OmniSTAR 8400HP

User Manual

FUGRO

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Notice to Customers

This manual has been produced to ensure the very best performance from your OmniSTAR receiver. The manual has been clearly set out with simple instructions to ensure trouble free usage of your OmniSTAR receiver.

This publication could contain technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the manual.

Should you require further assistance please contact your local dealer or the OmniSTAR B.V. office.

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One-Year Limited Hardware Warranty

OmniSTAR B.V and its operating companies world-wide (OmniSTAR), warrants this product to be free from defects in workmanship and material for a period of one year from the date of original sale by OmniSTAR or its authorised dealers, to the original purchaser or end user.

OmniSTAR reserves the right to repair and/or replace, at its option, any part or parts found to be defective, provided such defects, in their opinion, are due to faulty material or workmanship and are not caused by unauthorised or improper repair or abuse, or normal wear. Purchaser shall be responsible for shipping and insurance of the returned product for repair under this warranty. OmniSTAR will pay shipping and insurance for the product's return to purchaser provided that the product returned proves to be defective under this limited warranty.

This warranty applies only to normal usage of the product. It does not apply to units or electronic circuit boards defective due to improper installation or handling. Physical damage due to lightning or other electrical discharge and units subjected to fresh or salt-water contamination are not covered. OmniSTAR reserves the right not to warrant the product if, upon request, sufficient proof of recommended installation compliance as laid out in this manual is not provided. No other warranties are expressed or implied. No other warranties exist.

OmniSTAR assumes no responsibility for any consequential or incidental losses or damages of any nature with respect to the use of this product.

REVISION HISTORY		
Issue 0	December 2004	Draft
Issue 1	December 2004	Rx initial setup
Issue 2	June 2005	Firmware version p1
Issue 2.1	July 2005	Change baud rate, Ref. station list update
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Issue 2.21	Jan 2005	Minor change

Manual Reference: OmniSTAR 8400HP User Manual

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Introduction

About This Manual

This manual has been produced to assist the typical user with the installation and operation of the OmniSTAR 8400HP DGPS Receiver.

System Features

The OmniSTAR 8400HP DGPS Receiver is part of the Fugro worldwide DGPS Service. The Fugro service is a full-time differential GPS (DGPS) broadcast system, delivering corrections from an array of GPS reference stations located around the globe. Reference stations provide industry standard formatted corrections to Network Control Centres (NCC's) at strategic geographic locations, where the corrections are decoded, checked, and repackaged in a highly efficient format for broadcast. The data is modulated onto a RF carrier that is then uplinked to an L-band communications satellite.

The signals are received at the user's location by an antenna, demodulated by a receiver, and are made available, after selection of the desired individual reference site's data set, as corrections for use in a GPS, differential-capable, receiver.

The OmniSTAR 8400HP series of receivers support the following OmniSTAR® services:

HP, this is the High Performance service where dual frequency GPS carrier phase measurements are used in an intelligent and innovative way to create wide area positioning results of decimetre accuracy and performance.

XP, this is the High Performance service where dual frequency GPS carrier phase measurements are used with precise orbit and precise clock information from the satellite. For XP no Ground reference stations are needed

HPXP, Here the solution of HP and XP are merged to optimize performance and redundancy

VBS, this is the Virtual Base Station service where single frequency GPS code phase measurements are used to create RTCM corrections data optimised for the users current position.

Receiver Features

The OmniSTAR 8400HP receiver has the following features:

- 20 channel GPS L1/L2 C/A and P-Code Carrier

- Fast GPS reacquisition
- Fully field-upgradeable firmware
- Low power consumption

The following options are available for the 8400HP:

- L1 plus OmniSTAR VBS
- L1/L2 plus OmniSTAR HP
- L1/L2 plus RTK Note: Not supported by Omnistar.
- 5 Hz RAW data and position output rates
- 10 Hz RAW data and position output rates
- Internal Memory
- Advanced Multipath reduction, GPS L1
- Advanced Multipath reduction, GPS L1+L2

Housing

The 8400HP receiver is 159 mm wide, 172 mm deep, 88 mm high, and weighs 1.4 kg (Figure 1). The casing allocates space for two non-removable, on-board Li-Ion batteries, a power board, and two Euro cards. One of those cards is the GPS L1 receiver and the other is the OmniSTAR receiver.

The enclosure offers protection against environmental conditions and RF interference. In addition, it provides an easy-to-use interface to the GPS card's data, power and status signals and a rugged, water, shock and vibration resistant housing for outdoor applications.

Interfaces

The 8400HP provides the following interfaces:

- 2 serial ports with LEMO-brand connectors
- GPS antenna and power port
- LED indicators to provide status information
- 2 Internal batteries

Accessories

The following accessories are included with the 8400HP:

- 1 power adapter cable
- 1 straight serial port cable
- GPS antenna
- Antenna mounting bracket
- A CD containing PC utilities and product documentation

For technical specifications on the 8400HP, please see Appendix B.

Figure 1: 8400HP back side

Connector	Function
PWR	Power connector
A	GPS serial port connector
HP	HP serial port connector
GPS ANT	GPS/L-band antenna connector

Table 1: 8400HP Connectors

LED	Function
STAT	Status, # GPS satellite tracked
REC	Data recording indicator
BATT	Battery charge and power source
RX	OmniSTAR Satellite lock indicator
“Blue”	Bluetooth indicator

Table 2: 8400HP LED indicators

Installation and Set Up

Installation Considerations

Before commencing installation of the OmniSTAR 8400HP in a vehicle or aircraft, the following should be considered:

- Determine the preferred location for the unit. Consider cable length, connector attachment space (cable bend radius), stowing excess cable, moisture, chemical corrosion, vibration and heat exposure.

- Before drilling holes, consider using existing hardware and locations where equipment was previously installed. Avoid drilling holes that may damage other equipment (e.g. structural frame members, electrical cables or fluid lines).

- High vibration and high temperature locations should be avoided whenever possible.

- In applications where vibration exceeds 5Gs acceleration, shock mounts are required. (Refer to Customer support for mounting recommendations).

- Vehicle primary power has voltages that may be harmful to personnel and equipment. Disconnect the battery cable from the battery –ve (negative) terminal before making connection to any power terminal within the vehicle.

Counter Electromagnetic Force (CEMF)

A potential problem inherent in any installation of electronic systems within a vehicle is Counter Electro-magnetic Force (CEMF).

CEMF is caused when relays or solenoids, connected to the vehicle DC power distribution, are de-energised. The voltage produced may exceed – 400 volts.

CEMF is produced by equipment such as the following:

- **Electric fan brakes**
- **Air conditioners**
- **Starter relays**
- **Electric pump relays**

CEMF is more than sufficient to damage or cause erratic operation of any electronic system that is also connected to the same vehicle DC power supply. CEMF can be eliminated by installing diodes at the relays and solenoids that cause the problem, and more importantly at the power supply cable connections on the receiver.

A 47V, 5W, Zener diode (1N5368 or equivalent) should be connected between the receiver +ve (positive) power input terminal and ground, as illustrated in Figure 2.

Figure 2: Zener Diode Connected

Cable Installation

Cables must be correctly installed for optimum system operation. Therefore, the following should be noted:

- Do not route an L-Band receiver remote antenna cable with the cabling of any other radio system. This may cause interference between both systems.
- If at all possible, do not run L-Band receiver antenna cables parallel to other radio system cabling closer than 30 centimetres.
- If cables must cross, ensure that they cross at an angle of 90°. This minimises the possibility of interference.
- As far as is practicable, ensure that cables and I/O connectors are unique and fit only in their allocated location.
- Avoid routing cables along-side power generator cabling and other high electrical noise sources. This can cause interference.
- Do not kink or force cables into sharp bends that may damage the cables and cause system failure.
- After installation, ensure that excess cable is looped and clamped or tied safely away from any control cables, fuel lines, hydraulic lines or moving parts.
- When stowing over length cables, form loops not less than 150 mm minimum cable bend radius.
- Cable routing must avoid high temperature exposure (e.g. exhaust manifold).

Additional Features and Information

This section contains information on the additional features of the 8400HP receiver and an explanation of the Led functions.

Sleep Mode

In sleep mode, the power board and Bluetooth module will continue to draw power from the batteries, causing the batteries to drain over time. Follow these steps to put the 8400HP into sleep mode:

1. Turn on your receiver.
2. Press and hold the receiver's **power** key for more than four seconds and less than eight seconds. The STAT LED will be orange. The receiver enters Sleep Mode.
3. Any activity on the RS232 port will turn the receiver on.

If you press and hold the power key for more than 14 seconds, it will be ignored. This protects receiver operation against stuck keys.

Put the receiver in Zero Power Mode to prevent the draining of the battery.

Zero Power Mode

When your receiver is off, even in Sleep Mode, the power board will continue to draw power from the batteries. This means that if you fully charge your receiver, turn it off and store it, the receiver will drain its battery power in less than two months. To stop the power board from draining the batteries, you can put your receiver in Zero Power Mode:

1. Turn on your receiver.
2. Press and hold the **power** key for more than 8 seconds, but less than 14 seconds.
3. Release the **power** key when the STAT and REC LED"s all become red. When the LED's turn off, your receiver will be in Zero Power Mode.
4. Press the **Reset** key for about one second to return to Normal mode.

When the internal batteries have completely discharged and no external power is connected, the receiver will go into Zero Power Mode automatically to prevent the batteries from over discharging.

Status Indicators

The 8400HP has LED indicators that provide the status of the 8400HP. See Table 2: 8400HP LED indicators on page 3.

Status LED

- When the receiver is on and no GPS satellites are tracked, the STAT LED will blink red.
- When satellites are tracked, the STAT LED will produce one green blink for each tracked satellite.

Record LED and FN Key

- During the first second of pressing the **FN** key, the REC LED is orange.
- Pressing and holding the FN key for more than five and less than eight seconds will turn the baud rate of serial port A to 9600. After about five seconds of pressing the FN key, the REC LED becomes red. Release the FN key while the REC LED is red (during the next three seconds).
- Pressing and holding the FN key for more than eight seconds has no impact.
- After loading new firmware or clearing the receiver's NVRAM, the receiver checks its internal file system. During this operation, the REC LED flashes orange, and the file system is not accessible for CDU (control display unit) applications or for data recording. This operation may require from fractions of a second to several minutes, depending on the circumstances and the amount of internal memory.

Bluetooth LED

The colour of the BT LED indicates the level of activity at the Bluetooth communication link:

- Blue flashes – the Bluetooth module is on but no connection is established.
- Solid blue light – the Bluetooth module is on and a connection is established.
- No light – the Bluetooth module is off

If no Bluetooth module is installed the LED will flash when Blue tooth is switched on.

Battery LED

The colour of the BATT LED indicates the level of internal battery charge in the receiver:

- Green – indicates greater than 85% charge
- Orange – indicates an intermediate charge
- Red – indicates less than 15% charge

The pattern of blinks of the BATT LED also indicates the source of power:

- Solid light – an external power supply is used and the batteries are not being charged.
- Blinking once a second – the batteries are being charged.

- Blinking once every five seconds – the receiver uses the internal batteries for power.
- Not blinking – the receiver is in Zero Power Mode or the internal batteries are completely discharged and no external power is connected.

When the internal batteries have completely discharged and no external power is connected, the receiver will go into Zero Power Mode to prevent the batteries from over discharging.

RX LED
The colour of the RX LED indicates the status of the differential corrections for the OmniSTAR board.
For the OmniSTAR board when in operation mode:

- Blinks green – the receiver is searching for the selected OmniSTAR satellite.

Solid green – the OmniSTAR satellite is locked.

Clear NVRAM

The receiver's Non-Volatile Random Access Memory (NVRAM) holds data required for satellite tracking, such as ephemeris data and receiver position. The NVRAM also keeps the current receiver's settings, such as active antenna input, elevation masks and recording interval, and information about the receiver's internal file system.

Even though clearing the NVRAM is not a common (nor normally a recommended) operation, there are times when clearing the NVRAM can eliminate communication or tracking problems. Clearing the NVRAM in your receiver can be interpreted as a "soft boot" in your computer.

After clearing the NVRAM, your receiver will require some time to collect new ephemeris and almanacs (around 15 minutes).

Clearing the NVRAM of your receiver will not delete any files already recorded in your 8400HP's memory. However, it will reset your receiver to factory default values.

In addition, the NVRAM keeps information about the receiver file system. Note that after clearing the NVRAM, the receiver's STAT LED will flash orange for a few seconds indicating that the receiver is scanning and checking the file system.

Use Keys to Clear NVRAM

1. Press the **power** key to turn off the receiver.
2. Press and hold the **FN** key.
3. Press and hold the **power** key for about one second.
   Release the **power** key while continuing to hold the **FN** key.
4. Wait until the STAT and REC LED's are green

5. Wait until the STAT and REC LED's blink orange.
6. Release the **FN** key while the STAT and REC LED's blink orange.

Use View8400 to clear NVRAM

1. Connect the receiver to a computer via the HP port
2. Select in the Configuration menu the GPS receiver settings
3. Change cable from port HP to port A
4. Press Clear NVRAM button

Antenna Location

Antenna positioning is critical to system performance.

The following conditions must be met for optimum system performance:

- Antenna must be mounted at least 1.5 metres away from transmitting antennas of any frequency. Closer positioning may cause saturation of receiver RF circuits.

- The antenna should be mounted at the highest practical point that will give a good view of the horizon and be as near level as possible.

- The antenna must be located along the vehicle centre-line, or at a relevant reference point on the vehicle.

Power Supply Requirements

The 8400HP contains an internal power board that manages receiver power and battery charging, and is connected to the receiver board and the batteries. The power board receives power from the internal batteries, even when the receiver is turned off. This feature allows the internal batteries to charge, regardless of the receiver's status (on or off). To prevent the batteries from discharging when the receiver is stored, put the receiver in Zero Power Mode. A tightly regulated input supply to the 8400HP is not required, as long as it falls within the input range +8 to +28VDC.

If the voltage supplied is below the minimum specification, the receiver will suspend operation. If the voltage supplied is above the maximum specification, the receiver may be permanently damaged, voiding your warranty.

Operating considerations

The 8400HP is a high-quality positioning device. The accuracy that the user can obtain depends on several factors, including:

- Number of visible satellites
- Multipath
- Dilution of Precision (DOP)
- Satellite elevations
- Differential correction
- Distance to reference station network

Number of visible satellites

A minimum of four satellites is required to calculate a 3-dimensional position. In general it can be said that every increase in the number of visible satellites will result in an increase in the system's accuracy. As the GPS satellites orbit around the earth the number of visible satellites will change in time. The GPS constellation has been designed so as to provide a minimum of 4 visible satellites at any location at all times. The number of visible satellites can decrease due to blockage by objects such as trees and buildings.

Multipath

It is possible for satellite signals to reflect off large nearby objects such as buildings, cars or even the ground, thereby resulting in an erroneous distance measurement. This phenomenon is known as multipath. Multipath can cause significant errors in the position determination and it is therefore important to place the receiver in an environment, which is free of large reflective surfaces. It is also recommended to mount the receiver directly onto a surface, while maintaining a clear view of the sky in all directions.

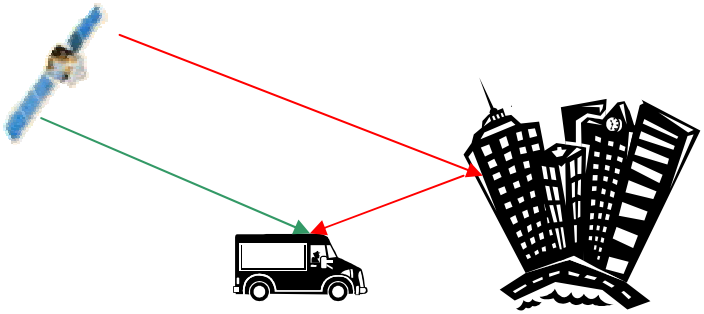

Figure 3: Multipath

Position Dilution of Precision (PDOP)

The Position Dilution of Precision (PDOP) is a measure of the satellite geometry. The lower the PDOP value, the more accurate the GPS position will be.

Satellite elevations

The signal from a satellite that is low on the horizon will travel a greater distance through the atmosphere. This results in a lower signal strength and a delayed reception, thereby causing erroneous and noisy data. By default the 8400HP is configured to ignore any satellites that have an elevation angle lower than 5° for VBS and lower than 8° for HP.

Differential corrections

For accurate positioning it is essential that the differential corrections are received. In order to ensure reception of the OmniSTAR satellite signal the line of sight towards the satellite must not be blocked by objects such as trees and buildings.

Multipath reflections can cause destructive interference, thereby significantly decreasing the signal strength. It is therefore recommended to mount the 8400HP antenna directly onto a surface in a reflection free environment.

Although the 8400HP has been designed to provide optimal system performance under most circumstances, it is possible, due to the nature of radio communications that the system performance degrades due to local interference sources.

Operation

Before operating the receiver for the first time, ensure that you have followed the installation instructions.

Communications with the Receiver

Communication with the receiver is straightforward, and consist of issuing commands through the communications ports from an external serial communication device. This could be either a terminal or an IBM-compatible PC that is directly connected to the receiver serial port. For more information about commands and logs that are useful for basic operation of the receiver, go to Appendix D.

Serial Port Default Settings

The receiver communicates with your PC or Terminal via serial port. For communication to occur, both the receiver and the operator interface have to be configured properly. The receiver's port A and HP port default settings are as follows:

- **115200 BPS, no parity, 8 data bits, 1 stop bit, no handshaking.**

The data transfer rate you choose will determine how fast information is transmitted. Take for example a log whose message byte count is 96. The default port settings will allow 10 bits/byte. It will therefore take 960 bits per message. To get 10 messages per second then will require 9600 BPS. Please also remember that even if you set the bps to 9600 the actual data transfer rate will be less and depends on the number of satellites being tracked, filters in use, and idle time. It is therefore suggested that you leave yourself a margin when choosing a data rate.

Getting Started

The purpose of this section is to get you started with the 8400HP as quickly as possible. The guide will address receiving the satellite data carrier, and then checking the functionality and status of the HP Process.

Generally when the receiver is supplied to you it will be configured for the mode and data link(s) you have subscribed to. In most cases to get up and running will be a case of connecting the appropriate cables and applying power to the system.

Included with your receiver is the View8400 application. This application allows you to check the status of the receiver and configure the GPS and HP receiver.

Initial Setup

Refer to the following diagrams, as you will need to assemble all the required items.

- OmniSTAR 8400HP Receiver
- GPS/L-band Antenna
- Antenna Cable
- Power Cable
- HP Port Cable

1. Install the antenna where it has a clear view of the sky in the direction of the satellite.

2. Connect the antenna cable between the antenna and the 8400HP (TNC connector labelled 'GPS ANT').

3. Connect the power cable to a suitable 8-28 VDC power source.

4. Turn on the receiver: press and hold the green **power** button for about 0.5 seconds and release it.

5. Check the colour of the BATT LED to verify the receiver has sufficient power.

6. Connect the receiver to the serial port of a computer via the HP port and start the View8400.exe application. View8400 is available on the supplied CD or on the www.omnistar.nl website. The following screen will appear, Figure 4: View8400 start screen.

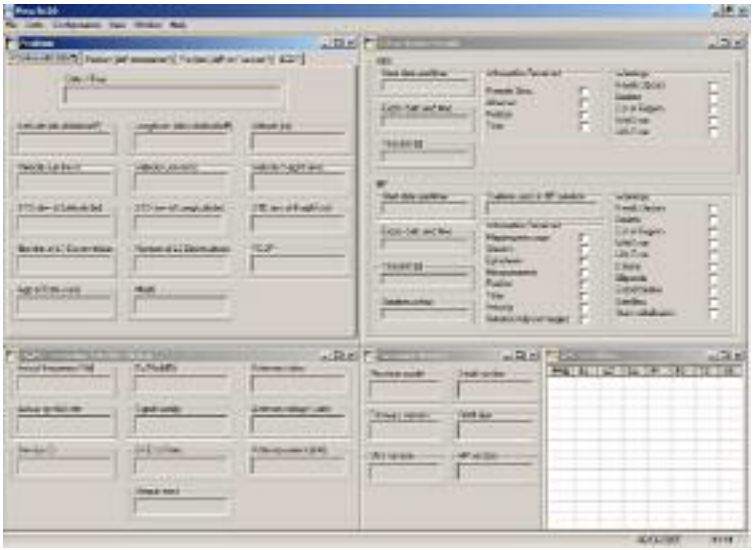

Figure 4: View8400 start screen

7. Select File and Connect.

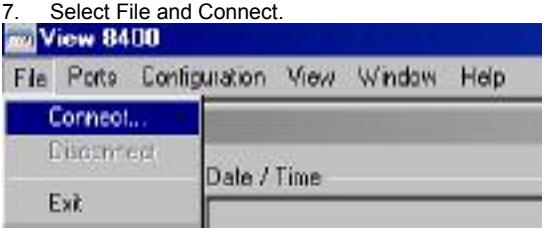

Figure 5: View8400 Menu File option Connect

The Select Com port screen enables you to select the COM port of the computer and select a different baud rate, Figure 6: View8400 Select Com Port. The 8400HP receiver uses two ports port A for the GPS and the HP port for the HP processor. The 'use two comports' selection box can be used if both ports are connected to the computer. When the 'Autoconnect' option is ticked the application will use the same settings next time the application is started.

> If the Autoconnect option was used before and the receiver is on a different COM port, please use disconnect in the File menu option and connect to get the Select Com port window.

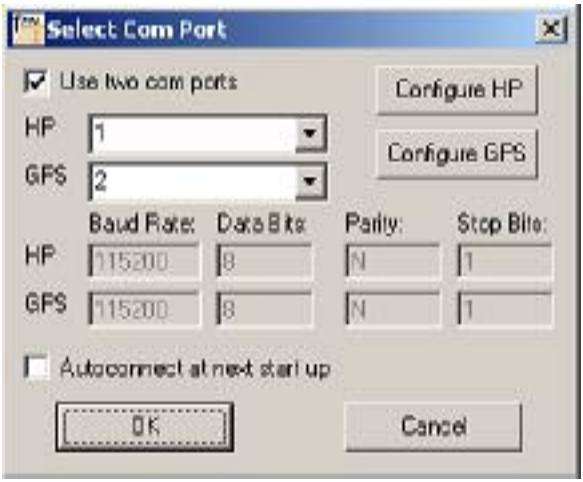

Figure 6: View8400 Select Com Port

When the connection is established the View8400 screen will show the current status of the receiver.

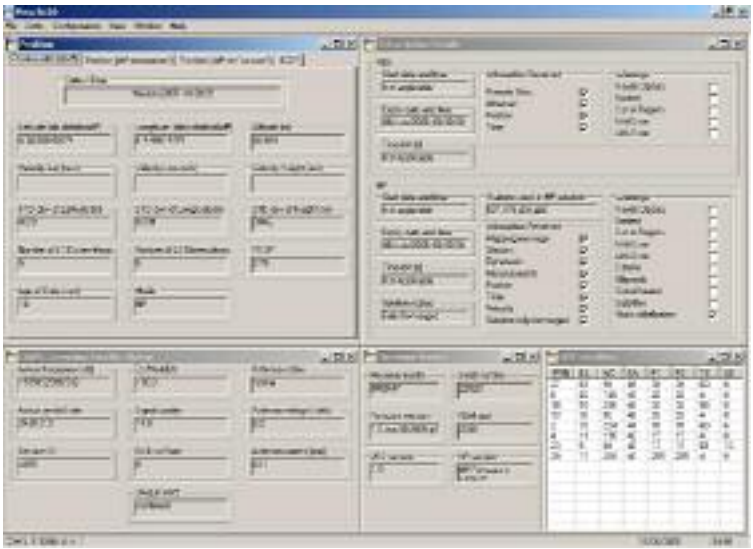

Figure 7: View8400 receiver status

The separate information blocks are:

- DGPS Correction Satellite Status (Figure 8)
- Subscription details (Figure 11)
- Firmware version (Figure 12)
- GPS Satellites (Figure 13)
- Position (Figure 14)

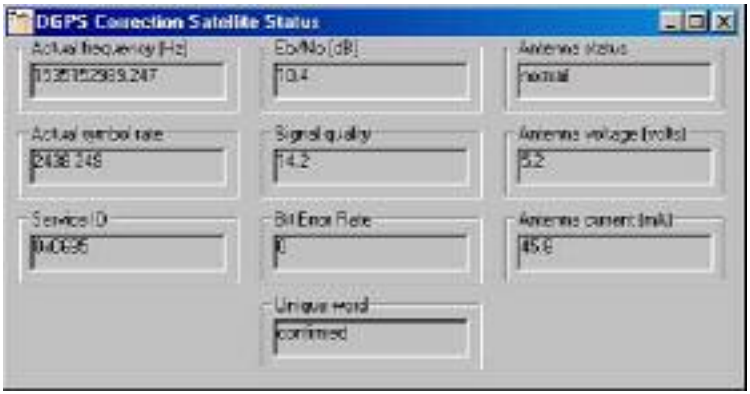

Figure 8: View8400 DGPS Correction Satellite Status

The OmniSTAR 8400HP receiver is configured for the area of work. For Europe this is the EA-Sat with frequency 1535.1525 MHz. The DGPS Correction Satellite Status window will show the current status of the satellite link. Appendix E contains a list of OmniSTAR Satellites. If the receiver is used in a different area of the world a different satellite must be selected.

8. Selecting 'DGPS service' in the menu option 'Configuration' opens the Select DGPS service window.

Figure 9: View8400 Configuration menu option DGPS service

Figure 10: View8400 Configuration menu option DGPS service

11. In the Satellite selection box all available OmniSTAR satellites can be selected.

12. The receiver is ready to work when the receiver is logged on to the correct satellite signal and the subscription is valid.

13. The Subscription details window (Figure 11) shows the status of both the VBS and the HP subscription. The warnings at the right of the window will show the errors if the subscription does not work. The Needs Update warning is generated when the receiver is switched after a long period of inactivity or after a change of satellite service. The 'Needs update' warning will disappear after the receiver has received the OmniSTAR Almanac and site table from the satellite link.

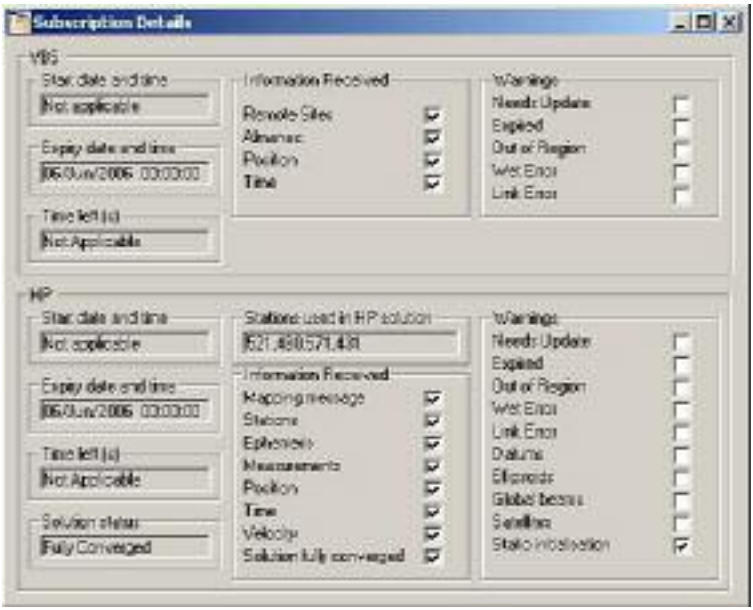

Figure 11: View8400 Subscription details

14. If one of the other warnings is active you will have to contact the OmniSTAR office for an activation.

Figure 12: View8400 Firmware Version

15. The OmniSTAR activation is sent by satellite to the receiver, which is identified by the OmniSTAR serial number.

16. The receiver must be switched on and be receiving the satellite signal at the moment the subscription is sent.

17. The GPS Satellites window will show which GPS satellites are tracked and supply all information about the satellites.

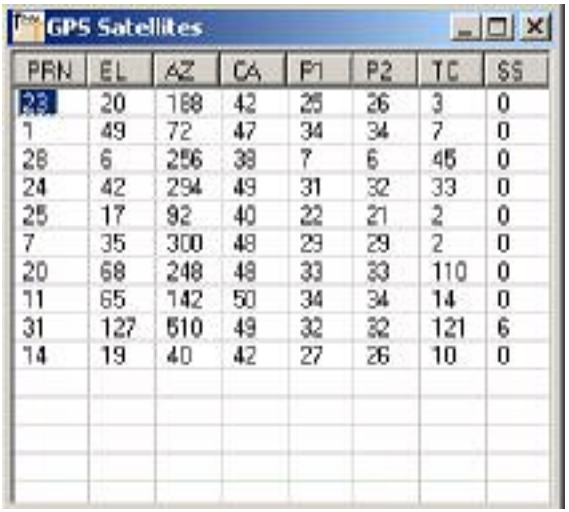

Figure 13: View8400 GPS Satellites

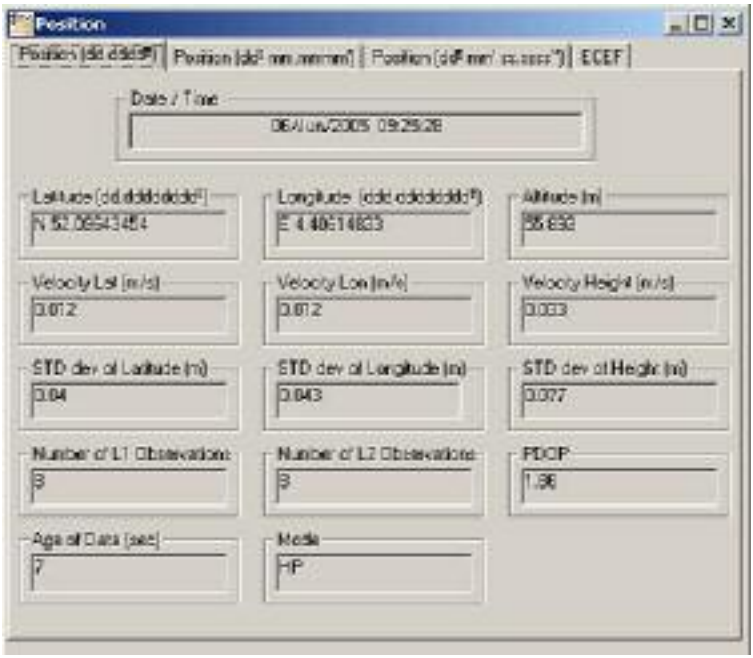

Figure 14: View8400 Position

The position window will show the current position. The tabs can be selected if you want to show the position information in a different format.

18. Enable the NMEA output on the HP port. Select in the Configuration menu option, NMEA output on HP Port.

Figure 15: View8400 Select HP Port NMEA output in Configuration menu

19. The following screen will appear.

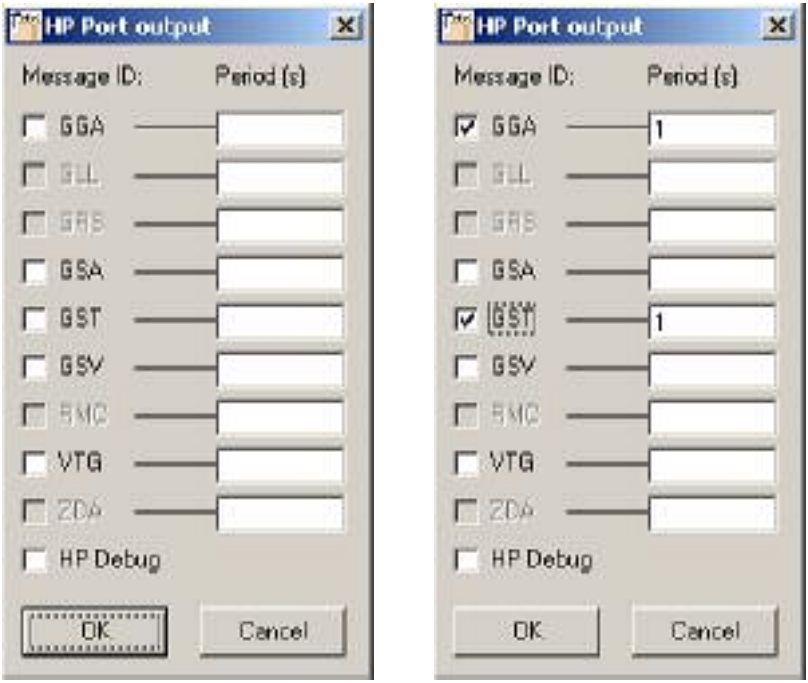

Figure 16: View8400 NMEA output on HP Port

If any message is switched on at startup of View8400, this message will be ticked and the output rate becomes visible.

20. When View8400 is closed the HP Port output will be as selected in the right figure.

8400HP receiver settings

In the Configuration menu option HP receiver settings the receiver HP parameter window will appear.

Figure 17: View8400 Select HP receiver settings

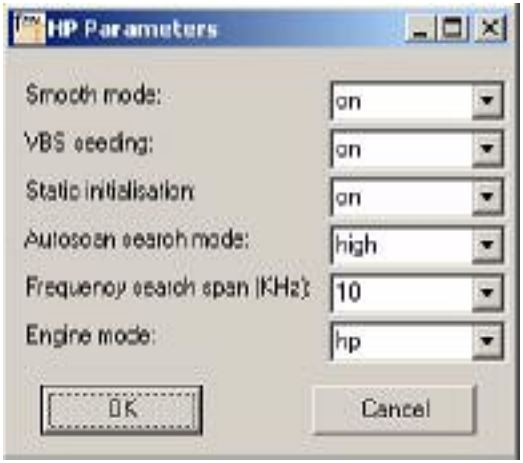

Figure 18: View8400 HP parameter

- Smooth mode, HP filter options
- VBS seeding, at start-up the VBS position is used as start position for the HP process.
- Static initialisation, if the receiver is static this mode will improve the initialisation time.

- Autoscan search mode, the receiver can use the Low and High power OmniSTAR satellites. In high mode the receiver will use the OmniSTAR spotbeams.
- Frequency search span, the receiver searches for the OmniSTAR satellite signal using the defined span. If an interfering satellite signal is close to the OmniSTAR frequency the receiver can lock on to that frequency. To prevent this the span can be reduced.
- Engine mode, the receiver can be set to 'HP or 'XP' mode. In 'HP' mode the receiver uses the Fugro network of reference stations for the HP positioning. In 'XP mode the receiver uses the precise orbits which are broadcasted by the OmniSTAR satellites.

OmniSTAR VBS position

The OmniSTAR 8400HP receiver can be configured to output HP corrected GPS positions over the HP port and simultaneously output VBS corrected position through port A. The receiver must have a valid VBS subscription, the View8400 Subscription Details screen (Figure 11, page 19) shows the current status of the subscription.

With the option 'GPS receiver settings…' in the Configuration menu the GPS receiver can be configured for VBS.

Figure 19: View8400 GPS receiver settings

If you are using a single COM port, the application will show the following screen.

Figure 20: View8400 Please switch to receiver port A

The serial cable will have to be disconnected from the HP port and connected to port A. Please press OK after the cable is switched.

The GPS receiver settings window shows the current GPS receiver configuration.

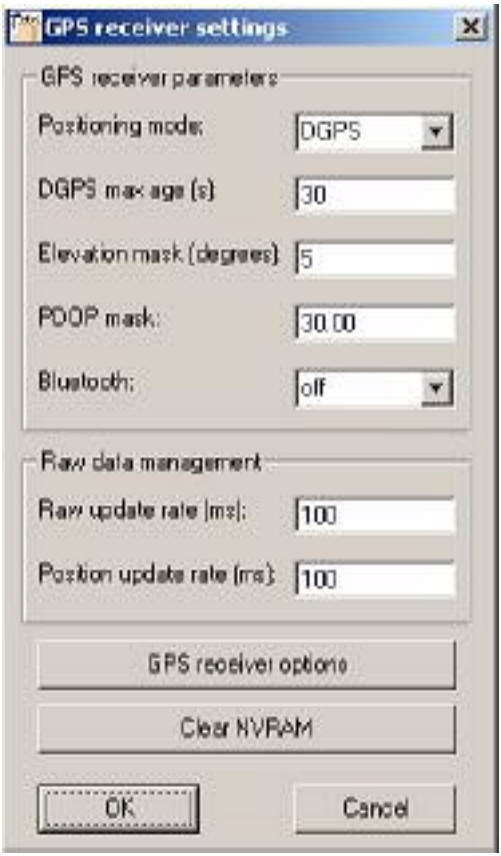

Figure 21: View8400 GPS receiver settings

- The Positioning mode can be either standalone or DGPS.
- The DGPS max age only applies for the VBS position.
- The Bluetooth option is not available in all 8400HP receivers, if it is not available the selection switches the blue LED off.
- If you require a NMEA output rate higher than 1 Hz, the Raw update and Position update rate has to be changed to the required interval time. In the GPS receiver options you can check if a higher update rate is available. The receiver options in Figure 22: View8400 GPS receiver options show the maximum update rate of the used receiver, this can be upgraded to 10 hz.

With the GPS receiver options button you can request a list of the available receiver options.

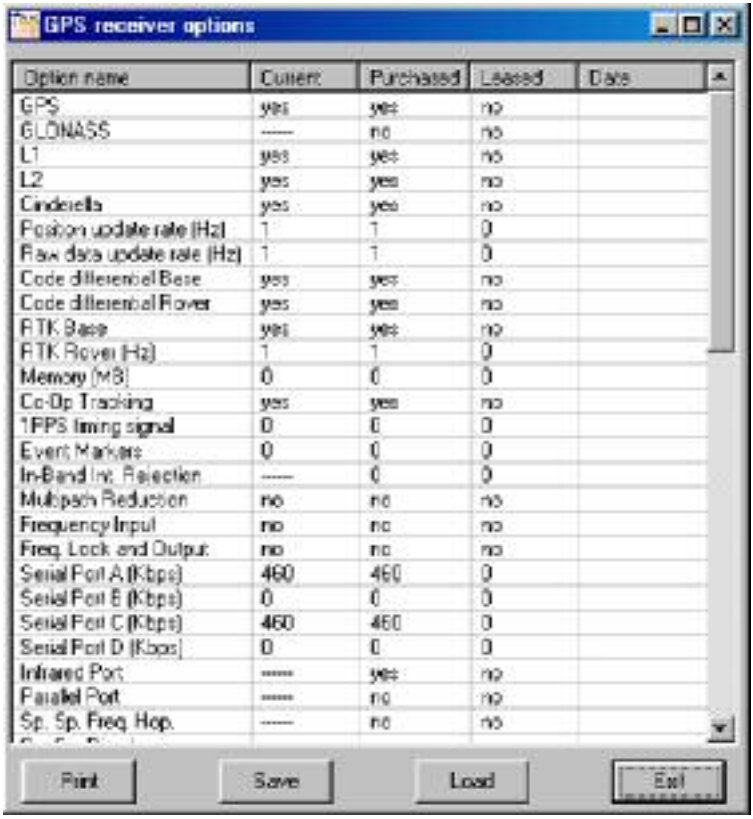

Figure 22: View8400 GPS receiver options

The options can be purchased or leased if you want to upgrade your receiver. With the 'Load' button the "jpo" upgrade file can be loaded in to the receiver. The upgrade file name contains the internal GPS receiver serial number. This number is necessary if you request a receiver upgrade. The 'Save' button will create a text file with all options. The 'Exit' button is used to close the window.

The options determine the receiver capabilities. For a receiver to work with VBS the Code differential Base and Rover options are necessary. If these options are available you can configure the receiver to output differential corrected positions from port A.

After configuring the GPS receiver press OK. Figure 23: View8400 Please switch back to the HP port will appear if you are using a single COM port connection.

Figure 23: View8400 Please switch back to the HP port

Change the serial cable first before pressing 'OK', the application does send a configuration command to the HP port after 'OK' is pressed.

The NMEA output of port A can be selected in the Configuration menu option 'NMEA output'. Select Port A and connect the serial cable to port A.

Figure 24: View8400 select Port NMEA output

The Port A output options window will appear and the required NMEA messages can be selected.

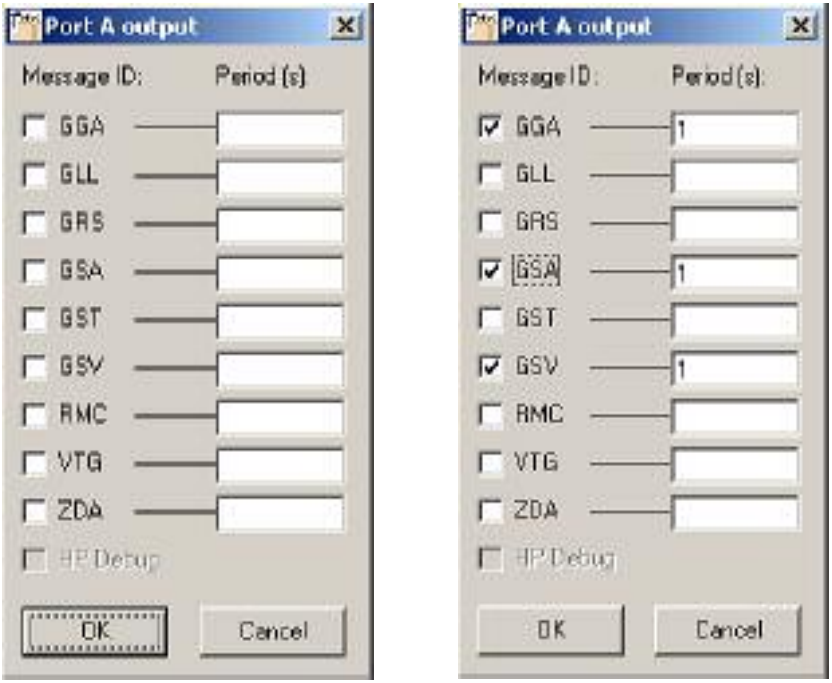

Figure 25: View8400 Port A NMEA output

Set Seed Point

The OmniSTAR HP system has a typical dynamic convergence time of 20 minutes. To improve the convergence time the OmniSTAR HP system can be started from a known position or seed point.

Figure 26: View8400 Select Set Seed Point

The Set Seed point window will appear, Figure 27: View8400 Set Seed Point. The application will read the current seed point which is stored in the receiver and show the values in the position fields. If the receiver does not have a seed position the fields will be empty.

The following options are available, see Figure 27: View8400 Set Seed Point:

1. Send seed point reset
2. Get current position and Std dev
3. Store seed point in file
4. Load seed point from file

1. Send seed point reset will reset the stored seed point in the receiver.
2. Get current position and Std dev, read the current position.
3. Store seed point in file, the position can be stored in a “ksp” “known start position” file.
4. Retrieve the seed position from a “ksp” file.

These functions can be used

a) Want to start work quickly
b) If you want to stop working and continue to work the next day starting at the last point.

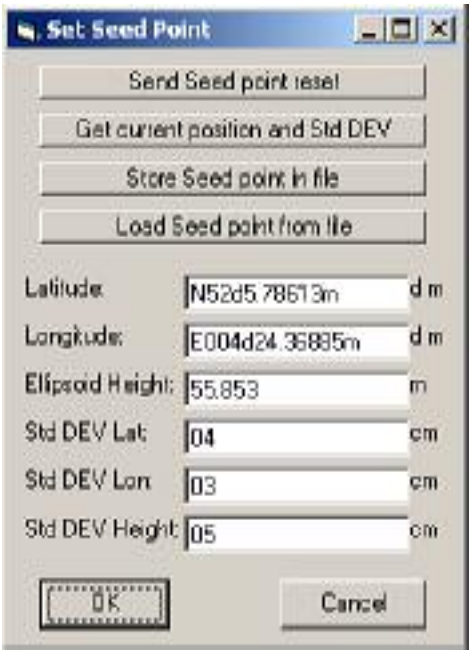

Figure 27: View8400 Set Seed Point

Terminal Mode

The View8400 application has a terminal option that can be used to send commands direct to the HP port of the receiver.

Figure 28: View8400 Select terminal Mode

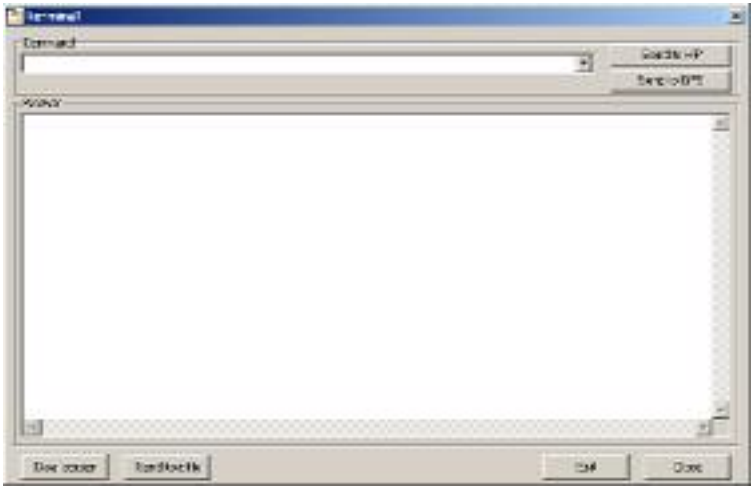

Figure 29: View8400 Terminal

If you are connected with the receiver using a single COM port, the commands will be sent to the HP port. If you are connected using two COM ports you can select the HP or the GPS port.

The terminal can be used to send text files that can contain a series of commands. Appendix B contains a list of the commands.

8400RTK

The 8400HP receiver can be used as a RTK rover and base station. These options will have to be purchased separately; this can be verified in the GPS receiver options. In the OmniSTAR VBS position paragraph it is shown how the options can be read from the receiver.

The 8400RTK base station can output RTCM messages from port A. The commands for this configuration have to be send to Port A:

```
dm
%%set,/par/rover/mode/,off
%%set,/par/base/mode/,off
%%set,/par/pos/mode/cur,sp
%%set,/par/ref/pos//geo,{W84,N52d5.7860586m,E4d24.3687564m
,55.782}
em,,rtcm{/18:1,/19:1,/20:1,/21:1,/22:1,/3:10}
```

The 8400RTK rover can output the GPS fixed position, GGA quality indicator value ‘4’, from both the HP port and port A.

8400RTK Rover, NMEA from HP Port:

```
dm,/dev/ser/b
dm
%%set,/par/dev/ser/b/echo,/dev/ser/a
```

8400RTK Rover NMEA from port A

```
dm
dm,/dev/ser/c
em,/dev/ser/c,/msg/nmea/GGA
em,,/msg/nmea/GGA
%%set,/par/pos/mode/cur,pd
%%set,/par/dev/ser/a/imode,rtcm
```

The last command sets the port A input mode to RTCM, this means that the receiver does not accept commands anymore. To configure the receiver for HP mode a Clear NVRAM has to be performed using the power and FN key first, see Clear NVRAM on page 9. After this the View8400 can be used to configure the 8400HP receiver.

Appendix A

Technical Specifications

PERFORMANCE

Position Accuracy [1]	VBS:σ 25 cm (X,Y) 50 cm Z HP: Seeding: σ 5 cm (X,Y) 10 cm Z Static σ_{3D} 30cm,10 min Dynamic σ_{3D} 30cm 25 min RTK:H: 10 mm + 1ppm V: 15 mm + 1ppm
GPS satellite Reacquisition	< 1 sec
Data Rates	1 Hz (default), 5, 10, 20 Hz optional

ENVIRONMENTAL

Operating Temperature	-30°C to +60°C with batteries
Storage Temperature	-40°C to +75°C with batteries
Humidity	Not to exceed 95% non-condensing

POWER REQUIREMENTS

Voltage	+8 to +28 VDC (for work) +9 to +28 VDC (for charge battery) Minimum Charge current <= 2Amp
Power consumption	OmniSTAR Mode 5.1 W

RF INPUT / LNA POWER OUTPUT

Antenna connector	TNC female, 50 Ω nominal

[1] Typical values. Performance specifications are subject to GPS system characteristics, U.S. DOD operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length and multipath effects.

	impedance
RF Input Frequencies	1575.42 MHz (L1), 1227.60 MHz (L2), 1525 MHz – 1559 MHz (L-Band)
LNA Power	+2.7 to +12 VDC; 15 mA @ 5.0 typical

INPUT / OUTPUT DATA INTERFACE

Electrical Specification	RS232
Baud Rate	300, 1200, 4800, 9600 19200, 57600, 115200(default) bps

Input / Output Connectors

GPS ANT	TNC female jack, 50 Ω nominal Impedance, + 5.42 VDC (output from 8400HP to antenna/LNA)

Physical

Size	W: 195 x H: 88 x D: 172 mm
Weight	1.4 kg
Enclosure	Aluminium

Port Pin-Outs

Power Connector

The power connector (Figure 30) is a sealed receptacle, 5 pin W.W. Fisher bulkhead plug.

Table 3 gives power connector specifications.

Figure 30: power Connector

Number	Signal Name	Dir	Details
1	Power_INP	P	6 to 28 Volts DC input
2	Power_INP	P	6 to 28 Volts DC input
3	Power_GND	P	Ground, power return
4	Power_GND	P	Ground, power return
5			Not Used

Table 3: Power connector Specification

Serial RS232 Connector

For ports A and HP. The RS232 connectors (Figure 31) are sealed receptacle, 7 pin W.W. Fisher bulkhead plugs.

Figure 31: Serial RS232 Connector

Table 4 gives the RS232 connector specification.

Number	Signal Name	Dir	Details
1	Power_OUT	P	Power Output (Supplied Voltage)
2	GND	-	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7			Not used

Table 4: RS232 Connector Specification

Cables

Power Cable

The power cable supplied with the 8400HP is a 5-pin W.W. Fisher Series 102 plug to 2-way SAE connector.

With the power cable a power charger is supplied which can be used as an external power source or as the charger for the internal batteries. This unit converts the alternating current (AC) normally supplied from an electrical outlet to a direct current (DC), which is used to charge the batteries and power the receiver.

- Input voltage – between 90 and 264 V AC
- Frequency of input power – between 47 Hz and 63 Hz
- Output voltage – 12 V DC @ 2.5 A (30 W)

RS232 Serial Cable

The RS232 serial cable is used to the receiver's port A or port HP and an external device (hand-held controller or computer).

The cable is a sealed DB-9 female plug to a sealed 7-pin W.W. Fisher plug.

Appendix B

Commands

Following are the commands with detailed descriptions that can be sent to the 8400HP.

```
        COMMANDS FOR HP-BULB RECEIVER { ver 1.0 p1 }
**********************************************************
```

Bulb commands

```
**********************************************************
```

set,...

```
    set,/par/bulb/init/fctr,mode

    {Set all the parameters to the default factory value}

    mode:

        y       {};
        on      {};
        yes     {};

        n       {};
        off     {};
        no      {}.
-------------------------------------------------------------

    set,/par/bulb/reset,mode

    mode:

        y       {};
        on      {};
        yes     {};

        n       {};
        off     {};
        no      {}.
-------------------------------------------------------------
```

```
    set,/par/bulb/conf,param

    param:

        off     {};
        on      { automatic configuration of system }.
-------------------------------------------------------------

    set,/par/bulb/mode,param

    param:

        off     { mode OFF };
        omni    { mode OmniStar }.
-------------------------------------------------------------

    set,/par/bulb/ant/pwr,mode

    mode:

        off     { a power of the antenna is turn off };
        on      { a power of the antenna is turn on }.
-------------------------------------------------------------

    set,/par/bulb/dev/ser/b/rate,param

    { Serial port Baud Rate }

    param:

        300     {};
        600     {};
        1200    {};
        2400    {};
        4800    {};
        9600    {};
        19200   {};
        38400   {};
        57600   {};
        115200  {};
        153600  {}.
-------------------------------------------------------------

    set,/par/bulb/dev/ser/b/imode,param

    { Serial port Input Mode }

    param:

        cmd     { command mode };
        jps     { JPS messages input mode };
        echo    { echo mode }.
-------------------------------------------------------------
```

```
    set,/par/bulb/dev/ser/b/eoff,string

    { Ech-off sequence parameter (arbitrary string
      comprising up to 32 characters) }

    For example: #BULB# {set,bulb/dev/ser/a/eoff,"#BULB#"}
-------------------------------------------------------------

    set,/par/bulb/dev/ser/b/echo,param

    { Serial port Echo Mode }

    param:

        /dev/null     { disable echo mode };
        /dev/ser/a    { echo in port A };
        /dev/ser/b    { echo in port B }.
-------------------------------------------------------------

    set,/par/bulb/spectr/spec,mode

    mode:

        off     { spectrum OFF };
        on      { spectrum ON }.
-------------------------------------------------------------

    set,/par/bulb/spectr/carrfrq,frequency

    frequency:

        in Hz   { carrier frequency }.

    frequency range:

        Omni:
                    1525000000 Hz - 1559000000 Hz


    for example:

        1535152500
-------------------------------------------------------------

    set,/par/bulb/spectr/spanfrq,frequency

    frequency:

        in Hz   { frequency span }.

    frequency range:
```

```
        0 Hz - 100000 Hz
    for example:
        100000
```

```
    set,/par/bulb/spectr/filfrq,frequency
    frequency:
        in Hz   { frequency filter }.
    frequency range:
        0 Hz - 10000 Hz
    for example:
        10000
```

```
    set,/par/bulb/spectr/detnum,number
    number:
        {}.
    number range:
        1 - 500
    for example:
        500
```

---

print,...

```
    print,/par/bulb:on
```

```
    print,/par/bulb/conf:on
```

```
    print,/par/bulb/mode:on
```

```
    print,/par/bulb/spectr:on
```

```
    print,/par/bulb/spectr/param

    param:

        spec    { spectrum ON/OFF };
        carrfrq { carrier frequency };
        spanfrq { frequency span };
        filfrq  { frequency filter };
        detnum  {}.
-------------------------------------------------------------

    print,/par/bulb/rcv/ver:on

    print,/par/bulb/rcv/ver/param

    param:

        main    { firmware version };
        boot    { boot-loader version };
        hw      { hardware version };
        board   { board version }.
-------------------------------------------------------------

    print,/par/bulb/rcv/uptime:on

    { time since last re-boot: day-hours-minutes-seconds,
      e.g. 0d01h31m12s }.
-------------------------------------------------------------

    print,/par/bulb/rcv/id:on

    { receiver ID }.
-------------------------------------------------------------

    print,/par/bulb/rcv/model:on

    { receiver model }.
-------------------------------------------------------------

    print,/par/bulb/rcv/mem:on

    { size of RAM in kilobytes }.
-------------------------------------------------------------

    print,/par/bulb/rcv/sn:on

-------------------------------------------------------------

    print,/par/bulb/dev/thermo/out

    { query receiver board temperature , [Celsius] }.
-------------------------------------------------------------
```

```
    print,/par/bulb/dev/ser/a/param

    print,/par/bulb/dev/ser/b/param

    param:

        rate    { Serial port Baud Rate };
        imode   { Serial port Input Mode };
        echo    { Serial port Echo Mode };
        eoff    { Echo-off sequence parameter }.
-------------------------------------------------------------

    print,/par/bulb/ant/param

    param:

        pwr     { status of power antenna };
        dc      { status of external antenna connection:
                  off - ext antenna will not draw any DC
                  normal - ext antenna draws normal DC
                  overload - ext antenna draws current
                   higher than expected }.
-------------------------------------------------------------

    print,/par/bulb/pwr/param

    param:

        extant   {query external antenna voltage,
                  [volts] };
        extantdc {query external antenna current, [mA] }.
-------------------------------------------------------------
    print,bulb/out/dev/ser/a
    print,bulb/out/dev/ser/a:on
    print,bulb/out/dev/ser/b
    print,bulb/out/dev/ser/b:on

    { This message set comprises messages enabled for
      output to the corresponding serial port (only for
      "jps" and "nmea" messages) }.
```

---

embulb,...

```
    embulb,/dev/ser/b,jps/message

    message:

        RT      { Receiver Time };
        RD      { Receiver Date };
```

```
        PG      { Geodetic Position };
        PV      { Cartesian Position and Velocity };
        DP      { Dilution of Precision (DOP)Parameters };
        SI      { Satellite Indices };
        EL      { Satellite Elevations };
        AZ      { Satellite Azimuths };
        EC      { C/A Carrier to Noise Ratio };
        E1      { P/L1 Carrier to Noise Ratio };
        E2      { P/L2 Carrier to Noise Ratio };
        TC      { Time Since Last Loss-of-Lock on
                  particular C/A signal };
        SS      { Satellite navigation status };
        EE      { Epoch End };
        ET      { Epoch Time };

        gt      { GPS Time << from OmniSTAR HP };
        po      { Cartesian Position << from OmniSTAR HP};
        pg      { Geodetic Position << from OmniSTAR HP};
        ve      { Cartesian Velocity << from OmniSTAR HP};
        pv      { Cartesian Position and Velocity << from
                  OmniSTAR HP };
        dp      { Dilution of Precision (DOP) Parameters
                  << from OmniSTAR HP };
        ss      { Satellite navigation status << from
                  OmniSTAR HP };
        hp      { data from OmniSTAR HP };
        St      { status OmniSTAR VBS and OmniSTAR HP }.
-------------------------------------------------------------

    embulb,/dev/ser/b,/msg/nmea/message

    message:

        GGA     { Global Positioning System Fix Data };
        GSA     { GNSS DOP and Active Satellites << from
                  OmniSTAR HP };
        GST     { GNSS Pseudorange Error Statistics <<
                  from OmniSTAR HP };
        GSV     { GNSS Satellites in Viev };
        VTG     { Course Over Ground and Ground Speed <<
                  from OmniSTAR HP }.
-------------------------------------------------------------

    embulb,/dev/ser/b,/msg/vbs
-------------------------------------------------------------
```

dmbulb,...

```
    dmbulb
```

```
    dmbulb,/dev/ser/a
    dmbulb,/dev/ser/b
-------------------------------------------------------------


*************************************************************

        OmniStar commands
*************************************************************
```

set,...

```
    set,/par/omni/init/fctr,mode

    { Set OmniStar the parameters to the default factory
      value. }

    mode:

        y       {};
        on      {};
        yes     {};

        n       {};
        off     {};
        no      {}.
-------------------------------------------------------------

    set,/par/omni/beam/chan,satellite

    satellite:

        easat   { EA-SAT (Europe) };
        asats   { ASAT S.America };
        amsce   { AMSC (N.America) East };
        amscc   { AMSC Central };
        amscw   { AMSC (N.America) West };
        optus   { Optus Austr./N.Z. };
        xsat    { XSAT Africa/Asia };
        apsat   { AP-Sat (Asia) };
        amsat   { AM-Sat (America) };
        afsat   { AF-Sat (Africa) };
        aorw    { AORW };
        aore    { AORE };
        ior     { IOR };
        por     { POR };
        auto    { automatic scan for Fugro };
        chartco { ChartCo };
        user    { user frequency }.
```

---

set,/par/omni/beam/cfnom,**frequency**

frequency:

in Hz { nominal carrier frequency }.

frequency range:

1525000000 Hz - 1559000000 Hz

for example:

1535152500

---

set,/par/omni/beam/srnom,**symbolRate**

symbolRate:

609 {};
1219 {};
2438 {};
4876 {}.

---

set,/par/omni/beam/serv/sid,**xxxx**

xxxx:

in Hexadecimal system { will be used only in "user" mode }.

for example:

c685

---

set,/par/omni/beam/serv/scrv,**xxxx**

{ scrambler vector }

xxxx:

in Hexadecimal system { will be used only in "user" mode }.

for example:

5c08

```
    set,/par/omni/beam/srch/span,frequency

    { search range }

    frequency:

        5       { 5 kHz };
        10      { 10 kHz };
        20      { 20 kHz }.
-------------------------------------------------------------

    set,/par/omni/beam/srch/sid,mode

    { search rule for SID }

    mode:

        off     { not use SID };
        userdef { use user defined };
        fugro   { will be used SID for Fugro };
        chartco { will be used SID for ChartCo }.
-------------------------------------------------------------

    set,/par/omni/beam/srch/power,mode

    { search rule for "auto" mode }

    mode:

        low     { will be used beam with "Low" power (only
                  for "auto" mode) };
        high    { will be used beam with "High" power
                  (only for "auto" mode) }.
-------------------------------------------------------------

    set,/par/omni/hpksp/pos,{position}

    { Known Start Position }

    position:

        {lat,lon,height,stdDevLat,stdDevLon,stdDevHeight}

    where:

        lat             Latitude [dm];
        lon             Longitude [dm];
        height          Ellipsoid Height [m];
        stdDevLat       Std Dev Latitude [cm];
        stdDevLon       Std Dev Longitude [cm];
        stdDevHeight    Std Dev Height [cm].

    format:
```

```
        lat             [N/S]DDdMM.MMMMMm
        lon             [E/W]DDDdMM.MMMMMm
        height          xxxx.xxx
        stdDevLat       xx
        stdDevLon       xx
        stdDevHeight    xx

    example:


set,omni/hpksp/pos,{S31d56.6766m,E115d50.5090m,10.24,10,10
,20}
-------------------------------------------------------------
```

```
    set,/par/omni/hpksp/clear,mode

    mode:

        n       {};
        y       {}.
-------------------------------------------------------------
```

```
    set,/par/omni/hpstatic,mode

    { HP Static Initialization }

    mode:

        off     {};
        on      {}.
-------------------------------------------------------------
```

```
    set,/par/omni/vbssd,mode

    { VBS Seeding }

    mode:

        off     {};
        on      {}.
-------------------------------------------------------------
```

```
    set,/par/omni/vbsdsd/mode,param

    { VBS Dynamic Seeding }

    param:

        off     {};
        on      {}.
-------------------------------------------------------------
```

```
    set,/par/omni/vbsdsd/time,sec
```

```
    { VBS Dynamic Seeding Timer }

    sec: time { second }.

    { min. value - 1 sec }
-------------------------------------------------------------

    set,/par/omni/debug/john,mode

    mode:

        off     {};
        on      {}.
-------------------------------------------------------------

    set,/par/omni/debug/emode,mode

    mode:

        hp      { HP Engine Mode };
        xp      { XP Engine Mode }.
-------------------------------------------------------------

    set,/par/omni/smooth,mode

    mode:

        off     {};
        on      {}.
-------------------------------------------------------------

     // clear NVRAM

    set,/par/omni/clear,mode

    mode:

        n       {};
        y       {}.

    // clear nvr

    set,/par/omni/clear/nvr,mode

    mode:

        n       {};
        y       {}.

    // clear HP subscription

    set,/par/omni/clear/hpsub,mode
```

```
    mode:

        n       {};
        y       {}.

    // clear VBS subscription

    set,/par/omni/clear/vbssub,mode

    mode:

        n       {};
        y       {}.
```

---

print,...

```
    print,/par/omni:on
-------------------------------------------------------------

    print,/par/omni/beam:on

    print,/par/omni/beam/param

    param:

        chan    { satellite name };
        cfnom   { nominal carrier frequency };
        srnom   { nominal symbol rate }.
-------------------------------------------------------------

    print,/par/omni/beam/serv:on

    print,/par/omni/beam/serv/param

    param:

        sid     { SID };
        scrv    { scrambler vector }.
-------------------------------------------------------------

    print,/par/omni/beam/srch:on

    print,/par/omni/beam/srch/param

    param:

        span    { search range };
        sid     { search rule for SID };
```

```
        power   { search rule for "auto" mode }.
-------------------------------------------------------------
```

```
    print,/par/omni/beam/cur:on

    print,/par/omni/beam/cur/param

    param:

        chan    { satellite name };
        cfnom   { nominal carrier frequency };
        cfact   { actual carrier frequency };
        srnom   { nominal symbol rate };
        sract   { actual symbol rate };
        sq      { signal quality };
        uw      {};
        sid     {};
        ber     { BER };
        rely    {};
        ebno    {}.
-------------------------------------------------------------
```

```
    print,/par/omni/hpstat:on

    print,/par/omni/hpstat/param

    param:

        mapmsg  { mapping msg };
        station { stations };
        vel     { velocity };
        time    { time };
        pos     { position };
        eph     { ephemeris };
        meas    { measurements };
        link    { link };
        wet     { wet };
        reg     { region };
        expr    { expiration };
        update  { need update };
        status  { status RTK float }.
-------------------------------------------------------------
```

```
    print,/par/omni/hpwarn:on

    print,/par/omni/hpwarn/param

    param:

        datupd  { datums updated };
        ellupd  { ellipsoids updated };
        glupd   { global beams updated };
        satupd  { satellites updated };
        stinit  { static init mode }.
```

```
-------------------------------------------------------------

    print,/par/omni/hpsub:on

    print,/par/omni/hpsub/param

    param:

        fugroid { Fugro ID };
        start   { starting time };
        exp     { expiration time };
        hour    { hour glass };
        mode    { mode };
        modus   { method of operation };
        gdate   { expiration gregorian date: Year-Month-
                  Day-hours-minutes-seconds,
                  e.g. 2004Y02M27D23h59m47s }.
-------------------------------------------------------------

    print,/par/omni/hpver:on
-------------------------------------------------------------

    print,/par/omni/hpbase:on

    print,/par/omni/hpbase/id
-------------------------------------------------------------

    print,/par/omni/hpksp:on

    print,/par/omni/hpksp/param

    param:

        pos     { Known Start Position };
        clear   { clear KSP }.
-------------------------------------------------------------

    print,/par/omni/hpstatic:on
-------------------------------------------------------------

    print,/par/omni/vbsstat:on

    print,/par/omni/vbsstat/param

    param:

        time    { time };
        pos     { position };
        alm     { almanac };
        rsit    { remote sites };
        link    { link };
        wet     { wet };
        reg     { region };
        expr    { expiration };
```

```
        update  {}.
-------------------------------------------------------------

    print,/par/omni/vbssub:on

    print,/par/omni/vbssub/param

    param:

        fugroid { Fugro ID };
        start   { starting time };
        exp     { expiration time };
        hour    { hour glass };
        gdate   { expiration gregorian date: Year-Month-
                  Day-hours-minutes-seconds,
                 e.g. 2004Y02M27D23h59m47s }.
-------------------------------------------------------------

    print,/par/omni/vbsver:on
-------------------------------------------------------------

    print,/par/omni/vbssd:on
-------------------------------------------------------------

    print,/par/omni/vbsdsd/mode:on
-------------------------------------------------------------

    print,/par/omni/vbsdsd/time:on
-------------------------------------------------------------

    print,/par/omni/debug/john:on
-------------------------------------------------------------

    print,/par/omni/debug/emode:on
-------------------------------------------------------------

    print,/par/omni/smooth:on
-------------------------------------------------------------

    print,/par/omni/clear:on

    print,/par/omni/clear/param

    param:

        nvr     { clear nvr };
        hpsub   { clear HP subscription };
        vbssub  { clear VBS subscription }.
-------------------------------------------------------------
```

```
************************************************************
```

Default parameters

```
************************************************************
```

Bulb parameters

```
    bulb/conf                   off
    bulb/mode                   omni
    bulb/dev/ser/a/rate         115200
    bulb/dev/ser/a/imode        cmd
    bulb/dev/ser/a/echo         /dev/null
    bulb/dev/ser/a/eoff         #BULB#
    bulb/dev/ser/b/rate         153600
    bulb/dev/ser/b/imode        jps
    bulb/dev/ser/b/echo         /dev/null
    bulb/dev/ser/b/eoff         #BULB#
    bulb/spectr/carrfrq         1551489000
    bulb/spectr/spanfrq         20000
    bulb/spectr/filfrq          100
    bulb/spectr/detnum          20
```

OmniStar parameters

```
    omni/beam/chan              auto
    omni/beam/cfnom             1551489000
    omni/beam/srnom             2438
    omni/beam/serv/sid          c685
    omni/beam/serv/scrv         5c08
    omni/beam/srch/span         10
    omni/beam/srch/sid          fugro
    omni/beam/srch/power        high
    omni/hpksp/pos
{N00d0.00000m,E000d0.00000m,0.000,00,00,00}
    omni/hpstatic               off
    omni/vbssd                  off
    omni/vbsdsd/mode            off
    omni/vbsdsd/time            1
    omni/smooth                 on
    omni/debug/john             off
    omni/debug/emode            hp
```

Appendix C

NMEA 0183 Message Options

The OmniSTAR 8400HP is factory configured with 2 NMEA 0183 sentences GGA and GST. The output rate is fixed at a 1 second interval. As an option faster output rates are available up to 20 times per second. There are more messages possible that are GPS receiver specific and not a NMEA 0183 standard.

Firmware version p1	Message Sentence	Description
	ALM	GPS Almanac Data
*	GGA	GPS Fix Data
	GLL	Geographic Position – Latitude/Longitude
	GRS	GPS Range Residuals
*	GSA	GPS DOP and Active Satellites
*	GST	GPS Pseudorange Noise Statistics
*	GSV	GPS Satellites in View
	RMC	Recommended Minimum Specific GPS Data
*	VTG	Track Made Good and Ground Speed
	ZDA	Time and Date

Table 5: NMEA 0183 messages available for the 8400HP

NMEA 0183 Message Formats

In this section each message is described in more detail.

ALM – GPS Almanac Data

The ALM message identifies the GPS week, SV health and contains the almanac for one satellite. One sentence per satellite, up to a maximum of 32.

$GPALM,1,1,03,698,00,6ae6,1d,779f,fdef,a10d68,6469a6,7c1f62,
5f5839,*43

Field Number	Description
1	Total number of ALM sentences for this cycle
2	Sentence sequence number
3	SV PRN number, 01 to 32
4	GPS week number
5	SV health status
6	Eccentricity
7	Almanac reference time
8	Inclination angle
9	Rate of right ascension
10	Root of semi-major axis
11	Argument of perigee
12	Longitude of ascension node
13	Mean anomaly
14	A f0, clock parameter
15	A f1, clock parameter

Table 6: Description of the ALM message.

GGA – GPS Fix Data

The GGA message includes time, position and fix related data for the GPS receiver.

$GPGGA,hhmmss.s,llll.llll,a,yyyyy.yyyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx

Field Number	Description
1	UTC of Position
2,3	Latitude, N (North) or S (South). *
4,5	Longitude, E(East) or W (West). *
6	GPS Quality Indicator: 0=No GPS, 1=GPS, 2=DGPS, 5=HP.
7	Number of Satellites in Use.
8	Horizontal Dilution of Precision (HDOP).
9,10	Height above Mean Sea level in Meters, M = Meters.
11,12	Geodial Separation in Meters, M = Meters. **
13	Age of Differential GPS Data. ***
14	Differential Reference Station ID (0000 – 1023)

Table 7: Description of the GGA message.

NOTES:
* The GGA message provides 4 decimal points of precision in non-differential mode, and 5 decimal points of accuracy in differential mode.

** Geodial Separation is the difference between the WGS-84 earth ellipsoid and mean-sea-level (MSL).

*** Time in seconds since the last RTCM SC-104 message type 1 or type 9 update.

GLL – Geographic Position – Latitude/Longitude

The GLL message contains the latitude and longitude of the present position, the time of the position fix and the status.

$GPGLL,llll.lll,a,yyyyy.yyy,a,hhmmss.s,A

Field Number	Description
1,2	Latitude, N (North) or S (South).
3,4	Longitude, E (East) or W (West).
5	UTC of Position.
6	Status: A = Valid, V = Invalid.

Table 8: Description of the GLL message.

GRS – GPS Range Residuals

The GRS sentence is used to support the Receiver Autonomous Integrity Monitoring (RAIM).

$GPGRS,220320.0,0,-0.8,-0.2,-0.1,-0.2,0.8,0.6,,,,,,,*55

Field Number	Description
1	UTC time of GGA position fix
2	Residuals 0: Residuals used to calculate position given in the matching GGA line 1: Residuals recomputed after the GGA position was computed
3 to 14	Range residuals for satellites used in the navigation solution, in meters

Table 9: Description of the GRS message.

NOTE:
* Because the contents of this NMEA message do not change significantly during a 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

** If running in HP mode this NMEA message is not valid.

GSA – GPS DOP and Active Satellites

The GSA message indicates the GPS receivers operating mode and lists the satellites used for navigation and the DOP values of the position solution.

$GPGSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x

Field Number	Description
1	Mode: M = Manual, A = Automatic.
2	Current Mode 1 = Fix not available, 2 = 2D fix, 3 = 3D fix.
3 to 14	PRN numbers of the satellites used in the position solution. *
15	Position Dilution of Precision (PDOP).
16	Horizontal Dilution of Precision (HDOP).
17	Vertical Dilution of Precision (VDOP)

Table 10: Description of the GSA message.

NOTE:
* When less than 12 satellites are used, the unused fields are null.

GST – GPS Pseudorange Noise Statistics

The GST sentence is used to support Receiver Autonomous Integrity Monitoring (RAIM).

$GPGST,220320.0,1.3,0.8,0.5,166.1,0.8,0.5,1.6,*4F

Field Number	Description
1	UTC time of GGA fix
2	RMS value of the standard deviation of the range inputs to the navigation process (range inputs include pseudo ranges and DGPS corrections)
3	Standard deviation of semi-major axis of error ellipse, in meters
4	Standard deviation of semi-minor axis of error ellipse, in meters
5	Orientation of semi-major axis of error ellipse, in degrees from true north
6	Standard deviation of latitude error, in meters
7	Standard deviation of longitude error, in meters
8	Standard deviation of altitude error, in meters

Table 11: Description of the GST message.

NOTE:
* Because the contents of this NMEA message do not change significantly during a 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

GSV – GPS Satellites in View

The GSV sentence identifies the number of satellites in view, the PRN numbers, elevation, azimuth and SNR values.

$GPGSV,4,1,13,02,02,213,,03,-3,000,,11,00,121,,14,13,172,05*67

Field Number	Description
1	Total number of sentences of this type in this cycle
2	Sentence number
3	Total number of satellites visible
4	SV PRN number
5	Elevation in degrees, 90 ½ maximum
6	Azimuth, degrees from true north, 000 ½ to 359 ½
7	SNR, 00-99 dB (null when not tracking)
8-11	Information about second SV, same format as fields 4-7
12-15	Information about third SV, same format as fields 4-7
16-19	Information about fourth SV, same format as fields 4-7

Table 12: Description of the GSV message.

NOTE:
* Because the contents of this NMEA message do not change significantly during a 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

RMC – Recommended Minimum Specific GPS Data

The RMC sentence identifies the UTC time, status, latitude, longitude, speed over ground (SOG), date and magnetic variation of the position fix.

$GPRMC,184804.00,A,3723.476543,N12202.239745,W,000.0,0.0,051196,15.6,E*7C

Field Number	Description
1	Time: UTC time of the position fix in hhmmss.ss format
2	Status A: Valid V: Navigation Receiver Warning (V is output whenever the receiver suspects something is wrong)
3	Latitude coordinate
4	Latitude direction: N = North, S = South
5	Longitude coordinate
6	Longitude direction: W = West, E = East
7	Speed Over Ground (SOG) in knots (0-3 decimal places)
8	Track Made Good, True, in degrees
9	Date in dd/mm/yy format
10	Magnetic Variation in degrees
11	Direction of magnetic variation E: Easterly variation from True course (subtracts from True course) W: Westerly variation from True course (adds to True course)
12	Mode Indication A: Autonomous D: Differential N: Data not valid

Table 13: Description of the RMC message.

VTG – Course Over Ground and Ground Speed

The VTG sentence identifies the actual track made good and speed over ground.

$GPVTG,0,T,,,0.00,N,0.00,K*33

Field Number	Description
1	Track made good
2	Fixed text 'T' shows that track made good is relative to true north
3	Not used
4	Not used
5	Speed over ground in knots (0-3 decimal places)
6	Fixed text 'N' shows that speed over ground is in knots
7	Speed over ground in kilometres/hour (0-3 decimal places)
8	Fixed text 'K' shows that speed over ground is in kilometres/hour

Table 14: Description of the VTG message.

NOTE:
* Because the contents of this NMEA message do not change significantly during a 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

ZDA – Time and Date

The ZDA message contains UTC, the day, the month and the year of the local time zone.

$GPZDA,hhmmss.s,xx,xx,xxxx,xx,xx

Field Number	Description
1	UTC.
2	Day (0 – 31).
3	Month (0 – 12).
4	Year.
5	Local Zone Description Hours (± 13 Hours). *
6	Local Zone Description Minutes.

Table 15: Description of the ZDA message.

NOTES:
* Local zone description is the number of whole hours added to local time to obtain UTC. The zone description is always negative for eastern longitudes. Fields 5 and 6 are Null fields in the "Trimble BD132". A GPS receiver cannot independently identify the local time zone offsets.
* Because the contents of this NMEA message do not change significantly during a 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

Appendix D

Acronyms used in this manual

1PPS	One Pulse Per Second
2D	Two Dimensional
3D	Three Dimensional
ASCII	American Standard Code for Information Interchange
BPS	Bits per Second
CEMF	Counter Electro-magnetic Force
DGPS	Differential Global Positioning System
GGA	Global Positioning System fixed data (NMEA standard)
GLL	Geographic position (NMEA standard)
GPS	Global Positioning System
GSA	Global Positioning System, dilution of position, active satellite (NMEA standard)
GSV	GPS satellites in view (NMEA standard)
HP	High Performance
LED	Light Emitting Diode
LNA	Low Noise Amplifier
NCC	Network Control Centre
NMEA	National Marine Electronics Association (Standard for interfacing marine electronic devices)
RF	Radio Frequency
RTCM	Radio Technical Commission Maritime
VTG	'Track mode good' and 'ground speed' (NMEA standard)
ZDA	Time and date (NMEA standard)

Appendix E

List of communication satellites

The following table presents a list of L-band communication satellites, which will enable you to use your 8400HP over the entire world (depending on your subscription type you might only be entitled to a restricted area).

Table 16: World-wide satellite frequencies and baud rates

Satellite Channel	Frequency (MHz)	Baud Rate	Latitude	Longitude
EA-SAT	1535.1525	1200	0° 0' 0.00"	25° 0' 0.00"
AF-SAT	1535.0800	1200	0° 0' 0.00"	25° 0' 0.00"
AP-SAT	1535.1375	1200	0° 0' 0.00"	109°30' 0.00"
AM-SAT	1535.1375	1200	0° 0' 0.00"	-98° 0' 0.00"
OPTUS	1558.5100	1200	-20° 0' 0.00"	145° 0' 0.00"
MSV-West	1536.7820	1200	45° 0' 0.00"	-120° 0' 0.00"
MSV-Central	1534.7410	1200	45° 0' 0.00"	-95° 0' 0.00"
MSV-East	1530.3590	1200	45° 0' 0.00"	-80° 0' 0.00"

Figure 32: Reference stations and coverage area for EA-SAT and AF-SAT.

Figure 33: Reference Stations and coverage area for AM-SAT and AP-SAT.

Figure 34: Reference stations and coverage area for OPTUS and MSV-ECW.

APPENDIX F

List of reference stations

The following tables present the current list of reference stations, which are broadcast over the different satellites. Check www.surveyplanner.com for the latest updates of these lists.

Table 17: Reference stations on EA-SAT

Nr	Station	ID	VBS	HP
1	Abu Dhabi, UAE	016	YES	YES
2	Kuwait	290	YES	YES
3	Bahrain	260	YES	NO
4	Aberdeen, Scotland	571	YES	YES
5	Alexandria, Egypt	310	YES	NO
7	Baku, Azerbaijan	400	YES	NO
8	Bodo, Norway	122	YES	NO
9	Crete, Greece	340	YES	NO
10	Faro, Portugal	371	YES	YES
11	Istanbul, Turkey	410	YES	NO
12	Leidschendam, The Netherlands	521	YES	YES
13	Malta	351	YES	NO
14	Ny Alesund, Spitsbergen	101	YES	NO
15	Orlandet, Norway	630	YES	YES
16	Rogaland, Norway	580	YES	YES
17	Shannon, Ireland	530	YES	NO
18	Torshavn, Faroes	620	YES	NO
19	Toulouse, France	431	YES	NO
20	Tromso, Norway	690	YES	NO
21	Vardo, Norway	114	YES	NO
22	Visby, Sweden	229	YES	NO
23	Vienna, Austria	480	YES	NO
24	Kharkiv, Ukraine	500	YES	NO

Table 18: Reference stations on AF-SAT

Nr	Station	ID	VBS	HP
1	Abidjan, Ivory Coast	050	YES	NO
2	Blantyre, Malawi	155	YES	NO
3	Cape Town, South Africa	335	YES	NO
4	Dakar, Senegal	144	YES	NO
5	Douala, Cameroon	043	YES	YES
6	Durban, South Africa	305	YES	NO
7	Faro, Portugal	371	YES	NO
8	Lagos, Nigeria	060	YES	NO
9	Las Palmas, Canaries	280	YES	NO
10	Luanda, Angola	095	YES	YES
11	Nairobi, Kenya	015	YES	NO
13	Pointe-Noire, Congo	045	YES	YES
14	Port Elizabeth, South Africa	337	YES	NO
15	Rogaland, Norway	580	YES	YES
16	Sao Tome, Sao Tome	011	YES	YES
17	Walvis Bay, Namibia	235	YES	NO

Table 19: Reference stations on AP-Sat

Nr	Station	ID	VBS	HP
1	Auckland, NZ	022	YES	NO
2	Karratha, Australia	215	YES	NO
3	Darwin, Australia	125	YES	NO
4	Broome, Australia	185	YES	NO
9	Asahikawa, Japan	261	YES	NO
10	Singapore	010	YES	YES
11	Miri, Malaysia	042	YES	YES
12	Vung Tua, Vietnam	012	YES	YES
13	Hong Kong	220	YES	NO
14	Seoul, S. Korea	370	YES	NO
15	Kota Kinabalu, Malaysia	061	YES	NO

16	Bali, Indonesia	096	YES	YES
17	Mumbai-Arvi, India	191	YES	YES
19	Subic Bay, Phillipines	151	YES	NO
20	Kuwait	290	YES	NO
21	Abu Dhabi, UAE	016	YES	NO
23	Kuantan, Malaysia	041	YES	NO
25	Bangkok, Thailand	141	YES	YES
26	Chennai, India	131	YES	NO
27	Bathurst, Australia	336	YES	NO
28	Kalgoorlie, Australia	315	YES	NO
31	Melbourne, Australia	385	YES	NO
32	Okinawa, Japan	261	YES	NO
33	Platong, Thailand	018	YES	NO
34	Sakhalin, Russia	510	YES	NO
35	Bahrain, Bahrain	260	YES	NO

Table 20: Reference stations on AM-Sat

Nr	Station	ID	VBS	HP
1	Houston, Texas	100	YES	YES
2	Cocoa Beach, Florida	120	YES	YES
3	Long Island, New York	333	YES	YES
4	Carmen, Mexico	110	YES	YES
5	Punta Arenas, Chile	210	YES	NO
6	Guayaquil, Ecuador	202	YES	NO
7	Rio de Janeiro, Brazil	225	YES	YES
8	St. Johns, Newfoundland	470	YES	YES
9	Dartmouth, Nova Scotia	440	YES	NO
10	Recife, Brazil	075	YES	NO
11	Port Of Spain, Trinidad	111	YES	YES
12	Caracas, Venezuela	112	YES	YES
13	Belem, Brazil	017	YES	NO
14	Caymen, Grand Cayman	192	YES	YES

15	Honolulu, USA	210	YES	NO
16	Curtiba, Brazil	257	YES	YES
17	Pensacola, USA	301	YES	YES
18	Vitoria, Brazil	205	YES	YES
19	Mercedes, USA	263	YES	YES
20	Buenos Aires, Argentina	345	YES	NO

APPENDIX G

Receiver Service Procedure

If an OmniSTAR receiver unit fails to perform, please contact the OmniSTAR office within your region, after following the procedural checks. We wish to hear about frequently experienced problems and your assistance will help by copying the form on the next page, filling in the details requested and faxing or mailing the form to the OmniSTAR office.

The most common problems are interfacing, and usually occur at installation time. If you have an interfacing connection not covered in this manual we would like to assist you and produce another technical bulletin that may assist other users in the future.

If a problem appears that you think may be caused by a system performance problem, please contact the OmniSTAR office in your region for any system aberrations that may have been experienced.

We are sensitive to our customers' needs and we want to assure specified system performance at all times. There could, however, be situations where conditions are below par, such as fringe area operations, radio communication disturbance etc., and, as the OmniSTAR receiver monitors the system performance continuously, these conditions would be noted.

APPENDIX H

OmniSTAR Receiver Problem Report Form

Please copy this form and report problem with as much detail as possible.

Problem with: **Signal Y/N** **Manual Y/N** **OmniSTAR Y/N** **Receiver Y/N**	**Date:**
Description of problem:	
Person Reporting:	**Contact Phone #:**
Model #:	**Serial #:**
Customer Name:	**Customer Address:**
Customer Phone #:	
Date purchased: / /	**Dealer:**
GPS Receiver used:	**Serial #:**
Area of operations:	
Symptoms from display (if any):	

User Notes