

# LD6 Operations Manual

Version 105

**VERIPOS** 

LD6 Operations Manual Version 105 AB-V-MA-00628 RevA2

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#### 1. INTRODUCTION

#### 1.1 GENERAL

For installation guidance please see the LD6 Installation manual.

Throughout this manual reference will be made to the VERIPOS Helpdesk. The Helpdesk is provided by VERIPOS and is the first point of contact for technical enquiries and assistance. It is manned 24 hours per day, 365 days per year.

Details are in the Contact Information chapter.

#### 1.2 SCOPE

This manual comprises of information on LD6 connections, general operation and data inputs/outputs via COM and IP ports.

Please be aware that this manual covers the operation of the LD6 receivers running software version 105 only. LD6's on this software version are equipped with either NovAtel OEM617D or OEM7720 GNSS cards. Some aspects of this version differ from the previous LD6 software versions. More information regarding versions is provided in <a href="Section 2">Section 2</a>. For operation of the LD6 on any other software versions, please refer to the appropriate Operations Manual.

Manuals are available for download at <a href="https://help.veripos.com">https://help.veripos.com</a>.

#### 1.2.1 Contents

Chapter	Contents		
1. Introduction	This chapter specifies the purpose and		
	target group for this manual. It also		
	contains a list of used abbreviations and a		
	specification of the document conventions.		
2. Operation	This chapter describes the interfaces in		
	detail, the initial start-up, the status		
	indicators and possible corrective actions		
	and how to shut the system down safely.		
<ol><li>VERIPOS Software Compatibility</li></ol>	This chapter states compatible and non-		
	compatible VERIPOS software.		
4. Troubleshooting	This chapter describes basic fault tracing		
	and a detailed description on how to report		
	problems or operating queries to the		
	VERIPOS Helpdesk.		
<ol><li>Reference information</li></ol>	This chapter comprises additional		
	information for configuration, station ID		
	listings and a list of the serial and IP port		
	designations.		
<ol><li>Contact information</li></ol>	This chapter contains contact information		
	details about the VERIPOS Helpdesk and		
	VERIPOS offices worldwide.		



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#### TERMS AND ABBREVIATIONS 1.3

**VERIPOS PPP GNSS service** Apex BeiDou Chinese GNSS constellation

BER Bit Error Rate

CoG Course over Ground CR Carriage Return

**CRP** Central Reference Point

**DGNSS** Differential GNSS **DGPS** Differential GPS DOP Dilution of Precision DP **Dynamic Positioning** 

European Geostationary Navigation Overlay System **EGNOS** 

European GNSS constellation Galileo **GDOP** Geometry Dilution of Precision

GLObal NAvigation Satellite System - Russian equivalent to GPS **GLONASS** 

**GPS** Global Positioning System

Global Navigation Satellite System **GNSS** Horizontal Dilution of Precision **HDOP** 

NMEA message format containing heading information HDT

Hz Hertz

IMU **Integrated Mobile Unit KPH** Kilometres per Hour Local Area Network LAN

LF Line Feed

Low Noise Amplifier LNA

L-BAND Methods of transmitting Correction data to mobile users

Liquid Crystal Display LCD

Unit containing GPS card, demodulator and PC processor LD6 Medium Frequency Radio used to Transmit Correction Data MF

MHz Mega-Hertz

Man-Machine Interface MMI

**MPH** Miles per Hour Metres per Second m/s

National Marine Electronics Association **NMEA** 

N/A Not applicable

Positional Dilution of Precision **PDOP** PPP Precise Point Positioning

**PPS** Pulse per Second **PRN** Pseudo Random Noise PVA Position, Velocity & Attitude

Quasi-Zenith Satellite System (Japanese constellation) **QZSS** 

RoHS Restriction of Hazardous Substances

Root Mean Square RMS

Radio Technical Commission for Maritime Services RTCM

SAL Service Access License

**SBAS** Satellite Based Augmentation System

SD Standard Deviation

**SDRAM** Synchronous Dynamic Random Access Memory

SNR Signal to Noise Speed over Ground SOG Spotbeam High Power LBAND Signal

Standard / Std VERIPOS Single frequency DGPS system

SV Space Vehicle

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> **VERIPOS PPP GNSS service** Ultra

**USB** Universal Serial Bus

UTC Coordinated Universal Time **VDOP** Vertical Dilution of Precision

VGA Video Graphic Array

VERIPOS Online Support System VOSS Wide Area Augmentation System
Waste Electrical and Electronic Equipment WAAS

WEEE

Word Error Rate WER

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### 1.4 DOCUMENT CONVENTIONS

# 1.4.1 Typographical Conventions

*Italic* or **bold** text is used to emphasize certain parts of the information. *Italic* is also used in cross-reference to other parts of the document.

**Bold text** is also used for indicators and touch screen "push-button" commands.

"Text within quotes" is used when display screens are mentioned in text. Monospace text is used for input/output strings to/from the device.

1.4.2 Special Notices
— WARNING———————————————————————————————————
— (! CAUTION
NOTE
A note shows important information that helps you make better use of the system.

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#### 1.5 VERIPOS HELPDESK

VERIPOS encourage all users to promptly report problems or operating queries to the Helpdesk so that they may receive assistance.

The VERIPOS Helpdesk is the first point of contact for technical enquiries and fault reports. It is manned 24 hours per day, 365 days per year.

Helpdesk contact details are in the Contact Information chapter.

For assistance with basic troubleshooting, see the *Troubleshooting* chapter. We recommend initial contact is made by email to the Helpdesk.

Users can also create a fault ticket on the website. This will ensure contact details and the description of the fault are correctly recorded.

The duty operator is trained to provide direct assistance with most queries and problems and can request technical staff to provide support for more complex issues.

### 1.6 VERIPOS ONLINE SUPPORT SYSTEM (VOSS)

VERIPOS have an online customer support system called VOSS (VERIPOS Online Support System).

VERIPOS recommend users to frequently view the announcements made on this system.

VOSS includes a facility for raising fault tickets which are then automatically submitted to the VERIPOS Helpdesk.

The VOSS URL is: https://help.veripos.com



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If you have any questions or comments about this Manual or our Privacy Policy, please contact us at: <a href="mailto:support@veripos.com">support@veripos.com</a>.

The LD6 hardware and associated software is subject to VERIPOS <u>Terms and Conditions Relating</u> to the Provision of VERIPOS Services.

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#### 1.8 WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

The Waste Electrical and Electronic Equipment Directive (hereinafter referred to as the "WEEE directive") places an obligation on EU-based manufacturers, distributors, retailers and importers to take back electronic products at the end of their useful life. A sister directive, RoHS (Restriction of Hazardous Substances) complements the WEEE directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE directive covers all VERIPOS products imported into the EU as of August 13 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the requirements contained in the WEEE Directive.

### Instructions for disposal of WEEE by users in the European Union

Products which have the undernoted symbol located on either the product itself or its packaging indicates that the product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of the product by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment (hereinafter referred to as "WEEE").

The separate collection and recycling of your WEEE at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about recycling centres, please contact the local city office, the household waste disposal service or the product supplier.

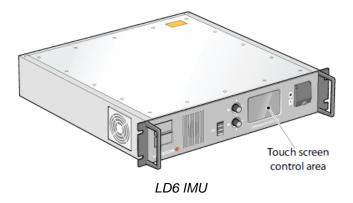


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### 2. LD6 OPERATION

The controls for working with the LD6 are all available via the touch screen front panel.

Use the LD6 touch screen to configure the unit.



### Description

The LD6 Integrated Mobile Unit (IMU) is used offshore on vessels to provide high precision Satellite Positioning Services from VERIPOS.

The LD6 can optionally be equipped to run VERIPOS's latest visualisation software - QUANTUM.

It can be fitted with modules to receive the following;

- GNSS satellite positioning data (Compatible with the new *Apex*<sup>5</sup> service)
- 2<sup>nd</sup> RF input for GNSS heading functionality
- L-Band satellite positioning augmentation data from geostationary satellite transmissions
- Optional MF Beacon positioning augmentation data
- Optional UHF positioning augmentation data

The LD6 supports all VERIPOS position augmentation data services.

The LD6 supports switching between high accuracy PPP solutions (subject to settling before position is output).

When configured the LD6 automatically selects the best available solution for output, with automatic fall-back to the next best solution.

Multiple messages are supported with configurable outputs of position data from the ports in NMEA format (V3).

For timing, a ZDA message can be output for use with 1PPS output.

The LD6 supports RS 232 and 422 output from galvanic isolated ports and output to LAN.



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#### 2.1 VERSIONS

Different version 105 build numbers may exist (for example, 105.03.00.10 or 105.03.00.11); however, these will collectively be referred to within this manual as 'Version 105'. LD6 systems on software version 105 feature either a NovAtel OEM617D or OEM7720 GNSS receiver card, and both are capable of providing a corrected solution in NMEA format.

Both NovAtel OEM617D or OEM7720 GNSS receiver cards feature GPS, GLONASS, Galileo and QZSS GNSS tracking capabilities, with the OEM7720 GNSS receiver card additionally capable of tracking Beidou. The multi-constellation tracking abilities of both cards allow for the computing of VERIPOS's *Apex*<sup>5</sup> service. The software version 105 LD6 can also compute all other VERIPOS solutions, e.g. Ultra<sup>2</sup>, Apex<sup>2</sup>, Standard<sup>2</sup> etc.

The table below shows details the LD6 GNSS variants:

Software Version	GNSS Variant	Tracking Capabilities	
8 (or) 50	Septentrio AsteRx2	GPS & GLONASS	
101	NovAtel OEM615	GPS & GLONASS	
105	NovAtel OEM617D	GPS, GLONASS, Galileo & QZSS	
105	NovAtel OEM7720	GPS, GLONASS, Galileo, QZSS & Beidou	

LD6 systems with an MF module\* installed allow the LD6 to be capable of receiving third party corrections directly from local reference stations (where available).

LD6 systems with UHF module\* installed allow the LD6 to receive corrections by UHF broadcast (where available).

<sup>\*</sup>An on-screen icon for each receiver card will be shown when the LD6 has that particular receiver card installed.

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#### 2.2 DO'S AND DON'TS FOR LD6

### DO's

- <u>Do</u> use **Shutdown** control (in the **Actions** menu) for the LD6 <u>BEFORE</u> turning off the power. Wait until the LD6 screen is blank before disconnecting power.
- <u>Do</u> take care not to obstruct the side ventilation panels for the fan assisted cooling tunnel.
- <u>Do</u> only connect the LAN Crossover network adapter (where required) to an LD6 LAN port. The adapter wiring is not compatible with serial COM ports.
- <u>Do</u> connect external monitor (where required) to the rear VGA connector <u>prior</u> to switching on the LD6. If a monitor is connected after LD6 is switched on, it will not be detected.

### **DON'TS**

- <u>Don't</u> load software onto the LD6 not issued from VERIPOS e.g. as part of the LD6 build. Doing so could seriously compromise system performance.
- <u>Don't</u> insert USB memory device unless first scanned with up to date virus scanning software.
- <u>Don't</u> activate the pin reset buttons on the rear of the unit unless directed by a VERIPOS representative.
- **Don't** use a pen or any other sharp object to operate the touch screen as this could cause damage.

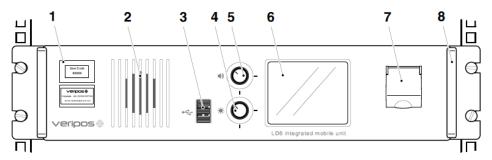
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#### FRONT AND REAR PANEL OVERVIEW 2.3

#### 2.3.1 **Front Panel**



LD6 IMU



LD6 Front Panel Controls

- Labels with Unit ID (above) and phone number to Helpdesk (below)
- 2 Front panel speaker
- 3 3 x USB 2.0 sockets
- Screen brightness control
- 5 Volume control (press to mute/un-mute)
- 6 Colour touchscreen display
- Front panel power on/off switch (with security cover)
- Removable handle (one on each side)

#### LD6 front panel controls



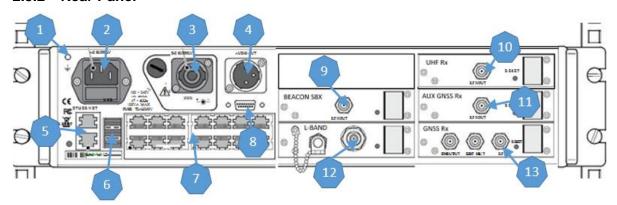
NOTE

There are currently no audio features enabled on the LD6.

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#### 2.3.2 Rear Panel



- 1. Earthing point
- 2. AC Power Input
- 3. DC Power Input
- 4. Audio Out
- 5. 2 x RJ45 LAN Interface Sockets
- 6. 3 x USB Sockets
- 7. 14 x Serial Ports (RJ45 Sockets)
- 8. VGA Socket
- 9. MF Beacon Antenna Input TNC
- 10. UHF Antenna Input BNC
- 11. AUX GNSS Antenna Input TNC
- 12. L-Band Antenna Input N-Type
- 13. GNSS (Main) Antenna Input TNC

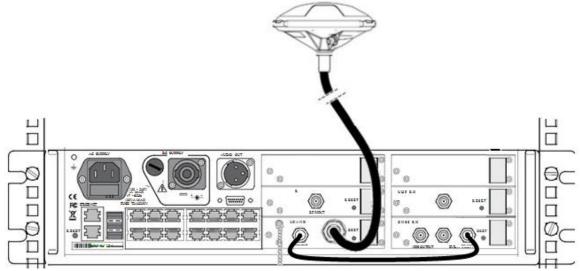
#### LD6 rear panel connections



NOTE

The Video out connection is only used with Quantum visualisation software.

If using a combined L-BAND / GNSS antenna (e.g. V460) connect it to the input to the L-BAND receiver card. Remove the terminator from the RF out of the L-BAND card and link the GNSS card RF in to the L-BAND RF out connector, using the lead which is supplied.



LD6 antenna connection using a combined GNSS & LBAND antenna



#### 2.4 LD6 START-UP

Confirm the LD6 has been correctly installed.

Where required refer to the *LD6 Installation Manual* and the *Antenna & Coaxial Cable Installation Guide*.

These documents are provided with the unit or may be downloaded in .pdf format from the VERIPOS online support system (VOSS) at:

### https://help.veripos.com

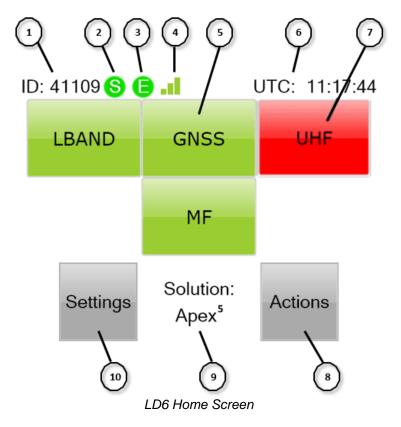
Plug in power to the rear of the unit. Turn on power switch.

Wait a few minutes while a self-test is performed.

Following successful test you will see the main or home screen.

The LD6 is disabled when first started. Before a beam is selected and the unit is enabled the *LBAND* icon will be red.

If there is a problem refer to the *Troubleshooting* chapter in this manual.



### Key

- 1. LD6 unit ID
- 2. S L-BAND beam Sync Green = yes, Red = not synced with beam

E – VERIPOS corrections Green = enabled Red = not enabled

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4. L-BAND signal strength indicator. These signal strength bars have three states:

No. of Signal Strength Bars	Signal Strength (dB/Hz)
0	0 (No Sync)
1	<32.5
2	32.5 to 36.5
3	>36.5

- 5. Touch screen buttons to access **L-BAND** card, **GNSS** card, *optional* **MF** (Beacon SBX receiver) and **UHF** ADL cards, information and controls. Buttons provide access to each receiver (as fitted).
- 6. LD6 time display (UTC)
- 7. Buttons in red indicates the cards have configuration or fault condition and are not working to correct limits.
- 8. **Actions** Shut down, Log Off, Reboot, Factory Reset or LD6 Screen calibration of screens 1 and 2, Launch Apps.
- 9. **Solutions** Displays LD6 solution status.
- 10. **Settings** –Set up of position output ports, network configuration and provides general status information.

The above Home Screen shows an enabled LD6 touch screen. Four of the six rear bays are equipped with receiver cards. Two bays are for future use.

The home page of the LD6 touch screen displays the Unit ID number (top left).

The time is shown in Coordinated Universal Time (UTC), 24 hour format (top right).

Each of the four upper touch screen buttons correspond to a receiver or card housed in bays accessed from the rear of the LD6. LD6 units may not have all cards fitted.



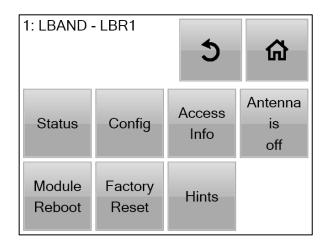
The LD6 Home Screen will only display receiver module icons which are installed.

Configuration of each installed and working receiver card is done using the touch screen front panel. Select the corresponding on screen button.



### 2.5 L-BAND RECEIVER

This section describes how to view L-Band status information and configure L-Band settings as required.



#### 2.5.1 Status - L-Band

To view L-Band status, from the Home screen, press LBAND / Status:



Confirm 'Frame Sync', 'Signal Lock' and beam settings for the selected beam.

For reliable operation the SS values should be ≥ 38.0dB/Hz.

### 2.5.1.1 Module Info - L-Band

From the L-Band Status page, press *Module Info*:





1: LBAND - LBR1

1: Status

2: Module Info

Slot: 1

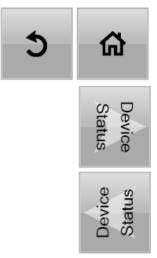
Variant: LBR1

SerNo: 41109 FWare: 1,2,11

Decode: 4.31

Boot: 1.11

GNSS: 1.2.11



#### The Module Info screen shows:

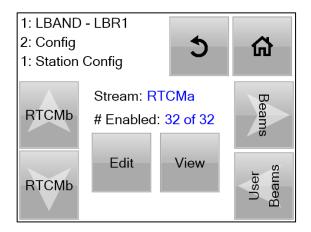
- Slot Indicates which LD6 module bay the L-Band card is physically installed in.
- Variant Details of the L-Band card model installed.
- SerNo Serial number of the L-Band card installed.
- **FWare** Firmware version currently installed on the L-Band card.
- Decode Decoder version currently installed on the L-Band card.
- Boot Bootloader version currently installed on the L-Band card.



L-Band firmware is updated automatically when LD6 software is updated, therefore there should be no requirements for users to manually upgrade L-Band firmware.

### 2.5.2 L-Band Configuration

To make changes to the L-Band, go to *Home / LBAND / Config*.





#### 2.5.2.1 Beams

# **Preparation**

To receive VERIPOS corrections select a geostationary satellite beam that covers the area of operation for the vessel. See the <u>L-band Coverage Map</u> for beam footprints.

Up to date copies and service update information available on VERIPOS online support system (VOSS) at:

### https://help.veripos.com

You need to know the VERIPOS beam(s) that cover the general area of operation for the vessel.

To ensure correct beam selection when configuring the LD6 use the **VeriChart** program.

This is a free download from VOSS and allows VERIPOS users to generate their own regional chart information.

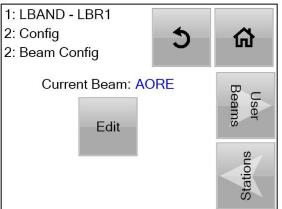
#### **Beam**

A chart showing the beam names and coverage is available in the *Reference information* chapter – 'L-band coverage chart'.

Beam	Coverage
143.5E	Asia, Australasia, Indian Ocean
IOR	Asia, Indian Ocean, East Africa, Persian Gulf, Caspian Sea
25E	North Sea, Mediterranean Sea, Africa, Persian Gulf, Caspian Sea
AORW	North America, Gulf of Mexico, South America
98W	North America, Gulf of Mexico, South America

Up to date beam coverage charts are available on **VOSS**.

Press the **Beams** button to view or amend the Beam selected. If the correct regional Beam is shown no edit is required.





If "No Beam" or the incorrect regional beam is shown, select Edit and select the beam for your work region.

Use the up/down on-screen arrows to highlight and select the beam required.



When the required beam name is highlighted, touch the *Enable* button, and then *Close*.

Return to the LD6 Home page.

The 'S' (Sync) icon will turn from red to green when a usable beam is correctly selected and signals are received.

If the beam has been changed, L-Band beam status can be checked as described in Section 2.5.1.

#### 2.5.2.2 User Beams

User Beams should only be selected under direction from VERIPOS.

User Beams are not used during normal LD6 operation. Custom entry of a user Beam is provided to allow the user to manually configure a Beam frequency and bit rate for reception of VERIPOS L-BAND corrections.

Full instructions regarding User Beam entry can be found in Section 4 of this manual.

#### 2.5.2.3 Edit L-Band Reference Stations

Once the LD6 is enabled, the VERIPOS reference station RTCM information is available.

The LD6 L-BAND card outputs two data streams of RTCM corrections:- **RTCMa** and **RTCMb**.

These may be configured independently and both may be selected for output on the LD6 COM or LAN ports.

**RTCMa** is additionally used internally, providing correction information to the LD6 internal position computation.



#### Recommendation

On the *RTCMa* data stream all reference stations should be enabled. The LD6 internal calculations will determine automatically the best stations for use.

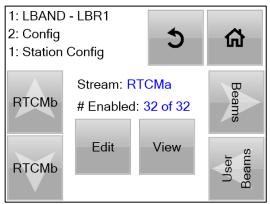
Use *RTCMb* to provide output of corrections to third party equipment. Depending on the application it may be desirable for the user to select only the appropriate stations for this equipment.

The following section describes this process.

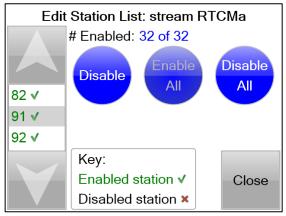
Refer to a list of all VERIPOS stations showing their station number, name and region which can be downloaded from <a href="https://help.veripos.com">https://help.veripos.com</a>.

To enable or disable station(s):

From the home screen select **LBAND/ Config** and select **RTCMa** or **RTCMb** then touch **Edit**.



Use the up/down arrows to highlight the station number and the disable button to remove it from use.



When finished editing touch the Close button.

The above process can be carried out for both RTCMa and RTCMb data streams.

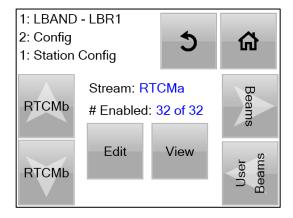




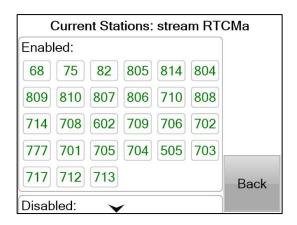
Reference stations on RTCMa are used internally and are also available for output to other devices. VERIPOS recommend in most cases that all stations are enabled. The LD6 will use the **closest six** (maximum) stations provided they are within 1500km of the users current location.

#### 2.5.2.4 View L-Band Reference Stations

To view stations go to **LBAND/ Config** and select the RTCM data stream required and touch the view button.



Press up or down on the touch screen to view more stations available on the Beam or to view the list of Disabled stations.



### 2.5.3 Access Info - L-Band

The *Access Info* page shows details of the VERIPOS services which the LD6 is currently enabled for. This page is accessible from *Home/LBAND/Access Info*:





/eripos

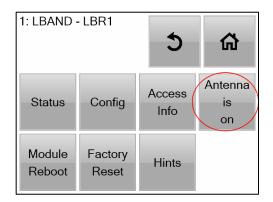




If the LD6 is disabled, the *Access State* field will say "Disabled". Disabled units will list the services which the LD6 was last enabled for.

#### 2.5.4 Antenna Voltage - L-Band

Antenna power must be toggled **On** (*Home/LBAND/Antenna is off*) when the L-BAND card is directly connected to an L-BAND antenna. The Antenna power should be toggled off where the LD6 is connected to a powered signal splitter or other external equipment such as a tracking dish.



#### 2.5.5 Enable for VERIPOS Corrections

Tel. +44 1224 965900 Email: <a href="mailto:support@veripos.com">support@veripos.com</a>

Go to the LD6 Access Code page LBAND/ Access Info.

Contact the VERIPOS Helpdesk to request the unit is enabled and quote:

- Unit ID
- Service Access Licence (SAL) number
- Provide details of the type of Service(s) you require, e.g. Standard, Standard<sup>2</sup>,
   Ultra, Ultra<sup>2</sup>, Apex, Apex<sup>2</sup>, Apex<sup>5</sup>.



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Only when the L-BAND receiver has Sync (**S**) to a valid beam will it display access code information or allow you to enable/disable the LD6.

The Helpdesk will enable the requested services for the LD6 over the air.

If after requesting the LD6 to be enabled the *Access Info* page still shows **Disabled**, confirm the LD6 still has Sync (**S** on the Home screen) and contact the VERIPOS Helpdesk. They can then resend the enable command over the air.

#### 2.5.6 Module Reboot - L-Band

Access this option via *Home/LBAND/ Module Reboot*. Pressing *Module Reboot* will reboot the L-Band card <u>only</u>, the LD6 will not reboot.

### 2.5.7 Factory Reset - L-Band

Use only under instruction from a VERIPOS engineer.

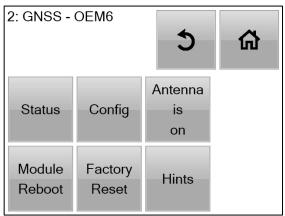
#### 2.5.8 Hints - L-Band

Provides general guidance information where available.



#### 2.6 GNSS RECEIVER

The LD6 GNSS menu is used to check GNSS status and to configure position calculations etc.



#### 2.6.1 GNSS - Status

The GNSS Status menu is accessed via Home/ GNSS/ Status.

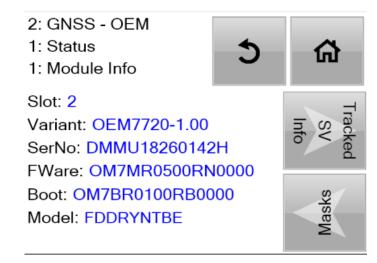
#### 2.6.1.1 Module Info

From the Home screen touch the GNSS/ Status button to view the Module Info screen.

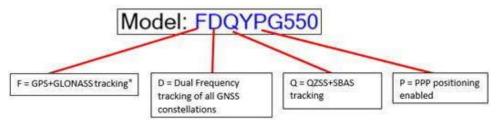
#### The *Module Info* screen shows:

- Slot Indicates which LD6 module bay the GNSS card is physically installed in.
- Variant Details of the GNSS card model installed.
- SerNo Serial number of the GNSS card installed.
- **FWare** Firmware version currently installed on the GNSS card.
- **Boot** Bootloader version currently installed on the GNSS card.
- Model Provides details relating to the GNSS card capabilities and permissions.
   All LD6 receivers running software version above 101 have the below standard default permissions.

NovAtel GNSS receivers are identifiable by the *Variant* within the *Module Info* page.



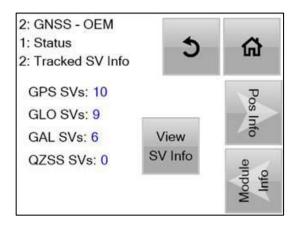




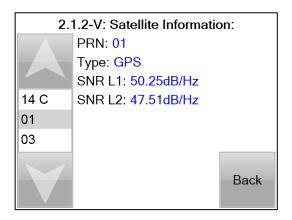
\*F will also indicate Beidou tracking capability on OEM7720 models

#### 2.6.1.2 SV Info

The **SV Info** screen shows the current number of satellites (SV's) being tracked from each of the available GNSS constellations.



Touch View SV Info to view each satellite in the constellation(s) in turn.



Move between SV's using the *Up/Down* arrows and return to the previous screen with the *Back* button.

Tracked **GPS** satellites will be displayed as **numbers only**.

**GLONASS** satellites will be displayed as "R" in the SV number field.

Galileo satellites will be displayed as "E".

On OEM7720 models BeiDou satellites will be displayed as "C".

QZSS satellites will be displayed as "J".



#### 2.6.1.3 Position Info

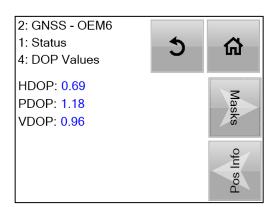
The **Pos Info** page displays the following information regarding the solution being calculated by the LD6:

- Status States the solution currently calculated by the LD6 e.g. Apex, Ultra.
- Latitude In DD° MM' SS.SSSS" format (WGS84)
- Longitude In DDD° MM' SS.SSSS" format (WGS84)
- **Height** Antenna height (WGS84)
- SVs Used Total number of GNSS satellites used in the solution
- Heading GNSS heading (Only displayed if feature is enabled).



#### 2.6.1.4 DOP Values

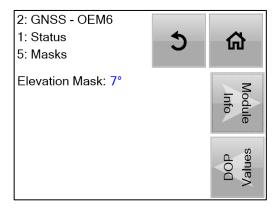
DOP values are shown for HDOP, PDOP and VDOP. DOP's are a measure of the geometrical strength of the GNSS satellites in view. Low DOP values indicate good satellite geometry.



#### 2.6.1.5 Masks

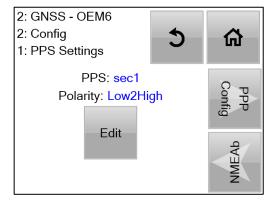
This page displays the solution elevation mask. This value is fixed at 7° and cannot be changed. This means any GNSS SV's below 7° elevation will be automatically rejected from the position solution.





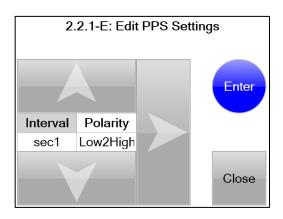
### 2.6.2 Config - GNSS

### 2.6.2.1 PPS Setting



The PPS (Pulse Per Second) settings can be edited to match the required polarity of the receiving system e.g. Multibeam.

Use the *Edit* button, arrow keys and *Enter* button to amend settings of pulse polarity characteristics between Low-to-High and High-to-Low.

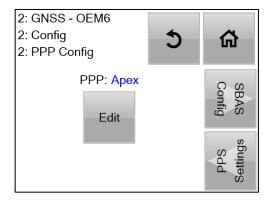


Touch Close when finished.

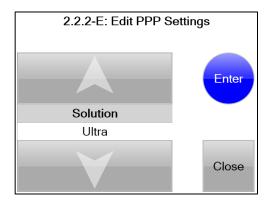
### 2.6.2.2 PPP Config

Use the *PPP Config* page to set which PPP calculation you wish to output from the LD6. The available options are *Apex* or *Ultra*.





Touch *Edit* then use the arrow icons to select the desired PPP solution. Press *Enter* to confirm the selection and then *Close*.

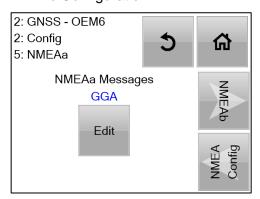




The LD6 will need to be enabled for the correct VERIPOS correction service in order to be able to output the selected solution.

After changing the PPP solution, the newly selected solution will then have to reconverge. It is recommended not to change the PPP solution during vessel operations.

### 2.6.2.3 NMEAa / NMEAb / NMEAc Configuration



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These pages allow the user to select the NMEA position messages required to be output from the LD6.

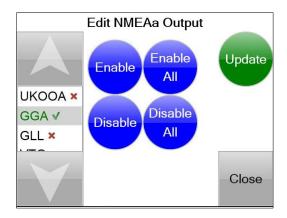
**NMEAa**, **NMEAb** and **NMEAc** are configured independently and are all available to output via COM or LAN interface. All three will output the same position calculation e.g. Apex<sup>5</sup> but specific messages on each can be configured based on the vessel system(s) requirements.

The LD6 will always output the best available position, for example, if the LD6 is configured to calculate an Apex solution and Apex fails, the output will automatically output the next best available position e.g. VERIPOS Standard or 3<sup>rd</sup> Party (e.g. IALA or SBAS).



Use of IALA requires an MF receiver card to be fitted to the LD6.

Use the arrow icons to scroll through the available NMEA messages and touch either *Enable* or *Disable* to ensure the correct message types are used.



The available message types for output are:

GGA	GLL	VTG	ZDA	GST	GSA
GSV	GRS	RMC	HDT*	UKOOA**	

Details of all the available output message types are available in **Section 5.8**.



It is recommended to enable only the messages which the receiving vessel system requires.

<sup>\*</sup>The HDT message is only available if the GNSS Heading feature has been enabled on the LD6.

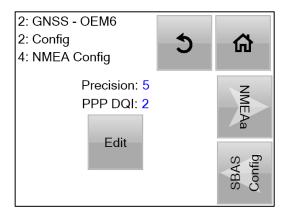
<sup>\*\*</sup>The UKOOA message can only be selected if all other NMEA messages are disabled.



#### 2.6.2.4 NMEA Config

This menu allows the user to configure some of the characteristics of the GGA message.

The two available options are **Precision** and **PPP DQI**.



#### **Precision**

The number of decimal places in the latitude and longitude fields of the GGA message. Values between **5** and **8** can be selected. Default is **5**.

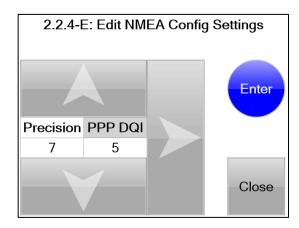
#### PPP DQI

The default PPP DQI value is **2**. This option relates to the output of Apex or Ultra (PPP) solutions. PPP solutions offer a higher positional accuracy compared to single frequency DGNSS (e.g. VERIPOS Standard).

One of the fields in the GGA string is the solution DQI (Differential Quality Indicator).

If the PPP DQI setting is set to 2 on this page, the DQI value in the GGA output will be 2 for all corrected solutions.

If the PPP DQI setting is set to **5** on this page, the DQI value in the GGA output will be **2** for all Differential solutions (e.g. VERIPOS Standard, 3<sup>rd</sup> Party) but will be **5** for PPP solutions.



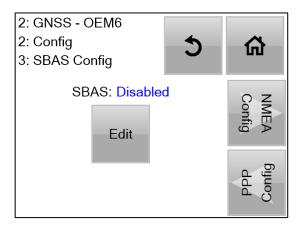
Use the *Up/ Down* arrows to change the values and the *Right* arrow to change between the *Precision* and *PPP DQI* fields.

Press *Enter* to confirm the changes then *Close*.

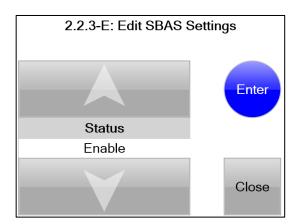


# 2.6.2.5 SBAS Config

This page allows the SBAS solution to be enabled or disabled as required. SBAS is **Disabled** by default. The page below displays the current SBAS status:



To change SBAS, touch *Edit*, then use the arrow icons to either *Enable* or *Disable*. Touch *Enter* to confirm the change followed by *Close*.



#### 2.6.2.6 GNSS Heading Offset

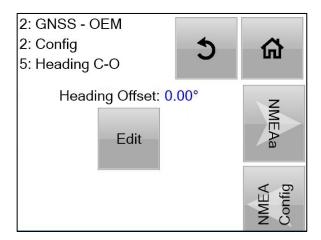
This menu item is only available if heading is enabled on the LD6 for further information relating to activating heading functionality please see section **2.9.5**.

The heading offset is sometime referred to as the c-o (computed minus the observed), in simple terms this is a calibration factor, in the case of a GNSS heading calculation the heading offset removes the installation error introduced at installation. The offset adjust for the misalignment of the GNSS antenna baseline and the vessel centre line

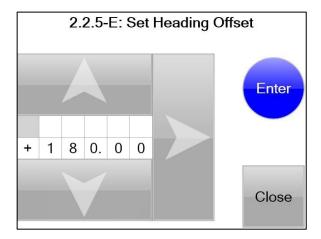
The use of a heading offset is optional and it is advisable for users to enter the offset within the interfaced DP or Survey software. This is to avoid the possibility for the double application of the heading offset which is a known risk.

The page below displays the current heading offset:





This page allows the Heading offset (c-o) to be applied.



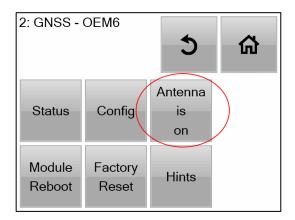
To change the heading offset, use the *Up/ Down* arrows to change the values and the *Right* arrow to change between the decimal places and the sign. The range of offset is to be entered +/- 180 degrees. In the example shown the offset is +180 degrees.

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### 2.6.3 Antenna Voltage - GNSS

Antenna power must be toggled **On** (*Home/GNSS/Antenna is off*) when the GNSS card is **directly** connected to a GNSS antenna. The Antenna power should be toggled off where the LD6 is connected to a powered signal splitter. This setting is applied to both primary and auxiliary antenna, if heading is enabled.



### 2.6.4 Module Reboot - GNSS

The **Module Reboot** option with the GNSS menu will perform a reboot of the GNSS card only (not the entire LD6 receiver).



There will be a loss of positioning while a GNSS module reboot is taking place.

### 2.6.5 Factory Reset - GNSS

Use only under instruction from a VERIPOS engineer.

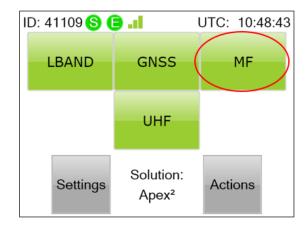
#### 2.6.6 Hints - GNSS

Provides hints where available.

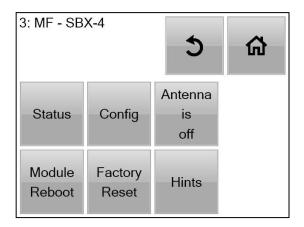


### 2.7 MF RECEIVER

The MF SBX-4 card (where fitted) allows for reception of non-VERIPOS MF Marine Beacon and IALA differential corrections.



#### Access from Home/MF:



#### 2.7.1 Status - MF

Touch the *Status* icon. This shows the device status screens for the MF card (MF-SBX4) and gives access to MF card Module info and available Is for correction data.



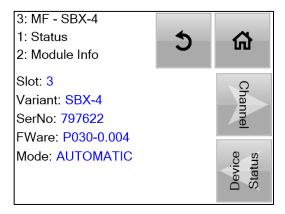
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The RTCM entry shows the correction age in seconds. In normal use this will correct every few seconds.

If the MF RTCM signal is lost the time will increment up to 300 seconds then show >300 s.

#### 2.7.1.1 Module Info

Touch the arrow to display the MF module information.



This gives information on whether the MF receiver is in AUTOMATIC or MANUAL mode as well as the serial and firmware numbers for the SBX-4 MF receiver card.

#### 2.7.1.2 Channel

Touching the *Channel* arrow shows the Channel Monitor screen with information on the channel selected – Station, Frequency, Bit rate, Signal strength (SS), Signal to noise ratio (SNR) and Word error rate (WER).



A typical MF channel values range is shown in the screen above.

**Stat:** Unique numerical ID number and name of station

**Freq:** Frequency of the received station

Rate: Data baud rate of the received transmission SS: The signal strength received in dB  $\mu$ V/m SNR: The current signal to noise ratio in dB/Hz

**WER:** The word error rate



## 2.7.2 Config - MF

Use *Home/ MF/ Config* to edit the operating mode of the SBX-4 card between *Automatic* and *Manual*.

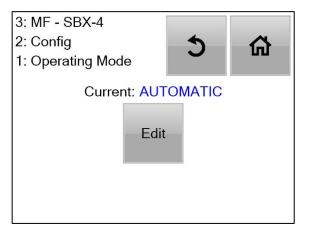
VERIPOS recommend the use of AUTOMATIC mode.

Operating mode options:

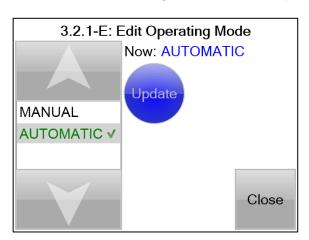
**AUTOMATIC** Searches for strongest signal

MANUAL User entered frequency and bit rate

To change operating mode, touch the *Edit* button to amend the card channel setting.



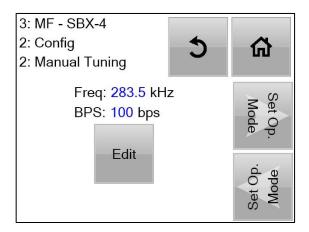
AUTOMATIC is selected from the options using the arrows and Update button.



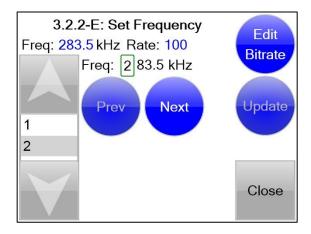
## 2.7.2.1 MANUAL Frequency Input

When selecting a manual frequency, first select the MANUAL mode and touch *Update* then *Close*.





Next use the *Manual Tuning* arrow on the right to *Edit* the Frequency and then the *Bitrate* for the channel required.



When the Bitrate is entered press *Update* button then touch *Close*.

## 2.7.3 Antenna Voltage - MF

Antenna power must be toggled **On** (*Home/MF/ Antenna is off*) when the MF card is **directly** connected to an MF antenna. The Antenna power should be toggled off where the LD6 is connected to a powered signal splitter.

### 2.7.4 Module Reboot - MF

The *Module Reboot* option with the MF menu will perform a reboot of the MF card only (not the entire LD6 receiver).

## 2.7.5 Factory Reset - MF

Should only be used under instruction by VERIPOS.

### 2.7.6 Hints - MF

Provides hints where available.



### 2.8 UHF RECEIVER

The UHF receiver card is an optional receiver.

The card comes preconfigured for use with Petrobras systems.

Channels 1 to 9 have channels configured as specified by Petrobras but can be reconfigured if required.

Channels 10 to 16 are available for user configuration.

Touch the onscreen UHF button to display **Status** and **Config** options.

#### 2.8.1 Status - UHF

## 2.8.1.1 Module Info

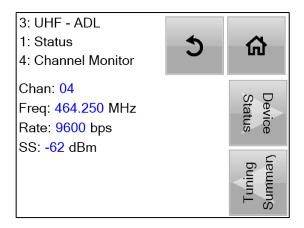
## Go to Home/ UHF/ Status/ Module Info



Displays the UHF card serial number and firmware version.

### 2.8.1.2 Channel Monitor

**UHF**/ **Status**/ **Channel** shows the Channel number, Frequency and Rate. It is useful to monitor the UHF signal strength.

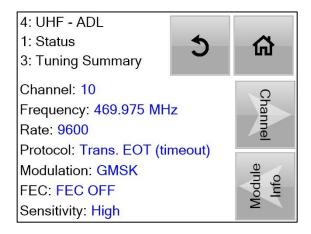


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## 2.8.1.3 Tuning Summary

Displays the Channel number used, Frequency entered, baud rate, protocol, Modulation, FEC and Sensitivity.



### 2.8.1.4 Device Status



Displays the time in seconds elapsed from the last RTCM string received.

The value provides the clearest indication of the UHF link.

Correction age >60 seconds – UHF main screen Icon will turn Green to Amber.

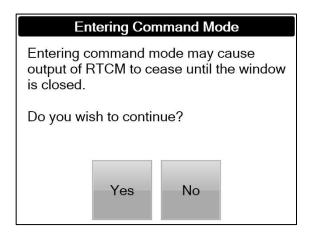
Correction age >90 seconds – UHF main screen Icon will turn Red.

Where the UHF RTCM signal is lost the time will increment up to 300 seconds then show >300 s.



## 2.8.2 Configuration

Configuration is accessed from Home/ UHF/ Config.





When amending the UHF receiver card configuration the output of UHF RTCM data is interrupted.

Amend the Frequency, Channel, Forward Error Correction, Sensitivity and Link Speed using the onscreen arrows and buttons.



Selection of existing Frequencies against channel numbers can be made if suitable. **Home/ UHF/ Config/ Yes** 

Use the *up/down* arrows to select from the pre-entered channel numbers and associated frequencies.



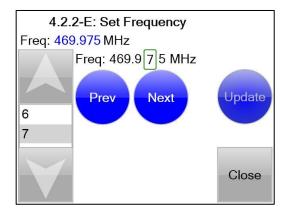
## 2.8.2.1 Manual Frequency Entry

To manually enter details for a UHF frequency:

## Home/ UHF/ Config/ Yes/ Tune/ Edit



Select using the Arrows to show the required Channel number then press the *Edit* button.



Use the Arrows, Previous and Next buttons to enter the Frequency required.

When entered touch the *Update* button then the *Close* button.

The Manually entered channel can then be selected for use;

## Home/ UHF/ Config/ Yes.

Select the channel number / frequency combination required and touch **Select**.





## 2.8.2.2 Link Speed, FEC and Sensitivity

Amend the link speed from Home/ UHF/ Config/ Yes/ Tune/ Link Speed.

Use the onscreen controls to select:

- Select Link Speed of 4800 or 9600 bps.
- Forward Error Correction (FEC) on or off
- Switch Sensitivity between Low, Medium and High.

When finished entering information return to the **Status** section (**Home/UHF/Status**) to review the RTCM data delay and channel settings applied.

### 2.8.3 Module Reboot - UHF

The module reboot will reboot the UHF module without disruption to the other receiver cards.

Only use when the UHF module is not operating correctly.

## 2.8.4 Factory Reset - UHF

This function should only be used under direction of a VERIPOS representative.

#### 2.8.5 Hints - UHF

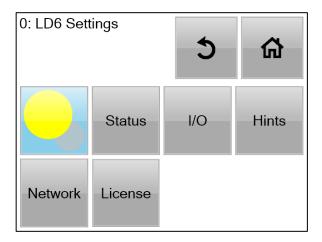
Provides advice where available.



## 2.9 SETTINGS

The **Settings** menu is used to view and configure general LD6 settings which are not specific to any one receiver module.

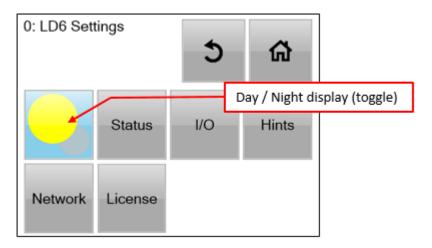
Access from Home/ Settings.



This section provides information on the controls to:

- View LD6 Status
- Configure serial I/O ports
- Configure IP Network settings
- Day / Night screen toggle
- Enable GNSS heading feature

## 2.9.1 Day / Night Mode



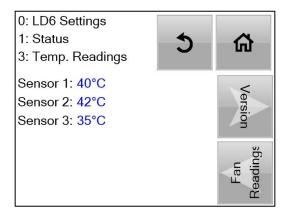
Day/ Night toggle setting of the LD6 screen, press the yellow "dot" button to switch screen display between night and day settings.



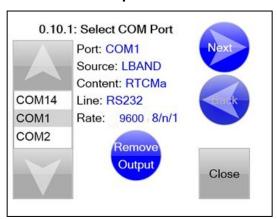
## 2.9.2 Status

This provides access to overall system status for the LD6; use the right hand side arrow keys to review:

- LD6 system version
- Fan speeds
- Temperature sensor readings
- System resource



# 2.9.3 I/O - Input Output COM Port Setup



This is used to access configuration of the fourteen com ports Default port settings are:

PORT	Device /Data Stream	Protocol	LAN
COM1	LBAND - RTCMa	RS232 9600 8N1	9001
COM2	GNSS - NMEAa	RS232 9600 8N1	19016
COM3	GNSS - NMEAb	RS232 9600 8N1	19017
COM4	LBAND - RTCMb	RS232 9600 8N1	9002
COM5	MF - RTCM	RS232 9600 8N1	9031
COM6	UHF - RTCM	RS232 9600 8N1	9051

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When the MF and UHF receiver modules are installed **COM5** and **COM6** are configured by default.

COM ports 7-14 are not configured by default. VERIPOS recommend using the default port settings wherever practical.

Changes to default port settings should be recorded so that they may easily be re-instated if it becomes necessary to replace a unit or perform a factory reset.

2.9.3.1 LD6 Default COM Port - Settings

## COM1 - L-BAND RTCMa Output - VERIPOS Corrections

The **L-BAND - RTCMa** output is typically used to provide corrections to other VERIPOS equipment or software.

The same RTCM data is supplied to the LD6 internal calculations.

VERIPOS recommend that <u>all reference stations are enabled on RTCMa</u>. All VERIPOS algorithms are designed to automatically select the optimum stations for use in the calculation.

### COM2 - GNSS NMEAa Output

The **GNSS NMEAa** output is the primary NMEA position and can be used to provide position data to the users' equipment.

The choice of NMEA messages are configured using the **GNSS/Config** menu. By default, the NMEA **GGA** message is configured.

## COM3 – GNSS NMEAb Output

The **GNSS NMEAb** output is the secondary NMEA position and can be used to provide position data to the users' equipment.

The choice of NMEA messages are configured using the *GNSS/Config* menu. By default, the NMEA **ZDA** message is configured.

# COM4 - L-Band RTCMb Output - VERIPOS Corrections

The **L-Band - RTCMb** output is typically used to provide corrections to users' equipment.

All available reference stations are enabled by default however the user can enable/disable only the reference station(s) required if necessary. Unlike RTCMa, RTCMb is not used internally by the LD6 therefore disabling stations on RTCMb do not affect any NMEA position outputs from the LD6.

#### COM5 – MF RTCM Output

The **MF – RTCM** output provides RTCM correction data from the MF (IALA) reference station currently in use.

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MF corrections are generally only used as a backup when VERIPOS corrections are unavailable or disabled.

## **COM6 – UHF RTCM Output**

The **UHF – RTCM** output provides RTCM data from the UHF station when in use. The addition of UHF corrections has primarily been designed to support the Petrobras UHF chain in Brazil. Users considering other applications should consult the VERIPOS Helpdesk for advice.

Further details for all ports are given in Section 4.

## 2.9.3.2 LD6 Available I/O Options

Device	Data Stream	Function
LBAND:LBR1	RTCMa	Primary output of RTCM data from L-Band receiver. The same data stream is used by the internal computations.
LDAND.LDR I	RTCMb	Secondary output of RTCM data from L-Band receiver.
	Config	Use only under VERIPOS Guidance
	NMEAa	NMEA data output. Set to GGA by default
GNSS:NovAtel	NMEAb	NMEA data output. Set to ZDA by default
OEM6	NMEAc	NMEA data output. Set to ZDA by default
<u></u>	Raw	Raw GNSS data. Use only under VERIPOS guidance
ME.CDV4	RTCM	RTCM data from MF receiver.
MF:SBX4	Config	Use only under VERIPOS Guidance
UHF:PacificCrest	RTCM	RTCM data from UHF receiver.
Unr:PacificCrest	Config	Use only under VERIPOS Guidance
Ext RTCM 1	Veripos	External Veripos RTCM data input
Ext RTCM 2	Veripos	External Veripos RTCM data input
Gyro Input	HDT / THS	Gyro heading input, for use with Quantum. Must be in NMEA HDT or THS format.
TIDE*	N/A	Available when Quantum is operational. Proprietary format.
TRINAV**	N/A	Available when Quantum is operational. Proprietary format specifically for TRINAV systems.

<sup>\*</sup>Tide data is also available on IP port 9900 if Quantum is operational

### 2.9.3.3 NMEA Position Output - Via COM

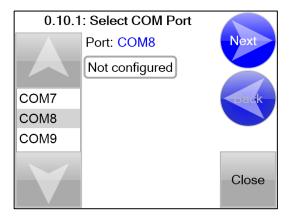
Before configuring any output of an NMEA position, you must have first selected which NMEA message types are required by the receiving system.

Please refer to **Section 4.8** for details regarding selection of NMEA message types.

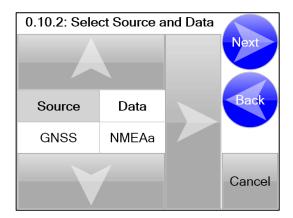
<sup>\*\*</sup>Trinav data is also available on IP port 9901 if Quantum is operational



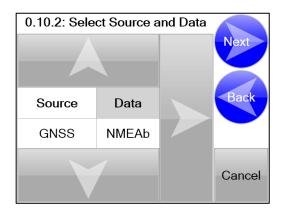
Go to *Home/ Settings/ I/O* and use the arrow icons to navigate to an unused COM port.



Touch *Next* then use the *Up/Down* arrow icons to select *GNSS* in the *Source* field.

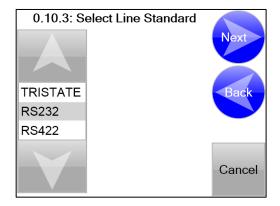


Use the *Right* arrow to move to the *Data* field then use the *Up/ Down* icons to select *NMEAa*, *NMEAb* or *NMEAc*.

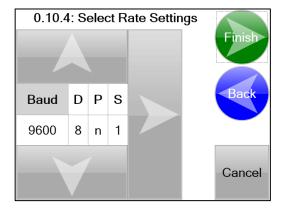


Touch *Next* then select the required data protocol e.g. *RS232* or *RS422*..

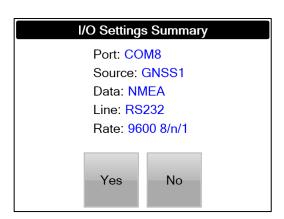




Touch **Next** then select the required baud rate, data bit, stop bit and parity settings using the arrow icons.



Finally, touch *Finish*. A summary of the I/O port settings will be displayed. Touch *Yes* to apply settings.



For details of LD6 COM pin-outs, refer to Section 5.5



### 2.9.3.4 External RTCM Inputs

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As detailed in Section 2.9.3.2, it is possible to input RTCM correction data to the LD6 from external sources.

It is possible to configure up to two Ext RTCM inputs. Only one RTCM data source will be used at any one time. Each data source will be designated with a priority level. The priority for VERIPOS RTCM corrections are as follows:

RTCMa (LD6 L-Band)
 Ext RTCM 1
 Ext RTCM 2
 PRIMARY
 SECONDARY
 TERTIARY

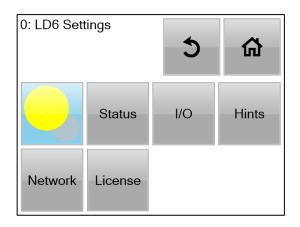


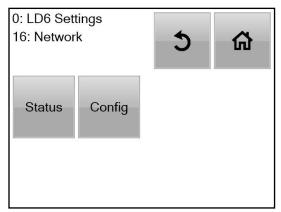
Any non-VERIPOS corrections available (e.g. on-board MF or UHF) will only be used in the event that all VERIPOS correction sources have failed or are disabled.

The LD6 is only able to receive VERIPOS RTCM corrections from external devices through serial connection, it will <u>not</u> use external 3<sup>rd</sup> Party RTCM corrections.

#### 2.9.4 Network

Touch the *Network* button in the Settings menu to open the Network page.



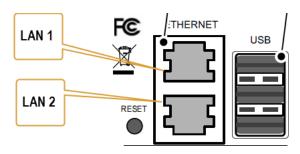


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### 2.9.4.1 LD6 LAN Ports

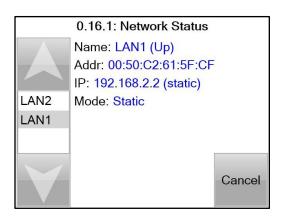
There are two RJ45 LAN ports mounted under the power connector on the extreme left of the rear panel labelled "Ethernet".

The upper port is LAN1, the lower port is LAN2.



#### 2.9.4.2 Network Status

Touch **Settings/Network/Status** button to display the current settings of the ports.



The *Up/Down* arrows may be used to switch between LAN1 and LAN2. The following information is displayed:

Name LAN1 or LAN2

(Up = Connected, Down = Disconnected)

Addr MAC address of network interface card

IP Current IP address of LAN port

Mode Static or DHCP

Static = Fixed IP which can be set by user

**DHCP** = Dynamic IP, normally assigned by a DHCP server

If an IP is assigned from the server, it is displayed followed by "(auto)".

If no IP is assigned from the server, the LAN port falls back to the static IP. The static IP is displayed followed by "(fallback)".

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### 2.9.4.3 Network Configuration

From the **Network** menu touch the **Config** button to open the configuration page.

Use the *Up/Down* arrows to switch between LAN1 and LAN2. The display shows the port name, current IP and current mode.

To change the current configuration, touch the *Next* button.

Use the *Up/Down* arrows to change the mode if required, then touch the Next button to move to the next setting. It is necessary to cycle through all four pages in order to reach the "Finish" button which is used to accept the changes.

These pages allow the user to set:

Set	Description
Mode	Choose between Static or DHCP – Veripos recommend use of Static
Static Address	To Set Static / Fallback address
Subnet Mask	To set the Subnet Mask info
Gateway Address	Where required – Use Finish button to confirm changes.

### 2.9.4.4 LAN Default Settings

The LAN default settings are as follows:

Mode: STATIC

Static IP (LAN1): 192.168.002.002

Static IP (LAN2): 192.168.003.003

Subnet Mask: 255.255.255.000

Gateway Address (LAN1): 192.168.002.001

Gateway Address (LAN2) 192.168.003.001

### 2.9.4.5 LAN Interface - TCP Port Numbers

All interfaces can be supported using a single CAT5e or CAT6 network cable.

Cable runs typically encountered on vessels fall within the Ethernet specification. This contrasts to using RS232 where multiple cables are required and longer runs may pose problems when high baud rates are required [e.g. for GNSS Raw data].

All I/O signals which are available on the COM ports can also be interfaced via the LAN. The table below shows the TCP port number which outputs and inputs are available on:

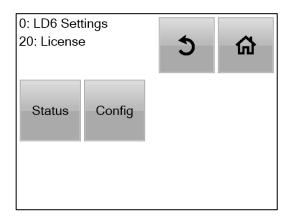
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Port	Port number	Notes
L-Band RTCMa	9001	
L-Band RTCMb	9002	
L-Band control	9003	
GNSS Raw	9012	Use only under VERIPOS guidance
GNSS NMEAa	19016	
GNSS NMEAb	19017	
GNSS NMEAc	19018	
MF RTCM	9031	If card present
UHF RTCM	9051	If card present
TIDES	9900	If Quantum operational
TRINAV	9901	If Quantum operational

#### 2.9.5 License

LD6 IMU's running software version 105can be used to produce a GNSS heading solution. In order to use this feature, it must first be activated. A license code can be obtained from the VERIPOS Helpdesk.





A hardware modification is also required if the GNSS feature requires to be enabled after initial installation. This modification adds a second GNSS antenna (Auxiliary) input. Contact VERIPOS Helpdesk to get further information regarding the required hardware upgrade.

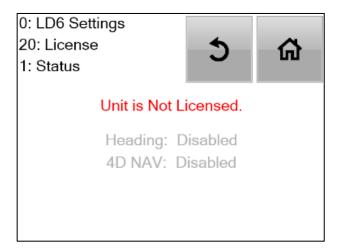
#### 2.9.5.1 License Status

To check if the GNSS feature has been activated on the LD6, check the **Status** page within the **License** menu.

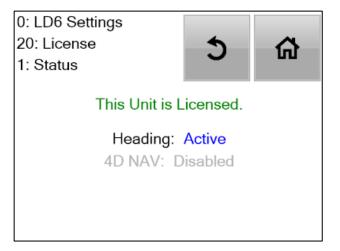
LD6's not enabled for GNSS heading will display the following message;







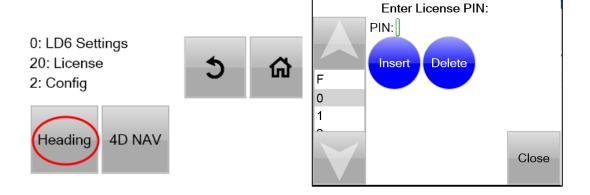
LD6's which are enabled for GNSS heading will display the following message;



## 2.9.5.2 License Config

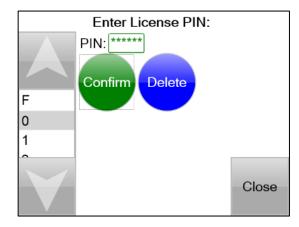
Use the *License Config* page to enter the LD6 heading PIN to enable the GNSS heading feature.

Once the license PIN has been obtained, enter using the *Up/ Down* arrows and the *Insert* icon to select a value.





When all characters have been entered, the *Insert* icon will be replaced by a *Confirm* icon. Press *Confirm* to apply.

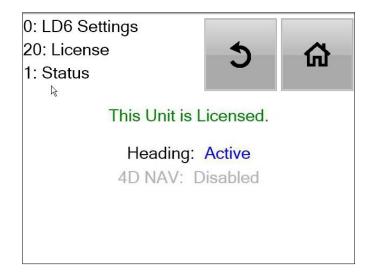


A message will then appear to indicate if the code entered was valid or not. If the code was not valid, check and re-enter. If it is still not accepted, contact the VERIPOS Helpdesk.





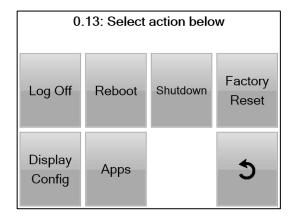
The license can be confirmed as shown below.



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### 2.10 ACTIONS

From the Home page select Actions. This displays the menu below





The **Display Config** and **Apps** icon will only be displayed if an external monitor has been connected to the LD6.

Certain actions, e.g. Factory Reset, should only be undertaken under instruction from a VERIPOS technician.

## 2.10.1 Log Off

Should only be used under instruction from VERIPOS.

## 2.10.2 Reboot

Will perform a system restart of the LD6. Positioning will be lost while LD6 is rebooting.

### 2.10.3 Shutdown

Will shut down the LD6 system. Once the system shuts down the power switch on the front of the LD6 should be switched off to ensure fans are powered off.



The LD6 should always be shut down via this icon before being switched off.

## 2.10.4 Factory Reset

Should only be used under instruction from VERIPOS and will reset all values back to default. This action is password protected.

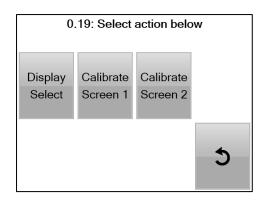
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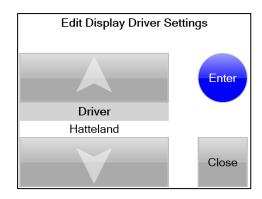
### 2.10.5 Display Config

### 2.10.5.1 Display Select

The **Display Select** menu is only relevant when a touch-screen enabled external monitor is connected to the LD6. This setting allows the correct drivers to be installed. The supported touch-screen monitors are **Hatteland** and **Norco**. For use with other monitors it is recommended to contact VERIPOS for further advice.

Select the appropriate drivers for the monitor in use using the *Up/Down* arrows then press *Enter*.







NOTE

After editing the Display select settings, a reboot will be required to ensure settings are applied resulting in a temporary loss of positioning.

## 2.10.5.2 Dual Monitor Screen Layout

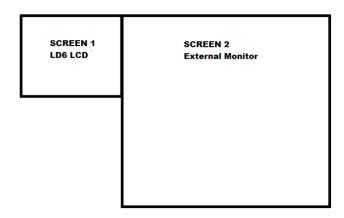
When an external monitor is attached, the external monitor effectively becomes an extension of The LD6 screen. The LD6 screen is *always* defined as screen 1 and the external screen is screen 2.

A mouse can be used to control both screen 1 and screen 2. To move the mouse from the LD6 screen on to the external monitor, drag the mouse to the right.

To move the mouse from the external monitor to the LD6 screen, drag the mouse to the top left of the monitor.

The screen layout used is shown below:

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### 2.10.5.3 Calibrate Screen 1 / 2

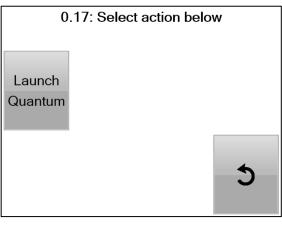
Touch these buttons when displayed and follow the instructions to calibrate the touchscreen.



The Calibrate Screen 2 will only appear when an external monitor has been connected.

## 2.10.6 Apps

The Apps button is where the on-board application *Quantum* can be launched:



\_\_\_\_\_ NOTE \_\_\_\_\_\_

The *Apps* icon will only appear when a VGA monitor has been connected to the LD6.

## 2.10.6.1 Launch Quantum

This will launch the VERIPOS Quantum software. Quantum will be displayed on the attached VGA monitor.

Please refer to the *Quantum User manual* for further information on its use. This manual is available at <a href="https://help.veripos.com">https://help.veripos.com</a>.

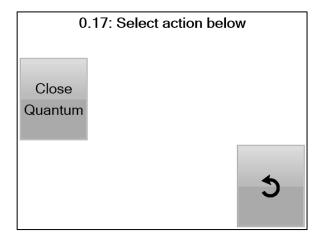




A Quantum License must be obtained in order to use the Quantum software.

#### 2.10.6.2 Close Quantum

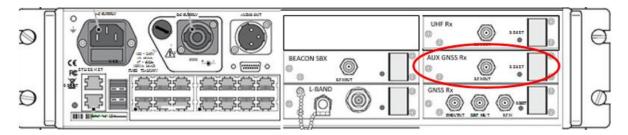
While Quantum is already running, the *Launch Quantum* icon will be replaced by a *Close Quantum* icon. Press this to close the Quantum software.



# 2.11 LD6 GNSS HEADING

LD6's may be fitted with dual input GNSS cards to provide a GNSS heading solution. This feature would most typically be requested before the LD6 is provided, however the GNSS heading can be enabled at a later date.

In order to use GNSS heading on an LD6, it must have a second (AUX) GNSS antenna input fitted to the module bay at the rear;



If the above *AUX* antenna input is not present and you require the GNSS heading feature, please contact the VERIPOS Helpdesk who will be able to assist to arranging the required upgrade.

Once the *AUX* connection is installed, the heading feature can be enabled by entering the heading license code via the LD6 front panel. Please refer to **Section 2.9.5** for further details on GNSS heading licenses.



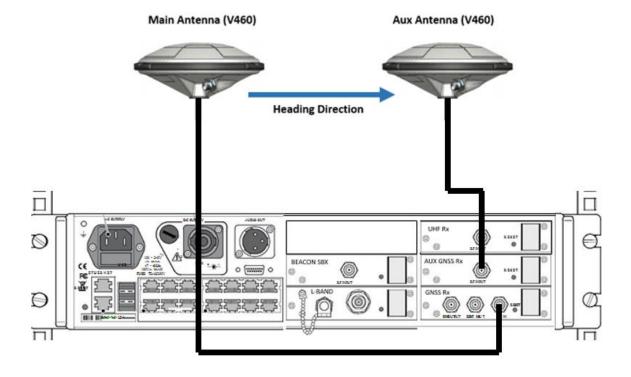
## 2.11.1 LD6 GNSS Heading Accuracy

The heading solution accuracy is dependent upon the baseline between the *Main* and *Aux* antennas. The longer the baseline, the better the heading solution will be. For example,

Antenna Baseline	Accuracy
0.5m	0.40°
1.0m	0.20°
2.0m	0.10°
5.0m	0.04°
10.0m	0.02°

After antenna installation, it is recommended that an offset calibration survey is conducted to compute any required heading C-O and establish precise offsets for the *Main* GNSS antenna.

Further guidance regarding antenna installation can be found in the *LD6 Installation Manual*.





### 2.12 ARCHIVING DATA

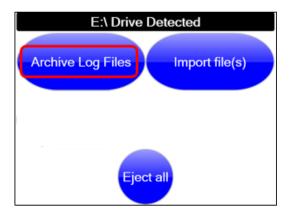
In the event of any receiver issues, such as loss of solution, it is possible to archive the raw GNSS and RTCM data in a VERIPOS proprietary format. These files can then be sent to VERIPOS for analysis in order to determine the cause of any issues.

The last 72 hours of data will be retained, then the oldest data will be overwritten.



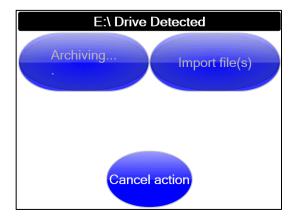
\_\_\_\_\_

To archive LD6 data, insert a USB memory stick into an available LD6 USB socket. The screen below will appear:



Select **Archive Log Files** to commence archiving the raw logged data to the USB memory stick.

The screen will now show that the data is currently being archived and an option to cancel the operation will be available if required:



The data archive may take several minutes and is complete when the *Eject all* icon becomes available.

Before removing the USB memory stick from the LD6, ensure that *Eject all* is pressed. This will then allow the USB memory stick to be safely removed.



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## 2.13 USE OF EXTERNAL TOUCHSCREEN MONITORS

A touchscreen monitor can be connected to the LD6. The VERIPOS *Quantum* software however is not designed to be operated via touchscreen. VERIPOS recommend using a USB keyboard and mouse to control the *Quantum* software.

Touchscreen monitors require both VGA and USB connection to the LD6. VERIPOS recommend the use of USB 2.0 cables, up to a maximum length of 5 metres.

The LD6 supports the use of *NORCO* and *HATTELAND* touchscreen monitors. Refer to **Section 2.10.5** for information on touchscreen display configuration.

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## 3. VERIPOS SOFTWARE COMPATIBILITY

LD6 system's running software version 105 are compatible with the following VERIPOS software:

• Quantum visualisation software

LD6 IMU's running software version 105 are **NOT** compatible with:

- Orion DP software
- Verify QC software

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### 4. TROUBLESHOOTING

The LD6 uses a touch screen to access an embedded Windows XP operating system.

The system contains no user-serviceable parts.

The cover should not be removed except under the guidance of a VERIPOS engineer, first ensuring that the unit is isolated from all AC and DC power supplies.

Problems experienced when using the LD6 system relate to antenna connectivity, correction signal reception, configuration errors or relate to the GNSS satellite positioning signal reception for inclusion in calculating a position solution.

Use this section to assist with any problems encountered when using LD6 NovAtel.

### 4.1 HARDWARE

Hardware fault finding should be limited to checking the security of connectors and checking supply voltage.

It is **strongly recommended** before detailed investigation is undertaken to first check coaxial cable integrity and correct location of antennas.

This manual provides some guidance for troubleshooting the LD6 IMU.

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## 4.2 POWER FAULTS

Fault	Reason	Remedy
	Shutdown has been activated from Action menu but the power switch in on position	Toggle the power switch. This will reboot the unit and the MMI should appear.
	External supply fault, disconnected or switched off	Check power to the LD6. Adjust screen brightness using the control on the left side of the LD6.  Check power connections to the unit for physical and electrical integrity.
Screen blank	Fault in AC Supply	Disconnect the power supply. Check voltages to and from unit. The LD6 AC is 110/240 V  Check fuse within the AC (IEC) power socket.  See the proceeding text and table for the AC fuse replacement information.
	Fault in DC supply	DC power 12–24 VDC. Reconnect power and allow LD6 to restart.
	LD6 fault.	If the PSU voltage is correct contact the VERIPOS Helpdesk.
	Screen brightness turned down	Use the brightness control knob to increase screen brightness.

The AC power is connected to an LD6 via a AC power connector. This type of AC power socket (IEC) has an integral AC fuse. In the event that the LD6 cannot power up the procedure and table below explains the step by step actions to be followed to test or replace the AC power fuse.





Figure 1 Fuse Holder and Rating

**Step 1** Ensure the AC power connector is **completely disconnected** before proceeding. The outline of the fuse holder is highlighted in red. The fuse type to be used is **T2AH250V**. **Do not use a fuse with an incorrect rating**.



Figure 2 Unclipping Holder 1

**Step 2** Using a flathead screwdriver gently pry free the side connecting clip.



Figure 3 Unclipping Holder 2

**Step3** Repeat for the opposite side connecting clip. The fuse holder will lift slightly out of the normal position.



Figure 4 Extracted Fuse Holder

**Step 4** The fuse holder can then be completely extracted by hand.



Figure 5 Extracted Fuse

Step 5 The fuse can be removed from the fuse holder.



Figure 6 Fuse Continuity Check

Step 6 The fuse continuity can be tested using a multimeter OR simply replaced with a new fuse. Reinsert the fuse into the holder and reinsert the fuse holder until it clips into a **fully closed** position. Finally connect the AC power cable and power up the system.

If the LD6 does not power up then there may be a more serious hardware fault, contact the VERIPOS Helpdesk with the details of the problem for further support.

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# 4.3 ENABLE \ DISABLE FAULTS

Fault	Reason	Remedy
Enable indicator shows red.  ID: 47033	Unit disabled; Access code incorrect.	Contact VERIPOS helpdesk for appropriate enable code.  Repeat entry of code. Use Quick Guide.  Disconnect unit from power for one minute.  Reconnect and allow to initialise, then repeat entry of code.
Unable to enter an Access code.  ID: 47033	Not receiving LBAND signal. 'Sync' icon is Red.	Unit needs to receive a beam (LBAND frequency) for the global work region before it can be enabled / disabled.  Ensure LBAND antenna is connected, has a clear view of sky to equator.  Use the Quick Guide to select and confirm a valid regional satellite beam has been selected for the work area.



# 4.4 LBAND SIGNAL FAULTS

Fault	Reason	Remedy
	No sync with satellite beam	Use the <u>L-band Coverage Map</u> to check which beam is correct for current location.
	No beam being received. Unit requires a restart	Go to <b>LBAND/Config/Beams</b> to check and, if required, amend to the correct regional beam.
		Where L-BAND signal is derived from vessel's Inmarsat. – Unit may have lost beam lock or has switched to a different geostationary satellite. Confirm the Inmarsat is tracking the correct satellite. Check the correct frequency is entered - refer to Section 4 of this manual. Contact Helpdesk.
<b>Sync</b> indicator shows red.	Vessel has moved to a new work region - beam used has not been	Check which beam is selected at LBAND/Status/ Device Status.
	changed	If necessary consult the <u>L-band Coverage Map</u> and if required select the regional beam.
ID: 47033 S (E)	Antenna blockage	Visually check whether the path between the antenna and satellite is subject to blockage.
		This can occur when the vessel is in port and/or alongside a large structure. Blockage can also be caused by the vessel's own superstructure. This may be eliminated by changing the heading.
	Interference	Investigate any source of L-BAND transmissions and high power transmissions of other frequencies.
		If possible shut down possible sources to eliminate them.
	Antenna disconnected or inoperative	Visually check antenna and cable for DC power and damage. Check coaxial connections and inspect antenna for damage.
	l .	



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# 4.5 GNSS SIGNAL FAULTS

Fault	Reason	Remedy
No Position displayed on Home Screen	Antenna placement.	Visually check whether there are any physical obstructions preventing the GNSS antenna from having a clear view of the sky.
		This can occur when the vessel is in port and/or alongside a large structure. Blockage can also be caused by the vessel's own superstructure.
	Interference.	Investigate any source signal transmissions around the same frequency as GNSS and high power transmissions of other frequencies.
		If possible shut down possible sources to eliminate them.
	Antenna disconnected or inoperative.	Visually check antenna and cable for DC power and damage. Check coaxial connections and inspect antenna for damage.

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# 4.6 GNSS HEADING FAULTS

Fault	Reason	Remedy
No GNSS heading available	No GNSS reception from Aux GNSS antenna.	Visually check antenna and cable for DC power and damage. Check coaxial connections and inspect antenna for damage.
		Confirm there are no potential sources of interference or physical obstructions around the <i>Aux</i> GNSS antenna.
	No GNSS reception from <i>Main</i> GNSS antenna.	Check the LD6 Home Screen to check if a valid GNSS signals are being received (GNSS icon should be green). Red GNSS icon indicates a problem with the <i>Main</i> GNSS feed.
		Visually check antenna and cable for DC power and damage. Check coaxial connections and inspect antenna for damage.
		Confirm there are no potential sources of interference or physical obstructions around the <i>Main</i> GNSS antenna.
	GNSS Heading Feature not enabled.	Check the <b>GNSS/Config</b> menu. If no " <b>Heading C-O</b> " menu is present, then GNSS Heading has not been activated.
		Contact VERIPOS Helpdesk for a GNSS Heading licence PIN.
GNSS Heading solution value not as expected	Incorrect heading offset (C-O) entered via the LD6 MMI	Navigate to the C-O setting within the GNSS/ Configmenu on the LD6. Update the C-O value to align the heading solution with vessel North.
	No C-O entered	Check the orientation of the LD6 Main & Aux GNSS antennas. If not installed in line with vessel North (Main furthest aft), the heading solution will need to be corrected.
		Alternatively and preferably, output a raw heading value from the LD6 and enter the C-O value within the receiving vessel system. Do not enter C-0 in LD6 & vessel system!



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# 4.7 QUANTUM FAULTS

Fault	Reason	Remedy
The Quantum	l -	Connect a secondary monitor to the VGA
icon is greyed out	not connected	connector and reboot the system using the Actions menu.
Quantum is not displayed in the Apps screen	Hardware version may be incorrect	Check the software version of the LD6 via <b>Settings</b> > <b>Status</b> . Contact VERIPOS with the version to discuss upgrade.
Tides data is not output.	Quantum is not operational	Execute the Quantum software by using the APPS menu (ensuring the external monitor is connected to the LD6).
TRINAV data is not output	Quantum is not operational	Obtain and apply a valid quantum license and activated. Execute the Quantum software by using the APPS menu (ensuring the external monitor is connected to the LD6).

Please refer to the Quantum user manual for detailed guidance. This manual can be obtained at via clicking <a href="here">here</a>.

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#### 4.8 VERIPOS HELPDESK

For assistance with basic troubleshooting please refer to the section in this manual.

VERIPOS encourage all users to report problems or operating queries to the Helpdesk so that they may receive assistance.

For general help please see the extensive library of FAQ and reference material on the VERIPOS Online support system, VOSS at:

#### https://help.veripos.com

The VERIPOS Helpdesk is the first point of contact for technical enquiries and fault reports. It is manned 24 hours per day, 365 days per year. Helpdesk contact details are in the *Contact information* chapter. VERIPOS recommend initial contact is made by email.

You can also create a fault ticket accessed from the VOSS. Using this system will ensure contact details, fault description etc. are correctly recorded and you can track progress without using email.

The Helpdesk is trained to provide assistance to most queries. They can request technical staff to provide support for complex issues.

To ensure a rapid response, initial communication should include the following information:

- User's name
- Telephone number

If possible, choose a phone near the equipment.

- Email address
- Full vessel name

Correct identification is important; VERIPOS may have installation drawings.

- Name of parent company
- **User Code** (on front panel) and current 'Access code' of LD6, see the Operation chapter for details.
  - Current status of the LD6
  - Brief description of other VERIPOS hardware and software installed
  - Vessel's current operating region and lat/long.
  - Vessel's status

Is it alongside, in transit, in operation, or shut down due to fault?

- History of fault including time when a problem occurred.
- Is this a new installation which has not yet been fully commissioned?
- Did a problem suddenly arise with a system which was previously operational?
- Did the system cease working after moving to a new region?
  - Description of fault

Once basic information has been received the Helpdesk will raise a fault ticket. Users can access the ticket from the VOSS site.



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# 5. REFERENCE INFORMATION

#### 5.1 SERVICE ACCESS LICENCE AND SERVICES NOTIFICATION FORM

VERIPOS correction signals are provided as a chargeable service.

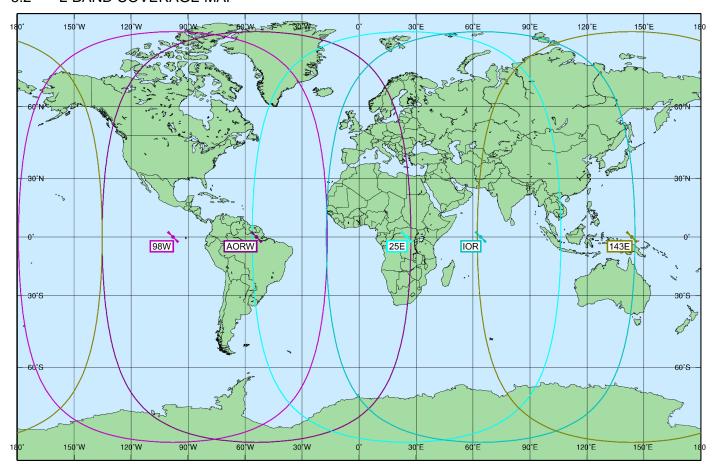
In order to receive this service the user must first arrange a **Service Access License** (SAL). This takes the form of a contract which is agreed between the user's company and the VERIPOS Operations department.

The equipment cannot be used until an enable code is obtained from the VERIPOS Helpdesk. The Helpdesk is not authorised to issue a code unless an active SAL exists and its number can be determined. To avoid delays the user should keep a record of the SAL number associated with his unit.



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# 5.2 L-BAND COVERAGE MAP

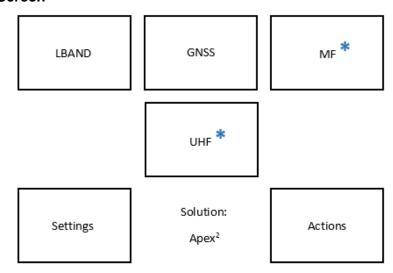


An up-to-date VERIPOS L-band Coverage Map can be found on the VERIPOS Online support system at <a href="https://help.veripos.com">https://help.veripos.com</a>.



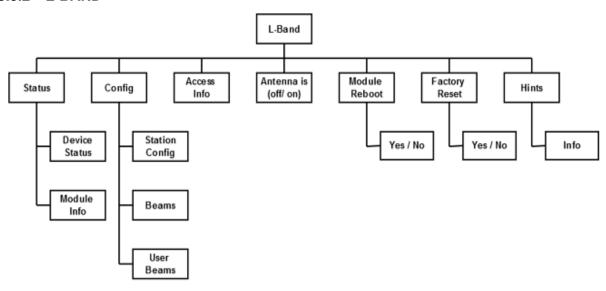
# 5.3 LD6 MENU STRUCTURE

# 5.3.1 Home Screen



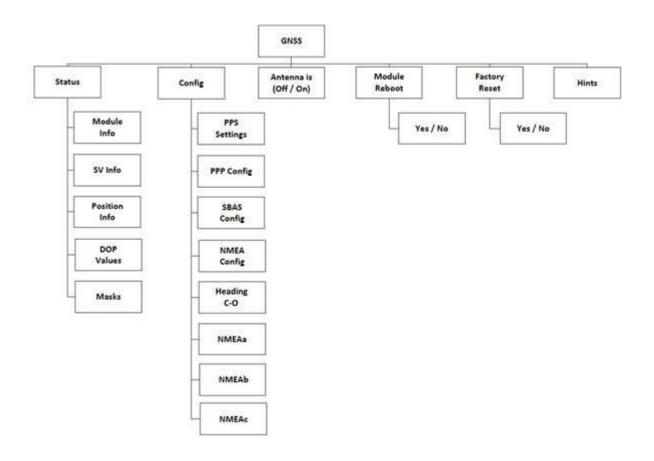
\* Icon appears only if relevant receiver card is fitted

# 5.3.2 L-BAND

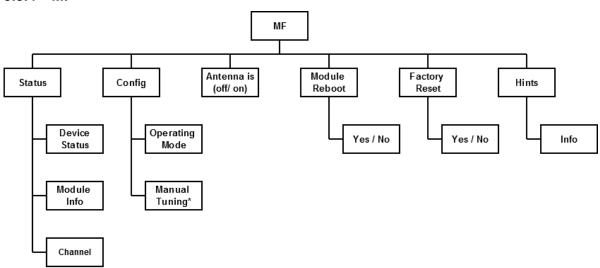


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# 5.3.3 GNSS



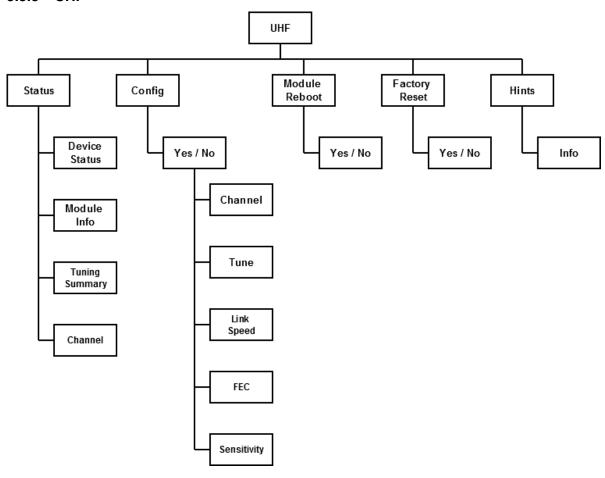
### 5.3.4 MF



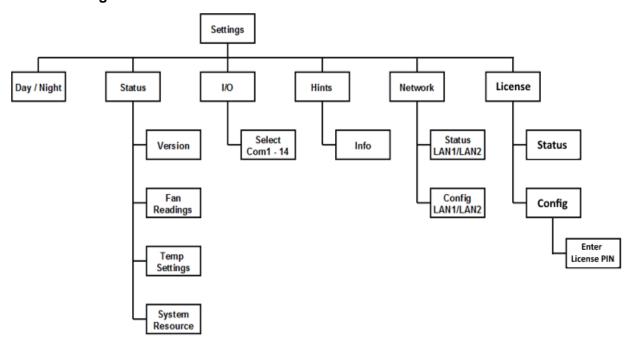
<sup>\*</sup> Manual Tuning page is only available whenin Manual Mode

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5.3.5 UHF

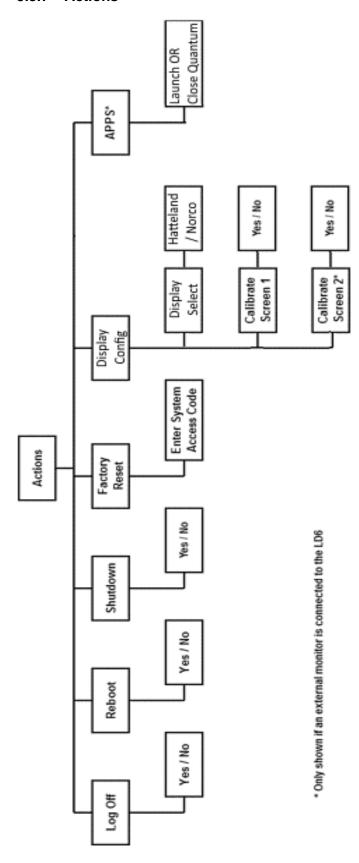


# 5.3.6 Settings





# 5.3.7 Actions





#### 5.4 ADD USER BEAM

The 'User Beam' facility is provided for the manual entry of new satellite beams to receive VERIPOS corrections.

Use this channel for your work region ONLY when advised by VERIPOS.

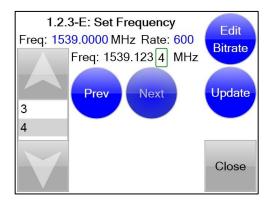
# Go to LBand/ Config/ Beams User Beams/ Edit



Use the Arrow buttons to Select from pre-set names, 'User 1-3'.

Where a new beam frequency needs to be entered:

On the **User beam** to edit (User1 - 3), touch **Edit** and use the **Arrow** buttons / **Next** to enter the frequency and Bitrate (normally 1200).



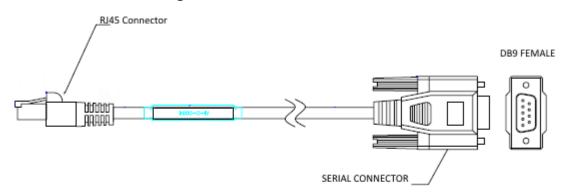
Touch *Update* to enter the frequency. Finally navigate to *Home / LBAND /Config / Beams* and *Enable* the User beam as required.

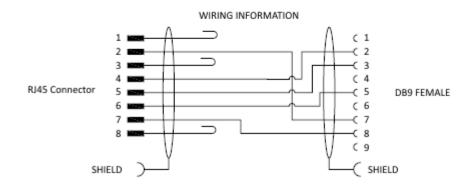




# 5.5 COM AND LAN PORT INFORMATION

# 5.5.1 LD6 Serial Cable Wiring





DB9	RS-232	RS422
1	Not connected	Not connected
2	TxD	Tx(-)
3	RxD	Rx(+)
4	Not connected	Not connected
5	Signal ground	Signal Ground
6	Not connected	Not connected
7	Not connected	Tx(+)
8	Not connected	Rx(-)
9	Not connected	Not connected



The LD6 is the transmitting device.

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#### 5.6 QUALITY STANDARDS

A number of standards offer marine satellite navigation system users DGNSS (DGPS/DGPS+DGLONASS) quality information. The most well-known and frequently referred to standards are:

- 1. NMEA-0183
- 2. UKOOA

Each standard is explained in more detail in the following sections.

NMEA have recently introduced the NMEA-2000 interface standard. This standard falls outside the scope of this document. See <a href="https://www.nmea.org">www.nmea.org</a> for further information.

# References

- [1] Guidelines for the use of Differential GPS in offshore surveying, UKOOA, 1994
- [2] NMEA 0183 Standard for interfacing marine electronic devices, version 3.01, January 1, 2002
- [3] Guidelines on the use of DGPS as a positioning reference in control systems, IMCA M 141. October 1997

#### NMEA-0183 STANDARD

The National Marine Electronics Association (NMEA) has developed a specification defining the interface between various pieces of marine electronic equipment. The standard permits marine electronics to send information to computers and to other marine equipment via a serial interface. A full copy of this standard is available for purchase at their web site (<a href="www.nmea.org">www.nmea.org</a>). The current version of the standard is 3.01.

GPS receiver communication is defined within this specification. The idea of NMEA is to send a line of data called a sentence that is totally self-contained and independent from other sentences. There are standard sentences for each device category and in addition NMEA permits hardware manufactures to define their own proprietary sentences for whatever purpose they see fit. All standard sentences have a two letter prefix defining the device using that sentence type. For GPS receivers the prefix is GP followed by a three letter sequence defining the sentence contents. All proprietary sentences begin with the letter P and are followed with 3 letters identifying the manufacturer controlling that sentence.

NMEA consists of sentences, the first word of which, called a data type, defines the interpretation of the rest of the sentence. Each data type has its own unique interpretation and is defined in the NMEA standard. Each sentence begins with a '\$' and ends with a carriage return/line feed sequence no longer than 80 characters of visible text (plus the line terminators). The data is contained within this single line with data items separated by commas. The data itself is ASCII text and may extend over multiple sentences in certain specialized instances but is normally fully contained in one variable length sentence. The data may vary in the amount of precision contained in the sentence. For example time might be indicated to decimal parts of a second or location may be shown with 3 or even 5 digits after the decimal point. Programs reading the data should only use the commas to determine the field boundaries and not depend on column positions. There is a provision

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for a checksum at the end of each sentence which may or may not be checked by the unit reading the data. The checksum field consists of a '\*' and two hex digits representing the exclusive OR of all characters between, but not including, the '\$' and '\*'. A checksum is required on some sentences.

There have been several changes to the standard but for GPS use the only ones that are likely to be encountered are 1.5 and 2.0 through 2.3. Version 2.3 added a mode indicator to several sentences used to indicate the kind of fix the receiver currently has. The value can be A=autonomous, D=differential, E=Estimated, N=not valid, S=Simulator. Sometimes there can be a null value as well. Only the A and D values correspond to an active and reliable sentence. This mode character has been added to the RMC, RMB, VTG, and GLL, sentences and optionally some others including the BWC and XTE sentences.

The hardware interface for GPS receivers is designed to meet the NMEA requirements. They are compatible also with most computer serial ports using RS232 protocols, however strictly speaking the NMEA standard is not RS232. They recommend conformance to EIA-422. The interface speed generally can be adjusted but the NMEA standard is 4800 baud with 8 bits of data, no parity, and one stop bit. All GPS receivers supporting NMEA should support this speed. Note that, at a baud rate of 4800, you can easily send enough data to more than fill a full second of time.

At 4800 baud 480 characters per second can be sent. As an NMEA sentence can be as long as 82 characters this can be limited to less than six different sentences. The actual limit is determined by the specific sentences used and it is easy to overrun the capabilities for rapid sentence response.

A cable is required to connect to the GPS receiver output. Data can be output also via Ethernet or wireless connection. For general NMEA use with a GPS receiver only two wires are required in the cable, data out from the GPS receiver and ground.

# **UKOOA STANDARD**

The UK Offshore Operator Association (UKOOA) issued 'Guidelines for the use of Differential GPS in offshore surveying' in 1994. These guidelines set out what is generally regarded as good practise in the offshore industry. They are not mandatory and operators are free to adopt different guidelines or standards.

These guidelines are now dated in certain areas due to advancements in positioning technology and algorithms. However, they contain useful suggestions for quality monitoring as indicated below [see 1]: -

"To assist DGPS operators and client representatives to monitor the quality of the DGPS system in real-time the following information should be continuously available:

- Pseudo-range residuals of all SV's and observation weight values used
- Unit variance
- Number of satellites in view and number used in solution
- Redundancy of least squares solution
- DOP values (HDOP, PDOP and VDOP)
- Latency of differential correction data
- Position comparisons derived from different reference stations
- Derived antenna height with respect to "known" height



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Monitor station information, especially position error measured at the monitor station. All data should be time tagged

Maximum external reliability figure and observation carrying it"

The UKOOA guidelines present a set of test statistics and quality measures recommended for use with DGPS. In its final recommendations [see 1] it states: -

"It is essential to assess the precision and reliability of each position in order to ensure the quality of the DGPS measurements. Thus is recommends that the following processing steps be implemented: -

w-test for outliers carried out for each position fix

F-test for unit variance carried out for each position fix

When no more outliers are identified in any fix, precision and reliability measures will be calculated:

Precision: a-posteriori error ellipse

Reliability: external reliability (positional MDE using a power of

test of 80%)"

Where accuracy and precision statistical parameters are generated these all represent a 95% ( $2\sigma$ ) confidence region.

Appendix A of the UKOOA guidelines emphasises this by listing 'Suggested parameters to be specified by a system user for typical marine survey operations' and states that 'In order to carry out rigorous QC, the covariance matrix generated by the least squares computation should be used to generate test statistics and quality measures'.

It recommends the following Test Statistics:

used to detect outliers 1. w-test

2. F-test used to verify the model which is being used to account for

'errors' in the DGPS observations

It recommends also the following Quality Measures:

an approximate graphical representation of the positional 1. Error Ellipse

standard deviation in two dimensions

2. External Reliability the effect of the maximum MDE (Marginally Detectable Error)

on the computed position

These recommendations are particularly aimed at survey applications but could be applied equally to DP applications.

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#### **NMEA SENTENCES** 5.7

This section describes the message structure of the following LD6 NMEA output messages:

GGA	GLL*	VTG*	ZDA	GST*	GSA*
GSV	GRS*	RMC*	HDT	THS	UKOOA



\*Message talker ID will differ depending on calculation being computed. For example, a GPS only solution such as Apex will begin GPxxx, whereas a solution utilising more than one constellation such as Apex<sup>2</sup> will begin GNxxx.

# **NMEA GGA Sentence**

The NMEA GGA sentence contains time and position fix related data for a GPS system. It includes basic quality information, which is limited to 'Fix Quality', 'Number of Satellites in Use', 'HDOP' and 'Age of Differential GPS Data'.

Structure and Example: -

\$GPGGA,hhmmss.ss,ddmm.mmm,a,dddmm.mmm,b,q,xx,p.p,a.b,M,c.d,M,x.x,nnnn\*hh<CR

\$GPGGA,123519,4807.0378783,N,01131.0054784,E,1,08,0.9,545.4,M,46.9,M,,\*47

GGA sentence defined: -

GGA	Global Positioning System Fix Data
hhmmss.ss	UTC of position
ddmm.mmm	latitude of position
а	N or S, latitude hemisphere
dddmm.mmm	longitude of position
b	E or W, longitude hemisphere
q	GPS Quality indicator (0 = invalid, 1 = GPS SPS, 2 = DGPS fix, 3 =
	GPS PPS, 4 = Fixed RTK, 5 = Float RTK, 6 = Estimated (dead
	reckoning), 7 = Manual Input Mode, 8 = Simulation Mode
XX	number of satellites in use
p.p	horizontal dilution of precision
a.b	antenna altitude above mean-sea-level
M	units of antenna altitude, meters
c.d	Geoidal height
M	units of geoidal height, meters
X.X	age of differential GPS data
nnnn	Differential reference station ID, 0000 to 1023
*hh <cr><lf></lf></cr>	checksum, carriage return and line feed



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### **NMEA GLL Sentence**

The NMEA GLL sentence provides 2D position data.

Structure and Example:

GLL sentence defined:

GLL = Geographic position - Latitude and Longitude

ddmm.mmmmmm latitude of position

a N or S

dddmm.mmmmmm longitude of position

b E or W

hhmmss.ss UTC of position

S status (A = data valid; V = data not valid)

I mode indicator (A = Autonomous, D = Differential, E = Estimated, M = Manual, S =

Simulator, N = data Not valid)

\*cc<CR><LF> checksum, carriage return and line feed

### **NMEA VTG Sentence**

The NMEA VTG sentence provides the actual course and speed relative to the ground.

Structure and Example:

\$GPVTG,p.p,T,q.q,M,r.r,N,s.s,K,u\*hh<CR><LF>

\$GPVTG,054.7,T,034.4,M,005.5,N,010.2,K\*33

VTG sentence defined:

VTG = Course over ground and ground speed

p.p course over ground

T degrees True

q.q course over groundM degrees Magneticr.r speed over ground

N knots

s.s speed over ground

K km/hr

U mode indicator (A = Autonomous, D = Differential, E = Estimated)

Note that, as of the 2.3 release of NMEA, there is a new field in the VTG sentence at the end just prior to the checksum. Receivers that don't have a magnetic deviation (variation) table built in will null out the Magnetic track made good.

<sup>\*</sup>hh<CR><LF>checksum, carriage return and line feed



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# **NMEA ZDA Sentence**

The NMEA ZDA sentence provides time and time zone information.

Structure and Example:

\$GPZDA,hhmmss.ss,dd,mm,yyyy,xx,yy\*hh<CR><LF> \$GPZDA,201530.00,04,07,2002,00,00\*6E

#### ZDA sentence defined:

ZDA = Time & Date

hhmmss.ss UTC time in hours, minutes, seconds of the GPS position

dd,mm,yyy Day,Month,Year (UTC)

xx local zone hours (00 to +/-13 hrs) yy local zone minutes (00 to 59)

\*hh<CR><LF> checksum, carriage return and line feed

# **NMEA GST Sentence**

The NMEA GST sentence provides error statistics of the position fix. These statistics follow from the position calculation process.

Structure and Example:

\$GPGST,hhmmss.ss,a.a,b.b,c.c,d.d,e.e,f.f,g.g\*hh<CR><LF>\$GPGST,024603.00,3.2,6.6,4.7,47.3,5.8,5.6,22.0\*58

#### GST sentence defined:

GST = GNSS Pseudo-range Error Statistics			
hhmmss.ss	UTC time in hours, minutes, seconds of the GPS position		
a.a	RMS value of the standard deviation of the range inputs to		
	the navigation process. Range inputs include pseudo-ranges		
	and differential DGNSS corrections		
b.b	Standard deviation of semi-major axis of error ellipse (meters)		
C.C	Standard deviation of semi-minor axis of error ellipse (meters)		
d.d	Orientation of semi-major axis of error ellipse (meters)		
e.e	Standard deviation of latitude error (meters)		
f.f	Standard deviation of longitude error (meters)		
g.g	Standard deviation of altitude error (meters)		
*hh <cr><lf></lf></cr>	checksum, carriage return and line feed		

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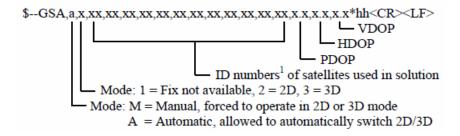
### **NMEA GSA Sentence**

GSA sentence defined:

**GNSS DOP and Active Satellites** 

GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence, and DOP values.

If only GPS, GLONASS, etc. is used for the reported position solution the talker ID is GP, GL, etc. and the DOP values pertain to the individual system. If GPS, GLONASS, etc. are combined to obtain the reported position solution multiple GSA sentences are produced, one with the GPS satellites, another with the GLONASS satellites, etc. Each of these GSA sentences shall have talker ID GN, to indicate that the satellites are used in a combined solution and each shall have the PDOP, HDOP and VDOP for the combined satellites used in the position.



#### Notes:

- 1) Satellite ID numbers. To avoid possible confusion caused by repetition of satellite ID numbers when using multiple satellite systems, the following convention has been adopted:
  - a) GPS satellites are identified by their PRN numbers, which range from 1 to 32.
  - b) The numbers 33-64 are reserved for WAAS satellites. The WAAS system PRN numbers are 120-138. The offset from NMEA WAAS SV ID to WAAS PRN number is 87. A WAAS PRN number of 120 minus 87 yields the SV ID of 33. The addition of 87 to the SV ID yields the WAAS PRN number.
  - c) The numbers 65-96 are reserved for GLONASS satellites. GLONASS satellites are identified by 64+satellite slot number. The slot numbers are 1 through 24 for the full GLONASS constellation of 24 satellites, this gives a range of 65 through 88. The numbers 89 through 96 are available if slot numbers above 24 are allocated to onorbit spares.



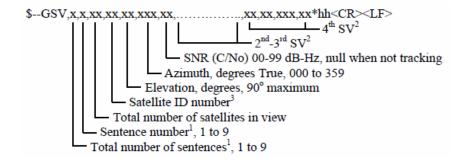
#### **NMEA GSV Sentence**

GSV sentence defined:

**GNSS Satellites in View** 

Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. Four satellites maximum per transmission. Total number of sentences being transmitted and the number of the sentence being transmitted are indicated in the first two fields.

If multiple GPS, GLONASS, etc. satellites are in view, use separate GSV sentences with talker ID GP to show the GPS satellites in view and talker GL to show the GLONASS satellites in view, etc. The GN identifier shall not be used with this sentence.



#### Notes:

1) Satellite information may require the transmission of multiple sentences all containing identical field formats when sending a complete message. The first field specifies the total number of sentences, minimum value 1.

The second field identifies the order of this sentence (sentence number), minimum value 1. For efficiency it is recommended that null fields be used in the additional sentences when the data is unchanged from the first sentence.

- 2) A variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.
- 3) Satellite ID numbers. To avoid possible confusion caused by repetition of satellite ID numbers when using multiple satellite systems, the following convention has been adopted:
  - a) GPS satellites are identified by their PRN numbers, which range from 1 to 32.
  - b) The numbers 33-64 are reserved for WAAS satellites. The WAAS system PRN numbers are 120-138. The offset from NMEA WAAS SV ID to WAAS PRN number is 87. A WAAS PRN number of 120 minus 87 yields the SV ID of 33. The addition of 87 to the SV ID yields the WAAS PRN number.
  - c) The numbers 65-96 are reserved for GLONASS satellites. GLONASS satellites are identified by 64+satellite slot number. The slot numbers are 1 through 24 for the full GLONASS constellation of 24 satellites, this gives a range of 65 through 88. The numbers 89 through 96 are available if slot numbers above 24 are allocated to onorbit spares.

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### **NMEA GRS Sentence**

### **GNSS** Range Residuals

This sentence is used to support Receiver Autonomous Integrity Monitoring (RAIM). Range residuals can be computed in two ways for this process. The basic measurement integration cycle of most navigation filters generates a set of residuals and uses these to update the position state of the receiver.

These residuals can be reported with GRS, but because of the fact that these were used to generate the navigation solution they should be recomputed using the new solution in order to reflect the residuals for the position solution in the GGA or GNS sentence.

The MODE field should indicate which computation method was used. An integrity process that uses these range residuals would also require GGA or GNS, GSA, and GSV sentences to be sent.

If only GPS, GLONASS, etc. is used for the reported position solution the talker ID is GP, GL, etc. and the range residuals pertain to the individual system. If GPS, GLONASS, etc. are combined to obtain the position solution multiple GRS sentences are produced, one with the GPS satellites, another with the GLONASS satellites, etc. Each of these GRS sentences shall have talker ID "GN", to indicate that the satellites are used in a combined solution. It is important to distinguish the residuals from those that would be produced by a GPS-only, GLONASS-only, etc. position solution. In general the residuals for a combined solution will be different from the residual for a GPS-only, GLONASS-only, etc. solution.

### 

Range residuals in meters for satellites used in the navigation solution1,2. Order must match order of the satellite ID3 numbers in GSA. When GRS is used GSA and GSV are generally required.

Mode: 0 = residuals were used to calculate the position given in the matching GGA or GNS sentence

1 = residuals were recomputed after the GGA or GNS position was computed

UTC time of the GGA or GNS fix associated with this sentence

#### Notes:

- 1) If the range residual exceeds +99.9 meters, then the decimal part is dropped, resulting in an integer (-103.7 becomes -103). The maximum value for this field is +999.
- 2) The sense or sign of the range residual is determined by the order of parameters used in the calculation.

The expected order is as follows: range residual = calculated range - measured range.

3) When multiple GRS sentences are being sent then their order of transmission must match the order of corresponding GSA sentences.

Listeners shall keep track of pairs of GSA and GRS sentences and discard data if pairs are incomplete.

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#### **NMEA RMC Sentence**

NMEA has its own version of essential GPS PVT (position, velocity, time) data. It is called RMC, The Recommended Minimum, which will look similar to: \$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W\*6A Where:

RMC	Recommended Minimum sentence C
123519	Fix taken at 12:35:19 UTC
Α	Status A=active or V=Void.
4807.038,N	Latitude 48 deg 07.038' N
01131.000,E	Longitude 11 deg 31.000' E
022.4	Speed over the ground in knots
084.4	Track angle in degrees True
230394	Date - 23rd of March 1994
003.1,W	Magnetic Variation
*6A	The checksum data, always begins with *

Note that, as of the 2.3 release of NMEA, there is a new field in the RMC sentence at the end just prior to the checksum. For more information on this field.

### **NMEA HDT Sentence.**

The NMEA HDT sentence provides heading information which can be input to the LD6 for displaying on Quantum software.

\$GPHDT,xxx.xx,T\*hh<CR><LF>

where:

\$GPHDT – is the message name stating it is a GPS heading (true) message

xxx.xx - this is the heading

T – states the heading is true

\*hh - is the check sum for the message

# **NMEA THS Sentence**

The NMEA THS provides heading information which can be input to the LD6 for displaying on Quantum software. This sentence includes a "mode indicator" field providing critical safety related information about the heading data.

\$GPTHS,x.x,a\*hh<CR><LF>

Where:

\$GPTHS - is the message name stating it is a GPS heading (true) message

x.x - Heading value (True)

a - Mode indicator

\*hh - Checksum

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# Notes:

1) Mode indicator:

A = Autonomous

E = Estimated (dead reckoning)

M = Manual Input

S = Simulator

V = Data not valid (including standby)

# **UKOOA Sentence**

# Example:

[ 240 6700 VERI 1 1921 432026.0 +0.1 +22.4 057 12.08202N 002 11.53784W 64.220 +50.40 1.344 0.650 1.176 7 0.192 0.360 0.02 0.008 -0.001 0.004 0.030 0.09 0.06 344.8 P 15{ 12 19 15 17 25 10 24 32 14 82 72 80 83 65 71} 1{ 268}]

# VERIPOS UKOOA sentence defined:

Content	Format	Field	Unit	Comments
Start Character	A1	1	-	Open string
Length of Message	14	25	-	Number of characters
Software Version	A5	610	-	
System Name	A6	1116		
Record Identifier	12	1718	ı	See comment 1
GPS Week Number	15	1923	ı	Since Jan 6 <sup>th</sup> 1980
GPS Time of Fix	F9.1	2432	sec	Seconds into current GPS Week
Age of Record	F5.1	3337	sec	See comment 2
Latency	F6.1	3843	sec	
Latitude	F13.6	4456	dm	^dd^mm.mmmmm (^=space)
Latitude Hemisphere Indicator (N or S)	A1	57	ı	N or S
Longitude	F13.6	5871	dm	^dd^mm.mmmmm (^=space)
Longitude Hemisphere Indicator (E or W)	A1	72	-	E or W
Altitude above MSL	F7.3	7379	m	Antenna height above mean sea level. See comment 3
Geoid Separation	F8.2	8087	m	See comment 4
PDOP	F7.3	8894		
HDOP	F7.3	95101	ı	
VDOP	F7.3	102108	ı	
Fix Status	12	109110	ı	See comment 5
Internal Reliability	F7.3	111117	m	See comment 6
External Reliability (m)	F8.3	118125	m	See comment 7
Unit Variance	F5.2	126130	m²	See comment 8



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# Field Formats:

Ax Alphanumeric text Ix Integer Field Fx.y Floating point field

#### Where:

x gives the total length including the decimal point and decimals

y the number of decimals

If a sign (+ or -) is included in the field, the sign must be immediately adjacent to the number it relates to with no spaces in between i.e. -3.12

Alphanumeric text fields must be left justified, and numeric fields must be right justified.

The field sizes are selected with a space between each field. This aids manual readability and protects against overflow.

# Comments:

1. Record Identifier shows the calculation used, as different calculations can

be labelled: 1, 2, 3 etc.

2. Age of Record time of the first character of the data string being output,

minus the time of position.

3. Altitude Above MSL the datum for height calculations.



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4. Geoid Separation separation between mean sea level and the WGS84

reference ellipsoid, based on a Geoid model as for

example EGM96.

5. Fix Status Codes shows the calculation used, as different calculations can

be labelled: 1, 2, 3 etc.

Single Frequency		
Status Code	Meaning	
0	No or Bad Fixes	
1	Altitude Aiding (Weighted Height used in Fix)	
2	Altitude hold (2D Fix)	
3	3D Fix	
Dual Frequency		
(4 is added to the above values when positioning is set-up for dual frequency		
calculations)		
Status Code	Meaning	
4	No or Bad Fix	
5	Altitude Aiding (Weighted Height used in Fix)	
6	Altitude hold (2D Fix)	
7	3D Fix	

6. Internal Reliability smallest outlier that is likely to be detected by the current solution.

7. External Reliability maximum positional effect of an undetectable error in an

observation. This quantity is related to the Power of the test (probability that the MDE would be detected) and the

Significance level used.

8. (Co)-variance The Variance and Covariance terms are elements from

the variance-covariance matrix of the position fix

computation (un-scaled)

9. 95% Error Ellipse Shows 95% confidence level of the semi-major and semi-

minor axis of the error ellipse

10. Orientation Orientation of the semi major axis (degrees from true

North)

11. F Test A test applied to the Unit Variance. A "Fail" may result

from large outliers in the measurements.



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# 6. VERIPOS CONTACT INFORMATION

All initial contacts regarding technical or support issues should be initially addressed to the VERIPOS support email. Where appropriate, these support cases may be referred to the regional operations and engineering teams.

# **VERIPOS Helpdesk**

VERIPOS Online support VERIPOS Technical support Helpdesk telephone Helpdesk e-mail https://help.veripos.com support@veripos.com +44 (0)1224 965900 helpdesk@veripos.com



NOTE

If shipping equipment back to VERIPOS, please contact the Helpdesk who will provide the current shipping address, according to the user's area of operations.

# **UK VERIPOS office address (Headquarters):**



Veripos House 1B Farburn Terrace Dyce, Aberdeen. AB21 7DT Scotland, UK

For up to date information on other VERIPOS offices worldwide visit <a href="www.veripos.com">www.veripos.com</a>