UM-8084-6510

User Manual for Lodestar 500

Issue A Rev 1

Issue Date: 27 January 2016

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Contacting the Sonardyne Support Team

24-hour Emergency Telephone Helpline: +44 (0) 1252 877600

The Sonardyne 24-hour helpline is answered at the UK Headquarters during normal office hours (08:00 to 17:00). Outside these hours, your call is automatically transferred to an agency, which logs the details of your emergency and alerts the appropriate Sonardyne personnel.

Our aim is to make sure emergency requests are dealt with immediately during office hours, and are responded to within 30 minutes at all other times.

Please note the helpline is for emergency use only.

If you require non-emergency product support, please contact your nearest Sonardyne office. Alternatively, contact the Sonardyne Head Office:

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Note

📄   **Email and telephone support is available during normal UK office hours (08:00 to 17:00).**

Contents

Figures

Tables

Amendment History

The amendment history records all amendments and additions made to this manual.

Issue	Revision	Date	Comments	Section	Page
A	1	27/01/16	Initial Issue	All	All

Section 1 – Introduction

1.1 Scope of this Manual

This user manual defines the safe installation, operation and maintenance of the Type 8084-6510 Lodestar AHRS / SPRINT INS hardware. Where applicable, the manual will refer the reader to related publications covering operation as an Attitude and Heading Reference System (AHRS) or SPRINT Inertial Navigation System (SPRINT).

1.2 Purpose of this Manual

This user manual contains information for anyone involved in Lodestar and INS system operations. This manual includes technical information to configure, operate and maintain Lodestar AHRS and specific information concerning Lodestar inertial systems supplied by Sonardyne.

To make sure the safety of the installer and operator is maintained it is important that all warnings and cautions in *Section 2 –Safety* of this manual and in any additional manuals are read and fully understood.

1.3 U.S. Department of Commerce License

This product contains U.S. Department of Commerce controlled items. As such the Lodestar 500, or Lodestar portion of the product, must not be removed from the housing, be disassembled or repaired, outside of the terms and conditions detailed in the U.S. Department of Commerce Re-Export Licence under which the product was sold. If any servicing or repair of the Seanet Lodestar, or Lodestar portion of the product is required, consult your nearest Sonardyne office for advice.

1.4 Related Publications

To make sure the equipment is operated safely, a *Sonardyne Safety Manual* is supplied with this user manual. It is important that the *Sonardyne Safety Manual* is read and fully understood before proceeding with any activity on the equipment.

Table 1-1 Related Publications

Publication	Title
Sonardyne Safety Manual	*Operational and Safety Precautions*
UM-8253	*User Manual for SPRINT*
UM-8084-107	*Lodestar AHRS Operation Manual*
UM-8084-109	*Lodestar AHRS Messages*

Section 2 – Safety

2.1   Introduction

Before any activity is carried out on the equipment, it is recommended that the included *Sonardyne Safety Manual* and all warnings and cautions in this manual are read and fully understood.

It is recommended that the operator complies with the Health and Safety Regulations applicable to the vehicle and the region before operating this equipment.

Operators and service personnel must be familiar with the normal operating and safety procedures for the subsea equipment being operated.

Documentation must be consulted whenever a ⚠ or ⚡ warning symbol is found on the equipment, in order to determine the nature of the potential hazard and any actions which must be taken.

If any additional equipment is used, any warnings and cautions in the equipment user manual must be read and fully understood.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The safety of any system incorporating this equipment is the responsibility of the assembler of the system.

2.2   Safety Procedures

2.2.1   Warnings

⚠   **Personal protection. Appropriate protective equipment such as protective footwear, hard hat and gloves must be worn when handling or carrying out any procedures involving Sonardyne and other equipment**

⚠   **Heavy equipment. Many Sonardyne products and equipment types, such as Lodestar, transponders, transceivers, cable drums etc. require Manual Handling Equipment (MHE) for lifting due to their heavy weight. If MHE is not available, it is the responsibility of the operator to perform a manual handling risk assessment prior to carrying out manual lifting/handling. Refer to the individual equipment documentation for weight specifications.**

⚠   **Dismanting. This instrument must only be accessed internally and dismantled by qualified Sonardyne personnel.**

⚠   **Lithium-ion Battery Pack. This instrument contains a backup lithium-ion battery pack. Refer to the Sonardyne Safety Manual for saftey information for lithium-ion batteries.**

⚠   **Risk of toxic gases and Corrosive Liquids. Do not stand in direct line with the end of the unit when operating the Pressure Relief Vent Valve. Sudden release of high pressure gases could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the Pressure Relief Vent Valve.**

2.2.2   Cautions

⚠   **Incorrect Power Supply. Make sure the Lodestar is supplied with 20 VDC to 50 VDC. Do not use an AC power supply.**

⚠   **Damage to connectors. Failure to clean sand or silt correctly could result in damage to the connectors and O-ring seals.**

Section 3 – Technical Description

3.1 Introduction

Sonardyne International Limited has applied its comprehensive experience in producing advanced and dependable marine solutions to the development of the Lodestar Attitude and Heading Reference System (AHRS) / Inertial Navigation System (INS).

The Lodestar is a solid state AHRS/INS that includes three Ring Laser Gyroscopes (RLGs) and three linear accelerometers. These inertial-grade components provide raw data to the Sonardyne-developed gyrocompass algorithm, which uses them to produce a full range of accurate real-time motion and attitude measurements in all sea states.

Developed originally to provide accurate heading and attitude measurements for Sonardyne's family of acoustic positioning systems, Lodestar is equally suited to a variety of other applications where the accuracy of heading and attitude measurements is of critical importance. Lodestar can operate either as a stand-alone AHRS or as part of an integrated system.

The Lodestar 500 provides the following as standard:

- Industry standard output telegrams
- Battery backup to maintain uninterrupted operation in the event of brief power failure
- 8 GB of internal memory.
- Upgrade capability to a full INS that provides additional outputs of position, velocity, orientation and angular velocity at high update rates.
- 0.04° (dynamic) to 0.1° secant-latitude.
- 0.01° roll and pitch measurement accuracy.
- Fast follow-up speed of >500° per second.
- A settling time of less than five minutes.
- Support for all industry standard telegrams.
- MTBF inertial sensors (RLG and Accelerometer) > 400,000 hours
- Flexible mounting arrangements
- Heave measurement accuracy the greater of 5 cm or 5% of measured heave.
- Robust heave algorithm.
- Data output through RS232 serial, RS485 serial or Ethernet interfaces.

The Lodestar 500 has undergone independent and exhaustive testing against an industry-recognised reference and has proved capable of delivering accurate measurements in highly dynamic marine environments.

Lodestar 500 benefits from Sonardyne's world-class manufacturing, support and training organisation, which has a well-established record for providing trusted solutions.

3.2   Physical Layout

The 8084-6510 Lodestar 500 is shown in *Figure 3-1*.

Figure 3-1 Lodestar 500 Layout
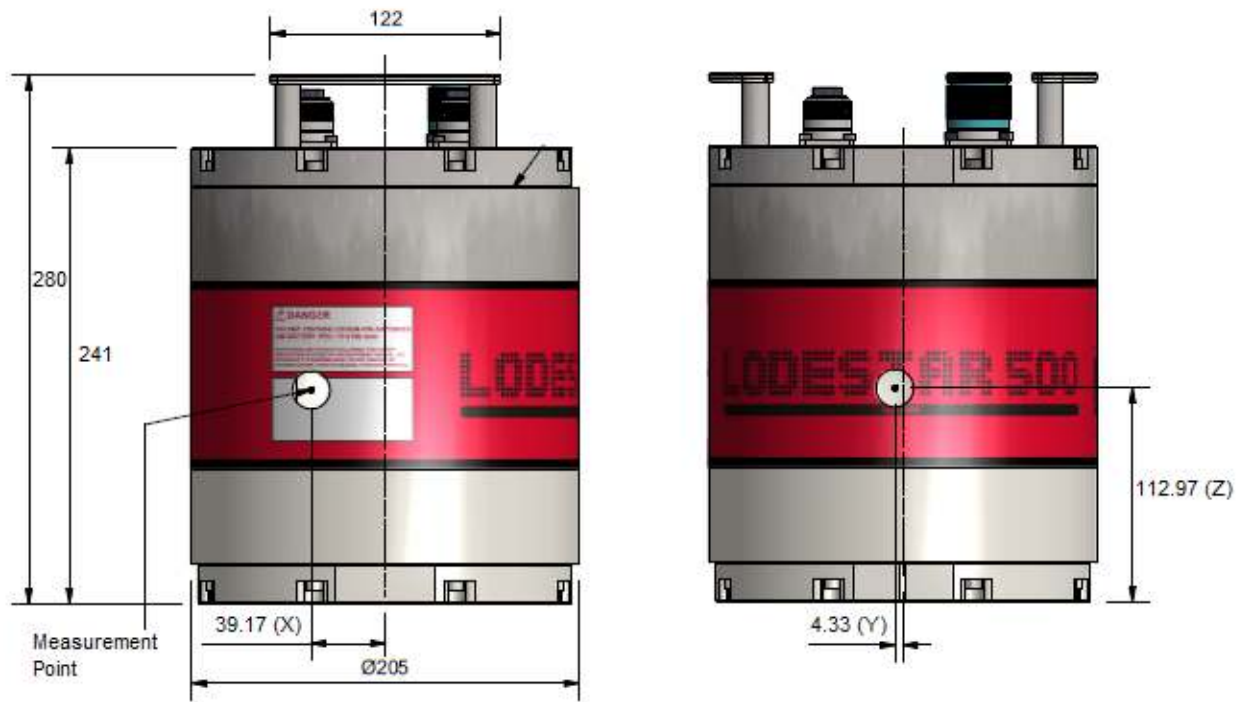
3.3   Power

The Lodestar is powered from an external 20V to 50V DC power supply through the CP port.
A power supply is not provided with the Lodestar 500. Refer to *Section 12 – Technical Specifications* for power requirements.

3.4   Power Pass Through

The Lodestar is capable of passing through input power (20V to 50V DC from an external power supply) to sensors connected to the Lodestar's C1, T1 and T2 ports. Refer to *SPRINT User Manual UM-8253* for operational use.

3.5   Battery

The Lodestar contains a backup lithium-ion battery to cope with short external power interruptions and has a life of approximately five minutes with no external power. The battery is charged from the external power supply and when depleted, takes approximately 20 minutes to reach full charge.

3.6   Connector Ports

The Lodestar 500 is provided with 4 x Seacon connector ports as shown in *Figure 3-2*. The connector port functions are described in *Table 3-1*.

Figure 3-2 Lodestar 500 Connect Ports
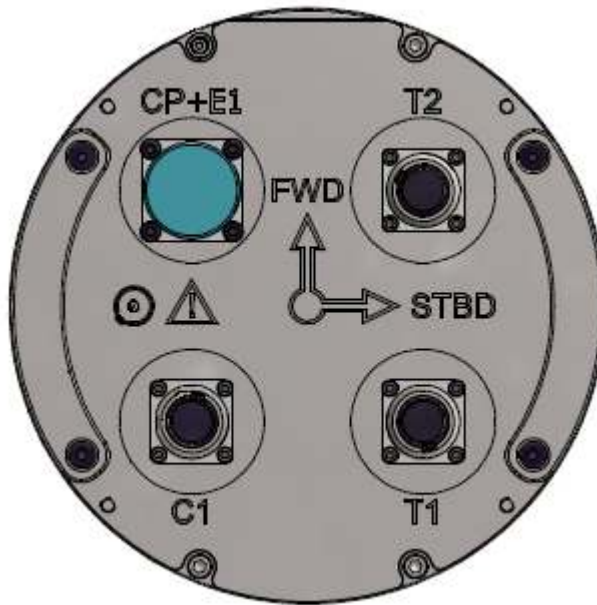
Table 3-1 Lodestar 500 Connector Port Functions

Lodestar 500 Port	Function
CP/E1	RS232 and RS485 Full Duplex Communications and Input Power Ethernet (100 Mbit/s) Communications and Input Trigger
C1	RS232 Communications, Input Trigger and Power Pass Through
T1	RS232 and RS485 Half Duplex Communications, Output Trigger and Power Pass Through
T2	RS232 and RS485 Half Duplex Communications, Output Trigger and Power Pass Through

3.6.1 CP/E1 Pin out Functions

The Lodestar 500 CP/E1 connector pin functions are shown in *Table 3-2*.

Table 3-2 Lodestar 500 CP/E1 Pin Out

Seacon Pin No.	Function	Connection
1	DC 0V	Black Socket
2	DC In	Red Socket
3	0V1	RS232 & RS485 Pin 5
4	Screen	
6	Trigger In	BNC Inner
7	Ethernet TD -	Pin 6
8	RS232/485 Select	Connect to 0V1 for RS232 / Not connected for RS485
10	Ethernet RD -	Pin 2
11	RX TX+	RS232 & RS485 Pin 3
12	Ethernet TD +	Pin 3
13	TX TX -	RS232 Pin 2 / RS485 Pin 4
14	RX -	RS485 Pin 1
15	Ethernet RD +	Pin 1
16	RX +	RS485 Pin 2

3.6.2 C1 Pin out Functions

The Lodestar 500 C1 connector pin functions are shown in *Table 3-3*.

Table 3-3 Lodestar 500 C1 Pin Out

Seacon Pin No.	Function	Connection
2	0V1	RS232 = Pin 5 BNC Inner
3	Trigger 0v	BNC Outer
4	DC 0V	Black Socket
5	TX TX-	RS232 = Pin 2
6	RX TX+	RS232 = Pin 3
7	DC Out	Red Socket

3.6.3   T1/T2 Pin out Functions

The Lodestar 500 CP/E1 connector pin functions are shown in *Table 3-4*.

Table 3-4 Lodestar 500 T1/T2 Pin Out

Seacon Pin No.	Function	Connection
2	0V1	RS232 & RS485 = Pin 5 BNC Inner
3	Trigger 0v	BNC Outer
4	DC 0V	Black Socket
5	TX TX-	RS232 = Pin 2 RS485 = Pin 4
6	RX TX+	RS232 & RS485 = Pin 3
7	DC Out	Red Socket

3.6.4   Trigger Input

The Lodestar trigger input characteristics are shown in *Table 3-5*.

Table 3-5 Lodestar 500 Trigger Input

Parameter	Specification	
Voltage	Recommended	0 V->5 V
	Minimum	0 V->3.6 V
Pulse Width	Recommended	10 ms
	Minimum	5 µs

3.7   Pressure Relief Vent Valve

A Pressure Relief Vent Valve is provided to stop a build-up of gas inside the transponder caused by the charging process or a failing battery.

The Pressure Relief Vent Valve must be checked before installing and operating the Seanet Lodestar; refer to *Section 4.6.1 "Checking the Pressure Relief Vent Valve"*.

Figure 3-3   Pressure Relief Vent Valve
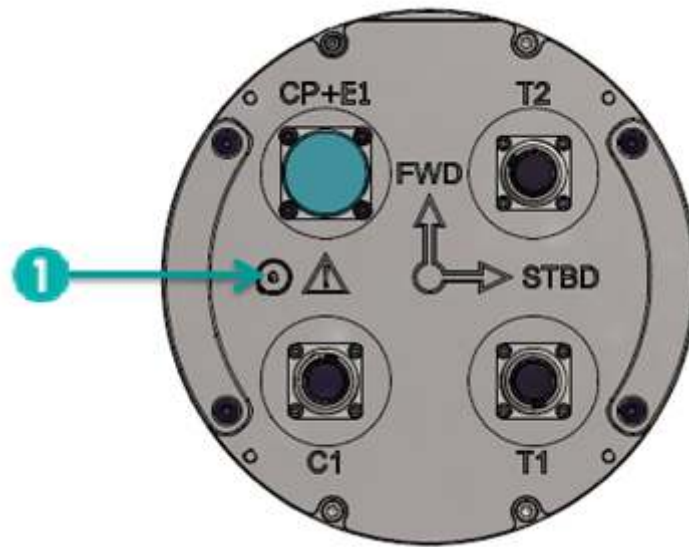
❶   Pressure Relief Vent Valve

Section 4 – Installation

4.1   Introduction

Before installing the equipment, make sure *Section 2 – Safety* is read and fully understood.

This section explains how to install the Seanet Lodestar before deploying.

4.2   Unpacking and Inspecting

The Lodestar AHRS includes a number of delicate and sensitive electronic components. In particular, the accelerometers and RLGs that form the Inertial Measurement Unit (IMU) are sensitive to shock and vibration. If damaged, these components cannot be replaced in the field, and the complete Lodestar unit must be returned to the factory for repair and recalibration.

Note

📄   **Always handle the Lodestar with care. Store the unit in the shipping container until it is ready to be installed in the prepared location.**

Inspect the Lodestar and all the supplied parts on receipt and check the shipment includes all the items listed on the shipping documents. Inform Sonardyne immediately if there are any parts missing, or if any of the supplied parts show signs of damage.

4.3   Installation Location

The Lodestar 500 can be installed at any convenient location on the vehicle. However, to gain optimal performance from the system, identify a location to install the Lodestar 500 that conforms as closely as possible to the following criteria:

- If possible, the location should be close to the vehicle centre of rotation under normal operating conditions.

- The location must not be subject to excessive vibration or impulse shock.

- The location must not exceed the environmental limits for temperature defined in *Section 12.2.3 "Environmental".*

- The location must provide a mounting surface that is of sufficient strength to support the Lodestar 500's weight safely and without flexing.

- The location must provide access for power and communication connections.

- There must be sufficient space to allow easy access to install the Lodestar 500.

- Do not store tools, equipment or chemicals where they can damage the Lodestar 500 or the connection cables.

- Make sure the Lodestar 500 and its connection cables do not cause an obstruction to personnel operating in the area.

- Do not use a location where the connection cables are likely to suffer damage from mechanical stresses or chemical attack.

4.4   Mounting

4.4.1   Site Preparation

The Lodestar 500 can be installed in any convenient orientation with respect to the vessel's body frame. You can compensate for any misalignment between the Lodestar 500 and the vessel by carefully measuring the mounting angles and entering them in the AHRS or SPRINT software; refer to *Section 4.5 "Vehicle Alignment"*.

4.4.2   Mounting Holes and Dowels
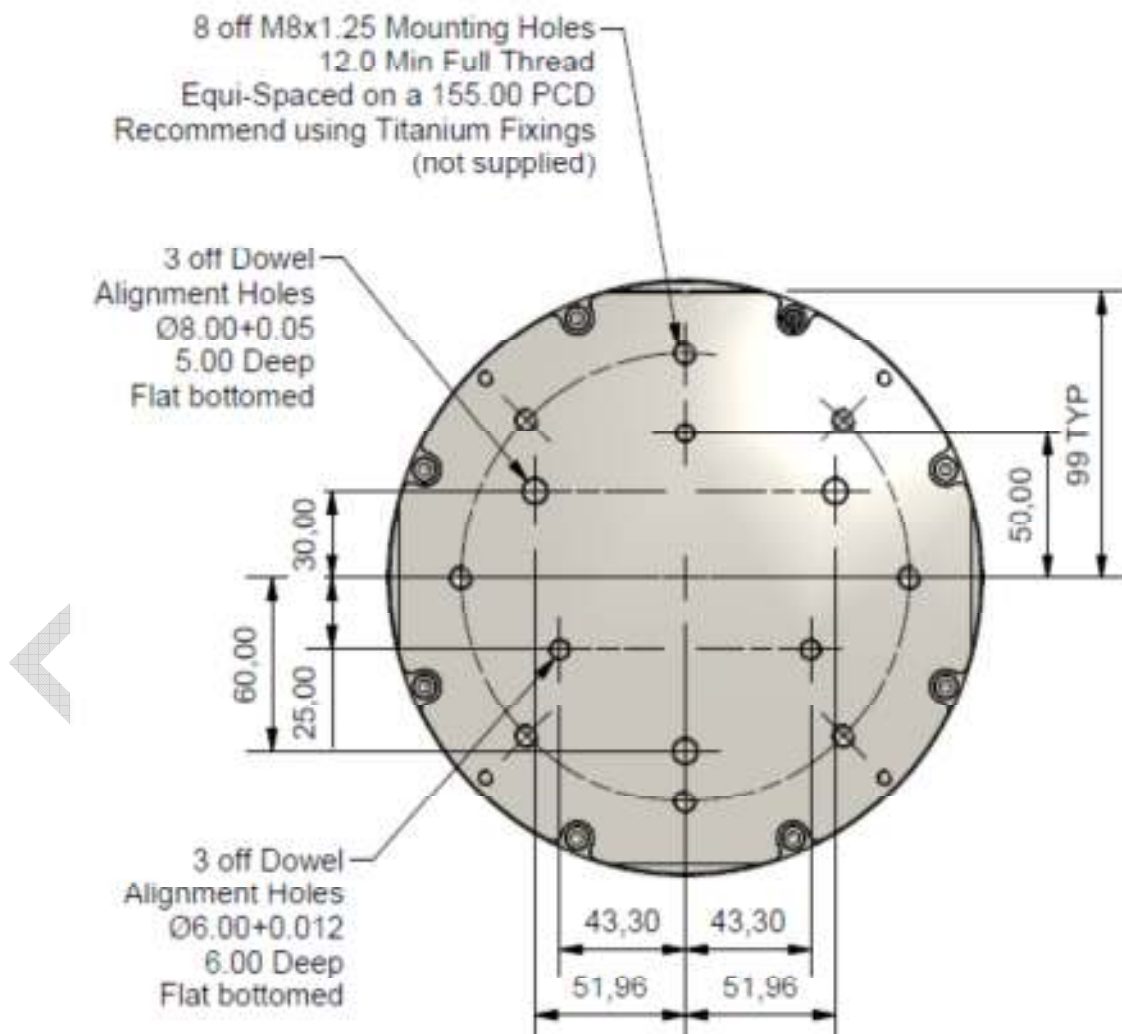
The subsea Lodestar has a set of eight mounting holes on the underside of the unit. In addition there are two sets of three-dowel alignment holes and four alignment flats. The mounting holes, dowel alignment holes and alignment flats are shown in *Figure 4-1.*

Note

📄   **The forward direction is UP in *Figure 4-1.***

Figure 4-1 Lodestar 500 Mounting and Alignment

4.5   Vehicle Alignment

The Lodestar 500's nominal alignment to the vehicle frame (FWD and STBD) is engraved on the top endcap as shown in *Figure 4-2*.

Figure 4-2 Endcap Alignment Markings
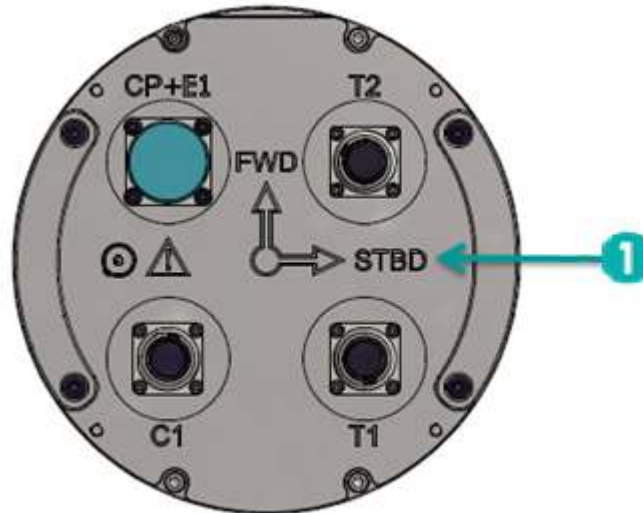
1️⃣   FWD and STBD Endcap Alignment Markings

Four flats machined into the base plate serve as alignment references.

If it is not possible to mount the Lodestar 500 within the limits described above for coarse alignment or if you wish to mount the Lodestar at other angles with respect to the reference axes on the vessel, ROV or platform, the mounting angles must be measured and configured on the Lodestar 500.

The Lodestar can be configured for any mounting angle that may be required.

An in-depth description of the theory and process for measuring and configuring mounting angles can be found in the following user manuals:

- *UM-8253 "User Manual for SPRINT"*

- *UM-8084-107 "Lodestar AHRS Operation Manual"*

These manuals also include an explanation for the effects of misalignments between the vehicle and the Lodestar.

4.6   Preparing the Lodestar 500 for use

The following checks and procedures must be carried out to make sure the Lodestar 500 is serviceable and ready for use:

- Check the Pressure Relief Vent Valve; refer to *Section 4.6.1 "Checking the Pressure Relief Vent Valve"*.

- Secure the Seacon Cables and fit the Seacon connector covers to all unused connector ports.

- Check communications with the Lodestar; refer to *Section 4.6.2 "Checking Communications with the Lodestar"*.

4.6.1   Checking the Pressure Relief Vent Valve

Check the Pressure Relief Vent Valve is flush with the endcap. If the Pressure Relief Vent Valve is not flush it could indicate a pressure build-up during previous operations due to a fault developing in the backup battery pack.
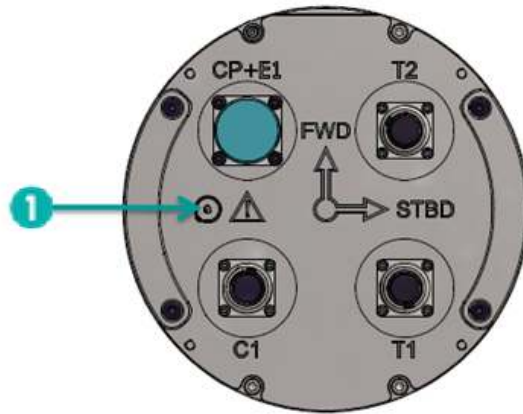
❶   Pressure Relief Vent Valve

To operate the Pressure Relief Vent Valve:

Note

📄   **Refer to *Warnings* in *Section 2 – Safety "Risk of toxic gases and corrosive liquids".***

1.   Screw an M4 bolt into the Pressure Relief Vent Valve.

2.   Slowly pull the M4 bolt to withdraw the vent valve.

3.   To close the vent valve, remove the M4 bolt and carefully push the valve in until it is flush with the endcap face.

4.6.2   Checking Communications with the Lodestar

Check communications with the Lodestar using the AHRS or SPRINT software; refer to *UM-8084-107 "Lodestar AHRS Operation Manual"* or *UM-8253 "User Manual for SPRINT".*

Section 5 – Operation

5.1 Introduction

The type 8084-6510 Lodestar 500 can be operated as both an AHRS and a SPRINT INS.

The Lodestar 500 connector ports restrict communications functionality compared to standard connector Lodestar variants, as shown below:

Lodestar 500 Port	Function
CP/E1	RS232 and RS485 Full Duplex Communications and Input Power Ethernet (100 Mbit/s) Communications and Input Trigger
C1	RS232 Communications, Input Trigger and Power Pass Through
T1	RS232 and RS485 Half Duplex Communications, Output Trigger and Power Pass Through
T2	RS232 and RS485 Half Duplex Communications, Output Trigger and Power Pass Through

5.2 AHRS Operation

For operation of the Seanet Lodestar as an Attitude and Heading Reference System (AHRS), refer to *UM-8084-107 "Lodestar AHRS Operation Manual"*.

5.3 SPRINT INS Operation

For operation of the Seanet Lodestar as a SPRINT Inertial Navigation System (INS), refer to *UM-8253 "User Manual for SPRINT"*.

5.4 After Use

On retrieval from the water, refer to *Section 6 – Retrieval and Storage*.

Section 6 – Retrieval and Storage

6.1 Introduction

Before retrieving the equipment, make sure *Section 2 – Safety* is read and fully understood.

6.2 Retrieval

On retrieval from the installation location, the following procedures must be carried out before the Lodestar 500 is stored.

1. Clean the Lodestar 500; refer to *Section 7.4 "Cleaning"*.
2. Inspect the Lodestar 500; refer to *Section 7.5 "Inspecting".*
3. Place Seacon connector covers on all connector ports.

6.3 Storage

On completion of all checks in the previous section the Lodestar can be placed in storage as described below. Refer to *Table 6-1* for the recommended storage conditions.

1. Store the Lodestar 500 in its transit case.
2. Equipment must be kept in a dry, non-condensing atmosphere (20% to 80% humidity), free from corrosive agents and isolated from sources of vibration.
3. The packaging should be stored on solid, level and damp proof floors. It must not be stored directly on damp or dirt floors or areas prone to flooding. In this case suitable shelving raised off the floor should be used.
4. It is recommended to visually insect the equipment at least annually.
5. When equipment is taken from low temperature storage for immediate use its temperature should be raised to normal operating temperature before use.

Table 6-1 Storage Conditions

Item	Specification
Storage Temperature	-20°C to 60°C (*see Note below*)
Relative Humidity	20 to 80% (non-condensing)

Note

📄   **To prolong the life of the lithium-ion batteries it is recommended not to exceed the storage temperature range of 0° to 30°C.**

Section 7 – Maintenance

7.1   Introduction

Before any maintenance is performed, make sure *Section 2 – Safety* is read and fully understood.

7.2   Retrieval from the Water

Refer to *Section 6 – Retrieval and Storage.*

7.3   Dismantling

Dismantling of the Lodestar 500 must only be carried out by Sonardyne qualified personnel.

7.4   Cleaning

Note

📄   **Do not use any abrasive brushes or sharp tools to remove marine growth when cleaning the as this may damage the instrument.**

1. Thoroughly wash the instrument in warm clean fresh water to remove accumulations of salt, sand or silt and marine growth, paying particular attention to the electrical connectors.
2. Remove any attached cabling or dummy plugs/protective caps and wash the external socket.
3. Dry the instrument and any attached cabling with a clean lint free cloth.
4. Replace any attached dummy plugs/protective caps.

7.5   Inspecting

Regularly inspect the instrument for the following:

1. Inspect the Pressure Relief Vent Valve; refer to *Section 4.6.1 "Checking the Pressure Relief Vent Valve"*
2. Inspect the housing for signs of damage. At full working depth, the instrument housing is at risk of failure damage is not repaired.
3. Inspect the connectors and cables for signs of abrasion, damage or corrosion.
4. Check the security of the connectors. Any movement will require attention and the connector to be secured.

7.6   Lubricating

7.6.1   Connectors

The Seacon connectors are dry mating and do not require lubrication on the connector pins/sockets.

7.7   Corrosion

The Lodestar 500 housing is manufactured from titanium and is highly resistant to corrosion. Under normal use the housing should not show any signs of corrosion and no maintenance is necessary.

7.8   Recalibration

Lodestar 500 uses rugged and durable high quality inertial sensors of unrivalled and thoroughly field proven reliability: The sensors are used in systems qualified for the most demanding and safety critical applications and are standard fit for use in the main navigation systems of the majority of today's commercial and business aircraft. The sensors are maintenance free.

Lodestar based products do not require re-calibration subsequent to initial factory calibration unless:

- The unit has been subject to excessive shock beyond quoted specification.
- Performance re-verification is requested by the customer.

Performance re-verification is often possible in the field without return to factory; contact Sonardyne Support to enquire.

Section 8 – Firmware Update

8.1   Introduction

The Lodestar firmware can be updated in the field by using the Lodestar PC utility software tool (included with the Lodestar 500). Customers will be informed of any required firmware updates by Sonardyne support.

The Lodestar will accept firmware updates on the CP port only.

To update the firmware using Lodestar PC Utility via a serial connection, follow the procedures in *Sections 8.2.1* and *8.2.2*.

8.2   Updating the Firmware

8.2.1   Pre-requisites

Before upgrading the firmware, ensure you have the following available:

- The new firmware file (IMU.hex)
- A serial connection to the Lodestar on the CP port.
- A Lodestar PC Utility installation.

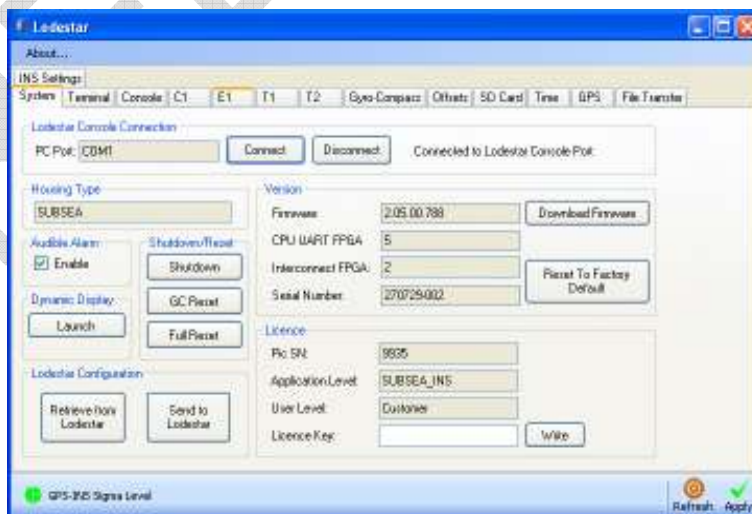### 8.2.2   Update Procedure

1. Connect the Lodestar CP port to the PC either directly via RS232 or through a Navigation Sensor Hub (NSH).

    Note

    📄 **Wait two minutes after applying power to allow the Lodestar 500 to start up.**

2. Click **Start > Programs > Sonardyne > Lodestar > Lodestar** to open the Lodestar PC Utility.
3. Click **Connect** to connect to the Lodestar 500.

4. Once connected click **Retrieve from Lodestar** to store the configuration of the Lodestar as a text file (this is recommended for a backup).

5. Click **Download Firmware**.
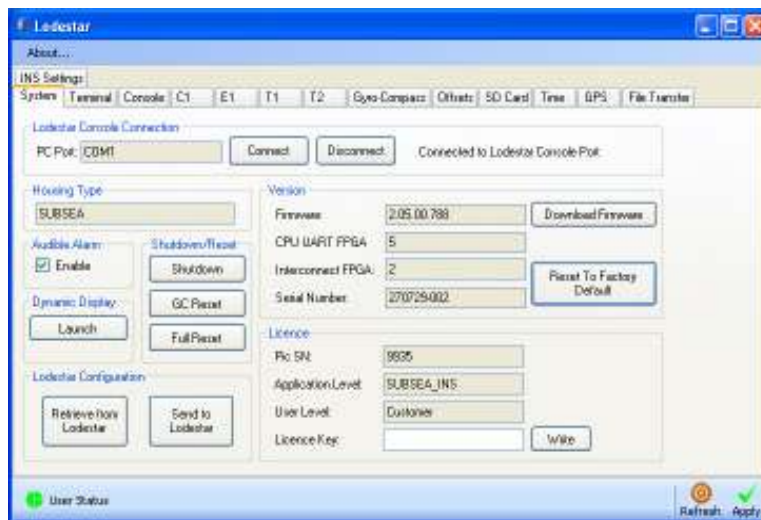
6. Click **Yes** to confirm.
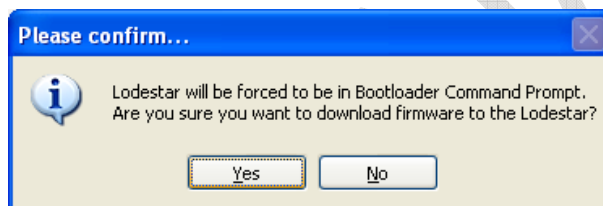
7. Browse to the folder and select the new IMU.HEX file to download (supplied by Sonardyne).
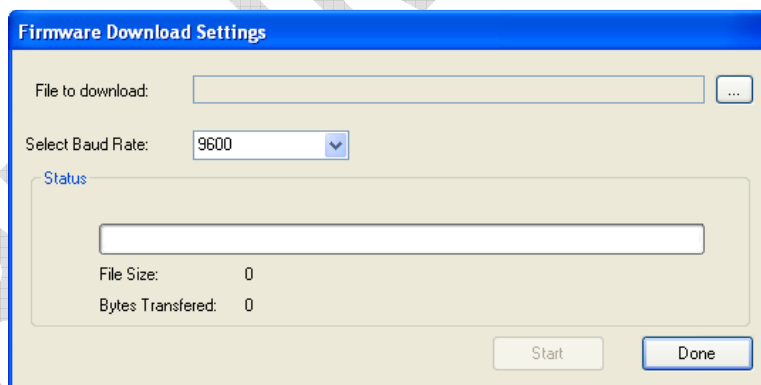
8. A warning will be displayed asking if you are sure that selected file is a Lodestar firmware file.

9. Click **Yes** to continue.

10. Select a **Baud Rate** for the download (Sonardyne recommends **115200** baud for all firmware downloads).
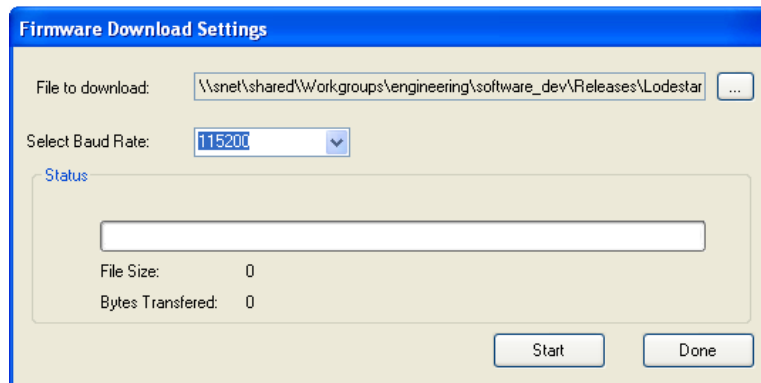
11. Click **Start** to commence the download (at this point the progress bar will show download status; download time at **115200** is less than five minutes).

Note

📄 **Do not interact with the PC while the download is in progress.**
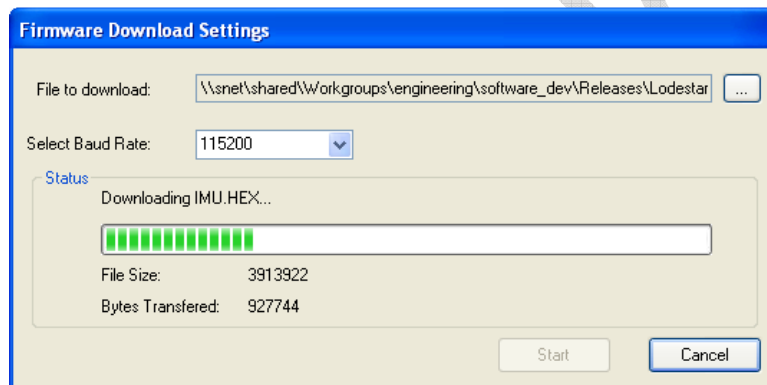
12. Once the download is complete click **Done**.
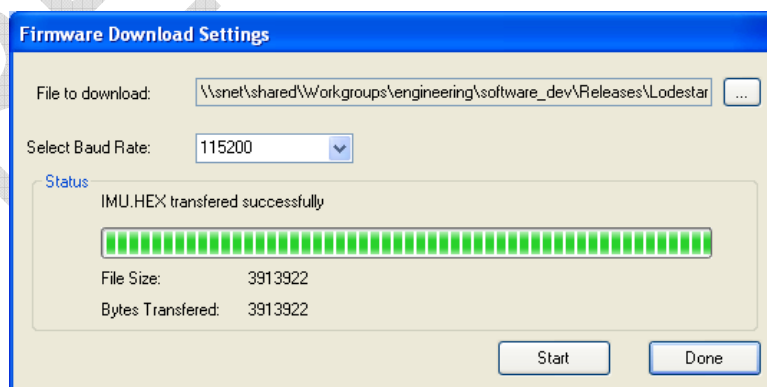
13. At this point the utility will re-boot the Lodestar.
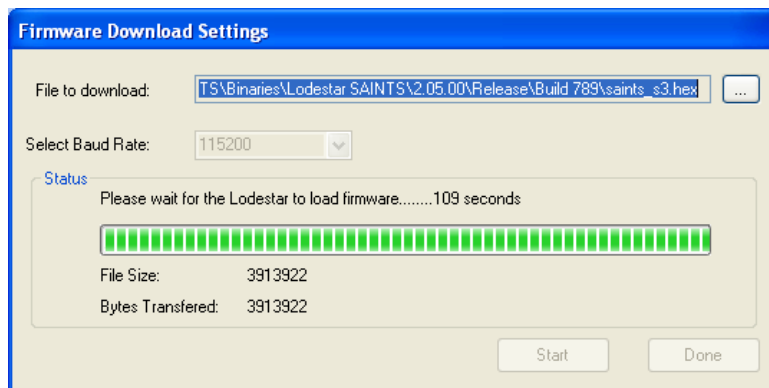
14. Once complete, the Lodestar PC Utility will re-program the Lodestar with the same configuration it had before the update.

Section 9 – Lodestar Messages Specification

9.1 AHRS Messages

Input and output messages supported by the Lodestar for AHRS operation are listed in the Lodestar AHRS Messages manual refer to *UM-8084-109 "Lodestar AHRS Messages".*

9.2 SPRINT INS Operation

In addition to the AHRS messages referenced above, additional Input and Output messages are supported for SPRINT INS Operation.

The additional messages are listed in SPRINT user manual; refer to *UM-8253 "User Manual for SPRINT".*

Section 10 – Troubleshooting

10.1 Introduction

This section provides guidance for troubleshooting and fault identification.

Before calling Sonardyne Support, preliminary checks should first be made on the Lodestar 500, so a full description relating to the problem can be provided.

If technical support from Sonardyne is required, provide information about the Lodestar configuration in use at the time when the problem occurred. You can do this by supplying a copy of the relevant configuration file saved automatically by the Lodestar or SPRINT INS log files; refer to *UM-8084-107 " AHRS Operation Manual"* or *UM-8253 "User Manual for SPRINT"* for more information.

10.2 Lodestar Hardware Test Procedure

Figure 10-1 shows the recommended test procedure to follow if it is suspected that Lodestar 500 has developed a fault.

You can use this test procedure after installation to check the system operates correctly, or if you suspect a fault during normal operation.

Note

📄 **There are no user-serviceable parts inside Lodestar. This Lodestar must only be accessed internally and dismantled by qualified Sonardyne personnel.**

Figure 10-1 Lodestar Hardware Test Procedure
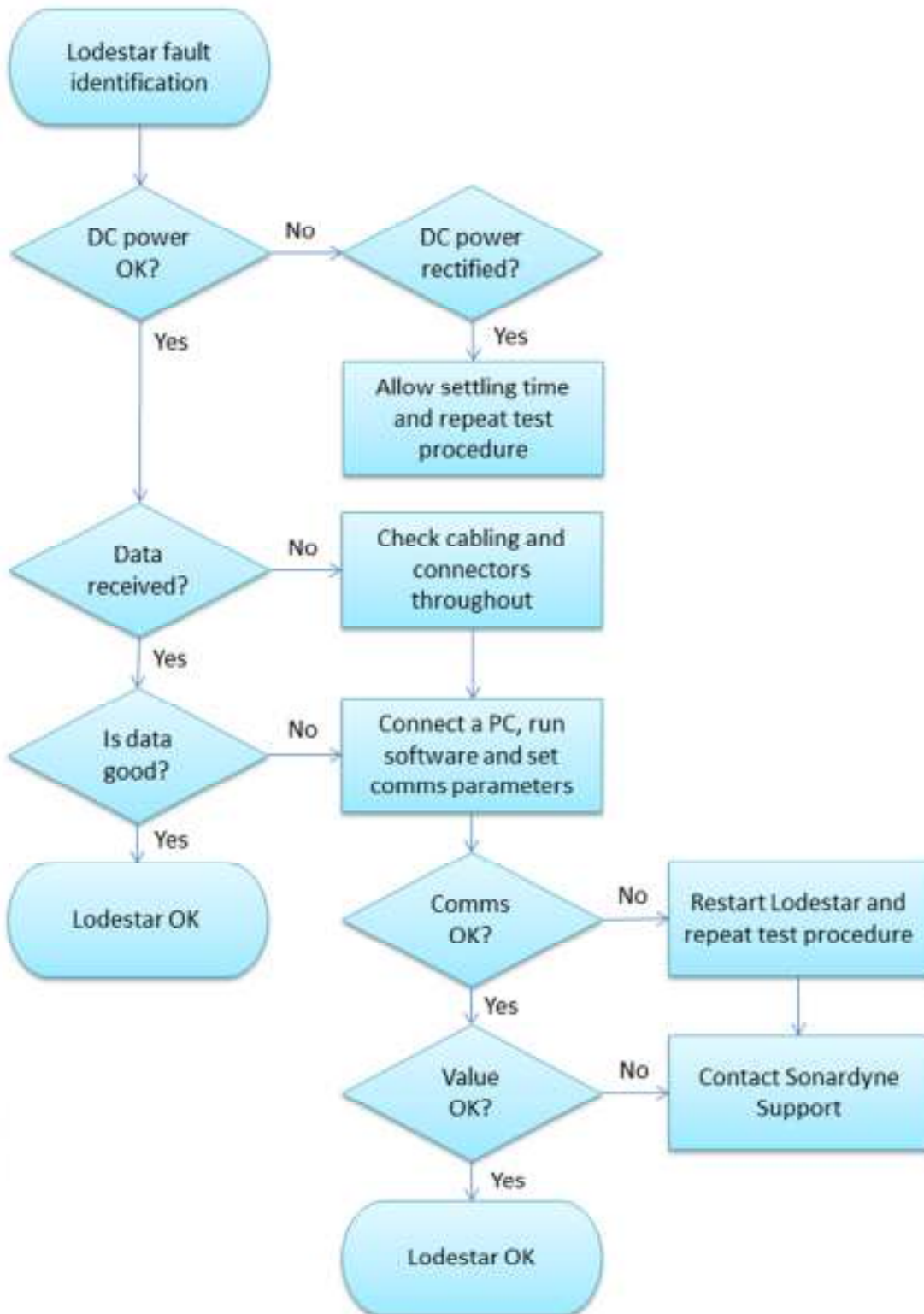
10.3 Recovery Procedures

The following procedures can be followed to recover the Lodestar to a known state in the event of a problem.

10.3.1 Lodestar Hardware Reset

The Lodestar can be commanded to perform a hardware reset if it becomes unresponsive.

To perform a hardware reset you must be connected to the Lodestar serially via the CP port using a terminal package such as HyperTerminal.

Make sure the connection to the Lodestar is 9600 baud and RS232 protocol. If these conditions are met, the Lodestar can be restarted by typing **UNLK**, and then return in the terminal window (note the use of uppercase letters). You may need to type **UNLK** and press return several times.

If the Lodestar is connected via Ethernet to the SPRINT software, a hardware reset can also be performed using the **Reset Lodestar** button on the Lodestar dialog.

10.3.2 Restore Lodestar Factory Settings

Lodestar can be commanded to restore its factory default settings.

If factory settings are restored, all previous user defined settings in Lodestar will be lost. It is recommended a careful note is taken of any required settings before restoring factory settings; refer to *UM-8084-107 "AHRS Operation Manual"* or *UM-8253 "User Manual for SPRINT"* for more information.

The Lodestar PC Utility can be used to restore Lodestar to its default state. This procedure will succeed even if the current baud rate of Lodestar isn't known.

1. Connect the Lodestar CP port to the PC either directly via RS232 or through a Navigation Sensor Hub (NSH).

   Note

   📄 **Wait two minutes after applying power to allow the Seanet Lodestar to start up.**

2. Click **Start > Programs > Sonardyne > Lodestar > Lodestar** to open the Lodestar PC Utility.

3. Click Connect and select the COM port that the Lodestar is connected to.

4. Click **Reset to Factory Default**.
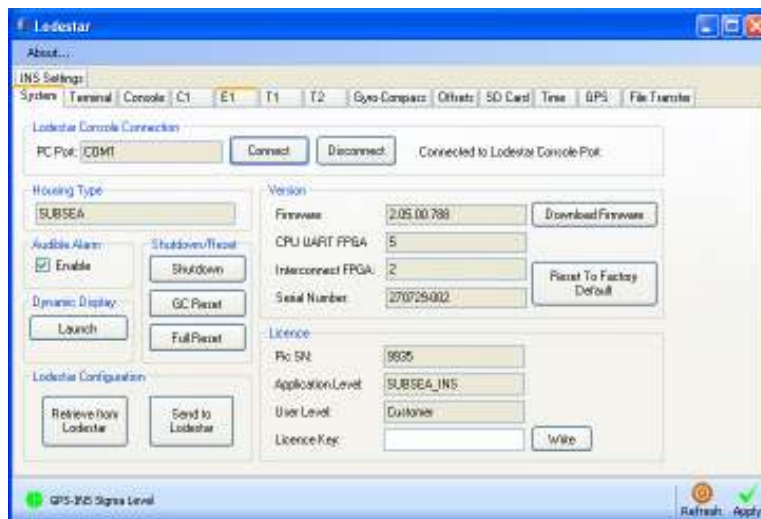
5. Click **Yes** to confirm.
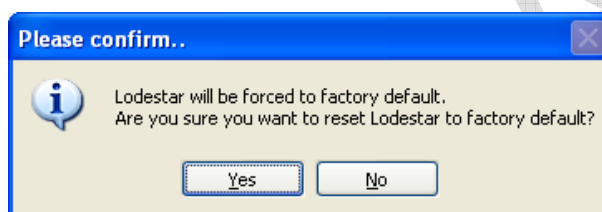
6. The PC Utility will reboot Lodestar and reset it to factory default state. It will then wait for Lodestar to re-boot.

7. After the boot process has completed the Lodestar PC Utility will attempt to connect to Lodestar using factory default settings. If successful the lodestar information will be displayed.

Section 11 – Spares

11.1 Introduction

When ordering spare parts, please provide:

    a)   The part number

    b)   The drawing number (if known)

    c)   The description

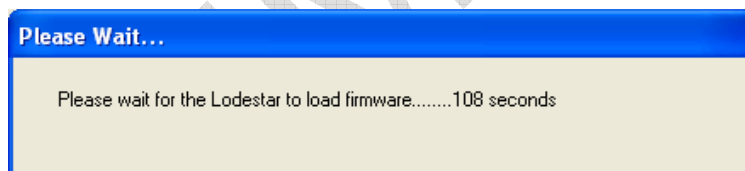Enquiries about, or orders for spare parts should be directed to your local Sonardyne office or agent (see back page for Sonardyne office addresses).

11.2 Lodestar 500 Spares List

Description	Drawing Number	Stock Code
Lodestar Battery	MGL200415s	270-0610
Lodestar Manual CD	8084-245-A1	920-0095
Lodestar Transit Case	PROTECHNIC 84447	790-1139

Section 12 – Technical Specifications

12.1 Technical Drawing

Figure 12-1 Lodestar Outline Dimensions (mm)
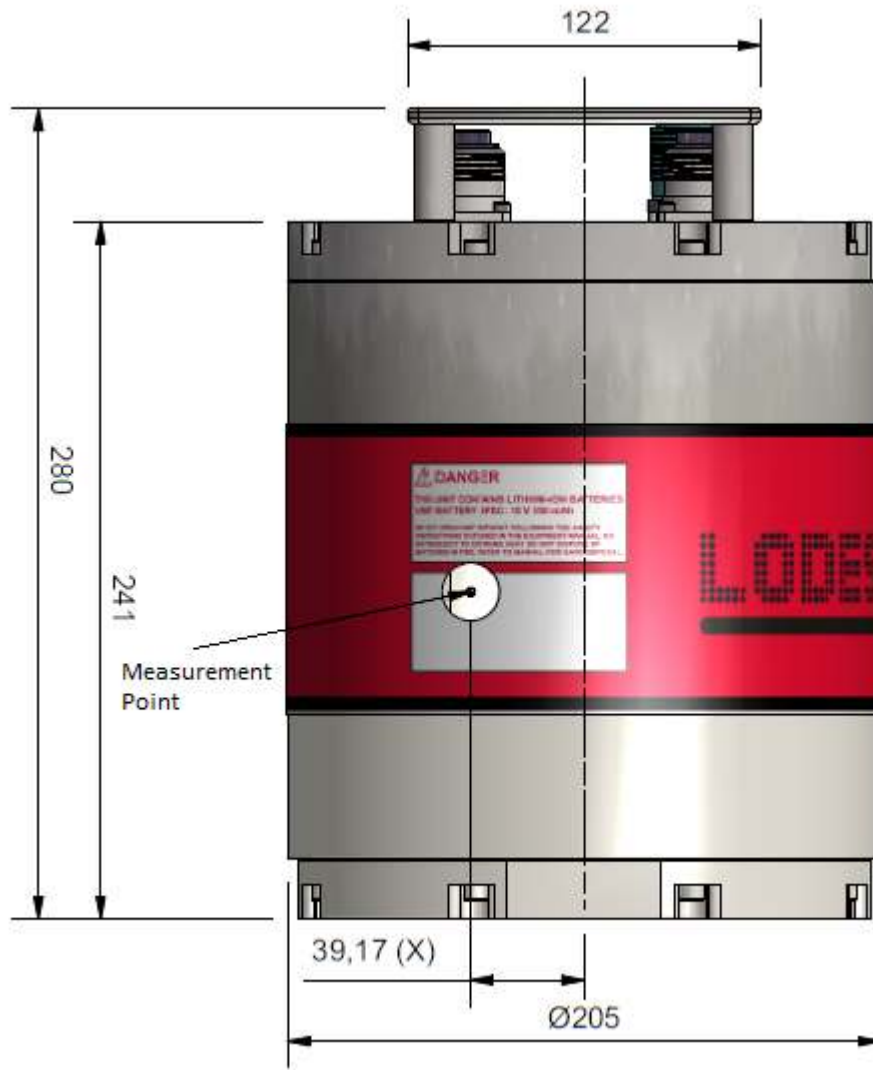
12.2 Specifications

12.2.1 Performance

Parameter	Specification
Heading Accuracy	0.04° to 0.1° Secant latitude RMS
Settling time	Better than 5 minutes
Follow-up speed	>500° per second
Roll and pitch range	-90° to +90° (no physical limit)

Parameter	Specification
Roll and pitch accuracy	0.01°

12.2.2 Electrical

Parameter	Specification
Electrical power requirement	20 VDC to 50 VDC
Power demand	18 watts nominal, 30 watts maximum excluding power pass through
Backup battery type	Lithium-ion rechargeable,
Backup battery support	Up to 5 minutes from a fully charged condition
Data storage	8 GB onboard
Number of digital communication ports	5
Protocol	RS232, RS485 Half and Full Duplex or Ethernet (100 Mbit/s)

12.2.3 Environmental

Parameter	Specification
Ingress	6000 metres depth rated
Operating Temperature	-20°C to 55°C
Storage Temperature	-20°C to 60°C
Operational Shock Rating	10 g, 11 ms half-sine

12.2.4 Mechanical

Parameter	Specification
Housing	Titanium
Size Length x Diameter)	280 x 205 mm
Weight in Air/Water*	22 kg/14 kg

*Estimated Weights

Definitions

Term	Definition
AAINS	Acoustically Aided Navigation System
AC	Alternating Current
Accelerometer	A sensor that measures changes in velocity (acceleration)
AHRS	Attitude and Heading Reference System. An inertial sensor that provides outputs of heading, pitch and roll
DC	Direct Current
FWD	Forward
IMU	Inertial Measurement Unit
Inertial Navigation System (INS)	A navigation aid that uses inertial sensors to continuously calculate the position, orientation and velocity of a moving object
MTBF	Mean Time Before Failure
PC	Personal Computer
RLG	Ring Laser Gyroscope, A sensor that measures rotation
SPRINT	An Acoustically aided inertial navigation system for subsea vehicles. The system extends the operating limits of USBL and improves the operational efficiency of LBL by using sparse arrays
STBD	Starboard

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