the vertical-arrow keys, select a function in the menu and then press \downarrow again to run this function
- Alternately, you can directly run a function by pressing the corresponding numeral key (see figures in the screen example above).

NOTE: The first icon is inactive.

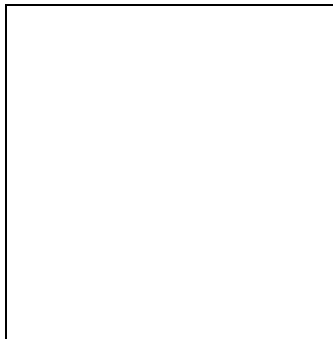
- **Help menus**

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:

- Press the key-letter to run the desired command.
- or simply press the **Esc** key if you do not want to run any command. Incidentally, this will remove the Help menu from the screen

For example, and as shown on the **Help** menu below, pressing the “↵” key 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 to a parameter, or after the auto-test, will allow you to switch from the **antenna height** screen (which automatically appears at the end of the auto-test) to the **main menu** screen.

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). Alternately, you can directly type the numeral key corresponding to the row in which the desired value is shown (same as function menus, see page 5-6).

- **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

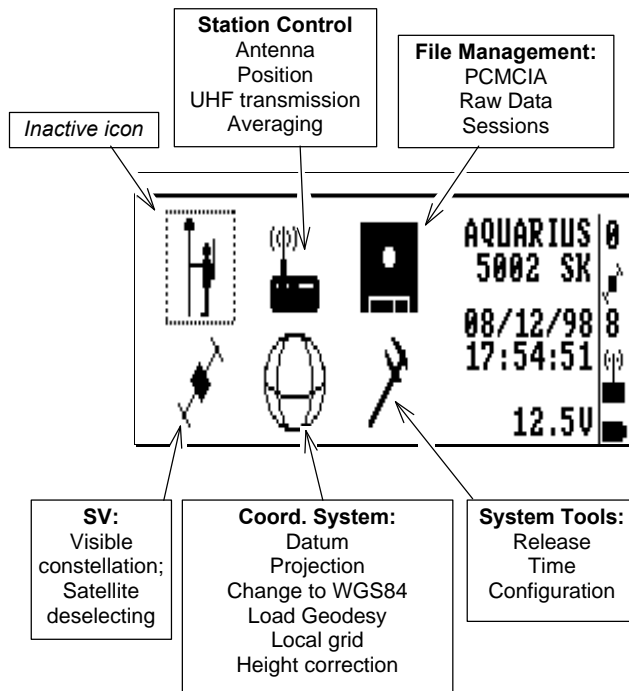
Assuming the base station is now ready and you have the palmtop in hand, do the following:

- From the DOS prompt, type in "T" or "t" and press ↵. The following screen appears denoting auto-tests in progress:




At the end of the auto-tests, the antenna height screen automatically appears. This is to suggest you not to forget to enter this very important parameter (this screen is described in page 5-12).

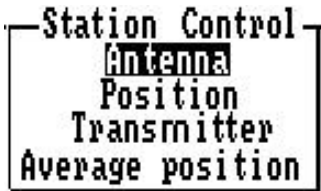
Then press the **Esc** key to access the main menu.



- Use the vertical- or horizontal-arrow keys (\uparrow , \downarrow , \rightarrow , \leftarrow) to select an icon. The selected icon is surrounded by dotted lines.
- Press \downarrow to validate your selection (or press the corresponding numeral key as a shortcut).

Station Control

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



Each of these functions is described below.

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.

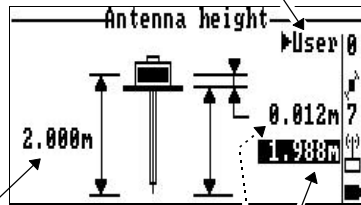
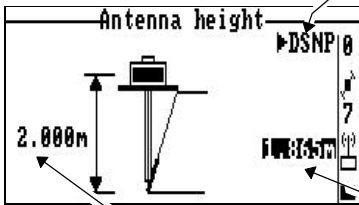
After choosing this function, press the ← key to access the field from which you can select the type of measurement made (see page 6-8) and then enter the measurement as explained in the screens which follow.

DSNP measurement

User measurement



Select measurement method from this field
(press → to access the selection menu)



True height computed after you
enter measurement and you
press ↵

Measurement entry
(an edit box appears
on top of the screen)

Position

This function allows you to enter the position of the station.
There are three ways of entering this position:

1. by typing in successively each of its coordinates in the dedicated fields (see screen example on next page). Then press ↵ to validate this position.
If the position is not accurately known, enter an estimate of each of the coordinates and then let the receiver run in the *Average Position mode* for some time to allow it to refine this position (see page 5-17).

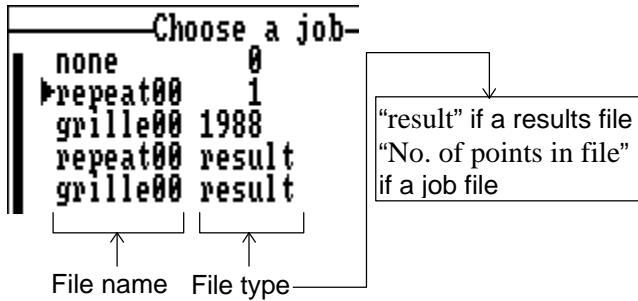


2. by loading it from a PCMCIA containing a job (see procedure below)
3. by transferring the solution available after running in *Average Position mode* as the new position of the station.

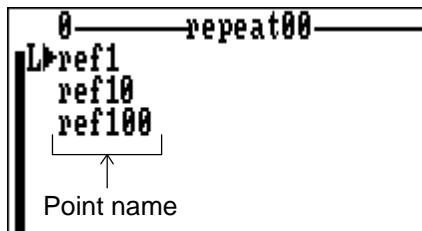
Position	
Coord. system	NAD Lambert 20
Easting	310505.575m
Northing	259119.368m
Altitude	3.920m
Antenna	2.000m

On the **position** screen (see example above), 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 defined using the **Coord. System** function (see page 5-27), and the antenna height is the one defined using the **Antenna** function (see page 5-12).

- **Loading the station position from a PCMCIA**
 - Insert the PCMCIA into the card reader
 - Select the **Position** function
 - Press the **F** key. This displays the list of jobs present on the PCMCIA:



- Select a file (a job file or a result file) and press →. A new screen appears showing the names of the points present in the file. If a job file is selected, two types of points may be selected: target points and reference points.

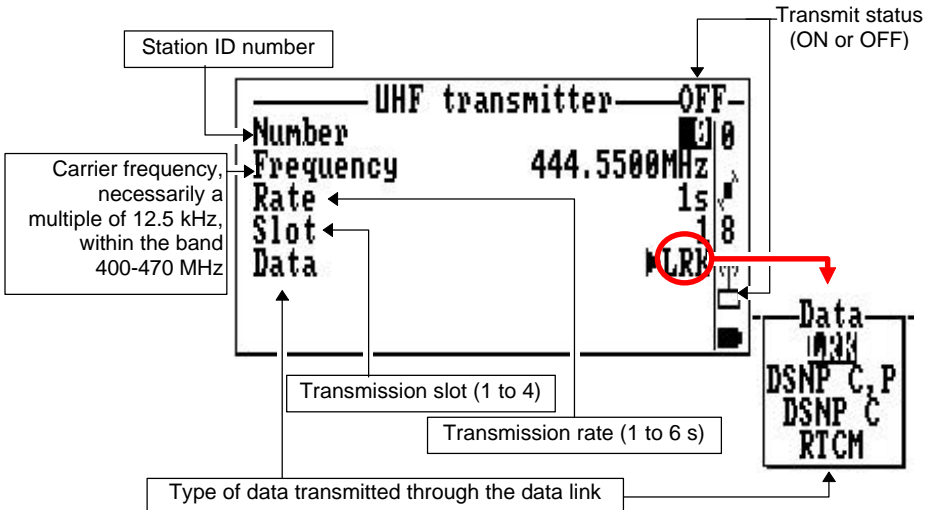


- Select a point and press →. This loads the coordinates of this point to the receiver as the position of the station.



Transmitter

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



Associated **Help** menu:

```

Help
E Start transmission
S Stop transmission
Esc Abandon
F4 Quit
    
```

(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

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 5-13) are just an estimate.

The screenshot shows the 'Average position' screen with the following data:

Field	Value
Status	Stop
Easting	310500.547m
Northing	259127.691m
Altitude	46.423m
Time elapsed	00h00/00h00

Callouts in the image point to:

- Status of the *Average Position mode* (Stop or Running)
- Time elapsed since you started this mode
- Total time planned in this mode

Text below the screenshot: 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*.



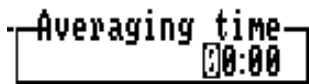
Associated **Help** menu:

```
Help
A Accept
R Start averaging
S Stop averaging
Esc Abandon
F4 Quit
```

(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 (hh:mm) during which you want the station to operate in this mode:



where hh: hours and mm: minutes

Choose this time according to the figures given in the table below.


Operating time in <i>Average Position mode</i>	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

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 5-13).

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

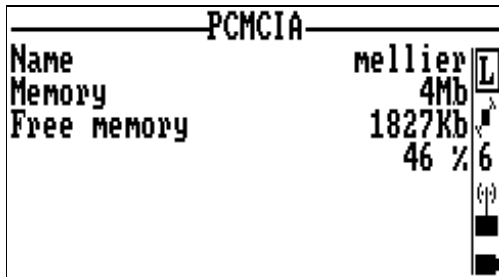
File Management

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



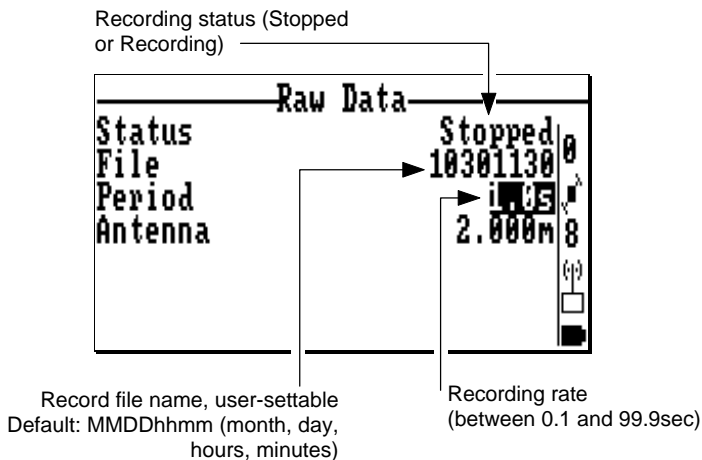
PCMCIA card

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:

```

  Help
  R Start recording
  S Stop recording
  Esc Abandon
  F4 Quit
  
```

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, thereby making the system ready for the next data recording.

Sessions

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

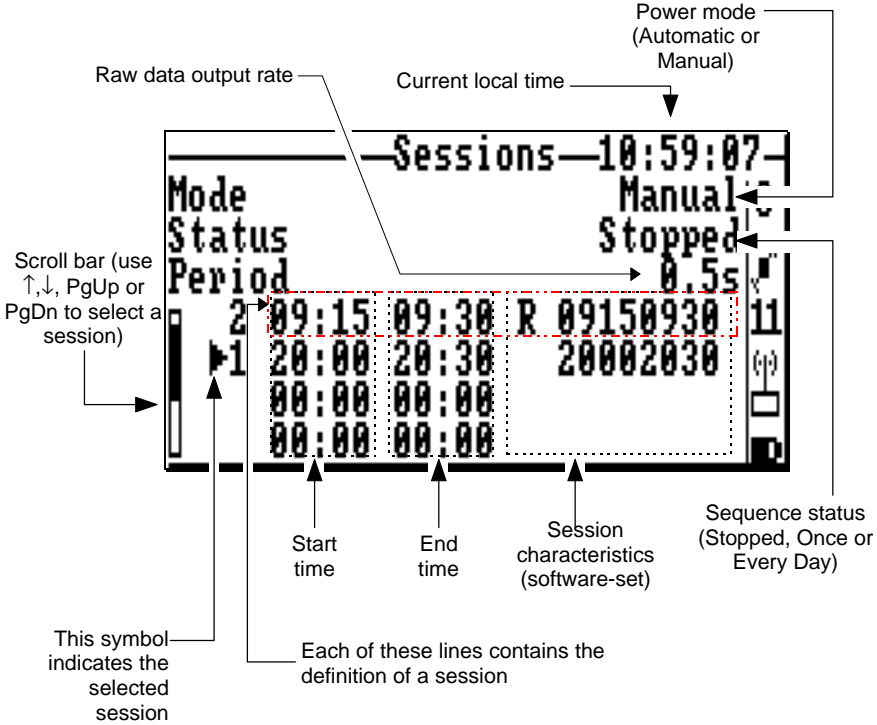
A session is an interval of time during which you wish the station to operate, combined with the possibility of having raw data recorded on the PCMCIA card.

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 menus:

```

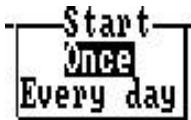
Help-1/2
R Start sessions
S End sessions
Yes Edit a session
1..8 Select a session
Del Delete a session
A Automatic power
    
```

```

Help-2/2
M Manual power
P Modify period
Esc Abandon
F4 Quit
    
```

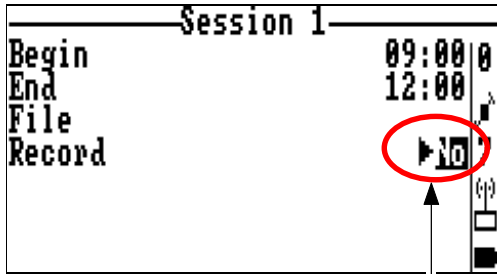
According to context:

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



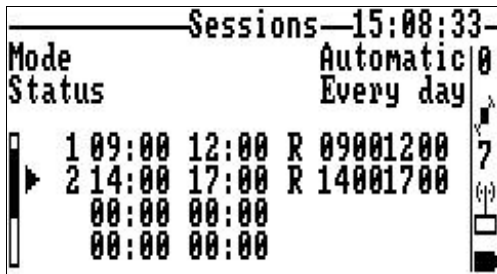
- Press the **S** key to stop the sequence of sessions.
- Press the **A** key to switch the station to **Automatic** power mode
- Press the **M** key to switch the station to **Manual** power mode.
- Press the **P** key to change the raw data output rate
- After placing the pointer in a session line, press a numeral key (**1** to **8**) to assign a run-time number to this session. For example, if you press "2", the session will be executed in second position within the sequence. Not assigning a number to a session line will result in the non-execution of the session
- Conversely, after placing the pointer in a session line, press the **Del** key to remove the session from the sequence (the session will no longer be executed).
- 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):



SVs

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



Visible Constellation

This function gives information about the GPS constellation visible from the base station. The information is arranged in two screens (1/2 and 2/2). Within the function, use the **PgUp** and **PgDn** keys to change screen.

Screen 1/2 example:

SV	El	Azi		SV	El	Azi		1/2
17	12	161	↑ U	24	03	42	↑ R	8
1	16	219	↓ U	6	16	149	↑ U	
8	23	148	↓ U	25	55	289	↑ U	
29	23	93	↓ U	30	56	83	↓ U	8
5	23	93	↓ U	22	02	281	↑ S	

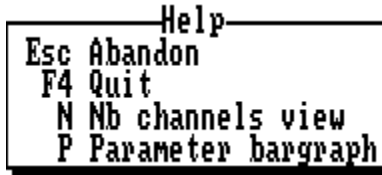
SV PRN No. ————
 Elevation angle in degrees ————
 Azimuth angle in degrees ————
 S: Searching
 U: Used
 R: Received but not used
 SV orbit: ascending (↑) or descending (↓)

(Same as opposite)



Screen 2/2 contains graphical and alpha-numerical information about the constellation.

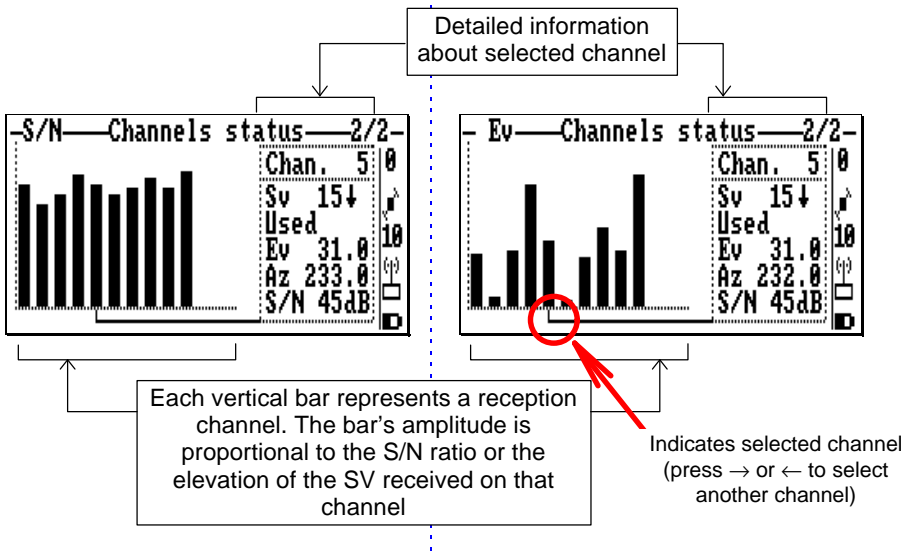
Help menu associated with screen 2/2:



- Press the **N** key to define the number of channels represented on the bar graph (typically 16 or 12)
- Press the **P** key to select which bar graph to show on the screen (either S/N Ratio or Elevation view):
- Use the horizontal-arrow keys to display complete information for the desired channel.

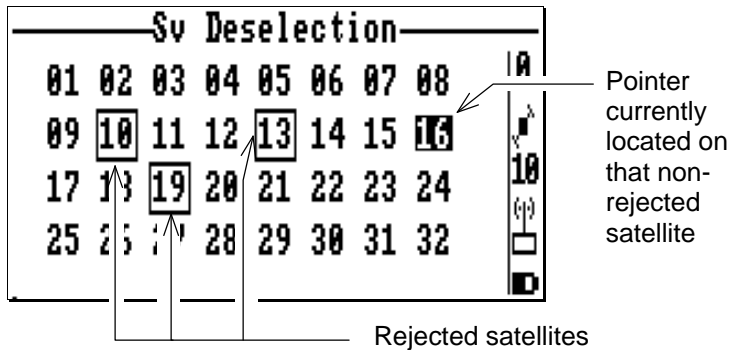
S/N ratio view

Elevation view

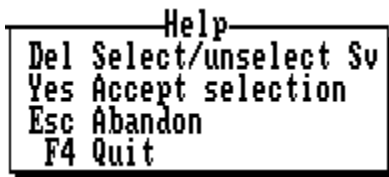


Deselection

This function allows you to reject one or more GPS satellites from the position processing performed at the station.



Associated **Help** menu:




According to context:

- Use the arrow keys to select the PRN of the SV you want to reject or re-select
- Press the **Del** key to reject or re-select the highlighted SV
- Press the **Yes** key to validate all the changes made to the PRN table



Coordinate System Used

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

```

Coord. system
  DATUM
Projection
Change to WGS84
Load geodesy
Local grid
Height correction
  
```

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.

Datum		1/2
Name		Ntf 0
A	6378249.145m	
1/F	293.4650000000	
S	1.00000000000000	8
Dx	-168.000m	(+)
Dy	-72.000m	
Dz	318.500m	

Datum		2/2
Ax	0.000000"	0
Ay	0.000000"	0
Az	0.554000"	8

Projection

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

Projection	
1P-Lambert	Lambert 2 0
Lori	46°48' 00.0000"N
Gori	2°20' 14.0240"E
Eori	600000.000m
Nori	200000.000m
Ko	0.999877420000



Change to WGS84

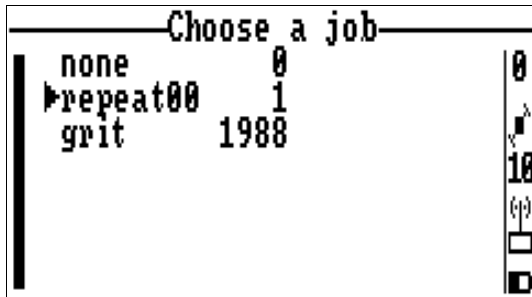
This function allows you to choose the WGS84 as the new system used by the receiver. User confirmation is required before the receiver switches to this system.

Load Geodesy

This function allows you to transfer the geodesy (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 Geodesy** function. The names of the jobs read from the PCMCIA appear on the screen.

Example:

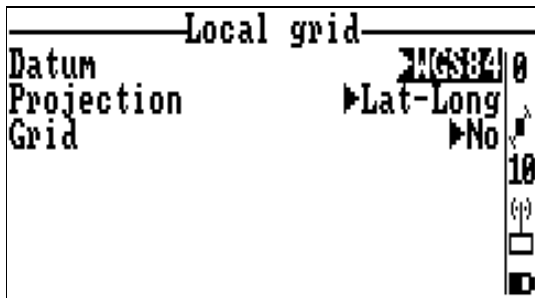


- Choose one and press ↵. This causes the selected coordinate system to be instantaneously loaded from the PCMCIA to the base station
- Press the **Esc** key to leave the function.

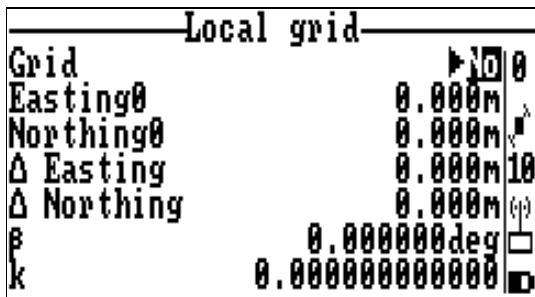
Local Grid

This function allows you to view the local grid used, if any. When selecting the function, the datum and projection currently used are recalled on the screen which then appears. From this screen, you can access the **Datum** and **Projection** functions described in the preceding pages.

Screen example:



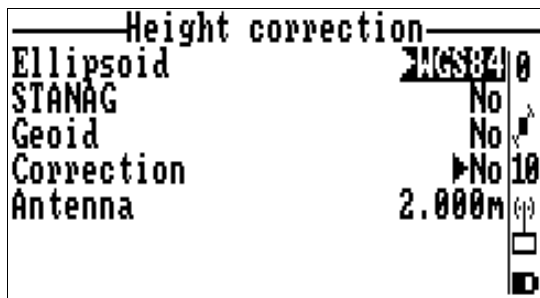
- Select the Grid field (third line) and press →. A new screen appears viewing the local grid:



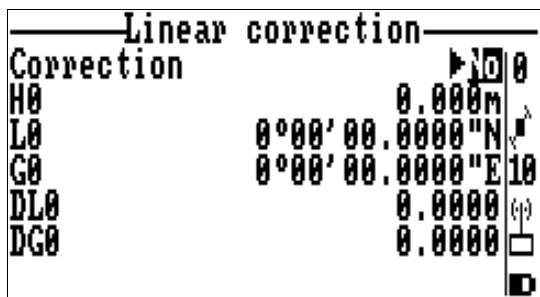
Height correction

This function allows you to view the vertical system used. When selecting this function, the ellipsoid and antenna altitude are recalled on the screen which then appears.


Screen example:



- To view the height correction, select the Correction field and then press →. A new screen appears viewing the height correction:



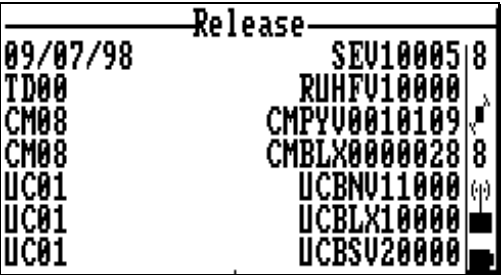
System Tools

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



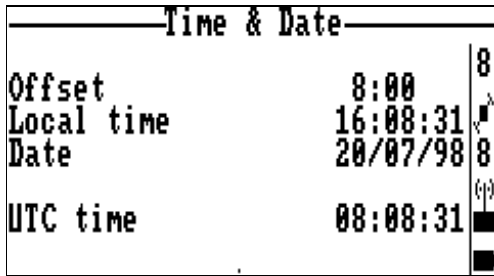
Release

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

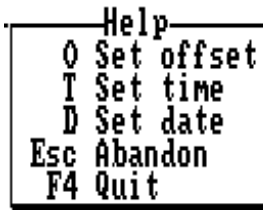


Time

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

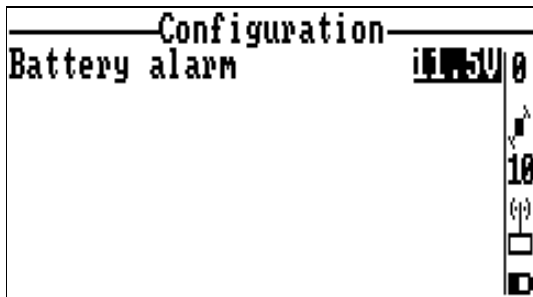


- Press **F1** to display the Help menu. Use the key-letters shown in this menu to change the time & date.



Configuration

This function allows you to define the lower operating limit of battery voltage.



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 reformat 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.

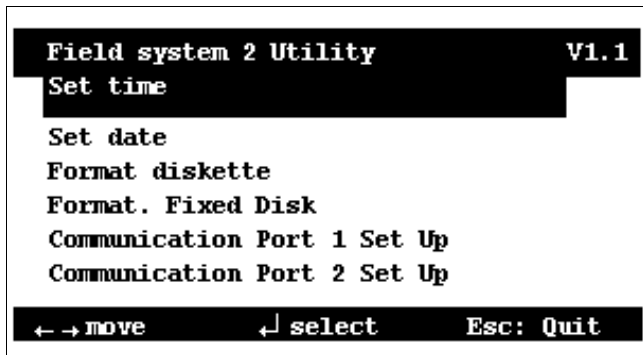
Fatal errors

- 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.



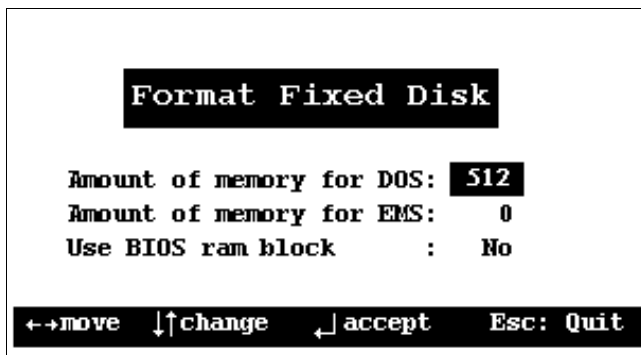
```
Field system 2 Utility          V1.1
Set time
Set date
Format diskette
Format. Fixed Disk
Communication Port 1 Set Up
Communication Port 2 Set Up

← → move      ↵ select      Esc: Quit
```


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



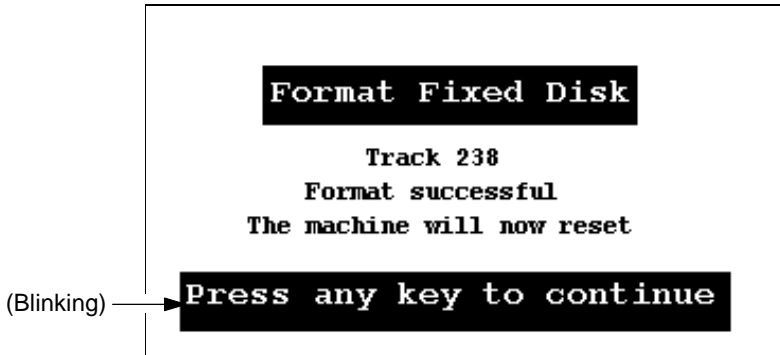
- Using the vertical-arrow keys, have "Yes" displayed in the selected field (instead of "No")
- Press the "Yes" key. A new screen appears.



- The amount of memory for DOS should be 512 (if 1Mbyte FS/GS) or 640 (if 2-Mbyte FSGS). 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.



- 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 462848 bytes free (1Mbyte FS/GS).



Station Installation Kit Option

NOTICE:

The Station Installation Kit is marketed as an option.

This section may be skipped unless you are the user of this option.

6. Station Installation Kit option

Introduction

The *Station Installation Kit* option contains all the accessories required to install an Aquarius 5000 receiver at a stationary point, on land, thus changing your receiver into a potential base station. The option also includes containers making it easier for the operator to move the whole equipment from an installation site to the other.

Note that this option includes neither a transmitter (for data link) nor the station firmware.

The *Station Installation Kit* option is part of the delivery if you ordered a 5001 SD or 5002 SK station.

The *Station Installation Kit* option may have been acquired separately if for example you wish to migrate your Aquarius 5000 receiver from a mobile sensor to a base station.

As this section is assumed to cover both the delivery of a 5001 SD or 5002 SK station and the separate delivery of the kit alone, the various parts of the *Station Installation Kit* option are presented complete with the Aquarius 5000 receiver, the GPS antenna, the UHF transmitter, the UHF antenna and various cables (all these parts being delivered to constitute either of the above-mentioned stations).

After this description, instructions are provided to implement a base station. Two procedures are also described to measure the height of the GPS antenna phase centre above the ground.

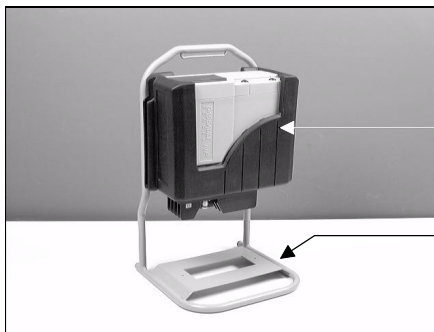
Kit description

The *Station Installation Kit* option consists of the following items (DSNP reserves the right to make changes to this list without prior notice):

- GPS station kit Part No. 26E1076434 (adapters, Meter Kit, and other small parts)
- Station container Part No. 790077805 (consists of the container as such + the inner foam trays used to secure the various items in the container):



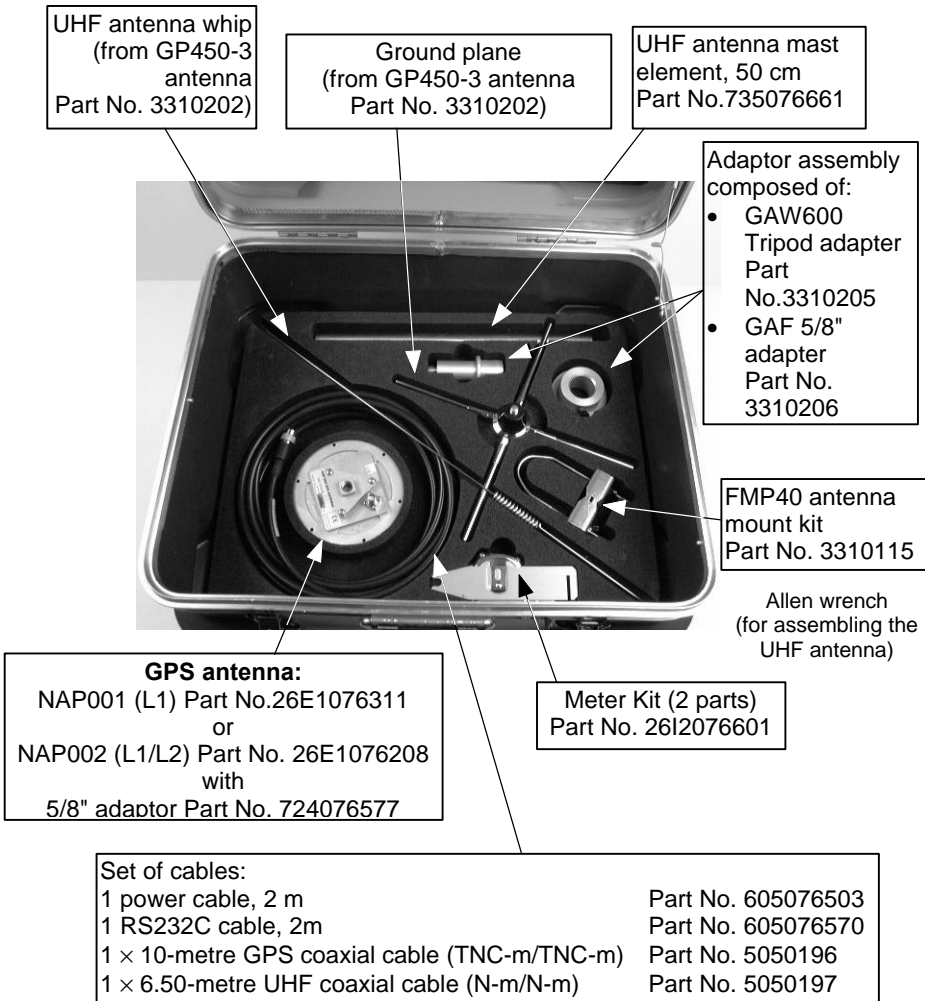
- Receiver holder Part No. 751076466 (black rubber) and metal support Part No. 751076467:

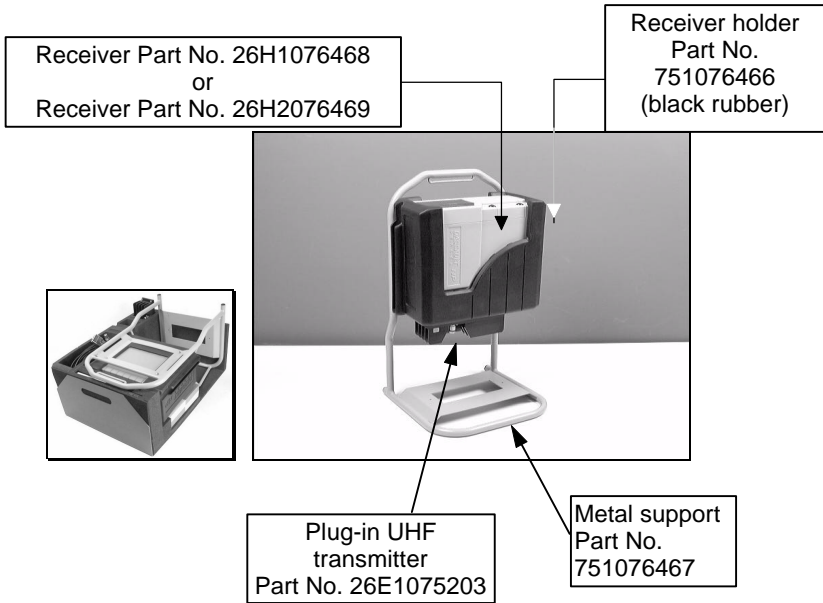


Receiver holder
Part No.
751076466
(black rubber)

Metal support
Part No.
751076467

Unpacking





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

Station installation

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

You do not need particular tool for the installation of the station, but your usual tool box.

Choosing a location where to install the station

Remember the station should be installed in a place clear of any devices likely to produce radio frequency interference and also of any obstructions liable to hinder GPS reception or to produce multipath effects.

- **GPS antenna**

Install the GPS antenna at a safe distance from high-power antennas and radio-transmitters. Refer to page 3-7 to know the minimum distance recommended between this antenna and the UHF antenna.

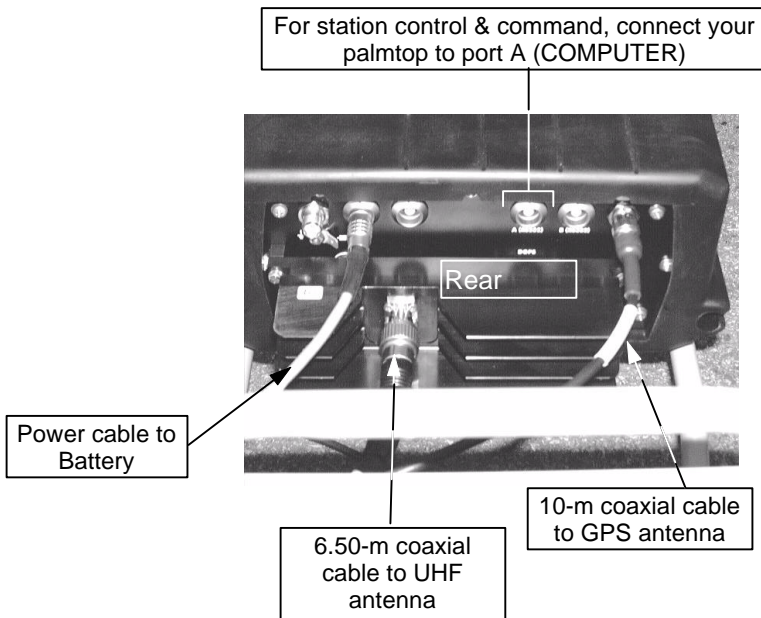
Choose a place providing a 360-degree view of the horizon for the best possible GPS reception.

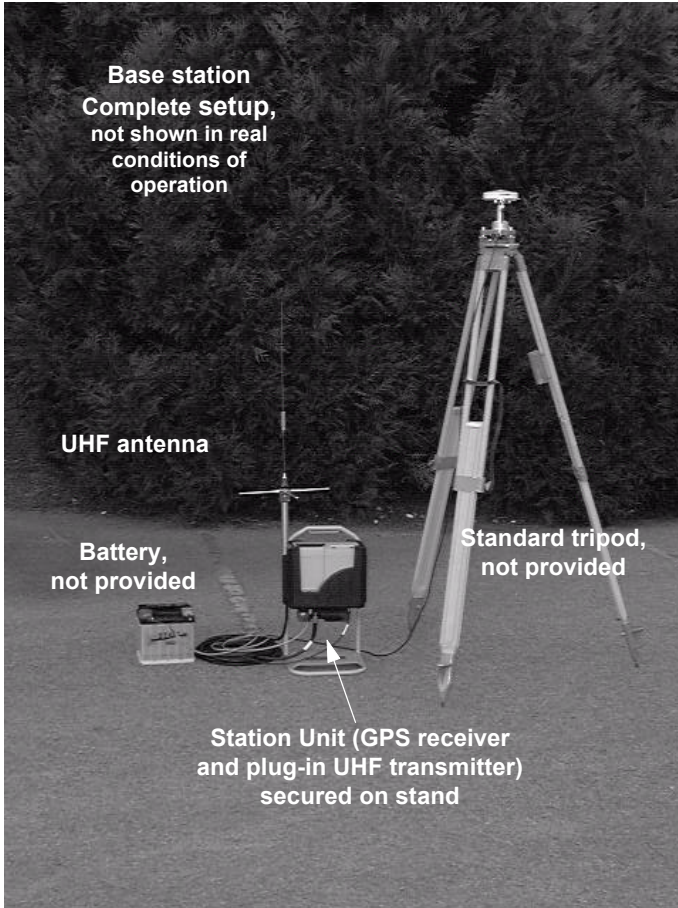
- **UHF antenna**

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





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

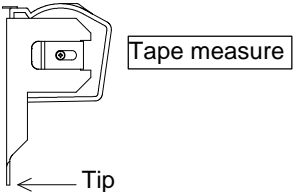
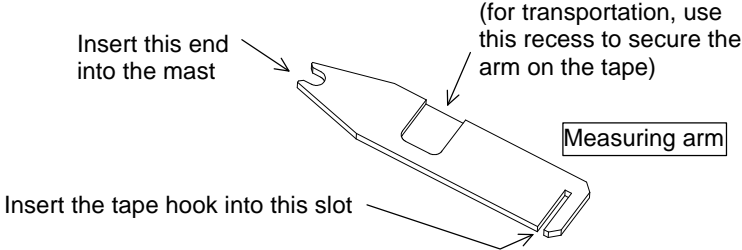
With this method, use the Meter Kit Part No. 26I2076601 as described below. The meter kit is composed of a tape measure and a measuring arm.

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

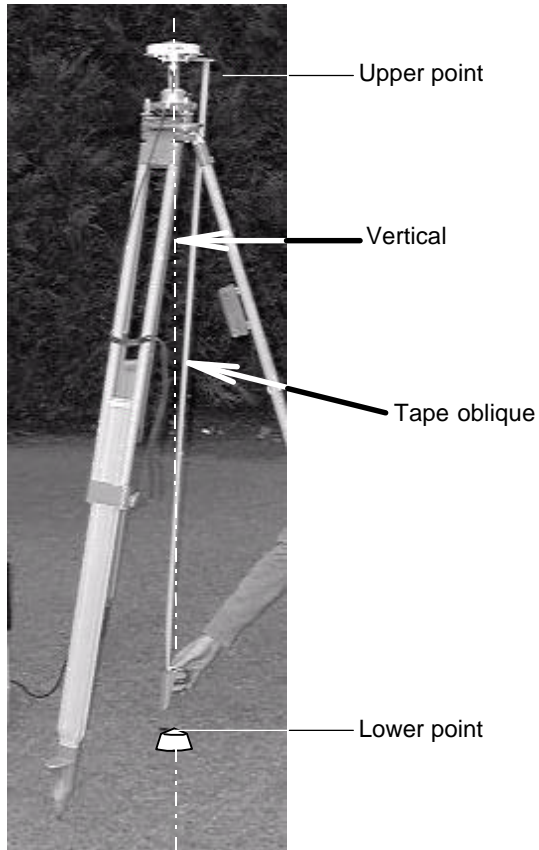
Insert the tape hook into the measuring arm (upper point)

- 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 5-12, *Antenna*).

Station Installation Kit option
Measuring the GPS antenna height



- DSNP measurement:



USER measurement

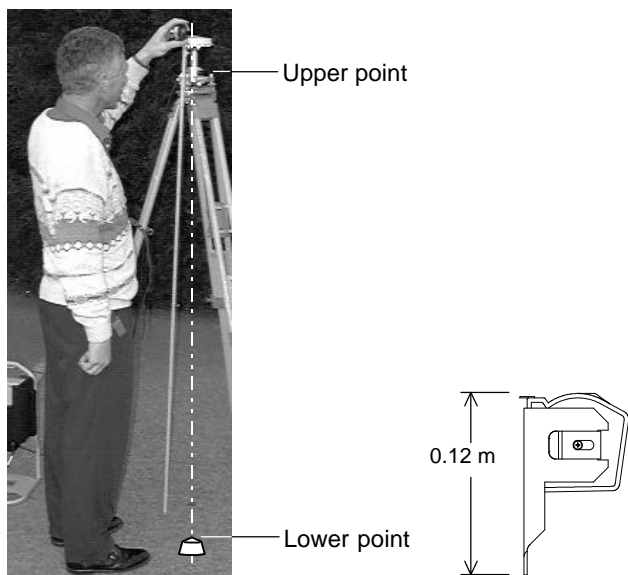
Knowing the location of the phase centre in the GPS antenna, you can measure its height above the landmark with your own method:

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 centre 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. ♣

A. Introduction to GNSS

GPS Constellation

The GPS system (Global Positioning System) consists of three segments:

- Space segment
- Control segment
- User segment

The Control segment is made up of monitoring stations distributed along the equator. They are used to pick up the signals from the satellites and relay the data they convey to a master station located in Colorado Springs (USA). The data collected are processed, corrected, filtered and finally uploaded to the satellites that broadcast them through a navigation message (ephemerides, almanacs, clock corrections).

The Space segment consists of 24 satellites (often referred to as "SVs" which is an abbreviation for Space Vehicles) orbiting approximately 20200 km above the earth's surface, so that at least four satellites can be simultaneously in view, round the clock, anywhere on earth. The satellites are distributed over 6 orbit planes inclined 55° with respect to the equatorial plane. Each satellite completes an orbit once every 12 hours approximately. From any point on earth, a satellite remains in view for 5 hours (maximum) above the horizon.

The user segment is naturally that which means most to us. It is made up of all the marine, land or air-borne applications deciphering and using the signals received from the satellites.





From a user's point of view, the user segment consists of a receiver capable of recording the GPS information so that it can be processed at a later date or a receiver computing a position in real time with an accuracy depending on the signals used.

Signals

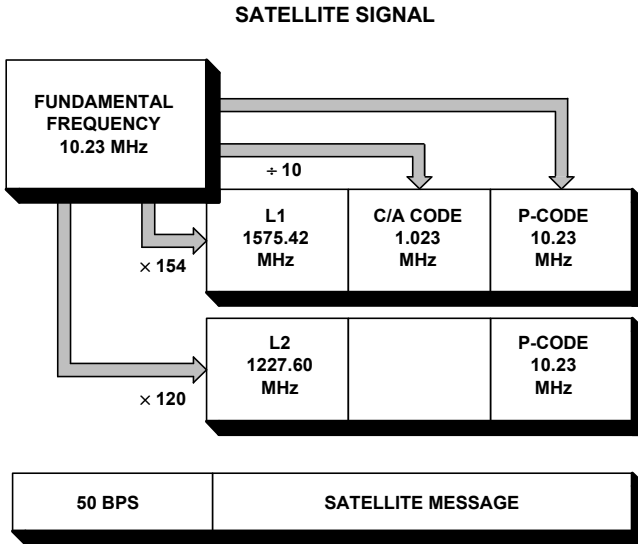
The signals transmitted by the satellites fall into two categories: signals used to control the system, and signals used for measurements within receivers (user segment).

The first type of signal is transmitted in the S-band on the following frequencies:

- 1 783.74 kHz for links from the control station to the satellites
- 2 227.5 kHz for links from the satellites to the monitoring stations.

The second type of signal is for signals known as L1 and L2, transmitted in the L-band, on the following frequencies:

- L1: 1 575.42 kHz
- L2: 1 227.6 kHz



Navigation Message

The Navigation Message contains the necessary information for the description of the constellation and for the position computation. The message includes orbital Keplerian parameters precisely defining the orbits of the satellites. It also includes parameters used to partially correct system errors (e. g. signal propagation errors, satellite clock errors, etc.).

The complete message is contained in a data frame that is 1500 bits long, with a total duration of 30 seconds (i. e. the data transmission clock rate is 50 bits/second). The 1500-bit frame is divided into five 300-bit subframes, each with a 6-second duration. Each subframe consists of 10 words of 30 bits each. Each word takes 0.6 second to transmit.

The content of subframes 4 and 5 changes on a page-roll basis: it changes on every frame and repeats every 25 frames. As a result, it takes at least 12 1/2 minutes to log the entire navigation message.

GNSS

General Description

Satellite navigation systems are now used in scores of applications worldwide. The best known two systems in operation as of today are:

- The US GPS (Global Positioning System) which is the most complete,
- The Russian GLONASS (GLObal NAVigation Satellite System).

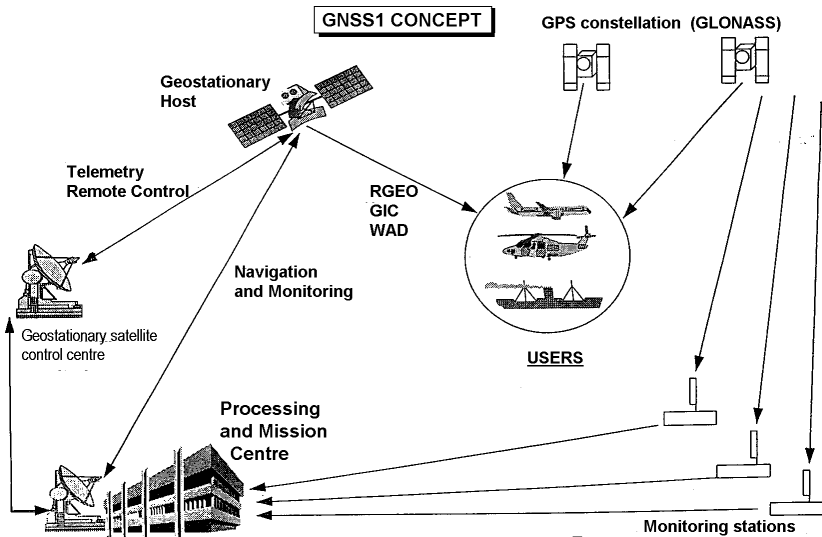
As both these systems are originally designed for military applications, they are entirely under the control of the respective Defence Department of the two countries. As a result, civilians cannot be sure of being allowed full access to the signals in critical periods of time. Moreover, the accuracy achieved using the non-encrypted signals is only on the order of a few tens meters.

All those aspects led the civilian community to devise a totally new system known as GNSS (Global Navigation Satellite System).



In future, a complete constellation —GNSS2— should provide civilian users with signals and data allowing them to compensate for any shortcomings in the navigation systems at sea, on land or in the air.

The current GNSS1 is the first phase in that scheme, based on the augmentation of the GPS service through geostationary satellites.



Purpose

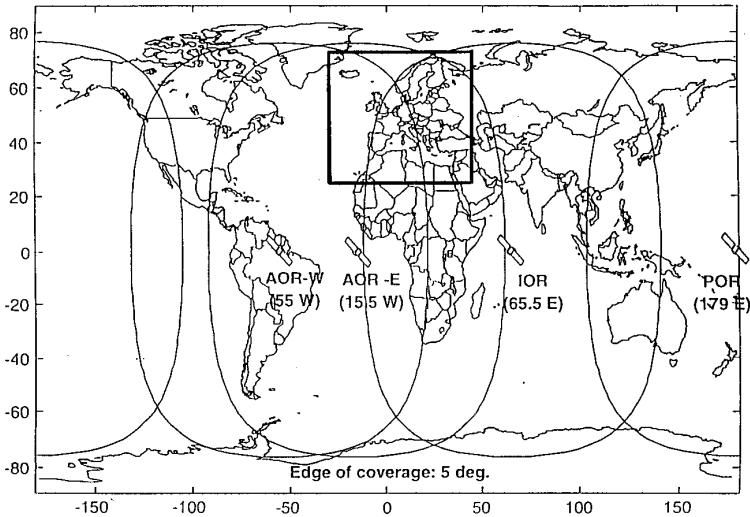
The GNSS scheme serves three major purposes:

- Complementing the range measurements with geostationary satellites (R_GEO),
- Controlling the integrity of the navigation system (GIC),
- Broadcasting differential corrections over a wide area (WAD).

GNSS concept

The GNSS system consists of the following elements:

- Stations monitoring the navigation system (GPS, GLONASS), distributed over the area to be covered, allowing continuous monitoring of the system,
- A Processing and Mission Center that collects and computes the data required for the performance of the system,
- A control center for the geostationary satellites, uploading the necessary data to the geostationary satellites,
- One or more geostationary satellites broadcasting the data (R_GEO, GIC, WAD) over the area to be covered.



The different systems

There are three systems as of today:

- For the American continent: WAAS (Wide Area Augmentation System)
- For Europe: EGNOS (European Geostationary Navigation Overlay System)
- For Asia: MSAT

WAAS

- **Definition & Purpose**

The FAA (US Federal Aviation Administration) has been developing a safety-critical navigation system, called WAAS (Wide Area Augmentation System), offering a geographically expansive augmentation to the GPS service.

The coverage includes all the United States as well as Canada and Mexico.

The purpose of the WAAS is to improve the *accuracy*, *availability* and *integrity* of the basic GPS signals. The definitions of these 3 parameters are recalled below:

Accuracy : Difference between position measured at any given time and actual position

Availability : Ability of a system to be used for navigation whenever needed

Integrity : Ability of a system to provide timely warnings to users, or to shut itself down when it should not be used for navigation

- **Description**

The WAAS is based on a network of approximately 35 ground reference stations that covers a very large service area. Signals from GPS satellites are received by wide area ground reference stations (WRSs). Each of these precisely surveyed reference stations receive GPS signals and determine if any errors exist.



These WRSs are linked to form the U.S. WAAS network. Each WRS in the network relays the data to the wide area master station (WMS) where correction information is computed. The WMS calculates correction algorithms and assesses the integrity of the system. A correction message is prepared and uplinked to a GEO via a ground uplink system (GUS).

The message is then broadcast on the same frequency as GPS (L1, 1575.42MHz) to users navigating within the broadcast coverage area of the WAAS. The communications satellites also act as additional navigation satellites for users, thus, providing additional navigation signals for position determination.

The WAAS will improve basic GPS accuracy to approximately 7 meters vertically and horizontally, improve system availability through the use of geostationary communication satellites (GEOs) carrying navigation payloads, and to provide important integrity information about the entire GPS constellation.

- **Schedule**

The delivery schedule will be accomplished in three phases by delivering an initial operating system and then upgrading the system through pre-planned product improvements (P³I). Phase 1 WAAS will also provide the WAAS initial operating system which consists of two WMSs, 25 WR%, leased GEOs, and ground uplinks.

Shortly after the contractor completion of Phase 1, the FAA will commission the WAAS for operational use in the U.S. National Airspace System (mid 1999).

More information about the WAAS and the GEO broadcast schedule can be obtained from the FAA site:

(<http://gps.faa.gov>)



EGNOS

EGNOS is the equivalent of the WAAS for the European countries. More information about this system can be obtained from <http://concord.cscdc.be>

GEO current status (December 1998)

WARNING!

At the present time, only test signals are broadcast by the different administrations involved in the development of the system. These signals are not guaranteed to be reliable and accurate and so may be the source of erroneous indications.

WAAS (North American Region)

Test signals are currently broadcast for use by the FAA. This broadcasting is under control of the NSTB (National Satellite Test Bed) and takes place from the following geostationary satellites (GEOs):

- PRN 122, INMARSAT III F4 AOR-W (Atlantic Ocean Region-West), located above the Equator at 54°W longitude
- PRN 134, INMARSAT III F4 POR (Pacific Ocean Region), located above the Equator at 178°E longitude

Updated information concerning the broadcasting from these satellites is constantly available from:

<http://gps.faa.gov/Programs/NSTB/Provisions/sis.htm>

EGNOS (Europe)

Test signals are intermittently broadcast from the following satellite:

- PRN 138, INMARSAT III F5 (Spare), located above the Equator at 25°E longitude

As from the middle of the year 1999, this broadcasting is scheduled to be continuous from the same satellite and progressively, from 2 other satellites (identified below):

- PRN 120, INMARSAT III F2 AOR-E (Atlantic Ocean Region-East), located above the Equator at 15.5°W longitude
- PRN 131, INMARSAT III F1 IOR (Indian Ocean Region), located above the Equator at 64°E longitude.





MSAS (Japan)

No information available to date concerning the availability of a signal.



B. Introduction to the DSNP Aquarius 5000 series

Preamble

Welcome to the DSNP *Aquarius 5000 series*. We hope that this equipment will give you full satisfaction.

The DSNP Aquarius 5000 series has been designed for marine surveys. As you know, the modular concept adopted in the design of the 5000 series has made it possible to optimize the purchase of your surveying equipment by allowing you to buy just the necessary pieces of equipment needed for your applications.

In this appendix, we will describe the whole 5000 series, from the basic equipment up to the most sophisticated one. In this description, you will recognize the equipment you have just purchased, you will read the preliminary instructions on how to control and operate it and you will be informed on how to make extensions to your initial configuration.

The heart of your equipment

The heart of your equipment is what we call the "GNSS engine". All the products from the Aquarius 5000 series are built around this engine.

The GNSS engine comes in two versions. Depending on your purchase, your equipment will use an L1 single-frequency engine, or an L1/L2 dual-frequency engine.

If necessary, your equipment will be easily transformable from single to dual-frequency by purchasing the L1-to-L1/L2 upgrade.

A large blue square containing a white, bold, serif letter 'B'.

Operating environment

The products of the 5000 series are of the "black box" type thus making them extremely flexible and versatile. For example the same receiver can be used as a navigator receiver or as a base station. In operation, all the data are made available on the serial ports to be sent to your usual terminals for further processing and display. Two types of serial lines are available for this purpose:

- RS232 ports A and B ("I/O" and "COMPUTER"),
- a dedicated RS422 port (port D) interfacing with the optional data link module,
- Optional RS422 port C ("I/O").

An integrated "intelligent" status display exists on the receiver front panel whose function is to provide information on how the receiver operates (reception conditions, current position solution, etc.) (not an input device).

To change the conditions of operation (new configuration, etc.), you will need to attach a computer to the receiver's RS232 A port ("COMPUTER") and then send a number of commands to make the changes required.

Configuration

As the receiver has no built-in user interface but a simple readout (status display) used for monitoring and performance checks, the user has to resort to commands sent from a control computer to be able to access the desired data for changes (e. g. geodetic system, output messages, etc.). Some data cannot be accessed in this way. In this case, the *Conf Pack* configuration software has to be employed (see the corresponding manual).

Three types of configurations are saved in the unit:

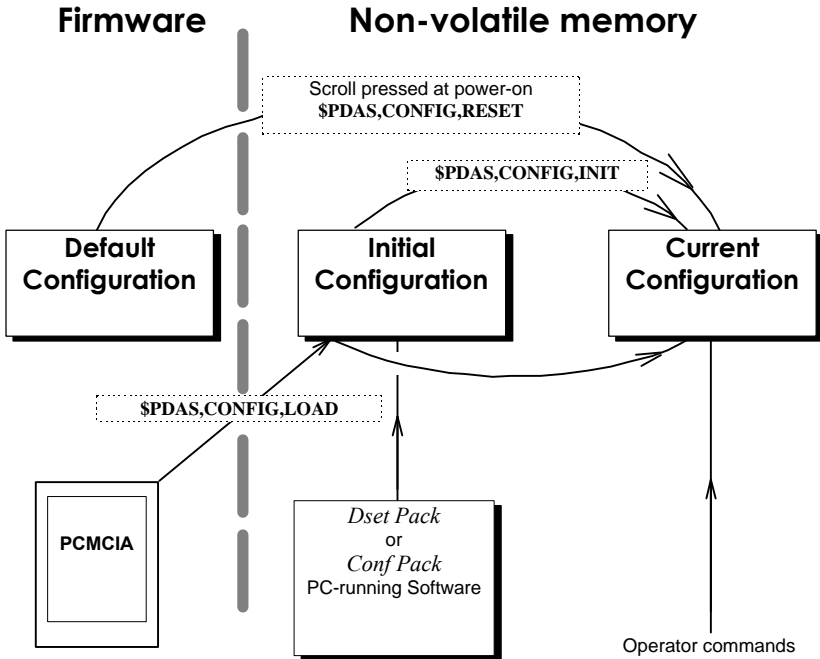
- *Default configuration*, resident in the firmware. This configuration cannot be modified. It resets all parameters in the unit to known values (operating mode, RS port configuration, output messages, etc.)
- *Initial configuration*, saved in a non-volatile memory. It can be modified using the configuration software. It contains the necessary parameter settings for the reference configuration of an application or for any particular operating mode (mobile, reference station, etc.).
- *Current configuration*, saved in a non-volatile memory. This configuration is modified by the operator's actions (through the human/computer interface or through remote control words).

The *Default configuration* can be loaded in place of the *current configuration* by pressing the pushbutton on the integrated display and holding it depressed, at power-on, or by sending the command \$PDAS,CONFIG,RESET.

B

The command `$PDAS,CONFIG,INIT` can be used to make the *initial configuration* the new *current configuration*.

The command `$PDAS,CONFIG,LOAD` can be used to load a configuration file from a PCMCIA to a receiver unit to become its new *initial* and *current configurations*.



The clue to product naming in the Aquarius 5000 series

In the Aquarius 5000 series:

- the "1" suffix refers to a single-frequency (L1) engine
- the "2" suffix refers to a dual-frequency (L1/L2),
- "M" refers to a roving receiver (Mobile)
- "S" refers to a stationary receiver (Station)
- "D" refers to DGNS capability
- "K" refers to KART or LRK® capability



Product applications

The 5001 and 5002 are multipurpose GNSS receivers intended for marine applications. They are directly derived from the two GNSS engines described previously:

- the 5001 is the single-frequency receiver
- the 5002 is the dual-frequency receiver

The 5001 MD sensor is intended for marine surveys in which sub-meter accuracies are required. It is fitted with a built-in UHF receiver whose function is to receive differential corrections transmitted in the DSNP UHF or RTCM104 format by a 5001 SD reference station.

The 5001 SD reference station is intended for marine surveys in which sub-meter accuracies are required. It is fitted with a plug-in UHF transmitter whose function is to broadcast differential corrections in the DSNP UHF or RTCM104 format. Corrections are intended for mobiles, typically of the 5001 MD type.

The 5002 MK mobile sensor is intended for marine surveys in which real-time centimeter accuracies is required (operation based on the use of the KART or LRK® format). It is fitted with a built-in UHF receiver whose function is to receive differential corrections transmitted in the DSNP UHF KART or LRK format by a reference station, typically a 5002 SK.

The 5002 SK Reference Station is intended for marine surveys in which real-time centimeter accuracies is required (operation based on the use of the KART or LRK® format). It is fitted with a plug-in UHF transmitter whose function is to broadcast differential corrections in the DSNP UHF KART or LRK format. Corrections are intended for mobiles, typically of the 5002 MK type.

Product Selection Guide

	5001	5002	5001 SD	5001 MD	5002 SK	5002 MK
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Hardware/Software Options

L1 Core Module	✓		✓	✓		
L1/L2 Core Module		✓			✓	✓
UHF Tx Module			✓		✓	
UHF Rx Module				✓		✓
Extended I/O				option		option
Topographic Kit				option		option
Station Firmware			✓		✓	

Processing Methods

DGNSS			✓	✓	✓	✓
KART			option	option	✓	✓
LRK					✓	✓



Software options

Below is the complete list of software items which you can acquire from DSNP to extend the configuration of your 5001 or 5002 receiver:

- PCMCIA recording capability
- Differential GNSS reference station firmware (using RTCM104 and DSNP formats)
- KART firmware
- LRK firmware
- Local geoid height input firmware (released at a later date)

Hardware options

Below is the complete list of hardware items which you can acquire from DSNP to extend the configuration of your 5001 or 5002 receiver:

- L1-to-L1/L2 upgrade (for 5001 only)
- Built-in UHF receiver
- Plug-in UHF transmitter
- Extended I/O board (plugged inside the case) offering the following new inputs and outputs:
 - External event input for time-tagging of this event
 - one extra RS422 port ("I/O" port C)
 - 1PPS output
 - 10-MHz input for use of an external oscillator
- Topographic kit
- Station kit with antenna tripod interface, container and miscellaneous.

Specifications

Physical

	Dimensions in mm (H×W×D)	Weight in kg	UHF antenna length in cm
5001	130×260×220	3.5	-
5002	130×260×220	3.5	-
5001 SD	130×260×250 ⁽¹⁾	4.5	85
5001 MD	130×260×220	3.7	85
5002 SK	130×260×250 ⁽¹⁾	4.5	85
5002 MK	130×260×220	3.7	85

⁽¹⁾ With plug-in UHF transmitter

Electrical

	Power Drain in W	DC Power voltage range in V	Type
5001	11	10 to 36	Floating
5002	13.6	10 to 36	Floating
5001 SD	24 ⁽¹⁾	10 to 15	Non-floating
5001 MD	15	10 to 36	Floating
5002 SK	26 ⁽¹⁾	10 to 15	Non-floating
5002 MK	17	10 to 36	Floating

⁽¹⁾ With 4-W radiated power



Environmental

Receiver operating temperature : – 20°C to + 55°C

Receiver storage temperature : – 40°C to + 70°C

GPS Antenna operating temperature : – 40°C to + 70°C

UHF Antenna operating temperature : – 40°C to + 70°C

Humidity : 100% fully sealed

Receiver standard features

- 16-channel (L1) receiver, WAAS/EGNOS compatible (5001)
- 12-channel (L1+L2) + 4-channel (L1) receiver, fully operational with P-code encryption (5002)
- Multipath mitigation techniques and low-noise observables
- GNSS raw data output: 10-Hz rate ASCII or binary formats
- Navigation algorithms (250 waypoints)
- Fully-configurable numerical outputs (NMEA0183 or user formats)
- Extensive set of remote commands
- User-defined datums and projections

Station standard features

- 16-channel (L1) receiver, WAAS/EGNOS compatible (5001 M...)
- 12-channel (L1+L2) + 4-channel (L1) receiver, fully operational with P-code encryption (5002 S...)
- Multipath mitigation techniques and low-noise observables
- GNSS raw data output: 10-Hz rate ASCII or binary formats
- Auto referencing
- Monitoring mode
- Sessions programming
- Carrier-smoothed C/A code data
- Update rate for a full set of corrections every 1 second for either L1 only or L1 & L2



B

Built-in UHF receiver

Frequency band : 410-470 MHz

Channelizing : 12.5 kHz

Modulation types : DQPSK (1200 bits/s) or GMSK (4800 bits/s), selectable

Plug-in UHF transmitter

Frequency band : 410-470 MHz

Channelizing : 12.5 kHz

Output power : 4 W

Modulation types : DQPSK (1200 bits/s) or GMSK (4800 bits/s), selectable

5001/5002 specific performance data

- **DGNSS performance characteristics**

(with optional built-in UHF receiver or with corrections decoded by third-party equipment)

- DGNSS fix at a rate of up to 10 Hz with latency:
< 0.1 s
- DGNSS accuracy: 1 meter typical (95%) at 1-s rate, 5 SVs or more, HDOP < 4 (with DSNP reference stations).

5001MD specific performance data

- **Corrections data processed**

- DSNP UHF format (1200 bits/s, of the NDS100 Mk II type)
- RTCM104 messages (Nos. 1, 2, 3, 5, 9, 16, 18*, 19*)

- **DGNSS Performance characteristics**

(With Aquarius 5002 SK or 5001 SD station)

- Fix from 4 SVs min and no limited range
- Fix at a rate of up to 10 Hz with latency < 0.1 second
- DGNSS accuracy : < 1 meter typical (95%), at 1-sec rate, 5 SVs or more, HDOP < 4.
- UHF reception range: up to 50 km using an Aquarius 5001 SD (range is height-dependent)

- **Performance characteristics with optional KART**

(With Aquarius 5002 SK or 5001 SD station)

- Automatic OTF initialization from 5 SVs within 12 km
- KART fix at a rate of up to 10 Hz with latency < 0.1 second
- KART accuracy: 2 cm X-Y, 5 cm Z (95%), at 1-sec rate, 5 SVs or more, HDOP < 4
- EDGPS backup: 20 cm X-Y-Z (95%)

(*: future implementation)



- **Performance characteristics with optional high-rate KART**

(With Aquarius 5002 SK or 5001 SD station)

- Automatic OTF initialization from 5 SVs within 12 km
- KART fix at a rate of up to 10 Hz with latency < 0.1 second
- KART accuracy: 1 cm X-Y-Z (95%), at 1-sec rate, 5 SVs or more, HDOP < 4
- EDGPS backup: 20 cm X-Y-Z (95%)

5001 SD specific performance data

- **Differential corrections generated**
 - DSNP UHF format (1200 bits/s, of the NDS100 Mk II type)
 - RTCM104 messages (Nos. 1, 2, 3, 5, 9, 16)

5002 MK specific performance data

- **Corrections data processed**

- Proprietary LRK® format (4800 bits/s)
- Proprietary high-rate KART format (4800 bits/s)
- Multi-station reception capability in LRK® or high-rate KART (up to 4 stations)
- Proprietary standard KART format (1200 bits/s, of the NDS100 Mk II type)
- RTCM104 messages (Nos. 1, 2, 3, 5, 9, 16, 18*, 19*)

- **UHF reception range**

- Up to 50 km using a 5002 SK station (range height-dependent)

- **LRK® Performance characteristics**

(With Aquarius 5002 SK station)

- Automatic OTF initialization from 4SVs
- Range: 30 km typical
- LRK fix at a rate of up to 10 Hz with latency < 0.1 second
- DGPS operational from 4 SVs minimum
- LRK® accuracy : 1 cm X-Y-Z (95%), at 1-s rate, 5 SVs or more, HDOP < 4.

(*: future implementation)



- **KART-, High-rate KART-, and DGNSS-compatible** (with Aquarius 5002 SK and 5001 SD stations)

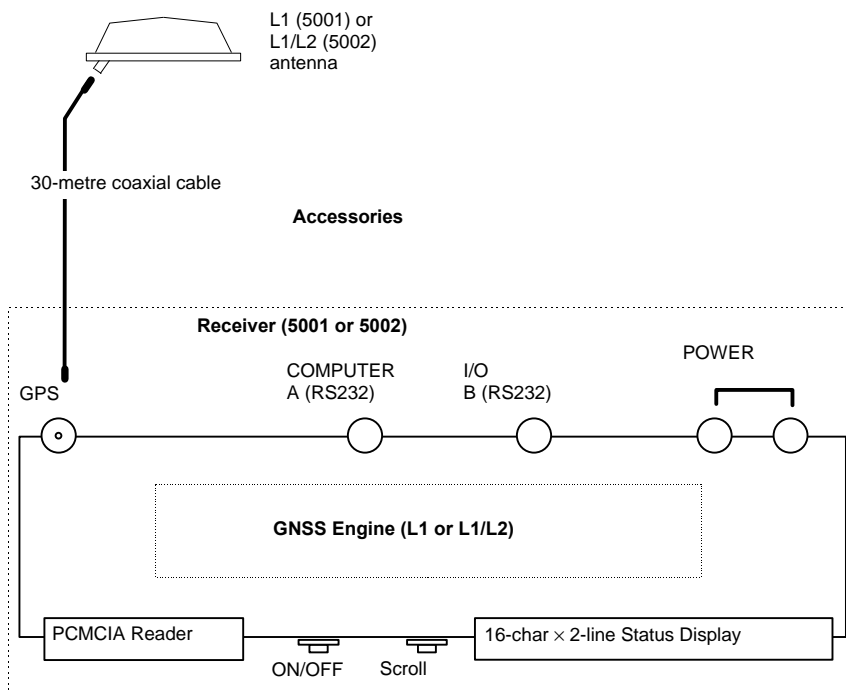
5002 SK specific data sheet

- **Differential corrections generated**
 - LRK® format (4800 bits/s)
 - High-rate KART format (4800 bits/s)
 - KART format (1200 bits/s, of the NDS100 Mk II type)
 - DSNP UHF format (1200 bits/s, of the NDS100 Mk II type)
 - RTCM104 messages (Nos 1, 2, 3, 5, 9, 16, 18*, 19*)
- **LRK® Performance characteristics**
 - L1/L2 code & phase data
 - Full set of corrections updated every 1 second
- **DGNSS, KART and High-Rate KART capability**
- **UHF coverage**
 - Up to 50 km (depending on the height of the installation location).

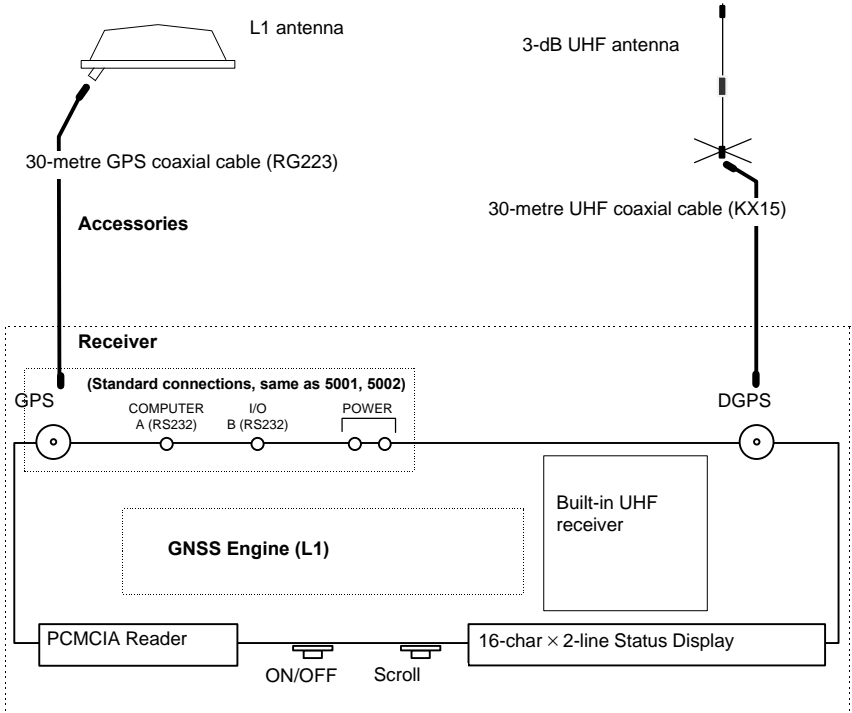
(*: future implementation)

Block Diagrams

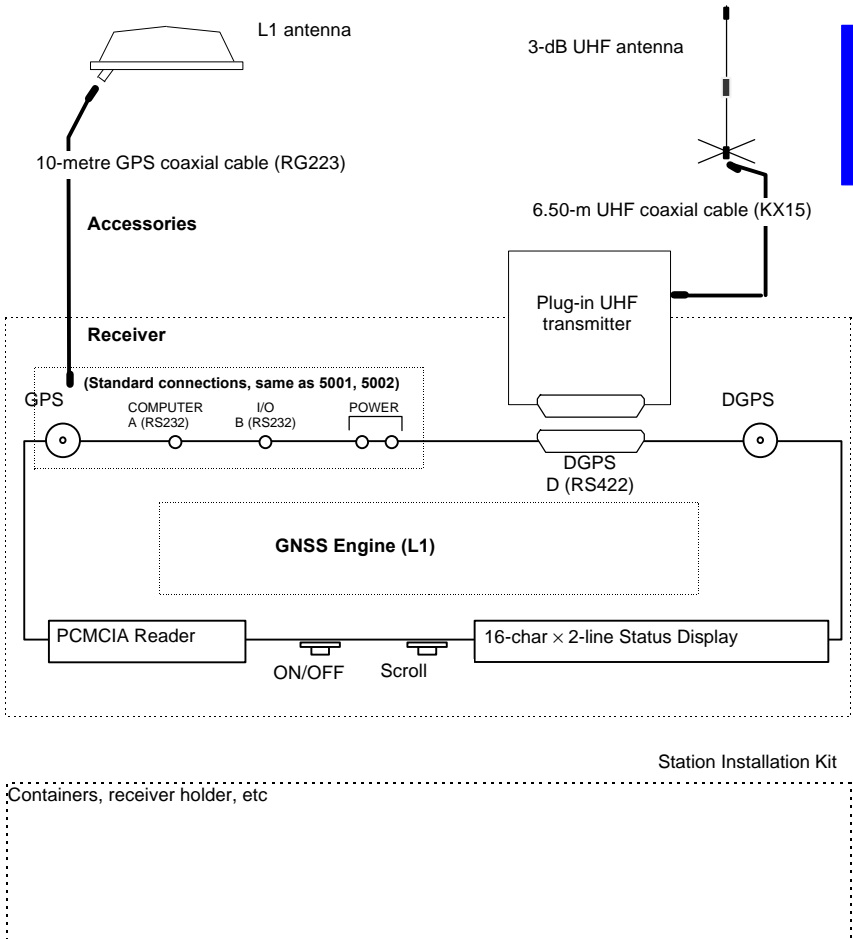
5001 & 5002



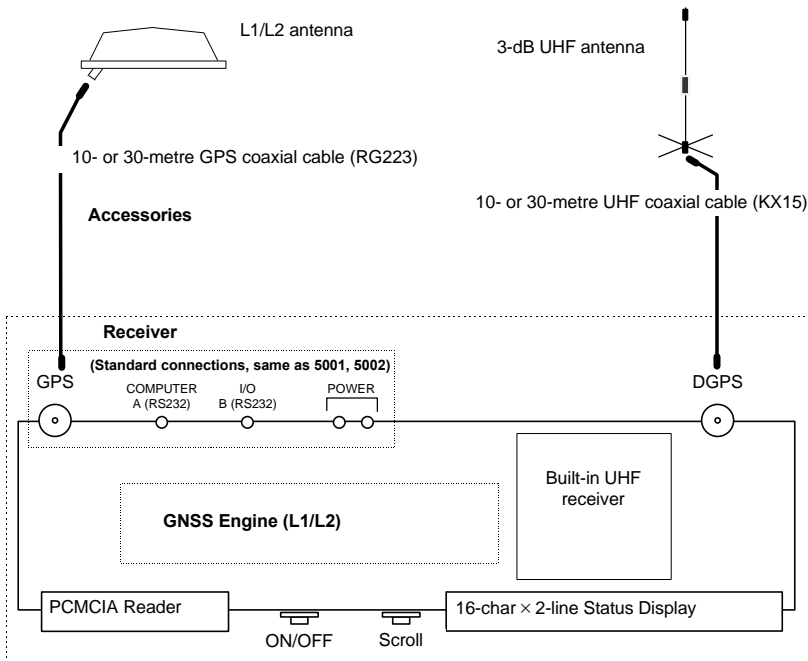
5001 MD



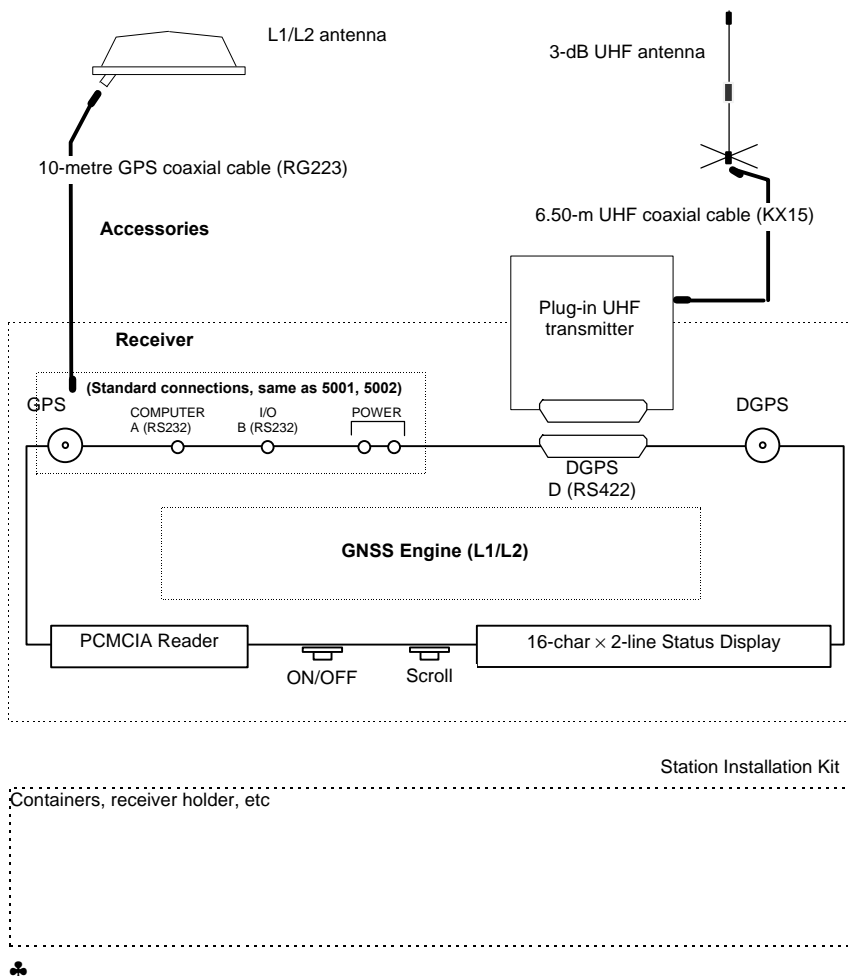
5001 SD Reference Station



5002 MK Mobile Sensor



5002 SK Long Range Kinematic Station





C. Commands library

Introduction

This appendix provides a description of all the DSNP proprietary commands.

Commands are presented in alphabetical order, and described outside their use contexts (emphasis is placed on the syntax rather than on the use context).

For each command, the description plan is always the same: function, syntax, parameters, examples.



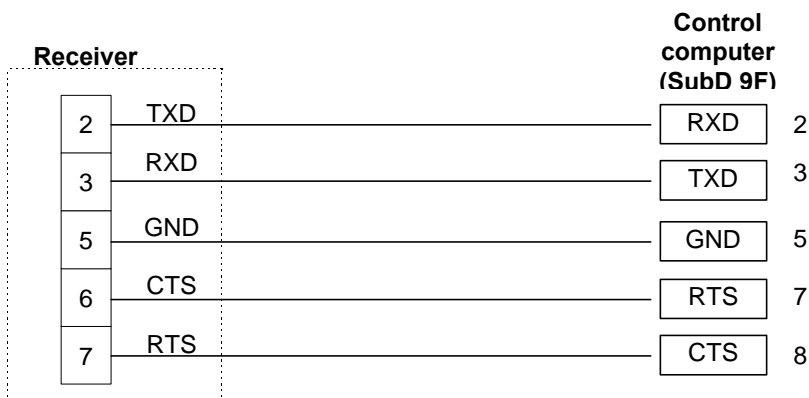
Purpose

The DSNP proprietary commands are intended for the control and configuration of your DGNSS receiver.

Applying commands to a DGNSS receiver

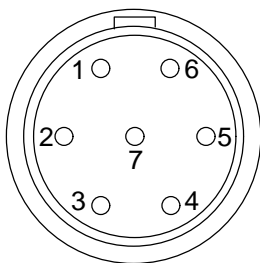
This requires an RS232 serial line between the control terminal (usually a PC computer) and the receiver (port A, COMPUTER). Commands are generated using the computer in terminal mode or better, using DSNP *DSet Pack* or *Win Comm* software.

If for any reason you do not have the serial cable required, you can prepare a cable according to the following wiring instructions:



Pinout of COMPUTER connector on DGNSS receiver rear panel:

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



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

Format

- The format of all the commands available complies with the NMEA 0183 standard.
- DSNP was assigned a manufacturer code by the NMEA 0183 Committee for all its proprietary sentences (which we call here "commands").

This code is "**DAS**".

As a consequence, the first field in any DSNP proprietary command will therefore be:

\$PDAS,

where:

\$ indicates the beginning of a command
P identifies a proprietary command
DAS is our manufacturer code

- The beginning of any field is denoted by a comma (,). This character is the only way to detect and identify a new field.
- Most fields containing numerical data are of variable length.
- Although from version 2.1 of the NMEA standard the checksum field is compulsory, it is optional in all DSNP proprietary sentences in order that commands can be sent from a simple, "non-intelligent" terminal or communications utility.
- When the checksum field is present and the test on this checksum fails, the command is rejected.
- Any command that you send can contain empty fields. If a field data is missing, it is assumed to keep its current value.



Conventions

The following symbols and conventions are used in the description of the DSNP proprietary commands:

- Square-brackets [] : used to bound optional parameters
 - x.x : designates the format of any numerical data, signed or not, with or without decimal point and decimal places, and with an integer part of variable length
 - a : designates a one-letter parameter (example: A)
 - x : designates the format of any numerical data which is necessarily an integer
 - xx : Numerical data, fixed length
 - c--c : Character string, variable length
 - cc : Character string, fixed length
 - a--a : Keyword
 - hhmmss.ss : Time
 - lll.llll : Latitude (ddmm.mmmmm)
 - yyyyy.yyyyyy : Longitude (dddmm.mmmmmm)
 - [y]x : Field containing two one-figure parameters the first of which is optional

In the examples given at the end of each description, the following fonts are used:

- **Times New Roman** for commands sent from the control computer
- Normal Times New Roman for replies to these commands returned by the DGNSS receiver.

Command summary table

Command	Function
\$PDAS,AGECOR	Changes/reads maximum age of corrections
\$PDAS,ALTI	Changes/reads altitude correction mode
\$PDAS,COMMNT	Reads comment present in configuration
\$PDAS,CONFIG	Reads data from current configuration
\$PDAS,CONFIG,INIT	Makes initial configuration the receiver's new current configuration
\$PDAS,CONFIG,LOAD	Loads configuration from PCMCIA into the receiver to be its new initial configuration
\$PDAS,CONFIG,READ	Reads data from initial configuration
\$PDAS,CONFIG,RESET	Makes default configuration the receiver's new current configuration
\$PDAS,DEFLT	Reports/acknowledges errors, if any
\$PDAS,DELSES	Cancels the specified programmed sessions
\$PDAS,DGPS,DELSTA	Cancels a DGPS transmitting station in the receiver
\$PDAS,DGPS,MODE	Controls DGPS transmit or receive channel
\$PDAS,DGPS,STATION	Describes/lists DGPS transmitting stations
\$PDAS,DGPDAT	Edits definitions of DGPS raw data outputs
\$PDAS,EXPSES	Edits the operating mode linked to sessions
\$PDAS,FILTER	Edits the speed filtering time constant
\$PDAS,FIXMOD	Edits the current fix mode & associated reference station or GEO
\$PDAS,GEO	Edits the coordinate system used



\$PDAS,GEODAT	Edits definitions of WAAS/EGNOS data outputs
\$ _GPQ, GLL	Edits estimated position
\$ _GLL	
\$PDAS,GNOS	Enables/disables operation with WAAS/EGNOS; also used to specify PRNs of GEOs tracked if chosen selection mode is "Manual"
\$ _GPQ, _ _ _	Returns the current value of the specified parameter (NMEA0183 compliant)
\$PDAS,GPSDAT	Edits definition of GPS raw data outputs
\$PDAS,HARDRS	Edits settings of serial ports
\$PDAS,HEALTH	Edits health status of reference station
\$PDAS,IDENT	Reads identification of hardware and software parts
\$PDAS,MEMORY	Reads amount of free memory space on PCMCIA card
\$PDAS,MEMORY,DIR	Provides characteristics of files stored on PCMCIA card
\$PDAS,NAVSEL	Edits the currently selected navigation mode
\$PDAS,OUTMES	Edits definitions of computed data outputs
\$PDAS,OUTON \$PDAS,OUTOFF	Respectively enables and disables data outputs on the serial ports
\$PDAS,PRANGE	Edits/adds definitions of pseudorange-data outputs
\$PDAS,PREFLL	Edits coordinates of reference position
\$PDAS,PREFNE	Edits projected coordinates of reference position
\$PDAS,QC	Deals with Quality Control in the receiver
\$PDAS,RAZALM	Deletes the specified type of almanac
\$PDAS,SELGEO	Selects the coordinate system that should be used by the receiver

\$PDAS,SESSN	Edits/adds definitions of sessions
\$PDAS,SVDESEL	Deals with rejected SVs & elevation threshold
\$PDAS,TR	Triggers data output in RS232 mode on the specified port
\$PDAS,UNIT	Edits receiver (or station) identification number
\$__GPQ,ZDA	Respectively changes and reads receiver date & time
\$__ZDA	



\$PDAS,AGECOR

- **Function**

- Edits the maximum age permitted for DGPS corrections.

- **Syntax**

- Complete command:

```
$PDAS,AGECOR,a[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,AGECOR[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,AGECOR

- **Parameters**

ref. format

a x.x : Maximum age of corrections, in seconds (default: 40 s)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

```
$PDAS,AGECOR            Reading current max. age of corrections
$PDAS,AGECOR,40*1E      (40 seconds)
```

```
$PDAS,AGECOR,50        Changing max. age of corrections (50 s)
```

```
$PDAS,AGECOR            Checking new max. age of corrections
$PDAS,AGECOR,50*1F
```

\$PDAS,ALTI

- **Function**

- Edits the altitude processing mode and the altitude correction mode.

- **Syntax**

- Complete command:

```
$PDAS,ALTI,a,b,c[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,ALTI[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,ALTI

- **Parameters**

ref. format

a **x** : Altitude processing mode (0 to 3)

0: $H_{user} = H_{WGS84 \text{ ellips}} - MSL_{Stanag} - EMSL_{Local} - offset$

1: $H_{user} = H_{WGS84 \text{ ellips}} - EMSL_{Local} - offset$

2: $H_{user} = H_{transfo \text{ geoid}} - EMSL_{Local} - offset$

3: $H_{user} = H_{WGS84 \text{ ellips}} - MSL_{User} - EMSL_{Local} - offset$

where *MSL*: Geoidal separation

- b** x.x : Offset altitude (from -999.999... to +999.999... m; default: 0.00 m). This parameter describes the height of the antenna phase center with respect to the reference surface.
- c** x : $EMSL_{Local}$ altitude correction mode (0 to 9).
 0: no altitude correction
 ($EMSL_{Local}=0.0$)
 > 0: model used for altitude correction
 (for future applications)
- *hh** : Checksum (optional)
- <CR><LF> : End of command

- **Examples**

\$PDAS,ALTI Reading current correction mode
\$PDAS,ALTI,0,2.000,0*0A

\$PDAS,ALTI,1,1.9,0 Changing correction mode
\$PDAS,ALTI Re-reading current correction mode
\$PDAS,ALTI,1,1.900,0*01

\$PDAS,COMMNT

- **Functions**

- Reads the "comment" field present in the current configuration (one or more lines). This field is assumed to identify the configuration.

- **Syntax**

```
$PDAS,COMMNT[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,COMMNT

- **Parameters**

(none)

- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,2,1,AQUARIUS 5000 SERIES*14
```

```
$PDAS,COMMNT,2,2,DEFAULT CONFIGURATION*2B
```



\$PDAS,CONFIG

- **Function**
 - Reads the data from the current configuration.

- **Syntax**

```
$PDAS,CONFIG[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,CONFIG

- **Parameters**

(none)

- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

\$PDAS,CONFIG Reading the data from the current configuration

```
$PDAS,CONFIG,BEGIN,52*60      (Reply)
$PDAS,COMMNT,2,1,AQUARIUS 5000 SERIES*14
$PDAS,COMMNT,2,2,DEFAULT
CONFIGURATION*2B
$PDAS,LANG,EN,f,1,1*43
$PDAS,AGECOR,040.0*31
$PDAS,ALTI,1,0.000,0*39
$PDAS,FILTER,6.00*1E
$PDAS,DOPMAX,40.0*13
$PDAS,SVDSEL,5.0,0*2A
$PDAS,SELGEO,0*21
...
$PDAS,CONFIG,END,0001C81B*66
```

\$PDAS,CONFIG,INIT

- **Function**

- Performs internal loading of the initial configuration so as to make it the receiver's new current configuration. The "current" configuration is referred to as the active configuration in the receiver.

The receiver is automatically re-initialized after running this command.

- **Syntax**

```
$PDAS,CONFIG,INIT[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,CONFIG,INIT

- **Parameters**

(none)

- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,2,1,AQUARIUS 5000 SERIES*14
```

```
$PDAS,COMMNT,2,2,DEFAULT CONFIGURATION*2B
```

```
$PDAS,CONFIG,INIT
```

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,1,1,CONFIG PALMTOP*61
```



\$PDAS,CONFIG,LOAD

- **Function**

- Loads the configuration from the PCMCIA into the receiver so as to make it the receiver's new initial *and* current configurations.

The file read from the PCMCIA card is necessarily CONFIG.CFG.

The receiver is automatically re-initialized after running this command.

- **Syntax**

```
$PDAS,CONFIG,LOAD[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,CONFIG,LOAD

- **Parameters**

(none)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,2,1,AQUARIUS 5000 SERIES*14
```

```
$PDAS,COMMNT,2,2,DEFAULT
```

```
CONFIGURATION*2B
```

```
$PDAS,CONFIG,LOAD
```

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,1,1,CONFIG PALMTOP*61
```


\$PDAS,CONFIG,READ

- **Function**

- Reads the data from the initial configuration.

- **Syntax**

```
$PDAS,CONFIG,READ[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,CONFIG,READ

- **Parameters**

(none)

- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

\$PDAS,CONFIG,READ

```
$PDAS,CONFIG,BEGIN,40*63          (Reply)
$PDAS,COMMNT,1,1,CONFIG PALMTOP*61
$PDAS,LANG,EN,f,1,1*43
$PDAS,AGECOR,040.0*31
$PDAS,ALTI,0,2.000,0*3A
$PDAS,FILTER,6.00*1E
$PDAS,DOPMAX,40.0*13
$PDAS,SVDSEL,5.0,0*2A
$PDAS,SELGEO,0*21
...
$PDAS,CONFIG,END,00015678*62
```



\$PDAS,CONFIG,RESET

- **Function**

- Performs internal loading of the default configuration so as to make it the receiver's new current configuration. The "current" configuration is referred to as the active configuration in the receiver.

The receiver is automatically re-initialized after running this command.

- **Syntax**

```
$PDAS,CONFIG,RESET[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,CONFIG,RESET

- **Parameters**

(none)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

```
$PDAS,CONFIG,RESET
```

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,1,1,CONFIG PALMTOP*61
```

```
$PDAS,CONFIG,RESET
```

```
$PDAS,COMMNT
```

```
$PDAS,COMMNT,2,1,AQUARIUS 5000 SERIES*14
```

```
$PDAS,COMMNT,2,2,DEFAULT CONFIGURATION*2B
```

\$PDAS,DEFLT

- **Functions**

- Reports the errors, if any, detected by the receiver. Errors are listed from the latest to the earliest.
- Can acknowledge these errors (they are then removed from the list), unless they are still persisting.

- **Syntax**

- Complete command:

```
$PDAS,DEFLT,a,b[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,DEFLT[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DEFLT

- **Parameters**

ref	format	
a	x.x	: Error code to be listed (1 to 104)
		If b is absent and a =0: all errors, except those still persisting, are acknowledged
b	x.x	: Error code to be acknowledged
*hh		: Checksum (optional)
<CR><LF>		: End of command



- Receiver reply to a QUERY command:

```
$PDAS,DEFLT,A,B,C,D,E,F[*hh]<CR><LF>
```

reply
data

format

A	x	: Error code (0 to 100)
B	x	: Error extra-code (1 to 256)
C	a--a	: Keyword (TD, SYSTM, CONFIG, POSIT, NAVIG, I/O, CM, IHM, DGPS, INTRF, GEODY, NONE)
D	x	: Day (1 to 31)
E	hhmmss.ss	: Time of first occurrence of the error
F	hhmmss.ss	: Time of latest occurrence of the error
*hh		: Checksum (optional)
<CR><LF>		: End of command

- **Examples**

```
$PDAS,DEFLT                               Listing all detected errors
$PDAS,DEFLT,23,0,I/O,18,174909,174910*6C
$PDAS,DEFLT,24,0,I/O,18,174835,175045*6D
$PDAS,DEFLT,103,1,I/O,18,174827,174828*59
$PDAS,DEFLT,102,4,I/O,18,174827,174828*5D
$PDAS,DEFLT,8,1003,CM,18,174826,174827*49

$PDAS,DEFLT,103                             Reading error 103
$PDAS,DEFLT,103,1,I/O,18,174827,174828*59

$PDAS,DEFLT,0                             Acknowledging all errors

$PDAS,DEFLT                               Re-listing errors
$PDAS,DEFLT,24,0,I/O,18,174835,175045*6D
                                         (error 24 persisting)
```

\$PDAS,DELSES

- **Function**

- Deletes the specified programmed sessions. All sessions invoked by the last EXPSES command run cannot be deleted.

- **Syntax**

- Complete command:

```
$PDAS,DELSES,a,b,...[*hh]<CR><LF>
```

- Command deleting all sessions that can be deleted:

```
$PDAS,DELSES,0[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DELSES

- **Parameters**

ref	format	
a	x	: Number of the session first deleted a=0: all existing programmed sessions are deleted
b,...	x	: Number(s) of the session(s) next deleted, if any
*hh		: Checksum (optional)
<CR><LF>		: End of command



- **Examples**

\$PDAS,SESSN Listing the existing programmed sessions

\$PDAS,SESSN,1,111500.00,140000.00,1,ESSAI1*23 (reply)
\$PDAS,SESSN,2,154500.00,173000.00,1,ESSAI2*22
\$PDAS,SESSN,3,180000.00,203000.00,1,TEST1*73

\$PDAS,DELSES,1,3 Deleting sessions 1 and 3

\$PDAS,SESSN Checking the new list of sessions

\$PDAS,SESSN,2,154500.00,173000.00,1,ESSAI2*22

\$PDAS,DELSES,0 Deleting all sessions

\$PDAS,SESSN Checking the new list of sessions

\$PDAS,SESSN,0*6E (None left)

\$PDAS,DGPS,DELSTA

- **Function**

- Erases a DGPS transmitting station in the receiver.

- **Syntax**

- Complete command:

```
$PDAS,DGPS,DELSTA,a,b,... [*hh]<CR><LF>
```

- Shortened command (cancels all stations):

```
$PDAS,DGPS,DELSTA[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DGPS,DELSTA

- **Parameters**

ref.	format	
a	x	: Station number (0 to 1023)
b	x	: Station number (0 to 1023)
...	x	: Station number (0 to 1023)
*hh		: Checksum (optional)
<CR><LF>		: End of command



- **Examples**

\$PDAS,DGPS,STATION (Listing all known stations)
\$PDAS,DGPS,STATION,1,LRK1,4716.28,N,00129.23,
W,UHF,446532000.0,50.00,,,4800.0,GN*4E
\$PDAS,DGPS,STATION,2,LRK2,4728.45,N,00148.19,
W,UHF,446532000.0,45.00,,,4800.0,GN*42
\$PDAS,DGPS,STATION,11,DSNP1,4710.00,N,00030.00
,E,UHF,443550000.0,35.00,,,1200.0,DN*3B
\$PDAS,DGPS,STATION,12,DSNP2,4630.00,N,00100.00
,E,UHF,443550000.0,35.00,,,1200.0,DN*3A

\$PDAS,DGPS,DELSTA,2,12 (Deleting stations 2 and 12)

\$PDAS,DGPS,STATION (Re-listing all known stations)
\$PDAS,DGPS,STATION,1,LRK1,4716.28,N,00129.23,W,U
HF,446532000.0,50.00,,,4800.0,GN*4E
\$PDAS,DGPS,STATION,11,DSNP1,4710.00,N,00030.00,E,
UHF,443550000.0,35.00,,,1200.0,DN*3B

`$PDAS,DGPS,MODE`

\$PDAS,DGPS,MODE (E)

(for receivers used as corrections generators and so connected to a transmitter)

- **Function**

- Defines the receiver's serial port as a DGPS transmit channel.

- **Syntax**

- Complete command:

```
$PDAS,DGPS,MODE,a,b,E,e,f[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,DGPS,MODE,a[*hh]<CR><LF>
```

- QUERY command (all lines are read):

```
$PDAS,DGPS,MODE[*hh]<CR><LF>
```

- **Command identification**

- `$PDAS,DGPS,MODE`



- Parameters

ref.	format	
a	x	: Line number (1 to 3)
b	a	: Port identification (A, B, etc.)
E	a	: "E" for "Transmitter". The other setting (R) for this third parameter is discussed in the next command description
d	x	: Transmitter identification number, as referenced in \$PDAS,STATION. If d is omitted, corrections are simply made available on the specified port (no transmitter control provided)
e	x.x	: Transmission programming (1): 0: free mode 1 to 6: transmission rate in seconds (synchronous mode)
	x.x	: In synchronous mode (e =1 to 6), f is the transmit slot number (1 to 6)
*hh		: Checksum (optional)
<CR><LF>		: End of command

`$PDAS,DGPS,MODE`

- **Examples**

\$PDAS,DGPS,STATION (Listing all known stations)
`$PDAS,DGPS,STATION,1,LRK1,4716.28,N,00129.23,W,
 UHF,446532000.0,50.00,,,4800.0,GN*4E`
`$PDAS,DGPS,STATION,11,DSNP1,4710.00,N,00030.00,E
 ,UHF,443550000.0,35.00,,,1200.0,DN*3B`

\$PDAS,DGPS,MODE,1,D,E,1,3,2 (Writing description line 1)
 - According to this description line (line 1), the receiver will transmit corrections via transmitter No. 1 in slot 2, at a transmit format of 3 seconds
 - (No receiver reply)

\$PDAS,DGPS,MODE (Listing all the description lines)
`$PDAS,DGPS,MODE,1,D,E,1,3,2*05`
`$PDAS,DGPS,MODE,2,N*79`
`$PDAS,DGPS,MODE,3,N*78`

\$PDAS,DGPS,MODE,1,D,E,11,0 (Re-programming line 1)
 - According to this line (line 1), the receiver will transmit corrections via transmitting station No. 11 in free-running mode.
 - (No receiver reply)

\$PDAS,DGPS,MODE,1 (Checking the content of line 1)
`$PDAS,DGPS,MODE,1,D,E,11,3,2*34`

\$PDAS,DGPS,MODE (R)

(for receivers processing corrections received from a reference station — via a transmitter).

- **Function**

- Defines the receiver's serial port as a DGPS receive channel.

- **Syntax**

- Complete command:

```
$PDAS,DGPS,MODE,a,b,R,d,e,f,g,h,i,j[*hh]  
<CR><LF>
```

- QUERY command (only the specified line is read):

```
$PDAS,DGPS,MODE,a[*hh]<CR><LF>
```

- QUERY command (all lines are read):

```
$PDAS,DGPS,MODE[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DGPS,MODE

- **Parameters**

ref. format

a x : Line number (1 to 3)

b a : Port identification (A, B, etc.)

R a : "R" for "Receiver". The other setting (E) for this third parameter is discussed in the previous command description

\$PDAS,DGPS,MODE

d	x	: Transmitter identification number, as referenced in \$PDAS,STATION. If d is omitted, corrections are simply allowed to be fed to the specified port (no receiver control provided)
e	x.x	: (Empty field)
f	x.x	: (Empty field)
g	x.x	Identification of the reference station from which corrections should be processed in priority (0 to 1023). If g is omitted, received corrections are processed without checking the reference station number (future development)
h	x.x	Identification of the reference station from which corrections should be processed in second priority (0 to 1023), optional
i	x.x	Identification of the reference station from which corrections should be processed in third priority (0 to 1023), optional
h	x.x	Identification of the reference station from which corrections should be processed in fourth priority (0 to 1023), optional
*hh		: Checksum (optional)
<CR><LF>		: End of command



- **Examples**

\$PDAS,DGPS,STATION (Listing all known stations)

\$PDAS,DGPS,STATION,11,DSNP1,4710.00,N,00030.00,E,
UHF,443550000.0,35.00,,,1200.0,DN*3B

\$PDAS,DGPS,STATION,12,DSNP2,4630.00,N,00100.00,E,
UHF,443550000.0,35.00,,,1200.0,DN*3A

\$PDAS,DGPS,MODE,1,D,R,11,,,11,12 (Writing description line 1)

- According to this line (line 1), the receiver will receive (R) corrections via its port D from transmitter No. 11. These corrections will be generated by reference stations Nos. 11 and 12.

\$PDAS,DGPS,MODE,1 (Checking the Content of description line 1)

\$PDAS,DGPS,MODE,1,D,R,11,,,11,12*21 (Reply)

\$PDAS,DGPS,MODE,2,B,R,,,712,713 (Writing line 2)

- According to this line (line 2), the receiver will receive (R) corrections from an external receiver (4th field blank) via its port B. These corrections will be generated by stations Nos. 712 and 713.

\$PDAS,DGPS,MODE (Listing all description lines)

\$PDAS,DGPS,MODE,1,D,R,11,,,11,12*21 (Reply)

\$PDAS,DGPS,MODE,2,B,R,,,712,713*26

\$PDAS,DGPS,MODE,3,N*78

\$PDAS,DGPS,STATION

- **Functions**

- Allows you to enter the complete description (including decryption code C3) of each of the usable reference stations.
- Allows you to list the description of each of them (or all of them).

- **Syntax**

- Complete command:

```
$PDAS,DGPS,STATION,a,b,c,d,e,...  
n[*hh]<CR><LF>
```

- QUERY command (only the specified station is reported):

```
$PDAS,DGPS,STATION,a[*hh]<CR><LF>
```

- QUERY command (all stations are listed):

```
$PDAS,DGPS,STATION[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DGPS,STATION



- **Parameters**

ref.	format	
a	x	: Transmitter identification number (0 to 1023)
b	c--c	: Transmitter name (12 char. max.)
c	lll.ll	: Reference latitude
d	a	: North or South latitude (N or S)
e	yyyyy.yy	: Reference longitude
f	a	: East or West longitude (E or W)
g	c--c	: Band of first transmission frequency (UHF)
h	x.x	: First transmission frequency, in Hz
i	x.x	: Range, in km
j	c--c	: Band of second transmission frequency (for future development)
k	x.x	: Second transmission frequency, in Hz (for future development)
l	x.x	: Baud rate (1200 or 4800 Bd)
m	cc	: Character string containing the following information: Modulation type: D for DQPSK, G for GMSK Encrypted/non-encrypted corrections: C for encrypted, N for non-encrypted

\$PDAS,DGPDAT

- **Function**

- Edits the definitions of the DGPS raw data outputs.

- **Syntax**

- Complete command:

```
$PDAS,DGPDAT,a,b,c,d,e,f,... [*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,DGPDAT,a[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,DGPDAT

- **Parameters**

ref.	format	
------	--------	--

a	x	: Output number (1 or 2) If a=0, all description lines are cleared
----------	---	---

b	a	: Output port identification (A, B, etc.)
----------	---	---

c	x	: Output mode (0 to 3)
----------	---	------------------------

0: stopped
1: time
2: trigger
3: immediate

- If a display terminal is connected to port A (this may be the terminal from which you sent the preceding commands), then data blocks of the following type are now received:

```
!D,945,329190.1
%R,14,,0
*3,5.9,0.33,0.0,201
*17,8.0,-0.19,0.0,183
*19,32.2,-0.28,0.0,224
*21,-40.5,0.14,0.0,204
*22,-2.6,-0.39,0.0,51
*23,-17.9,0.51,0.0,75
*27,-23.3,-0.22,0.0,228
*31,29.8,0.12,0.0,153
*15,12.5,0.13,0.0,50
```



\$PDAS,DGPDAT,2,A,1,50,1,2,3,5,9,16 Re-defining output 2:

- To port A, "Time" output mode, 5-sec. output rate, RTCM-SC104 data, messages Nos 2, 3, 5, 9, 16

\$PDAS,DGPDAT Re-listing definitions of outputs 1 & 2

\$PDAS,DGPDAT,1,D,1,10,3,1,2*71

\$PDAS,DGPDAT,2,A,1,50,1,2,3,5,9,16*54

- Again, if a display terminal is connected to port A, then data blocks of the following type are now received:

```
fAC\fEr~fRXnzdUO\orxDs~ICSnYOnY^}cTzCiXaOOu{MouRjplL@|ZPN@CzPM@mI_puAOulCosdYn}cp
ET{bo{}}Ym[qfLi@Dp{GpzWyC@KsMfQB}jEXsb_DCBey|pflZGDDbxOEhFL_L_fQB\OzoB|IDCbZLL
YsOGNDDGpzW\t^LdYn}cpy_tbiDCbVepfLRGMDQGpzWy[AIswYn}cUFhG|@DCbcXTMIss`cWJgxOEhFX
|vLJfQB|jy|pbj{|m_cgpvLY_bdFnXOEhF`lpLQfQB\OF@|jw{|m}y|svLy`MXe`xOEX|JWNwL~
```

\$PDAS,EXPSES

- **Function**

- Edits the operating mode linked to sessions.

- **Syntax**

- Complete command:

```
$PDAS,EXPSES,a,b,c,d,... [*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,EXPSES[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,EXPSES

- **Parameters**

ref. format

a c--c : Session type:

END: All sessions disabled, or ends the immediate session

ON: Programmed sessions are run once

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

IMMED: Will cause the receiver to start operating and recording data on PCMCIA (if option installed) on reception of the command.

b	c--c	: Power control type: AUTPW: Receiver power supply controlled by the programmed sessions MANPW: Receiver power supply controlled only by the operator
c	x	: Number of the session to be run first. Sessions are numbered from 1 to 8 corresponding to the description lines in which they are defined (see SESSN command)
d,...	x	: Number of the session to be run in the second, third,... place (up to 8 sessions in sequence)
*hh		: Checksum (optional)
<CR><LF>		: End of command



• Information supplement

The reply to the Query command will vary with time, depending first on the progress of the sessions, but also on the operating options chosen with this command.

- With ON selected as the session type, session numbers will disappear after the corresponding sessions have been run.
- With CYCLE selected as the session type, sessions will be run in the specified order. After a session has been run, the number corresponding to that session will be moved to the end of the session sequence.
- With AUTPW selected as the power control type, the receiver will be turned on 5 minutes before the beginning of the session, and turned off 30 seconds after the end of the session.

- With MANPW selected as the power control type, the receiver will be turned on 5 minutes before the beginning of the first session, unless it is already ON at that time. From that moment, the receiver will operate continuously until somebody turns it off.
- A receiver cannot be turned off with the ON/OFF button if a session (with/without recording) is in progress.
- The SCROLL front panel indicator will blink if a session is pending (with ON or CYCLE selected). It will be lit while the session is being run.

- **Examples**

\$PDAS,EXPSES	QUERY
\$PDAS,EXPSES,END,MANPW*28	No session pending
\$PDAS,EXPSES,IMMED	Running an immediate session
\$PDAS,EXPSES	QUERY
\$PDAS,EXPSES,IMMED,MANPW*2F	Immediate session in progress
\$PDAS,EXPSES,END	Ending an immediate session
\$PDAS,EXPSES	QUERY
\$PDAS,EXPSES,END,MANPW*28	

\$PDAS,SESSN

Listing the programmed sessions

\$PDAS,SESSN,1,103000,120000,1,RECORD1*63

\$PDAS,SESSN,2,140000,153000,1,RECORD2*60

\$PDAS,SESSN,3,070000,200000,0, *78

\$PDAS,EXPSES,ON,MANPW,1,2

Validating sessions 1 and 2 (in this order), run once (ON), manual power control (MANPW)

\$PDAS,EXPSES

QUERY (checking the validated sessions)

\$PDAS,EXPSES,ON,MANPW,1,2*65

\$PDAS,EXPSES,CYCLE,AUTPW,3

Cycling on session 3, in auto power mode (AUTPW)

\$PDAS,EXPSES

QUERY (checking the validated session)

\$PDAS,EXPSES,CYCLE,AUTPW,3*2A



\$PDAS,FILTER

- **Function**

- Edits the speed filtering time constant.

- **Syntax**

- Complete command:

```
$PDAS,FILTER,a[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,FILTER[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,FILTER

- **Parameters**

ref.	format	
a	x.x	: Speed filtering time constant (default: 6 seconds)
*hh		: Checksum (optional)
<CR><LF>		: End of command

- **Examples**

\$PDAS,FILTER

\$PDAS,FILTER,6*30

QUERY

(Reply:6 seconds)

\$PDAS, FIXMOD

- **Function**

- Edits the fix mode and the associated DGPS reference station or WAAS/EGNOS GEO.
About the selection of the associated reference station, this command will require prior execution of \$PDAS, DGPS, MODE.
- Wherever a reference position is required (for example at a reference station or for KART or LRK initialization), use the \$PDAS, PREFLL or \$PDAS, PREFNE command to enter that position.

- **Syntax**

- Complete command:

```
$PDAS, FIXMOD, a, b, c, ... [*hh]<CR><LF>
```

- QUERY command:

```
$PDAS, FIXMOD[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS, FIXMOD

- **Parameters**

ref. format

- a** **x** : Selects GPS fix mode:

0: no fix computation
1: Residuals computation in transmitting reference station mode
2: Residuals computation in monitoring reference station mode
(*for future use*)



- 3: "Straight" GPS fix mode
- 4: Single-station DGPS fix mode
- 5: Multiple-station DGPS fix mode (MDGPS) (*for future use*)
- 6: EDGPS fix mode (Enhanced DGPS)
- 7: KART or LRK fix mode (with OTF initialization)
- 8: KART or LRK fix mode (with Static initialization)
- 9: KART or LRK fix mode (with Z-FIXED initialization)
- 10: KART or LRK fix mode (initialization from a known point)

b **x** : Selects the source of corrections (none, from WAAS/EGNOS or from DGPS reference station) and simultaneously, enables or disables the use of pseudoranges from the selected GEO (if any):

- 0: Straight GPS without WAAS/EGNOS pseudoranges
- 1: DGPS/KART/LRK without WAAS/EGNOS pseudoranges
- 2: WADGPS without WAAS/EGNOS pseudoranges
- 10: Straight GPS with WAAS/EGNOS pseudoranges
- 11: DGPS/KART/LRK with WAAS/EGNOS pseudoranges
- 12: WADGPS with WAAS/EGNOS pseudoranges

\$PDAS,GEO

- **Function**

- Edits the characteristics the specified coordinate system (datum & projection).
- Lists the characteristics of all or specified coordinate systems.

- **Syntax**

- Complete commands:

```
$PDAS,GEO,a,b,c,d [*hh]<CR><LF>
$PDAS,GEO,a,b,e,f [*hh]<CR><LF>
$PDAS,GEO,a,b,A,1/F,S,j [*hh]<CR><LF>
$PDAS,GEO,a,b,Dx,Dy,Dz,n [*hh]<CR><LF>
$PDAS,GEO,a,b,Ax,Ay,Az,r [*hh]<CR><LF>
$PDAS,GEO,a,b,s,t [*hh]<CR><LF>
$PDAS,GEO,a,b,u,v,w,... [*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,GEO,e[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,GEO

- **Parameters**

ref.	format	
a	x.x	: Count of lines required to describe the specified coordinate system
b	x.x	: Number of the present line
c	x.x	: GPS week number (optional)
d	x.x	: GPS time within week, in sec. (optional)

e	x.x	: Coordinate system number (0 to 10) (default: 0)
f	c--c	: Coordinate system name (10 characters max.)
A	x.x	: Semi-major axis ("A," placed before)
1/F	x.x	: Inverse flattening ("1/F," placed before)
S	x.x	: Scale factor ("S," placed before)
j	x	: Unit code (see table below)
Dx	x.x	: X deviation ("Dx," placed before)
Dy	x.x	: Y deviation ("Dy," placed before)
Dz	x.x	: Z deviation ("Dz," placed before)
n	x	: Unit code (see table below)
Ax	x.x	: X angular deviation ("Ax," placed before)
Ay	x.x	: Y angular deviation ("Ay," placed before)
Az	x.x	: Z angular deviation ("Az," placed before)
r	a	: Unit code (see table below)
s	x.x	: Projection number (1.. 99)
t	c--c	: Projection name (12 characters max.)
u,...		: Projection parameters



...

***hh** : Checksum (optional)
 <CR><LF> : End of command

- **Examples**

\$PDAS,GEO,2

\$PDAS,GEO,8,1,0,0*6E

\$PDAS,GEO,8,2,02,NTF*33

\$PDAS,GEO,8,3,A,6378249.145,1/F,293.465000,S,1.0000
 0000,1*1E

\$PDAS,GEO,8,4,Dx,-

168.000000,Dy,72.000000,Dz,318.500000,1*4F

\$PDAS,GEO,8,5,Ax,0.000000,Ay,0.000000,Az,0.554000,e*03

\$PDAS,GEO,8,6,02,LambII*49

\$PDAS,GEO,8,7,Lori,0.81681408993,Gori,0.04079233948
 ,Eori,600000.000,Nori,200000.

000,d1*11

\$PDAS,GEO,8,8,Ko,0.999877420*6A

\$PDAS,GEODAT

- **Function**

- Edits the definitions of the SBIN@W or SVAR@W data outputs. This type of data is received from WAAS/EGNOS GEOs.
- Adds new definitions of SBIN@W or SVAR@W data outputs.

- **Syntax**

- Complete command:

```
$PDAS,GEODAT,a,b,c[*hh]<CR><LF>
```

- QUERY command (all output definitions are returned):

```
$PDAS,GEODAT[*hh]<CR><LF>
```

- QUERY command (only the specified output is returned):

```
$PDAS,GEODAT,a[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,GEODAT



- Parameters

ref.	format	
a	x.x	: Output number (1, 2, etc.) (default: 1)
b	a	: Output port identification (A, B, etc.)
c	x	: Data output control: 0: No output (invalidated) 1: Output of SBIN@W data, at regular intervals of time 3: Output of SVAR@W data, at regular intervals of time
*hh		: Checksum (optional)
<CR><LF>		: End of command

- Examples

\$PDAS,GEODAT,1

QUERY (about output 1 definition)

\$PDAS,GEODAT,1,A,1

(Reply: output 1 enabled, delivers SBIN@W data on port A)

\$PDAS,GEODAT,1,A,0

Invalidates output 1 (no reply)

\$_GLL and \$_GPQ,GLL

- **Function**

- Edits the estimated position used in the initial position-speed-time processing or displays the latest position solution.

- **Syntax**

- Complete command:

```
$_GLL,a,b,c,d,e,f[*hh]<CR><LF>
```

- QUERY command:

```
$_GPQ,GLL[*hh]<CR><LF>
```

- **Parameters**

ref. format

- a** IIII.III : Latitude of estimated position
- b** a : North or South latitude (N or S)
- c** yyyyy.yyy : Longitude of estimated position
- d** a : East or West Longitude (E or W)
- e** hhmmss.ss : UTC time
- f** a : Data status

A: data valid

V: data not valid

***hh** : Checksum (optional)

<CR><LF> : End of command

\$PDAS,GNOS

- **Functions**

- Enables/disables the tracking of the WAAS or EGNOS satellite
- Specifies the way WAAS/EGNOS GEOs should be selected by the receiver (Auto/Manual).
- Provides the receiver with the PRNs of the GEOs to be used in case of Manual selection.

- **Syntax**

- Complete command:

```
$PDAS,GNOS,a,b,c[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,GNOS[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,GNOS



- Parameters

ref.	format	
a	x	: Controls the tracking of the WAAS/EGNOS system in the receiver and the way the receiver selects GEOs (possible values for a : 0, 1 or 2; default:1): 0: Use of WAAS/EGNOS disabled 1: Automatic selection of the WAAS/EGNOS GEO: the receiver will be allowed to choose the GEOs with which to work (nothing then needs to be specified in fields b and c). 2: Manual selection of the WAAS/EGNOS GEOs: the receiver will work with the GEOs whose PRNs are specified in fields b and c below.
b	a	: If a =2, b is the PRN of the 1st WAAS/EGNOS GEO to be tracked ($120 \leq \mathbf{b} \leq 138$) (irrelevant for the other values of a)
c	a	: If a =2, c is the PRN of the 2nd WAAS/EGNOS GEO to be tracked ($120 \leq \mathbf{b} \leq 138$) (irrelevant for the other values of a). See also comments below.
*hh		: Checksum (optional)
<CR><LF>		: End of command

- **Examples**

\$PDAS,GNOS
\$PDAS,GNOS,0

QUERY

Reply: Use of WAAS/EGNOS currently disabled

\$PDAS,GNOS,1

Command allowing the use of the WAAS or EGNOS system; GEOs are selected automatically by the receiver

\$PDAS,GNOS,2,122

Command allowing the use of the WAAS or EGNOS system; The selected GEO is PRN 122 (Manual selection mode).

- **Comments**

Although in the *Aquarius* receiver, two channels can be reserved for the reception of one GEO each, we do not recommend users to select two GEOs in the case of Manual selection.

In future, users should be allowed to run such a command in which two GEOs are selected manually:

\$PDAS,GNOS,2,122,138



\$--GPQ,---

- **Function**

- Returns the current values of the parameters whose generic code accompanies the command. All replies are compliant with the approved sentences of the NMEA 0183 standard (vers. 2.30, March 1, 1998).

- **Syntax**

```
$--GPQ,a[*hh]<CR><LF>
```

- **Parameters**

ref. format

- a c--c** : NMEA code corresponding to the parameters for which you want the receiver to return their current values. The codes list is given below (entry is also possible, in the NMEA standard, for underlined data).

DTM Datum Reference
GLL Geographic Position - Latitude/Longitude
GSA GNSS DOP and Active Satellites
GSV GNSS Satellites in view
ZDA Time & Date

- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

\$ECGPQ,DTM

\$GPD~~TM~~,W84,,0.0000,N,0.0000,E,0.0,W84*6F

\$ECGPQ,GLL

\$GPGLL,4716.104353,N,00129.454296,W,134944.00,A
*1F

\$ECGPQ,GSA

\$GPGSA,A,3,30,,,23,02,26,07,08,21,09,05,,,,,2.5,1.3,-
1.0*1F

\$ECGPQ,GSV

\$GPGSV,3,1,09,30,03,223,31,23,35,270,44,02,13,051,3
8,26,51,152,49*75
\$GPGSV,3,2,09,07,33,077,43,08,37,278,45,21,23,309,4
2,09,74,306,49*7D
\$GPGSV,3,3,09,05,44,217,48*4D

\$ECGPQ,ZDA

\$GPZDA,135127.00,8,12,1998,+00,00*7C



\$PDAS,GPSDAT

- **Functions**

- Edits the definitions of the GPS raw data outputs.
- Adds new definitions of GPS raw data outputs.

- **Syntax**

- Complete command:

```
$PDAS,GPSDAT,a,b,c,d,e,f[*hh]<CR><LF>
```

- QUERY command (all output definitions are returned):

```
$PDAS,GPSDAT[*hh]<CR><LF>
```

- QUERY command (only the specified output is returned):

```
$PDAS,GPSDAT,a[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,GPSDAT

- **Parameters**

ref.	format	
a	x	: Output number (1 or 2)
b	a	: Output port identification (A, B, etc.)
c	x	: Ephemeris data output:
		0: none
		1: at regular intervals, in SBIN@E binary format

- 2: on request, in SBIN@E binary format
 - 3: at regular intervals, in SVAR!E format
 - 4: on request, in SVAR!E format
- d** **x** : Almanac data output:
- 0: none
 - 1: at regular intervals, in SBIN@A binary format
 - 2: on request, in SBIN@A binary format
 - 3: at regular intervals, in SVAR!A format
 - 4: on request, in SVAR!A format
- e** **x** : Iono-UTC data output:
- 0: none
 - 1: at regular intervals, in SBIN@U binary format
 - 2: on request, in SBIN@U binary format
 - 3: at regular intervals, in SVAR!U format
 - 4: on request, in SVAR!U format
- f** **x** : Health & A/S data output:
- 0: none
 - 1: at regular intervals, in SBIN@S binary format
 - 2: on request, in SBIN@S binary format
 - 3: at regular intervals, in SVAR!S format
 - 4: on request, in SVAR!S format



***hh** : Checksum (optional)
 <CR><LF> : End of command

- **Examples**

\$PDAS,GPSDAT QUERY
\$PDAS,GPSDAT,1,B,-3,-3,-3,-3*4C
\$PDAS,GPSDAT,2,N*43 (Reply: a single output defined, output 1, on port B, all GPS data blocks programmed in this output are invalidated)

\$PDAS,GPSDAT,1,B,3,3,3,3 Validating GPS data blocks in output 1

\$PDAS,GPSDAT QUERY
\$PDAS,GPSDAT,1,B,3,3,3,3*4C (Reply: 2 lines)
\$PDAS,GPSDAT,2,N*43

\$PDAS,GPSDAT,2,A,0,0,4,0 Adding output 2 on port A (iono-utc data)

- If a display terminal is connected to port A (this may be the terminal from which you sent the preceding commands), then data blocks of the following type are now received:

```
!U,945,378367.0
780F00,FF0136,FEFC03,000032,000000,0F90B1,0C9002,0CAAAA
```

\$PDAS,HARDRS

- **Function**

- Edits the settings of the receiver's serial ports.

- **Syntax**

- Complete command:

```
$PDAS,HARDRS,a,b,c,d,e,f,g[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,HARDRS[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,HARDRS

- **Parameters**

ref.	format	
a	x	: Count of lines containing definitions of serial ports
b	x	: Line number (from 1 to a)
c	a	: Port identification (A, B, etc.)
d	x.x	: Baud rate (1200, 2400, 4800, 9600, 19200) (default: 9600 Bd)
e	x	: Number of data bits (6, 7, 8) (default: 8)
f	x.x	: Number of stop bits (1, 1.5, 2) (default: 2)



g a : Parity control ("N" for None, "O" for Odd, "E" for Even, "M" for Mark, "S" for Space) (default: N)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

```
$PDAS,HARDRS          QUERY
$PDAS,HARDRS,6,1,A,9600,8,1.0,N*08
$PDAS,HARDRS,6,2,B,9600,8,1.0,N*08
$PDAS,HARDRS,6,3,C,9600,8,2.0,N*0B
$PDAS,HARDRS,6,4,D,19200,8,1.0,N*3D
```

\$PDAS,HARDRS,,,B,19200,7,1,0 Changing port B settings

```
$PDAS,HARDRS          QUERY
$PDAS,HARDRS,6,1,A,9600,8,1.0,N*08
$PDAS,HARDRS,6,2,B,19200,7,1.0,N*33
$PDAS,HARDRS,6,3,C,9600,8,2.0,N*0B
$PDAS,HARDRS,6,4,D,19200,8,1.0,N*3D
```

\$PDAS,HEALTH (for future use)

- **Function**

- Edits the health status of the reference station (information delivered at a monitoring station).

- **Syntax**

- Complete command:

```
$PDAS,HEALTH,a[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,HEALTH[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,HEALTH

Parameters

ref.	format
------	--------

a	x	: Health status (0 to 7) (default: 6 or 7)
----------	----------	--

RTCM-SC104 Health conventions:

7: station not working

6: station not monitored

5: UDRE scale factor is 0.1

4: UDRE scale factor is 0.2

3: UDRE scale factor is 0.3

2: UDRE scale factor is 0.4

1: UDRE scale factor is between
0.5 & 0.75

0: UDRE scale factor is 1

*hh	: Checksum (optional)
------------	-----------------------

<CR><LF>	: End of command
----------	------------------



- **Examples**

\$PDAS,HEALTH
\$PDAS,HEALTH,0*2A

QUERY
(Reply)

\$PDAS,HEALTH,6

Initializing health status for a
working station

\$PDAS,HEALTH
\$PDAS,HEALTH,6*2C

QUERY
(Reply)

\$PDAS,IDENT

- **Function**
 - Reads the identification of each of the hardware and software parts in the receiver.

- **Command syntax (a QUERY command only)**

```
$PDAS,IDENT[*hh]<CR><LF>
```

- **Receiver Reply syntax**

```
$PDAS,IDENT,a,b,c,d[*hh]<CR><LF>
```

- **Parameters returned in the reply**

ref. format

a x.x : Total count of reply lines

b x.x : Line number

c cccc : Subassembly hardware identification
Always 4 characters: **c1**, **c2**, **c3**, **c4**
where:

⇒ **c1c2** are the 2 characters identifying
the subassembly:

c1c2 = CM ⇒ Core Module

c1c2 = TD ⇒ Data Transmission

c1c2 = UC ⇒ Application Central Unit

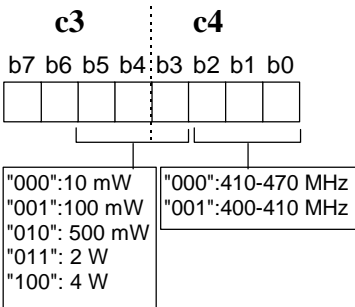
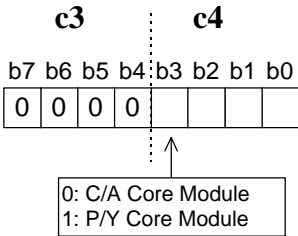
⇒ **c3c4** are the 2 characters identifying the hardware version of the subassembly:

□ If **c1c2** = CM, then **c3** identifies the type of board:

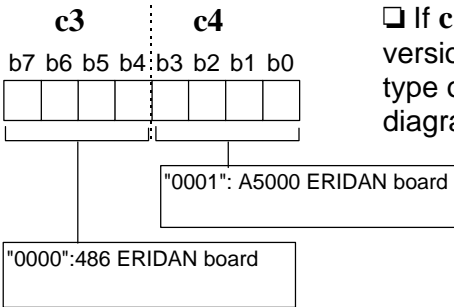
c3 = 0 ⇒ Core Module Type I

and **c4** represents the 4 bits read from the IC device

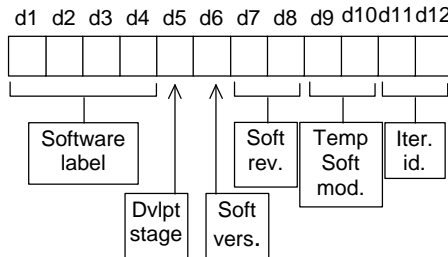
If **c3** = 0, see in the opposite diagram how to interpret bit b3 in character **c4**



□ If **c1c2** = TD, bits 2, 1 and 0 (character **c4**) identify the PCB version and bits 5, 4 and 3 the transmission power (see opposite diagram).



□ If **c1c2** = UC, **c4** identifies the PCB version of the Central Unit and **c3** the type of Central Unit (see opposite diagram)



d cc : Subassembly software identification (always 10 or 12 characters) (see diagram just above)

⇒ **d1** to **d4**: Software label:

CMBL: Core Module Boot Loader

CMCA: C/A L1 Core Module

CMPY: C/A & P/Y L1 & L2 Core Module

UCBS: BIOS application

UCBL: Application Boot Loader

UCBN: "Black Box" Application

EUHF: UHF transmitter (data link)

RUHF: UHF receiver (data link)

⇒ **d5**: Development stage (B for β -test version, V for production version, X for development version)



⇒ **d6**: Identification of software version or standard:

0: S0, S0+, S0.2 and S0.3 (Core Module)

1: E1 state (application)

2: E2 state (application)

3: E3 state (application)

⇒ **d7 & d8**: Revision of the software version

⇒ **d9 & d10**: Temporary or On-Site software modification

⇒ **d11 & d12**: Iteration identification (optional, applies to CM only)

***hh** : Checksum (optional)

<CR><LF> : End of reply

• Examples

Query:

\$PDAS,IDENT

Reply from a dual-frequency station:

\$PDAS,IDENT,6,1,TD20,EUHFV10300

\$PDAS,IDENT,6,2,CM08,COMPYV0020107

\$PDAS,IDENT,6,3,CM08,CMBLV0020107

\$PDAS,IDENT,6,4,UC01,UCBNV12000

\$PDAS,IDENT,6,5,UC01,UCBLV10000

\$PDAS,IDENT,6,6,UC01,UCBSV20000

\$PDAS,MEMORY

- **Function**

- Reads the amount of free memory space on the PCMCIA card (result returned in bytes).

- **Syntax**

```
$PDAS,MEMORY[*hh]<CR><LF>
```

- **Receiver Reply syntax**

```
$PDAS,MEMORY,DIR,a,b,c,d,e,f[*hh]<CR><LF>
```

- **Reply Parameters**

ref.	format	
a	x	: Total count of reply lines
b	x	: Reply line number
c	a	: PCMCIA card label (c omitted if no card)
d	x	: Total count of bytes used
e	x	: Total count of free bytes
f	x	: Number of files (f omitted if no card)
*hh		: Checksum (optional)
<CR><LF>		: End of reply

- **Examples**

```
$PDAS,MEMORY                QUERY
$PDAS,MEMORY,DIR,1,1,,122880,3858432,0
```

```
$PDAS,MEMORY                QUERY
$PDAS,MEMORY,DIR,1,1,0      (no PCMCIA inserted)
```



\$PDAS, MEMORY, DIR

- **Function**

- Provides the characteristics of a file (or of all files) stored on the PCMCIA card.

- **Syntax**

```
$PDAS, MEMORY, DIR, a[*hh]<CR><LF>
```

- **Receiver Reply syntax**

```
$PDAS, MEMORY, DIR, a, b, c, d, e, f[*hh]<CR><LF>
$PDAS, MEMORY, DIR, a, b, g, h, i, j, k, l[*hh]<CR><LF>
...
$PDAS, MEMORY, DIR, a, b, g, h, i, j, k, l[*hh]<CR><LF>
```

- **Reply Parameters**

ref. format

(first line)

a	x	: Total count of reply lines
b	x	: Number of reply line (1 necessarily)
c	a	: PCMCIA card label (c=0 if no card)
d	x	: Total count of bytes used (omitted if no card)
e	x	: Total count of free bytes (omitted if no card)
f	x	: Total count of files (omitted if no card)

ref.	format	
(next lines)		
a	x	: Total count of reply lines
b	x	: Reply line number
g	a	: File name
h	x	: File size, in bytes
i	xx	File creation day (dd)
j	xx	File creation month (mm)
k	xx	File creation year (yyyy)
l	hhmmss.s	File creation time
*hh		: Checksum (optional)
<CR><LF>		: End of reply

- **Examples**

Query:

\$PDAS, MEMORY, DIR

Reply without PCMCIA card:

\$PDAS, MEMORY, DIR, 1, 1, 0

Reply with a PCMCIA card inserted (example):

\$PDAS, MEMORY, DIR, 3, 1, , 122880, 3858432, 2

\$PDAS, MEMORY, DIR, 3, 2, sesimmed.d00, 69444, 18,
02, 1998, 092034.0

\$PDAS, MEMORY, DIR, 3, 3, sesimmed.d01, 30304, 18,
02, 1998, 092230.0



\$PDAS,NAVSEL

- **Function**

- Edits the navigation mode currently selected.

- **Syntax**

- Complete command:

```
$PDAS,NAVSEL,a,b,c,d[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,NAVSEL[*hh]<CR><LF>
```

- **Command identification**

- \$PDAS,NAVSEL

- **Parameters**

ref. format

- | | | |
|----------|---|--|
| a | x | : Type of fix used for navigation (1 to 4)
1: (D)GPS or WADGPS
2: EDGPS
3: KART A
4: KART R |
| b | x | : Navigation mode used (1 to 4)
1: Position (none)
2: Heading (future use)
3: Heading along a specified direction (future use)
4: Route (future use) |

- c** **c--c** : Navigation instructions (8 characters max.)
 If **b**= 2 or 3, **c**=label of target waypoint
 If **b**= 4, **c**=label of the route to follow
- d** **x** : Direction of travel along the route
 If **d**= 1, direct
 If **d**= 0, inverse
- *hh** : Checksum (optional)
- <CR><LF> : End of command

- **Examples**

\$PDAS,NAVSEL	QUERY
\$PDAS,NAVSEL,1,1*29	(DGPS, Position mode)
\$PDAS,NAVSEL,2	Changing fix used for navigation
\$PDAS,NAVSEL	QUERY
\$PDAS,NAVSEL,2,1*2A	(EDGPS, Position mode)



\$PDAS,OUTMES

- **Functions**

- Edits the definitions of the computed-data outputs.
- Adds new definitions of computed-data outputs.

- **Syntax**

- Complete command:

```
$PDAS,OUTMES,a,b,c,d,e[,...,n][*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,OUTMES,a,b[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,OUTMES

- **Parameters**

ref	format	
a	x.x	: message number (0 to 20)
b	a	: Port identification (A, B, C, D, P)
c	x	: Trigger mode (-8 to 8):
		0: disables the output (no possibility to know what the former trigger mode was for this output, as opposed to the "-" sign; see below)
		1: Time
		2: External Event is the triggering signal
		3: (<i>reserved</i>)
		4: 1pps is the triggering signal

5: Manual (future development)

6: by \$PDAS,TR command

7 & 8: for future development

A negative value will cause the output to be disabled (but the trigger mode information will still be present in the output definition for further use)

d	x.x	: if c =1, then d is the trigger rate expressed in 100-ms units
		if c =2 or 4, then d is the trigger rate expressed in count of events
e, ..., n	x.x	: numbers of the formats which will generate the message being defined
*hh		: Checksum (optional)
<CR><LF>		: End of command



- **Examples**

\$PDAS,OUTMES

Querying the receiver to obtain the list of its computed data outputs

\$PDAS,OUTMES,1,A,-1,10,1,5,7,8,9,10,20*4F

\$PDAS,OUTMES,2,A,-1,10,2,7,8,5,11,20*5B

\$PDAS,OUTMES,3,A,-1,10,12,20*51

\$PDAS,OUTMES,4,A,-1,10,13,20*57

\$PDAS,OUTMES,5,A,-1,10,3,5,6,20*64

\$PDAS,OUTMES,6,A,-1,10,4,5,11,7,8,14,20*70

\$PDAS,OUTMES,7,B,-2,1,15,20,16,20,17,20,18,20,19*4C

\$PDAS,OUTMES,2,B,4

Changing output 2

\$PDAS,OUTMES,2

Checking new output 2

\$PDAS,OUTMES,2,B,4,10,2,7,8,5,11,20*70

\$PDAS,OUTMES,2,B,-4

Invalidating output 2 (trigger information setting preserved)

\$PDAS,OUTMES,2

Checking output 2

\$PDAS,OUTMES,2,B,-4,10,2,7,8,5,11,20*5D

\$PDAS,OUTMES,2,B,0

Stopping output 2 (trigger information setting lost)

\$PDAS,OUTMES,2

Checking output 2

\$PDAS,OUTMES,2,B,0,10,2,7,8,5,11,20*74

\$PDAS,OUTMES,8,C,1,20,1,5,7,8,9,10,20

Creating output 8

\$PDAS,OUTMES,8

Checking output 8

\$PDAS,OUTMES,8,C,1,20,1,5,7,8,9,10,20*6A

\$PDAS,OUTMES,1,A,1,100 Creating/Validating output 1 on the port through which this command is sent

Data blocks, such as those below, are returned to your display terminal:

```
$GPGGA,104849.99,4716.12353,N,00129.44097,W,0,09,1,85.99,M,0.00,M,-1.0,0000
$GPGGA,104859.99,4716.12259,N,00129.43925,W,0,09,1,80.49,M,0.00,M,-1.0,0000
$GPGGA,104909.99,4716.12146,N,00129.43786,W,0,09,1,75.71,M,0.00,M,-1.0,0000
$GPGGA,104919.99,4716.12013,N,00129.43679,W,0,09,1,71.56,M,0.00,M,-1.0,0000
$GPGGA,104929.99,4716.11865,N,00129.43614,W,0,09,1,68.01,M,0.00,M,-1.0,0000
$GPGGA,104939.99,4716.11713,N,00129.43585,W,0,09,1,65.04,M,0.00,M,-1.0,0000
```



\$PDAS,OUTON and \$PDAS,OUTOFF

- **Functions**

- Respectively enables/disables data outputs on the port connected to the PC for receiver control.

These commands have no effect on the port currently used as far as the dialog between PC and receiver is concerned.

- **Syntax**

- Output disabling command:

```
$PDAS,OUTOFF[*hh]<CR><LF>
```

- Output (re)enabling command:

```
$PDAS,OUTON[*hh]<CR><LF>
```

- **Parameters**

(none)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

\$PDAS,OUTOFF

All data outputs suspended
(No reply)

\$PDAS,OUTON

All data outputs resumed
(No reply)

\$PDAS,PRANGE

- **Functions**

- Edits the definitions of the pseudorange-data outputs.
- Adds definitions of pseudorange-data outputs.

- **Syntax**

- Complete command:

```
$PDAS,PRANGE,a,b,c,d,e,f,g,h[*hh]<CR><LF>
```

- QUERY command (only the specified line is returned):

```
$PDAS,PRANGE,a<CR><LF>
```

- QUERY command (all output definitions are returned):

```
$PDAS,PRANGE<CR><LF>
```

- **Command identification:**

- \$PDAS,PRANGE

- **Parameters**

format

- | | | |
|----------|---|--|
| a | x | : Output number (1 or 2) |
| b | a | : Output port identification (A, B, C, etc.) |
| c | x | : Output mode (1, 2, etc.) |
| | | 0: stopped |
| | | 1: time |
| | | 2: trigger |

- d** x.x : Output rate:
 if **c**=1, output rate in units of 0.1
 second
 if **c**=2:
 1: Data block following External
 Event is output
 3: Data block following 1pps is
 output
- e** [y]x : Data type (1 to 5) (*see Appendices D & E*):
 1: SBIN@r
 2: SBIN@R
 3: SBIN@Q
 4: SVAR!R
 5: SVAR!Q
 and [y]: Multi-Core data (0 or 1)
 0:Master Core Module (default)
 1:All Core Modules (future use)
- f** x.x : GPS carrier/code filtering time
 constant, in seconds (0 to 600) (future
 use)
- g** x.x : WAAS carrier/code filtering time
 constant, in seconds (0 to 600) (future
 use)
- h** x.x : Pseudolite carrier/code filtering time
 constant, in seconds (0 to 600) (future
 use)
- *hh** : Checksum (optional)
- <CR><LF> : End of command

- Examples

\$PDAS,PRANGE QUERY
\$PDAS,PRANGE,1,B,-1,10,4,0,0,0*4F (Reply, 2 lines)
\$PDAS,PRANGE,2,N*59

\$PDAS,PRANGE,1,A,1,40 Validating SVAR!R
data blocks on port
A, in time mode
every 4 seconds

Data blocks, such as the one below, are returned to your display terminal
(if you sent the command through port A):

```
!R,945,393528.0
&P,30
*0,4,3118942645,2536448,2407692,38,A,70,BF,-16,-100,,0,,83,EF
*1,5,3019470900,3296845,2821288,47,2,00,8F,-27,-43,-119,6985938,2198376,01,7F
*2,14,3154649176,3909466,1131044,26,A,9C,FF,-500,,,0,,00,00
*3,8,2993264420,3359515,3040848,49,2,01,8F,-35,-2,-81,6011982,2369436,01,7F
*4,9,3111375648,3690470,4080896,42,2,21,AF,-35,-36,4,9813601,3179876,41,AF
*6,29,3056856053,7688995,-162032,45,2,23,9F,-20,-28,-139,1925823,-126280,22,9F
*7,25,3045055618,2261374,-2272900,46,2,16,9F,-31,-124,-231,7378134,-1771120,22,8F
*8,30,2968080800,5981519,718444,50,2,01,8F,-35,43,-76,9875600,559820,01,6F
*9,1,3035062400,3442959,2495792,45,2,03,9F,-39,-197,-244,9392251,1944616,21,9F
*A,6,3002300530,8653059,-1492552,49,2,00,8F,-31,-63,-139,7324873,-1163000,02,6F
*B,24,3062858884,5679502,186896,44,2,00,AF,4,-6,-29,1506867,145640,42,9F
```



\$PDAS,PREFLL

- **Functions**

- In a reference station, allows you to enter the precise latitude and longitude of this station.
- In a mobile receiver, allows you to enter the precise latitude and longitude of the position from which the receiver will be initialized.

In both cases, the command is used to enter a reference position. See also \$PDAS,FIXMOD.

- **Syntax**

- Complete command:

```
$PDAS,PREFLL,a,b,c,d,e,f[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,PREFLL[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,PREFLL

- **Parameters**

ref.	format	
a	x	: Coordinate system number (1 to 10) (default: 0)
b	lll.llll	: Reference station latitude (with centimetric accuracy)
c	a	: Latitude direction (N or S)
d	yyyyy.yyyyyy	: Reference station longitude (with centimetric accuracy)

\$PDAS,PREFNE

- **Function**

- In a reference station, allows you to enter the precise projected coordinates of this station.
- In a mobile receiver, allows you to enter the precise projected coordinates of the position from which the receiver will be initialized.

In both cases, the command is used to enter a reference position. See also \$PDAS, FIXMOD and \$PADS, PREFLL.

- **Syntax**

- Complete command:

```
$PDAS,PREFNE,a,b,c,d[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,PREFNE[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,PREFNE

- **Parameters**

ref.	format	
a	x	: Coordinate system number (1 to 10) (default: 0)
b	x.x	: Reference station Northing (<i>centimetric accuracy</i> required)
c	x.x	: Reference station Easting (<i>centimetric accuracy</i> required)

d x.x : Reference station altitude, in metres
(*centimetric accuracy* required)

***hh** : Checksum (optional)

<CR><LF> : End of command



- **Examples**

\$PDAS,PREFNE QUERY
\$PDAS,PREFLL,0,0000.000000,N,00000.000000,E,0.00*3E
(No projection)

\$PDAS,SELGEO,2 Changing coord. syst
\$PDAS,PREFNE,2,259127.688,310500.551,48.752
Changing station's coords

\$PDAS,PREFNE Checking new ccoords
\$PDAS,PREFNE,2,259127.6882,310500.5510,48.7520*38

\$PDAS, QC

- **Functions**

- Enables Quality (Integrity) Control in the receiver and simultaneously chooses the type of Quality Control used (internal or external).
- Disables Quality Control
- Reports the type of Quality Control currently used, if any

Of the two types of Quality Control possible, only the external one, relying on the WAAS/EGNOS system, is operational to date.

- **Syntax**

- Complete command:

```
$PDAS, QC, a, b, c[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS, QC[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS, QC

- **Parameters**

ref.	format	
a	x	: Internal (or autonomous) Quality Control:
		0: No internal Quality Control
		1: UKOOA Control

- b** **a** : External Quality Control:
 0: No external Quality Control
 1: WAAS/EGNOS Quality Control
 2: RTCM-SC104Quality Control,
 message type 5
- c** **x** : Provider of external Quality Control:
 if **b** = 1, PRN of the GEO to be
 received
 if **b** = 2, Number of the RTCM-
 SC104 reference station to be
 received
- *hh** : Checksum (optional)
- <CR><LF> : End of command



- **Examples**

\$PDAS, QC
\$PDAS, QC, 0, 0, 0

QUERY
No Quality Control
currently used

\$PDAS, QC, 0, 1, 138

Selecting External Quality
Control using
WAAS/EGNOS GEO
PRN 138

\$PDAS, QC
\$PDAS, QC, 0, 1, 0138

Checking new setting
(Reply)

\$PDAS,RAZALM

- **Function**

- Deletes the specified almanacs from the receiver's memory.

- **Syntax**

```
$PDAS,RAZALM,a[*hh]<CR><LF>
```

- **Parameters**

ref. format

a x : Defines the type of almanacs you want to delete:

0 (or **a** omitted): all

1: GPS almanacs only

2: WAAS/EGNOS almanacs only

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

\$PDAS,RAZALM

Deletes all almanacs

\$PDAS,SELGEO

- **Function**

- Of the coordinate systems defined with the \$PDAS,GEO command, selects one to be the current coordinate system in the receiver.

- **Syntax**

- Complete command:

```
$PDAS,SELGEO,a[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,SELGEO[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,SELGEO

- **Parameters**

ref.	format	
a	x	: Number of the coordinate system to be used (1 to 10) (default: 0)
*hh		: Checksum (optional)
<CR><LF>		: End of command

- **Examples**

```
$PDAS,SELGEO          QUERY
$PDAS,SELGEO,0*21    (Reply: coordinate system No. 1)

$PDAS,SELGEO,2       Selecting coord. system 2
$PDAS,SELGEO          QUERY
$PDAS,SELGEO,2*23    (Reply: coordinate system No. 2 used)
```

\$PDAS,SESSN

- **Functions**

- Edits the definitions of the programmed sessions in the receiver.
- Adds new sessions in the receiver.

- **Syntax**

- Complete command:

```
$PDAS,SESSN,a,b,c,d,e[*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,SESSN[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,SESSN

- **Parameters**

ref. format

a x : Line number (1 to 8)

b hhmss : Start time

c hhmss : End time

d x.x : Recording indicator

0: without data recording

1: with data recording on PCMCIA

e c--c : Session label (8 characters max.)
***hh** : Checksum (optional)
<CR><LF> : End of command

- **Information supplement**

- This command should be used in conjunction with \$PDAS,EXPSES (see page *C-36*).
- With AUTPW selected as the power control type (see \$PDAS,EXPSES), the receiver will be turned on 5 minutes before the beginning of the session, and turned off 30 seconds after the end of the session.
- For a session defined with Recording indicator=1, and provided the recording firmware is present, a file will be created on the PCMCIA at the beginning of this session. The file will be named <session_label>.Dxx, where xx is a software-set order number, and all outputs performed on port P will be written into that file until the end of the session.



- **Examples**

```
$PDAS,SESSN
```

```
QUERY
```

```
$PDAS,SESSN,0*6E
```

```
(Reply: no existing sessions)
```

Defining three sessions:

```
$PDAS,SESSN,1,111500,140000,1,ESSAI1
```

```
$PDAS,SESSN,2,154500,173000,1,ESSAI2
```

```
$PDAS,SESSN,3,180000,203000,1,TEST1
```

Listing the programmed sessions:

```
$PDAS,SESSN
```

```
$PDAS,SESSN,1,111500,140000,1,ESSAI1*23
```

```
$PDAS,SESSN,2,154500,173000,1,ESSAI2*22
```

```
$PDAS,SESSN,3,180000,203000,1,TEST1*73
```

\$PDAS,SVDSEL

- **Functions**

- Allows intentional rejection of satellites from the position processing in the receiver. Satellites may be GPS SVs or GEOs.
- Lists the intentionally rejected satellites
- Reads/changes the elevation threshold (minimum elevation angle) required of a non-rejected satellite to be involved in the position processing.

- **Syntax**

- Command relative to rejected satellites:

```
$PDAS,SVDSEL,a,b,c,d,...[*hh]<CR><LF>
```

- Command relative to elevation threshold:

```
$PDAS,SVDSEL,a [*hh]<CR><LF>
```

- QUERY command:

```
$PDAS,SVDSEL[*hh]<CR><LF>
```



- Parameters

ref.	format	
a	x.x	: Elevation threshold (in degrees)
b	x.x	: Indicates whether the PRNs that follow (c,d,...) are those of the only satellites you want to reject (this will be obtained by setting b to 0), or are added to the list of rejected satellites (in which case b will also designate one of these satellites). As a summary: $\mathbf{b} = 0 \Rightarrow \text{No satellite is rejected except those specified in the next fields } (\mathbf{c}, \mathbf{d}, \dots)$ $\mathbf{b} \neq 0 \Rightarrow \text{PRN of a satellite you want to reject}$ $(0 \leq \mathbf{b} \leq 210)$
c	x.x	: PRN of other satellite you want to reject ($1 \leq \mathbf{c} \leq 210$)
d	x.x	: PRN of other satellite you want to reject ($1 \leq \mathbf{d} \leq 210$) etc. (up to 12 SVs)
*hh		: Checksum (optional)
<CR><LF>		: End of command

- **Note**

The elevation threshold has no effect on the position processing when the EDGPS, KART or LRK processing mode is selected.

- **Examples**

\$PDAS,SVDSEL \$PDAS,SVDSEL,20,2,6,8	QUERY Elevation threshold is 20 °; SVs PRN 2, 6 ,8 are currently rejected
\$PDAS,SVDSEL,,5	Adding SV PRN 5 to the list of rejected satellites
\$PDAS,SVDSEL \$PDAS,SVDSEL,20,2,6,8,5	QUERY (checking the change made) (Reply)
\$PDAS,SVDSEL,,0,2,7	Clearing the list of intentionally rejected SVs. SV PRN 2 and 7 will now be the only SVs that are rejected
\$PDAS,SVDSEL \$PDAS,SVDSEL,20,2,7	QUERY (checking the change made) (Reply)
\$PDAS,SVDSEL,15 \$PDAS,SVDSEL \$PDAS,SVDSEL,15,2,7	Changing elevation threshold (15°) QUERY (checking the change made) (Reply)
\$PDAS,SVDSEL,,0 \$PDAS,SVDSEL \$PDAS,SVDSEL,15	Clearing the list of rejected satellites QUERY (checking the change made) (Reply) No satellite rejected



\$PDAS,TR

- **Function**

- Triggers data output in RS232 mode on the specified port.

- **Syntax**

```
$PDAS,TR,a,b[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,TR

- **Parameters**

ref. format

a **a** : Output port identification (A, B, etc.)

Placing a comma (,) behind this letter will delete the current user text (to be replaced by the next one (see below).

b **c--c** : User text (60 characters max.)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

\$PDAS,OUTMES,1,A,6,1 Validating output 1 on port A in TR mode

\$PDAS,OUTMES Checking output 1 definition

\$PDAS,OUTMES,1,A,6,1,1,5,7,8,9,10,20*55

\$PDAS,TR Asking for output 1 to be sent

Resulting data blocks (example):

```
$GPGGA,104849.99,4716.12353,N,00129.44097,W,0.09,1,85.99,M,0.00,M,-1.0,0000
```


\$PDAS,UNIT

- **Function**

- Edits the unit number, or the identification number in the case of a reference station.

- **Syntax**

- Complete command

```
$PDAS,UNIT,a[*hh]<CR><LF>
```

- QUERY command

```
$PDAS,UNIT[*hh]<CR><LF>
```

- **Command identification:**

- \$PDAS,UNIT

- **Parameters**

ref. format

a x : Unit number or station identification number (4 char. max.; 0 to 1023)

***hh** : Checksum (optional)

<CR><LF> : End of command

- **Examples**

\$PDAS,UNIT	QUERY
\$PDAS,UNIT,0*30	(Reply: No 0000)

\$PDAS,UNIT,801	Changing unit number
\$PDAS,UNIT	QUERY
\$PDAS,UNIT,801*39	(Reply: No 0004)

\$_ZDA and \$_GPQ,ZDA

- **Function**

- Respectively changes and reads the receiver date & time.

- **Syntax**

- Change command:

```
$--ZDA,a,b,c,d,e,f[*hh]<CR><LF>
```

- Read command:

```
$--GPQ,ZDA[*hh]<CR><LF>
```

- **Parameters**

ref. format

- a** hhhmss.ss : UTC time
- b** xx : Day (01 to 31)
- c** xx : Month (01 to 12)
- d** xx : Year (4 char.)
- e** xx : Local time offset (in hours) compared with UTC time (-13 to +13)
- f** xx : Local time offset (in minutes) compared with UTC time (00 to 59)
- *hh** : Checksum (optional)
- <CR><LF>** : End of command

- **Examples**

\$ECGPQ,ZDA QUERY
\$GPZDA,180919.00,17,2,1998,+00,00*78
(Reply)
\$ECZDA,082100,18,12,1997,-1,00 Changing time
\$ECGPQ,ZDA Checking new time
\$GPZDA,082117.00,18,12,1997,-01,00*4B

♣





Commands library

\$_ZDA and \$_GPQ,ZDA

D. GPS Raw Data in SVAR format

Notation rules

- **Reserved characters**

	(02h)	<stx>	Beginning of message
!	(21h)		Format indicator
,	(2Ch)		Field delimiter
@	(40h)		Checksum delimiter
.	(2Eh)		Decimal separator
"	(22h)		Beginning and end of label
	(0Dh,0Ah)	<eoln>	End of line
	(03h)	<etx>	End of message

Subscript letter h at the end of a character string means that this string is in hexadecimal notation.

- **Conventions used**

field	Generic term representing one or more data
data	Numerical value or label
< >	Surrounds a field name
<stx>	Beginning of message (02h)
<sobk>	Beginning of block: one or more characters, identifies beginning of block
<soln>	Beginning of line: one or more characters, identifies beginning of line in a block
<eoln>	End of line, 2 characters: CR,LF (0Dh 0Ah)
<etx>	End of message (03 _h)



The term "block" stands for a group of data of the same nature.

The term "numerical value" encompasses all types of possible codings : binary, decimal, hexadecimal.

The term "number" used without any further indication stands for a decimal number (base 10).

The term "label" stands for an ASCII character string.

- **General form**

<stx> <eoln>

<sobk> <,> < time tagging line > <eoln>

<soln> <,> < 1st data line > <eoln>

...

<soln> <,> < nth data line > <eoln>

<etx>

The count and type of data in any given line are predefined, which means that the count of separators <,> is invariable.

Any data missing or replaced by one or more spaces means that this data is not available.

- **Rule about numerals**

A "zero" value is assumed to be valid. Spaces placed before or after numerals are not significant. There cannot be spaces within a numeral. The following formats are usable:

decimal : decimal separator is the "." symbol. It is always preceded by at least one figure (.25 appears as 0.25) and followed by at least one figure, otherwise the integer notation is used.

integer : particular case of decimal notation without separator.

floating : exponent character is 'E' (example : 6.2512E3 = 6251.2)

signed : signs are placed at the beginning of the mantissa and after the exponent character. A numeral with no sign is assumed to be positive. There cannot be spaces between the sign and the first figure.

- **Rule about labels**

Labels are denoted by <"> characters surrounding them. They can take any ASCII value except <">, <stx> and <etx>.

Labels can optionally be associated with a numeral. In this case:

- They are placed just before or after the <,> field delimiter
- They are separated from the numeral by a <space> character



- **Error check rule**

An optional checksum can be placed at the end of every line (except for the <stx> and <etx> lines), between the last data in the line and <eoln>. The presence of the checksum is denoted by the @ character followed by the two end-of-line characters.

The checksum results from exclusive-OR gating all the characters in the line, excluding the @ character. The resulting 8-bit checksum is converted into 2×4 bits in hexadecimal notation and then the two half-bytes are ASCII-encoded. The most significant character is transferred first.

SVAR!D : Single-frequency Differential corrections

- **General Form**

```
<stx> <eoln>  
<!D>,< time tagging > <eoln>  
<soln>,< parameters > <eoln>  
<soln>,< 1st line of differential corrections> <eoln>  
...  
<soln>,< nth line of differential corrections > <eoln>  
<etx>
```

- **Time tagging line**

```
!D,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds.
- Reference time is jan 6 1980 at 0hr00.



- **Parameter line**

<soln>	2 char	<% S > DSNP-type corrections (includes ionospheric corrections)
		<% R > RTCM-type corrections (does not include ionospheric corrections)
		<# <i>n</i> > message other than corrections (further use to be notified at a later date)
<Station number>		Read from the receiver configuration or from the RTCM 104 message
<Reception Quality>		0 to 10, corresponds to the ratio of the messages received correctly; 10 = 100%
<iono/tropo flag>		0 : Iono/tropo corrections are not included in differential corrections 1 : Iono/tropo corrections are included in differential corrections
<eoln>		

- **Corrections line**

<soln>	3 characters: * and SV number
<C/A code correction>	PRC, in meters, at time To of message; Positive correction means it must be added to pseudorange
<correction speed>	RRC, in m/s

- <correction age> in seconds, algebraic difference between time of message and time of GPS measurements from which corrections were generated
- <IOD> Issue Of Data, for DSNP corrections, counter output modulo 256, incremented by 1 every time IOD changes state
- <UDRE> User Differential Range Error
- <eoln>

$$\text{Time correction value } (T) = PRC + RRC(T-T_0)$$

- Data block example

```
!D,945,410950.1
%R,710,,0
*3,-20.3,0.05,1.2,224
*19,20.7,-0.15,1.2,33
*17,-17.3,-0.06,1.2,235
*31,1.7,-0.09,1.2,181
*21,16.9,-0.10,1.2,231
*22,1.0,0.04,1.2,78
*23,-3.6,0.17,1.2,103
```



SVAR!R : Single-frequency GPS pseudoranges in satellite time

- **General Form**

```
<stx> <eoln>
<!R>,< time tagging > <eoln>
<soln>,< parameters > <eoln>
<soln>,< 1st line of raw data> <eoln>
...
<soln>,< nth line of raw data > <eoln>
<etx>
```

- **Time tagging line**

```
!R,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds.
- Reference time is jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).

- **Parameter line**

```
<soln> 1st char  <&> (data type 2)
          2nd char  <C> L1 phase measurement, C/A
                    code
<filter. time constant>  in seconds (code smoothed by carrier)
          <eoln>
```

- **Raw data lines**

<soln>	2 characters: * and channel No. (in hexadecimal)
<SV No.>	
<C/A code pseudorange>	in 10^{-10} s, modulo 10 s
<L1 _{C/A} carrier phase>	in 10^{-3} cycles, modulo 10^8 cycles
<L1 _{C/A} carrier speed>	in 10^{-3} cycle/s
<C/A L1 C/No>	in dBHz
<L1 channel status>	encoded on a 4-bit ASCII character [0 to F] bit 0 = 0 (<i>not used</i>) bit 1 = 0 (<i>reserved</i>) bit 2 = 1 if invalid L1 phase measurement bit 3 = 0 (<i>reserved</i>)
<L1 carrier quality indicator>	encoded on 2 ASCII characters [0 to F], 8 bits, MSB first 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 \leq 0.00391 cycle

"001": phase error \leq 0.00696 cycle

"010": phase error \leq 0.01239 cycle

"011": phase error \leq 0.02208 cycle

"100": phase error \leq 0.03933 cycle

"101": phase error \leq 0.07006 cycle

"110": phase error \leq 0.12480 cycle

"111": phase error $>$ 0.12480 cycle

<C/A code
quality indicator>

encoded on 2 ASCII characters [0 to
F], 8 bits, MSB first

bits 0 to 3: "pseudo-range multipath
error indicator", (complies with RTCM
message No. 19):

"1111": multipath error not determined

bits 4 to 7 : "pseudo-range data quality
indicator", (complies with RTCM
message No. 19):

"0000": pseudorange error \leq 0.020

"0001": pseudorange error \leq 0.030

"0010": pseudorange error \leq 0.045

"0011": pseudorange error \leq 0.066

"0100": pseudorange error \leq 0.099

"0101": pseudorange error \leq 0.148

"0110": pseudorange error \leq 0.220

"0111": pseudorange error $>$ 0.329

"1000": pseudorange error \leq 0.491

"1001": pseudorange error \leq 0.732

"1010": pseudorange error \leq 1.092

"1011": pseudorange error \leq 1.629

"1100": pseudorange error ≤ 2.430

"1101": pseudorange error ≤ 3.625

"1110": pseudorange error ≤ 5.409

"1111": pseudorange error > 5.409

<eoln>

- Data block example

!R,945,409178.0

&C,30

***0,3,1642748611,1336643,-3745940,50,0,21,8F**

***1,6,1770768785,6159605,1173036,38,0,20,BF**

***2,17,1653042024,2007234,66112,49,0,2A,8F**

***3,19,1765372780,2787887,-4030232,38,0,54,BF**

***4,21,1750942628,5177540,-5179588,46,0,02,9F**

***5,22,1622832882,903573,-850340,51,0,0B,7F**

***6,23,1707824729,5132206,-3991356,45,0,0C,9F**

***7,25,1786374004,4350534,1642228,37,0,40,BF**

***9,31,1756457738,8208042,-5146444,37,0,62,CF**



SVAR!R : Dual frequency GPS pseudoranges in satellite time

- **General Form**

```
<stx> <eoln>
<!R>,< time tagging > <eoln>
<soln>,< parameters > <eoln>
<soln>,< 1st line of raw data> <eoln>
...
<soln>,< nth line of raw data > <eoln>
<etx>
```

- **Time tagging line**

```
!R,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds.
- Reference time is jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).

- **Parameter line**

```
<soln> 1st char  <&>
                <P> L1 and L2 phase measurements,
                C/A, P/Y codes
<filter. time constant> in seconds (C/A code smoothed by
                carrier)
                <eoln>
```


- Dual-frequency raw data lines

<soln>	2 characters: * and channel No. (in hexadecimal)
<SV No.>	
<C/A code pseudorange>	in 10^{-10} s, modulo 10 s
<L1 _{C/A} carrier phase>	in 10^{-3} cycles, modulo 10^8 cycles
<L1 _{C/A} carrier speed>	in 10^{-3} cycle/s
<C/A L1 C/No>	in dBHz
<L1, L2 channel status>	encoded on a 4-bit ASCII character [0 to F] bit 0 = 0 (<i>not used</i>) bit 1 = 0 if code P; 1 if code Y (antispoofing) bit 2 = 1 if L1 _{C/A} phase measurement not valid bit 3 = 1 if L2 _{P/Y} phase measurement not valid
<L1 carrier quality indicator>	encoded on 2 ASCII characters [0 to F], 8 bits, MSB first 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

<C/A code quality indicator> encoded on 2 ASCII characters [0 to
F], 8 bits, MSB first

bits 0 to 3 : "pseudo-range multipath
error indicator", (complies with RTCM
message No. 19):

"1111": multipath error not determined

bits 4 to 7: "pseudo-range 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

<L1 _{P/Y} - L1 _{C/A} carrier phase deviation>	in 10 ⁻³ cycles, modulo 1 cycle, centered around zero
<P _{L1} - C/A _{L1} code deviation>	in 10 ⁻¹⁰ s
<P _{L2} - C/A _{L1} code deviation>	in 10 ⁻¹⁰ s
<L2 _P carrier phase>	in 10 ⁻³ cycles, modulo 10 ⁸ cycles of L2
<L2 _P carrier speed>	in 10 ⁻³ cycles
<L2 carrier quality indicator>	<p>encoded on 2 ASCII characters [0 to F], 8 bits, MSB first</p> <p>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)</p> <p>bits 5 to 7 : "data quality indicator", (complies with RTCM message No. 18):</p> <p>"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</p>
<P/Y code quality indicator>	<p>encoded on 2 ASCII characters [0 to F], 8 bits, MSB first</p>



bits 0 to 3: "pseudo-range multipath error indicator", (complies with RTCM message No. 19):

"1111": multipath error not determined

bits 4 to 7: "pseudo-range 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

<eoln>

- Data block example

```
!R,945,409517.0
&P,30
*0,3,2137408867,7051638,-1159380,51,2,0B,8F,-23,50,-45,50D76954,-903432,01,6F
*1,6,2275926394,9438843,3673120,39,2,60,BF,-43,17,-18,5496814,2862292,81,DF
*2,19,2259497283,5974953,-13A74584,39,A,43,BF,0,-208,,0,,A1,EF
*3,17,2155976904,3988834,2716264,48,2,21,8F,-23,-143,-211,1373394,2116524,01,7F
*4,21,2242445140,6696450,-2660704,47,2,46,9F,-20,64,28,5048311,-2073184,21,8F
*5,22,212381893S3,1570001,1821372,51,2,42,7F,-12,-158,-234,1893847,1419264,01,5F
*6,23,2202008192,7741120,-1358284,45,2,01,9F,12,-106,-130,6822254,-1058392,21,9F
*7,25,2292481156,6441213,4086108,37,A,54,BF,-500,,,0,,00,00
*9,31,2248027302,5125919,-2635232,39,2,5B,BF,12,-212,-243,3302338,-2053544,62,CF
```

SVAR!A : Almanac data

- General Form

```
<stx> <eoln>
<!A>,< time tagging > <eoln>
< parameters > <eoln>
< Almanac line > <eoln>
<etx>
```

- Time tagging line

```
!A,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds.
- Reference time is Jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).



- **Parameter line**

- <Number of the SV corresponding to the transmitted almanac>
- <Almanac reference week number> (assuming the modulo 2^{10} ambiguity is removed)
- <eoln>

- **Almanac data lines**

Bits 1 to 24 from words 3 to 10 in subframes 4 or 5 (depending on SV number).

Each GPS word (bits 1 to 24) is split into six 4-bit strings which are hex-encoded to form 6 bytes (0 to F), with the first byte corresponding to bits 1 to 4.

The almanac line is organized as follows:

<word 3>,<word 4>,<word 5>,<word 6>,<word 7>,<word 8>,<word 9>,<word 10>,<eoln>

- **Message example**

!A,945,414504.2

4,945

4426B6,901606,FD3F00,A10D2F,AAA009,DDC8B3,ECF6F5,01003B

SVAR!E : Ephemeris data

- **General Form**

```
<stx> <eoln>  
<!E>,< time tagging > <eoln>  
< parameters > <eoln>  
< 1st line of ephemeris data> <eoln>  
< 2nd line of ephemeris data> <eoln>  
< 3rd line of ephemeris data> <eoln>  
<etx>
```

- **Time tagging line**

```
!E,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds.
- Reference time is Jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).

- **Parameter line**

- <Number of the SV corresponding to the transmitted ephemeris>
- <eoln>



- **Ephemeris data line**

Line 1: bits 1 to 24 from words 3 to 10 in subframe 1

Line 2: bits 1 to 24 from words 3 to 10 in subframe 2

Line 3: bits 1 to 24 from words 3 to 10 in subframe 3.

Each GPS word (bits 1 to 24) is split into six 4-bit strings which are hex-encoded to form 6 bytes (0 to F, A to F), with the first byte corresponding to bits 1 to 4.

Each ephemeris data line is organized as follows:

<word 3>,<word 4>,<word 5>,<word 6>,<word 7>,<word 8>,<word 9>,<word 10>,<eoln>

- **Data block example**

!E,945,414347.7

10

**EC5701,73336D,D49E97,A3469F,FEEBFC,346432,000004,027605
34FBF4,2FAA69,5E1FFF,FCA201,5BF1EC,11BCA1,0D90EA,64327C
0006D4,97F2C8,002527,577D88,1B60F3,6B16D7,FFA8CD,340D02**

SVAR!U : Iono/UTC data

- **General Form**

```
<stx> <eoln>  
<!U>,< time tagging > <eoln>  
< Iono/UTC data line> <eoln>  
<etx>
```

- **Time tagging line**

```
!U,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week (Z count in seconds), when the receiver generates the message.
- Reference time is Jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).

- **Iono/UTC data line**

Bits 1 to 24 from words 3 to 10 in subframe 4, page 18.

Each GPS word (bits 1 to 24) is split into six 4-bit strings which are hex-encoded to form 6 bytes (0 to F), with the first byte corresponding to bits 1 to 4.

The Iono/UTC data line is organized as follows:

```
<word 3>,<word 4>,<word 5>,<word 6>,<word  
7>,<word 8>,<word 9>,<word 10>,<eoln>
```

- **Data block example**

```
!U,945,414740.3  
780F00,FF0136,FEFC03,000032,000000,0F90B1,0C9002,0CAAAA
```



SVAR!S : Health & A/S data

- **General Form**

```
<stx> <eoln>  
<!S>,< time tagging > <eoln>  
< Health & A/S data line> <eoln>  
<etx>
```

- **Time tagging line**

```
!S,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week (Z count in seconds), when the receiver generates the message.
- Reference time is Jan 6 1980 at 0hr00 (assuming the modulo 2^{10} ambiguity is removed).

- **Health & A/S data line**

A/S & Health: Bits 1 to 24 from words 3 to 10 in subframe 4, page 25

- Health: Bits 1 to 24 from words 3 to 10 in subframe 5, page 25.

Each GPS word (bits 1 to 24) is split into six 4-bit strings which are hex-encoded to form 6 bytes (0 to F), with the first byte corresponding to bits 1 to 4.

The Health & A/S data line is organized as follows:

```
<word 3>,<word 4>,<word 5>,<word 6>,<word  
7>,<word 8>,<word 9>,<word 10>,<eoln>
```

- **Data block example**

```
!S,945,414740.3  
7F9999,999999,009999,999099,999990,999080,000FC0,000FE9  
7390B1,000000,000000,000FFF,F00000,00003F,000000,AAAAAB
```

SVAR!W: WAAS/EGNOS Data

- **General Form**

```
<stx> <eoln>  
<!W>,<time tagging > <eoln>  
<soln><parameters> <eoln>  
<soln><Data from 1st GEO> <eoln>  
...  
<soln><Data from nth GEO> <eoln>  
<etx>
```

- **Time tagging line**

```
!W,< GPS week>,< GPS time><eoln>
```

- GPS week number and time within week, in seconds, when generating the message.
- Reference time is Jan 6 1980 at 0hr00.



- **Parameter line**

%C,<message counter>,<count of GEOs in the message> <eoln>

- The counter is modulo 16, incremented by 1 on arrival of a new message.
- GEO count: from 1 to 4

- **Pre-decoded WAAS data line**

<soln>	2 characters: * and channel No. (in hexadecimal)
<GEO Number>	PRN of geostationary satellite (≥ 100)
<CRC validity flag>	0: Good; 1: Bad
<WAAS message No.>	From 0 to 63 (same as WAAS encoding)
<Preamble identifier>	From 1 to 3 (byte number in preamble)
<WAAS word>	occupies 212 bits in 53 ASCII/HEX-encoded characters (preamble and parity excluded)
<Checksum>	Optional , but recommended, checksum word
<eoln>	

- **Data block example**

!W,980,209274.0

%C,14,2

*D,120,0,9,1,F471A0418A0F158CD50A1B178034D586AF55127E070B10E144F82@48

*E,132,0,9,1,8AC442C6AF0F16AF558A0F471A0410ECD500418A15837AF89A0B4@62



E. 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

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 transcoding 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.

A blue square containing a white capital letter 'E'.

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



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



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= $1/256$ th 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 μ s; MSB= sign; 8000_h =measurement not valid)

Next 2 bytes : $P_{L2} - C/A_{L1}$ code deviation (unit= 10^{-10} s; field ~ 3.2 μ s; 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)



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: lono/UTC data

- **General form**

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

- **lono/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



SBIN!W: WAAS/EGNOS Data

- **General Form**

```

    <stb><W> 2 bytes
    <long> 2 bytes
    <Parameters> 1 byte
    <Data from 1st GEO> 29 bytes
    ...
    <Data from nth GEO> 29 bytes
    <checksum> 2 bytes
    <etb> 1 byte
  
```

- **Parameters line**

A single byte:

bits 7 to 4 : Message counter (modulo 16, incremented by 1 whenever a new message is received)

bits 3 and 2 : =0 (no particular meaning)

bits 1 and 0 : Count of GEOs in the message:

Bit 1	Bit 0	GEO count
0	1	1
1	0	2
1	1	3
0	0	4

- **GEO data line**

First byte : GEO PRN

2nd byte : Message type:

Bit 7: CRC validity flag (0: Good; 1: Bad)

Bit 6: =0 (no particular meaning)

Bits 5 to 0: message type (0 to 63, same as WAAS encoding)

3rd byte : Bits 7 and 6: Identifies preamble (8 bits out of 24 totally) as follows:

“1”: 1st byte from preamble

“2”: 2nd byte from preamble

“3”: 3rd byte from preamble

Bits 5 and 4: = 0 (no particular meaning)

Bits 3 to 0: first 4 bytes (MSB) from the 212-bit WAAS word

Next 26 bytes : The last 208 bits from the 212-bit WAAS word (excluding preamble, message number and parity)

♣



E



F. Computed Data Outputs

Introduction

All computed data outputs programmed in the default configuration of your receiver comply with the NMEA 0183 standard.

The definition of any computed data output can be modified directly on the receiver using the \$PDAS,OUTMES proprietary command (see this command in *Appendix C*).

The definition of each of the *formats* generating an output cannot however be modified (this can be done only by using the DSNP *ConfPack* software).

Computed-data outputs (default)

Ident	Port	Mode	Rate	Contents
1	A	TIME	1sec	GPGGA (Global Positioning System Fix Data)
2	A	TIME	1sec	GPGLL (Geographic Position Latitude/Longitude)
3	A	TIME	1sec	GPVTG (Course Over Ground and Ground Speed)
4	A	TIME	1sec	GPGSA (GNSS DOP and Active Satellites)
5	A	TIME	1sec	GPZDA (Time and Date)
6	A	TIME	1sec	GPRMC (Recommended Minimum Specific GNSS Data)
7	A	TIME	1sec	GPGRS (GNSS Range Residuals)
8	A	TIME	1sec	GPGST (GNSS Pseudorange Error Statistics)
9	A	TIME	1sec	GPGSV (GNSS Satellites in View)
10	B	EVENT	1 tk	Time Mark

By default, all outputs are OFF at receiver power-on.



Output 1 : GPGGA

(Global Positioning System Fix Data)

\$GPGGA,hhmmss.ss,llll.llll,a,yyyyy.yyyyy,a,x,xx,x.x,x.xx,M,x.xx,M,x.x,xxxx*hh<cr><lf>

Field type	Variable (ConfPack)	Field Designation
\$GPGGA	:	NMEA183 message identifier
hhmmss.ss	: TUTC	: UTC time of position computation
llll.llll,a	: LAT	: Latitude degrees (2 char.), minutes (2 char.), 1/100 000 min., N/S indicator
yyyyy.yyyyy,a	: LON	: Longitude degrees (3 char.), minutes (2 char.), 1/100 000 min., E/W indicator
x	: FIXS+DS	: GPS quality figure : 0 : fix not available, or invalid 1 : straight GPS fix 2 : Differential GPS fix 4 : Real Time Kinematic (KINE A, KINE R, LRK or LRKW) 5 : Real Time Kinematic (EDGPS, KART or LRK initialization) 6 : Estimated (dead reckoning) mode
xx	: NSVU	: Number of SVs used to compute the fix

x.x	: HDOP	: Horizontal Dilution of Precision (-1 if not computed)
x.xx,M	: ZP	: Antenna altitude above MSL, in meters (if MSL \neq 0). If MSL = 0, ZP is the altitude above the WGS84
x.xx,M	: MSL	: Geoidal separation (between ellipsoid and Mean Sea Level)
x.x	: DAGE	: Age of Differential corrections, on average (null field if DGPS not used)
xxxx	: DSTA	: Identification of reference station used (null field if not used).
*hh		: Checksum field

- **Output example**

\$GPGGA,192348.99,4716.10435,N,00129.45430,W,4,09,1.1,93.83,M,0.00,
M,2.0,0055*5C

\$GPGGA,192349.99,4716.10435,N,00129.45430,W,4,09,1.1,93.79,M,0.00,
M,3.0,0055*5D

\$GPGGA,192350.99,4716.10435,N,00129.45430,W,4,09,1.1,93.78,M,0.00,
M,2.0,0055*51



Output 2 : GPGLL

(Geographic Position Latitude/Longitude)

**\$GPGLL,lll.llll,a,yyyyy.yyyyy,a,hmmss.ss,A,a
*hh<cr><lf>**

Field type	Variable (ConfPack)	Field Designation
\$GPGLL	:	: NMEA183 message identifier
lll.llll,a	: LAT	: Latitude in degrees (2 char.), minutes (2 char.), 1/100 000 min., N/S indicator
yyyyy.yyyyy,a	: LON	: Longitude in degrees (3 char.), minutes (2 char.), 1/100 000 min., E/W indicator
hmmss.ss	: TUTC	: UTC time of position computation.
A	: FIXS	: GPS quality figure V = Fix not available, or invalid. A = GPS fix available
a	:	: Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode N = Data not valid

- **Output example**

```
$GPGLL,4716.10435,N,00129.45430,W,192531.99,A,D*70
$GPGLL,4716.10435,N,00129.45430,W,192532.99,A,D*71
$GPGLL,4716.10435,N,00129.45430,W,192533.99,A,D*7E
```

Output 3 : GPVTG

(Course Over Ground and Ground Speed)

```
$GPVTG,x.x,T,x.xx,N,x.xx,K,a*hh<cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPVTG	:	: NMEA183 message identifier
x.x,T	: COG	: Course Over Ground (degrees)
x.xx,N	: SOG	: Speed Over Ground (knots)
x.xx,K	: SOG	: Speed Over Ground (km/hr)
a	:	: Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode N = Data not valid

- **Output example**

```
$GPVTG,120.4,T,,,5.74,N,10.63,K,D*45
```

```
$GPVTG,119.1,T,,,5.81,N,10.76,K,D*4E
```



F

Output 4 : GPGSA

(GPS DOP and Active Satellites)

```
$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,,,,,
x.x,x.x,x.x*hh <cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPGSA	:	: NMEA183 message identifier
A	:	: 2D/3D automatic switching mode
x	: MODE	: Fix mode 1 = invalid fix 2 = 2D mode 3 = 3D mode
xx,....,xx	: NSVU	: PRN of SVs used in the solution
x.x	: PDOP	: Position DOP (-1.0 if not computed)
x.x	: HDOP	: Horizontal DOP (-1.0 if not computed)
x.x	: VDOP	: Vertical DOP (-1.0 if not computed)

- **Output example**

```
$GPGSA,A,3,24,18,25,07,15,19,16,,04,14,,,,,,,,,2.0,1.1,-1.0*19
$GPGSA,A,3,24,18,25,07,15,19,16,,04,14,,,,,,,,,2.0,1.1,-1.0*19
```

Output 5 : GPZDA

(UTC, day, month, year and local time zone)

```
$GPZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPZDA	:	NMEA183 message identifier
hhmmss.ss	: TUTC	: UTC time
xx,xx,xxxx	: DUTC	: UTC date (day, month, year)
xx	:	: Local zone hours (00 to ± 13 hr)
xx	:	: Local zone minutes (00 to + 59)

- **Output example**

```
$GPZDA,075448.99,04,11,1998,+00,00*4A
```

```
$GPZDA,075449.99,04,11,1998,+00,00*4B
```



F

Output 6 : GPRMC

(Recommended Minimum Specific GPS/TRANSIT Data)

```
$GPRMC, hhmmss.ss,a,llll.lllll,a,yyyyy.yyyyy,a,
x.x,x.x,xxxxxx,,,a*hh <cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPRMC	:	: NMEA183 message identifier
hhmmss.ss	: TUTC	: UTC time
a	: FIXS	: GPS quality figure <div style="margin-left: 20px;">V = Fix not available, or invalid. A = GPS fix available</div>
llll.lllll,a	: LAT	: Latitude in degrees (2 char.), minutes (2 char.), 1/100 000 min., N/S indicator
yyyyy.yyyyy,a	: LON	: Longitude in degrees (3 char.), minutes (2 char.), 1/100 000 min., E/W indicator
x.x	: SOG	: Speed Over Ground (knots)
x.x	: COG	: Course Over Ground (degrees)
xxxxxx	:	: Date (ddmmyy)
a	:	: Mode indicator: <div style="margin-left: 20px;">A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode N = Data not valid</div>

- Output example

**\$GPRMC,193612.99,A,4716.10435,N,00129.45430,W,0.0,0.0,0,0
41198,,,D*64**

**\$GPRMC,193613.99,A,4716.10435,N,00129.45430,W,0.0,0.0,04
1198,,,D*65**

**\$GPRMC,193614.99,A,4716.10435,N,00129.45430,W,0.0,0.0,0
41198,,,D*61**



Output 7 : GPGRS

(GNSS range residuals)

```
$GPGRS,hhmmss.ss,1,x.xx,x.xx,x.xx,x.xx,,,,,,,,*hh
<cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPGRS	:	: NMEA183 message identifier
hhmmss.ss	: TUTC	: UTC time
1	:	: This "1" means that residuals were re-computed after the GNSS position was computed
x.xx	: CRE[i]	: Range residuals in meters for satellites used in the navigation solution (null for unused field)

- **Output example**

```
$GPGRS,143322.99,1,10.34,,3.40,0.12,-24.49,-0.91,-
6.47,6.90,,27.81,-16.70,,,,,*46
$GPGRS,143323.99,1,10.56,,3.46,0.11,-24.81,-0.77,-
6.55,7.01,,28.03,-16.82,,,,,*42
$GPGRS,143324.99,1,10.71,,3.44,0.09,-25.23,-0.49,-
6.72,7.08,,28.12,-16.92,,,,,*4C
```

Output 8 : GPGST

(GNSS pseudo-range error statistics)

```
$GPGST,hhmmss.ss,,,,,x.xx,x.xx,x.xx*hh <cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPGST	:	: NMEA183 message identifier
hhmmss.ss	: TUTC	: UTC time
,,,,,	:	: Null fields
x.xx	: NPSD	: Standard deviation of latitude error (meters)
x.xx	: EPSD	: Standard deviation of longitude error (meters)
x.xx	: HPSD	: Standard deviation of altitude error (meters)

- Output example

```
$GPGST,080154.99,,,,,0.02,0.02,0.03*6C
$GPGST,080155.99,,,,,0.02,0.02,0.04*6A
$GPGST,080156.99,,,,,0.02,0.02,0.03*6E
$GPGST,080157.99,,,,,0.02,0.02,0.04*68
```



Output 9 : GPGSV

(GNSS satellites in view)

```
$GPGSV,x,x,xx,xx,xx,xxx,xx.....,xx,xx,xxx,xx*hh
<cr><lf>
```

Field type	Variable (ConfPack)	Field Designation
\$GPGSV	:	: NMEA183 message identifier
x	:	: Total number of messages
x	:	: Message number
xx	: NSVR	: Total number of satellites in view
xx	: CSV[i]	: Satellite ID number
xx	: CEL[i]	: Elevation, in degrees (90 max.)
xxx	: CAZ[i]	: Azimuth, in degrees, True (0 to 359)
xx	: CSB[i]	: SNR (C/No) (00 to 99 dB-Hz)

The last four parameters are provided for each satellite in view. Depending on the number of satellites in view, the message can occupy up to 3 lines.

- **Output example**

```
$GPGSV,3,1,10,24,13,313,41,18,61,206,50,25,07,031,38,0
7,29,234,43*72
```

```
$GPGSV,3,2,10,15,08,136,41,19,09,168,39,16,78,020,50,1
3,03,222,37*78
```

```
$GPGSV,3,3,10,04,53,303,49,14,41,077,47*74
```

Output 10 : Time Mark

```

<stx><cr><lf>
!M,xxxx,xxxxxxx.x<cr><lf>
*1,x,xxxxxxxxxxxx<cr><lf>
*2,x,hhmmss.sss<cr><lf>
*3,x,xxx<cr><lf>
<etx>

```

Field type	Variable (ConfPack)	Field Designation
!M,xxxx	: GPSW	GPS week number
xxxxxxx.x	: GPST	GPS week time (Lsd 1/10 second)
*1,x	: FIXS	GPS status (1 character) 0 = GPS time solution computed 9 = GPS time solution not valid
xxxxxxxxxxxx	: GPST	GPS time Modulo 10 seconds (Low Significant Digit : 1×10^{-10} seconds)
*2,x	: FIXS	GPS status (1 character) 0 = UTC time solution computed 9 = UTC time solution not valid
hhmmss.sss	: TUTC	UTC time of event



***3,x** : Event origin (EVENT)
xxx : Event counter (modulo 256)

- **Output example**

!M,945,416249.0
***1,0,416249.0000000**
***2,0,193716.999**
***3,1,1**

!M,945,416250.0
***1,0,416250.0000000**
***2,0,193717.999**
***3,1,2**

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G. DSet Pack Software

Installation

DSet Pack comes in a separate set of 3¼-inch diskettes, or is part of a CD-ROM containing all the software applications developed for the Aquarius 5000 Series.

Computer requirements

Processor : DX2-66 minimum, Pentium
recommended

RAM : 16 Mbytes minimum, 24 Mbytes
recommended

Operating system : Windows 95

Display screen : SVGA, 17 inches recommended

Installation procedure from the CD-ROM

- Insert the Aquarius CD-ROM into the CD-ROM drive
The auto-start procedure presents a selection of software packages to be installed
- Select **DSet Pack** and proceed with the installation as described in the next pages (same procedure as with the diskettes).





Installation procedure from the set of 3¼" diskettes

- Insert the first diskette (disk. #1) into the PC drive
- From the Windows 95 task bar, click **Start**
- Select **Run** from the pop-up menu
- In the text box which then appears, type:

a:setup

and click the **OK** button (or press [Enter]). This causes the Setup program to be started from the diskette. This program will assist you through the entire installation procedure.

Below are the main stages in the installation.

- **Welcome Dialog box**

As mentioned in this box, we recommend you to close all the active applications before proceeding with the installation.

- **Registration**

- Specify the following in the two text boxes:
 - your name
 - your company's name

- **Destination directory**

- Specify the name of the target directory where you would like the software to be installed. You can specify a non-existing directory: the program will create it for you after confirmation.

- **Program folder**

- Specify the name of the folder where you would like the program shortcuts to be created.

- **Start copying files**

- Click the **Next** button to start installing the software (or click the **Back** button to come back to the installation parameters if you want to change any of them).
- After you have clicked **Next**, insert the next diskette when prompted by the Setup program (step to be repeated until the files from all the diskettes have been installed).

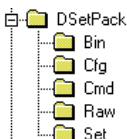
- **End of installation**

- The end of installation is denoted by the message "Setup is complete"



- **Program folders and shortcuts**

- After successful installation and using Windows95 explorer, the following is now visible on your disk:



Bin : Contains all the program files (mainly *.exe, *.dll, *.hlp, *.ocx, etc.)

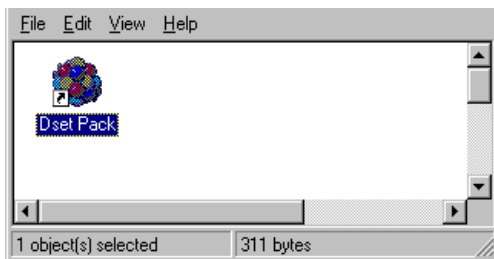
Cfg : Default directory for configuration files

Cmd : Default directory used to save all Win Comm command files

Raw : Default directory invoked when acquiring data records

Set : Default directory invoked when saving port settings

- In addition, a new folder (the "program folder") is present in C:\windows\Start Menu\Programs\D.S.N.P., containing the shortcuts listed below:



- **Getting started**

- Double-click on the DSet Pack icon to start the program.

Introduction to DSet Pack

Purpose

- DSetPack is designed to let you modify the DGNSS section of the configuration file present in your receiver or station.

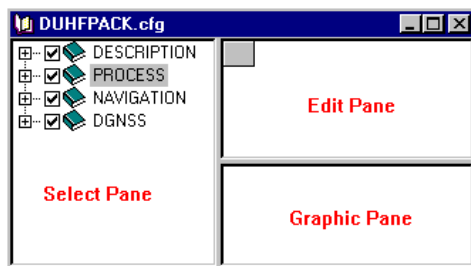
Whereas Conf Pack allows you to create a complete configuration file, DSet Pack only lets you edit the DGNSS-related section of an existing configuration file, although any Write, Read, Save or Save As operations you perform are necessarily run on the complete file, not only on its DGNSS section.

- DSetPack does not show the configuration file under its final aspect (i.e. a list of command lines executable in receivers) but instead provides **a more user-friendly view, using three different panes**, from which you can more easily modify the DGNSS-related section of the file.
- DSetPack lets you open several files concurrently if necessary. This feature allows you for example **to overwrite an open file with the content of another open file**.
- For effortless entry of beacons present in the work area, DSetPack lets you define them **through a simple click of the mouse** on the map of your work region (conventional entry from the keyboard remains possible however).
- DSetPack also includes a communication tool so that, among other things, **configuration files can be directly loaded into or read from your receivers**.



How a configuration file is shown with DSetPack

- When opening a configuration file with DSetPack, a new window appears showing the DGNSS-related parameters present in this file through three distinct Panes (Select, Edit and Graphic), as illustrated below.
- These three panes have been designed so that you can work more easily on the shown parameters.



- **Select Pane:**

- Lists the DGNSS-related parameters of the open configuration file. Except for the DGNSS data sub-module, which may be deselected, all the shown modules and sub-modules will be part of, or will remain, in the configuration file that you open.
- Also provides viewing options for each module (sub-modules can be shown or hidden by a simple click of the mouse)

- **Edit Pane:**

- Shows the Editor table corresponding to the parameter sub-module you select.
- The number of columns in the Editor table is specific to the selected sub-module.
- The number of rows depends on the number of entries you make for this sub-module.
- The Edit Pane is updated whenever you click the document icon of a sub-module, whether selected or not, in the Select Pane

- **Graphic Pane:**

- Shows the entries you make in the Edit Pane in a more synthetic, user-friendly way (not an entry pane).
- In the case of the **DGNSS** module only, this pane operates as a graphic editor as any click of the mouse in this pane will be translated directly into an alpha-numerical entry (a beacon) in the Edit pane.

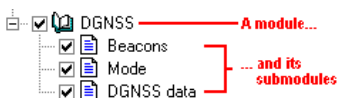
- **Re-sizing the three panes of the DSetPack main window**

- Position the pointer inside the main window, on either a vertical or horizontal pane border. This causes the pointer to change shape:
 - ✚ if the pointer is on a vertical border or
 - ⇕ if the pointer is on a horizontal border
- Using the left mouse button, drag the border to the desired location
- When you reach this location, release the mouse. This causes the three panes to be re-sized accordingly.





Using the Select Pane


The Select Pane shows the four parameter modules controlling the DGNSS function (read from the configuration file of the attached unit).




Handling the Select Pane is much similar to working with Windows 95 explorer. For each parameter module:

- The leftmost '+/-' button is used to show/hide all the sub-modules of a module:
 -  : sub-modules shown (book open)
 -  : sub-modules hidden (book close)
- The check button right-adjacent to the '+/-' button will turn gray if one of its sub-modules is deselected (only the DGNSS data sub-module can be deselected). This check button is always checked.
 - : button checked
 - : button checked, one or more sub-module deselected

- The check button left-adjacent to a sub-module name is used to select/deselect the sub-module. Only the DGNSS data sub-module can be deselected

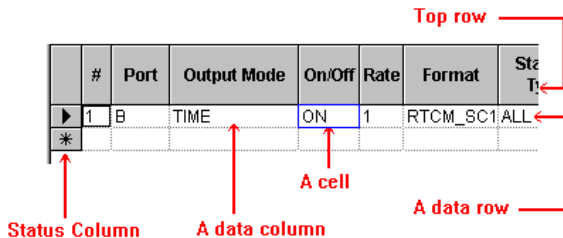
 : button checked: sub-module selected. Clicking the document icon will cause the Editor table corresponding to that sub-module to appear in the Edit Pane.

 : button cleared: sub-module deselected. Clicking the document icon will cause the Editor Pane to turn blank.

Using the Edit Pane

The Editor Pane shows the Editor table.

The Editor table consists of a top row (in gray), a Status column (leftmost column in gray) and a variable number of editable or non-editable cells arranged in rows and columns (data rows and columns)



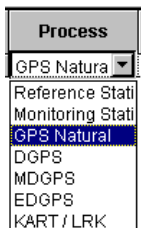
	#	Port	Output Mode	On/Off	Rate	Format	Status
▶	1	B	TIME	ON	1	RTCM_SC1:ALL	
*							



- **Cell types**

- There are 4 different types of cells:

Combo cells : Only the options from the combo box can be selected in this type of cell



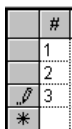
Text cells : Can contain a limited number of alpha-numerical characters



Numeral cells : Can only contain numerical values (with delimited range)




Software-set cells : Controlled by DSetPack



- Whenever the content of a cell is irrelevant to the current context, then the cell is locked (no data entry possible).

- **Re-sizing the editor table**


Re-sizing rows:

- Position the pointer on the bottom border of any cell in the status column (leftmost gray column). The pointer shape then looks like this: 
- Using the left mouse button, drag the pointer downward to increase the row height, or upward to decrease it
- Release the mouse button when you get the desired height.

Note that all other rows, if any, in the Editor table, are also resized according to your new setting.

Note also that re-sizing the Editor table rows from any sub-module will also affect the Editor Table of all other modules and sub-modules

Re-sizing a column:

- Move the pointer into the in the header (top gray cell) of the column you want to re-size and position the pointer on the right-hand border of this cell. The pointer shape then looks like this: 
- Using the left mouse button, drag the pointer to the right to enlarge the column, or to the left to narrow it
- Release the mouse button when you obtain the desired width.



- **Editing instructions**

- To move the cursor from cell to cell within the Editor table, use any of the 4 arrow keys. Alternately, you can use the tab key for horizontal forward jump, or the Shift+Tab keys for horizontal backward jump
- The Status column can contain the following symbols:




indicates that a cell is selected somewhere in this row



denotes an editing operation in progress somewhere in a cell of this row



denotes the last row of the Editor table (necessarily an empty row). Unless you have already created the last row possible in the table, this symbol will disappear as soon as you enter a single character anywhere in the row. A new empty row will then be created with this symbol in the first cell.

- The pointer will take the following shape if you move it on any cell (except the top cell) in the Status column:
 which means that you will select the entire row if you then click the left mouse button. This is useful when for example you want to delete a row. In this case you just need to select the row and then depress the Delete key.
- When the definition of a row is finished, simply press the Enter key to stop editing.

Using the Graphic Pane


- In most cases, the Graphic Pane will just display a summary of all the choices you have made in the selected sub-module. For example, the only possible choice in the Mode sub-module of the NAVIGATION module (Working mode: (D)GPS, and Mode: POSITION) will be illustrated as follows in the Graphic Pane:

```
Working Mode : (D)GPS  
Mode         : POSITION
```

- The Graphic Pane can also be used as an input device to define beacons (see page G-27)



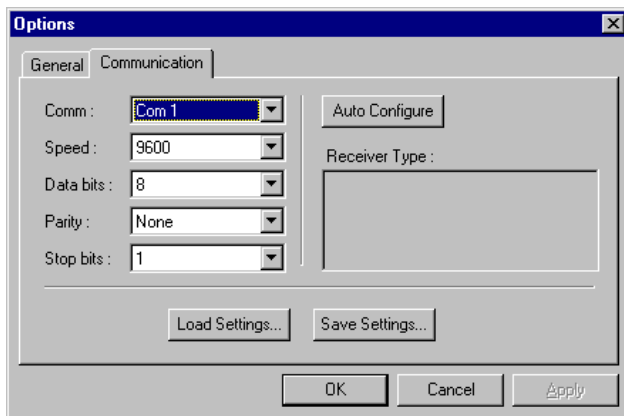
Changing the options of DSetPack

- In the toolbar, click  or from the menu bar, select **Tool** and then **Options**. A dialog box appears in which you can set the options of Dset Pack:

General tab

Timeout : Maximum time allowed for a receiver to send an acknowledge to DSetPack. At the end of this time, if no connection is made, DSetPack will cancel the operation in progress.

Communications tab



- Performs automatic settings of the serial port connected to a DSNP receiver or lets you enter these settings manually (see explanations in the next pages)
- Allows you to save/restore port settings (see explanations in the next pages).

- **Automatic settings**

Assuming a receiver is connected to your computer through a serial port:

- Click the **Auto Configure** button to initiate an automatic search for the Baud rate. Use this button if you are not sure about the Baud rate.

An automatic search for the Baud rate is only allowed with DSNP receivers as this requires that the receiver be capable of returning a consistent reply to a proprietary command.

After choosing **Auto Configure** you can:

- disable the communication by clicking "**Cancel**"
- or, if the identification is successful, close the **Communication Settings** dialog box, by clicking **OK**. This enables communications between the computer and the GPS receiver and allows you to transfer configuration files to the receiver or use any of the functions of WinComm.

- **Manual settings**

- Enter the following communication parameters:
 - Serial port No.
 - Baud rate
 - number of bits per character
 - parity check option
 - number of stop bits
- Click the **OK** button.



- **Saving port settings**

- Click the **Save settings** button. This opens a dialog box that allows you to save the serial port configuration currently enabled so that you can quickly retrieve it at a later date using the **Load Settings** pushbutton.
- In the **File Name** text box, enter a name for the file to which the serial port configuration should be saved (typically with '.set' as extension). Typically, serial port configuration parameters are saved to the 'set' directory.
- Click the **Save** button to save the following communication parameters (Serial port No., Baud rate, Number of bits per character, Parity check option, Number of stop bits)
Clicking **Cancel** would take you back to the **Communication Settings** dialog box without saving any settings.

- **Restoring port settings**

- Click the **Load settings** button. This opens a dialog box that allows you to select any serial port configuration file saved earlier using the **Save Settings** button.
- Click the desired file name in the list box, to select it (typically in the 'set' directory), and click **Open**. As a result the serial port parameters in the **Communication Settings** dialog box are automatically set as specified in the file you selected.
Clicking **Cancel** would take you back to the **Communication Settings** dialog box without loading any settings.

Modifying a configuration file using DSet Pack

Opening/saving/closing a configuration file

To open a configuration file located on the PC:

- Use the **Open** command from the **File** menu.
- Select the desired file and click the **OK** button. The file then opens and you can work on the DGNSS-related section of this file
- Save the changes made to the file using the **Save** command from the **File** menu.

You can create a new configuration file from the active file by using the **Save As** command from the **File** menu. Remember that in this case, you create a complete configuration file, not a file that would contain only the DGNSS-related section of the configuration.

To modify a receiver's configuration file directly from the PC, see page *G-41*, *Sending commands to a receiver*.

To close the active file, select **Close** from the **File** menu. If the file has not been saved yet, DSet Pack will ask you to confirm or reject the changes made before closing the file.

DSet Pack-modifiable modules

This chapter presents the four DGNSS-related modules from a configuration file which you can modify using DSet Pack.





- **DESCRIPTION**

Comment

Free text limited to 30 characters per line; 6 lines max.; a key note for clear identification of the configuration. This sub-module is made available to you for modifications with DSet Pack so that you can later identify the changes made to this configuration with this software.

- **PROCESS**

Reference Position

Precise coordinates of the DGPS reference station, or of the mobile receiver in the case of KART or LRK initialization from this location.

(A single row possible in the Editor table)

Coord. System : Specify the coordinate system in which the reference position is expressed (choose one of the coordinate systems you have defined, or the default one)

Input : Type of coordinates used to express the reference position

Latitude/East./Xgeo : Latitude, Easting or X coordinate of the reference position, depending on the coordinate system used

Longitude/North./Ygeo : Longitude, Northing or Y coordinate of the reference position, depending on the coordinate system used

Altitude/Height /Zgeo : Altitude of the reference position, depending on the coordinate system used

Mode

Process : Position process type (this choice depends on the destination of your receivers)

Reference Station : Configuration file intended for a stationary receiver, associated with a reference station transmitting corrections

Monitoring Station : Configuration file intended for a stationary receiver, associated with a monitoring station

GPS Natural : Configuration file intended for a "pure" GPS receiver (i.e. not including a DGPS correction receiver)

DGPS : Configuration file intended for a GPS receiver capable of receiving and processing DGPS corrections

MDGPS : Configuration file intended for a GPS receiver capable of receiving DGPS corrections and processing MDGPS solutions

EDGPS : Configuration file intended for a GPS receiver capable of receiving KART/LRK data and processing EDGPS solutions

KART/LRK : Configuration file intended for a GPS receiver capable of delivering a KART or LRK position solution with OTF initialization



System : Allows you to select the source of positioning data (GPS + corrections data) needed for the process you have chosen in the **Process** cell (previous cell). The possible options for this cell are also deduced from the selection you have made in the previous cell.

The possible combinations are listed below:

Process	System	Corresponding source of corrections or data
Reference station	GPS Nat	GPS
Monitoring station	GPS Nat	GPS
	DGPS/KART/LRK	GPS + Reference station or NMEA message
	WADGPS	GPS + GEO satellite
GPS Nat	GPS Nat	GPS
DGPS or MDGPS	DGPS/KART/LRK	GPS + Reference station or NMEA message
	WADGPS	GPS + GEO satellite
EDGPS or KART/LRK	DGPS/KART/LRK	GPS + Reference station or NMEA message

Station number(s)

or GEO PRN : Identification number(s) of the reference station used (up to 4 stations) or GEO PRN, according to the selection in the **System** cell

WAAS/EGNOS

Pranges : Allows you to specify the use of pseudoranges from WAAS/EGNOS in the position processing (only consistent with “WADGPS” selection in the **System** cell)

- **NAVIGATION**

Mode

(A single row possible in the Editor table)

Working mode : Specify the type of position solution that should be available for navigation (the possible options depend on the choice you make in the **Process** module, **Mode** sub-module)

Mode : Choose the default Navigation mode which should be used in your receiver(s). "Position" is the only option possible in this version

Waypoint

or Route : (Inactive cell)

Direction : (Inactive cell)

Bearing : (Inactive cell)



- **DGNSS**

Beacons

You can create up to 20 rows in the Editor table. Each row should contain the complete description of a beacon, as defined below:

Beacon ID : Identification number of the beacon

Name : Beacon name

Lat: : Beacon latitude

Long: : Beacon longitude

Band. 1 : Transmission band used

Freq. 1 (Hz) : Carrier frequency

Band. 2 : For future use

Freq. 2 (Hz) : For future use

Range (km) : Estimated beacon range

Baud Rate : Data Transmission baud rate

Modulation : DQPSK (D) or GMSK (G)

Encryption : Yes (corrections encrypted) or No (corrections in plain)

C3 code : C3 encryption code, provided by the beacon's owner. You may not type C3 at this stage, but when later the receiver user wishes to work with that beacon, the receiver will request that code (6 figures).

You can also use the Graphic Pane to define beacons (see page *G-26*)

Mode

You can create up to 3 rows in the Editor table.

In each row, you define the receiver either as a corrections generator (a reference station) or a corrections receiver (a user receiver). You can define one reference station max., and two corrections receivers max.

: Software-set field, identifies the row in the Editor table where this reference station is defined

Port : A, B, C or D

Mode : Reference station (XMTR) or corrections receiver (RCVR)

Beacon ID : Identification of the beacon connected to the reference station (if a reference station) or from which corrections are received (if a user receiver)

Period (XMTR) : Data transmission rate (if a reference station)

Slot (XMTR) : Number of the slot during which corrections are received from the specified beacon (if a user receiver)

Station ID (RCVR) : Number of the reference station connected to the specified beacon

Station ID (RCVR) : Number of other reference station connected to the specified beacon (if there is a second one)

Station ID (RCVR) : Number of other reference station connected to the specified beacon (if there is a third one)



Station ID (RCVR) : Number of other reference station connected to the specified beacon (if there is a fourth one)

NOTE: You can only enter 4 different station ID's over the possible three rows of the Editor table.

DGNSS data

You can create up to 2 rows in the Editor table. Each row should contain the complete description of a DGNSS-data message, as defined below:

: Software-set field, identifies the row in the Editor table where this DGPS-data message is defined

Port : Port on which this DGPS-data message will be available

Output Mode : Event triggering this message:

STOP : Message inhibited (no trigger event)

TIME : Message triggered at regular intervals of time defined in the Rate column

EVENT : Message triggered at every occurrence of the signal chosen from the Rate column

IMMEDIATE : Message triggered on releasing the message output (when changing the On/Off status to ON)

On/Off : Default **message** status when turning on the receiver (ON or OFF)

Rate : In TIME output mode, **Rate** is a factor defining the output rate of the message, expressed in 100 ms units.

In EVENT output mode, **Rate** is a drop-down menu from which you should choose the trigger event (EVT1 or 1PPS). In this mode, the value of output rate will simply result from the occurrence of the chosen trigger event (1 second with 1PPS).

In IMMEDIATE output mode, **Rate** is irrelevant

Format : Type of DGPS data contained in the message:

RTCM_SC104 : RTCM SC104-formatted data

LRK_UHF : DSNP-formatted data transmitted in the UHF band to operate in LRK

KART_UHF : DSNP-formatted data transmitted in the UHF band to operate in KART

SVAR!D : Non-configurable GPS data in ASCII format with field delimiters

USERS_DATA : Data transmitted in a user format





Station Type : Type of the station generating the DGPS corrections contained in the message:

ALL : Any type

UHF : Station transmitting in the UHF band

HF : Station transmitting in the HF band

MF : Station transmitting in the MF band

RTCM numeric : Station transmitting data in the RTCM format

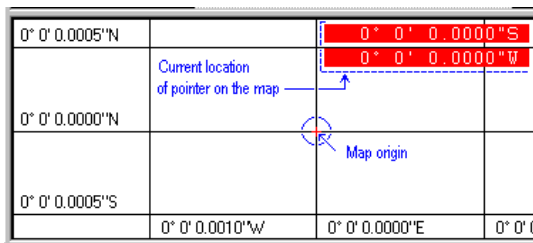
Message Number : Number of the corrections sentence, from the selected type of station, chosen to be part of the message (excluding the others) (for RTCM-SC104 and KART format only).

Defining beacons through a simple click of the mouse

- When you first select the Beacons sub-module (by clicking the corresponding document icon in the Select Pane), the Graphic Pane is changed into a map centered around the point $0^{\circ} 0' 0.000''\text{N} - 0^{\circ} 0' 0.000''\text{E}$ (WGS84 coordinate system used necessarily).

A grid is represented, adapted to the size of the Graphic Pane. The map is magnified with the maximum zoom-in ratio possible.

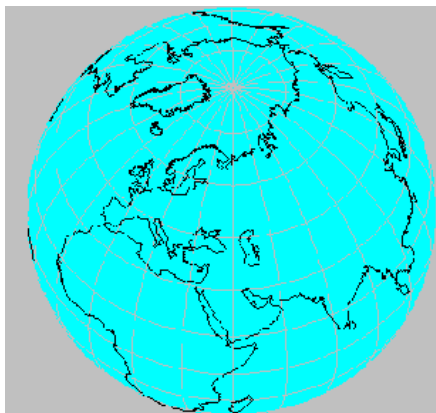
The coordinates of the mouse pointer, as you move it within the pane, are reported in white, with red background, in the upper-right corner of the map.



- A Shortcut menu is available from within this pane through which you can perform the operations described in the next pages.
 - Defining the region where to place your beacons using the World Map editor (see *next page*)
 - Zooming in/out on the map (see page *G-33*)




- Moving the map within the Graphic pane (see page *G-34*)
 - Adjusting the zoom so that all the beacons can be viewed on the map (see page *G-34*)
 - Placing beacons on the map (see page *G-35*)
- **Defining the region where to place your beacons using the World Map editor**
 - Position the mouse pointer anywhere on the Graphic Pane, click the right mouse button to display the Map Shortcut menu and then select the **Region...** command. A new window appears showing the World Map editor.




A Shortcut menu is available from within this pane through which you can perform the operations described in the next pages.

- Rotating the globe




If the current view of the globe does not display the region where you would like to work in, a function is available allowing you to rotate the globe:

- Position the mouse pointer anywhere on the pane of the World Map window.
- Click the right mouse button. The **World Map** shortcut menu pops up.
- Choose the **Grabber** command from this menu. The menu vanishes and the pointer looks like 
- Depress the left mouse button and drag the pointer in the direction where your region is. Note that the globe will rotate only when you release the mouse button. Note also that the rotation angle is defined by the distance covered by the pointer when you drag it.

- Zooming in

- Position the mouse pointer anywhere on the pane of the World Map window.
- Click with the right mouse button. The **World Map** shortcut menu pops up.
- Choose the **Zoom In** command from the menu. As a result the menu vanishes and the pointer looks like .
- Position the pointer somewhere on the region on which you want to zoom in and click with the left mouse button. As a result the window displays a magnified view of the region, centered around the clicked point

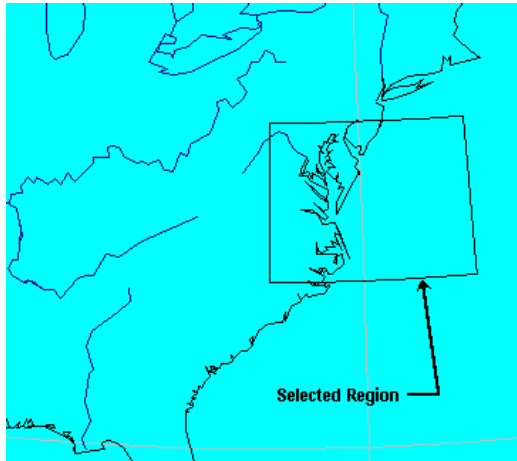


- You can zoom in repeatedly (i.e. so long as the mouse pointer looks like ). Up to 6 successive zoom-in operations are possible from the initial view of the World Map.
- Zooming out
 - Position the mouse pointer anywhere on the pane of the World Map window.
 - Click with the right mouse button. The **World Map** shortcut menu pops up.
 - Choose the **Zoom Out** command from this shortcut menu. As a result the menu vanishes and the pointer looks like .
 - Position the pointer somewhere on the region and click with the left mouse button. As a result the window displays a larger-scale view centered around the clicked point
 - You can zoom out repeatedly (i.e. so long as the mouse pointer looks like ) until you reach the view of the entire globe.
- Selecting a region on the World Map

Assuming the desired region is now visible on the World Map, after rotation and Zoom-in operations, do the following:

 - Choose the **Draw** command from the World Map shortcut menu.

- Drag the mouse button so as to surround the desired region. Release the mouse when you agree with the selection



- Click the **OK** button.
On the Graphic pane which then displays again, note that that the graduations have been updated to comply with your choice.
- Changing the viewing options of the World Map
 - Position the mouse pointer anywhere on the pane of the World Map window.
 - Click with the right mouse button. The **World Map** shortcut menu pops up.



- Choose the **Options** command from this shortcut menu. As a result the Options dialog box appears. The default options are shown below.





Four levels of map resolution are available:



- Low
- Medium
- High
- Very High

The higher the resolution, the more accurate the details on the map... but the longer the time required to display the map.

- **Zooming in**


- Position the mouse pointer anywhere on the Graphic Pane.
- Click with the right mouse button. The shortcut menu pops up.
- Choose the **Zoom In** command from the menu. As a result the menu vanishes and the pointer looks like .
- Position the pointer somewhere on the region on which you want to zoom in and click with the left mouse button. As a result the window displays a magnified view of the region, centered around the clicked point
- You can zoom in repeatedly (i.e. so long as the mouse pointer looks like ).

- **Zooming out**

- Position the mouse pointer anywhere on the Graphic Pane.
- Click with the right mouse button. The shortcut menu pops up.
- Choose the **Zoom Out** command from this shortcut menu. As a result the menu vanishes and the pointer looks like .
- Position the pointer somewhere on the region and click with the left mouse button. As a result the window displays a larger-scale view centered around the region
- You can zoom out repeatedly (i.e. so long as the mouse pointer looks like ).



- **Moving the map within the Graphic pane**

- Position the mouse pointer anywhere on the Graphic Pane.
- Click with the right mouse button. The shortcut menu pops up.
- Choose the **Grabber** command from this shortcut menu. As a result the menu vanishes and the pointer looks like .
- Depress the left mouse button and drag the pointer in the direction where you want the map to be moved. Note that the move will take place only when you release the mouse button and it will be proportional to the distance covered by the pointer when you drag it.

- **Adjusting the zoom so as to see all the beacons**

- Select the **Zoom to Fit** command from the Shortcut menu. This causes the map to be re-adjusted (through a zoom-and-grab operation) so that it can view all the beacons you have defined.
- The **Zoom to Fit** command is executed automatically whenever corrections are made to the Editor table of the **Beacons** sub-module.

• Placing beacons on the map

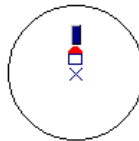
- Position the mouse pointer anywhere on the Graphic Pane.
- Click with the right mouse button. In the shortcut menu which then appears, choose the **Draw** command.

As a result the menu vanishes and the pointer

shape is changed to  .

- Watching the pointer coordinates displayed in the upper-right corner of the Graphic pane, position the pointer where you want a new beacon to be created and click with the left mouse button.

As a result, a beacon is created at this location: a milestone is placed to indicate its location and a default range (20 km) is assigned to it, represented by a circle centered around that location.



What's more, a new row is created at the bottom of the Editor table (Edit Pane) containing the complete definition of that new beacon, expressed in the currently selected coordinate system.

Beacon ID	Name	Lat	Long	Band. 1
0		0° 0'59.9999"N	0° 1'11.2455"E	UHF



- Notes:

- No default name is assigned to a beacon defined graphically. The corresponding field in the Editor table is left blank and a blue rectangle is shown above the milestone in the Graphic Pane (see above). You should therefore enter a name in the corresponding **Name** field (in the Editor table).
- Also, in the same row, you will need to verify/change a number of parameters, such as transmission band, carrier frequency, modulation, encryption, etc., as these parameters are defined with defaults in the case of a beacon defined graphically.
- Subsequent modifications to a beacon defined graphically will be possible only from the corresponding row in the Editor table (and the Graphic Pane will then be updated accordingly).
- Following any correction to the definition of a beacon in the Editor table, the Graphic Pane is refreshed and the **Zoom to Fit** command is executed automatically.
- You cannot delete a beacon if it is involved anywhere in the Mode sub-module (DGNSS module).

Using DSet Pack connected to a DSNP GNSS/GPS receiver

Using one of the serial ports of your computer, DSetPack can connect to a DSNP GNSS/GPS receiver so that you can work on the DGNSS section of its configuration.

Remember however that it's the entire configuration file that you transfer (and not only the DGNSS section) when you perform read or write operations with DSet Pack.

You can also use the integrated version of **Win Comm** to send commands to the receiver or log data from the receiver.

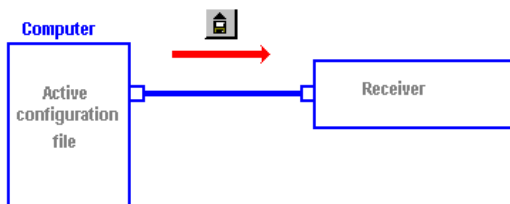
Prior to performing any of these functions, you should configure the PC serial port properly, using the Communications tab in the **Options dialog box**.

Then, and depending on what you intend to do, follow one of the procedures described in the next pages.




Writing a configuration into a receiver

- **Direction of transfer:**



Assuming the receiver is properly connected and the serial line is properly configured:

- Open the configuration file you want to write into the receiver
- In the toolbar, click  or in the menu bar, select the **Transfer** menu and then **Write Initial**

A dialog box appears asking you to confirm the write operation.

- Press the **Yes** button to start writing the active file into the receiver. A dialog box appears asking you to confirm or change the unit number assigned to the attached receiver.

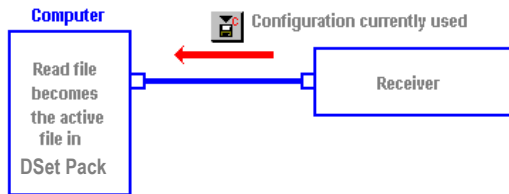
After sending the file, DSet Pack waits for a transfer acknowledgment from the receiver.

If the acknowledge signal is returned in time, then the write operation is considered to be successful (the transferred file is then the receiver's new initial and current configurations).


If no acknowledge signal is received, the write operation is aborted after the user-set time out.

Reading the currently used configuration from a receiver

- **Direction of transfer:**



Assuming the receiver is properly connected and the serial line is properly configured:

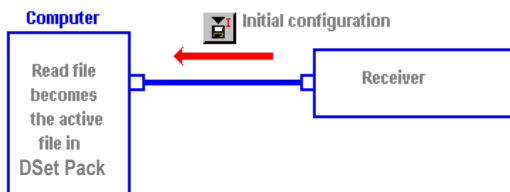
- In the toolbar, click  or in the menu bar, select the **Transfer** menu and then **Read Current**

DSet Pack then starts reading the current configuration file from the receiver. A new window is opened in DSet Pack showing this file (default name: *Confign*).




Reading the initial configuration from a receiver

- **Direction of transfer:**



Assuming the receiver is properly connected and the serial line is properly configured:

- In the toolbar, click  or in the menu bar, select the **Transfer** menu and then **Read Initial**

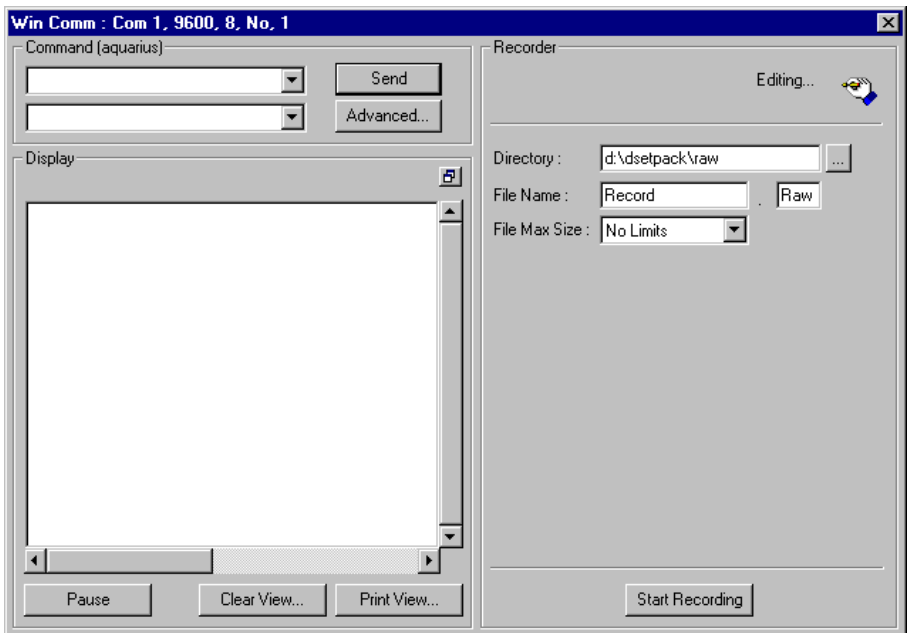
DSet Pack then starts reading the initial configuration file from the receiver. A new window is opened in DSet Pack showing this file (default name: *Confign*).

Sending commands to a receiver

Assuming the receiver is properly connected and the serial line is properly configured:

- In the toolbar, click  or in the menu bar, select the **Tool** menu and then **Win Comm**

A new window appears showing the **Win Comm** dialog box.



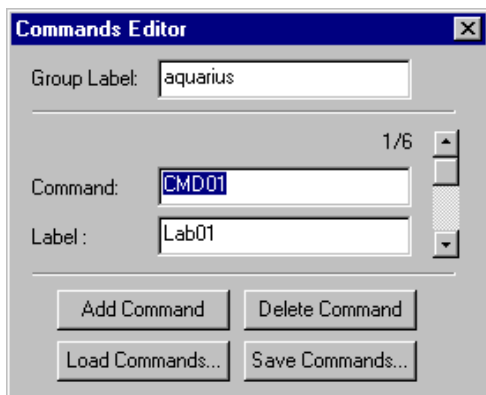
To send a command, use the **Command Pane** (upper-left):

- Directly type the command in the upper combo box, or select it from that combo box, or fill that box by choosing the corresponding label from the lower combo box.
- Click the **Send** button.



- **Adding new commands to the combo box**

- Click the **Advanced** button in the **Command** Pane. The **Commands Editor** dialog box appears allowing you to set up a group of commands interpretable by the connected receiver. The commands you select in this dialog box will be prompted in the main window. (As a result, you will only need to choose the desired command from the list in the main window and click to send the command to the connected receiver).



The buttons in the **Commands Editor** dialog box allow you to load any command-group file available, make any change to the group and save your own command groups.

The selected command group will be available in the main window after you close the **Commands Editor** dialog box (by clicking in the upper-right corner).

- **Using the Commands Editor dialog box**

Group Label : Text box used to enter and/or view the name given to a command group. For example, this name can suggest the type of receiver connected when this command group should be used.

Command : Text box used to enter and/or view each command script. Use the associated scrollbar to browse through the list of available commands.


Label : Text box used to enter and/or view a plain label for each command script. Use the associated scrollbar to browse through the list of available commands.

Add command : Adds the command viewed in the text box to the list of available commands.

Delete command : Removes the command viewed in the text box from the list of available commands.

Load commands : Opens a dialog box that allows you to choose the appropriate command group file for the connected receiver so that the command group becomes available in the main window after you close the Commands Editor dialog box.


Save commands : Opens a dialog box that allows you to save your own command group (as viewed in the Commands Editor dialog box) (cmd extension).

- Click  to close the Commands Editor dialog box. This loads the selected command group to the main window.



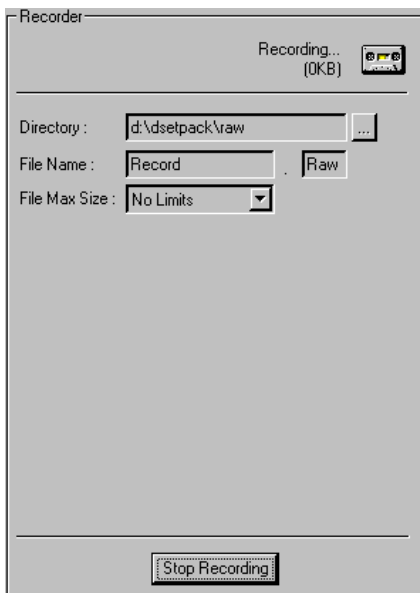
- **Logging data sent by the receiver**

Assuming the receiver is properly connected and the serial line is properly configured:

- In the toolbar, click  or in the menu bar, select the **Tool** menu and then **Win Comm**

A new window appears showing the **Win Comm** dialog box.

Unless the options shown in the **Recorder** Pane are incorrect, simply click the **Start/Stop Recording** button (lower-right corner) to start and stop the recording manually.



- **Changing the options in the Recorder Pane**

Directory : Used to specify the directory to which you wish to record the data from the receiver. Clicking the button to the right opens a dialog box that allows you to navigate through the directory tree on your hard disk or a floppy disk, and select the desired destination directory.

File Name : Used to specify the name of the file to which you wish to record the data from the receiver.

Unless a maximum size is selected for the file, you are also allowed to enter an extension into the associated box.

File Max Size : Used to specify whether a single file should be created on the disk (No Limits option) or the file should be split into 0.7 MB or 1.4 MB segments (with a view to storing it to floppy disks).

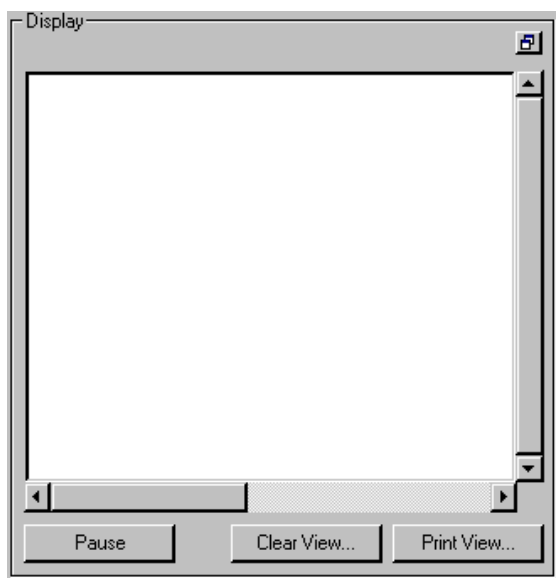
If you elect to split the file into segments, then the system will automatically add 001 as extension to the name of the first segment. This will automatically be incremented for each file segment generated, if the file exceeds the **File Max Size** selected.




Start Recording : Causes the data to be recorded to the specified file until you click the button again. (The label of the button changes from Start Recording to Stop Recording).



- **Display Pane / Window**

After communication is enabled between the computer and a GPS receiver the **Display** pane allows you to view the data stream on the receiver port, including data output in response to any command generated by **Win Comm**.



If you wish to enlarge the **Display** pane, click  in this pane (top right). This causes the pane to be transformed into a separate window which you can move/re-size using the usual commands assigned to windows in the Windows95 environment. To restore the Display pane at the initial location, click  or  (top right).

As the data may be refreshed every 0.1 seconds, it is not possible to log all that is relayed through the port so that it can be displayed at a later date, or this would require a huge memory size. For that reason, only the latest 100 data lines are stored and can be viewed using the vertical scroll bar available.

Each data line ends with a CR LF code and/or when it reaches the maximum length (90 characters).

The Display pane contains the following buttons:

Pause : Freezes the Display pane and changes the label of the button to **Resume**.

Pressing the **Pause** button does not suspend the data flow on the receiver port or the recording in progress.

Pressing this button again (now changed to a **Resume** button) will re-activate the Display pane.



Clear View... : Deletes any data displayed in the Display pane / window.

Print View... : Opens a Print dialog box that allows you to print any data displayed in the Display pane / window.



Copying all the data from an open configuration file to another open file

Assuming the two configuration files are open, do the following:

- Click the left mouse button anywhere within the Select Pane of the source file
- In the toolbar, click 
- Move the mouse pointer to the Select Pane of the target file and click the left mouse button anywhere within this pane
- In the toolbar, click . A message box appears asking you to confirm the copy operation.
- Click the **Yes** button if you really want to overwrite the entire target file with the data from the source file.

Viewing the resulting configuration file

- Click the left mouse button anywhere within the Select Pane.

- In the toolbar, click  or

from the menu bar, select **File** and then **Print Preview**.

The preview shows the current content of the configuration file (a list of command lines interpretable by DSNP GPS receivers), including the DGNSS-related commands defined with DSetPack.

Example (partial view):

```
$PDAS.CONFIG,BEGIN,59
$PDAS.COMMENT,2,1,NR302K DEFAULT CONFIGURATION
$PDAS.COMMENT,2,2,BY PATRICE BONNIN
$PDAS.GEO,5,1,,
$PDAS.GEO,5,2,1,NTF
$PDAS.GEO,5,3,3,5378249.145,1/F,293.465000000,S,1.000000000,1
$PDAS.GEO,5,4,Dx,-168.000,Dy,-72.000,Dz,318.500,1
$PDAS.GEO,5,5,Sx,0.000000,Sy,0.000000,Sz,0.554000,e
$PDAS.GEO,5,5,00,LGH NTF
$PDAS.GEO,8,1,,
$PDAS.GEO,8,2,2,NTF
$PDAS.GEO,8,3,3,5378249.145,1/F,293.465000000,S,1.000000000,1
$PDAS.GEO,8,4,Dx,-168.000,Dy,-72.000,Dz,318.500,1
$PDAS.GEO,8,5,Sx,0.000000,Sy,0.000000,Sz,0.554000,e
$PDAS.EOF 8 5 00 1 INTERPT 1
```

How to quit DSet Pack

- From the menu bar, select **File** and then **Exit**. Unless an unsaved configuration is still open, this causes the DSetPack main window to be closed immediately.

If one or more unsaved configurations are still open in the DSetPack window, warning messages appear successively for each of these configurations asking you to save the last changes made to the file before quitting DSetPack. Click the **Yes** button to save the last changes made, or the **No** button to discard them.



A review of the DSet Pack commands

File menu commands

The File menu offers the following commands:

- Open..** Opens an existing configuration file
- Close** Closes the active configuration file
- Save** Saves the active configuration file. Although you can only work on the DGNSS section of a configuration file, it's the entire configuration that you save when you use this command
- Save As...** Saves the active configuration as a .cfg file, or a .txt file. Although you can only work on the DGNSS section of a configuration file, it's an entire new configuration that you create when you use this command
- Print...** Prints the content of the currently active pane. If the Select Pane is active, then the configuration file as such is printed (i.e. a list of receiver-interpretable command lines)
- Print Preview** Displays the content of the currently active pane as it would appear printed. If the Select Pane is active, then the configuration file as such is displayed (i.e. a list of receiver-interpretable command lines)
- Print Setup...** Selects a printer and printer connection

- {File list}** Names of the configuration files last opened using DSetPack
- Exit** Exits DSetPack

Edit menu commands

The Edit menu offers the following commands:

- Cut** Moves the current selection to the clipboard
- Copy** Copies the current selection to the clipboard
- Paste** Pastes the clipboard content where the insertion point is positioned

View menu commands

The View menu offers the following commands:

- Toolbar** Shows/hides the toolbar
- Status bar** Shows/hides the status bar

Transfer menu commands

The **Transfer** menu offers the following commands:

- Read Current** Reads the current configuration file from the attached receiver
- Read Initial** Reads the initial configuration file from the attached receiver
- Write Initial** Writes an initial configuration into the attached receiver



Tools menu

The Tools menu offers the following commands:

- | | |
|-----------------|--|
| Win Comm | Starts the Win Comm software module |
| Options | Allows you to display/change the options of DSetPack |

Window menu

The Window menu offers the following commands:

- | | |
|--------------------------|--|
| Cascade | Arranges all the open windows in cascade configuration |
| Tile Horizontally | Places all the open windows side by side in the horizontal direction |
| Tile Vertically | Places all the open windows side by side, in the vertical direction |
| Close All | Closes all the open configuration files |
| {File list} | The names of the currently open configurations are listed here to let the user choose the active configuration directly from this menu |

Help menu

The Help menu offers the following commands, which provide you assistance with this application:

- | | |
|--------------------------|---|
| Contents | Displays the opening screen of Help |
| Using Help | Displays instructions for using Help |
| About DSetPack... | Displays the version number of DSetPack ♣ |

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