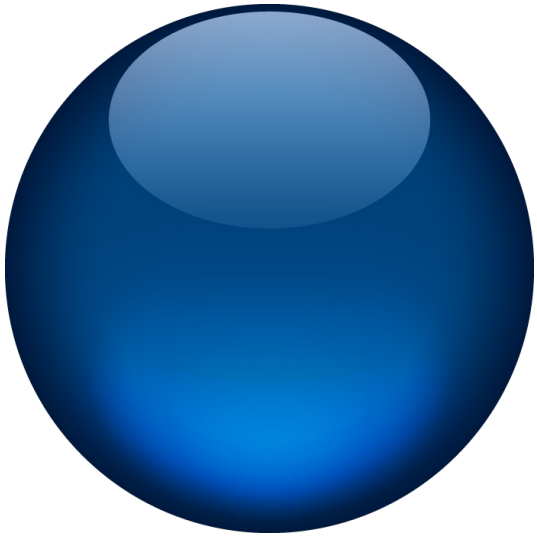


POSIDONIA
ACOUSTIC ANTENNA

User Guide

Revision History

Edition	Date	Comments
G	05/2016	Pack soft 6

Copyright

Disclaimer

iXBlue specifically disclaims all warranties, either express or implied, included but not limited to implied warranties of merchantability and fitness for a particular purpose with respect to this product and documentation. iXBlue reserves the right to revise or make changes or improvements to this product or documentation at any time without notify any person of such revision or improvements.

In no event shall iXBlue be liable for any consequential or incidental damages, including but not limited to loss of business profits or any commercial damages, arising out of the use of this product.

Trademarks

Microsoft, MS-DOS and Windows are registered trademarks of Microsoft Corporation. Intel and Pentium are registered trademarks and Celeron is a trademark of Intel Corporation.

Warranty

iXBlue provides a standard warranty of one (1) year covering this product against any defect in materials or manufacture. The warranty starts from the date of shipment of the product from iXBlue's manufacturing premises to customer's location and its duration is indicated in the certificate of warranty delivered with the product. In the event that a defect in materials or manufacture becomes obvious during the stipulated warranty period, iXBlue will undertake, at its sole discretion, either to repair the defective product, bearing the cost of all parts and labor, or to replace it with an identical product.

In order to avail itself of this warranty, Customer must notify iXBlue of the defect before expiry of the warranty period and take all steps necessary to enable iXBlue to proceed. Customer shall be responsible for the packaging and the shipment of the defective product to the repair center notified by iXBlue, the cost of such shipment being borne by Customer. iXBlue agrees to bear the cost of return freight, based on CPT (Cost Paid To) Customer's airport location, import tax-free.

This warranty shall not be construed as covering defects, malfunctions or damages caused by improper use or inadequate maintenance of the product. Under no circumstances shall iXBlue be due to provide repair or replacement under this warranty in order a) to repair damage caused by work done by any person not representing iXBlue for the installation, repair or maintenance of the product ; b) to repair damage caused by improper use or connection to incompatible equipment, and specifically, the opening of the housing of the equipment under warranty shall cause the warranty to be automatically cancelled ; c) to maintain any product that has been modified or integrated into a larger configuration, if such modification or integration increases the duration or difficulty of the maintenance of said product.

This warranty covers the product hereunder and is provided by iXBlue in place of all and any other warranty whether expressed or implied. iXBlue does not guarantee the suitability of the product under warranty for sale or any specific use. iXBlue's liability is limited to the repair or replacement of defective products, this being the sole remedy open to Customer in the event the warranty becomes applicable. iXBlue cannot be held liable for indirect, special, subsequent or consequential damage, irrespective of whether iXBlue has or has not received prior notification of the risk of occurrence of such damage.

Export Regulation

This export regulation concerns the POSIDONIA acoustic antenna.

This product is classified as a dual-use good: it has been developed for non-military use, but could be used for military applications.

As a consequence, this product is subject to dual-use goods export control procedures:

- iXBlue can deliver this product freely to France or any other country of the European Union;
- iXBlue can export this product under its own Community General Export Authorization EU 001 to the following countries: Australia, Canada, USA, Japan, New-Zealand, Norway and Switzerland;
- iXBlue can also export this product to other countries but only through the issuance of an individual export license by the French authorities.

Once in its country of first destination:

- From a country member of European Union, this product is free of movement (travel) as long as it remains within the European Union;
- From a country member of European Union, this product can only be re-exported to a non European Union member country under the dual-use goods export control procedures set forth by the national authorities;
- From another country, this product can only be re-exported under both the conditions of the original export license from France (depending on its type and content) and the dual-use goods export control procedures set forth by the national authorities.

If an individual export license has to be issued by the French authorities, iXBlue requires you to provide as needed a description of your usual activity (and the one of the end-user if different) and the end-user to fill out an end-user certificate which includes:

- The description of the intended application of the product
- A commitment not to re-export the product (without applying for an export license to the competent national authorities as set above).

This product cannot be exported or re-exported to Cuba, Syria, North Korea, Libya, Sudan and Iran.

Text Usage

bold	Bold text is used for items you must select or click in the software. It is also used for the field names used into the dialog box.
`Courier`	Text in this font denotes text or characters that you should enter from the keyboard, the proper names of disk Drives, paths, directories, programs, functions, filenames and extensions.
italic	Italic text is the result of an action in the procedures.

Icons

The **Note** icon indicates that the following information is of interest to the operator and should be read.

The **Caution** icon indicates that the following information should be read to forbid or prevent product damage.

The **Warning** icon indicates that possible personal injury or death could result from failure to follow the provided recommendation.

Overview of the POSIDONIA Acoustic Antenna User Guide

This document is the User Guide for POSIDONIA Acoustic Antenna. It must be read and understood prior to using it.

The manufacturer shall in no case be held liable for any application or use that does not comply with the stipulations in this guide.

The POSIDONIA Antenna User Guide is divided into six parts:

- **Part 1: Introduction** – This section gives a general overview of the POSIDONIA Antenna, the operating principles and some application examples.
- **Part 2: Specifications** – This section lists mechanical, electrical and acoustic specifications of the POSIDONIA Antenna
- **Part 3: Installing the POSIDONIA Antenna** – This section helps you to install the POSIDONIA Antenna.
- **Part 4**: **Calibrating the POSIDONIA Antenna** – This part is devoted to the calibration of the acoustic antenna POSIDONIA. This calibration ensures the best performance of the system under operation.
- **Part 5: Operating the POSIDONIA Antenna** – This part describes the operation of the POSIDONIA Antenna.
- **Part 6: Preventive Maintenance** – This part lists all the preventive maintenance operations that you can apply on the POSIDONIA Antenna.

Abbreviations and Acronyms

AHRS	Attitude and Heading Reference System
GPS	Global Positioning System
MFSK	Multiple Frequency Shift Keying
ROV	Remote Operated Vehicle
SIN	Spectral Isotropic Noise
USBL	Ultra Short Baseline

Table of Contents

1 INTRODUCTION 9
1.1 USBL SYSTEM 9
1.2 POSIDONIA ANTENNA 10
2 SPECIFICATIONS 11
2.1 ACOUSTIC SPECIFICATIONS 11
2.1.1 Acoustic reception modules 11
2.1.2 Acoustic transmission module 11
2.1.3 Preamplification 11
2.2 MECHANICAL SPECIFICATIONS 12
2.2.1 Antenna 12
2.2.2 Cable 13
3 INSTALLING THE POSIDONIA ANTENNA 14
3.1 SYSTEM DELIVERY 14
3.2 STORING THE ANTENNA 15
3.3 HANDLING THE ANTENNA 15
3.4 ARRAY POSITION 15
3.4.1 Deployable Array Requirements 17
3.4.2 Flush Array Requirements 17
3.5 INSTALLING THE CABLE 19
4 CALIBRATING THE POSIDONIA ANTENNA 20
4.1 PURPOSE OF THE CALIBRATION 20
4.2 USBLCAL SOFTWARE 22
4.2.1 Installing USBLCal 22
4.2.2 Overview of USBLCal 22
4.3 CALIBRATION PROCEDURE 23
4.3.1 Mooring Structure 23
4.3.2 Sailing in 8-Shape Pattern 24
4.3.3 Computing Offsets 25
4.3.4 Validating a Calibration 28
5 OPERATING THE POSIDONIA ANTENNA 30
6 PREVENTIVE MAINTENANCE 31
IXBLUE CONTACT - SUPPORT 37
IXBLUE CONTACT - SALES 37
APPENDICES 39
A CAGE ANTENNA 39
B FLUSH ANTENNA 40

1 INTRODUCTION

1.1 USBL System

The POSIDONIA antenna is used by a USBL positioning system to determine the position of one or more underwater objects or vehicles that can maneuver at depths up to 6000 meters. The system is based on a bi-directional exchange of acoustic signals between one or several acoustic transponders and a fixed acoustic array. These acoustic transponders can be fixed or mounted on a ROV or a tow fish, see Figure 1.

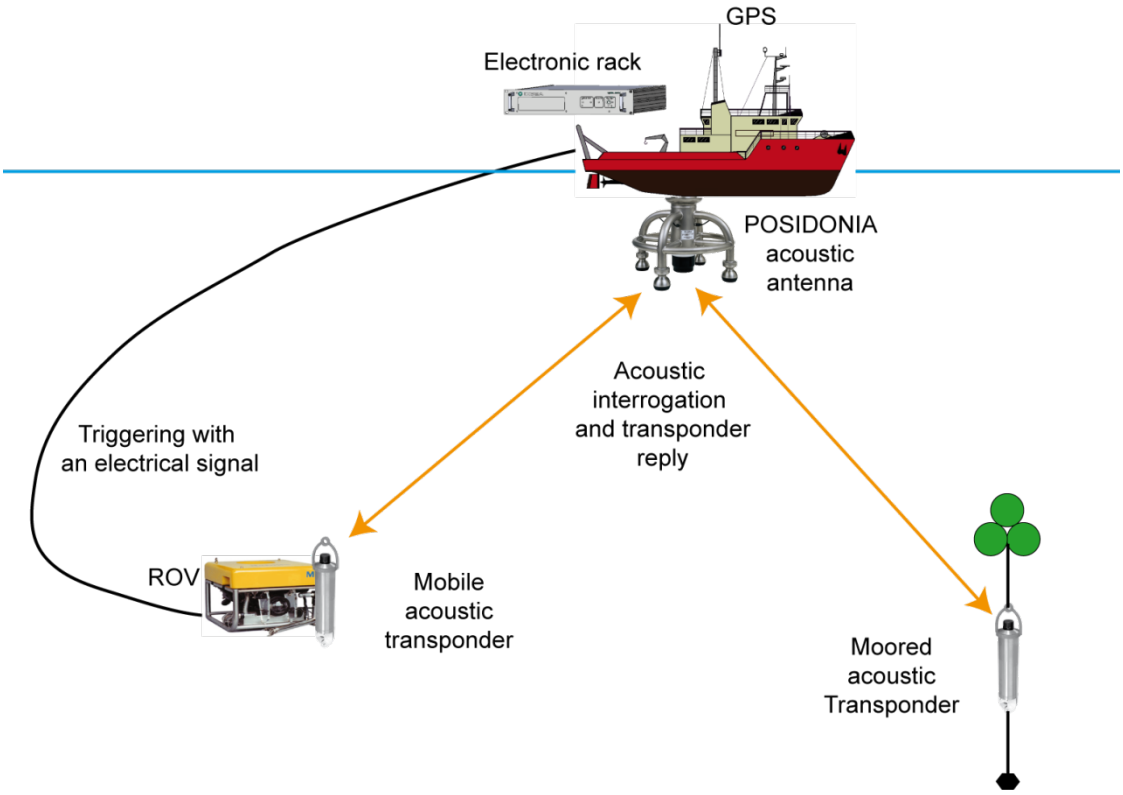


Figure 1 – USBL deep water positioning system

1.2 POSIDONIA Antenna

The acoustic array is composed of two ultra short baselines and is mounted on the ship hull. It ensures the emission of the acoustic triggering signal to the transponder and the reception of the transponder reply. This reply is filtered and amplified, and transmitted to the processing unit.

Two Versions

The acoustic array is available in two versions seen in Figure 2:

- The **Flush** version
- The **Deployable** version

Figure 2 - POSIDONIA arrays: deployable and flush versions and cable

Flush Array

The flush version is recommended for a fixed installation mounted on the ship hull, i.e. when the displacement of the array is never necessary and when the ship hull, the array location, and the angular field required for the operation are compatible. No hoisting device is however necessary and high-speed transit operations can be carried out without taking more precautions than those taken with a conventional fixed array of an echo sounding device for example.

Deployable Array

The deployable version is more intended for a mobile installation and/or when a well type installation is desired or essential. In this case, this installation must be combined with an additional hoisting system, a side pole or a lockable moon pool structure. The deployable version has an operating field below the ship slightly greater than that of the flush one. It must imperatively be hoisted before high-speed transit operations are carried out.

2 SPECIFICATIONS

2.1 Acoustic Specifications

2.1.1 ACOUSTIC RECEPTION MODULES

Parameter	Deployable Antenna	Flush Antenna
Reception Sensitivity (OCV)	-195 dB Vrms / µPa ± 3 dB	-195 dB Vrms / µPa ± 3 dB
Central frequency	16 kHz	16 kHz
Bandwidth	3 kHz	3 kHz
Beam aperture per channel ($2\theta_{-xdB}$ at 16 kHz)	–3 dB: 65° ± 5° –10 dB: 140°	–3 dB: 120° ± 5° –10 dB: 140°
Acoustic accuracy at 1 σ	60° cone: ± 0.3°	60° cone: ± 0.3°

2.1.2 ACOUSTIC TRANSMISSION MODULE

Parameter	Deployable Antenna	Flush Antenna
Transmit Sensitivity (TVR)	>138 µPa / Vrms @ 1 m	>138 µPa / Vrms @ 1 m
Central frequency	12 kHz	12 kHz
Bandwidth	8 kHz (at -3 dB) à 16 kHz	8 kHz (at -3 dB) à 16 kHz
Channels Number	16 with 500Hz steps	16 with 500Hz steps
Acoustic power, beam axis	>188 dB ref. 1 µPa @ 1m	>188 dB ref. 1 µPa @ 1m
Interrogating pulse	10 ms tonal, 500 Hz steps	10 ms tonal, 500 kHz steps
Telecommand	8x10 ms FSK2 Idle time 90 ms	8x10 ms FSK2 Idle time 90 ms
Beam aperture (8 to 14 kHz)	>60° ($2\theta_{-3dB}$) SL >188dB µPa @ 1m from 8.5 to 14 kHz	>60° ($2\theta_{-3dB}$) SL >188dB µPa @ 1m from 8.5 to 14 kHz

2.1.3 PREAMPLIFICATION

Parameter	Deployable Antenna	Flush Antenna
Variable gain	0 to 80 dB	0 to 80 dB
Central frequency	16 kHz	16 kHz
Bandwidth	4 kHz ± 0.5 kHz at -3 dB	4 kHz ± 0.5 kHz at -3 dB
Filter stiffness	24 dB/octave	24 dB/octave
Gain dispersion	1 dB	1 dB
Phase dispersion	1°	1°

2.2 Mechanical Specifications

2.2.1 ANTENNA

Table 1 – Mechanical specifications of the antennas

Parameters	Deployable Antenna	Flush Antenna
Diameter (mm)	580	800
Height (mm)	410	245
Weight in air (kg)	34	180
Weight under water (kg)	25	150

Under no circumstances the deployable array should rest or stand on the lower face of the acoustic transducers or transmitter.

During the removal or the installation, the array must be equipped with its handling tool to protect the slightly protruding acoustic modules from the mechanical structure.

Maximum speed with deployed cage and flush antenna is **12 knots** (mechanical limit).

Figure 3 - Flush acoustic unit

Figure 4 – Flush unit with its handling tool

Figure 5 - Deployable acoustic unit

2.2.2 CABLE

The characteristics of the POSIDONIA cable (see Figure 6) are the following:

Table 2 – Mechanical specifications of the cable

Length (m)	50 (default)
Cable diameter (mm)	26 +/- 0.5
Plug maximum diameter (mm)	63
Plug length (mm)	305
Minimum bending radius (mm)	156

Figure 6 – POSIDONIA cable

3 INSTALLING THE POSIDONIA ANTENNA

3.1 System Delivery

You have just received your equipment in protective transport boxes. Before starting the installation, **check the contents of the pack and the equipment immediately on receipt of your POSIDONIA acoustic antenna**. Specifically, you should check that all items are present on delivery and that none has sustained damage.

For that, you will find in the shipping case a packing-list detailing all the shipped items. This packing list had been completed and checked for by iXBlue shortly before shipment.

On receipt of the equipment, its overall condition should be checked and iXBlue informed of any damage suffered during the loading operations.

It is highly recommended to contact the insurance company in case damage is found.

Check that the shock label of every parcel is still white.

Figure 7 – POSIDONIA deployable antenna in its box

3.2 Storing the Antenna

After the equipment has been inspected for transport damage, the equipment must be placed back in its transport box (see Figure 7) and stored in a dry area until it is installed. The equipment must be embarked in its packaging.

Bad storage conditions may void certain clauses of the guarantee.

The limits of storage temperature are the following:

Table 3 – Limits of storage temperature

	Min T°	Max T°
Acoustic Array	-20°C	+70°C

3.3 Handling the Antenna

After unpacking and during installation, extreme care must be taken to protect the equipment against water, dust, paint splashes and electromagnetic fields (in particular in case of arc welding).

3.4 Array Position

Each installation is likely to be unique and characterized by its own specific set of difficulties and special requirements. The guidance hereafter can therefore only be of a generalized nature.
Contact iXBlue support for advice if your configuration raises some specific difficulties.

Ship's Hull

It is recommended to install the acoustic array in the front one-third part of the ship, as far as possible from any water discharge system. No device must protrude from the ship hull within a minimum 2 meters radius from the center of the array. The exact position of the acoustic base is determined by the shipyard depending on the beaching plane of the ship. When the ship is in a dry dock, the acoustic base must be between two keel blocks.

Reference Point

Record the exact position of the X, Y and Z array with respect to a reference point of the ship with an accuracy greater than 0.5 m (< 0.5 m).

Centering Pin

The orientation and location of the array is ensured by means of

- One centering pin (8g6 diameter) for the deployable array (see Figure 8)
- Two centering 38 mm pins (30g6 front and 26g6 rear) for the flush array (see Figure 9)

Hydrophone H1 must be directed towards the ship's bow.

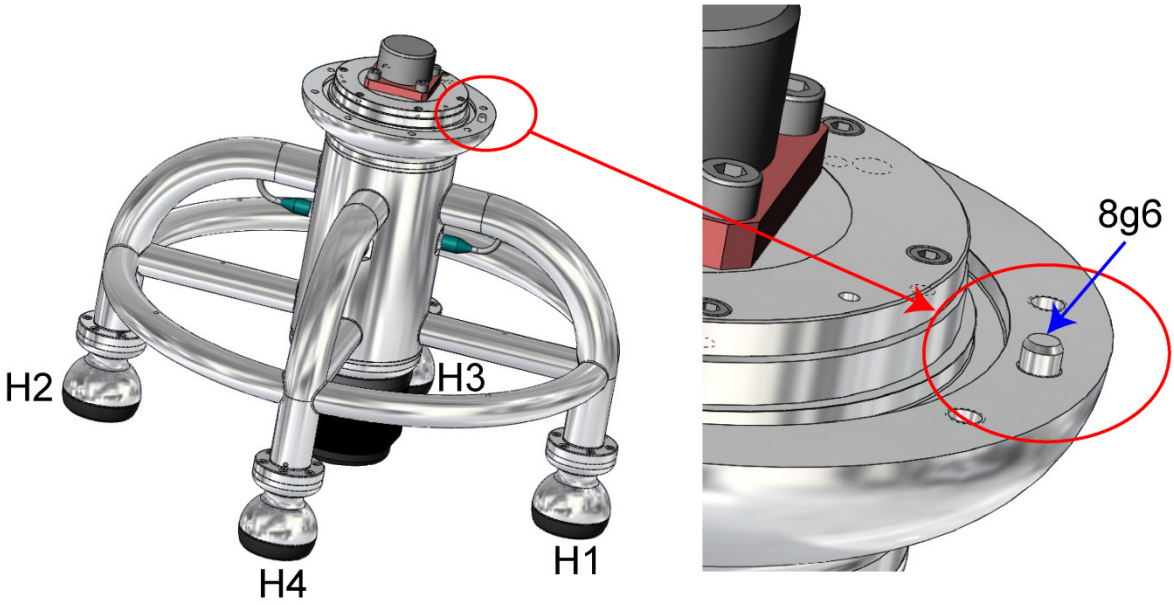


Figure 8 – Centering pin of the deployable antenna

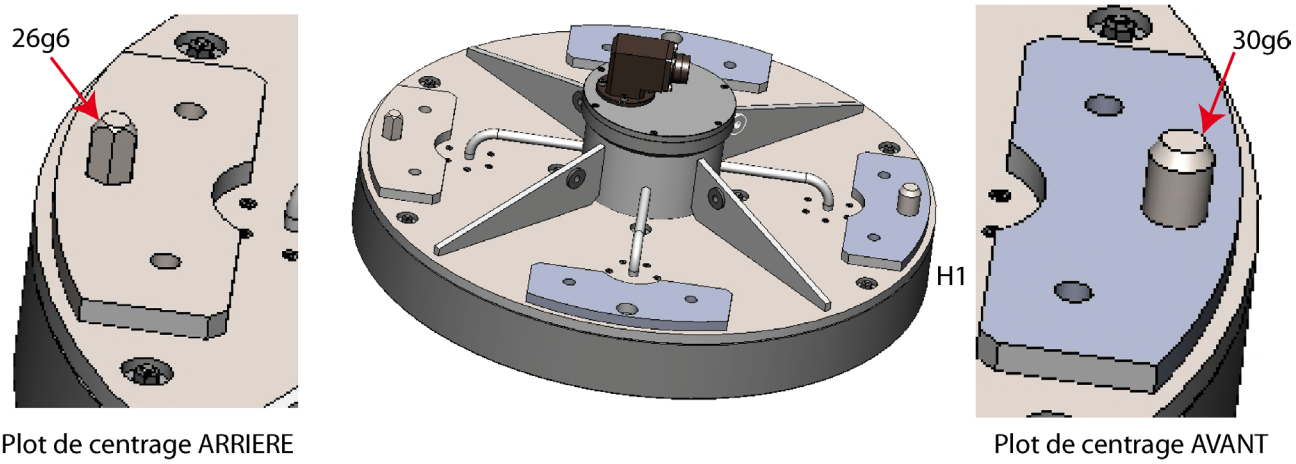


Figure 9 – Front and rear centering pins of the flush antenna

Cathodic protection

Since the array is made from stainless steel, provision must be made near the array for the installation of sacrificial anodes.

The POSIDONIA acoustic array contains electronic components which are sensitive to electromagnetic radiation.

Before any arc welding operation is performed near the array, the two ends of the array cable MUST BE disconnected (array and computer unit) and blanked off using metal plugs.

3.4.1 DEPLOYABLE ARRAY REQUIREMENTS

In the following table are listed the different requirements for the deployable antenna:

Table 4 – Installation requirements for the deployable antenna

Parameter	Value	Tolerance	Remarks
Attitude correction	Horizontal	± 2°	
Angular position	// to the ship axis	± 2°	
Mounting hardware	Tightening torque: 22 NM	± 1 Nm	Use eight stainless steel 8 mm screws fitted with lock washers
Cable			Depends on the hoisting system.
O-ring	D142.24 x 5.33 NBR 70 TR1		

3.4.2 FLUSH ARRAY REQUIREMENTS

In the following table are listed the requirements for the flush antenna:

Table 5 - Installation requirements for the flush antenna

Parameter	Value	Tolerance	Remarks
Interior well diameter	820 mm	+/- 10 mm	
Positioning in height	Flush	- 0, +3 mm	
Attitude correction	Horizontal	+/- 2°	
Mounting plane	Flat	+/- 0.1 mm	
Angular position	// to the ship axis	+/- 2°	
Mounting hardware	Tightening torque: 300 NM	± 10 Nm	Use eight stainless steel 316L M20 screws fitted with lock washers
Accessibility			Make sure to keep a sufficiently large compartment at the rear of the array to allow installation, inspection of the connector and cable as well as inspection and replacement of the zinc anodes.
Cable			The cable must be routed up through a 70 mm minimum welded steel tube, tight up to the ship water line.
Vent orifice			A vent tube or a vent valve must be installed at the highest point of the array compartment to vent air bubbles. The cable routing and venting functions may be combined in one tube.

The mechanical installation of the flush array is described on Figure 10 and Figure 11.

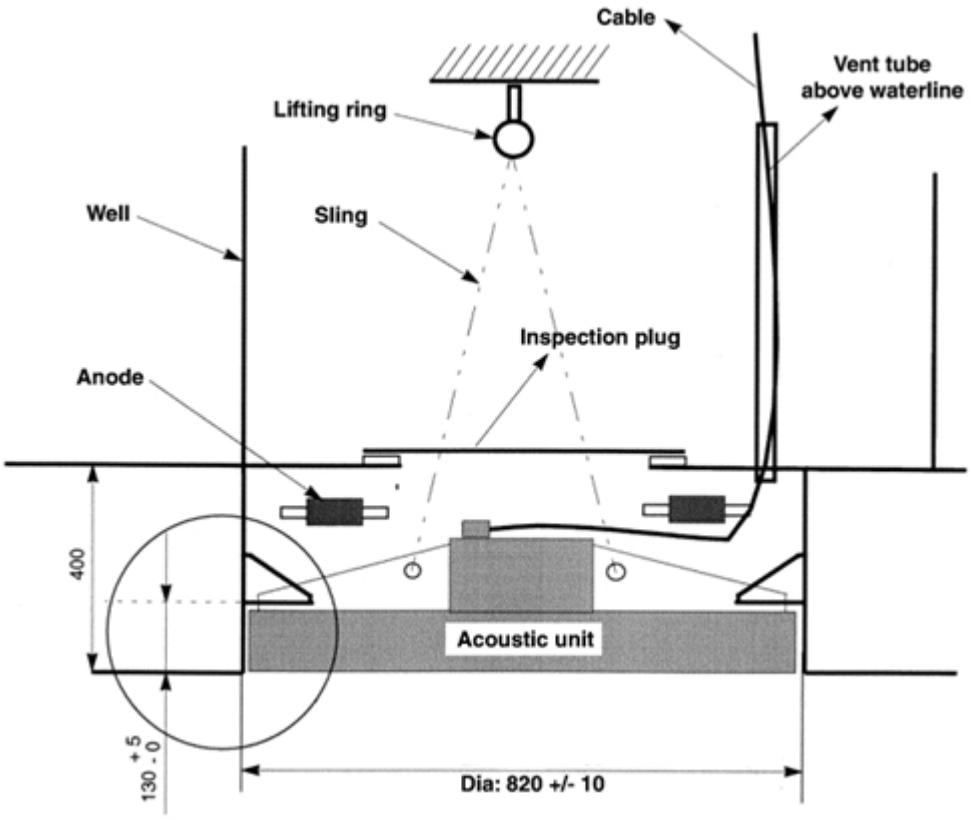


Figure 10 - Flush array installation principle

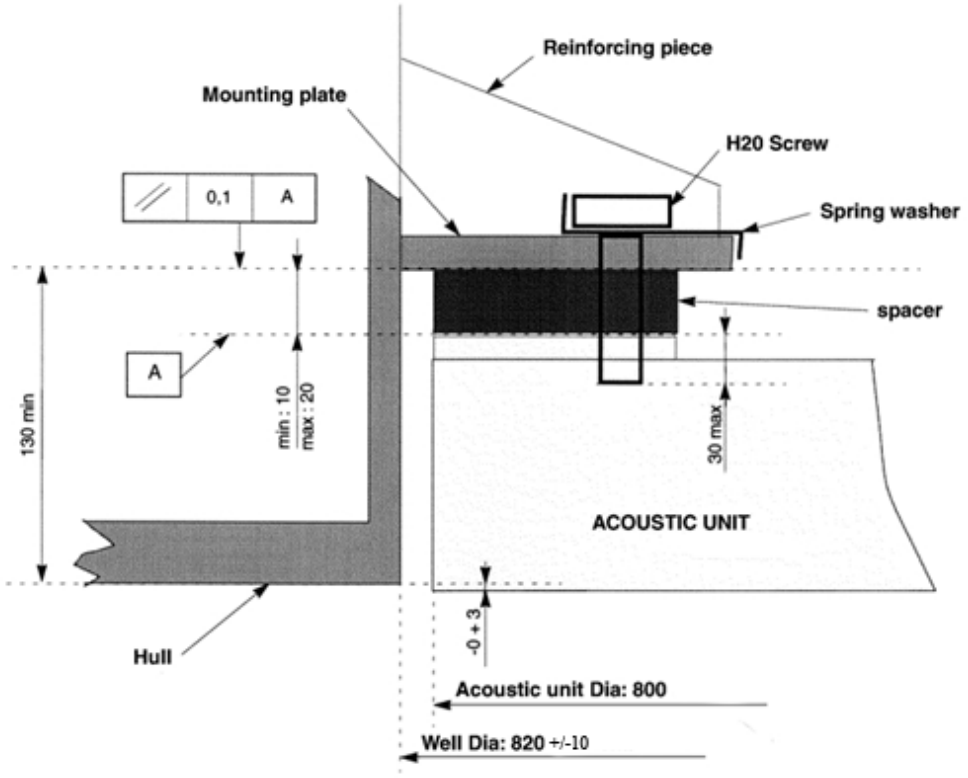


Figure 11 - Flush array mounting

3.5 Installing the Cable

When the cable route is selected, the routing rules applicable between cable routes must be observed. The connection cable of the POSIDONIA system array is classified under the category SOUNDER or ANALOG SUSCEPTIBLE cables (cable lengths > 10 m):

- Spacing between the routes of electrical energy and susceptible cables
  - When the routes of the electrical energy and susceptible cables follow parallel paths, the susceptible cable routes must be isolated. In addition, the susceptible cable routes must also be separated by a minimum distance of 30 cm from any fluorescent tubes. Exceptionally, these two rules may be disregarded. The minimum distance must not exceed 1 m.
  - If the cables must be routed across each other, the routes must cross at an angle as close as possible to 90°.
  - If the cables are separated by a metal partition, there is no reason for this rule to exist.
- Separation between susceptible cables:
  - The digital and analog susceptible cables may be routed through the same cable route. A minimum distance of 10 cm must be guaranteed between these 2 types of cables.
  - If these cables are separated by a metal partition, there is no reason for this rule to exist. The above distance may be reduced in the case of short cable lengths (less than 1 m) in particular for access to deck and bulkhead passages.
- **Sounder cables**

  As far as possible, these cables must be routed separately from the electrical energy cables and the susceptible cables.

4 CALIBRATING THE POSIDONIA ANTENNA

4.1 Purpose of the Calibration

Why calibrate?

To accurately calculate the position of the transponder, you have to know the exact position (linear offsets) of the acoustic antenna compared with the GPS antenna (defined positioning source) and the orientation (angular offsets) of the acoustic antenna compared with the reference point from the boat's axes. The calibration allows the computation of the angular offsets by tracking a fixed transponder.

Linear Offsets

The linear offsets can be easily measured and can be directly entered in the interface. The accuracy at which you should compute these values depends of the quality of the GPS that you are using. The Table 6 details a rough estimate of the accuracy depending of the type of GPS used.

Table 6 – Accuracy of the linear offsets measurements

	Accuracy of the position (m)	Measurement Accuracy (m)
Standard GPS	3	0.2
Differential GPS	1	0.1
RTK corrected GPS	0.03	0.01

Angular Offsets

The angular offsets exist as the antenna is never perfectly aligned with the vessel's axes due to the imperfect installation of the antenna on the vessel. See Figure 12. This is difficult to measure on site. Calibration enables you to calculate the angular offsets of the antenna in the vessel's system of reference.

When should calibration be carried out?

POSIDONIA system must be calibrated when the antenna is installed for the first time and also each time the acoustic antenna position is changed compared with the vertical and horizontal reference units, for example, after dry dock (where the hull might have been put out of shape) or after the dismantling of the antenna. In the case where the antenna is installed on a removable pole, it might be necessary to perform a calibration process after every deployment if the repositioning is not repeatable.

How to calibrate?

To perform a complete system calibration, you need to operate the complete positioning system and its external sensors (POSIDONIA acoustic antenna, cable, USBL-BOX electronic rack, GPS and motion sensor) to record the data of a fixed transponder (attached to a mooring). The calibration procedure involves maneuvering the vessel to perform an "8-shape" navigation pattern around the stationary transponder. While doing this, you compute the position of the transponder "seen" from every possible angle. The USBLCal software processes the data input in the system and computes the three angular offsets of the antenna as well as the coordinates of the hydrophones in the ship reference frame. These coordinates are displayed under the form of a 3x3 array.

After the input into the system of the coordinates of the hydrophones that were computed during the first navigation, a second "eight" navigation pattern allows their validation.

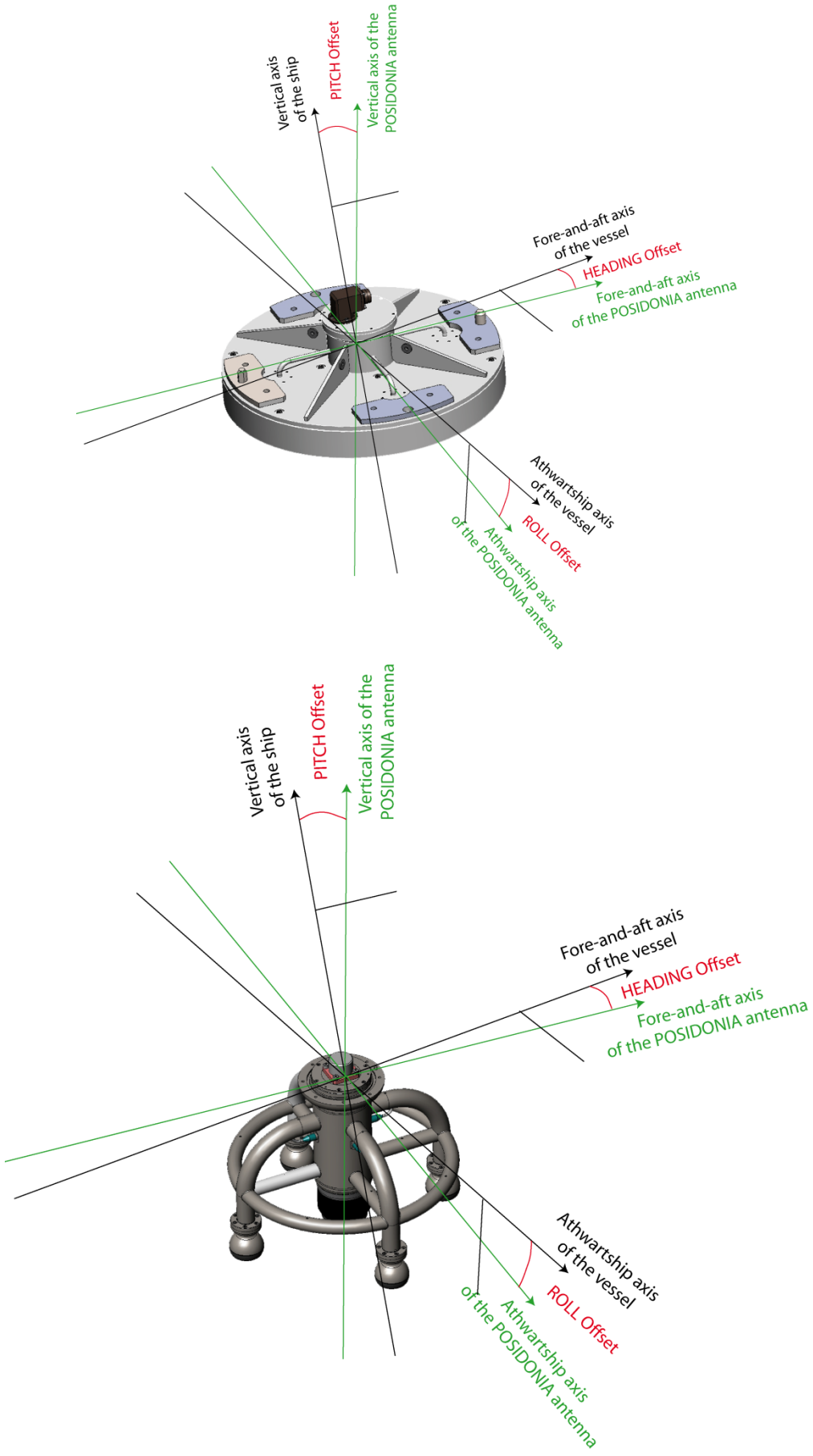


Figure 12 – The three angular offsets to compute during the calibration

4.2 USBLCal Software

4.2.1 INSTALLING USBLCAL

The USBLCal software is to be found on the CDROM which is delivered with the USBL-BOX. Installation commences automatically as soon as the CD is placed in the CD-drive of the user workstation.

The workstation should be equipped of the operating system Windows XP, Vista or Seven.

Make sure that you uninstall any previous version of USBLCal before trying to install the new version.

4.2.2 OVERVIEW OF USBLCAL

The USBLCal software calculates the angular offsets of the antenna set up. The main window is shown in Figure 13. This window is made of the following areas:

- **File**: opening of data files, choice of the language and display of the current file
- **Graphic**: choice to display in 3D, to hide the ship track, to zoom in and zoom out
- **Transponder**: selection of the transponder and of the radius of the area
- **Calibration**: calculation and display of calibration offsets
- **Planning**: computation of the geometry of the calibration sailing track
- Display: display of vessel track, transponder position before and after calibration

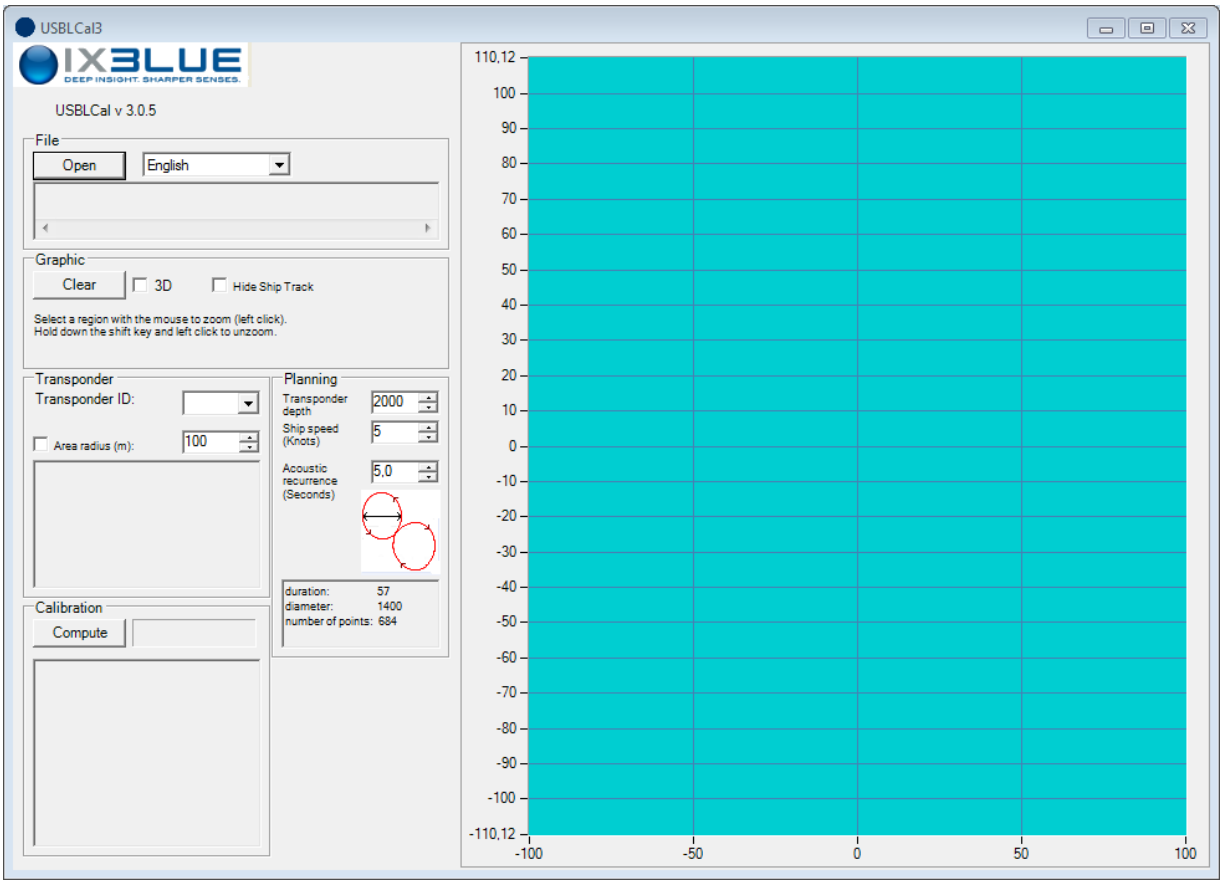


Figure 13 – Main window of the calibration software USBLCal

4.3 Calibration Procedure

Calibration consists of the following steps:

- Deploying the transponder mooring
- Sailing the first “8-shape” navigation pattern and data acquisition
- Loading the data in the USBLCal software and computing the offsets that must be residual
- Entering the offsets into the web user interface, see USBL-BOX User Guide
- Sailing a second “8-shape” navigation pattern and acquiring data
- Loading the data in the USBLCal software and computing once more the offsets that must be very small (same order of magnitude than the accuracy of the heading and vertical reference unit)

4.3.1 MOORING STRUCTURE

Transponder mooring is carried out by following the structure explained in Figure 14.

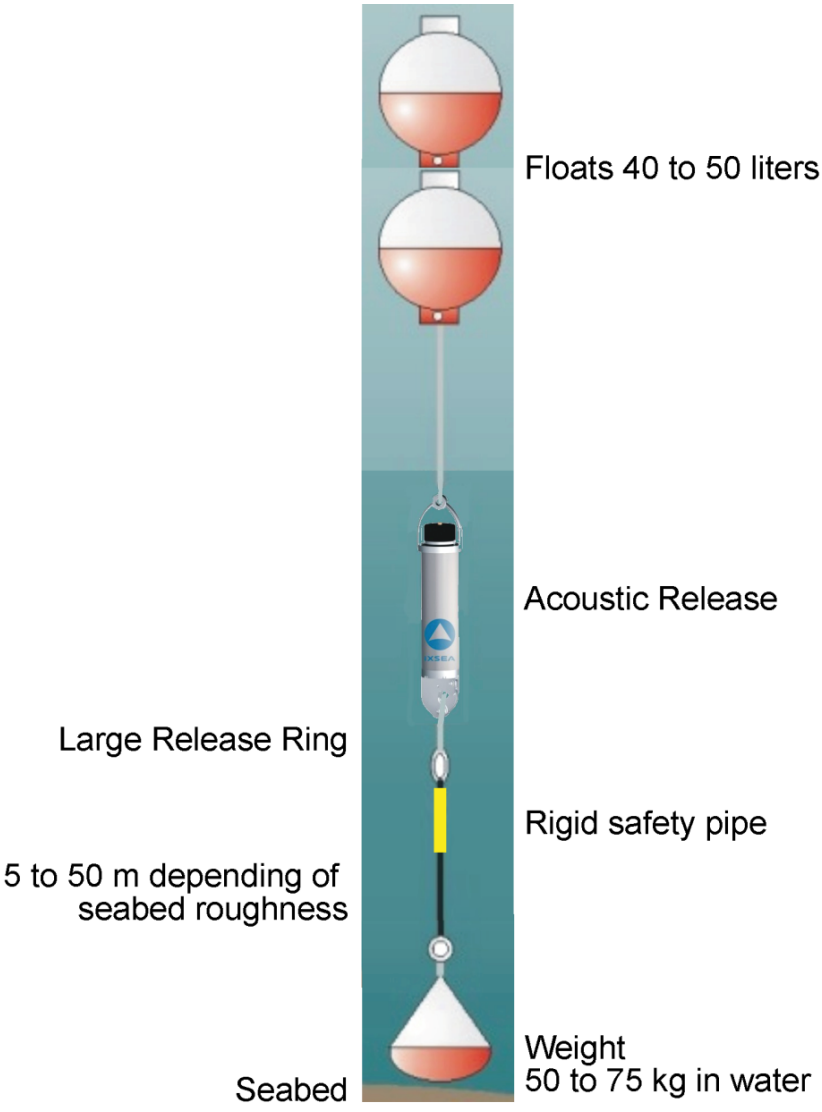


Figure 14 – Mooring structure

4.3.2 SAILING IN 8-SHAPE PATTERN

In order to perform the calibration, operate the USBL-BOX and POSIDONIA antenna system to collect the data. Please refer to the USBL-BOX user guide in order to have a complete description of the procedure.

"8-shape" navigation pattern is carried out by following a particular radius of curvature depending on the transponder depth. The depth must be between 1000 and 2000 m. For a depth between these values, you just have to interpolate between the two values that follows or you may use the USBLCal **Planning** tool to determine the duration, diameter and number of points for the calibration.

- 700 m of diameter of curvature with a depth of 1,000 m
- 1,400 m of diameter of curvature with a depth of 2,000 m

Once the radius of curvature has been estimated, data acquisition is carried out in a standard way through the USBL-BOX Web-based user interface. Please refer to the USBL-BOX user guide for detailed description of the different steps of the following procedure:

Procedure

Step	Action
1.	Configure (or check if it has already been done) the USBL-BOX network interface.
2.	Configure the USBL-BOX input and output if there are new sensors during this mission.
3.	Configure the synchronization mode and its associated parameters.
4.	Configure the transponders which are going to be positioned during the mission.
5.	Enter the sound velocity profile.
6.	Configure the data acquisition. Click on **Start Logging** if you intend to log as soon as you will start tracking in Step 7. You can also start logging after having started the tracking depending if you are on site or not.
7.	Click on **Start Tracking**. *The data acquisition window opens and data collection starts.*
8.	Open the navigation window in order to check the acquired data.
9.	Start the calibration.
10.	End of Procedure.

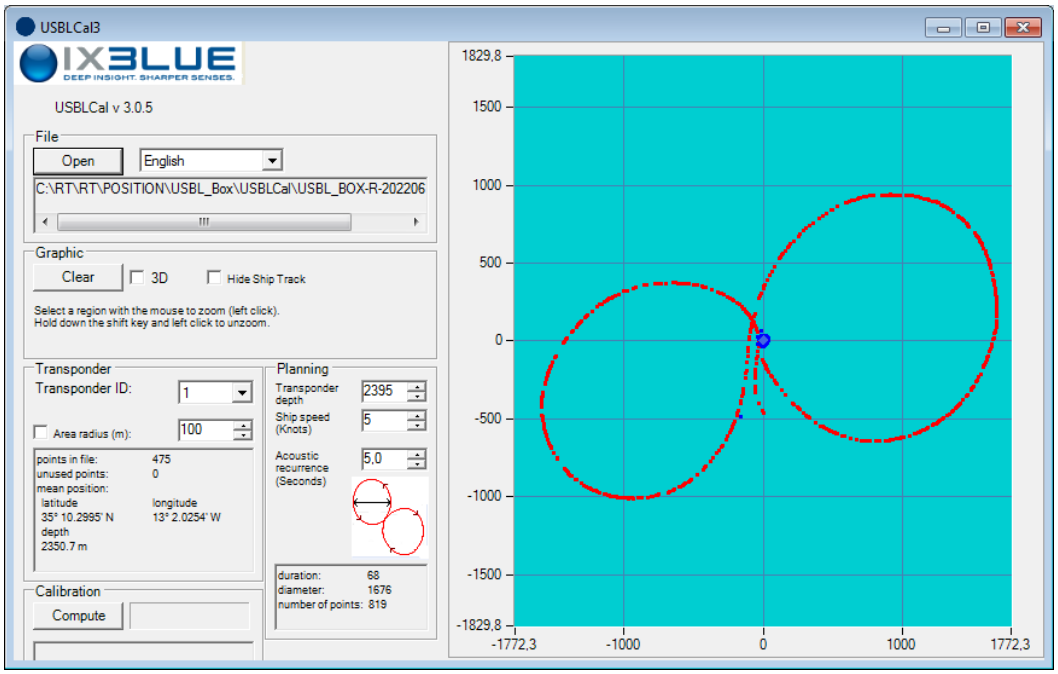
4.3.3 COMPUTING OFFSETS

The “8-shape” navigation data has been acquired and can now be loaded in the USBLCal software.

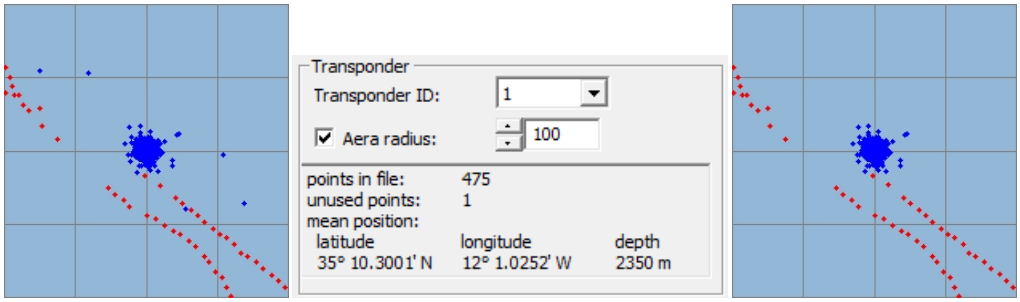
The USBLCal software calculates the angular offsets in the same way as in Figure 12. At the same time it calculates the scalar components of the vectors linking the hydrophones and the acoustic antenna. These components have to be entered in the USBL-BOX Web-based user interface.

Procedure

Step	Action
1.	Launch USBLCal by clicking on its icon or from the menu **Start**.
2.	Click on the **Open** button to select the “8-shape” navigation data file. *The data is charged and automatically displayed in the geographical display chart. The **Transponder** zone becomes active and the various fields are filled in.*
3.	In the **Graphic** zone, use the tools to improve the display, to zoom into the transponder position zone.



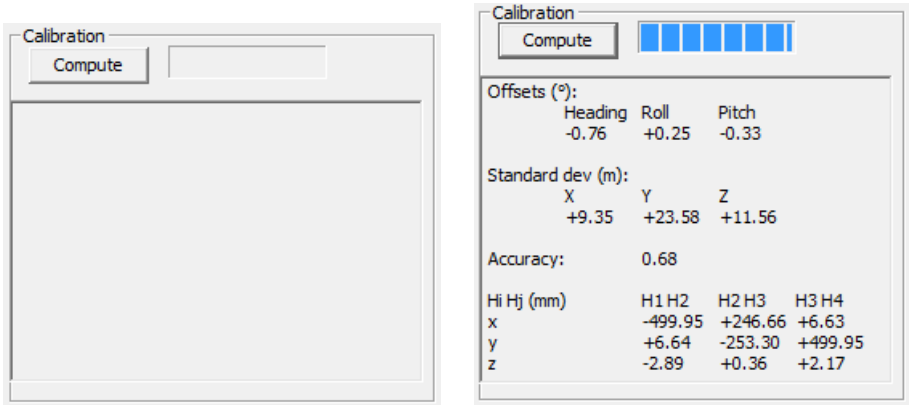
4. In the **Transponder** zone, start with a large **Area radius** and reduce it progressively in order to delete visually identifiable erroneous information or “rogue” points such as dots. If there is more than one transponder, select the transponder which is to be calibrated.



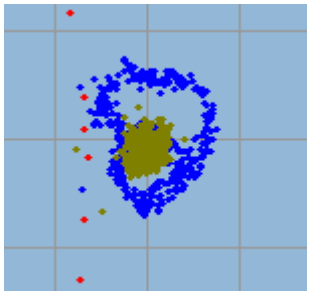
5. In the **Calibration** zone, press the **Compute** button to calculate the offset values.

A progress bar shows the completion of the computing. Once the calculation has been made, you see the following results:

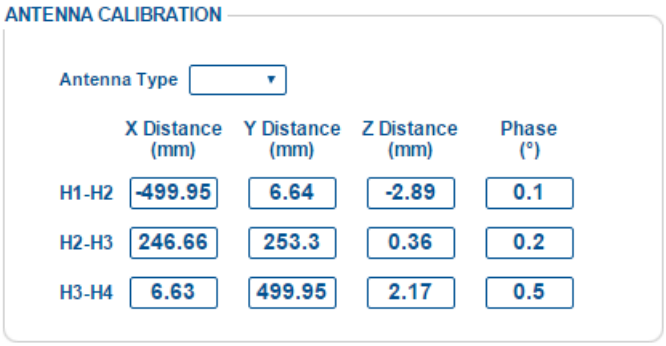
- *Three angular offset values with associated standard deviation*
- *Global accuracy value in percentage of the slant range*
- *Three vectors HiHj linking the hydrophones of the acoustic antenna*



The calibrated positions are displayed (raw data: blue; calibrated data: grey).

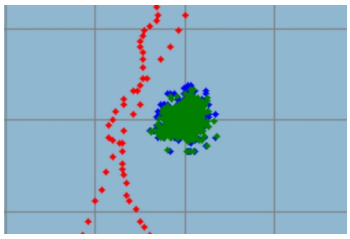


6. Enter the components of the vectors in the Web-based user interface of your system.



7. Perform a second calibration (minimum).

   This second calibration provides the residuals angular offsets (normally close to zero). The HiHj vectors are never zero. The green calibrated positions must cover the majority of blue non-calibrated positions.



8. End of Procedure.

4.3.4 VALIDATING A CALIBRATION

The next three criterions must be fulfilled to confirm that the calibration is successful.

- Criterion 1: The number of rejected points by the USBLCal (with the area radius) must be below 20 % of the total number of points.
- Criterion 2: A calibration can be said to be successful when the residuals, computed at the end of Step 7 of the last procedure, have the same order of magnitude than the accuracy of the AHRS. A factor two between them can be considered as a maximum. For example, with a motion sensor type OCTANS (heading accuracy of 0.1° and roll and pitch accuracy of 0.01°) the residual offsets must be below 0.2° for the heading and 0.02° for the roll and pitch.
- Criterion 3: The accuracy after calibration must be in line with the specifications that depend on GPS and AHRS class. Use the graphics on Figure 15 and tables below to check that you obtained the required accuracy after calibration:

	Heading	Roll / Pitch
AHRS Type 1 (PHINS)	0.01	0. 001
AHRS Type 2 (OCTANS)	0.1	0.01
AHRS Type 3 (OCTANS Nano)	0.5	0.1

GPS Type 1:	0.1 m
GPS Type 2:	1 m

Accuracy obtained from USBLCal after calibration:

$$Accuracy = \sqrt{Std\ dev_X^2 + Std\ dev_Y^2 + Std\ dev_Z^2}$$

Important

If one of the criterions is not fulfilled, the calibration must be entirely performed again.

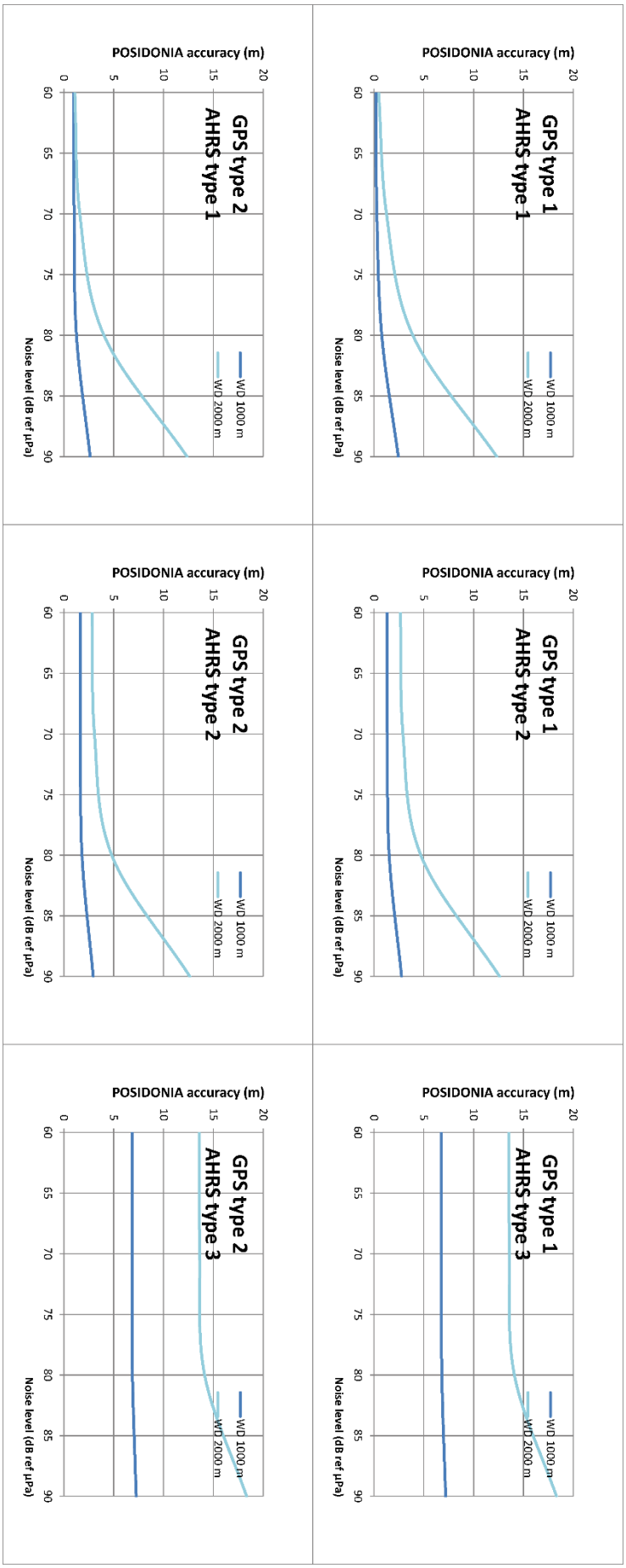


Figure 15 – Accuracy vs noise level

5 OPERATING THE POSIDONIA ANTENNA

USBL-BOX

The POSIDONIA acoustic antenna operates in conjunction with the USBL-BOX electronic rack. Please refer to the USBL-BOX User Guide for a complete description of the operation procedure.

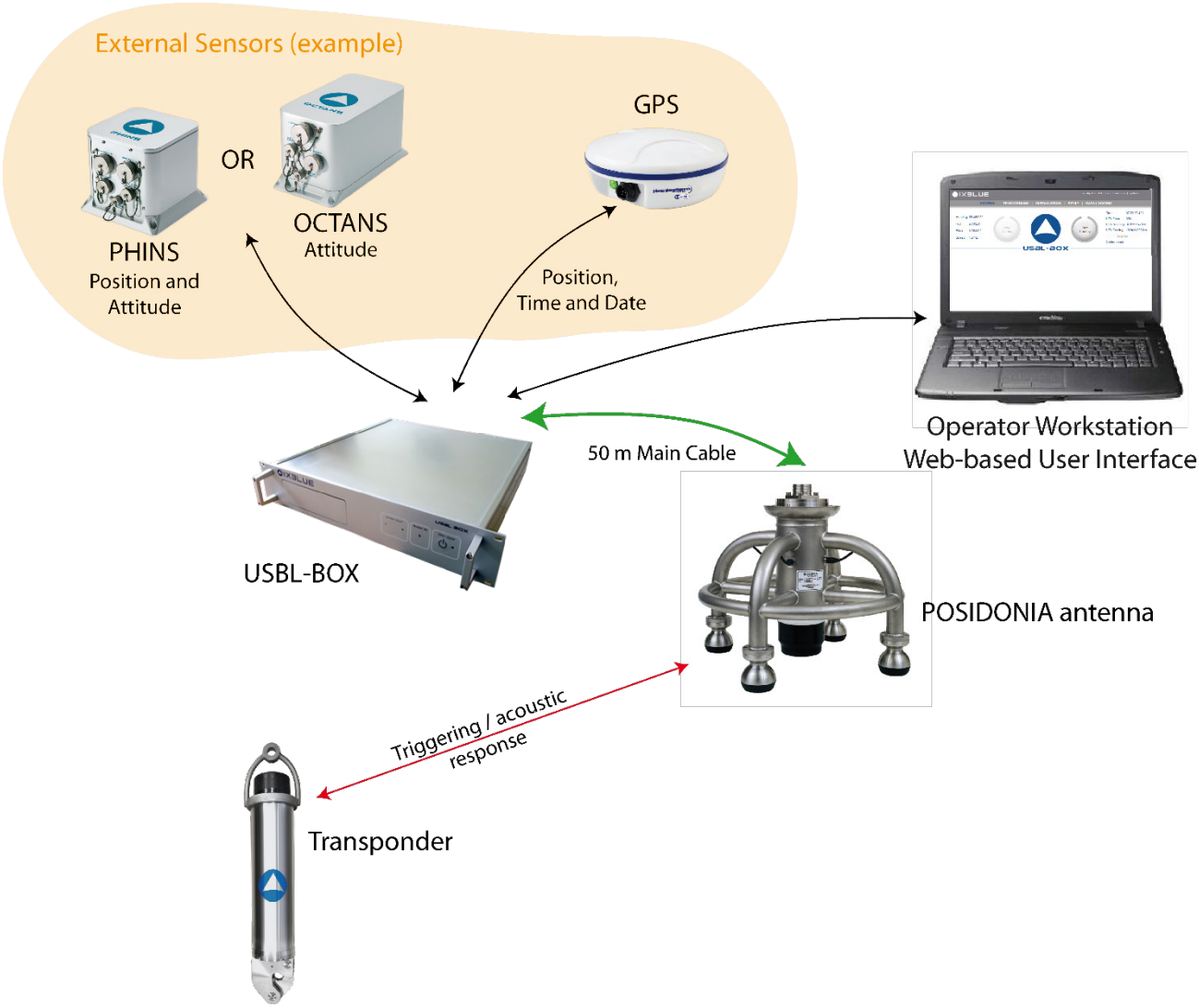


Figure 16 – Operating principle of the POSIDONIA antenna

6 PREVENTIVE MAINTENANCE

There are five preventive maintenance operations to perform on a regular basis with the POSIDONIA antennas:

PM01: Rinsing Deployable Acoustic Unit

PM02: Cleaning the Flush Acoustic Unit

PM03: Checking and Cleaning the Acoustic array

PM04: **G**reasing the Connector Thread

PM05: Checking the Sacrificial Anode

Electronic devices can be destroyed by static electricity. It is essential therefore that the service engineers are fully aware of the protections against static electricity.

System: POSIDONIA	**Preventive Maintenance**	
Sub-system: Deployable Acoustic Array	**Reference:** PM01	**Page:** 1/1
Subject: Rinsing Deployable Acoustic Array	**Maintenance Level**: 1 **Periodicity:** Every time the array is taken out of the water **Duration:** 30 minutes	

Equipment: Fresh water

Precaution: None

Preliminary Steps: None

Procedure

Step	Action
1.	Spread fresh water abundantly all over the antenna. Make sure the water gets into the air vents of each hydrophone arm.
2.	Turn over the antenna in such a way that ALL the water gets out from the arms. Let the antenna dry in an upside down position.
3.	End of procedure.

System: POSIDONIA	**Preventive Maintenance**	
Sub-system: Flush Acoustic Array	**Reference:** PM02	**Page:** 1/1
Subject: Cleaning Flush Acoustic Array	**Maintenance Level**: 1 **Periodicity:** Every year and when the vessel is in dry dock **Duration:** one hour	

Equipment: Sponge

Precaution: Contact iXBlue if this procedure is not sufficient to clean the antenna.

Preliminary Steps: None

Procedure

Step	Action
1.	Remove gently with the sponge the seaweed from the face of the hydrophones.
2.	End of procedure.

System: POSIDONIA	**Preventive Maintenance**	
Sub-system: Deployable Acoustic Array	**Reference:** PM03	**Page:** 1/1
Subject: Checking and Cleaning the Acoustic Array	**Maintenance Level: 2** **Periodicity:** Every time the ship is at dry dock **Duration:** 1 hour	

Equipment

Sponge, Alcohol, Flugene, Trichloroethane or equivalent

Precaution

Any mechanical operation such as the use of **abrasive paper**, **sand projection**, **scrapping**, etc. must be imperatively avoided.

The use of corrosive cleaning products (**tricloroethylene**, **detergent**, **acids**, **ketone-based solvents**, etc.) and all the products which could modify the original characteristics of the rubber are strictly prohibited:

To avoid any accidental splash resulting from **mechanical repairs**, **painting**, etc. carried out near the acoustic array, it is highly recommended to protect the array.

Preliminary Steps

None

Procedure

Step	Action
1.	Stop the power supply of the antenna.
2.	Clean the array with the sponge using **soapy water** or **alcohol**.
3.	End of procedure.

System: POSIDONIA	**Preventive Maintenance**	
Sub-system: Connector Thread	**Reference:** PM04	**Page:** 1/1
Subject: Greasing of the connector thread	**Maintenance Level: 2** **Periodicity:** Every time the ship is at dry dock **Duration:** 30 minutes	

Equipment

- Rag
- Silicone Grease

Precaution

Stop the antenna power supply.

Preliminary Steps

None

Procedure

Step	Action
1.	Disconnect the plug from the acoustic array.
2.	Remove the old grease from the plug (cable side) thread with the rag.
3.	Grease the thread of the plug.
4.	Reconnect the plug on the receptacle.
5.	End of procedure.

System: POSIDONIA	**Preventive Maintenance**	
Sub-system: Sacrificial Anode	**Reference:** PM05	**Page:** 1/1
Subject: Checking the Sacrificial Anode	**Maintenance Level: 2** **Periodicity:** Every time the ship is at dry dock **Duration:** 30 minutes	

Equipment

None

The acoustic array and the main processing unit of the POSIDONIA system contain electronic components, which are susceptible to electromagnetic radiation.

Before any arc welding operation is performed near the array, the two ends of the array cable MUST BE disconnected (array and electronic computer unit connectors) and blanked off using a metal plug.

Preliminary Steps

None

Procedure

Step	Action
1.	Visually check the anode for condition.
2.	Replace it if the wear extent exceeds 30 %.
3.	End of procedure.

iXBlue CONTACT - SUPPORT

FOR NON-URGENT SUPPORT:

BY EMAIL: support@ixblue.com

USING THE FORM ON THE IXBLUE WEB SITE www.ixblue.com

FOR 24/7 URGENT SUPPORT:

North America / NORAM

+1 508 975 4640 Ext 1

Europe Middle-East Africa Latin-America / EMEA-LATAM

+33 1 30 08 98 98

Asia Pacific / APAC

+65 6747 7027

iXBlue CONTACT - SALES

North America / NORAM

+1 508 975 4640

iXBlue Inc Boston area US

11 Erie Drive, Natick, MA 01760, US

Europe Middle-East Africa Latin-America / EMEA-LATAM

+33 1 30 08 88 88

iXBlue SAS France

34 rue de la Croix de Fer, Saint-Germain-en-Laye, F-78100, France

Asia Pacific / APAC

+65 6747 4912

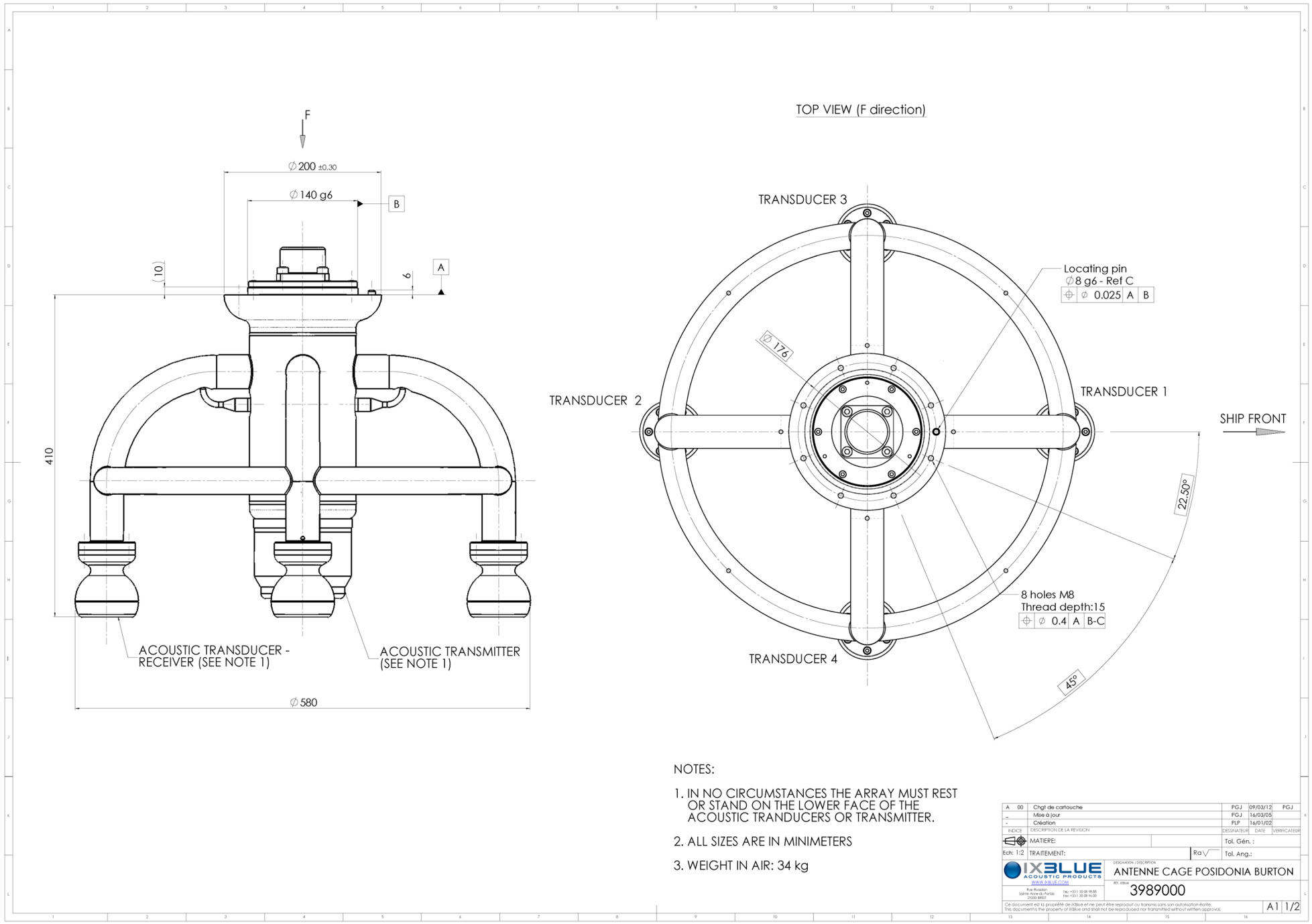
iXBlue Pte Limited Singapore

15A Changi Business Park Central 1#04-02 Eightrium Singapore 486035

PAGE INTENTIONALLY LEFT BLANK

Appendices

A CAGE ANTENNA



NOTES:

1. IN NO CIRCUMSTANCES THE ARRAY MUST REST OR STAND ON THE LOWER FACE OF THE ACOUSTIC TRANDUCERS OR TRANSMITTER.
2. ALL SIZES ARE IN MINIMETERS
3. WEIGHT IN AIR: 34 kg

A 00	Chgt de cartouche		PGJ 09/03/12	PGJ
_	Mise à jour		PGJ 16/03/05	
-	Création		PLP 16/01/02	
INDICE	DESCRIPTION DE LA REVISION		DESSINATEUR DATE	VERIFICATEUR
	MATIERE:		Tol. Gén. :	
Ech: 1:2	TRAITEMENT:	Ra√	Tol. Ang.:	

IXBLUE ACOUSTIC PRODUCTS
WWW.IXBLUE.COM
Rue Rivoalon 29200 BREST Tel: +33 1 30 08 98 88 Fax: +33 1 30 08 96 00

DESIGNATION / DESCRIPTION: ANTENNE CAGE POSIDONIA BURTON
REF. IXBLUE: 3989000

A1 1/2

B FLUSH ANTENNA