SeaBat 8150 upgrade to SeaBat 7150

R/V “Akademik Nicolaj Strakov”

Prepared for:

GINRAS

Ref No 02/1214442

Prepared by:
RESON

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Document Review

Author	Checked	Version	Comment
DW		V1.0	For Internal Review
RH		V2.0	Upgrade to SeaBat 7150

1. Introduction

This document details the upgrade of RESON SeaBat 8150 to SeaBat 7150 multibeam echosounder and related equipment onboard R/V “Akademik Nikolaj Strakhov” for the Geological Institute of the Russian Academy of Science (GINRAS). The upgrade took place in, Helsingor, Denmark. All equipment was installed in accordance with RESON’s Standard Operating procedures.

The upgrade began on Sunday 15th October 2006 and was completed on Wednesday 18th October 2006.

Export License issues meant RESON were unable to upgrade the SeaBat 8111er to SeaBat 7111. This upgrade will be completed at a later date.

1.1. Personnel

The RESON personnel involved in the installation are listed in the following table:

Name	Title
Richard Hill	RESON Project Surveyor
Artem Vassiliev	RESON Engineer
Jørgen Hansen	RESON Engineer
Michael Jensen	RESON Engineer
Natalia Becker	RESON Administrative Co-ordinator
Kim Khyl Jensen	RESON Sales Manager

2. Description of Vessel

R/V “Akademik Nikolaj Strakhov” is an academic research vessel owned by GINRAS. The main function of the vessel is for research in oceanography, geology and hydrography.

The vessel has an overall length of 75.5m, breadth of 14.7m, a design draft of 4.5m and a displacement of 2,600 GRT. The vessel is classified under the Russian Register. Normal operational crew for the vessel is 23 with 17 officers and 30 scientists. She was built in 1985 and is registered in Kaliningrad.

Figure 1: R/V ”Akademik Nikolaj Strakhov”

3. Wet End Installation

3.1. Gondola Installation

The wet end installation design incorporates a transducer mounting gondola on the hull from which cables are fed though three hull penetrations into three cable pipes. The cable pipes terminate in the survey room where all dry end equipment is installed.

The diagram below shows a general schematic of the gondola.

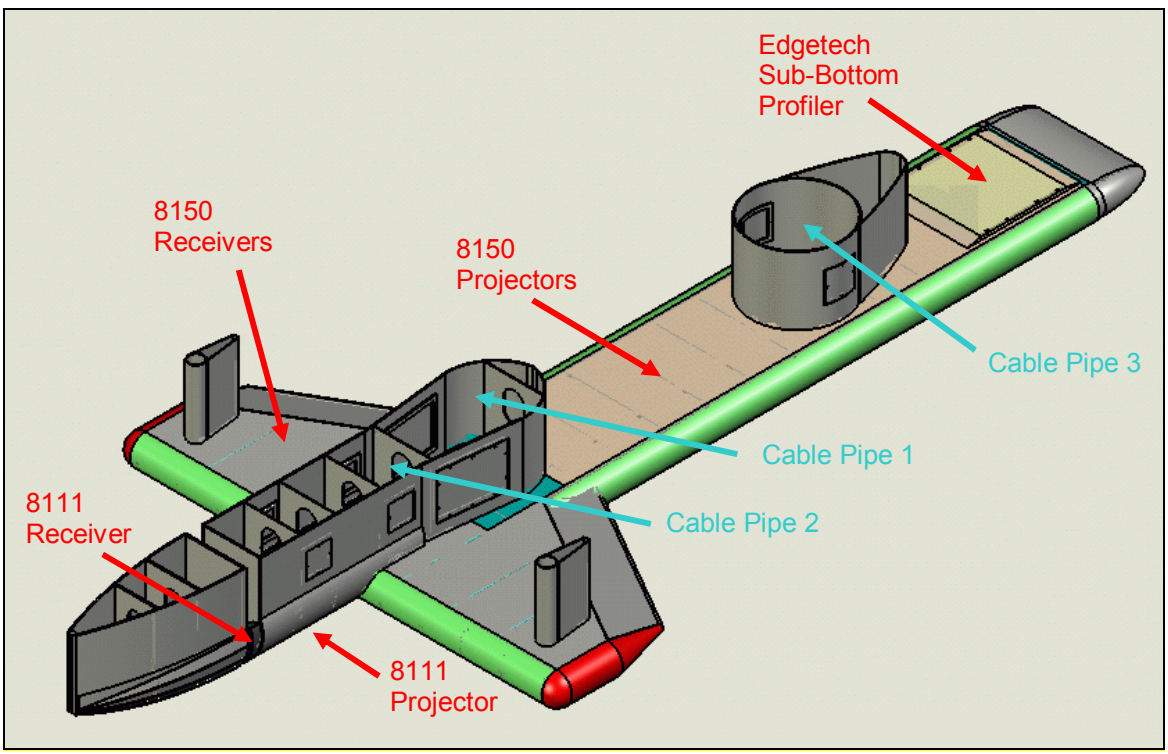


Figure 2: *Gondola Schematic*

The upgrade from 8150 to 7150 did not involve any changes to the wet-end.
On completion of the physical installation the system the transmit section was tested using the scan test routine. The scan test verified that 48 sequential pings were audible from the transmit section from fore to aft.

4. Dry End Installation

4.1. 19” Rack

The existing installation of the dry end equipment included changes, as follows:

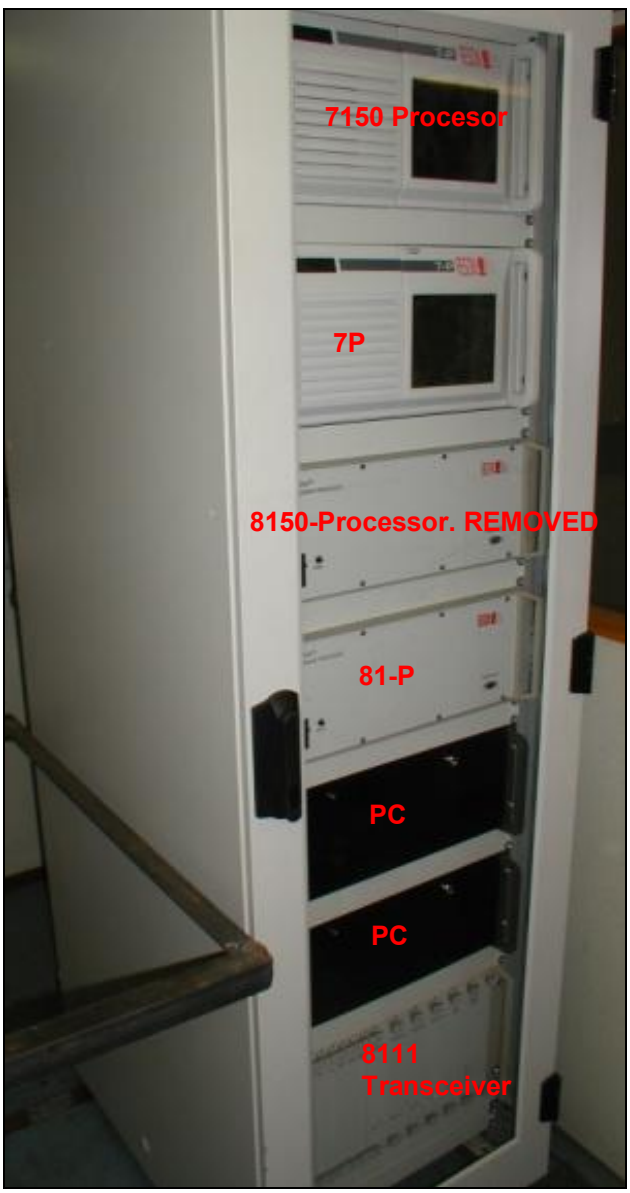


Figure 3: ***RESON 19” rack***

Changes:

- The original 7150 sonar processor (so-called G1, first generation) was replaced with a G2 unit.
- The 8150 8-P was removed.
- Some hardware interfacing changes, see later.

4.2. SeaBat 7150 Transceiver

The SeaBat 8150 transceiver was upgraded to a SeaBat 7150 transceiver by replacing the following parts:

- Three backplanes
- Six Receiver cards
- Six Transmitter cards
- Two power supplies
- One Controller card.

Figure 4: *Transceiver Bracket*

Figure 5: *Transceiver Installation*

Following the upgrade, a Scan Test verified that all but three channels were functioning. The three failed channels were present before the upgrade.

4.3. Software Installed

The following software was installed on the vessel prior to departure for SeaBat 7150 sea trials:

System	Software / Firmware	Comment
SeaBat 7150	7K User Interface 3.2.6.2 7Kcentre 2.12.1.0 I/O Module 2.6.1.1	All new
SeaBat 8111	8111-E208-3F66 Dry 8111-E101-AFAA Wet	No changes
Acquisition PC	PDS2000 v2.6.1.5 AgRemote v1.22 TSIP Talker v2.00 iXRepeater Octans 3452-645	Latest PDS2000
Processing PC	PDS2000 v2.6.1.5 Datalog 400	Latest PDS2000

Both the Acquisition and Processing PCs have a directory called C:\Install which contains all the install files necessary to re-install any of the software listed above.

5. Hardware Interfacing

5.1. Data Connections

	From	To	Data	Protocol
1 *	71-P processor	Survey Software	Bathy Data	Ethernet
2 *	71-P processor	Survey Software	Snippets Data	Ethernet
3	81-P processor	Survey Software	Bathy Data	Ethernet
4	81-P processor	Survey Software	Snippets Data	Ethernet
5	Trimble GPS	Acquisition DDU	Pos/Time/Speed	Serial, RS232
6	Acquisition DDU	Survey Software	Position	Serial, RS232
7	Acquisition DDU	Survey Software	Time & PPS	Serial, RS232
8 *	Survey Software	IXSEA Octans III	Position/Speed	Serial, RS232
9	IXSEA Octans III	Acquisition DDU	Heading/P/R/H	Serial, RS232
10	Acquisition DDU	Survey Software	Heading/P/R/H	Serial, RS232
11	IXSEA Octans III	Acquisition DDU	P/R/H	Serial, RS232
12	Acquisition DDU	81-P Processor	P/R/H	Serial, RS232
13	Acquisition DDU	81-P Processor	P/R/H	Serial, RS232
14	SVP-70	Acquisition DDU	Sound Velocity	Serial, RS232
15 *	Acquisition DDU	71-P Processor	Sound Velocity	Serial, RS232
16	Acquisition DDU	81-P Processor	Sound Velocity	Serial, RS232
17 *	Trimble GPS	71-P Processor	Time and PPS	Serial, RS232
18	Survey Software	81-P Processor	Time	Serial, RS232
19	Survey Software	Edgetech SBP	Position	Serial, RS232
20	IXSEA Octans III	GINRAS System	Heading/P/R/H	Serial, RS232

* denotes a change from original installation

CAUTION: The IXSEA Octans output A to the Acquisition DDU has been changed from Octans Standard to Simrad EM. The Simrad EM telegram is the preferred message for the Roll/Pitch data required by the SeaBat 7-P. A new PDS2000 Project template “template 7150” has been created and should be used when collecting SeaBat 7150 data.

In order to use the SeaBat 8111er, the output A will have to be changed back to the Octans Standard, and the appropriate PDS2000 Project Template used.

Changes to the Octans configuration are made using the Octans Repeater software utility on the Acquisition PC.

5.2. Communication Parameters

	Data	Message	From Port	To Port	I.O. Settings	Freq.
1 *	Bathy Data	7K 7006	7000	N/A	IP 10.0.10.1	Var
2 *	Snippets Data	7K 7008	7000	N/A	IP 10.0.10.1	Var
3	Bathy Data	R Theta	1040	N/A	IP 10.0.10.2	Var
4	Snippets Data	RESON Snippets	1046	N/A	IP 10.0.10.2	Var
5	Pos/Time/Speed	GGA/ZDA/VTG	Port A	DDU1	9600,8,N,1	Var
6	Position	GGA	DDU2	MOXA1	9600,8,N,1	1Hz
7	Time	ZDA	DDU3	MOXA2	9600,8,N,1	1Hz
8	Position/Speed	GGA/VTG	DDU4	Octans A	9600,8,N,1	1Hz
9	Heading/P/R/H	SIMRAD EM	Octans A	DDU 6	19200,8,N,1	50Hz
10	Heading/P/R/H	SIMRAD EM	DDU6	MOXA3	19200,8,N,1	50Hz
12 *	P/R/H	SIMRAD EM	DDU10	71-P Port1	115200,8,N,1	50Hz
13	P/R/H	Octans STD 1	DDU10	81-P Port 3	115200,8,N,1	50Hz
14	Sound Velocity	AML	RS232	DDU13	115200,8,N,1	1Hz
15 *	Sound Velocity	AML	MOXA7	71-P COM2	9600,8,N,1	1Hz
16	Sound Velocity	AML	DDU15	81-P DnLk	9600,8,N,1	1Hz
17 *	Time	NMEA ZDA / PPS	MOXA2	71-P COM1	115200	1Hz
18	Time	RESON UTC	MOXA4	81-P Port 1	115200	1Hz
19	Position	GGA	MOXA5	Nav	9600,8,N,1	1Hz
20	Heading/P/R/H	GINRAS System	Octans B	MCB 0	9600,8,N,1	5Hz

* denotes a change from original installation

5.3. Power Schematic

The following diagram shows the power schematic for all systems installed by RESON onboard R/V “Akademik Nikolaj Strakhov”.

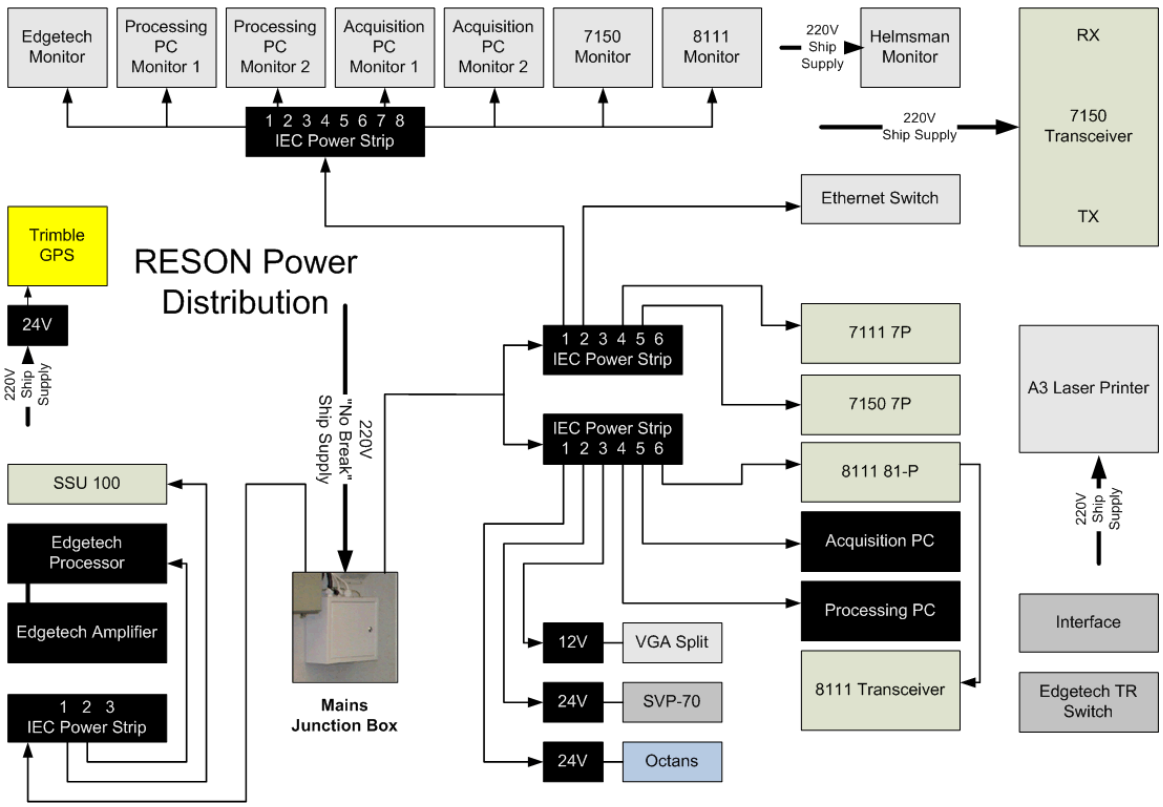


Figure 6: *Power Distribution*

5.4. Data Interfacing

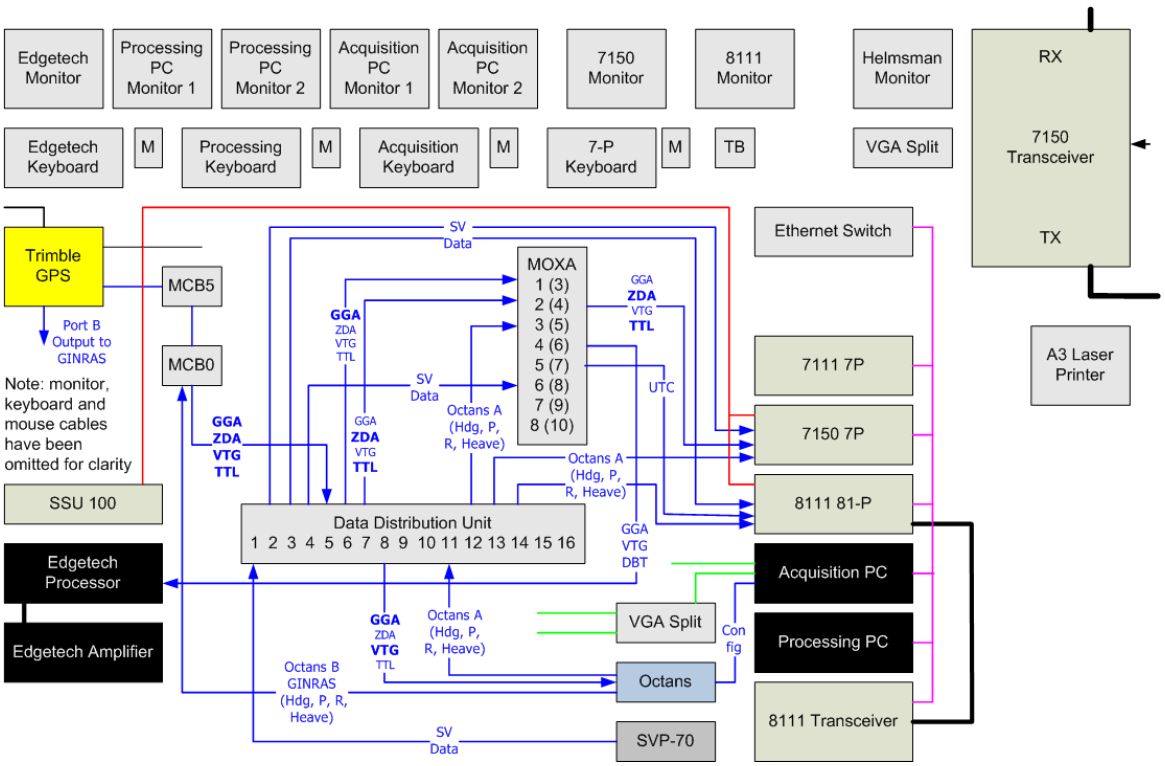


Figure 7: *Data Interfacing*

Known errors in Figure 7.

- The GGA / VTG to Octans, now comes from an Output of PDS2000 after it was noticed that when it was connected to the DDU the Octans reported “Serial I/O failure”.
- The SVP-70 data does not go to DDU port 1, but MOXA port 6, and there is an output from PDS2000 from MOXA port 7 to DDU port 1.

5.5. Data Distribution Unit

The following diagrams show the data interfacing to/from the data distribution board.

Figure 8: *Data Distribution Board*

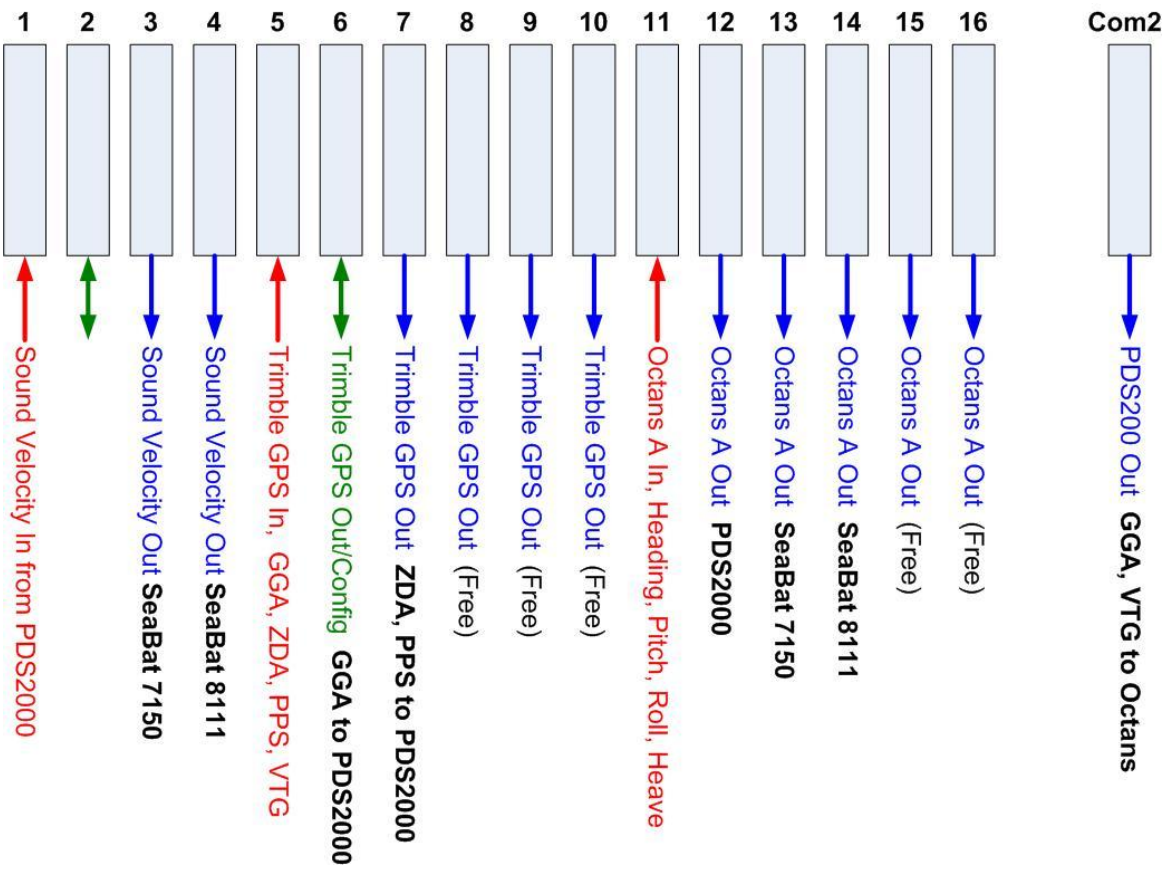


Figure 9: *DDU Connections*

The pin wiring of the DDU is as follows:

For all outputs (female connectors) data is transmitted on pin 3 and ground is on pin 7. For the Trimble GPS outputs pin 8 is wired to carry the TTL signal. The first output in the sequence for Sound Velocity and GPS (indicated in green) has pin 2 connected in order to be used for configuring the sensors.

5.6. MOXA Connections

The following diagrams show the data interfacing to/from the MOXA board.

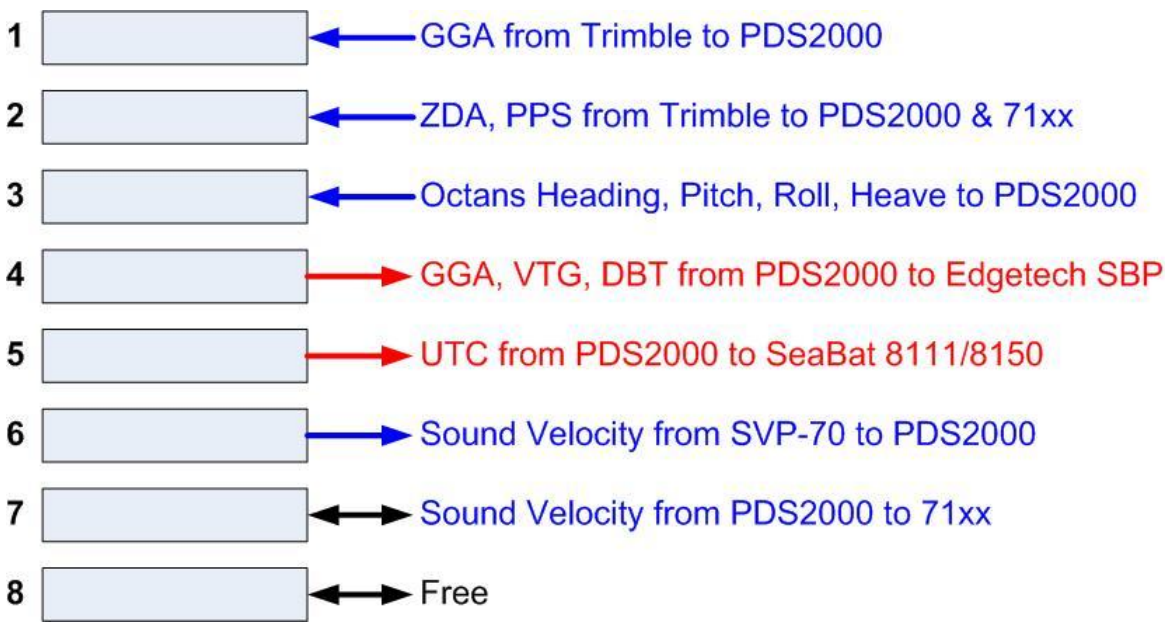


Figure 10: *Acquisition PC MOXA RS232 Multiport*

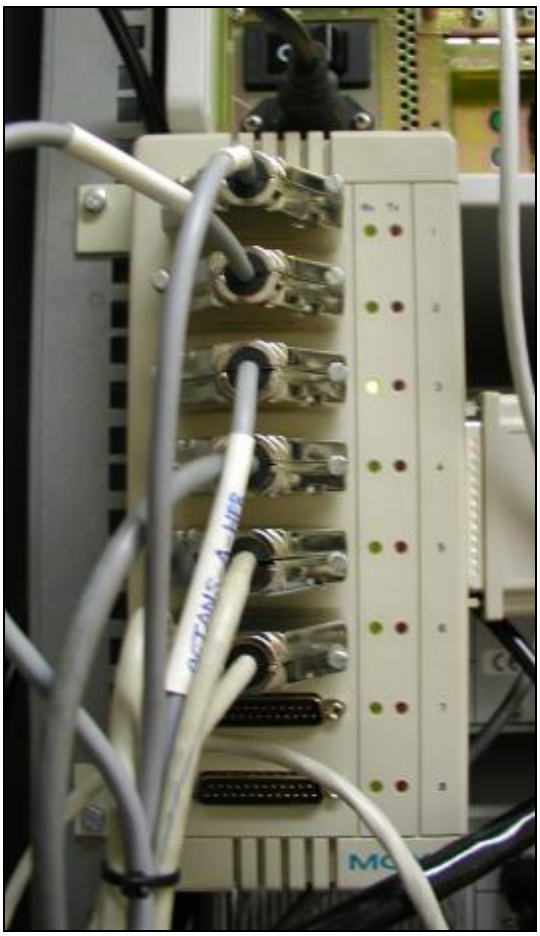


Figure 11: *MOXA Multiport*

6. Sensor Offsets and Orientations

The IXSEA Octans III was installed as close as practically possible to what is assumed to be the vessel's centre of rotation. For simplicity, the installed position of the Octans was taken to be the common reference point for sensor offsets.

The PDS2000 convention for offset measurements is adopted.

X axis is positive to Starboard
Y axis is positive to Bow
Z axis is positive Up

6.1. Sensor Offsets

Sensor offsets from CRP (metres)			
From CRP to…	**X (m)**	**Y (m)**	**Z (m)**
Octans	0.00	0.00	0.00
Trimble GPS Antenna	0.97	5.40	19.58
SeaBat 8150	1.60	2.36	-5.78
SeaBat 8111	1.60	6.62	-5.46
Edgetch SBP	1.60	-0.87	-5.73

6.2. Sensor Orientations

The alignment of the vessel reference frame was determined by land survey measurements to prisms located on the centre line at the bow and stern of the vessel.

The alignment of the SeaBat 8150 with respect to the vessel centre line was determined by using land survey techniques to measure the positions in X, Y and Z of the receiver and transmitter mounting bolt holes.

The heading of the vessel reference frame was determined by computing a bearing from two known positions: the Trimble GPS for the vessel position and a lighthouse 3.5km west on the channel approaches to Kaliningrad. Confidence in the positions is considered to be ±3m, typical for GPS and for geographical co-ordinates quoted to 3 decimals in minutes i.e. dd mm.mmm. This results in confidence in the baseline orientation of 0.1º assuming the lighthouse co-ordinates are correct.

Sensor Orientations			
	Heading	**Pitch**	**Roll**
Vessel Ref Frame	88.84º	0.11º (bu)	-0.15º (su)
SeaBat 8150	88.82º	0.32º (bu)	-0.16º (su)
SeaBat 8111	Assumed 0º	Assumed 0º	Assumed 0º
Octans	89.72º	0.03º	-0.15º (su)

Sensor Misalignments with respect to Vessel Frame			
	Heading	**Pitch**	**Roll**
SeaBat 8150	-0.02º	0.21º	-0.01º
SeaBat 8111	Assumed 0º	Assumed 0º	Assumed 0º
Octans	0.86º	-0.08º	0.00º

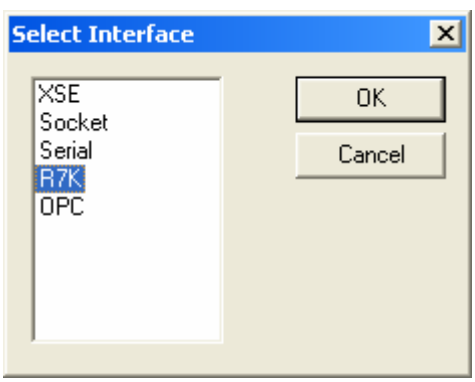
The alignment of the SeaBat 8111 was not observed due to the fact that the curved array cannot be measured accurately. As with both multibeam systems, the final misalignments will be determined by the patch tests to be carried out during the sea acceptance tests. The patch tests shall be used to verify the computed misalignment between Octans and SeaBat 7150.

7. PDS2000 Survey Software

The following changes were made to the PDS200 Project, for the SeaBat 7150. A new project, based on the SeaBat 8150 template and the following changes..

PDS2000 works together with the SeaBat 7150, by contacting the 7KCentre (running on the 7150 sonar processor) and requesting data records.

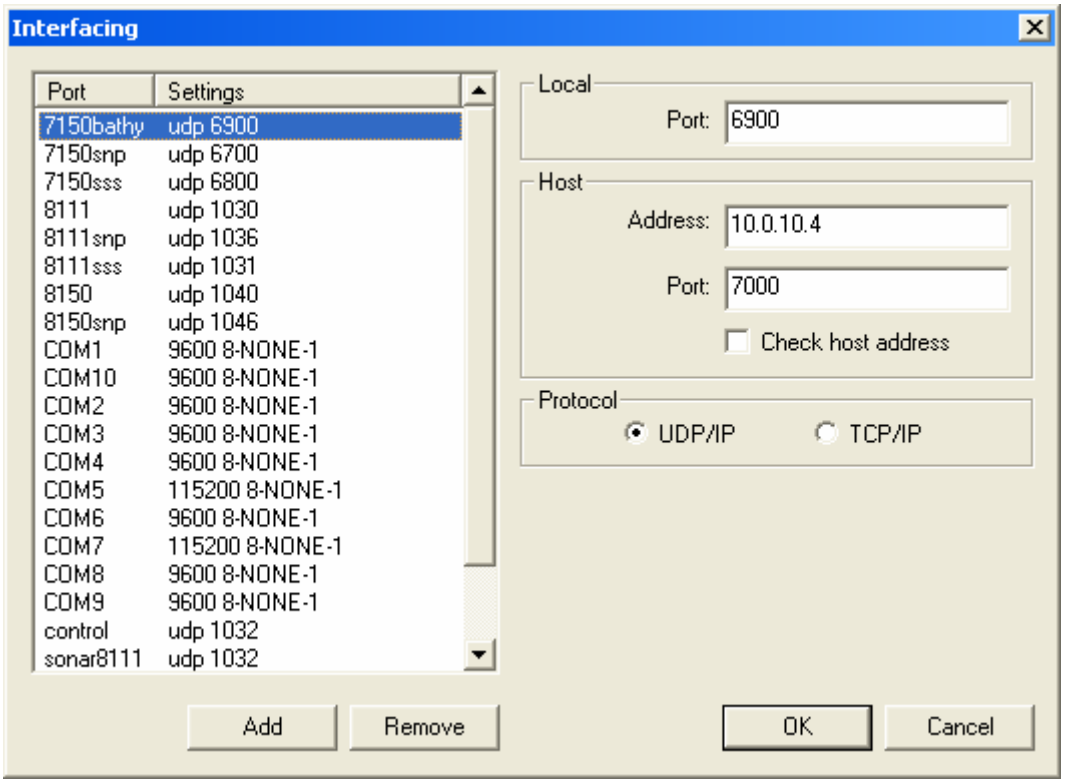
7.1. Interfacing Ports

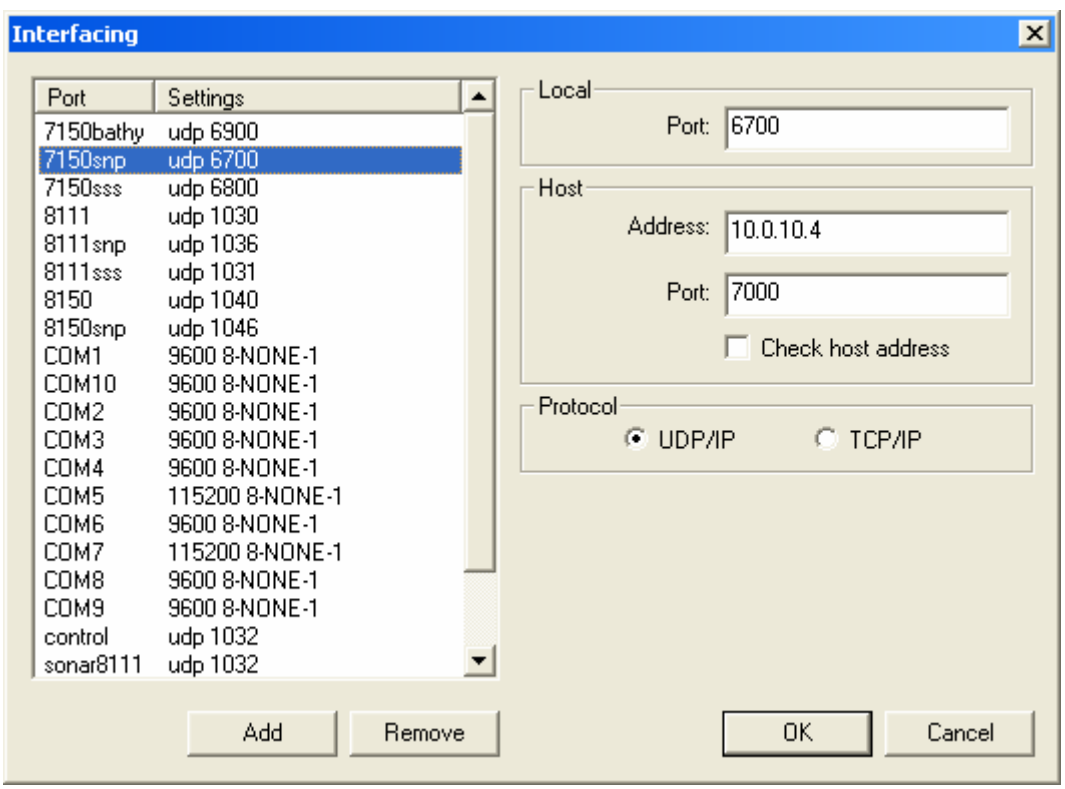


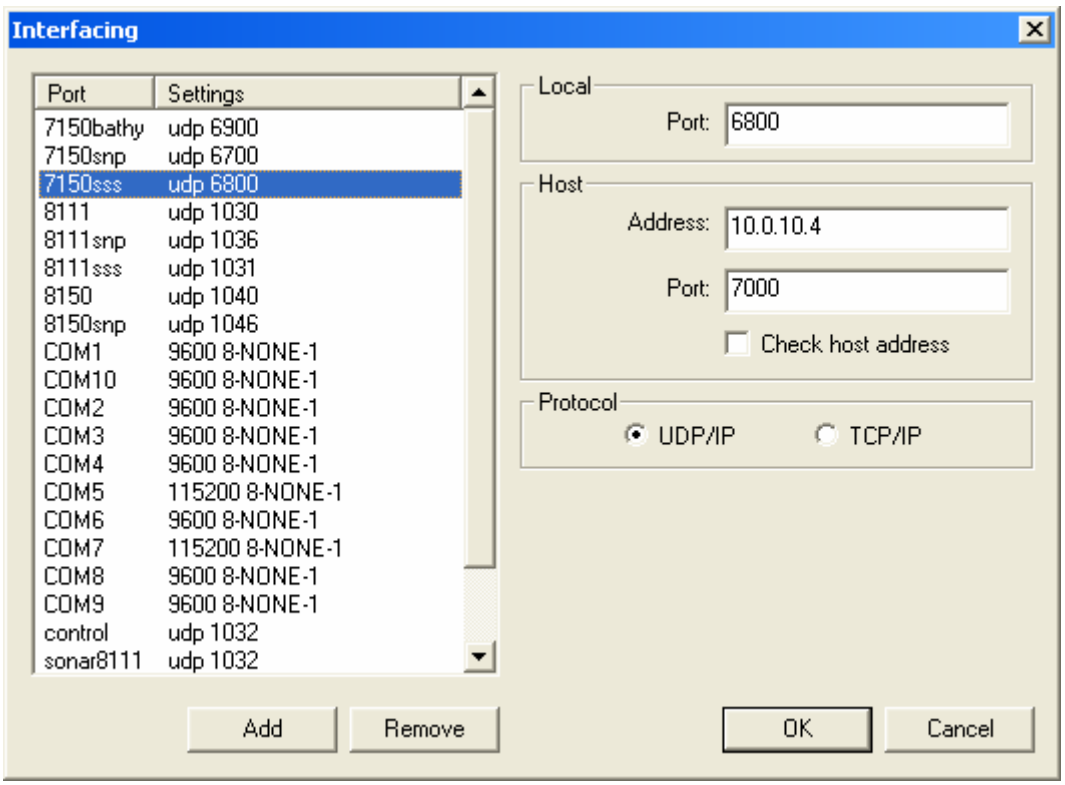
Four (4) new I/O Ports were created, of the type “R7K”, ass opposed to “Socket” that might normally be used for sensor data received over a network connection.

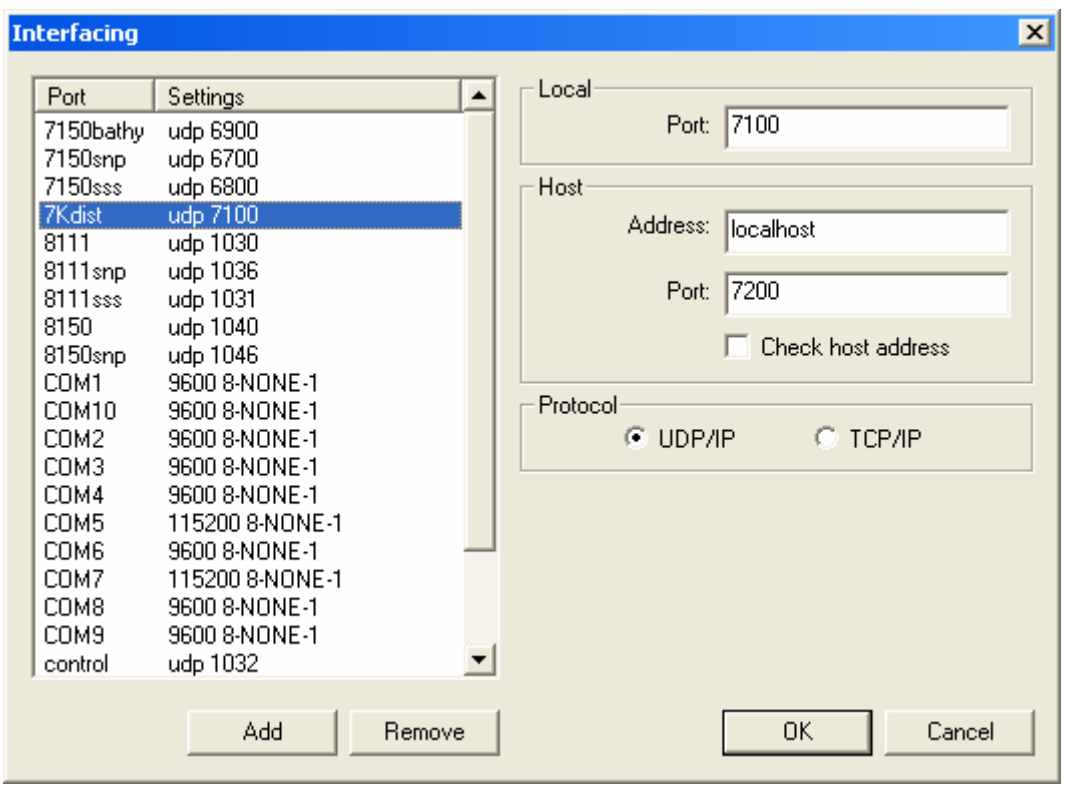
1. 7150bathy
2. 7150snp
3. 7150sss
4. 7Kdist (optional, only required for realtime broadcast of 7K records)

See next pages..


Interfacing
Port
Settings
7150bathy udp 6900
7150snp udp 6700
7150sss udp 6800
8111 udp 1030
8111snp udp 1036
8111sss udp 1031
8150 udp 1040
8150snp udp 1046
COM1 9600 8-NONE-1
COM10 9600 8-NONE-1
COM2 9600 8-NONE-1
COM3 9600 8-NONE-1
COM4 9600 8-NONE-1
COM5 115200 8-NONE-1
COM6 9600 8-NONE-1
COM7 115200 8-NONE-1
COM8 9600 8-NONE-1
COM9 9600 8-NONE-1
control udp 1032
sonar8111 udp 1032
Local
Port: 6900
Host
Address: 10.0.10.4
Port: 7000
Check host address
Protocol
UDP/IP
TCP/IP
Add
Remove
OK
Cancel


Interfacing
Port
Settings
7150bathy udp 6900
7150snp udp 6700
7150sss udp 6800
8111 udp 1030
8111snp udp 1036
8111sss udp 1031
8150 udp 1040
8150snp udp 1046
COM1 9600 8-NONE-1
COM10 9600 8-NONE-1
COM2 9600 8-NONE-1
COM3 9600 8-NONE-1
COM4 9600 8-NONE-1
COM5 115200 8-NONE-1
COM6 9600 8-NONE-1
COM7 115200 8-NONE-1
COM8 9600 8-NONE-1
COM9 9600 8-NONE-1
control udp 1032
sonar8111 udp 1032
Local
Port: 6700
Host
Address: 10.0.10.4
Port: 7000
Check host address
Protocol
UDP/IP
TCP/IP
Add
Remove
OK
Cancel


Interfacing
Port
Settings
7150bathy udp 6900
7150snp udp 6700
7150sss udp 6800
8111 udp 1030
8111snp udp 1036
8111sss udp 1031
8150 udp 1040
8150snp udp 1046
COM1 9600 8-NONE-1
COM10 9600 8-NONE-1
COM2 9600 8-NONE-1
COM3 9600 8-NONE-1
COM4 9600 8-NONE-1
COM5 115200 8-NONE-1
COM6 9600 8-NONE-1
COM7 115200 8-NONE-1
COM8 9600 8-NONE-1
COM9 9600 8-NONE-1
control udp 1032
sonar8111 udp 1032
Local
Port: 6800
Host
Address: 10.0.10.4
Port: 7000
Check host address
Protocol
UDP/IP
TCP/IP
Add
Remove
OK
Cancel

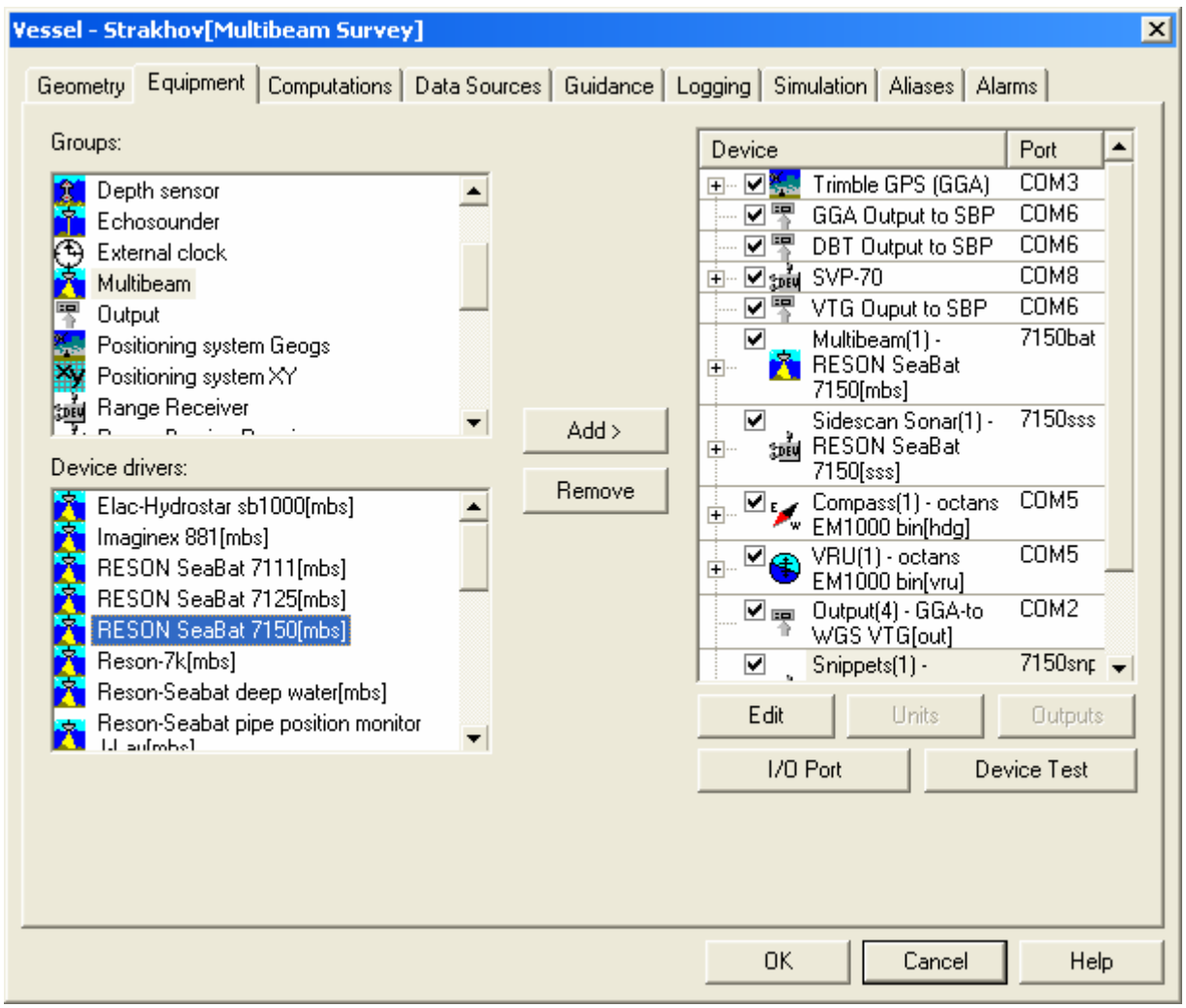

Interfacing
Port
Settings
7150bathy udp 6900
7150snp udp 6700
7150sss udp 6800
7Kdist udp 7100
8111 udp 1030
8111snp udp 1036
8111sss udp 1031
8150 udp 1040
8150snp udp 1046
COM1 9600 8-NONE-1
COM10 9600 8-NONE-1
COM2 9600 8-NONE-1
COM3 9600 8-NONE-1
COM4 9600 8-NONE-1
COM5 115200 8-NONE-1
COM6 9600 8-NONE-1
COM7 115200 8-NONE-1
COM8 9600 8-NONE-1
COM9 9600 8-NONE-1
control udp 1032
Local
Port: 7100
Host
Address: localhost
Port: 7200
Check host address
Protocol
UDP/IP
TCP/IP
Add
Remove
OK
Cancel

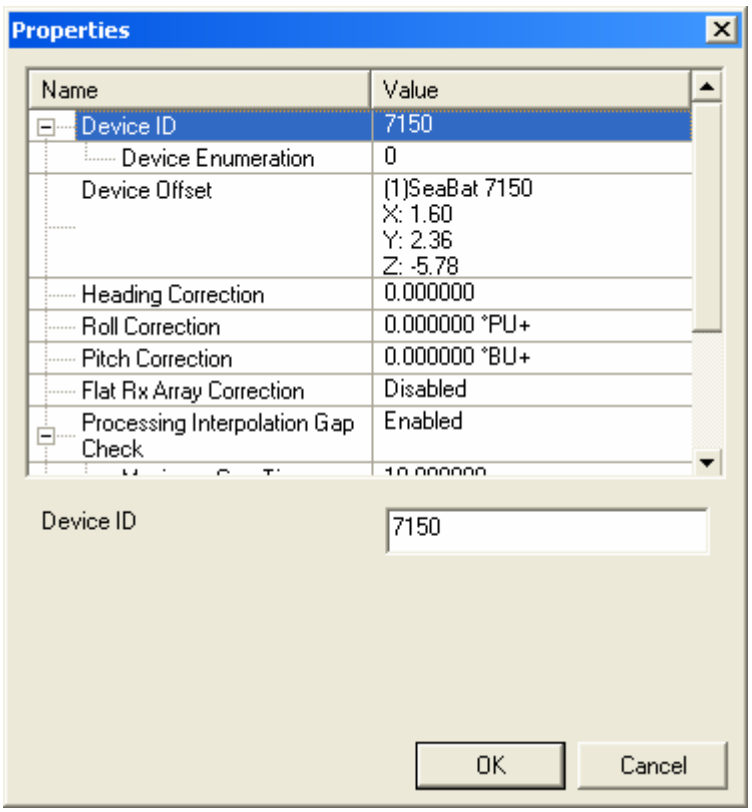
7.2. SeaBat 7150 Equipment

Any 8150 equipment was removed from the project, and the following 7150 equipment was added.

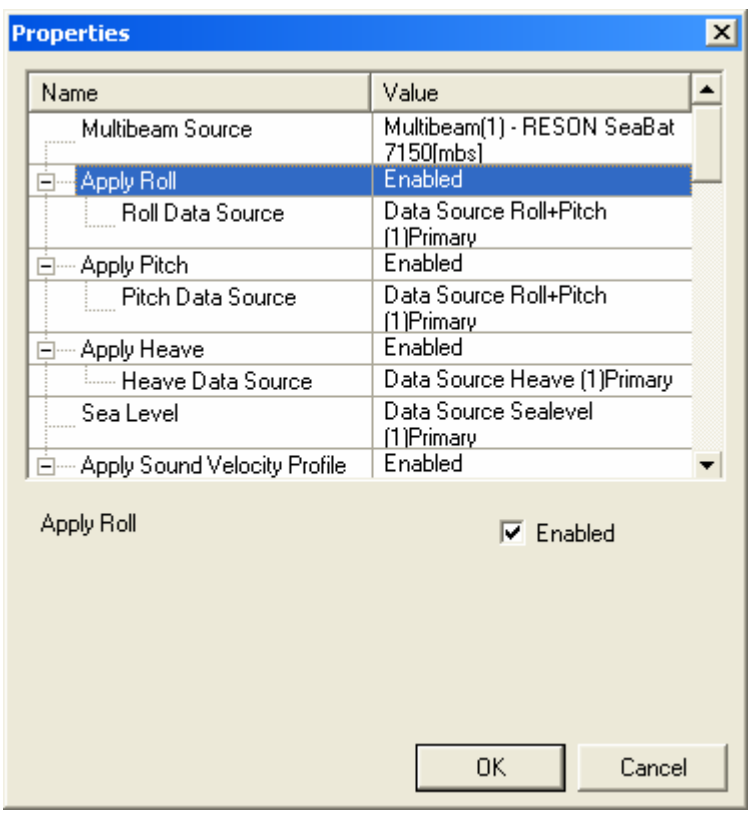
1. Multibeam, RESON SeaBat 7150
2. Sidescan Sonar, RESON SeaBat 7150
3. Snippets, RESON SeaBat 7150

See following..





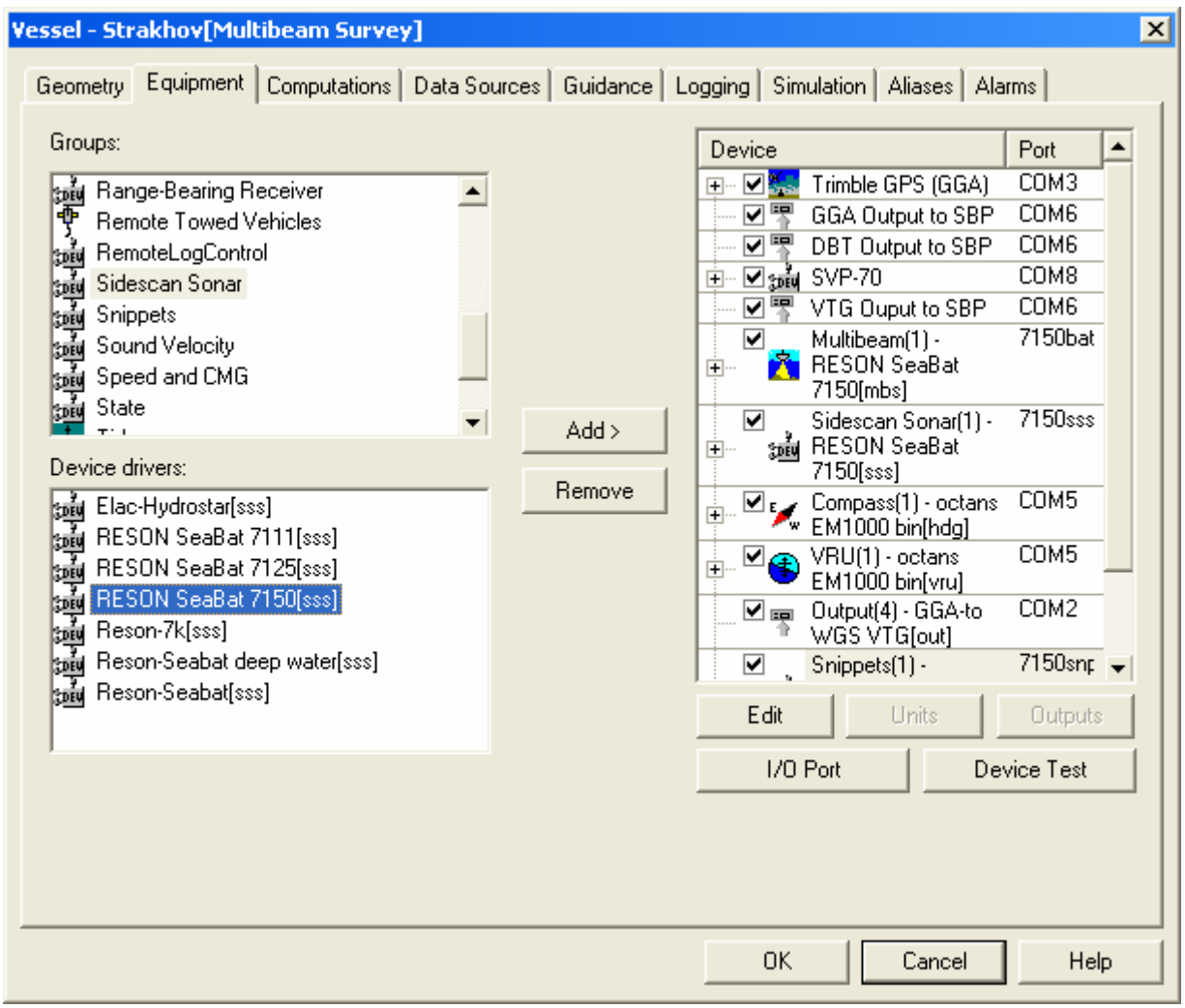
The “device ID and Enum” is automatically set to 7150 & 0 and should not be changed. As before, the other parameters should be configured.

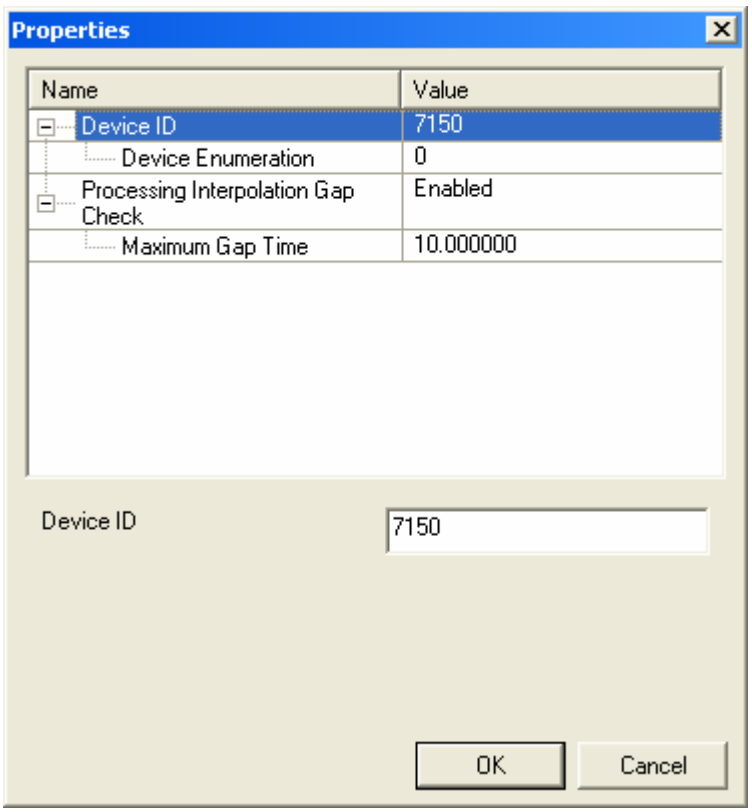


RESON SeaBat 8150 upgrade to 7150
Installation Report
R/V “Akademik Nikolaj Strakhov”

IMPORTANT: When ROLL or PITCH COMPENSATION is ENABLED on the SeaBat 7150 (using the SeaBat 7K User Interface menu options, then the “APPLY ROLL / PITCH” setting in PDS2000 MUST be manually DISABLED.

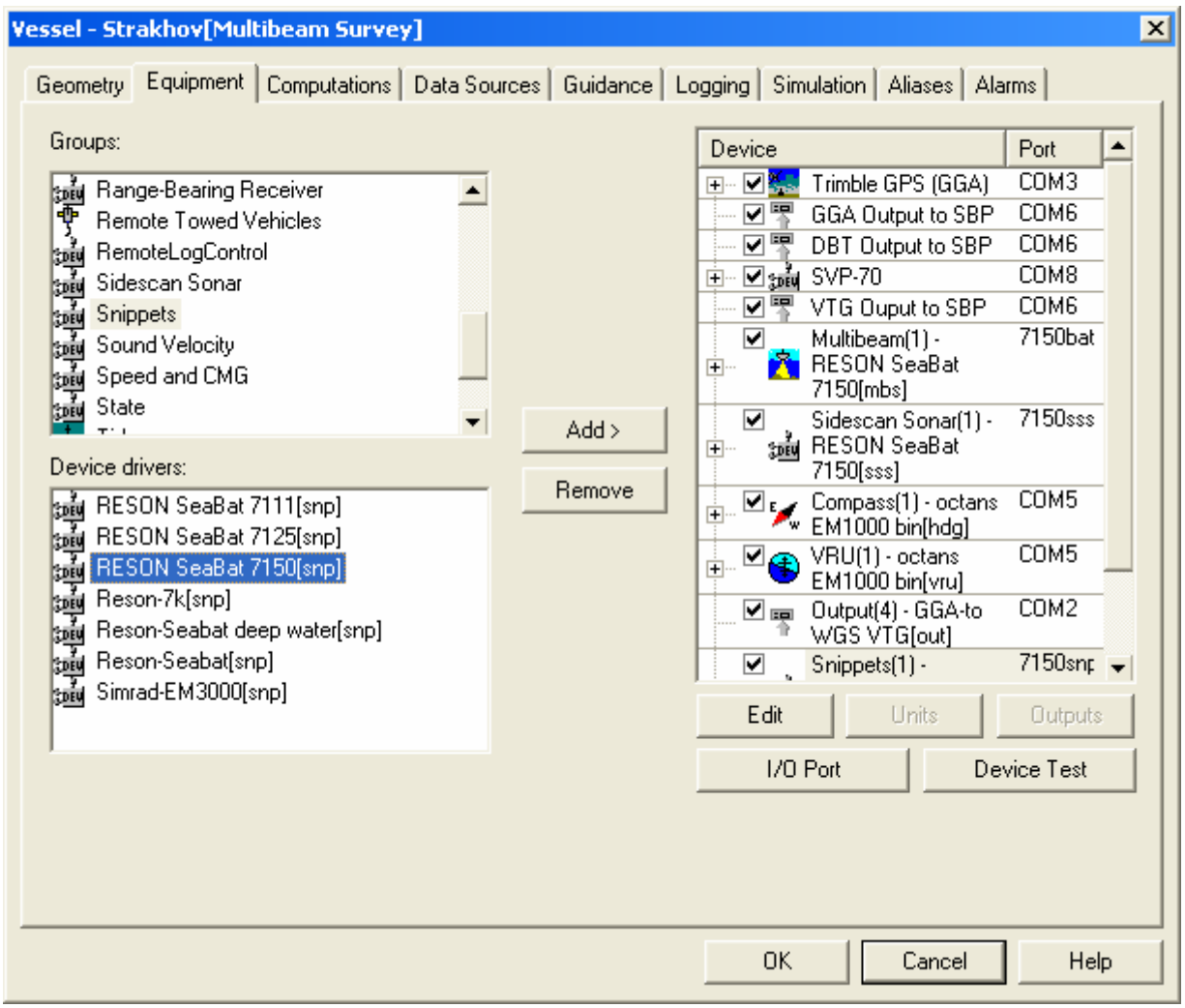
This will be automated in a forthcoming PDS2000 release.

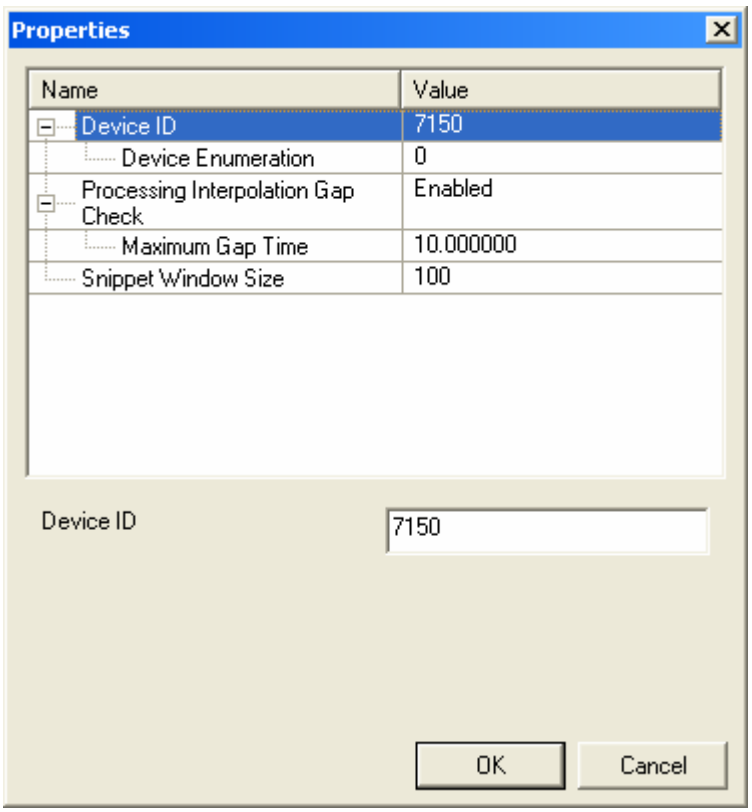




The “device ID and Enum” is automatically set to 7150 & 0 and should not be changed. Other items are correct by default.

RESON SeaBat 8150 upgrade to 7150
Installation Report
R/V “Akademik Nikolaj Strakhov”

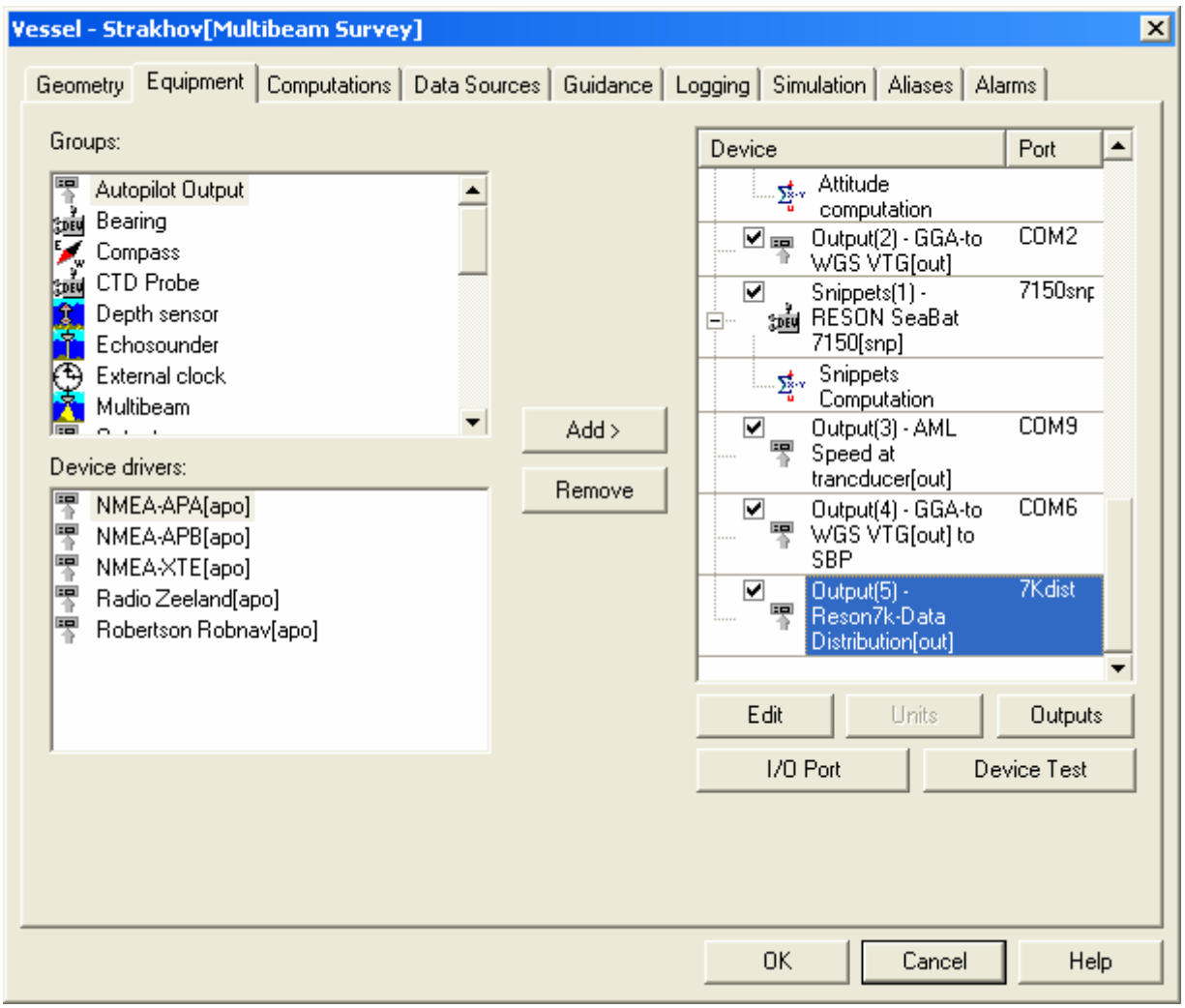




The “device ID and Enum” is automatically set to 7150 & 0 and should not be changed. Other items are correct by default.

7.3. R7K Data Distribution

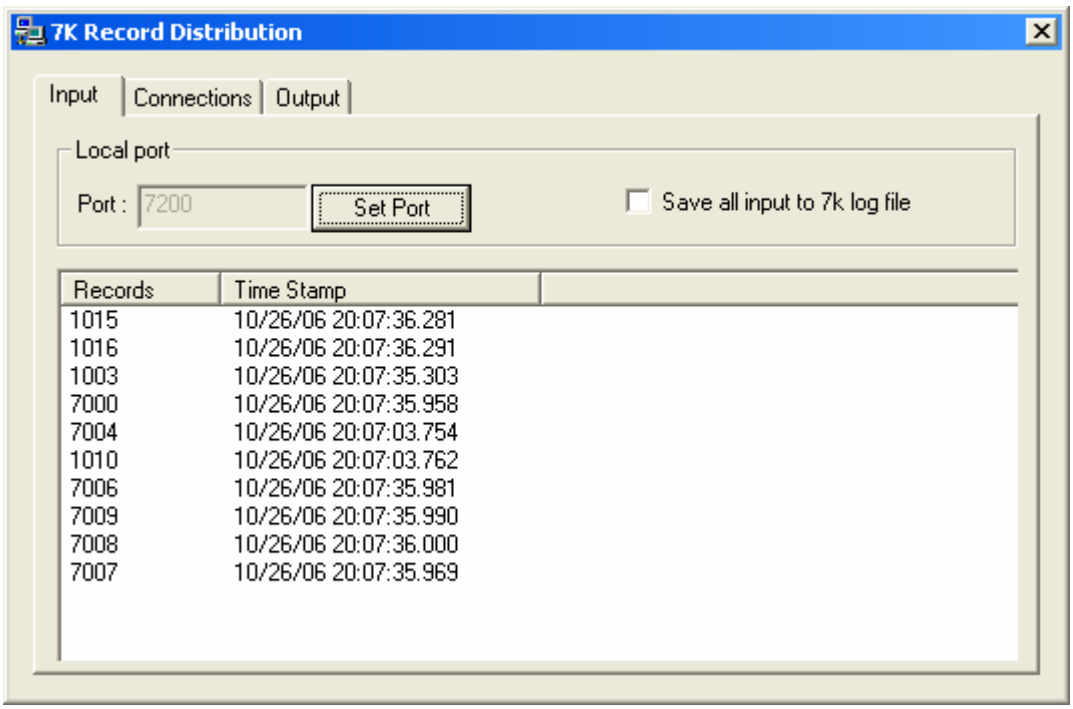
GINRAS requested the corrected bathymetry be available as a Network Broadcast. The PDS2000 “R7K Distribution” module allows this. Data from the SeaBat 7150 is sonar relative (launch angle and to way travel time) and it is PDS2000 that uses the GPS, motion, heading and sound velocity data, plus the SeaBat 7150 to calculate the corrected profile of seabed depths. The corrected depths are added to the “7006” Bathymetry data record and made available for distribution. The following describes the changes needed to the PDS project, and how to configure the data distribution.



An output, “Reson7k-Data Distribution” was added to the project. Like other outputs, during the equipment definition the selection of suitable data sources (outputs) is important.

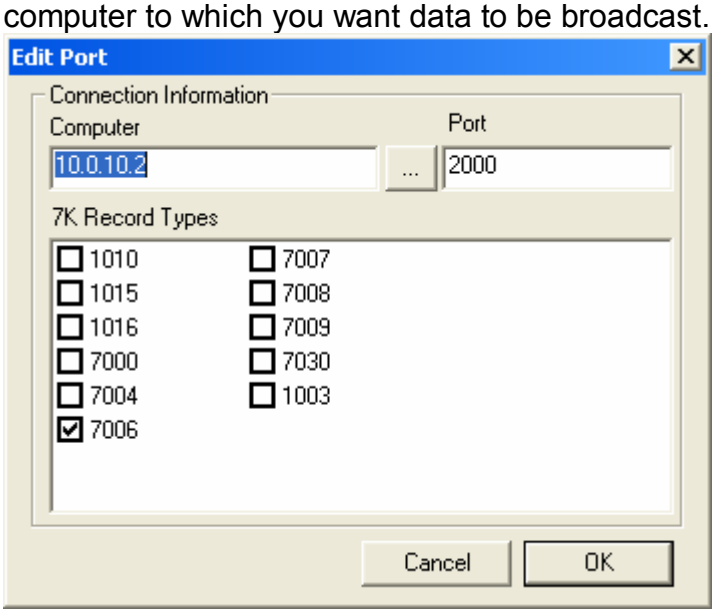
The I/O Port is the “7KDist” described earlier.

Once PDS2000 “Realtime” is started, besides the Windows Clock application (Windows Task Bar, lower right of screen) you can find the “R7KDistribution” application. It is started automatically. Double-click to open the application.



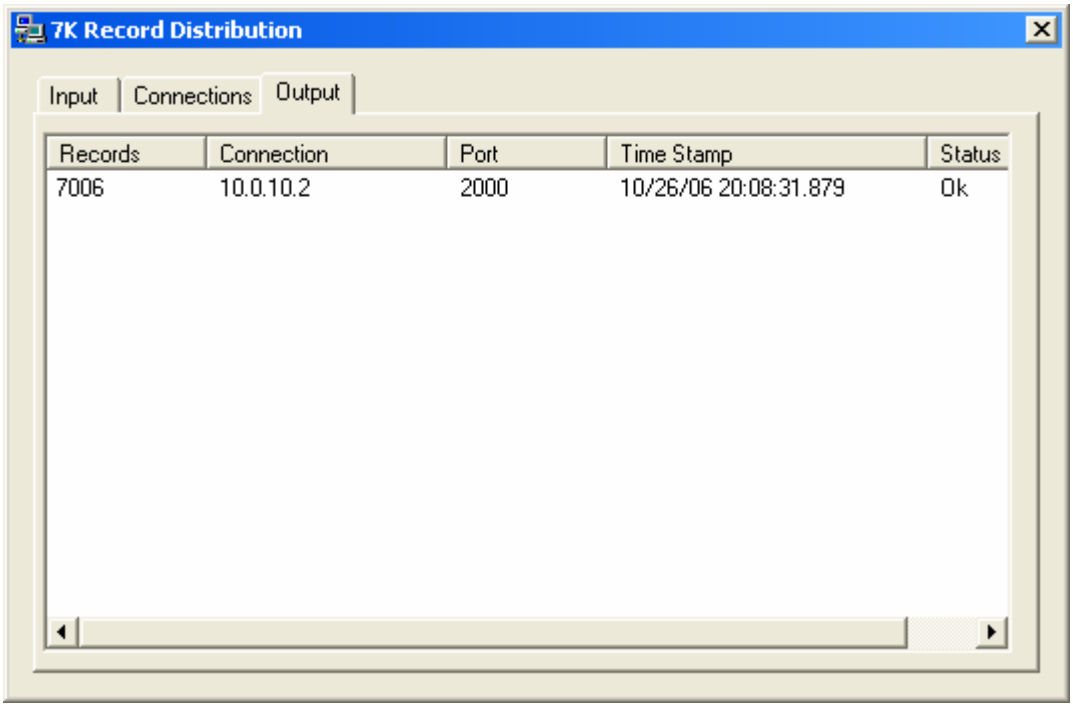
The Application has three tabs, a) Input, b) Connections, c) Output. The Input tab shows the data received from PDS2000 by the application. Do not change the LOCAL PORT setting. It is possible to record this data to a 7K formatted file.

b) Connections. This tab is where you can add the IP Address (and port) of the computer to which you want data to be broadcast. For example..



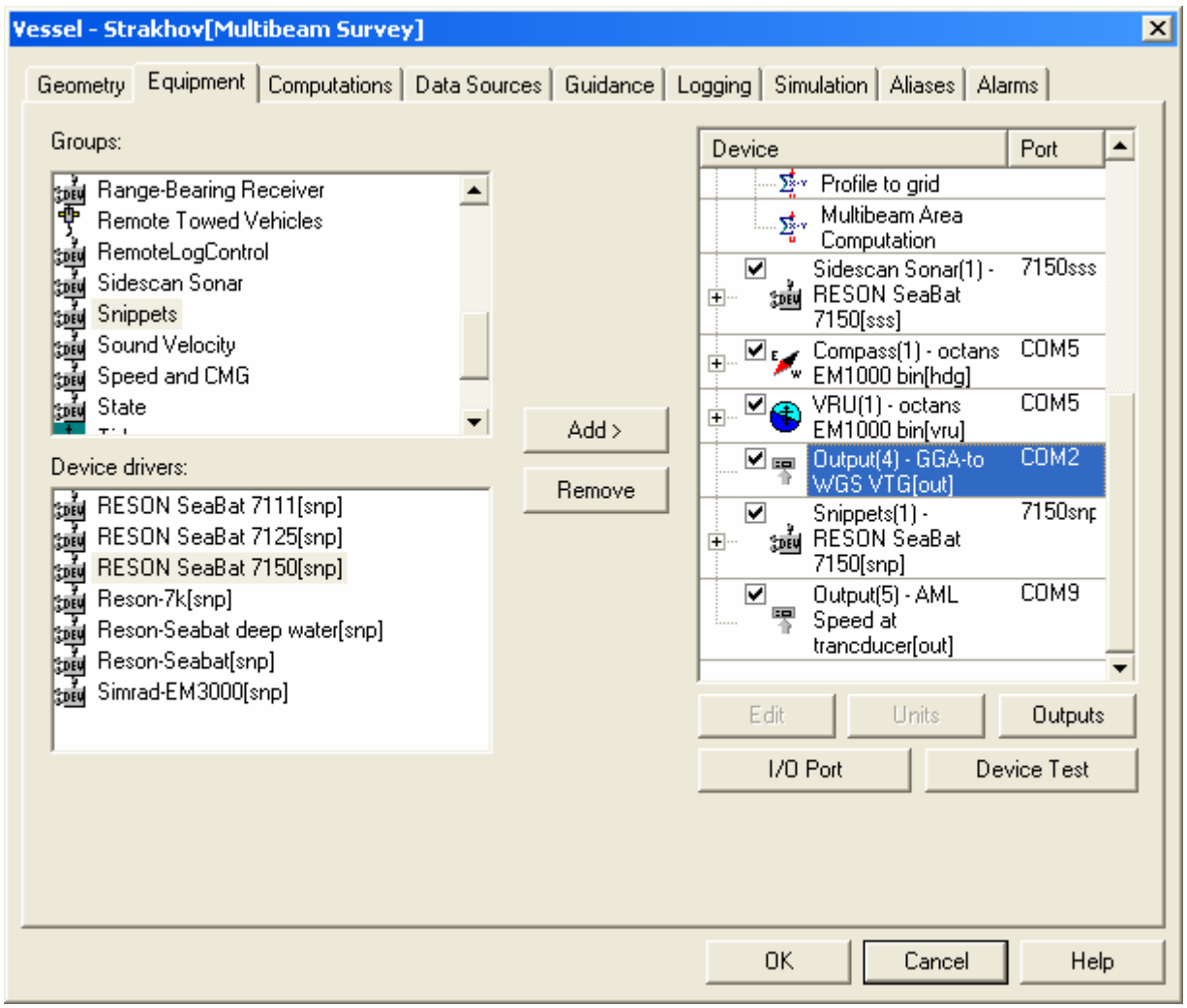
This example broadcast data to the PDS2000 Processing computer.

Refer to the 7K Interface Document for further information on each record. Record 7000 is Sonar Settings, 7006 is bathymetry, 7007 is sidescan, 7008 is snippets.



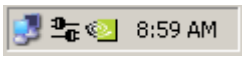
c) Output, on this tab you will the records being broadcast.

7.4. IXSEA Octans – GPS Aiding



As mentioned in Chapter 5.4 and 5.5, problems were encountered during the Harbour Acceptance when it was noticed that the Octans unit was not detecting the GPS data, needed for automatic “aiding”. Instead of an output of the DDU, a new NMEA GGA / VTG message output was added to the PDS2000 project.

8. SeaBat 7150 I/O Module



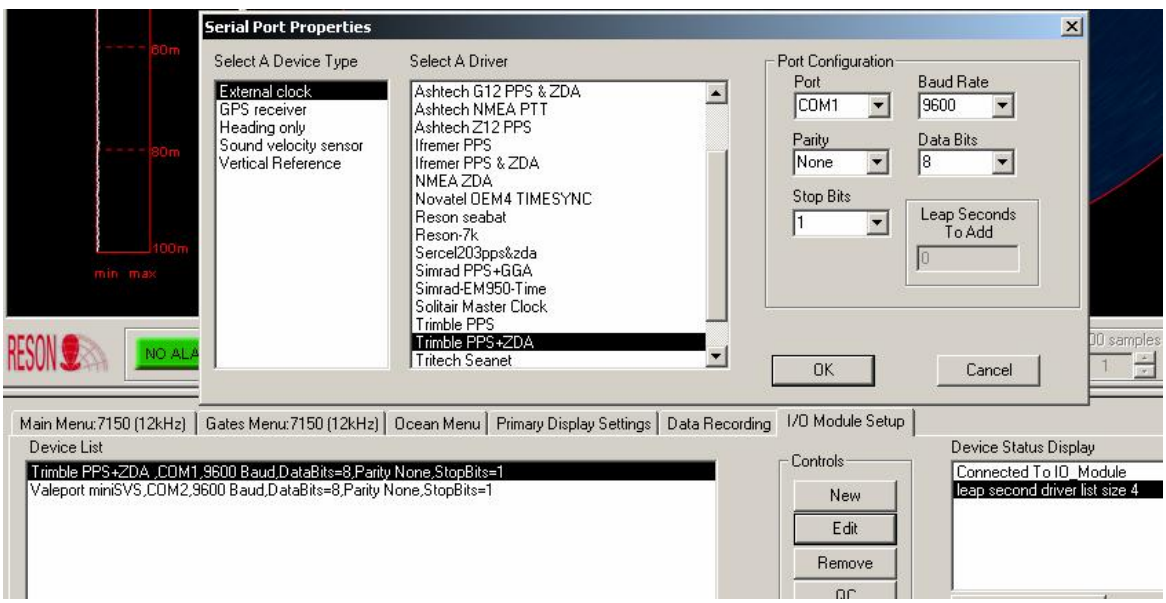
The I/O Module is installed on the 7150 Sonar Processor and is automatically started when the computer is started.

The I/O Module is responsible for:

1. Decoding the GPS NMEA ZDA time message and 1PPS (one pulse per second) from COM1 of the sonar processor. This is used for Windows Clock Synchronisation. Windows time is used by the Sonar Processor to time tag data packets.
2. Decoding the SVP-70 sound velocity data sent by PDS2000. The sound velocity (at the sonar array face) is used in the beamforming process.

The I/O Module has no settings or options. It is configured using the SeaBat 7K User Interface application.

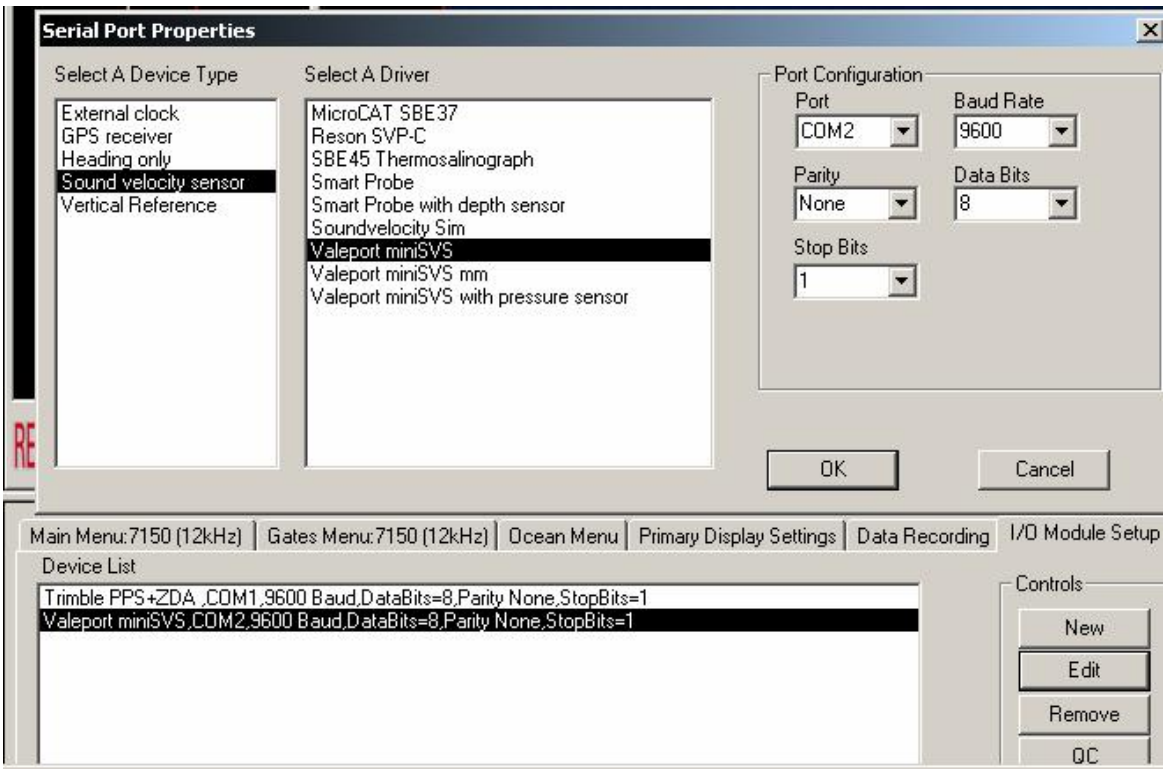
Once the sonar is started, locate the I/O Module Setup tab in the User Interface..



The above shows the settings for the Clock Sync device (Trimble PPS + ZDA).

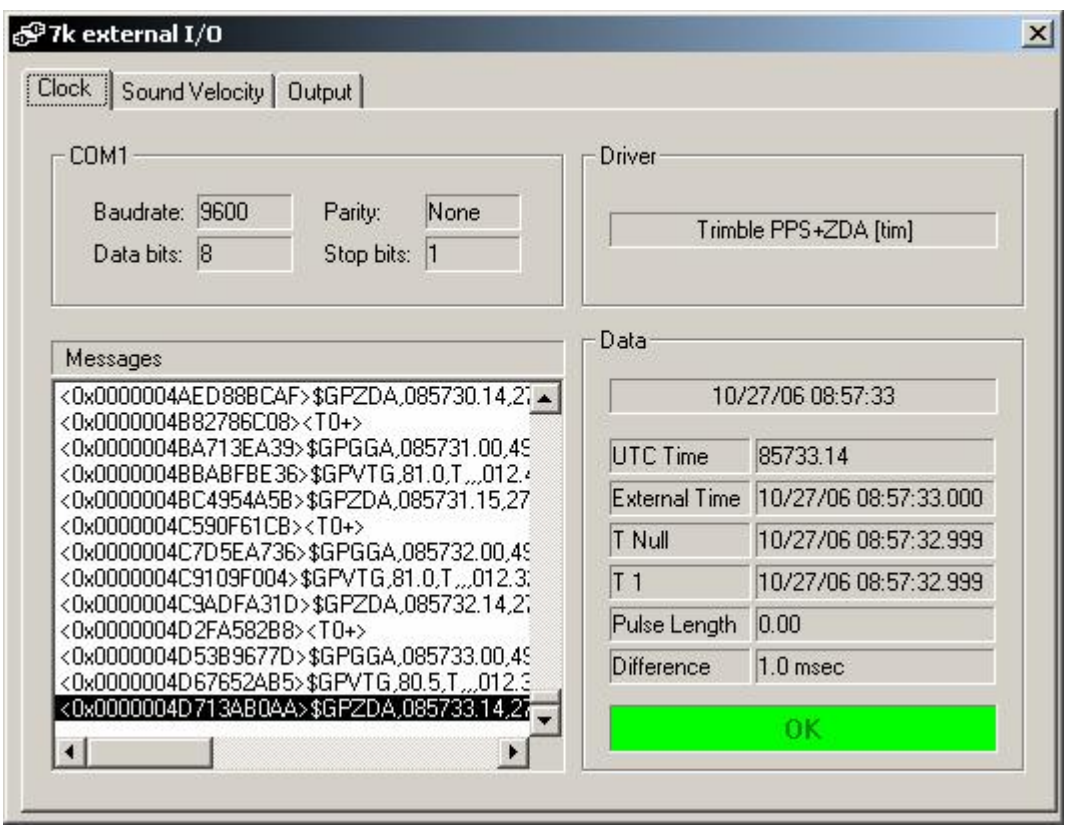
Each time the Sonar application is stopped, the I/O Module settings are stored. In case of problems, the existing device can be “Removed” and then a new device “Added” (for example External Clock, Trimble PPS+ZDA, COM1, 9600-8-N-1).

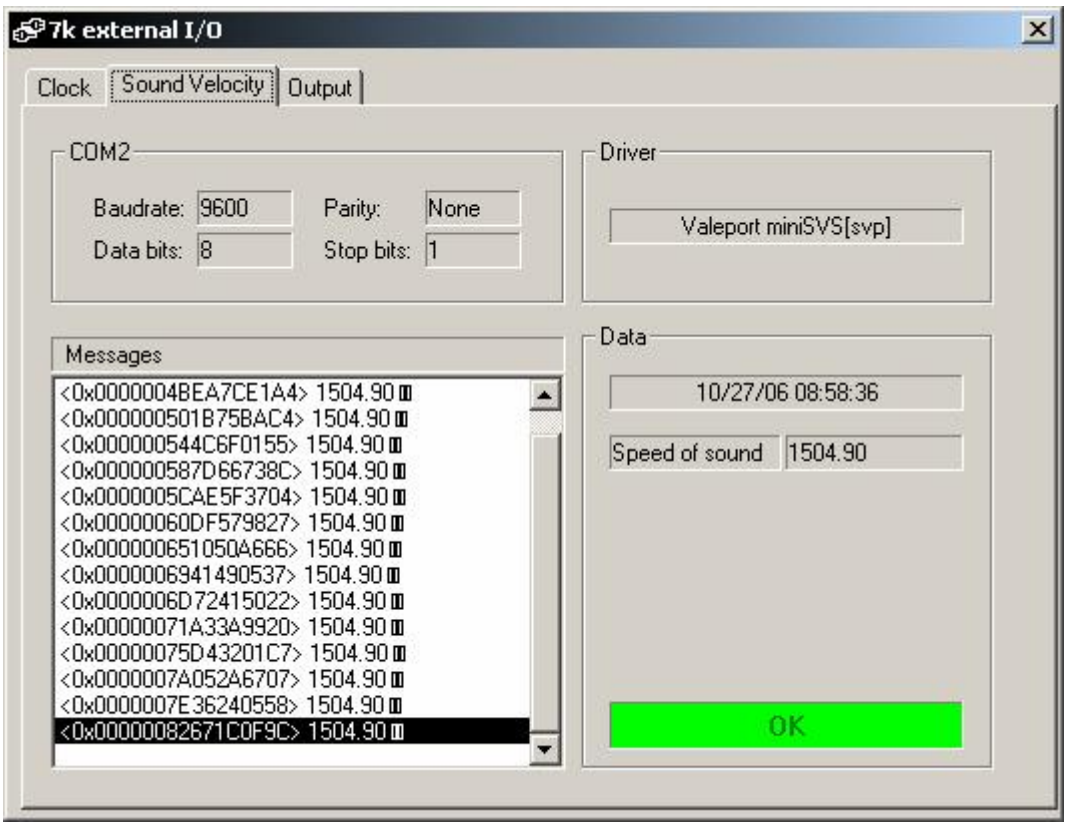
NOTE, the “Device Status” which is where errors are reported, and before starting any survey work, the status of the I/O Module should be checked.

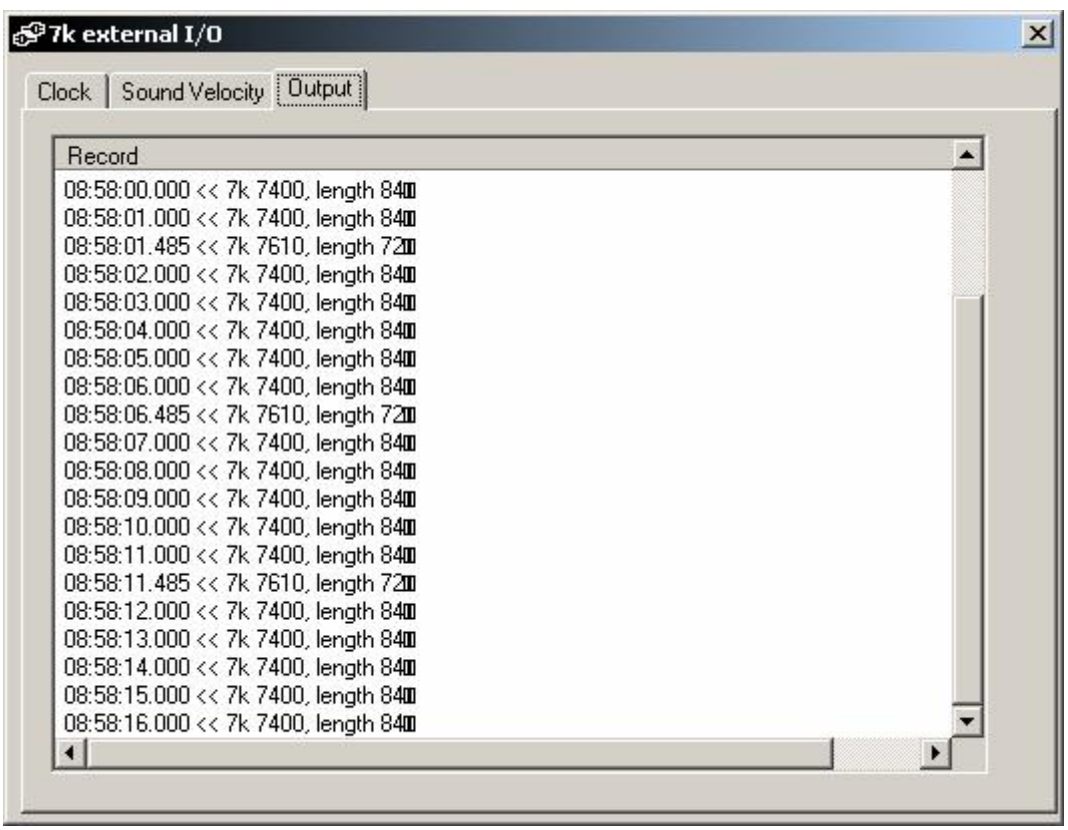


Above, the settings for the SVP-70 device.

Click “QC” to open the I/O Module using the 7K User Interface..




7k external I/O
Clock
Sound Velocity
Output
COM2
Baudrate: 9600
Parity: None
Data bits: 8
Stop bits: 1
Driver
Valeport miniSVS[svp]
Messages
<0x0000004BEA7CE1A4> 1504.90
<0x000000501B75BAC4> 1504.90
<0x000000544C6F0155> 1504.90
<0x000000587D66738C> 1504.90
<0x0000005CAE5F3704> 1504.90
<0x00000060DF579827> 1504.90
<0x000000651050A666> 1504.90
<0x0000006941490537> 1504.90
<0x0000006D72415022> 1504.90
<0x00000071A33A9920> 1504.90
<0x00000075D43201C7> 1504.90
<0x0000007A052A6707> 1504.90
<0x0000007E36240558> 1504.90
<0x00000082671C0F9C> 1504.90
Data
10/27/06 08:58:36
Speed of sound 1504.90
OK


7k external I/O
Clock
Sound Velocity
Output
Record
08:58:00.000 << 7k 7400, length 84
08:58:01.000 << 7k 7400, length 84
08:58:01.485 << 7k 7610, length 72
08:58:02.000 << 7k 7400, length 84
08:58:03.000 << 7k 7400, length 84
08:58:04.000 << 7k 7400, length 84
08:58:05.000 << 7k 7400, length 84
08:58:06.000 << 7k 7400, length 84
08:58:06.485 << 7k 7610, length 72
08:58:07.000 << 7k 7400, length 84
08:58:08.000 << 7k 7400, length 84
08:58:09.000 << 7k 7400, length 84
08:58:10.000 << 7k 7400, length 84
08:58:11.000 << 7k 7400, length 84
08:58:11.485 << 7k 7610, length 72
08:58:12.000 << 7k 7400, length 84
08:58:13.000 << 7k 7400, length 84
08:58:14.000 << 7k 7400, length 84
08:58:15.000 << 7k 7400, length 84
08:58:16.000 << 7k 7400, length 84

9. Valeport MIDAS System

The Valeport MIDAS was delivered during a visit to Helsingor, Denmark, in early 2006. The sensors comprising the MIDAS are listed as follows:

- Sound Velocity
- Turbidity
- Pressure
- Temperature
- Dissolved Oxygen
- Conductivity
- Water Bottle Sampler
- Fluorometer
- PH
- Redox

Figure 12a – Valeport MIDAS

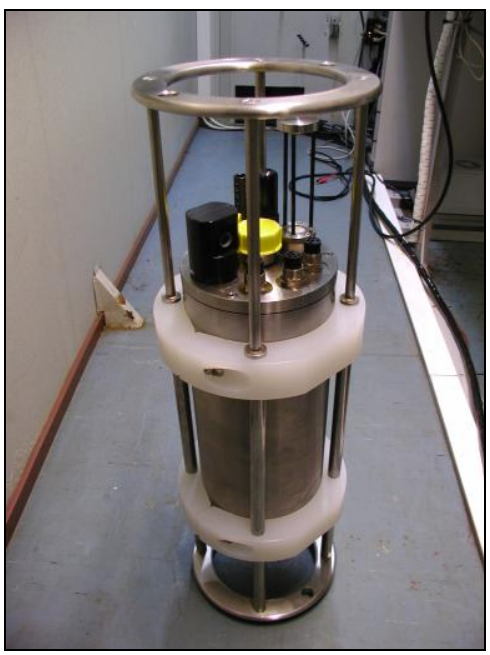


Fig 12b – Valeport MIDAS

Fig 12c – Valeport MIDAS

Normally data is recorded internally and exported to ASCII format using the Datalog 400 software installed on the processing PC. The 3m Y-splice is used to connect the sensor to a 9-way COM port.

9.1. Datalog 400 Errors

During the SeaBat 7150 upgrade in October 2006, it was reported that the MIDAS unit was not working. A bench test on 18th October was able to repeat the Error

Message. With telephone support from Valeport on 19th October, the unit was again functioning. Missing parameters from the REDOX sensor setup caused “out of range” values which in turn mean the Datalog 400 error.

9.2. PH Sensor

A bench test of the PH sensor on 20th October showed the unit to be faulty. On advice from Valeport, attempts were made to clean the sensor, but it failed altogether.

9.3. REDOX Sensor

A bench test of the PS sensor on 20th October in which the sensor was immersed in Standard Solution, showed the unit to be working well.

9.4. Water Sampler

A bench test of the water sampler and three bottles showed the unit to be working well.

9.5. Deployment To 2,000m

On 25th October the complete unit was deployed to 2,000m, but on it’s return it failed to allow data connection to recover the data. The unit was opened and found to be full of water.