HEXAGON

Quantum

User Manual

AB-V-MA-00641_RevA10
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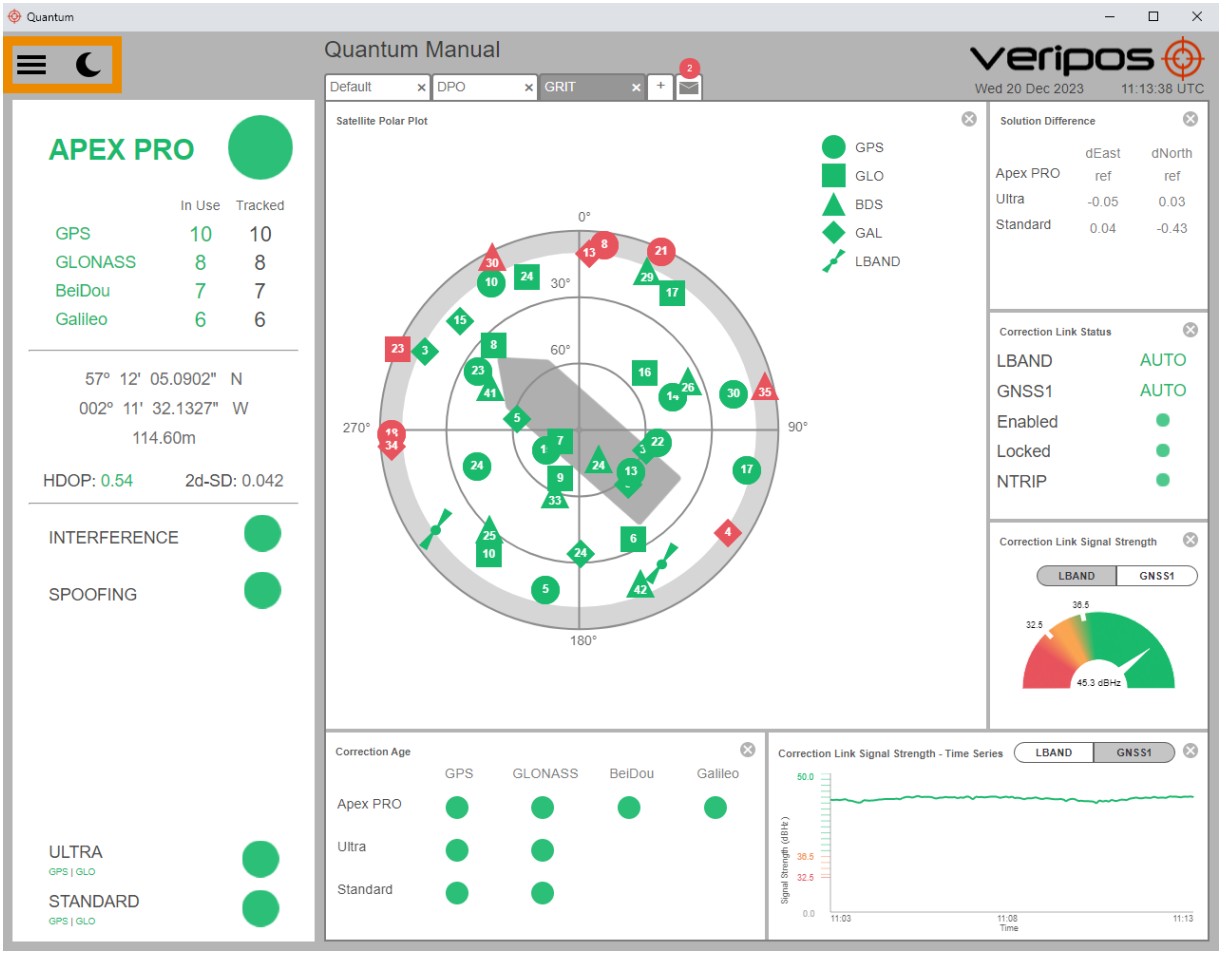
Contents

1 Introduction

Quantum is the latest visualisation software released by Hexagon | Veripos. It has been specifically designed to clearly display the most relevant information required for both DP and Survey operations.

Quantum is a quality, position and heading monitoring software package with a configurable graphical user interface. Displays can be customised to match the end user requirements and preferences. Views available range from high level, appropriate for standard operations, to detailed views for specific operating scenarios or troubleshooting. Users not requiring a custom configuration can select from predefined default page layouts.

This manual will focus on Quantum PC use, in conjunction with the LD8 and LD900 Veripos receivers:



Quantum software layout example

1.1 Scope

This manual covers the following aspects of Quantum for Microsoft Windows 7 and Windows 10:

• Installation

• Interfacing to compatible Veripos receivers

• Software configuration

• Operational procedures

• Receiver configuration

1.1.1 Contents

Chapter	Contents
Introduction	Specifies the purpose of this manual, provides an overview of the Quantum software and explains the document conventions used.
Installation	Describes the software installation process, minimum PC specifications and Veripos receiver compatibility.
Settings	Describes the Quantum settings menu in detail.
Screen overview	Describes the Quantum screen layout in detail.
Display Configuration	Explains the configurable display options such as adding and removing display tabs and configuring display tiles.
Views	Describes all available view options in detail.
Troubleshooting	Provides basic fault-finding advice and examples of possible error states.
Reference information	Provides technical specifications.
Contact information	Contains contact information for the Veripos Helpdesk.
Appendix	Provides additional supplementary material.

1.2 Document conventions

1.2.1 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.

1.2.2 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.

1.3 Disclaimer

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2 Installation

Quantum is available for download from the Veripos support site https://help.veripos.com.

2.1 PC Minimum Requirements

The only operating systems currently supported by Quantum are Windows 7 and Windows 10 (64 bit).

The minimum specifications for running Quantum software are:

Processor:	i5 (2nd generation or later) @ 3.2GHz
Memory:	3 GB RAM
Hard disk:	250 GB
Serial ports:	Optional for Tides data output and serial gyro input
Ethernet:	10/100 Mbps
Display:	17”, 1280 x 1024 minimum resolution
Peripherals:	Mouse & keyboard
Operating system:	Windows 7 or 10 (64 bit)

PC hardware with the correct specifications can be supplied by Veriposs to ensure compatibility.

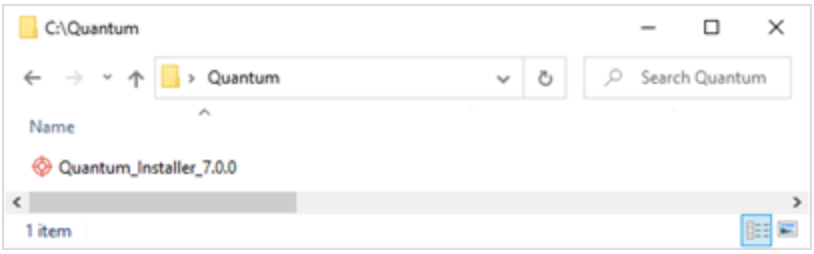
2.2 Software installation procedure

The procedure for installing the Quantum software on a PC is shown below.

NOTE
Uninstall any other previous versions of Quantum that already exist on the PC prior to installation of the latest version of Quantum.

2.2.1 Installing Quantum on a PC

Double-click the Quantum installer file (version number may differ from the example below):

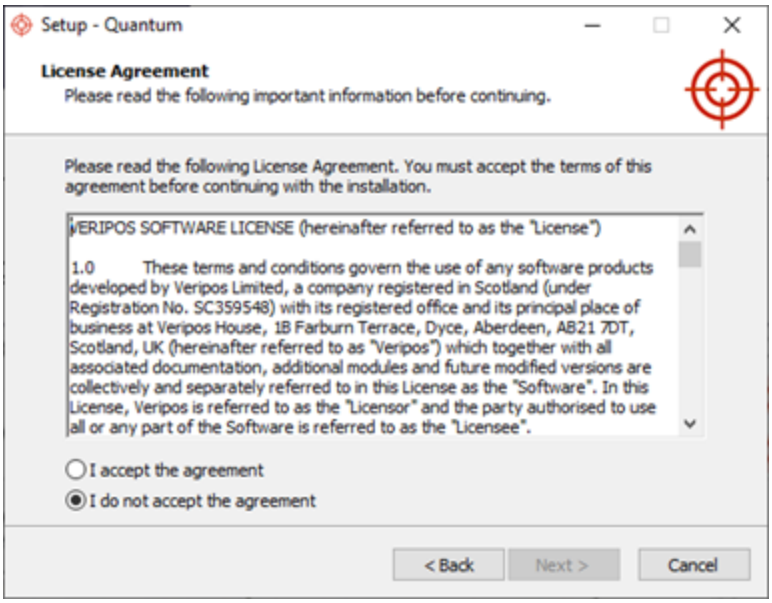


Quantum installer file

Running the installation files will launch the setup wizard. Click **Next >** to proceed with the installation:

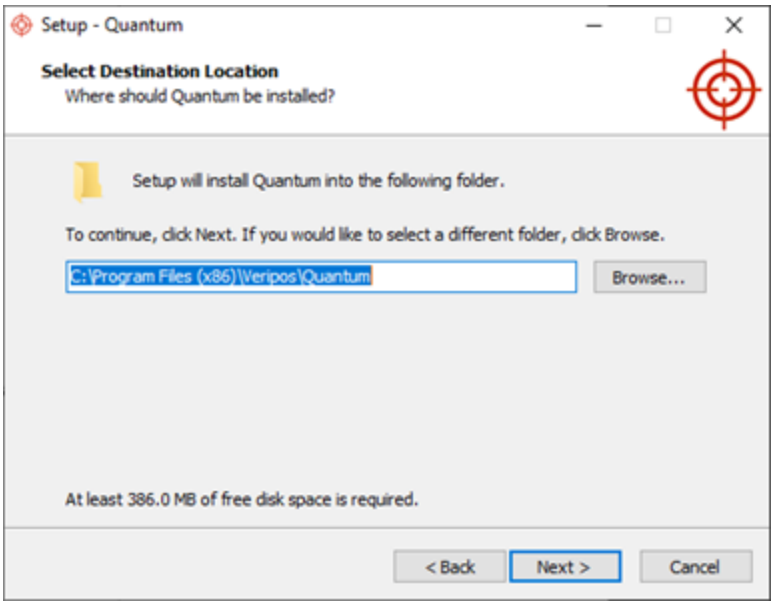
Quantum Setup Wizard – Initial page

Please review and if satisfied, agree to the license agreement then click **Next >**:



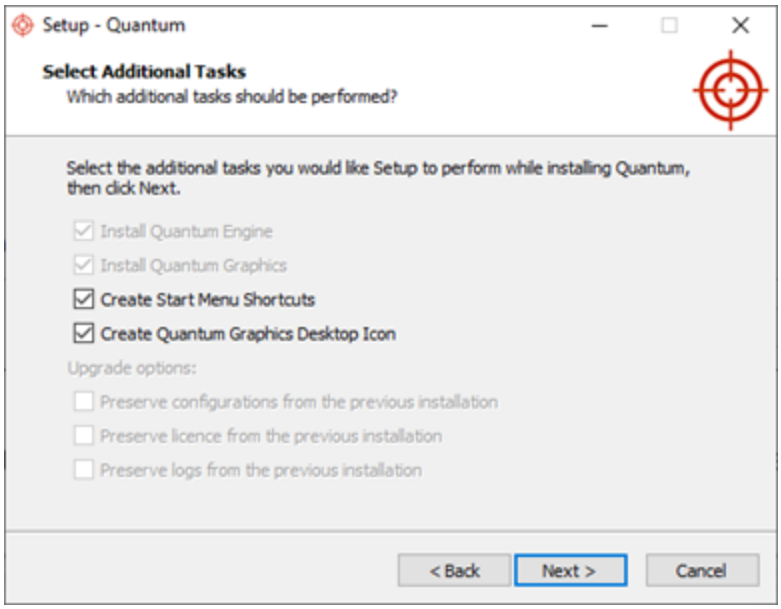
'License Agreement' page

Select the folder where you wish the Quantum software to be installed, or simply leave the setting as the default directory and click **Next >**:



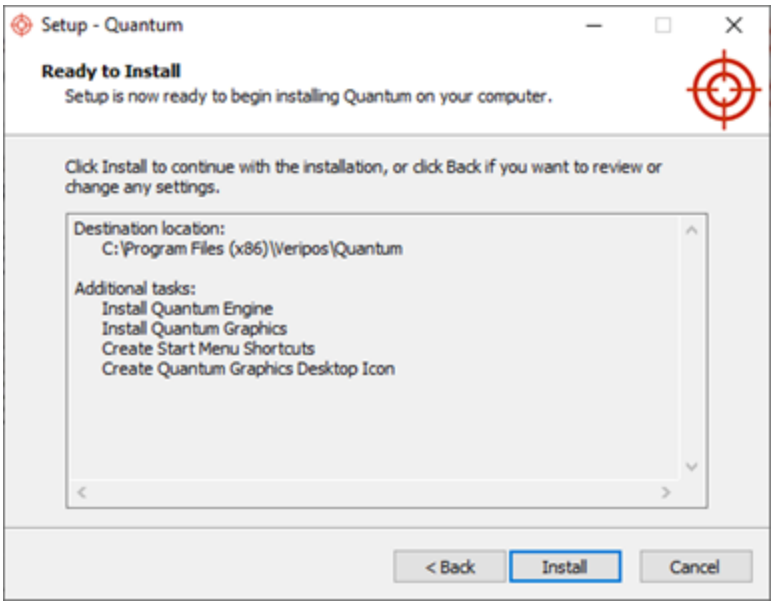
Installation directory

If desired, tick the **Create Quantum Graphics Desktop Icon** option, making it simpler to launch the software by using a desktop icon:



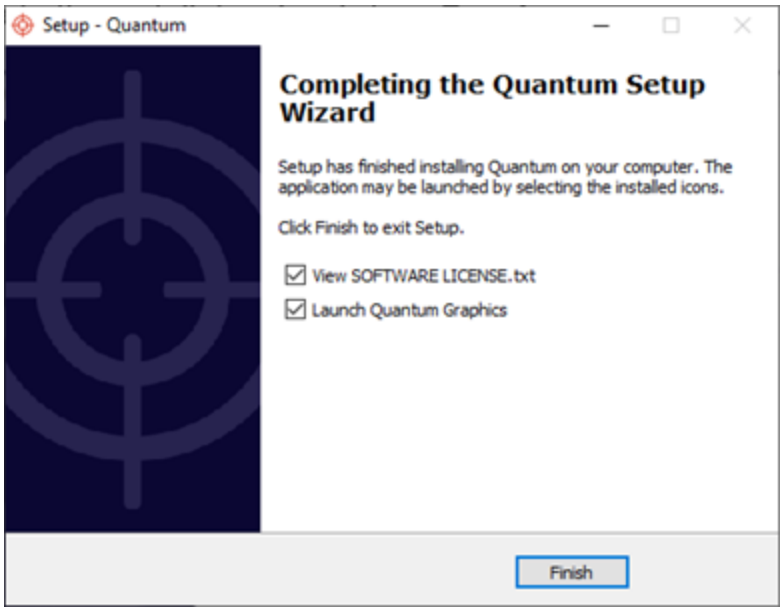
Additional installation options

Quantum is now ready to install. Click **Install** to continue:



Ready to Install' page

A completion confirmation will appear once the installation files are copied to the PC. Select the two checkboxes based on preference and complete the installation by clicking **Finish**:



Quantum Setup Wizard – Completion

Quantum can be launched using the desktop shortcut or the Windows Start Menu **(Start > All Programs > Veripos > Quantum > Run Quantum)**.

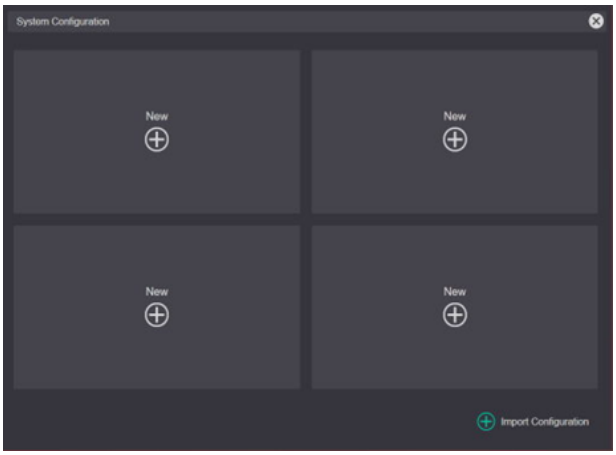
3 Settings

3.1 System Configuration

After launching Quantum on a PC for the first time an initial configuration needs to be created. Steps for Importing configurations are covered in section **Importing configurations**. Note only configurations from version 6 or later should be imported.

3.1.1 Creating a new configuration

Quantum can locally save up to four separate configurations. To create a new configuration, click any of the four tiles as shown below:



'System Configuration' page – First time run

3.1.2 Receiver configuration

Specify the Receiver Type and enter the Receiver IP address assigned to the unit. Clicking on any of the Receiver IP address fields will activate the on-screen keypad:

Once these details have been entered click **Next**.

The next page will list the Quantum licensing options currently associated with the active license, or prompt the user to enter a new license as below:

'New Configuration Licensing' page

If a new Quantum licence code is required, contact Veripos Support for assistance. For further information regarding Quantum licence codes, please refer to section Quantum - Software Licenses.

Once a licence code has been received from support, enter the code and click **Next**.

3.1.3 Save and launch configuration

Prior to saving, the configuration must be named. It is good practice to create an informative name for a configuration, such as the vessel name and the date, or the name of a specific project:

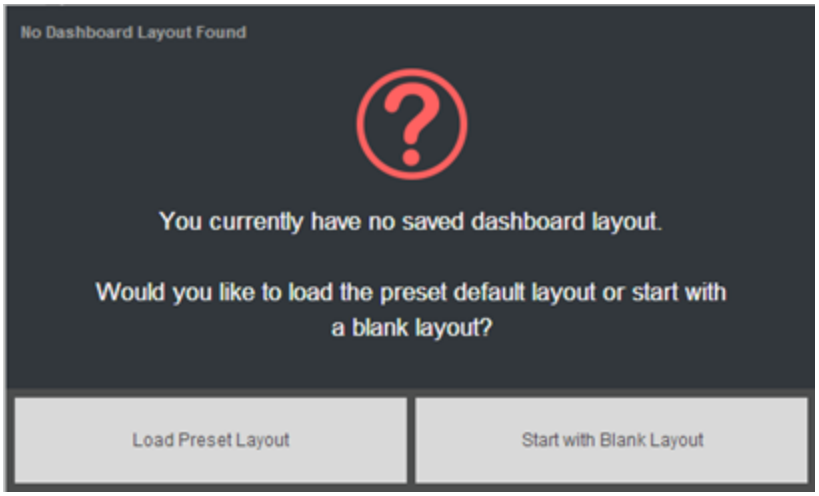
'Config Name' page

The configuration can then be saved by selecting either the **Save & Launch** or **Save & Manage** options. Save and Launch will start the configuration. Save and Manage will open the **System Configuration** menu, allowing more changes to be made if necessary, before the configuration is launched:

Save configuration options

3.1.4 Dashboard layout – First-time run

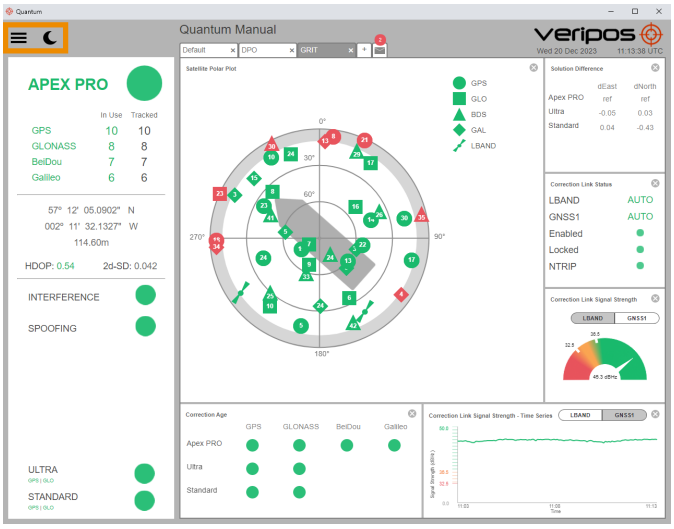
Upon starting a configuration, a user will be prompted by the display below, with options to choose either **Load Preset Layout** or **Start with Blank Layout**. Selecting the **Load Preset Layout** option will launch a predefined tile layout. Selecting **Start with Blank Layout** will require manual configuration of tiles:



Dashboard layout option

3.1.5 System Configuration – After initial setup

Quantum provides both a day mode (default) and night mode. A moon icon located at the top-left of the screen allows for switching between the two. Note this manual will use night mode for screen examples.



Quantum menu icon and day/night mode toggle

The **System Configuration** menu can be accessed after the initial setup is complete. To access the Quantum System Configuration menu, select the **menu** (☰) icon located at the top left of the screen.

Select the **Settings** icon:

Quantum Settings icon

The main **Settings** page is then shown.

As shown below, basic system information (configuration name, unit ID, unit type and IP address) will be displayed within the Settings page:

Settings main page – Quantum DP

Below the system information, the **System Configuration** menu item can be used to setup and edit Quantum configurations:

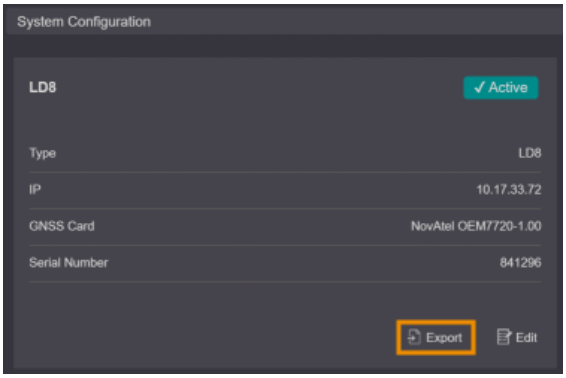
System Configuration menu

Clicking on the above will reveal two Settings sub-sections (Quantum Management and Receiver Management), as well as display any (active and inactive) configurations. These configurations can then be Exported, Edited or Launched.

3.1.6 Exporting configurations

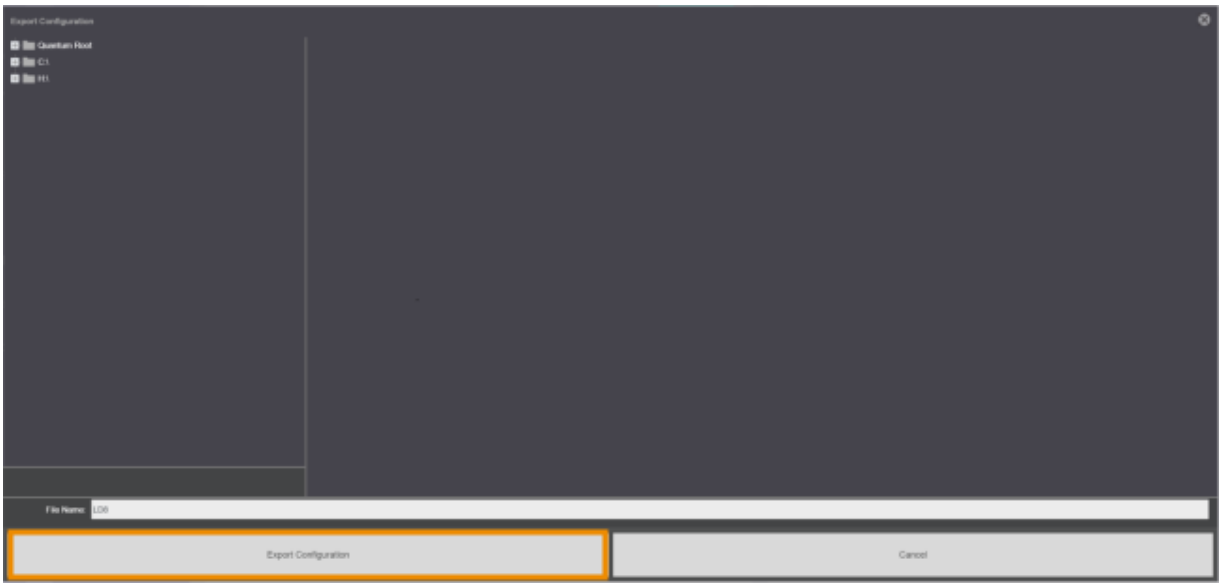
Once a configuration has been created, it is possible to export the configuration to file. This feature can be used for backing-up configurations, which can be imported back into Quantum later if required.

From the System Configuration menu, click **Export** on the desired configuration:



Export configuration option (LD8)

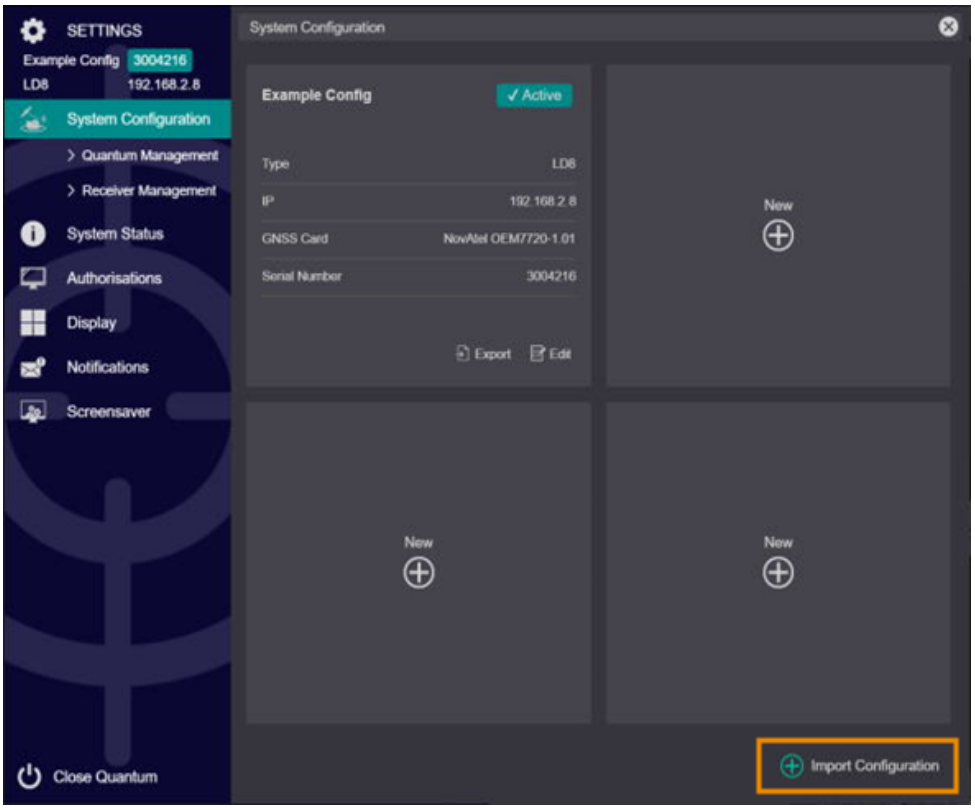
Choose a location to save the configuration file (e.g. PC hard drive or external USB storage) then select **Export Configuration** to save the configuration:



Save exported Quantum config file

3.1.7 Importing configurations

To import a Quantum configuration, go to **Settings > System Configuration** and click **Import Configuration**:

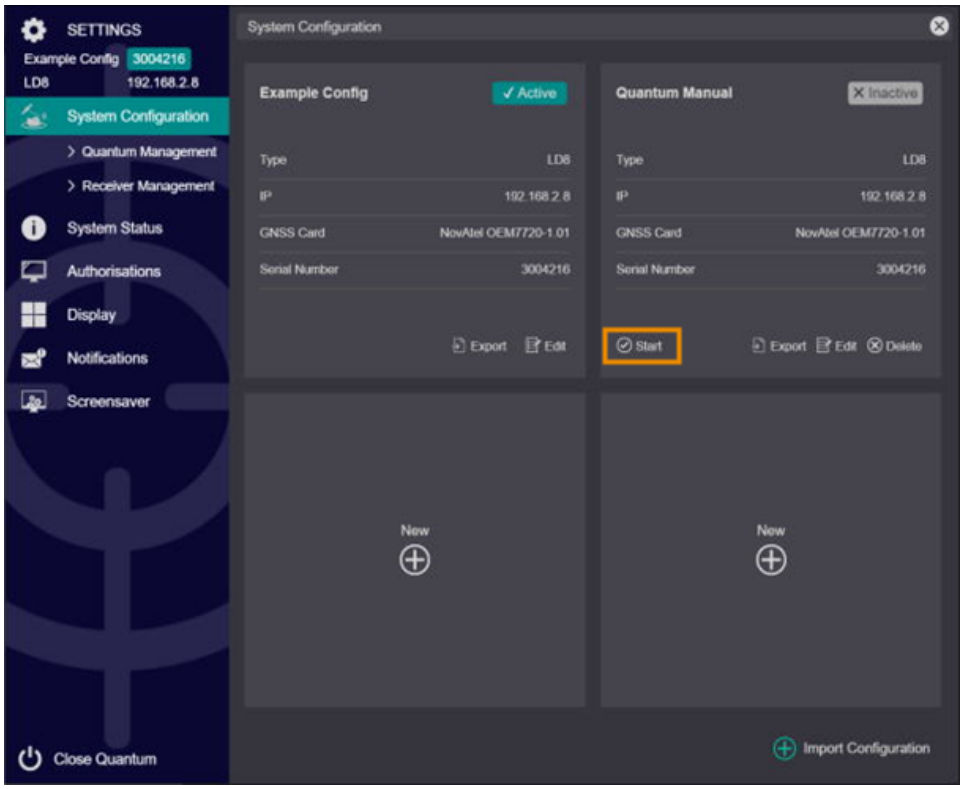


Import Configuration option

Browse to the Quantum file which is to be restored and then click **Import Configuration**:

Import Configuration – Browsing to

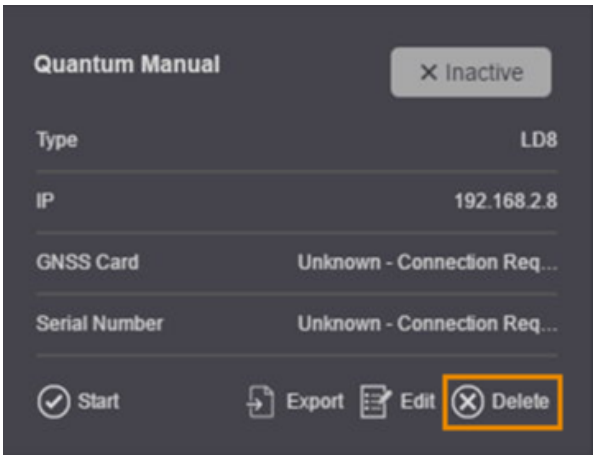
The configuration will then be displayed. To activate the imported configuration, click **Start**:



Start imported configuration

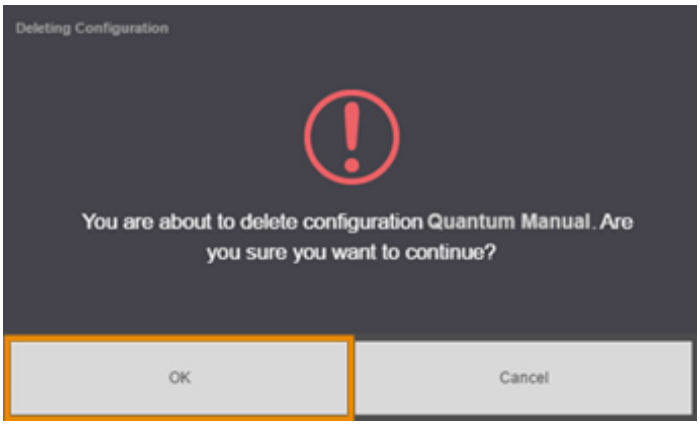
3.1.8 Deleting configurations

To delete a Quantum configuration, go to **Settings > System Configuration** and click **Delete**:



Delete configuration

A warning message will be displayed. Press **OK** to delete the configuration:

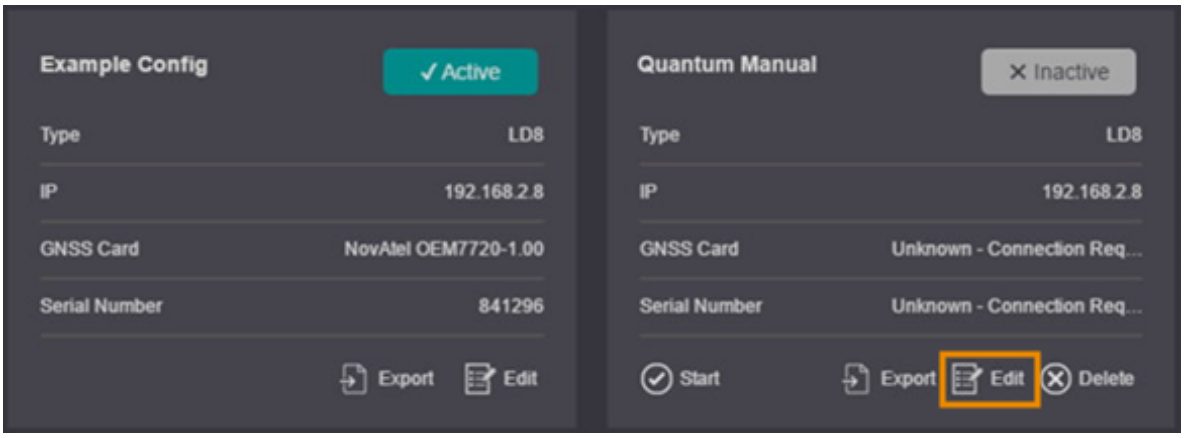


Delete configuration confirmation

NOTE
Active configurations cannot be deleted.

3.1.9 Editing configurations

To edit a Quantum configuration, go to **Settings > System Configuration** and click **Edit**:



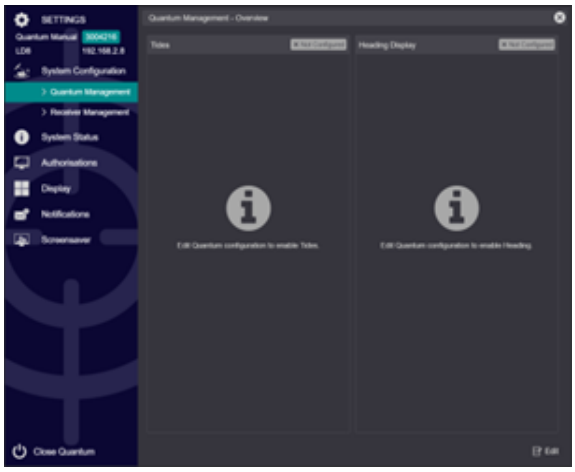
Edit configuration

Edit can be used to change configuration parameters, e.g. connection IP address or configuration name. After editing the configuration, select either to **Save & Launch** or **Save & Manage** this configuration.

If editing the active configuration, it is recommended to select the **Save & Launch** option for new settings to be applied.

3.2 Quantum Management

While in the System Configuration menu, clicking on **System Configuration** will allow access to the Quantum Management sub-menu:

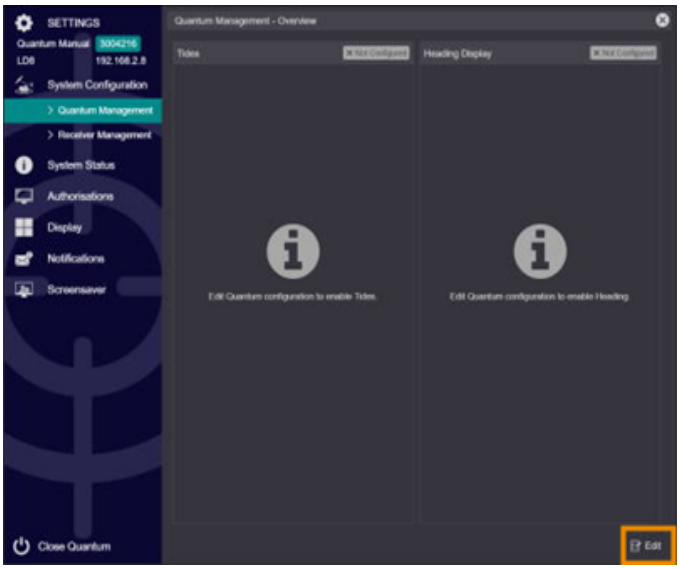


Clicking **Quantum Management** provides the ability to configure Quantum **Tides** and **Heading Display**.

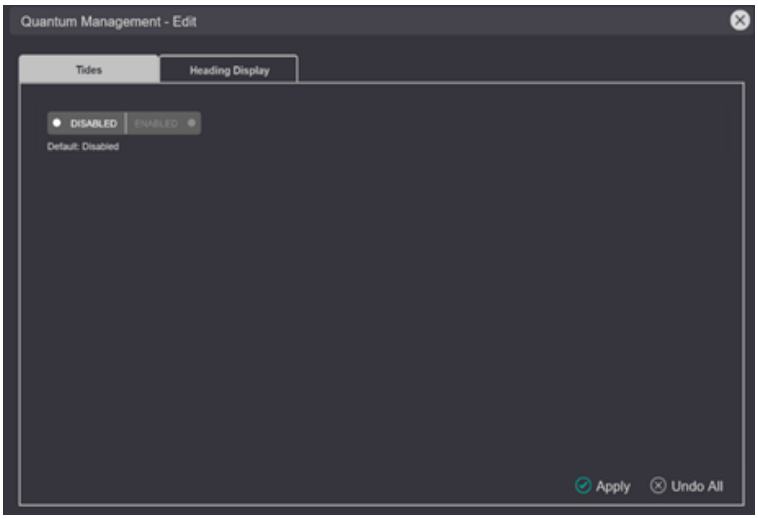
The Quantum Management - Overview page will show Tides in one of three states:

✓ Configured	Configuration carried out and applied
✕ Not Configured	Not yet configured or not active
Unlicensed	Not yet licensed, contact Veripos Support to license if required

To configure Tides select Edit, located at the bottom right hand corner of the Quantum Management - Overview screen:



Each licensed feature will be separated by tabs, with a highlighted background indicating which menu is presently selected. Upon clicking **ENABLED** configuration options will appear for the feature.

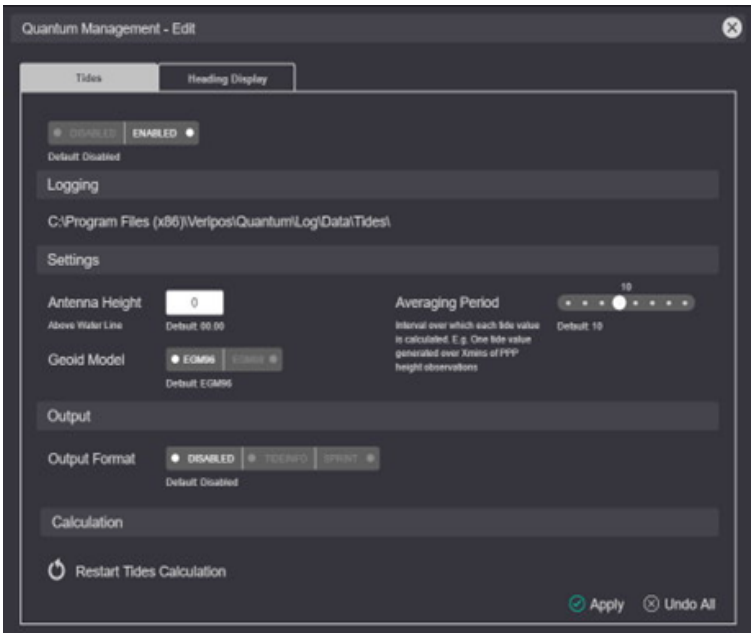


Tides & Heading Display menu (LD8 and LD900)

3.2.1 Tides

Enabling Tides

Upon first access Tides will be DISABLED and no options will be present. Toggling DISABLED to **ENABLED** will allow for configuration of Tides options. Use **Apply** to save any changes made.



Tides configuration

Logging
The path to which Tides logs are being saved will be displayed here. Both Sprint and Tidesinfo files will be generated in this location. If files are removed from this location the Doodson Tides calculation will be restarted. Copying of files will not impact the Tides calculation.

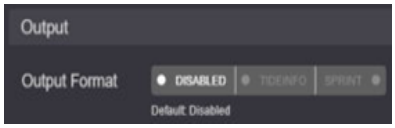
Settings > Antenna Height
The Antenna height above the waterline (in metres) can be entered here. When using the Geoid Tide, this value is required to be updated regularly with vessel draft changes. The antenna height is not used by MSS Tide

Settings > Averaging Period
The Averaging Period is the interval time with which each tide value is calculated. This sliding scale allows for the interval in which each tide value is calculated to be specified in minutes, from 1 to 60.

Settings > Geoid Model
The Geoidal Model EGM96 or EGM08 can be selected here. This change will only be applied to Geoid Tide. This Geoid Model selection is not applicable for any position output.

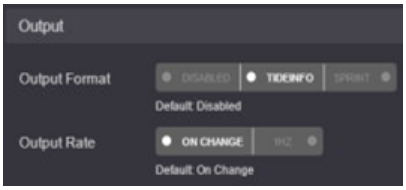
Output > Output Format
The system can output Tide information in two different formats TIDEINFO or SPRINT, details of these different formats can be found in the Reference information section.

By default the output format is **DISABLED**:



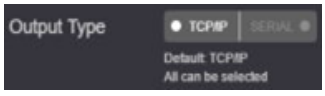
Tides output

Output > Output Format > TIDESINFO / SPRINT > Output Rate
Toggling Output Rate to either **TIDEINFO** or **SPRINT** will reveal the option to configure Output Rate, which can be toggled between **ON CHANGE** and **1HZ**. ON CHANGE will only output one epoch at the end of the averaging period, whereas 1HZ will output an epoch every second with a new timestamp.



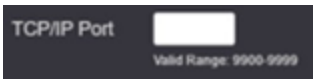
Output Rate

Output > Output Format > TIDEINFO / SPRINT > Output Type
The Tides output message can be output from the PC by **TCP/IP** and **Serial**. Either option (or both) can be selected. Choosing either will bring up additional configuration options.



Output Type

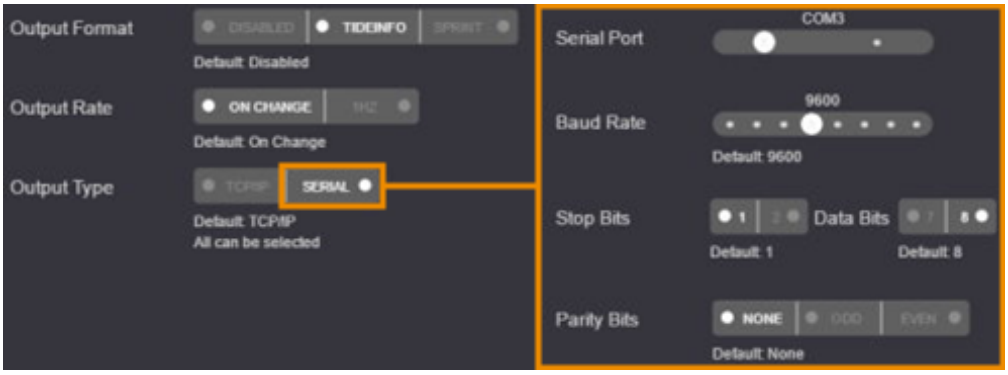
Output > Output Format > TIDEINFO / SPRINT > Output Type > TCP/IP Port
When selecting TCP/IP a port within the range of 9900-9999 should be specified:



TCP/IP Port

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL

When selecting the **SERIAL** output type, several additional options will appear:



Serial Port

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL > Serial Port

A sliding scale will allow selection of the desired serial port to output from.

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL > Baud Rate

The baud rates available for selection are **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600** or **115200**.

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL > Stop Bits

The Stop Bits can be set to **1** or **2**.

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL > Data Bits

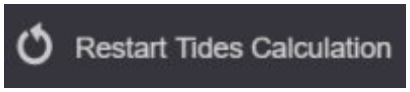
The Stop Bits can be set to **7** or **8**.

Output > Output Format > TIDEINFO / SPRINT > Output Type > SERIAL > Parity Bits

Parity Bits can be set to **NONE**, **ODD** or **EVEN**.

Calculation

The option to **Restart Tides Calculation** is provided by actioning a Tides restart. This will require the Doodson Tides to build up 39 hours of data prior to this being available. For users of Geoid Tides, after the first averaging period Tides will be available.



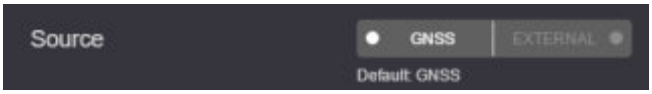
CAUTION
MSS Tides will take 39 hours to initialize after a reset

3.2.2 Heading Display

Upon first access Heading Display will be DISABLED and no options will be present. Toggling DISABLED to **ENABLED** will allow for configuration of Heading Display options. Use **Apply** to save any changes made.

Heading Display > Source

When toggled to GNSS no further configuration is necessary. Toggling to EXTERNAL will allow for an external source of heading to be input to Quantum for display purposes, it will also display additional options as detailed below:



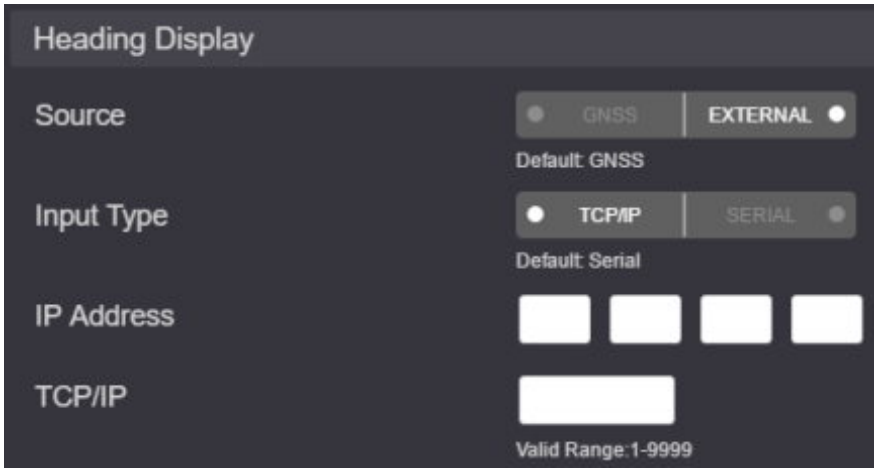
NOTE
When GNSS Heading is the selected source Heading must also be enabled in the LD8 or LD900 receiver

Heading Display > Offset

Will appear when Heading Output is ENABLED. It can be set to a value between -180° and 180°. This option allows for an offset to be applied to the calculation. Any offset value entered in here will only change the heading display and won't change the heading output.

Heading Display > Source > EXTERNAL > Input Type > TCP/IP

Toggling Input Type to TCP/IP will present additional configuration options:



TCP/IP configuration

Heading Display > Source > EXTERNAL > Input Type > TCP/IP > IP Address

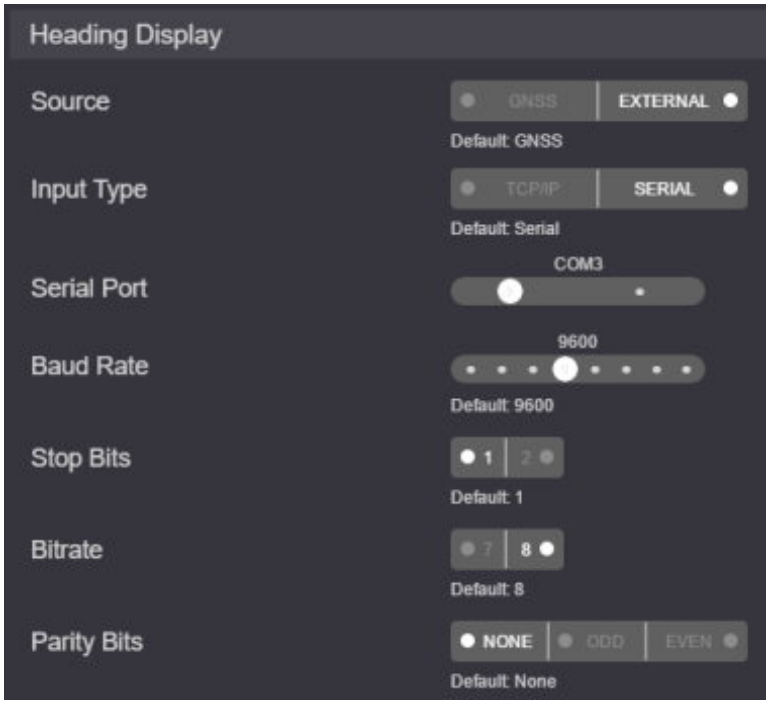
Clicking within any of the fields will bring up the onscreen keyboard, allowing the input of an IP Address

Heading Display > Source > EXTERNAL > Input Type > TCP/IP > TCP

A TCP/IP port number between 1-9999 should be entered.

Heading Display > Source > EXTERNAL > Input Type > SERIAL

Toggling Input Type to SERIAL will present additional configuration options as detailed below:



Heading Display - Serial configuration

Heading Display > Source > EXTERNAL > Input Type > SERIAL > Serial Port

The desired PC Serial port can be selected here.

Heading Display > Source > EXTERNAL > Input Type > SERIAL > Baud Rate

The baud rates available for selection are **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600** or **115200**.

Heading Display > Source > EXTERNAL > Input Type > SERIAL > Stop Bits

Either **1** or **2** Stop Bits can be selected.

Heading Display > Source > EXTERNAL > Input Type > SERIAL > Bit Rate

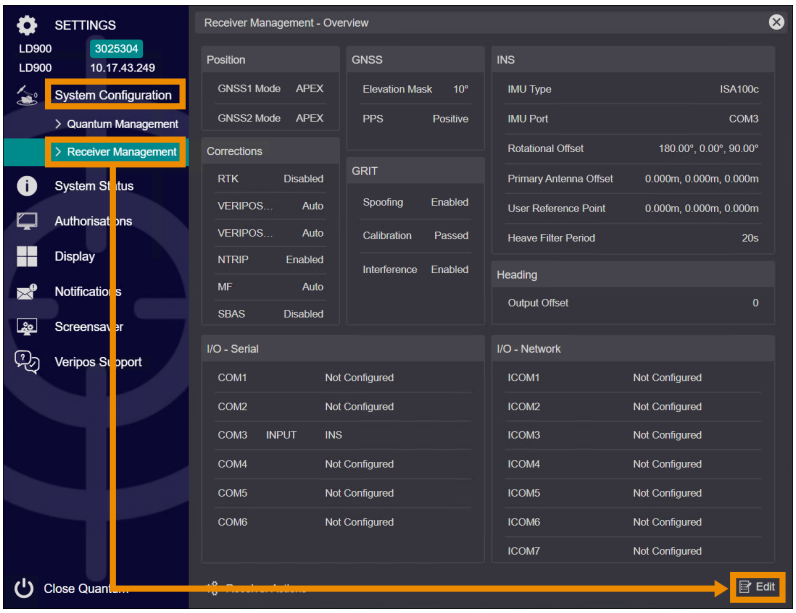
A bit rate of **7** or **8** can be chosen.

Heading Display > Source > EXTERNAL > Input Type > SERIAL > Parity Bits

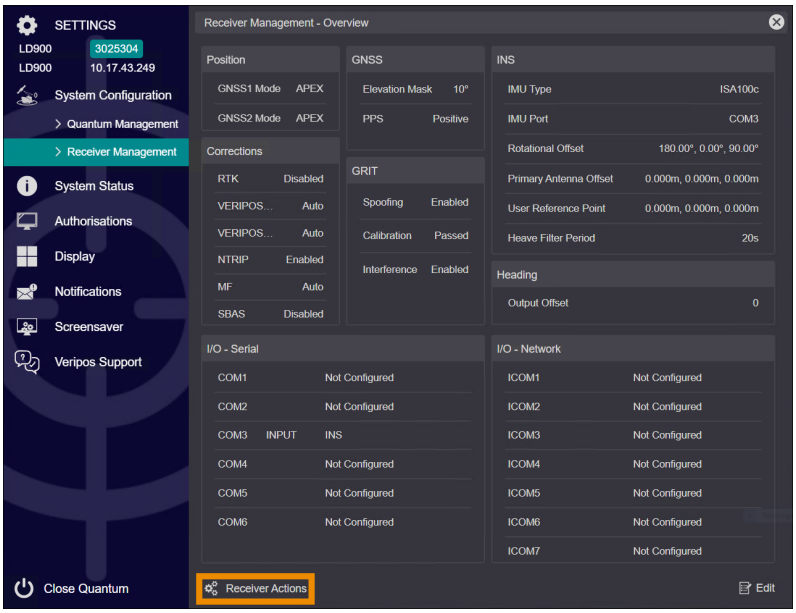
NONE, **ODD** or **EVEN** Parity Bits can be selected.

3.3 Receiver Management

Clicking on **System Configuration** will allow access to the **Receiver Management - Overview** sub-menu, which provides an overview of the current receiver configuration. Clicking **Edit** will display the configurable options for the receiver.



Clicking **Receiver Actions**, located at the bottom-left of the Receiver Management page will allow access to the receiver configurable options and receiver actions. Receiver Actions are detailed in the next section:

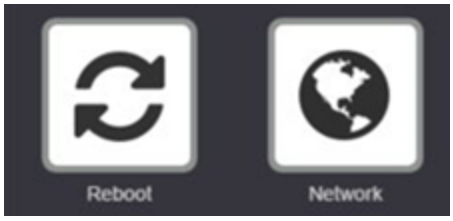


3.3.1 Receiver Actions

Receiver actions are available, with some differences between the LD8 and the LD900:

• A factory reset can be applied to the LD8.
• The LD8 TCP/IP configuration option is titled Modify Receiver IP while the equivalent LD900 option is titled Network.

Receiver Actions (LD8)



Receiver Actions (LD900)

Factory Reset (LD8)

Applying the factory reset will cause the receiver to revert to factory default settings (except the receiver IP Address). Ensure any important configuration information is recorded before performing a factory reset

Reboot

Rebooting the receiver will cause the unit to restart. Any active positioning will be reset and any PPP solution in use will require re-convergence.

Network / Modify Receiver IP

This will allow for LAN configuration.

Modify Receiver IP > IP Config (LD8) / Network > LAN1 (LD900)

Mode can be set to **STATIC** only, where the **IP Address**, **Subnet Mask** and **Gateway IP** must be defined, with **DNS** a configurable option if required.

Receiver Actions (LD8)

Receiver Actions (LD900)

Network (LD900) > LAN2

The LAN2 network settings are controlled by using the LD900 MMI. The information is displayed for reference only.

LAN2 configuration

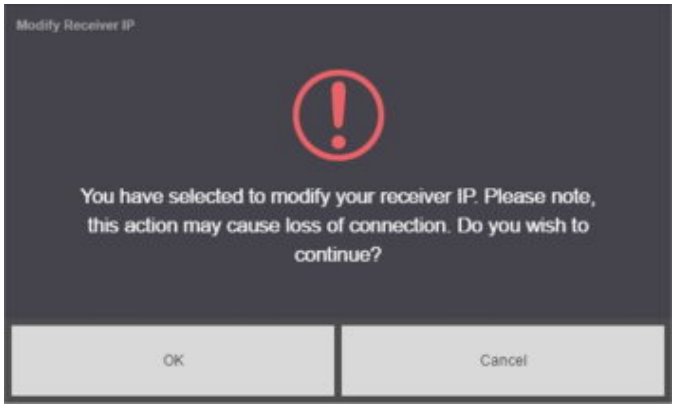
Network (LD900) > WiFi

WiFi options should be left DISABLED as the LD900 presently has no WiFi functionality.

WiFi settings

Modify Receiver IP (LD8)

LD8 IP addresses can be changed using the Modify Receiver IP action. The following warning message will be displayed:



IP address warning

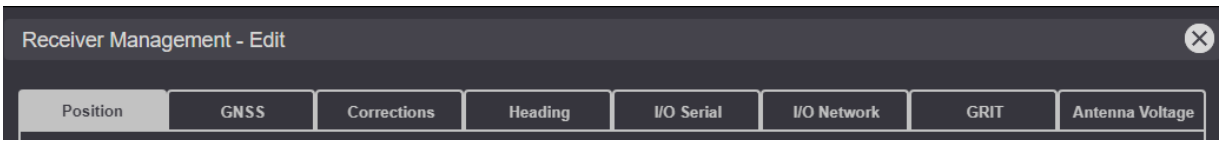
CAUTION
Care should be taken when changing the IP address, entering an incorrect IP address will cause Quantum to stop functioning.

New IP address

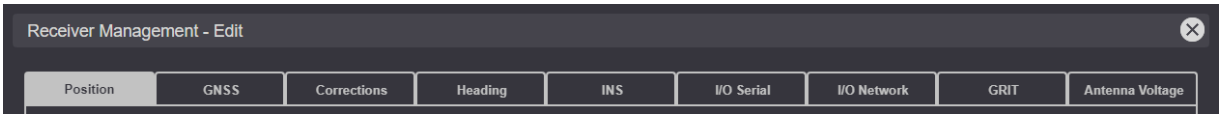
Enter a valid IP address and press **Apply** to activate the changes. Once actioned, Quantum will modify the IP address stored within the Quantum configuration and reconnect to the LD8.

3.3.2 Receiver Management – Edit

Within the Receiver Management - Edit page component menus are tab separated, with a highlighted background indicating which menu tab is selected. As shown in the examples below, the tabs available will depend on authorised features and the product in use:

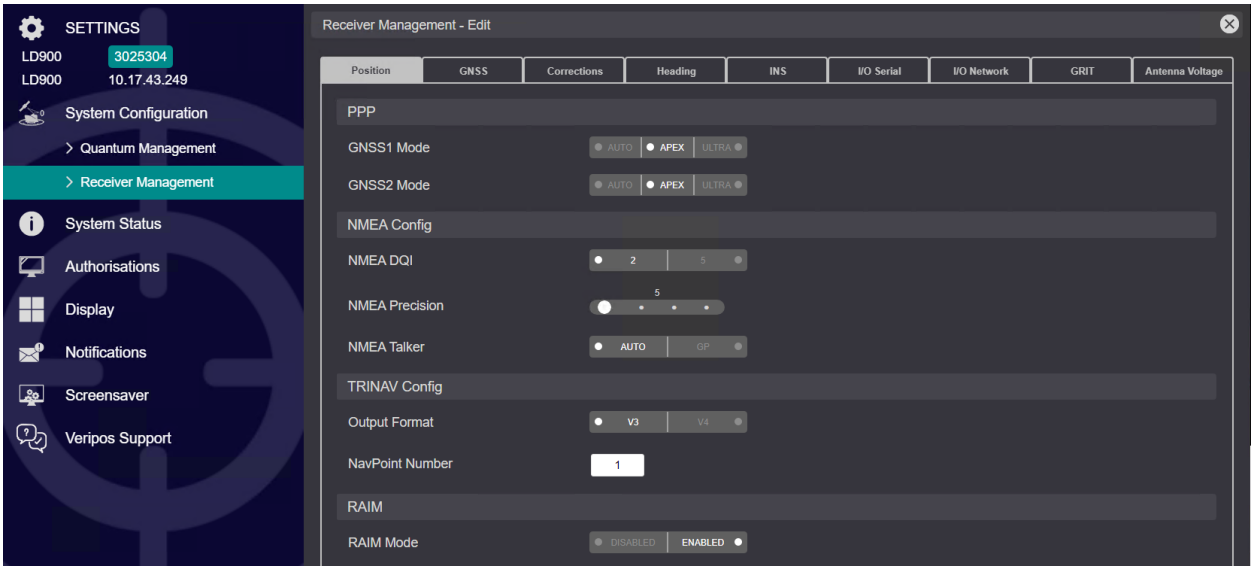


LD8 & LD900 Receiver Management, with authorised Heading



LD900 Receiver Management, with authorised INS (and) Heading

3.3.2.1 Position



PPP > GNSS1 Mode / GNSS2 Mode

CAUTION

Care should be taken when changing GNSS# Mode values as this will restart the PPP calculation. Changing the PPP solution will require time for convergence and during this time a Standard solution will be output from the receiver until the PPP solution becomes available.

Veripos offer two PPP solutions, Ultra and Apex, which offer decimetre accuracy, have no baseline limitations and can be used globally. On LD900 systems the calculation Mode for both the Primary positioning solution **GNSS1** and, where authorised, the Secondary positioning solution **GNSS2** can be set to APEX (default), ULTRA or AUTO. On systems with correction subscriptions that include both Ultra and Apex, setting Mode to AUTO will prioritise Apex and only change to Ultra if Apex becomes unavailable.

NOTE

Secondary Postioning is only available for Authorised LD900 systems.

- The activation code is applicable to both primary and secondary solutions.
- The secondary positioning mode does not support APEX Pro.
- The secondary positioning solution NMEA position output is limited 1 Hz and COM3 and COM4 only (ICOM ports are not available).
- IALA , 3rd Party and RTK corrections are not available for secondary positioning.

CAUTION
If using only Apex or Ultra corrections users should ensure that the Mode selected matches the service activated by the Helpdesk.

NMEA Config > NMEA DQI

When using either Apex or Ultra PPP services the NMEA DQI is a value reported within NMEA GGA messages to indicate a converged PPP solution status. This value can be toggled between either 2 or 5. When set to 2 and the system has corrections applied to the position, a 2 will be output. When set to 5 and a PPP solution is fully converged the DQI value will be 5.

NMEA Config > NMEA Precision

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.

NMEA Config > NMEA Talker

The ability to interface with legacy hardware is provided. The NMEA Talker can be toggled between Auto and GP.

TRINAV Config > Output Format

The ability to toggle TRINAV Output Format between V3 and V4 is provided.

TRINAV Config > NavPoint Number

The ability to enter a NavPoint Number is provided.

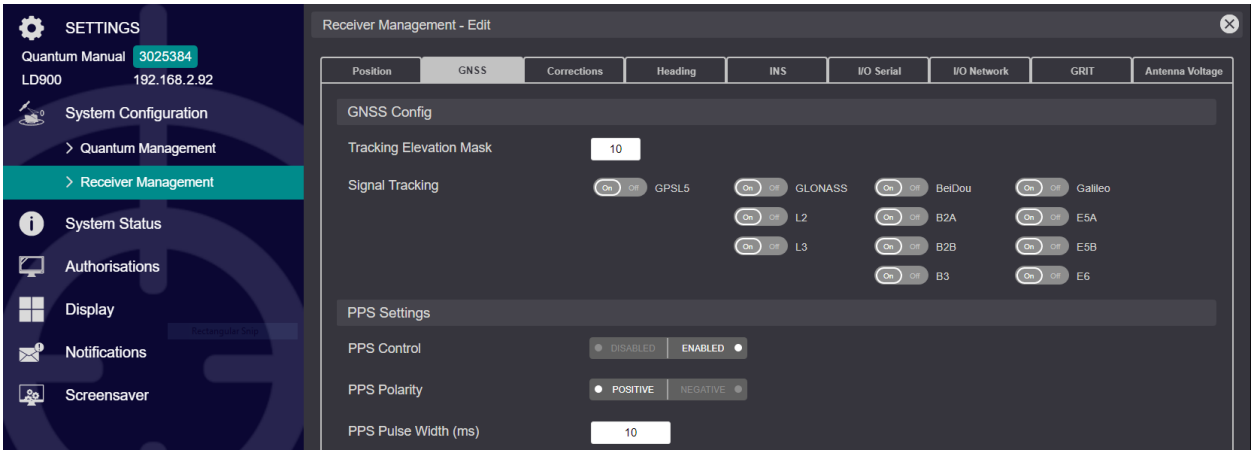
RAIM > RAIM Mode

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.

NOTE
The configuration parameters for NMEA Config and RAIM will be applied to both primary and secondary position solutions.

3.3.2.2 GNSS



Receiver Management – GNSS (LD900 example)

GNSS Config > Tracking Elevation Mask

The default mask value of 10 degrees prevents GNSS satellites on or below a 10 degrees elevation from being tracked. Veripos recommends having the tracking elevation mask set to the default value for optimal performance.

GNSS Config > Signal Tracking

> **CAUTION**
> **Do not change the default signal tracking unless under the instruction of Veripos Support.**

Quantum provides the ability to toggle specific GNSS constellations or particular constellation signals **On** or **Off**.

PPS Settings > PPS Control

The PPS functionality can be DISABLED and ENABLED.

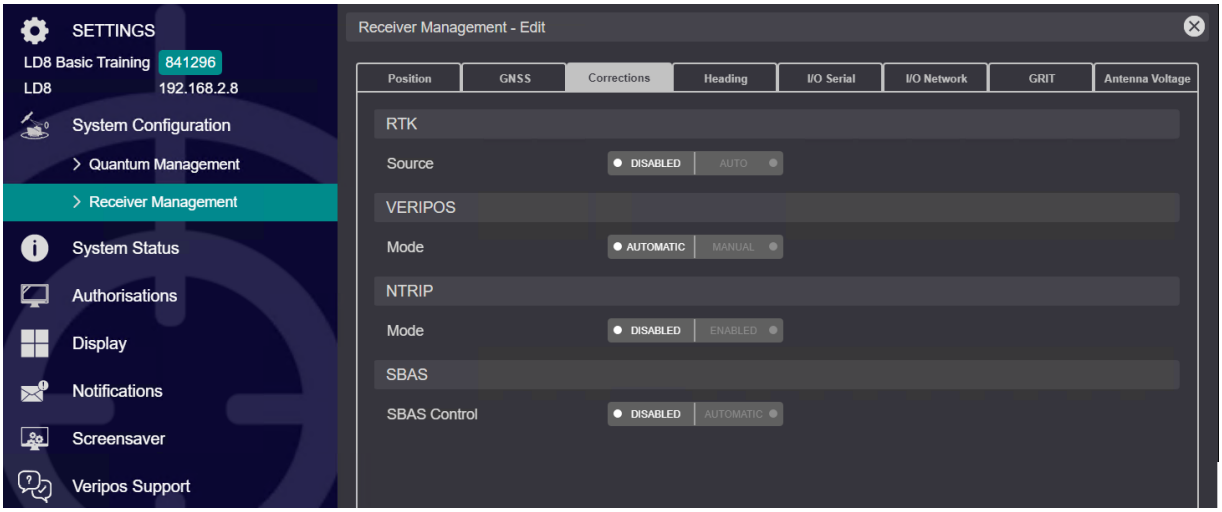
PPS Settings > PPS Polarity

The PPS Polarity can be switched between POSITIVE and NEGATIVE.

PPS Settings > PPS Pulse Width (ms)

The PPS Pulse width (set in milliseconds) may be changed if required and is configurable within a range of 1 to 500 milliseconds.

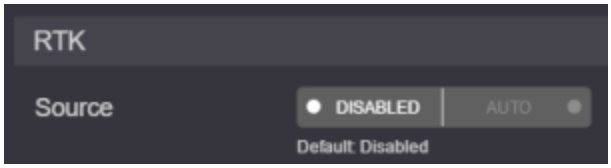
3.3.2.3 Corrections (LD8)



Receiver Management – Corrections (LD8 example)

RTK > Source

The LD8 can receive RTK corrections in the RTCM v3 format. Enable RTK by selecting AUTO for the Source.



RTK – Source

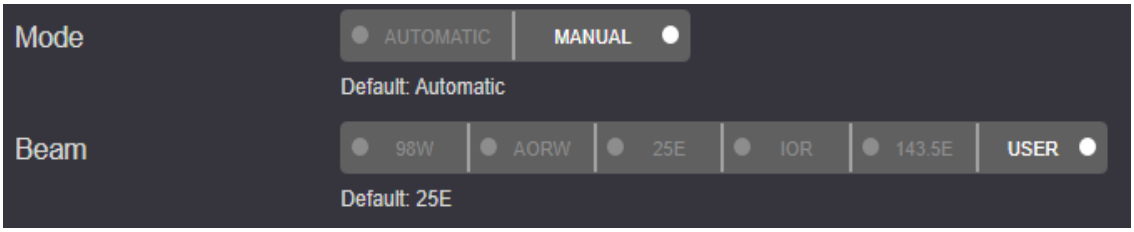
VERIPOS > Mode

The **Mode** determines which L-band beam management options are available. When using Mode **AUTOMATIC**, the receiver will track and use data from up to three beams simultaneously, with tracking determined based on the receiver location and the highest elevation beams. Using Mode **AUTOMATIC** mitigates against the impact of a single beam loss. Additionally, selecting the most appropriate beam for any given location will not be required whilst transiting across multiple regions in this mode. When tuning to **MANUAL**, an available **Beam** can be selected, or a **USER**-defined beam added.

AUTOMATIC beam selection

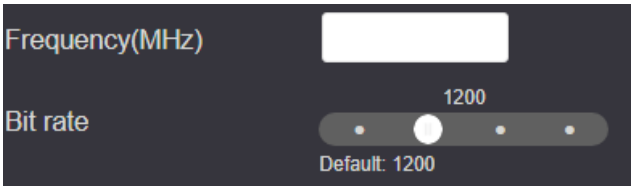
L-band > Mode > MANUAL

Toggling the Beam Types to MANUAL will allow the choice of the Veripospre-configured beams or a USER-defined beam:



MANUAL beam selection

Switching the **Beam** option to **USER** will allow for the input of a USER beam. Do not use unless instructed to by Veripossupport.

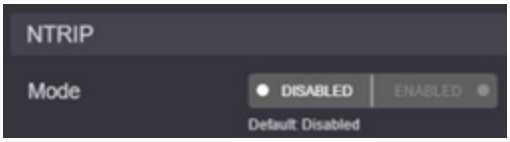


USER beam

NTRIP > Mode

This option allows the user to toggle between having NTRIP **DISABLED** or **ENABLED**.

If enabled the LD8 can receive Veripos RTCM corrections via NTRIP. An NTRIP service activation from Veripos Support is necessary for use. The LD8 must also be connected directly to a network with external access to obtain the data from the Veripos NTRIP caster.



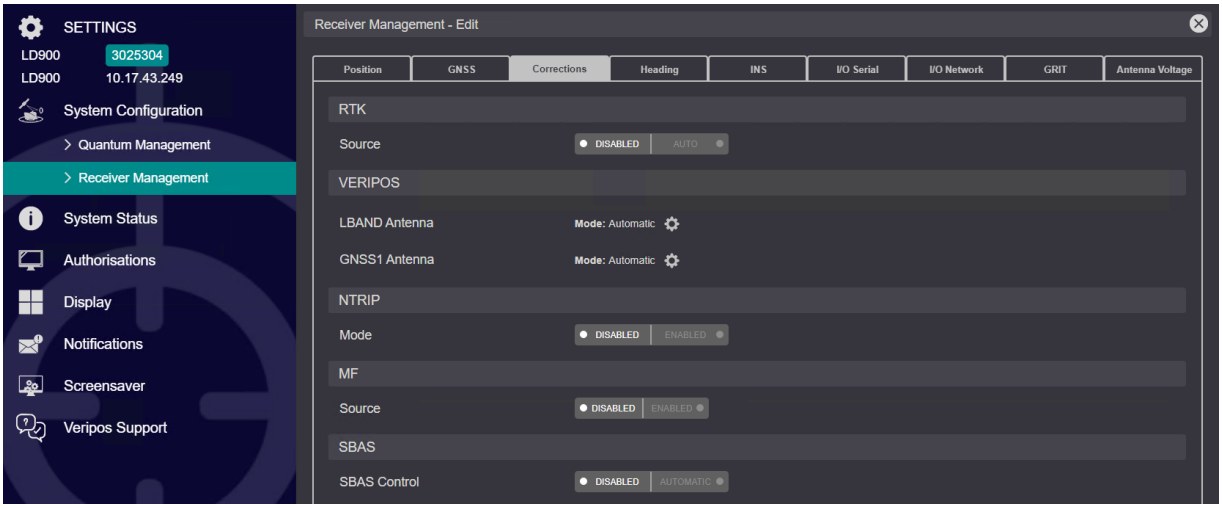
NTRIP Mode

SBAS > SBAS Control

This option allows the user to switch **SBAS** correction fallback to **DISABLED** or **AUTOMATIC**. When the option AUTOMATIC is selected, fallback will be available in case of a Veripos solutions failure. When DISABLED, the solution will revert to uncorrected in case of a Veripos solutions failure. Use of the SBAS solution will only occur should Veripos solutions be unavailable. Note: SBAS corrections are not available in all regions, additionally the SBAS service is not under the control of Veripos.

SBAS – SBAS Control

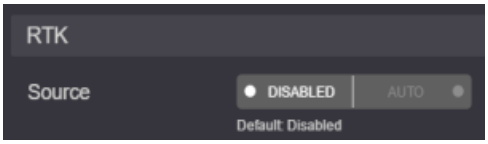
3.3.2.4 Corrections (LD900)



Receiver Management – Corrections (LD900)

RTK > Source

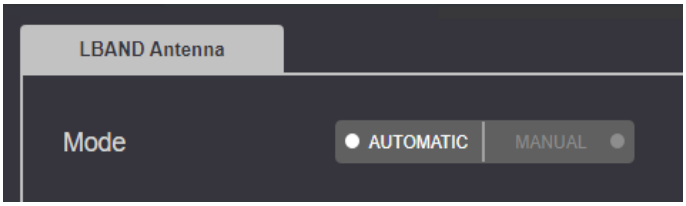
The LD900 is capable of receiving RTK corrections. Enable RTK by selecting AUTO for the Source.



RTK – Source

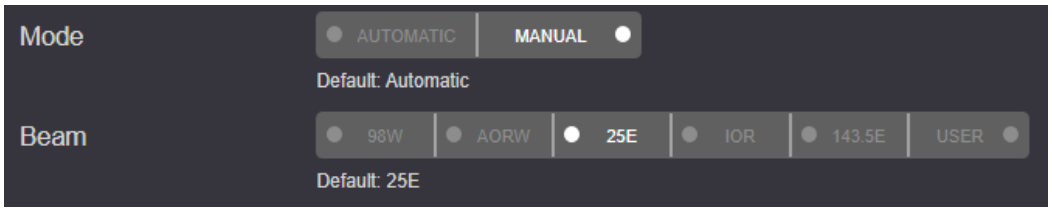
VERIPOS > LBAND / GNSS1 Antenna

Upon clicking the LBAND or GNSS1 Antenna settings cog, users can configure inputs for either Mode. When using the default of Mode **AUTOMATIC**, the receiver will track and use data from up to three beams simultaneously, with tracking determined based on the receiver location and the highest elevation beams. Using Mode **AUTOMATIC** can mitigate against the impact of a single beam failure or masking. Selection of the most appropriate beam for any given location will not be required whilst transiting across multiple regions in this mode.



LD900 LBAND Antenna Mode settings

Selecting **MANUAL** will provide additional LBAND beam management options. Anavailable **Beam** can be selected, or a **USER**-defined beam added.



Manual beam selection

The user may select pre-configured Veripos beam frequency or switch to **USER**.

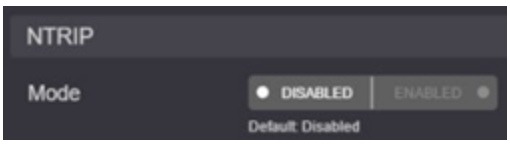
Switching the **Beam** option to **USER** will allow for the input of a USER beam. Do not use unless instructed to by Veripos support.

User Beam options

NTRIP > Mode

This option allows the user to toggle between having NTRIP **DISABLED** or **ENABLED**.

If enabled the LD900 can receive Veripos RTCM corrections via NTRIP. An NTRIP service activation from Veripos Support is necessary for use. The LD900 must also be connected directly to a network with external access to obtain the data from the Veripos NTRIP caster.



NTRIP Mode

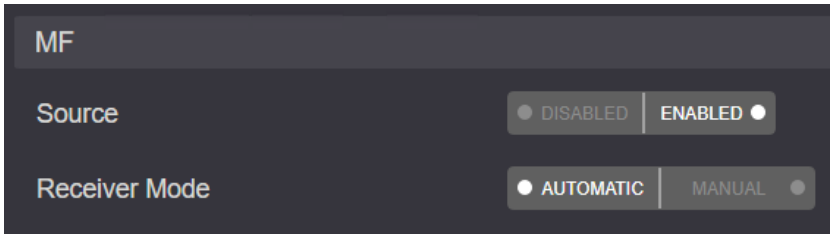
MF > Source

The MF Source setting can be toggled between **ENABLED** and **DISABLED**, defaulting to **ENABLED**.

NOTE
The MF option will only be available on Quantum if MF is available for the LD900.

MF > Receiver Mode

Receiver Mode can be set to either **AUTOMATIC** or **MANUAL**. **AUTOMATIC** will cause the MF receiver to lock onto the highest quality MF signal detected. **MANUAL** will require an MF station **Frequency(kHz)** to be entered, restricted to the range of 283.5 to 325.0 kHz:



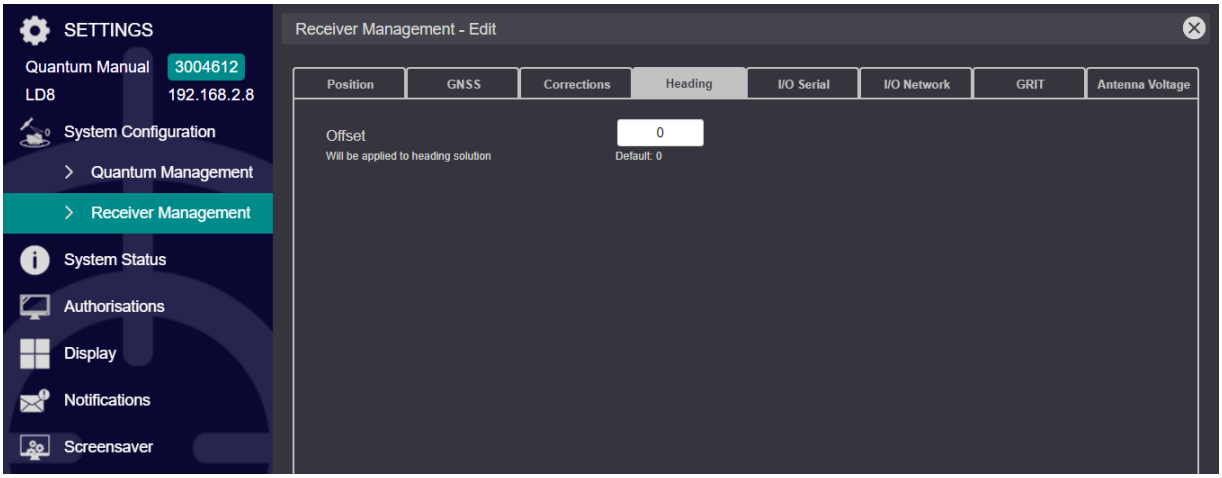
SBAS > SBAS Control

This option allows the user to switch **SBAS** correction fallback to **DISABLED** or **AUTOMATIC**. When the option AUTOMATIC is selected, fallback will be available in case of a Veripos solutions failure. When DISABLED, the solution will revert to uncorrected in case of a Veripos solutions failure. Use of the SBAS solution will only occur should Veripos solutions be unavailable.

Note: SBAS correction coverage is not available in all regions. The SBAS service is not under the control of Veripos.

SBAS – SBAS Control

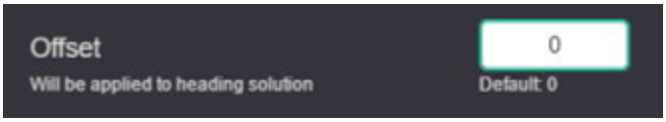
3.3.2.5 Heading (LD8)



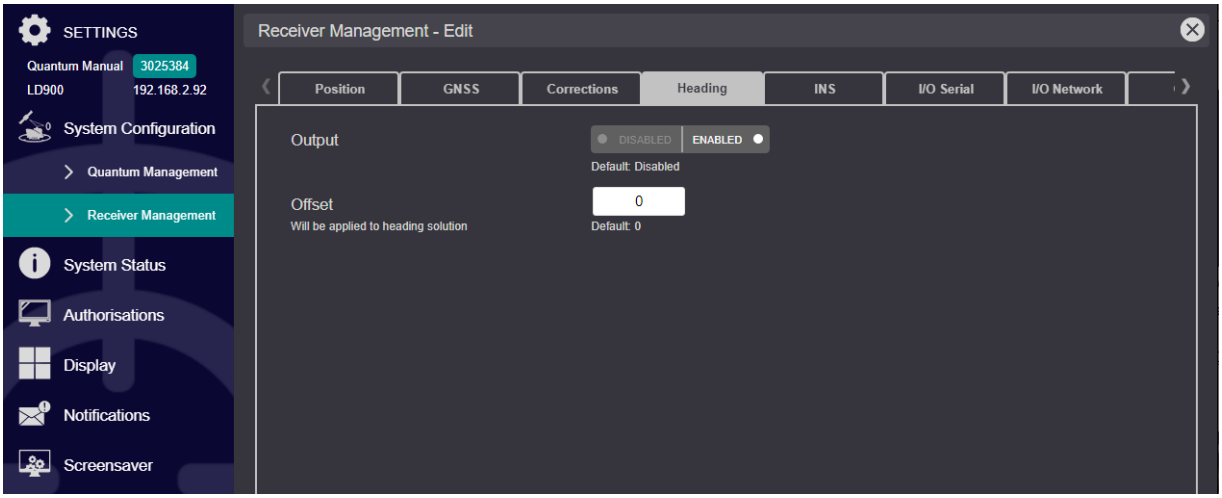
Heading configuration (LD8)

Heading Output (LD8) > Offset

Will appear all times. It can be set to a value between -180° and 180°. This option allows for an offset to be applied to the calculation. Any offset value entered in here will be applied to Heading outputs from the GNSS receiver.



3.3.2.6 Heading (LD900)

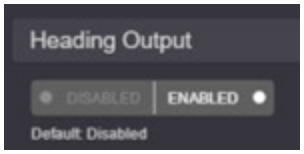


Heading configuration (LD900)

If licensed, the LD900 can be used to compute heading. However, if the applied Quantum license does not support heading, then Quantum will not display this item. Quantum can also input Heading from an external source via Serial or TCP/IP.

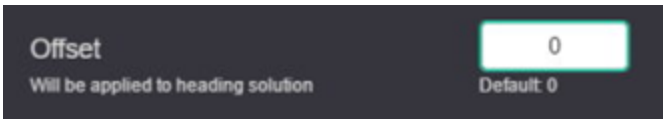
Heading Output (LD900)

This option toggles whether a heading output is available.

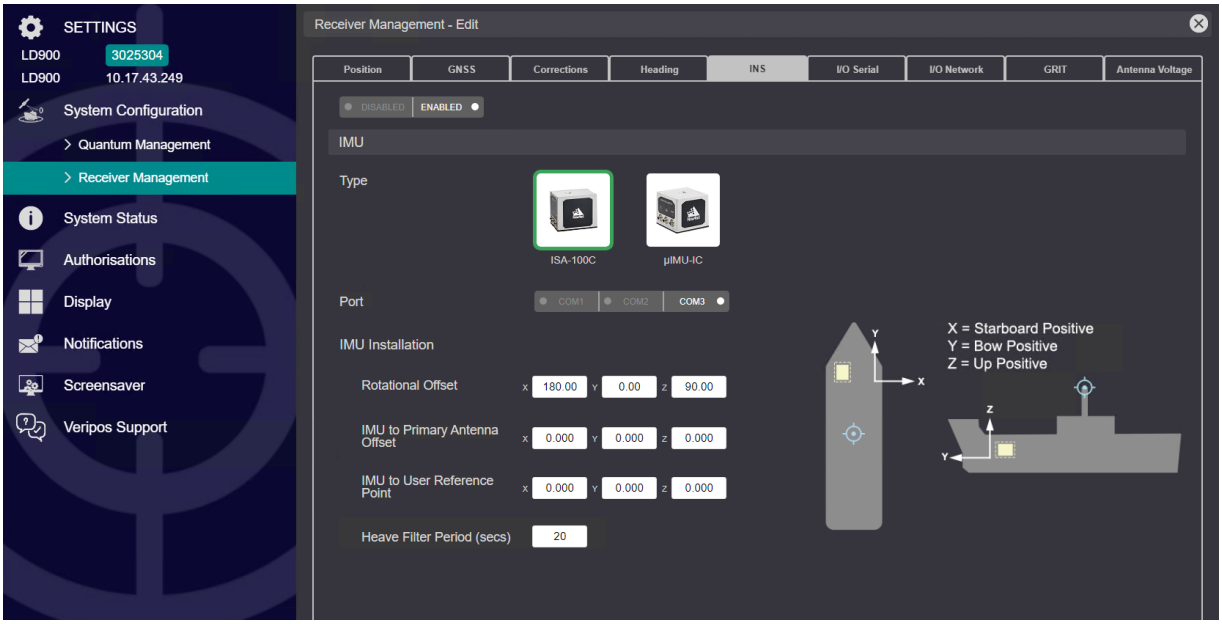


Heading Output (LD900) > Offset

Will appear when Heading Output is ENABLED. It can be set to a value between -180° and 180°. This option allows for an offset to be applied to the calculation. Any offset value entered in here will be applied to Heading outputs from the GNSS receiver.



3.3.2.7 INS (LD900)



INS configuration (LD900)

Where licensed, LD900 and LD900M model receivers interfaced to an appropriate IMU will be capable of INS.

Enabling INS

Toggling INS to **ENABLED** will allow for configuration of INS options. Use **Apply** to save any changes made.

IMU > Type

The two INS IMUs supported for use within Quantum are the **ISA-100C** and the **µIMU-IC**.

IMU > Port

The LD900 COM port which the IMU is being interfaced on (**COM1**, **COM2** or **COM3**) can be selected here.

IMU > IMU Installation > Rotational Offset

This field allows the user to enter Rotational Offset X, Y and Z values within a -180.00° to +180.00° range.

IMU > IMU Installation > IMU to Antenna Offset

This field allows the user to enter Primary (GNSS1) Antenna Translational Offset X, Y and Z values.

IMU > IMU Installation > IMU to User Reference PointThe User Reference Point represents a user-defined point or location, set separately from the INS and Antenna Reference Points. This reference point is not inherently part of the system's internal calculations but is rather a user-defined offset or adjustment applied to the INS-derived position or to align with specific user requirements.

By specifying X, Y, and Z value adjustments to shift the calculated position users may align the User Reference Point with external references.

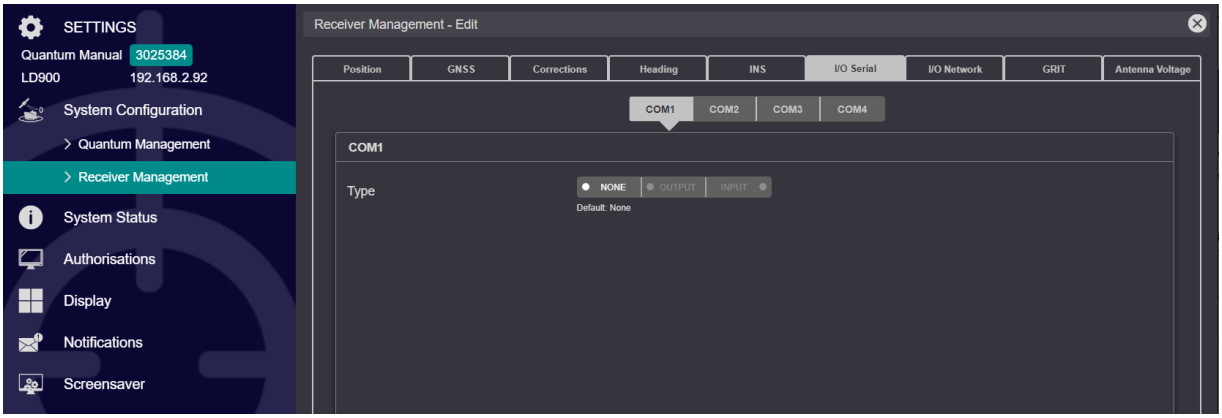
IMU > IMU Installation >Heave Filter Period

The Heave addresses heave motion (vertical movement of vessel in response to waves or other disturbances) and represents the duration of time which the filter analyses and adjusts for vertical displacement variations of the vessel. A shorter filter period might provide more frequent updates but may be susceptible to noise, while a longer filter period may smooth out the data but could introduce a delay in responding to changes in heave motion.

The time entered in seconds will determine how quickly the INS can adapt to changes in the vertical motion of the platform while maintaining accuracy and stability.

With an understanding of the trade-offs between responsiveness and noise filtering Users may adjust the Heave Filter period based on operational scenario requirements.

3.3.2.8 I/O Serial



I/O Serial configuration (LD900 example)

Serial ports can be configured to output data relating to the active calculation or input of Veripos correction data from an external source.

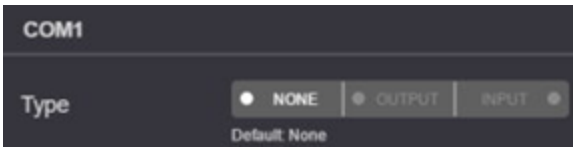
COM

Select the COM port that requires setting up. LD900-based installations will also include **COM4**, available for AUX port data output only and can additionally include with theuse of a 3-port Aux cable on DB15 HD connector:

- **COM5** supporting output of secondary positioning only, with baud rates between 9600 and 460800.
- **COM6** supporting correctional inputs (RTK, IOLAN, UHF) only, with a fixed baud rate of 38400.

COM# > Type

The intended COM communication type will be NONE, OUTPUT or INPUT. When selecting NONE all input and outputs for that port will cease. When selecting either **OUTPUT** or **INPUT** further configuration options will appear.

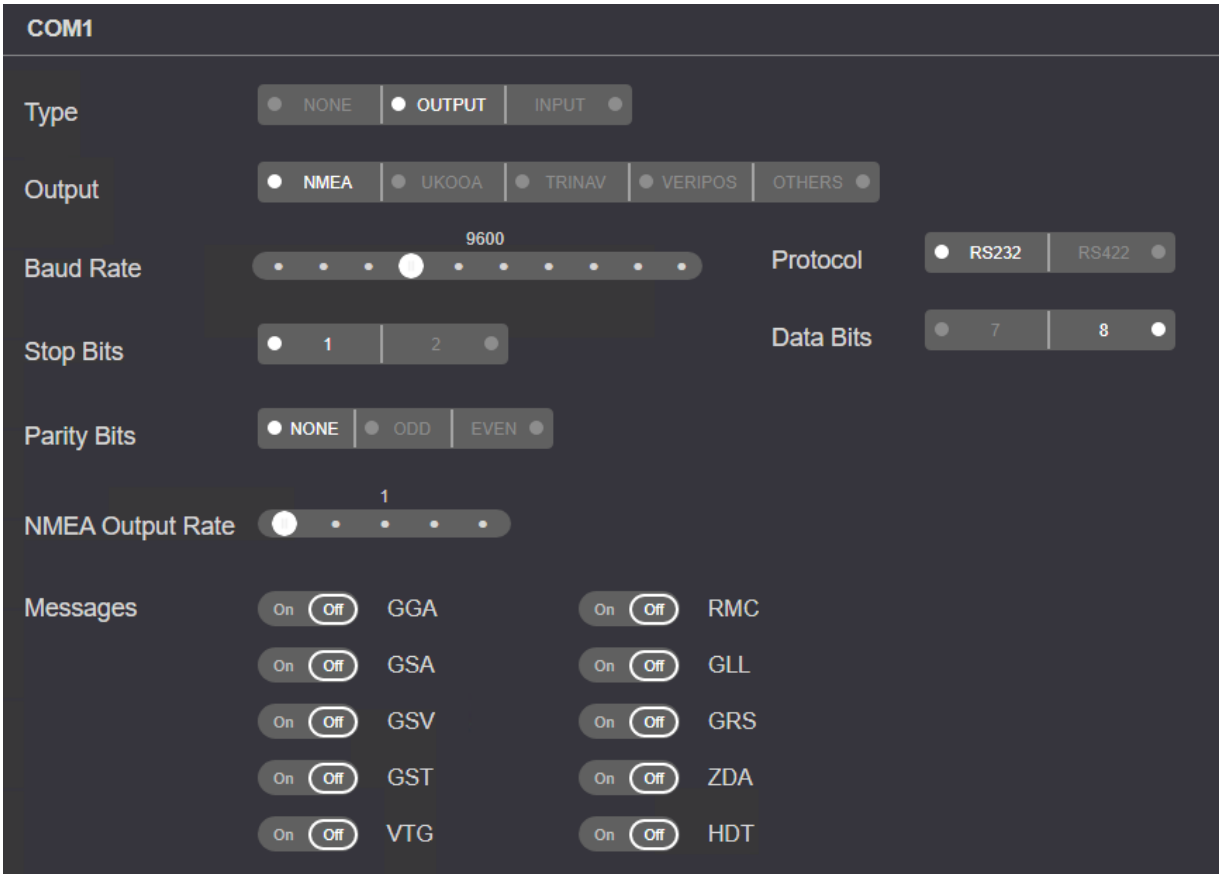


COM# > Type > Output

Selecting OUTPUT will allow for selection of **NMEA** (**GGA**, **GSA**, **GSV**, **GST**, **VTG**, **RMC**, **GLL**, **GRS**, **ZDA**, **HDT*** and **PASHR****), **UKOOA**, **TRINAV** (V3 or V4 as configured in **Position**), **VERIPOS** (Veripos corrections) and **INS**** (**TSS1**, **HEAVE**, **INSPVA**, **INSSTDEV**, **SYNCHEAVE** and **DELAYEDHEAVE**) and **OTHERS** (**BESTPOS**, **BESTGPSPOS**) message data outputs.

*Requires heading to be enabled and licensed.

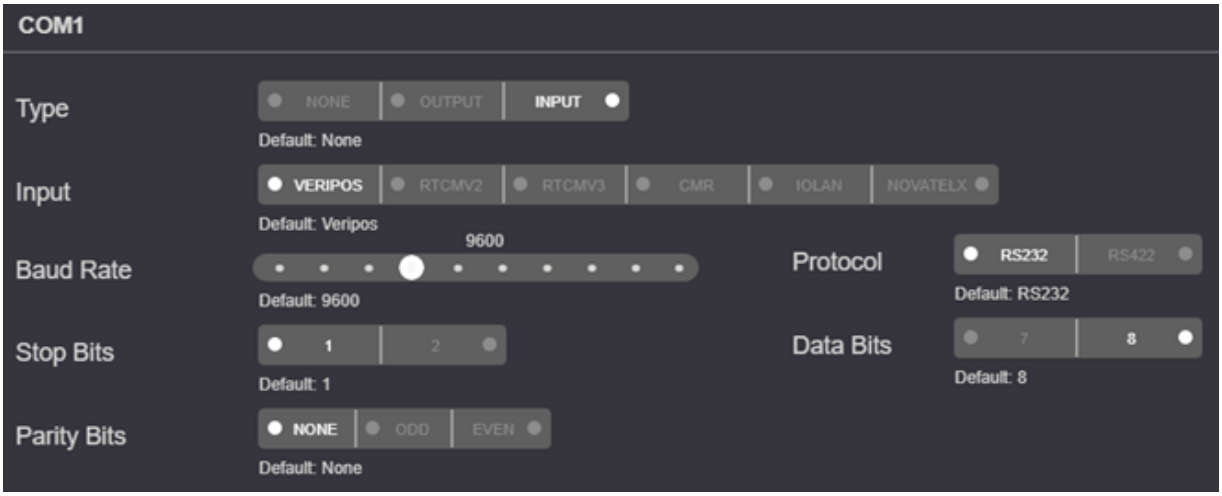
**Requires INS to be licensed and enabled



Type - Output

COM# > Type > Input

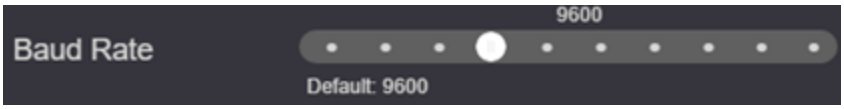
Selecting **INPUT** will allow for the input of external **VERIPOS** corrections**, RTCMV2** (3rd party DGNSS RTCM v2 corrections), **RTCMV3** (3rd party RTK or DGNSS RTCM v3 corrections), **CMR** (RTK correction data), **IOLAN** (NTRIP serial connections) or **NOVATELX** (NovAtel format corrections).



Type – Input (Veripos example)

Baud Rate

A variety of Baud Rates can be specified ranging from 1200 BPS and 460800 BPS. Select an appropriate rate for the required bandwidth of messages type output:



The baud rates available for selection are **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600**, **115200**, **230400** and **460800**.

Protocol

The LD900 can input and output **RS422** and **RS232** protocol on COMs 1-3 and output only on COM4.

Stop Bits

Stop Bits can be set to 1 or 2.

Data Bits

Data Bits can be set to 7 or 8.

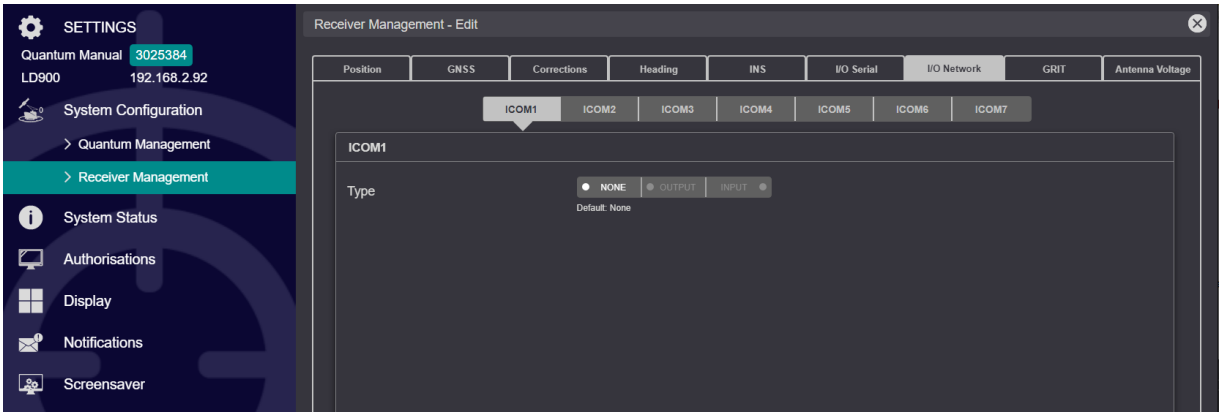
Parity Bits

Parity Bits can be set to NONE, ODD or EVEN.

NMEA Output Rate

When selecting NMEA data outputs (number of NMEA outputs within 1 second) rates of 1, 2, 5, 10 and 20 Hz are available. If selecting INS data outputs on LD900 units, rates of 1, 2, 5, 10, 20, 50, 100 and 200 Hz are available.

3.3.2.9 I/O Network



Receiver Management – I/O Network (LD900)

For the LD8, five TCP/IP ports are available, **ICOM1** (3001), **ICOM2** (3002), **ICOM3** (3003), **ICOM4** (3004) and **ICOM5** (3005).

For the LD900, either seven TCP/IP ports will be available, **ICOM1** (3001), **ICOM2** (3002), **ICOM3** (3003), **ICOM4** (3004), **ICOM5** (3005), **ICOM6** (3006) & **ICOM7** (3007), or a **MOXA** tab will appear (see next section).

Each port can be configured to output active calculation data.

ICOM# > Type

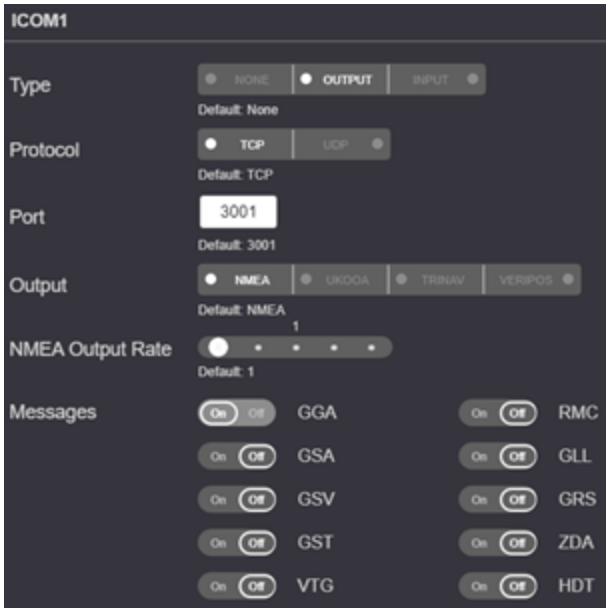
I/O Network ports can be set to **NONE**, **OUTPUT** or **INPUT**. When selecting NONE all input and outputs for that port will cease. When selecting **OUTPUT** or **INPUT** further configuration options will appear.

ICOM# > Type > Output

Selecting **OUTPUT** will allow for selection of **NMEA** (**GGA**, **GSA**, **GSV**, **GST**, **VTG**, **RMC**, **GLL**, **GRS**, **ZDA**, **HDT*** and **PASHR****), **UKOOA**, **TRINAV**(V3 or V4 as configured in **Position**), **VERIPOS** (Veripos corrections) and **INS**** (**TSS1**, **HEAVE**, **INSPVA**, **INSSTDEV**, **SYNCHEAVE** and **DELAYEDHEAVE**) message data outputs.

*Requires heading to be enabled and licensed.

**Requires INS to be licensed and enabled



Type - Output

ICOM# > Type > Input

Selecting **INPUT** will allow for the input of external **VERIPOS** corrections, **RTCMV2** (3rd party DGNSS RTCM v2 corrections), **RTCMV3** (3rd party RTK or DGNSS RTCM v3 corrections), **CMR** (RTK correction data), **IOLAN** (NTRIP serial connections) or **NOVATELX** (NovAtel format corrections).

Protocol

The LD900 can output and input TCP and UDP protocol on all I/O Network ports.

End Point Address

Selecting TCP will allow for the entry of an end-point address between 0.0.0.0 and 255.255.255.255

Port

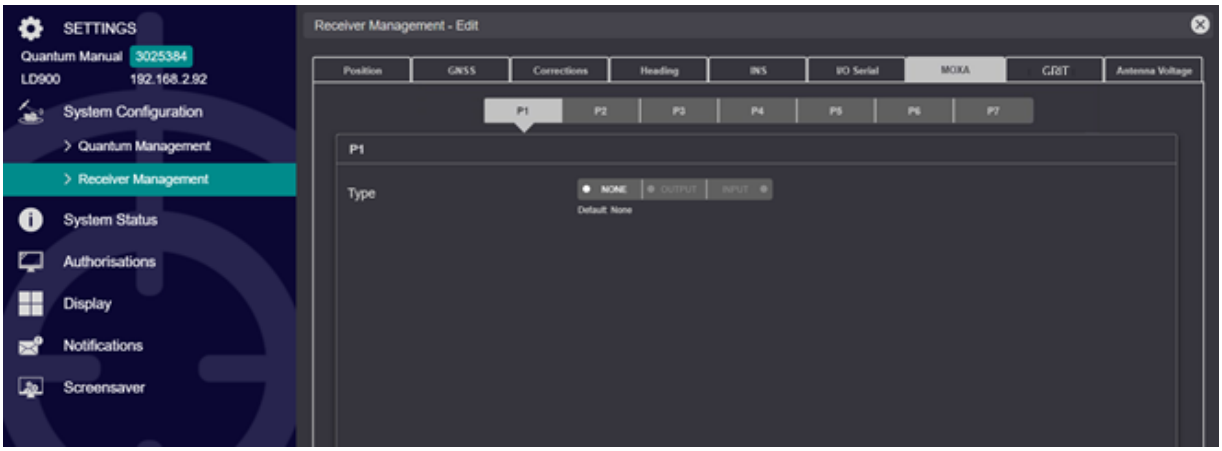
When using either TCP or UDP protocol the port number can be set within a range of 1 – 65535.

NMEA Output Rate

When selecting NMEA data outputs (number of NMEA outputs within 1 second) rates of 1, 2, 5, 10 and 20 Hz are available. If selecting INS data outputs on LD900 units, rates of 1, 2, 5, 10, 20, 50, 100 and 200 Hz are available.

3.3.2.10 MOXA (LD900)

Where required an optional Moxa serial port expansion unit can be used to convert ICOM to serial. If this has been interfaced, then a MOXA tab will be available within the Receiver Management page.



Select **P1**, **P2**, **P3**, **P4**, **P5**, **P6** or **P7**, depending on which port requires setting up.

NOTE
The settings of P7 will be duplicated to P8.

P# > Type

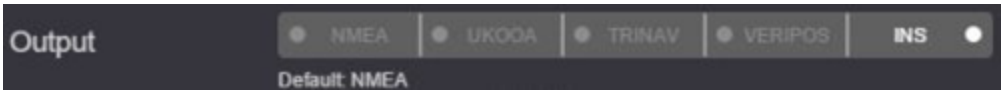
The intended COM communication type will be either **NONE**, **OUTPUT** or **INPUT**. When selecting NONE all input and outputs for that port will cease. When selecting either **OUTPUT** or **INPUT** further configuration options will appear.

P# > Type > Output

Selecting **OUTPUT** will allow for selection of **NMEA** (**GGA**, **GSA**, **GSV**, **GST**, **VTG**, **RMC**, **GLL**, **GRS**, **ZDA**, **HDT*** and **PASHR****), **UKOOA**, **TRINAV** (V3 or V4 as configured in **Position**), **VERIPOS** (Veripos corrections) and **INS**** (**TSS1**, **HEAVE**, **INSPVA**, **INSSTDEV**, **SYNCHEAVE** and **DELAYEDHEAVE**) message data outputs.

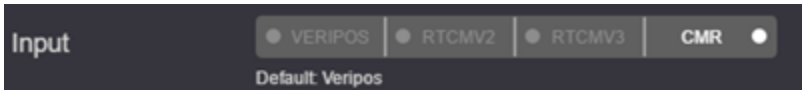
*Requires heading to be enabled and licensed.

**Requires INS to be licensed and enabled



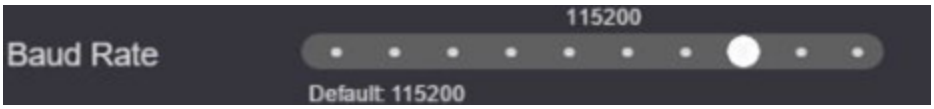
P# > Type > Input

Selecting **INPUT** will allow for the input of **VERIPOS** corrections, **RTCMV2** (3rd party DGNSS RTCM v2 corrections), **RTCMV3** (3rd party RTK or DGNSS RTCM v3 corrections) or **CMR**.



Baud Rate

Baud Rates can be specified ranging from 1200 BPS and 460800 BPS. Select an appropriate rate for the required bandwidth of messages type output:



The baud rates available for selection are **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600**, **115200**, **230400** or **460800**.

Protocol

The LD900 can input and output **RS422** and **RS232** protocol on P1-P7.

Stop Bits

Stop Bits can be set to **1** or **2**.

Data Bits

Data Bits can be set to **7** or **8**.

Parity Bits

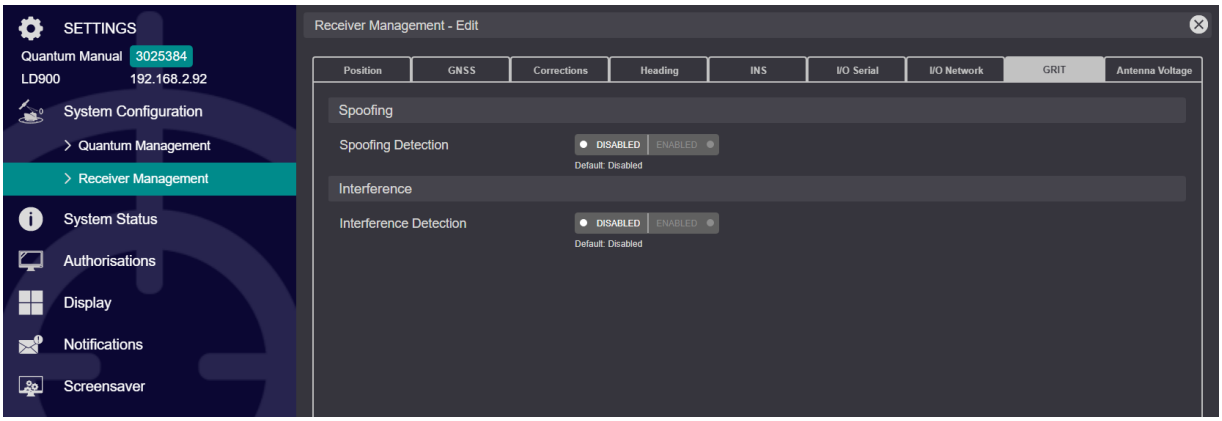
Parity Bits can be set to **NONE**, **ODD** or **EVEN**.

NMEA Output Rate

When selecting NMEA data outputs (number of NMEA outputs within 1 second) rates of 1, 2, 5, 10 and 20 Hz are available. If selecting INS data outputs on LD900 units, rates of 1, 2, 5, 10, 20, 50, 100 and 200 Hz are available.

3.3.2.11 GRIT

The GRIT tab allows for the enabling of **Spoofing Detection** and **Interference Detection**.



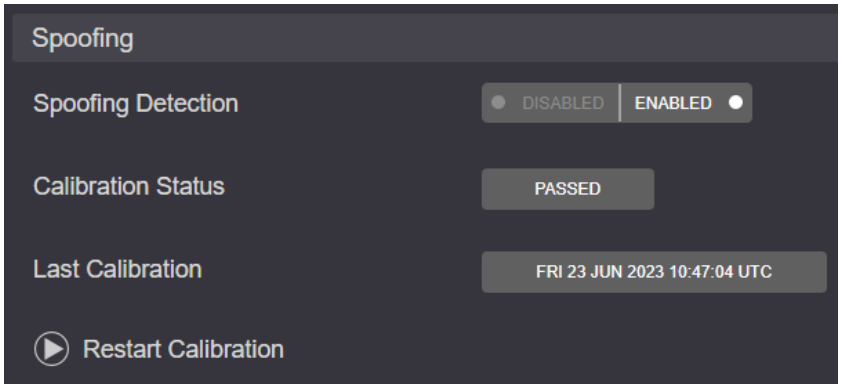
NOTE
When licensed for Interference Mitigation the option to configure filters will become available via the Spectrum view.

Spoofing

Upon first access, Spoofing will be DISABLED. Toggling DISABLED to **ENABLED** will display Spoofing Detection on the Quantum screen.

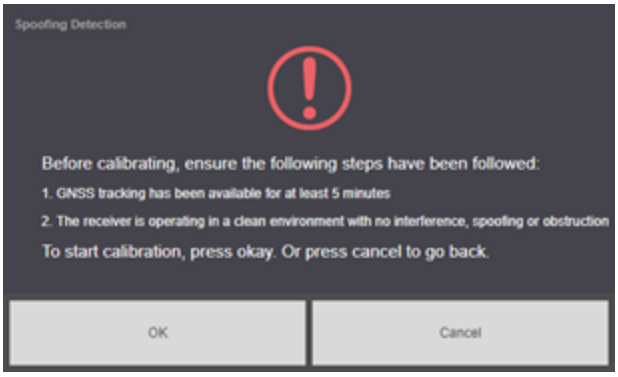
Calibration Status

This non-configurable field will appear when Spoofing is **ENABLED**, highlighting the Spoofing Calibration Status.



Start Calibration / Restart Calibration

If the Calibration Status is not PASSED, an option to Restart Calibration is available. Clicking this option will result in the display of the below dialog:

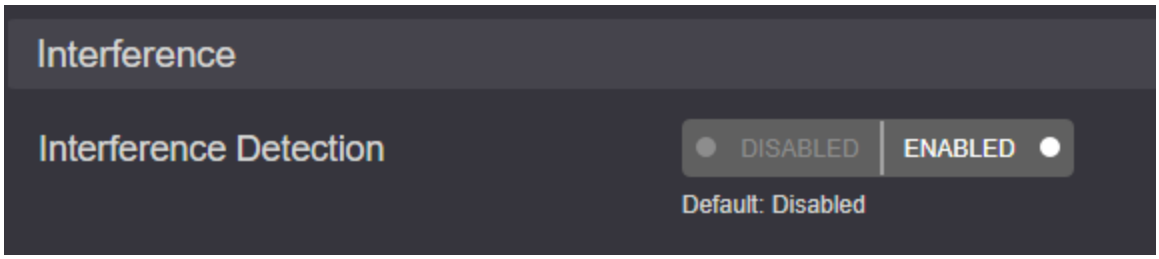


Upon clicking **OK**, calibration of Spoofing Detection will commence. This process will take a few minutes, **do not power off the receiver until the process is complete. Once complete, the GNSS card will reboot.**

> **CAUTION**
> **The calibration of spoofing detection will restart the PPP calculation. PPP convergence will require time; during this time, a Standard/Standard2 solution will be output from the receiver until the PPP solution becomes available.**

Interference

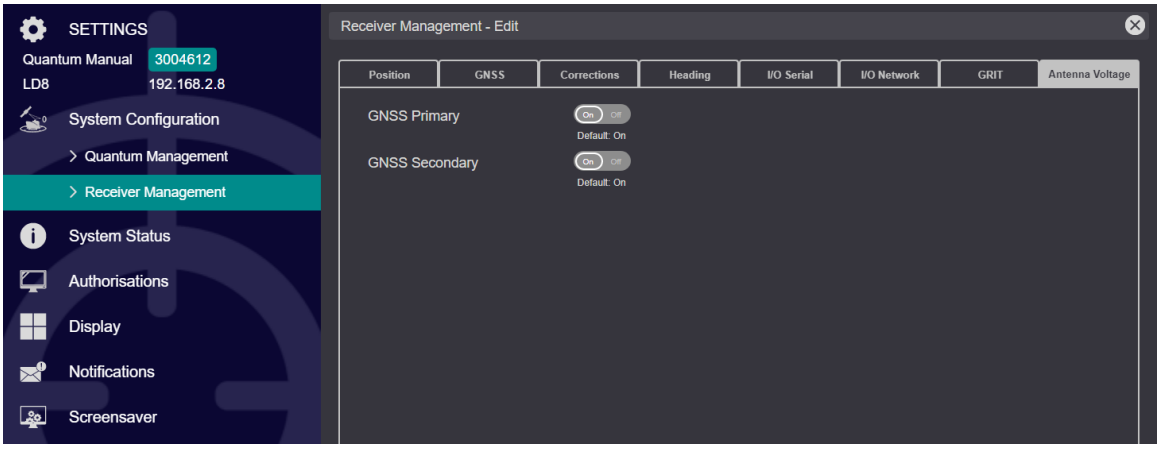
Upon first access, Interference will be DISABLED. Toggling DISABLED to **ENABLED** will display Interference Detection on the Quantum screen.



Use **Apply** to save any changes made.

Antenna Voltage (LD8)

The Antenna Voltage tab allows for toggling of antenna voltages between **On** or **Off**:

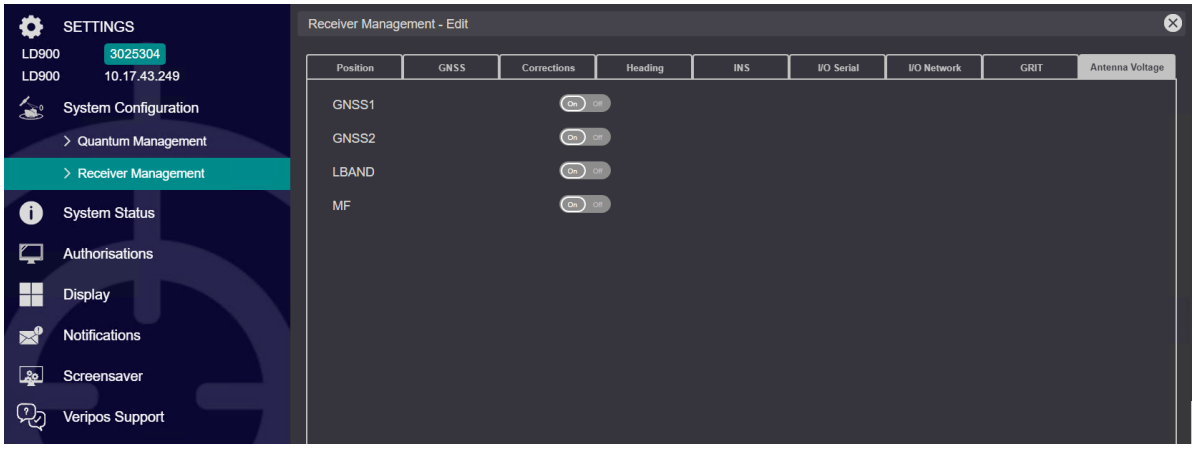


Receiver Management - Antenna Voltage (LD8)

CAUTION
Turning off the voltage may stop the antenna receiving power and result in a loss of signal reception. The voltage should only be turned off when signals are received through a RF splitter with another power source.

Antenna Voltage (LD900)

The Antenna Voltage tab allows for toggling of antenna voltages between **On** or **Off**:

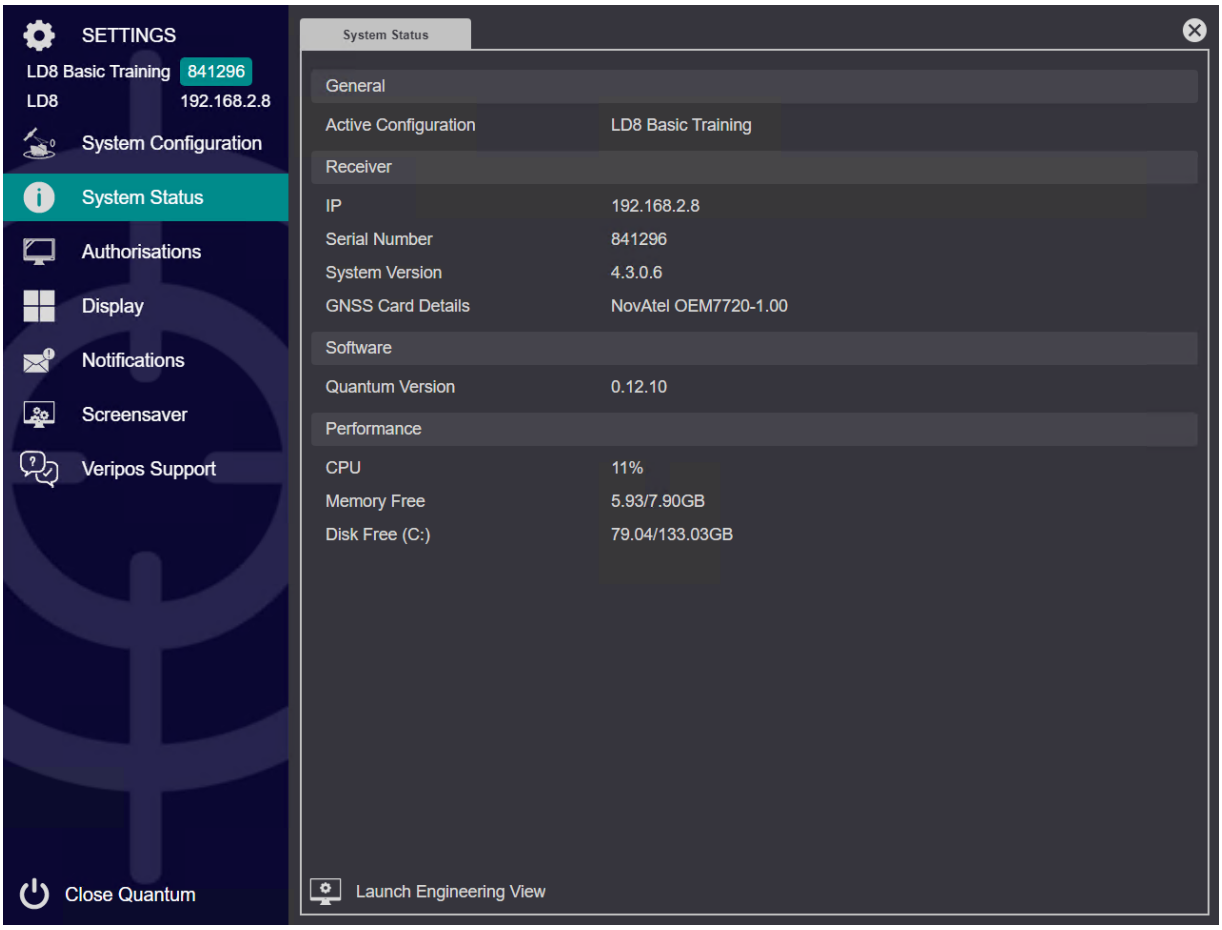


Receiver Management - Antenna Voltage (LD900)

CAUTION
Turning off the voltage may stop the antenna receiving power and result in a loss of signal reception. The voltage should only be turned off when signals are received through a RF splitter with another power source.

3.4 System Status

The **System Status** menu displays information relating to the Quantum configuration, such as details of the connected Veripos receiver and the Quantum software version.



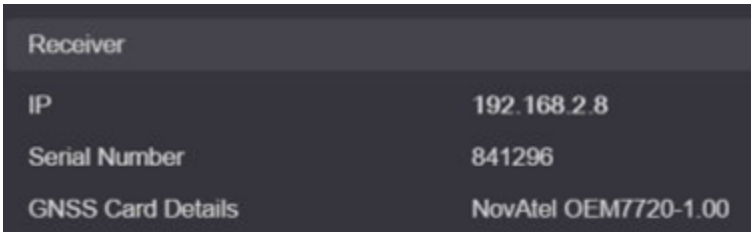
General

Displays the name of the active Quantum Configuration:

System Status - Active Configuration name

Receiver

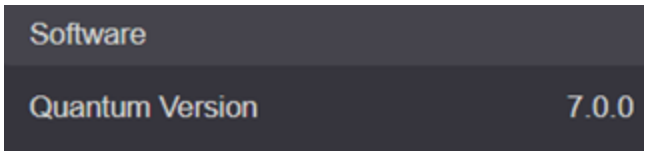
IP	Shows IP address of the connected Veripos receiver.
Serial Number	Displays unit ID of the connected Veripos receiver.
System Version	Displays System Version of the connected Veripos receiver.
GNSS Card Details	Displays GNSS card model information (not applicable for LD900)



System Status – Receiver

Software

Displays Quantum software version numbers (your version may differ):



System Status – Software

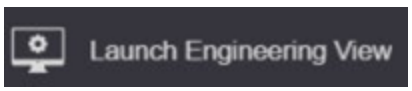
Performance

Displays system resource information. The scroll down arrow can be used to slide the bar to view the performance menu:

Performance information

Launch Engineering View

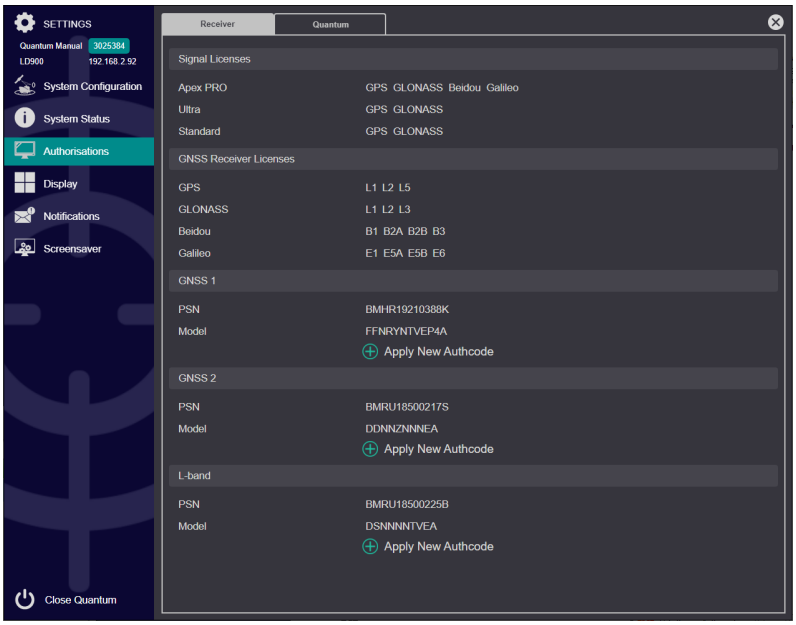
This option provides advanced information on L-band and GNSS signal tracking. Veripos may request information from the Engineering view during support cases. It is recommended to only use this view when under instruction from Veripos:



Engineering View

3.5 Authorisations

The Authorisations menu displays information relating to system licencing.



Authorisations (LD900 example)

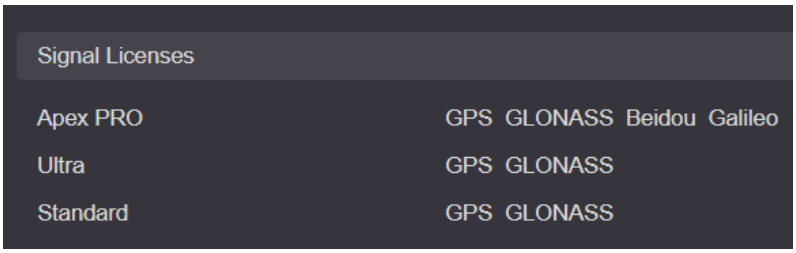
3.5.1 Receiver

Signal licenses

Quantum displays signal licence information relating to the type of correction service that is enabled on the interfaced Veripos IMU. This license information is **not** the Quantum software license.

Information on the three type of available Veripos solution (Apex, Ultra and Standard) is displayed. Each solution indicates which GNSS constellation is subscribed.

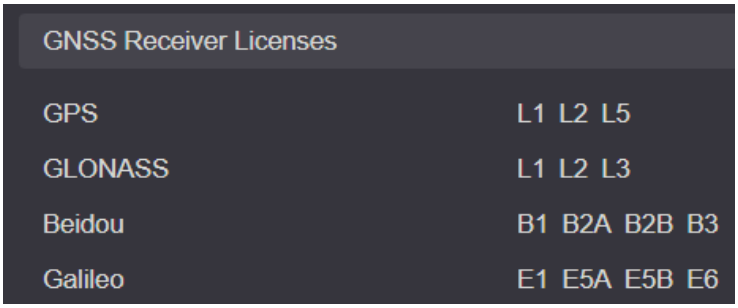
In the example below, the Veripos receiver has been enabled for the Apex5 service, which uses 5 GNSS constellations. GPS and GLONASS appearing next to Ultra and Standard indicates that the receiver has the backup services of Ultra² and Standard².



Signal Licences information

GNSS Receiver licenses

This section displays which GNSS constellations and frequencies the GNSS receiver has the capability to track.



GNSS Receiver Licences information

3.5.1.1 GNSS1 / GNSS2 / Lband (LD900)

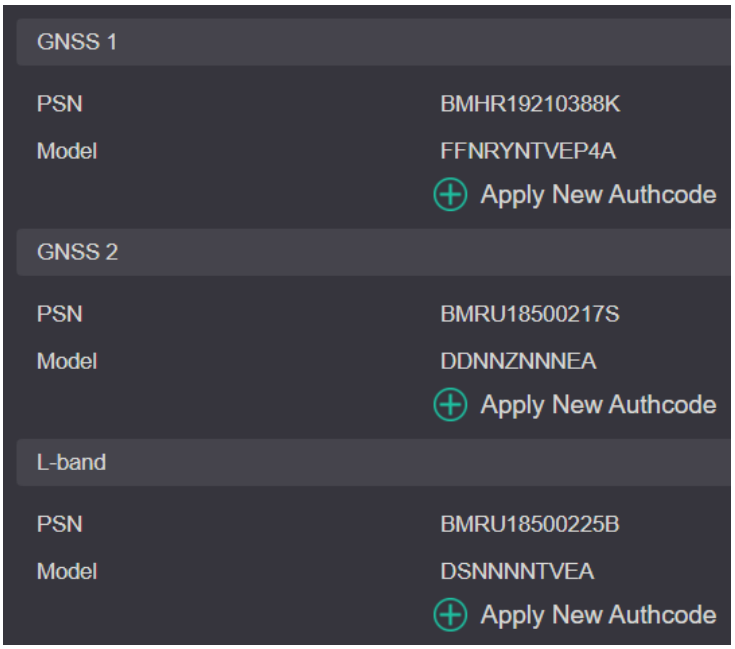
This section displays the PSN and Model of the GNSS1, GNSS2 and L-band receivers.

To purchase additional receiver functionality such as GNSS2 secondary positioning, e-mail the serial number of the LD900 system to your Veripos account manager, who will supply a corresponding authorisation code which may be applied to the corresponding receiver by clicking the corresponding **Apply New Authcode** button.

• Apply Heading upgrades within the GNSS1 section.

• Apply INS upgrades within the GNSS1 section.

• Apply Secondary Positioning upgrades within the GNSS2 section.



GNSS Receiver Licences information

3.5.2 Quantum

Software licenses

A Quantum software license is required. This is normally entered during the initial configuration process. The Software Licenses section displays the active Quantum license code and the enabled features of the license. Licenses can either be purchased (no expiry) or rented. Rented licenses have an expiry date and will need to be renewed.

The following modes are currently available:

- **DP** Enables Quantum optimised for DP operations
- **Survey** Enables Quantum optimised for Survey operations

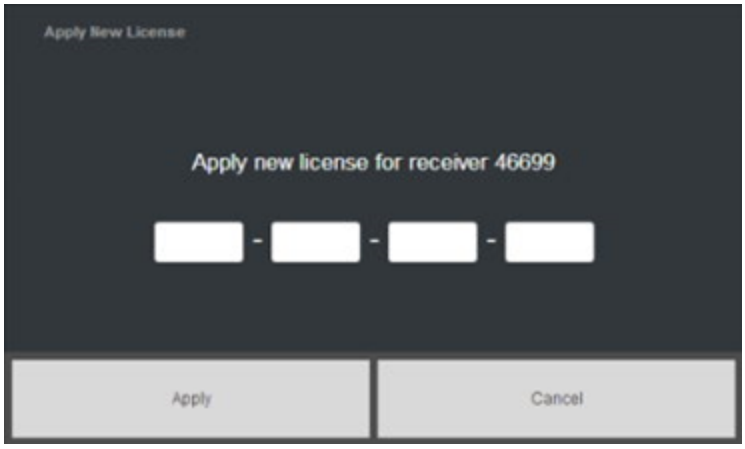
The following features are currently available:

- **Heading** Enables the use of heading functionality
- **Tides** Enables the use of Tides functionality
- **INS** Enables the use of INS functionality
- **Interference Mitigation** Enables interference mitigation technology functionality

When requesting a new or revised software license, it is important to ensure that the appropriate features are requested.

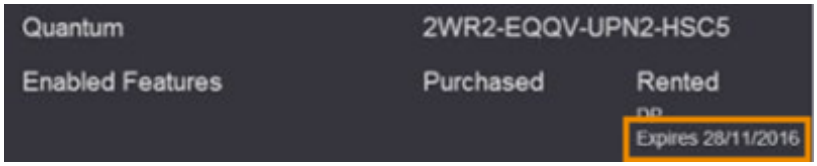
A new Software licence code can be applied by clicking **Apply New License**, then entering the supplied license code and finally clicking **Apply**:

Software licence details – Purchased license



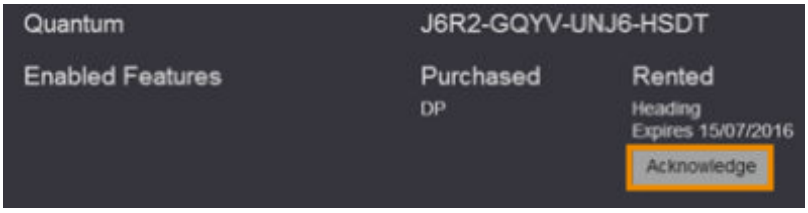
Apply New Licence

If a license is rented, the rental expiry date of the Quantum software license will be shown below the list of enabled features:



Software licence details – Rented license

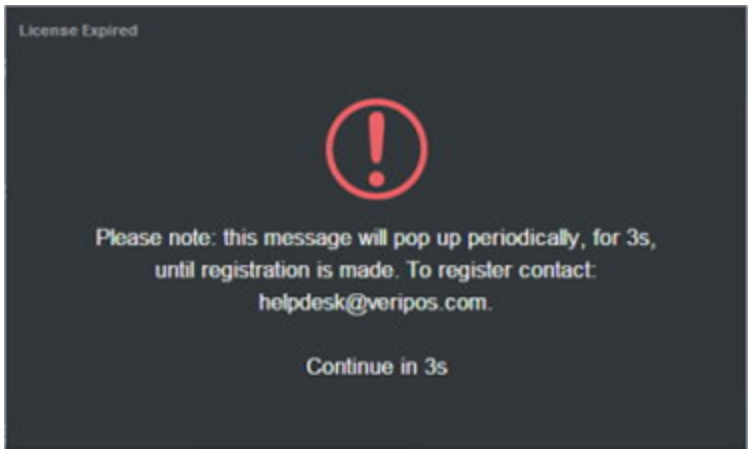
It is possible to have a combination of purchased and rented licenses. For example, the main Quantum license (DP or Survey) is purchased and an additional feature such as Heading could be rented. In this scenario, a license expired notification will appear periodically. If the expired feature is required a new license can be obtained by contacting the VeriposHelpdesk. If a feature is no longer required, the expired feature can be cleared by clicking Acknowledge. This will prevent the notification from appearing and it will remove the expired feature from the Software Licenses section.



Software licence details – Rental Acknowledge

3.5.2.1 Expired Licenses

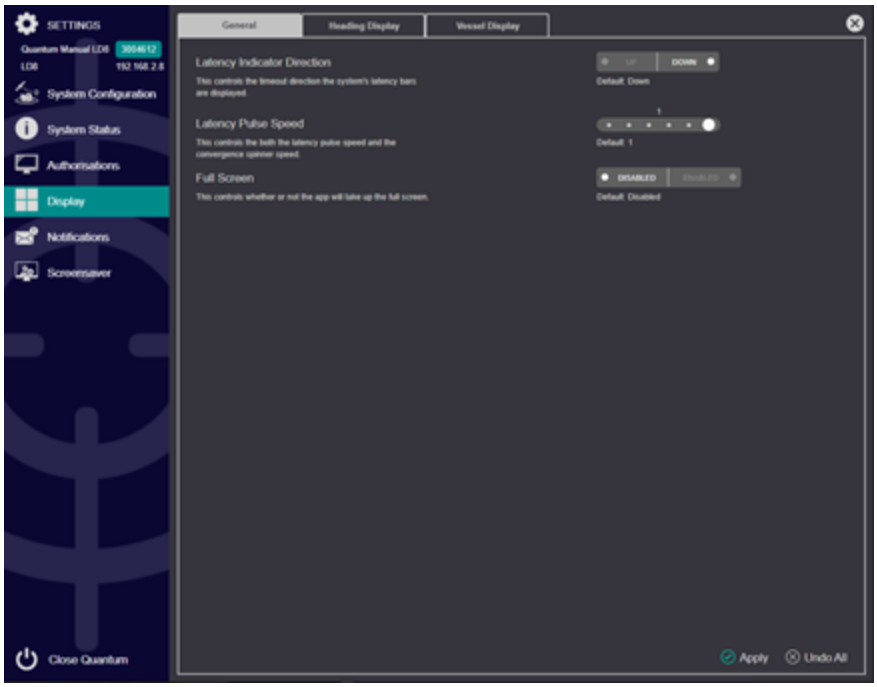
If a rental license has expired, the notification message shown below will be displayed at regular intervals. Contact Veripos Support to obtain a new license:



License Expired notification

3.6 Display

The **Display** settings page allows display setting changes.



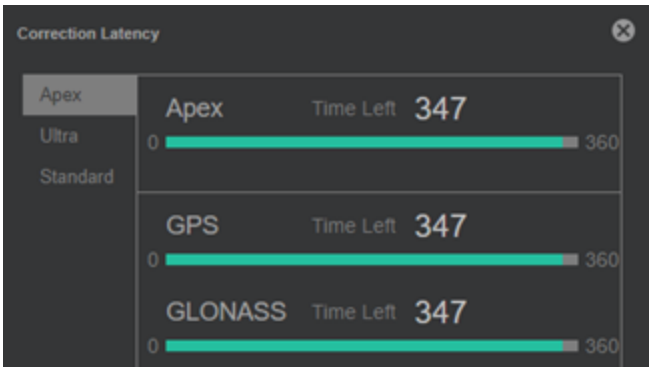
3.6.1 General

3.6.1.1 Latency Indicator Direction

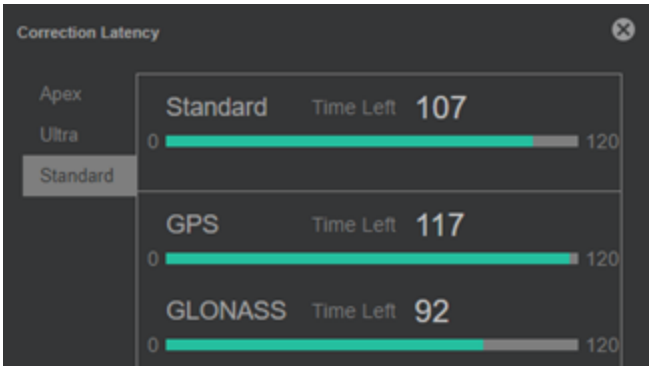
The **Latency Indicator Direction** setting controls the timeout graphic used to display corrections Latency:

Latency Indicator Direction setting

By default, this is set to **Down**. When set to Down, the correction latency bars will count down from the maximum correction age (360 seconds for PPP, 120 seconds for DGNSS solutions):



PPP Correction Latency – Counting down

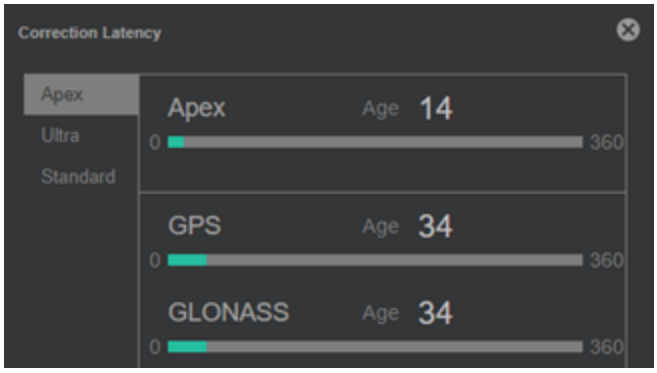


DGNSS Correction Latency – Counting down

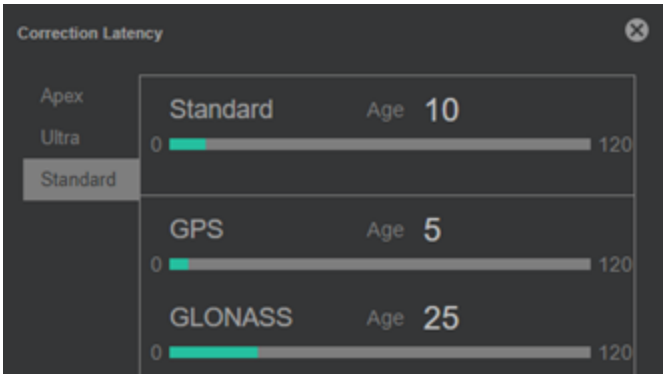
To change the **Latency Indicator Direction**, click **UP** followed by **Apply**.

Once **Apply** is selected a momentary message: **Changes Successfully Applied** will appear.

When set as **UP** the correction latency bars will count up from zero:



PPP Correction Latency – Counting up



DGNSS Correction Latency – Counting up

For further details regarding the Correction Latency view, refer to section **Correction Link Satellites**.

3.6.1.2 Latency Pulse Speed

The **Latency Pulse Speed** setting defines how fast or slow the **Correction Age** and **Solution Status** icons will pulse, ranging from 0 and 1 seconds (0.2 increments). A setting of 0 will disable the pulsing. It is recommended to leave the icons pulsating as this will show that the Quantum system is active:

Latency Pulse Speed setting

3.6.1.3 Full Screen

Quantum does not launch in full screen by default; however a full screen view can be enabled:

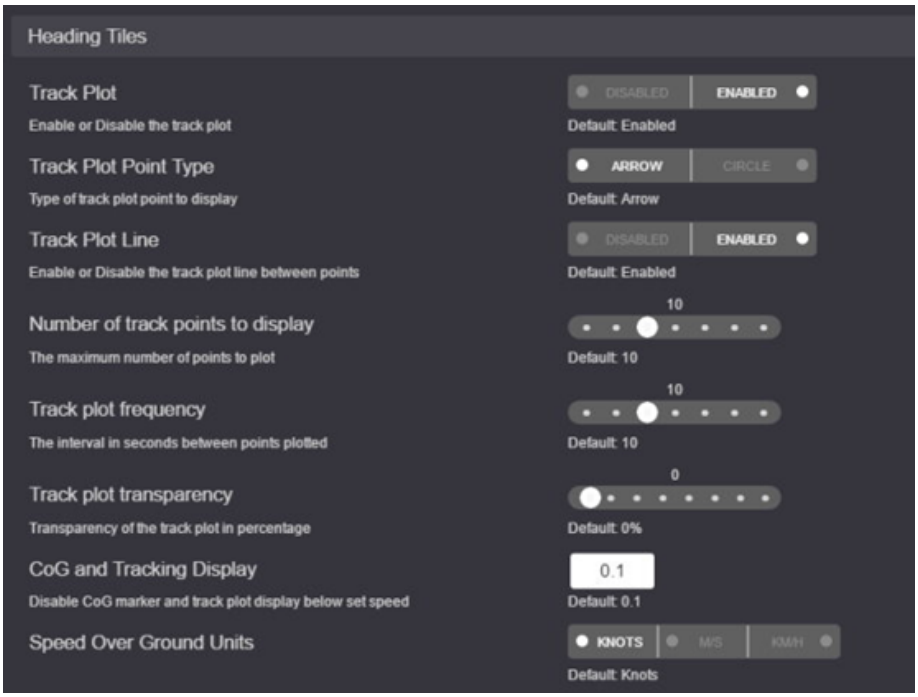
Latency Pulse Speed setting

3.6.2 Heading Display

Heading display settings are only visible when the system is licensed and configured for Heading.

DP/Survey:

The Heading display page allows users to change Track Plot, SOG, COG and Tracking display settings:



Heading Tiles configuration

3.6.2.1 CoG and Tracking Display

Defines the minimum vessel velocity at which the CoG marker and track plot will update. This threshold velocity should be defined to suit the vessel dynamics.

CoG and Tracking Display setting

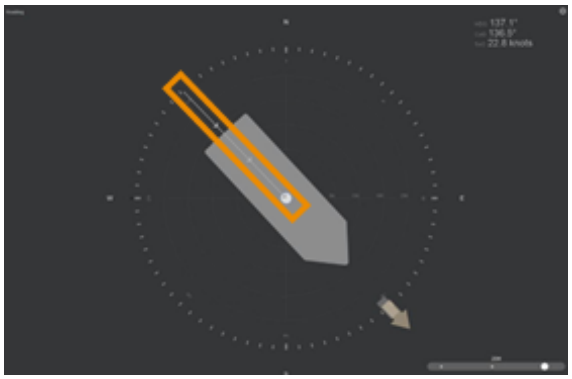
3.6.2.2 Speed Over Ground Units

Choose the units which vessel speed is displayed in. Choose between KNOTS, M/S or KM/H.

Speed Over Ground Units setting

3.6.2.3 Tracking

Tracking settings are used to change the style of the vessel track plot within the Heading view.



Heading view with track plot displayed

3.6.2.4 Track Plot

Choose if a track plot is to be **DISABLED** or **ENABLED**. Fields relevant to track plot will be shown once track plot is enabled.

Track Plot setting

3.6.2.5 Track Plot Point Type

Choose the type of track plot point symbol to be displayed (either an Arrow or Circle).

Track Plot Point Type setting

3.6.2.6 Track Plot Line

The vessel track plot can be configured as isolated points or interconnected with lines.

Track Plot Line Type setting

3.6.2.7 Number of track points to display

Defines the number of historical track points to be displayed.

Number of track points to display setting

3.6.2.8 Track Plot Frequency

Defines the interval (and therefore frequency) at which points will be plotted. A high track plot frequency value may result in the display becoming cluttered. Clutter can be reduced by decreasing the track plot frequency (increasing the interval).

Track plot frequency setting

3.6.2.9 Track Plot Transparency

Defines the transparency of vessel track plots. The maximum transparency value is 80%.

Track plot transparency setting

3.6.3 Vessel Display

DP/Survey:

The Vessel Display page allows users to change colour and type of vessel.

Vessel Display settings for DP/Survey

3.6.3.1 Colour

This option allows users to select colour of vessel graphic to be displayed on the Heading and navigation plot tiles. The default colour of the vessel graphic is grey.

Vessel colour

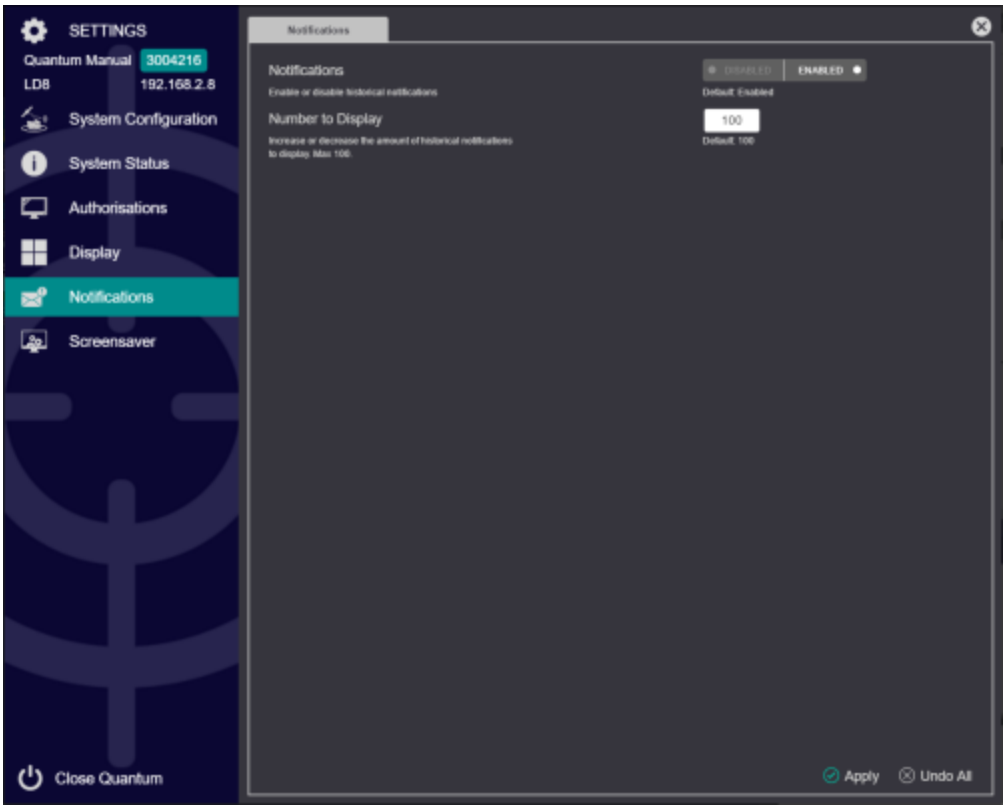
3.6.3.2 Type

Type allows Survey users to select the vessel type, Ship or Rig:

Vessel Type for Survey/DP

3.7 Notifications

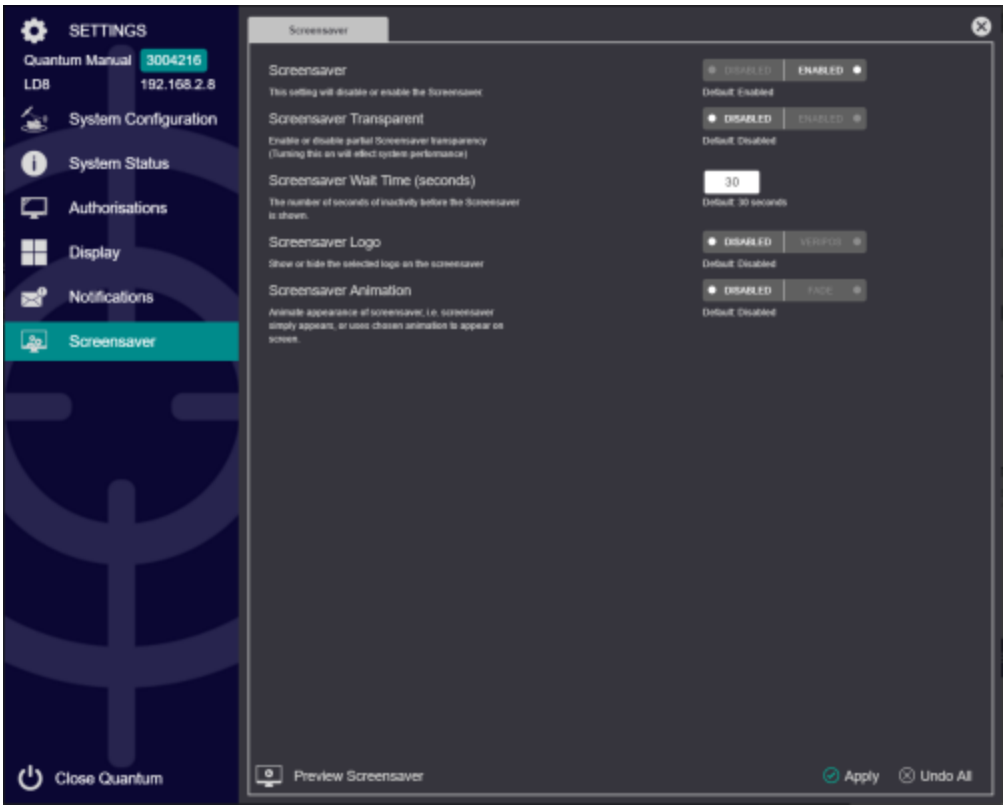
Quantum can log significant events as notifications, these logs can be **DISABLED** or **ENABLED** (recommended).



For more detailed information on Quantum notifications, please refer to section **Display Tabs**.

3.8 Screensaver

Quantum has a screensaver feature (enabled by default) which is displayed after a defined period of user inactivity. The settings detailed below alter the screensaver behaviour.



3.8.1 Screensaver

Configures the screensaver feature to be **DISABLED** or **ENABLED**:

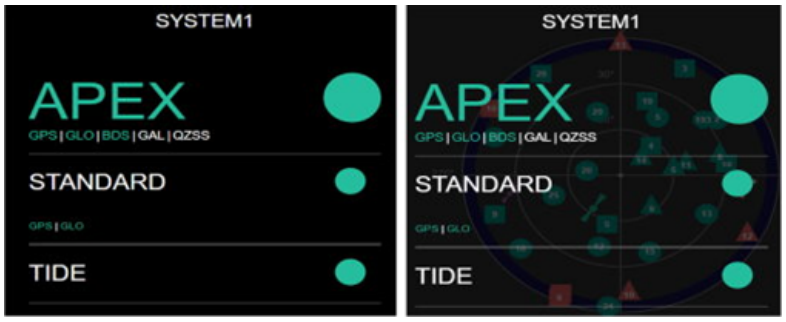
Screensaver setting

3.8.2 Screensaver Transparent

By default, when the screensaver is ENABLED, the main display is not visible because the screensaver is not transparent:

Screensaver Transparent setting

It is possible to make the screensaver transparent so that the main Quantum screen is visible behind the screensaver:



Screensaver - Transparent disabled *Screensaver - Transparent enabled*

3.8.3 Screensaver Wait Time

Used to define when the screensaver will be launched after a period of no user interaction or system events. The default is 30 seconds:

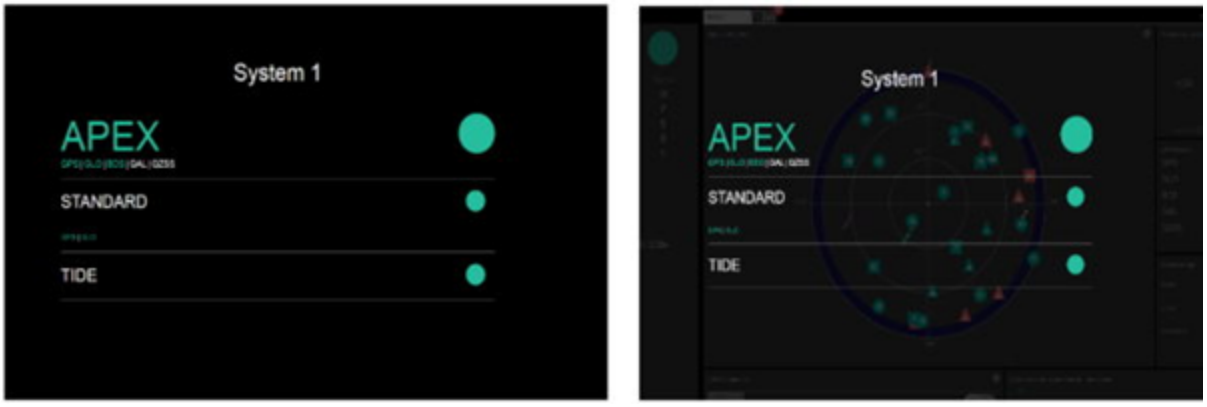
Screensaver Wait Time setting

3.8.4 Screensaver Logo

Choose if the Veripos target logo is to be included on the screensaver. The default setting is DISABLED.

Screensaver Logo setting

Screensaver Logo Enabled



Screensaver Logo Disabled

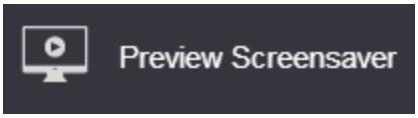
3.8.5 Screensaver Animation

Defines if animation is used when the screensaver appears or clears. Choose between **DISABLED** and **FADE**. The default setting is **DISABLED**:

Screensaver Animation setting

3.8.6 Preview Screensaver

Click Preview Screensaver to immediately display the screensaver. This is useful for checking the screensaver appearance following setting changes:



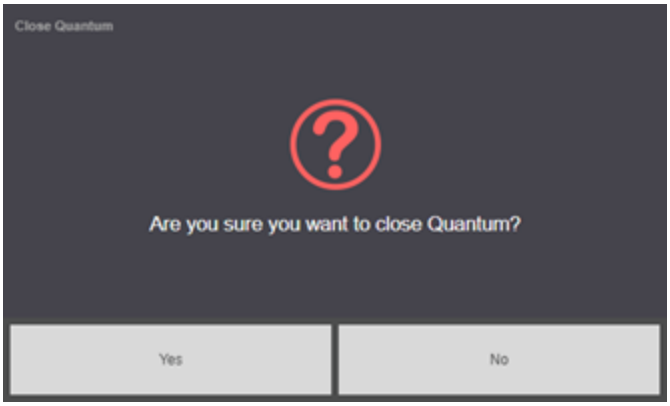
Preview Screensaver option

3.9 Close Quantum

To close the Quantum software, click **Close Quantum** on the **Settings** page:

Close Quantum

After clicking **Close Quantum**, a confirmation message will appear, Click **Yes** to close **Quantum**:

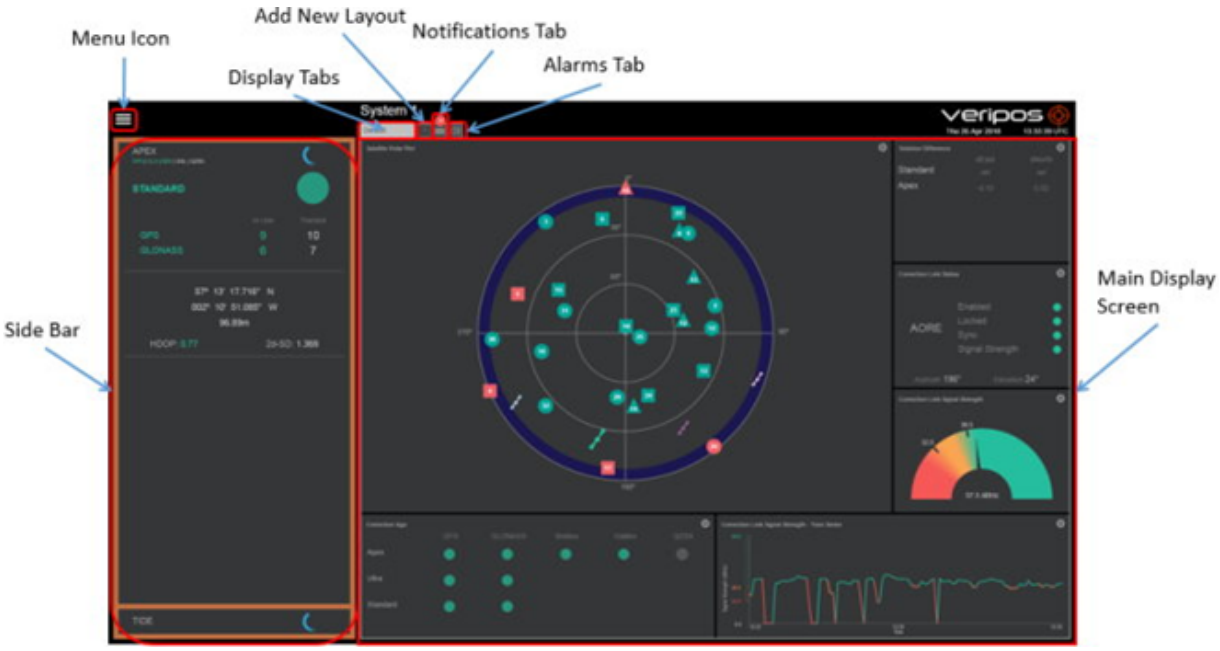


Close Quantum confirmation

NOTE
Closing Quantum will not stop the NMEA or UKOOA position outputs that originate from the Veripos receiver.

4 Screen overview

When Quantum has been launched and **System Configuration** has been completed (as detailed in section **System Configuration**), the Quantum screen should appear as below:



Quantum screen layout

The main elements of the Quantum screen are:

- Sidebar
- Main Display Screen
- Menu Icon
- Display Tabs
- Notifications Tab

4.1 Sidebar

The Quantum Sidebar, as seen on the left of the above Quantum screen layout image, displays overall status information for the active solution. The general health of the backup solution is also indicated by the colour and ‘pulse’ of the circular icon.

NOTE
The data displayed within the sidebar is not configurable.

4.1.1 Solution status

The name of the solution currently in use (active solution) will be displayed e.g. **APEX**. A pulsing circular icon is also displayed which is used to show general solution health.

A green pulsing circle indicates that the active solution is working within expected parameters with no issues. If there are any issues with the active solution, the colour of the solution status symbol will change.

An amber symbol indicates that the active solution is still working, but with some issues e.g. the correction age may be higher than expected.

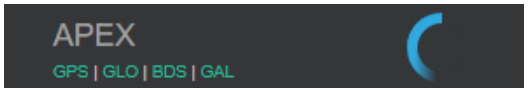
A red symbol indicates that there is a critical problem with the active solution and positioning e.g. Loss of GNSS or the correction age has exceeded the allowable limit.

A turning blue circular (partial) trail indicates that a solution is converging (and therefore not available):

Solution Status – Healthy

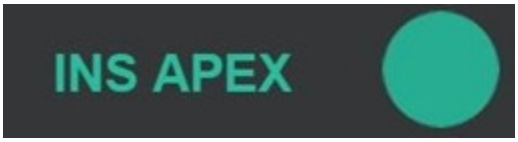
Solution Status – Warning

Solution Status – Failed



Solution Status – Converging

Solution Status – PPP Converged & INS Aligning



Solution Status – Blended GNSS / INS

Solution Status - GNSS Lost & Dead Reckoning

4.1.2 Satellite constellation

The **Sidebar** shows how many satellites from each relevant constellation are being tracked and how many are being used.

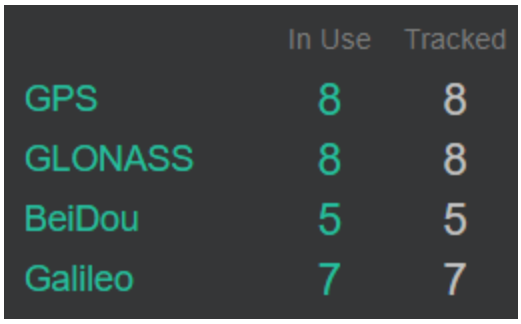
It is normal to see less satellites being used compared to the amount tracked. This is normal because some satellites are:

• Below the defined solution elevation mask

• Below the acceptable signal level mask.

• Not corrected.

Only GNSS constellations and satellites displayed in green are in-use by the active solution:

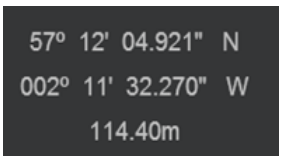


Sidebar – Satellite Constellation Status

4.1.3 Solution position and height

The Sidebar displays the WGS84 Latitude, Longitude and height of the active solution which is being provided by the Veripos receiver.

Latitude and Longitude are displayed in DD:MM:SS.SSS format. Height is displayed in metres to 2 decimal places:



Sidebar – Position & Heading

4.1.4 HDOP and 2d-SD

The Horizontal Dilution of Precision (HDOP) value is a measure of the quality of satellite horizontal geometry. A low satellite count typically leads to high HDOP values. Persistently high HDOP values may indicate issues with antenna obstructions or interference. The displayed HDOP value is colour coded. As shown below, a ‘healthy’ DOP (less than 2.0) is shown in green. A value of 2.0+ will result in an amber DOP and a red ‘poor’ DOP will be triggered by a value of 4.0+.

Sidebar – HDOP & 2d-SD

The 2d-SD value is at a 95% confidence. This provides an indication of the 2D accuracy of the active solution. The displayed value is in metres. A smaller 2d-SD value indicates a better solution accuracy.

4.1.5 Interference

The Interference indicator will illuminate red if interference has been detected in the L1, L2 or L3 signal bands. See the **Interference Status** tile for general information on effected frequencies or the **RF Spectrum** tile to help determine where the inference centre frequency lies in MHz.

4.1.6 Spoofing

The possible Spoofing indicator states are:
- Grey - Disabled (activate in **Settings**)
- Amber - Active but not yet calibrated (Calibrate in **Settings**)
- Green - No spoofing detected.
- Red - Spoofing detected.

4.1.7 Backup solution

In most circumstances, there will be a **backup** solution in addition to the active solution. The Quantum sidebar displays the name and status of the backup solution.

The backup solution will typically be either a secondary PPP solution or a Standard solution. However, if no other backup solutions are available a backup solution may be an uncorrected position. In the event that only an uncorrected position (stand-alone position) is the backup, the sidebar will display an amber border.

4.1.8 Tides solution

The Tides Solution panel is displayed below the sidebar and indicates the Tides status. This solution panel is not displayed unless the Quantum Tides feature is activated. Please refer to section Quantum - Software Licenses for further details.

Sidebar – Tides status

4.2 Main Display Screen

The “Main Display Screen” consists of configurable view tiles. Full details options see section Display configuration.

4.3 Date and time

The date and time displayed below the Veripos Logo is received from the connected Veripos receiver. Time is displayed in UTC:

Veripos logo, date and time

4.4 Menu icon

The Menu icon is used to access all Quantum configurations, ranging from initial setup to view configuration.

4.5 Display Tabs

Display Tabs allow users to setup configurable views. Multiple display tabs can be configured (maximum of 4). For further details please refer to section Display configuration.

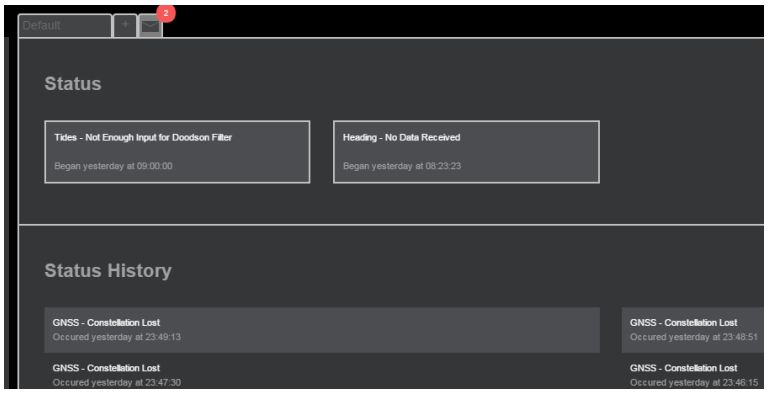
4.6 Notification Tab

The Notifications Tab is used to notify users of any significant systems events. The tab will show a red icon with the number of current system notifications:

Notification count

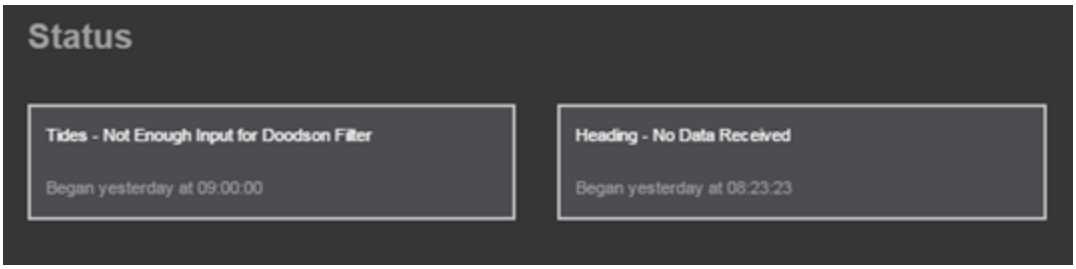
4.6.1 Viewing notifications

Click the Notification tab to display the list of system notifications. Notifications are split into two categories – **Status** and **Status History**:



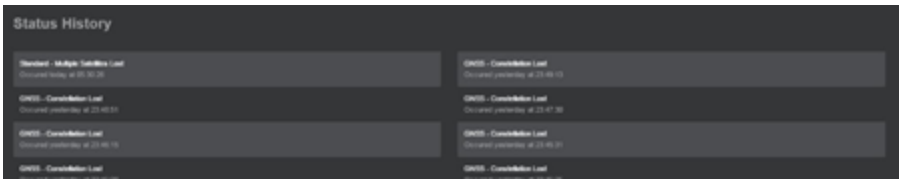
Current and Historical Status list

Events, such as system error states which are currently active, will be displayed in the Status section. These could relate to loss of GNSS, loss of corrections data or poor GNSS quality which all would impact system performance:



Example of a current event notification

Historical Status notifications generally require no user intervention. These are usually events such as L-band beam changes. Notifications raised in the Status section will move to the Historical Status section once the event is resolved (e.g. system error):



Example of Historical Status notification

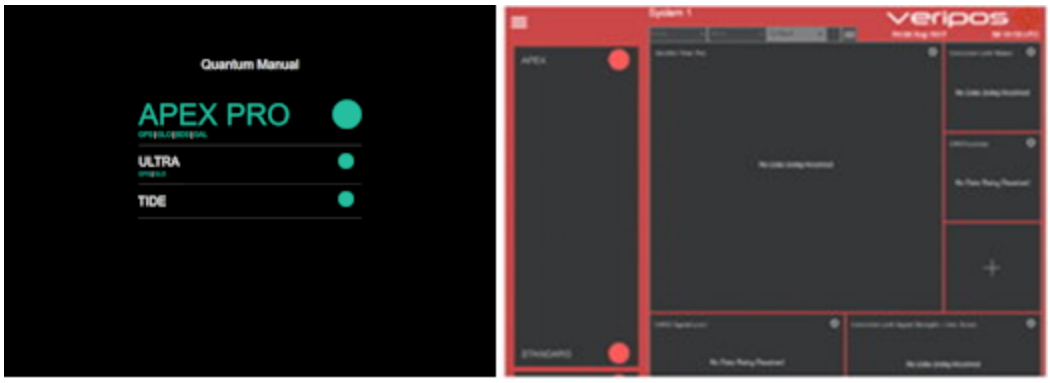
To view full details of a notification, click on the desired notification. If there is an issue with the system, the event description often contains useful troubleshooting guidance:

Full notification summary

4.7 Screensaver

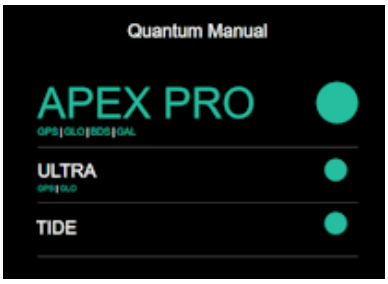
Quantum has an optional screensaver which provides an overall system status and displays a system label. This is defined on the top of the Quantum screen and is useful for monitoring the status of the software at a distance from the monitor. If critical issues arise the screensaver will cease.

Refer to section **Screensaver** for more information on screensaver configuration:



Screensaver clears when critical alarm present

Green pulsing circles on the screensaver are used to indicate that the active solution and backup solution are healthy:



Screensaver solution status indicator – Healthy

The screensaver will remain active during amber events, such as high correction age. During such Amber events the relevant solution will be displayed in amber. An example is shown below:

Screensaver solution status indicator – Amber

5 Display configuration

5.1 Tab configuration

Quantum can be setup to have a maximum of 4 view tabs (excluding the Notifications tab). Each tab can be given a customised grid layout of views. Users can choose from a predefined tile layout or manually select which views are to be displayed on each tab.

5.1.1 Preset tile layouts

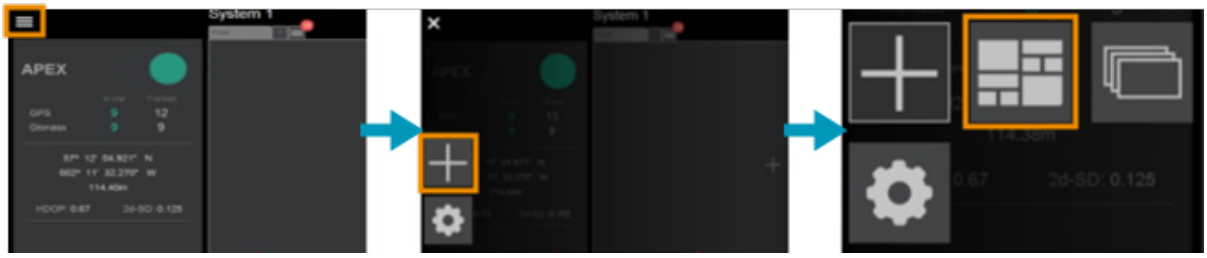
There are three predefined layouts:

• Default

• Polar Plot

• Heading (only present when Quantum is licensed for Heading)

To select a predefined layout, click **the** Menu icon followed by the large '**+**' icon. Select the page layout icon:

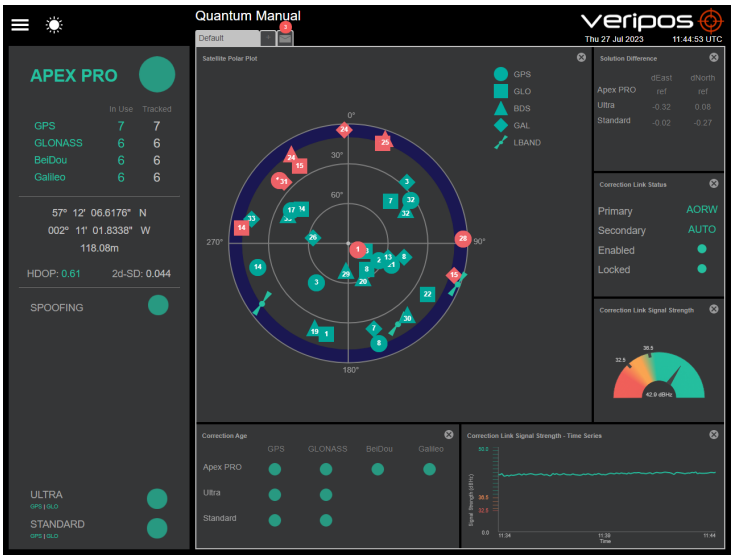


Accessing pre-defined layout options

The available tab layouts will be displayed. The right arrow can be used to view a third layout option:

Accessing layout options

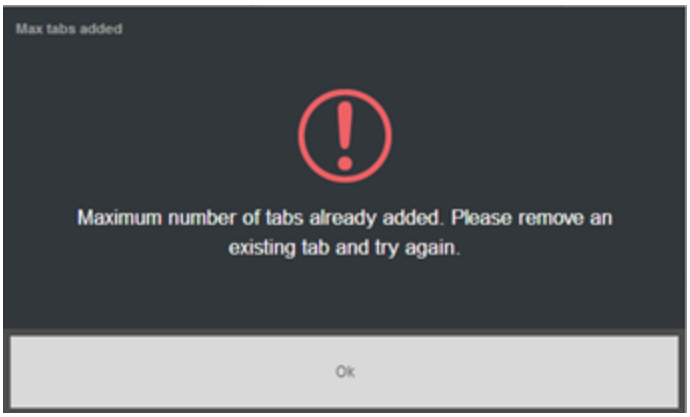
Click on the desired view. This selected view will now be displayed and the tab for this view will display the pre-set layout name e.g. **Default**:



Pre-set tab layout

Although the view windows displayed are pre-configured, the views can still be changed by deleting view tiles and then inserting new items.

If four view tabs are already open it is not possible to add a pre-set layout. In this case a tab must be deleted prior to adding a new pre-set layout:



Max tabs warning

5.1.1.1 Default tile layout

The **Default** tile layout consists of the following views:

- Satellite Polar Plot
- Solution Difference
- Correction Link Status
- Correction Link Signal Strength
- Correction Age
- Correction Link Signal Strength – Time Series

5.1.1.2 Heading tile layout

The **Heading** tile layout consists of the following views:

- Heading
- Heading Data
- Correction Link Status
- Correction Link Signal Strength
- Correction Age
- Correction Link Signal Strength – Time Series

5.1.1.3 GRIT tile layout

The **GRIT** tile layout consists of the following views:

- Interference Status
- Spoofing Status
- Solution DOP
- Correction Link Signal Strength
- GNSS Signal Level
- 2d-SD – Time Series

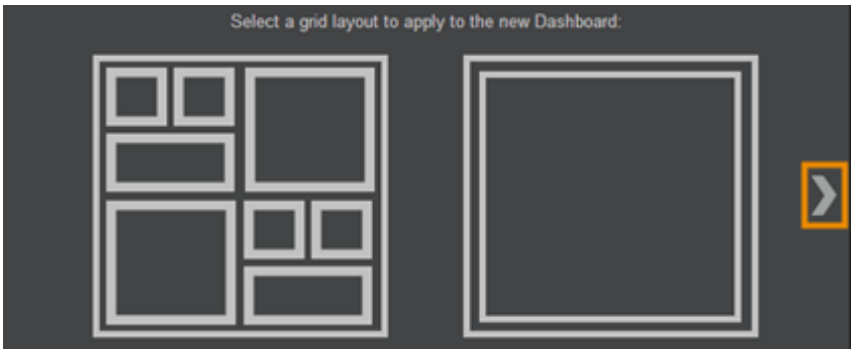
5.2 User-configurable tile layouts

In addition to the pre-set tile layouts covered in section **Preset tile layouts**, it is also possible to manually select from the various available views. There are also 4 grid layout options to choose from.

To start configuration of a user-configurable layout, a new tab must be opened. Click the '+' sign next to the notifications icon:

Open new tab icon

A pop-up will then appear to allow the user to choose from one of the four available tile layouts. Note that there is an arrow to the right which is used to scroll through the available tile layouts:



Select tile layout option

The available tile layouts are shown below:

Available tile layouts

Click on the desired view and the new tab will then appear in Quantum with the chosen tile layout.

The tiles will be empty so that the user can manually select which information is displayed within each tile.

NOTE
The size of the tile dictates which information can be displayed in each. For example, the **2d-SD – Time Series** view can only be displayed within a 2x1 sized tile.

5.2.1 Renaming tabs

Any opened display tabs can be renamed. Tiles, which have been manually configured by the user, will be named **New** by default. It is recommended to rename these so that it is easy to identify which views each tab contains. For example, if a tab has views which relate to the L-band correction status the tab could be named '**LBAND**'. Preset tile layout tabs can also be renamed.

To rename a tab, double-click the tab where the current name is displayed, an on-screen keyboard will appear. Type the new name and press **Enter** to confirm:

On-screen keyboard for renaming tabs

NOTE
Tab names are restricted to a maximum of twelve characters and special characters are not permitted.

The new name will now appear within the tab:

Renamed tab

5.2.2 Deleting tabs

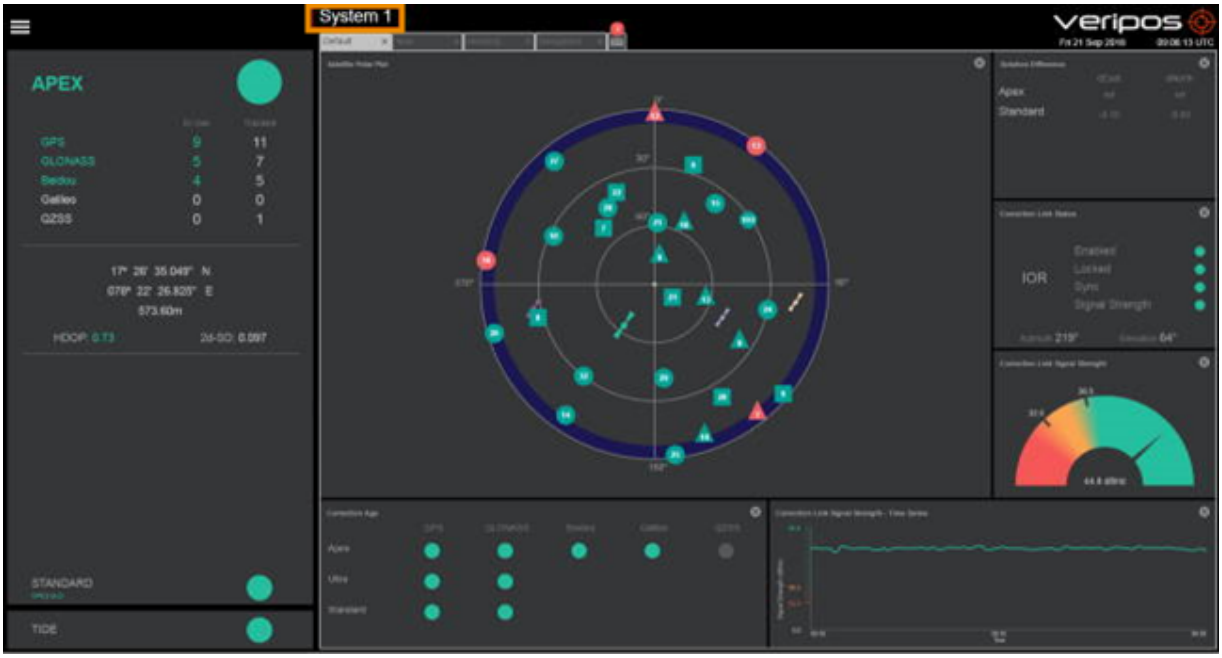
If a tab is no longer required, it is possible to delete it. Simply click on the close icon on the relevant tab:

Delete tab

5.2.3 Renaming Quantum screen

In addition to renaming each display tab, it is also possible to rename the title displayed at the top of the Quantum screen. The default name is **System 1**. It is recommended to set a descriptive name such as **DGNSS Port** or **Vessel Secondary**.

To rename the Quantum screen name, double-click the existing name e.g. **System 1**:



Quantum screen name

The new name can be entered using the on-screen keyboard then pressing Enter to confirm:

New Quantum screen name

NOTE
The name is restricted to 32 characters and no special characters are permitted.

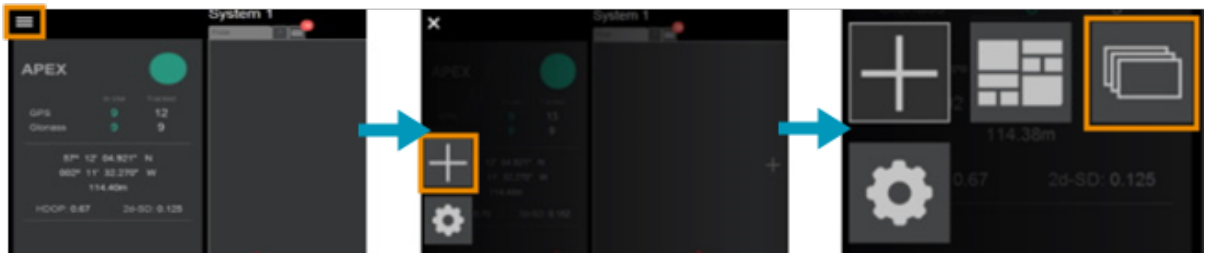
6 Views

There are many views available which allow the user to monitor system status. Some of these views relate to the overall solution status and some show more detailed information relating to either GNSS, correction or heading data.

The user can decide which views are most relevant for their requirements and arrange them accordingly.

6.1 Selecting views

To manually select views, select the relevant Tab display (either existing or a new tab). Press the Menu icon followed by the '+' symbol then the View icon (highlighted far right below):



Accessing manual views

After clicking the **View** icon, the icons below will be displayed:

View icons

The available views are split into seven categories, detailed in later sections, these are:

Correction View

Heading & INS View

GNSS Status View

Interference and Spoofing View

Solutions View

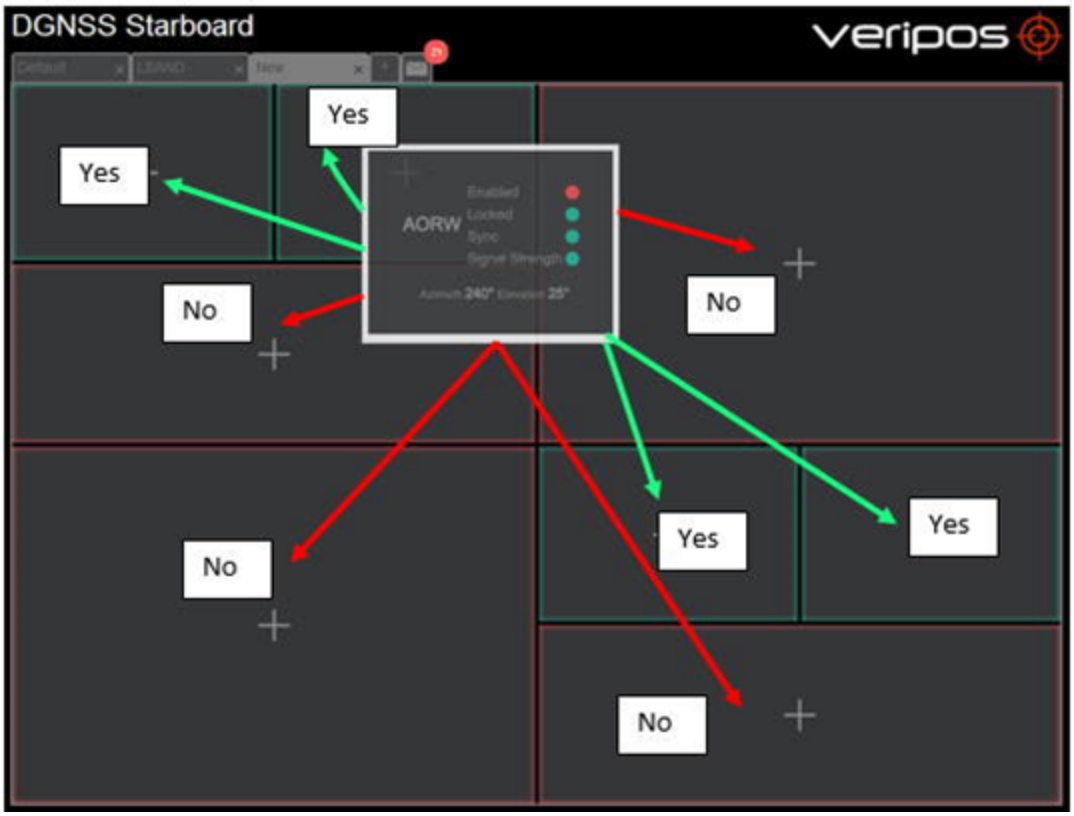
Tides View

System Status View

NOTE
Heading and Tides tabs are present when Quantum has the feature included within the software license.

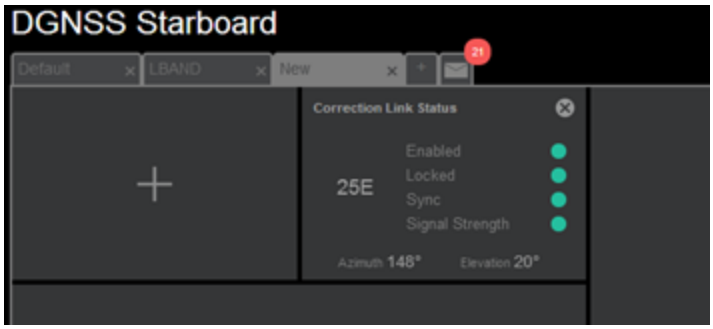
Click on the required category to access the available views. Once the required view has been found, press and hold the left mouse cursor and drag to the desired tile.

While dragging the selected view, tiles will be highlighted with a green border or a red border. Green indicates that the view is ok to be placed and red denotes the view is an incompatible shape for this tile.



Tile placement restrictions

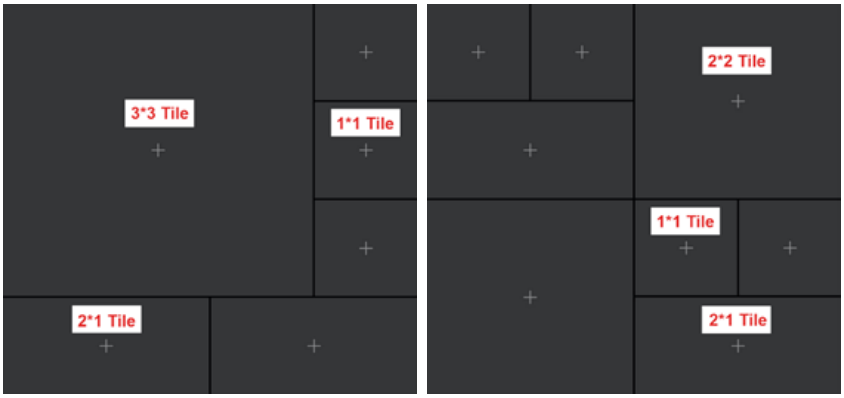
A selected view must be placed into an appropriate shaped tile dimension:



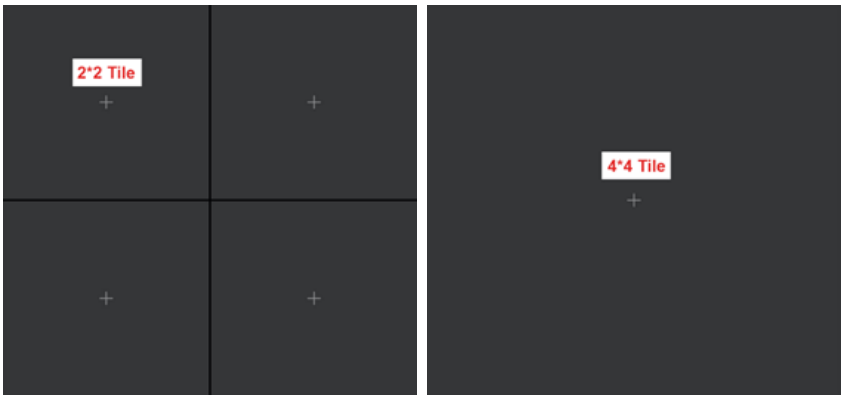
View placed in appropriate tile

6.1.1 Different types of tiles available

There are different types of tiles available within views. Namely 1*1, 2*1, 2*2, 3*3, 4*4:



*Different types of tiles available (1*1, 2*1, 2*2 & 3*3)*



*Different types of tiles available (2*2 & 4*4)*

6.1.2 Deleting view from tiles

If a tile contains information which is no longer required, it is possible to delete the contents of the tile. Simply click on the 'X' icon on the relevant tile:

Delete tile contents

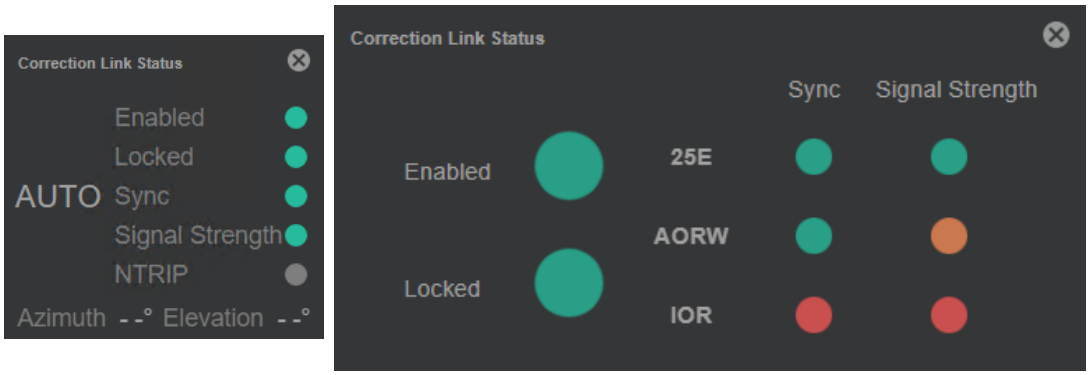
6.1.3 Replacing existing views

A tile does not need to be empty before a new view can be inserted into a tile. If a tile contains data which is no longer required, a new view can be inserted using the same method as explained in section Selecting views.

6.2 Correction View - Descriptions

6.2.1 Correction Link Status (LD8)

The **Correction Link Status** view provides high level information regarding various aspects of the L-band corrections in use. Note the information displayed will depend on the size of tile used:

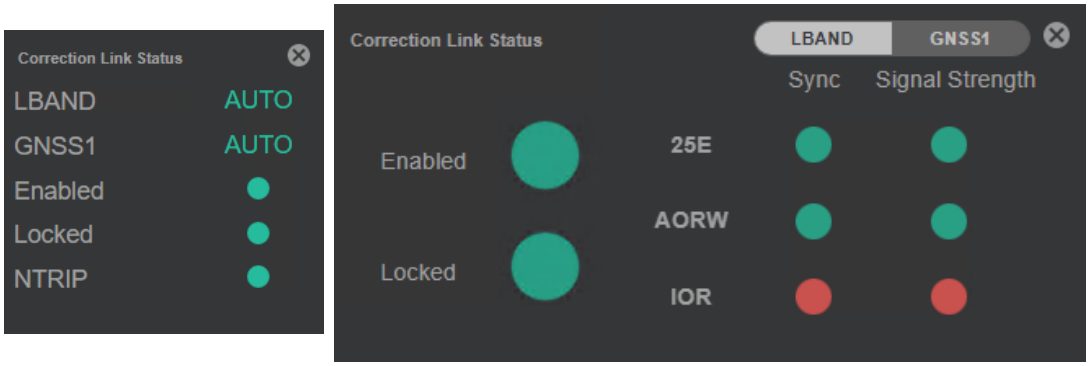


LD8 Correction Link Status 1x1 view (and) 2x1 view

Information	Details
L-band satellite in use	Name of the L-band correction satellite in use e.g. AUTO, or 25E
Enabled	Green icon = Enabled Red icon = Disabled
Locked	Green icon = Signal locked Red icon = No signal lock
Sync	Green = Receiving data from L-band satellite Red = Not receiving data from L-band satellite
Signal Strength	Signal strength of the selected L-band satellite. Thresholds: Green: >36.5dB Hz, Amber: Between 32.5 & 36.5dB Hz:, Red: <32.5dB Hz
NTRIP	Green icon = Source available Grey icon = Source not enabled within Settings Red icon = Source unavailable
Azimuth & Elevation	Orientation info' for active L-band correction satellite at present location.

6.2.2 Correction Link Status (LD900)

The **Correction Link Status** view provides high level information regarding various aspects of the L-band corrections in use. Note the information displayed will depend on the size of tile used, with toggling between LBAND and GNSS1 available on the 2x1 view, allowing for verification of individual beam states:



LD900 Correction Link Status 1x1 view (and) 2x1 view

Information	Details
LBAND (1x1, 2x1 tiles)	Name of the L-band correction satellite in use e.g. AUTO, or 25E
GNSS1 (1x1 tile)	Name of the L-band correction satellite in use e.g. AUTO, or 25E
Enabled	Green icon = Enabled Red icon = Disabled
Locked	Green icon = Signal locked Red icon = No signal lock
Sync	Green = Receiving data from L-band satellite Red = Not receiving data from L-band satellite

Signal Strength	Signal strength of the selected L-band satellite. Thresholds: Green: >36.5dB Hz, Amber: Between 32.5 & 36.5dB Hz:, Red: <32.5dB Hz
NTRIP	Green icon = Source available Grey icon = Source not enabled within Settings Red icon = Source unavailable

6.2.3 Correction Age

The **Correction Age** view shows a breakdown of L-band corrections which the Veripos receiver is enabled for. This view can be used to monitor correction age for all corrections types. The symbols have three colour states based on the current correction age.

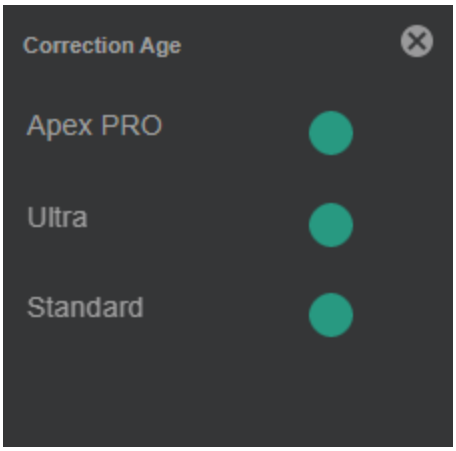
Correction types that the Veripos receiver is not enabled for are indicated by a grey icon with a cross. In the example shown below, the system is enabled for Apex2, Ultra2 and Standard2. The Apex5 service is not enabled:

Correction Age – Not enabled for Apex5 service

The table below details the default correction age range which determine the colour of the status icons for each correction service:

Veripos Correction type	Green = time left (seconds)	Amber = time left (seconds)	Red = time left (seconds)
Apex	0 – 179	180 – 359	≥ 360
Ultra	0 – 179	180 – 359	≥ 360
Standard	0 – 79	80 – 119	≥ 120

When displayed in a 1x1 sized tile, the Correction Age view provides high level information of the overall service (no breakdown of each GNSS constellation):

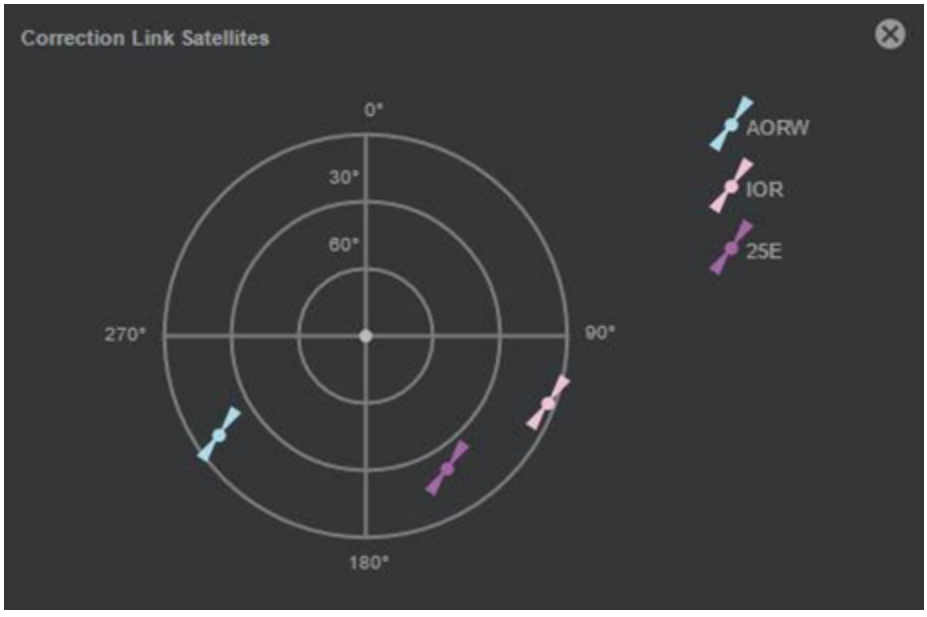


Correction Age view – 1x1 tile

6.2.4 Correction Link Satellites

The Correction Link Satellites view displays all L-band correction satellites (using a satellite symbol) which have an elevation of greater than 0° at the user's location.

The polar plot view shows the approximate elevation and azimuth to the correction satellite at the current location. The selected correction satellite will be denoted with the largest satellite symbol:



Correction Link Satellites view

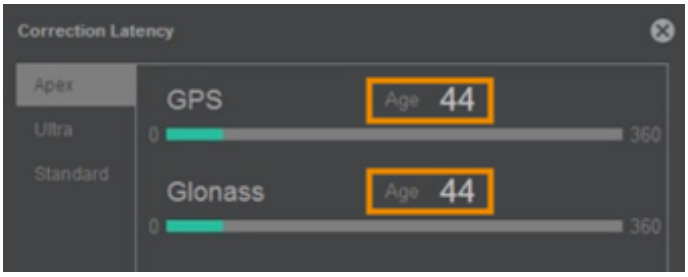
6.2.5 Correction Latency

Provides a dynamic display of the correction age (latency). The correction latency bars are colour-coded depending on their value.

By default, the latency bars will count down from their maximum allowable latency value. This makes it clear to the user exactly how long they have until that particular solution will timeout (when latency indicator bar reaches zero). A 'Time Left' value is also displayed to confirm how long each solution has until it reaches the maximum allowable correction age:

Correction Latency – Age counting down

Veripos Correction type	Green = time left (seconds)	Amber = time left (seconds)	Red = time left (seconds)
Apex	0 – 179	180 – 359	≥ 360
Ultra	0 – 179	180 – 359	≥ 360
Standard	0 – 79	80 – 119	≥ 120



Correction Latency – Age counting up

For details on where to set the *Correction* indicator direction refer to section **Latency Indicator Direction**.

The latency bars are colour coded. The tables below show the threshold ranges (count-up and count-down):

Veripos Correction type	Green = time left (seconds)	Amber = time left (seconds)	Red = time left (seconds)
Apex	0 – 179	180 – 359	≥ 360
Ultra	0 – 179	180 – 359	≥ 360
Standard	0 – 79	80 – 119	≥ 120

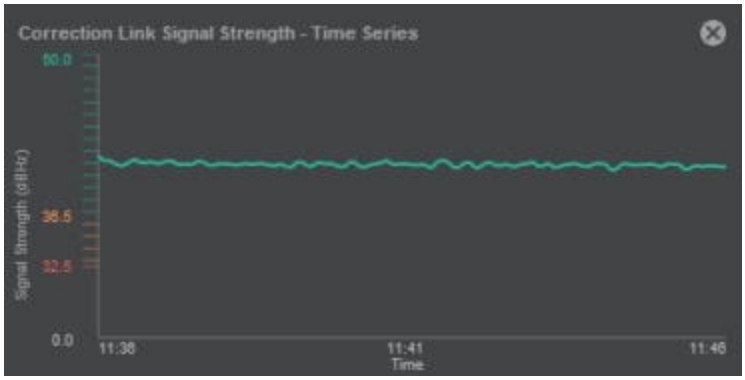
6.2.6 Correction Link Signal Strength

The **Correction Link Signal Strength** view is a fuel gauge type view which provides real-time L-band signal strength indication. The view is colour-coded to give a clear visual indication if the signal strength is acceptable:

Correction Link Signal Strength view

6.2.7 Correction Link Signal Strength – Time Series

Shows a graphical plot of the L-band signal strength over the previous 10 minutes:

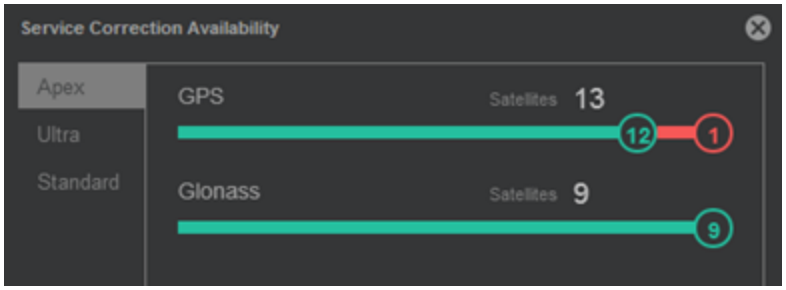


Correction Link Signal Strength – Time Series view

6.2.8 Service Correction Availability

Displays information regarding the availability of correction data for each Veripos service.

For Apex and Ultra solutions, the number of GNSS satellites with correction data is displayed in green numbers. GNSS satellites which have no correction data available are displayed in red numbers:

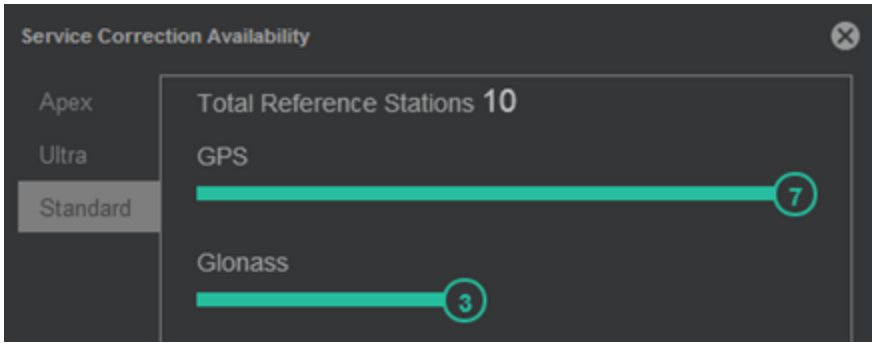


Service Correction Availability view

NOTE
The values in this view are based on all satellites above the horizon (0° elevation). These values may differ from the number of satellites used in a solution which has an elevation mask e.g. 7°.

For Standard solutions the number of Veripos DGNSS reference stations within range of the users' location are shown as the **Total Reference Stations**.

The number of reference stations for which **GPS** and **GLONASS** corrections are currently being received for will be displayed in the GPS and GLONASS bars:

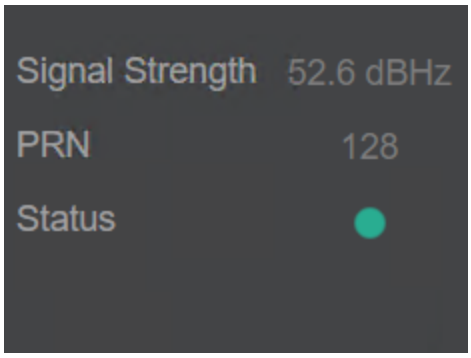


Service Correction Availability – Standard solution

Veripos Standard solutions will use a maximum of 6 reference stations even if there are more reference stations within range.

6.2.9 SBAS Status

Displays information regarding the availability of SBAS signal status.



SBAS Status view

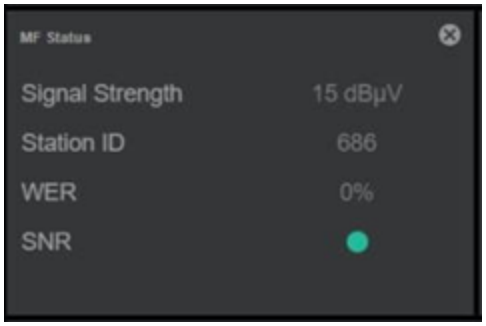
Signal Strength is displayed in dBHZ

PRN Unique PRN code of satellite in use.

Status is shown as a Green, Amber or Red Icon, Green indicates a healthy status, Amber is marginal and Red indicates an unhealthy status.

6.2.10 MF Status (LD900 Only)

Displays information regarding the availability of IALA signal status.



MF Status

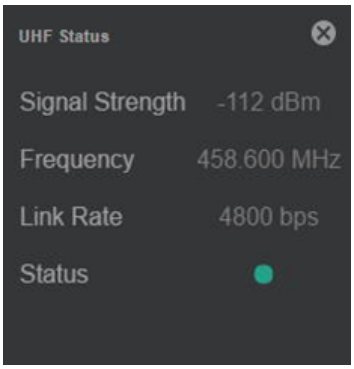
Signal Strength is displayed in dBuV

Station ID is unique for each IALA reference station, this ID can be used to determine which IALA station is being received. Where no station is available the Station ID will display 1024.

WER (Word Error Rate) is ideally 0% which means there is no errors within the decoded data.

A healthy **SNR** (Signal to Noise Ratio) will be indicated with a green indicator, amber indicates a marginal signal and red indicates an unhealthy SNR.

UHF Status (LD900 Only)



UHF Status

Signal Strength is displayed in **dBm**

Frequency in MHz of the selected UHF channel

Link Rate is 4800 BPS.

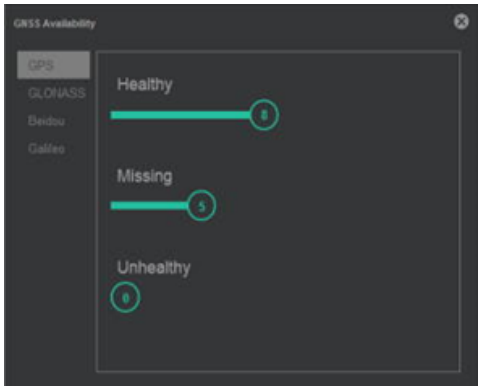
Status is shown as a Green, Amber or Red Icon, Green indicates a healthy status, Amber is marginal and Red indicates an unhealthy status.

6.3 GNSS Status View - Descriptions

6.3.1 GNSS Availability

Provides information regarding GNSS satellite status:

- **Healthy** How many useable satellites are tracked
- **Missing** Number of satellites not tracked
- **Unhealthy** Number of satellites which are not available for use

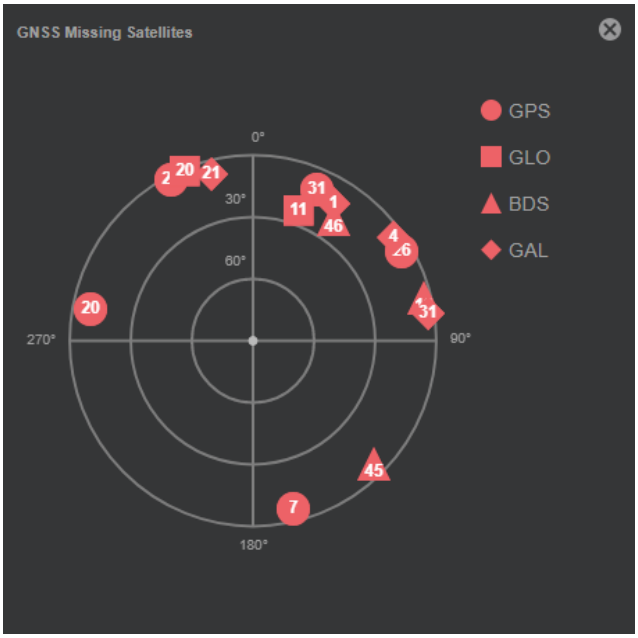


GNSS Availability view

6.3.2 GNSS Missing Satellites

Plots the location of any satellites which should be available at the user's location but are not currently being tracked.

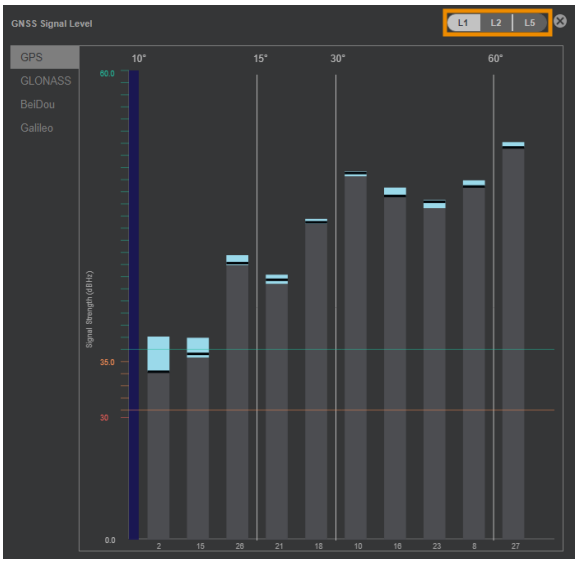
Failure to track available satellites could be due to various reasons, such as masking (blockage) or poor cable or antenna installation. If there are a significant number of missing satellites highlighted in this display, steps should be taken to investigate the cause.



GNSS Missing Satellites view

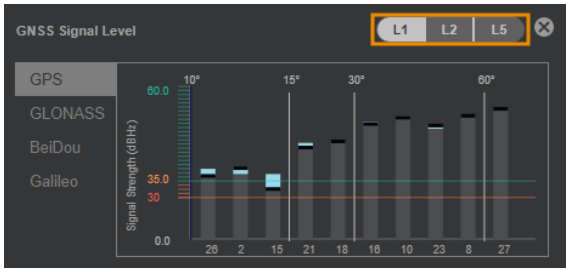
6.3.3 GNSS Signal Level

Shows the signal strength, measured in dB Hz for each GNSS satellite in view. There is a toggle switch in the top right of the window, allowing for different signals to be selected. The below example shows GPS satellite signal strengths, with a toggle option to display L1, L2 or L5 signals.



GNSS Signal Levels view on 4X4 tile

The image below shows the GNSS Signal Level 2x1 tile with a toggle switch toggle switch in the top right of the window, allowing for different signals to be selected.



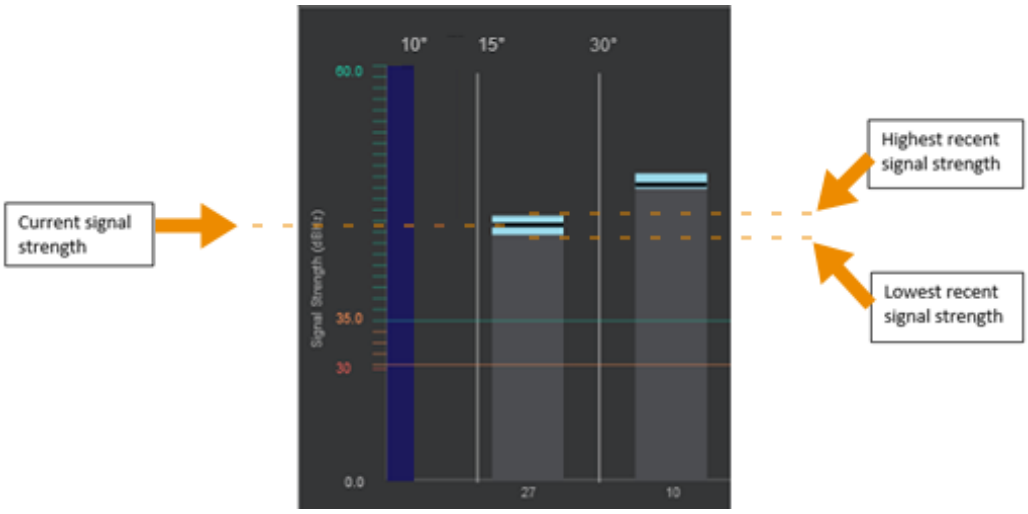
GNSS Signal Levels on 2x1 tile

GNSS satellites are sorted from left to right by elevation, from lowest to highest.

Veripos solutions have a default GNSS elevation mask of 10°, GNSS satellites that are tracked (but below 10° elevation) will be rejected from the solution. The blue area at the origin of the graph highlights the elevation from 0° to 10°. Satellites within this area will not be used in any solution.

The signal strengths shown are colour-coded to indicate if current signal strengths of tracked satellites are acceptable.

Fluctuations in a satellite signal strength will show as a light blue area at the top of the bar graph plot. Such fluctuations indicate that satellite signal tracking is unstable, which is typical for satellites tracked at low elevations; however, this is also a symptom of multi-path or interference.

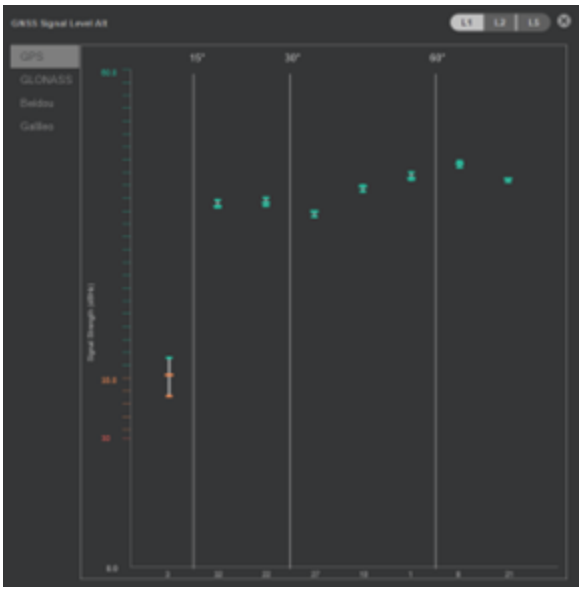


GNSS signal level variation

The configurable colour-coding thresholds are set to Veripos default values.

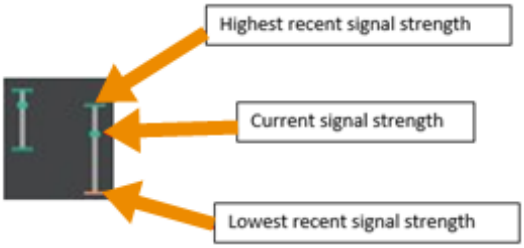
6.3.4 GNSS Signal Level Alt

Displays the same information as the GNSS Signal Level view but in a different graphical style:

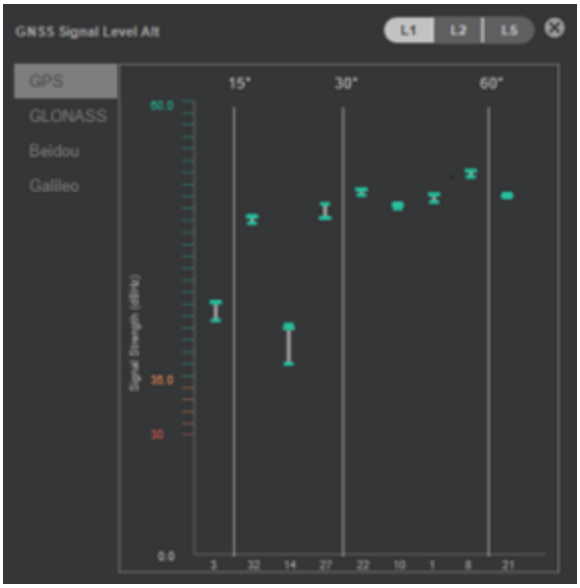


GNSS Signal Level Alt on 4x4 view

Recent fluctuation in a satellite signal strength are highlighted by a vertical white line:



GNSS signal level variation

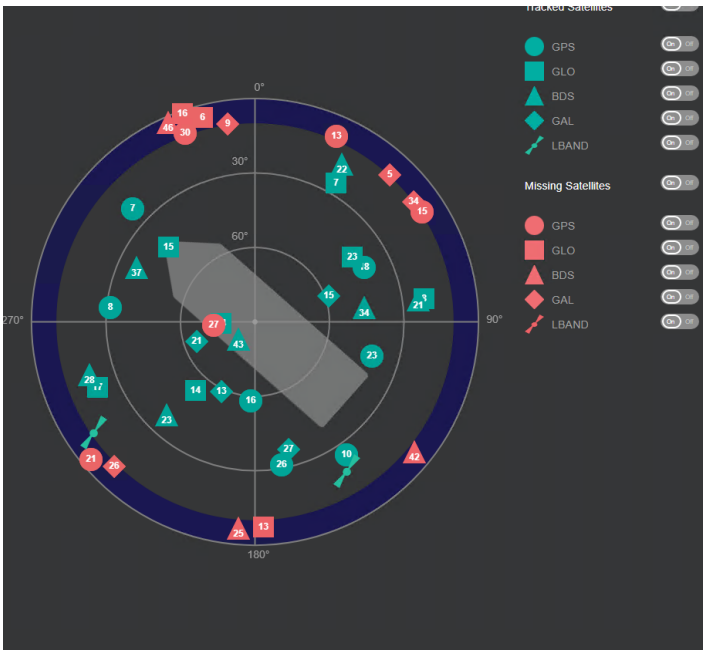


GNSS Signal Level Alt view on 2x2 view

6.3.5 Satellite Polar Plot

Besides the ability to display heading if available and enabled, the Satellite Polar Plot has the following functions:

Satellite (type)	Description
Tracked satellites	Displays all GNSS satellites currently tracked in green
Tracked satellites (not used)	Displays all GNSS satellites tracked but not used by active solution in grey
Missing satellites	Displays any GNSS satellites not available in red
Correction link satellites	Displays the calculated position of the L Band satellites visible at the vessel's current position



Satellite Polar Plot view on 4X4 view

This 4 x 4 view can be configured to show information for specific GNSS Satellite constellations. The 3 x 3 tile polar plot view cannot be customised:

Satellite Polar Plot view on 3X3 view with no toggles

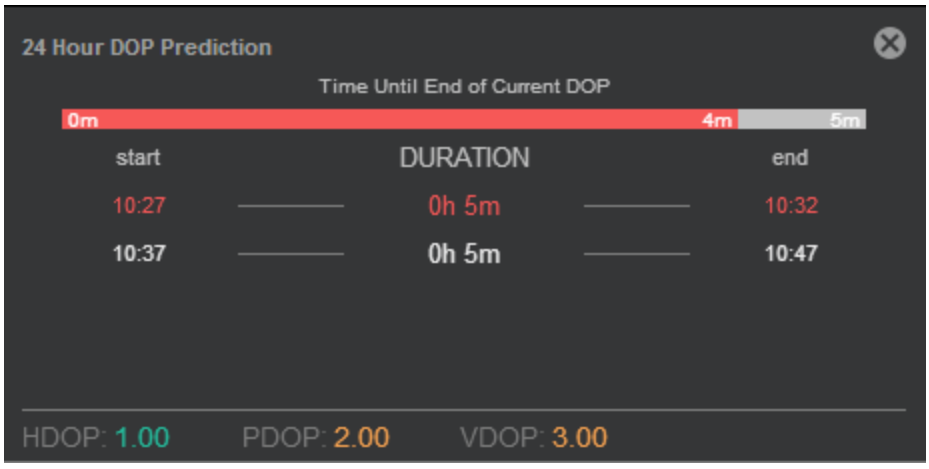
6.3.6 DOP

Displays the current solution DOP values (HDOP, PDOP and VDOP) of the current solution in green, amber and red when they are in good (<2), warning (2 - 4) and bad (>4) states.

DOP view

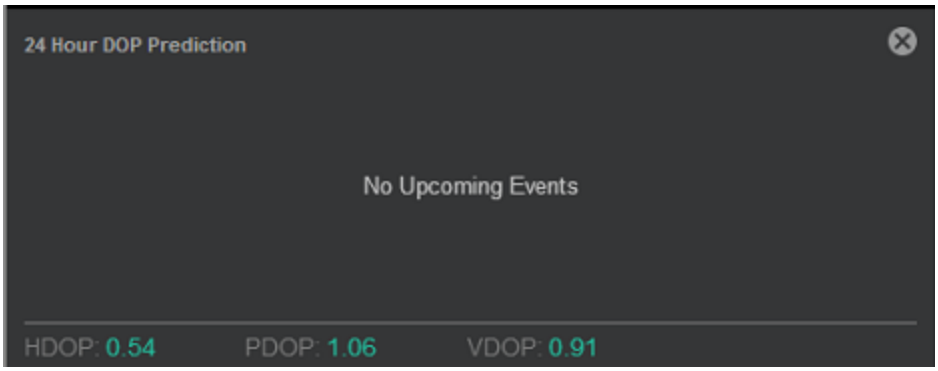
6.3.7 24 Hour DOP Prediction

Designed to alert the user to periods where the DOP values are predicted to be high. The ability to predict high DOP periods can assist the user to mitigate risks and to maintain additional vigilance. This view can be placed on either a 1x1 or 2x1 tile:



24 Hour DOP Prediction view

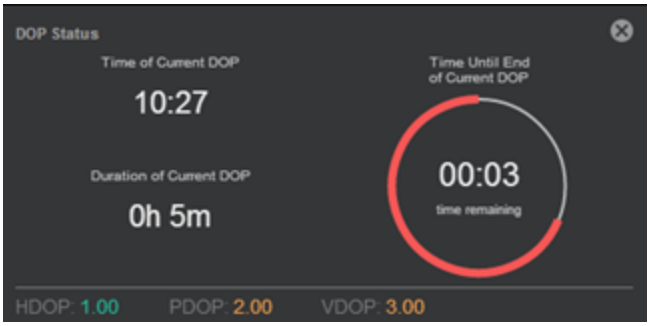
If no DOP issues are predicted, the main section of the view will be empty and only real-time DOP values (HDOP, PDOP and VDOP) will be displayed:



24 Hour DOP Prediction view – No events

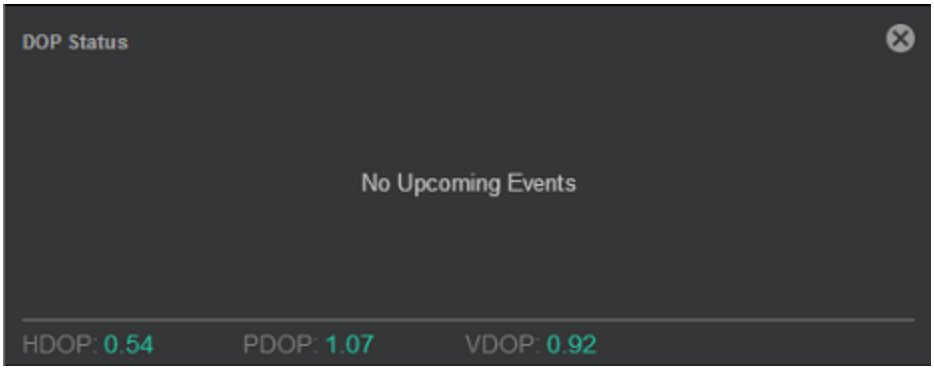
6.3.8 DOP Status

Displays details of current DOP events. 'DOP events' are periods when DOP values are unusually high, normally because of a low satellite count or poor satellite geometry:



DOP Status view

If there are no current DOP events, the main portion of the view will be empty and only real-time DOP values will be displayed. This view can be placed on either 1x1 or 2x1 tile:

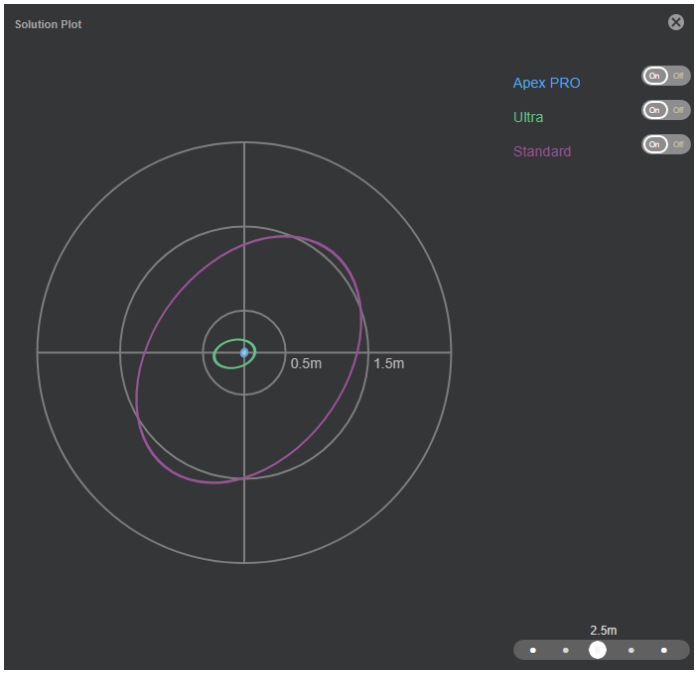


DOP Status view – No events

6.4 Solutions View - Descriptions

6.4.1 Solution Plot

Displays a polar plot with an error ellipse of the current and backup solution (if available):

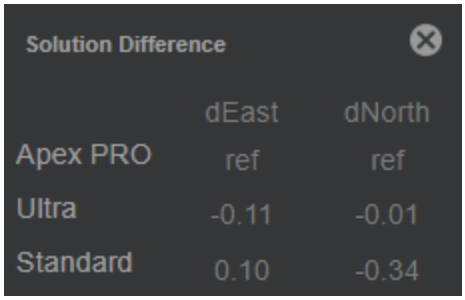


Solutions Plot

The scale of the polar plot can also be changed using the scale slider. Scales range from 50cm to 10m. The Solution Plot view centres on the active solution and the error ellipse for the backup solution is displayed relative to the active solution. Solution error ellipses can be selected using the solution slider.

6.4.2 Solution Difference

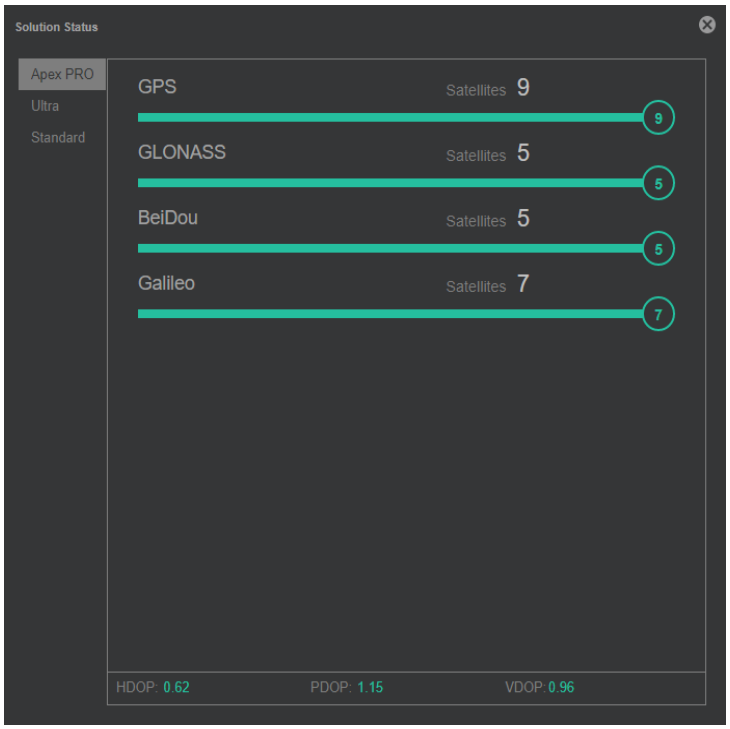
Displays delta values (dEast and dNorth) of the backup solutions relative to the primary solution. Large delta values indicate that the active or backup solution is not accurate and requires investigation.



Solution Difference

6.4.3 Solution Status

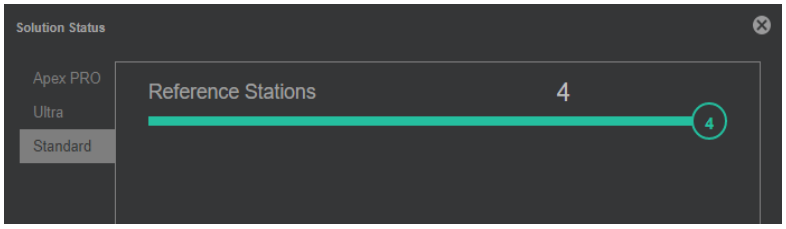
Displays the status of the active and backup solution:



Solution Status view - PPP

For PPP solutions, this view shows the number of GNSS satellites used (detailed by GNSS constellation). Green bars indicate how many satellites from each GNSS constellation are used. Amber values indicate satellites that are rejected or uncorrected and therefore not used in the solution. The current solution DOP values (HDOP, PDOP and VDOP) of the selected solution is displayed.

For Veripos Standard solutions, the number of reference stations used is displayed in green:



Solution Status view – Standard

6.4.4 UKOOA Statistics (Quantum Survey only)

Displays the following statistical information:

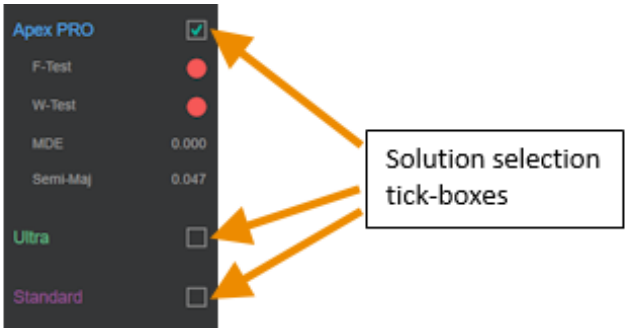
• F-Test status

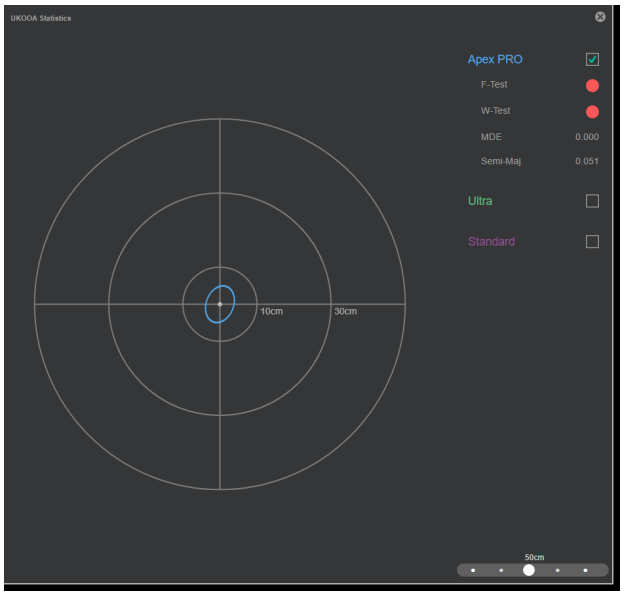
• W-Test status

• MDE value

• Semi-major value

Choose to display either the active or a backup solution information using the tick-boxes. The error ellipse for the selected solution will also be displayed, where the scale can be adjusted:



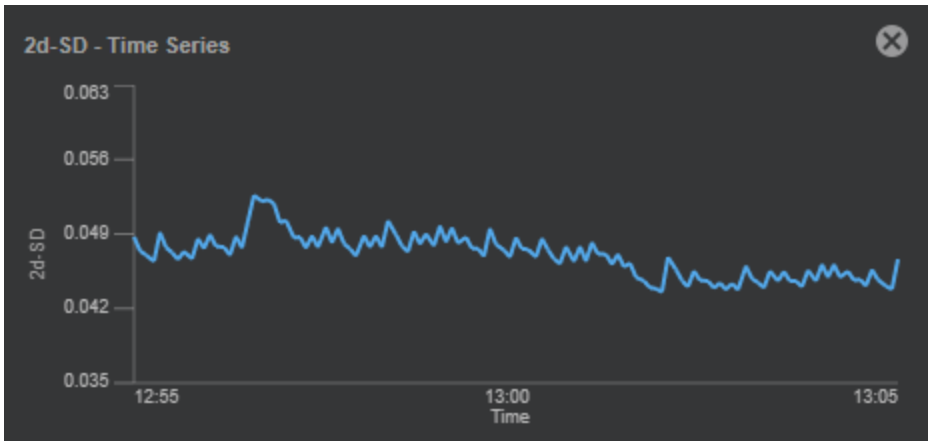


UKOOA Statistics view

NOTE
The UKOOA statistics view is only available when Quantum is enabled with a Survey license.

6.4.5 2d-SD Time Series

Displays a graph (which is auto-scaled) of the active solution 2d-SD (horizontal standard deviation) value for the last 10 minutes. The 2d-SD values shown are at 2σ (95%) confidence.

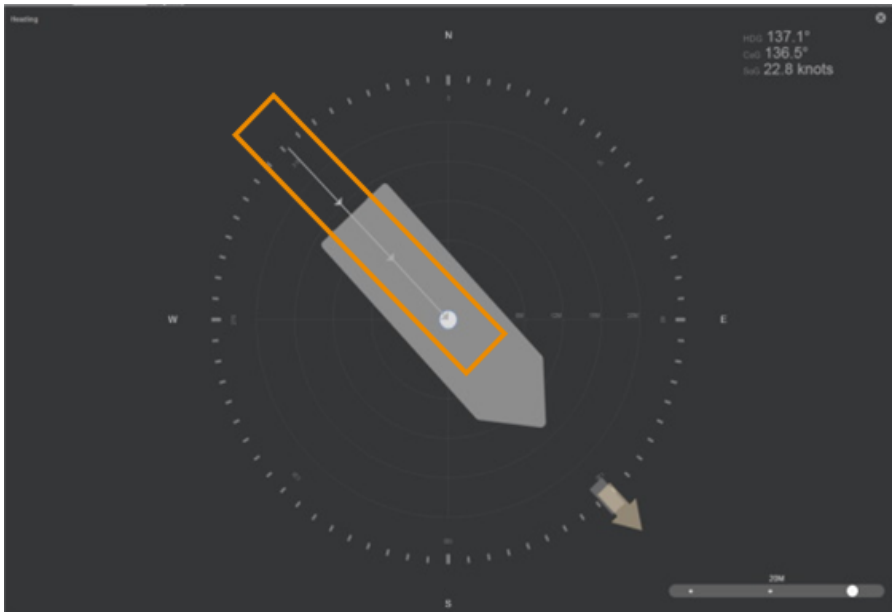


2d-SD – Time Series view

6.5 Heading and INS View - Descriptions

Heading views are unavailable unless the Quantum Heading feature is activated. Please refer to section Quantum - Software Licenses for further details.

6.5.1 Heading

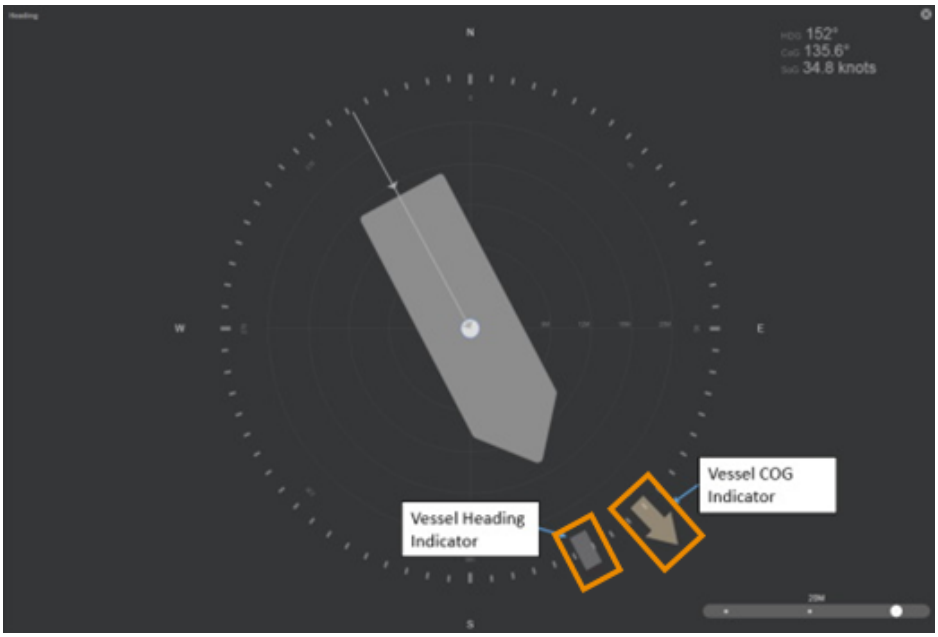


Heading view

This view graphically displays vessel heading, vessel trail and Course over Ground (CoG) with numerical values for heading, CoG and speed over ground (SoG) are also shown in the top right.

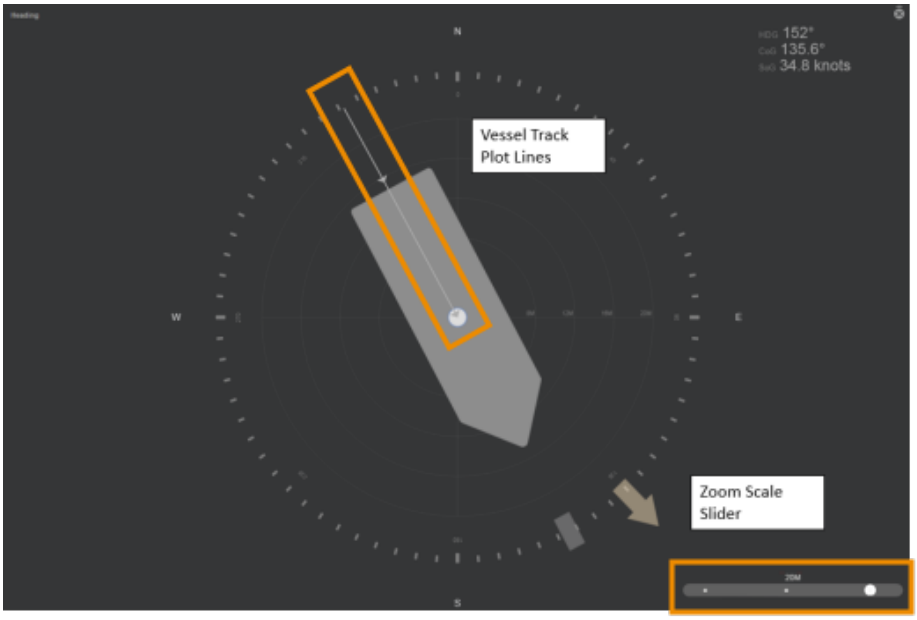
- **Heading (HDG)**refers to the direction in which a vessel's bow (front) points relative to the Earth's reference frame, measured in degrees clockwise from true north. HDG is crucial for navigational assistance, course-plotting, and determining the vessel's orientation in relation to its intended destination or other vessels in the vicinity.
- **Course Over Ground (CoG)**refers to the actual direction in which a vessel is moving relative to the Earth's surface, regardless of its heading, as influenced by factors such as the vessel's heading, current, wind, and other external forces.
- **Speed over Ground (SoG)**represents the actual speed, measured in knots, of vessel movement relative to the Earth's surface as determined by combining the vessel's speed through the water while influenced by the effect of external forces such as currents or tides.

The heading value is additionally indicated by a small rectangle (same colour as the vessel shape) on marked on the graticule. A brown arrow indicates the course:



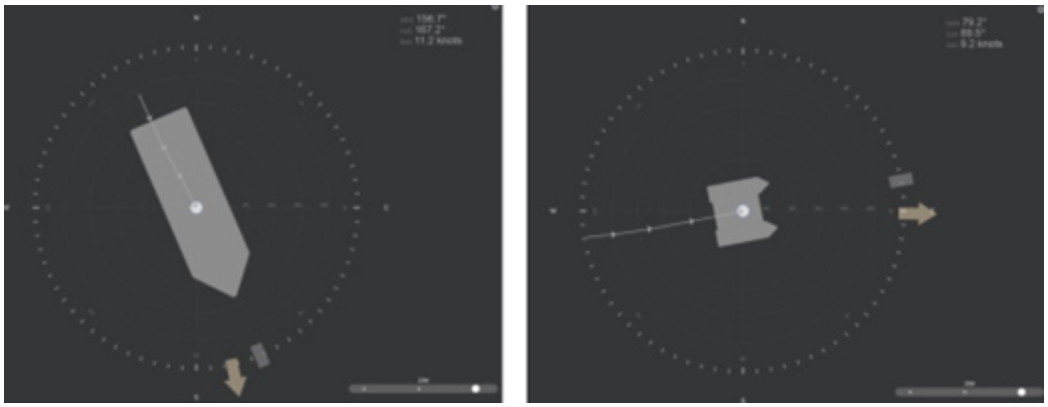
Heading and CoG indicators

This view also displays the vessel track plots (if enabled). The scale of the view may need to be adjusted to allow the vessel track plot to be visible:



Vessel track plot view

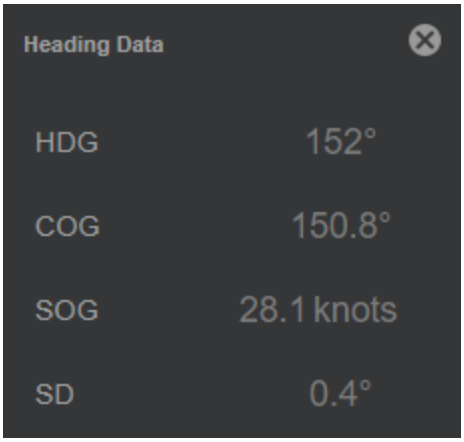
The vessel shape shown on the graphical views can be either a generic ship or generic rig as configured in the Settings - Display section:



Heading views – Ship shape (left), Rig shape (right)

6.5.2 Heading Data

Depicts the **HDG**, **CoG** and **SoG** numerical values as displayed in the Heading tab, with the addition of a Standard Deviation (**SD**) value representing the measure of the variability or dispersion of heading readings taken over a period of time. It quantifies the average amount of divergence or scatter from the mean heading, providing insights into the consistency and stability of the vessel's heading measurements. A lower standard deviation indicates more precise and consistent headings, with a higher standard deviation suggesting more significant variability or potential fluctuations in the vessel's heading observations.



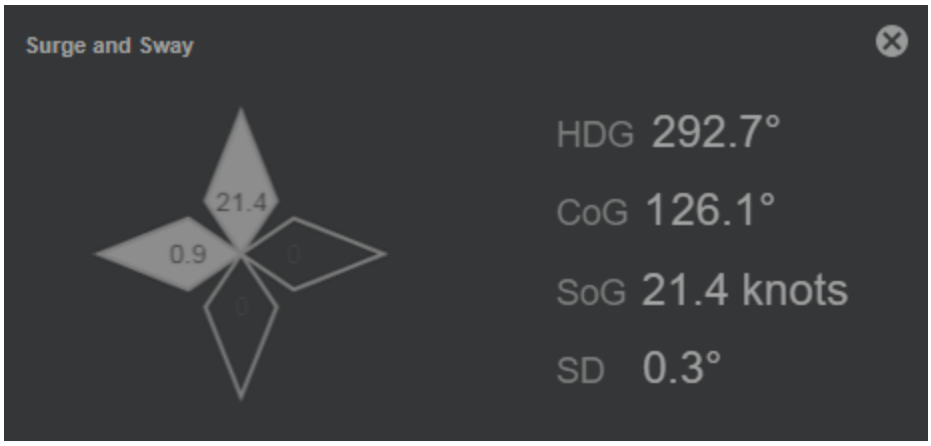
Heading view #2

6.5.3 Surge and Sway

Provides an indication of vessel Forward/Aft (Surge) and Port/Starboard (Sway) movement in terms of direction and speed.

Blue direction arrows indicate movement in that direction (in relation to vessel North). The direction arrows also show the speed (knots) in which the vessel is moving in each axis.

Overall vessel heading, CoG, SoG and vessel heading SD are also displayed:

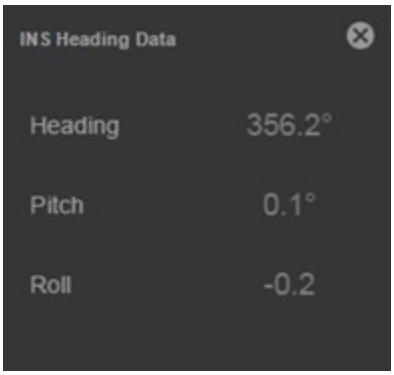


Surge and Sway view

NOTE
The layout of the Surge and Sway view will vary depending on the tile size it is placed in.

6.5.4 INS Heading Data

LD900 and LD900M models licensed for INS will be able to make use of the INS Heading Data view. Once INS has been interfaced and configured, this view will populate with Heading, Pitch and Roll values.



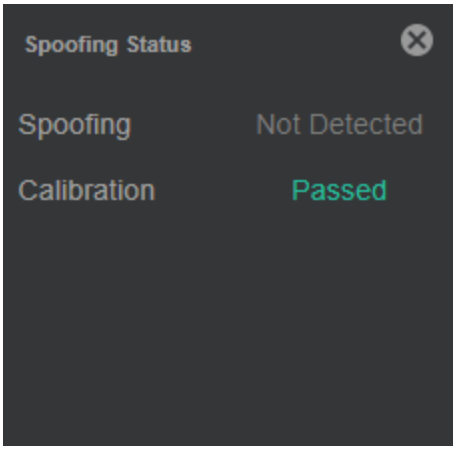
6.6 Interference and Spoofing View - Descriptions

Quantum has a licensed capability of enabling digital RF filters to protect (by approximately 30 dBs) the LD8 or LD900 positioning computation against RF interference. An active ITK license is required to configure and apply Interference Mitigation, without which the configuration options will not be visible. See the Quantum Software licenses section for more information.

NOTE
Without an active ITK license, users can still access RF spectrum monitoring and spoofing detection functions.

6.6.1 Spoofing Status

To display information relating to spoofing status, spoofing must first be activated and calibrated in **Settings > System Configuration > Receiver Management**. Will display 'Spoofing is not calibrated' until calibration/activation.



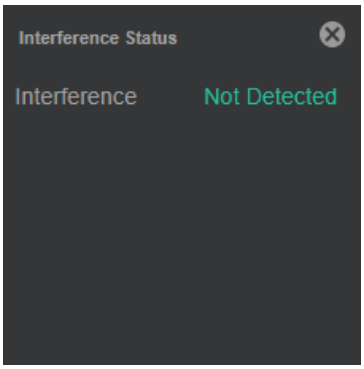
If not yet calibrated, the Spoofing state will remain 'Not Detected', switching to 'Detected' if spoofing occurs.

Calibration will remain 'Uncalibrated' until **Start Calibration** is initiated in Settings. Once Start Calibration is activated, Calibration will switch to 'Calibrating', changing to 'Passed' once complete. A Calibration status of 'Failed' will indicate that calibration has not been successful and that it must be re-attempted.

Upon successful spoofing detection calibration, the Last Calibration value will display the calibration completion time UTC date and time.

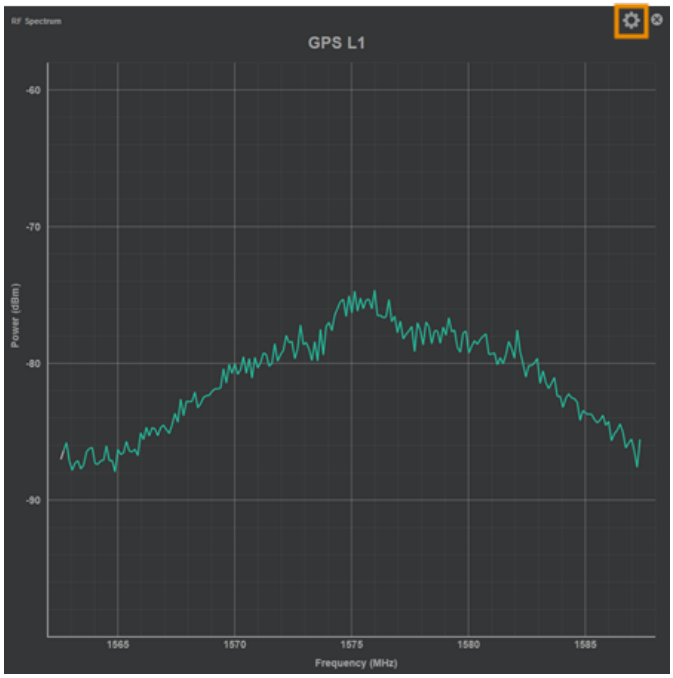
6.6.2 Interference Status

Shows high-level information regarding interference status. Will populate in instances of interference with information identifying impacted signal band/s, and the estimated centre frequency of the detected interference.



6.6.3 RF Spectrum

The **RF Spectrum** view monitors and identifies any potential interference source. The Spectrum view can determine an interfering signal's centre frequency, bandwidth, amplitude, and the GNSS signal bands potentially subject to impact (L1, L2, L5 L-band signal bands). The initial view shows the GPS L1 spectrum. The example below highlights a settings cog icon in the top right, which provides RF Spectrum and HDR Mode configuration options.



RF Spectrum view with Frequency (MHz) on X axis and Power dBm on Y axis.

6.6.3.1 RF Spectrum tab

Clicking on the RF Spectrum settings icon will open the Configure RF Spectrum window, allowing users to select particular frequencies (**L1**, **L2**, **L5** and **L-BAND**), which will change the RF Spectrum view accordingly, allowing for the monitoring of received signals used by different GNSS systems and their associated signal type.

To focus on a particular area of the radio spectrum, the user first selects **WIDE BAND** (pre-selected), **PASS BAND** or **FILTER BAND** (the filter band is only visible when an ITK license is enabled).

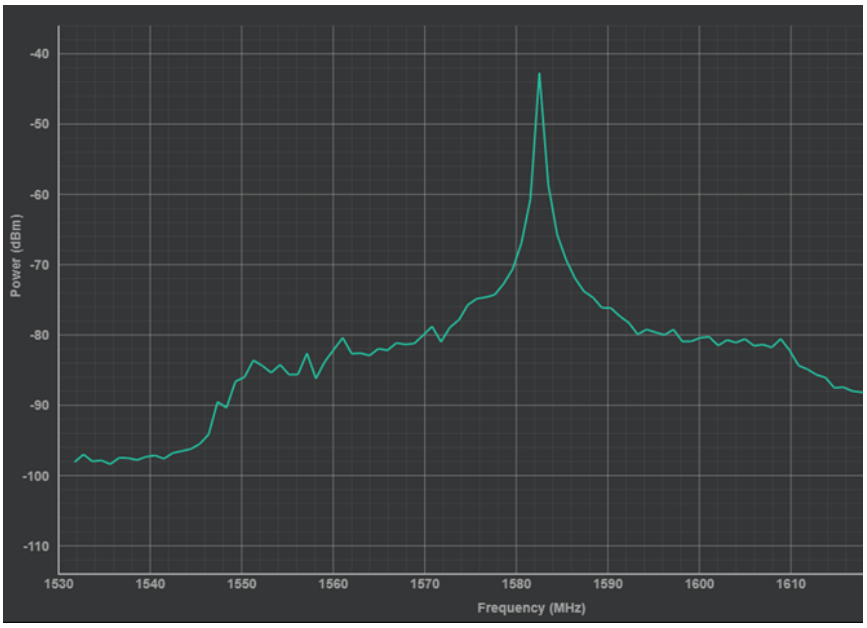
Clicking upon **PASS BAND** presents an option to toggle between specific frequency signals such as, in the case of the L1 frequency, '**GPSL1**', '**GLONASSL1**', '**BEIDOUB1I**', '**BEIDOUB1C**' and '**GALILEOE1**'.

As detailed in the next section, a filter must be defined and active to select the **FILTER BAND** view.

6.6.3.2 Filters tab

With an active ITK software license option, Quantum can configure and apply digital RF filters (a maximum of two filters) within the interfaced LD8 or LD900 receiver. These software filters can provide up to 30 dBs of protection from unwanted RF signals.

To illustrate the use of filters, consider an example scenario of an interfering signal at carrier 1582.5 MHz with a 100 KHz bandwidth. Initially, the user can observe interference within the RF Spectrum Pass Band - GPS L1 view. The spectrum view allows the user to estimate the centre frequency of the interfering carrier and to estimate the interference power:

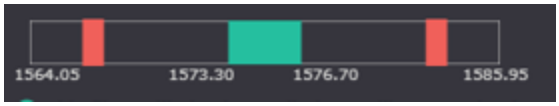


Interference identified within the RF Spectrum Pass Band - GPS L1 view

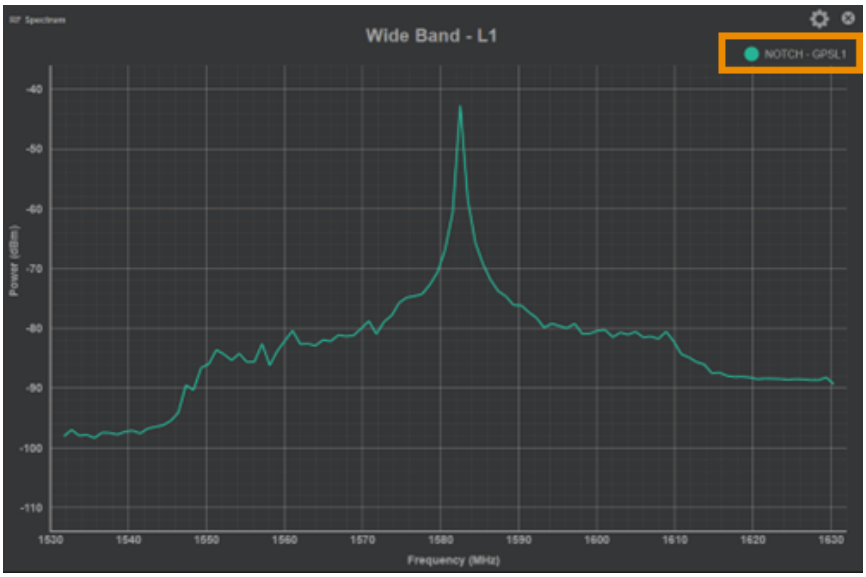
The spectrum view lets the user estimate the interfering carrier's centre frequency and interference power. A logical first step would be to enable HDR Mode for the L1 signal band:

The user selects the filters tab and adds a notch filter at 1582.5 MHz with a 1Mhz bandwidth. Shown below are the filter configuration options, with the chosen values highlighted. Parameters are set and applied:

The red and green graphic at the bottom of the filter configuration window illustrates the frequency of the notch filter (red) and the mirrored filter, which is a byproduct. The green section denotes the part of the spectrum reserved for the signal; in this example, GPS L1 centred on 1575.42 MHz:

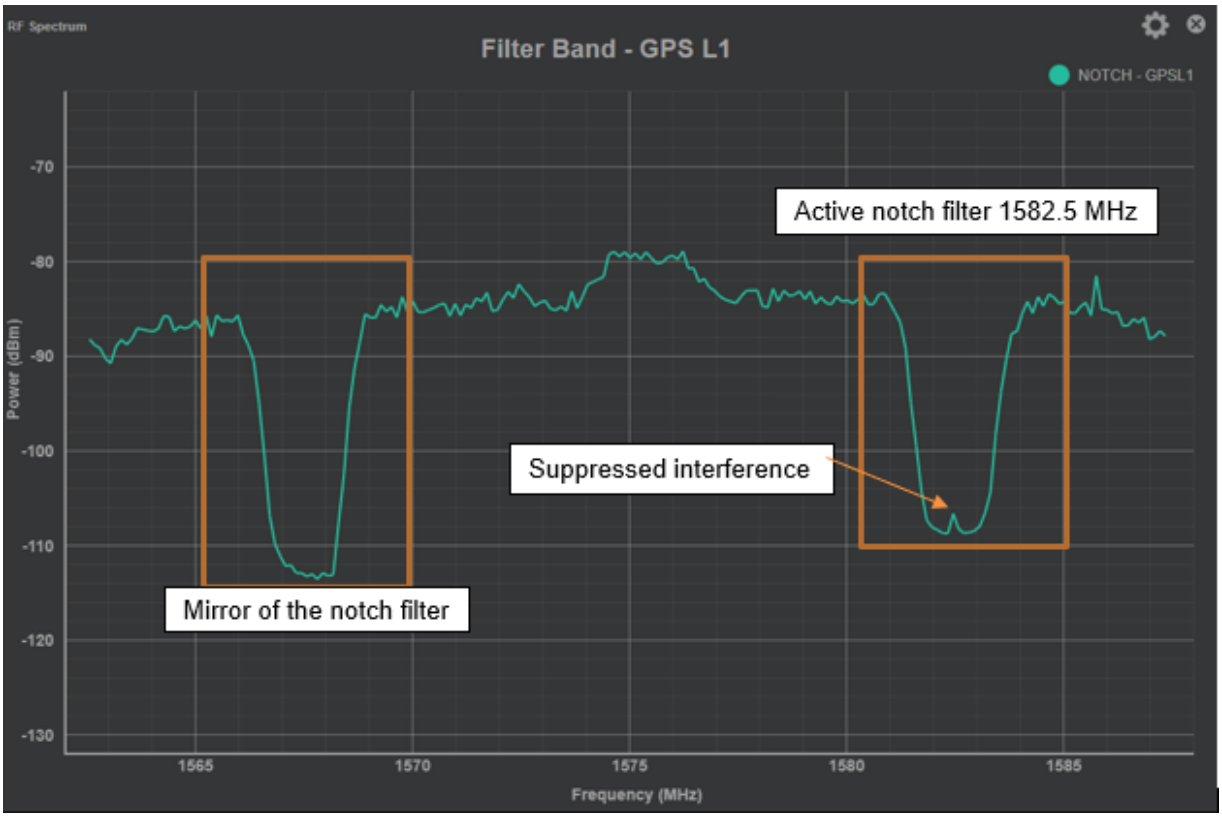


The spectrum view now displays an active GPS L1 Notch filter:

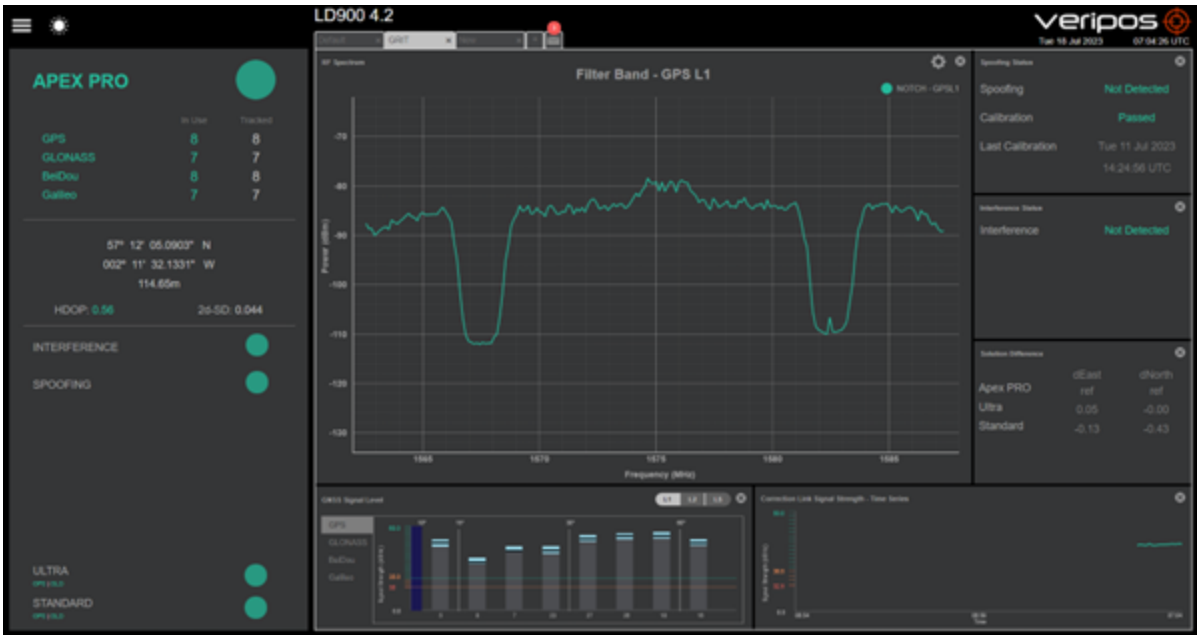


Selecting the filter band view allows observation of the effectiveness of the GPS L1 filter. This view is only available once a filter is active:

The GPS L1 filter view:



The notch filter is visible, with a second notch filter created as an automatic byproduct of the software filtering. The interference peak is still visible but suppressed. With the GPS L1 notch filter active, we can note the GPS L1 SNR values return to normal and stable signal strengths.



6.6.3.3 HDR Mode tab

Selecting the HDR Mode tab provides the ability to enable HDR (High Dynamic Range) Mode on **L1**, **L2**, **L5**, **Primary L-band** and **Secondary L-band** frequency bands. HDR mode assists with signal tracking when signal strength is low or interference is present. If any signal tracking issues occur (interference, low or no signal tracking), enabling HDR Mode will help restore signal tracking.

6.7 Tides View – Descriptions

Tides views are not available unless the Quantum Tides feature is activated with the Quantum Software license. Please refer to section Quantum - Software Licenses for further details.

6.7.1 Tides - GNSS

The **Tides-GNSS** view displays following information:

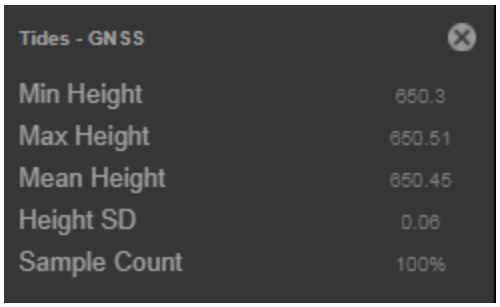
• **Min Height** - Smallest position height in the last interval

• **Max Height** - Largest position height in the last interval

• **Mean Height** - Mean of the position heights within the last interval

• **Height SD** - SD of the sample heights in the last interval

• **Sample Count** - Percentage of available samples for the current interval



Tides GNSS view

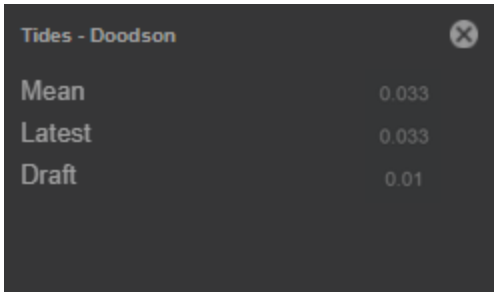
6.7.2 Tides - Doodson

The **Tides - Doodson** view displays following information:

• Mean - Mean MSS tide is the mean of all tides above MSS estimated by the Doodson filter.

• Latest - Latest MSS tide is the tide above MSS estimated by the Doodson filter.

• Draft - Calculated as the current Doodson value minus the Doodson value for the first record.



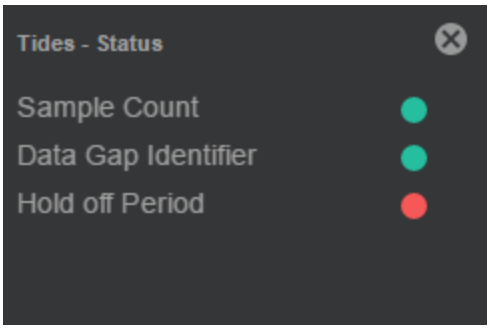
Tides Doodson view

NOTE
There is a 39 hour (hold-off) initialisation period for Quantum to calculate and display Tides Doodson values.

6.7.3 Tides – Status

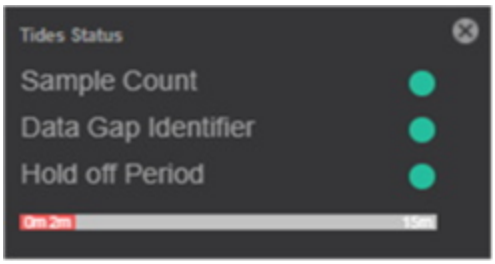
The **Tides - Status** view displays following information:

Information	Details
Sample Count	Displayed if sufficient samples during the last interval were used. Green=True (at least 50%) Red=False
Data Gap Identifier	Displayed if a data gap is detected (data gaps are not desired) Green icon=True (attention required) Red icon=False (this is desired status)
Hold off Period	Status showing if the hold-off period is active. Green=True Red=False



Tides - Status view

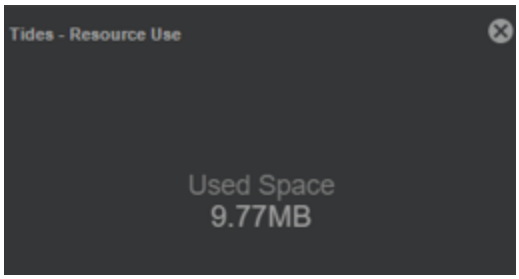
If the Hold-off Period is active (green), then a Hold off countdown bar is displayed. The bar shows the remaining time until the end of the hold-off period is reached:



Tides Status view – Hold off period active

6.7.4 Resource Use

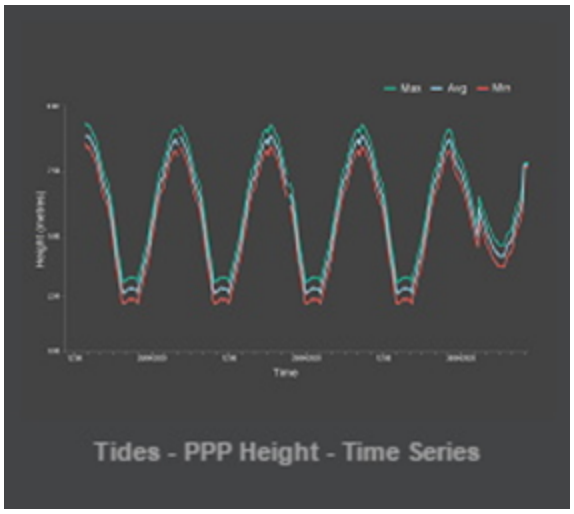
Displays the disk space used within the tides folder:



Tides - Resource Use

6.7.5 Tides – PPP Height – Time Series

Displays the maximum (green) average (blue) and minimum (red) PPP height values (metres) over time (past 72 hours).

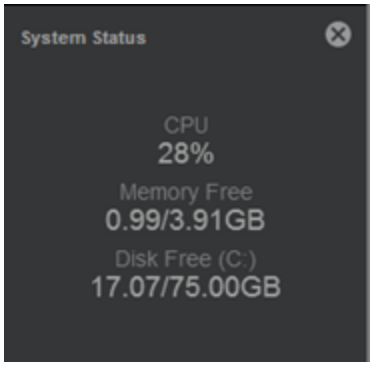


Tides - PPP Height - Times Series

6.8 System Status View

6.8.1 System Status

Displays the status of the hardware platform on which Quantum is operational:



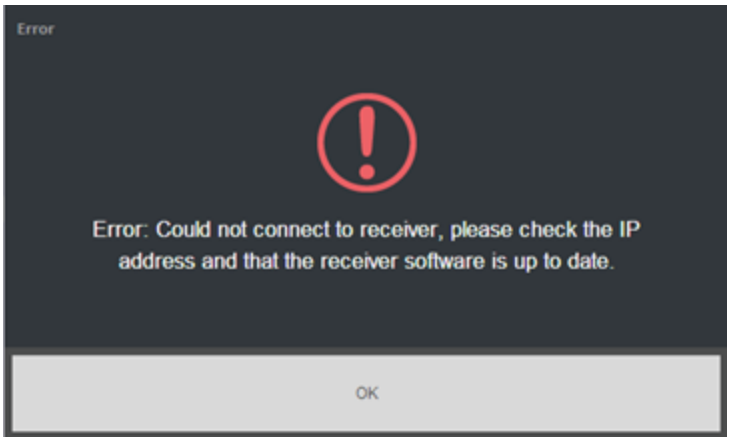
System Status

7 Troubleshooting

Use this section to assist with any problems encountered when using Quantum. Significant errors will trigger system notifications. These notifications will provide advice on how to troubleshoot the issue.

Example problem 1

Upon configuring Quantum on a PC to connect to a Veripos receiver, the following message appears:

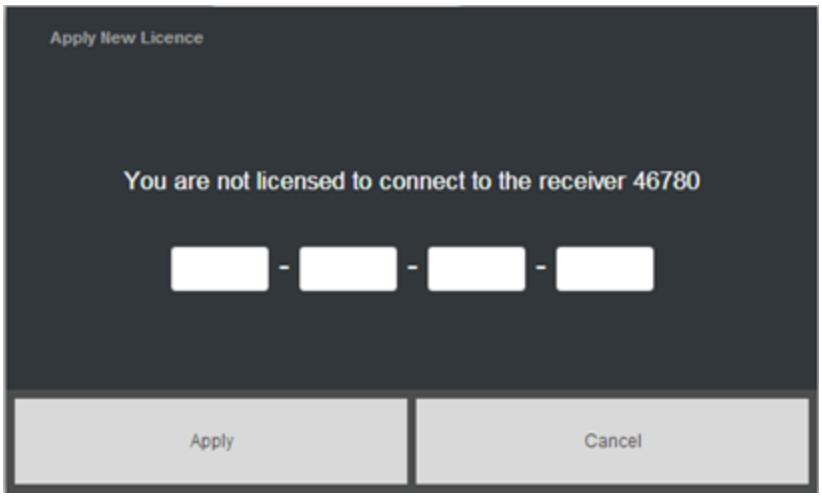


Solution

Check the receiver IP address and ensure that the IP address entered in Quantum is correct. Also ensure the correct receiver type is selected during configuration. Check that the Ethernet cable is properly connected between the Veripos receiver and the Quantum PC.

Example problem 2

When using Quantum, with a software license obtained for existing PC and then attempting to launch Quantum on another PC using the same license, the following message will be displayed:

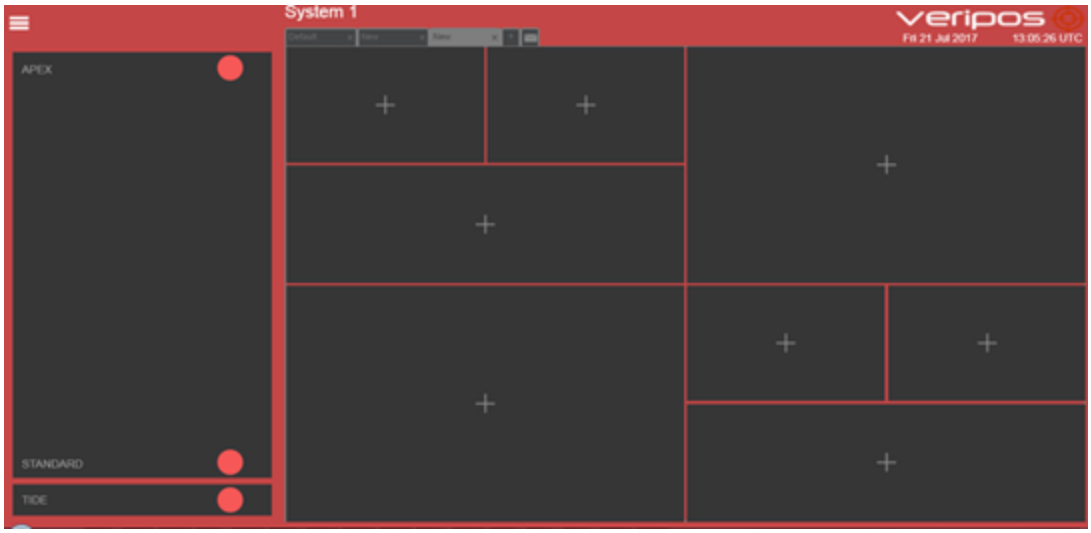


Solution

The license code used on the previous PC is still valid, this license must be entered on the new Quantum PC. Go to the **Authorisations** menu on the previous Quantum PC, copy the Quantum software license and then enter the same license on the new PC. If it is not possible to recover the code from the old PC, contact the Veripos Helpdesk who will be able to provide the license code.

Example problem 3

Quantum is flashing red and none of the display tiles are populated:



Solution

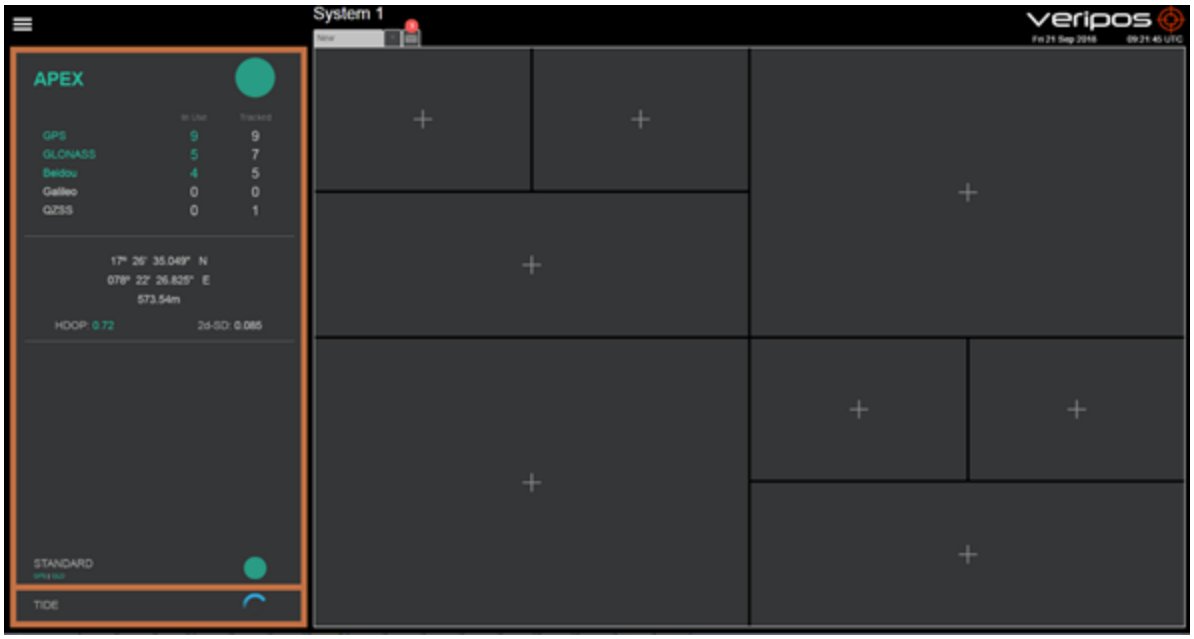
Check the **Notifications** Tab. Notifications in the **Status** section should provide an insight into why the Quantum system is alarming.

If the Veripos receiver in-use is working normally, check the Ethernet connection to the Quantum PC.

Check the status of the Veriposreceiver in-use. If the receiver also shows a loss of position or corrections, check antenna(s) and cabling.

Example problem 4

Sidebar has an amber border:



Solution

An amber sidebar indicates a non-critical issue with either the active or backup solution.

If, as shown in the example above, there is a blue spinner displayed next to one of the solutions, this indicates that the solution is currently converging. No action is required; the solution will settle after around 30 minutes.

Other situations can cause an amber sidebar, such as the backup solution being uncorrected, active solution having timed-out and system reverting to the backup solution.

Example problem 5

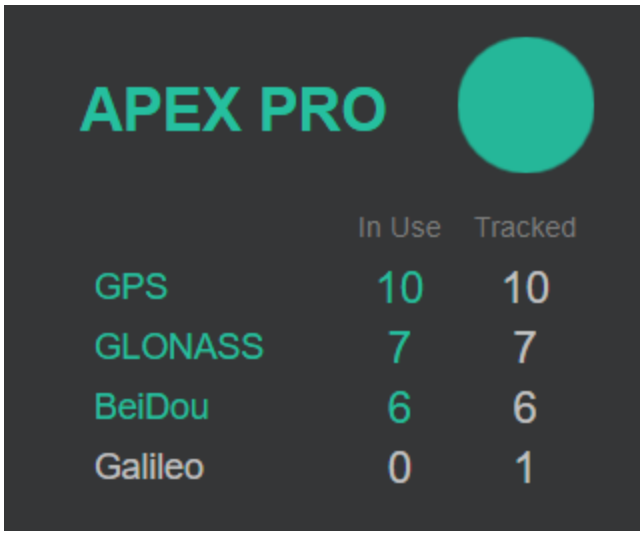
A heading input is configured in Quantum, but no heading views can be selected

Solution

To display heading information, the Quantum license must include the heading feature. Check the Authorisations page to confirm if there is an active heading license. Contact the Veripos Helpdesk to activate if required.

Example problem 6

A Veripos receiver is subscribed to the Apex5 service, but the Quantum display suggests that not all available constellations are being used:



Solution

Not all constellations are available at all locations. The Apex5 solution utilises a number of GNSS constellations. The solution actively adds or remove constellations as they become available or unavailable.

8 Reference information

8.1 Tides Formats

8.1.1 Tideinfo file format

Tideinfo file format description

The TideInfo.txt file contains current system height and tide information at the Averaging Period as configured by the user. This file contains comma delimited strings with variable length fields. Null fields indicate that no information is currently available; they should not be interpreted as 'zero'. A checksum is included for extra robustness. Negative tide is low tide and positive tide is high tide respectively.

Tideinfo sentence structure & example

$UltraTide,20070228,21:40:00,28,600,600,5236.2830,N,00143.5184,E,5.74,0.08,0.07,5.66,5.82,5.45,0.29,0.02,5.72,44.84,0.00,0.27,EGM96*2B

Tideinfo sentence defined

Content	Format	Unit	Notes
0	TalkerID	[-]	$UltraTide or $ApexTide (dependent on active PPP calculation)
1	yyyymmdd	[-]	Identifies year, month and day for which all information in the string is valid.
2	Time (UTC or GPS)	hh:mm:ss (UTC) or sssssssss (GPS)	Identifies time in UTC or GPS for which all information in the string is valid.
3	Sequence Number	numerical	Sequential number incrementing by 1 for each averaging period. Maximum is 99999999 after which an automatic reset back to 1 takes place.
4	Averaging Period	numerical	User selected period over which Veripos Apex or Ultra heights are averaged in seconds. Minimum is 60, maximum is 3600.
5	Sample Count	numerical	Number of Veripos Apex or Ultra height samples that were included to derive the antenna height average. Minimum is 50% of 'Averaging Period'. The sample count will increase every epoch if set to 1hz
6	Latitude	ddmm.mmmm (degrees, minutes and decimal minutes)	Location where height and tide information is valid.

Content	Format	Unit	Notes
7	Latitude Hemisphere	c	N or S
8	Longitude	dddmm.mmmm (degrees, minutes and decimal minutes)	Location where height and tide information is valid.
9	Longitude Hemisphere	c	E or W
10	Mean Height	hh.hh (metres)	Mean of the Veripos Apex or Ultra heights during the 'Averaging Period'
11	Mean of Height SD	hh.hh (metres)	Mean of the Height SD's associated with the Veripos Apex or Ultra heights during the 'Averaging Period'. This is an indication of the quality of the Veripos Apex or Ultra heights
12	SD of Heights	hh.hh (metres)	Standard deviation of the Veripos Apex or Ultra heights during the 'Averaging Period'. This is an indication if the variation of the height due to vessel motion and position quality.
13	Minimum of Heights	hh.hh (metres)	Minimum of theVeripos Apex or Ultra heights during the 'Averaging Period'
14	Maximum of Heights	hh.hh (metres)	Maximum of theVeripos Apex or Ultra heights during the 'Averaging Period'
15	Doodson	hh.hh (metres)	Estimated antenna height above Mean Sea Surface from the Doodson filter. First available after 39 hours.
16	MSS Tide	hh.hh (metres)	Local tide based on the Mean Sea Surface derived from the Doodson filter. First available after 39 hours.
17	Geoid Tide	hh.hh (metres)	Local tide relative to user selected Geoid (see field 22). Available instantaneously after 'hold-off' time
18	Antenna Height	hh.hh (metres)	User entered height of the antenna above the waterline.
19	Geoid Separation	hh.hh (metres)	Local offset between the user selected Geoid and the WGS84 reference ellipsoid.
20	Draft	hh.hh (metres)	The draft. Calculated as the current Doodson value minus the Doodson value for the first record.
21	Vertical Bias	hh.hh (metres)	The vertical bias detected between MSS Tide and Geoid Tide. Calculated as Antenna Height minus Doodson plus Draft.
22	Geoid Model	-	EGM96 or EGM08

8.1.2 Sprint_Tides file format

Sprint_Tides file format description

The SPRINT_Tides.txt file contains the current UltraTide with the opposite sign compared to the MSS Tide contained in the TideInfo.txt and Doodson.txt files. This file contains comma delimited strings with variable length fields. Null fields indicate that no information is currently available; they should not be interpreted as 'zero'. A checksum is included for extra robustness. Negative tide is high tide and positive tide is low tide respectively.

Sprint_Tides sentence structure & example

12,20,22,09,2006,-0.88

Sprint_Tides sentence defined

Content	Format	Unit	Notes
0	Hours	HH	Hours in the day (UTC). Time for which all information in the string is valid.
1	Minutes	MM	Minutes in the day (UTC). Time for which all information in the string is valid.
2	Day	DD	Day in the month.
3	Month	MM	Month in the year.
4	Year	YYYY	Year.
5	UltraTide	hh.hh (metres)	Local UltraTide based on the Mean Sea Surface derived from the Doodson filter. First available after 39 hours. Set as 99999.99 when no UltraTide value is available.
	*	c	Fixed end delimiter (real time output only)
		cc	Checksum (real time output only)

9 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.

9.1 Veripos Support details

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

10 Appendix

10.1 Veripos PPP station ID's

Service	Station ID	NMEA station ID
Ultra	68	0068
Ultra2	68 + 75	0268
Apex	81	0081
Apex2	81 + 82	0281
Apex5	81 + 82 + 91 + 92 + 62	0581*

*When Apex5 solution uses less than 5 GNSS constellations, the NMEA station ID will change according to the number of constellations in-use e.g. 0381 if 3 constellations are in-use.

10.2 Veripos reference stations

The latest Veripos station listing can be found on the Veripos support website.

10.3 MF / IALA beacons

A listing of IALA MF stations is available from https://www.iala-aism.org.

10.4 L-band coverage map