OmniSTAR 5120VBS

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 office.

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OmniSTAR.
The Global Positioning System

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 1.0	August 2007	Final version
Issue 1.1	September 2007	Improved commands, typos removed
Issue 1.2	November 2007	Added ground plate drawing
Issue 1.3	June 2008	Added USB driver
Issue 1.4	July 2008	Beam change

Manual Reference: OmniSTAR 5120VBS 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 5120VBS DGPS Receiver.

System Features

The OmniSTAR 5120VBS DGPS Receiver is part of the OmniSTAR worldwide DGPS Service. The OmniSTAR 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 an RF carrier that is then up-converted for transmission 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 5120VBS receivers support the following OmniSTAR® service:

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

Receiver Features

The OmniSTAR 5120VBS receiver has the following features:

- 12 parallel GPS code/carrier tracking channels (L1 C/A-code and carrier). When using Omnistar L-band 11 channels GPS.
- LCD top panel display
- Receiver configuration using the front panel
- Sub meter differential accuracy (RMS), assuming at least five satellites and a PDOP (Position Dilution of Precision) of less than four (OmniSTAR VBS)
- Low power consumption (<3 Watt)
- 1, 5, 10, 20[1] Hz position output data (user selectable)
- A rugged, environmentally-sealed enclosure
- Two RS232 data ports with DB9 connectors, supporting the following protocols:
  - RS-232:
    NMEA-0183 output,
  - RTCM SC-104 input and output,
  - ASCII input, proprietary binary input (if enabled)
  - 1 PPS (Pulse per second) strobe signal to enable an external instrument to synchronize its internal time with a time derived from the very accurate GPS system time.
- GPS antenna connector
- USB 2.0 type B connector to connect with a computer

Housing

The 5120VBS is housed in an enclosure to provide a complete receiver solution. When connected to an antenna and a power source, the 5120VBS is a fully functioning GPS/DGPS receiver.

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

[1]20 Hz is optional

Accessories

The following accessories are included with the 5120VBS:

- 1 power cable
- 1 RS232 data cable
- 1 USB cable
- 1 antenna cable (5 meters)
- A CD containing PC utilities and product documentation

Figure 1: 5120VBS Back End

Name	Description
PORT A	RS-232 signals, 1PPS and auxiliary strobe signal
PORT B	RS-232 signals
Antenna	Antenna connection 50 ohm
USB	USB type B connector
ON/OFF	On/off power switch
POWER	DC power input
GROUND	An extra ground terminal for grounding your receiver

Table 1: 5120VBS Interfaces

The preferred antenna for the 5120VBS receiver is the A20 antenna.

Figure 2: A20 antenna

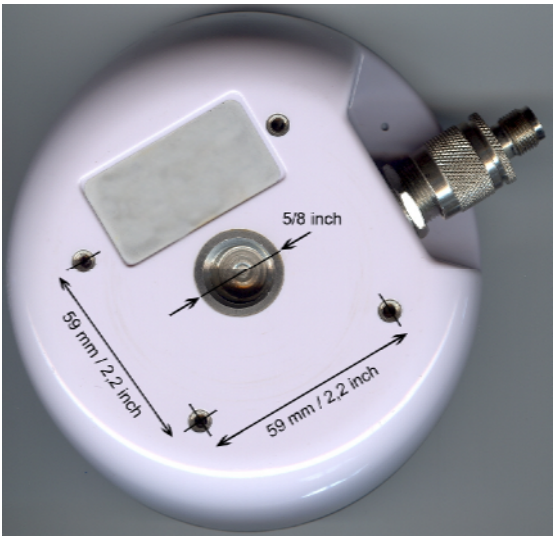


Figure 3: bottom side A20 antenna and mounting holes

Installation and Set Up

Installation Considerations

Before commencing installation of the OmniSTAR 5120VBS in a vehicle or aircraft, the following should be considered:

- Determine the preferred location for each 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 application 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 4.

Figure 4: 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 cables 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 cabling, form loops not less than 150 mm minimum cable bend radius.
- Cable routing must avoid high temperature exposure (e.g. exhaust manifold).

Features and Information

This section contains information on the features of the 5120VBS receiver.

Strobes

On the 5120VBS, a set of outputs that provide status and synchronisation signals are given. These signals are called strobes. Access to the 5120VBS strobe signals can be obtained through data port A.

The strobe available on the 5120VBS is the One Pulse Per Second (1 PPS) signal. The output is 3.3 Volts and duration is 1 microsecond.
The rising edge of this signal is synchronised with GPS time.

Event marker input creates the possibility to generate a marker with for instance a camera, that shows up in the data stream. The marker is active low, falling edge sync, 10 k-ohm, 10 pF load

Receiver status

The 5120VBS is equipped with an LCD display showing the status of the receiver. Using the display and the buttons around the display, the receiver can be configured without the need to connect a computer. The functions of the LCD display and the configuration menus are described further on in this manual.

Mounting the receiver

The 5120VBS casing is equipped with two mounting brackets to facilitate mounting the receiver to a surface. This section provides information on how to mount the receiver.

Note: The receiver casing was not designed for mounting in high-dynamics or high-vibration environments.

To mount the 5120VBS receiver:

1. Use the slots on the side of the receiver to place the mounting brackets.
2. Mark where the holes need to be and then drill holes in the mounting surface.
3. Use screws to secure the casing to the mounting surface. When using machine screws, tap the mounting holes to fasten the receiver to the mounting surface. Alternatively, self-tapping screws can be used.
4. Make sure ***not*** to mount the receiver in a location where it can easily be damaged during normal operation. Try to protect the receiver against harsh environmental conditions.

When choosing a mounting location, please ensure the menu screen, LEDs and buttons are visible and accessible. Also make sure it is possible to access the back panel, in order to switch cables or operate the power button. There is an option within the menu system to switch the direction of the display, so if it is easier for you to mount the unit upside down, you may do so and still operate the display easily.

Antenna Location

Antenna positioning is critical to system performance.

The following conditions must be met for optimum system performance:

1. Antenna must be mounted at least 1.5 metres away from transmitting antennas of any frequency. Closer positioning may cause overloading of receiver RF circuits.
2. 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.
3. The antenna must be located along the vehicle centre-line, or at a relevant reference point on the vehicle.
4. The antenna should not be mounted in a location where it can easily be damaged during normal operation.

Power Supply Requirements

The 5120VBS can be powered by a vehicle or by a customer-supplied power source of 8-36 VDC, capable of delivering at least 5W continuous output power. For continued protection against the risk of fire, the power lead to the 5120VBS receiver should be provided with a 10 Ampere (maximum) fuse.

Warning: Before powering the receiver, make sure the antenna cable and antenna are connected and the power and data cable is connected and secured. Connecting or disconnecting an antenna or antenna cable when the receiver is already powered may permanently damage the receiver's antenna port or the antenna itself, voiding your warranty. Connecting or disconnecting the power/data cable to/from the receiver when the cable is already powered may result in increased wear or an early failure of the power/data connector.

Warning: 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 5120VBS has proven to be 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
- OmniSTAR corrections

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 systems' accuracy. As the GPS satellites orbit the earth the number of visible satellites will change in time. The GPS constellation has been designed 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.

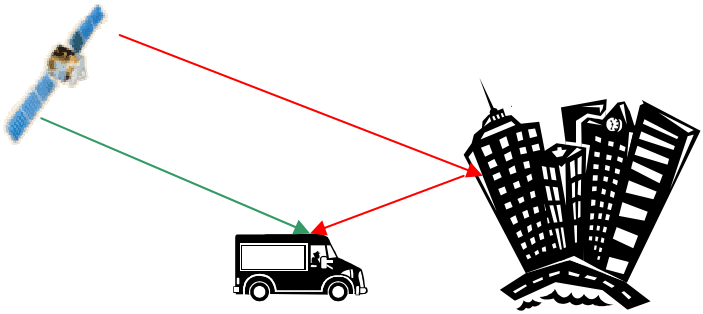


Figure 5: Multipath

Position Dilution of Precision (PDOP)

The Position Dilution of Precision (PDOP) is a measure of the satellite geometry. The closer to 1 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 lower signal strength and a delayed reception, thereby causing erroneous and noisy data. By default the 5120VBS is configured to ignore any GPS satellites that have an elevation angle lower than 5°.

OmniSTAR 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. To find out which OmniSTAR satellite(s) can be received at your geographic position, please visit the survey planner website (http://www.surveyplanner.com).

Interference

Although the 5120VBS has been designed to provide optimal system performance under most circumstances, due to the nature of radio communications it is possible, that the system performance degrades as a result of local interference sources. When interference levels are too high, the 5120VBS may even lose lock to either the OmniSTAR satellite or the GPS satellites.

Interference sources include radio and television transmitters, radars, microwave ovens, poorly shielded spark plugs and aeronautical radio navigation systems, in short: any device producing electromagnetic energy (directly or through harmonic frequencies) in the 1525 - 1580 MHz band.

Operation

Before operating the receiver for the first time, ensure that you follow the following installation instructions.

1. Mount the 5120VBS receiver in a suitable place (see also page 10).
2. Mount the OmniSTAR A20 antenna in a suitable place (see also page 11).
3. Connect the antenna cable to the antenna and the receiver, making sure the connector is connected to the antenna, making sure both connectors are secured well. Secure the antenna cable using tie wraps.
4. Connect the data and the power cable to port A of the 5120VBS receiver. If desired, also connect the data connector (9 pin sub D connector).
5. Connect the power leads to a suitable (8-36 V DC) power supply.
6. Push the power button once to power up the receiver.

Getting Started

The purpose of this section is to get you started with the 5120VBS as quickly as possible.

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 getting up and running will be a case of connecting the appropriate cables and applying power to the system.

Note: The first start-up can take from 15 to 60 minutes depending on your location. Subsequent start-ups will output a valid position within 1 to 5 minutes depending on your location and time since the last start-up.

Note: The receiver can take up to 60 minutes for a full network map to be received from OmniSTAR satellites. Optimum accuracy will be obtained once the unit is processing corrected positions using complete network information.

The 5120VBS uses three LEDs. The LED functions are defined as:

- Power Indicator LED: red.
  This LED will illuminate when the 5120VBS is powered.

- GPS Lock Indicator LED: yellow.
  This LED will remain illuminated once the receiver has solid GPS lock.

- DGPS Position Indicator LED: solid green.

This LED will illuminate solid green when the receiver has achieved a differential position and a pseudo range residual of better than 10.0 meters (default value, can be changed). If the residual value isworse than the current threshold, the green LED will blink indicating that differential mode has been attain ed, but that the residual has not met the threshold.

Communicating with the Receiver

Communicating with the receiver is possible using the receiver's front panel and LCD screen, a terminal program on a Microsoft Windows-based computer or Viewall on a PDA.
Because the 5120VBS's display is small, the receiver uses a number of menus and submenus to access all of the receiver's possible information and configuration screens.

The 5120VBS features two serial ports. The ports handle communication to and from the GPS Receiver. The ports may be configured for a mixture of NMEA 0183, binary data and RTCM SC-104 data.

Configuring the receiver via direct commands will be discussed on page 26

Starting the Receiver

Supply power to the receiver and press the power button to start the receiver.

Navigating the Receiver menu's

The menu structure of the 5120VBS consists of 3 top-level menu screens. Each top-level menu screen links to one or more sub-menu screens. Each sub-menu screen links sequentially to a number of information/configuration screens. Cycling through the top-menu screens is done by pressing the  or  button repeatedly. The order of the top level menu is GPS – L-Band – Config wizard – system setup.

Pressing the  button from one of the top-level menu screens will enter the corresponding sub-menu. Cycling through the sub-menu screens of a certain sub-menu is again done by pressing the  or  button repeatedly. To return to the top-level menu screen, select the 'Top menu' and press the  button.

To go back one menu, select the 'back' option and press the  button.

The information/configuration screens under a certain sub-menu can be accessed by pressing the  button. To cycle through the screens, use the  and  buttons. In some screens, information can be edited. These screens show a small arrow  next to the editable item. To enter edit mode, press  until the arrow changed to 2 smaller, up- and down-arrows 

To change the setting from the selected menu, press the  or  buttons until you reach the desired value.

When finished and leaving edit mode, press  . Other screens can show more information than fits the screen. These screens can be reached by pressing the  button.

It is encouraged to try out the different menus of the receiver so you will get familiar with it's user interface.

Note: The changes you make to the receiver via the serial port will not be saved to the memory for subsequent power-up unless a save command is issued ($JSAVE). If changes are made via the menu system, they will automatically be saved.

Top menu: home

The home screen is the receiver's default screen after a successful receiver power up.

Figure 6: the receiver main screen

In the main screen there are a couple of items that.

In the top-left of the screen are up to 11 bars, these represent the GPS satellites signal strength. Next to the GPS signal strength indicators, there is one stand-alone bar in the centre that shows the signal strength of the Omnistar satellite.

The top-right of the screen shows the time. By default this is the UTC or GPS time. This can be changed to the local time in the menu by selecting the UTC offset time accordingly.

The four main menu items are also visible: GPS, L-Band, Config wizard and System set-up.

The menu system on the 5120VBS is designed for easy setup and configuration of the unit in the field or in the office. the receiver can be configured almost entirely using the menu system without having to connect to a computer or PDA.

The menu software supports many different languages (French, Spanish) so that you can easily understand the configuration of the receiver. If at any time you need to return the menu system to the factory default configuration, simply hold down the enter key on power-on until the splash screen disappears.

This section of the manual will describe the 5120VBS's menu structure and screens.

Main Menu

The main sections of the main menu are listed below.

GPS
- **POSITION STATUS**
- **SATELLITES**
- **CONFIGURE**

L-BAND
- **SIGNAL STATUS**
- **CONFIGURE**
- **SUBSCIPTION**
- **DIFF: L-BAND**

CONFIG WIZARD
- **PROCEED WIZARD**
- **SAVE CURRENT**
- **DELETED SAVED**
- **USE PREVIOUS**
- **CANCEL**

SYSTEM SETUP
- **DISPLAY APPS**
- **DISPLAY FORMAT**
- **BAUD RATES**
- **DISPLAY LOGS**
- **SOFTWARE DISPLAY**

The sub sections of the sub menus are listed below.

GPS

Position status

	Displays current position
Lt	Latitude in DD MM.MMMMMM
Ln	Longitude in DD MM.MMMMMM
Hgt	Height in meters
Hdg	Heading in degrees
Vel	Velocity in Km/Hour
Age	Age of correction data in seconds
Sv count	Number of GPS Satellites used
Hdop	Horizontal Dilution of Precision

Precision

	Displays current precision
Res Rms	Residual Root Mean Square range
Sigma-a	Semi- Major Axis of accuracy
Sigma-b	Semi- Minor Axis of accuracy
Azimuth	Direction of lowest accuracy
Sigma-Lat	Standard deviation of Latitude
Sigma-Lon	Standard deviation of Longitude
Sigma-Alt	Standard deviation of Height

Navcnd

	GPS satellite info
Car Smooth	Carrier smoothing filter
Eph Exists	Satellite ephemeris are downloaded
Eph Healthy	Is the Satellite Ephemeris good.
NotUsed Prev	Satellites not used in calculation
Above Ele	Number of Satellites higher than min. elevation with healthy ephemeris
Diff corr	Number of Satellites with Lband correction data
No Diff Corr	Number of Satellites without L-band correction data

Dsp-arm

	Can be yes or no
DSP:CarLock	Carrier phase lock on Satellite
DSP:BER	Bit error rate
DSP:DSPLock	Is there a lock on the satellite?
DSP: FrmSync	Is the framing message decoded?
DSP: TrkMode	Tracking Mode

ARM: GPSLock	Lock to the GPS satellite?
ARM: DiffData	Is there differential correction data?
ARM: ARMLock	Is there lock to the Omnistar satellite?
ARM:DGPS	Is the solution differential?
ARM: Solutn	Is a position solution calculated?

SATELLITES

	Shows information about all visible GPS satellites
Chxx svxx elxxx	Show Channel, Satellite NR. (PRN)
Azxxx snr xx	Elevation and Azimuth and Signal-to noise ratio

Repeats for all visible satellites

CONFIGURE

Elev Mask	Set minimal Elevation Mask, see page 31 (Default 5 Degrees)
MaskDGPSAge	Set Maximum allowed correction. age. Default=250 Seconds
Data PORT A	set NMEA messages for port A
Data PORT B	set NMEA messages for port B
UTC Offset	Hours to Local time

L-BAND

Signal Status

	Status and location of the correction satellite form current position
Freq: 15xx.xxxx	Frequency of used correction satellite
SPS: 1200	Data rate of used correction satellite
BER: 500.... 0	Bit error rate of used satellite (500 is no lock, 0 is perfect reception)
In : xx.x°	Longitude of Omnistar Satellite on equator.
Elev: xx.x°	Elevation above horizon in degrees
AZ : xx.x°	Azimuth of correction satellite

Configure

	Configure the correction satellite
Mode : Auto	Frequency selection mode
Freq : 15xx.xxxx	Frequency of the current satellite

.

└t xx° └n xx°	latitude and longitude in degrees

Subscription

	Displays information about your subscription
Begin : 01/06/1980	Start date of the subscription
End : 12/31/2012	End date of the subscription
Optns : DRY	can be WET or DRY
Type : VBS	can be VBS or single point
LIB : VBS 2.06	VBS engine firmware version 2.06
Src : ALL	Use any DGPS source
Enter code >	upgrade codes can be entered here

Diff > L-Band

	Chosen differential source is L-Band (OmniSTAR)
autonomous	E-Diff
sbas	WAAS / EGNOS
External RTCM	External RTCM input
L-Band	Omnistar

CONFIG WIZARD

PROCEED WIZARD

You can use the wizard to setup different outputs and differential sources for your receiver

Create new

Enter Name XXX	name
Diff	Differential source
Data PORT A	output of port A
Data PORT B	output of port B
Elev Mask	Elevation mask GPS
MaxDGPSAge	Age limit for correction data
PORT A	baud rate port A
PORT B	baud rate port B

Save to Location There are 5 places to store a configuration

Save to Location
Not used1
Not used2
Not used3
Not used4
Not used5

SAVE CURRENT

Saves current configuration in memory

Enter Name

Save to Location
Not used1
Not used2
Not used3
Not used4
Not used5

DELETE SAVED

Remove unwanted configurations from stored memory

Not Used 1
Not Used 2
Not Used 3
Not Used 4
Not Used 5

USE PREVIOUS

Load a configuration from stored memory

Not Used 1
Not Used 2
Not Used 3
Not Used 4
Not Used 5

CANCEL

return to previous menu

SYSTEM SETUP

DISPLAY APPS

Applications currently on the 5120VBS

In-Use : L-Band	Currently selected application
Other : WAAS	second selectable application
SwapApplications	exchanges applications

DISPLAY FORMAT

Display update> 1 Hz	update rate of the receiver display
LL Unit > DM.M	GGA and GLL output; can be DMS, D.D OR DM.M
Hgt Unit > meters	Height an be feet or meters
Vel Unit > km/h	Can be MPH, km/h or knots

BAUD RATES

sets the baudrate of port A and port B

Port A > 9600	available rates in Table 2: baudrates
Port B > 9600	available rates in Table 2: baudrates

DISPLAY LOGS

Can be YES or NO, if YES then selectable in output.

Gga	Position latitude, longitude standard used.
Gll	Old position format.
Gsa	Satellites available
Gst	GPS position statistics
Gsv	GPS satellite vehicles tracked
Hdt	Heading information

Hpr	Proprietary message containing heading and roll or pitch (not useable for 5120VBS)
Rmc	Recommend minimum Configuration
Rot	RTC-derived GPS rate of turn (not useable for 5120VBS)
Rre	GPS Range Residuals
Vtg	Velocity and Course info
Zda	Timing information
Bin1	Binary GPS position message
Bin2	Binary message containing GPS DOP's
Bin80	Binary message containing SBAS information
Bin93	
Bin94	
Bin95	Binary message containing ephemeris info.
Bin96	Binary message containing code and carrier phase information
Bin97	Binary message containing process statistics
Bin98	Binary message containing satellite and almanac information
Bin99	Binary message containing GPS diagnostic information
RTCM	RTCM output
RD1	Lband diagnostic information, also see page 37
PCSI,1	Proprietary message

SOFTWARE DISPLAY

Menu System > 1.17	Menu version 1.17
ReceiverApp > 4.8K	Firmware version 4.8
S/n > 880XXX	OmniSTAR serialnumber
Sbx	Not used
Receiver	GPS Receiver firmware

CONTRAST

According to your local circumstances, you can alter the contrast of the display

ANIMATION > off

Either on or off, menu screens will slide instead of jump

SUBSCRIPTION

You can enter an upgrade code here

FLIP DISPLAY > NO

When changed to YES, it flips the display 180°. for reverse mounting

LANGUAGE

English, Spanish or French.

Terminal commands

Using the display and control buttons, setting the operating mode of the receiver is easy. For the more advanced user, there are also commands available to set the receiver with a terminal program.

These commands and their meaning are explained in this section.

Easylog

Although you can communicate with any terminal program, in this manual the program easylog is used.
You can freely obtain a version of easylog by the OmniSTAR website.

(http://www.omnistar.nl/site/293/default.aspx)

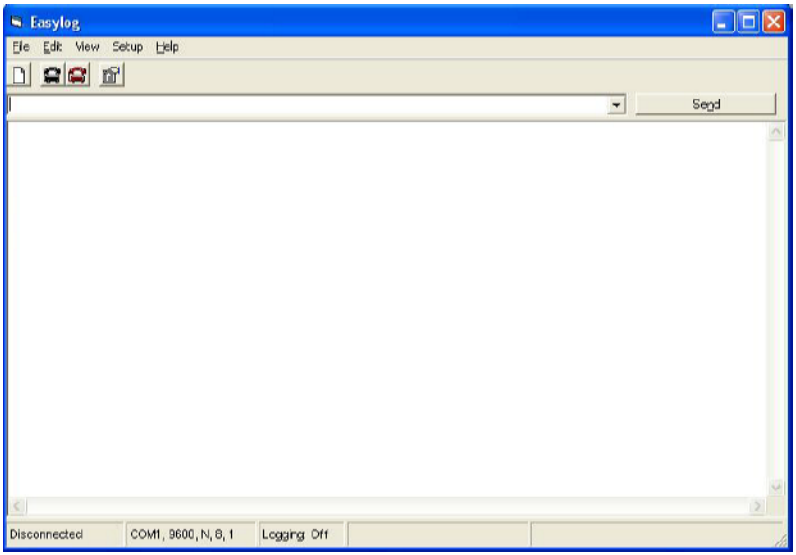


Figure 7 : A blank easylog window

Basic commands

The following commands can be used to request the settings of the receiver. The receiver reply is also explained.

Note: Please ensure that you save any changes that you wish to maintain beyond the current power-up by using the $JSAVE (page 34) command.

$JI

This command displays receiver information. It has the following format:

$JI<CR><LF>

This command queries receiver boards information and displays it.

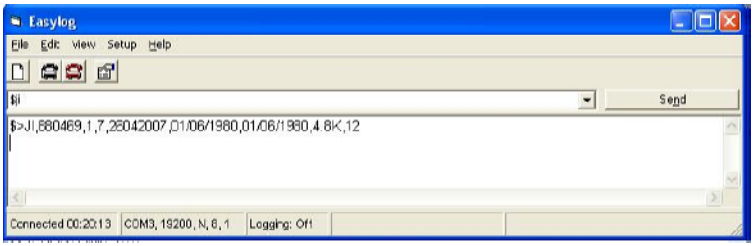


Figure 8 : $JI reply

The receiver will reply with the following message:

$>JI,880469,1,7,26042007,01/06/1980,01/06/1980,4.8K,12

Table 1 $JI

Message component	description
880469	This field provides the serial number of the GPS engine
1	This field is the fleet number
7	This is the hardware version
26042007	This field is the production date code
01/06/1980	This field is the subscription begin date
01/06/1980	This field is the subscription expiration date
4.8K	This field is the ARM version
12	This field is the DSP version

$JSHOW

This command is used to poll the receiver for the current operating configuration.

This command has the following structure:

$JSHOW[,SUBSET] <CR><LF>

Using the $JSHOW command without the optional ‘,subset’ field will provide a complete response from the receiver. An example of this response follows:

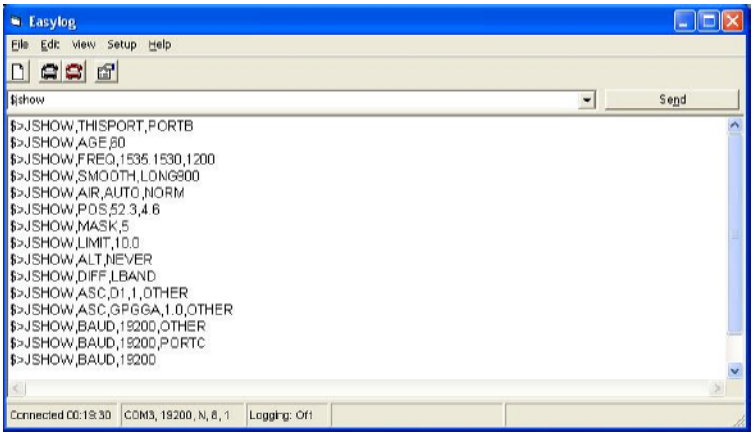


Figure 9 : $JSHOW response

$>JSHOW,THISPORT,PORTB (1)
$>JSHOW,AGE,60 (2)
$>JSHOW,FREQ,1535.1530,1200 (3)
$>JSHOW,SMOOTH,LONG900 (4)
$>JSHOW,AIR,AUTO,NORM (5)
$>JSHOW,POS,52.3,4.6 (6)
$>JSHOW,MASK,5 (7)
$>JSHOW,LIMIT,10.0 (8)
$>JSHOW,ALT,NEVER (9)
$>JSHOW,DIFF,LBAND (10)
$>JSHOW,ASC,D1,1,OTHER (11)
$>JSHOW,ASC,GPGGA,1.0,OTHER (12)
$>JSHOW,BAUD,19200,OTHER (13)
$>JSHOW,BAUD,19200,PORTC (14)
$>JSHOW,ASC,GPGGA,1.0 (15)
$>JSHOW,BAUD,19200 (16)

This example response is summarized in the following table:

Table 2:$JSHOW

1 Indicates that the current port is port B of the receiver.
2 Indicates the current maximum acceptable differential age in seconds.
3 Indicates the current frequency of the L-band receiver.
4 Indicates the carrier smoothing interval is long; 900 seconds
5 Indicates the current status of the AIR mode
6 Indicates the current seed position used for start-up, in decimal degrees.
7 Indicates the current elevation mask cut-off angle, in degrees.
8 Indicates that the current limit value is 10.0 meter.
9 Indicates the status of the altitude-aiding feature.
10 Indicates that the current differential mode is LBAND
11 Indicates that D1 is output at a rate of 1 Hz from the other port.
12 Indicates that GPGGA is output at a rate of 1 Hz from the other port.
13 Indicates that the other port is set to a baud rate of 19200.
14 Indicates that the port C is set to a baud rate of 19200.
15 Indicates that GPGGA is output at a rate of 1 Hz from the other port.
16 Indicates that the current port is set to a baud rate of 19200.

When issuing this command with the optional ‘,subset’ data field (without the square brackets), a one-line response is provided. The subset field may be either CONF or GP. When CONF is specified for ‘subset’, the following response is
provided:

$>JSHOW,CONF,N,0.0,10.0,5,A,60W <CR><LF>

This response is summarized in the following table:

‘N’	indicates no altitude aiding
‘0.0’	indicates the aiding value, if specified (either specified height or PDOP threshold)
10.0	Residual limit for the $JLIMIT command
5	Elevation mask cut-off angle, in degrees
A	AIR mode indication
60	Maximum acceptable age of correction data in seconds
W	Current differential mode, ‘W’ indicates WAAS mode.

When GP is specified for 'subset', the following is an example response provided:

$>JSHOW,GP,GGA,1.0 <CR><LF>

This response will provide the >$JSHOW,GP message header, followed by each message currently being output through the current port and also the update rate for that message.

$JT

This command displays the type of receiver engine within the receiver module and has the following format:

$JT<CR><LF>

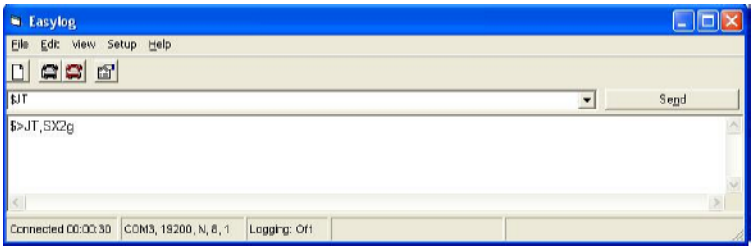


Figure 10 : $JT response

The receiver will return the following response, indicating that the receiver is an SX2g ('g' for global differential operation) when in SBAS mode and SX1i when in e-Dif mode ('i' for internal differential operation):

$>JT,SX2g

$JAGE

This command allows you to choose the maximum allowable age for correction data. The default setting for the 5120VBS is 1800 seconds, however, you may change this value as you feel appropriate.

Using COAST technology, the receiver is able to use old correction data for extended periods of time. If you choose to use a maximum correction age older than 1800 seconds, we recommend that you consider testing the receiver to ensure that the new setting meets your requirements as accuracy will slowly drift with increasing time.

This command has the following structure:

$JAGE,AGE<CR><LF>

Where maximum differential age timeout variable, 'age', may be a value from 6 to 8100 seconds.

The Receiver will reply with the following response:

$>

$JMASK

The system masks control whether or not the receiver will use a certain GPS satellite for its position calculations. Since the signals of low-elevation satellites have a larger distance to travel, the signals of those satellites will be weaker and may cause a larger position error than the signals of satellites at higher elevations. Default, all satellites with a signal to noise ratio of 37dB or less and all satellites with an elevation below 5 degrees will not be used in the position calculations. Valid SNR values lie between 10 and 60, valid elevation values lie between 0 (satellite at horizon) and 90 (degrees).
The default angle is 5 degrees, as satellites available below this angle will have significant tropospheric refraction errors.

This message has the following format:

$JMASK,E<CR><LF>

Where the elevation mask cut-off angle, 'e', may be a value from 0 to 60 degrees.

The Receiver will reply with the following response:

$>

$JNP

This command allows the user to specify the number of decimal places output in the GGA and GLL messages.

This command has the following definition.

$JNP,X<CR><LF>

Where 'x' specifies the number of decimal places from 1 to 8.
This command will affect both the GGA and the GLL messages.

The Receiver will reply with the following response: $>

$JASC

Using this command, you may turn GPS data messages on at a particular update rate or turn it off. When turning messages on, you have the choice of various update rates available, depending on what your requirements are.

This command has the following layout:

$JASC,MSG,R[,OTHER]<CR><LF>

Where 'msg' is the name of the data message and 'r' is the message rate, as shown in the table below. Sending the command without the optional ',OTHER' data field (without the square braces) will enact a change on the current port. Sending a command with a zero value for the 'r' field turns off a message.

GPGGA 10, 5, 1, 0, or .2	Global Positioning System Fix Data
GPGLL 10, 5, 1, 0, or .2	Geographic Position Latitude/Longitude
GPGSA 1 or 0	GNSS DOP and Active Satellites
GPGST 1 or 0	GNSS Pseudorange Error Statistics
GPGSV 1 or 0	GNSS Satellites in View
GPRMC 10, 5, 1, 0, or .2	Recommended Minimum Specific GNSS Data
GPRRE 1 or 0	Range residual message
GPVTG 5, 1, 0, or .2	Course over Ground and Ground Speed
GPZDA 5, 1, 0, or .2	Time and Date

When the ',OTHER' data field is specified (without the square brackets), this command will act as a change on the other port.

The Receiver will reply with the following response:

$>

$JOFF

This command allows you to turn off all data messages being output through the current or other port, including any binary messages, such as Bin95 and Bin96, etc.

This command has the following definition:

$JOFF[,OTHER]<CR><LF>

When the ',OTHER' data field is specified (without the square brackets), this command will turn off all messages on the other port.
There are no variable data fields for this message.

The receiver will reply with the following response: $>

$JAPP

This command allows you to request the receiver for the currently installed applications and to choose which application to use. The receiver, by default, comes pre-installed with WAAS (SBAS) in application slot 1 and a second application, e-Dif, in application slot 2.

To poll the receiver for the current applications, send the following message:

$JAPP<CR><LF>

There are no data fields to specify in this message.

The receiver will respond with the following message:

$>JAPP,CURRENT,OTHER,[1 OR 2],[2 OR 1]

Where "CURRENT" indicates the current application in use and "OTHER" indicates the secondary application that is not currently in use. 1 and 2 indicate which application slot is currently being used. Available applications are as follows: For the sake of the application names, the SBAS application is referred to as WAAS by the receiver's internal software. For example, if the response to $JAPP<CR><LF> is $>JAPP,WAAS,AUTODIFF,1,2 indicating that WAAS (SBAS) is in application slot 1, e-Dif is in application slot 2, and that WAAS in application slot 1 is currently being used. To change from the current application to the other application, when two applications are present, issue the following command:

$JAPP,OTHER<CR><LF>

Or

$JAPP,APP<CR><LF>

Application

LBAND
WAAS
AUTODIFF
LOCDIF (local differential rover)
RTKBAS (local differential base)

Where "APP" may be one of the following by name: If you issue a $JAPP,OTHER<CR><LF> on a receiver, continuing with the above example, the response to $JAPP<CR><LF> would then be $>JAPP,AUTODIFF,WAAS,2,1, indicating that application slot 2, containing e-Dif, is currently being used.

$JBAUD

This command is used to configure the baud rates of the receiver.

This command has the following structure:

$JBAUD,R[,OTHER] <CR><LF>

Where “R” may be one of the following baud rates:

Table 2: baudrates

Baudrate
4800
9600
19200
38400
57600
115200

When this command has been issued without the “,OTHER” data field (without the brackets), the baud rate of the current port will be changed accordingly. When the “,OTHER” data field is specified (without the brackets), a baud rate change will occur for the other port.

The receiver will reply with the following response:

$>

$JSAVE

Sending this command is required after making changes to the operating mode of the receiver module.

This command has the following structure:

$JSAVE<CR><LF>

The receiver will reply with the following two messages. Ensure that the receiver indicates that the save process is complete before turning the receiver off or changing the configuration further.

$> SAVING CONFIGURATION. PLEASE WAIT...

$> Save Complete

No data fields are required. The receiver will indicate that the configuration is being saved and will notify you when the save is complete.

OmniSTAR commands

$JFREQ

This message allows you to either manually or automatically tune the OmniSTAR receiver.

This command has the following structure:

$JFREQ,freq,baud<CR><LF>

Where “freq” is the frequency in kHz and “baud” is the symbol rate (1200 or 2400 baud). e.g. $jfreq,1535152.500,1200 Mind the “.” for the 100 Hz digit.

The receiver will reply with the following response:$>

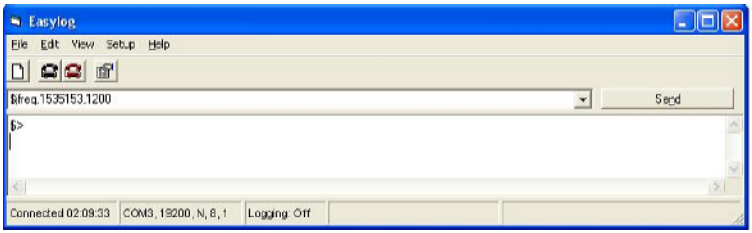


Figure 11 : $JFREQ and response

Entering a frequency of zero with no associated symbol rate will place the OmniSTAR engine into automatic mode. Entering a valid frequency and symbol rate will manually tune the receiver. The following table provides frequency information for the OmniSTAR satellites.

Coverage Area	Frequency	Longitude	Satellite Name	Baud Rate
Europe	1535.1525	25 East	**EA-sat**	1200
Africa	1535.0800	25 East	**AF-sat**	1200
Asia	1535.1375	109 East	**AP-sat**	1200
S-America	1535.1375	98 West	**AM-sat**	1200
Eastern U.S.	1557.8450	101 West	**MSV-EN**	1200
Central U.S.	1557.8350	101 West	**MSV-CN**	1200
Western U.S	1557.8550	101 West	**MSV-WN**	1200
Australia	1558.5100	145 East	**OPTUS**	1200

Table 3 : OmniSTAR beams worldwide

$JOMS

This command requests the raw OmniSTAR subscription information and has the following form:

$JOMS

The receiver will respond with the following message:

$>JOMS,Opt,Source,Type,AccrReduction,StartDate,EndDate,HourGlass,ExtentionTime,LinkVector,SoftwareVersion

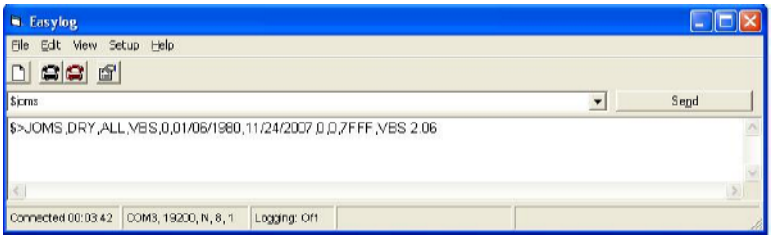


Figure 12 : $JOMS and response

This message is summarized in the following table.

An example of this response follows:

$>JOMS,DRY,ALL,VBS,0,01/06/1980,11/24/2007,0,0,7FFF,VBS 2.06

Table 4 : $JOMS

Data Field	**Description**
Ots	This field indicates a WET or DRY subscription
Source	RTCM source ID or ALL if VBS
AccrReduction	0 is most accurate (Default)
StartDate	Subscription end date
HourGlass	Seconds of metered time also named Count Down Timer.
Extension	Time Seconds of extension
Link Vector	Hexadecimal mask of links
SoftWareVersion	This item shows the OmniSTAR library version

$JLIMIT

This command is used to change the threshold of estimated horizontal performance for which the DGPS position LED is illuminated. The default value for this parameter is a conservative 10.0 meters.

This command has the following format:

$JLIMIT,LIMIT<CR><LF>

Where “LIMIT” is the new limit in meters.

The receiver will respond with the following message:

$>

$JRD1

This command is used to request diagnostic information from the receiver module. To command the receiver to output the diagnostic information message for the currently used SBAS satellites at a rate of 1 Hz, use the following query:

$JASC,D1,1[,OTHER]<CR><LF>

The receiver will respond with the following data message:

$>

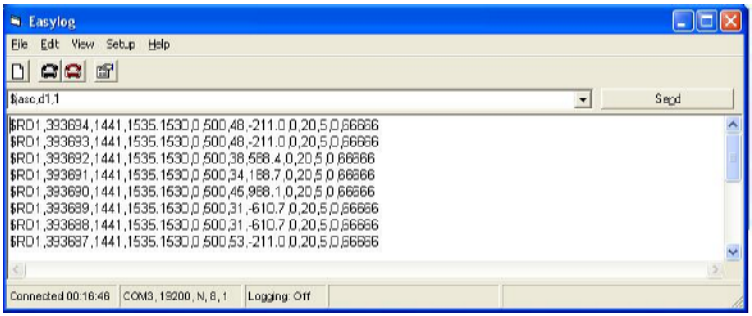


Figure 13 :$JRD1 and response.

[,other] is for outputting the message on another comport.

Setting the update rate to zero, as follows, will turn off this message:

$JASC,D1,0<CR><LF>

The RD1 message contains diagnostic information for Omnistar operation. Table xx breaks down the RD1 data message into its components. This message has the following format:

$RD1,SECOFWEEK,WEEKNUM,FREQMHZ,DSPLOCKED,BERBER2,
AGC,DDS,DOPPLER,DSPSTAT,ARMSTAT,DIFFSTATUS,NAVCON
DITION *CC<CR><LF>

Table 5: RD1 data message defined

Field	Description
SecOfWeek	The second of GPS week (may be a couple of seconds old)
WeekNum	The GPS week number
FreqMHz	The L-band frequency in MHz (1575.4200 is used for SBAS)
DSPLocked	N/A
BER-BER2	Bit error rate – bit error rates are given for both SBAS satellites being tracked
AGC	L-band Signal strength
DDS	0.0 for SBAS
Doppler	0 for SBAS
DSPStat	A status bit mask for the DSP tracking of SBAS
ARMStat	A status bit mask for the ARM GPS solution
DiffStatus	The SBAS PRN of the satellite in use
NavCondition	A series of hex character fields, which is read from right to left, with each field representing the number of GPS satellites satisfying a certain condition, all of which conditions are required if the satellite is to be used in the solution
*cc	Checksum
<CR><LF>	Carriage Return and line feed

The following table describes the ARM status.

Table 6 : ARM status

Field	Description
01	GPS lock
02	DGPS valid data
04	The ARM processor has lock
08	DGPS solution
10	DGPS solution is good
20	Not used
40	Not used

An example of the NavCondition is presented in the following table for the 179889A value.

Table 3: NavCondition explained

Field	Description
A	The number of satellites with lock and carrier phase
9	The number of satellites with ephemeris received
8	The number of satellites with healthy ephemeris
8	The number of satellites that are tracked, have an ephemeris, which is healthy, and are above the elevation mask
9	The number of satellites above the elevation mask
7	The number of satellites with differential
1	The number of satellites with no differential

$JASC,RTCM

This command allows you to configure the receiver to output RTCM corrections from SBAS, or beacon, through either receiver serial port.
The correction data output is RTCM SC-104, even though SBAS uses a different over-the-air protocol (RTCA). To have the receiver unit output RTCM corrections, send the following command to the 5120VBS receiver:

$JASC,RTCM,R[,OTHER]<CR><LF>

The message status variable “R” may be one of the following values:

Table 7 **:** $JASC,RTCM

R	Description
0	OFF
1	ON

When the ",OTHER" data field (without the brackets) is specified, this command will turn RTCM data on or off on the other port.

The receiver will reply with the following response:

$>

NMEA Messages

The NMEA messages screens are used to control the NMEA output of the 5120VBS. The 5120VBS is capable of outputting a number of NMEA messages on different output rates, which may not all be needed as inputs for the attached device. Furthermore, the number of NMEA messages that can be sent by the 5120VBS also depends on the baudrate of the communication port and the set output rate of the NMEA messages.

For example: Selecting GGA, GSV and RMC to be output at a 5 Hz. output rate, with an average of 8 satellites in view (so 2 GSV messages for every GGA message), the baudrate (bits per second) can be calculated as follows:

1 GGA-message = 89 bytes * (8+1) bits/byte =	801 bits
2 GSV messages = 2*72 bytes * (8+1) bits/byte =	1296 bits
1 RMC message = 77 bytes * (8+1) bits/byte =	693 bits
Total	2790 bits
5 Hz. output = 5 * 2790 =	13950 bits/sec.

In the above example, the baudrate should be set to the next higher standard baudrate, which is 19,200, to prevent a buffer overflow of the COM-port.

Warning: The above calculation is indicative, based on an average message length count. Actual values may differ, yielding different outcomes.

Warning: The initial NMEA standard called for a baud rate of only 4800. As a result, many external devices are still set to communicate with a GPS receiver at 4800 baud. This is an average of only 6 NMEA messages per second. Therefore, be aware not to select too many NMEA messages or a very high output rate for NMEA output, unless you have set the baudrate on both the communication port of the 5120VBS and the communication port of the external device to a (much) higher value first.

The NMEA GGA message is used to provide information about the quality of the (D)GPS solution. Possible values are listed in Table 4.

Value	Description
0	No GPS
1	GPS Standard Position Service
2	DGPS

Table 4: (D)GPS quality indicators

Although the 5120VBS features three communication ports, there are only two physical communication ports on the receiver back panel.

Appendix A

Technical Specifications

Performance	
Position Accuracy [1]	VBS: 0.78 m 2DRMS
Reacquisition	<1 s L1 (typical) Omnistar Lband: <10 s (typical)
Data Rates	1, 5, 10, 20[optional] Hz
Time Accuracy [1 2]	20 ns RMS
Velocity Accuracy	0.05 m/s RMS
Dynamics	Vibration 4 G (sustained tracking) Maximum Velocity 515 m/s [3,4] Maximum Height 18.288 m [3]
Environmental	
Operating Temperature	-32°C to +74°C
Storage Temperature	-40°C to +85°C
Humidity	Not to exceed 95% non-condensing

[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.

[2] Time accuracy does not include biases due to RF or antenna delay.

[3] In accordance with export licensing.

[4] 515 m/s in combination with an AirSTAR subscription. Otherwise the maximum velocity is 180 km/h (50 m/s).

Power requirements

Voltage	+8 to +36 VDC
Power consumption	3 W (typical)

RF input / LNA power output

Antenna connector	TNC female, 50 Ω nominal impedance
RF Input Frequencies	1575.42 MHz (L1), 1525 MHz – 1559 MHz (L-Band)
LNA Power	+ 5 VDC

Input / output data interface

Electrical Format	RS232 / USB 2.0
Bit Rate[1]	4800, 9600, 19200, 38400, 57600, 115200 bps
Lead input	CTS and DTR
Lead output	RTS and PPS
Signals Supported	TX, RX, RTS, CTS, DTR, PPS

Input / output connectors

A	Data port A
B	Data port B
USB	USB
Power	Power
Ant	Antenna

Physical dimensions

Size	160 (w) x 45 (h) x 114 mm (d)
Weight	0.54 kg

[1] Most external hardware using GPS NMEA-messages is set to use 4800 bps, 8 databits, 1 stopbit and no parity (8N1).

Receiver Connector Pin No.	Signal Name	Signal Description
1	NC	
2	TXD	RS-232 transmit
3	RXD	RS-232 receive
4	NC	
5	GND	Signal ground
6	Marker in	Event marker
7	NC	
8	NC	
9	1 PPS	1 PPS output

Table 5: 5120VBS data Port Pin-Out port A Descriptions.

Receiver Connector Pin No.	Signal Name	Signal Description
1	NC	
2	TXD	RS-232 transmit
3	RXD	RS-232 receive
4	NC	
5	GND	Signal ground
6	NC	
7	NC	
8	NC	
9	NC	

Table 6 : 5120VBS data Port Pin-Out port B Descriptions.

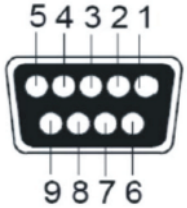


Figure 14 : DB9 pin layout on receiver (female connector)

Appendix B

NMEA 0183 Message options

The OmniSTAR 5120VBS is configured to output 3 NMEA 0183 sentences (*GGA, GSA and VTG) by default. Sentences can be added or removed by the user using the NMEA configuration screens (see page 20 or 32). The default output rate is set to 1 Hz, but 5, 10 and 20 Hz may also be selected. Apart from the 'common' NMEA messages (starting with $GP), some proprietary vendor-specific messages (starting with $R or $J) can be selected for output.

Default	Message Sentence	Description
*	GGA	GPS Fix Data
	GLL	Position Data
	RRE	GPS Range Residual Error
*	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 7: NMEA 0183 messages available for the 5120VBS

NOTES:

Default output of 3 NMEA 0183 messages, GGA, GSA and VTG, the receiver outputs these messages at a rate of 1 Hz.

NMEA 0183 Message Formats

In this section each message is described in more detail.

GGA – GPS Fix Data

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

$GPGGA,hhmmss.ss,ddmm.mmmmm,D,dddmm.mmmmm,D,Q,sv,H.H,h.hh,M,h.hh,M,A.AA,DRID*XX

Field Number	Description
1	UTC of Position fix
2,3	Latitude in DDMM,MMMM, N (North) or S (South). [1]
4,5	Longitude in DDDMM,MMMM format, E(East) or W (West). [1]
6	GPS Quality Indicator: 0=No GPS, 1=GPS, 2=DGPS (VBS), 4=HP/XP (fixed) [2], 5=HP/XP (float). [2]
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. [3]
13	Age of Differential GPS Data. [4]
14	Differential Reference Station ID (0000 – 1023) [5]

Table 8: Description of the GGA message.

NOTES:

1. The GGA message provides 8 decimal places. In non-differential mode, only the first four decimals are relevant. In (VBS) differential mode, the first five decimals are relevant. In HP/XP mode, the first seven decimals are relevant.
2. Status ‘fixed’ = converged HP/XP solution. Status ‘float’ = unconverged HP/XP solution.
3. Geodial Separation is the difference between the WGS-84 earth ellipsoid and mean-sea-level (MSL).
4. Time in seconds since the last OmniSTAR correction update.
5. For OmniSTAR, reference station ID 0100 = VBS, 1000 = HP, 1008 = XP, 1016 = HP+XP

GLL - Geographic Position – Latitude/Longitude

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

$GPGLL,ddmm.mmmmmmm,D,dddmm.mmmmmmm,D,hhmmss.ss,A*XX

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 9: Description of the GLL message.

RRE – GPS Range Residual Error

The RRE message is used to support the Receiver Autonomous Integrity Monitoring (RAIM).

$GPRRE,hhmmss.ss,R,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,r.r,*XX

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 10: Description of the RRE message.

NOTES:

* 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.

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,m,f,sv,sv,sv,sv,sv,sv,sv,sv,sv,sv,sv,sv,P.P,H.H,V.V*XX

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 11: 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 message is used to support Receiver Autonomous Integrity Monitoring (RAIM).

$GPGST,hhmmss.ss,S.S,M.M,m.m,ddd.d,y.y,x.x,h.h,*XX

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 pseudoranges 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 12: 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 message identifies the number of SVs in view, the PRN numbers, elevation, azimuth and SNR values.

$GPGSV,M,S,T,sv,el,azm,snr,sv,el,azm,snr,sv,el,azm,snr,sv,el,azm,snr*XX

Field Number	Description
1	Total number of sentences of this type in this cycle
2	Sentence number
3	Total number of SVs visible
4	SV PRN number
5	Elevation in degrees, 90° maximum
6	Azimuth, degrees from true north, 000° to 359°
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 13: 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 message identifies the UTC time, status, latitude, longitude, speed over ground (SOG), date and magnetic variation of the position fix.

$GPRMC,hhmmss.ss,A,ddmm.mmmmm,D,dddmm.mmmmm,D,sss.ss,T.T,DDMMYY,mm.m,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 F: Float RTK (HP/XP unconverged) N: Data not valid R: RTK (HP/XP converged)

Table 14: Description of the RMC message.

NOTE:

* The receiver outputs this message at a maximum rate of 10 Hz.

VTG – Course Over Ground and Ground Speed

The VTG (Velocity True Ground) message identifies the actual track made good and speed over ground.

$GPVTG,t,T,,,n.nn,N,k.kk,K

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 kilometers/hour (0-3 decimal places)
8	Fixed text 'K' shows that speed over ground is in kilometers/hour

Table 15: Description of the VTG message.

NOTE:

* The receiver outputs this message at a maximum rate of 10 Hz.

ZDA – Time and Date

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

$GPZDA,hhmmss.ss,DD,MM,YYYY,lh,lm

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 16: 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.
* The receiver outputs this message at a maximum rate of 10 Hz.

Appendix C

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
dB	Decibel
DGPS	Differential Global Positioning System
DOP	Dilution of Precision
EGNOS	European Geostationary Navigation Overlay Service
GPS	Global Positioning System
HP	High Performance
LCD	Liquid Crystal Display
LNA	Low Noise Amplifier
LBAND	Omnistar correction signal in the L-band frequ**ency**
NCC	Network Control Centre
NMEA	National Marine Electronics Association (Standard for interfacing marine electronic devices)
MSAS	MTSAT Satellite based Augmentation System
RF	Radio Frequency
RTCM	Radio Technical Commission Maritime
VBS	Virtual Base Station
WAAS	Wide Area Augmentation System
XP	Extended Performance

Appendix D

USB driver for 5120VBS

At the time of writing this manual, no USB driver has been officially released for the 5120VBS by the manufacturer.
OmniSTAR has found a workable driver that supports the 5120VBS' USB functionality.

The driver creates a virtual comport on the connected computer and can be used as a real comport by connecting different programs to the port.

First get the driver from the OmniSTAR CD or download it from the website:
http://www.omnistar.nl/DOWNLOAD/toolprograms/USB_COMv2.04.zip
unzip it and place it on a temporarily map on your computer.

Then power up the receiver and connect the USB cable to the receiver and computer.
The computer will ask for the driver for this unknown device, point the computer to the driver on the map on your computer where you placed the driver.

After a successful install, the comport will be available.

It is more difficult to determine what port has been added to your computer.
If you view the PORTS(COM&LPT) in the device manager window, you can see what number has been assigned.

In Figure 15 the port on this demo computer is USB serial number (COM 7)
Any program can now connect to this comport and be used as a normal comport.

With the device manager it is also possible to change the comport number when desired.

Note: If you connect the receiver to a different USB port on your computer, it is likely that a different comport number will be assigned, please verify this with your device manager.

Note: Since no official driver has yet been released, OmniSTAR cannot guarantee proper working and cannot support this driver in any way.

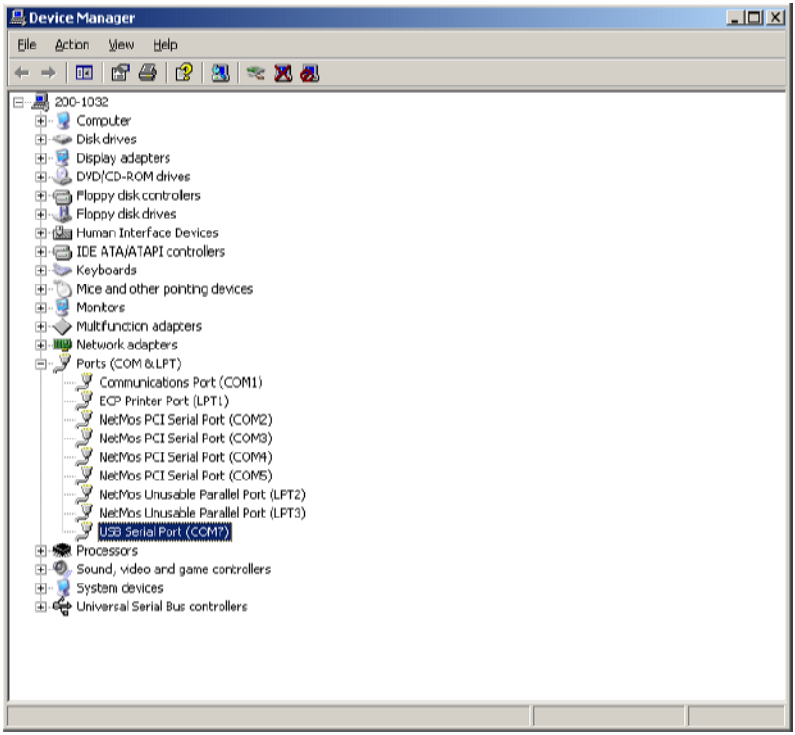


Figure 15 : screen view of PORTS in device manager

Appendix E

Updating the 5120VBS firmware

In order to update the 5120VBS firmware, an MS-Windows compatible computer (either desktop or laptop) and the RightArm program are required. The 5120VBS has to be connected to a communication port of the computer and has to be switched on. The update process does not require reception of either GPS or OmniSTAR satellite signals. During the update process, do not switch off either the computer or the 5120VBS receiver and do not disconnect the 5120VBS from the computer.

After installing and starting the RightArm program, the following screen will show.

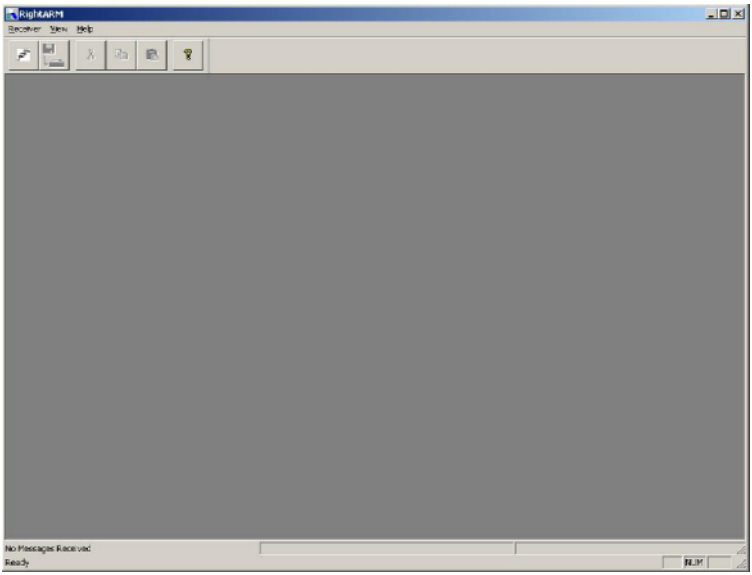


Figure 16: RightArm main screen

In the top left of RightArm there is a ‘connect’ window,  demonstrated in figureFigure 16, click on that to connect to a receiver. Select the proper comport and baud rate and click on ‘ok’.

When the below left screen shows ‘comport opened & ready’ the receiver is properly connected.

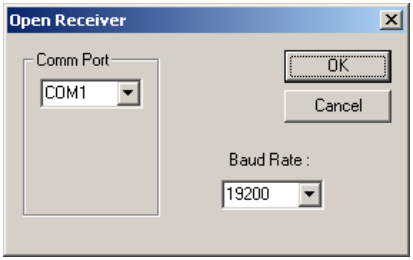


Figure 17 Open receiver screen

Click on the icon  'program the receiver' to open the loading screen. shown in Figure 18

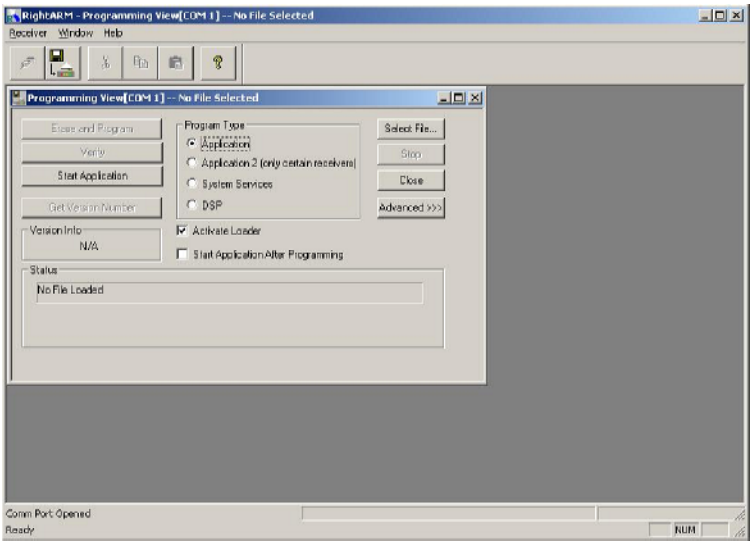


Figure 18 the loader screen.

Check the 'activate loader' box, activated by default. In the programming type, sub menu select 'application'. Then click on 'select file' an explorer screen will open in which the desired image file can be selected. (see Figure 19). Select the appropriate image file and click the 'Open' button once. The name of the selected image file will now be displayed in the grey textbox after 'Programming view'. (see Figure 20)

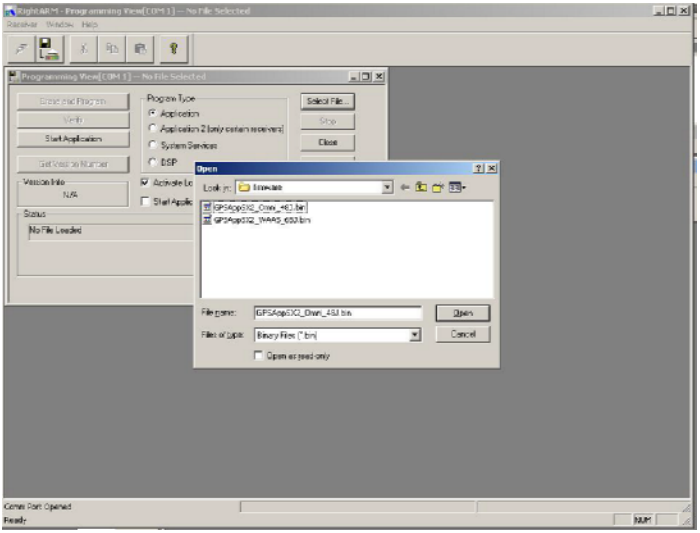


Figure 19 Firmware image selection screen

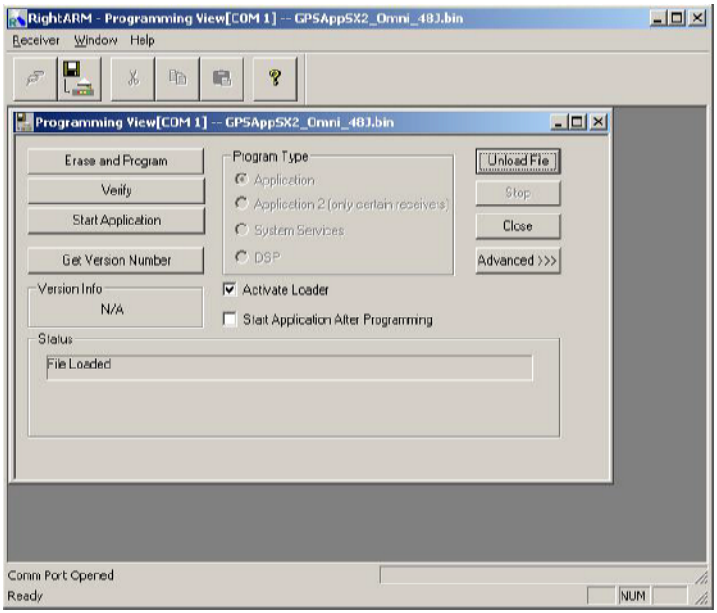


Figure 20 : Firmware image selection screen, firmware sele

Optionally, you can check the 'start application after programming' box to run the new firmware after it has been loaded.
You can choose to do it later with $japp command (page 33)

Click the 'Erase and Program button' button once to proceed with the update process.

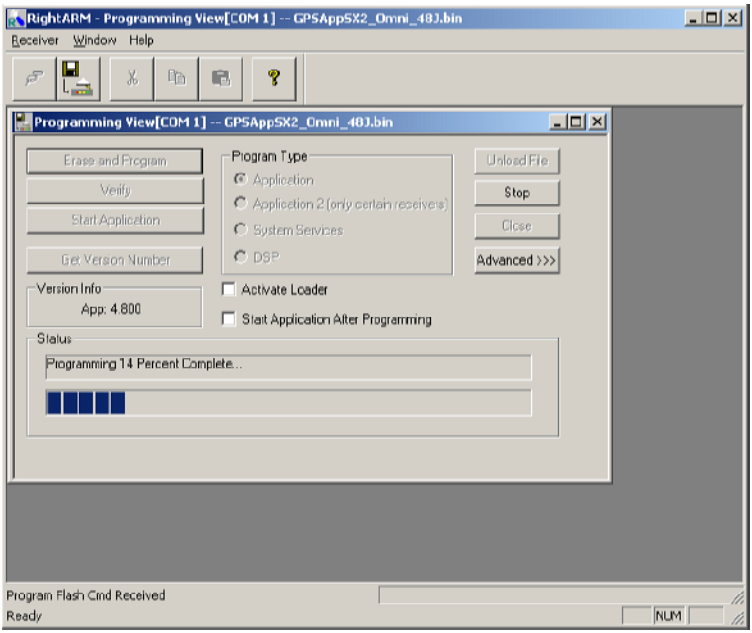


Figure 21 : Establishing communication with the receiver

The program will start searching for a compatible receiver to upload the firmware to. Then it will erase the old firmware, this will not take more than 5-10 seconds.

After the program has finished loading the firmware into the receiver, it will show ‘programming done’ in the status window as shown in Figure 22.

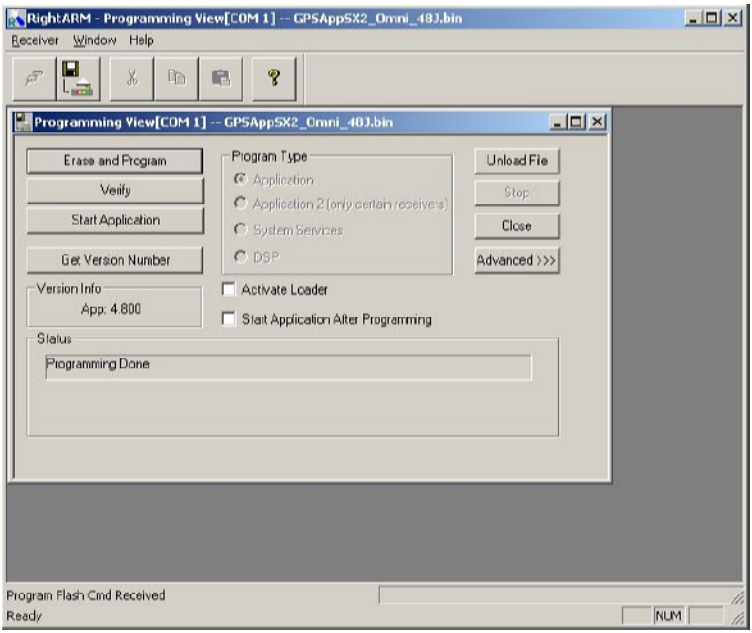


Figure 22: Programming done

After the firmware upload is completed, the 5120VBS's program space will be erased (See Figure 22), so the new firmware can be programmed.

After programming the new firmware, the RightArm program will report the flashing completed successfully. The updated 5120VBS is now ready to use.

Updating the firmware may (partly) erase existing OmniSTAR subscription information from receiver memory. It is therefore recommended to check the subscription end dates (see page 27) after each firmware upgrade.

Appendix F

OmniSTAR reference stations

For its satellite based DGPS service, OmniSTAR uses correction data from a number of reference stations distributed all over the globe. The most recent map can be found on the Internet: See http://www.surveyplanner.com

Appendix G

Receiver Service Procedure

If an OmniSTAR receiver unit fails to perform, contact the OmniSTAR office within the 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 for on forwarding to Product Marketing.

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, 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 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):	

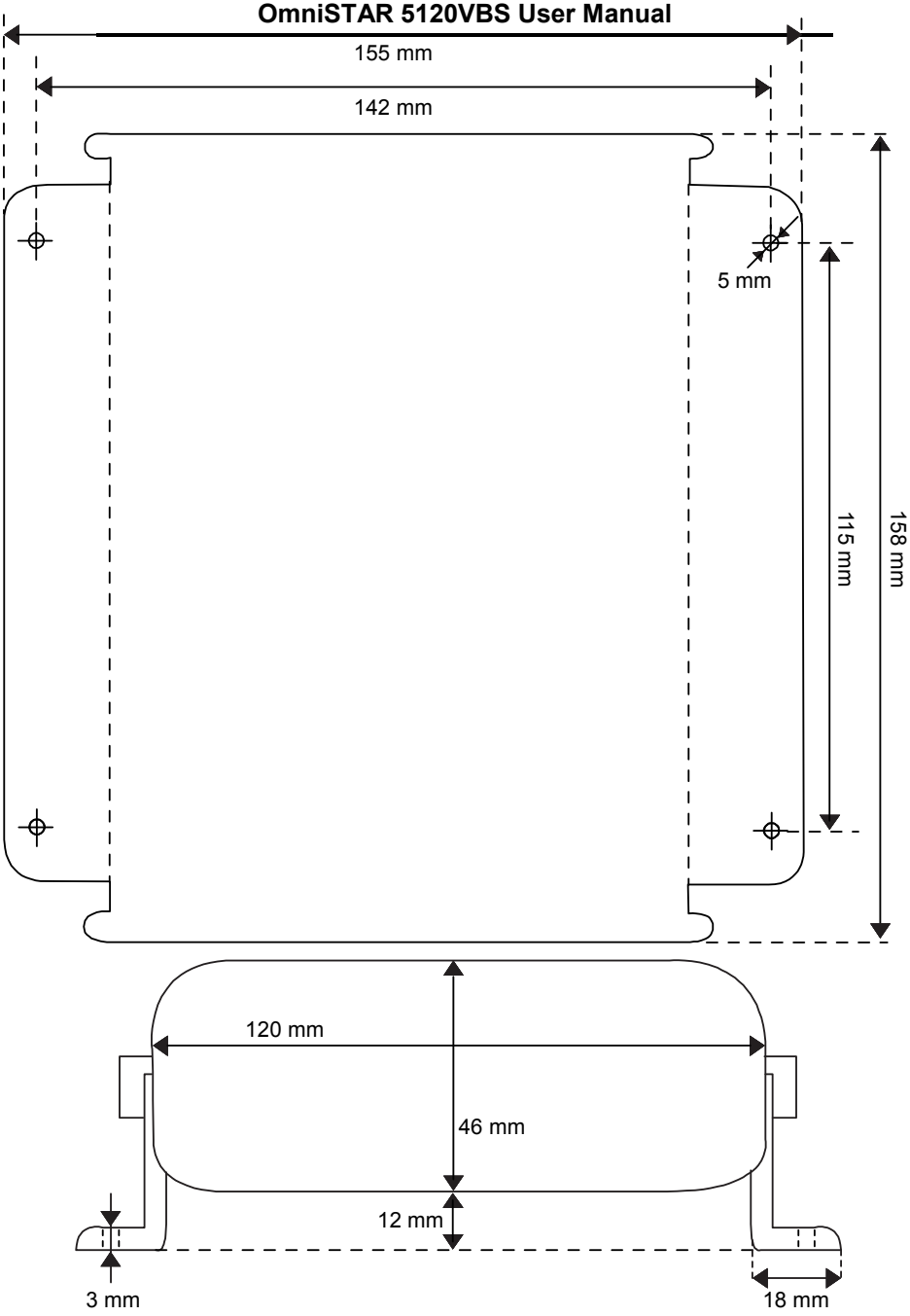
Appendix I

Mechanical drawing for mounting

This appendix show a 1:1 scale drawing of the 5120VBS receiver.

Please note the following drawing fits exactly on the mounting bracket and its holes.
For your convenience, you can print this and use as a drilling mould.

DO NOT scale this image when printing or you will risk misalignment with the real mounting holes.


155 mm
142 mm
5 mm
115 mm
158 mm
120 mm
46 mm
12 mm
3 mm
18 mm

User Notes