LD7 Installation

Manual

VERIPOS

Contents

1.   INTRODUCTION

1.1 GENERAL

This document provides the information required to install an LD7.

When consulting this document it will help the installer to have available the following items to assist in assessing and planning the work:

- VERIPOS LD7 and associated equipment shipped to site

- 'Equipment Packing list' (included with the equipment packing sent to site)

- LD7 Operations manual

- VERIPOS document "Antenna and Coaxial Cable Installation" provided with VERIPOS installation documentation

- Interactive training modules and VERIPOS product literature on CD ROM.

VERIPOS can provide these installation instructions in a language that is acceptable in the country in which the equipment is to be installed.

1.2 LD7 INTEGRATED MOBILE

The VERIPOS LD7 is easy to install and operate. It provides multi-frequency GNSS capability together with GNSS Heading, VERIPOS high accuracy positioning and wireless communications within a ruggedized IP67 housing for the broadest range of applications.

For maximum flexibility, the design includes Heading, wireless links and the highest levels of VERIPOS positioning accuracy. The LD7 has an additional processor for on-board configuration and applications running separately from the GNSS engine. The rear panel has an extensive suite of interfaces for data output, timing, event marks, and a second antenna port for the GNSS Heading application.

The LD7 can be upgraded as required to generate VERIPOS proprietary position solution depending on the data subscriptions enabled.

LD7 variants may also be used as a sensor to output received data and GNSS measurements to external processing or quality control software such as the VERIPOS Verify QC.

1.3 SCOPE

The purpose of this manual is to provide the necessary information to perform the installation of the VERIPOS LD7 Integrated mobile unit.

It covers installation of:

- Antennas

- Coaxial and data cables

- LD7 receiver and power requirement

- Housings and ancillary equipment provided with the LD7.

1.3.1 Contents

This manual provides guidance for engineers to install a VERIPOS LD7 receiver on to a vessel.

Details are provided to assist in locating and connecting equipment ready to be commissioned. The manual covers installation of LD7 receiver and associated antennas.

Read this manual in conjunction with the specific 'Scope of Supply' or Equipment Packing List' for your particular installation.

Chapter Contents

1. **Introduction**: This chapter specifies the purpose and target group for the manual. It also contains a list of used abbreviations and a specification of the document conventions.

2. **System description**: This chapter describes the interface in detail on the front and back side of the LD7 unit as well as LD7 technical data.

3. **Installation**: This chapter covers the installation of the LD7 unit as well as cabling guidelines.

4. **Reference information**: This chapter comprise additional information such as Safety check list, cable specifications, parts list and a description of LD7.

5. **Contact information**: This chapter contains contact information details about the VERIPOS Helpdesk and VERIPOS offices world-wide.

1.4 TERMS AND ABBREVIATIONS

Apex	VERIPOS High accuracy positioning systems
BER	Bit Error Rate
CoG	Course over Ground
CR	Carriage Return
DGPS	Differential GPS
DOP	Dilution of Precision
DP	Dynamic Positioning
EGNOS	European Geostationary Navigation Overlay System
GDOP	Geometry Dilution of Precision
GLONASS	GLObal NAvigation Satellite System – Russian
equivalent to GPS	
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
HDOP	Horizontal Dilution of Precision
IMU	Integrated Mobile Unit
KPH	Kilometres per Hour
LAN	Local Area Network
LF	Line Feed
LNA	Low Noise Amplifier
L-Band	Methods of transmitting Correction data to mobile
users	
LCD	Liquid Crystal Display
LD7	Unit containing GPS card, demodulator and PC
processor	
LVTTL	Low Voltage Transistor Transistor Logic
MF	Medium Frequency Radio used to Transmit
Correction Data	
MMI	Man-Machine Interface
MPH	Miles per Hour
m/s	Metres per Second
MSAS	Multi-functional Satellite Augmentation System
NMEA	National Marine Electronics Association
PDOP	Positional Dilution of Precision
PPP	Precise Point Positioning
PPS	Pulse per Second
PRN	Pseudo Random Noise
RMS	Root Mean Square
RTCM	Radio Technical Commission for Maritime Services
SBAS	Satellite Based Augmentation System
SD	Standard Deviation

SDRAM	Synchronous Dynamic Random Access Memory
SNF	Signal Notification Form
SNR	Signal to Noise
Spotbeam	High Power L-Band Signal
Standard	VERIPOS Single frequency DGPS system
SV	Space Vehicle
Ultra	VERIPOS High accuracy positioning systems
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
VGA	Video Graphic Array
VOSS	VERIPOS Online Support System
WAAS	Wide Area Augmentation System
WEEE	Waste Electrical and Electronic Equipment

1.5 LD7 SAFETY SUMMARY

This section summarizes safety guidelines when installing the LD7 unit.

1.5.1 Unpacking and inspection

Carefully unpack the unit and retain packaging to return the equipment where required.

Inspect the unit. If the equipment appears damaged return it using the original packaging. Responsibility for damage is not accepted if the approved packaging is not used.

Ensure all items and ancillary equipment is present. Contact your supplier or VERIPOS where this is not the case (see contacts in the Contact information chapter).

1.5.2 Safety symbols

Please see Section 1.6 *Document conventions* later in this manual.

1.5.3 Safety warnings

Always observe the following safety precautions:

- Disconnect power from power supply to isolate the equipment before working on it.
- Ensure adequate air circulation to ventilate the unit especially to the sides to avoid heat build - up.
- Connect only to a power supply with a voltage corresponding to that marked on the unit.
- *Always* disconnect the LD7 and associated equipment from the power supply when connecting equipment.
- Avoid excessive heat, humidity, dust and vibration.
- Always use the power connections supplied with the unit. See the *Reference information* chapter for details.

1.5.4 Installation

Ensure the DC power supply is disconnected during installation. The power connection is easily accessed on the rear of the unit.

Ensure that the unit is secured using the holes in the base plate. Position the unit to ensure there is ample spacing for ventilation of the unit and access to front and rear during normal operation.

Ensure all cables are routed safely to avoid sharp edges, bends and pinches.

Ensure only the specified cables are used for interconnection of the equipment.

1.5.5 Maintenance

Clean the unit using a clean dry cloth only. Do not wet the unit or allow moisture to penetrate the unit. Do not use solvents to clean the unit.

1.5.6 Servicing

This unit contains no user-serviceable parts. Please refer all repairs to a qualified service agent or to VERIPOS.

See the *Contact Information* chapter for details on contacting VERIPOS.

1.5.7 Fault diagnosis

Follow the guidance in this document to correctly install the LD7. Where the LD7 does not perform as indicated please first check all connections before contacting your supplier or VERIPOS for assistance (contact details in the *Contact information* chapter).

1.6 DOCUMENT CONVENTIONS

1.6.1 Typographical conventions

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

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

"Text within quotes" is used when display screens are mentioned in text.

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

1.6.2 Special Notices
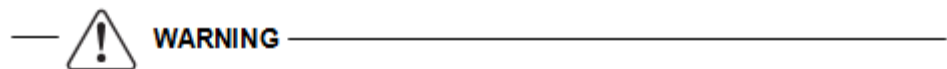
— ⚠ WARNING ——————————————

A warning indicates the risk of bodily harm or serious damage to the hardware.
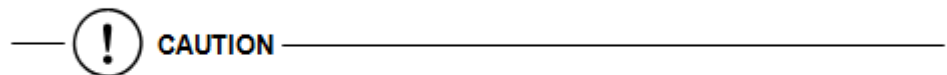
— ⓘ CAUTION ——————————————

A caution indicates the risk of damaging the hardware.
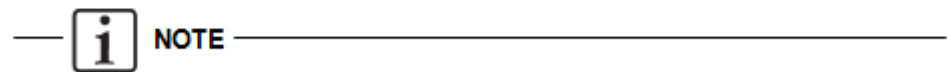
— ⓘ NOTE ——————————————

A note shows important information that helps you make better use of the system.

1.7 REFERENCES

Please read this manual and refer to the following information where required:

VERIPOS document "Antenna & Coaxial Cable Installation".

LD7 Operations manual and Quick Guide.

Information is available at VERIPOS Online support system (VOSS): **https://help.veripos.com**

1.8 WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

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

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

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

The separate collection and recycling of your WEEE at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about recycling centres, please contact the local city office, the household waste disposal service or the product supplier.
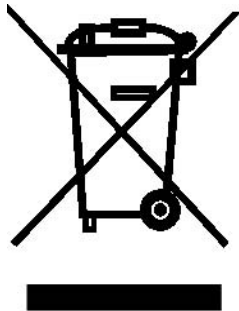
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2. LD7 SYSTEM DESCRIPTION

This section gives an outline description of the VERIPOS LD7 receiver and components used with the LD7 supplied.

The section covers overall information and details as follows:

- Equipment technical data

- Mechanical dimensions

- Electrical specification

- Processor

- GNSS Receiver

- L-Band Receiver

- Data interfaces including serial ports

- Antennas

2.1 LD7 RECEIVER

The VERIPOS LD7 is a small, lightweight and economical unit which may be configured as an Integrated Mobile Unit, complete with internal dual L1/L2 GPS and GLONASS receiver.

The unit incorporates front panel LED indicators for status monitoring. Configuration is performed using an external PC running the recommmended Web interface browser (Google Chrome).

For maximum flexibility, the design includes dual frequency Heading capability and all tiers of VERIPOS positioning accuaracy.

It can receive VERIPOS L-Band transmissions from Geostationary satellites and output RTCM correction data which may be used by external equipment. The LD7's internal dual-frequency GNSS receiver can be used with Verify QC software to provide the full range of VERIPOS GNSS augmentation services.

The unit can compute DGNSS position solutions using single or multiple reference stations. When subscribed to VERIPOS PPP corrections the unit is capable of computing position solutions with 10cm accuracy. Positions are output in NMEA format for use by the user's systems.

At the same time the GNSS engine can be used to compute a baseline between the 2 antennas installed and generate a heading value output in NMEA format.

The VERIPOS LD7 Receiver

LD7 comprises:

- L-Band receiver
- GNSS Heading receiver
- Interfaces for data output

2.1.1   Installation

Installation work for the LD7 varies for:

- the types of antenna(s) to be installed

- connections for input of data to or output of positioning data from the LD7.

Installation is described in detail in chapter *3 Installation*. An example is shown below to illustrate arrangement of a typical installation of antennas and position output from the LD7

2.1.2   LD7 installation – Schematic example
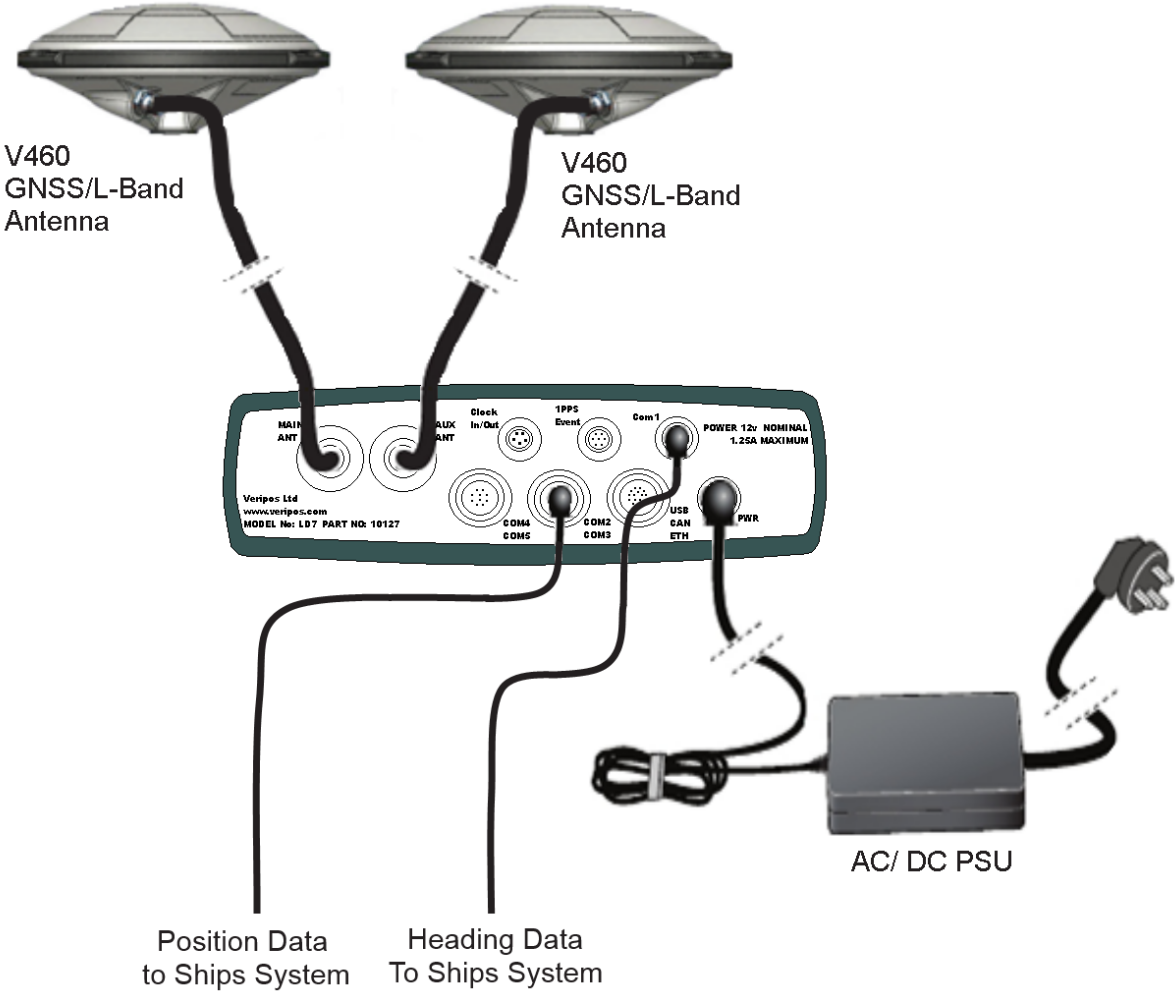
Example of an Installation Drawing for an LD7

2.2 TECHNICAL SPECIFICATIONS

This equipment is for indoor use only and meets performance specification within an ambient temperature range of -15 °C to +55 °C and a maximum relative humidity of 95%.

Equipment complies with EN60945:2002 [5] for "protected" equipment.

Cable specifications: Please refer to the *Reference information* chapter for details.

The LD7 is sealed to the IP67 specification.

LD7 Overview

2.2.1   Mechanical

Dimensions

Height	54 mm
Width	157 mm
Depth	164 mm
Weight	1.5 kg

2.2.2   Environmental

Enclosure material	Aluminium
Operating temperature range	-30 ℃ to +65 ℃
Storage temperature range	-40 ℃ to +75 ℃

2.2.3   Safety considerations

Though the test conditions for the LD7 unit provide for a max. operating temperature of +65 °C, continuous operation of all electronic components should if possible take place at ambient temperatures of only +25 °C. This is a prerequisite for long life and low service costs.

2.2.4   Electrical

DC power input	12–24 VDC
Power consumption -	<12 W
IEC60945	certified

2.2.5   Certification

Conforms to IP67, RoHS, CE, FCC Class B Part 15, IEC 60945.

2.2.6   Connectors and I/O ports

The controls etc. are detailed in this chapter

LD7 Front Panel

	Description
1	Power Button
2	Bluetooth Antenna Connector
3	Bluetooth LED
4	HDG (Heading) LED
5	PVT (Accuracy) LED
6	SYNC (Beam) LED
7	SS (Signal Strength) LED
8	ENB (Enabled)LED

—[i] NOTE ————————————————

There is no Bluetooth functionality currently available on the LD7.

2.2.7 Rear panel
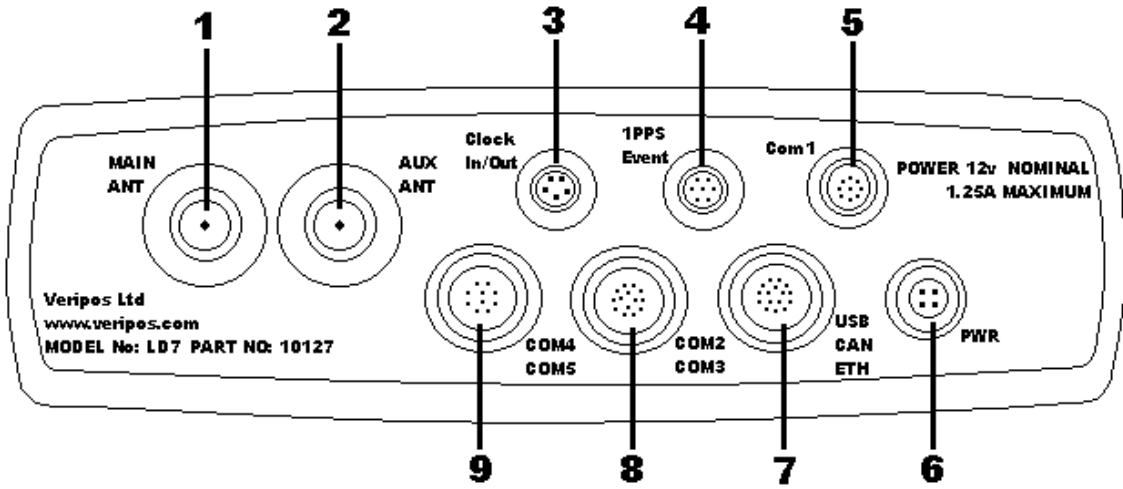
LD7 Rear Panel

	Description	Connector Type
1	Main Antenna Connector	TNC
2	Aux Antenna Connector	TNC
3	Clock In/ Out Connector*	Lemo 5-Pin
4	'1PPS' / Event Output BNC connector*	Lemo 7-Pin
5	COM1 Serial Connector*	Lemo 9-Pin
6	Power Connector*	Lemo 4-Pin
7	USB / Ethernet connector*	Lemo 16-Pin
8	COM2 / COM3 Serial Connector*	Lemo 14-Pin
9	COM4 / COM5 Serial Connector*	Lemo 10-Pin

* Interface cables are supplied to convert connectors to DB9 for interfacing to vessel systems.

2.2.8 Serial ports

Serial ports:	5 bidirectional
Format:	RS232
Interface type:	DB9

See the Installation chapter for details of data streams.

—☐ⅈ NOTE ——————————————————

Not all data streams are compatible with all baud rates.

2.2.9 Ethernet Interfaces

An Ethernet RJ45 LAN port is fitted on the rear panel.

The **LD7** has a default fixed IP address: **192.168.0.126**

The **GNSS card** has a default fixed IP address: **192.168.0.127**

The **L-Band card** has a default fixed IP address: **192.168.0.128**

The Ethernet port can be connected for communication to a PC or Ethernet router. This is internally connected to an Ethernet hub to communicate with the internal processor or the GNSS receiver.

—☐ⅈ NOTE ——————————————————

The **LD7** IP address is used only to access the Web Interface page. Data outputs via Ethernet can be obtained using the **GNSS** and **L-Band** card IP addresses.

2.2.10 USB Ports

The USB is most commonly used to check the LD7 IP address if the event that it is not known or have been forgotten. Steps for checking the LD7 IP address are detailed in *the LD7 Operations Manual*.

2.2.11 Power Supply

LD7 requires a 9 - 30V DC supply and is supplied with an external 110/240V AC power unit.

2.2.12 Summary Specification of Antennas

2.2.12.1 V460

L-Band/GPS/Glonass:	1525-1610 MHz
GPS L2/Glonass L2:	1160-1252 MHz
Fitted with a Narrow band filter for interference rejection	
LNA Gain:	45db
DC Voltage input:	3.0 to 15.0V
RF Input Connector:	TNC Socket
Material:	Weather Proof Polymer Plastic
Mount:	5/8" Tripod Tread Connector
Temperature Range:	-55 to +85°C
Certification:	IEC 60945
Diameter:	7.5" / 19.05cm
Height:	3.17" / 8.05cm
Weight:	1.6lbs / 0.73kg

2.2.12.2 V460 Phase Centre Offsets

The diagram below shows the antenna reference point (ARP) from which the phase centre values are measured. It also shows the V460 vertical (Up) phase centre values for the GNSS L1 and L2 frequencies:

V460 Phase Centre Values above ARP
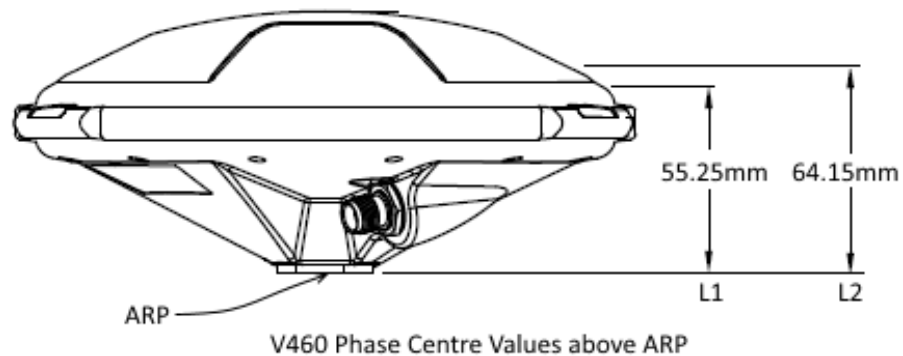
The below diagram shows the ARP at the antenna base and the antenna North alignment reference:
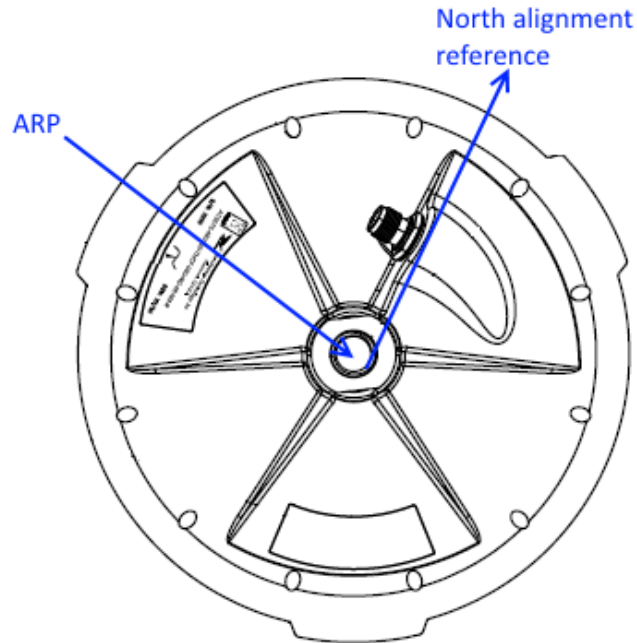
V460 ARP & North Alignment Reference

The table below details the North, East and Up phase centre values for the GNSS L1 and L2 frequencies:

GNSS Frequency	Relative to Antenna Reference Point (ARP)		
	North (mm)	**East (mm)**	**Up (mm)**
L1	2.78	-1.27	55.25
L2	0.82	-1.09	64.15

2.2.13   Antenna cables – Specifications

Typically VERIPOS provide with the system pre-terminated cables and tails for use with both L-band and GNSS/GPS antennas (see the 'Equipment Packing List').

VERIPOS recommend use of Times Microwave coaxial LMR cable for installation of all antennas. See the Reference information chapter for details.

2.2.14   GNSS Receiver

The GNSS receiver for the LD7 receives GPS broadcast information.

2.2.14.1   GNSS Module AsteRx2eH

Product features:

Channels	272
GPS	L1/L2/L2C
GLONASS	L1/L2
SBAS	WAAS, EGNOS, MSAS
<u>Accuracy</u>	
GNSS Heading	0.03 deg @ 10m separation
	0.1 deg @ 3m separation
	0.3 deg @ 1m separation
DGPS	Refer to VERIPOS Spec sheets
PPP	Refer to VERIPOS Spec sheets
Static	5 mm + 0.5 ppm Vertical
	5 mm + 0.5 ppm Vertical
Measurement Rate	100 Hz
Latency	<20 msec
Average Time to Fixed RTK	<7 sec
Cold Start	<45 sec
Warm Start	<20 sec
Re-acquisition	<1.2 sec
Input / Output	1PPS
	2 x Event Marks Ref In/Out
	RTCM2.x, RTCM3.x,
	CMR, CMR+
	NMEA 0183 V2.30 (*5 Hz max)

--- **i** NOTE ──────────────────

*The default data output rate on an LD7 is 1Hz. Contact VERIPOS for guidance if 5Hz outputs are required.

3.   INSTALLATION

This section provides guidance on the installation of the LD7 receiver.

Contact your supplier or VERIPOS with questions or for advice when installing this equipment.

3.1 LD7 SITING GUIDELINES

When choosing a location for the LD7 and variants the following requirements are **mandatory**:

1.   Ensure adequate ventilation for free air flow to the unit. This is important when working in hot or humid regions.

2.   Locate unit in areas free from excessive dust or smoke.

3.   Avoid locations that experience excessive vibration.

4.   Avoid exposure to high temperatures.

5.   Shield the unit from direct sunlight.

6.   Mount the unit securely to prevent movement.

7.   Ensure there is easy access to front panel.

8.   Ensure adequate access to the rear panel. Avoid mounting in a recess and have sufficient slack to be left in cables (power, interfacing and coaxial) for LD7 unit to be removed without disconnection.

9.   All bends in coaxial cables to be maintained above minimum bend radius.

10. Use short tails of flexible coaxial cable (e.g. LMR 240) with appropriate converter connections to connect antenna coaxial cables to the LD7. Support the antenna coaxial cable weight to avoid stress being placed on the rear coaxial connectors.

3.1.1   Mounting

The LD7 is supplied with mounting brackets. These can be fitted to the top or bottom of the receiver. This allows the receiver to be fixed to the top or underside of a shelf.

3.1.2   Ventilation Requirements

The LD7 needs 15–25 mm minimum clearance all round, to allow a flow of air.
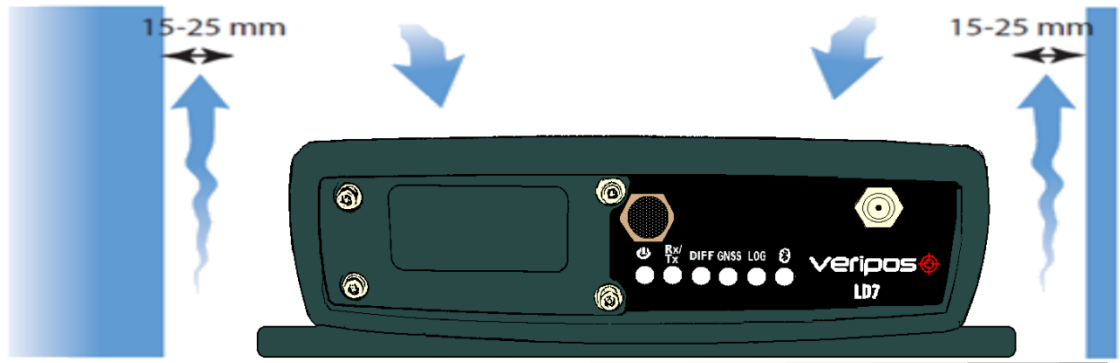
LD7 Ventilation

3.2 ANTENNA INSTALLATION

This section provides general guidance on installation of antennas and cabling when installing the LD7 receiver.

It is very important to the on-going performance of your system that a high quality installation is performed. This will ensure optimum performance and reliability.

— **i NOTE** —

After equipment installation it is recommended that a calibration survey is carried out to compute any heading C-O and GNSS offsets for the *Main* GNSS antenna. Antenna offsets and C-O values should be entered within the navigation or DP software.

3.2.1   GNSS / L-Band Antenna

The GNSS / L-Band antenna receives transmissions from GPS, GLONASS and L-Band communication satellites (used for VERIPOS Correction Signals).

This section describes best practice when positioning and installing your GNSS / L-Band antennas.

For more details please refer to VERIPOS document "*Antenna & Coaxial Cable Installation Guide*" provided as part of the installation documentation.

3.2.1.1   General

The GNSS/ L-Band antenna is used for vessel positioning and therefore its mounting location is of high importance to the system.

It should be mounted with a clear view of the sky in both the horizontal and vertical directions.

If the antenna does not have a full view of the sky there will be times when signals will be blocked, resulting in degraded performance of the system.

Good Installation – Antenna at Top of Mast with Good Spacing

During installation observe the following guidelines:

- Offsets to the GPS antennas must be measured by a competent person to ensure no errors are introduced to the DP, Survey or Navigation systems.

- Care must be taken to ensure that antennas are not installed in the direct path of Radar transmissions, Inmarsat-B Dome transmissions, VSAT transmissions or high power HF whip/wire antenna.

Good Installation – Antenna at Top of Mast with Good Spacing

If antennas cannot be installed directly at the top of the mast/ships structure, it is essential that the mounting point is sufficiently strong for this purpose. Arrangements must be able to withstand vibration and wind.

Alternatively a pole can be used with a 5/8"x11 UNC threaded end (standard marine mount). The pole can be attached by welding or using "U" clamps as above. This method allows the GNSS/GPS antenna to be mounted without the need for the bracket. Ensure that grease is applied to the threads when installing the antenna.

Fit the antenna to the bracket and clamp the bracket to the mounting pole or the mast using "U"-bolts. When mounting the antenna on an extension pole fit the antenna to the pole first for ease of handling at height.

Antenna with extension pole

If the threaded pole is already installed up the mast, use a small length of coaxial cable attached to the N-type connector as a safety lanyard for the antenna.

Carefully connect the coaxial cable following manufacturers' guidelines.

Form cable below the antenna into a small loop, approximately 150–220 mm (6 to 8in) in diameter. Attach the loop to the mounting pole under the antenna to provide strain relief from the cable.

For more detailed guidance please refer to the VERIPOS document "Antenna and Coaxial Cable Installation Guide".

3.2.2 Antenna Placement for GNSS Heading

Careful consideration of the placement of the Main and Auxiliary antennas is required to maximise the LD7's GNSS headlining accuracy.

3.2.2.1 Antenna Separation

The GNSS heading solution accuracy is largely determined by the distance (or baseline) between the Main and Auxiliary antennas. The larger the baseline, the better the heading precision will be.

The table below details the expected GNSS heading precision in relation to the baseline:

Baseline	GNSS Heading Precision
1m	0.3°
3m	0.1°
10m	0.03°

VERIPOS recommend a minimum baseline of 2m.

3.2.2.2 Antenna Orientation & Height

The LD7 GNSS heading is computed from the **Main to the Auxiliary** antenna as illustrated below:

GNSS Heading Solution Direction
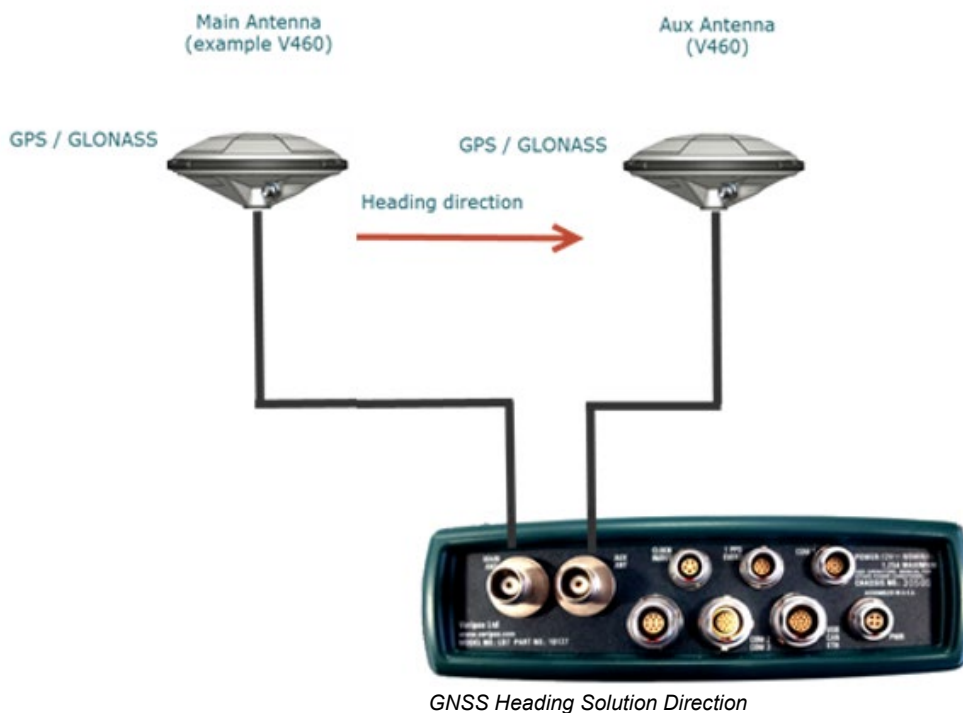
Assuming the antennas are mounted along the vessel Fwd/Aft centreline, with the *Aux* being the furthest forward antenna, the GNSS heading would correctly reflect the vessel's heading. In the below example, no heading correction would need to be applied in the navigation system software:
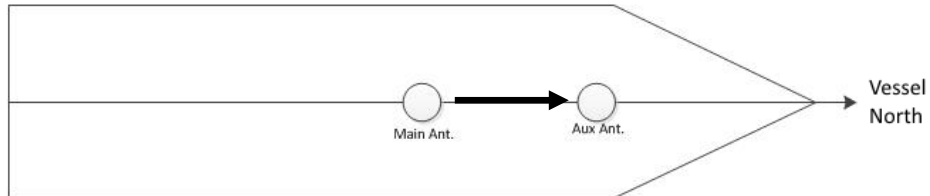
In the next example, the *Main and Auxiliary* antennas are installed perpendicular to vessel North with the *Main* antenna at the Starboard side and the *Auxiliary* antenna at the Port side. A correction (C-O) of +90° would be required in the navigation system software to align the GNSS heading to vessel North.
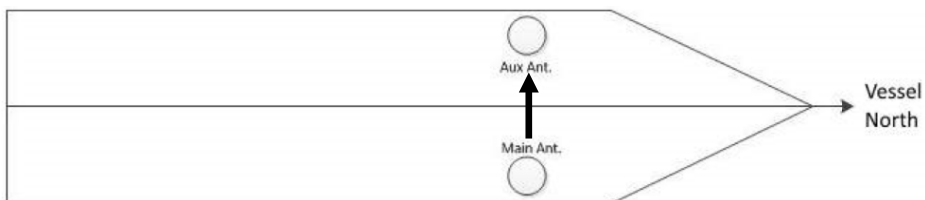
NOTE

The above examples are simplified for illustration purposes. To achieve the heading accuracies specified a gyro calibration should be conducted.

The *Main* and *Auxiliary* antenna should also be installed at similar heights to ensure consistent heading. If this is not done the heading solution will be noisy due to each antenna being subject to different amounts of vessel motion e.g. vessel roll.
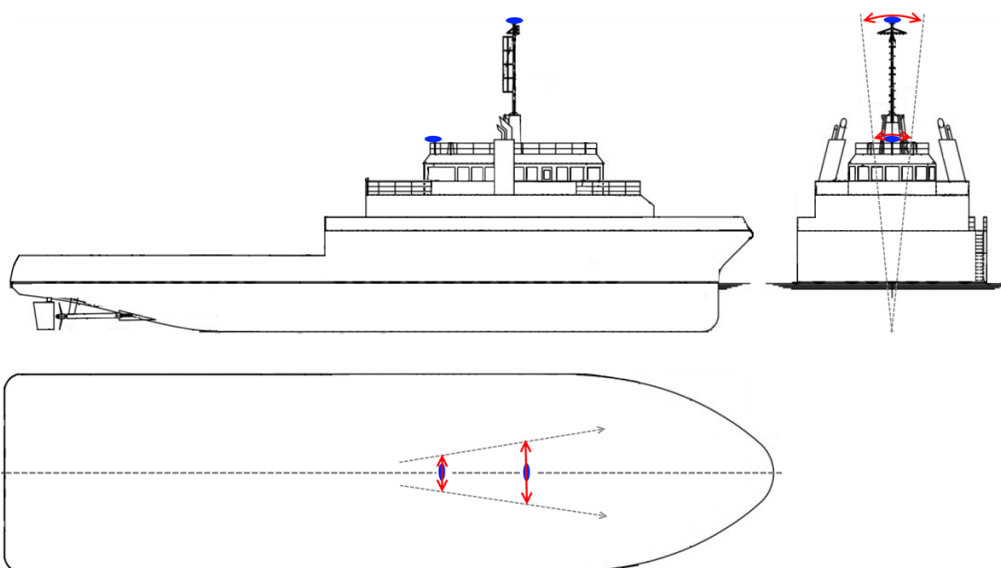
Vessel motion when antennas mounted at different heights

3.3 COAXIAL CABLE INSTALLATION

VERIPOS recommend and supply pre-terminated LMR coaxial cables as they give the best performance in permanent installations.

Label each cable carefully at top and bottom identifying the antenna attached.

3.3.1   Maximum recommended cable lengths

The signals received by the antennas will deteriorate at different rates as they are transmitted through coaxial cable. As a result VERIPOS recommend a maximum cable length.

The following table details the maximum length for each signal type.

	L1 GNSS only	L1/L2 GNSS	L-band	MF / HF
RG213 (M17/163-00001)	40 m / 125 ft	30 m / 110 ft	65 m / 210 ft	100 m / 328 ft
LMR400	70 m / 235 ft	52 m / 175 ft	120 m / 390 ft	200 m / 656 ft
LDF4-50	130 m / 425 ft	110 m / 360 ft	210 m / 700 ft	350 m / 1148 ft

3.3.2   General

VERIPOS recommended cable for the antenna runs is LMR 400.

Terminated tails of LMR 240 are used at either end for ease of attachment to hardware.

Terminated Tails of LMR240

When running multiple coaxial cables VERIPOS recommend labelling to ensure cables are attached to the correct antennas and equipment.

Survey the route of the antenna cabling to ensure:

1. The total length of the cable run does not exceed the supplied cable length for this installation. Contact your supplier or VERIPOS if this is the case.

2. The cable does not cross or run parallel with any **single phase or three phase mains** cable (110 VAC, 220 VAC or 440 VAC) or any high power RF cables leading to transmitting devices such as Inmarsat B and VSAT domes.

3. The cable **avoids fluorescent lights**.

4. A **support wire** is used where the cable run has to cross a free space and does not rely solely on cable ties for support.

5. Sufficient space is available in the selected cable entry through the bulk head for the connectors to pass through without damage. If the connector cannot pass through the cable entry it may be necessary to cut the connector off and re-terminate once the cable has been passed through.

6. The cable is **not pinched**.

7. The route is **free from all burrs or sharp edges** that could damage the cable jacket.

8. All **connectors and couplers are properly sealed** from the environment with self-amalgamating tape and electrical tape.

9. **Stress loops** are fitted to prevent excess force on the connectors, in particular the antenna connectors.

10. The **minimum bend radius** for the cable is not exceeded.

Once cables are in place **seal all connections with self-amalgamating tape** for protection against the marine environment.

Typical Cable installation in Bridge Mast Area

3.4 LD7 ANTENNA CONNECTIVITY

This section details the antenna connections made to the LD7 IMU.

3.4.1 Coaxial cables to antennas

3.4.1.1 Standard LD7 Variant

Two antenna connections (*Main* and *Auxiliary*) are required to obtain a GNSS heading solution.

These are shown below;
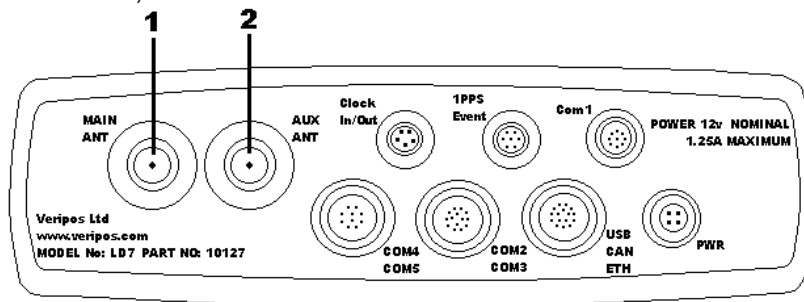
LD7 Rear Panel Antenna Connections

If a GNSS heading solution is not required, the LD7 can provide VERIPOS position solutions with just the *Main* antenna connection. **On a standard** LD7, the *Main* antenna input is used as both a GNSS and L-Band correction input.

Key:

	Connection Name	Function	Typical antenna
1	Main	L-Band, GNSS	V460
2	Aux	GNSS	V460

3.4.1.2 LD7 Mod 1 Variant – Dedicated L-Band Input

The LD7 can be supplied with a dedicated L-Band antenna input if required. This is useful on installations where the optimum location for the GNSS antennas may not be the optimum location for L-Band reception.

An LD7 *Mod 1* unit will therefore have three antenna inputs. The *Main* antenna will be the main GNSS input however will no longer be used for L-Band.

The function of the *Auxiliary* antenna input remains unchanged and is used a secondary GNSS input for GNSS heading.

There will be a dedicated coaxial connector (TNC) installed on the front of the LD7 which will be used only to receive L-Band correction data using a dedicated L-Band antenna e.g. V86 antenna.

LD7 Mod 1 Unit with dedicated L-Band input

The table below shows the antenna connectors used on an LD7 Mod 1 IMU:

Connector Name	Connector Type	Function	Typical Antenna
Main	TNC	GNSS (Primary)	V460
Auxiliary	TNC	GNSS (Secondary)	V460
LBAND Ant	TNC	L-Band corrections	V86

3.5 LD7 POWER AND INTERFACE

This section details the power and interface cables connected to the LD7 IMU.

3.5.1   LD7 Rear connections
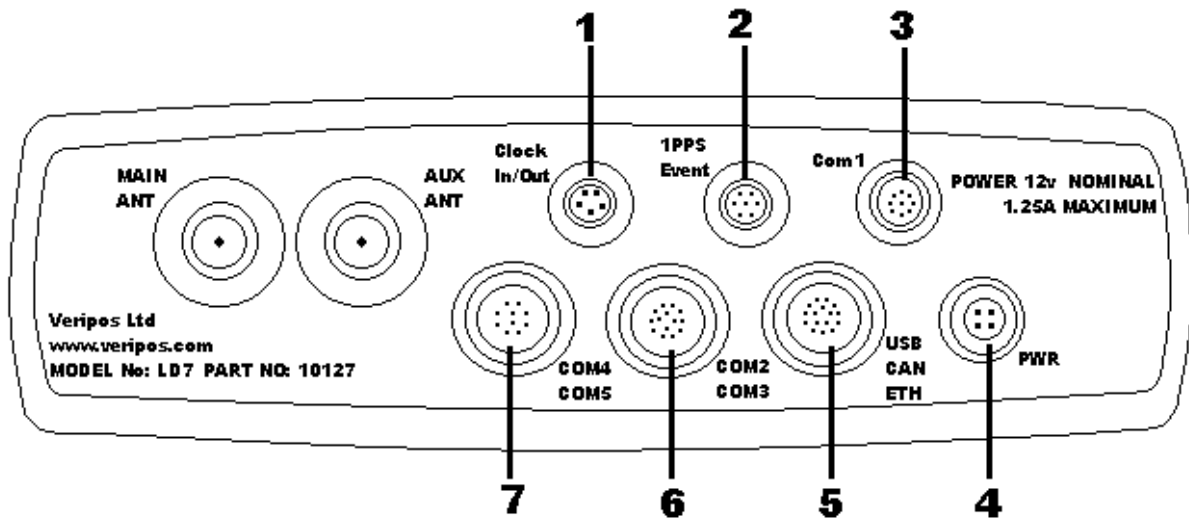
LD7 Rear Panel Power and Interface Connections

Label	Description	Connector Type
1	Clock In/ Out Connector	Lemo 5-Pin
2	'1PPS' / Event Output BNC connector	Lemo 7-Pin
3	COM1 Serial Connector	Lemo 9-Pin
4	Power Connector	Lemo 4-Pin
5	USB / Ethernet connector	Lemo 16-Pin
6	COM2 / COM3 Serial Connector	Lemo 14-Pin
7	COM4 / COM5 Serial Connector	Lemo 10-Pin

3.5.2 Interface cabling

This section details the types of data cables connected to systems and used by systems on the vessel.

Serial Data interface cables from the LD7 will use RS232 cables.

For Cable Pin-out details refer to the *Reference Information* Section of this manual.

Cables and adapters supplied:

Com 1

Com2 / Com3

Com4 / Com5

Ethernet / USB

PPS / Event

3.5.3 Serial Ports

LD7 has five RS-232 serial ports (COM 1–5) to make connections to ships system.

Com1: Direct communication with the internal processor.
Com2: Direct communication with the internal processor.
Com3: Direct communication with the GNSS Receiver.
Com4: Direct communication with the L-Band Demodulator.
Com5: Direct communication with the L-Band Demodulator.

For reference the **LD7** default settings are shown below:

COM Port	*Data String*	Baud rate	Function
COM1	*NMEA a*	9600 8,N,1	NMEA data to vessel system Default GGA Message
COM2	*NMEA b*	9600 8,N,1	NMEA data to vessel system Default HDT Message
COM3	*GNSS RAW*	115200 8,N,1	Raw Data messages for use with Verify QC
COM4	*RTCM B*	115200 8,N,1	VERIPOS Corrections for use with Verify QC or standalone GNSS receiver
COM5	*L-Band Control*	115200 8,N,1	For use with VERIPOS L-Band Control

See the *Reference information* chapter for pin-out details and contact VERIPOS for advice where required.

3.5.4 Ethernet interface

The LD7 is configured via Web Interface. The Ethernet RJ45 connector on the LD7 rear panel can be connected directly to a PC with Ethernet port.

The default IP address used to access the Web Interface is **192.168.0.126.** This can be changed if required.

The Ethernet interface can also be used to output any data which is available via serial port. When outputting data via Ethernet, the IP address and the data source must be used, **NOT** the IP address of the LD7. For example, to output NMEA position or Heading data, the GNSS card IP address must be used. To output RTCM correction data, the L-Band card IP address must be used.

The default IP addresses are as follows:

LD7 default IP address: **192.168.0.126**

GNSS card default IP address: **192.168.0.127**

L-Band card default IP address: **192.168.0.128**

The network ports for the data streams available on the LD7 are:

Data Stream	Port
RTCMa	9001
RTCMb	9002
L-Band Config	9003
NMEAa	9011
NMEAb	9012
Raw GNSS	9013

3.5.5 PPS/ Event/ Clock In/Out

The LD7 has a rear connector for output of a 1PPS (one pulse per second) signal, used by external equipment for accurate time synchronisation to navigation systems or multi-beam sonar. Output voltage is 3.3V.

This can be configured using Septentrio RX Control.

Event and Clock In/ out are not currently used.

3.5.6 Power and cabling

This section details the type and typical source for power supply to the LD7.

VERIPOS recommend using supplied external AC/DC Power supply unit.

Details and power source specification available from VERIPOS.

Power requirement of the LD7:

Input Voltage: 12 – 24 VDC

Power consumption: <12W.

The LD7 unit can alternatively be attached to the vessel DC supply.

The unit should be connected to a clean supply, e.g. UPS system.

Contact the Veripos Helpdesk if you need advice on supply of power to the LD7.

4.   REFERENCE INFORMATION

4.1 CABLING AND CONNECTORS

This section contains details on the Interface and power connector pin assignments for the LD7 IMU. It also details the termination procedure for LMR400 Coaxial cabling.

VERIPOS recommend that prefabricated main cables and coaxial tails are used for connection of antenna to the VERIPOS below decks equipment.

4.1.1   Power Cable Pinout Details

The external power input is via the 4-pin Push-Pull LEMO connector.

LD7 4 Pin Lemo Pin	Description	Cable Colour
1	Power +	Red
4	Gound -	Black

4.1.2   Com1 Cable Pinout Details

This port uses cable assembly p/n 10120 which has 9-Pin Push-Pull Lemo plug to the LD7 rear panel and a DB9 connector for RS232 communication with COM1 of the system; direct communication with the internal processor.

LD7 9 Pin Lemo Pin	Description	Cable End Connector Com1 9 D-Type
1	CTS	8
6	RX	3
7	TX	2
8	RTS	7
9	Ground	5

4.1.3   Com2/ Com3 Cable Pinout Details

This port uses cable assembly p/n 10121, which has a Lemo 14---Pin plug that splits into 2 DB9 connectors for RS232 communication with Com2 and Com3 of the system.

LD7 14 Pin Lemo Pin	Description	Com2 (9pin D-Type)	Com3 (9Pin D-Type)
5	RX 3		2
6	TX 3		3
7	RTS 2	8	
8	TX 2	3	
9	CTS 2	7	
10	RX 2	2	
11. 12, 13, 14	Ground	5	5

4.1.4   Com4/ Com5 Cable Pinout Details

This port uses cable assembly p/n 10121, which has a Lemo 10---Pin plug that splits into 2 DB9 connectors for RS--- 232 communication with Com4 and Com5 of the system.

LD7 10 Pin Lemo Pin	Description	Cable End Connector	
		Com4 (9pin D-Type)	Com5 (9Pin D-Type)
5	RX 5		2
3	TX 5		3
5	TX 4	3	
7	RX 4	2	
9, 10	Ground	5	5

4.1.5   Ethernet / USB Cable Pinout Details

The port uses a 16-pin Lemo plug that splits into a USB (Type A) port communicates directly to the internal processor, and an Ethernet RJ45. The Ethernet port can be connected for communication to a PC or Ethernet router. This is internally connected to an Ethernet hub to communicate with the internal processor or the GNSS receiver.

LD7 14 Pin Lemo Pin	Description	Cable End Connector	
		USB (TypeA)	Ethernet (RJ45)
2	LRXP		3
3	LRXN		6
4	LTXP		1
5	LTXN		2
7	USB_DM	3	
6	USB_DP	2	
8	USB_VBUS	1	
12	Ground	4	

4.1.6   PPS / Event Cable Pinout Details

The port uses a 7-pin Lemo plug that splits that into a BNC (50 ohm) connector for 1 Pulse Per Second (PPS) out, and wire connectors for Event A & B markers.

LD7 14 Pin Lemo Pin	Description	Cable End Connector	
		Event (Bare End)	PPS (BNC)
2	Event A	Tag with 'Event A'	
3	Event B	Tag with 'Event B'	
4	Ground	Tag with 'GND'	
6	(PPS) Out		Center Conductor
7	Ground		Shell

* Connect Pins 4 & 7 Together to Ground Not Connected

4.1.7 Times LMR 400

4.1.7.1 Electrical specifications

Performance Property	Units	US	(metric)
Attenuation @1.5GHz:			
30.77m (100ft.)	5.1dB		
100m	16.8dB		
Velocity of propagation	%	85	
Dielectric constant	N/A	1.38	
Time delay	nS/ft (nS/m)	1.20	(3.92)
Impedance		50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding effectiveness	dB	>90	
DC resistance Inner conductor Outer conductor	 /1000 ft (/km) /1000 ft (/km)	 1.39 1.65	 (4.6) (5.4)
Voltage withstand	VDC	2500	
Jacket spark	Vrms	8000	
Peak power	kW	16	

4.1.7.2 Mechanical specifications

Performance property	Units	US	(metric)
Bend radius, installation	in. (mm)	1.00	(25.4)
Bend radius, repeated	in. (mm)	4.0	(101.6)
Bending moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile strength	lb (kg)	160	(72.6)
Flat plate crush	lb/in. (kg/mm)	40	(0.71)

4.1.7.3 Environmental specifications

Performance property	°F	°C
Installation temperature range	-40 to +185	-40 to +85
Storage temperature range	-94 to +185	-70 to +85
Operating temperature range	-40 to +185	-40 to +85

4.1.8   Times LMR 240

4.1.8.1   Electrical specifications

Performance Property	Units	US	(metric)
Attenuation @1.5GHz:			
30.77m (100ft.)	9.9dB		
100m	32.4dB		
Velocity of propagation	%	84	
Dielectric constant	N/A	1.42	
Time delay	nS/ft (nS/m)	1.21	(3.97)
Impedance		50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding effectiveness	dB	>90	
DC resistance Inner conductor Outer conductor	/1000 ft (/km) /1000 ft (/km)	3.2 3.89	(10.5) (12.8)
Voltage withstand	VDC	1500	
Jacket spark	Vrms	5000	
Peak power	kW	5.6	

4.1.8.2   Mechanical specifications

Performance property	Units	US	(metric)
Bend radius, installation	in. (mm)	0.75	(19.1)
Bend radius, repeated	in. (mm)	2.5	(63.5)
Bending moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile strength	lb (kg)	80	(36.3)
Flat plate crush	lb/in. (kg/mm)	20	(0.36)

4.1.8.3   Environmental specifications

Performance property	°F	°C
Installation temperature range	-40 to +185	-40 to +85
Storage temperature range	-94 to +185	-70 to +85
Operating temperature range	-40 to +185	-40 to +85

4.1.9   Coaxial Cable Connectors

The below connectors are those most commonly used by VERIPIOS. For further information, such as connector termination instructions, please refer to the "Antenna and Coaxial Cable Installation Manual".

LMR400 Connectors

- Times Microwave EZ-400-NF (N-Type Female connector)
- Times Microwave TC-400-NMH-X (N-Type Male connector)

LMR240 Connectors

- Times Microwave EZ-240-NMH-H (N-Type Male connector)
- Times Microwave EZ-240-TM-X (TNC Male connector)

—— ⓘ NOTE ————————————————————

Other connector and cable types may be used, depending on vessel operating region, cable run length etc. More detailed information in the "Antenna and Coaxial Cable Installation Manual".

5. CONTACT INFORMATION

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

5.1 VERIPOS HELPDESK

Veripos Online support   **VOSS** https://help.veripos.com

Helpdesk telephone   +44 (0)1224 965900

Helpdesk e-mail   helpdesk@veripos.com

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

5.2 VERIPOS OFFICE LOCATIONS

5.2.1   VERIPOS UK

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

5.2.1   Additional VERIPOS offices

For other sites visit www.veripos.com

APPENDIX I.

COM PORT DETAILS – CABLE PIN OUTS

Port Descriptions

Note that each connector on the LD7 uses a different connector.
This ensures the correct cable harness is used.

LEMO	Description	Purpose
5-pin	Clock In/Out	Clock In/Out to Device
14-pin	Com2/Com3	Dual RS-232 to PC
		Com2 RS-232 to PC (Connection to Internal Processor)
		Com3 RS-232 PC (Connection to GNSS Receiver)
		Com4 RS-232 to PC (Connection RTCM to PC /other)
		Com5 RS-232 to PC (Config of L-Band)
7-pin	PPS/Event	PPS Output & Event input
16-pin	USB/ETH	USB to PC (Connection to Internal Processor). Ethernet to router or PC (Connection to System or GNSS).
9-pin	Com1	RS-232 to PC (Communication to Internal Processor)
4-pin	Power	DC Power Input

Clock In/Out

This port uses cable assembly p/n 10118 which has a 5-Pin Lemo plug to the LD7 that splits into two BNC connectors for Clock In & Out:

- Clock Out: This outputs a 10MHz signal from GNSS Receiver.
- Clock In: This inputs a 10MHz signal to GNSS Receiver.

Pin #	Description	Connector
1	Ground	BNC Shell
2	Clock Out	BNC Center Conductor
3	Ground	Not Connected
4	Clock In	BNC Shell
5	Ground	BNC Center Conductor

PPS & Event In

This port uses cable assembly p/n 10119 which has a 7-Pin Lemo plug to the LD7 rear panel that into a BNC connector for 1 Pulse Per Second (PPS) out, and wire connectors for Event A & B markers.

Pin #	Description	Connector
1	Not Connected	Not Connected
2	Event A	Tag with 'Event A'
3	Event B	Tag with 'Event B'
4*	Not Connected	Tag with 'GND'
5	Not Connected	Not Connected
6	Pulse Per Second (PPS) Out	BNC Center Conductor
7*	Not Connected	BNC Shell
*	Connect Pins 4 & 7 Together to Ground	Not Connected

COM1

This port uses cable assembly p/n 10120 which has 9-Pin Lemo plug to the LD7 rear panel and a DB9 connector for RS-232 communication with COM1 of the system; direct communication with the internal processor.

Pin #	Description	Connector
1	CTS	8 (DB9-Female)
2	Not Connected	Not Connected
3	Not Connected	Not Connected
4	Ground	Not Connected
5	Ground	Not Connected
6	RX	3 (DB9-Female)
7	TX	2 (DB9-Female)
8	RTS	7 (DB9-Female)
9	Ground	5 (DB9-Female)

COM2 & COM3

This port uses cable assembly p/n 10121, which has a Lemo 14-Pin plug that splits into 2 DB9 connectors for RS-232 communication with Com2 and Com3 of the system.

- Com2: Direct communication with the internal processor.
- Com3: Direct communication with the GNSS Receiver.

Pin #	Description	Connector
1	VBUS	Not Connected
2	USB_DP	Not Connected
3	USB_DN	Not Connected
4	Ground	Not Connected
5	Tx3	2 (DB9-Female)
6	Rx3	3 (DB9-Female)
14	Ground	5 (DB9-Female)
7	Rx2	8 (DB9-Female)
8	RTS2	3 (DB9-Female)
9	Tx2	7 (DB9-Female)
10	Ground	2 (DB9-Female)
11	Ground	5 (DB9-Female)
12	Ground	Not Connected

COM4 & COM5

- Com4: Used for RTCM comms (in/out).
- Com5: Used for RTCM comms (in/out).

Pin #	Description	Connector
1	VBUS	Not Connected
2	-	Not Connected
3	-	Not Connected
4	Ground	Not Connected
5	Tx3	2 (DB9-Female)
6	Rx3	3 (DB9-Female)
14	Ground	5 (DB9-Female)
7	Rx2	8 (DB9-Female)
8	RTS2	3 (DB9-Female)
9	Tx2	7 (DB9-Female)
10	Ground	2 (DB9-Female)
11	Ground	5 (DB9-Female)
12	Ground	Not Connected

Ethernet & USB

The port uses cable assembly p/n 10122, which has a 16-pin Lemo plug that splits into a USB (Type A) port communicates directly to the internal processor, and an Ethernet RJ45. The Ethernet port can be connected for communication to a PC or Ethernet router. This is internally connected to an Ethernet hub to communicate with the internal processor or the GNSS receiver.

Pin #	Description	Connector
1	Ground	Not Connected
2	LRXP	3 (Ethernet Plug)
3	LRXN	6 (Ethernet Plug)
4	LTXP	1 (Ethernet Plug)
5	LTXN	2 (Ethernet Plug)
7	USB_DM	3 (USB Type A Plug)
6	USB_DP	2 (USB Type A Plug)
8	USB_VBUS	1 (USB Type A Plug)
12	Ground	4 (USB Type A Plug)
9	CAN_TX0	Not Connected
10	CAN_RX0	Not Connected
11	NC	Not Connected
13	Ground	Not Connected
14	Ground	Not Connected
15	Ground	Not Connected
16	Ground	Not Connected

DC Power Input

The external power input is via the 4-pin LEMO connector.

The specifications are:

External Power:	12 VDC to 24 VDC
Current:	1.25 A @ 12 VDC Nominal

Table 1: Power Cable Description

Wire Colour	Function
RED	Power (+)
BLACK	Ground (-)
GREEN	Not Used
WHITE	Not Used

APPENDIX II.

LD7 TECHNICAL SPECIFICATION

LD7 Mount

LD7 Bottom View

As shown above, two mounting brackets are attached to the bottom of the LD7. The brackets may be mounted on the top or bottom of the LD7 housing. Two brackets are supplied with each LD7 unit.

LD7 Features

- 272 Channel AsteRx2eH, with L1/L2/L2C GPS, GLONASS and SBAS.
- GNSS Heading
- Serial & Ethernet interfacing
- Remote access via Ethernet
- Configurable via WebUI
- Bluetooth® (class 1)

GNSS Navigation Accuracy

Navigation Performance	Horizontal (m)	Vertical (m)
DGPS (RTCM1,3 / 9,3)	1.0	-
Veripos APEX Ultra	0.1	0.2

GNSS Heading Accuracy

Separation	Heading	Pitch or Roll
1 metre	0.3°	0.6°
10 metre	0.03°	0.06°