



# ZPulse® Doppler Current Sensor 4420/4420R, 4830/4830R, 4520/4520R, 4930/4930R

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## Introduction

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### Purpose and scope

This document is intended to give the reader knowledge of how to operate and maintain the Aanderaa ZPulse® Doppler Current Sensor 4420/4830/4520/4930-series. These sensors are described in a single manual since the measurement principle and electronics is the same for all sensors. 4420 and 4830 are Shallow Water (SW) units with maximum depth rating 300meter. 4520 and 4930 are available in two versions 3000meter Intermediate Water (IW) and 6000meter Deep Water (DW) version. 4420 and 4520 are without temperature and are mainly used with the SeaGuard RCM to measure current. 4830 and 4930 also measure temperature as an extra parameter.

The sensor is designed to fit directly on the top-end plate of SeaGuard or SeaGuardII Platform using a sensor foot or in a string system connected to SmartGuard or SeaGuard String logger using AiCaP. The sensor can also be used as stand-alone sensor using RS-232. The R-version of each sensor is only RS-422 output and is intended for stand-alone use with longer cables than can be used with the RS-232 version. There is hardware differences between a standard version and a R-version so this need to be specified when ordered.

Aanderaa Smart Sensors utilize common communication protocols at the RS-232 and RS-422 interface where the Smart Sensor Terminal protocol is a simple ASCII command string based protocol and the AADI Real Time is an XML based protocol. The common updates of these protocols are called framework 3, and was released August 2012 for most of the Aanderaa smart sensors (See [Appendix 1 Product change notification: Frame Work3](#)). When used together with one of the Aanderaa Dataloggers the can bus based AiCaP communication protocol is used.

To configure and control the sensor we use sensor properties. A complete list of user accessible sensor properties is listed in [chapter 1.7](#). The sensor properties are divided in 4 groups with different access levels. Some properties may be set on or off when others may contain different values. To change these setting you can either use AADI Real-Time Collector for stand-alone use described in [CHAPTER 2](#), AADI Real-Time collector for sensor connected to SeaGuard with plug bar assembly, SeaGuardII or SmartGuard described in [CHAPTER 3](#), Touch screen for sensor connected to SeaGuard with display described in [CHAPTER 4](#) or terminal software like Terra Term for stand-alone sensor, described in [CHAPTER 6](#).

The sensor has 3 different alternatives for Compass calibration. This need to correspond with the installation and use, otherwise it might be a deviation in the calculated current direction. The alternative calibration is: only up, only down or both. This calibration can only be performed at the factory. If nothing else is specified when ordered the sensor will be calibrated only up.

## **Document Overview**

**CHAPTER 1** gives a short description of the ZPulse® Doppler Current Sensor

**CHAPTER 2** gives an overview of stand-alone configuration using AADI Real-Time Collector

**CHAPTER 3** gives an overview of configuration via SmartGuard, SeaGuard or SeaGuardII Datalogger

**CHAPTER 4** gives a description of how to log data via AADI Real-Time Collector.

**CHAPTER 5** gives an overview of configuration using SeaGuard touch screen

**CHAPTER 6** gives an overview of how to configure a stand-alone sensor using a Terminal Software like Terra Term

**CHAPTER 7** presents Electromagnetic Compatibility concerns regarding the sensor.

**CHAPTER 8** gives some other detail about the sensor like sensor orientation and different test procedures

**CHAPTER 9** describes Maintenance issues

**CHAPTER 10** gives information Installation issues like how to set up using Windows 10, available cables and example of applications

**Appendix 1** is a copy of Product Change Notification: Framework 3.

## **Applicable Documents**

V9810 / V9811	Assembly Drawing
Form 769	Test & Specification Sheet, ZPulse® DCS 4420/4830/4520/4930
Form 726	Calibration Certificate, ZPulse® DCS 4420/4830/4520/4930
Form 667	Pressure Certificate
D 367	Data sheet, ZPulse® DCS 4420/4830/4520/4930
D 410	Data sheet, Test Unit 5048
TD 262a	Manual for SeaGuard Platform
TD 310	Manual for SeaGuardII Platform
TD 293	Manual for SmartGuard
TD 268	AADI Real-Time collector operating manual

## Abbreviations

ADC	Analog to Digital Converter
AiCaP	Aanderaa Protocol: Automated idle Line CANbus Protocol
ARMA	In the statistical analysis of time series, <b>autoregressive–moving-average (ARMA) models</b>
ASCII	American Standard Code for Information Interchange
CAN	Controller Area Network - sometimes referred to as CANbus
COM port	Communication port used for Serial communication RS232/RS422
DAC	Digital to Analog Converter
DCS	Doppler Current Sensor (Single point)
DSP	Digital Signal Processor
EIA	Electronic Industry Alliance
EPROM	Erasable Programmable Read Only Memory
MSB	Most significant bit
RTC	Real Time Clock
UART	Universal Asynchronous Receiver and Transmitter
USB	Universal Serial Bus

## CHAPTER 1 Short description and specifications of the DCS

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### 1.1 Description

The AADI Aanderaa ZPulse® Doppler Current Sensor is a single point current sensor based on the Doppler Shift principle.

To measure current speed and direction the sensor transmits acoustic pulses (pings) into the water and samples the backscattered (echo) signal at specific distance away from the sensor. Complex acoustic pulses comprising two distinct frequencies are combined into a single acoustic pulse which is sent out in two orthogonal directions at regular time intervals. The ZPulse® based DCS separates the received signal into different frequency bands, one for each frequency in the transmitted signal. Further it analyses the frequency shift using a high speed Digital Signal Processor. An ARMA based parametric model processing algorithm is used to find the Doppler frequency.

It uses four acoustic transducers (beams) but only two are necessary to be able to calculate the 2D-current. The sensor can be configured to use all four beams or only two or three if necessary. It can also be configured to only use the 2 transducer that is pointing towards the current. This is done to avoid turbulence that might occur behind the sensor.

The sensor includes a solid-state 3-axis magnetometer and inclinometer providing the tilting and compass heading of the sensor. The tilt is necessary for correct horizontal placement of the cell. The compass also uses the tilt internally to find the correct horizontal components of the earth magnetic field to be able to calculate the correct compass heading from the earth magnetic field. The compass heading and tilt (pitch, roll) is measured for each acoustic ping and is used for calculation of the current vectors (north, east) for each ping. At the end of the recording interval a vector average is calculated to obtain the correct averaged horizontal speed and direction. The sensor can also output the horizontal north and east speed components in addition to the horizontal speed and direction. The sensor also calculates and outputs several quality data which can be used to identify any suspicious data (user enabled). The different quality data from the sensor are described in details in this manual. To minimize the effect of marine fouling and local turbulence, the ZPulse® DCS is measuring the horizontal current at least 0.4 meter away from the instrument, refer .

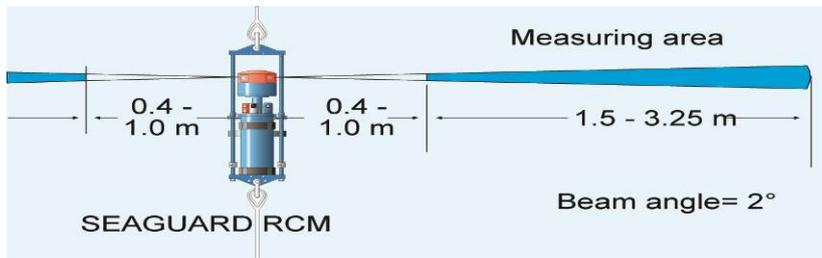
In ZPulse® mode, a measurement interval comprising 150 pings (150 on each axis) will normally provide a good estimate of the current speed. The number of pings can be reduced to lower the power consumption, but this also increases the statistical noise (standard deviation).

The ZPulse® technology reduces statistical variance with a factor of  $\sqrt{2}$  . This again reduces the required number of Pings needed in order to achieve an acceptable statistical error.

The ZPulse® DCS 4420/4830 has POM Housing and is depth rated to 300m; All 4830 sensors and 4420 sensors has a POM housing but titanium base plate. ZPulse® DCS 4520/4930 has a Titanium Housing and base plate and is depth rated to 3000m or 6000m. The output formats of the 4420/4830/4520/4930 are AiCaP and RS-232, while the output format of the 4420R/4830R/4520R/4930R are RS-422. The sensor can be used in polled mode when set to Smart Sensor Terminal mode.

The ZPulse® DCS 4420/4830/4520/4930 fits directly onto the Top-end plate of the Aanderaa SeaGuard or SeaGuardII data logger; the sensor is then used in AiCaP mode. When used with SmartGuard both AiCaP and RS-232 mode can be used. The sensor may also be used as a stand-alone RS-232 sensor for other applications. The R-version cannot be used on a SeaGuard platform. This sensor is for use with SmartGuard or as stand-alone RS-422 sensor on longer cables. RS-422 is based on differential data transmission, which makes it more insensitive to noise than RS-232. RS-422 was designed for greater distances and higher Baud rates than RS-232.

**Note! RS-422 must be enabled from the factory prior to delivery. Enabling RS-422 disables the AiCaP and RS-232 interface.**



**Figure 1-1: Measuring area for ZPulse® DCS**

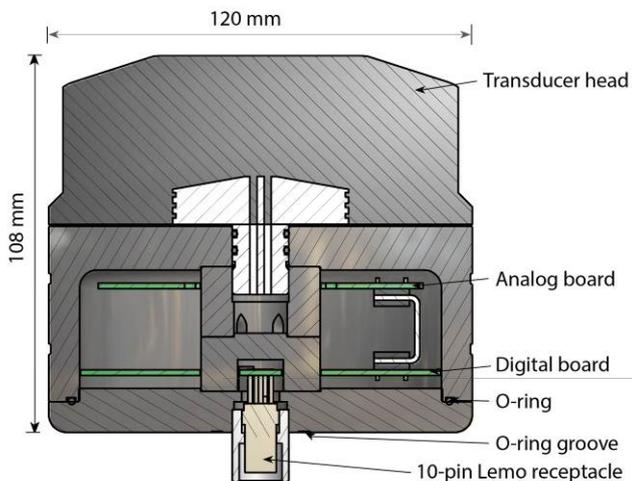
## 1.2 Sensor Dimension



**Figure 1-2: Shallow Water SW**



**Figure 1-3: Intermediate Water IW/ Deep Water DW**



**Figure 1-4: Sensor dimension**

### 1.3 Sensor pin configuration and data output

DCS 4420/4520/4830/4930 is using a 10-pin lemo plug for RS-232 and AiCaP communication between sensor and logger; see [Figure 1-5](#) for pin configuration. DCS 4420R/4520R/4830R/4930R is using a 10-pin lemo plug for RS-422 connection to external logger; see [Figure 1-6](#) for pin configuration. For a list of available cables see [chapter 10.2](#) or contact [aanderaa.sales@xylem.com](mailto:aanderaa.sales@xylem.com).

#### 1.3.1 Sensor pin configuration 4420/4520/4830/4930 with RS-232 and AiCaP communication

##### PIN CONFIGURATION

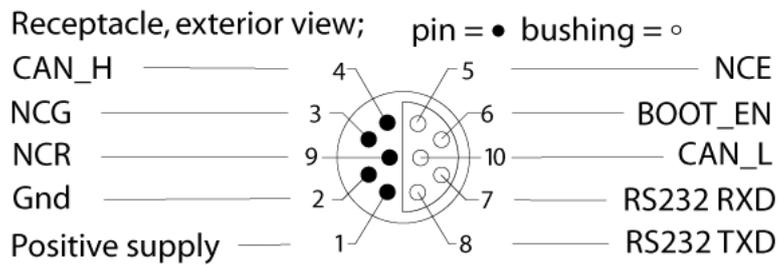


Figure 1-5: 4420/4520/4830/4930 Sensor communication 10-pin plug with RS-232 and AiCaP

Sensor Signal name	Input (I) Output (O)	Sensor plug MCBH10M. Pin no:
TXD	O	8
RXD	I	7
Positive supply		1
GND		2
NCE		5
NCR		9
NCG		3
CAN_H		4
CAN_L		10
BOOT ENABLE	I	6

Table 1-1: 4420/4520/4830/4930 Sensor pin configuration 10-pin plug AiCaP and RS-232

### 1.3.2 Sensor pin configuration 4420R/4520R/4830R/4930R with RS-422 communication

#### PIN CONFIGURATION

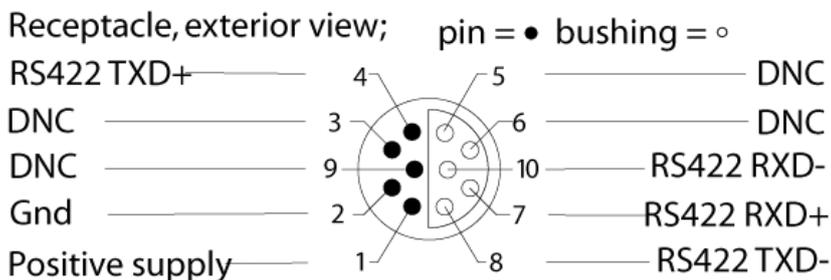


Figure 1-6: 4420R/4520R/4830R/4930R Sensor communication 10-pin plug with RS-422

Signal name	Input (I) Output (O)	Sensor plug Pin no: MCBH6F
RX-	I	10
RXD/RX+	I	7
TXD/TX-	O	8
TX+	O	4
GND		2
Positive supply		1

Table 1-2: 4420R/4520R/4830R/4930R Sensor pin configuration 10-pin plug RS-422

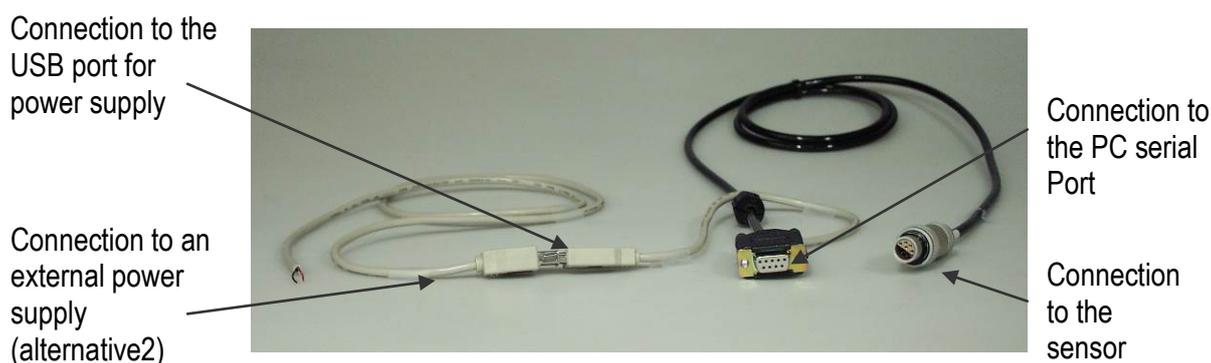
### 1.4 Sensor Connection

Aanderaa offers a wide range of cables for different use of the sensors, both standard cables for use with loggers using AiCaP, RS-232 and RS-422 but also special customer specified cables for use in project. See [chapter 10.2](#) for an overview of standard cables or contact [aanderaa.sales@xylem.com](mailto:aanderaa.sales@xylem.com) for more info. To configure the sensor it either need to be connected to an Aanderaa logger using AiCaP, a real-time RS-232/RS-422 cable or you need a RS-232 configuration cable. This cable can be used for all sensors regardless of version since all sensors have a RS-232 connection for configuration.

### 1.4.1 Configure sensor using RS-232 configuration cable

The 3855 cable is a non-watertight 1.5 meter cable for laboratory use only used for connection between sensor and PC in the office/lab. This cable can also be used to configure all other Aanderaa Smart Sensors.

The cable is supplied with a USB port providing power to the sensor but since the USB port on a computer normally gives 5V power and the DCS needs 6-14V the sensor cannot be powered from the computer like for most other Aanderaa Smart Sensors. A USB extension is supplied with the cable so we recommend connecting the free end to an external power (6-14V). An alternative solution is to use a 9V alkaline battery (6LF22) to set the sensor up or log it in the laboratory. Sensor Cable 3855 is also available in other lengths.



**Figure 1-7: Configuration Cable 3855**

Signal name	Sensor plug	9-p D-Sub	USB
TXD	1	2	
RXD	2	3	
Boot Enable	3		
BV	4		4 (black)
GND	7	5	1 (red)
Positive Supply	8		
RTS short to CTS		7-8	
DSR short to DTR		6-4	

**Table 1-3: 3855 Cable pin configuration**

## 1.5 User accessible sensor properties

All configuration settings that determine the behaviour of the sensor are called properties and are stored in a persistent memory block (flash). One property can contain several data elements of equal type (Boolean, character, integer etc.). The different properties also have different access levels.

To read the value of a certain properties you need to send ASCII string starting with the command get and then followed by the property name to the sensor, see example below.

To change the content of a property an ASCII string starting with set and then followed by the property name and new value in brackets need to be sent to the sensor.

**Get Interval** //When sending this string to the sensor, it will then return the value stored in this property.

**Interval 4520 7 60** //Returned from sensor, where 4520 is the product number, 7 is the serial number of the sensor and 60 is the value stored as interval in seconds. To change the value you might send the following command:

**Set Interval(600)** //This will change the value for this property to 10 minutes

**Save** //Always end with save to store setting in flash

The interval will now be changed to 10 minutes.

## 1.6 Passkey for write protection

To avoid accidental change, most of the properties are write-protected. There are four levels of access protection, refer [Table 1-4](#).

A special property called **Passkey** must be set according to the protection level before changing the value of properties that are write-protected, refer [Table 1-4](#). After a period of inactivity at the serial input, the access level will revert to default. This period corresponds to the **Comm TimeOut** setting, or 1 minutes if the **Comm TimeOut** is set to **Always On**.

Output	Passkey	Description
No		No Passkey needed for changing property
Low	1	The Passkey must be set to 1 prior to changing property
High	1000	The Passkey must be set to 1000 prior to changing property This Passkey value also gives read access to factory properties that usually are hidden
Read Only	Factory	The user have only read access

**Table 1-4: Passkey protection**

## 1.7 Sensor Properties

When using AADI Real-Time Collector you don't need to think about the command string sent to the sensor since this is fully controlled by the software, see [CHAPTER 2](#) and [CHAPTER 3](#).

Some properties of the 'AiCaP' sensor will not be applicable / visible when the sensor is connected to a SeaGuard, SeaGuardII or SmartGuard Datalogger, as these properties will be controlled by the instrument.

All sensor properties are listed in [chapters 1.7.1](#) through [1.7.4](#).

### 1.7.1 Factory Configuration

All properties in this section are Read Only, not possible to overwrite for the user. Only certified Aanderaa service personal can alter these settings. The access level for reading the status of this properties are however different for each property, see table for more details. In this group we find information about Software and hardware settings, Production, Service and Calibration dates.

**Table 1-5: Sensor properties for Doppler Current Profiler Sensor 4420/4420R, 4520/4520R, 4830/4830R and 4930/4930R.**

**ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')**

Property	Type	No of elements	Use	Category	Access Protection Read/Write
<i>Product Name</i>	String	31	AADI Product name, default Doppler Current Sensor	FC	No / Read Only
<i>Product Number</i>	String	6	AADI Product number, default 4420, 4420R, 4520, 4520R, 4830, 4830R, 4930 and 4930R		
<i>Serial Number</i>	INT	1	Serial Number		
<i>SW ID</i>	String	11	Unique identifier for internal firmware		
<i>SW Version</i>	INT	3	Software version (Major, Minor, Built)		
<i>HW ID X</i>	String	19	Hardware Identifier, X =1..3 <sup>1)</sup> unique identifier for hardware		High / Read Only
<i>HW Version X</i>	String	9	Hardware Identifier, X =1..3 <sup>1)</sup> (Rev. x)		
<i>System Control</i>	INT	3	For AADI service personnel only		
<i>Production Date</i>	String	31	AADI production date, format YYYY-MM-DD (Not in use)		
<i>Last Service</i>	String	31	Last service date, format YYYY-MM-DD, empty by default		
<i>Last Calibration</i>	String	31	Last calibration date, format YYYY-MM-DD (Not in use)		
<i>Calibration Interval</i>	INT	1	Recommended calibration interval in days (Not in use)		

<sup>1)</sup> Hardware ID 1 is Analog Board for Transducer 1 and 2. Hardware ID 2 is Analog Board for Transducer 3 and 4 and Hardware ID 3 is for Digital Board

## 1.7.2 Deployment Settings

Deployment Settings contains settings interval and for instruments metadata like location and position.

**Table 1-6: Sensor properties for Doppler Current Sensor 4420/4420R, 4520/4520R, 4830/4830R and 4930/4930R**

**ENUM=Enumeration, INT=Integer, BOOL=Boolean ('yes'/'no')**

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write
<i>Interval</i>	ENUM	1	Set the output interval in seconds.. Minimum available interval is dependent on configuration (time to do all ping measurements). <sup>1)</sup>	DS	No / No <sup>2)</sup>
<i>Location</i>	String	31	User setting for location		No / No
<i>Geographic Position</i>	String	31	User setting for geographic position		
<i>Vertical Position</i>	String	31	User setting for describing sensors vertical position/depth		
<i>Reference</i>	String	31	User setting for describing sensor reference, user definable.		

<sup>1)</sup> The interval is an enumerated type. The enumerated value for the Interval is shown when sending a Help command to the sensor.

<sup>2)</sup> Only available for stand-alone use. Not visible in AiCaP mode.

### 1.7.3 System Configuration

This group is used to control the sensor via properties for configuring mode settings, sensor setup and parameter enabling and controlling the output from sensor. Some of the properties are only visible depending on the mode selected or if the function is enabled or not. These properties will either be grey or not visible at all.

**Table 1-7: Sensor properties for Doppler Current Profiler Sensor 5400/5400R, 5402/5402R, and 5403/5403R**  
**ENUM=Enumeration, INT=Integer, BOOL=Boolean ('yes'/'no')**

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write
<i>Mode</i>	ENUM	1	Sets the sensor operation mode (AiCaP, Smart Sensor Terminal, AADI Real-Time and Smart Sensor Terminal FW2). AiCaP is not available on the R-versions of the sensor. Smart Sensor Terminal is an ASCII output when AADI Real-Time is XML output. Smart Sensor Terminal FW2 is old settings used before release of Frame Work 3.	SC	No / No <sup>1)</sup>
<i>Enable Sleep</i>	BOOL	1	Enables sleep mode in Smart Sensor Terminal and AADI Real-Time operation to save power (In AiCaP the sensor always tries to sleep when not busy).		
<i>Enable Polled Mode</i>	BOOL	1	Enables polled mode in Smart Sensor Terminal Mode. When set to 'no' (non-polled operation) the sensor will sample at the interval given by the <i>Interval</i> property. When set to 'yes' the sensor will read the last measured data on request only (use the <i>Do Sample</i> command). A <i>Do Sample</i> command triggers the end calculations and output of data. A <i>Do Output</i> command can be sent to repeat the output of the last calculated data.		
<i>Enable Text</i>	BOOL	1	Controls the insertion of descriptive text in Smart Sensor Terminal mode, i.e. parameter names and units. Can be used to reduce message size.		
<i>Enable Decimalformat</i>	BOOL	1	Controls the use of decimal format in the output string in Smart Sensor Terminal mode. Default is scientific format (exponential format).		No / No <sup>1)</sup>
<i>Ping Number</i>	ENUM	1	The number of ping measurements to be executed in one interval (set by interval property), i.e. the number of ping measurements to be averaged in one recording. Selectable from 50 to 600. Default value is 150.		
<i>Polled Pingrate</i>	ENUM	1	Selectable ping rate in Polled mode between 0.1 and 25.0 Hz. Default value is 10 Hz. Only for use in Smart Sensor Terminal mode and when Enable Polled Mode is used.		
<i>Enable Burst Mode</i>	BOOL	1	If set to 'No', the pings are uniformly spread over the interval. If set to 'Yes' the pings are transmitted at the end of the interval. <sup>2)</sup>		

<i>Enable Single Interval</i>	BOOL	1	Set yes to perform only one single measurement interval. Default is no	SC	No / No <sup>1)</sup>
<i>Start Distance</i>	ENUM	1	Set the distance for the pulse propagation before measurements starts. Default value is 0.50		Low / Low
<i>Cell Size</i>	ENUM	1	Set the cell size. Default value is 1.50		
<i>Enable ZPulse Operation</i>	BOOL	1	Activate/deactivate ZPulse operation; Set yes to activate. Default value is yes. ZPulse operation gives two separate frequencies in each ping and therefor higher quality data without increasing power consumption		No / Low
<i>Sensor Id</i>	ENUM	1	When the DCS is connected to AiCaP, a list of other available sensors connected to the SmartGuard/SeaGuard Datalogger is shown. This makes it possible to get a correct heading input from another sensor through the Datalogger. Only in AiCaP mode		
<i>Parameter Id (Deg.M)</i>	ENUM	1	A list of all available Heading parameters with Deg.M as unit is shown in the dropdown menu. Make sure that the correct heading parameter is selected. Only in AiCaP mode.		
<i>Sound Speed</i>	Float	1	Sets the speed of sound in water. The sound speed is approximately 1500m/s in seawater. Default value is 1500.		Low / Low
<i>Enable Fixed Heading</i>	BOOL	1	Allows the user to deactivate the internal compass and set a fixed heading value. This can be used if for example the sensor is standing on a fixed platform where the earth magnetic field is disturbed. <sup>3)</sup>		
<i>Fixed Heading [Deg.M]</i>	Float	1	The fixed heading value is used if fixed heading is enabled. <sup>3)</sup>		
<i>Enable Tilt Compensation</i>	BOOL	1	Enable/disable tilt compensation to correct the measured current speed according to the sensor tilt. Default value is yes		
<i>Activation X-axis</i>	ENUM	1	Controls active transducers on the X-axis: 1, 3, 1+3. Default is 1+3. If there is a fixed obstruction in front of one transducer this transducer might be turned off		Low / Low
<i>Activation Y-axis</i>	ENUM	1	Controls active transducers on the Y-axis: 2, 4, 2+4. Default is 2+4. If there is a fixed obstruction in front of one transducer this transducer might be turned off		
<i>Enable Forward Ping</i>	BOOL	1	Set yes to enable forward ping to improve the current speed accuracy, The sensor will try to measure upstream to reduce problems related to turbulence. Default value is yes.		

<sup>1)</sup> Only available for stand-alone use. Not visible in AiCaP mode.

<sup>2)</sup> The burst mode should be enabled when using a longer interval where the user does not want to average the current over the entire interval. The burst duration for executing all the pings is dependent on the configuration of the sensor (profile size, number of columns, number of cells and number of ping).

<sup>3)</sup> The fixed heading value here is the angle in degrees between north direction and transducer 1 (clockwise) – Refer [Figure 8-2](#). When viewing the sensor from the front (label side) transducer 1 is to the left on the rear side. If for example transducer 1 is 118° clockwise from north, the fixed heading should be set to 118°. The fixed heading is a value between 0 and 360 (0 and 360 is the same point).

## 1.7.4 User Maintenance

This group contains sensor settings that normally are not altered by the user. To access most of these properties you need to send **passkey(1000)** or with Real-Time Collector use password: 1000. These properties are used to configure serial port settings, communication to and from sensor. If you got a wave license key you may also enable wave functionality, you may enter temperature coefficients if Temperature sensor is included, set limits for discarding ping if sensor tilt exceeds the limits and property to set the distance from pressure sensor port to centre of transducer elements.

**Table 1-8: Sensor properties for Doppler Current Sensor 4420/4420R, 4520/4520R, 4830/4830R and 4930/4930R**

**ENUM=Enumeration, INT=Integer, BOOL=Boolean ('yes'/'no')**

Table 1-1 Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write
<i>Node Description</i>	String	31	User text for describing node, placement etc. Default Doppler Current Sensor #xxx. Where xxx is the serial number.	UM	No / Low
<i>Owner</i>	String	31	User setting for owner information, company name etc.		No / High
<i>Interface</i>	String	31	Factory use only, RS232 for standard version, RS422 for R-version		High / High
<i>Baudrate</i>	ENUM	1	RS232 baudrate: 4800, 9600, 57600, or 115200. Default baudrate is 9600. The baudrate affects the minimum available Interval setting.		High / High <sup>1)</sup>
<i>Flow Control</i>	ENUM	1	RS232/RS422 flow control: 'None' or 'Xon/Xoff'. The Xon/Xoff characters are also sent for each Doppler ping measurement. To remove the "disturbance" on the receiver, select None. Be aware that this may also lead to missing characters when sending commands to the sensor.		
<i>Enable Comm Indicator</i>	ENUM	1	Enable communication sleep ('%') and communication ready ('!') indicators. After the last communication with the sensor, it normally outputs a '%' when the <i>Comm Timeout</i> time is over. When a character is sent to the sensor, it outputs a '!' to indicate that it is ready to communicate.		
<i>Comm TimeOut</i>	BOOL	1	Time communication is active (Always On, 10 s, 20 s, 30 s, 1min, 2 min, 5 min, 10 min). A short time means that the sensor is going to sleep faster after a communication input.		
<i>Enable Old Wakeup Character</i>	BOOL	1	Enables old wakeup character '#' instead of '!'. Use Enable Comm Indicator to switch on and off these characters.		
<i>Enable 4100 Output</i>	BOOL	1	Enables the old 4100 output for use in old system where the sensor is replacing an older version. Output structure is set by select mode using Select 4100 Output Mode		

Select 4100 Output Mode	ENUM	1	Select the 4100 output string. Available settings are: Normal-Polar, Normal-Rectangular, Comprehensive-Polar or Comprehensive-Rectangular.	UM	High / High <sup>1)</sup>
Exchange Temp with SP Std Dev	BOOL	1	Exchange the Temperature reading with Single Ping Standard Deviation in the output string, to be used with 4100 Output mode.		High / High
Enable Spike Filter	BOOL	1	Activate/deactivate spike filter; Set yes to activate. Default is yes. Spike filter tracks and eliminates spikes in measured data.	UM	High / Read Only
Enable Axis Strength	BOOL	1	Enables output of strength X and strength Y. Result is an average of the two transducers on each axis. Default is no		High / High
Enable Transducer Strength	BOOL	1	Enables output of signal strength from each of the four transducers. Default is no.		High / Read Only
Compass Calibrated Orientation	ENUM	1	Indicate the possible operation direction for the sensor. Available alternative is. Only UP, Only Down and Up and Down. This setting can only be altered by authorized personal and reflects the calibration performed. To change this the sensor need to be recalibrated at the factory		High / Read Only
Compass Deviation (Deg)	Float	1	Compass offset correction value (deg. M)		High / High
Enable Magnetic Declination	BOOL	1	Enables use of magnetic declination angle input (see Declination Angle for value used) <sup>2)</sup>		High / High
Declination Angle	Float	1	A value to correct for the magnetic variation on the site where the sensor is used. This is the angle in degrees between magnetic north and true north. <sup>2)</sup>		High / High
Enable Sensor Parameter Input	BOOL	1	Only for use with SeaGuardII and SmartGuard. Need to be disabled if used with SeaGuard. If enabled Parameter Input selection will be available in AiCaP mode.		High / High

<sup>1)</sup> Only available for stand-alone use. Not visible in AiCaP mode.

<sup>2)</sup> Magnetic declination (variation) is the angle between the magnetic north and the true north. This angle varies depending on the position on the Earth's surface and also varies over time. Declination is positive when magnetic north is east of true north and negative when it is to the west (input angle value  $\pm 180^\circ$ ). Magnetic declination at the deployment location can be found for i.e. on NOAA website: <http://www.ngdc.noaa.gov/geomag-web/>

## 1.8 Specifications for ZPulse® Doppler Current Sensor 4420/4830/4520/4930

Doppler Current Sensor 4420/4520/4830/4930 Specifications Refer Datasheet D 367 which is available on our web site <http://www.aanderaa.com> or contact [aanderaa.info@xylem.com](mailto:aanderaa.info@xylem.com).

You will find the latest versions of our documents on Aanderaa website.

## 1.9 Manufacturing and Quality Control

Aanderaa Data Instruments products have a record for proven reliability. With over 50 years' experience producing instruments for use in demanding environments around the globe you can count on our reputation of delivering the most reliable products available.

We are an ISO 9001, ISO 14001 and OHSAS 18001 Certified Manufacturer. As a company we are guided by three underlying principles: quality, service, and commitment. We take these principles seriously, as they form the foundation upon which we provide lasting value to our customers.

## CHAPTER 2 Stand-alone sensor configuration using AADI Real-Time Collector

This chapter describes the sensor configuration using AADI Real-Time Collector when the sensor is used as stand-alone sensor with serial communication RS-232 or RS-422 via the PC COM-port. The menus shown here are slightly different from the menus shown when the sensor is working in AiCaP mode and configured through an Aanderaa Datalogger via serial or USB connection to the PC (described in [CHAPTER 3](#)) or configured via the SeaGuard touch screen (described in [CHAPTER 5](#)). It's also possible to use terminal software to configure a stand-alone sensor, refer [CHAPTER 6](#), but then you need to enter all the commands and send them to the sensor. With Real-Time collector it's much easier since the software will then let you configure the sensor using the available choices in each category. Before connecting the sensor you need to install and start the AADI Real-Time Collector software on your PC (provided on memory stick delivered with the instrument if ordered). If you don't have the AADI Real-Time Collector please contact [aanderaa.sales@xyleminc.com](mailto:aanderaa.sales@xyleminc.com). If using windows 10 please see [chapter 10.1](#)

For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual.

### 2.1 Establishing a new connection

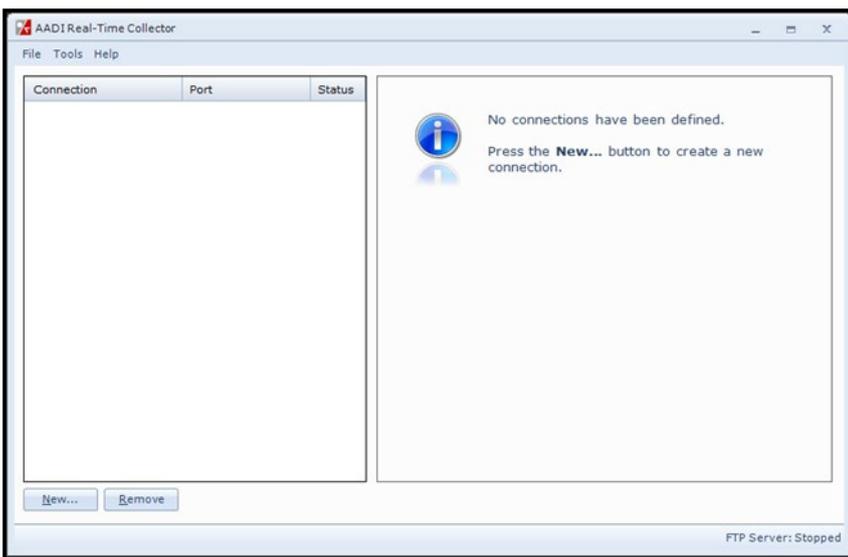
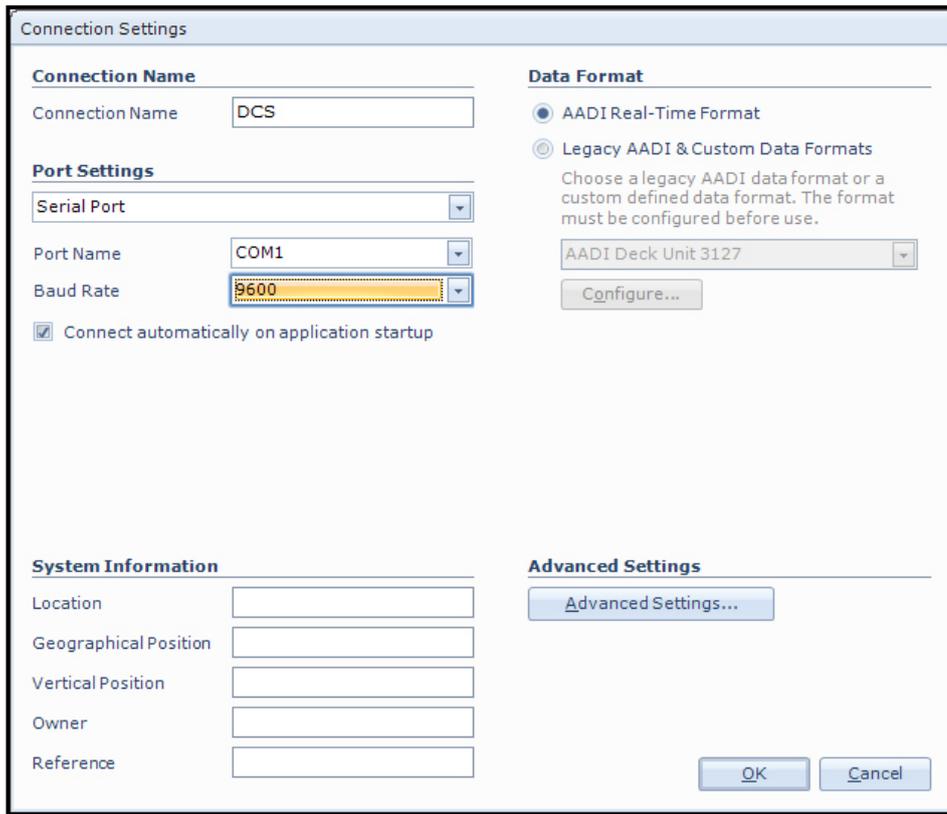


Figure 2-1: AADI Real-Time Collector start up menu

If the AADI Real-Time Collector program is being used for the first time, the connection list will be empty. Click on the **New** button in the lower left corner to create a new connection (refer [Figure 2-1](#)).

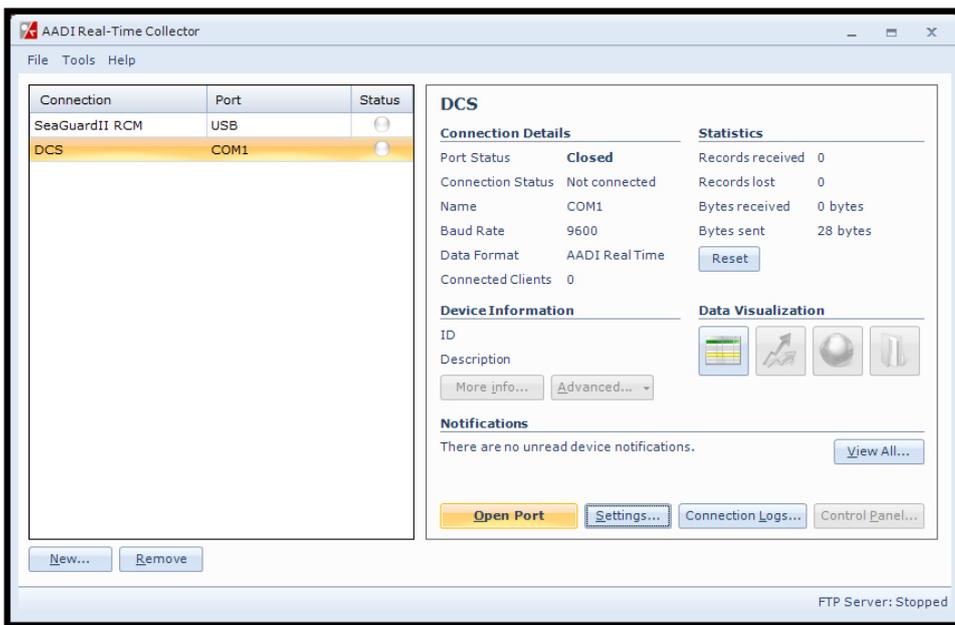
NOTE: This only needs to be done once. AADI Real-Time Collector will keep the information for later use and next time you might select it from the connection list.



First enter a new **Connection Name**, we recommend using name and serial number. Select **Serial Port** in the dropdown menu under **Port Setting**, and choose the correct COM-port on your computer under **Port Name**. Select **9600** as **Baud Rate**. This is the default baud rate on all DCS sensors. The **Baud Rate** needs to match the baud rate set in **User Maintenance**.

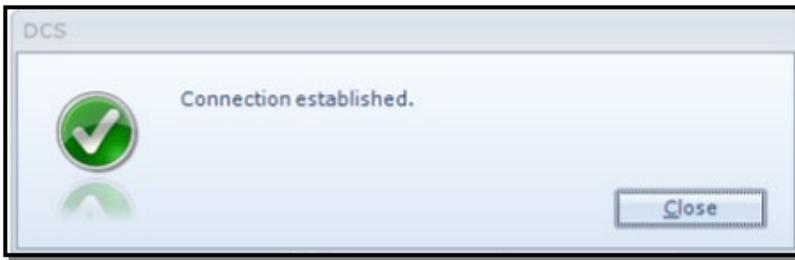
Figure 2-2: AADI Real Time Collector connection settings

### 2.1.1 Establish connection



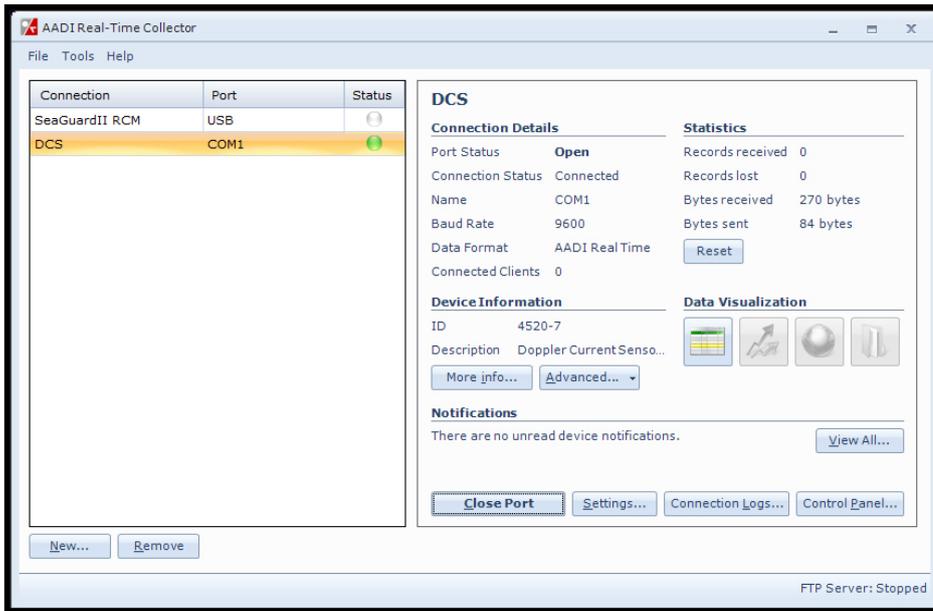
The new connection is now shown in the AADI Real-Time Collector connection list. Click on the line with the new connection to highlight the line and then click on the **Open Port** button.

Figure 2-3: New connection



When the connection is established a small window will show up confirming the connection.

Figure 2-4: Connection established



The status changes to green when the port is opened. After green light is obtained click on the **Control Panel** button on the lower right side to continue.

Figure 2-5: Green Status

## 2.2 Control Panel

In the **Control Panel** window you will find two tabs, **Recorder Panel** and **Device Configuration**. Under **Recorder Panel** you can start and stop recordings. If the recorder is running first click on the **Stop Recorder** as you are not allowed to configure the sensor when recording. The recorder panel is dependent on the Sensor Mode. In **AADI Real-Time** mode you may start and stop the recorder. For **AiCaP and Smart Sensor Terminal** you can only refresh the status but not start the recording.

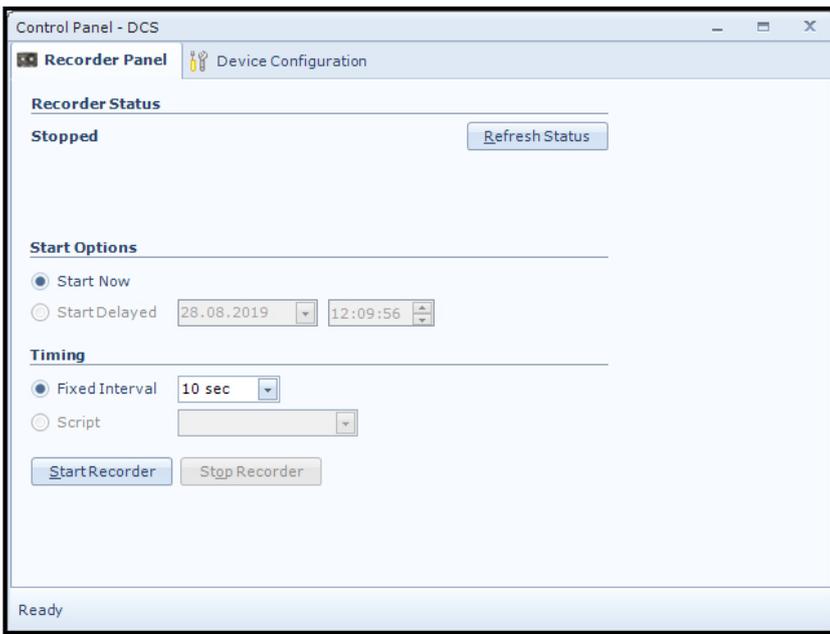


Figure 2-6: Recorder Panel

Under **Start Option** you can start sensor immediately by **Start Now**. The **Start Delayed** option is not yet implemented.

In the **Timing** session you may select the recording interval using **Fixed Interval**. The available interval will be dependent on the sensor configuration. If you change the configuration it might cause a change in the **Fixed Interval** so we recommend always checking the interval after configuration is finished.

The **Script** is not yet implemented.

The sensor will output one recording every interval.

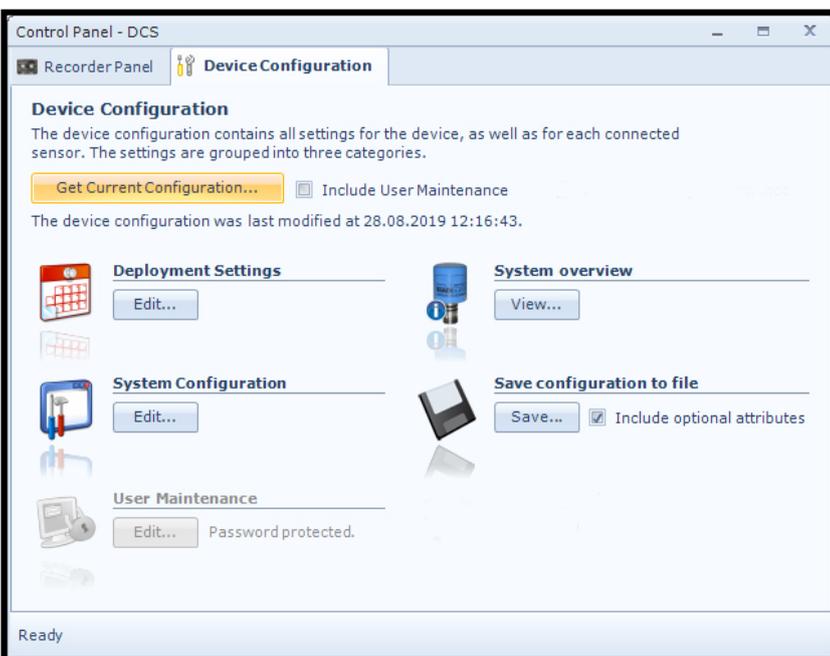


Figure 2-7: Device configuration

Click on the **Device Configuration** tab to continue and access the sensor property menus.

Under the **Device Configuration** tab click on the **Get Current Configuration...** button in order to receive the current configuration from the sensor.

To include the **User Maintenance** settings tick off the **Include User Maintenance** box before clicking the **Get Current Configuration...** button.

The settings in **User Maintenance** are protected with a higher access level. To access this menu you will need to enter a **password**. This **password is 1000** for all sensors.

The device configuration is separated into **Deployment settings**, **System Configuration**, **User Maintenance**, **System overview** and **Save configuration to file**.

You can save current settings to a backup file by pressing **Save...** under the heading **Save configuration to file**. Edit the name for your file and press **Save...** to save the new configuration to file in .xml format.

**System overview** shows a short list of sensor properties like product name, serial number and Software version.

User accessible sensor properties are found in **Deployment settings**, **System Configuration** and **User Maintenance**. Refer **Table 1-5** to **Table 1-8** for an overview of the properties.

**Note! The screen shots might show minor discrepancies compared to screen shots taken from your sensor due to sensor updates.**

**Note! We recommend that you verify the system settings prior to starting a recording session.**

## 2.3 Changing Values

DeploymentSettings

**Doppler Current Sensor #7**  
Doppler Current Sensor (4520, Version 18)  
Serial No: 7

**Common Settings**

Property	Value
<input checked="" type="radio"/> Interval (Sec)	1.000000E+01

**Site Info**

Property	Value
<input checked="" type="radio"/> Location	Bergen
<input checked="" type="radio"/> Geographic Position	60.323605,5.37225
<input checked="" type="radio"/> Vertical Position	
<input checked="" type="radio"/> Reference	

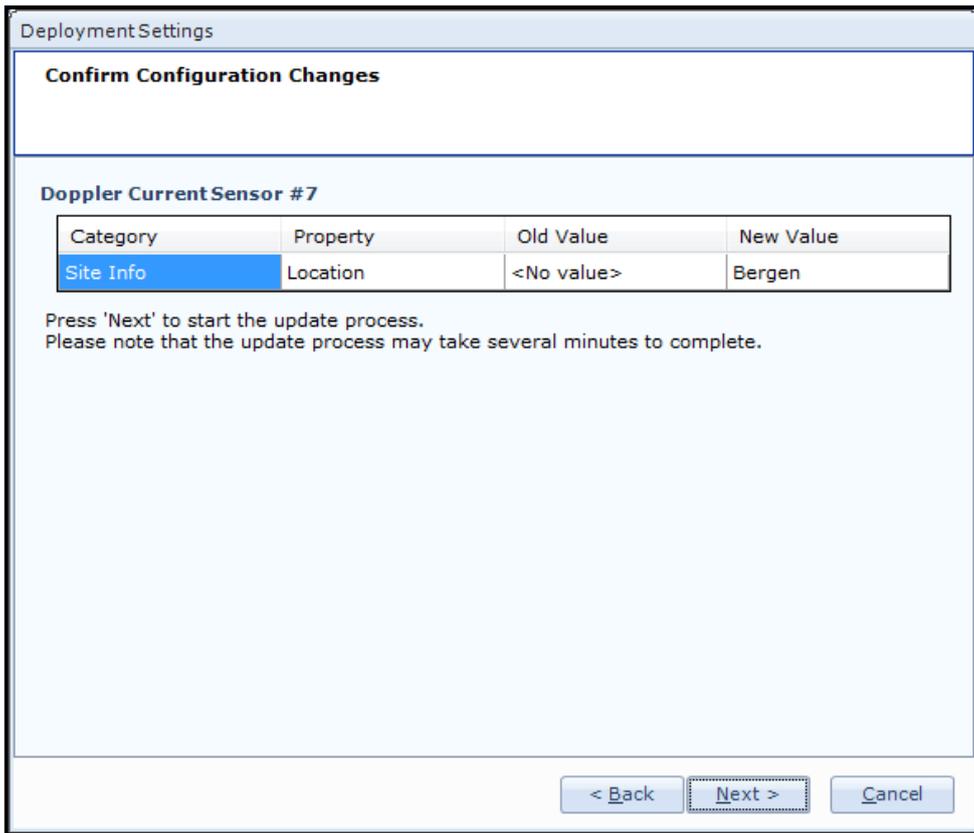
< Back   Next >   Cancel

To change the content of a property first tick in the value box of the actual property and then enter the text or number before pressing **Next**.

See example in **Figure 2-8** where the text for **Location** has been changed.

The value is not changed before you have finished the full process. If you press **Cancel** the changes will not be stored.

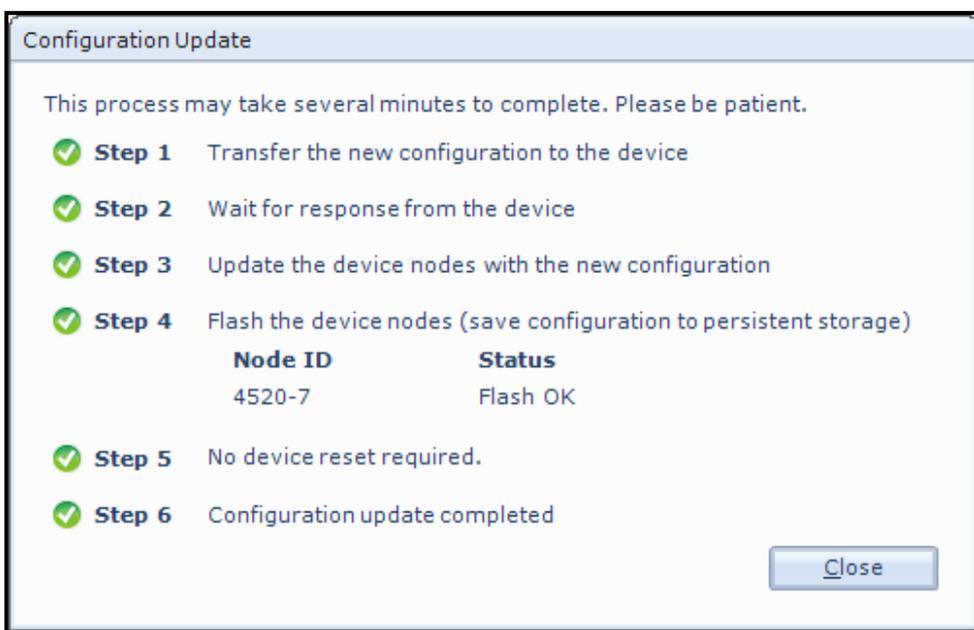
**Figure 2-8** Change value



In the next picture a list of all properties that has been changed will show up.

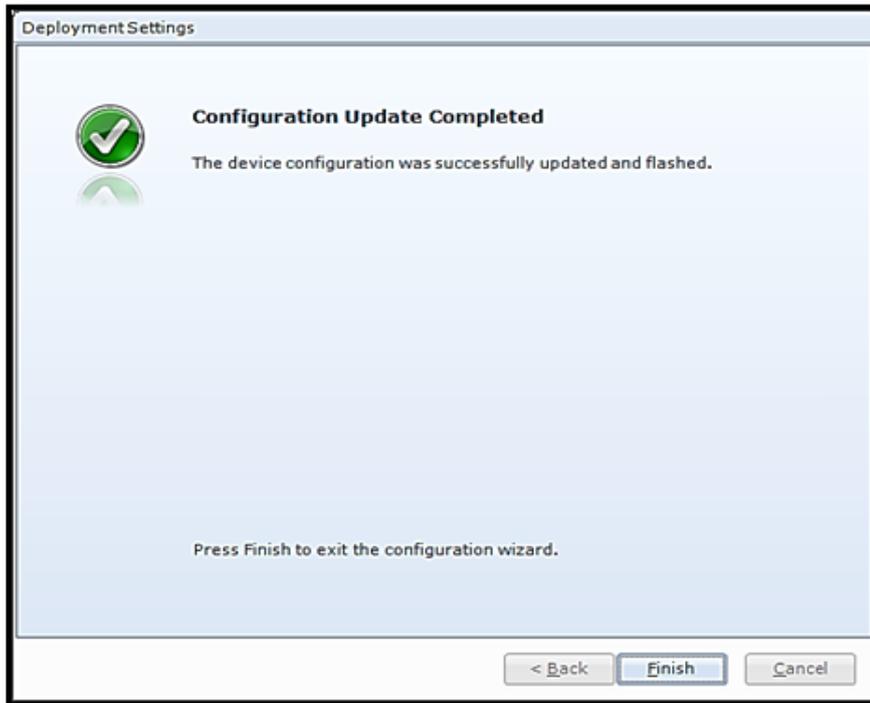
If the list of configuration changes is correct press **Next** to start the update process.

Figure 2-9: Confirm Configuration Changes



An automatic process will start with 6 steps transferring and storing the new information/setting in the sensor Flash. If necessary a reset will be executed. Do not switch off before the entire process is completed.

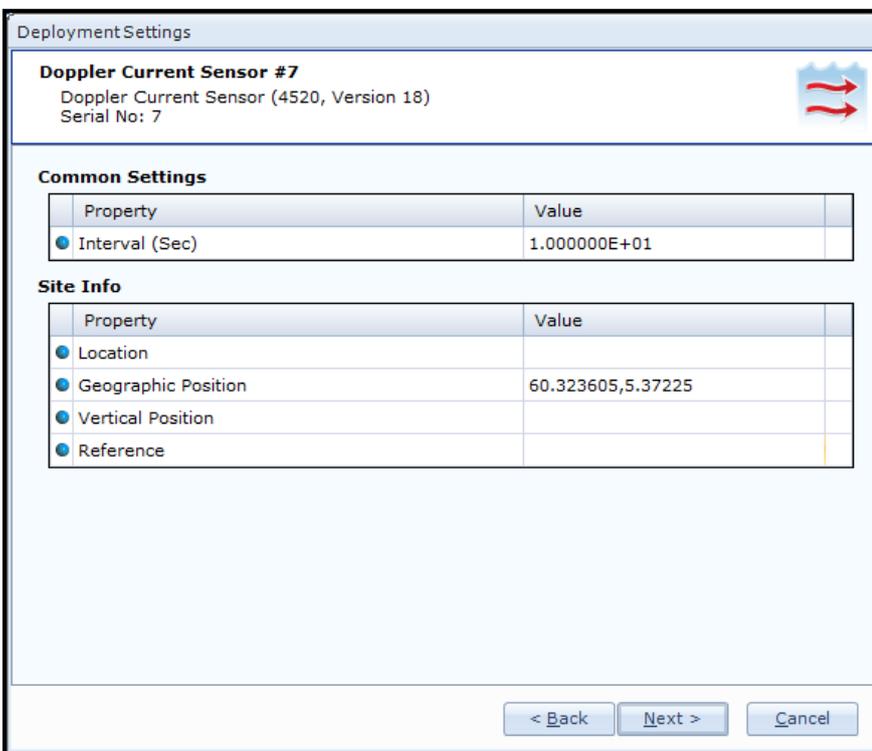
Figure 2-10: Configuration Update



When the updating process is finished a confirmation will show up. Press **Finish** to continue.

Figure 2-11: Configuration Update Completed

## 2.4 Deployment Settings



In the **Device Configuration** menu (refer [Figure 2-7](#)) select **Deployment Settings**.

The **Deployment Settings** is separated in 2 groups. Except from the interval setting all settings in this groups are mainly used as information.

Refer [chapter 1.7.2](#) for more information on the properties in **Deployment Settings**.

In AiCaP mode more settings are available. See [chapter 3.10](#)

For more information on each property see [chapter 2.4.1](#) and [2.4.2](#)

Figure 2-12: Deployment Settings

## 2.4.1 Common Settings

Common Settings	
Property	Value
<input checked="" type="radio"/> Interval	2 min

Figure 2-13: Common Settings

The interval can be changed in the [Deployment Settings](#) but can also be defined in the [Control Panel](#) under the [Recorder Panel](#) tab before starting the sensor. It can be changed here also if for example the sensor is going to be used without Real-Time Collector to collect data while running.

## 2.4.2 Site Info

Site Info	
Property	Value
<input checked="" type="radio"/> Location	
<input checked="" type="radio"/> Geographic Position	60.323605,5.37225
<input checked="" type="radio"/> Vertical Position	
<input checked="" type="radio"/> Reference	

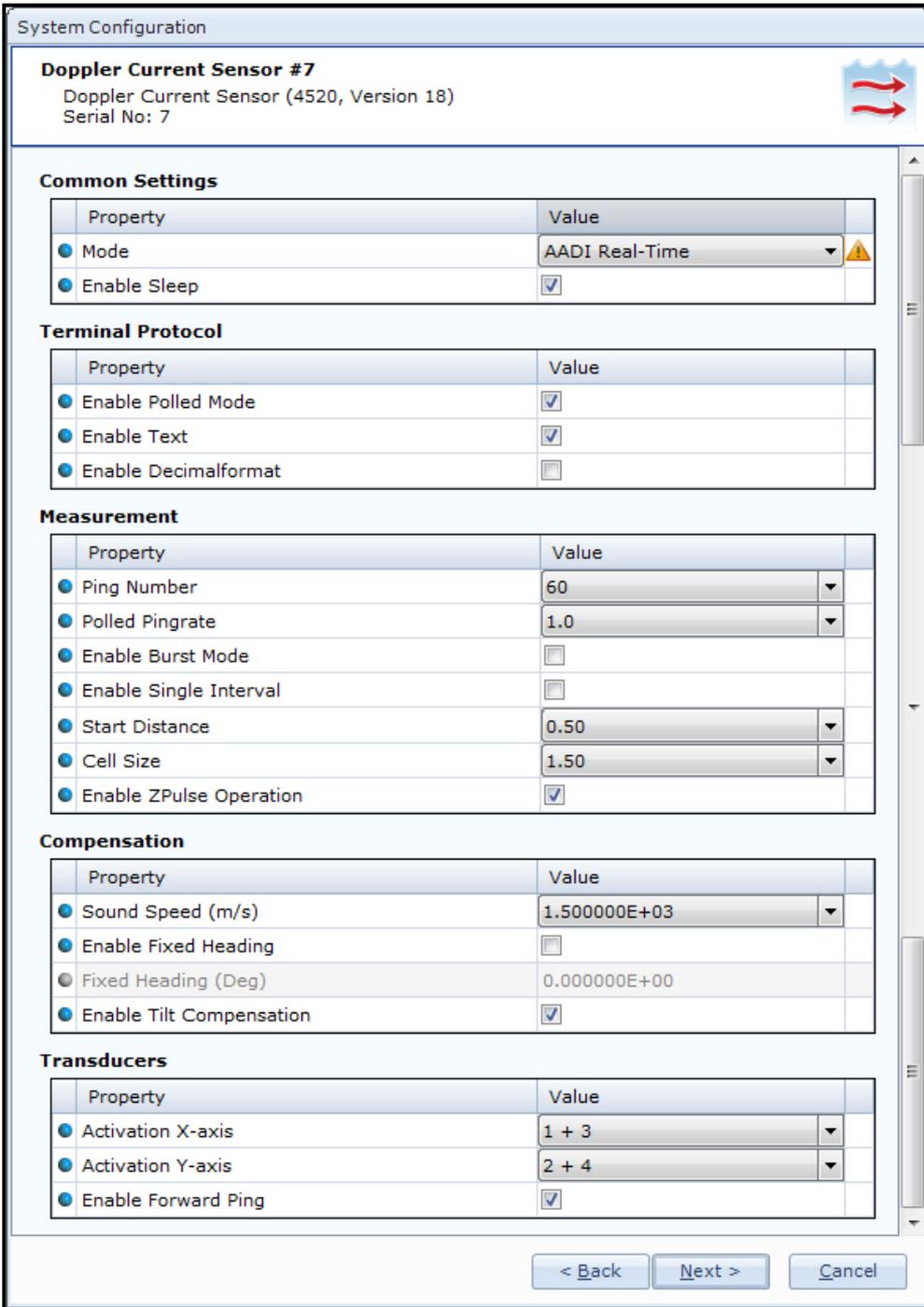
Figure 2-14: Site Info

[Site Info](#) containing four properties:

- [Location](#)
- [Geographic Position](#)
- [Vertical Position](#)
- [Reference](#)

All these settings are optional information to be entered to store information about the deployment. These setting are not used in calculation. [Geographical Position](#) is used to give the map coordinates unless a GPS input is connected to the logger

## 2.5 System Configuration



The **System Configuration** is separated in 5 groups. The settings in these groups are mainly used to configure the sensor. Refer [chapter 1.7.3](#) for more information on the properties in **System Configuration**.

If you change mode you might need to go back to the Recorder panel and **Refresh Status** and or **Stop Recorder** before you can continue to configure.

The Mode setting will also influence some of the alternatives in the rest of the session.

For more information on each property see [chapter 2.5.1 to 2.5.5](#).

Figure 2-15: System Configuration

## 2.5.1 Common settings

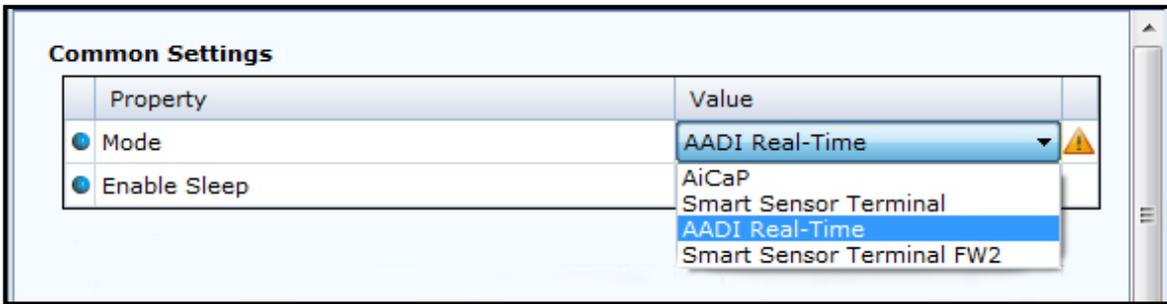


Figure 2-16: Common settings configuration

Refer to [Figure 2-16](#): the communication protocol has to be defined under **“Mode”**. There are four different choices:

- **AiCaP** mode: If the sensor is going to be used on a SeaGuard, SeaGuardII or SmartGuard Datalogger, the mode has to be changed to **AiCaP** mode first and saved before connecting it to the Datalogger.
- **Smart Sensor Terminal** protocol is a simplified ASCII protocol which is easy to use together with a PC terminal program. This protocol is described more detailed in [CHAPTER 6](#).
- **AADI Real-Time** is the correct mode (protocol) when the sensor is used stand-alone together with Real-Time Collector or if xml protocol is wanted for RS-232/RS-422 output. **AADI Real-Time** is an xml based protocol which includes more metadata in the data messages.
- **Smart Sensor Terminal FW2** protocol is a simplified ASCII protocol same as **Smart Sensor Terminal** but with some settings and output string that make it compatible with older versions of the sensor. FW2 is an abbreviation for Frame Work 2. For more information see [Appendix 1 Product change notification: Frame Work3](#)

It is possible to configure the sensor even if it is set to **AiCaP** or **Smart Sensor Terminal** mode when it is connected via RS-232 to the PC, but it is not possible to run and log data with Real-Time Collector unless the sensor is set to **AADI Real-Time**. Notice that the sensor always has to be reset when the protocol/mode has been changed.

## 2.5.2 Terminal Protocol settings

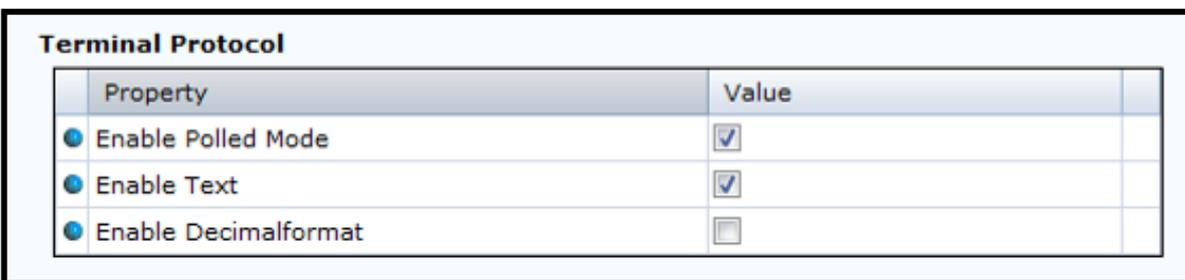


Figure 2-17: Smart Sensor Terminal protocol settings

The **Terminal Protocol** settings are available as shown in **Figure 2-17** but are only used if the sensor is set to **Smart Sensor Terminal** protocol. See **CHAPTER 6** for more details. This mode also opens up for a polled mode where the sensor is pinging on the selected ping rate and outputs data when the user/system polls for data by sending a **Do Sample** command to the sensor.

When **Enable Polled Mode** are set to 'no' (non-polled operation) the sensor will sample at the interval given by the **Interval** property. When set to 'yes' the sensor will read the last measured data on request only (use the **Do Sample** command). A **Do Sample** command triggers the end calculations and output of data. A **Do Output** command can be sent to repeat the output of the last calculated data.

**Enable Text** is used to switch on text information in the serial output from the sensor, only in **Smart Sensor Terminal** mode. Without text enabled the output string will be plain numbers for each output, see **Figure 6-5**.

**Enable Decimalformat** is used to either set decimal format or exponential format. Example of decimal format is 1023.45 and exponential format is 1.02345E+03.

### 2.5.3 Measurement settings

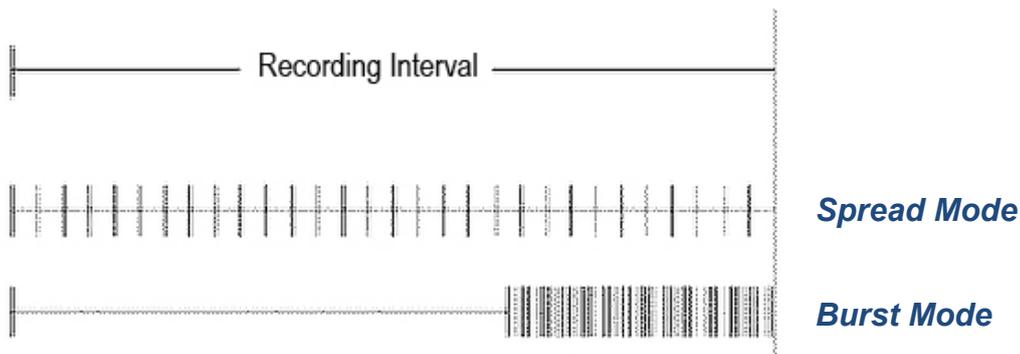
Measurement	
Property	Value
● Ping Number	300
● Polled Pingrate	10.0
● Enable Burst Mode	<input type="checkbox"/>
● Enable Single Interval	<input type="checkbox"/>
● Start Distance	0.50
● Cell Size	1.50
● Enable ZPulse Operation	<input checked="" type="checkbox"/>

**Figure 2-18: Sensor orientation settings**

**Ping Number** is the number of ping transmitted during one recording interval. One ping is a transmitted pulse on both axes, so one pulse on two transducers.

**Polled Pingrate** sets the ping frequency for sensors in polled mode. If set to 1.0 the sensor will continuously ping at 1Hz in Polled mode. For non-polled operation the sensor will not be influenced by this setting. Ping rate is then decided by recording interval, number of ping and bust/spread mode.

**Enable Burst Mode**. The sensor can run in burst mode or spread mode. When burst mode is enabled the sensor performs all ping measurements at the end of the recording interval. The instrument activates sleep mode between each measurement, which reduces the power consumption. Power consumption in spread and burst mode is about the same.



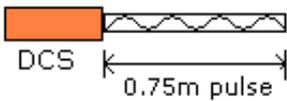
**Figure 2-19: Spread mode and burst mode ping distribution during the recording interval**

**Enable Single Interval** is for use in **Smart Sensor Terminal** mode. If enabled and you send a **Start** command to the sensor then the sensor will do one single recording before it enter sleep again. An alternative is to do a power reset instead of the **Start** command. Note that if the sensor is in sleep when you switch off the power then it will be some time before the sensor is discharged and you can put the power back on again to start a new interval. Alternatively you may send a wake-up character to the sensor before power reset.

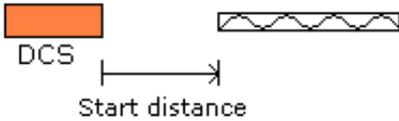
The transmitted pulse has a fixed length of 0.75m. Internal ringing in the transducers will always occur after transmitting acoustic pulses; the transducers cannot receive backscattered signal until the ringing stops. For the ZPulse DCS the pulse must have travelled at least a distance of minimum 0.4m before backscattered signals from the pulse can be received by the transducers. This is called the **Start Distance**. The transducers continue to receive backscattered signal from particles present in the beam until the pulse has propagated a distance equal to the **Cell Size**.

The total area from which the DCS receives backscattered energy is called the Measurement Area. Due to the shape of the pulse, the main contribution to backscattered energy is from particles that are present in an area around the Cell Centre. The measurement area outside the cell contributes very sparsely to the measured Doppler frequency shift. Refer **Figure 2-20** for an illustration.

Surrounding objects must be further away from the DCS than the described measurement area to avoid influencing the measurements.



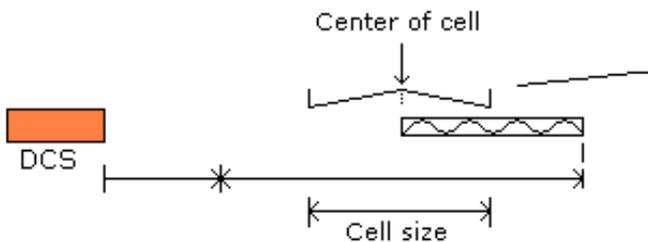
The transmitted pulse gives backscatter from a 0.75m long area after transmission.



The pulse propagates away from the sensor giving backscatter further away from a 0.75m area. A 0.4m start distance means that the DCS starts to measure the backscattered signal while the pulse gives backscatters from 0.4m to 0.4+0.75=1.15m area away from the sensor.



The sensor measures the backscattered signal while the pulse propagates a distance equal to the selected cell size. In this example the cell size is equal to the pulse length, i.e. the sensor measures the backscattered signal while the pulse propagates 0.75m further away.



The sensitivity is greatest at the center of the cell, i.e. the area close to the center of the cell gives more backscatter energy. The measurement area outside the cell gives very little contribution to the measured Doppler frequency shift.

**Figure 2-20: Illustration of Pulse, Cell and the Measurement area.**

The Measurement Area is defined as: *Pulse Length + Cell size*

The Cell Start is defined as:  $Start\ distance + \frac{Pulse\ Length}{2}$

The Cell End is defined as: *Cell start + Cell size*

The Cell Centre is defined as:  $Start\ distance + \frac{Pulse\ Length + Cell\ Size}{2}$

**Enable ZPulse Operation.** Activate/deactivate ZPulse operation; Set yes to activate. Default value is yes. ZPulse operation gives two separate frequencies in each ping and therefore higher quality data without increasing power consumption

## 2.5.4 Compensation settings

Compensation	
Property	Value
● Sound Speed (m/s)	1.500000E+03
● Enable Fixed Heading	<input type="checkbox"/>
● Fixed Heading (Deg)	0.000000E+00
● Enable Tilt Compensation	<input checked="" type="checkbox"/>

Figure 2-21: Surface cell configuration

**Sound Speed (m/s)** is the fixed sound speed setting in m/s. This value is used for calculation of current speed values. Variable sound speed values can be used while sensor is running in **Smart Sensor Terminal** mode. Default value for sea water is 1500.

**Enable Fixed Heading** might be used if there is any magnetic disturbance that might interfere with a compass heading and the instrument has a fix position. Then **Fixed Heading (Deg)** can be used to set the offset between the Sensor North direction and the Magnetic North.

**Enable Tilt Compensation** is recommended to set active at all time because then the sensor will automatically compensate for any tilt.

## 2.5.5 Transducers

Transducers	
Property	Value
● Activation X-axis	1 + 3
● Activation Y-axis	2 + 4
● Enable Forward Ping	<input checked="" type="checkbox"/>

Figure 2-22: Configuration of Transducers

**Activation X-axis** controls active transducers on the X-axis: Alternative settings are **1, 3** or **1+3**. Default is **1+3**. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Activation Y-axis** controls active transducers on the Y-axis: Alternative settings are **2, 4** or **2+4**. Default is **2+4**. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Enable Forward Ping**. If set to yes the sensor will try to only measure upstream to reduce problems related to turbulence. If enabled the sensor will start to measure using one transducer on each axis, then it will continue using these transducers as long as they measure a positive Doppler shift. If one transducer then changes to negative Doppler shift it will change to the other transducer on the same axis.

## 2.6 User Maintenance settings

**User Maintenance**

**Doppler Current Sensor #7**  
 Doppler Current Sensor (4520, Version 18)  
 Serial No: 7

---

**Mandatory**

Property	Value
Node Description	Doppler Current Sensor #7

**Site Info**

Property	Value
Owner	Aanderaa

**Serial Port**

Property	Value
Interface	RS232
Baudrate	9600
Flow Control	None
Enable Comm Indicator	<input checked="" type="checkbox"/>
Comm Timeout	10 s
Enable Old Wakeup Character	<input type="checkbox"/>

**Backward Compatibility**

Property	Value
Enable 4100 Output	<input checked="" type="checkbox"/>
Select 4100 Output Mode	Comprehensive-Rectangular
Exchange Temp with SP Std Dev	<input checked="" type="checkbox"/>

**Operation**

Property	Value
Enable Spike Filter	<input checked="" type="checkbox"/>
Enable Axis Strength	<input checked="" type="checkbox"/>
Enable Transducer Strength	<input checked="" type="checkbox"/>

**Calibration**

Property	Value
Compass Calibrated Orientation	Up and Down
Compass Deviation (Deg)	0.000000E+00

**Dependencies**

Property	Value
Enable Magnetic Declination	<input type="checkbox"/>
Declination Angle (Deg.M)	0.000000E+00

**SGII and SmG Features**

Property	Value
Enable Sensor Parameter Input	<input checked="" type="checkbox"/>

Under **User Maintenance**, you find properties that are password protected and are normally only set/ altered by a trained user. It is not recommended to change properties unless instructed.

To access the **User Maintenance**, check the **“Include User Maintenance”** box in the device configuration before clicking on the **“Get Current Configuration...”** button. The password is: **1000**.

The user maintenance settings are accessible by clicking the **“Edit...”** button under **User Maintenance** (refer to **Figure 2-7**).

There are 8 groups under **User Maintenance**. Each group are described in **chapter 2.6.1 to 2.6.8**.

Figure 2-23: User maintenance

### 2.6.1 Mandatory

Mandatory	
Property	Value
Node Description	Doppler Current Sensor #7

Figure 2-24: Mandatory

All sensors are given a **Node Description** text like DCS #xxx (xxx is the serial number of the sensor). The user can modify this node description text if required. Be aware that the node description changes to **\*Corrupt Configuration** if it has lost the configuration in flash. Contact the factory if this happens. The configuration is saved in two sectors in flash memory. A flash sector can be corrupted if the power is lost during the saving of new configuration. The double flash sector saving ensures that it does not lose the configuration. If one of the sectors is corrupted, the other sector is used and also saved to the corrupt sector.

### 2.6.2 Site Info

Site Info	
Property	Value
Owner	

Figure 2-25: Site Info

**Owner** is only used for information and will be a part of the Meta data from the sensor. Not used in any calculations.

### 2.6.3 Serial Port

Serial Port	
Property	Value
Interface	RS232
Baudrate	9600
Flow Control	None
Enable Comm Indicator	<input checked="" type="checkbox"/>
Comm Timeout	10 s
Enable Old Wakeup Character	<input type="checkbox"/>

Figure 2-26: Serial Port

**Interface** is the interface between sensor and PC used for configuration. 4420, 4520, 4830 and 4930 are using RS-232 when 4420R, 4520R, 4830R and 4930R are using RS-422. RS-422 sensors can be used with longer cables.

**Baudrate** is the speed of communication via the serial port. The default setting from factory is 9600. If the sensor is going to be used on longer cables it may be necessary to lower the baud rate but then also the transmission time will increase.

**Flow Control** is used to control the transmission speed between two units. Available settings are **None** and **Xon/Xoff**. Default setting is **Xon/Xoff**. The **Xon/Xoff** characters are also sent for each Doppler ping measurement. To remove the “disturbance” on the receiver, select **None**. Be aware that this may also lead to missing characters when sending commands to the sensor.

**Enable Comm Indicator** is enable communication sleep ('%') and communication ready ('!') indicators. After the last communication with the sensor, it normally outputs a '%' when the **Comm Timeout** time is over. When a character is sent to the sensor, it outputs a '!' to indicate that it is ready to communicate. If this setting is disabled the sensor will not send any indicators.

**Comm Timeout** is the time communication is active (**Always On, 10 s, 20 s, 30 s, 1min, 2 min, 5 min, 10 min**). A short time means that the sensor is going to sleep faster after a communication input.

**Enable Old Wakeup Character**. Enables old wakeup character '#' instead of '!'. Use **Enable Comm Indicator** to switch on and off these characters.

## 2.6.4 Backward Compatibility

Backward Compatibility	
Property	Value
Enable 4100 Output	<input checked="" type="checkbox"/>
Select 4100 Output Mode	Comprehensive-Rectangular ▾
Exchange Temp with SP Std Dev	<input checked="" type="checkbox"/>

Figure 2-27: Backward Compatibility

**Backward Compatibility Settings** are used to change output format to be compatible with some of the older version sensors.

**Enable 4100 Output** is used to set output string to be compatible with the older version of in-line DCS 4100 and 4100R.

**Select 4100 Output Mode** is used to select the 4100 output string. Available settings are: **Normal-Polar**, **Normal-Rectangular**, **Comprehensive-Polar** or **Comprehensive-Rectangular**. Only available if **Enable 4100 Output** is set.

**Exchange Temp with SP Std Dev** Exchange the Temperature reading with Single Ping Standard Deviation in the output string, to be used with 4100 Output mode.

## 2.6.5 Operation

Operation	
Property	Value
<input checked="" type="checkbox"/> Enable Spike Filter	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Enable Axis Strength	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Enable Transducer Strength	<input checked="" type="checkbox"/>

Figure 2-28: Operation

**Enable Spike Filter** Activate/deactivate spike filter; Set **yes** to activate. Default is **yes**. Spike filter tracks and eliminates spikes in measured data.

**Enable Axis Strength** Enables output of **strength X** and **strength Y**. Result is an average of the two transducers on each axis. Default is **no**.

**Enable Transducer Strength** Enables output of signal strength from each of the four transducers. Default is **no**.

## 2.6.6 Calibration

Calibration	
Property	Value
<input type="radio"/> Compass Calibrated Orientation	Up and Down
<input checked="" type="radio"/> Compass Deviation (Deg)	0.000000E+00

Figure 2-29: Calibration

**Compass Calibrated Orientation**. Indicate the possible operation direction for the sensor. Available alternative is. **Only UP, Only Down** or **Up and Down**. This setting can only be altered by authorized personal and reflects the calibration performed. To change this, the sensor needs to be recalibrated at the factory

**Compass Deviation (Deg)** Compass offset correction value (**deg. M**) used to adjust for an offset in the compass calibration.

## 2.6.7 Dependencies

Dependencies	
Property	Value
<input checked="" type="radio"/> Enable Magnetic Declination	<input type="checkbox"/>
<input type="radio"/> Declination Angle (Deg.M)	0.000000E+00

Figure 2-30: Dependencies

**Enable Magnetic Declination** is normally used when sensor is used close to South Pole or North Pole. **Declination Angle (Deg.M)** is a value to correct for the magnetic variation on the site where the sensor is used. This is the angle in degrees between magnetic north and true north. Magnetic declination (variation) is the angle between the magnetic north and the true north. This angle varies depending on the position on the Earth's surface and also varies over time. Declination is positive when magnetic north is east of true north and negative when it is to the west (input angle value  $\pm 180^\circ$ ). Magnetic declination at the deployment location can be found for i.e. on NOAA website:

<http://www.ngdc.noaa.gov/geomag-web/>

## 2.6.8 SGII and SmG Features

SGII and SmG Features	
Property	Value
<input checked="" type="radio"/> Enable Sensor Parameter Input	<input checked="" type="checkbox"/> 

Figure 2-31: SGII and SmG Features

**Enable Sensor Parameter Input** If enabled the sensor might use heading data from other sensors via SeaGuardII or SmartGuard. E.g. if a Airmar compass is connected to the same logger but placed in away from any magnetism that disturb the internal compass, data from this sensor can be used by the sensor in calculations. Only to be used in AiCaP mode and needs to be disabled if used with SeaGuard.

## CHAPTER 3 Configuration via SmartGuard, SeaGuard or SeaGuardII Datalogger

### 3.1 Introduction

The Doppler Current Sensor 4420, 4520, 4830 and 4930 can easily be installed on the Aanderaa SeaGuard platform, SeaGuardII platform or connected using a cable. For more information about the SeaGuard, refer to TD 262a or SeaGuardII, refer to TD 303.

It can also be used with the SmartGuard Datalogger using a cable for surface buoy applications or placed on land.

To be able to control the DCS via SeaGuard, SeaGuardII or SmartGuard the sensor need to be in AiCaP mode.

SeaGuardII and SmartGuard are using USB connection for configuration. SeaGuard with touch display are using the touch screen to configure. SeaGuard with plug assembly are using RS-422/RS-232 for configuration. All instruments can also be configured via the real-time RS-232/RS-422 output.

### 3.2 Installation of the DCS on SeaGuard and SeaGuardII

The ZPulse® Doppler Current Sensor 4420/4830/4520/4930 can easily be installed on Aanderaa SeaGuard data loggers.

#### Note!

Mount the ZPulse® DCS on the stud and connect the stud in sensor position 1, refer [Figure 3-1](#) and [Figure 3-2](#). Always replace O-rings when connecting to a sensor or a sealing plug.

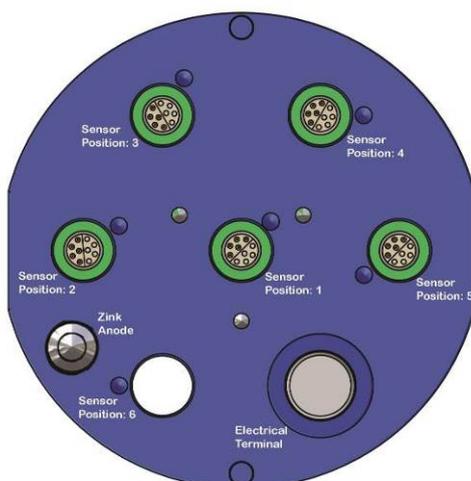


Figure 3-1: SeaGuard/SeaGuardII Top End plate



Figure 3-2: ZPulse® DCS 4520/4930 with sensor foot and top-end plate

### 3.3 Configuration with Real-Time collector

To establish connection between the Instrument and AADI Real-Time collector you need to decide how to connect. If you are using a USB connection follow the instructions in [chapter 3.4.1](#), USB is the most used connection for SeaGuardII and SmartGuard. If you are using a serial connection follow the instruction in [chapter 3.4.2](#), this connection is most used with SeaGuard including plug assembly and Real-Time connected instruments. If you want to use the touch screen (only available with SeaGuard) then jump to [CHAPTER 5](#).

#### 3.3.1 Connected via SeaGuardII

- Connect the micro USB configuration cable between the USB connector in front of the instrument and to the PC
- Install and start the AADI Real-Time Collector software on your PC (provided on the Memory stick delivered with the instrument if ordered). For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual
- Switch on the instrument by pressing the power button in the front of the instrument.
- Wait approximately 30 seconds before the instruments starts up and connection is available.

#### 3.3.2 Connected via SmartGuard

- Connect the USB configuration cable between the USB connector on the left hand side of the SmartGuard and the USB port on your PC
- Install and start the AADI Real-Time Collector software on your PC (provided on the Memory stick delivered with the instrument if ordered). For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual
- Switch on the logger by turning the power switch to the “ON”- position.
- Wait approximately 30 seconds before the logger starts up and connection is available.

#### 3.3.3 Connected via SeaGuard with plug assembly 5561

- Connect the 0-modem cable between the serial port in front of the instrument and the computer RS-232 port. If your computer have no serial port you might use a Keyspan USB to serial converter or simmlar.
- Install and start the AADI Real-Time Collector software on your PC (provided on the Memory stick delivered with the instrument if ordered). For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual
- Switch on the instrument by pressing the power button in the front of the instrument.
- Wait approximately 20 seconds before the instruments starts up and connection is available.

### 3.3.4 Connected via Real-Time cable on SeaGuard, SeaGuardII or SmartGuard

- Connect real-time cable from the instrument to the RS-232/RS-422 port on your computer. If your computer have no serial port you might use a Keyspan usb to serial converter or simmilar. For RS-422 you also might need a RS-422 to RS-232
- Install and start the AADI Real-Time Collector software on your PC (provided on the Memory stick delivered with the instrument if ordered). For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual
- Switch on the instrument by pressing the power button in the front of the instrument.
- Wait approximately 30 seconds before the instruments starts up and connection is available.

### 3.4 Establish connection via USB

#### NOTE!

When using a USB connection, you also need to install Windows Mobile Device Center (Windows Vista, and Microsoft Windows 7) if not already installed on your computer. It can be downloaded from Microsoft website.



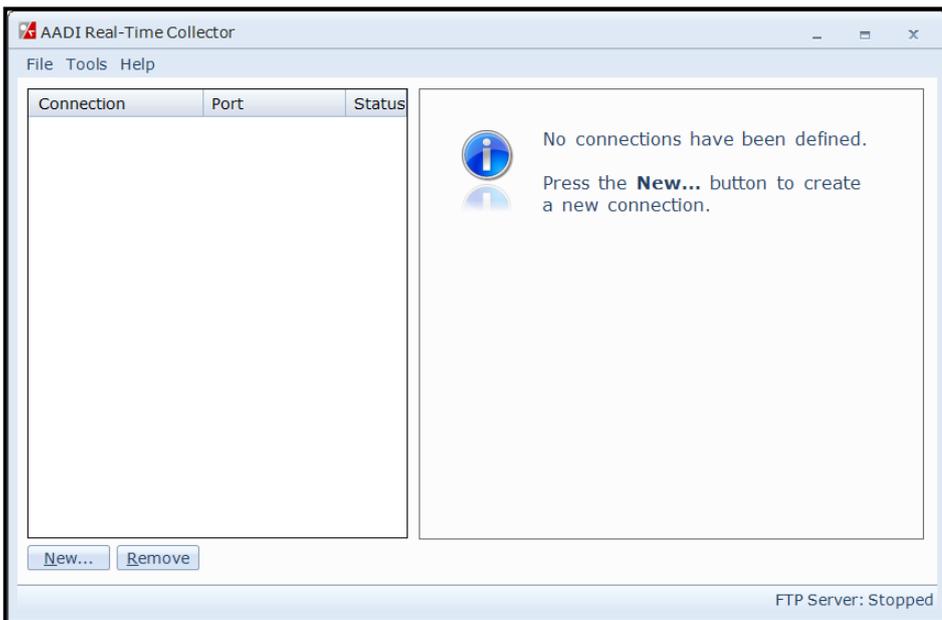
Windows Mobile Device Center acts as device management and data synchronization between a Windows Mobile-based device and a computer.

Once the USB connection has been established, Windows Mobile Device Center will start automatically:

If using windows 10 please see [chapter 10.1](#)

You may close this window after connection is established.

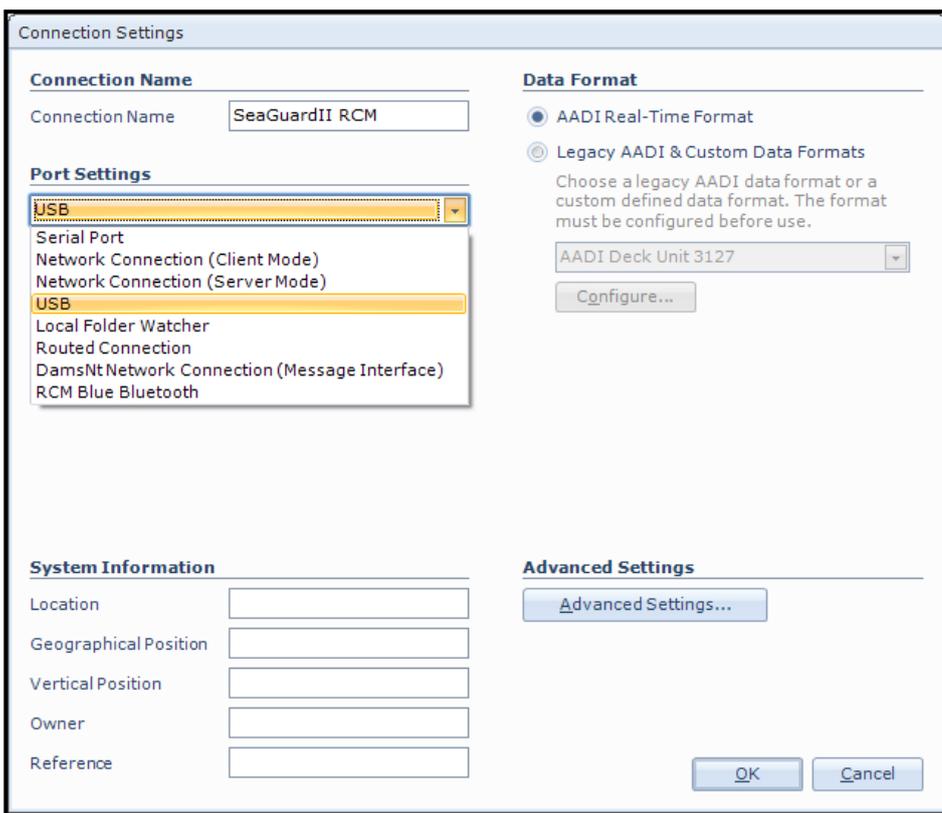
Figure 3-3: Windows Mobile Device Center



At first connection with AADI Real-Time Collector the connection list will be empty. Click on the **New** button in the lower left corner to create a new connection

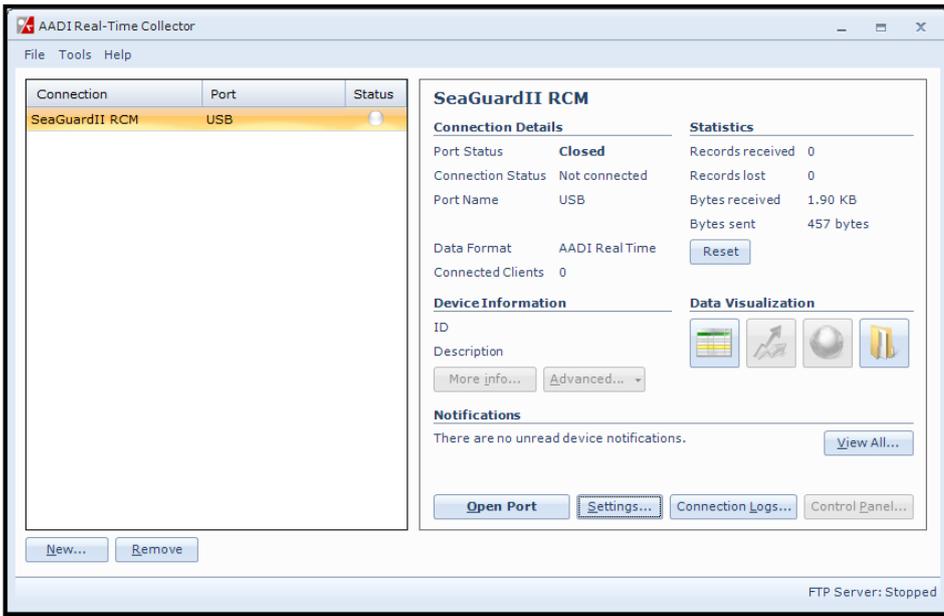
NOTE: This only need to be done once. AADI Real-Time Collector will keep the information for later use and next time you might select it from the connection list.

Figure 3-4: AADI Real-Time Collector start up menu



If your instrument is connected via USB then select **USB** from the **Port Settings** drop down menu (see **Figure 3-5**); and write a name in the **Connection Name** box (for i.e. SeaGuardII). We recommend using product name and serial number if you want to connect multiple instruments to the same software.

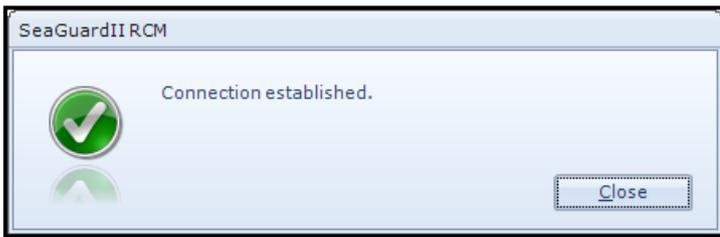
Figure 3-5: AADI Real time Collector connection settings



The new connection is now shown in the AADI Real-Time Collector connection list. Click on the line with the new connection to highlight and then click on the **Open Port** button.

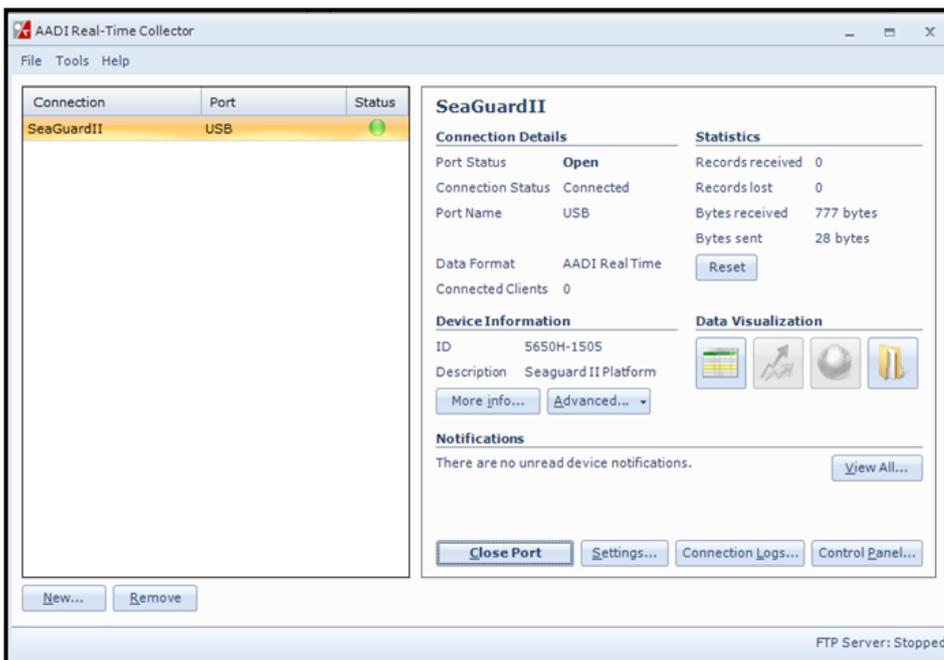
After pressing the **Open Port** button the connection to the SeaGuardII or SmartGuard should be established within a few seconds and the status will turn to green.

Figure 3-6: New connection



When the connection is established a small window will show up confirming the connection. After power up it will take approximately 30 seconds before the logger is ready.

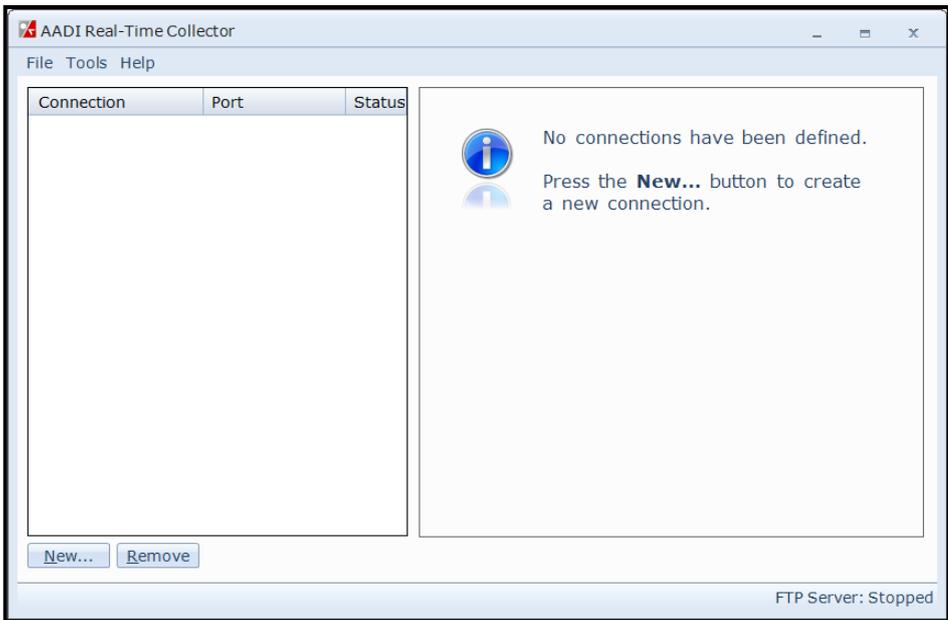
Figure 3-7: Connection established



Open **Control Panel** in the lower right corner (refer [Figure 3-8](#)), and then jump to [chapter 3.5](#) for SeaGuardII and SmartGuard or [chapter 3.6](#) for SeaGuard configuration.

Figure 3-8: AADI Real-Time Collector main menu

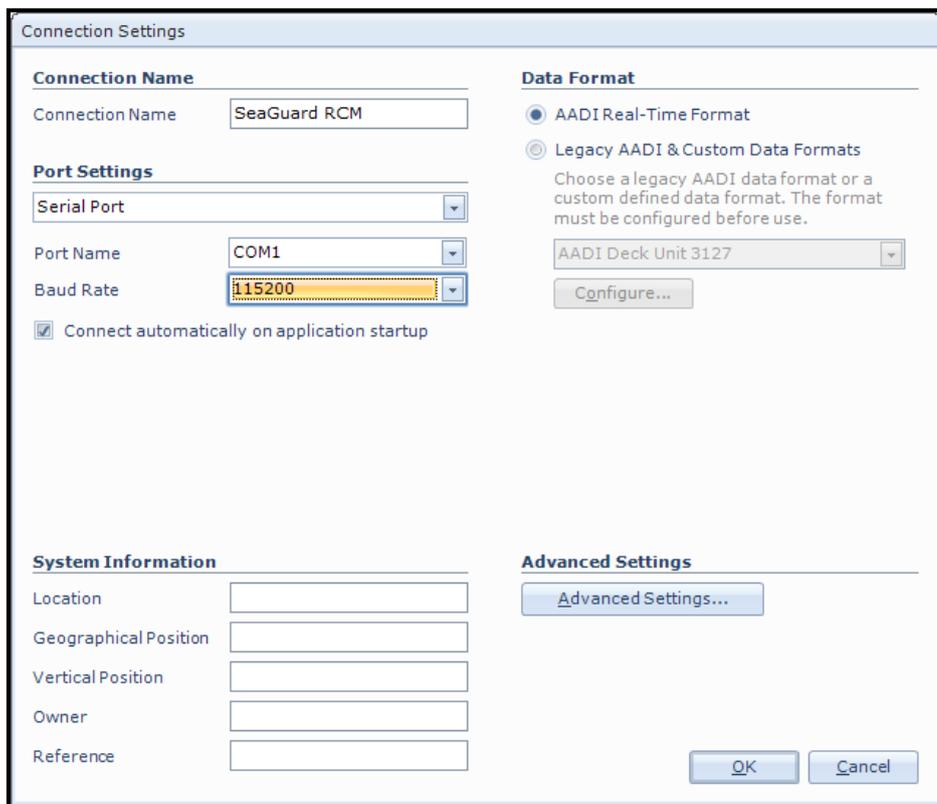
### 3.5 Establish connection via Serial port



At first connection with AADI Real-Time Collector the connection list will be empty. Click on the **New** button in the lower left corner to create a new connection

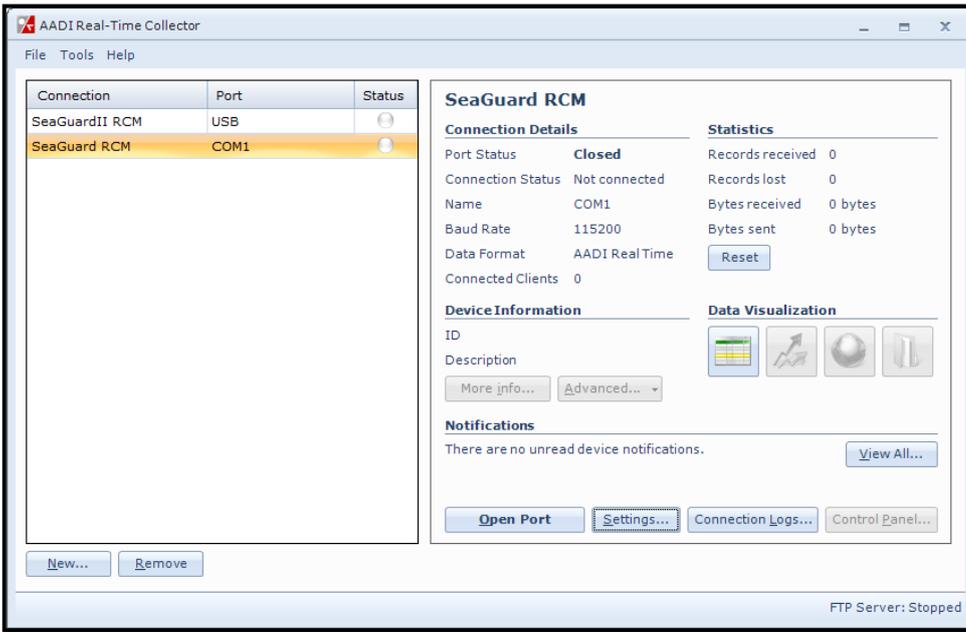
NOTE: This only need to be done once. AADI Real-Time Collector will keep the information for later use and next time you might select it from the connection list.

Figure 3-9: AADI Real-Time Collector start up menu



If your instrument is connected via Serial port then select **Serial Port** from the **Port Settings** drop down menu (refer [Figure 3-10](#)); and write a name in the **Connection Name** box (i.e. SeaGuard). We recommend using product name and serial number if you want to connect multiple instruments to the same software.

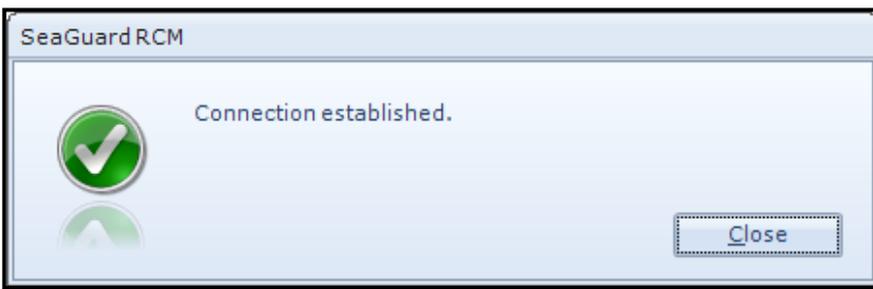
Figure 3-10: AADI Real time Collector connection settings



The new connection is now shown in the AADI Real-Time Collector connection list. Click on the line with the new connection to highlight the line and then click on the **Open Port** button.

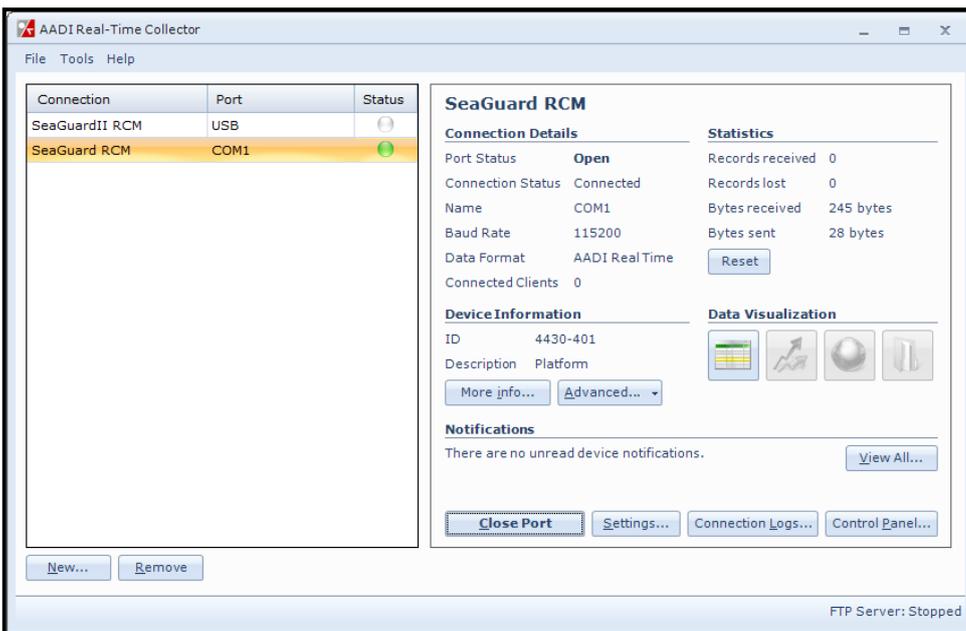
After pressing the **Open Port** button the connection to the SeaGuardII or SmartGuard should be established within a few seconds and the status will turn to green.

Figure 3-11: New connection



When the connection is established a small window will show up confirming the connection. After power up it will take approximately 30 seconds before the logger is ready

Figure 3-12: Connection established



Open **Control Panel** in the lower right corner (refer [Figure 3-13](#)), and then jump to [chapter 3.5](#) for SeaGuardII and SmartGuard or [chapter 3.7](#) for SeaGuard configuration.

Figure 3-13: AADI Real-Time Collector main menu

### 3.6 Control Panel SeaGuardII and SmartGuard

In the **Control Panel** window on SeaGuardII and SmartGuard you will find four tabs, **Recorder Panel**, **Device Configuration Device Layout** and **System Status**. Under **Recorder Panel** you can start and stop recordings. If the recorder is running first click on the **Stop** or **Stop All Groups** as you are not allowed to configure the sensor when recording. For information about **Device Layout** and **System Status** see Manual for SeaGuardII Platform TD303 or SmartGuard TD293.

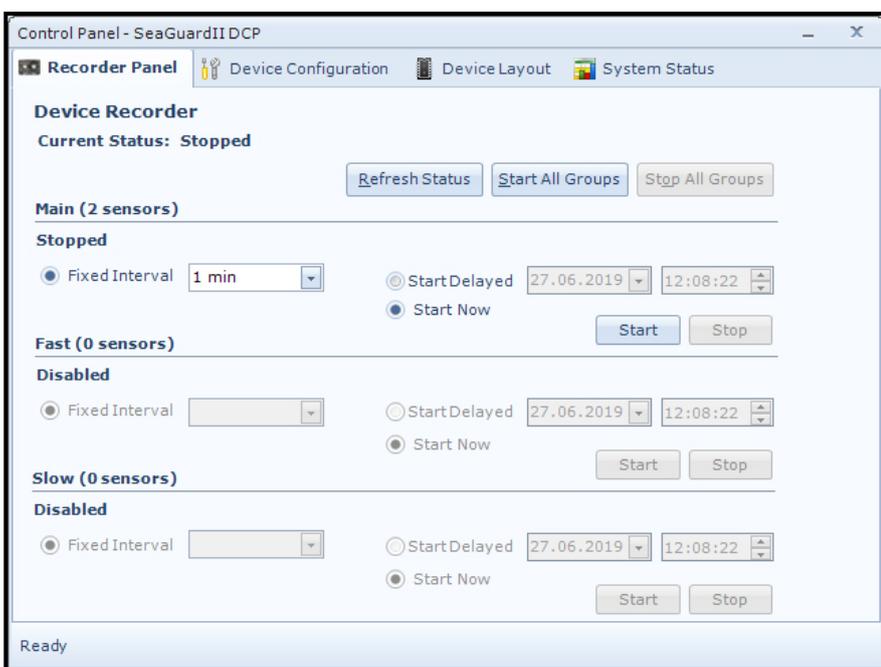


Figure 3-14: Recorder Panel

The **Fixed Interval** is the recording interval for each group. The configuration of sensors in each group will influence on the available recording interval. If you change the configuration of one sensor and this cause a longer processing time the **Fixed Interval** might be changed.

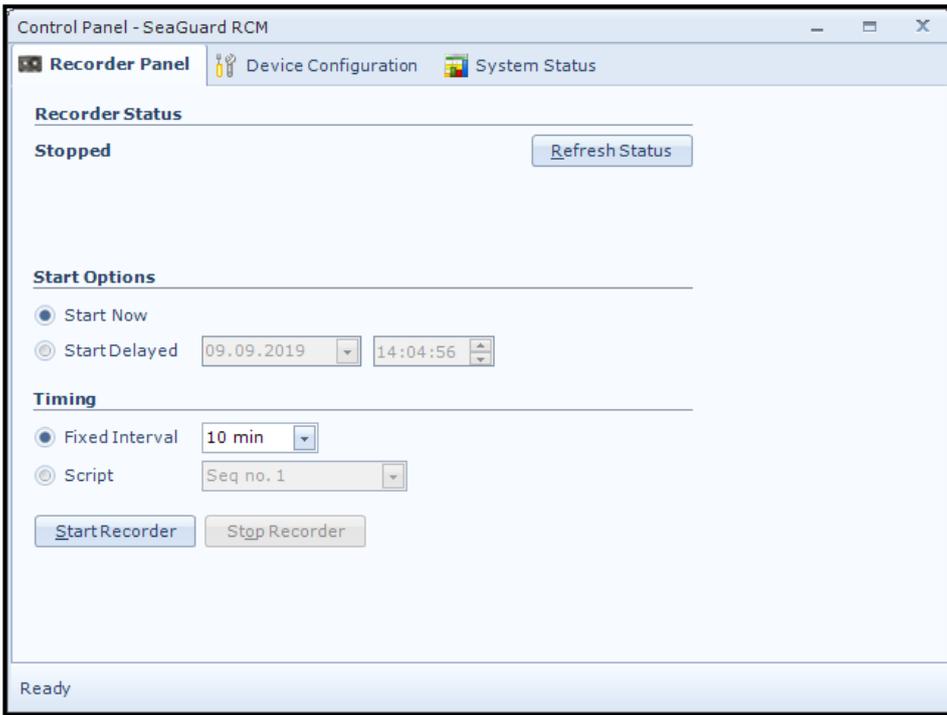
**Note!** We recommend that you verify the system settings prior to starting a recording session.

The **Control Panel** is controlling the SeaGuardII/SmartGuard recorder and not individual sensors. However the **Recorder Panel** consist of three recording groups where you might put individual sensors in each group to run them on different recording interval. See Operation Manual SeaGuardII / SmartGuard for more info.

Under each group you can start the group immediately by **Start Now**, or start at a later time using the **Start Delayed** option. You may also use **Start All Groups**.

The different groups are controlled under **Device Configuration > Deployment Settings > Multi Group Recorder**

### 3.7 Control Panel SeaGuard



In the **Control Panel** window for SeaGuard you will find three tabs, **Recorder Panel**, **Device Configuration** and **System Status**. Under **Recorder Panel** you can start and stop recordings. If the recorder is running first click on the **Stop Recorder** as you are not allowed to configure when recording. For information about **System Status** see Manual for SeaGuard Platform TD262a.

The **Control Panel** is controlling the SeaGuard recorder and not individual sensors.

You can either set the instrument to **Start Now**, or start at a later time using the **Start Delayed** option.

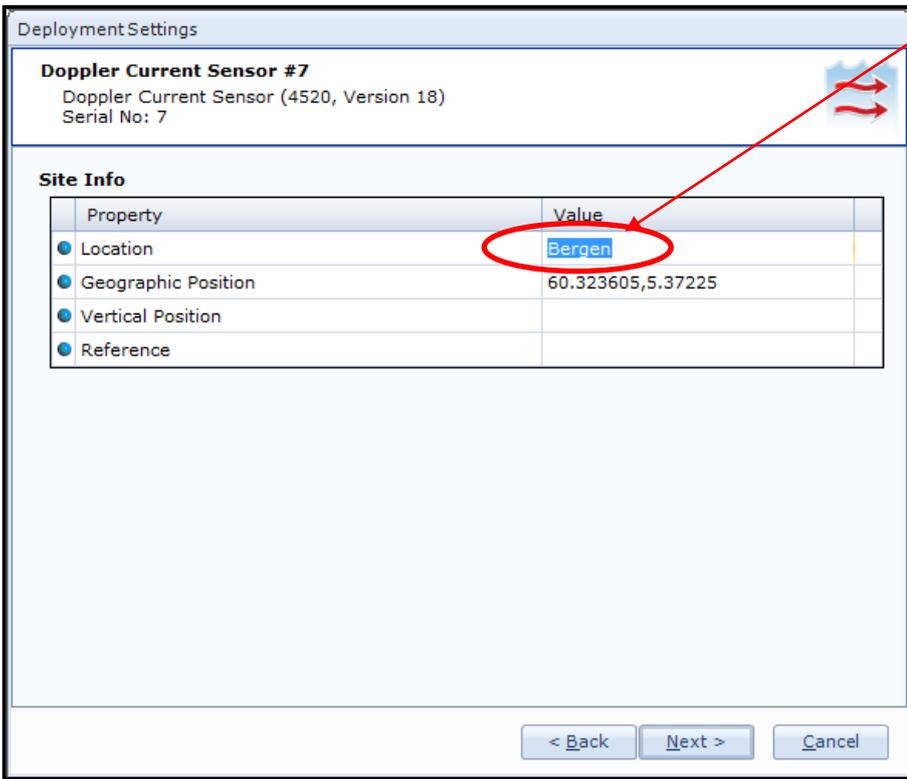
**Figure 3-15: Control Panel SeaGuard**

The Timing may either be set to **Fixed Interval** or **Script**. The **Fixed Interval** is the recording interval for the instrument. The configuration of sensors will influence on the available recording interval. If you change the configuration of one sensor and this cause a longer processing time the **Fixed Interval** might be changed.

**Script** is a possibility to run advanced recording interval with variable sub intervals. Setting up the script is only available via the touch screen.

Each Sensor will do a calculation based on the configuration for each recording interval

### 3.8 Changing Values

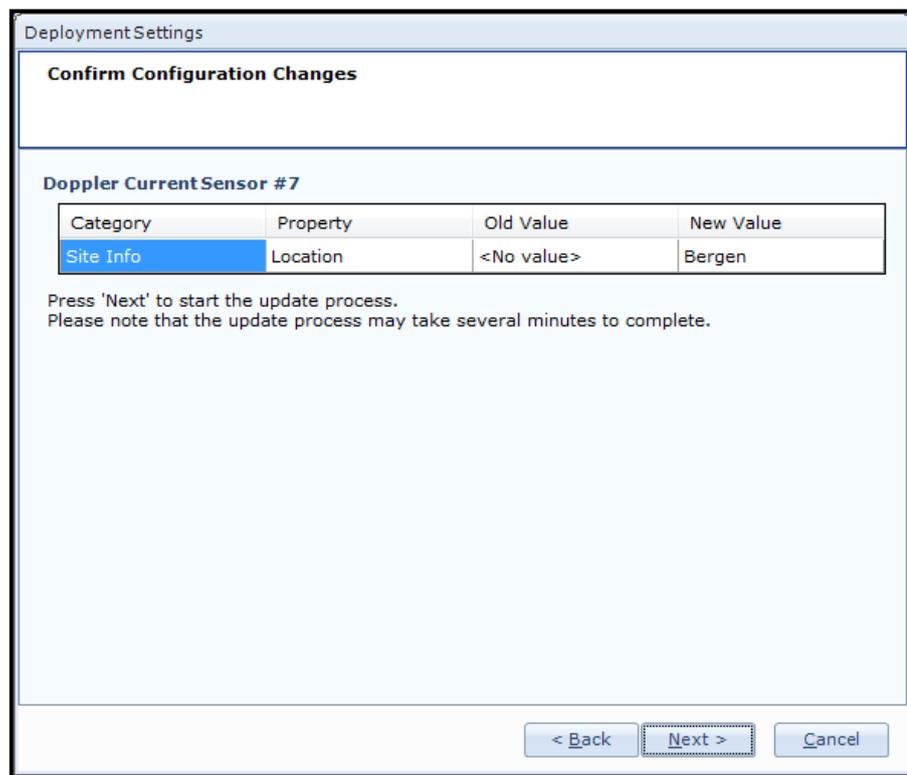


To change the content of a property first tick in the value box of the actual property and then enter the text or number before pressing **Next**.

See example in **Figure 3-16** where the text for **Location** has been changed.

The value is not changed before you have finished the full process. If you press **Cancel** the changes will not be stored.

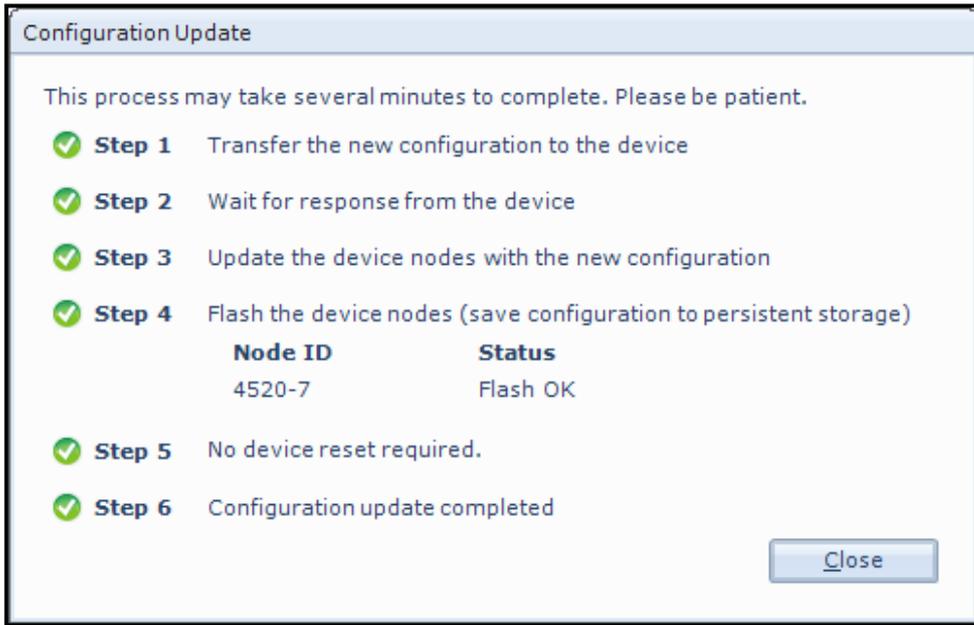
**Figure 3-16 Change value**



In the next picture a list of all properties that has been changed will show up.

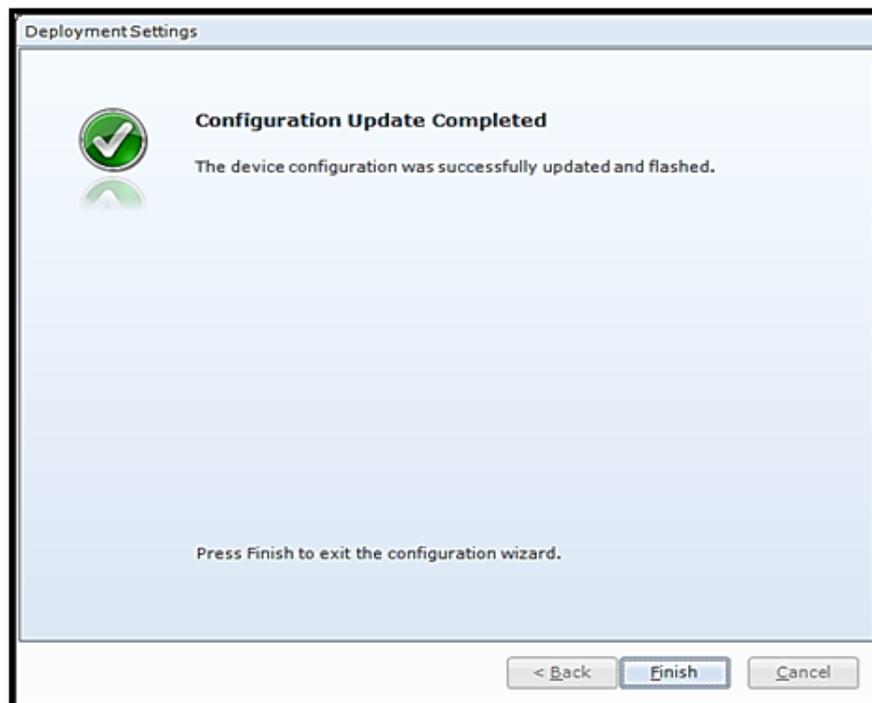
If the list of configuration changes is correct press **Next** to start the update process.

**Figure 3-17: Confirm Configuration Changes**



An automatic process will start with 6 steps transferring and storing the new information/setting in the sensor Flash. If necessary a reset will be executed. Do not switch off before the entire process is completed.

Figure 3-18: Configuration Update



When the updating process is finished a confirmation will show up. Press **Finish** to continue.

Figure 3-19: Configuration Update Completed

### 3.9 Device Configuration using SeaGuardII and SmartGuard

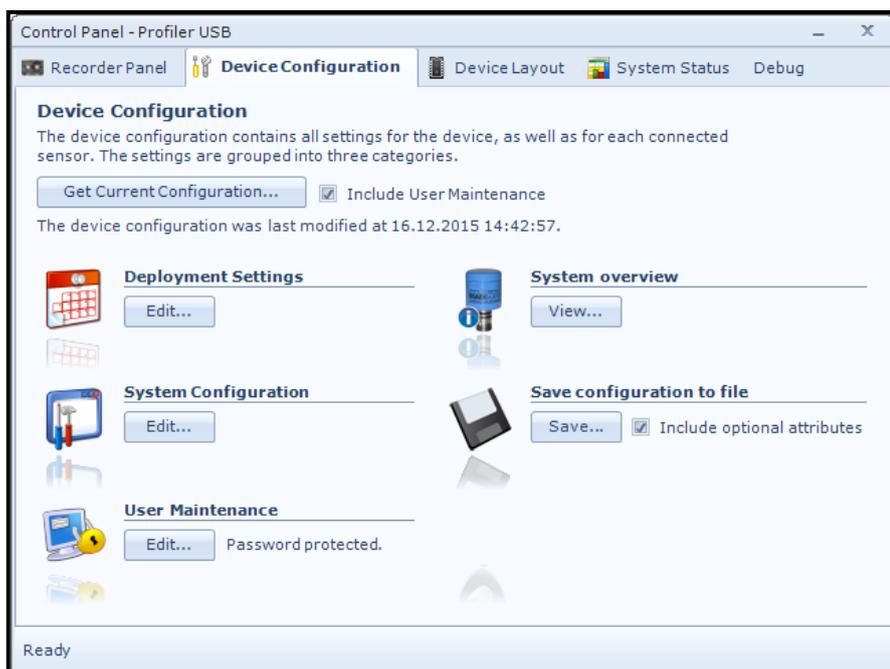


Figure 3-20: Device configuration SeaGuardII and SmartGuard

### 3.10 Device Configuration using SeaGuard

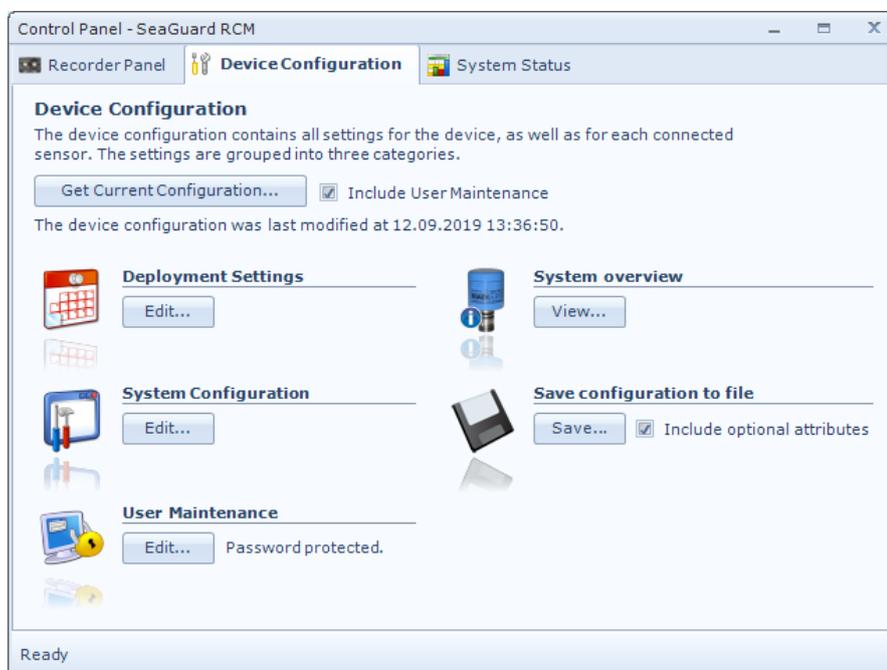


Figure 3-21: Device configuration SeaGuard

**Note!** The screen shots might show minor discrepancies compared to screen shots taken from your sensor due to sensor updates.

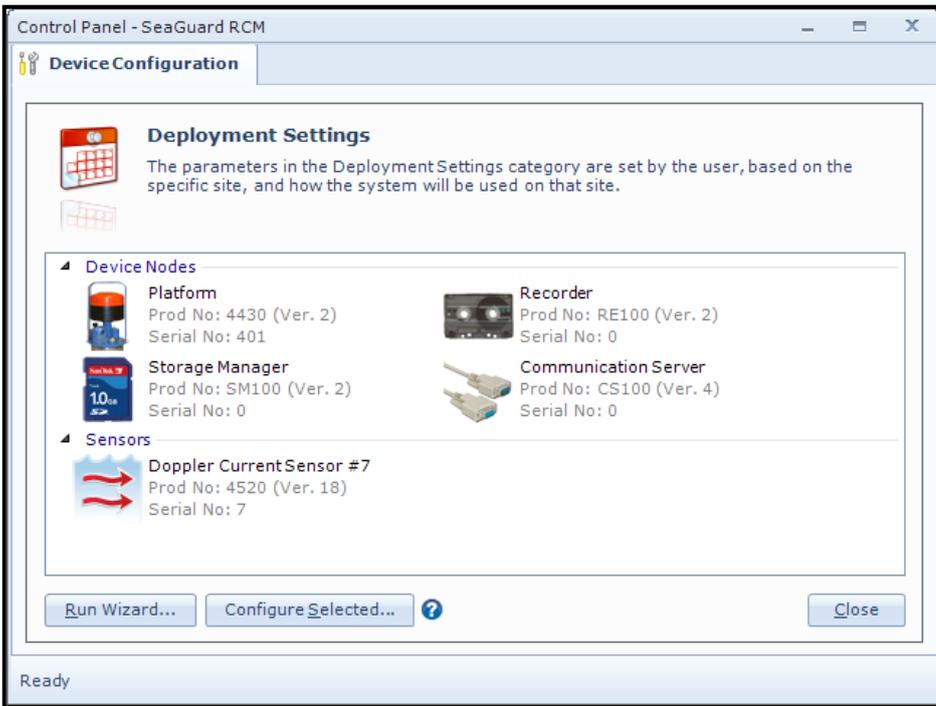
The device configuration is separated into **Deployment settings, System Configuration, User Maintenance, System overview** and **Save configuration to file**.

Settings related to the DCS can be configured under **Deployment Settings, System Configuration** and **User Maintenance**. **System overview** shows a short list of sensor properties like product name, serial number and Software version. Under the heading **Save configuration to file** you can save current settings to a backup file by pressing **Save...** Edit the name for your file and press **Save...** to save the new configuration to file in .xml format.

The device configuration is separated into **Deployment settings, System Configuration, User Maintenance, System overview** and **Save configuration to file**.

Settings related to the DCS can be configured under **Deployment Settings, System Configuration** and **User Maintenance**. **System overview** shows a short list of sensor properties like product name, serial number and Software version. Under the heading **Save configuration to file** you can save current settings to a backup file by pressing **Save...** Edit the name for your file and press **Save...** to save the new configuration to file in .xml format.

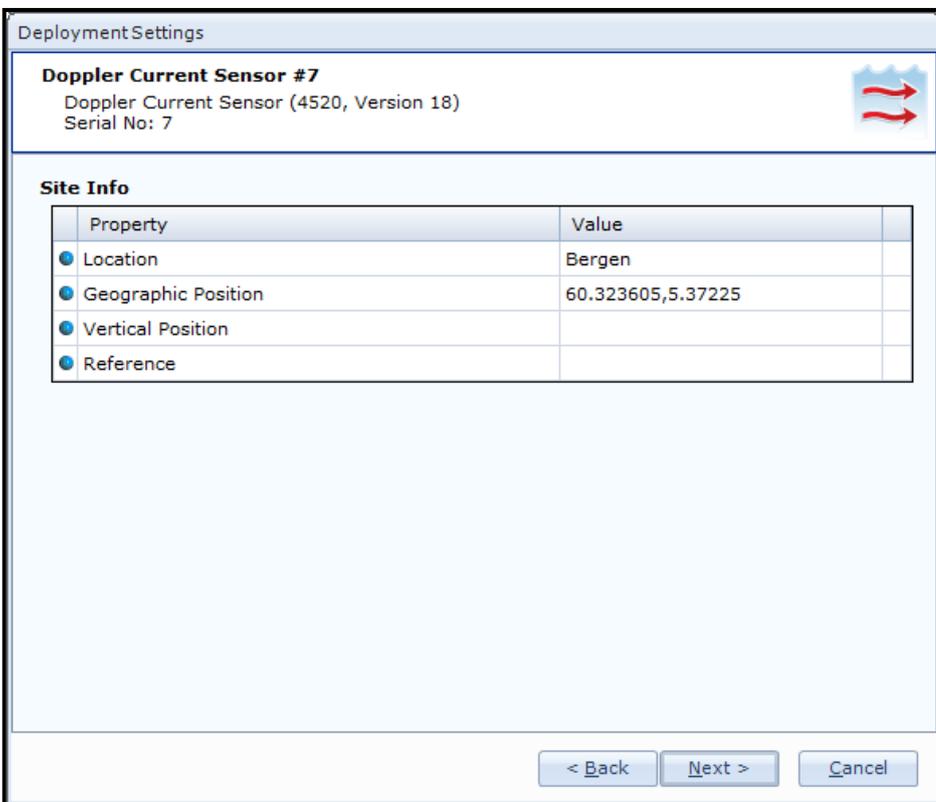
### 3.11 Deployment settings



Under **Device Configuration** (refer [Figure 3-20](#) and [Figure 3-21](#)). Select **Deployment Settings**. Double-click on the **DCS** to select the Doppler current sensor (refer [Figure 3-22](#))

If additional sensors are connected to the SeaGuardIII platform or SmartGuard it is possible to configure the DCS to take input from an external compass.

Figure 3-22: Deployment settings



The **Deployment Settings** holds only one group. The settings in this group are mainly used as information.

Figure 3-23: Deployment Settings DCS

### 3.11.1 Site Info

Site Info	
Property	Value
● Location	Bergen
● Geographic Position	60.323605,5.37225
● Vertical Position	
● Reference	

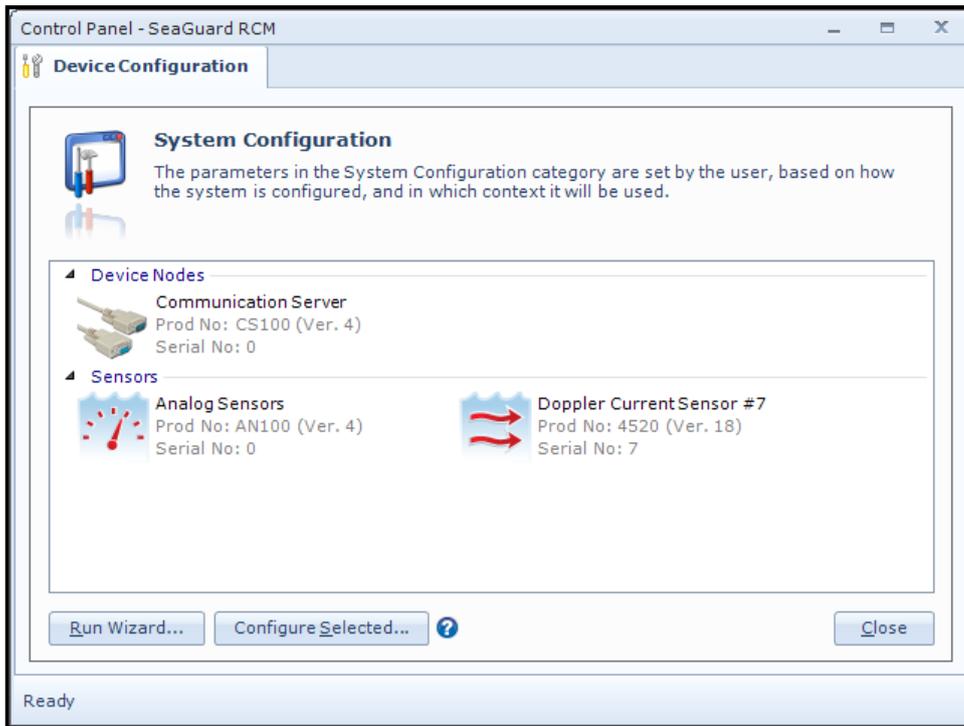
Figure 3-24: Site Info

**Site Info** containing four properties:

- **Location:** Name of location where the instrument is deployed.
- **Geographic Position:** GPS position for deployment format Latitude, Longitude.
- **Vertical Position:** Position in water column, e.g. 5 meter depth.
- **Reference:** Free text for additional information.

All these settings are optional information to be entered to store information about the deployment. These settings are not used in calculation. **Geographical Position** is used to give the map coordinates unless a GPS input is connected.

## 3.12 System Configuration



**Figure 3-25: System configuration**

**Input Parameter Compass** is only available in AiCaP mode and only when used with SeaGuardII or SmartGuard. This setting is used to read an external compass. If the internal compass is disturbed by any magnetic influence this can be useful to correct for this deviation.

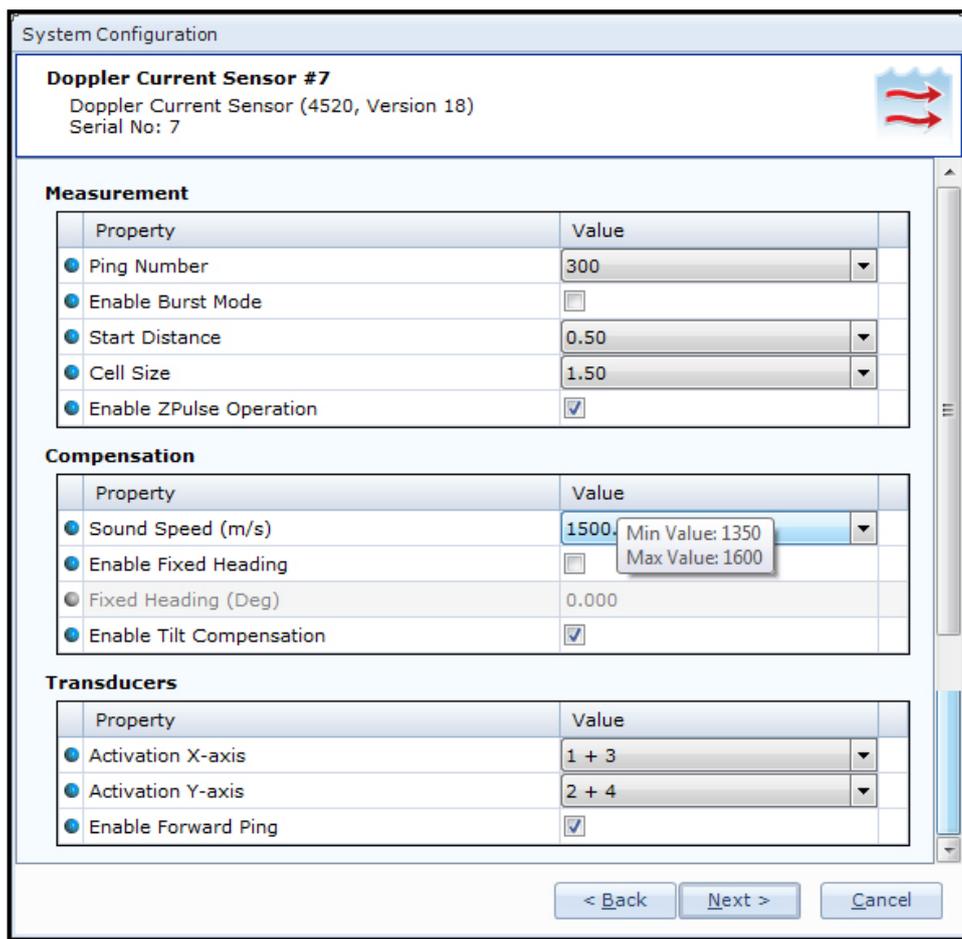
Select **System Configuration** under **Device Configuration** (refer [Figure 3-20](#) and [Figure 3-21](#)). The different sensors connected to the same Datalogger will show up as selectable items, Refer [Figure 3-25](#).

Double-click on the DCS to start configure

Note that this menu is dependent on the **SGII and SmG Feature** setting under **User Maintenance**.

If **Enable Sensor Parameter Input** is enabled then an additional group called **Input Parameter Compass** will show up.

### 3.12.1 System Configuration DCS without Input Parameter Compass



**System Configuration** is separated in 3 groups. The settings in these groups are mainly used to configure the sensor.

Refer [chapter 1.7.3](#) for more information on the properties in **System Configuration**.

Refer [chapter 3.12.3](#) through [3.12.6](#) for a description of each group and settings.

Figure 3-26: System Configuration DCS without Input Parameter Compass

### 3.12.2 System Configuration DCS with Input Parameter Compass

**System Configuration**

**Doppler Current Sensor #7**  
 Doppler Current Sensor (4520, Version 18)  
 Serial No: 7

**Measurement**

Property	Value
Ping Number	300
Enable Burst Mode	<input type="checkbox"/>
Start Distance	0.50
Cell Size	1.50
Enable ZPulse Operation	<input checked="" type="checkbox"/>

**Input Parameter Compass**

Property	Value
Sensor Id	Not Selected
Parameter Id (Deg.M)	Not Available

**Compensation**

Property	Value
Sound Speed (m/s)	1500.00
Enable Fixed Heading	<input type="checkbox"/>
Fixed Heading (Deg)	0.000
Enable Tilt Compensation	<input checked="" type="checkbox"/>

**Transducers**

Property	Value
Activation X-axis	1 + 3
Activation Y-axis	2 + 4
Enable Forward Ping	<input checked="" type="checkbox"/>

< Back    Next >    Cancel

**System Configuration** is separated in 4 groups. The settings in these groups are mainly used to configure the sensor.

Refer [chapter 1.7.3](#) for more information on the properties in **System Configuration**.

Refer [chapter 3.12.3](#) through [3.12.6](#) for a description of each group and settings.

Figure 3-27: System Configuration DCS with Input Parameter Compass

### 3.12.3 Measurement

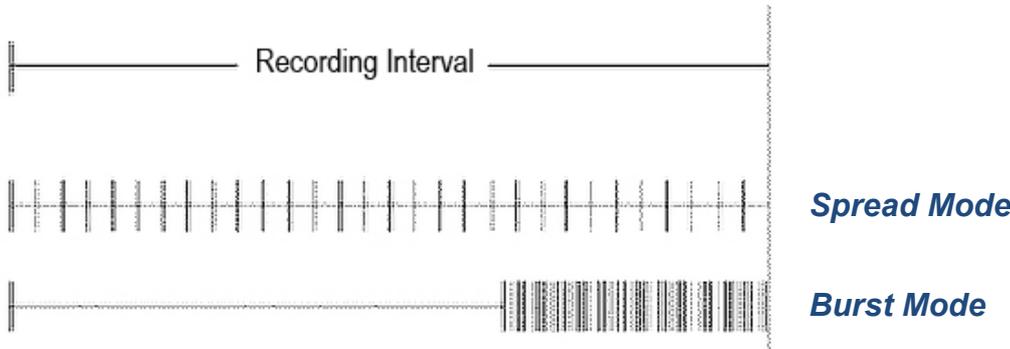
**Measurement**

Property	Value
Ping Number	300
Enable Burst Mode	<input type="checkbox"/>
Start Distance	0.50
Cell Size	1.50
Enable ZPulse Operation	<input checked="" type="checkbox"/>

Figure 3-28: Measurement

**Ping Number** is the number of ping transmitted during one recording interval. One ping is a transmitted pulse on both axes, so one pulse on two transducers.

**Enable Burst Mode.** The sensor can run in burst mode or spread mode. When burst mode is enabled the sensor performs all ping measurements at the end of the recording interval. If it is disabled the ping measurements are evenly spread out during the recording interval. The instrument activates sleep mode between each measurement, which reduces the power consumption. Power consumption in spread and burst mode is about the same. Refer [Figure 3-28](#).



**Figure 3-29: Spread mode and burst mode ping distribution during the recording interval**

The transmitted pulse has a fixed length of 0.75m. Internal ringing in the transducers will always occur after transmitting acoustic pulses; the transducers cannot receive backscattered signal until the ringing stops. For the ZPulse DCS the pulse must have travelled at least a distance of minimum 0.4m before backscattered signals from the pulse can be received by the transducers. This is called the **Start Distance**. The transducers continue to receive backscattered signal from particles present in the beam until the pulse has propagated a distance equal to the **Cell Size**.

The total area from which the DCS receives backscattered energy is called the Measurement Area. Due to the shape of the pulse, the main contribution to backscattered energy is from particles that are present in an area around the Cell Centre. The measurement area outside the cell contributes very sparsely to the measured Doppler frequency shift. Refer [Figure 3-30](#) for an illustration.

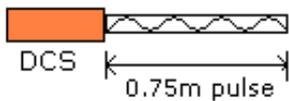
Surrounding objects must be further away from the DCS than the described measurement area to avoid influencing the measurements.

The Measurement Area is defined as the *Pulse Length + Cell size*

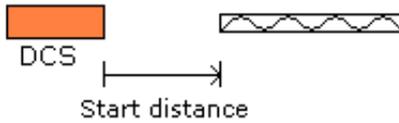
The Cell Start is defined as:  $Start\ distance + \frac{Pulse\ Length}{2}$

The Cell End is defined as:  $Cell\ start + Cell\ size$

The Cell Centre is defined as:  $Start\ distance + \frac{Pulse\ Length + Cell\ Size}{2}$



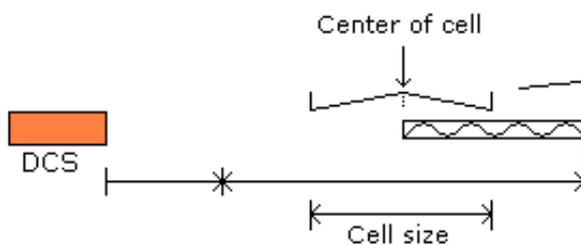
The pulse gives backscatter from a 0.75m long area after transmission.



The pulse propagates away from the sensor, giving backscatter further away from a 0.75m area. A 0.4m start distance means that the DCS starts to measure the backscattered signal while the pulse gives backscatters from 0.4m to  $0.4+0.75=1.15\text{m}$  area away from the sensor.



The sensor measures the backscattered signal while the pulse propagates a distance equal to the selected cell size. In this example the cell size is equal to the pulse length, i.e the sensor measures the backscattered signal while the pulse propagates 0.75 further away.



The sensitivity is greatest at the center of the cell, i.e the area close to the center of the cell gives more backscatter energy. The measurement area outside the cell gives very little contribution to the measured doppler frequency shift.

Figure 3-30: Illustration of Pulse, Cell and the Measurement area.

**Enable ZPulse Operation.** Activate/deactivate ZPulse operation; Set yes to activate. Default value is yes. ZPulse operation gives two separate frequencies in each ping and therefor higher quality data without increasing power consumption

### 3.12.4 Input Parameter Compass

Input Parameter Compass	
Property	Value
● Sensor Id	Not Selected ▼
● Parameter Id (Deg.M)	Not Available ▼

Figure 3-31: Input Parameter Compass

This menu is only available in AiCaP mode and when **SGII and SmG Feature** are enabled under **User Maintenance**. Do not use this feature with SeaGuard.

By using the **Input Parameter Compass** function the sensor can take an input from an external Compass, like for example the Airmar H2183 Compass. Surface buoys are often made of steel. The magnetic influence from the buoy can give a big error on the compass heading measured by the DCS. A compass mounted on a mast away from the buoy structure is often a better method which gives a more accurate compass measurement. Select a compass connected to the Logger in the **Sensor Id** drop-down menu if available and the heading parameter in **Parameter Id (Deg, M)**. The **Heading Alignment Offset (Deg.M)** value can be set to compensate for the misalignment between the compass axes and the axes on the DCS.

NOTE!

Do not use the DCS as an external reference even if it is available in the list

### 3.12.5 Compensation

Compensation	
Property	Value
● Sound Speed (m/s)	1500.00
● Enable Fixed Heading	<input type="checkbox"/>
● Fixed Heading (Deg)	0.000
● Enable Tilt Compensation	<input checked="" type="checkbox"/>

Figure 3-32: Compensation

**Sound Speed (m/s)** is the fixed sound speed setting in m/s. This value is used for calculation of current speed values. Default value for sea water is 1500.

**Enable Fixed Heading** might be used if there is any magnetic disturbance that might interfere with a compass heading and the instrument has a fix position. Then **Fixed Heading (Deg.M)** can be used to set the offset between the Sensor North direction and the Magnetic North.

**Enable Tilt Compensation** is recommended to set active at all time because then the sensor will automatically compensate for any tilt.

### 3.12.6 Transducers

Transducers	
Property	Value
● Activation X-axis	1 + 3
● Activation Y-axis	2 + 4
● Enable Forward Ping	<input checked="" type="checkbox"/>

Figure 3-33: Transducers

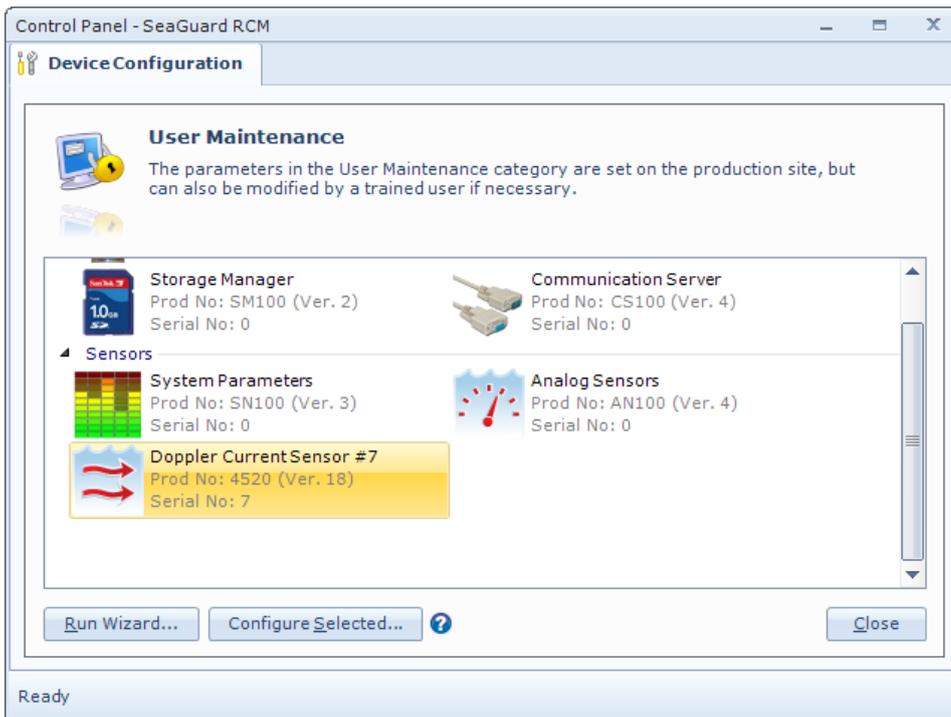
**Activation X-axis** controls active transducers on the X-axis: Alternative settings are **1, 3** or **1+3**. Default is **1+3**. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Activation Y-axis** controls active transducers on the Y-axis: Alternative settings are **2, 4** or **2+4**. Default is **2+4**. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Enable Forward Ping**. If set to yes the sensor will try to only measure upstream to reduce problems related to turbulence. If enabled the sensor will start to measure using one transducer on each axis, then it will continue using these transducers as long as they measure a positive Doppler shift. If one transducer then changes to negative Doppler shift it will change to the other transducer on the same axis.

When finished with the configuration, click **Next** twice and wait for the Datalogger to finish the saving of the new configuration.

### 3.13 User Maintenance



Under **User Maintenance**, (refer **Figure 3-20** and **Figure 3-21**) you find properties that are password protected and are set / altered by a trained user. It is not recommended to change properties unless instructed. To access these, check the **“Include User Maintenance”** box in the device configuration before clicking on the **“Get Current Configuration...”** button. The password is: **1000**. The user maintenance settings are accessible by clicking the **“Edit...”** button under **User Maintenance**

Figure 3-34: User Maintenance

### 3.13.1 User Maintenance settings

**User Maintenance**

**Doppler Current Sensor #7**  
 Doppler Current Sensor (4520, Version 18)  
 Serial No: 7



**Mandatory**

Property	Value
<input checked="" type="radio"/> Node Description	Doppler Current Sensor #7

**Site Info**

Property	Value
<input checked="" type="radio"/> Owner	Aanderaa

**Serial Port**

Property	Value
<input checked="" type="radio"/> Interface	RS232

**Operation**

Property	Value
<input checked="" type="radio"/> Enable Spike Filter	<input checked="" type="checkbox"/>
<input checked="" type="radio"/> Enable Axis Strength	<input checked="" type="checkbox"/>
<input checked="" type="radio"/> Enable Transducer Strength	<input checked="" type="checkbox"/>

**Calibration**

Property	Value
<input type="radio"/> Compass Calibrated Orientation	Up and Down
<input checked="" type="radio"/> Compass Deviation (Deg)	0.000

**Dependencies**

Property	Value
<input checked="" type="radio"/> Enable Magnetic Declination	<input type="checkbox"/>
<input type="radio"/> Declination Angle (Deg.M)	0.000

**SGII and SmG Features**

Property	Value
<input checked="" type="radio"/> Enable Sensor Parameter Input	<input type="checkbox"/>

< Back
Next >
Cancel

There are 7 group under **User Maintenance**. Each group are described in chapter 3.13.2 to 3.13.8

Figure 3-35: User maintenance

### 3.13.2 Mandatory

Mandatory	
Property	Value
<input checked="" type="radio"/> Node Description	Doppler Current Sensor #7

Figure 3-36: Mandatory

All sensors are given a **Node Description** text like DCS #xxx (xxx is the serial number of the sensor). The user can modify this node description text if required. Be aware that the node description changes to \*Corrupt Configuration if it has lost the configuration in flash. Contact the factory if this happens. The configuration is saved in two sectors in flash memory. A flash sector can be corrupted if the power is lost during the saving of new configuration. The double flash sector saving ensures that it does not lose the configuration. If one of the sectors is corrupted, the other sector is used and also saved to the corrupt sector.

### 3.13.3 Site Info

Site Info	
Property	Value
<input checked="" type="radio"/> Owner	

Figure 3-37: Site Info

**Owner** is only used for information and will be a part of the Meta data from the sensor. Not used in any calculations.

### 3.13.4 Serial Port

Serial Port	
Property	Value
<input checked="" type="radio"/> Interface	RS232

Figure 3-38: Serial Port

**Interface** is the interface between sensor and PC. But when used in AiCaP mode the only alternative is RS-232 as this is the used to configure a AiCaP sensor not connected to an Aanderaa AiCaP logger,

### 3.13.5 Operation

Operation	
Property	Value
<input checked="" type="checkbox"/> Enable Spike Filter	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Enable Axis Strength	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Enable Transducer Strength	<input checked="" type="checkbox"/>

Figure 3-39: Operation

**Enable Spike Filter** Activate/deactivate spike filter; Set yes to activate. Default is yes. Spike filter tracks and eliminates spikes in measured data.

**Enable Axis Strength** Enables output of strength X and strength Y. Result is an average of the two transducers on each axis. Default is no

**Enable Transducer Strength** Enables output of signal strength from each of the four transducers. Default is no.

### 3.13.6 Calibration

Calibration	
Property	Value
<input type="radio"/> Compass Calibrated Orientation	Up and Down
<input checked="" type="radio"/> Compass Deviation (Deg)	0.000000E+00

Figure 3-40: Calibration

**Compass Calibrated Orientation**. Indicate the possible operation direction for the sensor. Available alternative is; Only UP, Only Down or Up and Down. This setting can only be altered by authorized personal and reflects the calibration performed. To change the sensor need to be recalibrated at the factory

**Compass Deviation (Deg)** Compass offset correction value (deg. M)

### 3.13.7 Dependencies

Dependencies	
Property	Value
<input checked="" type="radio"/> Enable Magnetic Declination	<input type="checkbox"/>
<input type="radio"/> Declination Angle (Deg.M)	0.000000E+00

Figure 3-41: Dependencies

**Enable Magnetic Declination** is normally used when sensor is used close to South Pole or North Pole. **Declination Angle (Deg.M)** is a value to correct for the magnetic variation on the site where the sensor is used. This is the angle in degrees between magnetic north and true north. Magnetic declination (variation) is the angle between the magnetic north and the true north. This angle varies depending on the position on the Earth's surface and also varies over time. Declination is positive when magnetic north is east of true north and negative when it is to the west (input angle value  $\pm 180^\circ$ ). Magnetic declination at the deployment location can be found for i.e. on NOAA website:

<http://www.ngdc.noaa.gov/geomag-web/>

### 3.13.8 SGII and SmG Features

SGII and SmG Features	
Property	Value
<input checked="" type="radio"/> Enable Sensor Parameter Input	<input checked="" type="checkbox"/> 

Figure 3-42: SGII and SmG Features

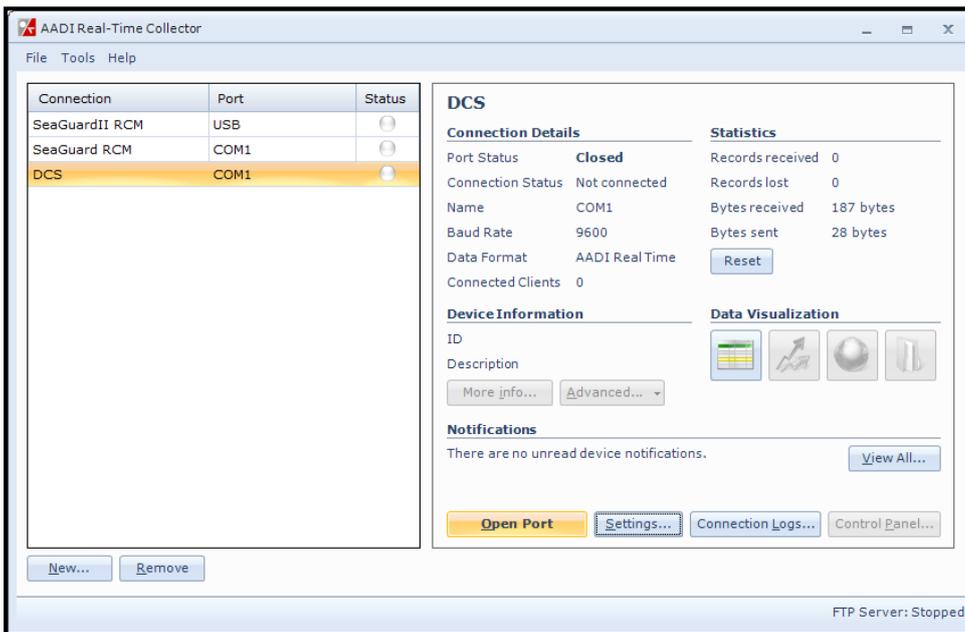
**Enable Sensor Parameter Input** If enabled the sensor might use data from other sensors via SeaGuardII or SmartGuard. E.g. if a Conductivity Sensor 4319 is connected to the same logger Salinity and Temperature from this sensor can be used in calculations of e.g. depth and Sound of Speed. Only in AiCaP mode, and need to be disabled if used with SeaGuard

## CHAPTER 4 Logging data via AADI Real-Time Collector

### 4.1 Logging data on PC

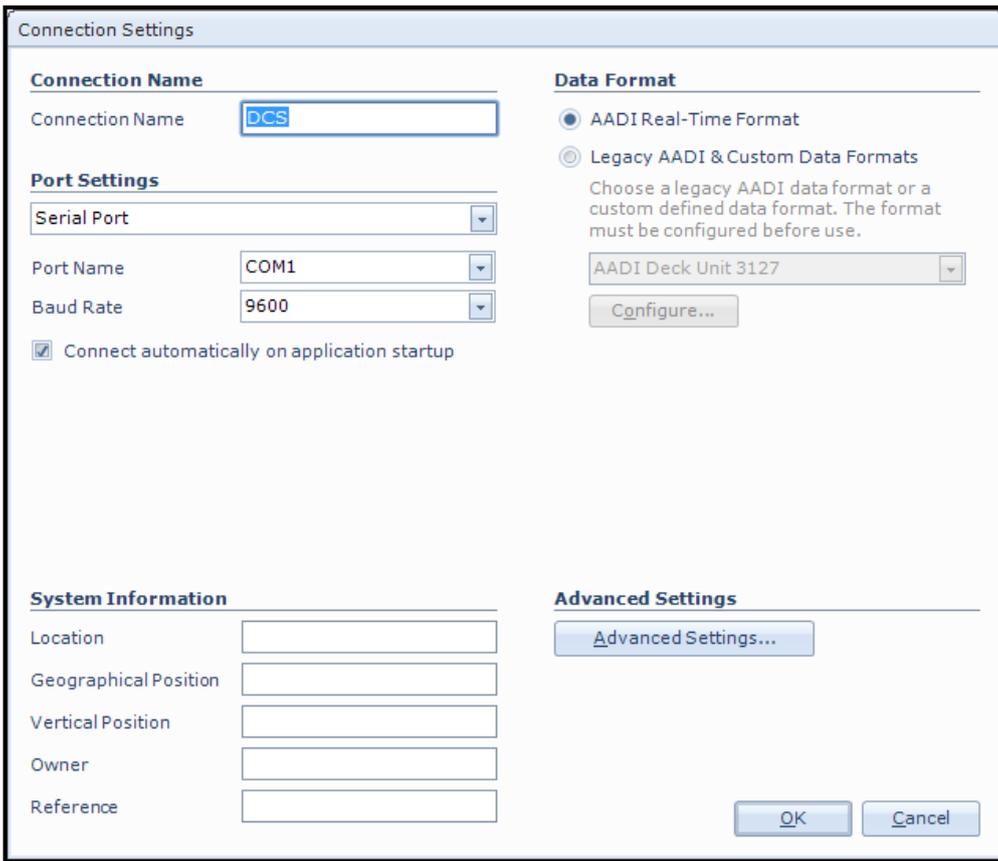
The Real-Time Collector can save the incoming data to file if the sensor is in AADI Real-Time mode, either to a txt-file or to xml-files.

#### 4.1.1 Enabling file output



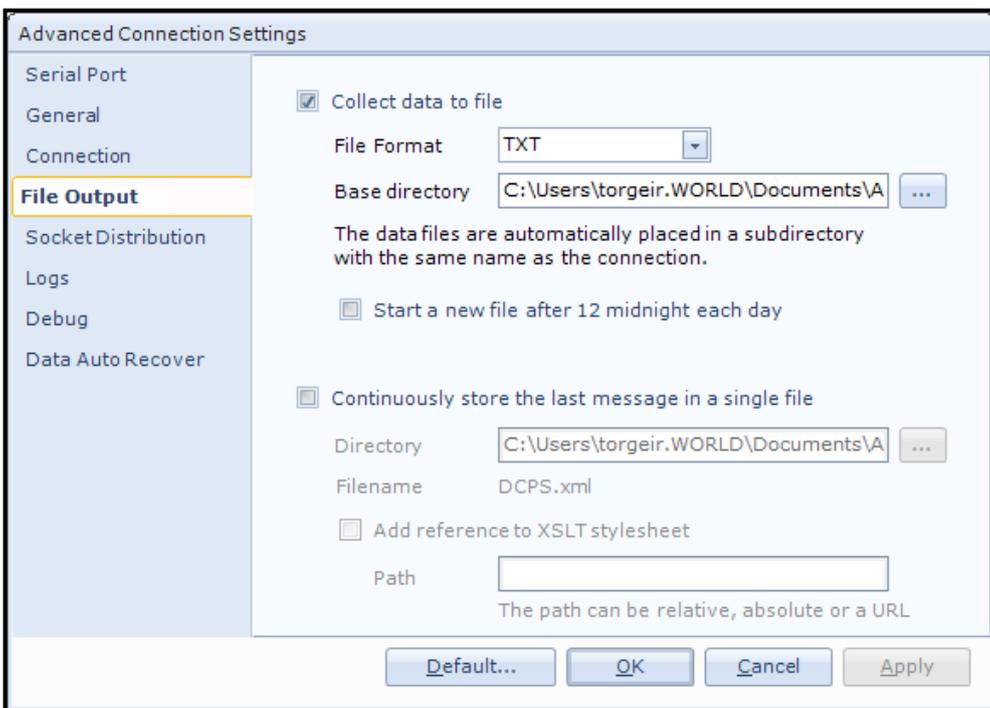
If your connection is open (port open, status green in the AADI Real Time Collector main menu) close the port first to be able to change the file output settings. Click on the connection you are using. Then click on the **“Settings...”** button, as shown in Figure 4-1.

Figure 4-1: AADI Real-Time Collector start up menu



Then click on the **“Advanced Settings...”** button in the Connection Settings window; refer **Figure 4-2**

**Figure 4-2: Connection settings menu**



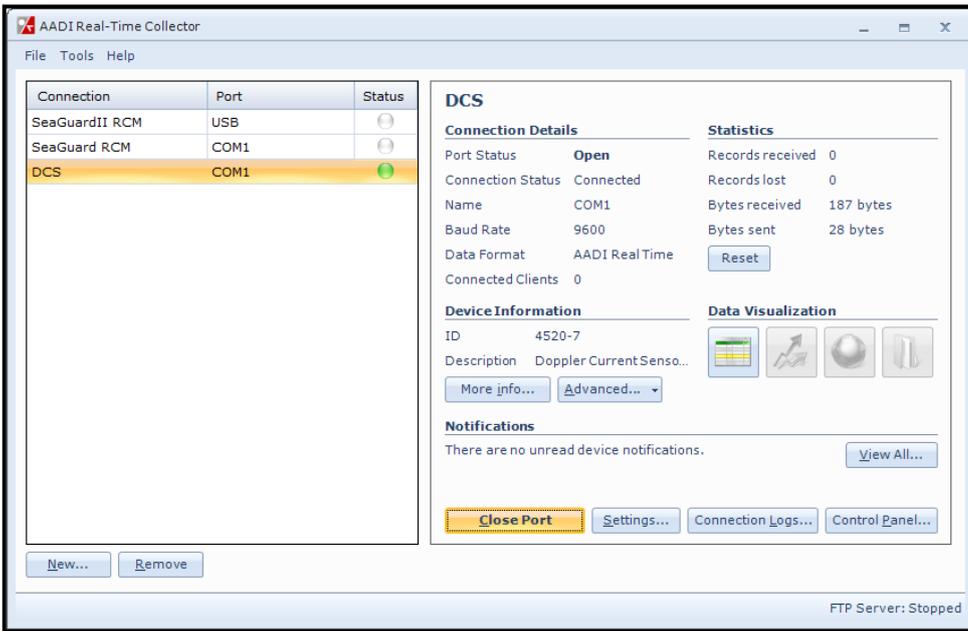
Choose **File Output** from the list on the left side. Check the **“Collect data to file”** box to enable file output. Select a file format either XML or TXT and choose a base directory where you want the file to be saved.

Alternatively you may select **“Continuously store the last message in a single file”**.

Click **“OK”** in the **Advanced Connection Settings** window, and **“OK”** in the **Connection Settings** window

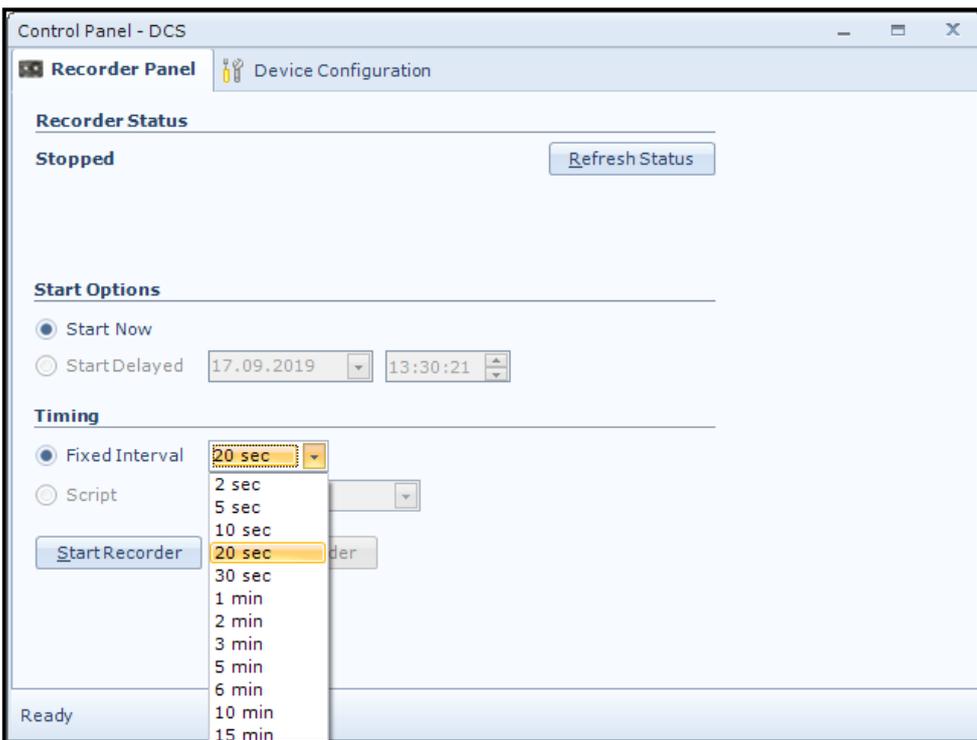
**Figure 4-3: Advanced connection settings / File Output**

### 4.1.2 Starting the sensor and logging to file



Click on the connection and “**Open Port**”. The Status turns green when the port is opened and connected.

Figure 4-4: AADI Real-Time Collector start up menu



Click on the “**Control Panel...**” button in the lower right corner.

Select the interval duration and click the “**Start Recorder**” button. The shortest interval available depends on the sensor configuration. More cells give longer ping processing time and a higher minimum available recording interval.

This configuration is only available if the sensor is in **AADI Real-Time** mode.

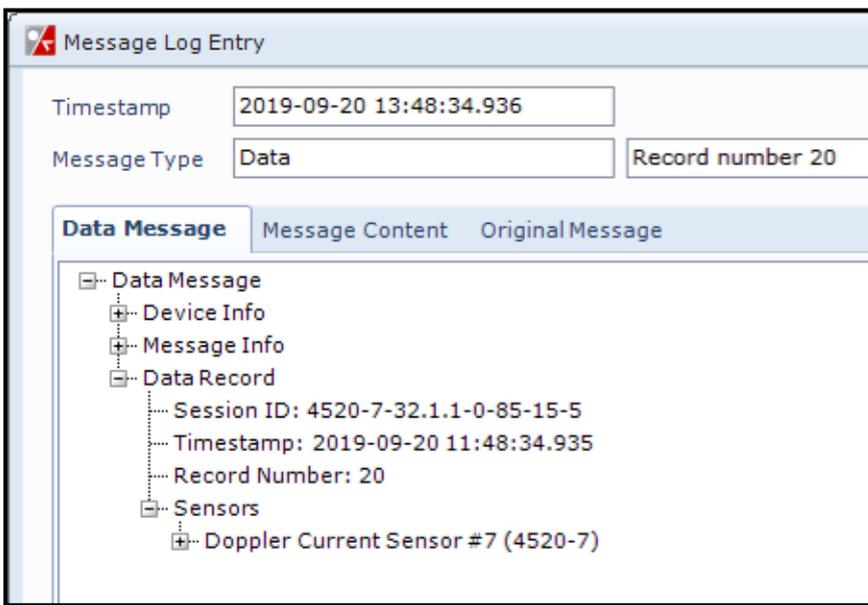
Figure 4-5: Recorder panel

Data will start logging in the defined directory. If it is a txt-file, the easiest way to view it is in Excel. **Figure 4-6** gives an example of obtained data file. The different parameters are organized in columns.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Description	Doppler Current Sensor #7												
2	Product Name	Doppler Current Sensor												
3	Product Number	4520												
4	Serial Number	7												
5	Device ID	4520-7												
6	Session ID	4520-7-32.1.1-0-83												
7	Location	Bergen												
8	Geographic Position	60.323605,5.37225												
9	Vertical Position													
10	Owner	Aanderaa												
11	Reference													
12														
13														
14		Doppler Current Sensor #7												
15	Record Time	Record Number	Sensor St	Abs Speec	Status	Direction	Status	North [cm	Status	East [cm/s	Status	Heading [l	Status	Tilt X [Deg
16	17.09.2019 14:24	4	(0)	OK	8.33E+00	3.32E+02		7.33E+00		-3.94E+00		1.08E+02		1.19E+01
17	17.09.2019 14:24	5	(0)	OK	3.31E+01	2.87E+02		9.62E+00		-3.17E+01		1.08E+02		1.13E+01
18	17.09.2019 14:24	6	(0)	OK	1.04E+01	2.09E+02		-9.17E+00		-4.99E+00		1.09E+02		1.04E+01

Figure 4-6: Example of a txt-file obtained from the sensor using RT Collector

## 4.2 Viewing incoming data in real-time

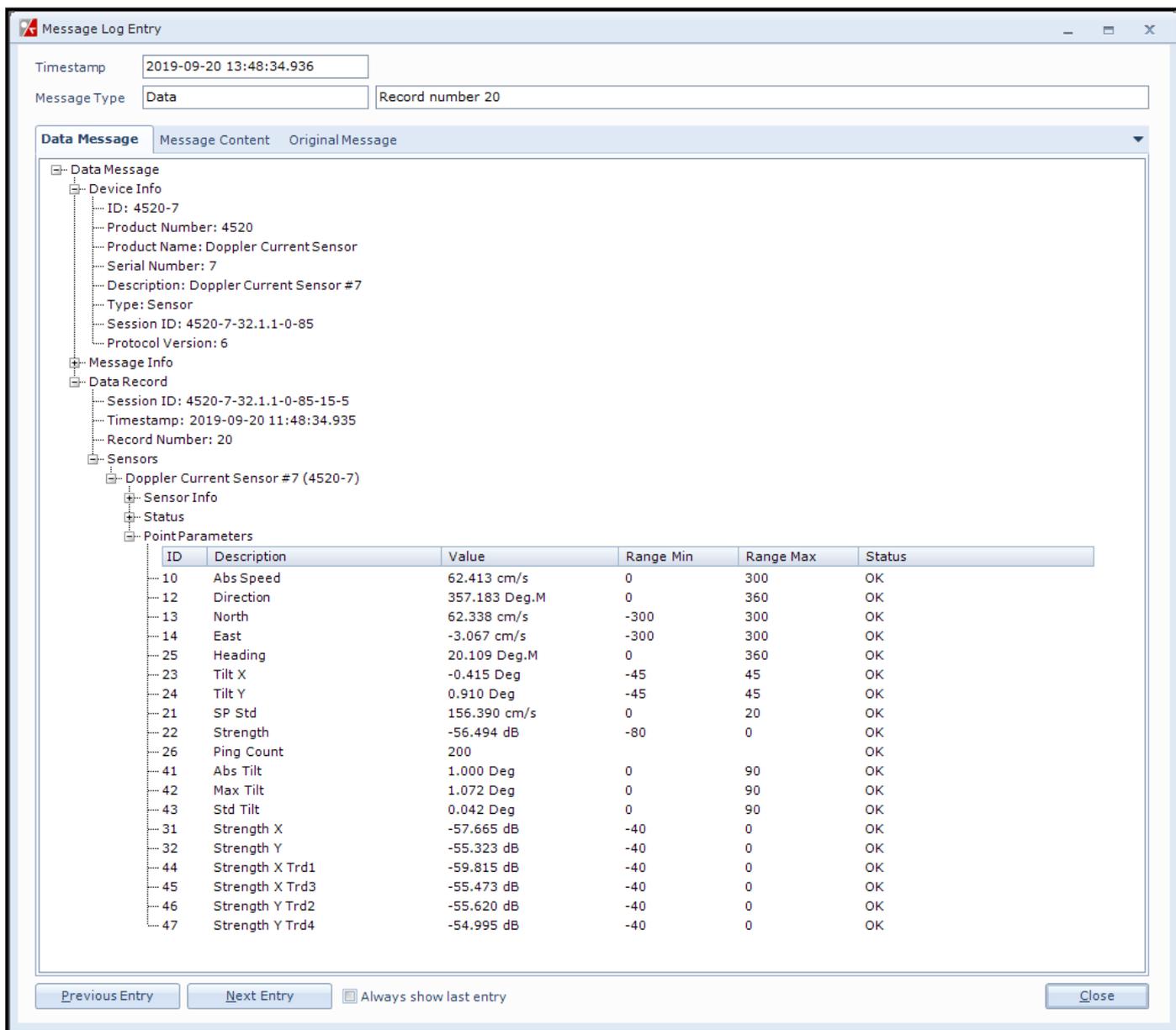


When the sensor is running, the incoming data can be viewed under “[Connection Logs...](#)” in the main AADI Real-Time Collector menu (refer to [Figure 4-7](#) and [Figure 4-8](#)).

Double-click on one of the Record numbers to look at the data.

Click on the + signs to open up and see all the data in the message.

Figure 4-7: Message Log Entry



**Figure 4-8: Visualization of incoming data from the sensor in real time**

Previous records or newer records can be viewed by clicking on **Previous Entry** button or **Next Entry** button. An automatic update to the last data message can be enabled by checking the Always show last entry check box.

The original message content can be seen if clicking on the Original Message tab.

## CHAPTER 5 Configuration via SeaGuard using Touch screen

SeaGuard Platform is available either with Plug Assembly used to communicate and configure via serial port or a Touch Screen Display used to do all configuration directly on the screen without need of any PC.

How to configure SeaGuard with Plug Assembly are described in chapter 3.3.3 to 3.12.8

In this chapter we will described how to configure DCS on a SeaGuard using the touch screen display. For menus dealing with general configuration of the SeaGuard platform and other sensors see TD262a Manual for SeaGuard Platform.

### 5.1 Start Menu



To start the instrument push the button underneath the display and wait for approximately 15 seconds before the display turns one and then another 15 seconds before its ready for configuration.

Use the supplied stylus to push the **Menu** button in the left lower corner.

This menu keeps all the different menus used to control the entire instruments. In this manual we will only cover **Administrative Tools**, **System Configuration** and **Deployment Setting** that are all containing setting for the DCS.

We will start with selecting **System Configuration** from the menu.

Figure 5-1: Start Menu

## 5.2 System Configuration



Figure 5-2: System Configuration

When you select **System Configuration** you will first enter a window with a **Run Wizard** button on the top and then to tabs named **Instruments** and **Sensors**.

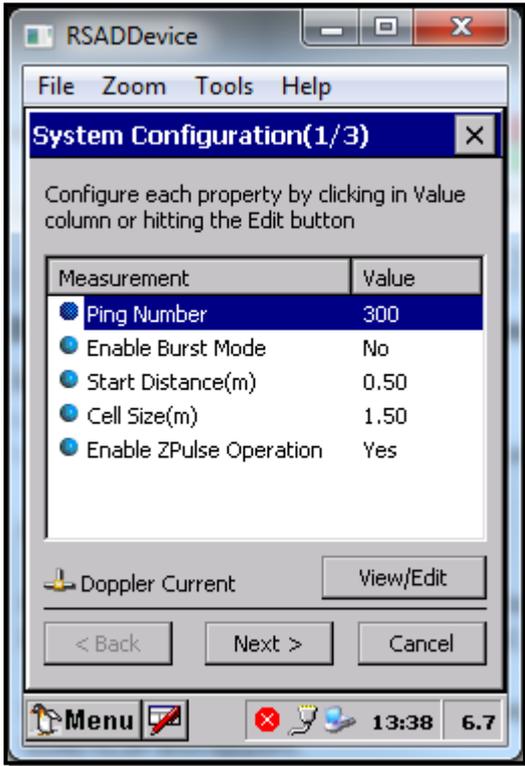
To configure the DCS you might either select the **Run Wizard** button and then step through all the **System Configuration** settings until you reach the DCS settings or you might select the **Sensors** tab.



Figure 5-3: System Configuration Sensors

Under the **Sensor** tab you will find a list of all available sensors.

Select the DCS and then tick the **Configure** button.



The DCS System Configuration is divided in three different sheets.

Sheet 1/3 contain settings for **Measurement settings**.

**Ping Number** is the number of ping transmitted during one recording interval. One ping is a transmitted pulse on both axes, so one pulse on two transducers.

**Enable Burst Mode.** The sensor can run in burst mode or spread mode. When burst mode is enabled the sensor performs all ping measurements at the end of the recording interval. If it is disabled the ping measurements are evenly spread out during the recording interval. The instrument activates sleep mode between each measurement, which reduces the power consumption. Power consumption in spread and burst mode is about the same.

Figure 5-4: Measurement

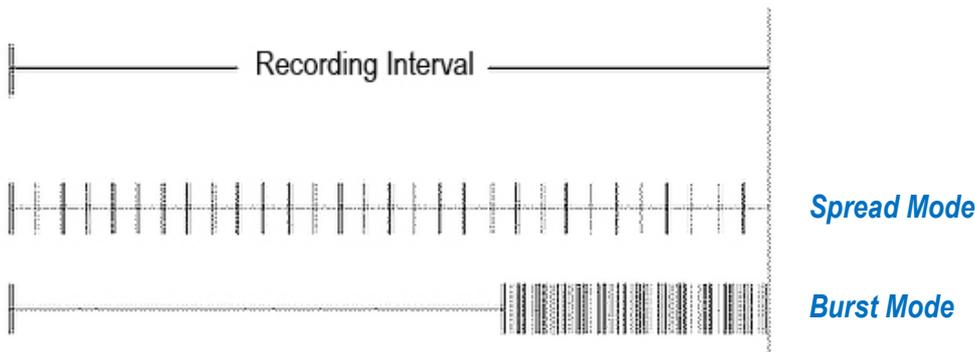


Figure 5-5: Spread mode and burst mode ping distribution during the recording interval

The transmitted pulse has a fixed length of 0.75m. Internal ringing in the transducers will always occur after transmitting acoustic pulses; the transducers cannot receive backscattered signal until the ringing stops. For the ZPulse DCS the pulse must have travelled at least a distance of minimum 0.4m before backscattered signals from the pulse can be received by the transducers. This is called the **Start Distance**. The transducers continue to receive backscattered signal from particles present in the beam until the pulse has propagated a distance equal to the **Cell Size**.

The total area from which the DCS receives backscattered energy is called the Measurement Area. Due to the shape of the pulse, the main contribution to backscattered energy is from particles that are present in an area around the Cell Centre. The measurement area outside the cell contributes very sparsely to the measured Doppler frequency shift. Refer **Figure 5-6** for an illustration.

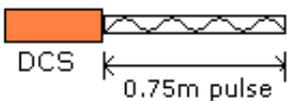
Surrounding objects must be further away from the DCS than the described measurement area to avoid influencing the measurements.

The Measurement Area is defined as the *Pulse Length + Cell size*

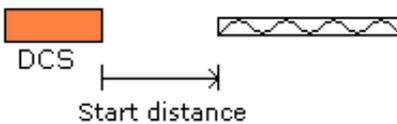
The Cell Start is defined as:  $Start\ distance + \frac{Pulse\ Length}{2}$

The Cell End is defined as:  $Cell\ start + Cell\ size$

The Cell Centre is defined as:  $Start\ distance + \frac{Pulse\ Length + Cell\ Size}{2}$



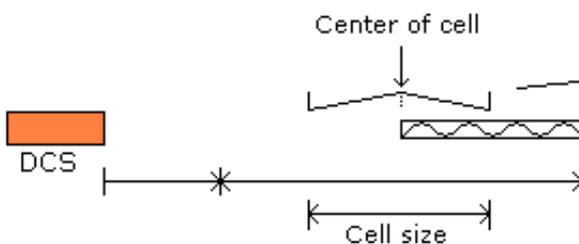
The pulse gives backscatter from a 0.75m long area after transmission.



The pulse propagates away from the sensor, giving backscatter further away from a 0.75m area. A 0.4m start distance means that the DCS starts to measure the backscattered signal while the pulse gives backscatters from 0.4m to 0.4+0.75=1.15m area away from the sensor.



The sensor measures the backscattered signal while the pulse propagates a distance equal to the selected cell size. In this example the cell size is equal to the pulse length, i.e the sensor measures the backscattered signal while the pulse propagates 0.75 further away.



The sensitivity is greatest at the center of the cell, i.e the area close to the center of the cell gives more backscatter energy. The measurement area outside the cell gives very little contribution to the measured doppler frequency shift.

Figure 5-6: Illustration of Pulse, Cell and the Measurement area.

**Enable ZPulse Operation.** Activate/deactivate ZPulse operation; Set yes to activate. Default value is yes. ZPulse operation gives two separate frequencies in each ping and therefore higher quality data without increasing power consumption

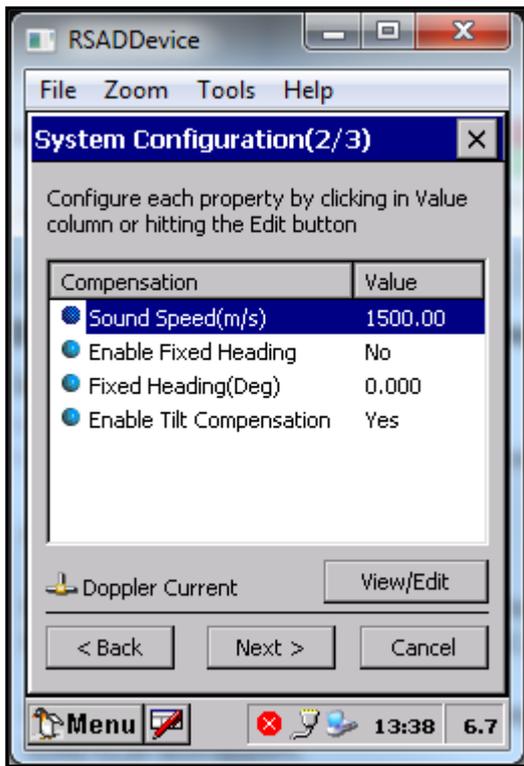


Figure 5-7: Compensation

Sheet 2/3 contains Compensation settings

**Sound Speed (m/s)** is the fixed sound speed setting in m/s. This value is used for calculation of current speed values. Default value for sea water is 1500.

**Enable Fixed Heading** might be used if there is any magnetic disturbance that might interfere with a compass heading and the instrument has a fix position. Then **Fixed Heading (Deg.M)** can be used to set the offset between the Sensor North direction and the Magnetic North.

**Enable Tilt Compensation** is recommended to set active at all time because then the sensor will automatically compensate for any tilt.

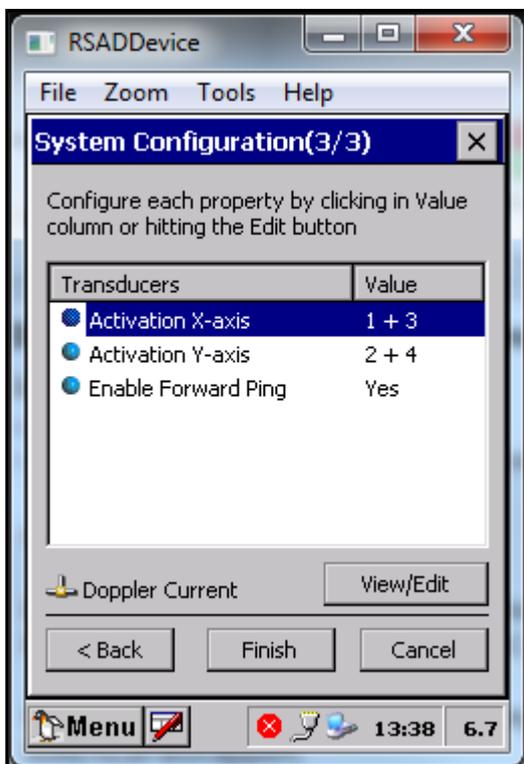


Figure 5-8: Transducers

Sheet 3/3 contains Transducers settings

**Activation X-axis** controls active transducers on the X-axis: Alternative settings are 1, 3 or 1+3. Default is 1+3. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Activation Y-axis** controls active transducers on the Y-axis: Alternative settings are 2, 4 or 2+4. Default is 2+4. If there is a fixed obstruction in front of one transducer this transducer might be turned off by only selecting the other transducer on that axis.

**Enable Forward Ping**. If set to yes the sensor will try to only measure upstream to reduce problems related to turbulence. If enabled the sensor will start to measure using one transducer on each axis, then it will continue using these transducers as long as they measure a positive Doppler shift. If one transducer then changes to negative Doppler shift it will change to the other transducer on the same axis.

When finished with the configuration, click **finish** to store new settings and the X in the top right corner to leave this menu.

## 5.3 Deployment Settings



Figure 5-9: Deployment Settings

When you select **Deployment Settings** you will first enter a window with a **Run Wizard** button on the top and then to tabs named **Instruments** and **Sensors**.

To configure the DCS you might either select the **Run Wizard** button and then step through all the **Deployment Settings** until you reach the DCS settings or you might select the **Sensors** tab

Under the **Sensor** tab you will find a list of all available sensors.

Select the **DCS** and then tick the **Configure** button.



Figure 5-10: Deployment Settings Sensors

Under the **Sensor** tab you will find a list of all available sensors.

Select the **DCS** and then tick the **Configure** button.

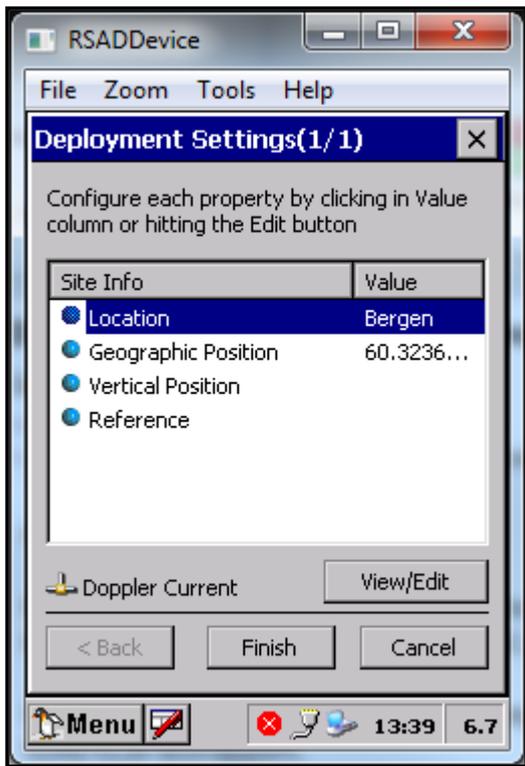


Figure 5-11: Site Info

Sheet 1/1 contain settings for Site Info

**Site Info** containing four properties:

- **Location:** Name of location where the instrument is deployed.
- **Geographic Position:** GPS position for deployment format Latitude, Longitude.
- **Vertical Position:** Position in water column, e.g. 5 meter depth.
- **Reference:** Free text for additional information.

All these settings are optional information to be entered to store information about the deployment. These settings are not used in calculation. **Geographical Position** is used to give the map coordinates unless a GPS input is connected.

## 5.4 User Maintenance



Figure 5-12: Administrative Tools

In the **Administrative tools** menu you'll find useful tools used to test individual sensors, power calculator, import/export functions and options modul. These menus are covered in TD 262a.

In this Manual we will focus on **User Maintenance** which is used to control each sensor.

Double click on the **User Maintenance** icon



When you select **User Maintenance** you will first enter a window with a Run Wizard button on the top and then two tabs named **Instrument** and **Sensors**.

To configure the DCS you might either select the **Run Wizard** button and then step through all the **User Maintenance** settings until you reach the **DCS** settings or you might select the **Sensors** tab

Under the **Sensor** tab you will find a list of all available sensors.

Figure 5-13: User Maintenance



Select the **Sensor** tab and then the **DCS** before ticking the **Configure** button

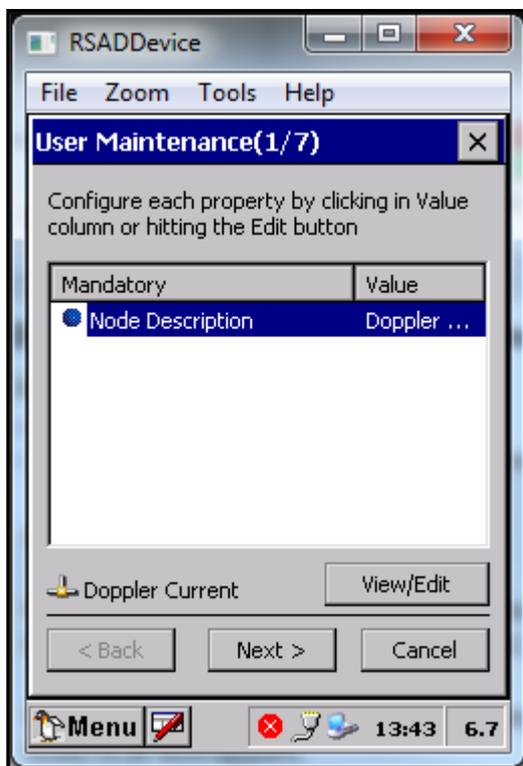
Figure 5-14: User Maintenance DCS



**User Maintenance** is a password protected menu that contain settings that normally are not altered by non trained personel. However if you need to change some settings here the password will be **1000** for all units

Enter the password and press **OK** og select the read only to only check the settings without risk of incidentaly change one of the properties.

Figure 5-15: User Maintenance Password

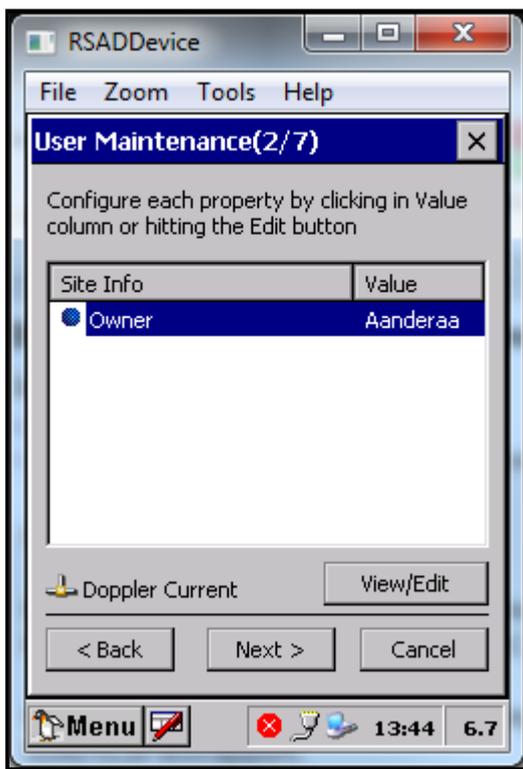


**User Maintenance** are devided into 7 sections

Sheet 1/7 contains **Mandatory** settings.

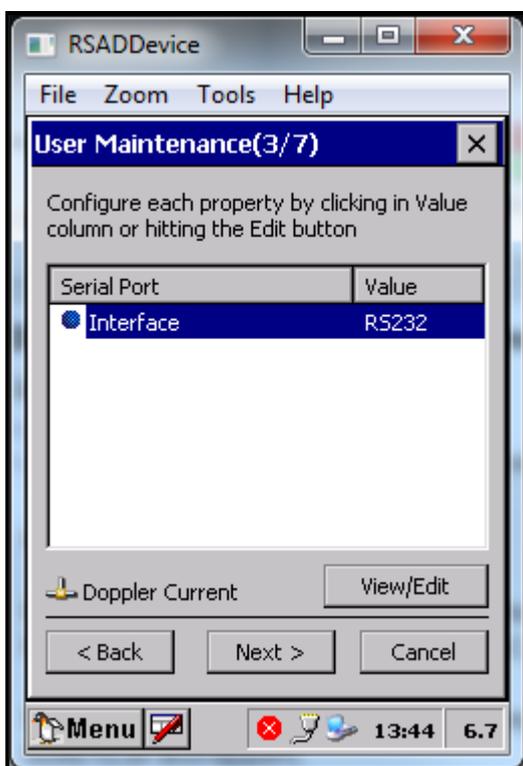
All sensors are given a **Node Description** text like DCS #xxx (xxx is the serial number of the sensor). The user can modify this node description text if required. Be aware that the node description changes to \*Corrupt Configuration if it has lost the configuration in flash. Contact the factory if this happens. The configuration is saved in two sectors in flash memory. A flash sector can be corrupted if the power is lost during the saving of new configuration. The double flash sector saving ensures that it does not lose the configuration. If one of the sectors is corrupted, the other sector is used and also saved to the corrupt sector.

Figure 5-16: Mandatory



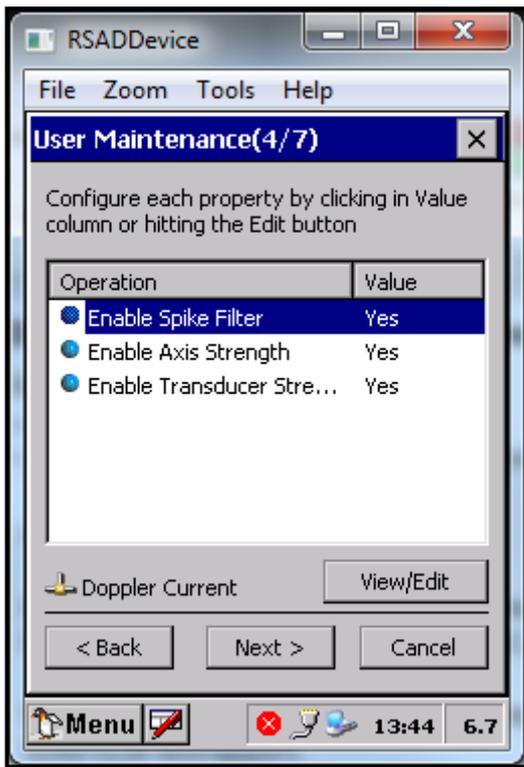
**Owner** is only used for information and will be a part of the Meta data from the sensor. Not used in any calculations.

Figure 5-17: Site Info



**Interface** is the interface between sensor and PC. But when used in AiCaP mode the only alternative is RS-232 as this is the used to configure a AiCaP sensor not connected to an Aanderaa AiCaP logger,

Figure 5-18: Serial Port

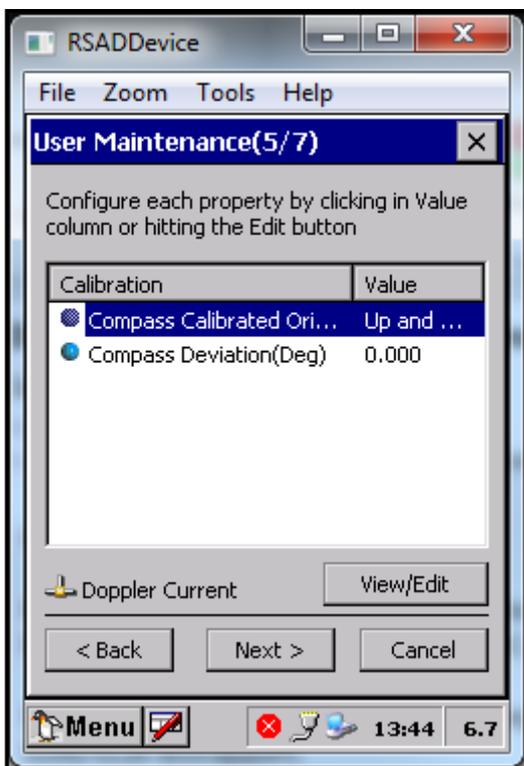


**Enable Spike Filter** Activate/deactivate spike filter; Set yes to activate. Default is yes. Spike filter tracks and eliminates spikes in measured data.

**Enable Axis Strength** Enables output of strength X and strength Y. Result is an average of the two transducers on each axis. Default is no

**Enable Transducer Strength** Enables output of signal strength from each of the four transducers. Default is no.

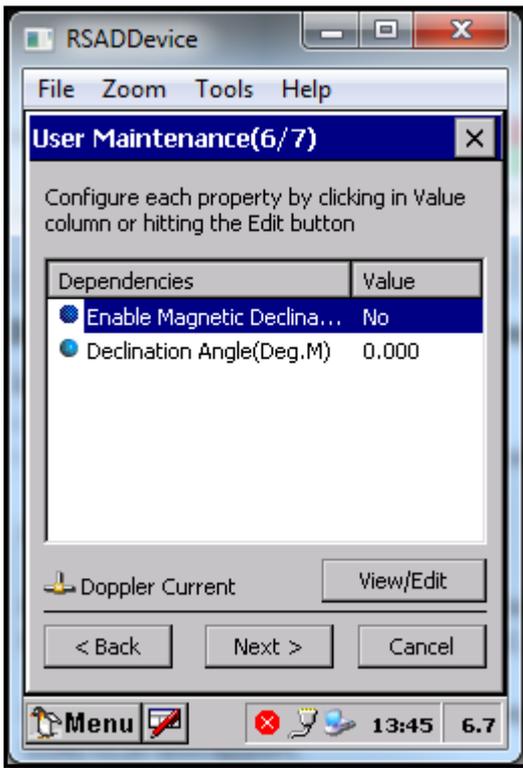
Figure 5-19: Operation



**Compass Calibrated Orientation.** Indicate the possible operation direction for the sensor. Available alternative is; **Only UP, Only Down** or **Up and Down**. This setting can only be altered by authorized personal and reflects the calibration performed. To change the sensor need to be recalibrated at the factory

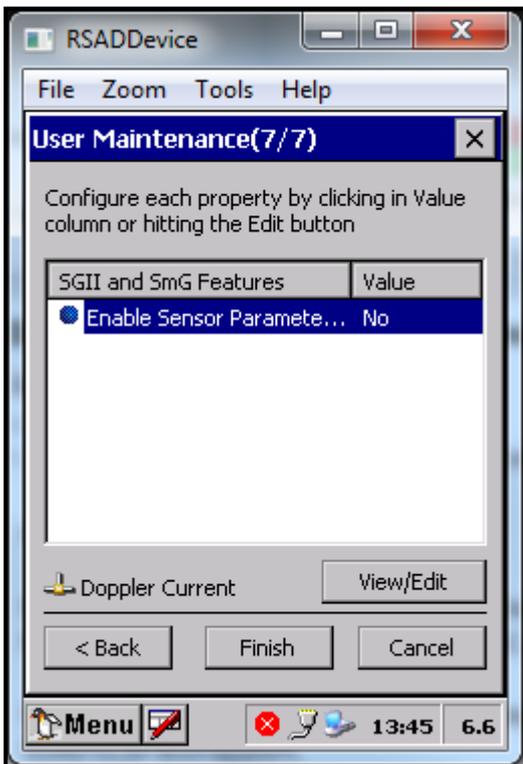
**Compass Deviation (Deg)** Compass offset correction value (deg. M)

Figure 5-20: Calibration



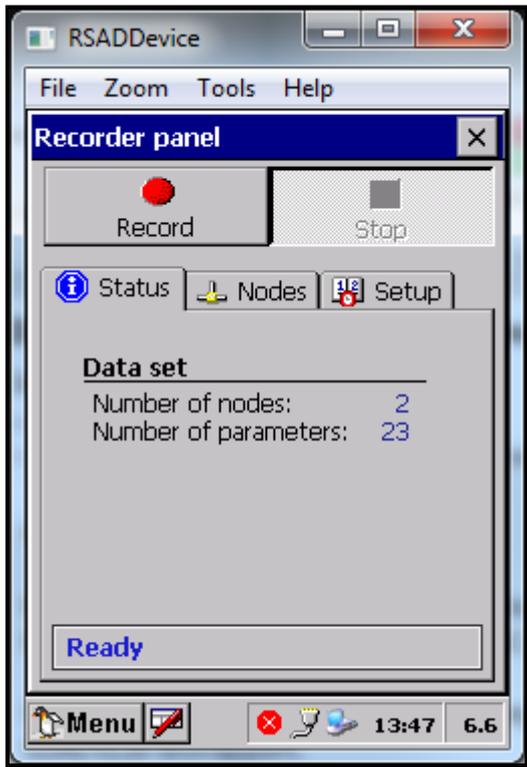
**Enable Magnetic Declination** is normally used when sensor is used close to South Pole or North Pole. **Declination Angle (Deg.M)** is a value to correct for the magnetic variation on the site where the sensor is used. This is the angle in degrees between magnetic north and true north. Magnetic declination (variation) is the angle between the magnetic north and the true north. This angle varies depending on the position on the Earth's surface and also varies over time. Declination is positive when magnetic north is east of true north and negative when it is to the west (input angle value  $\pm 180^\circ$ ). Magnetic declination at the deployment location can be found for i.e. on NOAA website: <http://www.ngdc.noaa.gov/geomag-web/>

Figure 5-21: Dependencies



**Enable Sensor Parameter Input** If enabled the sensor might use data from other sensors via SeaGuardII or SmartGuard. E.g. if a Conductivity Sensor 4319 is connected to the same logger Salinity and Temperature from this sensor can be used in calculations of e.g. depth and Sound of Speed. Only in AiCaP mode, and need to be disabled if used with SeaGuard

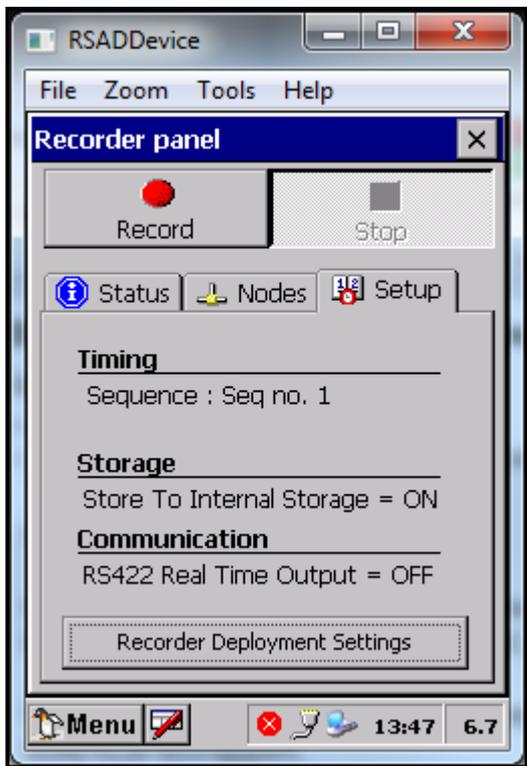
Figure 5-22: SGII and SmG Features



When all the settings are configured as desired the sensor is ready to measure current.

In the *Recorder Panel* you will find three tabs; *Status*, *Nodes* and *Setup*

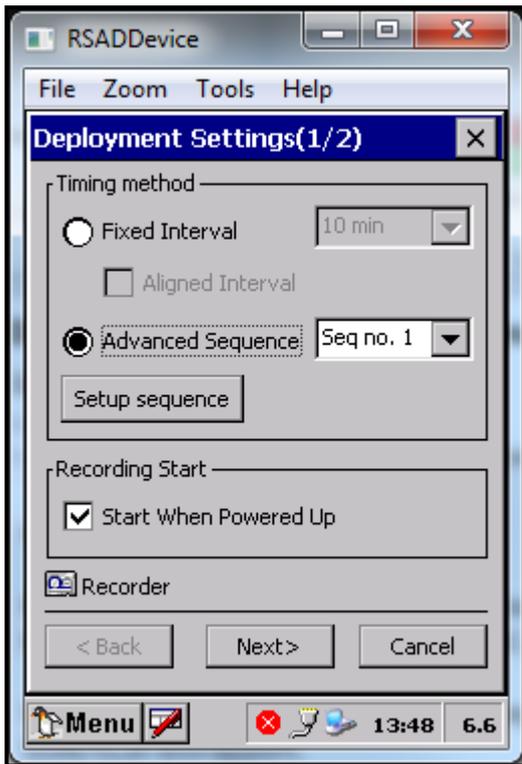
Figure 5-23: Recorder Panel - Status



Under the *Setup* tab you will find an overview of *Timing*, *Storage* and *Communication* setting and a button called *Recorder Deployment Settings*

Tick the *Recording Deployment Settings* to enter the deployment settings menu

Figure 5-24: Recorder Panel - Setup



In the *Deployment Settings(1/2)* you might set the *Timing method*.

*Fixed Interval* is the most used and gives a repeating interval as selected.

Aligned Interval is a setting to control the start of each interval.

Figure 5-25: Deployment Settings(1/2)

## CHAPTER 6 Stand-alone Sensor configuration using Smart Sensor Terminal

This chapter describes how to communicate with the Doppler Current Sensor using the RS-232/RS-422 Smart Sensor Terminal protocol.

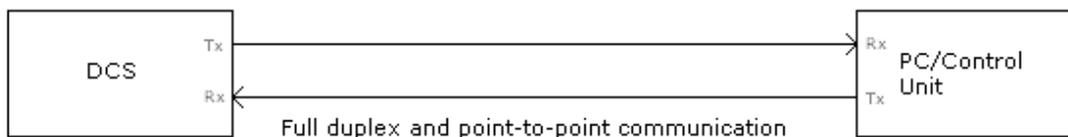
### 6.1 Smart Sensor Terminal communication setup

The Sensor communication is a point-to-point full duplex system; the ZPulse® DCS can transmit output data and receive commands simultaneously (this feature requires that the connected PC can handle Xon/Xoff correctly).

Most terminal programs can be used for *Smart Sensor Terminal* communication with the sensor when connected to a PC, e.g. Tera Term. A copy of Tera Term is included on the CD following the sensor. Copy the content of the zip file to the Program File folder on your PC. Start the teraterm.exe file and the terminal program will start up with standard sensor setup. The following RS-232/RS-422 setup should be used:

9600 Baud  
 8 Data bits  
 1 Stop bit  
 No Parity  
 Xon/Xoff Flow Control

\*) **Note!** The options “Send line ends with line feeds” and “Echo line ends with line feeds” in the terminal ASCII setup must be selected.



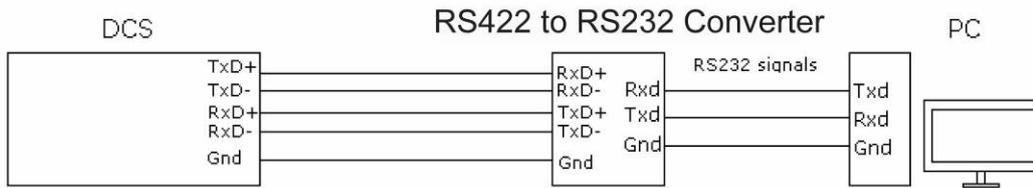
**Figure 6-1 Point-to-Point Communication RS-232.**

### 6.2 Sensor versions and interface

The 4420, 4520, 4830 and 4930 sensors can be used on a SeaGuard, SeaGuardII and SmartGuard (AiCaP) Dataloggers or connected to a RS-232 com-port (PC or other devices with RS232 com-port).

The R-version sensor (4420R, 4520R, 4830 and 4930R) supports only RS-422. The R-version wired for RS-422 operation cannot be used for AiCaP operations on SeaGuard, SeaGuardII or SmartGuard Dataloggers.

Sensors with RS-422 output must use a cable designed for RS-422 communication when connected to the PC. If your PC does not support RS-422, you can purchase an expansion card or you can use an RS-232 port using a RS-232/RS-422 converter.



**Figure 6-2 ZPulse® DCS Communication RS-422**

### 6.3 RS-422 transmission line explained

RS-422 has differential transmission lines with twisted pairs. The sensor signals are less influenced by external noise than with RS-232 serial communication, which makes it possible to use longer cables.

RS-422 has one balanced signal pair for the transmitted signal, TxD (also called TxD+ and TxD-) and one balanced signal pair for the received signal, RxD (also called RxD+ and RxD-).

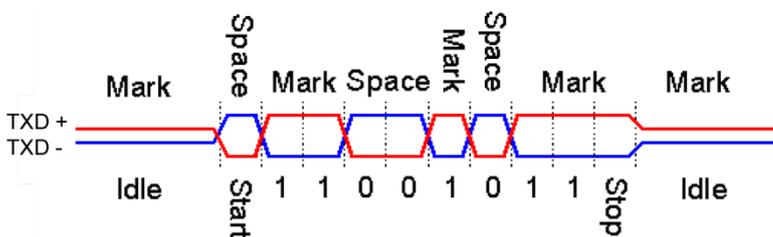
RxD+ and TxD+ are often named B and called non-inverting input and output, respectively.

RxD- and TxD- are often named A and called inverting input and output, respectively.

The EIA standard uses the notation A and B as described above; many manufacturers of signal converters uses the opposite naming (A for non-inverting input/output, and B on inverting input/output) which is not correct.

*Note! Always ensure which signal is non-inverting and which is inverting.*

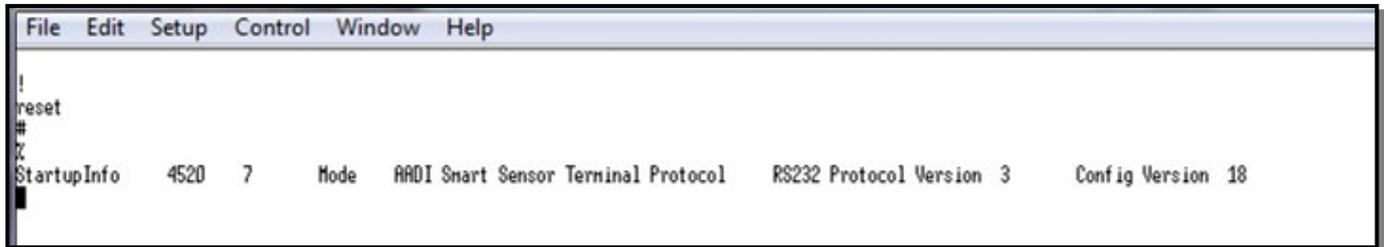
**Figure 6-3** illustrates the balanced signals of a RS-422 line during transmission of a byte. The non-inverting signal is called TxD+ while the inverting signal is called TxD-.



**Figure 6-3: RS-422 transmission of a byte**

## 6.4 Sensor start-up

When property **Enable Text** is set to **Yes**, **StartupInfo** is displayed at sensor power up or after **Reset**. **StartupInfo** contains this information about **Product Number**, **Serial Number**, **Mode**, **Protocol Version** and **Config Version**.



```

File Edit Setup Control Window Help
!
#
StartupInfo 4520 7 Mode AADI Smart Sensor Terminal Protocol RS232 Protocol Version 3 Config Version 18

```

Figure 6-4 Sensor Start-up Information

In order to minimize the current drain the sensor normally enters a power down mode after each sampling; the sensor can be awakened by any characters on the RS-232 input, and will stay awake for a time set by the **Comm TimeOut** property after receiving the last character, refer [chapter 1.5](#).

If the property **Comm TimeOut** is set to other than **'Always On'** the serial interface will not be activated after power-up (or the **Reset** command). Any character will activate the serial interface, but a **Carriage Return** (CR or CR+LF), **'/'** or **','** are often preferred since these characters do not interfere with the command syntax. The serial interface will then be active until a period of input inactivity specified by the **Comm TimeOut** value (10 s, 20 s, 30 s, 1 min, 2 min, 5 min, 10 min). The **Communication Sleep Indicator**, **'%'**, will be transmitted when the serial communication is deactivated, and the **Communication Ready Indicator**, **'!'** is outputted subsequent to activation (electronics require up to 500ms start up time). When **Comm TimeOut** is set to **'Always On'** the communication (and microprocessor) will be kept active all time.

The **Communication Sleep Indicator** **'%'** and the **Communication Ready Indicator** **'!'** are not followed by Carriage Return and Line Feed.

Any character will cause the electronics to return to normal operation; when the sensor has responded with the character **'!'**, new commands may be entered.

**Enable Old Wakeup Character.** Enables old wakeup character **'#'** instead of **'!'**. Use **Enable Comm Indicator** to switch on and off these characters.

When communicating with the sensor, you must start by pressing **Enter**. The sensor will respond in two ways (**Comm TimeOut** is 1 minute by default in the following description):

- If the sensor is ready for communication, it will not send any response indicator. The sensor will stay awake and ready to receive commands for 1 minute (controlled by the **Comm TimeOut**) since the last command.
- If the sensor is in sleep mode and not ready for communication, the sensor will send a 'communication ready' indicator **(!)** when awakened (within 500ms). The sensor will then be ready for communication.

The **'Communication Sleep Indicator** **'%'** and the **'Communication Ready** **'!'** are not followed by **Carriage Return** and **Line Feed**.

## 6.5 Description of protocol

All inputs to the sensor are given as commands with the following format:

- **MainCmd SubCmd** or **MainCmd Property(Value, ..., Value)**

Description of ASCII coded communication rules:

- The main command, **MainCmd**, is followed by an optional subcommand (**SubCmd**) or sensor property (**Property**).
- The **MainCmd** and the **SubCmd/Property** must be separated with the space ' ' character.
- When entering new settings the **Property** is followed by a parenthesis containing comma-separated values.
- The command string must be terminated by Carriage Return and Line Feed (ASCII code 13 & 10).
- The command string is not case sensitive (UPPER/lower-case).
- The ENUM property settings are case sensitive. E.g. "**Set Mode(AiCaP)**" Here AICAP will result in argument error.
- A valid command string is acknowledged with the character '#' while character '\*' indicates an error. Both are followed by **Carriage Return/ Line Feed** (CRLF).
- For most errors a short error message is also given subsequent to the error indicator.
- There are also special commands with short names and dedicated tasks, as **save**, **reset**, and **help**.
- All names and numbers are separated by tabulator spacing (ASCII code 9).
- The string is terminated by Carriage Return and Line Feed (ASCII code 13 & 10).

*Note! Losing power during the flashing process can cause corruption of vital settings, such as coefficients, serial number, model number etc. If losing settings, contact AADI Service department for new setting file for the specific sensor with further instructions.*

### 6.5.1 Save and Reset

When the required properties are set, you should send a **Save** command to make sure that the new configuration is saved internally in the flash memory. The sensor always reads the configuration from the internal flash memory after reset and power up. The **Save** command takes about 20 seconds to complete (indicated with the character '#').

Always send a **Reset** command when a new configuration has been saved (or switch the power OFF and then back ON), or else calculated parameters may be corrupted. This forces the sensor to start up with the new configuration input. If the **Enable Sleep** property is set to **Yes** and the **Comm TimeOut** property is not set to **Always On** the sensor enters sleep mode after reset.

At startup/reset the sensor performs measurements according to the interval setting if the mode is **Smart Sensor Terminal**. If **Enable Text** is set to **Yes**, the **Startup Info** is presented.

If the **Save** command is executed the new setting will be stored in the internal Flash memory.

Property changes will be lost when the sensor is reset or loses power unless you type the **Save** command.

```

File Edit Setup Control Window Help
%
StartupInfo 4520 7 Mode AAOI Smart Sensor Terminal Protocol R8232 Protocol Version 3 Config Version 18
MEASUREMENT 4520 7 Abs Speed(cm/s) 7.544063E+00 Direction(Deg.M) 7.077708E+01 North(cm/s) 2.483841E+00 East(cm/s) 7.123441E+00
Heading(Deg.M) 1.954339E+02 Tilt X(Deg) 3.299071E-01 Tilt Y(Deg) 8.038222E-02 SP Std(cm/s) 1.089536E+02 Strength(dB) -6.274225E+01 Ping Cou
nt 200 Abs Tilt(Deg) 3.422220E-01 Max Tilt(Deg) 4.685547E-01 Std Tilt(Deg) 4.053430E-02 Strength X(dB) -6.310851E+01 Strength Y(dB) -6.23759
9E+01 Strength X Trd1(dB) -6.423395E+01 Strength X Trd3(dB) -6.202712E+01 Strength Y Trd2(dB) -6.238919E+01 Strength Y Trd4(dB) -6.236250E+01

!stop
#
set passkey(1)
#
set enable text(no)
#
save
#
reset
#
74520 7 1.644243E+01 8.913383E+01 2.485576E-01 1.644055E+01 1.956471E+02 3.325126E-01 7.614192E-02 1.081742E+02 -6.275717E+01 200
3.423844E-01 4.275009E-01 3.203431E-02 -6.310002E+01 -6.241432E+01 -6.422464E+01 -6.201950E+01 -6.244789E+01 -6.237724E+01

```

Figure 6-5: Save and reset in Tera Term

## 6.5.2 Available commands

Available commands and properties for the sensors are given in [Table 6-1](#) and [Table 1-5](#) to [Table 1-8](#) respectively.

**Table 6-1 Available commands for the ZPulse™ DCS 4420/4830/4520/4930.**

Command	Description
Start	Starts sensor measurements
Stop	Stop sensor measurements
Do Sample	Execute sampling, present enabled parameters
Do Output	Present latest reading of enabled parameters
Get All	Output all property values (depends on passkey access level)
Get ConfigXML	Outputs info on available properties on XML format
Get DataXML	Outputs info on available(enabled) parameters on XML format
Get Passkey	Get encrypted passkey (not applicable for the user)
Set Passkey	Set passkey to change access level
Get Property	Output value(s) of one property
Set Property(Value,..Value)	Set property to value,.. value
Get Data Parameter	Get a specific parameter from the sensor (polled mode only)
Save	Store current settings
Reset	Reset sensor
Help	Print help information
;	Comment string, following characters are ignored
//	Comment string, following characters are ignored

### 6.5.3 The Get command

The **Get** command is used to read the value/values of a property and to read the latest value of a parameter.

The command name **Get** followed by a **Property** returns a string in the following format:

**Property ProductNo SerialNo Value, ..., Value**

The string starts with the name of the property, the product number and serial number of the sensor, and finally the value of the property.

```

File Edit Setup Control Window Help
get serial number
Serial Number 4520 7 7
#
get product number
Product Number 4520 7 4520
#
get enable burst mode
Enable Burst Mode 4520 7 No
#
get interval
Interval[Sec] 4520 7 6.000000E+01
#

```

Figure 6-6: The Get Command

The command name **Get** followed by a parameter returns the name and unit of the parameter, the product and serial number of the sensor, and finally the latest parameter reading.

A special version, **Get All**, reads out all available properties in the sensor. Some properties are passkey protected and will not be shown without first writing the passkey. To see all user accessible properties, use passkey **1000**.

```

File Edit Setup Control Window Help
get all
Product Name 4520 7 Doppler Current Sensor
Product Number 4520 7 4520
Serial Number 4520 7 7
SH ID 4520 7 1940011
SH Version 4520 7 32 1 1
Node Description 4520 7 Doppler Current Sensor #7
Owner 4520 7 Aanderaa
Mode 4520 7 Smart Sensor Terminal
Enable Sleep 4520 7 Yes
Enable Polled Mode 4520 7 No
Enable Text 4520 7 Yes
Enable Decimalformat 4520 7 No
Ping Number 4520 7 150
Polled Pingrate(p/s) 4520 7 10.0
Enable Burst Mode 4520 7 No
Enable Single Interval 4520 7 No
Interval[Sec] 4520 7 6.000000E+02
Location 4520 7 Bergen
Geographic Position 4520 7 60.323605,5.37225
Vertical Position 4520 7
Reference 4520 7
#

```

Figure 6-7: Get All command

### 6.5.4 The Set command

The **Set** command is used for changing a property. The corresponding **Get** command can be used to verify the new setting, as shown in [Figure 6-8](#).



```

File Edit Setup Control Window Help
set interval(30s)
#
get interval
Interval[Sec] 4520 7 3.000000E+01
#

```

**Figure 6-8: The Set Command**

Use the **Save** commands to permanently store the new property value. Remember to always wait for the acknowledge character **#** after a save before switching off power to the sensor. If the power is lost while saving, the previous configuration saved to flash is used by the sensor.

The **Mode** and **Baudrate** property will require a **Reset** before the change is executed. All other property changes will be executed immediately.

Some properties are passkey protected and will not be accessible without first writing the passkey. If the passkey is needed you get the error message: **"ERROR PROTECTED PROPERTY"**. Using passkey **1000** opens up all user accessible property settings.

### 6.5.5 XML commands

The **Get ConfigXML** command outputs all available sensor properties in XML-format.

The **Get DataXML** command outputs all available sensor parameters in XML-format.

The **XML-output** is a general format shared by all Aanderaa smart sensors; the output from different types of smart sensors can be read and presented as e.g. in a general smart sensor setup program.

To avoid accidental change, most of the properties are write-protected with a Passkey. There are five levels of access protection, refer [Table 6-2](#). After a period of inactivity at the serial input, the access level will revert to default. This period corresponds to the **Comm TimeOut** setting, or 1 minutes if the **Comm TimeOut** is set to **Always On**.

**Table 6-2 Access protection levels**

Protection Level	Passkey	Description
No		No Passkey needed for changing property
Low	1	The Passkey must be set to 1 prior to changing a property
High	1000	The Passkey must be set to 1000 prior to changing a property This Passkey also provides read access to factory properties that usually are hidden
Read Only		The user have only read access, no passkey needed
Factory Write	XXXX	Sensor specific Passkey for factory level access. Not available for the user.

## 6.6 Standard ZPulse™ DCS with AiCaP and RS-232

The standard ZPulse™ DCS 4420/4830/4520/4930 can be used both with AiCaP protocol or Smart Sensor Terminal protocol. At delivery, the sensor is configured to AiCaP mode. Ensure that the sensor is configured for AiCaP mode when used in SeaGuard applications; refer chapter 1.5 for Mode property settings. The sensor must be configured to Smart Sensor Terminal mode before it can be used in RS-232 operations.

Procedure to configure the sensor to Smart Sensor Terminal mode from AiCaP mode:

1. Disconnect the sensor from the SeaGuard Platform.
2. Connect the sensor to a PC using e.g. cable 3855.
3. Set the **Mode** property to Smart Sensor Terminal, refer example below. Save the configuration and reset the sensor.

Example:

```
//Press Enter to start communicating with the sensor, refer chapter 6.4
↵ //press Enter
Stop ↵//Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Mode(Smart Sensor Terminal) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings
```

Procedure to configure the sensor to AiCaP mode from Smart Sensor Terminal:

1. Connect the sensor to a PC using e.g. cable 3855.
2. Set the **Mode** property to **AiCaP**, **save** the configuration and **reset** the sensor.
3. Mount the sensor to the SeaGuard Platform.

## 6.6.1 Examples – How to configure sensor in Smart Sensor Terminal mode

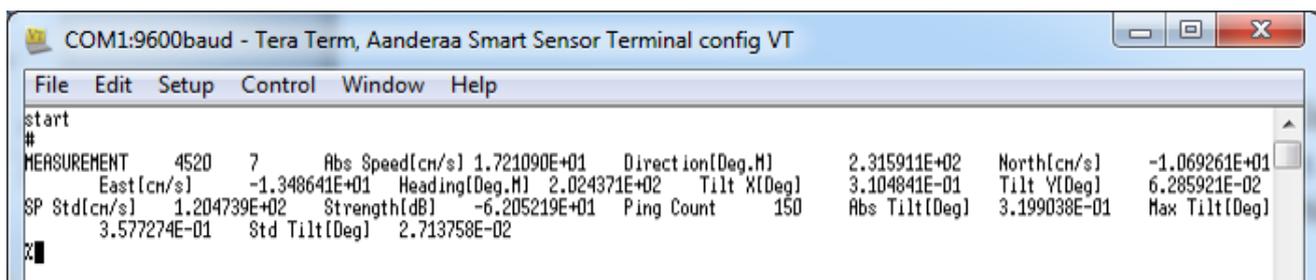
Use a terminal program e.g. Tera Term or Hyperterminal, refer [chapter 3.3](#) for communication setup.

In the following examples several configuration changes are shown. The command **Stop** is recommended to avoid output strings while configuring the sensor. If the sensor has started to transmit data when the user tries to communicate, it may take a while before the command response is sent from the sensor.

Example 1: typical full output

```
//Press Enter to start communicating with the sensor
↵ //press Enter
Stop ↵ //Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Mode(Smart Sensor Terminal)↵ //wait for ack #
Set Enable Sleep(Yes) ↵ //wait for ack #
Set Enable Polled Mode(No) ↵ //wait for ack #
Set Enable Text(Yes)↵ //wait for ack #
Set Enable Decimalformat(No) ↵ //wait for ack #
Set Ping Number(150) ↵ //wait for ack #
Set Enable Burst Mode(No) ↵ //wait for ack #
Set Enable Single Interval(No)↵ //wait for ack #
Set Start Distance(0.5) ↵ //wait for ack #
Set Cell Size(1.5) ↵ //wait for ack #
Set Enable ZPulse Operation(Yes) ↵ //wait for ack #
Set Sound Speed(m/s)(1500) ↵ //wait for ack #
Set Enable Fixed Heading(No) ↵ //wait for ack #
Set Enable Tilt Compensation(Yes)↵ //wait for ack #
Set Activation X-axis(1+3) ↵ //wait for ack #
Set Activation Y-axis(2+4) ↵ //wait for ack #
Set Enable Forward Ping↵ //wait for ack #
Set Interval(600) ↵ //an error message is sent from the sensor if the interval is too short
Save ↵ // wait for ack #
Reset ↵ // the sensor will restart with new settings
```

Comments to example 1: This is a typical sensor setup for use in seawater with free space for all four transducers. All parameters except the once controlled under [User Maintenance](#) are enabled. For [User Maintenance](#) settings see [Example 3](#).



The screenshot shows a terminal window titled "COM1:9600baud - Tera Term, Aanderaa Smart Sensor Terminal config VT". The window displays the following output:

```
start
#
MEASUREMENT 4520 7 Abs Speed[cm/s] 1.721090E+01 Direction[Deg.M] 2.315911E+02 North[cm/s] -1.069261E+01
East[cm/s] -1.348641E+01 Heading[Deg.M] 2.024371E+02 Tilt X[Deg] 3.104841E-01 Tilt Y[Deg] 6.285921E-02
SP Std[cm/s] 1.204739E+02 Strength[dB] -6.205219E+01 Ping Count 150 Abs Tilt[Deg] 3.199038E-01 Max Tilt[Deg]
3.577274E-01 Std Tilt[Deg] 2.713758E-02
```

Figure 6-9: Output from example 1.

## 6.7 Help command output

The available/selectable values for **Ping Number**, **Start Distance**, **Cell Size**, **Sound Speed**, **Active X-axis**, **Active y-axis** and **Interval** can be found by sending the command **Help**. This gives a printout from the sensor showing a short help text from the sensor, refer **Figure 6-10**. Setting a value which is not shown here for enumerated properties gives an error message (**\*ERROR ARGUMENT ERROR**).

```

File Edit Setup Control Window Help
help
#
Commands:      Do_SUBCMD<CRLF>          = Execute SUBCMD
               Get_PROPERTY<CRLF>      = Output PROPERTY value.
               Get_ALL<CRLF>           = Output all property values.
               Get_All Parameters<CRLF> = Output all parameter values.
               Set_PROPERTY(V,..V)<CRLF> = Set PROPERTY to V,..V.
               Set_Passkey(V)<CRLF>     = Set Passkey.
               Save<CRLF>              = Store current settings.
               Load<CRLF>              = Load stored settings.
               Reset<CRLF>              = Reset node.
               Stop<CRLF>               = Stop measurement
               Start<CRLF>              = Start measurement
               Help<CRLF>               = Print help information.

Sub commands:  Sample
               Output

Argument list for enumerated properties:
Interface:    RS232
Baudrate:    4800,9600,57600,115200
Flow Control: None,Xon/Xoff
Comm Timeout: Always On,10 s,20 s,30 s,1 min,2 min,5 min,10 min
Select 4100 Output Mode: Normal-Polar,Normal-Rectangular,Comprehensive-Polar,Comprehensive-Rectangular
Compass Calibrated Orientation: Only Up,Only Down,Up and Down
Mode:        AiCaP,Smart Sensor Terminal,ARDI Real-Time,Smart Sensor Terminal FH2
Ping Number: 50,60,75,100,150,200,250,300,350,400,450,500,550,600
Polled Pingrate: 0.1,0.5,1.0,2.0,5.0,10.0,15.0,20.0,25.0
Start Distance: 0.40,0.50,0.60,0.70,0.80,0.90,1.00
Cell Size:    0.75,0.90,1.00,1.10,1.20,1.30,1.40,1.50,1.60,1.70,1.80,1.90,2.00
Activation X-axis: 1 + 3,1,3
Activation Y-axis: 2 + 4,2,4

Argument list for properties with default values:
Sound Speed: 1473.000000,1500.000000,1525.000000
#

```

**Figure 6-10: Output example from the Help command**

## Commands:

Do_SUBCMD<CRLF>	= Execute SUBCMD
Get_PROPERTY<CRLF>	= Output PROPERTY value.
Get_All<CRLF>	= Output all property values.
Get_All Parameters<CRLF>	= Output all parameter values.
Set_PROPERTY(V,..V)<CRLF>	= Set PROPERTY to V,..V.
Set_Passkey(V)<CRLF>	= Set Passkey.
Save<CRLF>	= Store current settings.
Load<CRLF>	= Load stored settings.
Reset<CRLF>	= Reset node.
Stop<CRLF>	= Stop measurement
Start<CRLF>	= Start measurement
Help<CRLF>	= Print help information.

## Sub commands:

Sample  
Output

## Argument list for enumerated properties:

Interface:	RS232
Baudrate:	4800,9600,57600,115200
Flow Control:	None, Xon/Xoff
Comm Timeout:	Always On,10 s,20 s,30 s,1 min,2 min,5 min,10 min
Select 4100 Output Mode:	Normal – Polar, Normal Rectangular, Comprehensive – Polar, Comprehensive – Rectangular
Compass calibrated Orientation:	Only Up, Only Down, Up and Down
Ping Number:	50,60,75,100,150,200,250,300,350,400,450,500,550,600
Polled Pingrate:	0.1, 0.5, 1.0, 2.0, 5.0, 10.0, 15.0, 20.0, 25.0
Start Distance:	0.40, 0.50, 0.60, 0.70, 0.80, 0.90, 1.00
Cell Size:	0.75, 0.90, 1.00, 1.10, 1.20, 1.30, 1.40, 1.50, 1.60, 1.70, 1.80, 1.90, 2.00
Activation X-axis:	1+3, 1, 3
Activation Y-axis:	2+4, 2, 4

## Argument list for properties with default values:

Sound Speed:	1473.000000, 1500.000000, 1525.000000
--------------	---------------------------------------

Example 2: Typical setting for reduced output and only two active transducers. Start distance and cell size set to minimum to be able to measure in a restricted area. Interval set to 30 second.

```
//Press Enter to start communicating with the sensor
↵ //press Enter
Stop ↵ //Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Mode(Smart Sensor Terminal)↵ //wait for ack #
Set Enable Sleep(Yes) ↵ //wait for ack #
Set Enable Polled Mode(No) ↵ //wait for ack #
Set Enable Text(No) ↵ //wait for ack #
Set Enable Decimalformat(Yes) ↵ //wait for ack #
Set Ping Number(150) ↵ //wait for ack #
Set Enable Burst Mode(No) ↵ //wait for ack #
Set Enable Single Interval(No)↵ //wait for ack #
Set Start Distance(0.4) ↵ //wait for ack #
Set Cell Size(0.75) ↵ //wait for ack #
Set Enable Zpulse Operation(Yes) ↵ //wait for ack #
Set Sound Speed(1500) ↵ //wait for ack #
Set Enable Fixed Heading(No) ↵ //wait for ack #
Set Enable Tilt Compensation(Yes)↵ //wait for ack #
Set Activation X-axis(1) ↵ //wait for ack #
Set Activation Y-axis(2) ↵ //wait for ack #
Set Enable Forward Ping(Yes) ↵ //wait for ack #
Set Interval(30) ↵ //an error message is sent from the sensor if the interval is too short
Save ↵ // wait for ack #
Reset ↵ // the sensor will restart with new settings
```

Comments to example 2: Typical setup if measured close to an obstruction. By using only two transducers the sensor can be placed close to a wall, platform leg or similar where the two active transducers are facing away from the obstruction. The limited start distance and cell size also reduce the measured area and make it possible to measure within a smaller area.

File	Edit	Setup	Control	Window	Help										
start															
#															
4520	7	164.713	294.027	67.065	-150.441	269.436	-0.423	-0.188	82.824	-61.785	150	0.464	0.545	0.042	
4520	7	149.010	287.773	45.484	-141.898	269.430	-0.420	-0.184	82.419	-61.862	150	0.459	0.500	0.017	

Figure 6-11: Typical output from example 2

The output from example two is showing:

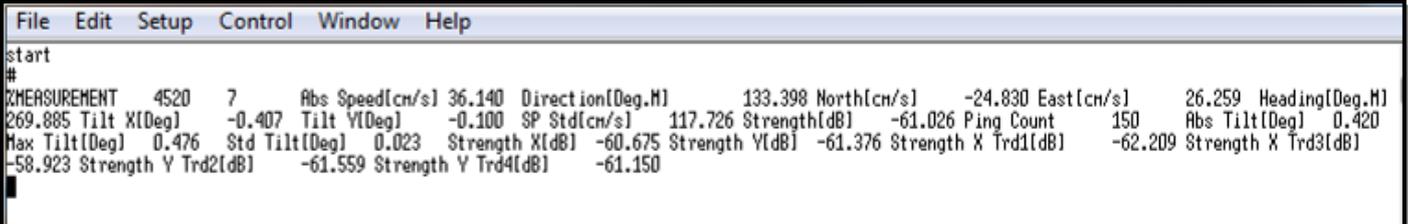
- Product Number
- Serial Number
- Abs Speed
- Direction
- North
- East
- Heading
- Tilt X
- Tilt Y
- Sp Std
- Strength
- Ping Count
- Abs Tilt
- Max Tilt
- Std Tilt

Example 3: Enable settings in User Maintenance

```
//Press Enter to start communicating with the sensor.
↵ //press Enter
Stop ↵//Wait for ack #. Repeat if necessary
Set Passkey(1000) ↵
Set Mode(Smart Sensor Terminal)↵//wait for ack #
Set Enable Text(Yes) ↵//wait for ack #
Set Activation X-axis(1+3) ↵ //wait for ack #
Set Activation Y-axis(2+4) ↵//wait for ack #
Set Enable Spike Filter(Yes) ↵//wait for ack #
Set Enable Axis Strength(Yes) ↵//wait for ack #
Set Enable Transducer Strength(Yes) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings
```

Comments example 3:

The sensor always outputs some information which is not possible to disable. In this example only 1 cell is enabled just to show the shortest possible output first, see [Figure 6-12](#).



```
File Edit Setup Control Window Help
start
#
ZMEASUREMENT 4520 7 Abs Speed[cm/s] 36.140 Direction[Deg.M] 133.398 North[cm/s] -24.830 East[cm/s] 26.259 Heading[Deg.M]
269.885 Tilt X[Deg] -0.407 Tilt Y[Deg] -0.100 SP Std[cm/s] 117.726 Strength[dB] -61.026 Ping Count 150 Abs Tilt[Deg] 0.420
Max Tilt[Deg] 0.476 Std Tilt[Deg] 0.023 Strength X[dB] -60.675 Strength Y[dB] -61.376 Strength X Trd1[dB] -62.209 Strength X Trd3[dB]
-58.923 Strength Y Trd2[dB] -61.559 Strength Y Trd4[dB] -61.150
```

Figure 6-12: Typical output from example 3

The data output message starts with MEASUREMENT followed by **Product Number, Serial Number** (tabulator between). The rest of the message is the output parameters which change from record to record. The parameter names and values are separated by tabulator (ASCII code 09).

## 6.8 Output parameters provided by the ZPulse®

These data are output as a string from the sensor in Smart Sensor Terminal mode. The name with unit shown in the table 5-2 is the exact same way as these are sent from the sensor, i.e. parameter name with unit in [ ] parentheses. The parameter name and the value output are separated by a tabulator (ASCII code 09). The output is a long string terminated by carriage return + line feed after all the profile data at the end. Each parameter can be read with a Get command using the RS-232 Protocol

**Table 6-3: Overview of available data parameters for ZPulse™ DCS 4420/4830/4520/4930**

Parameter	Description
Abs speed	The average absolute speed from the orthogonal current vectors (vector averaged).
Direction	The current direction, i.e. the direction of the absolute speed vector referenced to magnetic north.
North	North current speed vector.
East	East current speed vector.
Heading	The last measured compass heading.
Tilt X	The last measured tilt x.
Tilt Y	The last measured tilt y.
SP std	Single ping standard deviation, i.e. the standard deviation of all speed measurements (ping) in an interval.
Strength	Signal strength value.
Ping count	Number of ping performed in an interval.
Abs Tilt	Absolute sensor tilt (ref horizontal plane) during a recording interval.
Max Tilt	Maximum sensor tilt (ref horizontal plane) during a recording interval.
Std Tilt	Standard deviation of sensor tilt during a recording interval.
Temperature	NB! Available for ZPulse™ DCS version 4830/4930.
Strength X	Signal strength, X-axis: available parameter if axis strength is enabled.
Strength Y	Signal strength, Y-axis: available parameter if axis strength is enabled.
Strength X Trd1	Signal strength, X-axis Transducer 1: available parameter if transducer strength is enabled.
Strength X Trd3	Signal strength, X-axis Transducer 3: available parameter if transducer strength is enabled.
Strength Y Trd2	Signal strength, Y-axis Transducer 2: available parameter if transducer strength is enabled.
Strength Y Trd4	Signal strength, Y-axis Transducer 4: available parameter if transducer strength is enabled.

## CHAPTER 7 Electro Magnetic Compatibility

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In order for a manufacturer to legally produce and sell a product, it has to apply for CE marking. This means that the commercialized product is conform to the CE applicable standards and can freely circulate within the EFTA (European Free Trade Association) & European Union countries. The applicable directive for the Acoustic Doppler products is the EU EMC 89/336/EMC (all electrical and electronic appliances) which mainly focus on the electromagnetic disturbances the sensor can generate, which should not exceed a level allowing radio and telecommunication equipment to operate as intended, and that the sensor has an adequate level of intrinsic immunity to electromagnetic disturbance to be able to operate as intended. This chapter describes the requirements for the Electromagnetic Compatibility (EMC) of the sensor; EMC filter and protection solutions required for the Doppler Current Sensor.

### 7.1 EMC Filter and Protection

The sensor is designed to have an extremely high amplification in the Doppler frequency range around 2 MHz. This also means that severe common mode noise on the power lines may affect the Doppler measurements if the noise frequencies are close to 2 MHz. This can be checked from the signal strength when connected to the power of the system.

Two different options are delivered from the factory, one for underwater/buoy systems and one for cable to land systems.

#### 7.1.1 Underwater/Buoy systems

A common mode line filter on the power lines has to be inserted between the sensor and the system. This filter should be as close as possible to the cable output from the system and the ground connection on the filter has to be connected to the common chassis ground of the system or a common ground structure. The chassis ground serves as a return path for noise currents decoupled by the common mode filter. This is necessary since the noise currents should have a low impedance path back to the noise source in the system.

This common mode filter may be left out if the system designer knows (from EMC emission tests) that the system does not emit any noise on the cable to the sensor in the range around 2 MHz.

#### 7.1.2 Cable to land systems

A Filter Box with surge protection on all lines is delivered together with the cables. This box also has the same built-in common mode filter as delivered for underwater systems. This box needs a good connection to earth to divert any large surge currents to earth. Cable screen from sea side cable and land side cable needs a good connection to the chassis of the box.

Surge currents are generated from nearby lightning and can cause surge currents in the kilo-ampere range on a cable. The sensor has some protection built-in but the safest is to remove as much as possible of these large surge currents on the land side of the cable.

If using the SeaGuard DCS or SeaGuardII DCP with Real-Time cable to land, the same filter box is delivered together with the instrument and should be installed the same way. The operating manual for SeaGuardII, TD 303, gives more information on the available cables.

## 7.2 EMC Testing

The DCS sensor has been tested at an accredited test laboratory to verify that the sensor fulfils the requirements in the EU EMC directive (89/336/EMC).

### ***Applied standards***

- EN55011 (2009)+A1
- EN 61326-1 (2013)

### ***Applied tests***

- Conducted Emissions
- Electrostatic Discharge Immunity
- Surge Immunity
- Conducted RF Disturbance Immunity

Other tests were found as not relevant to this sensor due to underwater use and DC power.

## 7.3 Cables

Different cables are available for stand-alone use with free end and connectors. The cables have both power and signal lines (RS-232/RS-422). Contact factory for more information on cables that is best suited for use in the actual application. When delivered, system drawings/cable drawings give details on parts connection and installation overview with best EMC performance (best noise and surge immunity).

In underwater and buoy systems the sensors are delivered with a common mode line filter to be used on the power lines. This is necessary to remove any present common mode noise frequencies in the Doppler frequency range.

In systems with cable to land the sensor is delivered with a Filter Protection box. This box has a common mode noise filter and surge protection on power lines and signal lines.

## 7.4 Power – Voltage range

The input voltage range is from 6 to 30Vdc. When using long cables the voltage should be as close to 30V as possible. The peak current while the sensor is pinging (after power on) is normally well below 1A (normally below 0.5A), but it varies dependent on how high the input voltage is and how large the voltage drop is in the cable (lower voltage on the sensor gives higher peak current).

## CHAPTER 8 Other details

### 8.1 Block schematic of ZPulse® DCS

The four transducers are placed with 90° spacing around the transceiver head, i.e. two and two transducers are placed on the same axis. The axis formed by Transducer 1 and 3 are called the X-axis and the axis formed by Transducer 2 and 4 are called the Y-axis, refer [Figure 8-1](#) for a block schematic illustration measurement process and [Figure 8-2](#) for an illustration of the sensor orientation.

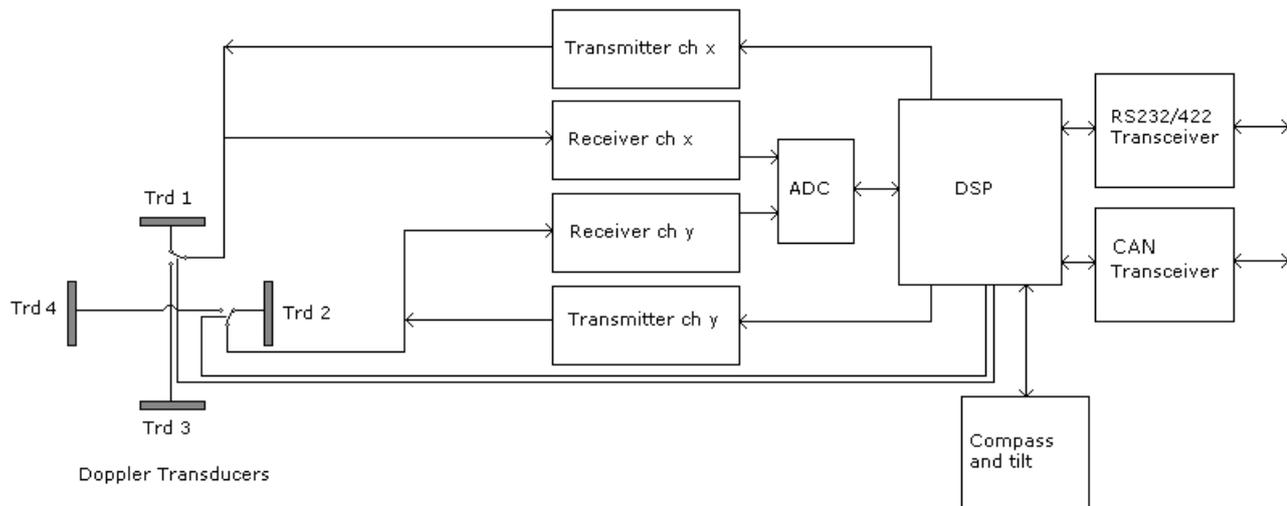


Figure 8-1 Block schematic illustration of the ZPulse™ DCS measurement process.

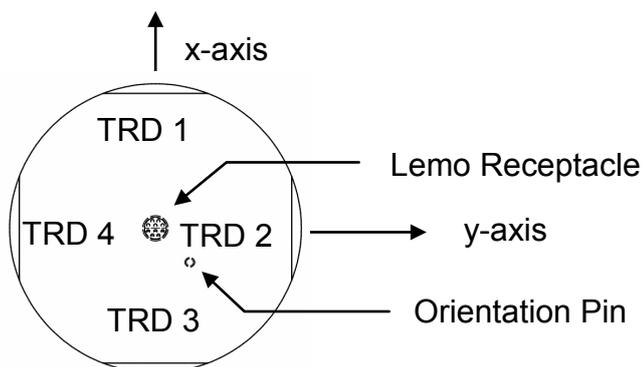


Figure 8-2 Orientation of DCS 4420/4830/4520/4930-series; top view.

## 8.2 Compass heading 0° reference direction

In some cases it is necessary to know the orientation of the sensor's axes. This can be necessary when the sensor is placed in a fixed position with a fixed orientation (for example in a frame on the sea floor) where the magnetic influence by an object nearby gives an erroneous heading measurement. In this case the fixed heading input can be enabled, but to set the correct fixed heading the 0° reference has to be known. On surface buoys made of iron/steel there can also be problems related to magnetic influence from the buoy structure/body. This can be improved by using an external compass (parameter input via SeaGuardII or SmartGuard Datalogger) placed away on a mast arm which gives a more correct compass heading to the sensor. In this case the misalignment/offset between the external compass and the axes on the DCS has to be known. This is not possible with SeaGuard.

### 8.2.1 Transducer 1 is 0° reference

When transducer 1 on the sensor is orientated towards magnetic North, the compass heading is 0°. One method is to measure in which direction transducer 1 is pointing. Position of transducer 1 is shown in [Figure 8-2](#). Moving transducer 1 clockwise gives an increasing heading.

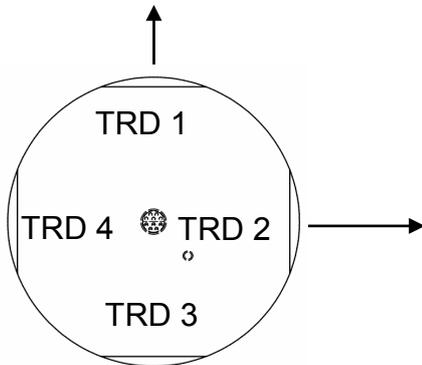
- Find direction of magnetic north.
- Find x-axis on DCS, axis with transducer 1 and 3 (opposite side on same axis).
- If a fixed and non-moving application, align x-axis and transducer 1 towards correct magnetic north. Alternatively measure the angle clockwise from magnetic north to x-axis transducer 1 and set the fixed heading equal to this value (degrees).
- If used on a buoy with external compass input, align the x-axis transducer 1 in the same direction as the north mark on the compass. Alternatively, try to measure the clockwise angle from the north mark (0 degree) on the external compass to the x-axis transducer1 on the DCS. Set the heading alignment offset equal to this measured angle (input parameter heading see [chapter 3.12.2](#). Also remember to select the external compass as heading input to the DCS. Only available I AiCaP mode with SeaGuardII or SmartGuard

**NOTE: To check the value measured by the tilt and heading sensor refer to chapter 4.2. Viewing incoming data in real-time.**

The same procedure can be used if the DCS is orientated upside-down.

## 8.2.2 Orientation/Steering pin as reference

Another method is to use the orientation pin underneath the sensor. This pin is placed between transducer 2 and 3. The heading is 225 degrees (360-135) if the orientation pin is towards magnetic north, i.e. transducer 1 is 225 degree clockwise from the orientation pin. The positioning of the orientation pin is shown in [Figure 8-3](#).



- Use the same methods as described in [chapter 8.2.1](#)
- Remember that the angle between transducer 1 and the steering/orientation pin is 225 degrees.
- Add 225 degrees to the measured orientation of this pin when used as fixed heading setting. If larger than 360, subtract 360 from the value.
- If external compass input, add 225 degrees to the angle measured between the external compass and the orientation pin. Set the heading alignment offset value equal to this value. If larger than 360, subtract 360 from the value.

**Figure 8-3 Orientation pin placement on end plate**

## 8.2.3 Transducer 1 as reference when upside-down

Use the same method as when the sensor is upward looking. Rotating clockwise gives an increasing angle. The sensor is able to sense its vertical orientation sensor and automatically correct for the upside-down orientation of the sensor.

**NOTE:** To check the value measured by the tilt and heading sensor refer to [chapter 4.2. Viewing incoming data in real-time](#).

## 8.2.4 Orientation/Steering pin as reference when upside-down

Now transducer 1 is 135 degrees clockwise from the orientation pin. Add 135 degrees instead of 225 degrees.

### 8.3 Tilt Orientation

The distance between each transducer is 90 degrees. Transducer 1 and 3 is on the X-axis and Transducer 2 and 4 are on the Y-axis.

Transducer 1 is the transducer left and behind when you look at the front of the instrument. The other transducers are numbered clockwise.

The X, Y and Z-axis are all perpendicular to each other. The positive axes are as a right hand system with positive X-axis going from transducer 3 to transducer 1, and positive Y-axis going from transducer 2 to transducer 4.

If transducer 1 is aligned to the north, the direction of the beam speed will be zero (in the XY-plane).

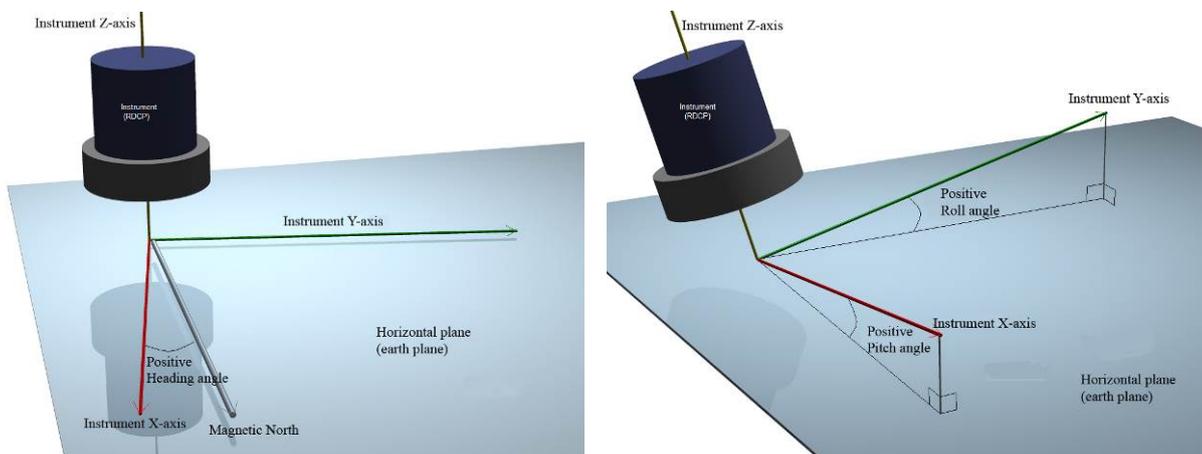
A positive heading means that the instrument X-axis is rotated clockwise in relation to magnetic north. When heading = 0, the instrument X-axis is pointing towards magnetic north.

If the current is along the positive X-axis, you should expect a negative beam speed in transducer 1, and a positive beam speed in transducer 3. If the current is along the positive Y-axis, there should be a negative beam speed in transducer 4, and a positive beam speed in transducer 2.

If the instrument is tilted, we define a positive roll angle between the horizontal plane and the instrument Y-axis, and a positive pitch angle between the instrument X-axis and the horizontal plane.

On the DCS, pitch and roll is defined to be the angle between the instrument axis and the horizontal component of transducer 1 beam of the transducer head.

Given 4 beam speeds, compass heading and tilting of a current measurement (instrument), the current speeds along North (N) and East (E) will be calculated. From the N/E speeds absolute speed and direction referenced to magnetic north will be found.



**Figure 8-4: Sensor axis related to heading, pitch and roll**

## 8.4 Checking the compass

First point transducer 1 towards North. The compass heading should lie close to  $360^{\circ}/0^{\circ}$  (same point).

**NOTE: To check the value measured by the tilt and heading sensor refer to chapter 4.2. Viewing incoming data in real-time.**

A clockwise rotation gives an increasing compass angle. Keep the sensor away from magnetic object like table legs (if iron, these are acting as a permanent magnet magnetized by the earth magnetic field). Big objects like for example a car outside the room where the compass is tested can affect the earth magnetic field at the point where the sensor is placed. Also the structure of the building can influence on the earth magnetic field around the sensor.

Be aware that nearby objects may influence the magnetic field when the sensor is used. This can for example be a problem on a buoy as described above or if hanging from a boat. The rule of thumb is that the bigger the magnetic object is (hard and/or soft magnetic) the further away sensor should be positioned to eliminate the influence. If the sensor is in a fixed position the fixed heading input can be used as described earlier in this chapter. On buoys the solution is often to use an external compass which is placed on a non-magnetic mast away from the buoy.

Even alkaline batteries can be a problem if placed close enough to the sensor. When used on SeaGuard or SeaGuardII the upper battery compartment can give problems when using alkaline battery cells. The battery cells provided by Aanderaa do not give problems when using the lower battery compartment. When batteries are own-built, you have to be aware of this problem. The influence from the batteries can be checked by looking at the heading output from the sensor while placing the batteries closer to the sensor. Moving the batteries around a hand held compass also gives a good indication on whether the batteries are low magnetic or not. Batteries can also be degaussed to reduce the magnetic influence from the batteries.

## 8.5 Checking the tilt sensor

The sensor has a 3-axis inclinometer. The tilt is converted to rotational angles pitch and roll. When the sensor is placed horizontal the pitch and roll should be close to zero. Pitch is the rotation around the y-axis while roll is the rotation angle around the x-axis. The x-axis is aligned with transducer 1 and 3 and the y-axis is aligned with transducer 2 and 4.

- Place the sensor horizontal. See that the pitch and roll is close to zero.
- Tilt sensor towards transducer 1 (transducer 1 downwards) and see that the pitch value is decreasing (more negative).
- Tilt the sensor in the opposite direction against transducer 3 and see that the pitch is increasing (positive).
- Tilt the sensor towards transducer 2 and see that the roll value is increasing (positive).
- Tilt the sensor towards transducer 4 and see that the roll value is decreasing (more negative).
- Hold the sensor upside-down and horizontal. The roll should now be close to 180 degrees.
- Place the sensor upside-down on a table on transducer 1. The pitch should be close to -25 degrees and the roll close to 180.
- Do the same now on transducer 3. The pitch should now be close to +25 degrees and the roll close to 180.
- Do the same now on transducer 2. The roll should be close to 155 degrees while the pitch should be close to 0.
- Do the same on transducer 4. The roll should be close to 205 degrees and the pitch close to 0. For software version 8.2.1 and over, the roll range is  $\pm 180$  so the roll reading should be close to -155.

**NOTE: To check the value measured by the tilt and heading sensor refer to chapter 4.2. Viewing incoming data in real-time.**

## 8.6 Checking the acoustics

The best way to check the acoustics is to do a short pre-deployment where the sensor is hanging from a floating raft or boat. Checking the signal strength from the different beams gives an indication if some of the beams are much weaker than the others. When checking the beam strengths close to the sensor, the signal strength should normally be within 2-3dB between the different beams.

A weaker signal strength on all transducers than seen earlier is not necessarily an indication that something is wrong with the sensor. The signal strength can show big variations during a year due to changes in biological activities, etc. Some places variations of the backscatter conditions can give several dB in signal strength variation.

### 8.6.1 Test using Test Unit 5048

The Test Unit 5048 is designed to verify that vital parts of the ZPulse Doppler Current Sensor (DCS) are working correctly. The Test Unit is designed for DCS installed on the SeaGuard SeaGuardII, RCM Blue and for stand-alone DCS in the 4420, 4520, 4830, 4930 series. For older DCS with single frequency use Test Unit 3731. The Test Unit consists of a ring with 4 test transducers suspended by mechanical springs, enabling each test transducer to be pressed against the DCS transducers. The test transducers pick up some of the energy transmitted by the 'ping' from the DCS. This energy is used to start oscillation of the test transducers. In the receiving stage of the DCS the test transducers are still oscillating and thus transmitting a weak signal back to the DCS. Each of the four test transducers consist of 2 oscillators corresponding to the two frequencies in each ZPulse signal. Two of the test transducers are made of crystals with slightly higher resonance frequency than the DCS transducers, and two are made of crystals with slightly lower resonance frequency. The high frequency corresponds to the received signal when the current direction is towards the DCS, and the low frequency corresponds to a current flowing away from the DCS. The frequency shift corresponds to a simulated current speed of about 2.20 m/s if Forward Ping is disabled. The direction of the simulated current is along the center line between the two low frequency test transducers, marked by a slot in the Test Unit ring.

### 8.6.2 Procedure for mounting the Test Unit to the DCS:

- Moisten the surface of the transducers for optimal contact.
- Bring the test transducers to their outer position by pulling and turning the grey handles.
- Hold the Test Unit around the DCS and align the test transducers to face the DCS transducers.
- Release carefully the mechanical springs one by one so that the test transducers are in contact with the DCS transducers.
- Tilting the instrument/DCS corresponds to a slight increase in current speed readings:
- 10° tilt corresponds to 2% increase in reading.
- 35° tilt corresponds to 8% increase in reading.

### 8.6.3 SeaGuard using internal display

1. Mount the Test Unit to the transducer head/DCS according to procedure.
2. Start instrument and switch off forward pinging
3. Open Menu > Administrative Tools > Sensor Monitor to read the speed and direction from sensor.
4. Align the instrument/DCS and the Test Unit so that the orientation slot is in the north direction.
5. Always disregard the first two readings. Read speed and direction
6. Dismount the Test Unit and rotate it 90° without moving the instrument/DCS. Remount the Test Unit to the instrument/DCS. Read the Current speed and direction.
7. Repeat the 90° increment until you back to the start position.
8. Check that the Direction reading is incremented with approximately 90° after each turning and the Speed reading is approximately 220cm/s.
9. To check compass keep the ring on and turn instrument/sensor in 90° steps.

### 8.6.4 SeaGuard Basic with plug assembly or stand-alone using AADI Real-Time Collector

1. Establish contact with the sensor using Bluetooth or cable, for RCM Blue connect a wire from temperature housing under the DCS head and the battery connector to simulate in water condition. This is necessary to start the pinging on RCM Blue.
2. Start sensor and switch of Forward pinging.
3. Open Graphical tool to read speed direction, Tilt X and Tilt Y, see example on next page.
4. Repeat point 4. to 9. from procedure above.

### 8.6.5 Stand-alone sensor using terminal software

1. Establish contact with the sensor and switch off Forward pinging
2. Start sensor and read Speed, Direction, Tilt X and Tilt Y from data string
3. Repeat point 4. to 9. from procedure above.

## CHAPTER 9 Maintenance

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With 50 years of instruments design and production for the scientific community, in use around the world, you can count on our reputation for designing the most reliable products available.

We are guided by three underlying principles: quality, service, and commitment. We take these principles seriously, as they form the foundation upon which we provide lasting value to our customers. Our unmatched quality is based on a relentless program of continuous monitoring to maintain the highest standards of reliability.

In order to assure the quality of this sensor, critical properties are tested during production. A special form, named 'Test and Specification Sheet' (delivered with the sensor) lists the tests and their results and checkpoints.

### 9.1 Retrieval of the sensor

Clean the Transducer Head after each deployment.

#### **Note!**

**Do not use any form of steel brush or any sharp objects on the Transducer Head, as this will damage the acoustic elements.**

The sensor housing will tolerate most cleaning agents. Often 30% Hydrochloric acid (HCL) (Muriatic acid) or acetic acid will be useful for removing barnacles and similar fouling.

Be sure to follow the safety precaution for such acids.

### 9.2 Anti-fouling on transducer surface

The front layer on the transducers is optimized to give optimal matching between the transducers and the sea water to get as high sensitivity as possible. Applying anti-fouling to the surface may give reduced sensitivity. The best way to keep the fouling away would have been to wash the surface at a regular interval, for example once a week or dependent on how fast the growth is. This is however not very practical.

If applying anti-fouling, use a very thin and evenly layer on the transducer surfaces. The best is to use a coating which can be sprayed on as very thin layer.

### 9.3 Factory service

Factory service is offered for maintenance, repair or calibration.

When returning your DCS for service please contact Aanderaa Service department, [aanderaa.support@xyleminc.com](mailto:aanderaa.support@xyleminc.com) or your local representative for a Return Material Authorization number (RMA) prior to shipment. This RMA number should follow the shipment, and be included in all further correspondence with Aanderaa regarding the equipment returned.

You will also need to enclose a Service Order Form with the shipment, which you will receive when requesting a RMA number.

Normal servicing time is four to six weeks, but in special cases the service time can be reduced.

A main overhaul and service is recommended at the factory every three years

## 9.4 Test of ZPulse® DCS 4420/4830/4520/4930

We recommend that you perform a function test of the sensor operating in air to verify the sensor readings.

Sensor readings when operating in air:

- The Abs Speed will give a variable reading from measurement to measurement.
- The Direction will normally give variable readings.
- North and East (Speed) will give variable readings.
- The Heading (compass heading) depends on the sensor orientation. Placing transducer 1 towards magnetic north will give a value close to 0 or 360°.
- Tilt X and Tilt Y depend on the sensor tilt. If the sensor is placed horizontal, both should be close to 0°.
- The SP Std will normally give a reading below 20 cm/s.
- The Strength will be close to -70dB.
- The Ping count depends on the ping setting.

## 9.5 SeaGuard applications

Leave to DCS mounted onto the SeaGuard Platform. Power the instrument; refer TD262a and TD262b for operating instructions.

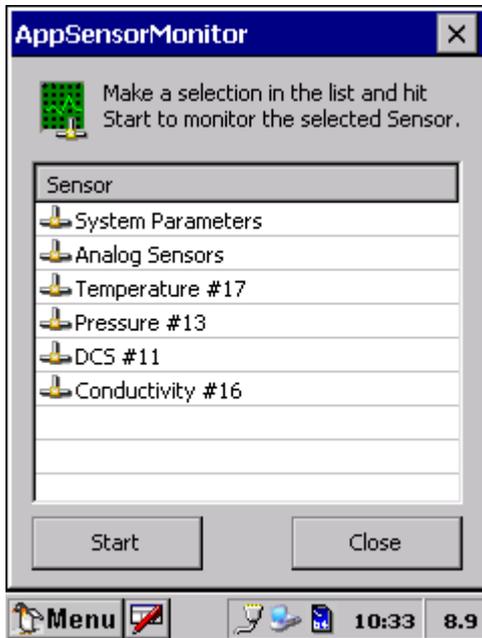


Figure 9-1 Select sensors to monitor

Open **Administrative Tools -> Sensor Monitor**.

**Sensor Monitor** can be used as a direct reading of the sensor; the function is mainly used for test purposes.

Select the DCS from the list and press **Start**, refer [Figure 9-1](#).

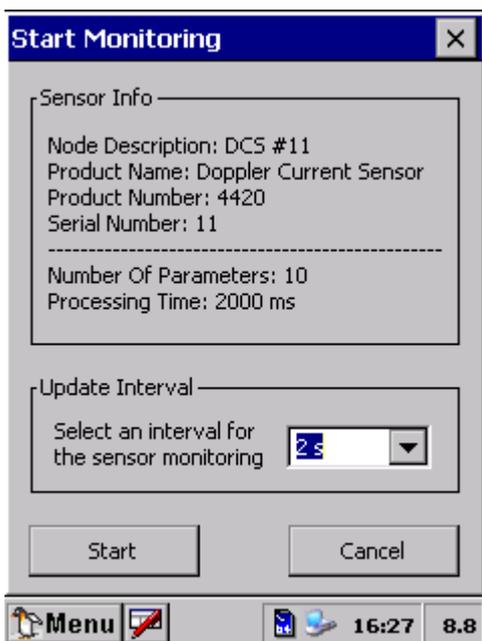


Figure 9-2 Set the update interval

The next window shows sensor information like the **Node Description**, **Product name**, **Product number** and **Serial number**, refer [Figure 9-2](#).

The number of sensor parameters and the processing time can be viewed in the window.

Select an **Update Interval** for the sensor monitoring. Press **Start** to start monitoring the sensor readings.

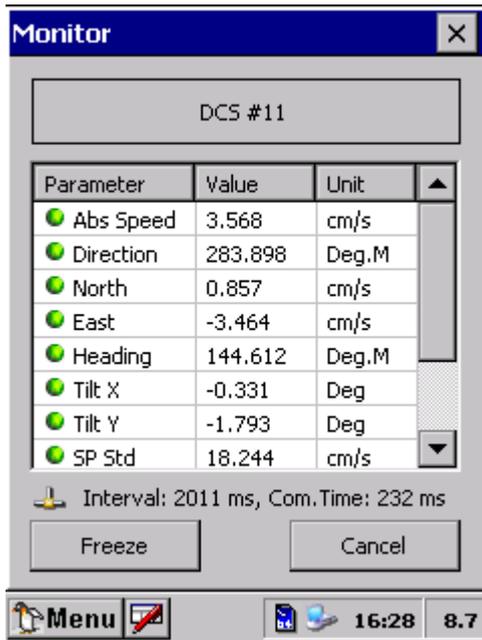


Figure 9-3 Monitor sensor readings.

The parameter reading in engineering units is shown as illustrated in [Figure 9-3](#). The reading updates according to the update interval.

Press **Freeze** to temporarily stop the update; press **Start** to restart the monitoring (**Start** is the same button as **Freeze**).

Press **Cancel** to stop the monitoring.

The sensor readings should be according to the description in [chapter 9.4](#).

## 9.6 RS-232/RS-422 applications

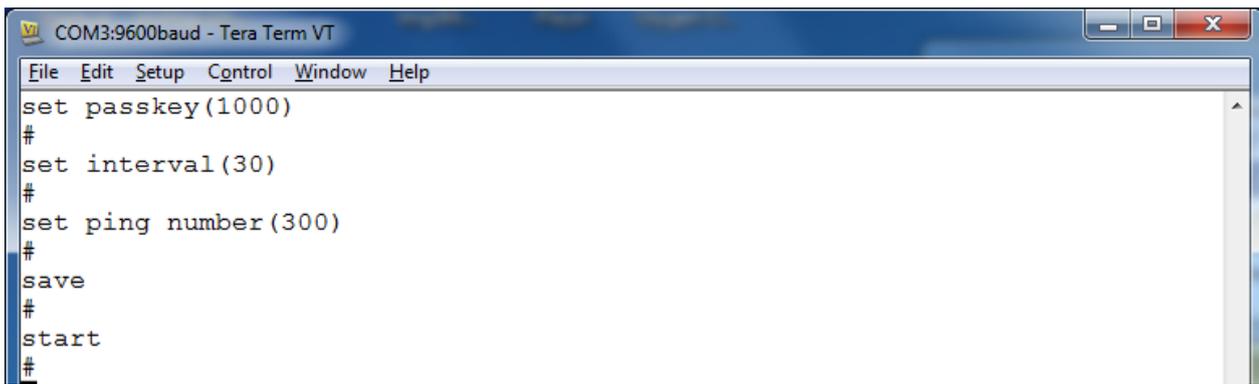
Connect the DCS to your PC using e.g. sensor cable 3855 (refer [chapter 1.4.1](#)). Use a RS-422/RS-232 converter between the sensor and your PC if necessary.

Procedure for test of the ZPulse DCS sensor 4420/4830R/4520/4930R:

1. Connect power to the sensor.
2. Wake up the sensor.
3. Set the interval in seconds.
4. Set number of ping measurements.
5. Save the settings (this is only necessary if the sensor has to keep these settings after power up or reset).
6. Send **Start** command or **Reset** command.

Since the default interval is 0 and the default ping number is 0, the sensor outputs a '%' on the next line before it activates the sleep operation (lowest current consumption).

Send a character to wake up the sensor before setting the interval and the number of pings. The sensor outputs a communication ready indicator, '!', when wakened up.

A screenshot of a terminal window titled "COM3:9600baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal content shows the following commands and prompts:

```
set passkey(1000)
#
set interval(30)
#
set ping number(300)
#
save
#
start
#
```

**Figure 9-4: Sensor configuration**

After the **Start** command the sensor starts the first 10s measurement interval. A ticking can be heard from the transducer head. After 10s the sensor outputs all the measurement parameters, as illustrated in [chapter 6.4](#).

All parameters are presented in one line terminated with CR+LF (the line is broken by the terminal program in the above example).

The sensor readings should be according to the description in [chapter 9.4](#).

## 9.7 Example of Test & Specifications sheet and Certificates

# AANDERAA TEST & SPECIFICATIONS

a xylem brand

Form No. 769, Jun 2008

Layout No:  
Circuit Diagram No: 83

Product: DCS 4930  
Serial No: Demo

### Digital Board

1. Tested according to Test Procedure Form 754.

### Analog Board

2. Tested according to Test Procedure Form 757.

### Complete Sensor

3. Tested according to Test Procedure Form 759.

### Performance test and results from Test Procedure Form 759

4. **Visual Check**
  - 4.1. Inspection of o-ring groove.
  - 4.2. Pressure tested.
  - 4.3. Electrical isolation to flange after pressure test (only 4520).
  - 4.4. Communication tested (AiCaP, Rs-232/Rs-422).
5. **Current Consumption**

5.1. Quiescent, no ping (maximum 265 $\mu$ A)	206.00 $\mu$ A
5.2. Total with one ping each second (maximum 14.5 mA)	12.40mA
6. **Compass and Tilt sensor**
  - 6.1. Compass calibrated and verified to be within  $\pm 2.0^\circ$  at  $0^\circ$  tilt and  $\pm 3.5^\circ$  at  $30^\circ$  tilt.
7. **Tilt Compensation**
  - 7.1. Tilt sensor calibrated and verified to be within  $\pm 1.0^\circ$  in the range from  $+35^\circ$  to  $-35^\circ$  on both axes.
8. **Performance test**
  - 8.1. The sensor is tested with Test Unit 3731 during climatic tests to control sensor performance over the whole temperature range.
  - 8.2. The direction data is also controlled by changing the direction of the Test Unit 3731.

Date: 03 Feb 2017

Sign.

*Halvard Skurve*  
Halvard Skurve, Production Engineer

Figure 9-5 Example of Test and Specification sheet

# AANDERAA CALIBRATION CERTIFICATE

a xylem brand

Form No. 726, June 2007

Product: DCS 4930

Serial No: Demo

Calibration Date: 06 Feb 2017

This is to certify that this product has been calibrated using the following instruments:

Calibration Bath model FNT                    321-1-40  
 ASL Digital Thermometer model F250    Serial: 6792/06

### Calibration points and readings:

Parameter:     Temperature

Calibration points and readings

Temperature (°C)	1.010	11.979	24.017	35.991	0.000	0.000
Reading (LSB)	2659221	5152565	8023188	10726261	0	0

Giving these coefficients

Index	0	1	2	3	4	5
Temp Coef	2.55716E01	3.58517E01	3.87776E00	5.91229E00	0.00000E00	0.00000E00

Date: 06 Feb 2017

Sign:



Tor-Ove Kvalvaag, Calibration Engineer

Figure 9-6: Example of Calibration Certificate compass and tilt page 1

**AANDERAA** **PRESSURE CERTIFICATE**  
 a xylem brand Form No. 667, Sept 2009

**Product:** DCS 4930  
**Serial No:** Demo  
**Date:** 16.02.2017

**Certificate No:** 127426220197

This is to certify that this product has been pressure tested with the following instrument, and we confirm that no irregularities were found during the test:

Autoklav 800 bar – sn: 0210005

**Pressure readings:**

Pressure (Bar)	Pressure time (hour)
600	1

Date: 16 Feb 2017

Sign:

  
 Marius Hosøy, Production Engineer

Figure 9-7: Example of Calibration Certificate compass and tilt page 2

## CHAPTER 10 Installation

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### 10.1 AADI Real-Time Collector connection with Windows 10

#### Windows 10 USB to SeaGuard / SmartGuard fixes

Download Windows mobile device center (WMDC) 32 or 64 bit version:

<https://support.microsoft.com/en-us/help/931937/description-of-windows-mobile-device-center>

Windows 10 ver. 1703 / 1709

Problem: WMDC (Windows mobile device center) hangs at splash screen

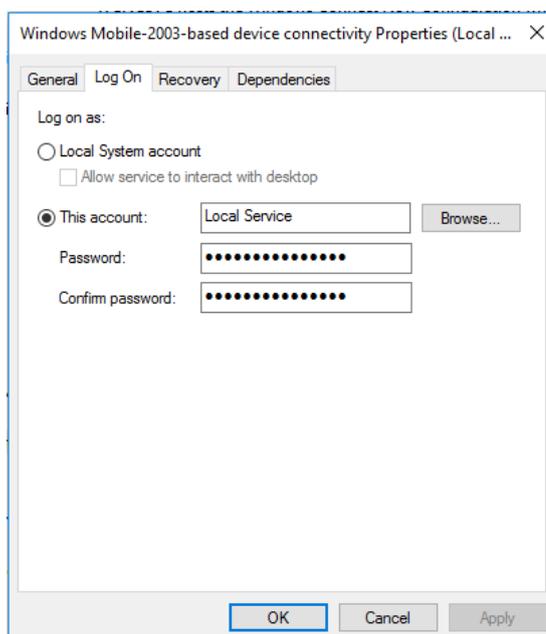
Log on with local administrator privileges

In the search field enter: services

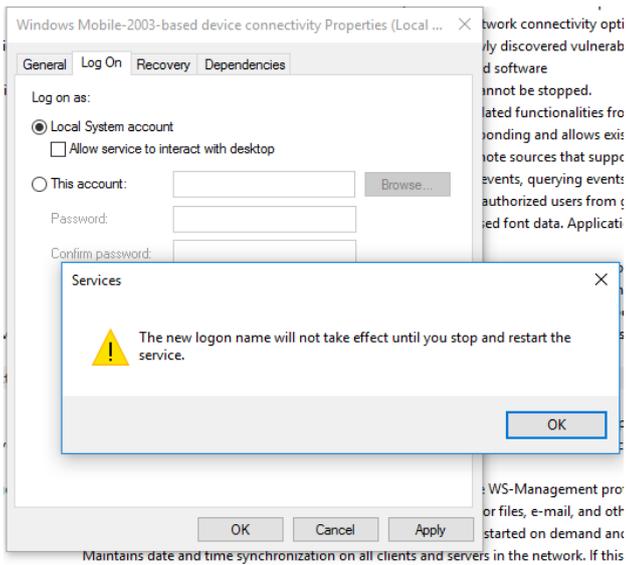
Scroll down to “Windows Mobile-2003-based device connectivity”

Windows Mobile-2003-based device connectivity	Provides connectivity for Windows Mobile-2003-based devices	Running	Automatic	Local Service
Windows Mobile-based device connectivity	Provides remote command and control to Windows Mobile-based devices.	Running	Automatic	Local Service

Right click and click on properties on the Windows Mobile-2003-based device connectivity



Click on Local System account.



Click ok and ok.

Do the same with Windows Mobile-based device connectivity.

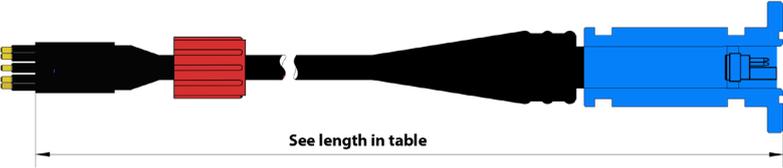
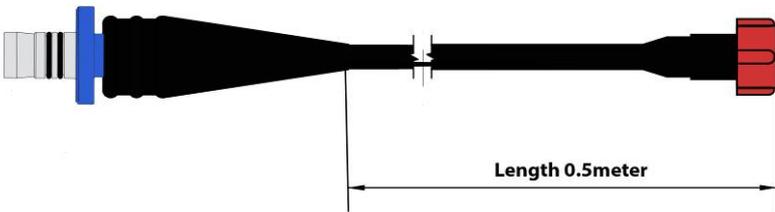
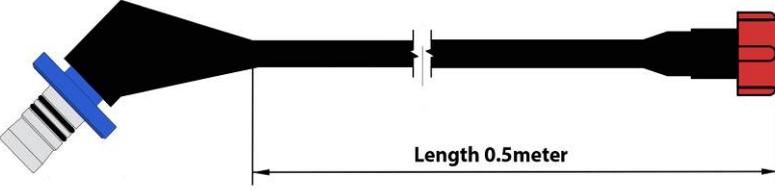
Restart pc and plug in the USB cable from SmartGuard / SeaGuard.

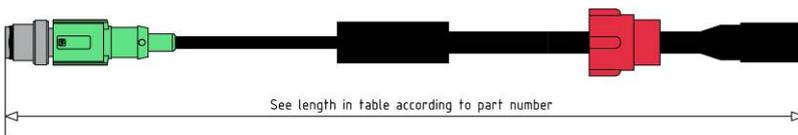
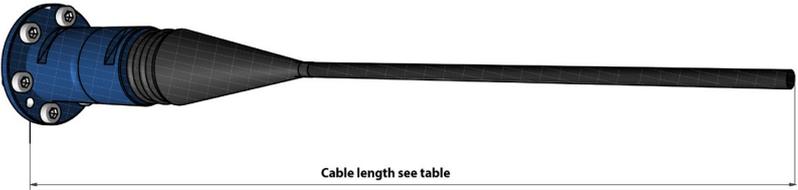
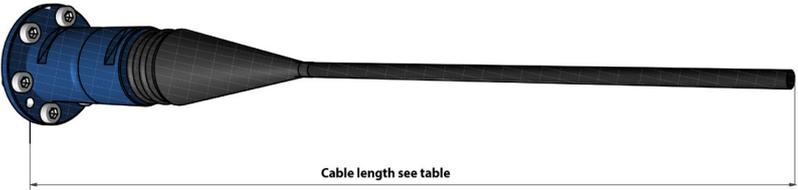
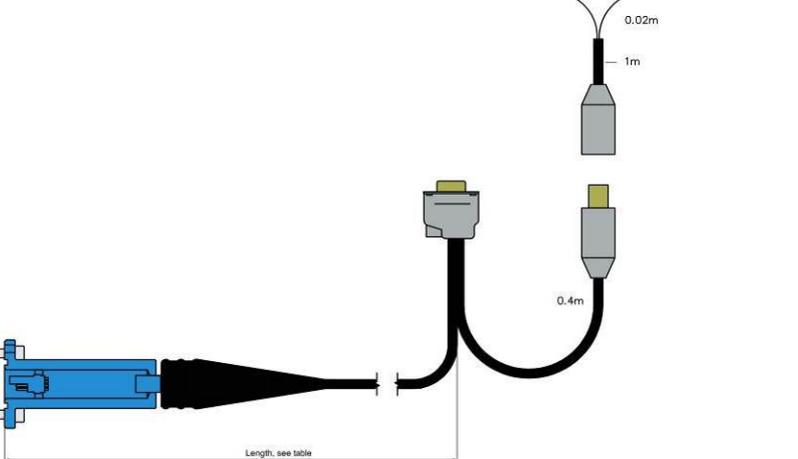
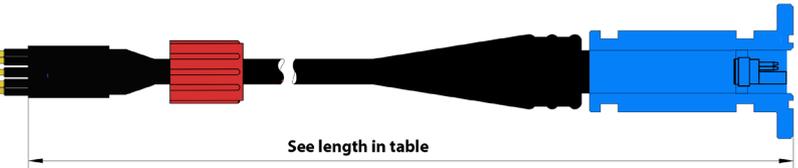
## 10.2 Connecting Cables

Aanderaa offers a wide range of standard cables;

### 10.2.1 For AiCaP and RS-232 use

Table 10-1: Available cables for AiCaP and RS-232

	<ul style="list-style-type: none"> <li>• 4318 Sensor Foot AiCaP</li> <li>• Used to connect DCS to SeaGuard or SeaGuardII top-end plate</li> <li>• Only for use in center hole</li> </ul>
	<ul style="list-style-type: none"> <li>• 4838 Sensor Cable AiCaP</li> <li>• Used for remote connection of DCS, between sensor and SeaGuard or SeaGuardII top-end plate</li> <li>• Only for use in center hole</li> </ul>
 <p>See length in table</p>	<ul style="list-style-type: none"> <li>• 5340 Sensor Cable AiCaP and RS-232</li> <li>• Used for remote connection of DCS, between sensor and top-end plate via male 8pin Subconn</li> <li>• Needs 5662 or 4872 for connection to SeaGuard top-end plate or 5245 for connection to SmartGuard</li> </ul>
 <p>Length 0.5meter</p>	<ul style="list-style-type: none"> <li>• 5662 Connection Cable AiCaP</li> <li>• Connection between straight plug on SeaGuardII top-end plate using sensor hole and 8pin Subconn on 5340 cable</li> <li>• Needs 5340 cable for connection</li> </ul>
 <p>Length 0.5meter</p>	<ul style="list-style-type: none"> <li>• 4872 Connection Cable AiCaP</li> <li>• Connection between angular plug on SeaGuardII top-end plate using sensor hole and 8pin Subconn on 5340 cable</li> <li>• Needs 5340 cable for connection</li> </ul>

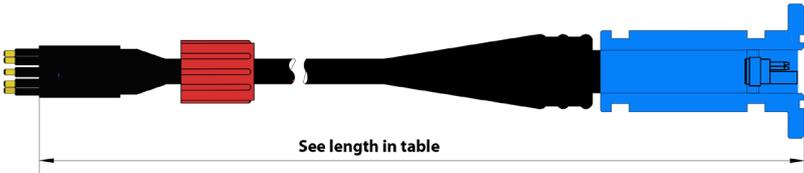
	<ul style="list-style-type: none"> <li>• 5245 Connection Cable AiCaP</li> <li>• Connection between SmartGuard M12 plug and 8pin Subconn on 5340 cable</li> <li>• Needs 5340 cable for connection</li> </ul>
	<ul style="list-style-type: none"> <li>• 5414 Sensor Cable AiCaP</li> <li>• Free end cable for connection between sensor and Aanderaa logger</li> </ul>
	<ul style="list-style-type: none"> <li>• 4860 Sensor Cable RS-232</li> <li>• Free end cable for connection between sensor and 3<sup>rd</sup> party logger</li> </ul>
	<ul style="list-style-type: none"> <li>• 4834 Sensor Cable</li> <li>• Sensor cable with 9pin Dsub for connection between DCS and PC</li> </ul>
	<ul style="list-style-type: none"> <li>• 5159 Sensor Cable RS-232</li> <li>• RS-232</li> <li>• To be used with Real-Time cable</li> </ul>

<p>0.02m 1m 0.4m Length, see table</p>	<ul style="list-style-type: none"> <li>• 3855 Set-up and configuration cable</li> <li>• Non watertight Set-up cable with 9pin D-suB for connection between 10pin Lemo and PC for laboratory use only</li> </ul>
--	---

### 10.2.2 For RS-422 use

Table 10-2: Available cables for RS-422

<p>Cable length see table</p>	<ul style="list-style-type: none"> <li>• 4860 Sensor Cable RS-422</li> <li>• Free end cable for connection between sensor and 3<sup>rd</sup> party logger</li> </ul>
<p>0.02m 1m 0.4m Length, see table</p>	<ul style="list-style-type: none"> <li>• 4902 Sensor Cable</li> <li>• Sensor cable with 9pin D-suB for connection between DCS and PC</li> <li>• RS-422/RS-232 converter included</li> </ul>

 <p>See length in table</p>	<ul style="list-style-type: none"> <li>• 5159 Sensor Cable RS-422</li> <li>• To be used with Real-Time cable</li> </ul>
 <p>Positive Supply Negative Supply</p>	<ul style="list-style-type: none"> <li>• 5618 Set-up and configuration cable</li> <li>• Non watertight Set-up cable with 9pin D-suB for connection between 10pin Lemo and PC for laboratory use only</li> <li>• RS-422/RS-232 converter included</li> </ul>

### 10.3 Mounting considerations



Figure 10-1: Frame 5127

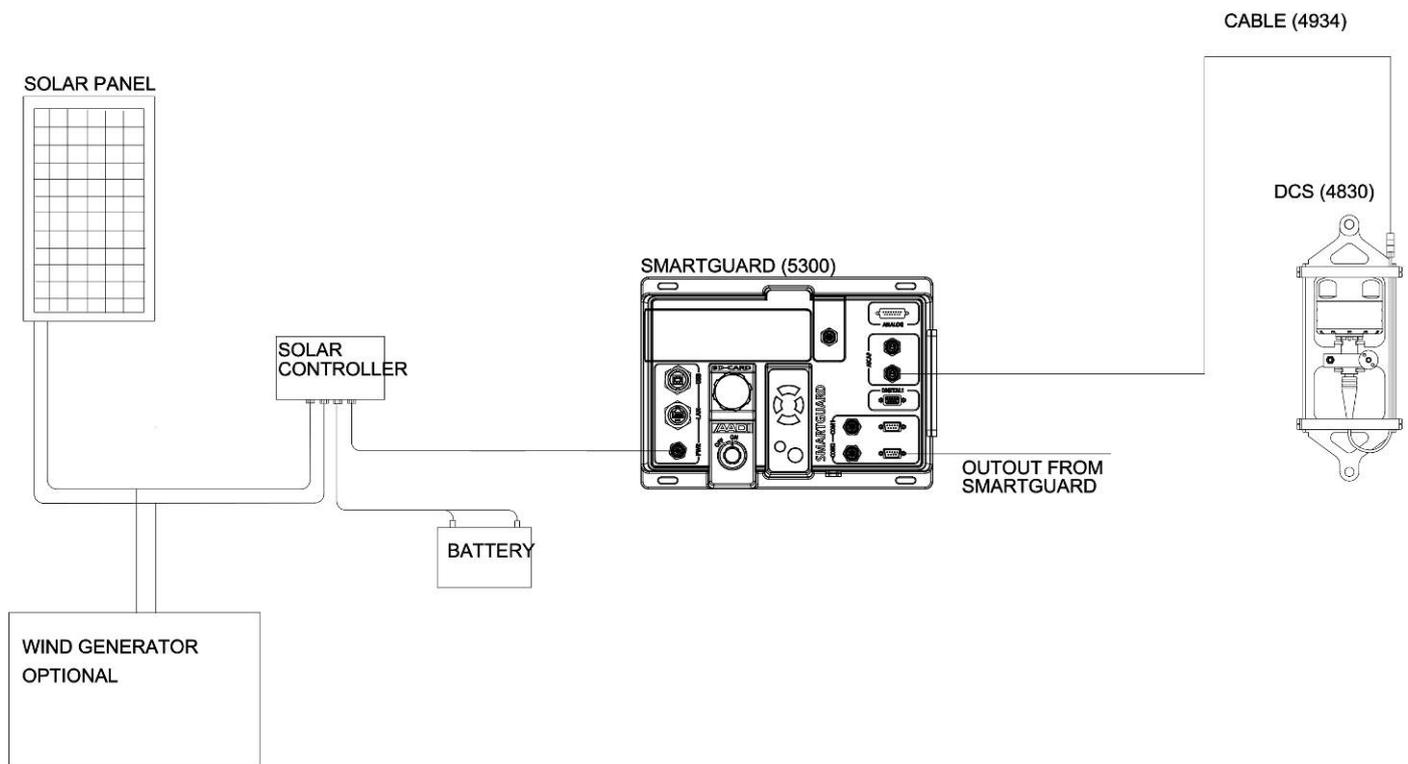


Figure 10-2: Inline mooring frame 5744A

## 10.4 Application examples

DCS is a flexible sensor that can be used in many different applications, either as a part of a SeaGuard or SeaGuardII self-contained multiparameter observatory or as a part of a flexible user designed observation point. The factory also helps users with designing system to solve a specific task. The next examples are just three of many hundreds system already delivered.

First example in **Figure 10-3** shows a small system designed measuring sea current in just one layers. This system is easily scalable to fit the individual needs



**Figure 10-3: Example 1**

Example 2 in *Figure 10-4* shows a similar system but with also a vented tide sensor attached to the logger.

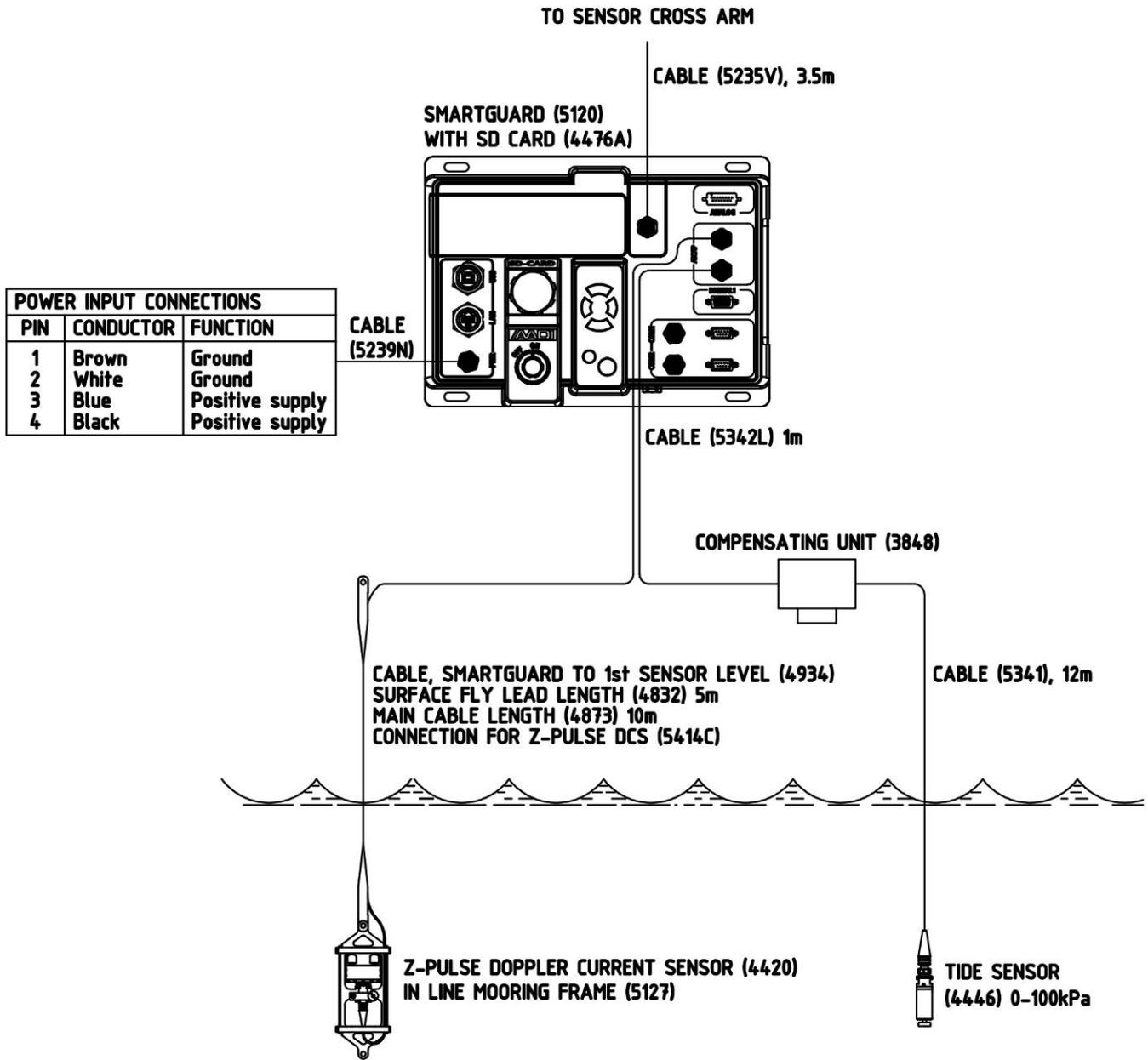


Figure 10-4: Example 2

Example 3 in shows a more complex buoy system with meteorological sensors, satellite communication, solar panels as well as Motus directional wave sensor and DCS. This system is also easily scalable with possibilities for adding water quality sensors and profiling current measurement for measuring current in the full column.

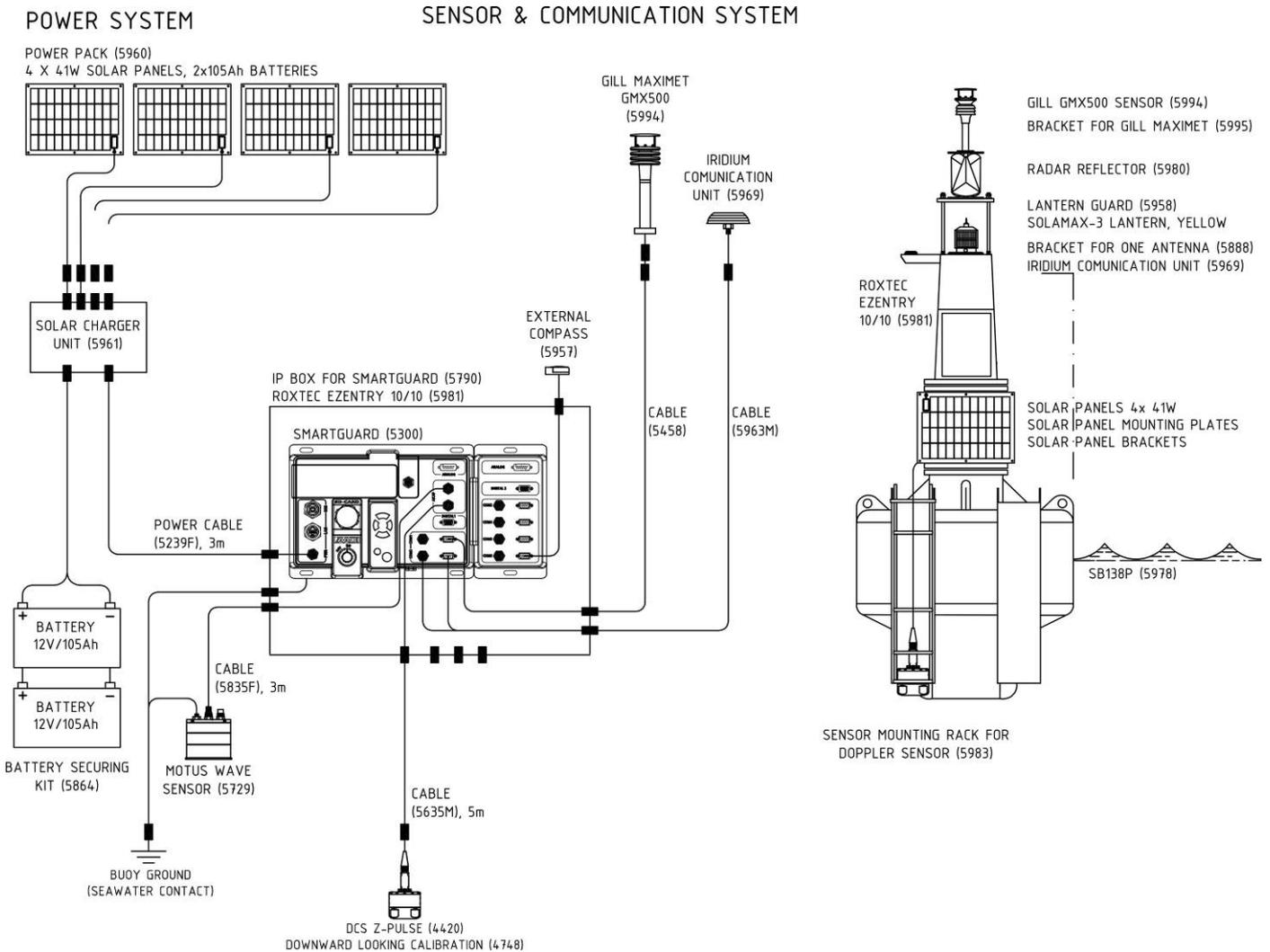


Figure 10-5: Example 3

## Appendix 1 Product change notification: Frame Work3

Copy of content in Product Change Notification Document ID: DA-50009-01 of date 09 December 2011:

### Product(s) Affected:

Product Number	Product Name	From Serial No.
4050	Temperature Sensor	300
4060	Temperature Sensor	500
4017	Pressure Sensor	700
4117	Pressure Sensor	600
4319(A/B)	Conductivity Sensor	800
4330(F/A)	Oxygen Optode	1000
4420	ZPulse® Doppler Current Sensor	500
4520	ZPulse® Doppler Current Sensor	600
4646(R)	Pressure Sensor	600
4647(R)	Tide Sensor	600
4648(R)	Wave and Tide Sensor	600
4830	ZPulse® Doppler Current Sensor	100
4835	Oxygen Optode	300
4930	ZPulse® Doppler Current Sensor	100
4880(R)	Temperature Sensor	200
4930	ZPulse® Doppler Current Sensor	100

### General Change Description:

Most of AADI's Smart Sensors utilized common communication protocols for use at the RS-232 and RS-422 interface. Two protocols are available; Smart Sensor Terminal protocol and the AADI Real Time protocol, where the Smart Sensor Terminal protocol is a simple ASCII command string based protocol and the AADI Real Time is an XML based protocol. To accommodate for higher security and future expansions both protocols will be updated when releasing Sensor Framework version 3 (common software for the above sensors). This notification aim to give an overview of the changes in the Smart Sensor Terminal protocol. Please refer to the specific Operating Manuals for further details and to Technical Description TD267a for updates in the AADI Real Time protocol.

## Specific Changes:

1. Input command line termination is changed from line feed (LF) with optional carriage return to line feed and mandatory carriage return (LF+CR).
2. 'Do Stop' and 'Do Start' command changed to 'Stop' and 'Start'
3. All units in output string changed from '(' and ')' type parenthesis to '[' and ']' type, example [hPa].
4. The Sleep indicator ('%') and the Wakeup indicator ('#') is replaced by a Communication Sleep ('%') indicator and a Communication Ready ('!') indicator. A property called 'Enable Comm Indicator' can be used for enabling/disabling of these characters.
5. Polled mode is no longer enabled by setting the interval to zero (Set Interval(0) is now illegal). A property called Enable Polled Mode is now used for controlling polled/non-polled mode.
6. The 'Output' property is substituted by a 'Mode' property for changing the operation mode, for example; 'Set Mode(Smart Sensor Terminal)'. Specific properties control the formatting of the output string, for example 'Set Enable Text(no)'.
7. The startup notification (at power up) is changed from 'Mode <Mode name>' to the following format: 'StartupInfo <Product No.> <Serial no.> Mode <Protocol Name> Version <Version No.> Config Version <Version No.>', for example; 'StartupInfo 4330 83 Mode AADI Smart Sensor Terminal Protocol RS-232 Protocol Version 3 Config Version 6'
8. The startup notification will be switched off when the 'Enable Text' property is set to 'no'.
9. A '\*' will precede the parameter name if an error status related to the specific parameter occur. This applies for example to the tide parameter of the Wave an Tide Sensor before the sample base is complete : '\*Tide Pressure[kPa] 0.000000E+00'

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email: [aanderaa.info@xylem.com](mailto:aanderaa.info@xylem.com) - [www.aanderaa.com](http://www.aanderaa.com)

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