LD8

Operations Manual

Contents

1 Introduction

1.1 General information

To assist with LD8 operation, it will help to have the following items available when consulting this document:

- LD8 and associated equipment shipped to the site.
- A PC or Laptop meeting the system requirements specified below
- The Delivery note provided within the shipment from Veripos.
- LD8 Installation Manual
- Veripos document Antenna and Coaxial Cable Installation.
- LD8 FAQs and Quick Guides, available from https://help.veripos.com.

1.2 LD8 receiver

The LD8 is a high precision system, built into a lightweight, compact and environmentally protected enclosure and designed to operate reliably in the most demanding of marine environments. Key system features:

- Supports decimetre-level multi-constellation positioning with Veripos APEX and Ultra PPP correction services
- Compatible with Veripos Quantum software
- EN60945 Marine Certified
- 555 channels, all constellations, multi-frequency tracking
- Simultaneously track up to three Veripos correction service satellites
- ALIGN® GNSS heading solution
- Supports RTK operations
- Multiple communication interfaces for easy installation
- WebUI configuration utility

1.3 System requirements

This release of LD8 requires a PC or laptop with Windows 7 or Windows 10 installed, capable of running the latest version of Microsoft Edge, Mozilla Firefox or Google Chrome (see individual browser requirements for more information) and an Ethernet port.

1.4 Veripos Support

Veripos Support is a service provided as the first point of contact for all Veripos technical support and fault reports. It is available 24 hours a day, 365 days per year. Full contact details are available in the Contact information section.

For support cases, contact support.veripos@hexagon.com or raise a ticket at https://help.veripos.com. Either method will immediately notify Veripos Support, who will then assist.

Veripos Support will provide initial help and may, if necessary, escalate tickets to regional on-call engineers to provide more in-depth technical support.

To aid support, upon first contact, please provide the following:

• Details of the issue or question

• Vessel name

• Company name

• Telephone number

• Unit user code

• Veripos hardware type

• Veripos software type

• Operating area

• Is this issue holding up operations?

• Any other relevant information

1.5 Activating Veripos correction services

Veripos correction signals are provided on a subscription basis by Veripos.

Activation of the LD8 is necessary for the system to decode corrections and output a corrected position. Users may request activation of services from Veripos Support, who will send the activation signal to the unit via an L-band satellite.

When not in use, some service agreements may allow for service deactivation.

> **NOTE**
> To use Veripos correction signals, a contract with Veripos must first be in place. Veripos refers to this as a Service Access License (SAL).
>
> To avoid delays, users should record the SAL number associated with the Veripos equipment. Veripos Support is unable to activate any equipment unless an active SAL exists.

1.6 Terms and abbreviations

AC	Alternating Current
APEX	Veripos high accuracy positioning solution
BEIDOU	Chinese commissioned GNSS
dB	Decibel
DHCP	Dynamic Host Configuration Protocol
DOP	Dilution of Precision
DP	Dynamic Positioning
DQI	Differential Quality Indicator
EU	European Union
GALILEO	European commissioned GNSS
GLONASS	GLObal NAvigation Satellite System - Russian commissioned GNSS
GNSS	Global Navigation Satellite System
GPS	Global Positioning System - United States commissioned GNSS
HDOP	Horizontal Dilution of Precision
Hz	Hertz
ID	Identification
IP	Internet Protocol
IPv4	Internet Protocol version 4
LAN	Local Area Network
L-band	Signal transmitted to carry correction data to mobile users
LD8	Veripos receiver containing combined L-band and GNSS card
LED	Light Emitting Diode
NMEA	National Marine Electronics Association
PDOP	Positional Dilution of Precision
PPP	Precise Point Positioning
PPS	Pulse Per Second
PRN	Pseudo Random Noise
PSN	Product Serial Number
PWR	Power
RJ45	A physical network interface standard used in telecommunications
RTCM	Radio Technical Commission for Maritime Services
RTK	Real-Time Kinematic
SAL	Service Access License
SBAS	Satellite Based Augmentation System
SMA	SubMiniature version A
Standard	Veripos Single frequency DGNSS system
TCP	Transmission Control Protocol

UAL	User Accuracy Level
UI	User Interface
Ultra	Veripos high accuracy position solution
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VDC	Volts Direct Current
VDOP	Vertical Dilution of Precision
VOSS	Veripos Online Support System
WAAS	Wide Area Augmentation System
WebUI	Web User Interface
WEEE	Waste Electrical and Electronic Equipment
Wi-Fi	IEEE 802.11 (wireless) standard

1.7 Document conventions

1.7.1 Typographical conventions

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

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

Blue text is used for hyperlinking to other sections within this document or to external documents or websites.

Bold italic text is used when display screens are mentioned in text.

`Monospace` text is used for input/output strings to/from the device.

1.7.2 Special Notices

WARNING
A warning indicates the risk of bodily harm or serious damage to the hardware.

CAUTION
A caution indicates the risk of damaging the hardware or adversely impacting the operation of the system.

NOTE
A note contains important information to help you make better use of the system.

1.8 LD8 Notices

The following notices apply to the LD8:

1.8.1 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 electronics 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 WEEE. The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment.

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.

1.8.2 FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

LD8 has been tested and found to comply with the radiated and conducted emission limits for a Class B digital device. The Class B limits are designed to provide reasonable protection against harmful interference in a residential installation.

The equipment listed generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the LD8
- Increase the separation between the equipment and the LD8
- Connect the equipment to an outlet on a circuit different from that to which the LD8 is connected
- Consult Veripos for help

> **CAUTION**
> **To maintain compliance with the limits of a Class B digital device, you must use shielded interface cables.**

> **WARNING**
> **The LD8 has been authorised for use in mobile applications. At least 20 cm (8 inches) of separation between the LD8 and the User must be maintained during normal operation.**

> **WARNING**
> **Changes or modifications to this equipment, not expressly approved by Veripos could void the user's authority to operate this equipment.**

1.8.2.1 Wi-Fi

The LD8 contains a Wi-Fi radio with the following approval:

- FCC ID: UTU-01019715

1.8.3 European Union / United Kingdom (UK)

1.8.3.1 Radio Equipment Directive

Veripos declares that the LD8 including its Wi-Fi transceiver is in compliance with:

1. EU Directive 2014/53/EU
2. UK Regulations S.1. 2017/1206

The full text of either the UK or EU Declaration of Conformity may be obtained from Veripos upon request.

1.8.3.2 ROHS

The LD8 is in conformity with Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

1.9 Disclaimer

Hexagon Autonomy & Positioning division proprietary data

This document and the information contained herein are the exclusive properties of Veripos Limited, and/or their affiliates within the Hexagon Autonomy & Positioning division ("Hexagon").

No part of this document may be reproduced, displayed, distributed, or used in any medium, in connection with any other materials, or for any purpose without prior written permission from Hexagon. Applications for permission may be directed to contact.ap@hexagon.com. Unauthorized reproduction, display, distribution or use may result in civil as well as criminal sanctions under the applicable laws. Hexagon aggressively protects and enforces its intellectual property rights to the fullest extent allowed by law.

This document and the information contained herein are provided AS IS and without any representation or warranty of any kind. Hexagon disclaims all warranties, express or implied, including but not limited to any warranties of merchantability, non-infringement, and fitness for a particular purpose. Nothing herein constitutes a binding obligation on Hexagon.

The information contained herein is subject to change without notice.

2 Hardware overview

This section describes the physical characteristics of the LD8, provides information on the different possible LED statuses and details the interface panel inputs.

2.1 Overview and description

- The LD8 is a small, lightweight and low power system.
- Veripos provide a +9 to +36 VDC power supply with the LD8.
- The unit incorporates front panel LED indicators for status monitoring.
- Command-line driven terminal configuration can be carried out via a web-based interface.

2.2 LEDs

There are five LED indicators used to communicate the receiver status to the user:
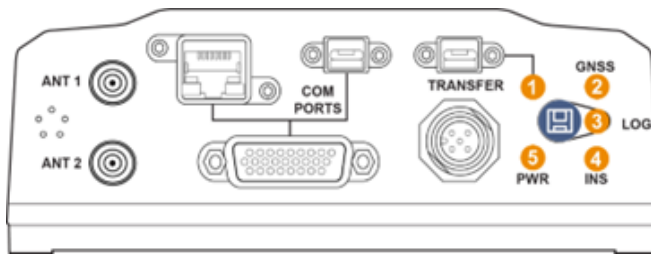
LED	Description
1. TRANSFER	Used for transferring logged data
2. GNSS	Indicates the position status of the receiver.
3. LOG	Indicates the status of logging to the receiver internal memory
4. INS	Not currently supported
5. PWR	Indicates the power status

The following subsections detail the different possible LED states and their corresponding definitions:

2.2.1 PWR LED

State	Description
Solid green	Operational mode
Solid yellow	In the process of booting
Solid red	Error, or update of receiver component in progress

2.2.2 GNSS LED

State	Description
Solid green	PPP (APEX or Ultra) solution
Slow green blink	RTK
Fast green blink	DGNSS (Standard or SBAS) solution or uncorrected
Solid yellow	No solution

2.2.3 LOG LED

State	Description
Off	LD8 is connected to a computer as a mounted device
Green blink	Logging to internal memory
Green solid	Internal logging stopped
Green/yellow alternating blink	Logging to internal memory with low memory available
Yellow solid	Internal logging stopped with low memory available
Yellow fast blink	Memory is busy
Red solid	Internal memory full and system is utilising a rolling log, or memory has corrupted

2.3 Interface panel connections

This section details the antenna and data connectivity available from the LD8 interface panel.

2.3.1 Coaxial

The LD8 interface panel is fitted with two SMA antenna connectors labelled ANT 1 and ANT 2:
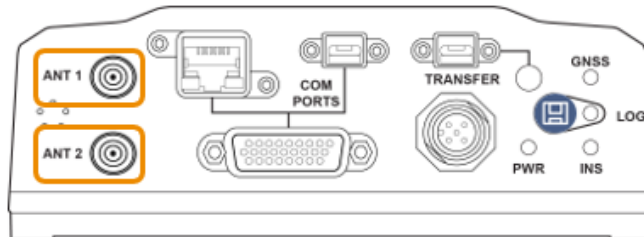
Interface panel of LD8 with two GNSS antenna connectors

- The L-band and GNSS position antenna should be connected to the **ANT 1** connector.
- Where the LD8 will be used to compute a heading, a second GNSS antenna should be connected to **ANT 2** connector.
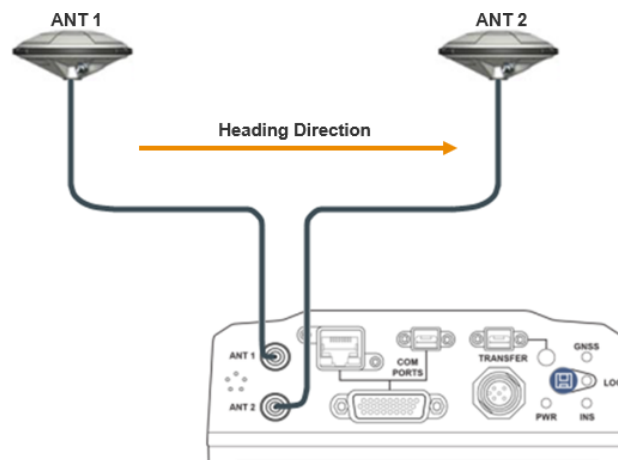
GNSS Heading Solution Direction

2.3.2 Data cables

The LD8 System is supplied with a multiport adapter that splits out into cabling for COM1, COM2, COM3 and 1 PPS signal from a 26-pin high-density connector:

3 Ethernet and WebUI connection

The LD8 supports Ethernet (10Base-T/100Base-TX) for configuration and interfacing to other vessel systems. The Ethernet port supports IPv4 Internet layer and TCP/IP transport.
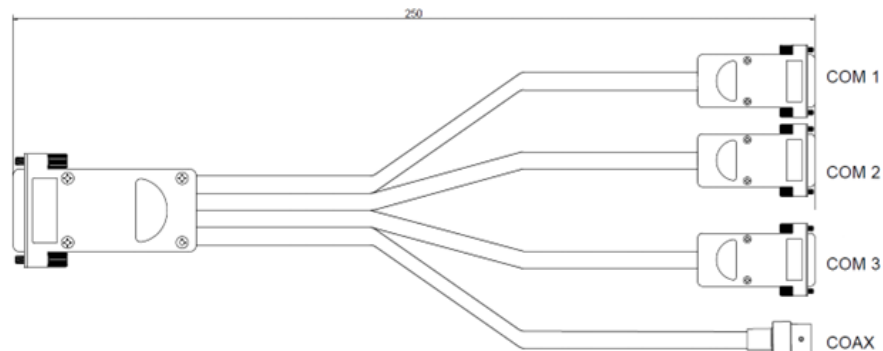
3.1 Ethernet

A PC or laptop with an Ethernet port and an up-to-date version of Microsoft Edge, Mozilla Firefox or Google Chrome is required to configure the LD8 for operation. Microsoft Edge comes pre-loaded onto Veripos PCs when issued with the unit.

The LD8 is shipped with a factory default IP address of 192.168.2.8. The connecting PC or laptop should be configured to use the same IP subnet.

If the LD8 needs to be configured to join an existing TCP/IP network, the commands to assist configuration can be found in section Ethernet configuration.

3.2 WebUI connection

Once network connectivity has been established to the LD8, open a browser and enter the default LD8 IP of 192.168.2.8 into the address bar. This will load the LD8 WebUI:
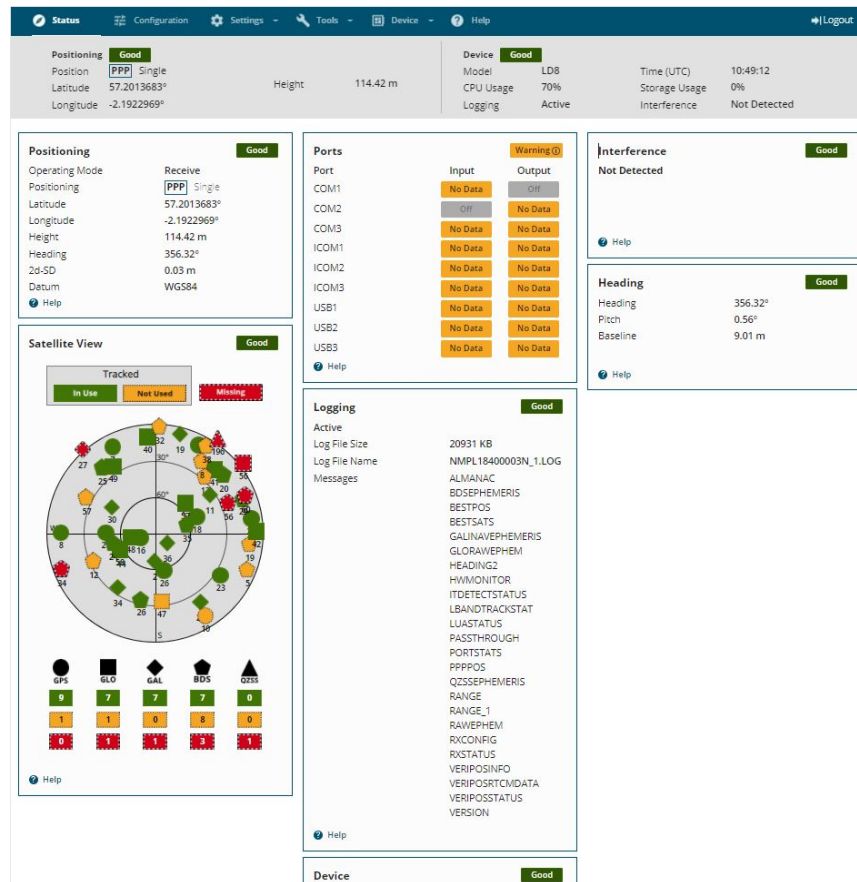
4 Configuration and operation

The two ways in which the LD8 can be configured are by using Veripos Quantum software, or by using the LD8 WebUI. Quantum must be used if being used for system monitoring. If Quantum is not available, system configuration must be performed through the WebUI, which features a terminal application that can be used for sending commands.

This section introduces the WebUI and details how to perform LD8 system configuration using both terminal commands and, where available, the WebUI. For configuration with Quantum please refer to the Quantum User Manual.

4.1 WebUI status

Once connected to the LD8 via Ethernet and the WebUI has been loaded, the user will be presented with the LD8 WebUI *Home > Status* page. This page displays information relating to the status and behaviour of the system. To gain access to any other pages or functionality it is necessary to use the **Login** option, found in the top right-hand corner of the page. To login to the system locate the LD8 serial number, which typically starts with 'NMPL' and can be found on the underside of the unit. When prompted, use the LD8 serial number as the password and click **Log In**. Changing the password is possible, as detailed in section LD8 password.
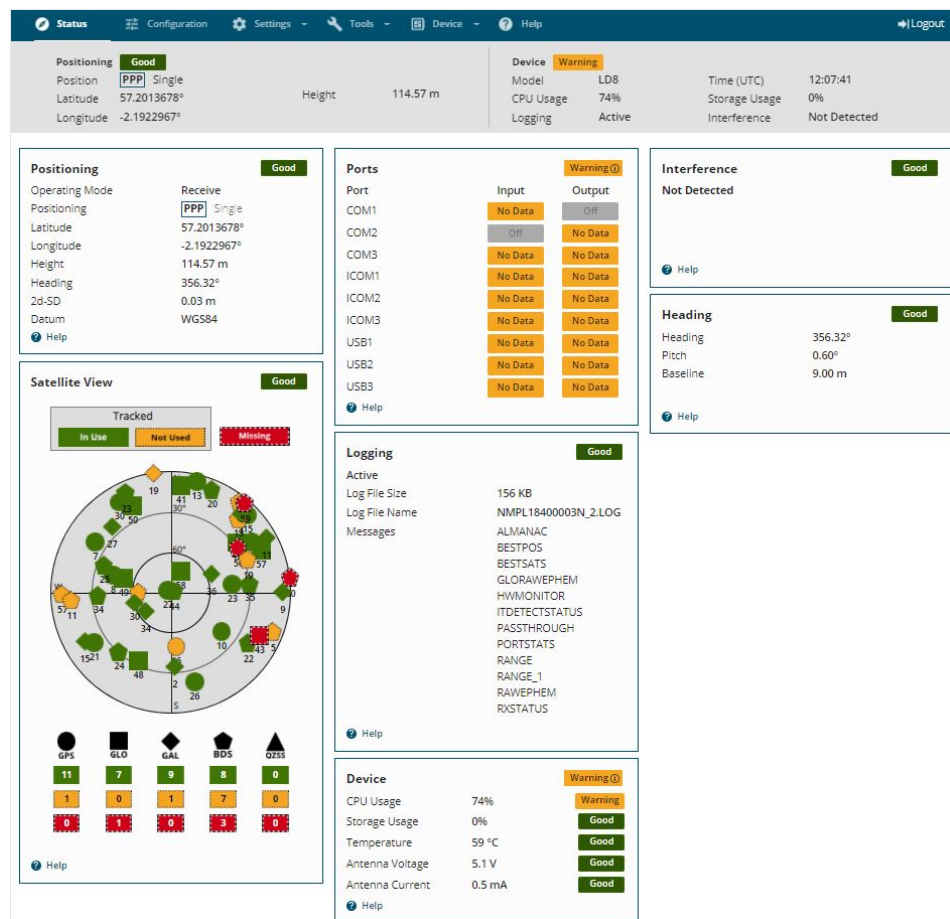
4.1.1 WebUI Status page items

At the top of the page is a summary bar containing key system information. Below this, the main body of the LD8 WebUI *Home > Status* page is split into several boxes, with each box containing useful system information:

Item	Description
Positioning	Information relating to the operating mode, calculated position type, latitude, longitude, height, heading (if available), 2d-SD and datum.
Satellite View	A polar plot, showing currently tracked GNSS satellites. Clicking on any satellite will reveal elevation, azimuth and signal strength information for that satellite. Highlighted below the plot are the numbers of satellites used in the solution, (green) unused (orange), and unhealthy (red).
Ports	Information regarding available ports. Highlights which ports are configured for input (and/or) output, as well as which are available and in use (green), available but idle (orange).
Logging	The system logging status. Includes present log file size, the name of the currently logging item and which messages are being logged.
Device	Present CPU and storage usage, system temperature, antenna voltage and current.
Interference	Highlights detected interference.
Heading	Heading and pitch information, and baseline length.

4.1.2 Sending commands via WebUI terminal

Once a user has logged into the LD8, the system can be configured by using terminal commands. The WebUI provides a terminal window which can be used for sending commands and receiving status information from the unit. The WebUI terminal can be accessed by clicking on **Tools** on the top bar then **Terminal**.

Commands entered into the input bar can be sent to the unit by using the keyboard Return/Enter key. They will appear in the terminal in green, with echoed responses from the LD8 appearing in black.
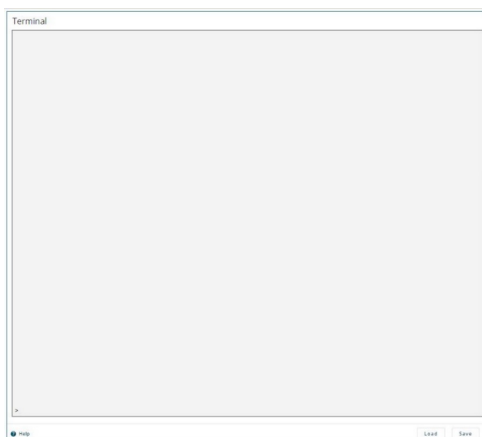
Sending commands will trigger one of three different responses from the LD8:

Status response

When requesting system status information, such as querying which L-band beam/s are presently being tracked, the LD8 should respond with an '`<OK`' echo, followed by the requested information.

Acknowledgement response

When successfully making a configuration change a single or multiple line response containing '`<OK>`' can be expected.

Rejection of command

A rejected command will be flagged as such with '`INVALID MESSAGE`' or '`ERROR`' appearing somewhere within the echoed response, or no response will be received. These responses indicate that a command has not been understood, or that a command has not been successfully implemented.

4.1.3 Saving changes

Whilst configuring the LD8 via the WebUI terminal, any configuration changes made will not get automatically saved. Although any configuration changes made may appear to immediately work, **without the use of a save command these changes will be lost in the event of a power cycle**. One command is used for saving network changes and another command is used for saving all other changes. Once either of the below commands has been sent an acknowledgement response should be received:

Command	Description
SAVEETHERNETDATA	Saves any Ethernet configurations
SAVECONFIG	Saves all settings excluding Ethernet configurations

4.2 LD8 password

To login to the system users will need to locate the LD8 serial number, which typically starts with 'NMPL' and can be found on the underside of the unit or in the Log File Name on the WebUI Status page. Before proceeding with mounting or configuration of the LD8, users may wish to change the password from the LD8 serial number default.

4.2.1 LD8 password configuration via terminal

The LD8 password can be changed via the terminal.

The LD8 password can be changed from one password (such as LD8 serial number) to a new one by entering:

```
SETADMINPASSWORD OLDPASSWORD NEWPASSWORD
```

To change the LD8 password back to the LD8 serial number enter:

```
FRESET USER_ACCOUNTS
```

4.3 LD8 firmware

To verify the present firmware on the LD8, send the below command:

```
LOG VERSION
```

The following information will appear in the terminal program. The firmware version has been highlighted:

```
GPSCARD "FDDRYNTVEA" "DMMU205000412" "OEM7720-1.01"
"OM7CR0814RN0000 OEM7FPGA """OMV070001RN0000" "" DEFAULT_CONFIG ""
""""""EP7CD0814RN0001" "" "2022/Oct/13" "15:43:41 APPLICATION """"
"""EP7AR0814RN0000" "" "2022/Oct/13" "15:43:35" PACKAGE "" "" ""
"EP7PR0814RN0000" "" "2022/Oct/13" "15:43:38" DB_LUA_SCRIPTS
"SCRIPTS" "Block1""" "SaM_4.1.0.4" "" "2022/Oct/10" DB_WWWISO
"WWWISO" "O" "" "1.9.0" "" "2022/Aug/08" "16:44:47" ENCLOSURE
"PWRPAK7D-E1" "NMPM21030008J" "" ww WIFI "RS9113" "" """1.7.12" ""
"2022/Oct/13" "15:43:48" REGULATORY "US" "" "" "" "" "" ""
```

4.4 L-band configuration

Tracking of an L-band beam is required to receive Veripos service correction and activation data. This section will detail how to establish and confirm successful L-band tracking to make use of Veripos services. **Auto Beam is the recommended way to manage L-band beam choices**. When in this mode, the LD8 will track up to three beams simultaneously with tracking determined based on available L-band satellites and elevation and data received from each L-band satellite used within the calculation.

Using Auto Beam can mitigate against the impact of a single beam failure or masking. Additionally, when using Auto Beam and transiting across different geographic regions, the LD8 will automatically select available L-band beams. Whilst in this mode no manual beam selection is required.
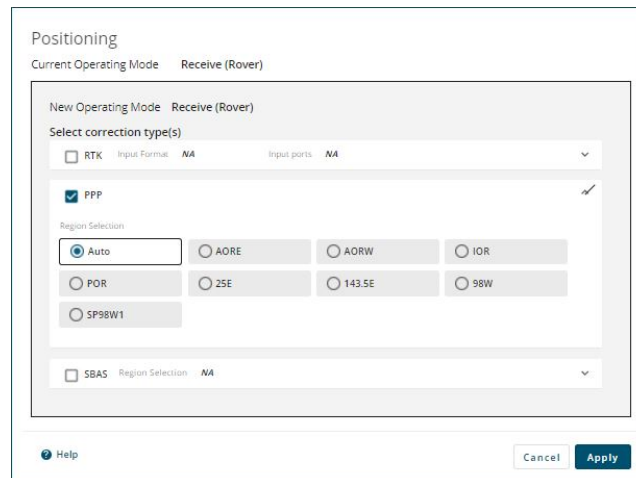
The receiver also allows for selection of a single L-band beam. If a single beam is selected, it will disable the Auto Beam selection. Veripos have five beams available as detailed below and, in most regions, more than one beam should be available. A global map with a beam overlay can be found in the Appendix, however the below table can be used as a general guide:

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

Where possible, different Veripos receiver units on the same vessel should be set to different beams to maximise redundancy.

4.4.1 Selecting beam via WebUI

To select Auto beam (or a single beam if required) navigate to **Configuration > Positioning** and click **Receive (Rover)**, followed by **Next**. On the next page expand the **PPP** section and select either Auto or an available beam, followed by **Apply**:

4.4.2 Selecting Auto beam via terminal

To enable the use of Auto beam enter the following:

```
ASSIGNLBANDBEAM AUTO
```

4.4.3 Selecting a single beam via terminal

The format for assigning a specific L-band beam (98W, AORW, 25E, IOR, 143.5) is as follows:

```
ASSIGNLBANDBEAM BEAMNAME
```

4.4.4 Entering a custom beam frequency via terminal

A custom L-band beam name and frequency (in Hz) can be manually entered, however this should be used only under the instruction of Veripos Support. The format for assigning a user L-band beam is as follows:

```
ASSIGNLBANDBEAM MANUAL BEAMNAME FREQUENCY 1200
```

4.4.5 Tracked L-band beam and signal strength status via terminal

The presently tracked L-band beam/s and signal strength/s can be found by entering:

```
LOG LBANDTRACKSTAT
```

The returned status will display information relating to any of the beams that are being actively tracked or searched for. The tracked L-band beam names will be found in quotation marks at the start of each line, i.e. "25E". The value after the beam name relates to the L-band beam frequency followed by the baud rate, which is typically 1200 bps. The signal strength will be found in the 8th field along for each beam line. Signal strengths are output in dB and a value of 36.5dB or above is optimal.

When in **Auto beam** mode the terminal output will be similar to the below:

```
LBANDTRACKSTAT WCOM1_30 0 50.5 FINESTEERING 2062 457753.000
0a000020 29e3 15441
3
"IOR" 1545865000 1200 974c 00c2 0 -91.416 43.052 3.6091 15658.910
298176 2330
746 38166528 290966 0.0000
"25E" 1545825000 1200 974c 00c2 0 -223.267 43.704 3.8057 78985.820
1504384 5 5 192561152 515 0.0000
"AORW" 1545845000 1200 974c 00c2 0 -280.645 40.858 2.8379 78986.523
1504448 607 571 192569344 68081 0.0015
```

4.4.6 HDR mode configuration via terminal

Enabling HDR mode can assist with L-band tracking when potential interference sources are present. HDR Mode uses signal processing to dampen potential sources of RF distortion, at the cost of increased CPU usage. It is recommended that if any L-band tracking issues are observed (intermittent, low or no signal) this option is enabled.

HDR mode can be enabled by entering:

```
ITFRONTENDMODE LBAND HDR
```

HDR mode can be disabled by entering:

```
ITFRONTENDMODE LBAND CIC3
```

4.5 Activation and deactivation of Veripos services

To activate or deactivate Veripos services, firstly ensure that the LD8 is switched on and tracking an L-band beam with a healthy signal level (>36.5 dB). Tracking of a L-band beam is required as activation and deactivation updates are sent via the beam.

Email Veripos Support (support.veripos@hexagon.com) with the **Unit ID**, **Vessel Name**, **SAL number** and **services required**.

> ### ℹ NOTE
> Veripos Support cannot enable services unless an active SAL exists. To avoid delay, please make sure that the SAL number is known and available prior to requesting services.

4.5.1 Checking unit activation status via terminal

To check the present activation status of an LD8 enter:

```
LOG VERIPOSSTATUSA
```

The unit activation status can be either ENABLE (or) DISABLE.

The unit L-band sync status can be either LOCKED (or) NO_SIGNAL. For activation of Veripos services the unit is required to have a sync status of LOCKED. Refer to section L-band configuration for assistance on selecting an L-band beam if required.

An example of a status message response, with activation status showing DISABLE and Sync status LOCKED:

```
VERIPOSSTATUSA,WCOM1,0,67.0,FINESTEERING,2040,375008.267,02008020,0
719,14970; DISABLE,LOCKED*0d439ce3
```

4.5.2 Checking unit ID and activation service code via terminal

If in doubt as to the LD8 unit ID and/or the activation service code enter the following:

```
LOG VERIPOSINFO
```

The LD8 unit ID is required for Veripos to activate services and each activation/deactivation is unique to each unit ID. The activation service code can be used to determine what services the unit is activated to receive.

In the below terminal output, the unit has been successfully activated and the unit ID has been highlighted, followed by the service activation code:

```
VERIPOSINFO WCOM1 0 66.0 FINESTEERING 2039 314993.573 02008020 2bd7
14970
<123456 NCC_CONTROLLED 80000111 "2"
```

In the below terminal output the unit has not yet been activated. The unit ID has been highlighted and no value yet exists for the service activation code:

```
VERIPOSINFO WCOM1 0 66.5 FINESTEERING 2040 378378.140 03008020 2bd7
14970 <123456 UNASSIGNED 00000000 ""
```

> **ℹ NOTE**
>
> While a unit may be enabled for single PPP services it may not be fully utilising the service as further configuration may be required to choose which Veripos PPP service to use (APEX or ULTRA).

4.6 Calculation configuration

There are several calculation configuration options which can be changed by the use of commands. These configuration options can update the way in which Veripos service types are utilised.

4.6.1 PPP mode selection via terminal

The two PPP solutions that Veripos offer, Ultra and APEX, allow for decimetre accuracy positioning. Each of these services have no range limitations and can be used in any location.

Some Veripos service codes include both the APEX and Ultra solutions. On systems with corrections subscriptions that include both Ultra and Apex, it is recommended that users set the LD8 to prioritise Apex, and automatically fall back to Ultra should Apex become unavailable:

```
PPPSOURCE AUTO
```

If only one PPP solution is enabled users may configure the LD8 to use the activated service. Users should ensure that the solution selected matches the service requested from support. The format for assigning a specific solution (APEX or ULTRA) is as follows:

```
PPPSOURCE APEX
```
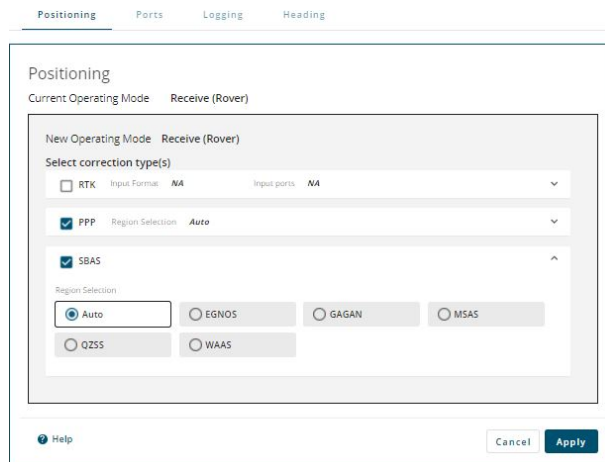
> **NOTE**
> Changing the PPPSSOURCE will re-initialise the PPP calculation, which will take time to settle before a PPP solution output becomes available.

4.6.2 SBAS configuration via WebUI

The LD8 is capable of tracking and using correction data from Satellite Based Augmentation Systems (SBAS). If SBAS is enabled a SBAS DGNSS solution will be output in the event of Veripos solutions failure.

To enable/disable SBAS navigate to **Configuration > Positioning** and click **Receive (Rover)**, followed by **Next**. On the next page expand tick the **SBAS** box to enable SBAS. then select region (**Auto** is recommended). Click **Apply** to confirm any changes.

4.6.3 SBAS configuration via terminal

The LD8 SBAS mode can be enabled or disabled via the terminal.

The SBAS positioning mode can be enabled by entering:
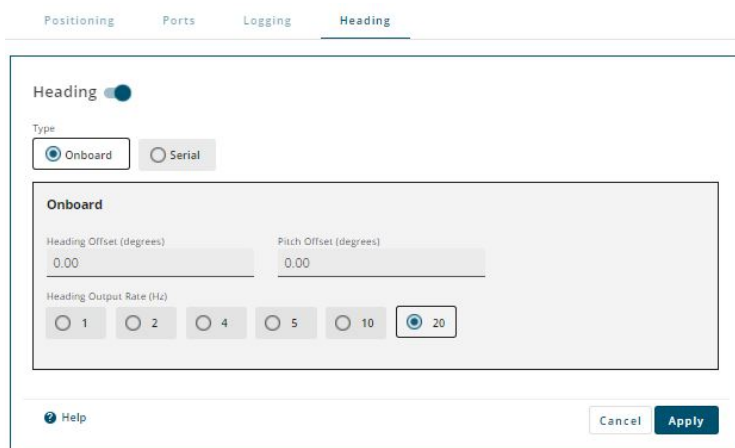
```
SBASCONTROL ENABLE AUTO
```

The SBAS positioning mode can be disabled by entering:

```
SBASCONTROL DISABLE
```

4.6.4 Heading offset and output frequency via WebUI

The Heading can be turned on or off from the **Heading** switch. The heading offset and the heading output rate can be configured within the WebUI by navigating to **Configuration > Heading**. The heading offset value can be set between -180o and +180o. The output rate can be set between 1Hz and 20Hz (this does not apply to the HDT output message). Click **Apply** to confirm any changes.

4.6.5 Heading offset and output frequency via terminal

A heading offset and the heading output rate can also be configured via terminal. The heading offset value can be set between -180° and +180°. The heading offset can be added by entering:

```
HEADINGOFFSET HEADINGOFFSETINDEG
```

The output rate can be set between 1Hz and 20Hz (this does not apply to the HDT output message). The last value of the LOG message is the output rate field (1 = 1Hz, 0.5 = 2Hz, 0.2 = 5Hz, 0.1 = 10Hz, 0.05 = 20 Hz). The output rate can be set by entering:
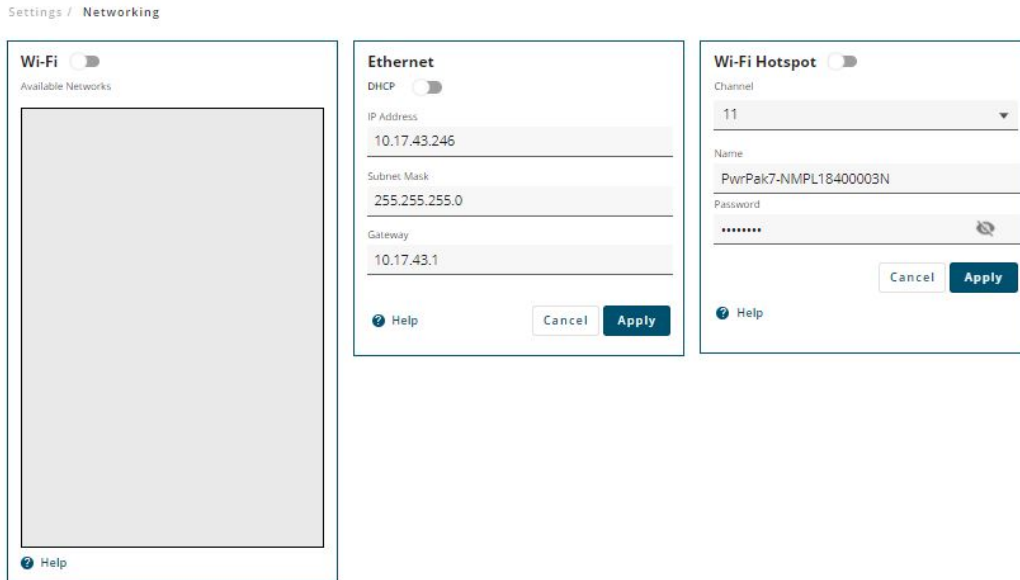
```
LOG COM1 GPHDTDUALANTENNA ONTIME 1
```

4.7 Ethernet configuration

Network connectivity to the LD8 is essential for configuration and implementing changes. The following sub-sections detail how to check and change the present IP address settings.

4.7.1 IP configuration via WebUI

IP addresses can be checked and configured by navigating to **Settings > Networking**. Within the **Ethernet** Window, the DHCP setting can be toggled to Off or On. Toggling DHCP to Off will allow for Static IP address details to be input. Note the Wi-Fi related features are unavailable at present.

> **i NOTE**
> If no connectivity via Ethernet is available, commands can also be sent through the Serial COM ports.

4.7.2 Checking IP and subnet status via terminal

To check the current IP settings of the LD8 enter the command below:

```
LOG IPSTATUSA ONCE
```

IP and subnet settings will be returned, proceeded by ETHA, within quotation marks as highlighted below:

```
IPSTATUSA,WCOM1_
30,0,65.0,FINESTEERING,2043,203989.000,02008020,7fe2,14970;2,ETHA,
"192.168.1.123"
,"255.255.255.0","192.168.1.1",WIFI,"192.168.19.1,"255.255.255.0","
",1,"0.0.0.0"*d9d1437c
```

4.7.3 Setting a static IP via terminal

The LD8 is preconfigured with a static IP of 192.168.2.8, however this IP address can be changed to a different static IP address. The command to change to a static IP follows the structure of:

```
IPCONFIG [interface_name] [address_mode] [IP_address] [netmask]
[gateway]
```

An example for this:

```
IPCONFIG ETHA STATIC 192.168.2.8 255.255.255.0 192.168.2.1
```

When configured for a static IP address the LD8 does not have a DNS server configured and cannot resolve host names. To configure a DNS server entry, use the DNSCONFIG command:

```
DNSCONFIG 1 DNSSERVERIP
```

4.7.4 Changing IP to DHCP via terminal

The LD8 can be assigned an IP address via DHCP. If changing to DHCP use the IPSTATUSA command to determine the newly assigned IP address.

> **! CAUTION**
> Changing the IP address mode to DHCP will require verification of any newly assigned IP address, which must be performed through connection to one of the three COM ports.

To automatically assign a dynamic IP to the LD8 use the below command:

```
IPCONFIG ETHA DHCP
```

To change the unit back to a static IP, follow the instructions in section 'Setting a static IP via terminal'.

4.8 Output configuration

The LD8 is capable of outputting Veripos RTCM data and a selection of message formats via the following:
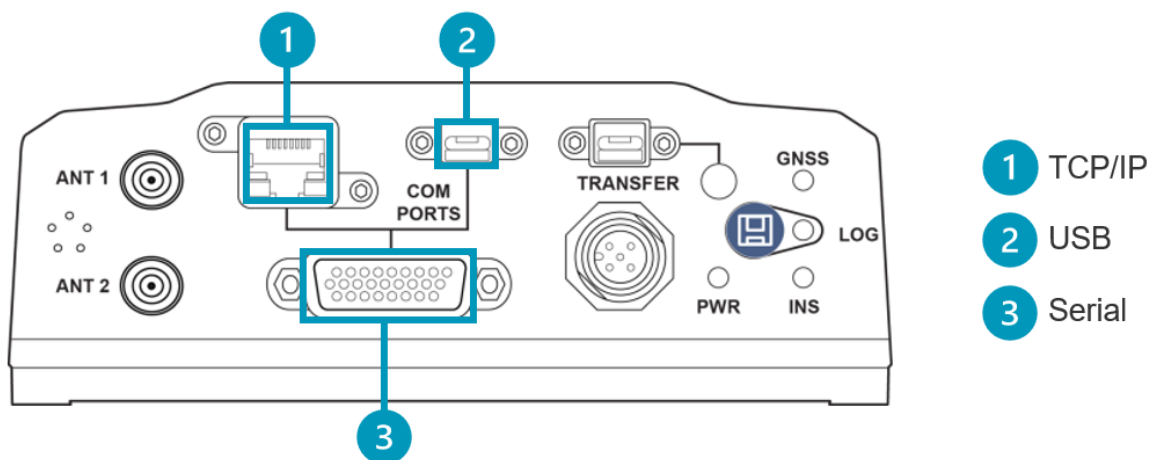
- **Serial** outputs are available for reference within commands or selected in the WebUI by using 'COM1', 'COM2' and 'COM3'.
- **TCP/IP** output can be established to one of five ports: 3001, 3002, 3003, 3004 and 3005. These are available for reference within commands or selected in the WebUI by using 'ICOM1', 'ICOM2', 'ICOM3', 'ICOM4' and 'ICOM5' respectively. Only one connection can be established to each port.
- **USB** outputs are available for reference within commands or selected in the WebUI by using 'USB1', 'USB2' and 'USB3'. Only one connection can be established to each port.
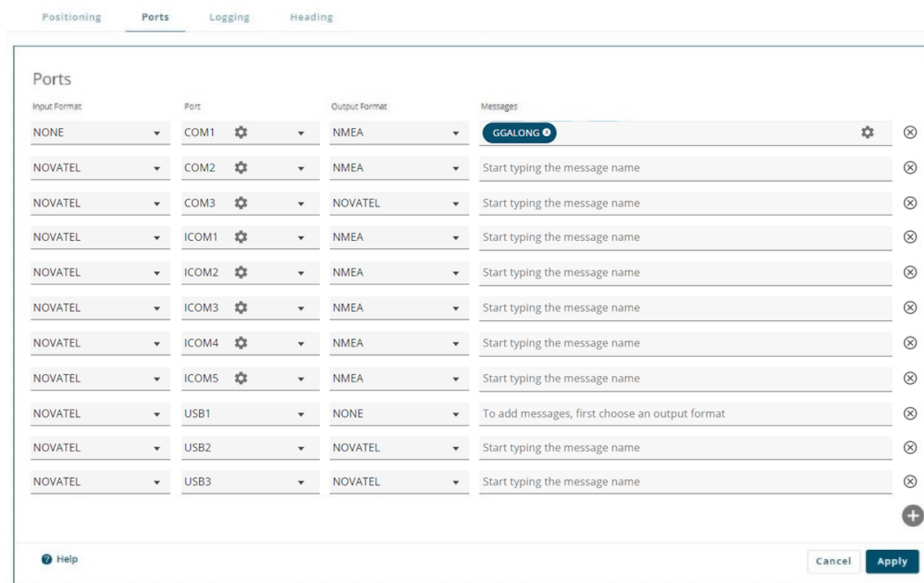
The available LD8 message types and the associated command variable to use when referencing each type within the WebUI or terminal are shown below:

Message	Command variable
GGA	GPGGA
GST	GPGST
ZDA	GPZDA
GSA	GPGSA
GSV	GPGSV
GLL	GPGLL
VTG	GPVTG
GRS	GPGRS
RMC	GPRMC
HDT	GPHDTDUALANTENNA
TRINAV V3*	VERIPOSTRINAVVERSION V3 1
TRINAV V4*	VERIPOSTRINAVVERSION V4 1
VERIPOS UKOOA*	VERIPOSUKOOASENTENCE
BESTPOS	BESTPOS

Selection of TRINAV or UKOOA is only possible using the terminal.

4.8.1 Configuring message outputs via WebUI

Navigate to **Configuration > Ports**, where configuration of **COM 1-3**, **ICOM 1-5** and **USB 1-3** ports is available. Using command variables to specify message type, enter the appropriate command variable next to the required COM, ICOM or USB port in the **Messages** field. Select the command variable once it appears in the **Messages** field as shown below and then click **Apply** to confirm settings.

To remove any message outputs, click on the '⊗' appearing next to the Command variable and click **Apply**.

4.8.2 Specifying baud rate via WebUI

To specify a baud rate for COM Ports 1, 2 or 3 navigate to **Configuration > Ports** click on the cog wheel within the **Port** field:

A window will open that will allow for a baud rate of **2400**, **4800**, **9600**, **19200**, **38400**, **57600**, **115200**, **230400** or **460800** to be selected. The parity, Data bits and Stop Bits can also be selected. Once these and the appropriate baud rate have been selected, click on **Done** followed by **Apply**.

4.8.3 Message output rate via WebUI

Once a NovAtel command variable has been specified a cog wheel will appear within the right hand corner of the **Messages** field:

Input Format	Port	Output Format	Messages	
NOVATEL ▼	COM1 ⚙ ▼	NONE ▼	To add messages, first choose an output format	⊗

Clicking on the settings cog will open a **Message Settings** window where an output rate can be specified in the Period field. LD8 receivers are capable of outputting messages at rates of **1Hz**, **2Hz**, **5Hz**, **10Hz** and **20Hz**. Enter the required rate in seconds as per table below and click **Apply**:

Message Settings ✕

NMEA Log Prefix
○ GP ◉ AUTO

BeiDou Log Prefix
○ GB ◉ BD

Precision   Quality Indicator
◉ 5 ○ 6 ○ 7 ○ 8   ◉ 2 ○ 5

Message	Format	Trigger	Period
GGA		ONTIME ▼	1 s

Cancel   **Apply**

4.8.4 Enabling message outputs via terminal

To enable a message, a single command must be sent for each message on each port. Message types can be output on **COM 1-3**, **ICOM 1-3**, or **USB 1-3**. This, along with the message command variable, should be entered in the command line. The command to be used is given below with COM1 and GPGGA used as an example:

```
LOG COM1 GPGGA ONTIME 1
```

LD8 receivers are capable of outputting messages at rates up to 20Hz. The last value as part of the LOG message is the output rate field. See below table for the output rates and the command variables:

Output rate	Command variable
1Hz	1
2Hz	0.5
5Hz	0.2
10Hz	0.1
20Hz	0.05

An example of the command for outputting GGA on COM 1 at 20Hz:

```
LOG COM1 GPGGA ONTIME 0.05
```

4.8.5 Disabling message outputs via terminal

To disable a message from being output, the command below should be issued to the unit. This consists of the command required, the port and the message type:

```
UNLOG COM1 GPGGA
```

To stop all output messages on a single port, the command below can be issued stating the port:

```
UNLOGALL COM1
```

4.8.6 Setting GGA precision selection via terminal

It is possible to configure the number of decimal places used in the Latitude and Longitude fields output in the GGA Message. The precision can be set to 5, 6, 7 or 8. When changing the precision value, the same value should be applied to both the Longitude and Latitude. The command requires to state `GGA_LATITUDE` or `GGA_LONGITUDE`, followed by a precision value detailed in the table below:

Precision	Latitude command	Longitude command
5	NMEAFORMAT GGA_LATITUDE 10.5	NMEAFORMAT GGA_LONGITUDE 11.5
6	NMEAFORMAT GGA_LATITUDE 11.6	NMEAFORMAT GGA_LONGITUDE 12.6
7	NMEAFORMAT GGA_LATITUDE 12.7	NMEAFORMAT GGA_LONGITUDE 13.7
8	NMEAFORMAT GGA_LATITUDE 13.8	NMEAFORMAT GGA_LONGITUDE 14.8

4.8.7 Setting PPP DQI via terminal

When using either Apex or Ultra PPP services the Differential Quality Indicator is a value reported within GGA messages to indicate solution status. The LD8 allows for two configurable behaviours for this value.

DQI behavior	Command variable
When the calculation is converged to a PPP service the DQI will report the value 2.	2
When the calculation is converged to a PPP service the DQI will report the value 5.	5

The below command example shows the behaviour of the DQI when converged for PPP to a value of 2. The highlighted area below is where the variable of 2 or 5 should be set:

```
GGAQUALITY 4 OUT_OF_BOUNDS 2 WAAS 2 PPP 2 PSRDIFF 2
```

4.8.8 Setting baud rates via terminal

The LD8 allows for each Serial Port to be set at different baud rates. The following baud rates are available to be set: 2400, 4800, 9600, 19200, 38400, 57600,115200, 230400 or 460800

To set the baud rate the SERIALCONFIG command should be used along with the port name for the desired change. An example of the command is below, with the port and baud rate highlighted:

```
SERIALCONFIG COM1 9600 N 8 1 N OFF
```

4.8.9 Setting PPS via terminal

The LD8 allows for the PPS polarity to be configured and set to an increase in pulse from 0v (`POSITIVE`) or a decrease in pulse to 0v (`NEGATIVE`). The pulse has a width of 2000 microseconds.

An example of the `PPSCONTROL` command is given below which shows the pulse being set to `POSITIVE`:

```
PPSCONTROL ENABLE POSITIVE
```

PPS output can be disabled by sending the following:

```
PPSCONTROL DISABLE
```

4.8.10 Enabling RAIM Mode via terminal

Receiver autonomous integrity monitoring (RAIM) is a technology developed to assess the integrity of GNSS signals used by a GNSS receiver. RAIM uses redundant signals and a statistical function to determine if there are problems with the positioning solution; in simple terms, RAIM acts as an internal self-check. RAIM is enabled by default.

High Ionospheric activity may cause problems with the RAIM algorithm; only in this scenario and with consultation and guidance from Veripos Support should users disable RAIM. RAIM should be enabled once conditions return to normal.

RAIM Mode can be enabled by sending the following:

```
RAIMMODE VERIPOS RAIM ON
```

RAIM Mode can be disabled by sending the following:

```
RAIMMODE VERIPOS RAIM OFF
```

4.8.11 Enabling Veripos RTCM output via terminal

RTCM can be output on any of the LD8 serial COM ports. Within the terminal window enter the commands below where updating COM1 with the desired output COM port number.

```
UNLOGALL COM1
INTERFACEMODE COM1 NONE RTCM OFF
LOG COM1 VERIPOSRAWRTCMDATAB ONNEW
```

To change the baud rate of the serial port, send command below. COM should be the same COM port as used in the initial step and the field 9600 replaced with the appropriate baud rate.

```
SERIALCONFIG COM1 9600 N 8 1 N ON
```

4.9 Input configuration

The LD8 is capable of utilising corrections from external sources of Veripos RTCM (RTCM v2, RTCM v3 or CMR) and RTK correction data. For RTK solutions the position will be output in the datum of the correction source.

4.9.1 Inputting external Veripos RTCM via terminal

To input external corrections, you must issue two commands to the unit. These two commands will configure the required baud rate of input and then set the port for decoding of Veripos RTCM data. These commands are `SERIALCONFIG` and `INTERFACEMODE`.

The example commands below show configuration of COM1 for input of Veripos RTCM data, with a baud rate of 115200:

```
SERIALCONFIG COM1 115200 N 8 1 N OFF
INTERFACEMODE COM1 VERIPOS_RTCM NOVATEL ON
```

> **NOTE**
> The LD8 is preconfigured to receive **RTK** corrections. Only port and interface mode settings need to be applied.

4.10 Rolling log

4.10.1 Viewing rolling log via WebUI

The LD8 is preconfigured to utilise a rolling data log. This data can be used to conduct various types of analysis or for troubleshooting purposes by Veripos. From this data, RINEX observation logs can be generated, if required. If RINEX data are required, please contact Veripos Support.

The Logging Status, current logged file's size and name in addition to the logged messaged are presented on the **Home > Status** page of the WebUI:

Logging	Good
Active	
Log File Size	4086 KB
Log File Name	NMPL18400003N_2.LOG
Messages	ALMANAC
	BDSEPHEMERIS
	BESTPOS
	BESTSATS
	GALINAVEPHEMERIS
	GLORAWEPHEM
	HEADING2
	ITDETECTSTATUS
	LBANDTRACKSTAT
	LUASTATUS
	PORTSTATS
	PPPPOS
	QZSSEPHEMERIS
	RANGE
	RAWEPHEM
	RXCONFIG
	RXSTATUS
	VERIPOSINFO
	VERIPOSRTCMDATA
	VERIPOSSTATUS
	VERSION
❓ Help	

4.10.2 Downloading logs

Hourly-separated logs can be found within **Device > Export**. Each log file will be displayed with a date, time stamp and also the file size. As the rolling log builds up there may be multiple pages of stored logs.

To download logs, an FTP transfer utility such as FileZilla needs to be used. Launch FileZilla then connect to the LD8 using its IP address as Host, "admin" for the Username and the LD8 serial number for the password and press Quickconnect. This should establish a connection with the LD8 and will show the logged files in the right bottom panel of the FileZilla. Drag the required files to the appropriate folder on your PC which can be selected in the left bottom panel of FileZilla.

If requested to provide logs by Veripos Support, ensure that the logs cover the period that needs analysing plus 3 hours prior to the event and 1 hour after.
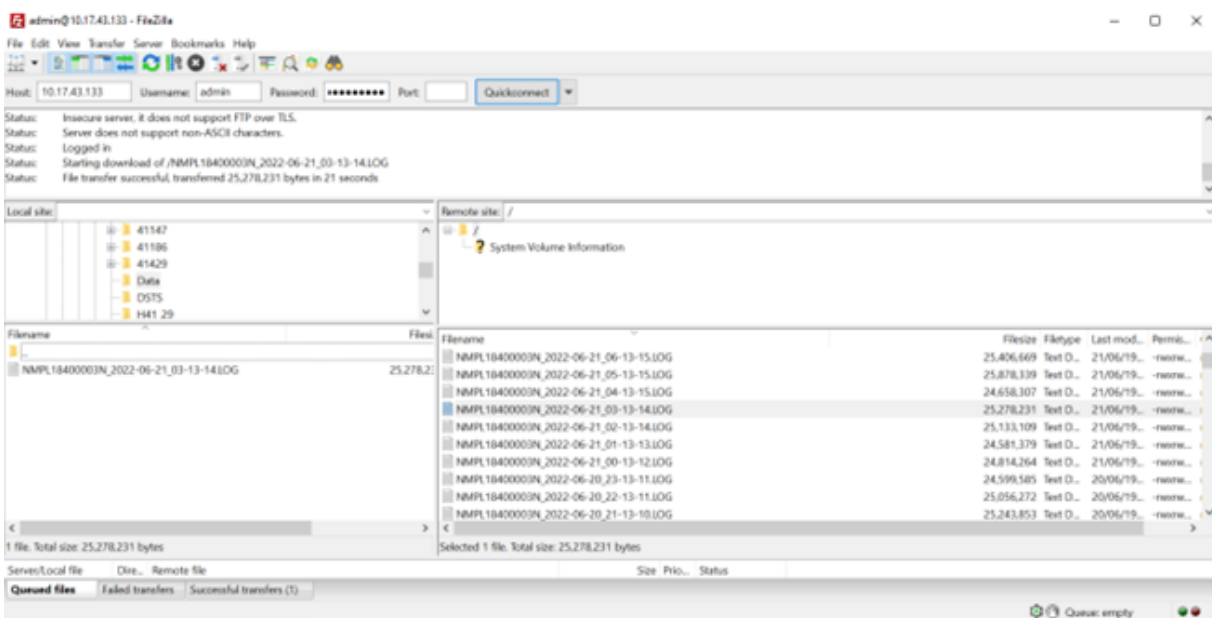
4.11 Factory reset

A factory reset can be performed to revert the LD8 back to default factory settings. This should only be carried out under the advice of Veripos Support.

4.11.1 Factory resetting via terminal

A factory reset should be performed by issuing the case sensitive command:

```
LUA START factoryreset.lua
```

5 Reference information

5.1 Commands list index

Commands used within this manual are listed below. Highlighted text should be changed as required.

Command	Description
ASSIGNLBANDBEAM **25E**	The format for assigning a specific L-band beam
ASSIGNLBANDBEAM AUTO	Setting for automatically tracking L-band beams
GGAQUALITY 4 OUT_OF_BOUNDS 2 WAAS 2 PPP **2** PSRDIFF 2	Set PPP DQI to 2 or 5
IPCONFIG ETHA DHCP	Change IP assignment to DHCP
IPCONFIG ETHA STATIC **192.168.2.8 255.255.255.0 192.168.2.1**	Set a Static IP
LOG COM1 GPGGA ONTIME 1	Enable message output on a specified port
LOG IPSTATUSA ONCE	Check current IP settings
LOG LBANDTRACKSTAT	Check tracked L-band beam/s and signal strength/s
LOG VERIPOSINFO	Check unit ID and activation service code
LOG VERIPOSSTATUSA	Check present activation status of LD8
NMEAFORMAT GGA_LATITUDE **10.5**	Configure number of Latitude decimal places in GGA message
NMEAFORMAT GGA_LONGITUDE **11.5**	Configure number of Longitude decimal places in GGA message
PPSCONTROL ENABLE **POSITIVE**	Set PPS polarity to either positive or negative
PPPSOURCE **AUTO**	Select either Auto, Ultra or Apex solution
SAVECONFIG	Saves all settings excluding Ethernet configurations
SAVEETHERNETDATA	Saves any Ethernet configuration settings
SBASCONTROL DISABLE	Disable the SBAS fallback solution
SBASCONTROL ENABLE AUTO	Enable the SBAS fallback

Command	Description
	solution
SERIALCONFIG **COM1 9600** N 8 1 N OFF	Specify a baud rate for a specified port
SERIALCONFIG **COM1 115200** N 8 1 N OFF INTERFACEMODE **COM1** VERIPOS_RTCM NOVATEL ON	Input external RTCM specifying port and baud rate
UNLOG **COM1 GPGGA**	Disable message output on a specified port
UNLOGALL **COM1**	Stop all messages on a specified port

5.2 LD8 output sentences

This section outlines the structure of the following message output types:

- GGA
- GST
- ZDA
- GSA
- VTG
- GSV
- GLL
- GRS
- RMC
- HDT
- TRINAV
- Veripos UKOOA
- BESTPOS

5.2.1 NMEA talker IDs

The NMEA talker identifier serves to define the nature of the data being transmitted. The talker is the first two characters after the $ sign within the NMEA sentence. As the LD8 is capable of utilising more than only the GPS constellation, the talker has a set value for each constellation. For sentences where the data relates to multiple constellations the ID '**GN**' will be found.

Not all NMEA sentences will have a variable talker ID (the GGA and ZDA will be fixed with **GP**) however all other NMEA messages will have a variable talker.

Note that the talker ID is determined by the constellation/s in use and cannot be changed to another value.

The table below shows the talker IDs and the represented constellation:

Talker ID	Constellation
GP	GPS
GL	GLONASS
GA	Galileo
BD	BeiDou
GQ	QZSS
GN	Multiple Constellations

5.2.2 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 Corrections'.

GGA sentence structure & example

$GPGGA, hhmmss.ss, ddmm.mmmmm, a, dddmm.mmmmm, b, q, xx, p.p, a.b, >M, c.d, M, x.x, nnnn *hh

$GPGGA, 123519.00, 4807.03787, N, 01131.00547, E, 1, 15, 0.9, 545.4, M, 46.9, M, 14.0, 0281 *47

GGA sentence defined

Field	Content
GGA	Global Positioning System Fix data
hhmmss.ss	UTC of position
ddmm.mmmmm	Latitude of position
a	N or S, latitude hemisphere
dddmm.mmmmm	Longitude of position
b	E or W, longitude hemisphere
q	GPS Quality indicator (0 = invalid, 1 = GPS SPS, 2 = DGNSS fix, 4 = Fixed RTK, 5 = Float RTK / PPP, 6 = Dead Reckoning), 7 = Manual Input Mode, 8 = Simulation Mode
xx	Number of satellites in use
p.p	HDOP (Horizontal dilution of precision)
a.b	Antenna altitude above/below mean-sea-level
M	Units of antenna altitude, meters
c.d	The relationship between the geoid and the WGS84 ellipsoid
M	Units of meters
x.x	Age of differential GNSS data
nnnn	Differential reference station ID, 0000 to 1023
*hh	Checksum
[CR][LF]	Sentence Terminator

> **NOTE**
> The number of decimal places in the GGA message Latitude and Longitude values is configurable, see section Setting GGA precision selection via terminal for details. If making changes from five decimal places the sentence will no longer conform with NMEA v3.01.

5.2.3 GST sentence

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

GST sentence structure & example

$GNGST, hhmmss.ss, a.aa, b.bb, c.cc, d.dddd,   e.ee, f.ff,   g.gg *hh
$GNGST, 024603.00,   1.47, 0.11, 0.07, 28.3688, 0.10, 0.08, 0.16 *58

GST sentence defined

Field	Content
GST	Estimated error in position solution
hhmmss.ss	UTC time in hours, minutes, seconds of the GPS position
a.aa	RMS value of the standard deviation of the range inputs to the navigation process. Range inputs include pseudo-ranges and differential DGNSS corrections
b.bb	Standard deviation of semi-major axis of error ellipse (meters)
c.cc	Standard deviation of semi-minor axis of error ellipse (meters)
d.dddd	Orientation of semi-major axis of error ellipse (meters)
e.ee	Standard deviation of latitude error (meters)
f.ff	Standard deviation of longitude error (meters)
g.gg	Standard deviation of altitude error (meters)
*hh	Checksum
[CR][LF]	Sentence terminator

5.2.4 ZDA sentence

The NMEA ZDA sentence provides time and time zone information.

ZDA sentence structure & example

$GPZDA, hhmmss.ss, dd, mm, yyyy, null, null *hh
$GPZDA, 201530.00, 04, 07, 2019, ,   ,   *6E

ZDA sentence defined

Field	Content
ZDA	Time and Date data
hhmmss.ss	UTC time in hours, minutes, seconds of the GPS position
dd	Day, 01 to 31
mm	Month, 01 to 12
yyyy	Year
null	Local zone hours (not available)
null	Local zone minutes (not available)
*hh	Checksum

5.2.5 GSA sentence

The NMEA GSA sentence provides time and time zone information.

GSA sentence structure & example

$GNGSA, a, 1, cc, cc, cc, cc, cc, cc, cc, cc, cc, cc, cc, cc, d.d, e.e, f.f   *hh
$GNGSA, a, b, 02, 12, 15, 20, 21, 24, 25, 29, 32, ,   ,   ,   1.7, 0.9, 1.5 *58

GSA sentence defined

Field	Content
GSA	GNSS DOP and Active Satellites
a	Mode (M = Manual mode, forced to operate in 2D or 3D mode, A = Automatic mode, allowed to automatically switch 2D/3D)
b	Fix (1 = Not available, 2 = 2D, 3 = 3D)
cc	PRN ID numbers of satellites used in solution a total of 12 fields GPS = 1 to 32 GLONASS = 65 to 96 As shown in the above example, if less than 12 satellites for one constellation are used null values will be output in the string.
d.d	PDOP
e.e	HDOP
f.f	VDOP
hh	Checksum

5.2.6 VTG sentence

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

VTG sentence structure & example

$GNVTG, ppp.ppp, T, qqq.qgg, M, rr.rrr, N, ss.sss, K, U, *hh
$GNVTG, 167.608, T, 167.608, M, 0.006, N, 0.012, K, D, *3D

VTG sentence defined

Field	Content
VTG	Course over ground and ground speed
ppp.ppp	True course over ground
T	Degrees True indicator
qqq.qgg	Magnetic course over ground
M	Degrees Magnetic
rr.rrr	Speed over ground, knots
N	Nautical speed indicatior (N = Knots)
ss.sss	Speed over ground, kilometres/hour
K	Speed indicator (K = km/hr)
U	Positioning mode indicator (A = Autonomous, D = Differential, E = Estimated (Dead reckoning), M = Manual, N = Data not valid)
*hh	Checksum

5.2.7 GSV sentence

The NMEA GSV sentence provides information relating to the number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value in one sentence.

GSV sentence structure & example

$GPGSV, a, b, cc, dd, ee, fff,   gg, dd, ee, fff,   gg, dd, ee, fff,   gg, dd, ee, fff,   gg, *hh,
$GPGSV, 4, 1, 13, 02, 10, 043, 41, 05, 05, 103, 38, 10, 04, 238, 42, 12, 13, 030, 44, *7E,
                      (Satellite 1)   (Satellite 2)   (Satellite 3)   (Satellite 4)

GSV sentence defined

Field	Content
GSV	GNSS Satellites in view
a	Total number of sentences (1-9)
b	Sentence number (1-9)
cc	Total number of satellites in view, within the talker ID constellation
dd	Satellite ID number GPS = 1 to 32 GLONASS = 65 to 96
ee	Elevation, degrees (90° maximum)
fff	Azimuth, degrees true, 000 to 359
gg	SNR (C/No) 00-99 dB-Hz, null when not tracking
hh	Checksum

> **NOTE**
> Fields dd, ee, fff and gg will be repeated a maximum of 4 times per sentence, where all satellite info is already output null values will be output.

5.2.8 GLL sentence

The NMEA GGL sentence provides Latitude and Longitude position data for the present position.

GLL sentence structure & example

$GNGLL, ddmm.mmmmmmm, a, dddmm.mmmmmmm, b, hhmmss.ss, S, I *hh
$GNGLL, 5708.7104685, N, 00217.1169613, W, 062859.00, A, D *72

GLL sentence defined

Field	Content
GLL	Geographic position - Latitude and Longitude
ddmm.mmmmmmm	Latitude of position
a	Latitude direction (N or S)
dddmm.mmmmmmm	Longitude of position
b	Longitude direction (E or W)
hhmmss.ss	UTC time of position
S	Status (A = data valid ; V = data not valid)
I	Positioning mode indicator (A = Autonomous, D = Differential, E = Estimated (Dead reckoning), M = Manual, N = Data not valid)
*hh	Checksum

5.2.9 GRS sentence

The NMEA GRS sentence provides range residuals for each satellite.

GRS sentence structure & example

$GNGRS, hhmmss.ss, a, b.b, b.b, b.b, b.b, b.b, b.b, b.b, b.b, b.b, b.b, b.b, b.b, ,cc ,dd *67

$GNGRS, 142406.00, 1, -1.1, -0.1, 1.7, 1.2, -2.0, -1.3, 1.3, -0.4, -1.2, -0.2, , , 1, 1, *hh

GRS sentence defined

Field	Content
GRS	GNSS range residuals
hhmmss.ss	UTC time of position
a	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)
b.b	Range residuals for satellites used in the navigation solution. Order matches order of PRN numbers in GPGSA.
cc	GNSS System ID (see tables below for further explanation).
dd	Ranging Signal ID (see tables below for further explanation).
*hh	Checksum

	GNSS Constellation: GPS					
GNSS System ID:	1 (GP)					
Signal Channel:	All Signals	L1 C/A	L1 P(Y)	L2 P(Y)	L2C-M	L2C-L
Ranging Signal ID:	**0**	**1**	**2**	**3**	**4**	**5**

	GNSS Constellation: GLONASS				
GNSS System ID:	2 (GL)				
Signal Channel:	All Signals	L1 C/A	L1 P	L2 C/A	L2 P
Ranging Signal ID:	**0**	**1**	**2**	**3**	**4**

	GNSS Constellation: Galileo					
GNSS System ID:	3 (GA)					
Signal Channel:	All Signals	E5a	E5b	E5a+b	E6-A	E6-BC
Ranging Signal ID:	**0**	**1**	**2**	**3**	**4**	**5**

	GNSS Constellation: BeiDou								
GNSS System ID:	4 (BD)								
Signal Channel:	All Signals	B1I	B1C	B1A	B2-a	B2-b	B3I	B3Q	B3A
Ranging Signal ID:	0	1	3	4	5	6	8	9	A

	GNSS Constellation: QZSS					
GNSS System ID:	**5** (GQ)					
Signal Channel:	All Signals	L1 C/A	L1C (D)	L1C (P)	L2C-M	L2C-L
Ranging Signal ID:	**0**	**1**	**2**	**3**	**5**	**6**

5.2.10 RMC sentence

The NMEA RMC sentence provides essential GPS PVT (position, velocity, time) data.

RMC sentence structure & example

$GNRMC, hhmmss.ss, a, ddmm.mmmmmmm, b, dddmm.mmmmmmm, c, dd.ddd, eee.e, ddmmyy f.f, g, h *hh

$GNRMC, 143909, A, 5107.0020216, N, 11402.3294835, W, 0.036, 348.3, 210307, 0.0, E, D *31

RMC sentence defined

Field	Content
RMC	Recommended Minimum Sentence C
hhmmss.ss	UTC time of position
a	Position status (A = Active V = Void)
ddmm.mmmmmmm	Latitude of position
b	Latitude direction (N or S)
dddmm.mmmmmmm	Longitude of position
c	Longitude direction (E or W)
dd.ddd	Speed over the ground, knots
eee.e	Course over ground, degrees True
ddmmyy	Current date
fff.f	Magnetic variation, degrees
g	Magnetic variation direction E/W Easterly variation (E) subtracts from True course. Westerly variation (W) add to True course.
h	Mode indicator (A = Autonomous, D = Differential, E = Estimated (dead reckoning), M = Manual input, N = Data not valid)
*hh	Checksum

5.2.11 HDT sentences (V3 & V4)

The NMEA HDT sentence provides heading information derived from the receiver.

HDT sentence structure & example

$GNHDT, dd.dddd, T hh
$GNHDT, 75.5664, T *36

HDT sentence defined

Field	Content
HDT	Heading (true) message
dd.dddd	Heading in degrees
T	Degrees True
*hh	Checksum

5.2.12 TRINAV sentences (V3 & V4)

TRINAV version 3 sentence example

[WGPOS,3,1,OEM7VERI,APEX5,OM7MR0702AN0006,1041,392609.00,0.0,57 12.08207N,002 11.53782W,114.421,0.7,1.2,,0.005948,0.000899,0.004640,0.030111,0.14,3,1,3,16,0,1,8,10,11,14,20,2 2,27,28,32,65,66,67,73,81,82,]

TRINAV version 3 sentence defined

Field	Content	Unit	Notes
Start character	A6	[-]	$WGPOS
Format version	I	[-]	= 3 for this version
Nav. point no.	I	[-]	See comment 1
System name/version	A	[-]	Name + version of DGPS system. See comment 2
GPS week number	I	[-]	GPS week no. since April 6 2019
GPS time of fix	F10.2	[s]	Seconds into GPS week (GPS time).
Age of fix	F4.1	[s]	See comment 3
Latitude	A13	[dm]	dd mm.mmmmmN, space between D and M
Longitude	A14	[dm]	dd mm.mmmmmE, space between D and M
Height	F7.3	[m]	Antenna height above ellipsoid. See comment 4
HDOP	F5.1	[-]	Horizontal dilution of position
VDOP	F5.1	[-]	Vertical dilution of position
Unit variance	F9.3	[m2]	See comment 5
Variance latitude	F10.6	[m2]	See comment 5
Covariance lat/long	F10.6	[m2]	See comment 5
Variance longitude	F10.6	[m2]	See comment 5
Variance height	F10.6	[m2]	See comment 5
External reliability	F7.2	[m]	See comment 6
Fix status	I	[-]	See comment 7
Computation type	I	[-]	See comment 8
Correction type	I	[-]	See comment 9
No. of satellites (n)	I	[-]	No. of satellites used for this fix
No. of ref. stations (r)	I	[-]	No. of ref. stations used for fix. See comment 10
PRN's of sats. used	I*n	[-]	Satellites used for this fix. Separated by commas
Ref. station idents	I*n	[-]	Ref. stations used for this fix. Separated by commas
End character	A1	[-]	Close string
CRLF	A2		

TRINAV version 3 definitions commentary

1. The "Nav point no." is a unique integer identifying the position. It should be manually entered into the software according to requests from Positioning Engineers. Alternatively, this should start from 1 and be incremented if several positions are output from the same system.

2. The system name should identify the system (or contractor) and software version (e.g. "SEADIFF 2.1" or "MFIX 1.2.3").

3. The "Age of fix" is the time of the first character of the data string being output to WesternGeco's positioning system minus the time of position.

4. WGS84 ellipsoid and datum must be used. The height must be antenna height above the WGS84 ellipsoid.

5. The variance and covariance terms are elements from the variance-covariance matrix of the position fix computation (un-scaled).

6. The external reliability is the maximum positional effect of an undetectable error in an observation. This quantity is related to the power of the test (the probability that the MDE would be detected) and the significance level used.

   1. The values recommended by UKOOA should be used (see UKOOA Guidelines for the use of Differential GPS in offshore surveying, Issue no. 1, Sept. 1994) i.e. a significance level of test 1% and the power of the test 80%.

   2. If values other than those given above are used, this must be explicitly stated by the contractor.

7. TRINAV V3 fix status codes:

Status code	Meaning
0	No or bad fix
1	Altitude aiding (Weighted height used in fix)
2	Altitude hold (2D fix)
3	3D fix
4	3D fix INS aided
5	INS only (dead reckoning)

8. TRINAV V3 computation type codes

Type code	Meaning
0	No corrections
1	Single frequency DGNSS
2	Dual frequency DGNSS
3	PPP (satellite orbit and clock corrections)
4	PPP-AR (ambiguity resolution) using phase bias information.
5	Other

9. TRINAV V3 source codes:

Type code	Meaning
L	L-band only, always followed by 1 (i.e. L1)
M	L-band multi-channel, followed by number of links tracked (e.g. M3)
I	Internet source, always followed by 0 (i.e. I0)
O	Other, always followed by 0 (i.e. O0)

10. "No. of ref. stations" gives the number of reference stations in use for this fix, not the number of stations available. This field must be set to 0 if the fix is not differential.

TRINAV version 4 sentence example

[WGPOS,4,1,OEM7VERI,APEX5,OM7MR0702AN0006,1041,396729.00,0.0,57 12.08195N,002 11.53806W,113.340,0.7,0.9,,0.285460,0.009316,0.156003,0.663714,1.33,3,2,G,R,1,0,0,0,1,M3,IOR,2 5E,AORW,18,2,G01,G03,G08,G10,G11,G14,G17,G18,G22,G28,G32,R02,R03,R09,R11,R17,R18,R19 ,777,706,]

TRINAV version 4 sentence defined

Field	Content	Unit	Notes
Start character	A6	[-]	$WGPOS
Format version	I	[-]	= 4 for this version
Nav. point no.	I	[-]	See comment 2
System	A	[-]	Application name and version, space separated e.g. Quantum 3.0.0.0
Service level	A	[-]	Highest enabled service permitted e.g. APEX Pro
Version	A	[-]	Firmware version as reported by the GNSS card e.g. OEM060700SN0062
GPS week number	I	[-]	GPS week no. since April 6 2019
GPS time of fix	F10.2	[s]	Seconds into GPS week (GPS Time).
Age of fix	F4.1	[s]	This field indicates the age of the solution as reported by the GNSS card, based on the time between receiving measurements and generating output.
Latitude	A13	[dm]	dd mm.mmmmmN, space between D and M
Longitude	A14	[dm]	ddd mm.mmmmmE, space between D and M
Height	F7.3	[m]	Antenna height above ellipsoid. See comment 3
HDOP	F5.1	[-]	Horizontal dilution of position
VDOP	F5.1	[-]	Vertical dilution of position
Unit variance	F9.3	[m2]	See comment 4
Variance latitude	F10.6	[m2]	See comment 4
Covariance lat/long	F10.6	[m2]	See comment 4
Variance longitude	F10.6	[m2]	See comment 4
Variance height	F10.6	[m2]	See comment 4
External reliability	F7.2	[m]	See comment 5
Fix status	I	[-]	See comment 6
Constellations in fix (c)	I	[-]	Number of constellations used in the computation
Identifiers of constellations	A*c	[-]	Constellation character based on RINEX format (G-GPS, R-GLONASS, E-Galileo, C-BeiDou, J-QZSS)
GNSS frequency	I	[-]	Number of GNSS frequencies used in the computation (i.e. single frequency, dual frequency, triple frequency)

Field	Content	Unit	Notes
PPP-AR	I	[-]	Phases biases used or not to perform ambiguity resolution. Value of 1 indicates a PPP-AR solution, 0 it is not.
Atmospheric corrections	I	[-]	Use of external atmospheric corrections in computation Value of 1 shows it has atmospheric correction applied, 0 it hasn't.
GNSS integrity/Authentication message	I	[-]	External information used as an integrity check on GNSS broadcast data. Value of 1 shows it has been used, 0 it hasn't.
Correction type	I	[-]	See comment 7
Correction source(s)	A2	[-]	See comment 8
Names of correction links	A*s	[-]	Link names providing corrections. Separated by commas
No. of SV's (n)	I	[-]	No. of GNSS satellites used for this fix
No. of ref. stations (r)	I	[-]	No. of ref. stations used for fix. Set to 0 for non-differential solutions
PRN's of SV's used	A*n	[-]	GNSS satellites used for this fix in RINEX format (G-GPS, R-GLONASS, E-Galileo, C-BeiDou, J-QZSS). Separated by commas (e.g. G01,R03)
Ref. station ID	I*r	[-]	Reference stations used for this fix. Separated by commas. Field(s) will not appear for non-differential solutions.
End character	A1	[-]	] (Close string)
CRLF	A2		

TRINAV version 4 definitions commentary

1. CSV formatting is provided as a guide and it is possible and expected that greater resolution will be output if required.

2. The "Nav point no." is a unique integer identifying the position. It should be manually entered into the software according to requests from Positioning Engineers. Alternatively, this should start from 1 and be incremented if several positions are output from the same system.

3. WGS84 ellipsoid and datum must be used. Must be antenna height above the WGS84 ellipsoid.

4. The variance and covariance terms are elements from the variance-covariance matrix of the position fix computation (un-scaled).

   1. Unit variance currently unavailable and will be a NULL field for the moment.

5. The external reliability is the maximum positional effect of an undetectable error in an observation. This quantity is related to the power of the test (the probability that the MDE would be detected) and the significance level used.

   1. The values recommended by IMCA/OGP should be used (see IMCA/OGP Guidelines for GNSS positioning in the oil & gas industry Report No. 373-19 or IMCA S015, June 2011) i.e. a Significance level of test 1% and the Power of the test 80%.

   2. If values other than those given above are used, this must be explicitly stated by the contractor.

3. Veripos statistics are implemented as per the IMCA/OGP 'Guidelines for GNSS positioning in the oil & gas industry' Report No. 373-19 or IMCA S015, June 2011, unless otherwise indicated.

6. TRINAV V4 fix status codes:

Status code	Meaning
0	No or bad fix
1	Altitude aiding (weighted height used in fix)
2	Altitude hold (2D fix)
3	3D fix
4	3D fix INS aided
5	INS only (dead reckoning)

1. TRINAV V4 computation type codes:

Type code	Meaning
0	No corrections
1	Single frequency DGNSS
2	Dual frequency DGNSS
3	PPP (satellite orbit and clock corrections)
4	PPP-AR (ambiguity resolution) using phase bias information.
5	Other

2. TRINAV V4 correction source codes:

Type code	Meaning
L	L-band only, always followed by 1 (i.e. L1)
M	L-band multi-channel, followed by number of links tracked (e.g. M3)
I	Internet source, always followed by 0 (i.e. I0)
O	Other, always followed by 0 (i.e. O0)

5.2.13 Veripos UKOOA sentence

The Veripos UKOOA sentence is compliant with **OGP 373-19** and **IMCA S015 (July 2011)**. For further information relating to these standards please visit https://www.iogp.org and https://www.imca-int.com.

Veripos UKOOA sentence structure & example

[240 7300 VERI 1 2067 295238.0 +0.1 +8.0 057 12.08207N 002 11.53776W 63.997 +50.40 1.151 0.564 1.004 7 0.025 0.054 0.14 0.001 0.000 0.000 0.003 0.06 0.05   6.5 P 15{ 20 27 13 30 26 8 21 16 7 10 15 85 77 75 86} 1{ 481}]

Veripos UKOOA sentence defined

Field	Content	Notes
Field	Content	Notes
1	Start Character	Open string
2…5	Length of Message	Number of characters
6…10	Software Version	
11…16	System Name	
17…18	Record Identifier	Shows the calculation used, as different calculations can be labelled: 1, 2, 3 etc
19…23	GPS Week Number	Since Jan 6th 1980
24…32	GPS Time of Fix	Seconds into current GPS Week
33…37	Age of Record	Time (in seconds) of the first character of the data string being output, minus the time of position.
38…43	Latency	Latency in seconds
44…56	Latitude	Latitude displayed with spaces, dd mm.mmmmm'
57	Latitude Hemisphere Indicator	N or S
58…71	Longitude	Longitude displayed with spaces, dddmm.mmmmm'
72	Longitude Hemisphere Indicator	E or W
73…79	Altitude above MSL	Antenna height (in metres) above mean sea level (datum for height calculations)
80…87	Geoid Separation	Separation between mean sea level and the WGS84 reference ellipsoid (in metres), based on a Geoid model as for example EGM96.
88…94	PDOP	
95…101	HDOP	
102…108	VDOP	

Field	Content	Notes
109…110	Fix Status	Single Frequency
0 = None or Bad Fixes	4 = None or Bad Fixes	0 = None or Bad Fixes
1 = Altitude Aiding (weighted height)	5 = Altitude Aiding (weighted height)	1 = Altitude Aiding (weighted height)
2 = Altitude hold (2D Fix)	6 = Altitude hold (2D Fix)	2 = Altitude hold (2D Fix)
3 = 3D Fix	7 = 3D Fix	3 = 3D Fix
111…117	Internal Reliability	Smallest outlier (in metres) that is likely to be detected by the current solution.
118…125	External Reliability	Maximum positional effect (in metres) 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.
126…130	Unit Variance	The Variance and Covariance terms are elements from the variance-covariance matrix of the position fix computation (un-scaled) in metres².
131…137	Variance Latitude	
138…145	Covariance Lat/Long	
146…152	Variance Longitude	
153…159	Variance Height	
160…165	95% Error Ellipse Semi Major Axis	Shows 95% confidence level of the semi-major axis of the error ellipse in metres.
166…171	95% Error Ellipse Semi Minor Axis	Shows 95% confidence level of the semi-minor axis of the error ellipse in metres.
172…177	Orientation Of Semi Major Axis of Error	Orientation of the semi major axis (degrees from true North)
178…179	F Test	A test applied to the Unit Variance. (P=Pass, F=Fail). A "Fail" may result from large outliers in the measurements.
180…182	No of Satellites used in the Fix (n)	

Field	Content	Notes
Variable	Satellite PRN Numbers of Satellites used in Fix	PRN numbers are space separated
Variable	Number of Reference Stations used for this Fix (00 – 99)	
Variable	Ids of the Reference Stations used in the Fix	Station ID numbers are space separated
	End of Character	Close string
	Carriage Return	
	Line Feed	

5.2.14 BESTPOS sentence

The BESTPOS 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 Corrections'.

BESTPOS sentence structure & example

#BESTPOSA,USB1,0,58.5,FINESTEERING,2209,502061.000,02000020,cdba,16809;SOL_
COMPUTED,PPP,51.15043706870,-114.03067882331,1097.3462,-
17.0001,WGS84,0.0154,0.0139,0.0288,"TSTR",11.000,0.000,43,39,39,38,00,00,7f,37*52483ac5

BESTPOS sentence defined

Field	Content
1. Log header	BESTPOS header
2. sol stat	Solution status
3. pos type	Position type
4. lat	Latitude (degrees)
5. lon	Longitude (degrees)
6. hgt	Height above mean sea level (metres)
7. undulation	Undulation - the relationship between the geoid and the ellipsoid (m) of the chosen datum
8. datum id#	Datum ID number 61 = WGS84 63 = USER
9. lat σ	Latitude standard deviation (m)
10. lon σ	Longitude standard deviation (m)
11. hgt σ	Height standard deviation (m)
12. stn id	Base station ID
13. diff_age	Differential age in seconds
14. sol_age	Solution age in seconds
15. #SVs	Number of satellites tracked
16. #solnSVs	Number of satellites used in solution
17. #solnL1SVs	Number of satellites with L1/E1/B1 signals used in solution
18. #solnMultiSVs	Number of satellites with multi-frequency signals used in solution
19. Reserved	
20. ext sol stat	Extended solution status
21. Galileo and BeiDou sig mask	Galileo and BeiDou signals used mask
22. GPS and GLONASS sig mask	GPS and GLONASS signals used mask

Field	Content
23. xxxx	32-bit CRC (ASCII and Binary only)
24. [CR][LF]	Sentence terminator (ASCII only)

6 Contact information

All initial contacts regarding technical or support issues should be initially addressed to Veripos Support. Where appropriate Support will refer issues to the regional operations and engineering teams.

6.1 Veripos Support details

Veripos Support website	https://veripos.com/support
Veripos Support telephone	+44 1224 965900
Veripos Support e-mail	support.veripos@hexagon.com

7 Appendix

7.1 L-band coverage map