

Saab TransponderTech

R4 Navigation System

MANUAL SUPPLEMENT

**Prediction of Tide and Dual Display Mode
(Display software version 5.0.96)**



SAAB

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iii Software

This manual is a supplement to the R4 Navigation System Operator's Manual (7000 109-143 rev. F2). It describes new features implemented in the R4 Navigation Display software version 5.0.96

iv Supplemental Manual Part Number and Revision

Part number 7000 109-168, revision C.

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1 R4 NAVIGATION SYSTEM TIDAL PREDICTION

1.1 General

The R4 Navigation Display, sw version 5.0.94 onwards, can be used for calculation of tidal predictions based on user input of data from the Admiralty Tide Tables published by the U.K Hydrographic Office.

The user is required to input data for the specific port and select the point in time for which the prediction is to be calculated.

The tidal prediction features in the R4 Navigation Display are centered around three views, the *Port List*, *Tide Plot* and *Tide Table* views available in the *Plan Voyage* mode.

Note that meteorological effects (e.g wind and barometric pressure) as well as other factors not accounted for in the generalized tidal models may cause significant deviation between actual and predicted tide.

1.2 Calculation Method and Source Data

The tidal predictions are calculated by the so called ‘simplified harmonic method’. Harmonic constants and other parameters required are included in publications below. Note that the algorithms applied are specifically adapted for this data. Tidal parameters obtained from other sources shall not be used with the R4 Navigation Display tidal calculations.

Predictions calculated according to this method will not be fully consistent with the tabulated high/low and hourly predictions from the Admiralty tide tables. This is due to the fact that the tabulated values are based on a more extensive data set compared to the limited number of parameters used by the simplified harmonic method

The source data is split between volumes with different geographical coverage as follows:

U.K Hydrographic Office ADMIRALTY TIDE TABLES (ATT)

Volume 1 (NP 201): United Kingdom and Ireland (including European channel ports)

Volume 2: (NP 202): Europe (excluding United Kingdom and Ireland), Mediterranean Sea and Atlantic Ocean

Volume 3 (NP 203): Indian Ocean and South China Sea

Volume 4 (NP 204): Pacific Ocean

Optionally, for European ports, ATT Volume 1 and European part of Volume 2 can be substituted by:

TIDAL HARMONIC CONSTANTS, EUROPEAN WATERS (NP 160).

1.3 Input of Tidal Parameters

Tidal data for a new port is entered as follows:

1. Enter *Plan Voyage* mode by pressing the **MODE** key followed by function key **Plan Voyage**.
2. Press the function key **Tide**. The *Tide Plot* view is shown.
3. Press function key **Select Location** to enter the *Port List* view.
4. Press function key **Add Port**
5. Input data for the tidal parameters from the relevant volume of ATT, part III. Press function key **Apply and Exit** when done in order to store the data in the port list.

The following data can be input for each port:

ID	Port No. from ATT part III.
Name	Place name from ATT part III
Zone	UTC offset time zone (UTC time – Local Time) in hours and minutes from ATT part III. This information is important since ATT data is referenced to a local time in port with this offset from UTC. Enter this data as defined in ATT regardless of adjustments for other local time offsets (e.g daylight savings time). See further notes on treatment of time offset in sections below.
Position	Latitude & longitude of port. This is optional information that not is required for calculation of tide. If entered, the current distance to the actual port will be shown in the list of tidal stations. Position is not listed in ATT part III.
ML (Z0)	This is mean level in meters from ATT part III. For most stations this is a fixed value. Tables of seasonal corrections and fortnightly variations as required for some stations can be entered as described below.
ML Seasonal	Seasonal corrections to the mean level value as defined for some ports. If so, this parameter shall be set to 'Use Table' which will provide a new function key Edit Table . Use this key to access an editable list of values for each month and input the corrections listed in ATT part III.
ML Fortnightly	Fortnightly variations in mean level as defined for some ports. If so, this parameter shall be set to 'Use Table' which will provide a new function key Edit Table . Use this key to access an editable list of parameters to be entered from a supplementary table in ATT. When used, a lock icon will be displayed next to the ML(Z0) parameter in the list and the ML(Z0) value will be replaced by a 'W'. This indicates that the actual value used will be deduced from the fortnightly parameters.

M2(G)	Harmonic constant from ATT part III.
M2(H.m)	Harmonic constant from ATT part III. Fixed value used for most ports.
M2 Seasonal	Seasonal depending values of M2(H.m) as defined for some ports. If so, this parameter shall be set to 'Use Table' which will provide a new function key Edit Table . Use this key to access an editable list of values for each month and input values listed in ATT part III. When used, a lock icon will be displayed next to the M2(H.m) parameter in the list and the M2(H.m) value will be replaced by a 'v'. This indicates that the actual value used will be deduced from the seasonal table.
S2(G)	Harmonic constant from ATT part III.
S2(H.m)	Harmonic constant meters from ATT part III. Fixed value used for most ports
S2 Seasonal	Seasonal depending values of S2(H.m) as defined for some ports. Function is equivalent to M2 as described above.
K1(G)	Harmonic constant from ATT part III.
K1(H.m)	Harmonic constant from ATT part III.
O1(G)	Harmonic constant from ATT part III.
O1(H.m)	Harmonic constant from ATT part III.
f4	Shallow water correction from ATT part III.
F4	Shallow water correction from ATT part III.
f6	Shallow water correction from ATT part III.
F6	Shallow water correction from ATT part III.

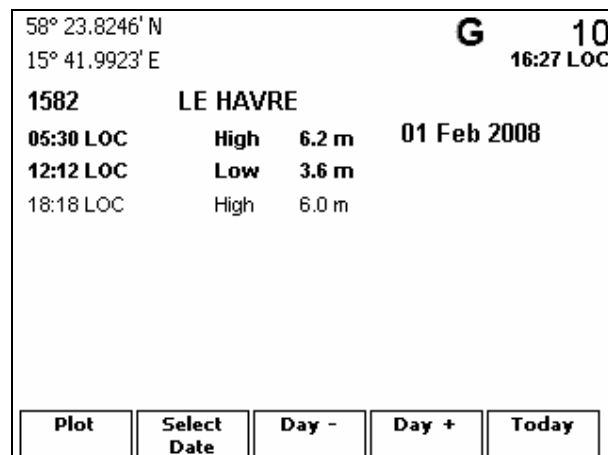
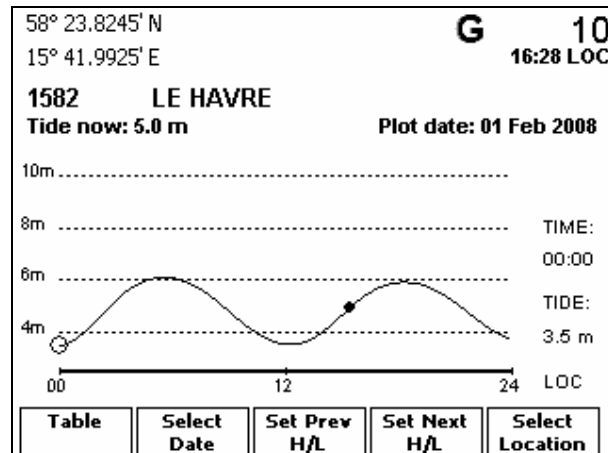
1.4 Tidal Predictions

Once port data has been entered, tidal predictions can be generated as follows:.

1. Enter *Plan Voyage* mode by pressing the **MODE** key followed by function key **Plan Voyage**.
2. Press the function key **Tide**. The *Tide Plot* view is shown.
3. Press function key **Select Location** to enter the *Port List* view.
4. Use the rocker key to step through the list and select the port for which a prediction is to be generated. Press function key **Use Port** or **ENTER** in order to select it.
5. The *Tide Plot* view is shown with a graphical prediction for the current day or a previously selected date. In order to calculate predictions for another day use function key **Select Date** to access an almanac or use the rocker key to toggle up/down one day for each step.

6. By toggling the rocker key left/right a cursor will be moved along the plot. Time and height values for the cursor are displayed to the right of the plot area. It is also possible to step the cursor between local high and low points using function keys **Set Prev H/L** and **Set Next H/L**.
7. While data for the current day is shown, a small diamond cursor will indicate the actual time. Value of current tide will also be displayed as 'Tide Now'
8. The function key **Table** will replace the graphical view with a table of local low and high points of the actual day. The maximum high and minimum low values for the actual day are displayed with bold characters. Up to eight values can be displayed in a table view. If there are more data points for a particular day, two views will be available that can be selected by the left/right rocker switch. This is indicated by labels 1/2 or 2/2 together with a small arrow in the right bottom part of the view.

Typical examples of *Tide Plot* and *Tide Table* views are shown in the figures below



1.5 Units of Predicted Tide

Predicted tide can be displayed in meters, feet or fathom units as defined by the 'Depth Unit' configuration parameter. This parameter is accessed from the *Units Configuration* view in *Configuration* mode.

1.6 Treatment of Local Time Frames

For each port, a 'Zone' parameter shall be entered as defined in ATT part III. This parameter defines the relationship of data published in ATT with respect to UTC.

When a tide prediction is generated, a graph will be displayed for 00 to 24 hours of a selected date. This time will be in UTC or with any user selectable local time offset as defined in the *Time Configuration* view. If UTC is used, times will be denoted 'UTC'. If a local time frame is used, times will be denoted 'LOC'. This is in analogy with how all times generally are treated by the display.

Thus, it is important to realize that a tide displayed in 'LOC' time not necessary is the local time in port defined by the 'Zone' parameter. If this is desired, the user must manually define a local time in the *Time Configuration* view that corresponds to the 'Zone' value for the actual port.

To make things more complicated, the 'Zone' parameter in ATT part III is defined as (UTC time – Local Time) and thus being negative when moving eastwards from Greenwich. On the other hand, the local time offset in the *Time Configuration* view is to be added to UTC and thus positive when moving eastwards. Thus, a negative 'Zone' value is equivalent to a positive offset of time configuration and vice versa.

Thus, in general: always enter 'Zone' for the port as indicated in ATT part III and select local time offset in *Time Configuration* view to obtain the desired local time frame for which the prediction is to be obtained.

Examples of 'Zone' setting and corresponding local time configuration are shown in the following two figures.

58° 23.8246' N G 10
15° 41.9925' E 16:36 LOC

Insert port data from Admiralty Tables Part III

Parameter	Value
ID	1582
Name	LE HAVRE
Zone (UTC Offset)	-01.00
Position	Not Set
ML (ZD)	4.88
ML Seasonal Corr	Use table
ML Fortnightly	Negligible

Apply and Exit

58° 23.8246' N G 10
15° 41.9926' E 16:39 LOC

01 Feb 15:39:18 UTC
01 Feb 16:39:18 LOC

Local Time: UTC 1 Hours and 0 Minutes

Use UTC **Use Local**

2 DUAL DISPLAY MODE

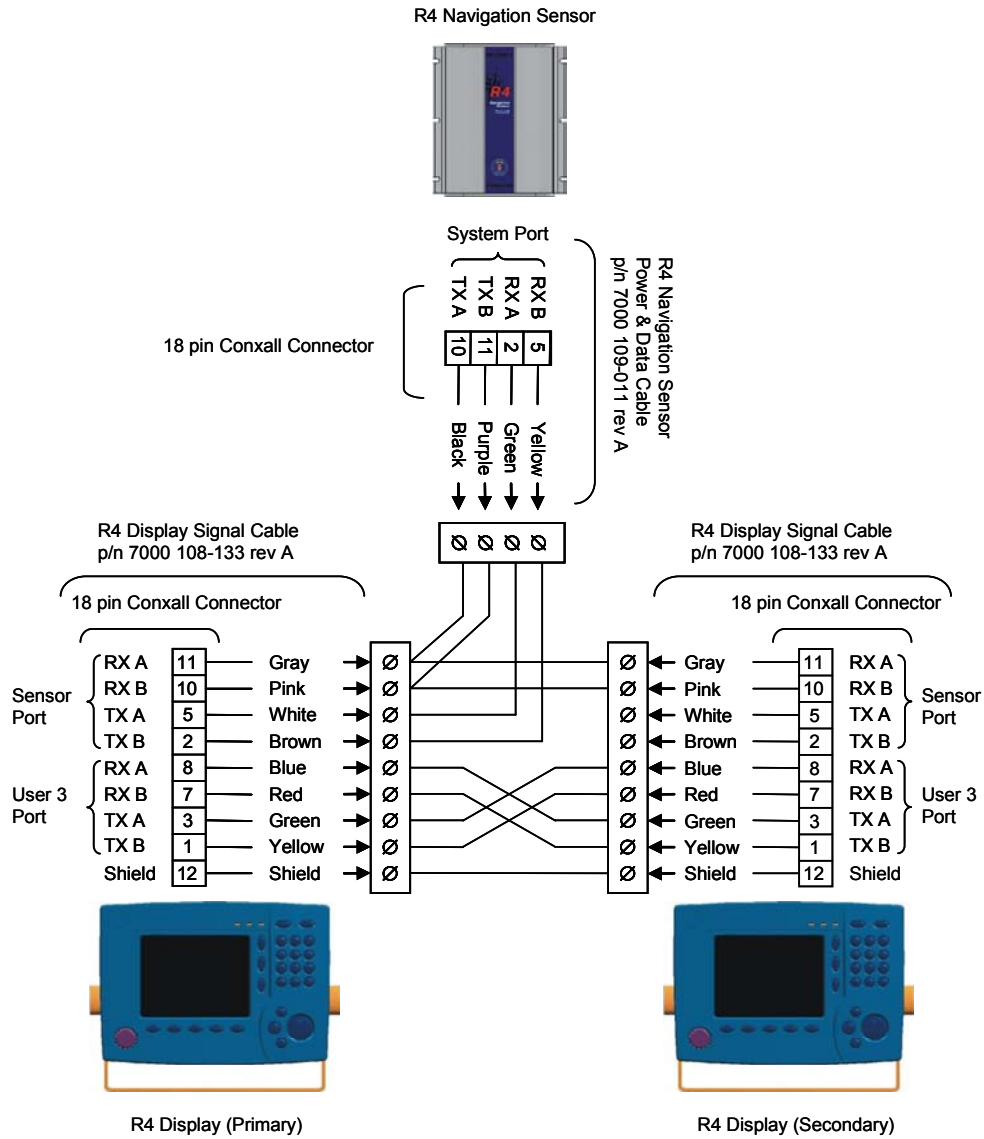
The R4 Navigation System supports a dual display mode where two R4 Navigation Displays can be interconnected and used together with a single R4 Navigation Sensor. One of the displays (the primary display or dual display master) will have the full functionality of the R4 Navigation System whereas the other display (the secondary display or dual display slave) will be somewhat limited in terms of mainly configuration related tasks. Normal operational functions and databases for waypoints and routes will be shared by both displays.

2.1 Dual Display Installation

The primary display is to be installed as in a basic R4 Navigation System. The secondary display shall be added to the basic system as follows:

- The Rx lines of the secondary R4 Navigation Display sensor port shall be connected to the Tx lines of the R4 Navigation Sensor system port (in parallel with the Rx lines of the primary display sensor port). The Tx lines of the secondary display sensor port shall not be connected
- The User 3 ports of the primary and secondary displays shall be interconnected (Rx to Tx and vice versa)
- Power may be supplied to the secondary display in parallel with the power supply to the primary display. One common or two individual 2A fuses may be used for the display power supply

The signal connections between the dual displays and the R4 Navigation sensor are illustrated in the figure below. Note that this is not a complete installation diagram. For details about power connections and other connections to the R4 Navigation Sensor refer to the R4 Navigation System installation manual.



Details of signal connections between primary display, secondary display and R4 Navigation Sensor in a dual display installation

2.2 Dual Display Configuration and Initial Synchronization

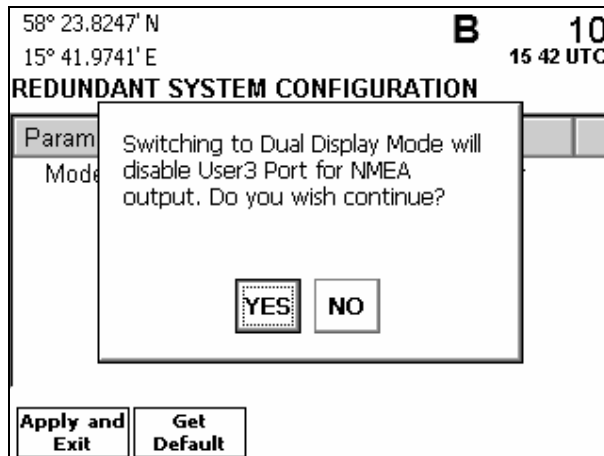
1. In the *Port Rate Configuration* view make sure that the User 3 port rate is set to 57600 in both displays. This view is accessed by pressing the **MODE** key followed by function key **Config**, the **PAGE** key, function keys **I/O Config** and **Port Rate Config**

58° 23.8250' N		B		10	
15° 41.9741' E				10 05 LOC	
PORT RATE CONFIGURATION					
Port	Rate	Checksum			
-R4 Sensor-					
User Port 1	38400	Always			
User Port 2	19200	Always			
User Port 3	57600	Always			
R4 Sensor	4800	Always			
Speed Log Output	9600				
	19200				
	38400				
	57600				
	115200				
Apply and Exit	Get Default	Vi			
	Data				

2. The displays must be configured for operation in dual display mode. This is determined by the 'Mode' parameter in the *Redundant System Configuration* view. This view is accessed by pressing the **MODE** key followed by function key **Config**, the **PAGE** key and function key **Redund Config**. In the primary and secondary displays, set the 'Mode' parameter to 'Dual Display Master' and 'Dual Display Slave' respectively

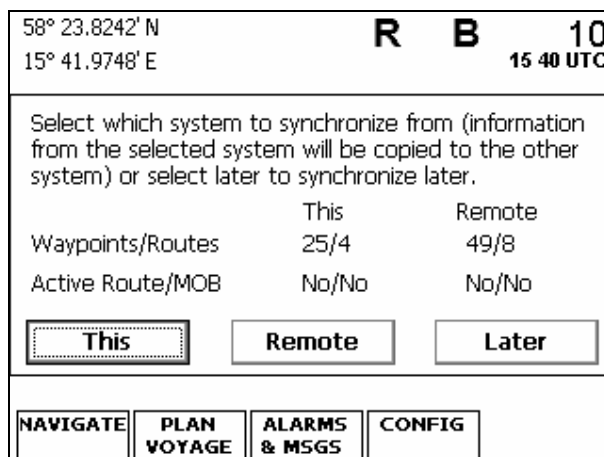
58° 23.8250' N		B		10	
15° 41.9749' E				15 38 UTC	
REDUNDANT SYSTEM CONFIGURATION					
Parameter	Value				
Mode	Dual Display Master				
	Stand-Alone				
	Redundant Master				
	Redundant Slave				
	Dual Display Master				
	Dual Display Slave				
Apply and Exit	Get Default				

3. A warning will be displayed with request for confirmation as illustrated below. Press the **ENTER** key to accept.



4. An 'R' icon will be shown in the status bar at the top of the display as an indication of connection between the two displays. A crossed-over 'R' icon with additional text 'No Com' indicates that there is a problem with the connection. In this case, check electrical connection between the User 3 ports on the displays (Rx lines on one display connected to the Tx lines with same polarity on the other display and vice versa). Also recheck that the User 3 port rate is 57600 in both displays per above.

5. The databases and settings of both displays will now be compared. If they differ, the user will be requested to select which of the displays to synchronize from. The contents of the selected display will be transferred to and overwrite the previous contents of the other display unit. The **Later** option can be used to perform any desired changes before synchronization begins. In this case, function keys **Synch This** and **Synch Remote** will be available in the *Redundant System Configuration* view



6. During synchronization, small chevrons will be displayed below the 'R' icon on the display unit receiving data. If a large number of waypoints and routes are to be transferred, initial synchronization may take a few minutes. During this time some functionality (e.g. the active route) will be temporarily disabled. It is recommended that no attempt to modify the database in either system is done during this period. Once initial

synchronization has been performed, changes to synchronized items will be applied to both displays automatically without the need for any actions by the operator.



2.3 Dual Display Operation

During operation, most normal tasks can be performed from either display. Most functions are also synchronized between the displays. However, there are some functions that work individually in each display and also some functionality that is available in the primary display only. In general, normal operation of the system can be performed from either display while system configuration tasks e.g. definition of serial output messages and GPS receiver settings shall be performed from the primary display.

The following functions are synchronized between the displays in the dual display mode of operation:

- Waypoint and route databases
- Active route
- Anchor Watch function
- MOB function
- RAIM settings
- Acknowledge of alarms
- Time configuration
- Nav, Alarm and Units configuration settings

The following functions works independently in each display:

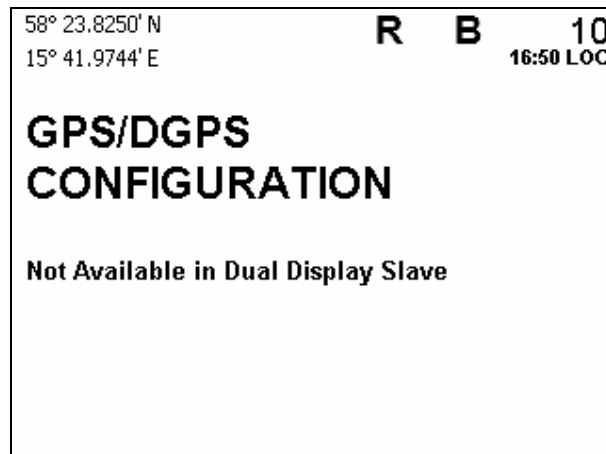
- Trip logs
- Tidal calculations
- Display configurations
- Compass & depth input configurations

The following functions are available in the primary display only:

- Scheduled alerts
- Beacon receiver 'Auto' tuning function key in *Beacon Status* view
- *SBAS Information* view
- Upload of waypoints and routes to external equipment
- All GPS/DGPS configuration settings

- User 1 & 2 port rate settings
- Serial port output settings
- Wp/Rte Input configuration settings
- Nav configuration 'Rnn Wp Limit' parameter
- Alarm configuration parameters 'Use External Ack' and 'Ack Disables External Alarm'
- R4 Navigation Sensor SW/HW version

It will be indicated where information is not available in the secondary display as illustrated by the example below



3 OTHER NEW FEATURES

3.1 Improved Range Resolution

A range value (in NM, Km or Statue miles) not exceeding 1.0 in the given unit will now be displayed without the leading zero. Range resolution at short range is thus increased to three decimals.

3.2 Number of Remaining Waypoints in Transmitted Active Route

It is now possible to configure the maximum number of remaining waypoints in the active route that shall be transmitted in the Rnn message. Previously, only the four next waypoints were transmitted per default. This value can now be configured between 4 and 13.

This is controlled by a new 'Rnn WP Limit' configuration parameter in the *Navigation Configuration* view in *Configuration* mode as shown below. The default value is 4.

58° 23.8247' N		G 10
15° 41.9936' E		19:35 UTC
NAVIGATION CONFIGURATION		
Parameter	Value	
RTE Nav. Algorithm	Rhumb Line	
-Upload Routes-		
Rnn WP Limit	4	
-Time Estimation-		
Average ETA SOG	10 s	
-Presentation-		
Status Information	Position	
Apply and Exit	Get Default	

3.3 External Alarm Output Configuration

It is now possible to configure whether the external alarm discrete output will be reset as soon as all active alarms (of alarm types configured as 'external') have been acknowledged or will remain set as long as any ('external') active alarm condition is present.

This is determined by the 'Ack Disables Ext ALR' parameter in the *Alarm Configuration* view in *Configuration* mode as illustrated below.

58° 23.8250' N		B	10
15° 41.9736' E		17:27 LOC	
ALARM CONFIGURATION			
Parameter	Value		
-General-			
Allow External Ack	Enabled		
Ack Disables Ext ALR	Yes		
-Navigation Alarms-			
HDOP Limit Exceeded	Popup & External		
Position Data Lost	Popup & External		
DGPS Position Data Lost	Popup & External		
Apply and Exit	Get Default		

The default setting of 'Ack Disables Ext ALR' is 'Yes'. This corresponds to the behavior of the discrete alarm output in previous versions of the R4 Navigation system before this setting was available.

3.4 Increased Range of Smoothing for SOG and COG

It is possible to apply a certain amount of smoothing to the outputs of SOG (speed over ground) and COG (course over ground) from the R4 Navigation system.

The maximum time constant for smoothing of these parameters has been increased from ten to twelve seconds for SOG and from five to seven seconds for COG.

Note: Smoothing results in a loss of response to short time speed and heading changes. It is the responsibility of the user to ensure that the amount of smoothing selected is suitable for the particular application. Unless otherwise required, it is recommended that the time constants for smoothing shall be set to values not exceeding two seconds.

3.5 HDOP in User Defined Views

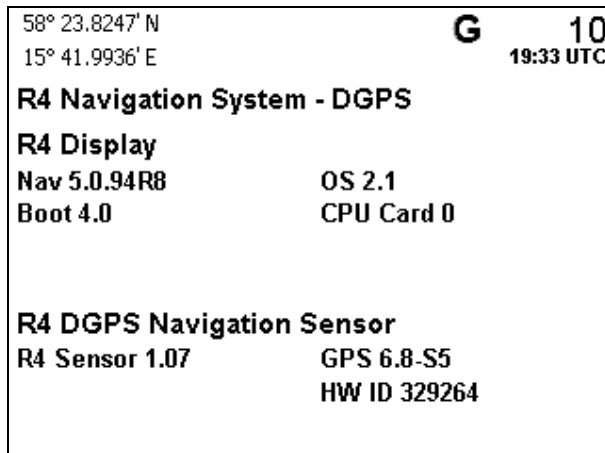
HDOP has been added as a selectable item during creation of user defined views.

3.6 RTCM output on User 2 Port

It is possible to output correction data from the internal DGPS beacon receiver in RTCM format on the user 2 port. This function is available only if the R4 Navigation Display is used together with an R4 DGPS Navigation Sensor with routing software version 1.07 or higher.

To determine current system type and current version of routing software proceed as follows:

1. Enter *Configuration* mode by pressing the **MODE** key followed by function key **Config**.
2. Press **PAGE** in order to access a second set of function keys followed by function key **System Info**.
3. Press the function key **SW/HW Versions**. A view per below is shown. System type (GPS or DGPS) is displayed after heading 'R4 Navigation System'. Current routing software version is displayed after heading 'R4 Sensor'



If this function is available, an 'RTCM' option will be added to the list of output messages in the *User 2 Port Output Configuration* view as illustrated below. This view is reached as follows:

1. Enter *Configuration* mode by pressing the **MODE** key followed by function key **Config**.
2. Press **PAGE** in order to access a second set of function keys.
3. Press function key **I/O Config** followed by **Output Config** and **User Port 2 Config**.

58° 23.8247' N G 10
15° 41.9937' E 19:37 UTC

USER PORT 2 OUTPUT CONFIGURATION

Estimated Port Load 5 %

Sentence	Rate
WPL/RTE Working	Disabled
WPL/RTE Upload	Disabled
XTE	Disabled
-Corrections-	
RTCM	Enabled

Apply and Exit **Get Default**

It is possible to interleave RTCM output data with the ordinary NMEA style text messages on the User 2 port. However, this may be a problem for receiving equipment and thus it is recommended that all other User 2 Port output messages shall be set to 'Disabled' when this feature is used.

The baud rate for RTCM output data is controlled by the 'User Port 2' rate parameter in the *Port Rate Configuration* view. Selectable rates are 4800, 9600 and 19200. This view is reached as follows:

1. Enter *Configuration* mode by pressing the **MODE** key followed by function key **Config**.
2. Press **PAGE** in order to access a second set of function keys.
3. Press function key **I/O Config** followed by **Port Rate Config**.