NR203

Multi-Differential

GPS Receiver

User's Manual

Software version : V4.1

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The information in this manual is believed to be accurate and reliable. However, DSNP reserves the right to make changes to its products or specifications at any time, without notice, in order to improve design or performance and to supply the best possible product.

CONTENTS

WARNING

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 judgement.
The NR203 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.

NOTICE

DSNP DGPS receivers can use the correction signals broadcast by the long-range DGPS stations installed by DSNP on the French territory.

So long as no broadcasts by radio-positioning systems are taxed in this country, DSNP can offer its customers free access to the corrections provided by those stations.

However if French regulations changed in the future, to impose taxation on radiopositioning transmissions, DSNP would reserve the right to pass on the resulting financial expenses to the users working with those stations.


NR203
INTEGRATED
MULTI DIFFERENTIAL
GPS RECEIVER
47°16.08251 N
1°29.39171 W
345° H 50.4m
0.7% + 0.0%
MADE IN FRANCE

1 - INTRODUCTION

1-1 ABOUT THE NR203 RECEIVER

Multidifferential

All-in-view real-time survey receiver, the NR203 integrates a powerful multi-frequency, multi-station correction receiver capable of processing differential messages from a variety of sources :

- DSNP NDS200 HF Station
- DSNP NDS100 UHF Station
- IALA Radiobeacon
- Any RTCM 104 compatible DGPS system

The corrections are subsequently used to compute either KART and EDGPS positions (when phase data are available) or up to 4 single station solutions (when only PRCs available) then mixed in an optimized multistation DGPS solution. Thus, in any case the NR203 gives the user the best possible position with the highest degree of reliability.

The most advanced and powerful real-time survey receiver available.

The NR203 is based on DSNP latest high-performance 15-channel GPS core and is fully compatible with industry standards (RTCM, UKOOA, etc.). It makes use of sophisticated statistical testing and quality control procedures to guarantee the reliability of results. Furthermore, it delivers high-rate raw GPS data and includes advanced facilities including a 1 pps output, and 3 event trigger inputs. A fully programmable serial interface able to accommodate virtually all industry standard protocols as well as non-standard user-specific requirements is also included to guarantee a smooth integration into the user's working environment.

1-2 ABOUT DSNP'S DIFFERENTIAL GPS

DSNP's Differential GPS provides :

- Centimetric to metric accuracy according to the processing mode,
- Optimal correction messages for high-accuracy navigation,
- A coherent line of transmitters and receivers,
- Numerous Differential transmitting stations worldwide.

The absolute positioning accuracy as well as the excellent repeatability of the system are continually afforded whether the SA (*Selective Availability* under the control of the US Department of Defense) is activated or not.

One should remember that in the presence of SA, most non-Differential GPS receivers provide poor results (position accuracy no better than 100 to 500 metres, speed accuracy from 1 to 2 knots), which makes those receivers inefficient in most applications on continental shelves.

Naturally, differential corrections are not available everywhere on the Earth's surface. However, with its 15 *true* parallel channels capable of processing the complete set of GPS data, your receiver, in Straight GPS mode, keeps up with the best competitors on the market.

1-3 ABOUT THIS MANUAL

The present manual includes two major chapters :

- Chapter 2 takes you to the standard navigation display in just one step : pressing the ON/OFF key. The standard navigation display provides basic navigation data (position, course, speed, quality figure) which are continually visible on the screen (even when other navigation functions are being used).
- Chapter 3 teaches you how to use the available navigation functions (HOMING, ROUTES) and auxiliary functions.

These two chapters are summarized in the User's Quick Guide accompanying this manual.

Appendices provide general support information in connection with the use of your receiver :

-Installation,

-Connection to a peripheral,

-The Differential technique,

-Datum's,

-receiver specifications, etc.

Conventions used in this manual

The following symbols are used to represent the arrow keys :

[↑] for 

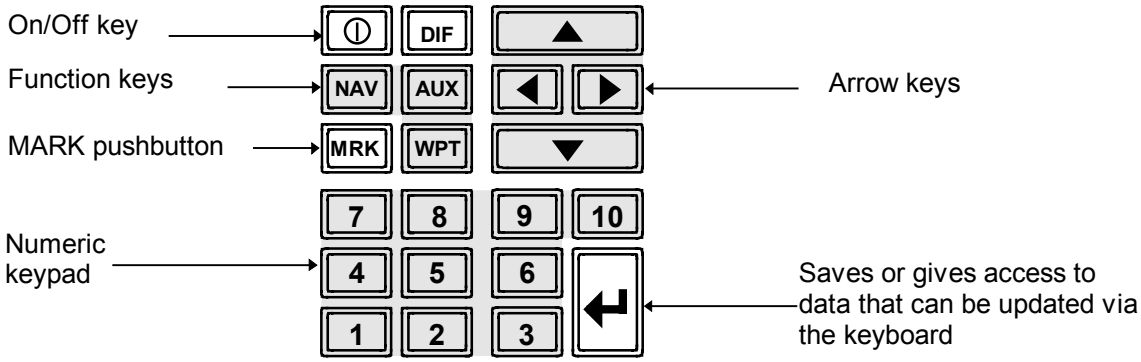
[←] for 

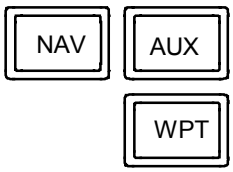
[↵] for 

[↓] for 

[→] for 

1-4 HOW TO USE THE KEYBOARD





Pressing a function key causes a specific menu to show up in the lower part of the screen.

KEYS	WHEN THE CURSOR RESTS :	
	on a menu at the bottom of the screen	**on a character or option that you are allowed to update ("[↵] Valid" is prompted)**
◀ ▶	Move the cursor horizontally within the menu	Move the cursor to the next characters or options that you are allowed to update
▲ ▼	Scroll through the display pages	Scroll through the possible values for a character or option. Possible values for an alphanumeric character are : - figures from 0 to 9 - upper-case letters A to Z - characters + - .*/ : and "space".
7 STU, 8 VWY, 9 YZ_, 0 4 JKL, 5 MNO, 6 PQR 1 ABC, 2 DEF, 3 GHI	Direct choice within a menu. The **[0]** key may act as an EXIT key, taking you back to the previous menu or step	Entry of a permitted numeral if the cursor rests on a character entry field. Entry of a letter (1 of 3) within an alphanumeric field.

How to select a menu

In the procedures described throughout this manual, you will be required to press a function key ([NAV] or [AUX] or [WPT]) and to ***select*** a menu.

- For example, if you are required to :

  *Press **[AUX]** and select "**5**-Init" then "**2**-Position".*

  You only need to press [**AUX**] then [**5**] then [**2**].

  The direct method above allows you to rapidly access any menu (or submenu).

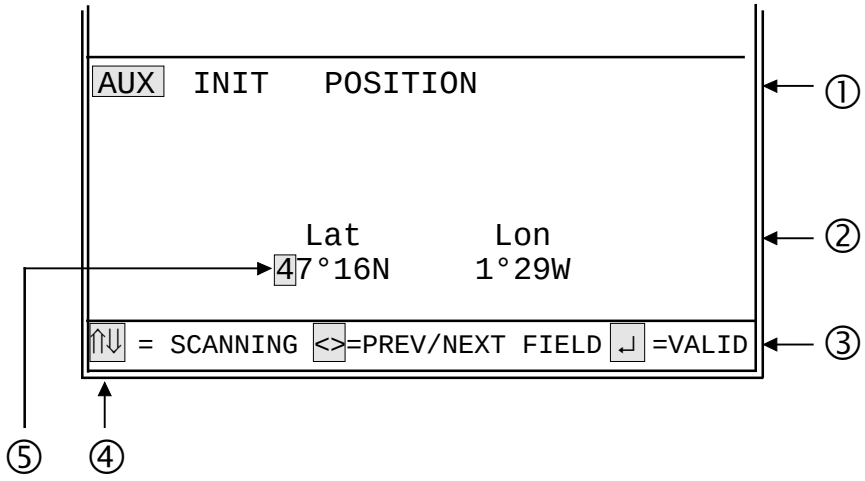
- The cursor may be prepositioned on the field you are most likely to wish to change. In that case you only need to press [↵] to select the highlighted choice number, or press the desired key to select another choice number (you may also use [→] or [←] to move the cursor to the desired choice number then press [↵]).

Depending on the context, the two equivalent procedures :

- take you to a submenu or a display
- or cause the immediate performance of an action
- or take you to fields and/or options that you are allowed to update.

After selecting a menu or submenu

Example :After pressing [**AUX**] then [**5**] then [**2**], you should get the following screen :



① Current menu selection steps

② Current values in memory

③ The bottom row on the screen will be used for any of the following purposes :

- simply displaying information
- or displaying a menu (with a cursor)
- or displaying the highlighted prompt "↵ ***Update***" meaning that you only need to press [↵] to access entry fields that will allow you to make changes to some data.
- or displaying the highlighted prompt "↵ ***Valid***" meaning that you are allowed to update some parameters and/or options. The cursor automatically shows up on the first character or entry field you are allowed to update : use the [→] or [←] arrow key to move the cursor to the desired character or entry field, and make the necessary changes, then press [↵] to save the new values or options.

④ Whenever the data to be displayed are in the form of a list (with two or more pages) you may scroll through the list, using [↓] and [↑].

⑤ For each entry field, you can enter only authorized characters. The value typed on the keyboard is tested as you press [↵]. If it is inconsistent, then the cursor keeps blinking on the first suspect character until you type an authorized value or you leave the entry field by pressing any function key. (An error message appears, self-explanatory in some cases, which disappears as you next press any key).

NOTE : *In an alphanumeric field, you may use the numeric keys rather than* [↑] *or* [↓] *to enter the desired letters.*
Example, pressing :

[1] will enter "1"
[1] [1] will enter "A"
[1] [1] [1] will enter "B"
[1] [1] [1] [1] will enter "C"
[1] [1] [1] [1] [1] will enter "1" and so on ...

NOTICE

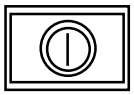
Whenever you wish to terminate the step in progress, simply press any function key.

Pressing the [0] key allows you to quit some dialog screens (unless a numeric entry field is selected). This takes you back to the screen that initiated the dialog.

Pressing the [0] key also allows you to move up one step in any menu.

2 - STANDARD NAVIGATION

- Your receiver is very easy to use : simply press the ON/OFF key...



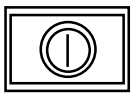
...and that's all ! All the parameters required at power-up (position last computed, selection of a Differential GPS station, etc.) were saved to the non-volatile memory when the receiver was last turned off.

In most cases, you will not need to care about those parameters when you turn it back on.

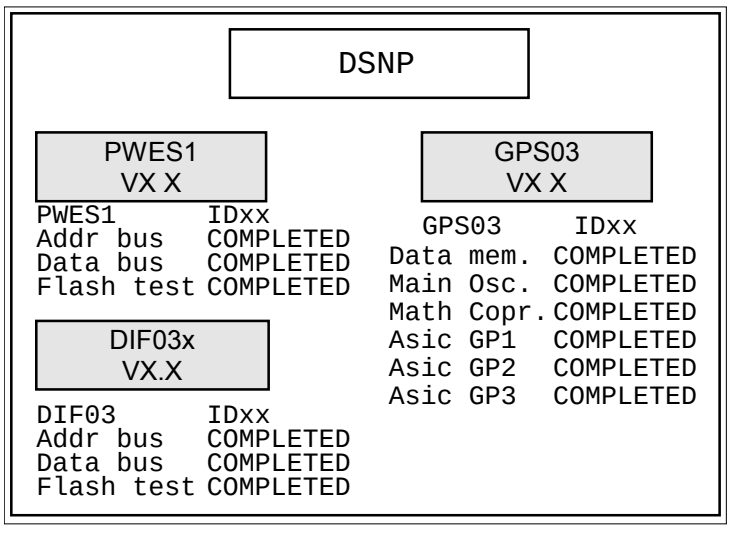
Furthermore, the date and time, continually updated during power outages, are available straight away at power-up.

2-1 THE STANDARD NAVIGATION DISPLAY

- To turn on the receiver, briefly press the ON/OFF key (top left key in the keypad).

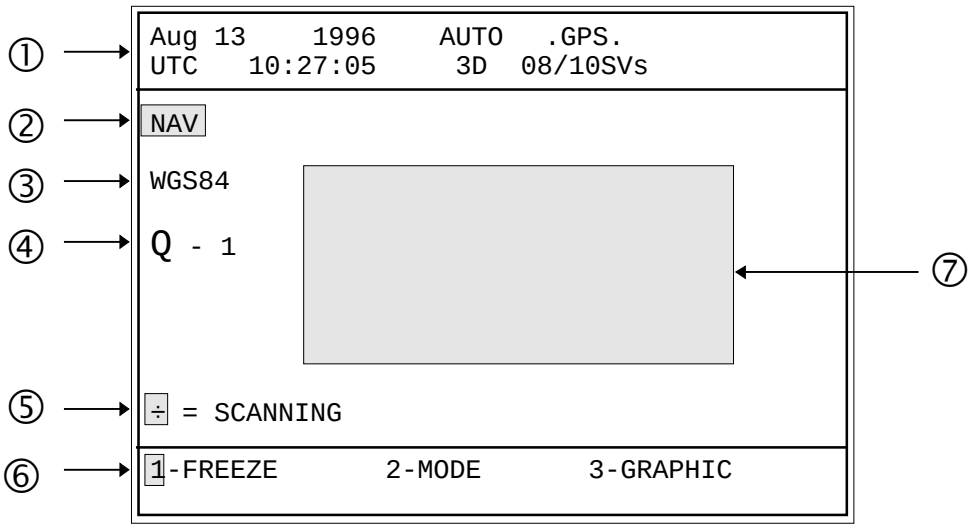


The receiver automatically runs its power-on self-test and retrieves the parameter settings saved when it was last turned off.



When self-test is complete, the receiver automatically selects the standard navigation display (providing the data helpful to most navigators most of the time).

At power-up, the standard display shows the latest position computed when the receiver was last turned off, as in the example below.



① Abridged status area (see details below)

② Tells you which function is selected

③ Tells you which Datum or geodetic system is currently used

④ Fix Quality figure (0 to 9 for DGPS ; 10 to 19 for KART)

⑤ Appears if two or more screenfuls are available

⑥ Menu area (depends on the function selected)

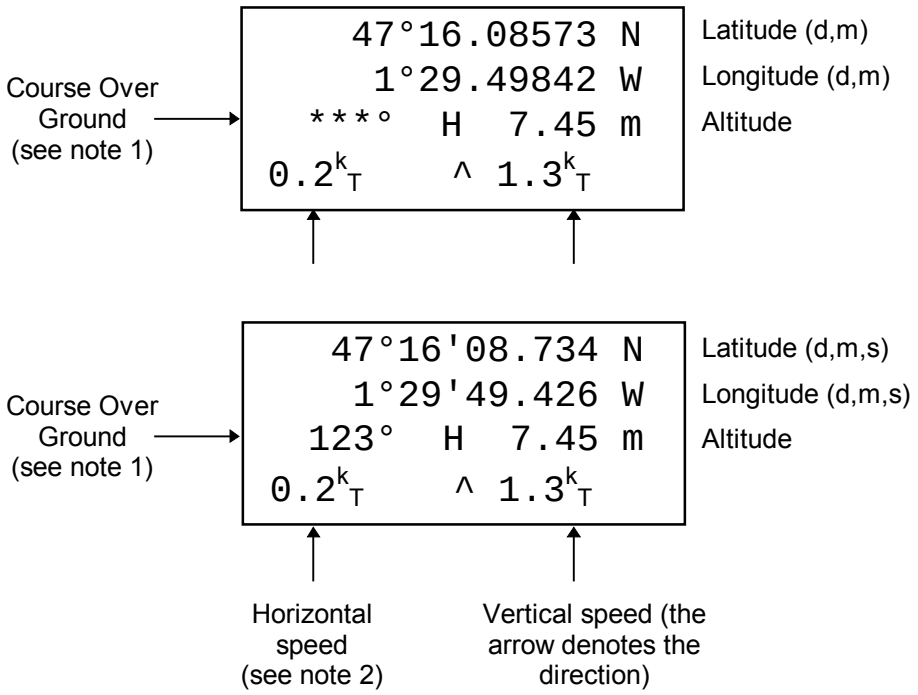
⑦ Large-size navigation display area (see details below).

Large-size navigation display area

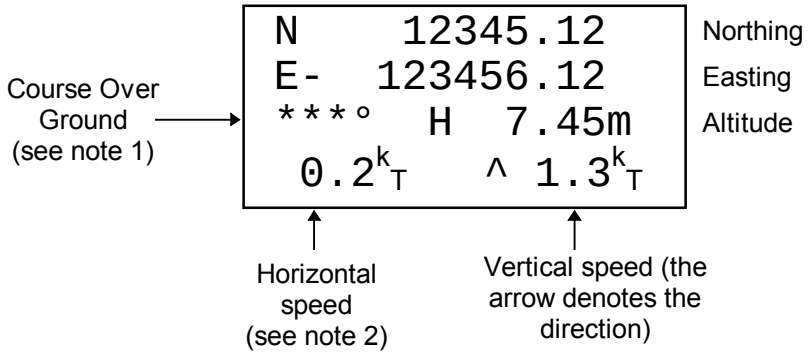
Depending on the geodetic system selected (AUX→5→4), either Latitude/Longitude or Northing/Easting coordinates may be displayed.

- **Latitude/Longitude**

  Depending on the units selected (AUX→5→6), either a ***degrees, minutes*** or ***degrees, minutes, seconds*** format may be used to display the Latitude and Longitude.



- **Northing/Easting**



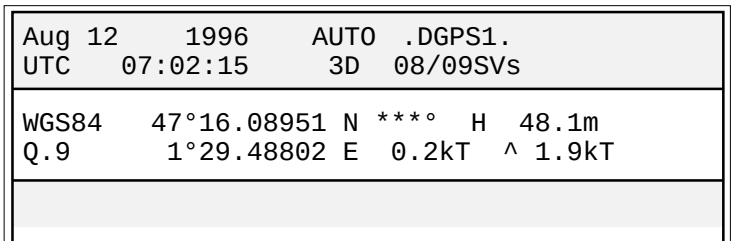
NOTE 1 : *** is displayed if the COG is inconsistent (if the speed is zero or near zero).

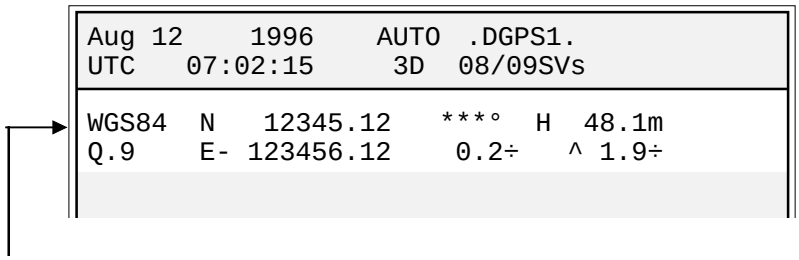
NOTE 2 : Depending on the unit selected (AUX → 5 → 6) the speed may be expressed in :

knots (kT)
metres/second (m/s)
kilometres/hour (k/h)

NOTE 3 : Selecting FREEZE prevents the display from being refreshed for about 10 seconds.

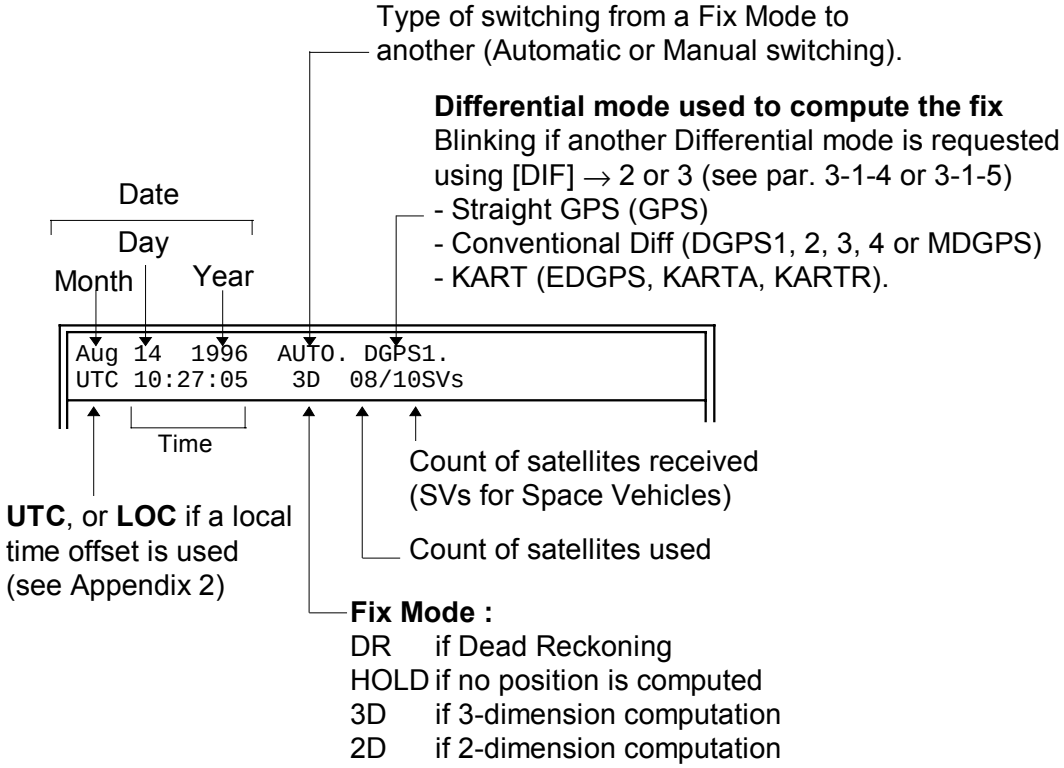
The navigation display data are continually visible, either occupying the large-size navigation display area or shrunk in the upper part (under the abridged status area).





Shrunk navigation display data (whenever a function other than the standard navigation display is used).

Abridged status area



NOTE : *"FRZ" or "MRK" appears in the upper right corner (displayed for about 10 seconds after selecting **FREEZE** in the **NAV**igation menu or pressing **MRK** on the keypad).*

- Naturally, at power-up no satellite is locked on, so the count remains at "0" but at the end of 1 to 2 minutes, the count increases (1, 2...) up to a maximum of 15 SVs. The receiver processes the 15 best usable satellites concurrently and completely.

At the end of 3 to 4 minutes :

- The blinking "HOLD" indicator vanishes (replaced by the Fixing Mode : 2D or 3D),
- The speed is computed and displayed (along with the Course Over Ground),
- The position is computed and updated,
- Finally, within an area covered by Differential GPS stations and depending on the count of SVs received and on the way they are received, the Differential mode used is displayed (if no Differential station is received or the reception level is too weak, whereas the Differential mode is activated, the Differential mode indicator is blinking).

If no fix is obtained after 15 minutes of operation, the "Search in sky" process is started during which the receiver tries to track all the known satellites, in succession, until a position solution can be obtained.

- Depending on the configuration of your receiver, one or more navigation displays are available (standard display and other displays ; see chapter 3 for more details).

  In the case of several displays available, use the [↑] and [↓] keys to scroll through the different displays.

- During this very simple procedure (simply pressing the ON/OFF key), special cases may arise that require a few more actions of an operator :

  - entering an initial estimate (see par. 2-2)

  - entering the date and time (see Appendix 2).

  - selecting another Differential station, or changing the fixing mode or Differential mode (see Chapter 3).

NOTES *:*

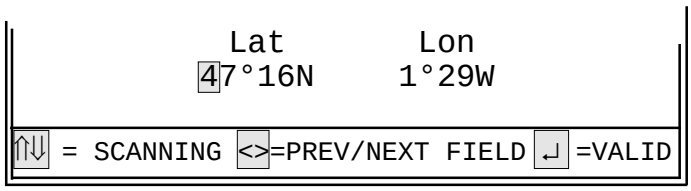
- *The keypad is tested at power-on if you press any key after pressing the ON/OFF key.*
- *The default GPS and DIF configuration parameters are restored at power-on if you press the ↵ key and hold it depressed during the power-on sequence until the DSNP logo re-appears.*

2-2 HOW TO ENTER AN INITIAL ESTIMATE

Entering an initial estimate may be helpful if the ship has moved more than 1° in latitude or longitude since the receiver was last turned off. This will substantially shorten the time required for the receiver to lock on satellites and compute the first fix.

The initial estimate entry procedure is as follows :

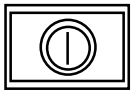
- After turning on the receiver, wait for the Standard Navigation Display to show up.
- Press **[AUX]** and select the initialization menu **(5-Init)**. For detailed information on how to use the keyboard, see par. 1-4.
- Select the submenu **"2-Position"** This causes the latest computed position to show up in the bottom row.



- Enter the estimated latitude and longitude (or Northing and Easting).
- Check the coordinates keyed in, then press **[↵]** to validate your entry. This completes the entry procedure.
- To call back the previous navigation display, press [NAV] again.

2-3 HOW TO TURN OFF THE RECEIVER

- To turn off the receiver, hold down the ON/OFF key



until the screen becomes blank (about 2 seconds), then release the key : the receiver is off.

This completes the few actions required to operate the receiver for standard navigation.

The next chapter is intended for users who wish to take advantage of all the advanced functions provided by the receiver.

3 - HOW TO USE ALL ADVANCED FUNCTIONS

The operator is assumed to be familiar with the few actions required to operate the receiver for ordinary navigation (described in Chapter 2).

As a reminder, the only steps to be taken, unless you wish to change something in the parameters displayed, are :

- turning the receiver on or off,
- entering an initial estimate (exceptionally),
- selecting a navigation display.

The present chapter provides detailed information on the following functions :

- Differential GPS
- Navigation modes and corresponding screens
- Auxiliary functions (purpose and operating instructions).

NOTICE

For detailed information on how to use the keyboard, see par. 1-4.

Installation instructions, mostly intended for the persons in charge of setting up and servicing the equipment, are provided in Appendix 1.

3-1 THE DIFFERENTIAL MODE

Your receiver has been configured to receive the Differential GPS (DGPS) stations covering your region. (The theory of operation of Differential GPS is explained in Appendix 4).

3-1-1 Introduction

This paragraph introduces the few key points and definitions required to understand all the capabilities offered by your receiver to operate in Differential mode.

- Differential corrections may be input to the receiver through a radio link or a serial wireline.

  - **Radio link**

    Corrections broadcasted in the HF band (DSNP format) or in the MF band (RTCM format) — received through the WIDE BAND (or NARROW BAND) antenna connector — are input to four analog channels.

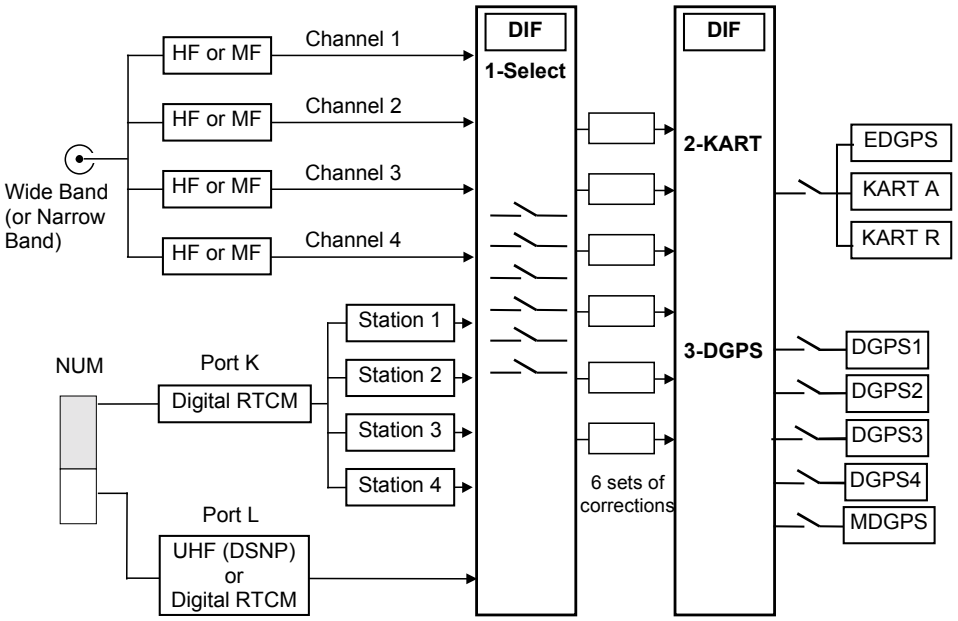
    If an NDR104 UHF receiver is used — optional, on the NUM connector — corrections received in the UHF band (DSNP or RTCM format) may also be available.

  - **Serial line**

    If an auxiliary receiver is used — connected to the NUM connector — providing digital RTCM 104 corrections, four sets of corrections may be available (from four distinct DGPS stations).

By pressing the ***DIF*** key and selecting ***1-Select***, you can assign DGPS stations to your receiver's reception channels thus allowing the processing of up to 6 sets of corrections.

By pressing the ***DIF*** key and selecting ***2-KART*** or ***3-DGPS***, you can choose the desired Differential mode. From the available processed corrections (up to 6 sets) you can generate up to four DGPS positions, and an MDGPS position (weighted mean DGPS position) or a KART position (EDGPS, KART A, KART R). Also, you specify the position to be used in the navigation display.



- The receiver has a non-volatile station library that can hold the specifications of up to 15 stations.

  You can view/change the specifications of the stations in the library or enter new stations (see par. 3-1-6, which also covers the case of encrypted stations).

- When the receiver works with an RTCM station (via the radio channel or a serial port, whichever is used) not only does it receive the expected corrections from the station, but also the specifications (coords, type, frequency, etc.) of nearby stations. You can view the specifications by pressing ***DIF*** and selecting ***4-Stations***. You may want to copy the specifications of one of these stations manually as one of the possible 15 stations saved in the receiver's non-volatile station library, if there is room for one or more non-encrypted stations (see par. 3-1-6).

- At power-on, the receiver automatically selects the stations, Differential mode, Fixing mode that were used when you last turned it off, and automatically starts computing the requested position or positions as soon as the necessary signals are available.

3-1-2 VIEWING THE STATUS OF DGPS STATIONS

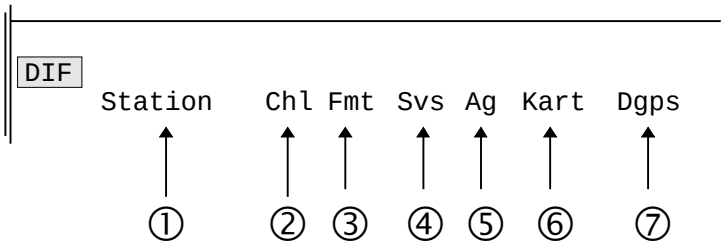
```
Aug 27    1996    AUTO  .DGPS1.
UTC   13:06:38     3D  08/10SVs

WGS84   47°16.08951 N   ***°  H  16.3m
         1°29.48802 E  0.4KT ^  1.4KT

DIF                                          ▲
                                             ▼
     Station   Chl Fmt  Svs  Ag  Kart  Dgps
.........................................
0008 PORSPODER 1+2 SHF   8   10        Used
0012 LA COUBRE 3+4 SHF   9   10        Used
0822 ABERDEEN  N L RTCM  8   10        Reje
0821 SCILLY    N L RTCM  7    8        Avai
0014 BREST     N K SUHF  8   10        Avai

 1-SELECT 2-KART 3-DGPS 4-STATION 5-MSGES
```

Press the ***DIF*** key to view the above screen, showing the status of each DGPS station from which corrections are available.



- Columns ① to ⑤ tell you how corrections are received.
- Columns ⑥ and ⑦ tell you how corrections are used.

① ***Station*** : Number and Label of the station

② ***Chl*** : Identification of the analog channel (No. 1 to 4) or digital channel (NUM port K or L) assigned to the station.

As an HF DSNP station has two transmitting frequencies, two channels may be assigned to such a station (one for each frequency).

③ ***Fmt*** : Format : SHF (DSNP HF)
SUHF (DSNP UHF or RTCM UHF)
RTCM (RTCM 104, MF or numeric)

④ ***SVs*** Count of satellites for which differential corrections are available from the station.

⑤ ***Ag*** Average age of corrections (in seconds)

⑥/⑦ ***Used*** means that corrections from the station are actually used to compute a KART/DGPS position.

Avai means that corrections are available from the station but not requested to compute any KART/DGPS position.

Reje means that corrections from the station are rejected because they do not allow any KART/DGPS position to be computed.

*{**Blank**}* means that corrections are not available from the station but anyway not requested to compute a Kart/DGPS solution.

▸ Pressing [↑] or [↓] displays another screenful showing the status of Differential reception on all four analog channels.

B : Frequency band

Frq : DGPS Station frequency

Sn : Signal-to-Noise ratio

Qu : Quality figure used to appreciate the reception of corrections :

– 1 : station not received

0 : carrier detected but no words detected

1 to 10 : carrier detected and words decoded:

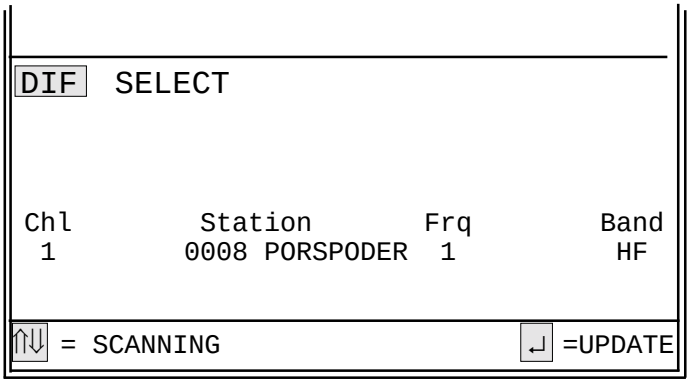
1 to 3 : very poor reception (single-frequency station)

4 to 6 : intermittent reception (single-frequency station)

7 to 10 : good quality reception (single-frequency station)

The time required for the link to be established with a DGPS station is less than 30 seconds (after power-up, and after selection of a new station).

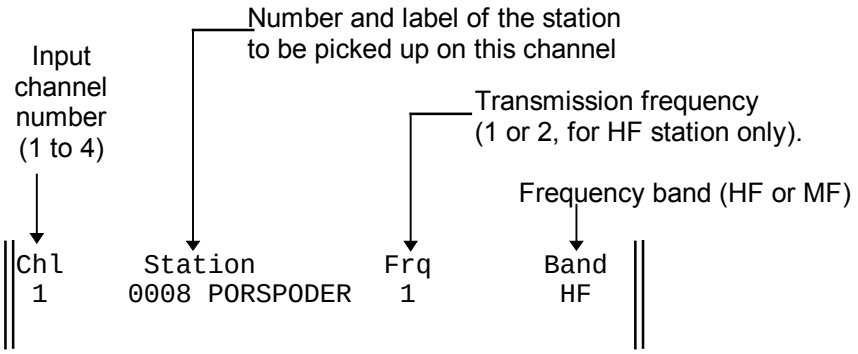
3-1-3 SELECTING DIFFERENTIAL STATIONS



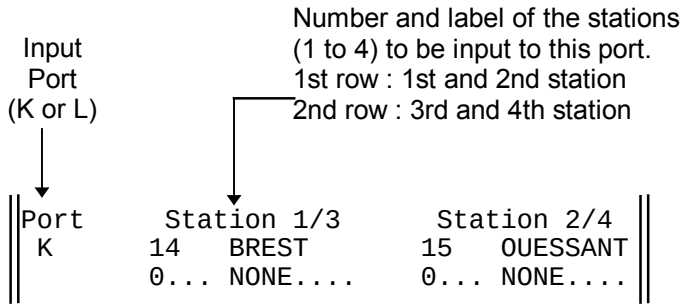
Press the ***DIF*** key and select ***1-SELECT*** to view the above screen.

Use the Up (↑) and Down (↓) arrow keys to view the stations assigned to the four analog channels and the two digital ports, if any.

Analog channels

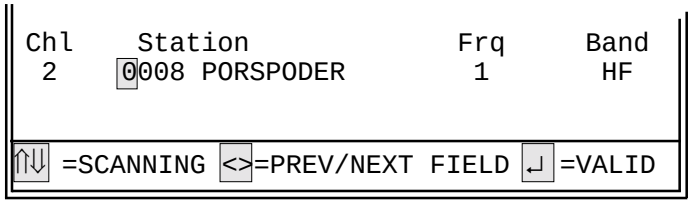


Digital ports (K, L)



To make any changes, scroll through the list until the desired channel or port is displayed and select UPDATE (press [↵]).

Selecting a station on an analog channel



After you select ***UPDATE*** the cursor appears on the first character of the Station Number field. Use the ↓ and ↑ arrow keys to scroll through the available stations. Only the HF or MF stations are prompted (HF or MF stations whose specifications have been saved in the non-volatile library).

....NONE.... is also prompted, to be used if you do not wish to select any station on the channel.

For an HF station, you are allowed to jump to the ***Frq*** (Frequency) field. As HF stations may have two transmission frequencies, you have to specify the frequency (No. 1 or No. 2) to be received on the channel. You will be able to assign the second frequency to another channel.

After selecting the desired station (and frequency, if any) press [↵] to enable your choice.

NOTE 1 *: You cannot select any station that is already assigned to another channel. This is why the following message may show up :*

```
Already used here or on another channel !
```

NOTE 2 *: All selected stations should be in the same frequency band. If one or more stations on another HF or MF band are selected, the following message shows up :*

```
Other(s)  on another band : Confirm ?
1-YES                     2-NO
```

- *Choosing **YES** enables the station you are selecting. As a result, any stations on another band are disabled ("NONE" is assigned to the corresponding channels).*
- *Choosing **NO** cancels your selection and restores the initial assignment.*

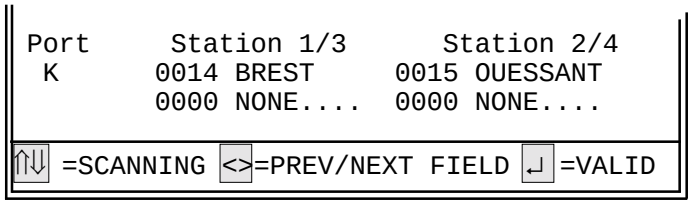
NOTE 3 *A maximum of 6 sets of corrections (whether from analog or from digital channels) can be processed. You are not allowed to add any station if those already selected amount to 6 sets of corrections. In that case, the following message shows up :*

```
More than 6 sets of corrections !
```

- *Cancel your choice (press **DIF**).*
- *Disable one or more stations, to make room for one or more sets of corrections*

  *(choose **1-SELECT**, select a channel or port, press* [↵]*, select "....NONE....", and press* [↵]).
- *Select again the station you wish to add.*

Selecting a station on a digital port



After you select ***UPDATE*** the cursor appears on the first character of the Station Number field. Use the ↓ and ↑ arrow keys to scroll through the available stations.

Use the → and ← arrow keys to jump to another digital channel.

The receiver prompts the UHF or RTCM stations from its station library. It also prompts any additional RTCM station whose corrections are available.

The following options are also prompted :

- ....NONE.... to be used if you do not wish to select any station on the digital channel.

-.... RTCM.... to be used if you wish to enter a station that is absent from the stations library (see the procedure below after the NOTES).

After selecting the desired station or stations, press [↵] to enable your selection.

NOTE 1 *: You cannot select any station that is already assigned to another channel. This is why the following message may show up :*

```
Already used here or on another channel !
```

NOTE 2: *A maximum of 6 sets of corrections (whether from analog or from digital channels) can be processed. You are not allowed to add any station if those already selected amount to 6 sets of corrections. In that case, the following message shows up :*

```
More than 6 sets of corrections !
```

- *Cancel your choice (press **DIF**).*
- *Disable one or more stations, to make room for one or more sets of corrections*

  *(choose **1-SELECT**, select a channel or port, press* [↵]*, select "....NONE....", and press* [↵]).
- *Select again the station you wish to add.*

NOTE 3 *: On each digital port, you should not mix UHF and RTCM stations.*

NOTE 4 *: At high input rate, synchronizing the RTCM data flow causes heavy processing load. In order to guarantee correct operation of the whole DGPS acquisition, it is recommended to observe the following rules:*

1 *– Do not feed the NR203 digital ports with DGPS data that are not in UHF DSNP format or RTCM (6 of 8) numeric format.*

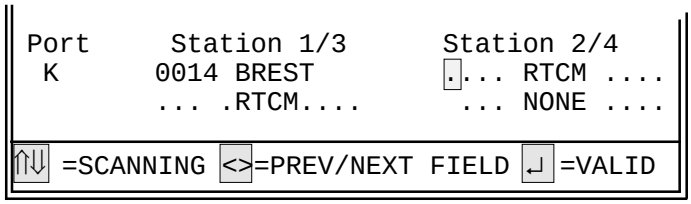
2 *– Do not feed the NR203 digital ports with data that use transmission characteristics (baud rate, parity, etc.) different from those programmed on its serial ports K and L. In addition, do not use baud rates greater than 9600 Bd.*

3 *– If demodulators are used to deliver several corrections sets (this may be a satellite-system demodulator or any other demodulator), please limit the number of corrections sets available at the demodulator output to those really useful in the working area.*

Entering an RTCM station number

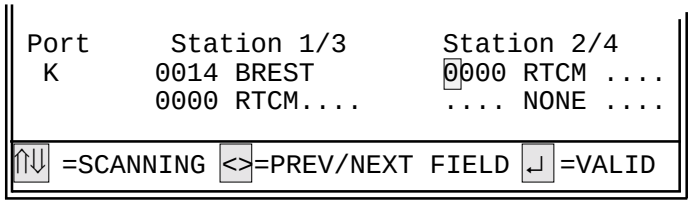
When you select stations on a serial port you may choose the **.... RTCM ....** option to reserve a blank field for an RTCM station (see above).

Example :



In this example the first station was selected from the station library (whether saved in non-volatile memory or received). The 2nd and 3rd station fields are available for you to enter the number of an RTCM station that is not listed in the library. The 4th station field is not to be assigned to any station.

Pressing ↵ again allows you to access the blank RTCM station number entry fields. The cursor appears on the first blank RTCM field.



Enter the desired RTCM station number (0000 to 1023), using the numeric keypad.

Press ↵ to enable your selection.

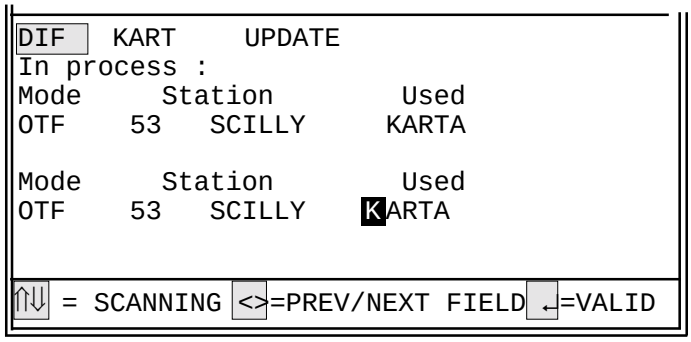
***NOTE** : On each digital port, you should not mix UHF and RTCM stations.*

3-1-4 KART PROCESSING *(DIF 2-KART)*

If corrections including phase corrections are available (from a DSNP UHF station), your NR203 is capable of computing a KART position (see Appendix 4 for details).

View current settings →

Change current settings →



- Pressing the ***DIF*** key and selecting ***2-KART*** displays the above screen that allows you to view and set parameters for the KART processing :
  - KART initialization mode (or EDGPS). If "NONE" is displayed for the current mode, this means that the receiver does not use the KART technique. Either the straight GPS or DGPS mode is used.
  - Station to be used (selection from the available sets of Differential measurements).
  - KART position to be used for navigation (selection from three KART positions computed in different ways).
- The cursor automatically appears on the "Used" field. Use the arrow keys to go to the desired field and make the necessary changes, and press [↵]. This enables the new settings and triggers an initialization sequence If the cursor is on "Mode" field.

Used : allows you to specify the computed position which is to be used for the navigation display :
EDGPS or KARTA or KARTR
(see Appendix 4)

If the initialization Mode field is set at EDGPS you cannot choose KARTA or KARTR.

Station : prompts the first UHF station received or the latest used. Use ↑ or ↓ to scroll through the stations from

which differential measurements are available that can be used for the KART processing. Only DSNP UHF stations are prompted.

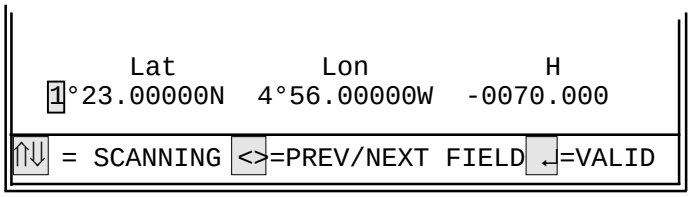
If ....NONE.... appears, this means that no suitable corrections are available and the KART technique cannot be used.

Mode : KART initialization mode.

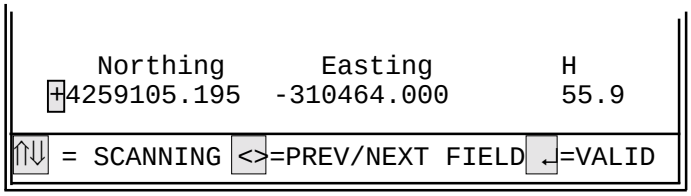
INITK : causes reinitialization in the same Mode (which is viewed in the "In Process" display area).

POINT : you have to key in the exact position of the antenna (assuming you have determined it accurately by some means of your own).

Latitude/Longitude format



Northing/Easting format



OTF : Antenna motion is free. The antenna position is determined "On The Fly" (standard mode for sea navigation).

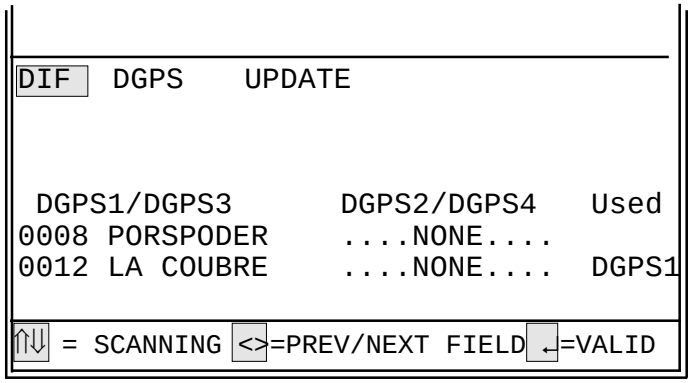
STATIC The antenna should be kept motionless (± 1 cm along the three axes) for a few minutes, with at least 5 satellites in view, to accurately determine its position. Initialization time is shorter than in OTF.

ZFIXED Same as OTF, except that the altitude is assumed constant. Therefore, the antenna may move horizontally during the initialization step, but its height should not change.

Initialization is easier than in STATIC mode but requires that one more satellite be used. Time required for initialization between Static and OTF.

EDGPS : If you do not need centimetric accuracy you can use the EDGPS mode : you will not have to care about any initialization step, still your NR203 will achieve decimetric accuracy within a few minutes.

3-1-5 DGPS PROCESSING *(DIF 3-DGPS)*



Press the ***DIF*** key and select ***3-DGPS*** to view the above screen that allows you to select up to four sets of measurements — to be used for conventional DGPS — and specify the differential position which is to be used for the navigation display.

With the cursor resting on the 1st or 2nd (upper row) or 3rd or 4th (lower row) station selection field, use the ↑ or ↓ arrow key to scroll through the available differential measurements.

With the cursor resting on the ***Used*** field, use the ↑ or ↓ arrow key to select the DGPS position to be used for the navigation display :

DGPS1 : computed from 1st set of measurements (in the upper row)

DGPS2 : computed from 2nd set of measurements (in the upper row)

DGPS3 : computed from 3rd set of measurements (in the lower row)

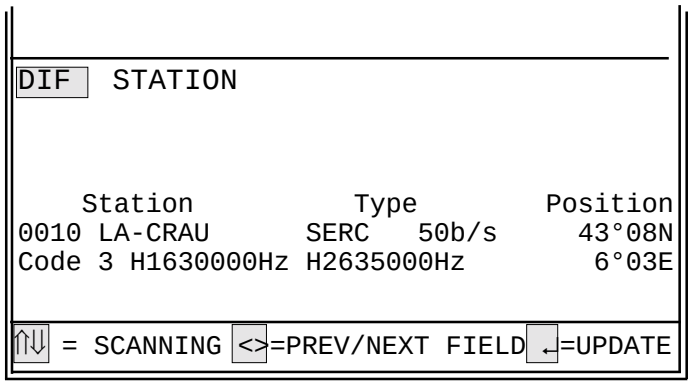
DGPS4 : computed from 4th set of measurements (lower row).

MDGPS : weighted mean DGPS position (Multi-differential), resulting from the combination of DGPS1, DGPS2, DGPS3, DGPS4 (depending on whether two or three or four DGPS positions are available).

.GPS. : straight GPS (the **....NONE....** option may be selected for all four DGPS fields).

3-1-6 VIEWING/UPDATING THE STATION LIBRARY (DIF 4-STATIONS)

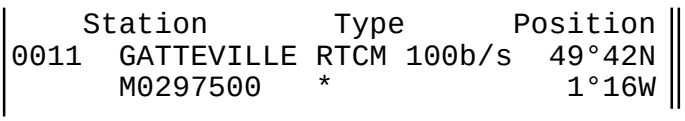
Press the ***DIF*** key and select ***4-Stations***.



The above screen allows you to view and update the specifications of the stations contained in the receiver's station library.

Only 15 stations can be saved in the non-volatile memory, but the station library has room for 30 more stations whose specifications are received via the radio link or from the numeric input. If corrections are available from any stations that are not saved in the non-volatile memory, those stations are prompted too. (The station library may contain up to 45 stations).

The above screen shows an encrypted station, with two transmission frequencies (hence a DSNP HF station). For an non-encrypted station with a single frequency the screen would look like the one below.



▸ To view the specifications of a station

Use the ↓ and ↑ arrow keys until the desired station is displayed.

To change the specifications of a station

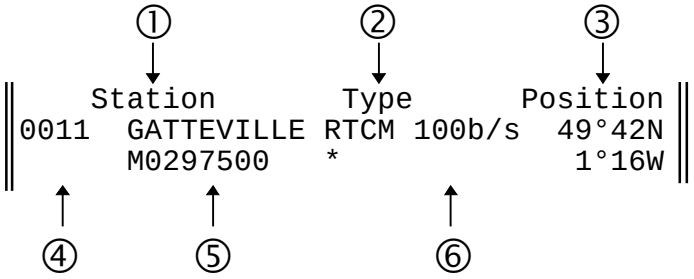
With the desired station viewed on the screen, press [↵] (Update) and change the specifications using the keyboard as explained in par. 1-4.

All the specifications of a non-encrypted station may be changed. Do not attempt to assign the same identification number to two different stations (the receiver would discard such a request).

After typing the new specifications press [↵] again to enable the changes.

WARNING !

In the case of a station currently in use, you can make changes to its frequency, format, baud rate and C3 code only after deselecting it. Your changes will take effect when you select the station again.



① Station number and label

② RTCM or DSNP, and data bit rate

③ Station latitude and longitude

④ Blank, unless the station is encrypted

⑤ Transmission band and frequency

H : HF band

M : MF band

U : UHF band (with and NDR104 option)

⑥ Second transmission frequency, in the case of an HF station.

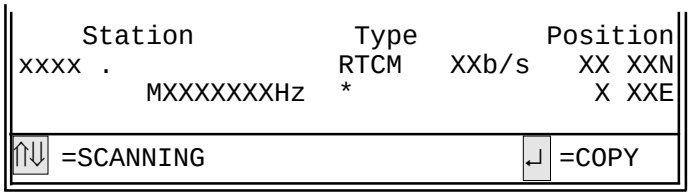
To copy specifications received to the non-volatile library area

The station library includes two areas :

- a *non-volatile* area that may contain the specifications of up to 15 stations,
- a *volatile* area that may contain the specifications of up to 30 stations received along with Differential corrections.

If you wish to update the library with any specifications from the volatile area, scroll through the list of stations in the volatile area, until the desired station is displayed.

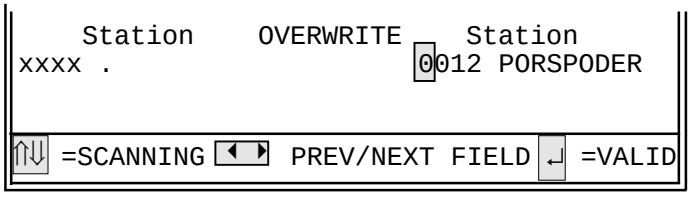
So long as you are scrolling through the non-volatile area the label of the ↵ key is ***UDPATE***. This changes to ***COPY*** when you are scrolling through the volatile area.



- Press [↵]

  If all 15 stations in the non-volatile area are encrypted, you are not allowed to make any change (apart from changing the access code). As a result the COPY key label is dimmed.

  If that is not the case the screen should look like this :



  The screen now prompts stations from the non-volatile area.

- Use the ↑ and ↓ arrow keys to scroll through the non-volatile area and select a memory location you do not mind erasing (encrypted stations are not prompted).

You are allowed to change the station's label.

Press [↵] to enable the copy.

A warning message appears with two options so you can choose to confirm the copy or quit without making any change to the non-volatile area :

```
Previous data will be lost. Confirm ?
```

1 - Yes : overwrite the specifications of the station selected in the non-volatile area with those from the volatile area.

2 - No : quit without making any change.

To update the list of stations in the non-volatile library

If you wish to enter the specifications of any station into the non-volatile library area, choose a memory location you do not mind erasing. For example, choose a saved station which is of no interest (e.g. because it is too far away), press ↵ (UPDATE) and overwrite its specifications with those of the new station.

You are not allowed to make any change to an encrypted station, apart from changing the access code (code 3).

If you choose to enter a new station in place of any of those listed, make sure the new station :

- is nearer,
- is available (if it is encrypted, you will not be allowed to use it unless the administrator gives you an access code).

About encrypted stations

Some stations using the DSNP format broadcast encrypted corrections. This type of station is identified in the list by "code 3" appearing on the left of the station number.

None of the specifications of an encrypted station can be changed (only your client support centre can do it).

If you intend to insert an encrypted station into your DGPS station library, consider what follows :

- If the encryption code was not changed at the station since your receiver was last configured, then nothing particular is required to use this station, compared to a non-encrypted station.
- But if the encryption code was changed since then, you should key in the new C3 code for this station (if you are allowed to use the station, the station's administrator should have sent it to you).

- To enter a new code, press [↵] (Update). In our preceding example the lower line would change as follows :

```
    Station          Type       Position
0010   LA-CRAU      SERC 50 b/s    43 08N
000000 H1630000Hz  H2635000Hz       6 03E
```

Enter the C3 code into this field

- Key in the 6 characters making up the new code and press [↵]. The new code is then saved and the initial data are restored in the lower line.

WARNING !

In the case of a station currently in use, you need to deselect the station first if you want to change the C3 code. The change will take effect when you select the station again.

3-1-7 CHECKING THAT THE SELECTED STATIONS ARE PROPERLY RECEIVED

The quality of the DGPS signal is indicated on the screen after you press [**DIF**]**,** in the "**Ag**" column. Check that the average age of corrections is correct ("Ag" figure reset to 0 whenever new corrections are received).

Up to 4 analog channels can be monitored concurrently by reading the "Qu" column on the screen after you press [**DIF**] then [↑]. The quality figure ("**Qu**") should be interpreted as previously explained in par. 3-1-2.

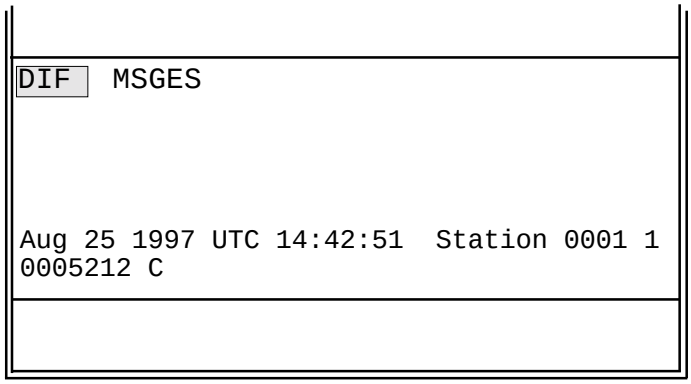
*NOTE : Reading a good quality figure and a good signal-to-noise ratio on your receiver display does not mean that DGPS corrections are necessarily available. Indeed, reception can be correct whereas the C3 code you have entered is wrong. In this case however, corrections won't be decoded. This operational status will result in an abnormally high corrections refresh rate (reported in the "**Ag**" column, see above).*

3-1-8 DISPLAYING DGPS MESSAGES (DIF-5-MSGES)

This function allows you to view the following types of messages received, including the time of reception :

- RTCM 104 message, type 16
- DSNP HF user message

Screen example :



You can view the last 8 messages received by pressing repeatedly the ↑ or ↓ key. These messages are those received from any station, including non-selected stations.

3-2 WAYPOINTS AND TRACKS

3-2-1 DEFINITIONS

Waypoints are defined as particular locations holding interest in terms of navigation (locations of buoys, fishing spots, work marks, emergency destinations, dangerous spots, etc.)

A wapyoint is defined by :

- a waypoint number (00 to 99)
- a label (7 alphanumeric characters)
- a type (optional) represented by an icon
- X-Y or L-G coordinates (a 2D position)

The number of possible waypoints in your receiver has been configured using CONF203 (max. 100). Using this software, waypoints may also have been created. An additional feature offered by CONF203 is that you can create "protected" waypoints which cannot be deleted at receiver level.

Waypoints can also be created in the receiver provided waypoint numbers still remain free. They can also be updated or deleted provided they are not protected waypoints.

Waypoint No. 00 cannot be part of a track definition as the number " 00" is used to inform the receiver of the end of a track (see below).

Tracks are defined as series of waypoints (up to 12 waypoints per track) representing routes along which to navigate. The path between any two successive waypoints is called a "segment".

A track is defined by :

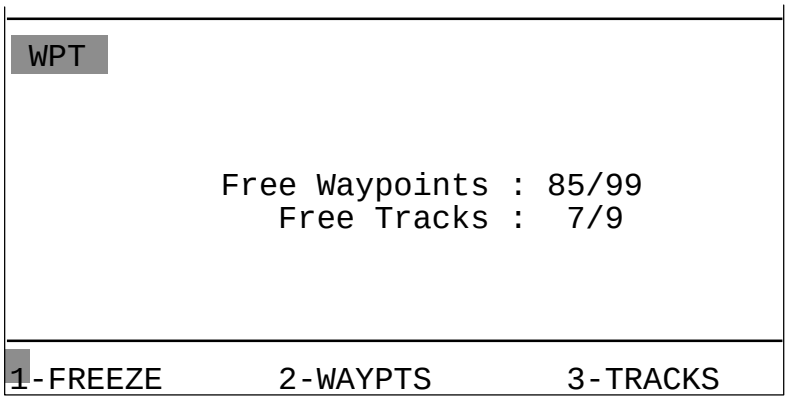
- a track number (1 to 9)
- a label (8 alphanumeric characters)
- a series of waypoints numbers (up to 12 ; if a track consists of n waypoints, where n < 12, enter "00" in the (n+1) field to indicate the end of the track, that is why waypoint No. 00 cannot be part of a track definition).

Up to 9 tracks can be stored into the receiver. Tracks can be defined using CONF203 or at receiver level.

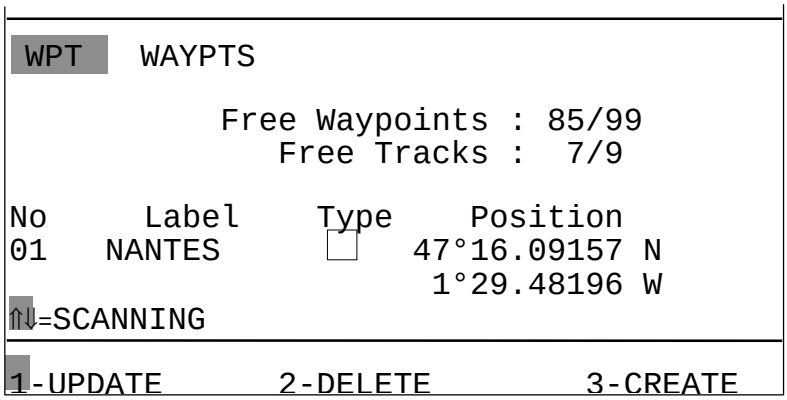
The purpose of storing waypoints and tracks into your receiver is to guide you to these waypoints or along these tracks by choosing the appropriate mode (see par. 3-3).

3-2-2 HOW TO READ THE LIST OF WAYPOINTS STORED IN YOUR RECEIVER

- Press [**WPT**]. The screen displays the number of free memory locations (i.e. the number of free waypoint numbers) out of the total number allowed by the configuration file and also the number of free tracks (9 tracks max.).



- Select "**2-WAYPTS**". The first waypoint (with lowest waypoint number) appears in the lower part of the screen.



- Press [⇑] to scroll through the waypoint library. Each press on [⇑] causes the receiver to search for the next higher existing waypoint and display it in place of the one previously displayed (a single waypoint definition is shown at a time).
- Press [⇓] to scroll through the library in the reverse direction.

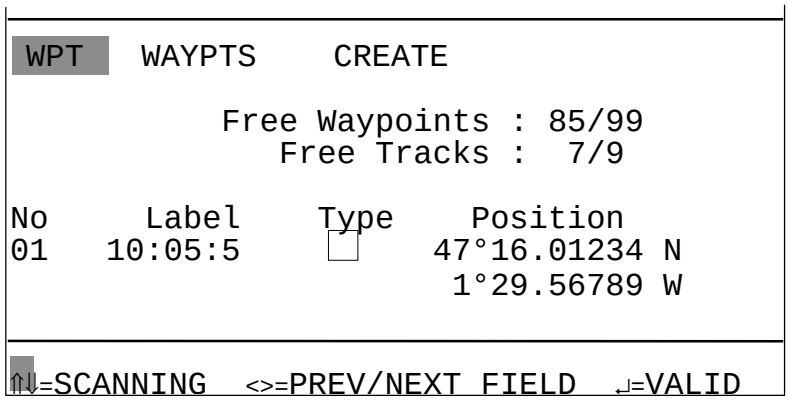
3-2-3 HOW TO CREATE A WAYPOINT FROM AN EXISTING WAYPOINT

- Press [**WPT**] and then "**2-WAYPTS**"
- Press [↓] or [↑] repeatedly until the definition of the waypoint from which you want to create a new waypoint appears on the screen.
- Press "**3-CREATE**". The receiver automatically assigns a waypoint number (the lowest free waypoint number) to the waypoint you are creating. You cannot choose the waypoint number for a waypoint that you create from the NR203 keypad. The cursor appears on the first modifiable field ("Label" field).
- Enter a label for your waypoint (see par. 1-3 how to enter alphanumeric characters).
- Enter a type for your waypoint (optional). Choose one of the available icons, using [↓] or [↑], as a visual indication on the nature of your waypoint.
- Enter the coordinates of your waypoint in the geodetic system currently selected (see top of the screen)
- Press [↵] to create the waypoint. The screen then shows this waypoint from the updated library of waypoints.

3-2-4 HOW TO CREATE A WAYPOINT FROM THE "NAV" SCREEN

This function allows you to save the position currently displayed on the NAV screen as a waypoint.

- From the NAV screen, and whatever the mode used, select "**1-FREEZE**". This causes the FRZ indicator to show up in the abridged status line at the top of the screen.
- Before this indicator vanishes (i.e. in the next 10 seconds) press [**WPT**]. The screen looks like this :



The lowest free waypoint number is prompted to be assigned to the waypoint you want to create (no other choice is possible).

- Change the label if necessary (default : time when you selected "**1-FREEZE**").
- Press [↵] to create the new waypoint.

Note : You can "freeze" the current position also from the [**WPT**] screen.

3-2-5 HOW TO UPDATE A WAYPOINT

- Press [**WPT**] and then select "**2-WAYPTS**"
- Press [↑] or [↓] repeatedly until the desired waypoint is displayed.
- Select "**1-UPDATE**". The cursor shows up on the first character in the "**Label**" field.

  If the waypoint is part of a track or is involved in the navigation mode currently used, the blinking message "Wpt in use or in track : Confirm update ?" shows up.
- Make all the necessary changes to the label, type and coordinates.
- Press [↵] to store the new definition of the waypoint.

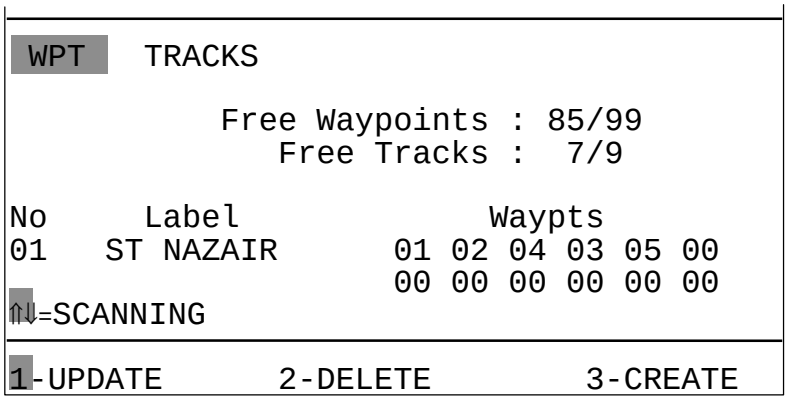
3-2-6 HOW TO DELETE A WAYPOINT

- Press [**WPT**] and select "**2-WAYPTS**"
- Press [↑] or [↓] repeatedly until the desired waypoint is displayed
- Select "**2-DELETE**".
- Select "**1-YES**" to confirm your choice (otherwise select "**2-NO**"). The waypoint is removed from the waypoints library.

NOTE : You cannot delete a "protected" waypoint (Delete command dimmed when you display this waypoint) or any waypoint part of a track or involved in the navigation mode currently used.

3-2-7 HOW TO VIEW EXISTING TRACKS

- Press [**WPT**] and then select "**3-TRACKS**". The screen should look like this.



- Scroll through the list of tracks previoulsy defined, if any, by pressing repeatedly [↑] or [↓].

3-2-8 HOW TO DEFINE A NEW TRACK

- Press [WPT] and then select "**3-TRACKS**".
- Select "**3-CREATE**". The receiver automatically assigns a track number (the lowest free track number) to the track you are creating.
- Enter a label for the track (8 characters max)
- Choose the waypoints making up the track (12 waypoints max.). To do this, first move the cursor to the first field by pressing [→].
- Press [↑] or [↓] until you display the desired waypoint. After each press on [↑] or [↓], note that the complete definition of the selected waypoint is displayed in the centre of the screen.
- Press [→] to access the second waypoint field and repeat the above step, etc.
- Press [↵] when the definition of the track is complete.

NOTES : - Leave the last unused waypoint fields filled with "00".

- You can define a track as a close loop by specifying the same waypoint at the beginning and at the end of the track.

3-2-9 HOW TO DELETE A TRACK

- Press [**WPT**] and then select "**3-TRACKS**"
- Press [↑] or [↓] repeatedly until the track you want to delete is displayed.
- Select "**2-DELETE**". The blinking message "Delete this track : Are you sure ?" appears.
- Select "**1-Yes**" to confirm your choice (otherwise "**2-NO**")

NOTE : You cannot delete a track if it's currently followed by the receiver (Profile mode currently active along this track).

3-3 NAVIGATION MODES

3-3-1 DEFINITIONS

The positioning and navigation information you get from your NR203 depends on two different factors :

- The configuration of your receiver, which defines the content, aspect and number of alphanumeric displays (not including the standard navigation display(s) and the graphic screen). These displays are independent of the navigation mode selected.
- the navigation mode you select on your receiver. Depending on this choice, additional information is provided on a chart from which you can deduce steering instructions (see graphic screen in the next paragraph).

HOMING : Navigation mode based on a waypoint that you specify. This mode provides graphic information to help you reach that point along a great circle.

The basic positioning information (from the standard display) is recalled on the right of the chart.

BEARING : Navigation mode also based on a waypoint that you specify. This mode provides graphic information to help you reach that point according to the bearing angle defined by the waypoint location and your current location when you select this mode.

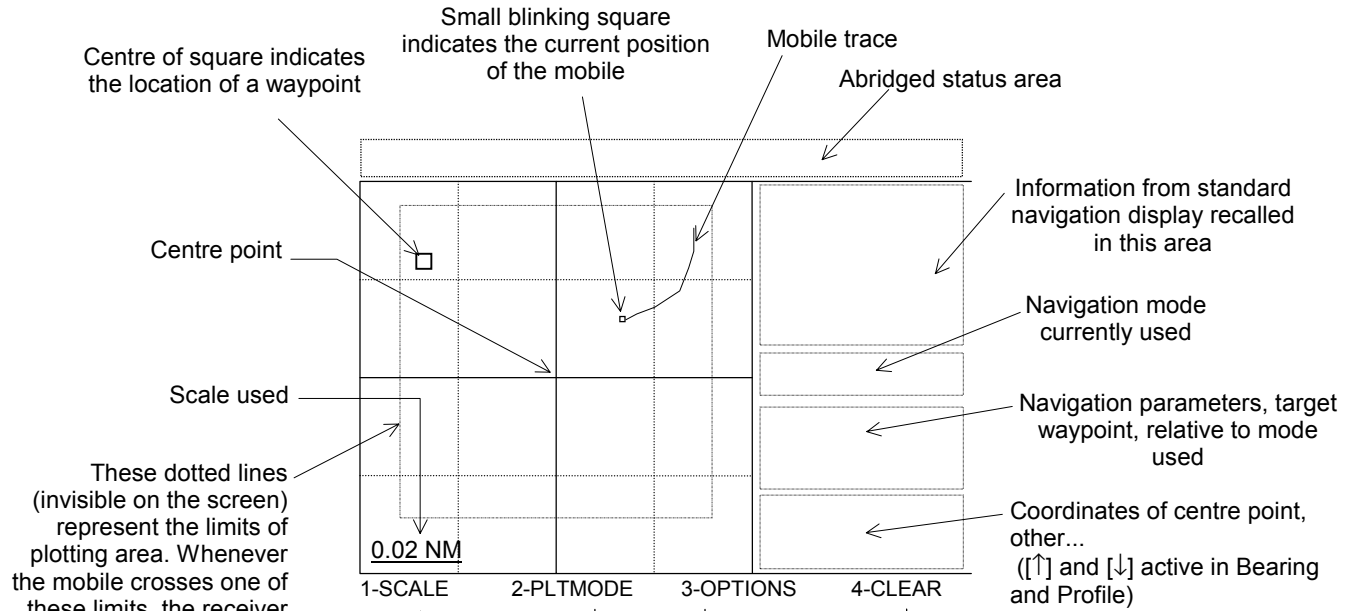
The basic positioning information (from the standard display) is recalled on the right of the chart.

PROFILE : Navigation mode based on a track that you specify. This mode plots graphic information to help you follow this track.

The basic positioning information (from the standard display) is recalled on the right of the chart.

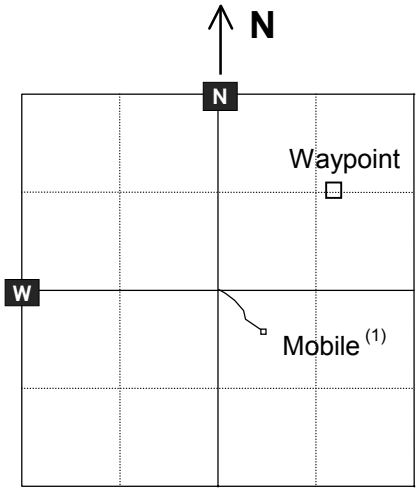
POSITION : Provides positioning information (position, speed, course, etc.). This mode can be used when no further navigation information is required. The mobile position and the possible waypoints nearby are however shown on the graphic screen.

3-3-2 GRAPHIC SCREEN [NAV] [3-GRAPHIC]



3-3-3 HOW TO USE THE POSITION MODE

- Press [**NAV**]
- Select "**2-MODE**". The screen displays the navigation mode currently used ("In progress : ..).
- Select "**1-POSITION**". This causes the receiver to switch immediately to the POSITION mode and the screen to switch back to the standard navigation display.
- Select "**3-GRAPHIC**" if you want to plot the position solution on a chart. No further information is provided compared with the standard navigation display.



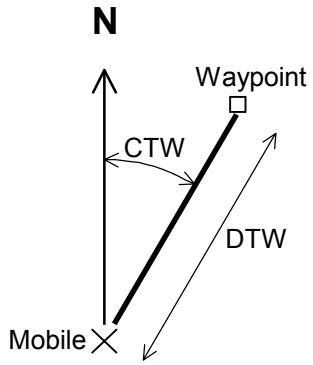
(1) The mobile trace starts from the moment you select the Profile mode. The first position solution available from that moment is plotted at the centre point.

3-3-4 HOW TO USE THE HOMING MODE

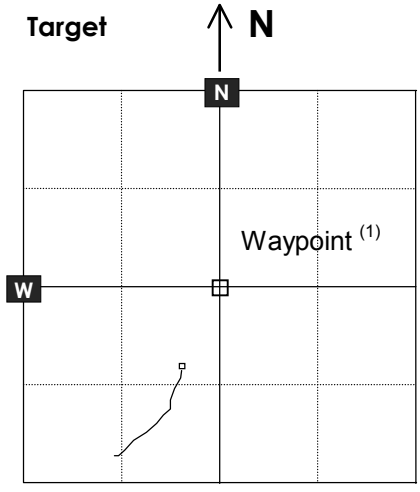
- Press [**NAV**]
- Select "**2-MODE**". The screen displays the navigation mode currently used ("In progress : ...")
- Select "**2-HOMING**"
- Using [↑] or [↓], look up the waypoint you want to use as the target :
- Once the characteristics of the target waypoint are shown in the lower part of the screen, press [↵] to validate this waypoint. This causes the receiver to switch to the homing mode and the screen to switch back to the standard navigation display.
- Select "**3-GRAPHIC**" to display the graphic screen.

Navigation parameters relevant to the Homing Mode:

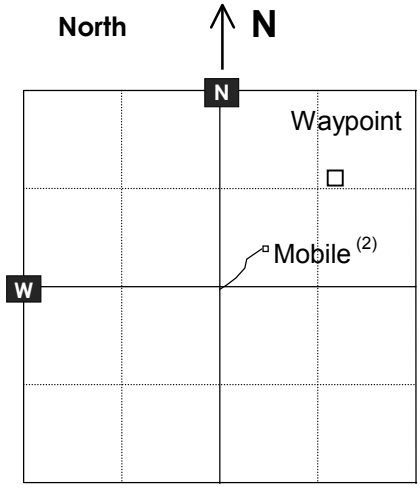
CTW : Course To Waypoint
DTW : Distance To Waypoint
TTG : Time To Go



Plot Modes



(1) Held fixed at centre point



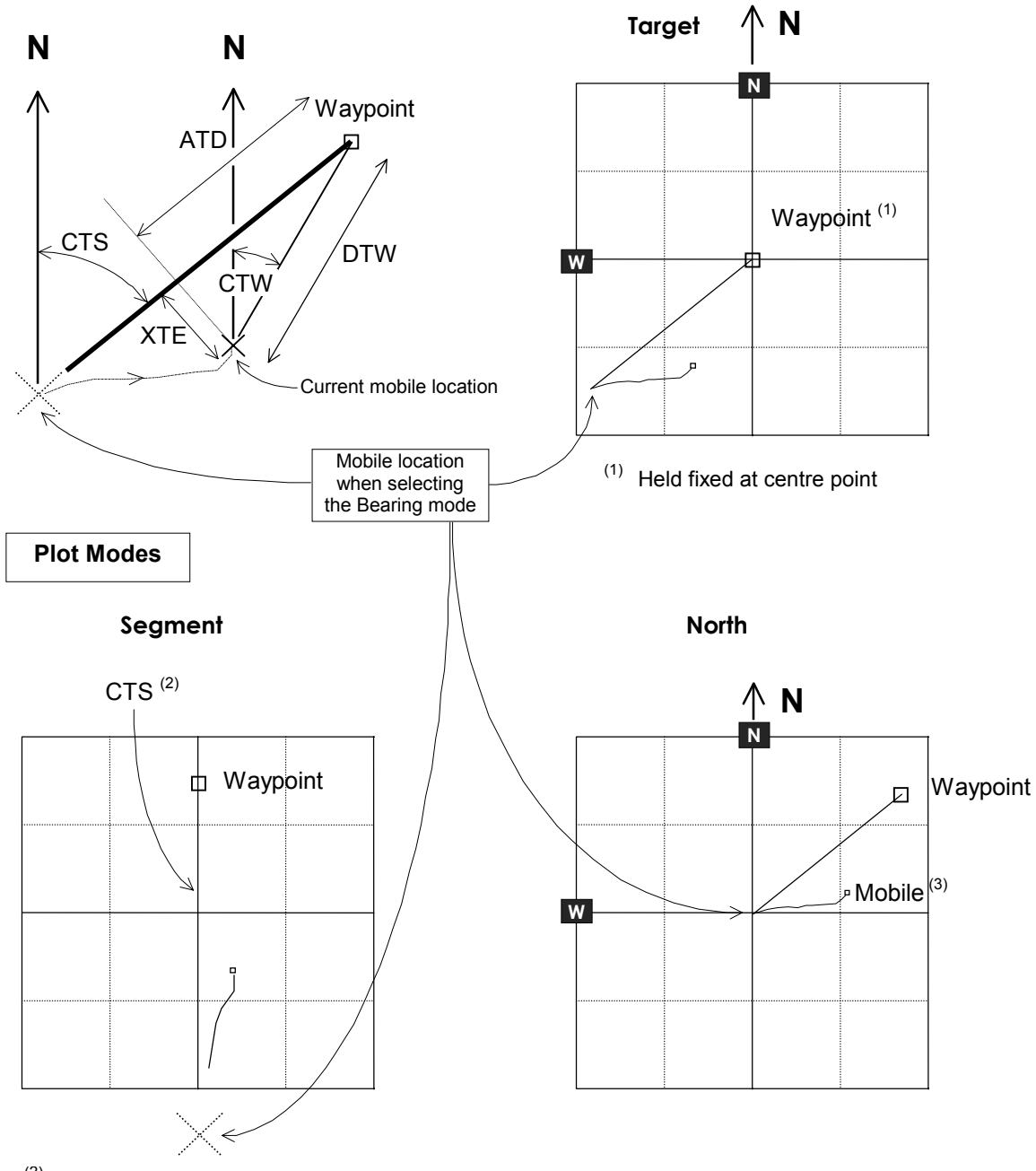
(2) The mobile trace starts from the moment you select the Homing mode. The first position solution available from that moment is plotted at the centre point

3-3-5 HOW TO USE THE BEARING MODE

- Press [**NAV**]
- Select "**2-MODE**". The mode currently used is indicated on the screen ("In progress : ...")
- Select "**3-BEARING**".
- Using [↑] or [↓], look up the waypoint you want to use as the target :
- Once the characteristics of the target waypoint are displayed, press [↵] to validate this waypoint. This causes the receiver to switch to the bearing mode. The course to steer (CTS) is computed from the current position and then the screen switches back to the standard navigation display.
- Select "**3-GRAPHIC**" to display the graphic screen.

Navigation parameters relevant to the Bearing Mode:

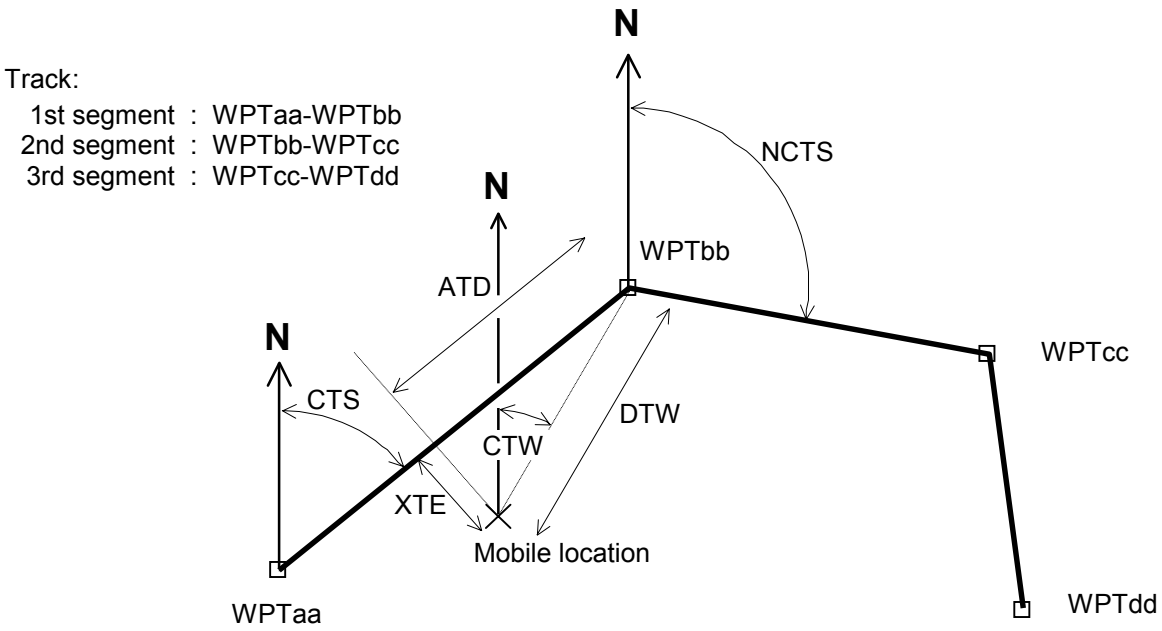
CTS : Course To Steer	CTW : Course To Waypoint
XTE : Cross Track Error	DTW : Distance To Waypoint
ATD : Along Track Distance	TTG : Time To Go



NOTE : CTS and CTW are computed with respect to the WGS84 geographical North.

3-3-6 HOW TO USE THE PROFILE MODE

- Press [**NAV**]
- Select "**2-MODE**". The screen displays the navigation mode currently used ("In progress : ...")
- Select "**4-PROFILE**"
- Using [↑] or [↓], look up the track you want to follow.
- Using [→] or [←], specify the direction of travel along the track (direct or reverse).
- Press [↵] to validate the track. This causes the receiver to switch to the Profile mode and the screen to switch back to the standard navigation display.
- - Select "**3-GRAPHIC**" to display the graphic screen.

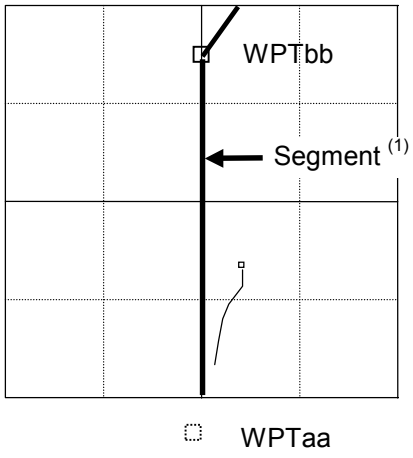


Navigation parameters relevant to the Profile Mode:

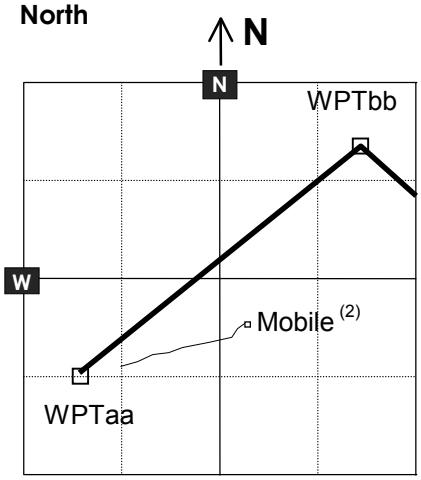
CTS : Course To Steer	CTW : Course To Waypoint
NCTS : Next Course To Steer	DTW : Distance To Waypoint
XTE : Cross Track Error	ATD : Along Track Distance
TTG : Time To Go	

Plot Modes

Segment



North

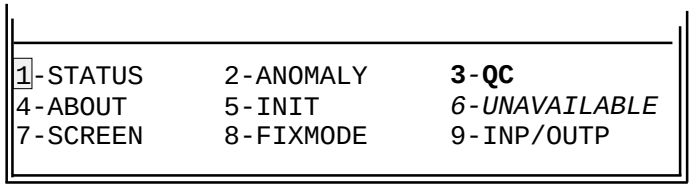


(1) Direction held fixed on central vertical line

(2) The mobile trace starts from the moment you select the Profile mode. The first position solution available from that moment is plotted at the centre point

NOTE : CTS, CTW and NCTS are computed with respect to the WGS84 geographical North.

3-5 AUXILIARY FUNCTIONS ([AUX] KEY)



The [AUX] key allows you to access the following functions :

1 - Status: *see par. 3-5-1.*

2 - Viewing and clearing events and anomalies.
See par. 3-5-2.

3 - UKOOA QC data

4 - About : *See par. 3-5-4*

5 - Initialization (INIT) :

- Date and time : *see Appendix 2*
- Position : *see Chapter 2*
- Viewing/updating intendedly discarded satellites (Manual rejection of any satellite is a very exceptional operation). *See par. 3-5-5-1.*
- Geodesy and projection *See par. 3-5-5-2*
- Speed filtering *See par. 3-5-5-3.*
- Units : *See par. 3-5-5-4*
- Altitude mode : *See par. 3-5-5-5*
- Maximum age of DGPS corrections

6 - Unavailable

7 - Screen :*See par. 3-5-7*

8 - Fix mode *See par. 3-5-8*

9 - Viewing/Updating output port configurations : *See Appendix 3* (information intended for the person in charge of installing the receiver).

3-5-1 STATUS (AUX 1-Status)

Pressing the ***AUX*** key and selecting ***1-Status*** causes a screen to appear that provides information on the computed position or positions, depending on the Differential mode in progress : DGPS, KART initialization, KART in use. All three status screens have a common area showing the following information :

- Master oscillator source : (INTernal or EXTernal) and drift rate.
- SA status : ON or OFF.
- Number of received SVS.

DGPS Status

```
AUX  STATUS                                    ⇑⇓
Master Oscill.      SA          Received SVs
INT   0.00E+00      OFF             0
-------------------DGPS-----------------
Fx  Station   USV   Q  Dop   Lpme  Delta
D1  0013 DSNP  6    1  1.5  14.12  0.00
D2
D3
D4
MD MULTI DGPS  6    1  1.5   14.12 0.00
```

Fx : DGPS positions available. The DGPS position requested to be use for the navigation screen is highlighted.

Station : DGPS station used.

USV : Number of SVs used.

Q : Quality figure 0 to 3 : straight GPS
4 to 9 : Differential GPS

Dop : Horizontal Dilution of Precision

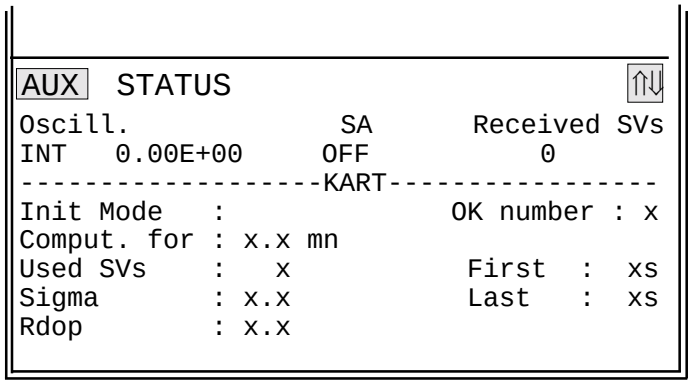
(-1 if not available).

Lpme : Mean Error of Lines of Position

Delta : Deviation between each DGPS position and the position used for the navigation screen

$$\left(\Delta = \sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}\right)$$

KART initialization status



Init Mode : KART initialization mode

Comput. for : time elapsed since the search for a KART solution was initiated.

Used SVs : Number of SVs used

Sigma : Standard deviation (should decrease with time)

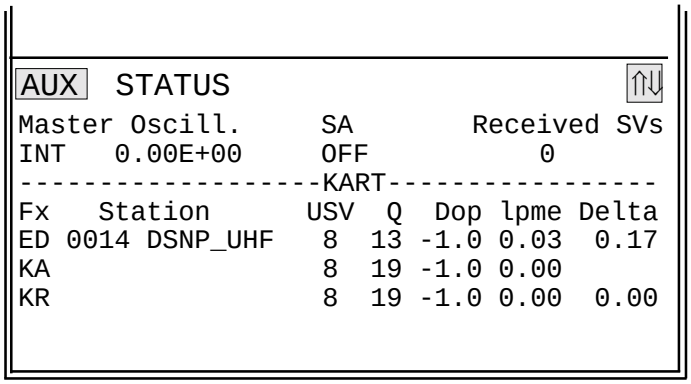
Rdop : Relative Dilution of Precision (qualifying the geometry during initialization process).

OK number : Number of "KART OK" solutions providing the same result (is combined with elapsed times, see below, to decide of the end of the initialization stage).

First : Time elapsed since the first KART solution was detected.

Last : Time elapsed since the last KART solution was detected.

KART Status (in use)



Fx : KART positions available. The KART position requested to be used for the navigation screen is highlighted.

Station : DGPS station used.

USV : Number of SVs used.

Q : Quality figure

0	waiting for a consistent EDGPS solution.
11 to 13	EDGPS fix
14 to 19	KART A or KART R fix

Dop : Horizontal Dilution of Precision

(-1 if not computed).

Lpme : Mean Error of Lines of Position

Delta : Deviation between KART R and EDGPS solutions is one of them is used for the navigation screen :

$$\left(\Delta = \sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}\right)$$

No Delta is computed in relation to the KA position.

Another screenful is accessible by pressing the ↑ or ↓ arrow key, showing the status of the GPS constellation.

AUX STATUS ⇑⇓

Ch	Sv	St	Sn	Elv	Azi	Ch	Sv	St	Sn	Elv	Azi
01	03	u	43	^39	133	09	27	u	49	v38	171
02	02	r	28	^02	040	10	28	u	46	^12	210
03	21	u	42	^36	052	11					
04	23	r	30	^02	040	12					
05	15	u	47	v49	271	13					
06						14					
07	31	u	47	v78	155	15					
08	14	u	36	^17	208						

Ch Receiver channel number
Sv Satellite identification number (PRN Number)
St Satellite status :
"s" : **S**earching for a satellite
"r" : Satellite **R**eceived, but not used (Elevation too low, or no DGPS corrections received).
"u" : satellite received and **U**sed.
Sn Signal-to-Noise ratio
Elv Satellite Elevation (∧ if rising ; ∨ if setting)
Azi Satellite Azimuth

▸ To quit, press any function key

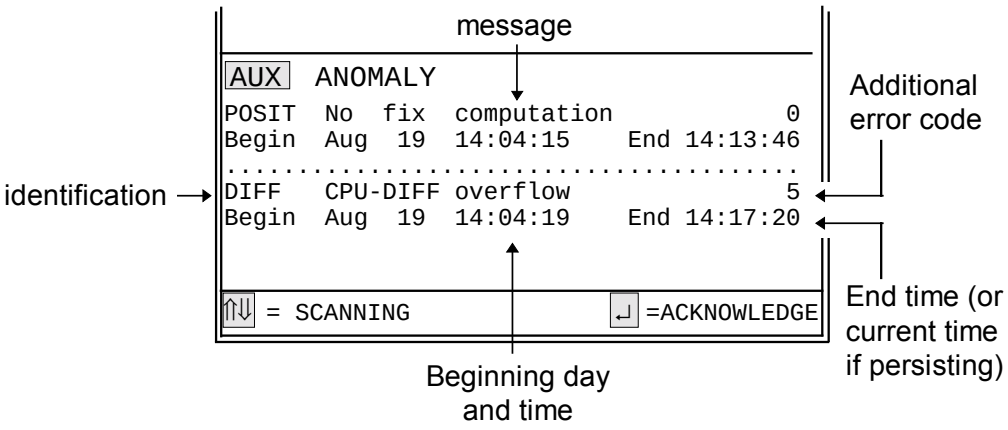
3-5-2 Viewing and clearing events and anomalies *(AUX 2-Anomaly)*

In most cases, anomalous events detected by the receiver do not result from a malfunction of the receiver itself, so they do not appear automatically on the screen.

Instead, they are recorded so that the navigator can look at the list of anomalies whenever he wishes to, as if they where recorded in a log book. Then he is allowed to clear (erase from the list) those anomalies which ***do not persist***.

How to view anomalies

- Press **[AUX]** and select **"2-Anomaly"**. If one or more anomalies are currently reported, the latest two are viewed first. Scroll through the list of anomalies (if any) using the [↓] and [↑] arrow keys. ("None" means the list is empty; all possible anomalies and their meanings are listed in Appendix 10).



How to delete an anomaly from the list

You are allowed to erase those anomalies which have come to an end :

- Press [↑] or [↓] until the desired anomaly is displayed in the bottom rows.
- Press [↵] : this removes the anomaly from the list.

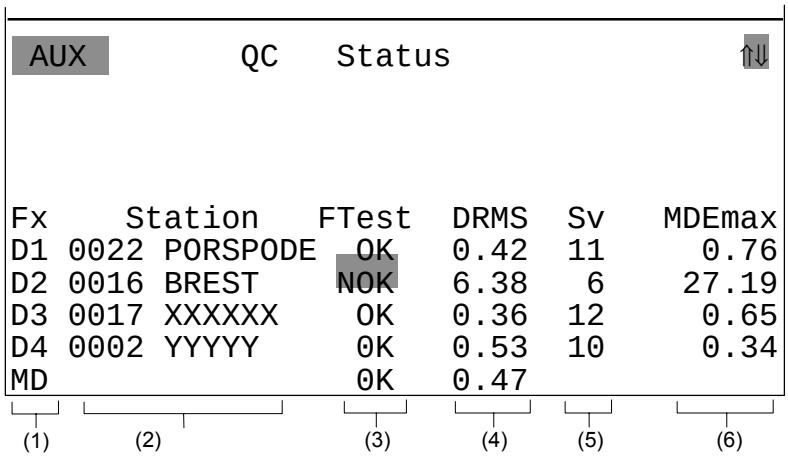
If an anomaly persists, then the current time is displayed as "End time". There is no point in trying to erase such an anomaly as it shows up again in the list so long as it is persisting.

- To quit without making any changes, press any function key.

3-5-3 Viewing the UKOOA QC data

From V3.0 and only if the NR203 operates in DGPS or MDGPS mode, a new function is available showing the results of QC tests (Quality Control tests) performed according to the UKOOA recommendations.

- Press [**AUX**] key and select "**3-QC**". The QC status screen displays showing the results of the FTEST :



Basically, the FTEST (or Unit variance test) checks the validity of the noise model used. The following results are provided :

(1) DGPS Fix identification

(2) Identification of the station from which the position solution results : station number, label of station assigned to this fix.

(3) FTest result :

OK displayed if mean value of unit variance is "1" (otherwise NOK is displayed).

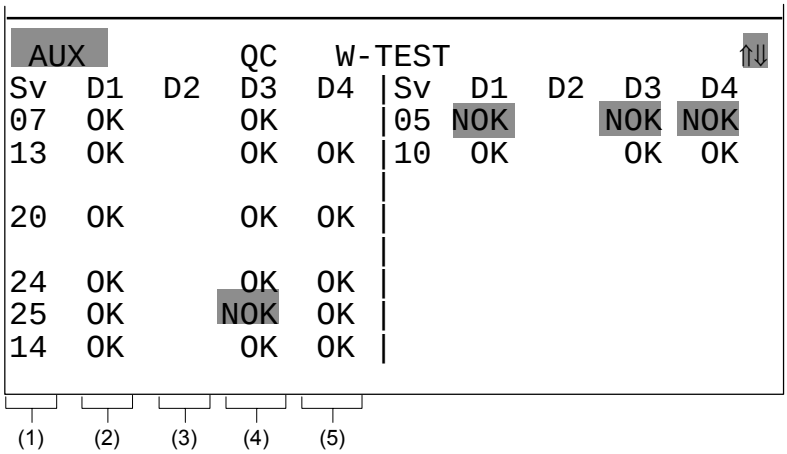
(4) DRMS

(5) Identification of the satellite for which MDE2 max is found.

(6) 2 Dimensional MDE max, in metres.

The maximum value of MDE (Marginally Detectable Error) is the smallest bias that can be detected by the W-test with a certain probability.

Press [↑] or [↓]. The results of the W-test display :



The W-test is a statistical test performed on observations. The results of the test are the following :

(1) Satellite number

(2) W-test result on DGPS Fix 1

$|\text{W-test}| \leq 2.576 \rightarrow$ OK (good)

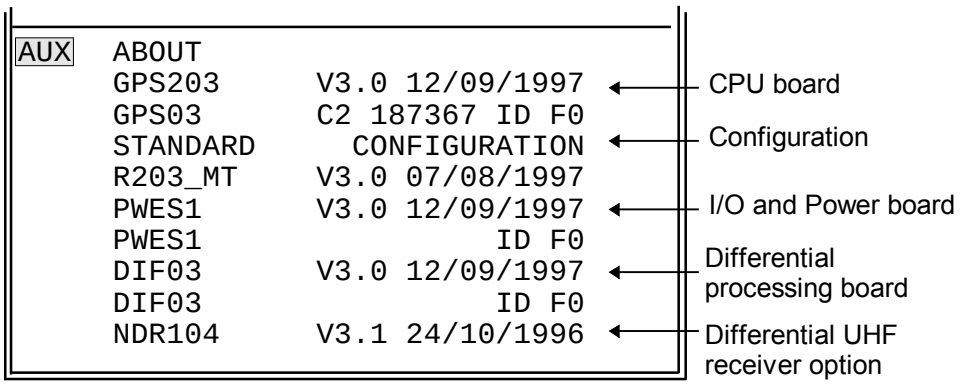
$|\text{W-test}| > 2.576 \rightarrow$ NOK (bad)

(3) Same as (2) on DGPS Fix 2

(4) Same as (2) on DGPS Fix 3

(5) Same as (2) on DGPS Fix 4

3-5-4 Viewing the software version (*AUX 4-About*)



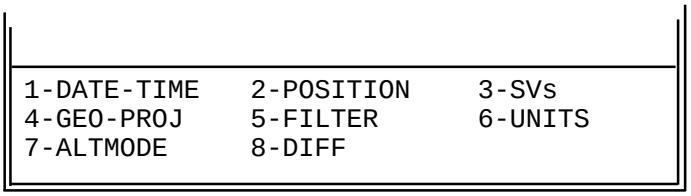
Press the ***AUX*** key and select ***4-About*** to view the above screen showing the software version of each board in the NR203 and the configuration.

For the CPU board, the receiver identification code (C2) is also viewed. The C2 code is used by an encrypted DGPS station administrator to generate a secret code (C3) that will allow the receiver to use the encrypted station.

The ID hexadecimal code provides hardware information on each board :

- the first digit stands for the printed circuit version
- the second digit stands for the options installed on the board.

3-5-5 INITIALIZATION *(AUX 5-INIT)*



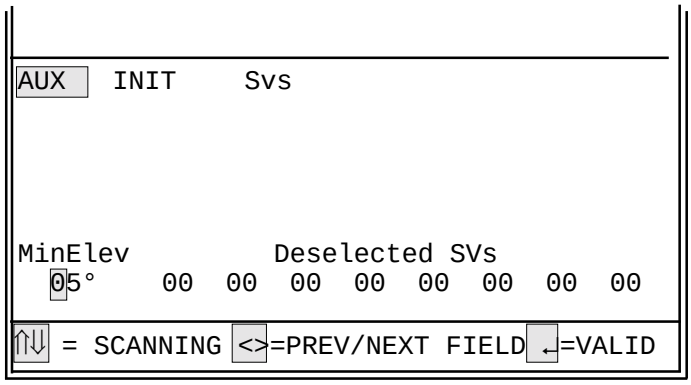
For the Date and Time function (AUX → 5 → 1) see Appendix 2.

For the Position function (AUX → 5 → 2), see chapter 2.

For the other AUX functions, see below.

3-5-5-1 Intentionally discarded satellites & Minimum elevation

- press **[AUX]** and select **"5-Init"**.
- Select **"3-SVs"**.



The cursor shows up on the "Min Elev" field. Any satellite whose elevation is less than the value you enter into the "Min Elev" field will automatically be discarded by the receiver.

The eight "Deselected SVs" fields allow you to forcibly discard any satellite suspected of malfunction.

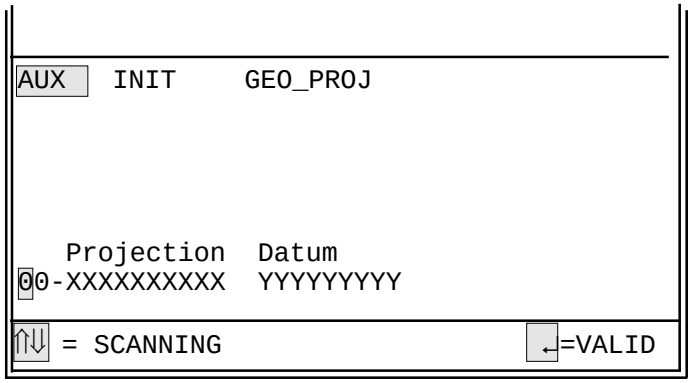
WARNING

The operation consisting of intentionally discarding a satellite should be considered only on very exceptional occasions, such as notices from authorized vendors or urgent international notice to navigators. Any change to the list of intentionally discarded satellites (if any) is saved during power outages.

- If all 8 numbers are "00", then no satellite is discarded.
- If you need to discard a satellite, simply enter its identification number, then press [↵] to store the list (this takes you back to the INIT menu of the AUX function).

‣ To quit without making any changes, press any function key.

3-5-5-2 Geodesy and projection



Press the ***AUX*** key and select ***5-Init***, next ***4-Geo Proj*** to view the above screen showing the Projection system and Datum currently in use.

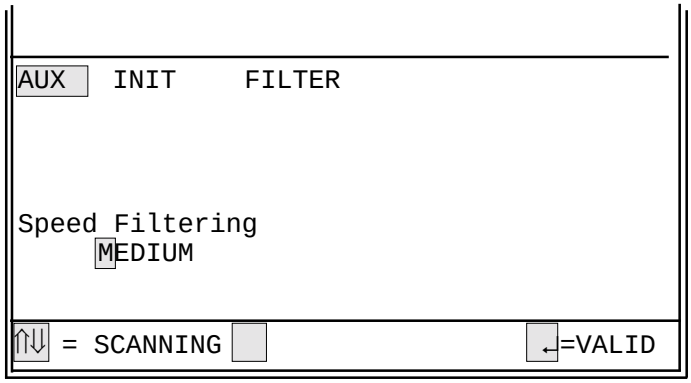
GPS positions are normally on the WGS84 Datum. On-line Datum transformation routines in your NR203 convert the WGS84 latitude/longitude of the fix displayed on the navigation screen to a latitude/longitude or Northing/Easting on the Datum of your navigation charts (see Appendix 5).

Use the ↑ and ↓ arrow keys to select your Datum. Press [↵] to enable your choice. The Datum currently used is continually indicated in the shrunk standard navigation display area.

- To quit without making any changes, press any function key.
- To go back to the Init menu, press [0].

You need to use the software program called «CONFGEO» (provided on CONF203 diskette) to add new projections and datums into your receiver.

3-5-5-3 Speed filtering



- Press **[AUX]** and select **"5-Init"**.
- Select **"5-Filter"**.

  This function allows you to view and, if required, update the filtering coefficient currently applied to the speed :

  None : 0.06-s time constant

  Wide : 2-s time constant

  Medium : 6-s time constant

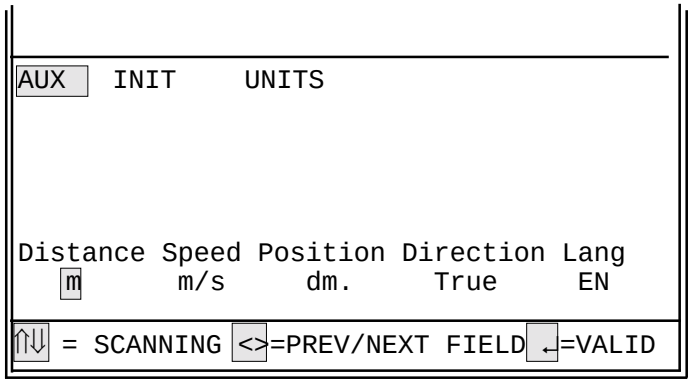
  Tight : 20-s time constant

  ▸ If you wish to change the filtering, use [⇑] or [⇓] to select the desired option and press [↵] to store your selection and quit.

  ▸ To quit without making any changes, press any function key.

  ▸ To go back to the Init menu, press [0].

3-5-5-4 Units



Press the ***AUX*** key and select ***5-Init*** next ***6-Units*** to view the above screen that allows you to select units for :

Distance : metres (m) or Nautical Miles (NM), for navigation screens

Speed : metres/second (m/s)

kilometres/hour (k/h)

knots (KT)

Position : degrees, minutes,

degrees, minutes, seconds

Direction: (Angular reference) : True North

Magnetic North

Grid

The Magnetic North and Grid options are not yet available.

Lang : language option : EN for English

FR for French

- If you wish to make changes use [→] or [←] to go to the desired field and [↑] or [↓] to select the desired unit. Press [↵] to store your selection and quit.
- To quit without making any changes, press any function key.
- To go back to the Init menu, press [0].

3-5-5-5 Altitude calculation mode

```
AUX   INIT     ALTMODE




AltMode    Offset          Dmsl
   0      +0000.000m    +0000.000 m

⇑⇓ = SCANNING <>=PREV/NEXT FIELD ↵=VALID
```

Press the [AUX] key and select ***5-Init***, next ***7-ALTMODE*** to view the above screen that allows you to select the altitude calculation mode and enter an offset and a DMSL correction.

AltMode : Altitude correction mode :

0 $ALT_{USER} = ALT_{WGS84} - DMSL_{STANAG} - Offset$

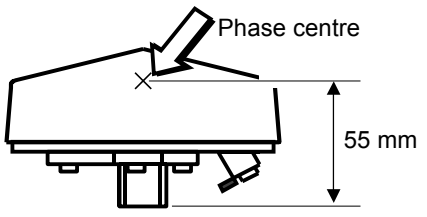
1 $ALT_{USER} = ALT_{WGS84} - DMSL_{USER} - Offset$

2 $ALT_{USER} = ALT_{UserEllipsoid} - Offset$

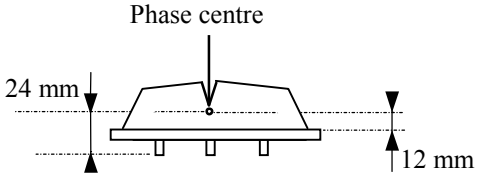
Offset : Antenna height above user reference

Dmsl : Geoid/WGS84 separation

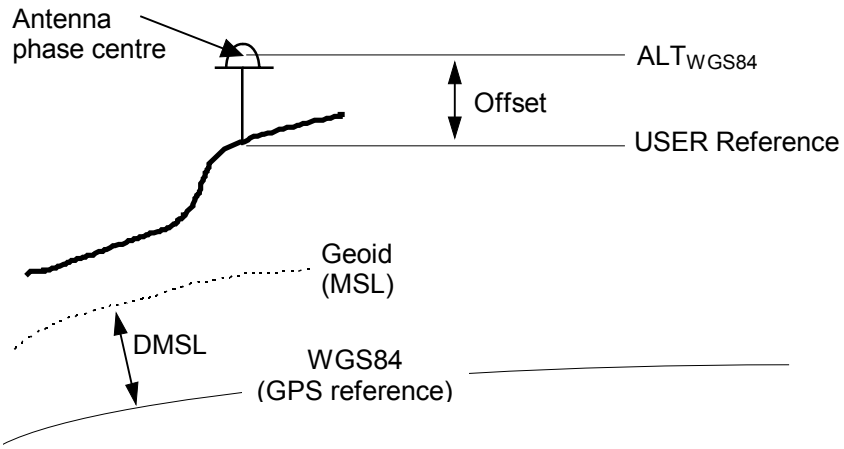
- You only need to enter a Dmsl value for AltMode 1.
- For AltMode 0, it is the MSL value from the STANAG model which is used.
- For AltMode 2, $ALT_{UserEllipsoid}$ is the altitude above the ellipsoid chosen by the user. The transformation already includes the necessary MSL correction.



NAP4 GPS antenna



NAP001 GPS Antenna



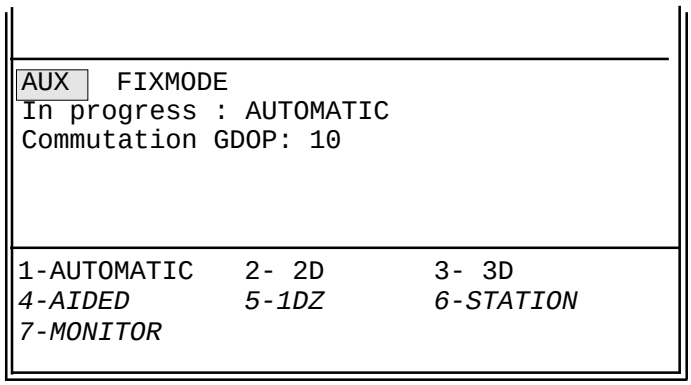
- If you wish to make changes use [→] or [←] to go to the desired field and [↑] or [↓] to select the desired unit. Press [↵] to store your selection and quit.
- To quit without making any changes, press any function key.

3-5-6 Unavailable ...

3-5-7 Screen brightness

Press [AUX] then [7] changes the display brightness mode from high to low or the other way round.

3-5-8 GPS FIX MODE *(AUX 8-FIXMODE)*



Press the ***AUX*** key and select ***8-FIX MODE*** to view the above screen that allows you to select a mode for computing the GPS position. The mode currently enabled is displayed. The menu at the bottom of the screen allows you to select one of the following modes :

1) Automatic

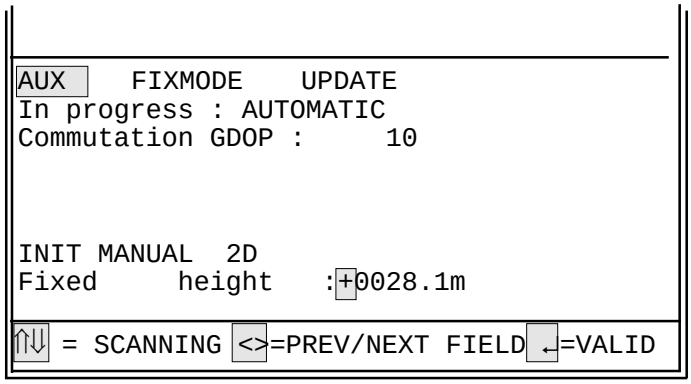
The normal mode is 3D+T.

If the GDOP exceeds the programmed threshold, or if less than four satellites are received, then the receiver ***automatically*** switches to the 2D+T mode. The programmed threshold ("Commutation GDOP") is displayed.

2) 2D (2D+T, manual).

With this option the altitude is assumed constant, so it is not computed. The fix accuracy then depends on the accuracy of the altitude entered.

Therefore, when you select the 2D option, you are required to see if the altitude entered is correct, and confirm or update it :



-To confirm the altitude displayed, simply press [↵].

-To update the altitude displayed, enter the correct value, then press [↵] to store it.

3) 3D (3D+T, manual).

This option is used to prohibit the use of the 2D+T mode. If the GDOP exceeds the programmed threshold or if less than 4 satellites are received, then the fix is no longer computed.

This function is usable only in conventional DGPS. It has no effect if the receiver uses the KART technique.

‣ To quit without making any changes, press any function key.

APPENDIX 1
INSTALLATION

UNPACKING

The shipment case should contain all the items appearing in the accompanying LIST OF ITEMS. We recommended you to keep that list so that you can order any spare part you may need at a later date. The shipment is mainly composed of :

- an NR203 unit
- an NAP001 GPS antenna
- an HF/MF receiving antenna (DHM5000)
- a set of cables
- an accessory kit
- the present manual including a "User's Quick Guide".
- CONF203 Configuration software disk with manual.

Options :

- NDR104 UHF receiver
- DMA8 HF/MF magnetic antenna
- DSA7 HF selective antenna

ENVIRONMENT

The receiver is designed to withstand a marine environment (waterproof case), resist dripping water and operate from – 10° to 55°C. Subject to these conditions, the receiver does not require any special precaution.

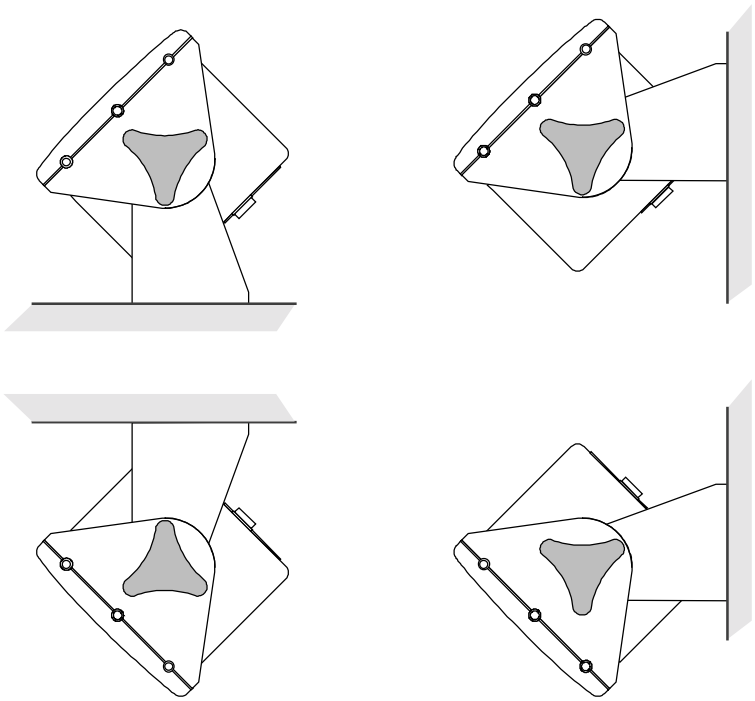
However, it is advisable to install the receiver clear of any moving device and away from splashes of lubricant or water.

Also, direct exposure to excessive heat should be avoided.

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

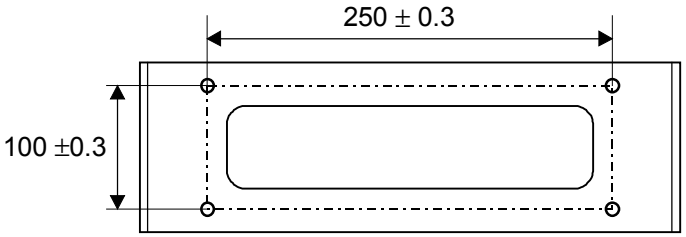
INSTALLING THE RECEIVER AND THE ANTENNAS

The receiver should be mounted using the bracket supplied, allowing quick installation in any position, even in cluttered bridges.



Mounting bracket viewed from top

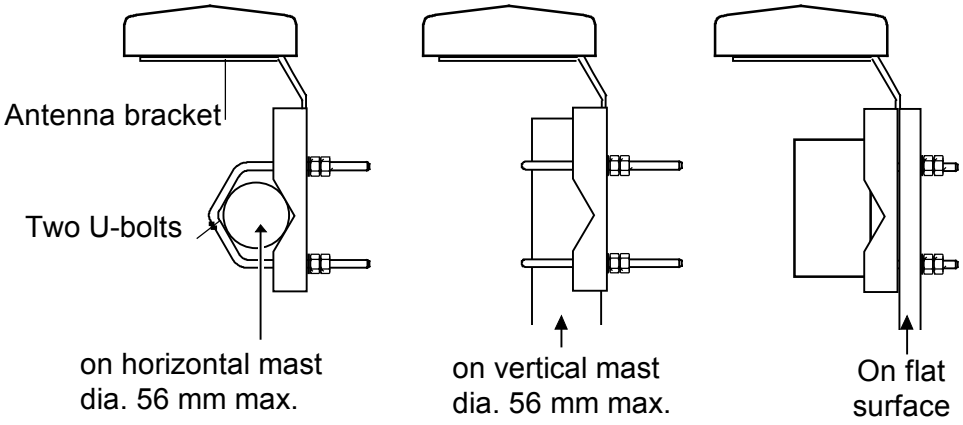
(All dimensions in mm)



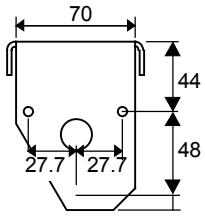
- Drill two holes (dia. 6.5) in the desired mounting surface (using the bracket as a template) and attach the bracket with four screws.
- Slide the receiver into the bracket and secure it in position by tightening the knobs on either side.

A mounting bracket and two clamps (moisture resistant) are supplied that allow you to install the NAP4 antenna on a vertical or horizontal rod (approx. dia. 35 to 50 mm) as shown below.

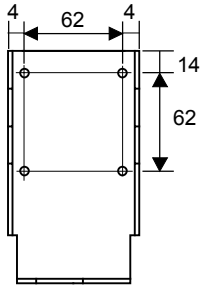
Mounting the NAP001 on its bracket



Mount dimensions of antenna bracket



Mount dimensions for U-bolts



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

Mounting the HF/MF antenna

The DHM5000 is fitted with the same type of bracket as the NAP001 (see preceding page).

For good reception of Differential corrections :

- The HF/MF antenna should be at least 1.5 m away from any wire antennas or guy wires. Also, any such wires, including those more than 1.5 m away, should not overlook the antenna.
- The antenna should not be installed within the reach of any source of radio interference. The traditional method for choosing a place for the antenna is recommended : using a portable radio set and successively turning on every electric or electronic shipboard device. The traditional protective measures including interference suppression on electric generators and grounding of moving mechanical structures are also recommended.
- The HF/MF antenna downlead is floating above the ship's ground system ; the shield of the ***downlead should not be grounded at any end***. A grounding capacity is included in the antenna.
- The above requirements are necessary for the nominal 500 Nautical Mile DGPS coverage to be achieved.

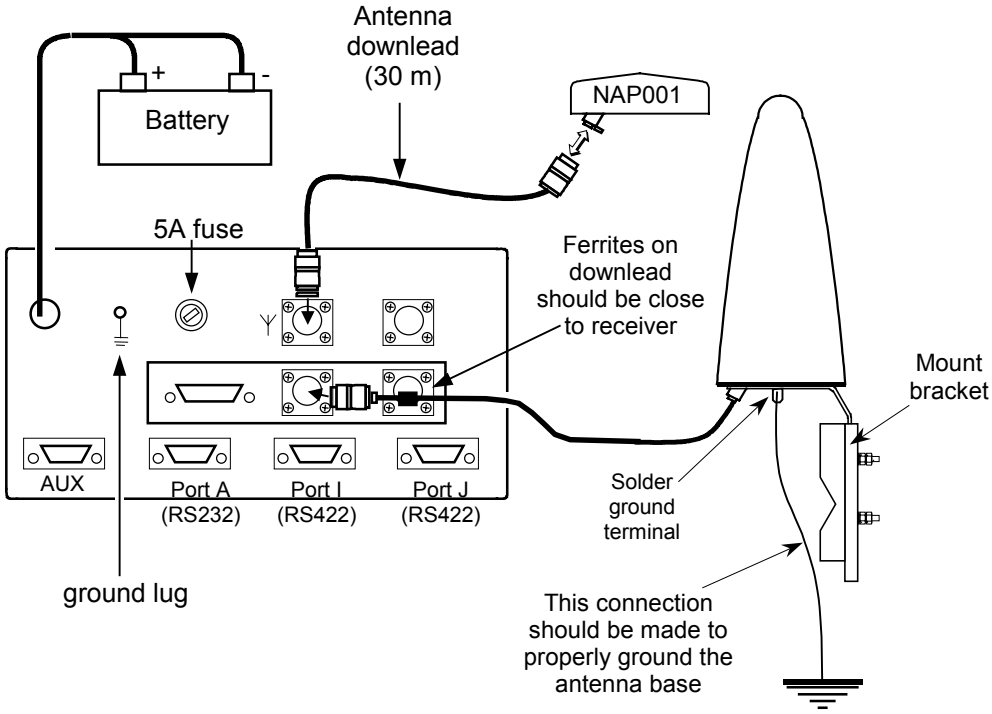
NOTICE

If you need to shorten the GPS antenna downlead :

- ***cut the end to be connected to the receiver*** *rather than the end connected to the antenna, to preclude any problem of sealing,*
- *the antenna cable should not be less than 10 m long,*
- *the wiring of the new TNC connector should be done by skilled personnel only.*

CONNECTIONS

The receiver should be connected to a power source, to the antennas and, if required, to any peripheral device needed (recorder, video plotter, etc.) as shown below. The antenna ground lead should be connected to the ship's ground system.



Antennas

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 and grounding lead should be attached to the mast (using adhesive or clamps) to preclude any stress on the connectors.

Options

The DMA8 magnetic antenna should be connected to the WIDE BAND input.

The DSA7 selective antenna should be connected to the NARROW BAND input. If this antenna is used, the receiver can only operate at the antenna tuning frequency. To use the NARROW BAND input a hardware change should be made to the DIF03 board ***(Warning : the change should be made by skilled personnel only).***

Peripherals

Turn off both the receiver and the peripheral whenever you need to plug/unplug any cable between the two.

Peripherals should be connected to port A or port I, or port J.

10 MHz external oscillator input

- Any sinewave, with amplitude level between 0 and 10 dBm, frequency 10 MHz $\pm$ 10^{-6} 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.

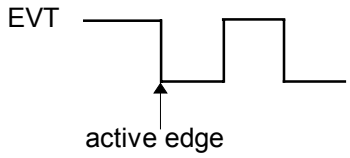
AUX connector

(Sub-D-9 male connector)

PIN	SIGNAL	DESCRIPTION
1	GND	Ground
2	sensEVT	Not used
3	EVT	Ext. event input (Trg I)
4	– 1 PPS	1pps output (true)
5	1 PPS	1 pps output (complement)
6	Env data	Not used
7	Alarm	Not used
8		Not used
9	MOB	Ext event input (Trg B)

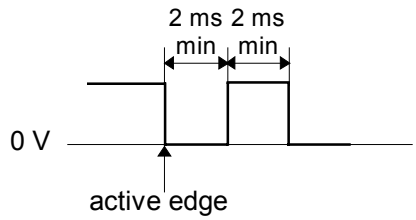
Time-tagging of ext. event input Trg I (pin 3)

- Accurate to within ± 100 ns + SA
- Input featuring 10- kΩ pull-up resistor to + 5 V DC
- Active edge



Time-tagging of ext. event input Trg B (pin 9).

- Accurate to within ± 1 ms
- Input featuring 10 kΩ pull-up resistor tied to + 12 V DC.
- Input signal requirements :



1 pps output (pin 5)

- 1 Hz square waveform
- Rising edge synchronized onto UTC time
- Accurate to within ± 100 ns + SA 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.

1 pps output (pin 4)

- Pin 5's complement. Same characteristics as above except that it is the trailing edge, instead of the rising edge, which is synchronized onto UTC time.
- Using both pin 4 and pin 5 makes the 1 pps compatible with the signal requirements of an RS422 line.

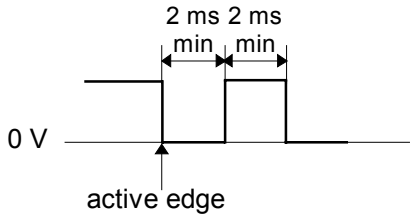
RS232C port (port A)

(Sub-D-9 female connector)

PIN	SIGNAL	RS 232 C line
1	TOP EXT	Ext. event input (TrgA)
2	TXD	Data output
3	RXD	Data input
4	DSR	*Not used*
5	GND	0 Volt (ground)
6	DTR	*Not used*
7	CTS	Control signal input
8	RTS	Control signal output
9		*Not used*

Time tagging of Ext. event input Trg A (Pin 1)

- Accurate to within ± 1 ms
- Input featuring 10 kΩ pull-up resistor tied to + 12 V DC.
- Input signal requirements :



RS422 ports (Port I and Port J)

(Sub-D-9 female connector)

PIN	SIGNAL	RS 422 line
1	GND	Ground
2	CTS+	Control signal input
3	CTS–	
4	RXD+	Data input
5	RXD–	
6	RTS–	Control signal output
7	RTS+	
8	TXD+	Data output
9	TXD–	

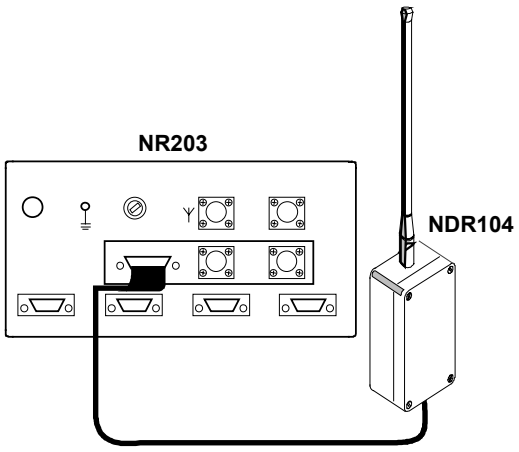
NDR104 (UHF receiver) option or RTCM104 corrections receiver

These two devices can be attached to the NR203 receiver through the NUM connector described below.

NUM connector (Sub-D-15 female)

PIN	SIGNAL	RS 232 Line (port K)	RS 422 Line (port L)
1	N. C.		
2	+ 12 V		NDR 104 VDC
3	GND	Ground	Ground
4	CTS1	Control Signal Input	
5	RTS1	Control Signal Ouput	
6	RXD1	Data Input	
7	TXD1	Data Output	
8	CTS +		Control signal input
9	CTS –		
10	RXD +		Data input
11	RXD –		
12	RTS –		Control signal output
13	RTS +		
14	TXD +		Data output
15	TXD –		

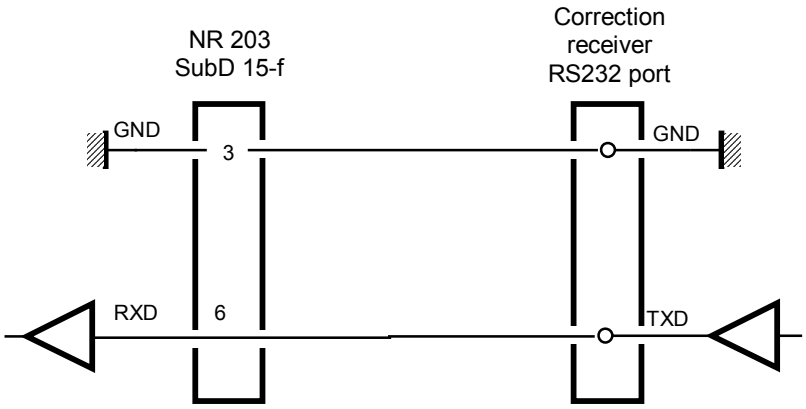
Port L (RS422) is especially designed for the UHF NDR104 receiver but it can also be used for RTCM104 digital input.



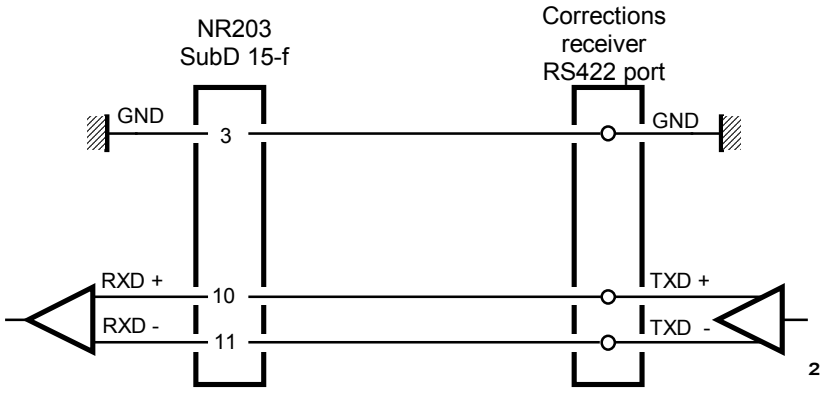
Connecting an RTCM corrections receiver

Three cases are possible depending on the type of serial port used on the corrections receiver side.

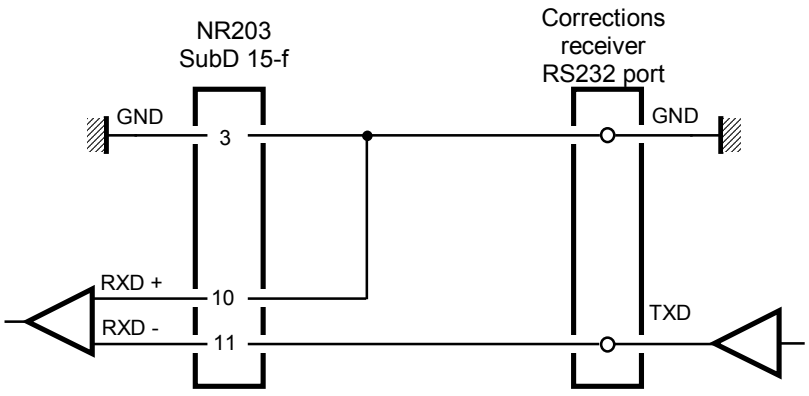
1) The corrections receiver uses an RS232 port (Port K)



2) The corrections receiver uses an RS422 port (Port L)

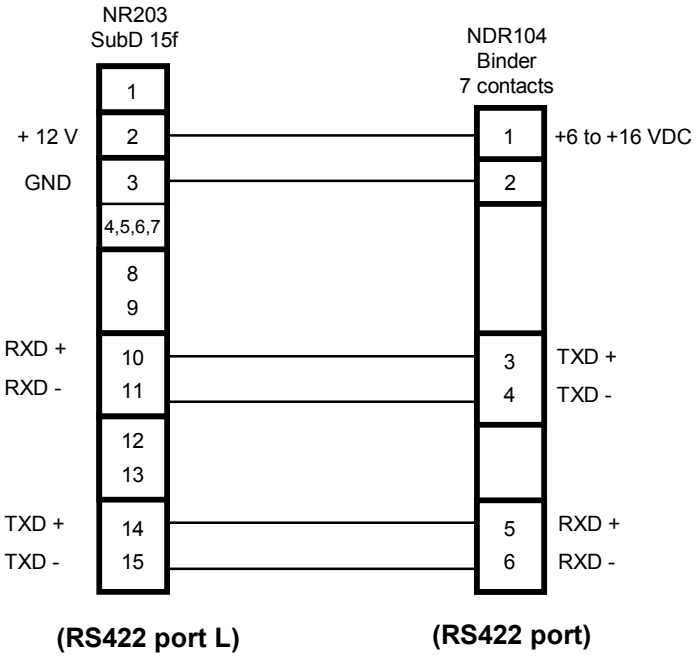


3) Using the RS422 port with an RS232 receiver output (Port L)



Connecting an NDR104 UHF receiver

Use the cable described below.



Power input connector

Socket : 3 contacts, male

Plug : 3 contacts, female

PIN	SIGNAL	FUNCTION
A B C	– Vcc + Vcc not used	Battery – terminal Battery + terminal

The power supply is floating, meaning that the + Vcc and – Vcc lines are not tied to the receiver's chassis ground.

The input power supply voltage should be between 10 and 36 VDC.

APPENDIX 2

GETTING STARTED

POWER ON

- Check for a power input between 10 and 36 VDC, with the correct polarity. Typically the power source used is a 12- or 24-V battery.
- Turn on the receiver (press the ON/OFF key).
- At the end of a few seconds, the self-test is complete and the receiver is ready to operate.

SOFTWARE

- Press the ***[AUX]*** key and select ***"5-Init"***, then ***"4-About"***. The screen shows :
  - the GPS reception software version,
  - the identification of the configuration file loaded,
  - the version of the PWES1 and DIF03 boards.

If an NDR104 UHF correction receiver is connected, this also appears in the ABOUT screen.

CHECK AND/OR UPDATE THE DATE AND TIME

The Date and Time are entered once and for all into the receiver and continually updated even when the power is turned off or disconnected. Therefore, the operator will not have to enter or update the date and time.

The first time the receiver is put into service, however, it is advisable to verify these two parameters.

About the time at the initialization stage

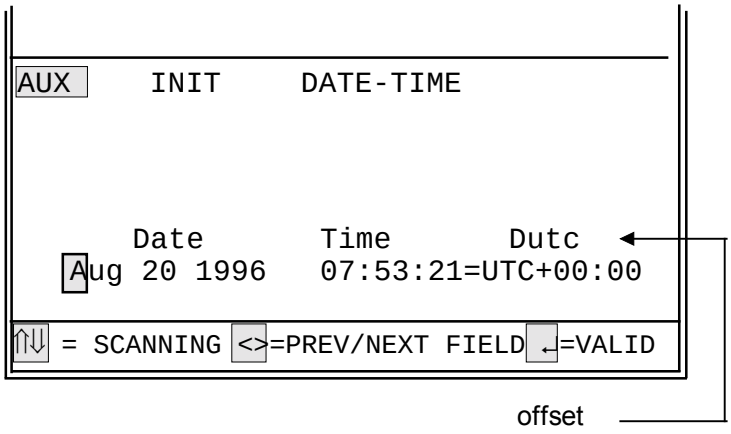
The time should be accurate to within 5 minutes. When the receiver is capable of computing a fix, the data from the satellites will allow the time to be automatically updated to within 1 second. (Incidentally, if you try to enter any incorrect time or date, the receiver makes the necessary corrections within 1 second).

The time displayed may be UTC or local, as requested by the operator. The time is displayed in the 0-24 h format as follows :

Ex : 22:10:15
hour minute second

See if the date and time are correct and, if necessary, make the necessary corrections as follows :

- Press ***[AUX]*** and select ***"5-Init"***.
- Select ***"1-Date Time"***. The screen should look like this :



- The cursor rests on the first character of the month. If required, press [⇑] or [⇓] until the desired month is displayed.
- If required enter the time (UTC or local).
- If you wish to view the local rather than UTC time, then you need to enter the Local-UTC time offset ("Dutc" field) :

  - Move the cursor to the sign of the offset, using [←] or [→].

- Choose the desired sign, using [↑] or [↓] .
- Press [→] and enter the offset (± 12 hours in 30-minute steps).
- Press [↵]. This takes you back to the INIT menu of the AUX function.

The abridged status in the top section of the screen indicates :

"UTC" if the offset is 00:00

"LOC" if the offset is other than 00:00.

PERFORMANCE CHECK

After you have completed the above instructions, the receiver should be ready to operate.

- Check the configuration and selection of local DGPS stations.

  (see par. 3-1 for any details)
- See if the navigation data are displayed as shown in Chapter 2.
- Check for proper operation in both straight GPS and Differential GPS. Check the Quality figure of local DGPS stations.
- See if each navigation mode works properly
- Check for anomaly messages (AUX function key).

This completes the instructions for putting the receiver into operation.

***NOTE** : DSNP agents should give users any necessary advice on DGPS stations.*

APPENDIX 3

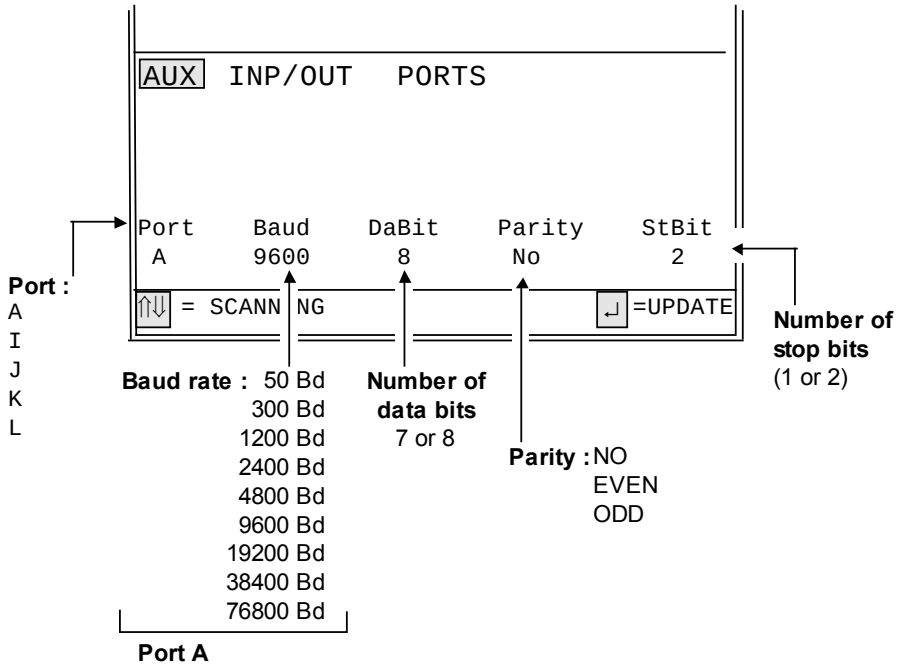
CONNECTING A PERIPHERAL

If you wish to connect your receiver to a peripheral device such as a digital plotter, or video plotter, then you need to set the parameters of the I/O port to be used on the receiver and select the messages to be generated (computed or raw data).

Depending on the peripheral to be used, the vendor should give the user any advice needed to make appropriate choices.

HOW TO SET THE CONFIGURATION OF AN OUTPUT PORT

- Press **[AUX]** and select "**9-Inp/Outp**".
- Select "**1-Ports**". The screen that shows up allows you to select the appropriate parameters for the peripheral to be used (see the manufacturer documentation).



- The [↓] or [↑] key allows you to select the desired port :

  A (RS232) : used for computed or raw data outputs or GPS board software loading.

  I (RS422) : used for computed or raw data outputs or I/O board software loading.

  J (RS422) : used for computed or raw data outputs

  K (RS232) : used to connect an RTCM digital correction receiver or for DGPS board software loading.

  L (RS422) : used to connect an NDR104 UHF option or an RTCM digital correction receiver.

- You are allowed to make any changes needed by pressing [↵] :

- The cursor shows up on the first digit of the Baud rate. Press [↑] or [↓] until the desired Baud rate is displayed.

  NOTE 1 : *The Maximum baud rate on port A is limited to 19200 bauds.*

  NOTE 2 : *There is a restriction on the Baud rate choice on ports I, J and K, L : if you choose 50 Bauds or 19200 Bauds on one port, you cannot choose 76800 Bauds on the other.*

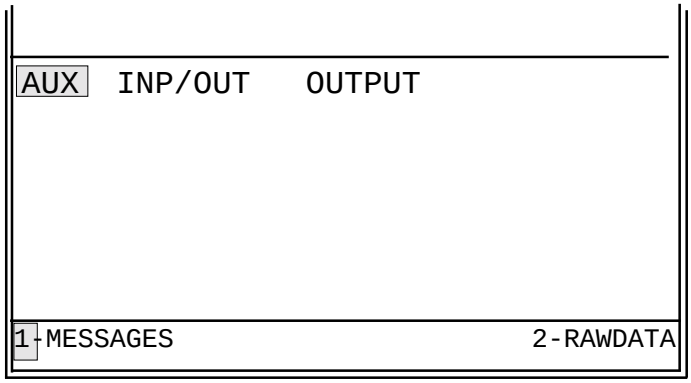
- Press [→] then [↑] or [↓] to select the number of data bits (7 or 8).
- Press [→] then [↑] or [↓] to select the parity (No, Odd, Even).
- Press [→] then [↑] or [↓] to select the number of stop bits (1 or 2).

- After selecting the appropriate options, press [↵] : as a result the selected options are entered and saved into the memory (even during power outages).

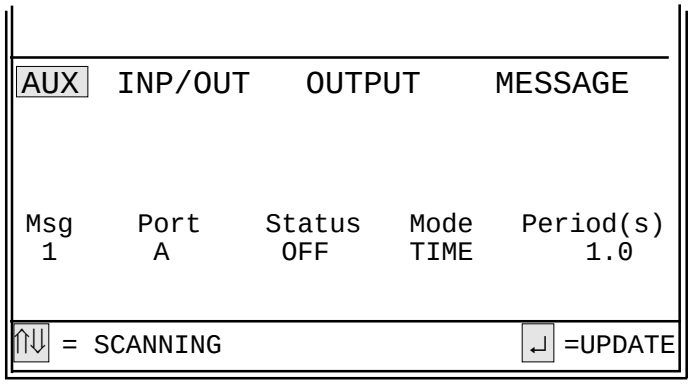
SELECTING MESSAGES AND ACTIVATING THE OUTPUT

- Press ***[AUX]*** and select ***"9-Inp/Outp"***.
- Select ***"2-Output"***.

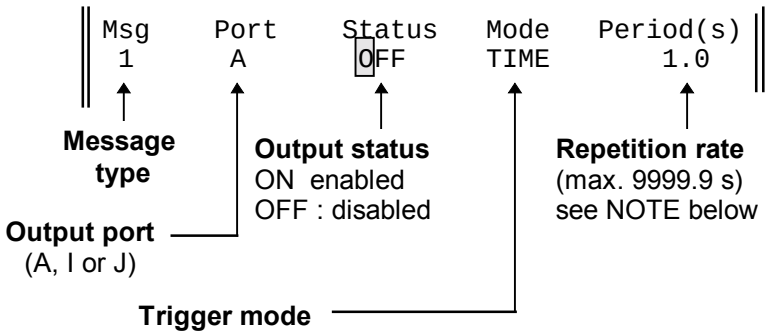
  The screen that shows up allows you to select the type of message to be transmitted via port A, I or J, and the trigger mode and repetition rate.



Select **1-Messages.** The screen that shows up allows you to view and modify the characteristics of the computed data output messages.



- [⇑] or [⇓] allows you to view the available messages (see description in the next paragraph).
- You are allowed to select the output port, status, trigger mode and repetition rate by pressing [↵].



TIME	Time between two consecutive messages
MARK	Manual output by MARK key
ASYNC	TR remote control word input via RS232C or RS422 port
TRG1	Triggered by 1pps signal
TRGA	Triggered by TOPEXT signal (pin 1 on "Port A" connector).
TRGB	Triggered by MOB signal (pin 9 on AUX connector)
TRGI	Triggered by EVT signal (pin 3 on AUX connector).

- Move the cursor to the desired parameter, using [→] or [←], and select the desired option using [↓] or [↑] (for the repetition rate, use the numeric keypad to enter the value).

- After making the necessary choices, press [↵] : as a result the selected options are entered and saved into the memory (even during power outages).

***NOTE** : The "Period" field is only prompted for the TIME trigger mode. For other modes it is replaced by a "Ticks" field used to specify the number of events between any two successive messages.*

DESCRIPTION OF AVAILABLE MESSAGES

Ident	Port	Mode	Rate	Contents
1	A	TIME	1sec	Global Positioning System Fix Data – GPGGA (NMEA183 V2.0). Position chosen for navigation, precision 10^{-5} minutes, no parity check.
2	A	TIME	1sec	Geographic Position Latitude/Longitude – GPGLL (NMEA183 V2.0). Position chosen for navigation, precision 10^{-5} minutes, no parity check.
3	A	TIME	1sec	Course Over Ground and Ground Speed – GPVTG, no parity check.
4	A	TIME	1sec	GPS DOP and Active Satellites – GPGSA, no parity check.
5	A	TIME	1sec	Time and Date - GPZDA, no parity check.
6	A	TIME	1sec	Recommended Minimum Specific GPS/TRANSIT Data - GPRMC, no parity check.
7	I	TRIG-I	1 tk	Raw Data Time Mark
8	A	TIME	1sec	NR103-type message (beginning) QLY, ZDA
9	A	TIME	1sec	NR103-type message (continued) GLL, VTG
10	A	TIME	1sec	NR103-type message (end) SGD, SYS, ZEF
11	A	TIME	1sec	Global Positioning System Fix Data – GPGGA WGS84 position, precision 10^{-4} minutes, with parity check
12	I	TIME	1sec	Global Positioning System Fix Data – GPGGA WGS84 position, precision 10^{-4} minutes, with parity check
13	I	TIME	1sec	Course Over Ground and Ground Speed – GPVTG With parity check.
14	I	TIME	1sec	Global Positioning System Fix Data – GPGGA WGS84 position, precision 10^{-5} minutes, with parity check
15	J	TIME	1sec	Position chosen for navigation, precision 10^{-4} minutes, with parity check.
16	J	TIME	1sec	GPS Pseudorange Noise Statistics – GPGST With parity check.

By default, all output messages are OFF at power-on.

Message 1 : Global Positioning System Fix Data - GPGGA (NMEA183 v2.0)

```
$GPGGA,hhmmss.ss,llll.lllll,a,yyyyy.yyyyy,a,x
,xx,x,x,M,x,M,x.x,xxxx<cr><lf>
```

`$GPGGA`	:		:	NMEA183 message identifier
`hhmmss.ss`	:	**TUTC**	:	UTC time of position computation
`llll.lllll,a`	:	**LAT**	:	Latitude degrees (2 char.), minutes (2 char.), 1.10^{-5} min., N/S indicator
`yyyyy.yyyyy,a`	:	**LON**	:	Longitude degrees (3 char.), minutes (2 char.), 1.10^{-5} min., E/W indicator
`x`	:	**PS+DS**	:	GPS quality figure : 0 = fix not available, or invalid 1 = straight GPS fix 2 = Differential GPS fix
`xx`	:	**NSVU**	:	Number of SVs used to compute the fix.
`x`	:	**HDOP**	:	Horizontal Dilution of Precision (-1 if not computed)
`x.xx,M`	:	**ZP**	:	Antenna altitude above MSL (metres)
`x,M`	:	**MSL**	:	Geoidal separation (between ellipsoid and Mean Sea Level)
`x.x`	:	**DAGE**	:	Mean age of Differential corrections (-1.0 if not computed)
`xxxx`	:	**DSTA**	:	Identification of Differential station used.

Message 2 : Geographic Position Latitude/Longitude - GPGLL (NMEA183 v2.0)

```
$GPGLL,llll.lllll,a,yyyyy.yyyyy,a,hhmmss.ss,a <cr><lf>
```

`$GPGLL`			:	NMEA183 message identifier
`llll.lllll,a`	:	**LAT**	:	Latitude degrees (2 char.), minutes (2 char.), 1.10^{-5} min., N/S indicator
`yyyyy.yyyyy,a`	:	**LON**	:	Longitude degrees (3 char.), minutes (2 char.), 1.10^{-5} min., E/W indicator
`hhmmss.ss`	:	**TUTC**	:	UTC time of position computation.
`a`	:	**PS**	:	GPS quality figure V = Fix not available, or invalid. A = GPS fix available

Message 3 : Course Over Ground and Ground Speed - GPVTG

```
$GPVTG,x.x,T,,,x.xx,N,,<cr><lf>
```

`$GPVTG`	:			NMEA183 message identifier
`x.x,T`	:	**COG**	:	Course Over Ground (degrees)
`x.xx,N`	:	**SOG**	:	Speed Over Ground (knots)

Message 4 : GPS DOP and Active Satellites - GPGSA

$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,,,x,x,x <cr><lf>

$GPGSA	:			NMEA183 message identifier
A	:			2D/3D automatic switching mode
x	:	**MODE**	:	Fix mode 1 = invalid fix 2 = 2-dimension mode 3 = 3-dimension mode
xx,...,xx	:	**NSVU**	:	PRN of SVs used in the solution
x	:	**PDOP**	:	Position DOP (-1 if not computed)
x	:	**HDOP**	:	Horizontal DOP (-1 if not computed)
x	:	**VDOP**	:	Vertical DOP (-1 if not computed)

Message 5 : Time and Date - GPZDA

$GPZDA,hhmmss.ss,xx,xx,xxxx,,<cr><lf>

$GPZDA	:			NMEA183 message identifier
hhmmss.ss	:	**TUTC**	:	UTC time
xx,xx,xxxx	:	**DUTC**	:	UTC date (day, month, year)

Message 6 : Recommended Minimum Specific GPS/TRANSIT Data - GPRMC

```
$GPRMC,hhmmss.ss,a,llll.lll,a,yyyyy.yyy,a,x.xx,x.x,,,<cr><lf>
```

`$GPRMC`	:			NMEA183 message identifier
`hhmmss.ss`	:	**TUTC**	:	UTC time
`a`	:	**PS**	:	GPS quality figure V = Fix not available, or invalid. A = GPS fix available
`llll.lll,a`	:	**LAT**	:	Latitude degrees (2 char.), minutes (2 char.), 1.10^{-5} min., N/S indicator
`yyyyy.yyy,a`	:	**LON**	:	Longitude degrees (3 char.), minutes (2 char.), 1.10^{-5} min., E/W indicator
`x.xx`	:	**SOG**	:	Speed Over Ground (knots)
`x.x`	:	**COG**	:	Course Over Ground (degrees)

Message 7 : Time Mark

```
<stx><cr><lf>
#T xxxx xxxxxxx<cr><lf
*1 xxxxxxxxxxx<cr><lf>
<etx>
```

`#T xxxx`	:	**GPSW**	:	GPS week number
`xxxxxxx`	:	**GPST**	:	GPS week time (Lsd 1/10 second)
`*1 xxxxxxxxxxx`	:	**GPST**	:	GPS time Modulo 10 seconds (Lsd:1×10^{-10} seconds)

Message 8 : **Of the NR103 type (beginning)**

<cr><lf>
$<cr><lf>
QLY,x,1,x.x,M,x,x,x,x,x,x,x,x,x,x<cr><lf>
ZDA,hhmmss.s,xx,xx,xxxx,x.x<cr><lf>

QLY,	:			Message line identifier
x,1	:	**PS**	:	GPS position status 0 = Fix not available, or invalid. 1 = GPS fix available
x.x,M	:	**DRMS**	:	Position DRMS (meters) (-1 if not computed)
x,...,x	:	**SVU[]**	:	PRN of SVs used in the solution
ZDA,	:			Message line identifier
hhmmss.s	:	**TUTC**	:	UTC time
xx,xx,xxxx	:	**DUTC**	:	UTC date (day, month, year)
x.x	:	**GPSD**	:	Time difference UTC/GPS (sec.)

Message 9 : **Of the NR103 type (continued)**

GLL,llll.llll,a,yyyyy.yyyy,a,x.xx,M<cr><lf>
VTG,hhmmss.s,xx,xx,xxxx,x.x<cr><lf>

GLL,	:			Message line identifier
llll.llll,a	:	**L84**	:	Latitude in degrees (2 char.), minutes (2 char.), 1.10^{-4} min., N/S indicator
yyyyy.yyyy,a	:	**G84**	:	Longitude in degrees (3 char.), minutes (2 char.), 1.10^{-4} min., E/W indicator
x.xx,M	:	**Z84**	:	Antenna altitude above ellipsoid (m)

VTG,	:			Message line identifier
x.x,T	:	**COG**	:	Course Over Ground (degrees)
x.xx,H	:	**SOG**	:	Horizontal Speed (m/s)
x.xx,V	:	**ZS**	:	Vertical Speed (m/s)

Message 10 : **Of the NR103 type (end)**

SGD,x.x,G,x.x,M<cr><lf>
SYS,cc,x<cr><lf>
ZEF,x.xxxxE-006<cr><lf>
&

SGD,	:			Message line identifier
x.x,G	:	**GDOP**	:	Geometric Dilution of Precision (-1 if not computed)
x.x,M	:	**LPME**	:	Line of position Mean Error (meters) (-1 if not computed)
SYS,	:			Message line identifier
cc	:	**MODE**	:	Position Mode H = Hold DR = Dead reckoning 2T = 2 dimensions + T 3T = 3 dimensions + T
x	:	**DRT**	:	If MODE = H or DR Time since DR (sec) If MODE = 2D or 3T Fix Quality figure
ZEF,	:			Message line identifier
x.xxxxxE-006	:	**HS**	:	Frequency pilot drift speed (sec/sec)

Messages 11 & 12: Global Positioning System Fix Data - GPGGA (with parity check)

```
$GPGGA,hhmmss.ss,llll.llll,a,yyyyy.yyyy,a,x,xx
  ,xx.x,+xxx.x,M,+12.5,M,xx.x,xxxx*hh<cr><lf>
```

`$GPGGA`	:		:	NMEA183 message identifier
`hhmmss.ss`	:	**TUTC**	:	UTC time of position computation
`llll.llll,a`	:	**L84**	:	Latitude in degrees (2 char.), minutes (2 char.), 1.10^{-4} min., N/S indicator
`yyyyy.yyyy,a`	:	**G84**	:	Longitude degrees (3 char.), minutes (2 char.), 1.10^{-4} min., E/W indicator
`x`	:	**DS**	:	GPS quality figure : 1 = straight GPS fix or not available 2 = Differential GPS fix
`xx`	:	**NSVU**	:	Number of SVs used to compute the fix.
`xx.x`	:	**HDOP**	:	Horizontal Dilution of Precision (-1 if not computed)
`+xxx.x,M`	:	**ZP**	:	Antenna altitude above MSL (meters)
`+12.3,M`	:		:	Altitude correction
`xx.x`	:	**DAGE**	:	Mean age of Differential corrections (-1.0 if not computed)
`xxxx`	:	**DSTA**	:	Identification of Differential station used.
`*hh`	:			Message parity

Message 13 : Course Over Ground and Ground Speed – GPVTG (with parity check)

```
$GPVTG,xxx.x,T,,,x.xx,N,,*hh<cr><lf>
```

$GPVTG	:		:	NMEA183 message identifier
xxx.x,T	:	**COG**	:	Course Over Ground (degrees)
xx.xx,N	:	**SOG**	:	Speed Over Ground (knots)
*hh	:		:	Message parity

Message 14: Global Positioning System Fix Data - GPGGA (with parity check)

```
$GPGGA,hhmmss.ss,llll.lllll,a,yyyyy.yyyyy,a,x,xx
,xx.x,+xxx.x,M,+12.5,M,xx.x,xxxx*hh<cr><lf>
```

$GPGGA	:		:	NMEA183 message identifier
hhmmss.ss	:	**TUTC**	:	UTC time of position computation
llll.lllll,a	:	**L84**	:	Latitude in degrees (2 char.), minutes (2 char.), 1.10^{-5} min., N/S indicator
yyyyy.yyyyy,a	:	**G84**	:	Longitude in degrees (3 char.), minutes (2 char.), 1.10^{-5} min., E/W indicator
x	:	**DS**	:	GPS quality figure : 1 = Straight GPS fix or not available 2 = Differential GPS fix
xx	:	**NSVU**	:	Number of SVs used to compute the fix.
xx.x	:	**HDOP**	:	Horizontal Dilution of Precision (-1 if not computed)
+xxx.x,M	:	**ZP**	:	Antenna altitude above MSL (metres)
+12.3,M	:		:	Altitude correction

xx.x	:	**DAGE**	:	Mean age of Differential corrections (-1.0 if not computed)
xxxx	:	**DSTA**	:	Identification of Differential station used.
*hh	:			Message parity

Message 15: Global Positioning System Fix Data - GPGGA (with parity check)

```
$GPGGA,hhmmss.ss,llll.llll,a,yyyyy.yyyy,a,x,xx,x
    x.x,+xxx.x,M,+12.5,M,xx.x,xxxx*hh<cr><lf>
```

$GPGGA	:			NMEA183 message identifier
hhmmss.ss	:	**TUTC**	:	UTC time of position computation
llll.llll,a	:	**LAT**	:	Latitude in degrees (2 char.), minutes (2 char.), 1.10^{-4} min., N/S indicator
yyyyy.yyyy,a	:	**LON**	:	Longitude in degrees (3 char.), minutes (2 char.), 1.10^{-4} min., E/W indicator
x	:	**DS**	:	GPS quality figure : 1 = straight GPS fix or not available 2 = Differential GPS fix
xx	:	**NSVU**	:	Number of SVs used to compute the fix.
xx.x	:	**HDOP**	:	Horizontal Dilution of Precision (-1 if not computed)
+xxx.x,M	:	**ZP**	:	Antenna altitude above MSL (meters)
+12.3,M	:		:	Altitude correction
xx.x	:	**DAGE**	:	Mean age of Differential corrections (-1.0 if not computed)
xxxx	:	**DSTA**	:	Identification of Differential station used.
*hh	:			Message parity

Message 16: GPS Pseudorange Noise Statistics - GPGST (with parity check)

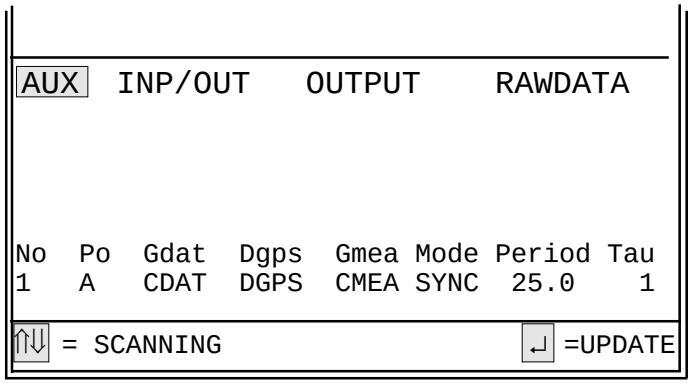
```
$GPGST,hhmmss.ss,xx.x,xx.x,xx.x,xxx.x
,xx.x,xx.x,xx.x*hh<cr><lf>
```

$GPGST	:		:	NMEA183 message identifier
hhmmss.ss	:	**TUTC**	:	UTC time of position computation
xx.x	:	**DRMS**	:	RMS value of the standard deviation of range inputs in fix (meters) (-1 if not computed)
xx.x	:	**SDMA**	:	Standard deviation of semi-major axis of error ellipse (meters) (-1 if not computed)
xx.x	:	**SDMI**	:	Standard deviation of semi-minor axis of error ellipse (meters) (-1 if not computed)
xxx.x	:	**EI**	:	Orientation of semi-major axis of error ellipse (degres from North) (-1 if not computed)
xx.x	:	**M[1]**	:	Standard deviation of latitude error (meters) (-1 if not computed)
xx.x	:	**M[3]**	:	Standard deviation of longitude error (meters) (-1.0 if not computed)
xx.x	:	**M[6]**	:	Standard deviation of altitude error (meters) (-1.0 if not computed)
*hh	:			Message parity

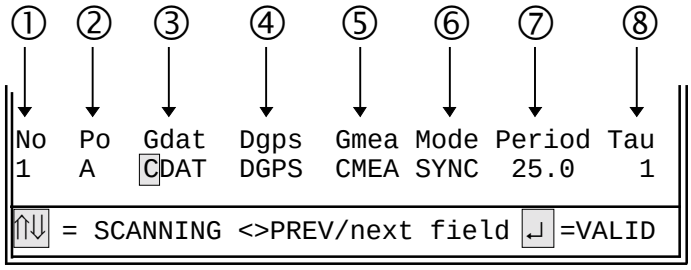
DEFINING AND ACTIVATING A RAW DATA MESSAGE

- Press the **[AUX]** key and select ***"9-Inp/Outp"***.
- Select **"2-RawData"**. A screen appears showing the current description of a raw data message, with the output rate, the trigger mode, and the port used.

  Use the ↑ or ↓ arrow key to view the description of the other raw data messages, if any.



- If you wish to make changes, press [↵]. Use [→] or [←] to go to the desired field and [↑] or [↓] to select the desired data (see the description of each entry field below). After making the necessary selections, press [↵] to enable the new configuration and quit.



① Raw Data Message Number

② Port to which the raw data message is routed (A or I or J)

③ **Gdat** : Type of GPS data contained in the message.

- NONE
- FDAT : Formatted GPS data
- CDAT : Compacted GPS data
- CBIT : Data Bits flow
- BDAT : Data Bits flow + Compacted GPS data

④ **DGPS** : Type of differential GPS corrections contained in the message

- NONE
- DGPS PRC corrections (SFIX Format)
- KGPS Phase measurements at reference (SFIX Format)
- FGPSPRC corrections + Phase measurements (SFIX Format)
- DVAR PRC corrections (SVAR Format)

⑤ **Gmea** : Type of GPS measurements contained in the message.

- NONE
- SMEA : Sampled and filtered measurements (SFIX Format)
- CMEA : Compacted measurements (not compatible with TRG_A and TRG_I trigger modes) (SFIX Format)
- SVAR: Sampled and filtered measurement (SVAR format)
- CVAR : Compacted measurements (SVAR format)
- SBIN : Sampled and filtered measurement (SBIN format)
- CBIN : Compacted measurements (SBIN format)
- RBIN : Sampled measurement (SBIN Reduced format)

- RBI0 : Sampled measurement (SBIN Reduced format) without phase measurements.

⑥ **Mode** : Output trigger mode

- OFF : no message is output
- SYNC : synchronized onto the GPS format
- TRG1 : triggered by PPS signal
- TRGA : triggered by TOPEXT signal (Port A connector pin 1)
- TRGB : triggered by MOB signal (AUX connector pin 9).
- TRGI : triggered by EVT signal (AUX connector pin 3).

⑦ **Period** : Output rate or number of messages :

- With the SYNC trigger mode, the output rate is specified in 0.6-second steps in this field.
- For all the other trigger modes, the Period field tells the receiver to insert only the next available Data Block (Period=1) or the next and preceding Data blocks (Period=2) into the raw data message.

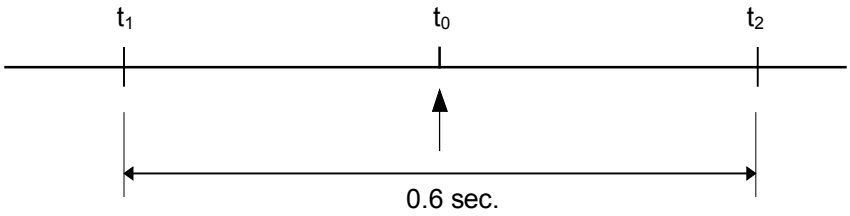
Example /

Assuming

t1 : time when Data Block n is available in the receiver

t0 : time of message request (from external equipment)

t2 : time when Data Block (n+1) is available



If Period =1, only Data Block *n+1* is inserted into the message

If Period =2, both Data Blocks *n* and *n+1* are inserted into the message

⑧ **Tau :** Filter time constant (seconds), only for filtered GPS measurements (i.e. with the SMEAS, SVAR and SBIN options of the ***Gmea*** field).

APPENDIX 4
DIFFERENTIAL GPS

1 - WHY DO WE NEED DIFFERENTIAL GPS ?

- The signals and data from the GPS satellites may exhibit some inherent ("normal") errors, such as errors due to wave propagation, inaccuracies on satellite orbit predictions and clock drifts. All such errors affect the positioning accuracy in traditional GPS receivers.

  On average, horizontal positioning errors may be as high as 30 to 50 metres for a 95% probability. Of course, the user may occasionally notice better accuracies but in the long run, for example over one or more years, problems of repeatability will lead to the above figures.

- Furthermore, both the signals and data available to civilian GPS users are subject to intentional impairment through the Selective Availability process (SA) that may be activated at any time by the US Department of Defence.

  S.A. will be systematically implemented when the global 3-dimension positioning capability of the GPS system is achieved.

  The effect of S.A. is a decrease in position and speed accuracies achievable worldwide, to a level consistent with the security requirements set out by the U.S. military.

  Accuracies of the order of 100 to 500 m, 95%, were experienced when SA was first activated. The current policy aims at setting the accuracy impairment at about 100 m. Also, inaccuracies on the speed observed may reach 2 knots, 95%, which, for many applications, is still more detrimental than the position error.

- All those errors, whether intentional or inherent in the GPS system when it is used "straight" away, have a common characteristic : high degree of correlation in space.

  A "high degree of space correlation" means that the errors observed by all GPS receivers locked on a given satellite will be virtually the same over an area of several thousand miles.

2 - THE DIFFERENTIAL GPS TECHNIQUE

- The basic principle of the Differential GPS technique consists of observing each satellite separately and measuring the error brought about by the satellite, using a receiver installed at a station with known coordinates.

  The DGPS technique relies on the error measured for each satellite ***separately***.

  If, instead, the technique consisted of directly comparing the geographical positions computed by two receivers (one of which still being stationary), one could never be sure that both receivers used the same satellites to compute the respective positions, which might lead to large errors.

  The deviations — called "corrections" — observed on each satellite, incorporated in digital messages, must be broadcast to Differential GPS users through a specific, highly reliable radio frequency link.

  The corrections received are applied to the signals and data from the SVs in DGPS receivers before the fix is computed.

- The Differential GPS reference stations from DSNP may offer a coverage of up to 500 nautical miles.

- The DGPS policy is approved and even recommended by the U.S. D.O.D. since the DGPS system is a regional — rather than global — enhancement of precision and, therefore, its military impact is relatively unimportant.

- Some DSNP DGPS stations provide free access to the corrections they are broadcasting (no encryption).

  Other stations, owned by local organizations acting as service administrators, may broadcast encrypted corrections so that only authorized users can receive them. In that case, the station's administrator may periodically disclose the necessary password (i.e. user code C3) to authorized users.

- The NR203 is capable of receiving and using DGPS corrections from both non-encrypted and encrypted stations (for an encrypted station, the C3 user code must be entered into the receiver).

  The NR203 is also capable of processing RTCM-formatted corrections either through a radio link or through a serial line connecting them to an auxiliary receiver.

3 - THE KART TECHNIQUE

With the KART processing, the same general technique is used but, in addition, the complete carrier phase cycles — known as ***phase integers*** — are determined, therefore the resulting accuracy is from 1 to a few centimetres. This far better accuracy, however, is only achievable after a short initialization interval (3 to 10 minutes typically) the precise duration of which depends on the constellation, on the distance from the reference station, on environmental conditions (extent of multipath effect).

After the initialization is complete, centimetric accuracy is achieved continually, provided that at least four satellites remain simultaneously in view, as is always the case at sea.

4 - THE DIFFERENTIAL GPS IN THE NR203

The differential receiver board (DIF03) houses six parallel input channels :

- Four analog inputs for HF or MF (radiobeacon) signals.
- Two serial ports :
  . an RS232 port for digital RTCM104 corrections
  . an RS422 port for RTCM104 or DSNP UHF corrections.

The signals from up to six different stations can be fed to six parallel processing channels, depending on the selections made by the operator using the DIFF SELECT menu.

As a result, six sets of differential corrections may be available to the GPS board, used either for KART or for DGPS processing.

- **KART** : This processing mode can be used if the corrections include phase corrections (DSNP UHF stations). The resulting position can be :
  - KART A : providing 1 cm XYZ accuracy. The position is updated at the same rate as the corrections received from the UHF station (typically every 2 seconds) which means a position latency figure of about 2 to 3 seconds.

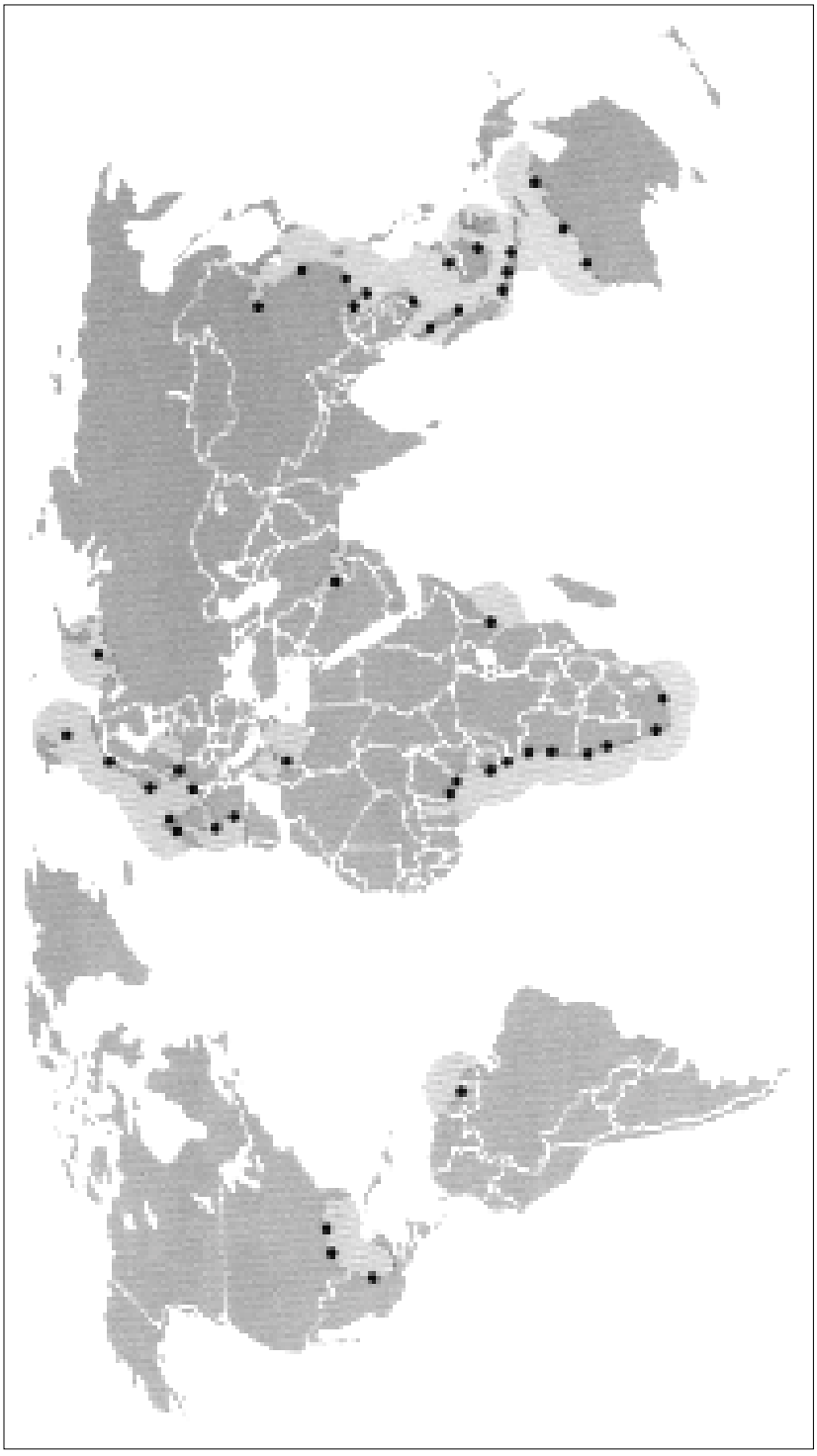
- KART R : providing 2 cm XYZ accuracy. Corrections are extrapolated from the last two successive corrections received from the UHF Differential Station, in order to achieve a higher update rate for the KART position (0.6 seconds), i.e. a position latency less than 1 second.
- EDGPS : providing 20 cm XYZ accuracy with a 0.6-second output rate. Where the 1 or 2 cm accuracy of KART A or KART R is unnecessary, the EDGPS (Enhanced DGPS) mode allows you to benefit from the KART processing to achieve decimetric accuracy without the need for any initialization step.

- **DGPS** : This mode allows you to use corrections from up to four stations. Three options are available for the position solution :
  - DGPS1, "Primary" solution (0.6 s output rate), resulting from a single station.
  - DGPS2, DGPS3, DGPS4 : up to three distinct solutions resulting from three more stations.
  - MDGPS : "Multistation" solution (0.6 s output rate) from a least-square processing on the available DGPS positions (DGPS1, 2, 3, 4), providing a weighted mean position with submetre to metre accuracy.

NOTICE

KART and standard DGPS modes cannot be run simultaneously.

5 - DSNP DGPS COVERAGE



APPENDIX 5
DATUM

The parameters visible on each navigation display (Latitude, Longitude, Course Over Ground, etc.) are described in Chapter 2. The specific parameters in each navigation mode are described in par. 3-3.

Below are a number of comments concerning the ***Datum*** (e.g. WGS84).

A Datum results from taking an ellipsoid and moving its centre so the ellipsoid matches the geoid very closely in your area of interest. The Datum is used to specify the geodetic reference and type of projection of the position displayed : it allows you to identify the type of navigation chart to be used to pinpoint your position.

"European Datum 50" is the reference of virtually all european charts. In some countries, minor discrepancies may give rise to deviations of a few metres relative to local charts. DSNP agents are informed of such discrepancies and will configure their receivers so as to take them into account.

WGS84 (World Geodetic System 84) is the reference for the GPS. Unfortunately, no local detailed mapping is available yet in this Datum. However, local WGS84-referenced charts may gradually become available in the decades to come.

In that respect, it is worth noting that most GPS receivers currently marketed display positions computed in the WGS84 datum and, in most cases, do not even warn the operator. This may give rise to additional errors, of up to 100 to 200 metres in some regions, in pinpointing the positions on local navigation charts.

To preclude any such error, which is essential if one wishes to benefit from the centimetric accuracy in Kinematic or Differential GPS, the position displayed must be in the same Datum as local navigation charts.

Different regions on Earth may have different Datum's : for example, the DGPS stations covering some Australian coasts use the AGD Datum (Australian Geodetic Datum).

On-line Datum transformation routines in your NR203 will convert the WGS84 latitude/longitude to a latitude/longitude or Northing/Easting on the Datum you select with the ***AUX → 5-Init → 4-Geo-Proj*** function, depending on the type of navigation chart you are using. DSNP agents will give you all necessary information in that respect.

APPENDIX 6

ALLOWABLE COMMANDS

FROM A PC

ALT	Altitude correction
ALMANAC	Almanac data
CONFIG	Read/load configuration data
DATE	Date & time
DEFAULT	Read/Recover faults
DIFF	Commands related to differential corrections
DSELECT	List of excluded satellites
DUMP	Status of output messages
D_RECK	Read current position/enter position estimate
EPHEM	Ephemeris data
EVMIN	Minimum elevation of satellites
GEODESY	Read/load Geodesy data
$aaGPQ,WPL	Read characteristics of waypoint No. 00
IONO	Iono-UTC data
OUT_MES	Computed data output
RAWDAT	Raw data output
SEL_GEO	Geodesy selection
TR	RS232 mode output
$aaTLL	Change/initialize any waypoint
UNIT	Receiver identification number
$aaWPL	Change/initialize waypoint No. 00
$aaGPQ,TLL	Read characteristics of all waypoints

Conventions used below to describe the commands

1) In the syntax of commands :

Parameters between square brackets : optional

<sp> : space required

2) In examples :

Bold characters : commands from PC

Normal characters : receiver reply

Command : ALT

Function :

This command is used to read/change the altitude correction mode and the correction value.

Syntax

ALT<cr><lf>	(read)
ALT<sp>**alt_mode,dmsl,offset**<cr><lf>	(change)

Parameters

`alt_mode` : Altitude correction mode
- 0: above MSL(1) $_{STANAG}$ - WGS84
- 1: above WGS84 ellipsoid
- 2: above ellipsoid chosen by operator

`dmsl` : User-supplied DMSL (9999.999 m max.), used if alt_mode = 1.

`offset` : Antenna height correction (9999.999 m max.)

(1) Mean Sea Level

Comments

If `alt_mode` = 0 :
Mobile Altitude = $Alt._{WGS84}$ - (MSL_{STANAG} + `offset`)

If `alt_mode` = 1 :
Mobile Altitude = $Alt._{WGS84}$ - (`dmsl + offset`)

If `alt_mode` = 2 :
Mobile Altitude = $Alt._{Ellips}$ - (`offset`)

Examples

```
ALT
ALT    0    0.000    0.000
ALT 0,0.0,10.5
ALT
ALT    0   0.0000    10.500
```

Command : ALMANAC

Function :

This command is used to read the latest almanac transmitted by the specified satellite or latest almanacs transmitted for all satellites.

Syntax

AL**MANAC**[<sp>**SV_No**] [**,format**] <cr><lf>

Parameters

SV_No : PRN No. of the satellite for which you wish to read the latest almanac received (latest almanacs of all SVs if no SV is specified).

Format : Almanac data format
C : Compacted
F : Formatted
(compacted if no format specified)

Comments

The ALMANAC command reads all or part of the data identified as %A or *A, which may also be included in GPS messages.

Examples

```
ALMANAC 21
<stx>
%A  643 1332660
21  643
...
```

Command : CONFIG

Function :

This command is used to read the configuration data saved in the receiver, or to load the default configuration data.

Syntax

CONFIG<cr><lf>	(read)
CONFIG<sp>**INIT**<cr><lf>	(reset to default)

Parameters : none

Comments

Loading a configuration file may take a few minutes during which the receiver cannot execute any other command.

To load configuration data other than the default configuration data, you must transmit a configuration file, whose format is shown below, using serial port A.

<stx>GPS000.....<etx><par1><par2><^Z>

The "CONFGPS" PC software provided on the "CONF203" disk can be used to prepare and load the GPS configuration file.

Examples

CONFIG

```
GPS000
016,40,LABEL
026,02,COMMENT
082,00,ELIPS
078,00,PROJ
  :       :
  :       :
        0
D7
```

CONFIG INIT

```
CONFIG INIT proceeding
CONFIG INIT completed
```

Command : DATE

Function :

This command is used to read/change the date & time parameters.

Syntax

DATE<cr><lf>	(read)
DATE<sp> **DD/MM/YYYY,HH:MM:SS**[,**HH:MM**]<cr><lf>	(load)

Parameters

DD/MM/YYYY	:	Day (1..31), month (1..12), year
HH:MM:SS	:	UTC time if no offset (Local - UTC= 0) or Local time if offset (Local - UTC ≠ 0)
HH:MM	:	Offset (local time - UTC time)

Comments

- Reading the Date & Time will cause the (Local - UTC) offset to be reported as well if other than 0.
- If at least one satellite is received, then the time is updated with the GPS time.
- When specified in the command, the (Local - UTC) offset is saved to the receiver's configuration memory.

Examples

```
DATE
DATE    04/11/1991    13:32:43
DATE 4/11/1991,14:30:00,1:00
DATE
DATE    04/11/1991    14:33:12    +01:00
```

Command : DEFAULT

Function :

This command is used to read/clear the faults detected by the receiver.

Syntax

DEFAULT[<sp>Fault_No] <cr><lf>	(read)
DEFAULT[<sp> Fault_No]<sp>RESET<cr><lf>	(clear)

Parameters

`Fault_No` :Fault identification code

Comments

- If no fault identification code is specified in the command, then all faults detected in the receiver will be read/cleared.
- The fault list starts from the latest to the oldest.
- The information provided for each fault is described below.
- Appendix 10 reviews all the possible faults and anomalies which the receiver may detect.

```
DEFAULT I/O    35   255   5   7:24:00 /  8:17:14
```

I/0	:	Fault label
35	:	Fault identification code
255	:	Auxiliary code
5	:	Day (1..31) when fault was first detected
7:24:00	:	Time when fault was first detected
8:17:14	:	Time when fault vanished (current time if still persisting)

- The last line in the list is blank.

Examples

```
DEFAULT
DEFAULT I/O    35   255   5   7:24:00 /  8:17:14
DEFAULT I/O    34   255   5   7:23:00 /  8:16:22
DEFAULT RCVER  10     0   4  16:21:14 / 12:16:23
DEFAULT POSIT  28     0   4  16:21:14 / 16:25:38

DEFAULT 34 RESET
DEFAULT
DEFAULT I/O    35   255   5   7:24:00 /  8:17:14
DEFAULT RCVER  10     0   4  16:21:14 / 12:16:23
DEFAULT POSIT  28     0   4  16:21:14 / 16:25:38

DEFAULT RESET
DEFAULT
DEFAULT NONE               5           / 10:48:21
```

Command : DIFF

Function :

This command is used to control the DIFF section of the receiver. Five sub-commands are available :

CONFIG	Returns the configuration data
MODE	Select DGPS mode
SELECT	Select DGPS station
STATION	List of known DGPS stations

Syntax

`DIFF`<sp> `com` [<sp>`par1, …, parn`]<cr><lf>

`Com` : Sub-command

`par1,...parn` : Parameters in the sub-command (see next pages).

Command : **DIFF**

DIFF CONFIG

Function :

This command is used to read the configuration data from the receiver.

Syntax

DIFF<sp>CONFIG<cr><lf>	read
DIFF<sp>CONFIG<sp>INIT<cr><lf>	reset to default

Parameters

Comments

- The configuration data are displayed in the following format :
  `<stx>DIF000.....<etx><par1><par2><^Z>`
- To load configuration data to the receiver, send your configuration file in the following format, via serial port A :
  `<stx>DIFxxx.....<etx><par1><par2><^Z>`
- The "CONFDIF" PC software provided on the "CONF203" disk can be used to prepare and load the DIFF configuration file.

Examples

DIFF CONFIG

```
DIF002
 16, 7,LABEL.
 20, 3,COMMENT
 92, 3,STATION
 12, 3,HARD_RS
  :         :
  :         :

  :         :

02,03,02,0A,02,03, 100,NR,EN,NR,E4,01
1,******,******
 2,******,******
 5,******,******

A1
```

DIFF CONFIG INIT

```
DIFF 1 CONFIG INIT proceeding
DIFF 1 CONFIG INIT completed
```

Command : **DIFF**

DIFF MODE

Function :

This command is used to read/change the DGPS processing and initialization mode, the type of fix to use and the sets of PRC data to use in computing fix or fixes.

Syntax

DIFF<sp>MODE<cr><lf>	(read)
DIFF<sp>MODE<sp>dgps-mode[,fix-used[,set1[,set2[,set3[,set4]]	(load)

Parameters

`dgps_mode` : DGPS mode processing or initialization mode

- 0 = not DGPS
- 1 = Conventional DGPS
- 2 = KART with On the Fly (OTF) initialization
- 3 = KART with Static initialization
- 4 = KART with Fixed-altitude initialization
- 5 = KART with known-position initialization
- 6 = Enhanced DGPS

`fix_used` : Computed fix used for navigation and geodesy change

- 1 = DGPS Fix with PRC set 1
- 2 = DGPS Fix with PRC set 2
- 3 = DGPS Fix with PRC set 3
- 4 = DGPS Fix with PRC set 4
- 5 = Multistation DGPS fix

(if dgps-mode = 0 or 1)

- 6 = Enhanced DGPS fix
- 7 = Accurate KART fix
- 8 = Real time KART fix

(if dgps-mode = 2 to 6)

Set 1 :Set of PRC's to use for DGPS fix 1, Enhanced DGPS or KART (1 to 6).

Set 2 :Set of PRC's to use for DGPS fix 2

Set 3 :Set of PRC's to use for DGPS fix 3

Set 4 :Set of PRC's to use for DGPS fix 4.

Comments

Before selecting "KART with known-position initialization" (dgps_mode = 5), accurate position must be provided using D-RECK command.

Example :

```
DIFF MODE
DIFF 1 MODE 1,1,1,0,0,0

DIFF MODE   1,5,1,2,5,6
DIFF MODE
DIFF 1 MODE 1,5,1,2,5,6
```

Command : DIFF

DIFF SELECT

Function :

This command is used to read/change the DGPS stations to be used.

Syntax

DIFF<sp>SELECT<cr><lf>

DIFF<sp>SELECT<sp>chnl,station,Frq	(Load for analog channel)

DIFF<sp>SELECT<sp>chnl,station1,station2,station3,station4

(Load for digital channel)

Parameters

chnl :	Reception channel to set up 1 to 4 Analog channels for HF/MF reception 5 : digital channel (RS232 port K) 6 : digital channel (RS422 port L)
Station :	DGPS HF or MF station identification (0 to 1023) -1 = unused
Frq :	Broadcast frequency (for dual-frequency HF station)
station 1 :	DGPS station identifier to receive on digital channel
station 2 :	DGPS station identifier to receive on digital channel
station 3 :	DGPS station identifier to receive on digital channel
station 4 :	DGPS station identifier to receive on digital channel (0 to 1023 ; - 1 = unused)

Comments

- The total number of stations selected should not exceed 6. An HF station with 2 frequencies selected stands only for one.

- Mixing HF and MF stations on analog channels is not allowed. All 4 channels should be programmed on HF band or MF band.

- Digital channels (ports K and L) can only be programmed with UHF or RTCM-SC104 digital station (6 of 8 format).

- Mixing UHF and RTCM-SC104 digital station is not allowed on the same digital channel.

Examples :

```
DIFF SELECT
DIFF 1 SELECT
1  11  1
2  11  2
3  -1  0
4  -1  0
5  703 704  -1  -1
6   14  -1  -1  -1
DIFF SELECT 3,13,1
DIFF SELECT
DIFF 1 SELECT
1   11   1
2   11   2
3   13   1
4   -1   0
5  703   704  -1  -1
6   14    -1  -1  -1
```

Command : DIFF

DIFF STATION

Function :

This command is used to provide the list usable stations.

Syntax

DIFF<sp>STATION<cr><lf>

Parameters

Comments

The list includes all stations whose characteristics have been described in the configuration file saved in the receiver and characteristics of stations broadcasted (RCTM-SC104 message types 3 and 7). The configuration file is generated and loaded to the receiver by the CONFDIF program.

Examples

```
DIFF STATION
DIFF 1 STATION
 1    1 H 2, 2    2 H 2, 3    3 H 2, 4    4 H 2, 5    5 H 2
 6    6 H 2, 7    7 H 2, 8    8 H 2, 9    9 H 2,10   10 H 2
11   11 M 1,12   12 M 1,13   14 U 1,14   99 H 2,15   13 H 2
16   -1 * 0,17   -1 * 0,18   -1 * 0,19   -1 * 0,20   -1 * 0
21   -1 * 0,22   -1 * 0,23   -1 * 0,24   -1 * 0,25   -1 * 0
26   -1 * 0,27   -1 * 0,28   -1 * 0,29   -1 * 0,30   -1 * 0
31   -1 * 0,32   -1 * 0,33   -1 * 0,34   -1 * 0,35   -1 * 0
36   -1 * 0,37   -1 * 0,38   -1 * 0,39   -1 * 0,40   -1 * 0
41   -1 * 0,42   -1 * 0,43   -1 * 0,44   -1 * 0,45   -1 * 0
```

- Characteristics of up to 45 stations are listed. The first 15 entries are reserved for the stations in the configuration file.

- For each station the following information is viewed :
  - Station row (1 to 45)
  - Station ID (0 to 1023) -1 if unused
    * if unused
  - Frequency band H : HF
    M : MF
    U : UHF
    N : NUMERIC
  - Number of Frequencies (1-2)

Command : DSELECT

Function :

This command is used to read/modify the list of excluded satellites.

Syntax

DSELECT<cr><lf>	(read)
DSELECT<sp> SV_No[,SV_No[,SV_No ...]]]]]]<cr><lf>	(modify)

Parameters

SV_No : PRN of the satellite to be excluded (1 to 32)
0 : re-selects all excluded satellites

Comments

Satellites may be excluded one by one whereas sending a re-select command (DSELECT 0) applies to all excluded satellites at the same time.

Examples

```
DSELECT
DSELECT  00 00 00 00 00 00 00 00
DSELECT 21
DSELECT
DSELECT  21 00 00 00 00 00 00 00
DSELECT 21,24
DSELECT
DSELECT  21 24 00 00 00 00 00 00
DSELECT 0
DSELECT
DSELECT  00 00 00 00 00 00 00 00
```

Command : DUMP

Function :

This command is used to read/modify the state of the output messages.

Syntax

DUMP<cr><lf>	(read)
DUMP<sp>Command<cr><lf>	(modify)

Parameters

Command : ON : suspends or disables the output messages

OFF : restores the initial state of the output messages

Comments

⇒ The DUMP command returns the state of the output messages via the RS232 port receiving the command.

⇒ The DUMP ON command suspends all output messages normally released via the RS232 port receiving the command and disables the Automatic Stop function.

⇒ The DUMP OFF command restores the states of the output messages — such as they were defined before sending DUMP ON — normally released via the RS232 port receiving the command and restores the Automatic Stop function.

Examples

```
DUMP
DUMP OFF RAWDAT:none OUT_MES: 01=off 02=off 03=off
04=off 05=off
DUMP ON
DUMP
DUMP ON RAWDAT:none OUT_MES: 01=off 02=off 03=off
04=off 05=off
DUMP OFF
```

Command : D_RECK

Function :

This command is used to read the known current position or to enter a position estimate.

Syntax

D_RECK<cr><lf>	(read)
D_RECK<sp>Datno,DD<sp>MM.ddddN,DDD<sp>MM.ddddE,+mmmmm.m<cr><lf>	(enter)

Parameters

Datno :	Identification number of the datum used (0 : WGS84). Only WGS84 is implemented whatever the selected datum.
DD MM.ddddN :	WGS84 latitude in degr., min., dir. (N : North, S : South)
DDD MM.ddddE :	WGS84 longitude in degr.,min., dir. (E : East, W : West)
+mmmmm.m :	Altitude in metres.

Comments

You may enter any number of decimal places for latitude, longitude and altitude.

The altitude you enter must be consistent with the definition you give to this parameter through the ALT command.

Examples

```
D_RECK
D_RECK 0,47 16.07240N,  1 29.47050W,   +79.000
D_RECK 0,47 10.2N,1 29.0W,35
D_RECK
D_RECK 0,47 10.20000N,  1 29.00000W,   +35.000
```

Command : EPHEM

Function :

This command is used to read the latest ephemeris data from the receiver for a specified reception channel or for all channels.

Syntax

EPHEM[<sp>[channo][,format]<cr><lf>

Parameters

Channo	:	Channel No. on which the desired ephemeris is received (or all ephemerides from all channels if no channel is specified).
Format	:	Format of ephemeris data C : Compacted F : Formatted (Compacted if no format specified)

Comments

This command reads all or part of the data labelled %E or *E from the receiver. %E and *E data may also be part of the GPS messages.

Examples

```
EPHEM 1,F
<stx>
*E  643 1335368
Channel   :            1
SV        :            3
...
```

Command : EVMIN

Function :

This command is used to read or modify the minimum elevation angle for all satellites.

Syntax

EVMIN<cr><lf>	(read)
EVMIN<sp>min_elev<cr><lf>	(modify)

Parameters

`min_elev` : Minimum elevation angle in degrees.

Examples

```
EVMIN
EVMIN   5
EVMIN 10
EVMIN
EVMIN  10
```

Command : GEODESY

Function

This command is used to read/load geoedesy and projection data.

Syntax

GEODESY[<sp>Geod_No]<cr><lf>	(read)

Parameters

Geod_No : Number of the geodetic system to be listed. If you do not specify the number, all geodetic systems are listed.

Comments

To load geodetic and projection data you must transmit a configuration file, whose format is shown below, using serial port A.

```
<stx><cr><lf>
! G,.....................;<etx>
```

The "CONFGEO" PC software provided on the "CONF203" disk can be used to prepare and load the Geodesy configuration file.

Examples :

```
GEODESY 1
^
!G,,
*1, 1"ntf"
*2,"A"6378249.145,"1/F"293.4649999999,"S"1.0000000000
0,1
*3,"Dx"-168.000,"Dy"-72.000,"Dz"318.500,1
*4,"Ax"0.000000000,"Ay"0.000000000,"Az"0.554000000,e
#1, 0"ntf"
#2,,"Gori"-0.03490658500,,,d
~
```

Command : $aaGPQ,WPL

Function

This command is used to read the characteristics of waypoint No. 00.

Syntax

```
$aaGPQ,WPL[*hh]
```

Parameters

aa :	identification of talker
*hh :	message parity (optional)

Comments

- NMEA 0183 Query sentence sent to read the characteristics of the waypoint No. 00.
- The receiver reply to this command is an NMEA WPL approved sentence.

Examples :

$ECGPQ,WPL
$GPWPL,4716.09077,N,00129.48151,W,WPT00

Command : $aaGPQ,TLL

Function

This command is used to read the characteristics of all the waypoints stored in the receiver.

Syntax

$aaGPQ,TLL[***hh**]

Parameters

aa : identification of talker
*hh : message parity (optional)

Comments

- NMEA 0183 Query sentence sent to read the characteristics of all the waypoints stored in the receiver.
- The receiver reply to this command is a list of NMEA 0183 TLL approved sentences for all the waypoints.

Examples :

$ECGPQ,TLL
$GPTLL,00,4716.09077,N,00129.48151,W,WPT00
$GPTLL,01,4728.01230,N,00129.52133,W BOUEE
$GPTLL,04,4709.47332,N,00127.00832,W,JETY

Command : IONO

Function

This command is used to read the latest Iono-UTC data from the receiver.

Syntax

IONO[<sp>format]<cr><lf>	(read)

Parameters

Format : Format of Iono-UTC data
C : Compacted
F : Formatted
(Compacted if no format specified)

Comments

This command reads all or part of the data labelled %U or *U from the receiver. %U and *U data may also be part of the GPS messages.

Examples

```
IONO
<stx>
%U  643 1332802
...
```

Command : OUT_MES

Function :

This command is used to read or modify the configuration of the output messages (computed data).

Syntax :

`OUT_MES`[<sp>`Mes`] <cr><lf>	(read)
`OUT_MES`<sp>`Mes`<sp>`Port`[`,Trig_Mode`[`,Period`[`,Form_lines`]]]<cr><lf>	(modify)

Parameters

`Mes`	:	Message identification No. (1 to 10)
`Port`	:	Port used for the transfer A : port A I : port I J : port J
`Trig_mode`	:	Message output mode
1	:	time
5	:	Manual (MRK key on front panel)
6	:	RS232 (on reception of TR command)
9	:	trigger (by 1 sec PPS signal)
10	:	trigger (by input signal on port A pin 1)
11	:	trigger (by input signal on AUX pin 9)
18	:	trigger (by input signal on AUX pin 3)
negative	:	message suspended

`Period` : Message output rate

. With output mode 1, time interval, in seconds, between any two consecutive messages.

. With all other output modes, number of events required between any two consecutive messages.

`Form_lines` : identification Nos. of the format description lines generating the message (1 to 5 lines).

Examples

```
OUT_MES
OUT_MES  1 A,-1,   0.6,12,14,15,16, 0
OUT_MES  2 A,-1,   0.6,17,18,19, 0, 0
OUT_MES  3 A,-1,   0.6,20,21,22, 0, 0
OUT_MES  4 A,-4,   1.0,13,16,17,18,22
OUT_MES  5 I, 1,  10.0, 5, 7, 8, 9, 0
OUT_MES  6 I,-4,   1.0, 5, 7, 8, 9, 0
OUT_MES 1 A,1,1.0
OUT_MES 1
OUT_MES  1 A, 1,   1.0,12,14,15,16, 0
```

Command :RAWDAT

Function

This command is used to read or modify the configuration of the GPS raw data messages.

Syntax

RAWDAT[<sp>No]<cr><lf>	(read)

RAWDAT[<**sp**>**Nb**]<**sp**>**Port**[**,Tr_Mode**[**,Period**[**,Meas,Diff,Data,Tau**]]] <cr><lf>	(modify)

Parameters

No	:	message number (1 or 2), 1 by default
Port	:	Port used for the transfer
		A : Port A
		I : Port I
		J : Port J
Tr_mode	:	Message output mode
		<0 : output suspended
		8 : synchronous with GPS format
		9 : trigger (by 1 PPS signal)
		10 : trigger (by input signal on port A)
		18 : trigger (by input signal on port I)
Period	:	output period and compacting

Mode 9 TRG1 Mode 10 TRGA	1 : Only the data block available right after the trigger time is provided in the message
Mode 18 TRGI	2 : Both the data blocks available right before and right after the trigger time are provided in the message.

Mode 8 SYNCH : Multiple of 0.6 s.

`Meas` :GPS measurements

0 : **NONE**	=	No GPS measurement output	
1 : **SMEAS**	=	SFIX Format	Code/phase smoothed measurements
2 : **CMEAS**	=	SFIX Format	Measurement average
11 : **SVAR**	=	SVAR Format	Code/phase smoothed measurements
12 : **CVAR**	=	SVAR Format	Measurement average
21 : **SBIN**	=	SBIN Format	Code/phase smoothed measurements (extended format)
22 : **CBIN**	=	SBIN Format	Measurement average (extended format)
30 : **RBIN0**	=	SBIN Format	Code/phase smoothed measurements (Abridged format with no phase)
31 : **RBIN**	=	Format SBIN	Code/phase smoothed measurements (Abridged format with phase)

`Diff` :Differential GPS corrections

0 : **NONE**	=	No Differential correction output	
3 : **DGPS**	=	SFIX Format	Differential correction output
6 : **KGPS**	=	SFIX Format	Station's phase measurement output
7 : **FGPS**	=	SFIX Format	Correction and phase measurement output
13 : **DVAR**	=	Format SVAR	Multistation differential correction output

`Data` : GPS data

0 : **NONE**	=	no GPS data output	
4 : **FDAT**	=	SFIX Format	Formatted data
5 : **CDAT**	=	SFIX Format	Compacted data
10 : **CBIT**	=	SVAR Format	Bit flow
15 : **BDAT**	=	SFIX compacted data +SVAR Format	Bit flow

Tau : Measurement filtering time constant, in seconds, when SMEAS or SVAR or RBIN or SBIN is part of the message (otherwise, meaningless).

Comments

- Reads the raw data output specifications from the configuration memory.
- Writes the new raw data output specifications to the configuration memory. The *Trigger* output mode is prohibited if CMEAS or CVAR or CBIN is part of the message.

Examples

```
RAWDAT                                          ①
RAWDAT 1 A,-8,   1.0, 1, 3, 5, 1, 0
RAWDAT 1 A,8,25.0                               ②
RAWDAT                                          ③
RAWDAT 1 A, 8,  25.0, 1, 3, 5, 1, 0
```

① Raw data output status
② Enabling 15-second compacted output mode
③ Raw data output status

Command : SEL_GEO

Function

This command is used to read/change the geodetic system used by the receiver.

Syntax

SEL_GEO<cr><lf>	(read)
SEL_GEO<sp>Geod_No<cr><lf>	(change)

Parameters

Geod_No. : Identification No. of the new geodetic system (it must be known to the receiver).

Examples

SEL_GEO
SEL_GEO 0
SEL_GEO 1
SEL_GEO
SEL_GEO 1

Command : TR

Function

This command is used to trigger an output message, configured with output mode 6 (RS232), via the specified port.

Syntax

TR[<sp>Port][<sp>Label]<cr><lf>

Parameters

Port : RS port used by the message

Label : ASCII label (string of up to 127 characters)
. stored as ULA variable if port A
. stored as ULI variable if port I
. stored as ULJ variable if port J

Comments

⇒ If no port is specified, the triggered message is that configured on the port receiving the command.

⇒ Variables ULA, ULI, ULJ may be included in an output message thanks to the TXT operator. For more information, refer to the CONFGPS Reference Manual (Doc. part No. 0311227).

⇒ If it is specified in the command line, the ASCII label is loaded to the relevant variable (ULA, ULI or ULJ) before the output message is triggered.

Example

```
TR
$GPGGA,101456,4716.0727,N,00129.472,W,9,6,3,35,M,85,M
TR A
TR A Ptopo 10
```

Command : $aaTLL

Function

This command is used to change/initialize the characteristics of any waypoint.

Syntax

```
$aaTLL,xx,llll.lllll,A,yyyyy.yyyyy,A,C--C
```

Parameters

aa	*:*	Identification of talker
xx	*:*	Waypoint number (00 to 99)
llll.lllll,A	*:*	Latitude of waypoint ddmm.mmmmm, N or S
yyyyy.yyyyy,A	*:*	Longitude of waypoint dddmm.mmmmm, E or W
C--C	*:*	Waypoint label

Comments

Waypoint position is entered in latitude and longitude on the currently selected datum.

Example

$ECTLL,01,4716.723,N,00129.412,W,TARGET

Command : UNIT

Function

This command is used to read/change the receiver identification number.

Syntax

`Unit`<cr><lf>	(read)
`Unit`<sp>`Unit_No`<cr><lf>	(change)

Parameters

`Unit_No` : receiver identification number (0 to 999)

Example

```
UNIT
UNIT 000
UNIT 4
UNIT
UNIT 004
```

Command : $aaWPL

Function

This command is used to change/initialize the characteristics of waypoint No. 00.

Syntax

```
$aaWPL,llll.lllll,A,yyyyy.yyyyy,A,C--C
```

Parameters

aa	*:*	Identification of talker
llll.lllll,A	*:*	Latitude of waypoint ddmm.mmmmm, N or S
yyyyy.yyyyy,A	*:*	Longitude of waypoint dddmm.mmmmm, E or W
C--C	*:*	Waypoint label

Comments

Waypoint position is entered in latitude and longitude on the currently selected datum.

Example

$ECWPL,4716.723,N,00129.412,W,ZPOINT

APPENDIX 7

RAW DATA

Notice : The expression "non-configurable" refers to those data whose format is predefined, and therefore not modifiable by the user.

A7 - 1 NON-CONFIGURABLE GPS DATA IN ASCII FORMAT (Fixed-size Fields - SFIX format)

A7-1-1 NOTATION RULES

- **RESERVED CHARACTERS**

(02_h)	<stx>	beginning of message
(25_h)	<%>	indicates type of block
(23_h)	<#>	indicates type of block
($2A_h$)	<*>	indicates type of block
($0D_h$,$0A_h$)	<eoln>	end of line
(03_h)	<etx>	end of message
(20_h)	<sp>	space separator

Subscript letter **h** *following a character string means that the string is in hexadecimal notation.*

- **CONVENTIONS USED**

Field	:	Generic term standing for one or more data
Data	:	Numerical value or label
<>	:	Denotes a field
<stx>	:	Beginning of message (02_h)
<sobk>	:	Beginning of block : one or more characters identifying beginning of block
<soln>	:	Beginning of line : one or more characters, identifying beginning of line in a block
<eoln>	:	End of line, 2 characters : CR, LF ($0D_h$, $0A_h$)
<etx>	:	Enf of message (03_h)

The term "block" stands for a group of data of the same nature.
The expression "numerical value" encompasses all notation types : binary, decimal or hexadecimal.
The term "number", if no further indication is provided, depicts a decimal number (in base 10)
The term "Label" stands for an ASCII character string.

- **GENERAL FORM OF MESSAGE**

  one "A" element : <stx> <eoln>
  one "B" element : <sobk> < time tagging line > <eoln>
  one or more "C" elements : <soln> < 1st data line > <eoln>
  ...
  one "D" element : <soln> < nth data line > <eoln>
  <etx>

  For any given line type, the count and type of data are predefined. The count of characters in any data is also predefined.

A7-1-2 DATA CLASSIFICATION

There are four main categories of raw data :

- **GPS DATA MESSAGES**

  Two types:

  – CDAT: non-formatted GPS data message (in hexadecimal) (%E, %A, %U, %S, %H)

  – FDAT: formatted GPS data message (in ASCII) (*E, *A, *U, *S, *H)

- **DIFFERENTIAL CORRECTIONS**

  #D : corrections received by user receivers

- **DGPS RAW DATA MEASUREMENTS**

  Two types:

  – CMEAS: Compacted raw data measurements (through FIR-type filtering) (%R)

  – SMEAS: Sampled raw data measurements (through IIR-type filtering) (#R)

A7-1-3 CDAT : NON-FORMATTED GPS DATA (Hex-encoded binary)

The CDAT generic term gathers the following data : %E, %A, %U, %S and %H.

- **EPHEMERIDES (%E)**

Format :

<stx><eoln>
%E<sp><b1><sp><b2><eoln>
<c1><sp><c2><eoln>
<t1m3><sp><t1m4>..<t1m9><sp><t1m10><eoln>
<t2m3><sp><t2m4>..<t2m9><sp><t2m10><eoln>
<t3m3><sp><t3m4>..<t3m9><sp><t3m10><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units
c1	(1 char)	Channel number (1 to F for 15 channels ; 1 to 9, 0 for 10 channels)
c2	(2 char)	Satellite number
t1m3..t1m10		Words 3 to 10 from Frame 1, bits d01..d24 (6 char per word)
t2m3..t2m10		Words 3 to 10 from Frame 2, bits d01..d24 (6 char per word)
t3m3..t3m10		Words 3 to 10 from Frame 3, bits d01..d24 (6 char per word)

Count of transmitted characters : 198

Example :

```
%E  570 2092740
7 21
8E9201 92DBF6 3B6CF8 697523 D2C00D 4534BC 00FFF3 FE2209
4500B9 326A27 89C2F3 FFFC05 170DD1 1406A1 0D6841 34BC56
001D4F 709505 FF9426 E1542A 183054 C42E11 FFA7CF 45F155
```

- **ALMANACS (%A)**

Format :

<stx><eoln>
%A<sp><b1><sp><b2><eoln>
<c1><sp><c2><eoln>
<t4m3><sp><t4m4>..<t4m9><sp><t4m10><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units
c1	(2 char)	Satellite number
c2	(4 char)	Almanac week number

t4m3..t4m10 : Words 3 to 10 from Frame 4, pages 2 to 5, 7 to 10, bits d01..d24 (almanacs for satellites 25 to 32)
Words 3 to 10 from Frame 5, pages 1 to 24, bits d01.. d24 (almanacs for satellites 1 to 24)
(6 characters per word)

Count of transmitted characters: 87

Example :

```
%A  570 2873946
 3  570
424964 72096A FD4100 A10CCF CEFBE1 808A11 DEED18 FD001F
```

- **IONO-UTC (% U)**

  Format :

  <stx><eoln>
  %U<sp><b1><sp><b2><eoln>
  <t4m3><sp><t4m4>..<t4m9><sp><t4m10><eoln>
  <etx>

  Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units
t4m3..t4m10		Words 3 to 10 from Frame 4, page 18, bits d01.. d24 (6 char per word)

  Count of transmitted characters: 78

  Example :

```
%U  570 2092746
782204 FE004C F5FF03 FFFF41 000000 2D723A 060901 06AAA8
```

- **ANTI-SPOOFING (%S)**

Format :

<stx><eoln>
%S<sp><b1><sp><b2><eoln>
<t4m3><sp><t4m4>..<t4m9><sp><t4m10><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units
t4m3..t4m9		Words 3 to 10 from Frame 4, page 25, bits d01 to d24 (for satellites 1 to 32, health data for SVs 25 to 32) (6 characters per word)

Count of transmitted characters: 78

- **HEALTH (% H)**

Format :

<stx><eoln>
%H<sp><b1><sp><b2><eoln>
<t5m3><sp><t5m4>..<t5m9><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units
t5m3..t5m9		Words 3 to 9 from Frame 5, page 25, bits d01.. d24 (satellites 1 to 24). 6 characters per word

Count of transmitted characters: 71

Example :

```
%H  570 2100564
73723A FC003F FC0FFF 03F000 000000 000000 03F03F
```

A7-1-4 FDAT : FORMATTED GPS DATA (ASCII)

The FDAT generic term gathers the following data : *E, *A, *U, *S and *H.

- **EPHEMERIDES (*E)**

Format :

<stx><eoln>
*E<sp><b1><sp><b2><eoln>
<c1> <eoln>
.. <eoln>
.. <eoln>
<c31><eoln>
<c32><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units

c1 to c32		Ephemeris data
	c1	parameter name (11 char) and value (16 char)
	----	parameter name (11 char) and value (16 char)
	c31	parameter name (11 char) and value (16 char)
	c32	27 char

Count of transmitted characters: 949

Example :

```
*E  570 2092740
Channel   :               7
Sv        :              21
Iodc      :             325
Af0   (us):         -14.2446
Af1 (ns/s):          -0.0015
Af2(ns/s2):       0.0000E-6
Toc    (s):          216000
Iode      :             325
A      (m):    26560375.336
W  (d m s):  119 12  9.5351
Mo (d m s):   55 36  1.7879
Io (d m s):   54 40 30.9644
Idt  (d/s):      -0.1921E-7
Om (d m s):  111 42 43.8552
Omdt (d/s):      -4.6201E-7
e         :   0.99415128E-2
Toe    (s):          216000
Wk_nb     :             570
Dn   (d/s):       2.6410E-7
Crc    (m):          193.50
Crs    (m):            5.78
Cuc    (d):      -0.0004E-3
Cus    (d):       0.5471E-3
Cic    (d):       0.0031E-3
Cis    (d):      -0.0115E-3
C_L2      :               1
Uare   (m):             4.0
Health    :               0
L2_Df     :               1
Fit(hours):               4
Tgd   (ns):             6.1
```

- **ALMANACS (*A)**

Format :

<stx>oln>
*A<sp><b1><sp><b2><eoln>
<c1> <eoln>
.. <eoln>
.. <eoln>
<c13><eoln>
<c14><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units

c1 to c14 Almanac data

c1	parameter name (11 char) and value (14 char)
--	parameter name (11 char) and value (14 char)
c13	parameter name (11 char) and value (14 char)
c14	25 char

Count of transmitted characters: 399

Example :

```
*A  570 2873946
Sv        :             3
A      (m):  26560338.828
W  (d m s):  147 26 42.07
Mo (d m s):  135 44 50.46
Io (d m s):   63 59 45.03
0m (d m s):    5  2 54.12
Omdt (d/s):    -3.3790E-7
e         :    1.25647E-2
Af0   (us):        -229.8
Af1 (ns/s):          -0.1
Toa    (s):        466944
Wk_nb_Alm :           570
Health    :             0
```

- **IONO-UTC (*U)**

Format :

<stx><eoln>
*U<sp><b1><sp><b2><eoln>
<c1> <eoln>
.. <eoln>
.. <eoln>
<c16><eoln>
<c17><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units

c1 to c17 Iono-UTC data
- c1 : parameter name (11 char) and value (14 char)
- --- : parameter name (11 char) and value (14 char)
- c16 : parameter name (11 char) and value (14 char)
- c17 : 25 char

Count of transmitted characters: 480

Example :

```
*U  570 2092746
a0    (ns):          31.7
a1 (ns/sc):          29.8
a2(ns/sc2):        -119.2
a3(ns/sc3):           0.0
b0     (s):        155648
b1  (s/sc):       -180224
b2 (s/sc2):        -65536
b3 (s/sc3):        196608
A0     (s):  0.0000000419
A1  (ns/s):    -0.0001696
Tot    (s):        466944
DTls   (s):             6
DTlsf  (s):             6
WNt   (wk):            58
WNlsf (wk):             9
DN   (day):             1
```

- **ANTI-SPOOFING (*S)**

Format :

<stx><eoln>
*S<sp><b1><sp><b2><eoln>
<c1><eoln>
<c2><eoln>
<c3><eoln>
<c4><eoln>
<c5><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units

c1 to c5 Anti-spoofing data

c1	8 × 4 char
---	
c4	8 × 4 char
c5	25 char

Count of transmitted characters: 184

Example :

```
*S  570 2092752
   0   1   0   0   0   0   0   0
   0   0   0   0   0   1   1   1
   1   1   1   1   1   0   1   0
   0   0   0   0   0   0   0   0
```

- **HEALTH (*H)**

Format :

<stx><eoln>
*H<sp><b1><sp><b2><eoln>
<c1><eoln>
<c2><eoln>
<c3><eoln>
<c4><eoln>
<c5><eoln>
<etx>

Data :

b1	(4 char)	GPS week number
b2	(7 char)	GPS time in reference to week, in 1/10 s units

c1 to c5		Health data
	c1	8 × 4 char
	---	
	c4	8 × 4 char
	c5	25 char

Count of transmitted characters: 184

Example :

```
*H  570 2100564
  63   0   0  63  63   0  63  63
   0  63   0   0   0   0   0   0
   0   0   0   0   0  63   0  63
  63  63  63  63  63  63  63  63
```

A7-1-5 DIFFERENTIAL CORRECTIONS

- **DIFFERENTIAL CORRECTIONS, RECEIVED (# D)**

Format :

<stx><eoln>
#D<sp><b1><sp><b2><eoln>
<c1><sp><c2><sp><c3><sp><c4><sp><c5><sp><c6><eoln>
..
<etx>

Data :

b1	:	(4 char)	GPS week number
b2	:	(7 char)	GPS time in reference to week, in 1/10 s units
c1	:	(2 char)	DSNP station number (1 to 99, depending on configuration) c1=0 for numeric RTCM
c2	:	(7 char)	Differential correction in cm (max. ± 999 999 cm)
c3	:	(4 char)	Age of correction. Unit : 1×10^{-1} second
c4	:	(2 char)	Satellite number

For DSNP station :

c5	:	(1 char)	Always 0
c6	:	(2 char)	Rate of good words received on that frequency (– 1 to 10) – 1 : carrier not detected 0 to 20 : transmission quality (only up to 10 for single-frequency station)

For RTCM station :

c5, c6 : Station identification number (=100 c5 +c6)

Count of transmitted characters: 21 + (25 × SV count)

Correction is to be ***subtracted*** from measurement.

DSNP corrections include IONO/TROPO terms.

RTCM corrections do not include IONO/TROPO terms.

If several stations are received, there is one block for each station.

Examples :

DSNP Station No. 1

```
#D  570 2092800
 1      55   16  2 0 10
 1      78   33  9 0 10
 1     -77    6 11 0 10
 1     -53    9 12 0 10
```

RTCM Station No. 720

```
#D  620 2058420
 0      45   16  3 7 20
 0      70   33  9 7 20
 0     -71    6 12 7 20
 0     -63    9 13 7 20
```

A7-1-6 PSEUDORANGE RAW DATA

- **CMEAS : COMPACTED GPS RAW DATA MEASUREMENTS (% R)**

Format :

<stx><eoln>
%R<sp><b1><sp><b2><eoln>
<c1><sp><c2><sp><c3><sp><c4><sp><c5><sp><c6><sp><c7><eoln>
..
<etx>

Data :

Each line describes the measurements made on a reception channel while tracking a satellite (15 lines max), where :

b1	:	(4 char)	GPS week number
b2	:	(7 char)	GPS time in reference to week, in 1/10 s units
c1	:	(2 char)	* and channel number (1 to 9, 0, A to F)
c2	:	(11 char)	Code pseudorange in 1×10^{-10} seconds modulo 10 seconds
c3	:	(11char)	Carrier phase in 1×10^{-3} cycles modulo 1×10^{11} thousandths of a cycle. Phase measurement decreases as distance increases.
c4	:	(2 char)	Satellite number

c5	:	(2 char)	C/No in dB Hz
c6	:	(3 char)	Pseudorange/phase standard deviation in 1×10^{-10} seconds
c7	:	(1 char)	Validity of phase and pseudorange measurements over the compacting period. The 8 bits (bits 0 to 7) of c7 are described below :

bit 0 = 1 if parity error
bit 1 = 1 if code and carrier unlocked
bit 2 = 1 if phase leaps by (2n+1) π
bit 0=1 and bit 3=1 : phase measurement not valid

Count of transmitted characters: 21 +(40 × SV count)

Leading "0's" are replaced by spaces as field separators.

Example :

```
%R  570 2092800
*1  7769273215     9724661  2 31   0 0
*2  7848424467    21861933  9 40   0 0
*3  7736550634    27759127 11 35   0 0
*4  7840226253      451393 12 31   0 0
*5  7734216380 99973224991 14 39   0 0
*6  7669679457 99995383873 15 38   0 0
*7  7790593602    33314106 21 41   0 0
```

- **SMEAS : SAMPLED GPS RAW DATA MEASUREMENTS (# R)**

Format :

<stx><eoln>
#R<sp><b1><sp><b2><eoln>
<c1><sp><c2><sp><c3><sp><c4><sp><c5><sp><c6><sp><c7><eoln>
..
<etx>

Data :

Each line describes the measurements made on a reception channel while tracking a satellite (15 lines max.), where :

b1	:	(4 char)	GPS week number
b2	:	(7 char)	GPS time in reference to week, in 1/10 s units

c1	:	(2 char)	* and channel number (1 to 9, 0, A to F)
c2	:	(11 char)	Code pseudorange in 1×10^{-10} seconds modulo 10 seconds
c3	:	(11 char)	Carrier phase in 1×10^{-3} cycles modulo 1×10^{11} thousandths of a cycle. Phase measurement decreases as distance increases.
c4	:	(2 char)	Satellite number
c5	:	(2 char)	C/No in dB Hz
c6	:	(3 char)	Pseudorange/phase standard deviation in 1×10^{-10} seconds
c7	:	(1 char)	Validity of phase measurement at the moment of sampling. bit 0 = 1 if parity error bit 1 = 1 if code and carrier phase unlocked bit 2 = 1 if phase leaps by (2n+1) π bit 0 = 1 and bit 3 = 1 : phase measurement not valid at the moment of sampling.

Count of transmitted characters: 21 + (40 × SV count).

Leading "0's" are replaced by spaces as field separators.

Example :

```
#R  570 2092800
*1  7769273215     9724661  2 31   0 0
*2  7848424467    21861933  9 40   0 0
*3  7736550634    27759127 11 35   0 0
*4  7840226253      451393 12 31   0 0
*5  7734216380 99973224991 14 39   0 0
*6  7669679457 99995383873 15 38   0 0
*7  7790593602    33314106 21 41   0 0
```

A7-1-7 PROCESSED DATA

- **PHASE DATA RECEIVED FROM A KART DIFF STATION (#K)**

Format :

<stx><eoln>
#K<sp><b1><sp><b2><eoln>
<c1><sp><c2><sp><c3><sp><c4><c5><eoln>
<etx>

Data :

b1	:	(4 char)	GPS week number
b2	:	(7 char)	GPS time in reference to week, in 1/10 s units
c1	:	(2 char)	Station number
c2	:	(6 char)	Phase measurement modulo 10000 turns (9999 trs, LSB: 10^{-2} tr)
c3	:	(2 char)	SV PRN number
c4	:	(1 char)	Phase continuity (4 hex, ASCII-encoded bits, 0.to.F)
c5	:	(1 char)	Phase quality (4 hex, ASCII-encoded bits, 0 to F)

Message length : 21 char + (17 char $\times$ message count) : 21 ... 191 char

Direction : CPU $\rightarrow$ port A, I or J

Recurrence : Depends on reception

Example :

```
#K 0629 2015186
 1 981280 12 01
 1 898120 28 01
 1 198502 14 01
 1 098128 01 01
 1 289810 23 01
 1 981280 06 01
 1 981280 13 01
 1 981280 11 01
```

- **ECEF POSITION OF REFERENCE (%N)**

Format :

<stx><eoln>
%N<sp><b1><sp><b2><eoln>
*1<sp><c1><sp><c2><eoln>
*2<sp><c3><sp><c4><sp><c5><eoln>
<etx>

Data :

	b1	(4 char)	GPS week number
	b2	(7 char)	GPS time in week when corrections are computed (low significant digit = 0.1s)
*1			
	c1	(4 char)	Station identification (0..1023)
	c2	(1 char)	Station health (0..7)
*2			
	c3	(10 char)	ECEF X Coord (±9999999 metres, LSB 10^{-2} metre)
	c4	(10 char)	ECEF Y Coord (±9999999 metres, LSB 10^{-2} metre)
	c5	(10 char)	ECEF Z Coord (±9999999 metres, LSB 10^{-2} metre)

Message length : 69 char

Function : Station status and WGS84 ECEF Reference position

Direction : CPU → port A, I or J

Recurrence : 30 seconds

Example :

```
%N 0629 2015186
*1 0012 6
*2 +433441175 -011281184 +466213155
```

A7-2 NON-CONFIGURABLE GPS DATA IN ASCII FORMAT WITH FIELD DELIMITERS (SVAR)

A7-2-1 NOTATION RULES

- **RESERVED CHARACTERS**

	(02_h)	<stx>	Beginning of message
!	(21_h)		Format indicator
,	($2C_h$)		Field delimiter
@	(40_h)		"checksum" delimiter
.	($2E_h$)		Decimal separator
"	(22_h)		Beginning and end of label
	($0D_h$,$0A_h$)	<eoln>	End of line
	(03_h)	<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 (**02_h**)
<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 (**$0D_h$ $0A_h$**)
<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 encodings : 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 OF MESSAGE**

<stx> <eoln>
<sobk> <,> < time tagging line > <eoln>
<soln> <,> < 1st data line > <eoln>
...
<soln> <,> < n^{th} 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 is written 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**

  Optionally a checksum can be placed at the end of every line 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.

A7-2-2 SINGLE-FREQUENCY GPS RAW DATA (Satellite time)

- **GENERAL FORM OF MESSAGE**

  <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 character:

  <#>
  2nd character:
  <C> L1 phase measurement, C/A code
  <filtering 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 }
<C/A L1carrier phase>, { in 10^{-3} cycles, modulo 10^{8} cycles }
<C/A L1carrier 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 *(not used)*
bit 1 = 0 if P code, 1 if Y code (Anti Spoofing)
bit 2 = 1 if invalid L1 phase measurement
bit 3 = 1 if invalid L2 phase measurement
<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", (always 00000) (includes parity errors)
bits 5 to 7 : "data quality indicator", (000 = valid data, 111 = invalid data)
<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", (always 1111)
bits 4 to 7 : "pseudo-range data quality indicator", (always 1111)
<eoln>

The C/A pseudorange is the value of the receiver's time base at the moment the C/A code transition is detected, at the beginning of the word corresponding to the GPS time of the message. The carrier phase is sampled at the same time.

Message example:

```
!R,570,209274.6
#C, 120
*1,12,  7769273215,  9724661575,-1126895, 35, 8, 00,FF
*B,23,  7769266082,  5966327231, 3820775, 37, 8, 00,FF
```

A7-2-3 SINGLE-FREQUENCY DIFFERENTIAL CORRECTIONS

These messages are generated by receivers provided with differential corrections through a data transmission line.

- **GENERAL FORM OF MESSAGE**

  <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>

  Time-tagging, in GPS time, of message:
  GPS week number and time, in reference to week, in seconds.
  Reference time is jan 6 1980 at 0hr00.

- **PARAMETER LINE**

<soln>, 2 characters:	<**%S**> DSNP corrections <**%R**> RTCM corrections <***#n***> message other than corrections (to be defined for future use)
<station number> ,	{ Read from receiver configuration or from RTCM 104 message}
<reception quality> ,	{ 0 to 20, describes the ratio of good messages 10 = 100% for single-freq; 20=100% for dual freq. bifrq}
< iono/tropo flag > ,	{ 0 : iono/tropo corrections are no part of the corrections message } { 1 : iono/tropo corrections are present in the corrections message}
<eoln>	

- **CORRECTIONS LINE**

<soln>,	{ 3 characters: * and SV number }
< C/A code correction>,	{ PRC, in metres, 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 measuremens 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>	

Time correction value (T) = PRC + RRC(T-To)

Message example:

```
!D,570,209274.6
%S, 12, 9, 1
* 9,  721.5, -15.75,2.4, ,
*23, 608.2,   2.31, 3.0, ,
%R, 45, , 0
*05,  471.5, 14.35,1.2,125,
*23, 458.2,   2.75, 1.2,125,
```

A7-2-4 GPS BIT FLOW

- **GENERAL FORM OF MESSAGE**

  <stx> <eoln>
  <**!B**>,< time tagging > <eoln>
  <soln>,<block counter > <eoln>
  <soln>,<1st line of bit flow> <eoln>
  ...
  <soln>,<nth line of bit flow> <eoln>
  <etx>

- **TIME-TAGGING LINE**

  !B,<GPS week>,<GPS time><eoln>

  GPS week number and time, in reference to week and in seconds , when the last bit was transmitted.
  Reference time is jan 6 1980 at 0hr00.

- **BLOCK COUNTER LINE**

  %C,<block counter> <eoln>

  This counter is incremented by one every time a message is issued (counter modulo 10).

- **GPS BIT FLOW LINE**

  <soln>, { 2 characters: * and channel No. (in hexadecimal) }
  <SV No.>,
  <count of useful bits>,
  <GPS bit block> { n last bit received, hex-encoded }
  <eoln>

  Following the reception of N bits, M bits, all "0's", are appended at the end of the message in such a way that N+M = *k* times 4. The *k* hexadecimal values are ASCII-encoded to form a block. The N useful bits are placed at the beginning of the block.

  GPS data are provided regardless of their meaning and error checks at the end of the words (CRC).

  The count of bits in a block depends on the message output rate and the channel throughput (50 bits/s for GPS, 250 bits/s for a WAAS geostationary). It is limited to 480 bits max, i.e. 120 hexadecimal characters.

  Message example:

```
!B,570,209274.6
%C,3
*1,12,30, 3F471A04
*2,23,30, 18AC442C
```

A7- 3 NON-CONFIGURABLE GPS DATA IN BINARY FORMAT (SBIN)

A7-3-1 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 step :

FD_h	is transcoded into	**FD_h 00_h**
FE_h	is transcoded into	**FD_h 01_h**
FF_h	is transcoded into	**FD_h 02_h**

- **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.

< >	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 (transmission error check)
<etb>	end of block: ASCII character **FF_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.

- **GENERAL FORM OF MESSAGE**

<stb>	1 byte
<blid>	1 byte
<long>	2 bytes
<data>	1 to 1023 bytes
<checksum>	2 bytes
<etb>	1 byte

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.

- **RULE ABOUT LABELS**

Labels cannot be included in a binary format, unless a specific block is defined for that purpose.

A7-3-2 SINGLE-FREQUENCY GPS RAW DATA (short)

- **GENERAL FORM OF MESSAGE**

<stb>**B**	2 bytes
<long>	2 bytes
<time tagging>	3 bytes
<raw data, 1st SV>	6 or 9 bytes
...	
<raw data, last SV>	6 or 9 bytes
<checksum>	2 bytes
<etb>	1 byte

- **TIME TAGGING**

  3 bytes : GPS time in reference to week (in 1/10 s units)

- **RAW DATA FROM SV**

1 byte	SV number
4 bytes	code pseudorange (in 10^{-10}s units, modulo 0.1s)
1 byte	bits 0 to 4 : [C/No - 20] (in dBHz)
	bits 5 and 6 : channel status
	0 = okay
	1 = parity error
	2 = cycle slip
	3 = phase measurement not valid
	bit 7: 0 = field of "carrier phase" bits absent
	1 = field of "carrier phase" bits present
3 bytes	L1 carrier phase (in 10^{-3}tr units, modulo 10^{4}tr)

A7-3-3 SINGLE-FREQUENCY GPS RAW DATA (Satellite Time)

- **GENERAL FORM OF MESSAGE**

<stb>**R**	2 bytes
<long>	2 bytes
<time tagging>	5 bytes
<parameters>	2 bytes
<raw data, 1st SV>	14 bytes
...	
<raw data, last SV>	14 bytes
<checksum>	2 bytes
<etb>	1 byte

- **TIME TAGGING**

  2 bytes : GPS week number (assuming the modulo 2^{10} ambiguity is removed)
  3 bytes : GPS time within week (in 1/10 s units). Reference time is jan 6 1980 at 0hr00.

- **PARAMETERS**

  1 byte :
  bits 0 and 1 : code smoothing by carrier, according to RTCM, message 19
  bits 2 to 6 = 0 *(future development)*
  bit 7 = 0 (single-frequency measurements)

- **RAW DATA FROM SV**

  1 byte SV No.
  4 bytes C/A code pseudo range (unit 10^{-10}s, modulo 0.1s)
  1 byte bits 0 to 4 : [C/No - 20] (dBHz)
  bits 5 and 6 = 0 *(not used)*
  bit 7 = 1 if invalid phase measurement
  3 bytes $L1_{C/A}$ carrier phase (unit 10^{-3} cycles, modulo 10^4 cycle)
  3 bytes $L1_{C/A}$ carrier speed (unit 2×10^{-3} cycle/s, field ~16kHz, MSB=sign, 800000_h= invalid measurement)
  1 byte carrier quality indicator $L1_{C/A}$
  bits 0 to 4 : "cumulative loss of continuity indicator", (always 00000) *(includes parity errors)*
  bits 5 to 7 : "data quality indicator", (000 = valid data, 111 = invalid data)
  1 byte C/A code quality indicator
  bits 0 to 3 : "pseudo-range multipath error indicator", (always 1111)
  bits 4 to 7 : "pseudo-range data quality indicator", (always 1111)

  The C/A pseudorange is the value of the receiver's time base at the moment the C/A code transition is detected, at the beginning of the word corresponding to the GPS time of the message. The carrier phase is sampled at the same time.

APPENDIX 8

VARIABLES ACCESSIBLE USING CONFGPS SOFTWARE IN OUTPUT MESSAGES AND USER-DEFINED SCREENS

The CONFGPS software contained in the CONF203 floppy disk allows you to define formats using the variables listed below.

Some of the variables mentioned below can be combined with the TXT: function to produce a string of characters or numeric values.

The underlined variables are interpolated for the time of output.

Navigation fix results

L84 WGS84 Latitude (radians)
G84 WGS84 Longitude (radians)
Z84 Altitude above WGS84 ellipsoid (metres)
DATM Selected Datum/Projection (0..9)
TXT:DATM → Selected Datum/Projection name
LAT Latitude on selected datum (radians)
LON Longitude on selected datum (radians)
YP Northing on selected datum (metres)
XP Easting on selected datum (metres)
ZP Altitude above geoid (metres)
HP Master Oscillator offset (seconds)

Speed results

YS North Speed, smoothed (metres/sec)
XS East Speed, smoothed (metres/sec)
ZS Upward Speed, smoothed (metres/sec)
HS Clock Speed (seconds/sec)
SOG Speed Over Ground Module (metres/sec)
COG Course made Good (radians)

Navigation Fix Quality

MSL Computed Mean Sea Level (metres)

MODE Position Mode (0..6)

TXT:MODE → Mode label

Mode identification	Position mode	Mode label
Hold	0	" H"
Dead Reckoning	1	"DR"
Time mode (Ref.)	2	" T"
2 dimensions	3	" 2"
2 dimensions + Time	4	"2T"
3 dimensions	5	" 3"
3 dimensions + Time	6	"3T"

NSVR Number of SVs received (0..15)

NSVU Number of SVs Used (0..15)

TXT:NSVU → PRN of the SVs used

HDOP Horizontal DOP (-1: not available)

VDOP Vertical DOP (-1: not available)

PDOP Position DOP (-1: not available)

TDOP Time DOP (-1: not available)

GDOP Geometric DOP (-1: not available)

XDOP Expected GDOP (-1: not available)

LPME LPME (metres) (-1: not available)

DRT Fix Quality (same as QUAL) or
Dead Reckoning Time (in seconds) if MODE=1 ("DR")

DRMS DRMS (metres) (-1: not available)

SDMA Standard deviation of semi-major axis of error ellipse (metres)

SDMI Standard deviation of semi-minor axis of error ellipse (metres)

EI Orientation of semi-major axis of error ellipse (radians)

QUAL Fix Quality (0..19)

0..3 = Straight GPS
4..5 = DGPS 2D + T
6..9 = DGPS 3D + T
10..19 = EDGPS & KART

PS Position Status Flag (0..1)
TXT:PS → Position Status Label

Position status flag definition	Position status flag	Position status label
No fix	0	"BAD"
Fix available	1	"GOOD"

SA Selective Availability (SA) Flag (0..1)
TXT:SA → Selective Availability Label

SA Flag definition	SA flag	SA label
No SA	0	"OFF"
SA activated	1	"ON"

NM2DM MDE 2d Max (meters)
NSV2D PRN of the SV causing 2d Max (1..32)
NM3DM MDE 3d Max (meters)
NSV3D PRN of the SV causing 3d Max (1..32)
NFVAL F_TEST value
NFMEA F_TEST value, mean
NFTST F_TEST result flag (0..1)

Navigation Fix DGPS Status

DS DGPS Status Flag (0..1)
TXT:DS → DGPS Status Label

DGPS Status Flag definition	DGPS Status flag	DGPS Status label
No DGPS	0	"NAT" or "HOLD"
DGPS available	1	"DIFF"

DFT DGPS Fix Type (0..8)
TXT:DFT → DGPS Fix Label

DGPS Fix Type definition	DGPS Fix Type	DGPS Fix label
No DGPS	0	" . GPS . "
DGPS with PRC set 1	1	"DGPS1"
DGPS with PRC set 2	2	"DGPS2"
DGPS with PRC set 3	3	"DGPS3"
DGPS with PRC set 4	4	"DGPS4"
Multi-ref. DGPS fix	5	"MDGPS"
Enhanced DGPS fix	6	"EDGPS"
Accurate RTK fix	7	"KARTA"
Real-time RTK fix	8	"KARTR"

DSTA DGPS Station number (0..1023)
DRCV DGPS Reception Quality (-1..10)

-1 : not received
0 : carrier detected but no data
1..3 : very poor reception
4..6 : intermittent reception
7..10 : good reception quality

DAGE Average age of DGPS corrections (seconds)

Time information

GPSW GPS Week Number
GPST GPS Week Time (seconds)
GPSD GPS - UTC Time difference (seconds)
TUTC UTC Time (seconds)
DUTC UTC Date (yyyymmdd)
TP Local Time (seconds)
DP Local Date (yyyymmdd)

Navigation Fix Track data

WPF Current Starting Waypoint Number
WPN Current Target Waypoint Number
TXT:WPN → Current Target Waypoint Label
WPY Lat/Northing of current target waypoint (radians/m)
WPX Lon/Easting of current target waypoint (radians/m)
CTS Course to Steer (radians)
CTW Course to Target (radians)
DTW Distance to Target (metres)
TTG Time To Go to Target (seconds)
XTE Transverse distance (metres)
ATD Along-Track distance (metres)
NCTS Next Course To Steer (radians)

Various data

ULA User label Port A (used only with TXT: function)
ULB User label Port B (used only with TXT: function)
ULC User label Port C (used only with TXT: function)
ULI User label Port I (used only with TXT: function)
ULJ User label Port J (used only with TXT: function)
NMEA NMEA message Port A (used only with TXT: function)
UM Time of last DGPS User Message received (sec)
TXT:UM → Last DGPS User Message received
UR Station ID of last DGPS User Message received
UM1 Time of DGPS User Message, PRC set 1
TXT:UM1 → GPS User Message, PRC set 1
UM2 Time of DGPS User Message, PRC set 2
TXT:UM2 → GPS User Message, PRC set 2
UM3 Time of DGPS User Message, PRC set 3
TXT:UM3 → GPS User Message, PRC set 3
UM4 Time of DGPS User Message, PRC set 4
TXT:UM4 → GPS User Message, PRC set 4
UM5 Time of DGPS User Message, PRC set 5
TXT:UM5 → GPS User Message, PRC set 5
UM6 Time of DGPS User Message, PRC set 6
TXT:UM6 → GPS User Message, PRC set 6

Data array

SVU[1.. 15] PRN of SV used (1..32)

M[1.. 10] Fix Variance/Covariance Matrix (m^2)
- M[1] = Latitude variance
- M[2] = Lat/Long covariance
- M[3] = Longitude variance
- M[4] = Lat/Altitude covariance
- M[5] = Long/Altitude covariance
- M[6] = Altitude variance
- M[7] = Lat/Clock covariance
- M[8] = Long/Clock covariance
- M[9] = Altitude/Clock covariance
- M[10] = Clock variance

MRK[1.. 16] External Trigger Mark number
- "+1" every time a new trigger event occurs

UV[1.. 9] User variable
- Value computed at format execution

Channel information [1 to 15]

CST Channel Status (0..5)
- 0: Free
- 1: SV Received
- 2: SV Lost
- 3: SV Usable
- 4: SV Used
- 5: SV Searched

CSV Channel SV PRN (0..32)
- 0: channel not used

CR1 Channel Residual for DGPS1 fix (metres)

CR2 Channel Residual for DGPS2 fix (metres)

CR3 Channel Residual for DGPS3 fix (metres)

CR4 Channel Residual for DGPS4 fix (metres)

CRE Channel Residual for Navigation fix (metres)

CRS Channel Residual Speed (metres/sec)

CCS Channel Correction Status (N, M, D)
- 'N'= Not available
- 'M'= No DGPS correction
- 'D'= DGPS correction

CSB Channel Signal/Noise Ratio (dB)
CEL Channel SV Elevation (radians)
CAZ Channel SV Azimuth (radians)
CIO Channel Iono correction (metres)
CTR Channel Tropo correction (metres)
WT1 W_Test for DGPS1 fix
WT2 W_Test for DGPS2 fix
WT3 W_Test for DGPS3 fix
WT4 W_Test for DGPS4 fix
WT W_Test Navigation fix
MD1 MDE 2D for DGPS1 fix (meters)
MD2 MDE 2D for DGPS2 fix (meters)
MD3 MDE 2D for DGPS3 fix (meters)
MD4 MDE 2D for DGPS4 fix (meters)
MDE MDE 2D for Navigation fix (meters)

Individual Fixes results [1..8]

Index value	Corresponding DGPS Fix	Corresponding label
1	DGPS with PRC set 1	"DGPS1"
2	DGPS with PRC set 2	"DGPS2"
3	DGPS with PRC set 3	"DGPS3"
4	DGPS with PRC set 4	"DGPS4"
5	Multi-ref. DGPS fix	"MDGPS"
6	Enhanced DGPS fix	"EDGPS"
7	Accurate RTK fix	"KARTA"
8	Real-time RTK fix	"KARTR"

L[1..8] WGS84 Latitude (radians)
G[1..8] WGS84 Longitude (radians)
Z[1..8] Altitude above WGS84 ellipsoid (metres)

S[1..8] Fix Status flag (0..1)
0: No fix
1: Fix available

Q[1..8] Fix Quality (0..19)
0..3= Straight GPS
4..5= DGPS 2D + T
6..9= DGPS 3D + T
10..19= EDGPS & KART

HD[1..8] Horizontal DOP (-1 : not available)
N[1..8] Number of SVs Used (1..15)
T[1..8] UTC Time of Fix (in seconds)
D[1..8] UTC Date of Fix (yyyymmdd)
DT[1..8] DGPS fix type (0..8)

DGPS Fix Type	DGPS Fix Type definition	Corresponding DGPS Fix label
0	No DGPS	" . GPS . "
1	DGPS with PRC set 1	"DGPS1"
2	DGPS with PRC set 2	"DGPS2"
3	DGPS with PRC set 3	"DGPS3"
4	DGPS with PRC set 4	"DGPS4"
5	Multi-ref. DGPS fix	"MDGPS"
6	Enhanced DGPS fix	"EDGPS"
7	Accurate RTK fix	"KARTA"
8	Real-time RTK fix	"KARTR"

DB[1..8] DGPS Station number (0..1023)
DQ[1..8] DGPS Reception Quality (-1..10)
-1: not received
0: carrier detected but no data
1..3: very poor reception
4..6: intermittent reception
7..10: good reception quality

DA[1..8] Average age of DGPS corrections (seconds)
FDRM[1..5] DRMS (meters)
M2DM[1..4] MDE 2d Max (meters)
SV2D[1..4] PRN of the SV causing 2d Max (1..32)
M3DM[1..4] MDE 3d Max (meters)
SV3D[1..4] PRN of the SV causing 3d Max (1..32)
FVAL[1..5] F_TEST value
FMEA[1..5] F_TEST value, mean
FTST[1..5] F_TEST result (0..1)

APPENDIX 9

NR203 SPECIFICATIONS

GPS CHARACTERICTICS

GPS Reception

- SPS L1 type, 1575.42 MHz
- 15 parallel channels
- Low-noise C/A code and L1 carrier phase

GPS Antenna

NAP001 micro-strip antenna

- Built-in preamplifier (39 dB)
- 30 m RG223 cable

DIFFERENTIAL FEATURES

Corrections messages

- NDS200 HF format
- NDS100 UHF format (phase and/or PRCs)
- RTCM 104 (V2.1) format

Differential channels

Six parallel channels :

- 4 HF or Radio-beacon MF
- 1 UHF (or RTCM 104)
- 1 RTCM 104

Differential antenna

- HF & Radio-beacon MF integrated reception
- Active type
- Freq. Bands : 283.5 to 325 kHz
  1.6 to 3.5 MHz
- 30 m KX15 cable

Antenna options :

- Narrow band passive HF
- Wide band (HF-MF) H-field
- NDR 104 UHF module

PERFORMANCE

General

- Kinematic OTF KART mode offering :
  - Automatic initialization with 5 Vs or more
  - Operational range : 10 to 15 km
  - KART R fix : 0.6 s rate, 2-cm X-Y-Z accuracy.
  - KART A fix : 2 s rate, 1-cm X-Y-Z accuracy.
  - E DGPS fix : 0.6 s rate 20 cm X-Y-Z accuracy.

or[1]

- Conventional DGPS mode offering :
  - A "Primary" single station solution 0.6 s rate (DGPS 1)
  - Up to 3 other parallel single station solutions (DGPS2 to DGPS4)
  - An optimized "Multistation" solution 0.6 s rate (MDGPS) providing sub-meter to meter accuracy

Processing features

- Multi-path mitigation techniques
- Weighted least squares position processing
- UKOOA compliant navigation and QC processing

Other data

- PPS output (< 1 μs)
- External event time tagging (< 1μs)
- Raw data 0.6 sec rate

PHYSICAL CHARACTERISTICS

NR203 Receiver

- Dimensions (H × W × D) : 165 × 365 × 220 mm
- Weight : 4.4 kg (Fixing parts 2.3 kg)
- Temperature :
  - operating : - 10°C, + 55°C
  - storage : - 40°C, + 70°C
- Humidity : 95% non-condensing

NAP001 Antenna

- Dimensions :
  - Diameter: 143 mm
  - Height: 44 mm
- Weight: 0.360 kg
- Temperature:
  - operating: - 40°C, + 65°C

DHM5000 HF-MF Antenna

- Height: 234 mm
- Diameter: 137 mm
- Weight: 0.400 kg
- Temperature:
  - operating: - 40°C, + 65°C

Electrical

- Input voltage : 10-36 Volts
- Consumption : 16 Watts

INTERFACES

- Wide-angle 180° electro luminescent display
- 1 RS 232 I/O port (up to 19200 bauds)
- 2 RS 422 I/O ports (up to 76800 bauds)
- Configurable display and digital ports
- External oscillator

[1] KART mode and conventional DGPS mode cannot be run simultaneously

APPENDIX 10

List of possible anomalies

No	Family	Error message	Additional error code
01	1-SYSTM	GP12 test at power-up	Test result status
02	1-SYSTM	Progr. Memory at power-up	Number of error
03	1-SYSTM	Data Memory at power-up	Test result status
04	1-SYSTM	Main Oscill. at power-up	Test result status
05	1-SYSTM	Proc/Coproc at power-up	1
06	2-RCVER	GP12-0 ASIC read error	Test status asic1
07	2-RCVER	GP12-1 ASIC read error	Test status.asic2
08	2-RCVER	Synthesizer error	0
09	2-RCVER	AGC error	0
10	2-RCVER	Antenna error	0
11	3-CONFG	Configuration write error	Number of error
12	3-CONFG	DIFF configuration error	98 = at initialization 99 = Checksum error
13	3-CONFG	Configuration read error	**xxyy** **xx** = Configuration section error **yy** = Section line number **xx values:** **1** LABEL **2** COMMENT **3** ELIPS **4** PROJ **5** ALMANAC **6** IONO **7** UTC **8** RAWDAT **9** D_RECK **10** ALT **11** EVMIN **12** FILTER **13** SEL_GEO **14** DSELECT **15** FIXMODE **16** HARD_RS **17** FMT **18** OUT_MES **19** DSP **20** WAYPT **21** SEGM **22** NAV **23** DSP_W **26** RDNAV **27** DATE **38** GENCOR **40** CONST
14 15 17	3-CONFG	Configuration parameter error 14,15 = Data not valid 17 = number of parameters not valid	**xxyy** **xx** = Configuration section error **yy** = Section line number **xx values :** See error 13
20		Reserved for other board	0
22	5-POSIT	No Differential reception	0

No	Family	Error message	Additional error code
23	5-POSIT	Too few SVs	Number of SVs
24	5-POSIT	GDOP too high	DOP value
25	5-POSIT	LPME too high	LPME value
27	5-POSIT	* err 27 *	1PPS signal error
28	5-POSIT	Less than 4 differential corrections	
29 31	5-POSIT 6-NAVIG	No fix computation Navigation error	0 Error code 0 = command error
33	7- I / O	Overflow on A port	1 = on trigger or timed output 254 = on GPS synchro ouput 255 = on Raw data output
34	7- I / O	Overflow on B port	2 = on trigger or timed output 254 = on GPS synchro ouput 255 = on Raw data output
35	7- I / O	Overflow on port	Port Number 3 = C 9 = I 10 = J 11 = K 12 = L
36	7- I / O	Format interpretation	Number of erroneous format
37	7- I / O	A-Port control error	
38	7- I / O	B-Port control error	
39	7- I / O	* err 39 *	Dual port RAM error code
40	7- I / O	CPU-PWES1 data transfer	Error code
41	8- DIALG	Operator error : cursor	
43	10-DIF03	CPU-DIFF overflow	Error code
50	11- PWES1	Relay task : buffer overflow on	Physical port number
51	11- PWES1	Relay task : read error on	Physical port number
52	11- PWES1	Output DPRAM buffer overflow	0
53	11- PWES1	Input DPRAM : bad command	Error code
54	11- PWES1	* err 54 *	Serial port initialization error code
60	10 - DIF03	* err 60 *	Physical port number
61	10 - DIF03	* err 61 *	Physical port number
62	10 - DIF03	Output DPRAM buffer overflow	0
63	10 - DIF03	Input DPRAM : bad command	Error code
64	10 - DIF03	* err 64 *	Serial port initialization error code

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