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TD 302 OPERATING MANUAL
PRESSURE SENSOR 4117/4117R
TIDE SENSOR 5217/5217R
WAVE & TIDE SENSOR 5218/5218R
JANUARY 2026

PRESSURE SENSOR 4117/4117R
TIDE SENSOR 5217/5217R
WAVE & TIDE SENSOR 5218/5218R

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1st Edition	30 June 2013	Preliminary
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CHAPTER 1 **Warnings & Precautions**

1.1 General safety precautions

Pressure, Tide and ***Wave & Tide*** are reliable and safe to use. Care has been taken to ensure that safety is an important part of the design. To provide high quality data over an extended period and in addition to prevent injuries during operation the guidelines and precautions in this manual should be followed.

Any marine operation involving heavy equipment is by default categorized as dangerous. To ensure health and safety principles are followed, a ***Safe Job Analysis (SJA)*** should be conducted locally before any operations take place. Special care needs to be taken concerning assembly, test, transport, deployment and lifting operations.

- ***Personal Protective Equipment PPE*** includes helmet, eye protection, hearing protection, gloves, coveralls and protective footwear need to be considered in such an operation.

Warning: An over pressure supplied to the transducer element will permanently damage the sensor.

Warning: Do not use any sharp object to clean the pressure port. Any damage to the transducer element will permanently reduce the sensor accuracy.

Warning: Do not open the sensor unless you are instructed by an official representant from the factory.

Warning: Communication with Real-Time Collector may be slow or not possible if Flow Control is set to None. If set to Xon/Xoff the communication with sensor will be prioritized.

Warning: When configuring the sensor make sure that you always wait for the acknowledge before you switch off power since you may risk a corrupt flash if power is switched off during writing to Flash.

1.2 REACH Statement

1.2.1 SVHC Status in the Product

In accordance with REACH Article 33(1), we as the supplier are obligated to inform our professional customers about the presence of substances on the Candidate List for SVHC when the concentration exceeds 0.1% w/w in an article.

SVHC substance (name + CAS no.)	Part of the product where the substance is present	Concentration	Safe use / precautions
[Lead (Pb) 7439-92-1]	Internal spacer made of brass	>0.1% w/w <3.5%	No specific risk under normal use; avoid grinding/heating etc.]

Please note that the inclusion of lead as SVHC is not a restriction of use, the only requirement is as stated above.

1.2.2 Safe use of product

The product can be used safely when used as intended.
Avoid activities that may release the substance (e.g. grinding, cutting or high temperatures) unless adequate protective measures are in place.
Disposal must comply with local requirements for waste handling of products that may contain SVHC substances.

1.2.3 Additional Notes

The Candidate List is typically updated twice a year by ECHA. New substances added to the list may trigger new information obligations.
If the product is modified, or the SVHC status is updated, new documentation or communication will be distributed.

1.2.4 Contact for Questions

E-mail: Aanderaa.support@xylem.com

1.3 Waste Management & Disposal

WEEE: Waste Electrical and Electronic Equipment. Electrical waste or WEEE is the term used to designate all electrical items that should be recycled. Its official definition is set by the Waste Framework Directive (2006/12/EC).

Aanderaa Data Instruments AS is a member of RENAS

To address environmental concerns Aanderaa Data Instruments AS has joined the industry's own recycling company for electric and electronic waste - RENAS AS. All EE products sold are part of a system for collecting and processing and can be delivered to the dealer or municipal waste treatment plant.

As members of RENAS we take responsibility for the environment!

More information on return policies can be found at renas.no.

If you located outside Norway, contact our local dealer or contact your local WEEE authorized representative.
For further assistance contact Aanderaa.support@xylem.com

1.4 Batteries.

The sensor itself does not contain any batteries but be aware about the polarity and maximum voltage when powering the sensor. Reverse polarity or too high voltage will permanently damage the sensor.

Warning: Be aware of the polarity and maximum voltage when powering the sensor. Reverse polarity or too high voltage will permanently damage the sensor.

1.5 Material used

Warning: The sensor may leak silicon oil during transport, storage and operation.

The above warnings are of a general nature. Instructions and safety precautions relevant to each phase of the sensor operational lifetime are found in the remaining sections of this manual. The relevant sections must be read carefully prior to initiating any work on the sensor.

Only skilled and trained personnel should be allowed to do physical work in field. Any equipment used to perform work on the sensor or sensor-related objects should have the required approval/certificates for the actual work being done.

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1.6 INTRODUCTION

1.6.1 Purpose and Scope

This document is intended to give the reader knowledge of how to operate and maintain the ***Aanderaa Pressure Sensor 4117/4117R, Tide Sensor 5217/5217R*** and ***Wave and Tide Sensor 5218/5218R***. These sensors are described in a single manual since the measurement principle, and the sensor housing are the same for all sensors. ***Tide Sensor 5217*** and ***Wave and Tide Sensor 5218*** have extended capabilities compared to ***Pressure Sensor 4117***.

It also aims to give insight into how the sensor works and how the Pressure measurement can be converted to depth. How Tide is calculated using an average during integration time and how Wave is calculated using a set number of samples.

Tidal datum is a reference level used to measure the height of tides. It serves as a baseline from which tidal heights (both high and low) are measured and interpreted. These datums are essential for navigation, coastal engineering, and understanding sea level changes. After installation offset from a known local datum may be calculated and the value may be entered to ***Installation Depth***.

Pressure Sensor 4117, Tide Sensor 5217 and ***Wave & Tide Sensor 5218*** are designed to fit directly on the top-end plate of ***SeaGuard/SeaGuardII*** or in a string system connected to ***SmartGuard*** or ***SeaGuardII String*** logger using ***AiCaP***. The sensor can also be used as stand-alone sensor using ***RS-232***. Pressure Sensor 4117R, Tide Sensor 5217R and ***Wave & Tide Sensor 5218R*** are only ***RS-422*** output and are intended for standalone use with longer cables than can be used with the ***RS-232*** version.

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. 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 0.*** The sensor properties are divided into 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***, described in ***CHAPTER 4*** and ***CHAPTER 5*** or terminal software like Terra Term, described in ***CHAPTER 7*** .

All sensors also include a Temperature sensor used to compensate for internal temperature drifting, but the output from this sensor is also presented as an additional Temperature output. The accuracy of the Temperature output depends on the sensor configuration due to internal self-heating.

Note! Some settings are only visible when certain properties are enabled.

Screen dumps shown in this manual may vary from what you experience on your sensor. This may be caused by using different versions of AADI Real-Time Collector, different configuration of configuration software or different versions of sensor software.

For image upgrade on sensor the sensor needs to be returned to factory or an approved service facility.

1.7 Document Overview

CHAPTER 1 is a short introduction to the sensor with warnings and recommendations.

CHAPTER 2 is an introduction to the sensor including dimension and sensor properties.

CHAPTER 3 gives the theory of operation and calculations of main parameters.

CHAPTER 4 is an overview of how to configure the sensor with AADI Real-Time Collector when connected via an Aanderaa logger such as SmartGuard/SeaGuardII.

CHAPTER 5 is an overview of how to configure the sensor with AADI Real-Time Collector when the sensor is used stand-alone.

CHAPTER 6 describes how to log data using AADI Real-time Collector.

CHAPTER 7 describes sensor configuration using terminal software such as Tera Term.

CHAPTER 8 gives information about typical Current drain with different configurations.

CHAPTER 9 gives information about how to use Pressure inlet with membrane

CHAPTER 10 describes the sensor electromagnetic compatibility (EMC).

CHAPTER 11 gives information about maintenance.

CHAPTER 12 gives a list of Status codes

CHAPTER 13 describes how to calculate engineering values from raw data

CHAPTER 14 gives an overview of wave parameter calculations

CHAPTER 15 gives installation recommendations and available cables.

1.8 Applicable Documents

Form 764	Test & Specification Sheet for 4117/4117R, 5217/5217R, 5218/5218R
Form 765	Calibration Certificate for 4117/4117R, 5217/5217R, 5218/5218R
Form 667	Pressure Certificate
D362	Data Sheet for Pressure Sensor 4117/4117R
D405	Data Sheet for Tide Sensor 5217/5217R
D407	Data Sheet for Wave and Tide Sensor 5218/5218R
TD 293	Operating manual SmartGuard
TD 303	Manual for SeaGuardII Platform
TD 268	AADI Real-Time collector operating manual
TD 277	Calculation of current drain for the Pressure Sensor, Tide Sensor and Wave & Tide Sensor

1.9 References

Equation of state 1980 UNESCO polynomial implementation.
IEEE Journal of Oceanic Engineering, Vol. OE-5, No. 1, January 1980.

1.10 Abbreviations

ADC	Analog to Digital Converter
AiCaP	Aanderaa Protocol: Automated idle Line CANbus Protocol
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
DSP	Digital Signal Processor
EMC	Electromagnetic compatibility
GND	Ground
HCL	Hydrochloric acid(Muriatic acid)
hPa	Hectopascal unit for measuring pressure, 1hPa=1mbar
Hz	Hertz is the derived unit of frequency in the International System of Units (SI)
kPa	Kilopascal unit for measuring pressure
mbar	Millibar unit for measuring pressure, 1mbar=1hPa
RS-232	Recommended Standard 232 refers to a standard for serial communication of
RS-422	Differential serial communication for longer cables
RXD	Serial communication Received data
SD-Card	Secure Digital Card a storage device used to store data
TXD	Serial communication Transmitted data
UART	Universal Asynchronous Receiver and Transmitter
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USB	Universal Serial Bus
WTS	Wave and Tide Sensor
QA	Quality Assurance, how it establishes a set of requirements for creating
QC	Quality Control, the operational techniques and activities used to fulfil

CHAPTER 2 **Short Description and Specifications**

2.1 Description

In most measuring systems used in the sea, pressure is a vital parameter to derive other parameters like the salinity, water density and the speed of sound. For deep water moorings the pressure can be used to determine the actual depth of the instrument. For fixed installations on the seabed the pressure can be used for deriving the water level and wave parameters.

The ***Pressure Sensor***, ***Tide Sensor*** and the ***Wave and Tide Sensor*** are compact, yet intelligent sensors designed for use on ***Aanderaa SeaGuard/SeaGuardII*** and ***SmartGuard*** as well as in other measuring systems. These sensors measure the absolute pressure based on a silicon piezoresistive bridge. The pressure measurements are sampled and temperature compensated by an advanced Digital Signal Processor. A temperature thermistor is located next to the pressure bridge and are used both as a Temperature output but also for internal temperature compensation.

Since all calibration and raw data are stored inside the sensor, the parameters can be presented directly in engineering units without any external calculations.

The output formats of ***4117, 5217***, and ***5218*** are ***AiCaP*** and ***RS-232***, while the output formats of ***4117R***, ***5217R***, and ***5218R*** are ***RS-422***.

The sensors can be used in polled operation when set to ***Smart Sensor Terminal*** mode. Then the sensor will do a new output every time a ***do sample*** is sent to the sensor.

The ***4117***, ***5217***, and ***5218*** version fits directly on to the top end plate of ***Aanderaa SeaGuardII Platform***. The sensor is then used in ***AiCaP*** mode. When used with ***SmartGuard*** both ***AiCaP*** and ***RS-232*** connection can be used. The sensors may also be used as a stand-alone ***RS-232*** sensor for other applications.

The R-versions (***4117R***, ***5217R***, and ***5218R***) can be used on a ***SeaGuardII*** platform using one of the two serial inputs. The main use of this sensor is as stand-alone ***RS-422*** sensor on longer cables.

The first letter in the product number gives the maximum deployment depth for the sensor, refer datasheet for more info.

IMPORTANT!

A 4117, 5217, and 5218 sensors cannot be made into an R-version, and a 4117R, 5217R, and 5218R sensor cannot be made into an AiCaP or RS-232 sensor after delivery.

2.2 Measurement principles

The ***Pressure Sensor 4117/4117R***, ***Tide Sensor 5217/5217R*** and ***Wave and Tide Sensor 5218/5218R*** measure raw data of Pressure and Temperature. The pressure measurement is based on a piezoresistive bridge. This bridge consists of 4 resistors implemented on a silicon diaphragm. One side of the diaphragm is exposed to water pressure, while the other is facing a zero-atmosphere vacuum chamber.

When the diaphragm is flexed by hydrostatic pressure the resistance of the resistors will change. By applying a constant voltage over the bridge, a voltage that varies with the pressure is generated. This voltage is sampled by a high-resolution analog to digital converter (ADC) controlled by a digital signal processor (DSP).

A thermistor sensing the water temperature is also sampled by this ADC. Engineering data are calculated by software in the sensor (Sensor Firmware) based on this raw data and referred to sets of calibration coefficients stored in the sensor.

All pressure transducers have a temperature drift. By calibrating the sensor at different temperatures, this drift can be determined. The DSP stores the data from the calibration and is thus able to temperature-compensate sampled pressure data, as well as to convert the data into linearly calibrated data in engineering units.

All calibration coefficients and settings are stored in the DSP flash-memory. These properties can be displayed and changed using the RS-232 or RS-422 port.

The Sensors can be logged directly by a PC (via the RS-232/RS-422 protocol) and by most PLC's DCP's i/o devices, data loggers and systems.

2.3 Functional diagram

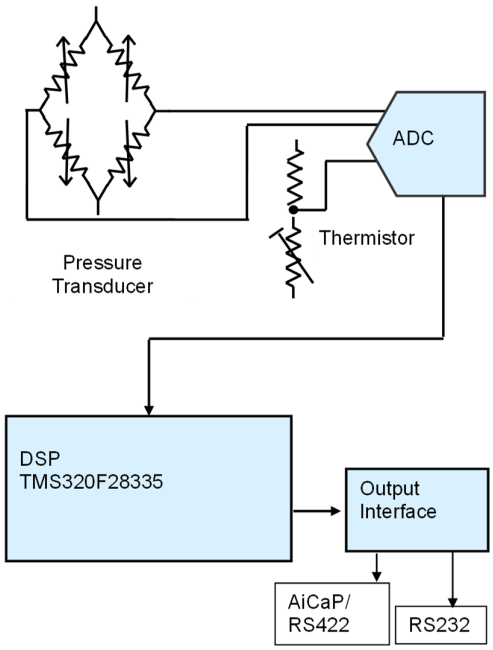


Figure 2-1: Functional Diagram

2.4 Sensor Integrated Firmware

The firmware's main task is to sample raw data, compute calibrated temperature compensated and linearized pressure, and present the result at different interfaces.

All calibration coefficients and settings are called sensor properties and are stored in the DSP flash-memory. These properties can be displayed and changed using the RS-232/RS-422 port.

2.5 Startup delay for calculated wave and tide parameters

The calculations of wave and tide parameters require several pressure samples, which will take some time for the sensor to perform due to the ***Number of samples*** and the ***Tidal Average Period*** set by the user. The value of the output parameter will be ***0*** until the required samples are available, and the parameter will get a status code: ***Warning Not Ready***.

Once the sensor has performed the required number of samples, wave and tide parameters will be calculated for every output interval based on the most recent samples in the pressure time series. The pressure time series are updated according to the sampling rate.

Tide parameters will be calculated after *the* ***Tidal Average Period*** in seconds.

Wave parameters will be calculated after $\frac{Number\ of\ samples}{Sampling\ rate}$ seconds.

The sampling rate is by default ***2 Hz***, but you can enable ***Enable High Sampling Rate*** to set the sensor to sample at ***4 Hz***.

Note! The ***pressure time series*** *is cleared: after* ***sensor power up****, after a* ***Reset*** *or* ***Start*** *command, and after change in one of the properties* ***Interval, Enable High Sample Rate, Tidal Average Period, Enable Tide, Enable Spectrum, Enable Wave*** *and* ***Number of samples****.*

Example:
A ***Tide*** sensor set to a ***Tidal Average Period*** of '***40 s***' and a sample rate of ***4 Hz*** will require ***40 * 4 = 160*** pressure points before calculating the first tide parameter value.

If the *Interval* setting is 10 seconds, the sensor will measure ***10 * 4 = 40*** new pressure points before the next calculation. After 10 second it will output a value calculated using the last 160 pressure points.
.

2.6 Calculated parameters

Based on the measured parameters described above the sensor software will produce several measurements. ***Tide sensor 5217*** and in the ***Wave and Tide sensor 5218*** calculates additional parameters depending on the configuration, refer ***Table 2-1***.

Refer ***CHAPTER 14*** for a primer describing the calculation of wave parameters for 5218/5218R.

Table 2-1 Calculated Sensor parameters.

Full Name	Parameter Name	Unit	Pressure sensor 4117/4117R	Tide sensor 5217/5217R	Wave and Tide sensor 5218/5218R
Pressure	Pressure	kPa	x	x	x
Temperature	Temperature	°C	x	x	x
Tide pressure	Tide Pressure	kPa		x	x
Tide level	Tide Level	m		x	x
Significant wave height	Sign. Height	M			x
Maximum wave height	Max Height	M			x
Mean period	Mean Period	s			x
Peak period	Peak Period	s			x
Energy wave period	Energy Period	s			x
Mean zero crossing period	Mean Zero Crossing	s			x
Steepness	Steepness	-			x
Irregularity of sea-state	Irregularity	-			x
Cut-off frequency	CutOff Freq High	Hz			x
Pressure Series	Pressure Series	kPa			x
Last Pressure Sample Index	Last Pressure Sample Index	-			x
Spectrum	Spectrum	m^2			x

2.7 Sensor Dimension

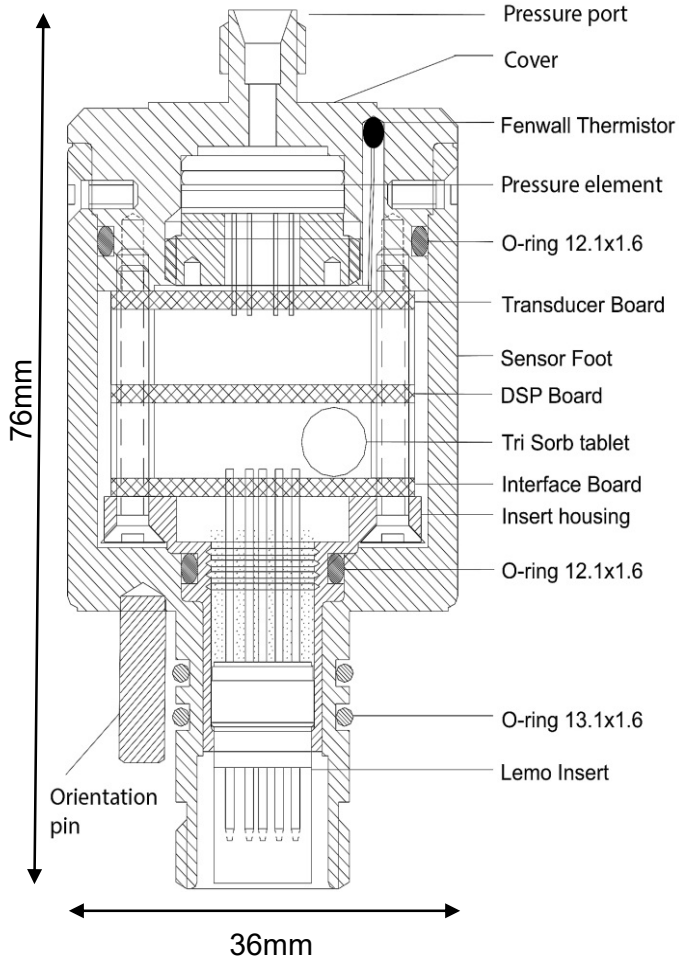


Figure 2-2: Sensor Cross section and Dimension

Figure 2-3: Sensor housing

2.8 Sensor pin configuration and data output

All standard sensor versions are using a 10-pin lemo plug for ***RS-232*** and ***AiCaP*** communication between sensor and logger; see ***Figure 2-4*** for pin configuration.

All R-versions are using a 10-pin lemo plug for ***RS-422*** connection to external logger; see ***Figure 2-5*** for pin configuration. For a list of available cables see ***chapter 15.1*** or contact ***aanderaa.support@xylem.com***.

2.8.1 Pin configuration 4117,5217 and 5218 with RS-232 and AiCaP communication

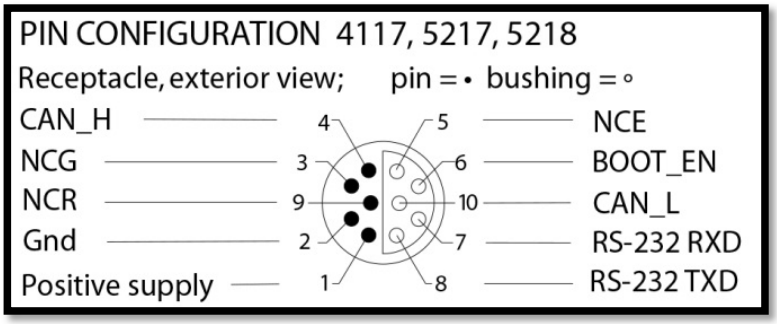


Figure 2-4: 4117,5217 and 5218 Sensor communication 10-pin plug with RS-232 and AiCaP

Table 2-2: 4117,5217 and 5218 Sensor pin configuration 10-pin plug AiCaP and RS-232

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

2.8.2 Pin configuration 4117R,5217R and 5218R with RS-422 communication

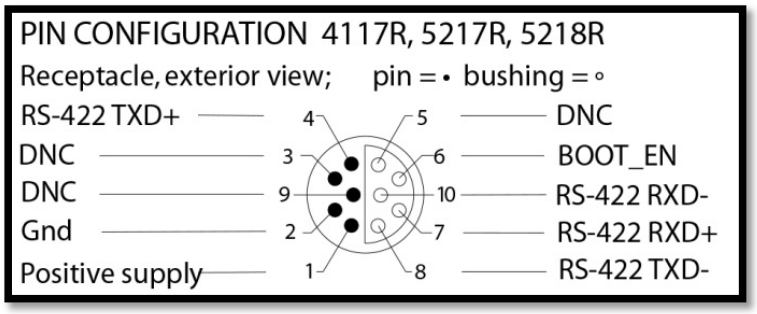


Figure 2-5: 4117R, 5217R and 5218R Sensor communication 10-pin plug with RS-422

Table 2-3: 4117R, 5217R and 5218R Sensor pin configuration 10-pin plug 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
Boot Enable	I	6

2.9 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. To configure the sensor, it needs to be connected to an ***Aanderaa*** logger using ***AiCaP***, a real-time ***RS-232/RS-422*** cable or you need a ***RS-232/RS-422*** configuration cable.

2.9.1 Configure sensor using RS-232 configuration cable

Connect your sensor to one of the COM ports on your PC.

2.9.2 Using PC without COM-port

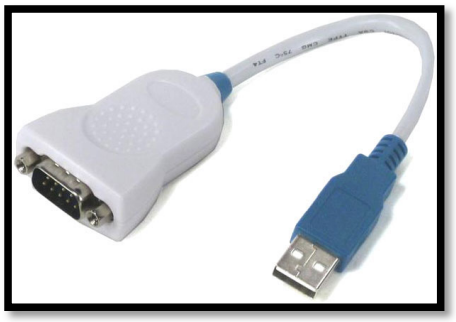


Figure 2-6: Serial to USB converter

If your PC comes without a ***COM-port*** we recommend using a ***USB to serial*** converter. ***Figure 2-6*** shows one alternative, ***FTDI Serial to USB***, recommended for use with Win10 and newer.

Connect the ***USB*** plug to your ***PC's USB-port*** and then your sensor to the ***9pin DSub***.

Use power from PC USB port or external power source.

2.9.3 Configuration Cable 3855

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 is a standard cable that can also be used to configure most other Aanderaa Smart Sensors as well.
The cable is supplied with a ***USB port*** providing power to the sensor from the ***PC's USB port***. Please note that a standard laptop does not deliver more than 5V on the USB port. Therefore, a USB extension cable is supplied with the cable so alternatively you may connect the free end to an external power (***5-14V***). 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. Do not use this cable underwater.

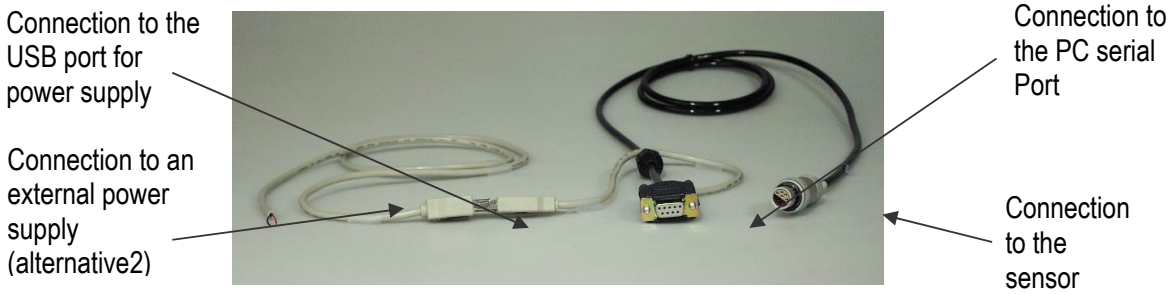


Figure 2-7: Set-up and configuration cable 3855

Table 2-4: Cable 3855 pin configuration

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	

2.9.4 Configure sensor using RS-422 configuration cable 5618

Connect your sensor to one of the ***COM ports*** on your PC using the ***RS-422 to RS-232 adapter*** or use an ***RS-422*** port if available. If your PC comes without serial ports (***COM ports***) you may also use a ***USB to Serial Adapter***. We recommend ***FTDI Serial to USB***, for use with Win10 and newer.

The ***5618F*** is a 3-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 most of the other ***RS-422 Aanderaa Smart Sensors*** with ***RS-422*** as well.
The cable is supplied with a ***USB port*** providing power to the sensor from the ***PC USB port***. Please note that a standard laptop does not deliver more than 5V on the USB port. Therefore, a USB extension cable is supplied with the cable so alternatively you may connect the free end to an external power (***5-14V***). An alternative solution is to use a 9V alkaline battery (6LF22) to set the sensor up or log it in the laboratory. A ***RS-422 to RS-232 converter*** is also Included with the cable. Sensor Cable ***5618*** is also available with other lengths. Do not use this cable underwater.

2.9.5 Configuration Cable 5618

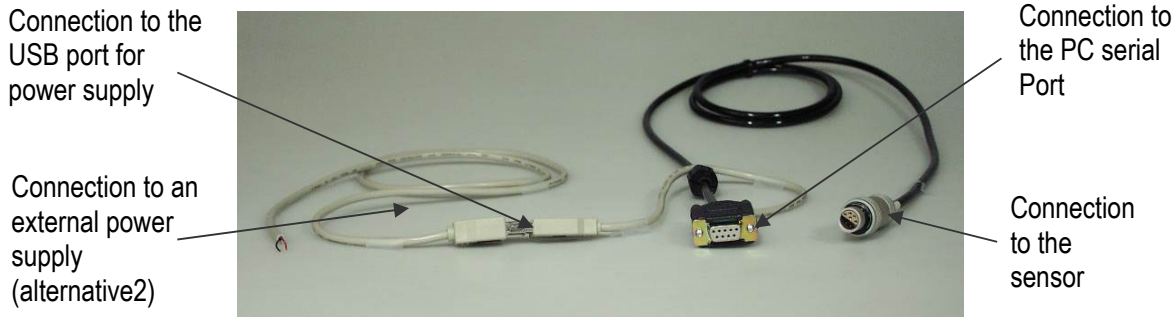


Figure 2-8: Set-up and configuration cable 5618

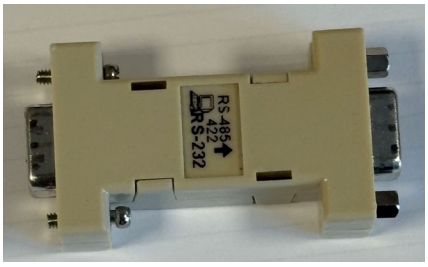


Figure 2-9: Antona RS-422 to RS-232 converter

Table 2-5: Cable 5618 pin configuration

Signal name	Sensor plug	9-p D-Sub	USB
RS-422 Tx-	1	2	
RS-422 RX+	2	3	
NC(Not Connected)	3		
NC(Not Connected)	4		
RS-422 Tx+	5	7	
NC(Not Connected)	6		
Gnd	7	5	Black
Positive Supply / V+	8		Red
RS-422 RX-	9	8	
NC(Not Connected)	10		

2.10 Configuration of sensor using Aanderaa logger

If your sensor is connected to a Aanderaa logger, ***SeaGuardII*** or ***SmartGuard*** you may also configure the sensor through this logger. For more information about this see ***CHAPTER 4***

2.11 Specifications for Sensors

For specifications refer to Datasheet D 362, 405 or 407 which is available on our web site http://www.aanderaa.com or contact aanderaa.support@xylem.com.
You will find the latest versions of our documents on Aanderaa website.

2.12 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 for 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.

2.13 User accessible sensor properties

All configuration settings that determine the behavior 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 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 5217 597 10	//Returned from sensor, where 5217 is the product number, 597 is the serial number of the sensor and 10 is the value stored as interval. To change the value, you might send the following command:
Set Interval(20)	//This will change the value for this property to 20 seconds.
Save	//Always end with save to store setting in flash.

The interval will now be changed to 20 seconds.

2.14 Passkey for writing protection.

To avoid accidental change, most of the properties are write-protected. There are four levels of access protection, refer ***Table 2-6***.

A special property called ***Passkey*** must be set according to the protection level before changing the value of properties that are write-protected. 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 minute it the ***Comm TimeOut*** is set to ***Always On.***

Set Passkey(1000) *//Will set the access level to high*

Table 2-6: Passkey protection

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 has only read access.

2.15 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 4*** and ***CHAPTER 5*** . Some properties of the '***AiCaP***' sensor will not be applicable / visible when the sensor is connected to a ***SeaGuardII*** or ***SmartGuard*** Datalogger, as these properties will then be controlled by the logger.

2.15.1 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 these properties is however different for each property, see ***Table 2-7*** for more details. In this group we find information about ***Software*** and ***Hardware settings***, ***Production***, ***Service*** and ***Calibration dates***.

Table 2-7: Sensor properties, Factory Configuration for Pressure 4117/4117R, Tide 5217/5217R and Wave & Tide 5218/5218R ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Product Name	String	31	AADI Product name, default Pressure, Tide or Wave and Tide Sensor	FC	No / Read Only	x	x	x
Product Number	String	6	AADI Product number, default 4117,5217,5218,4117R,5217R or 5218R with letter indicating the Range.			x	x	x
Serial Number	INT	1	Serial Number			x	x	x
SW ID	String	11	Unique identifier for internal firmware			x	x	x
SW Version	INT	3	Software version (Major, Minor, Built)			x	x	x
HW ID X	String	19	Hardware Identifier, X =1, 2 unique identifier for hardware		High / Read Only	x	x	x
HW Version X	String	9	Hardware Identifier, X =1, 2 (Rev. x)			x	x	x
System Control	INT	3	For AADI service personnel only			x	x	x
Production Date	String	31	AADI production date, format YYYY-MM-DD (Not in use)			x	x	x
Last Service	String	31	Last service date, format YYYY-MM-DD, empty by default			x	x	x
Last Calibration	String	31	Last calibration date, format YYYY-MM-DD (Not in use)			x	x	x
Calibration Interval	INT	1	Recommended calibration interval in days (Not in use)			x	x	x

2.15.2 Deployment Settings

Deployment Settings contain settings for instruments metadata like position and owner, but also site dependent properties storing data that might influence the measurement. Value stored in these settings can be used as default values but might also be exchanged with real-time measured data if sensors are connected to the AiCaP bus.

Table 2-8: Sensor properties, Deployment Settings for Pressure 4117/4117R, Tide 5217/5217R and Wave & Tide 5218/5218R ENUM=Enumeration, INT=Integer, Float=Floating Point Number, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Interval	INT	1	Set the output interval in seconds	DS	No / No	x	x	x
Location	String	31	User setting for location			x	x	x
Geographic Position	String	31	User setting for geographic position format: xx.xxxxxx,xx.xxxxx			x	x	x
Vertical Position	INT	1	User setting for describing sensors vertical position/depth in meter.			x	x	x
Reference	String	31	User setting for describing sensor reference, user definable.			x	x	x
Local Gravity	Float	1	Gravity constant in m/s² used for calculation of depth. Default 9.81				x	x
Salinity	Float	1	Salinity in PSU is used for calculation of depth and density. Can be altered while sensor is running to compensate for variable salinity. Default value is 35.				x	x
Installation Depth	Float	1	Installation depth in meter relative to chosen datum, default set to 0 = instrument referred. See ***chapter 3.2.3*** for more info.				x	x
Distance to Seafloor	Float	1	Set the distance between the sensor and the seafloor in meter. Default is 0. Used in wave calculations.					x

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Air Pressure	Float	1	The air pressure in kPa. The air pressure value is used when calculating depth. It can be altered while sensor is running to compensate for variable air pressure. Default is set to 101.3	DS	No / Low	x	x	x
Air Pressure Sensor Id	ENUM	1	When the Sensor is connected to AiCaP, a list of other available sensors connected to the SmartGuard/ SeaGuardII Datalogger is shown. This makes it possible to get a correct air pressure input from another sensor through the datalogger. Only in AiCaP mode			x	x	x
Air Pressure Parameter Id	ENUM	1	A list of all available Air Pressure parameters with hPa or mbar as units is shown in the dropdown menu. Make sure that the correct pressure parameter is selected. Only in AiCaP mode.			x	x	x

2.15.3 System Configuration

This group is used to control the sensor via properties for configuring communication with logger, 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. The Tide and Wave properties are only visible if enabled.

Table 2-9: Sensor properties, System Configuration for Pressure 4117/4117R, Tide 5217/5217R and Wave & Tide 5218/5218R ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Mode	ENUM	1	Sets the sensor operation mode (AiCaP, Smart Sensor Terminal, AADI Real-Time or Smart Sensor Terminal FW2). AiCaP is not available on the R-version of the sensor. Smart Sensor Terminal is an ASCII output when AADI Real-Time is XML output.	SC	No / Low	x	x	x
Enable Sleep	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). Default is Yes.			x	x	x
Enable Polled Mode	BOOL	1	Enable Polled Mode if set to (Yes) the sensor will output data every time the user/system polls for data Do Sample () command). Do Sample trigger a calculation. Pressure Sensor 4117/4117R will output the last measurement. Tide Sensor 5217/5217R will output the newest calculation given by the Tidal Average Period setting. Wave and Tide Sensor 5218/5218R will output the newest calculation given by the Number of Sample setting.			x	x	x

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Enable Text	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 if set to No. Default is Yes.	SC	No / Low	x	x	x
Enable Decimalformat	BOOL	1	Controls the use of decimal format in the output string in Smart Sensor Terminal mode. Default is scientific format (exponential format). Default is No.			x	x	x
Enable High Sample Rate	BOOL	1	Set the sample rate to 4 Hz if enabled. If not enabled the sample rate will be 2 Hz. Default is Yes.				x	x
Enable Temperature	BOOL	1	Enables the output of Temperature from Temperature sensor. Default is Yes.			x	x	x
Enable Rawdata	BOOL	1	Enables the output of Rawdata. Default is No.			x	x	x
Enable Tide	BOOL	1	Enable Tide output parameters. Default is Yes for Tide Sensor.				x	x
Tidal Average Period	ENUM	1	Set the averaging interval for the tide measurements (10 s, 20 s, 30 s, 40 s, 50 s, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 7 min, 8 min). Default is 40s.				x	x
Enable Wave	BOOL	1	Enable Wave output parameters. Default is Yes for Wave sensor.					x
Number of Samples	ENUM	1	Are used to set the number of samples in a time series and number of samples in a wave calculation: (256, 512, 1024, 2048). Default is 1024.				x	x
Enable Air Pressure Output	BOOL	1	Enable Air Pressure output. Default is No. Only if Air Pressure Sensor Id and Air Pressure Parameter Id are enabled.			x	x	x

2.16 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 the ***Get Current Configuration.*** These properties are used to configure serial port settings, communication to and from sensor. Enable time series and listing of all calibration coefficients.

Table 2-10: Sensor properties, User Maintenance for Pressure 4117/4117R, Tide 5217/5217R and Wave & Tide 5218/5218R ENUM=Enumeration, INT =Integer, Float=Floating Point Number, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Node Description	String	31	User text for describing node, placement etc. Default Sensor Name and Number.	UM	No / Low	x	x	x
Owner	String	31	User setting for owner information, company name etc.		No / High	x	x	x
Interface	String	31	Factory use only, RS232 for standard version, RS422 for R-version		High / High	x	x	x
Baudrate	ENUM	1	Serial sensor baudrate: 4800, 9600, 57600, or 115200. Default baudrate is 9600. Unless used with RCM Blue then set to 57600.	UM	High / High	x	x	x
Flow Control	ENUM	1	RS232/RS422 flow control: 'None' or 'Xon/Xoff'. To remove any "disturbance" on the receiver, select None. Be aware that this may also lead to missing characters when sending commands to the sensor. When using Real-Time collector we recommend 'Xon/Xoff'. Default is 'Xon/Xoff'.			x	x	x
Enable Comm Indicator	BOOL	1	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. Default is No.			x	x	x

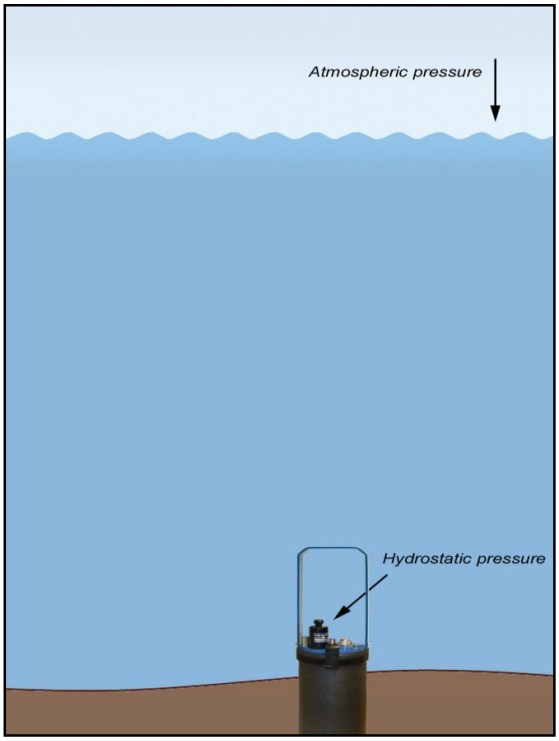
Property	Type	No of elements	Use	Configuration Category	Access Protection Read/Write	Pressure	Tide	Wave & Tide
Comm TimeOut	ENUM	1	Time communication is active (Always On, 10 s, 20 s, 30 s, 1min, 2 min, 5 min, 10 min). A short time means that the sensor is going to sleep faster after a communication input. Default is 1min	UM	High / High	x	x	x
Enable Pressure Series	BOOL	1	Controls inclusion of pressure series in the output string. This means that all individual pressure measurements in an interval are presented in an array. Default is No.				x	x
Enable Spectrum	BOOL	1	Controls inclusion of spectrum elements in the output string. Default is No.					x
Cut Off Frequency Factor	Float	1	Factor used to calculate Cut-Off Frequency. Cut Off Frequency are calculated by using this Factor, Local Gravity and Installation Depth measured by sensor. Default 0.282. See ***chapter 14.1*** for more info					x
Maximum Wave Period	Float	1	Used to set the upper Cut-Off frequency. Default 30s.					x
Pressure Coeffs X	Float	5	Pressure Calibration Coefficients X = 0..4. Coefficients calculated from calibration. One set for each of the temperature selections. Correct calibration set will be used based on the temperature measurement performed at the start of each calculation.			x	x	x
Temp Coeffs	Float	1	Temperature calibration coefficients. One set covering the full calibration range.			x	x	x

CHAPTER 3 **Theory of Operation**

If the variation in the measured hydrostatic pressure is dominated by surface waves and ocean swell, the Tide sensor 5217/5217R and Wave & Tide sensor 5218/5218R provide time averaged measurements, to compensate for the dynamic water pressure variations seen by the sensor at depth due to vertical movement of the sea surface.

The main objective of the temperature reading is to temperature-compensate the pressure reading. Aanderaa Data Instruments offers other sensors designed to measure the water temperature more accurately if required.

3.1 Pressure measurements for sensors 4117/4117R



The ***Pressure Sensor 4117/4117R*** measures absolute pressure at the installation depth. The 4117 sensor is a momentary / instantaneous pressure measurement; the pressure is sampled at an update interval (output interval) from 1 second to 255 minutes (user configurable). The absolute pressure measured by the sensor is comprised by the weight of the water column above the sensor (hydrostatic pressure), plus the atmospheric pressure at the sea surface.

The pressure sensor is mainly used to identify where the sensors are placed in a mooring line or used to give the water level in a closed system without waves.

Figure 3-1: Illustration of the pressure measurement situation

3.2 Tide measurements for sensors 5217/5217R, 5218/5218R

Tide pressure measurements are an average of the sampled pressure time series measured over a user defined time interval of 10 seconds to 8 minutes (user configurable average base), which filters out all but the longest or low frequency dynamic variations of the water surface. The default sample rate is 2 Hz; the user can enable a higher frequency sampling rate of 4 Hz.
The sensor updates or output interval is user set from 1 second to 255 minutes.

The tide parameter output value will be sent as 0 in the beginning until the sensor has performed enough samples to satisfy the average base and calculate the output value.

Note! The tide calculations are always based on the latest samples in time, so even though you specify a longer averaging time, e.g. 8 minutes averaging, the computed value for tide will be calculated from a running sample set and a new value sent as an output message at the 1 second to 255 minutes interval according to your settings for the output interval.

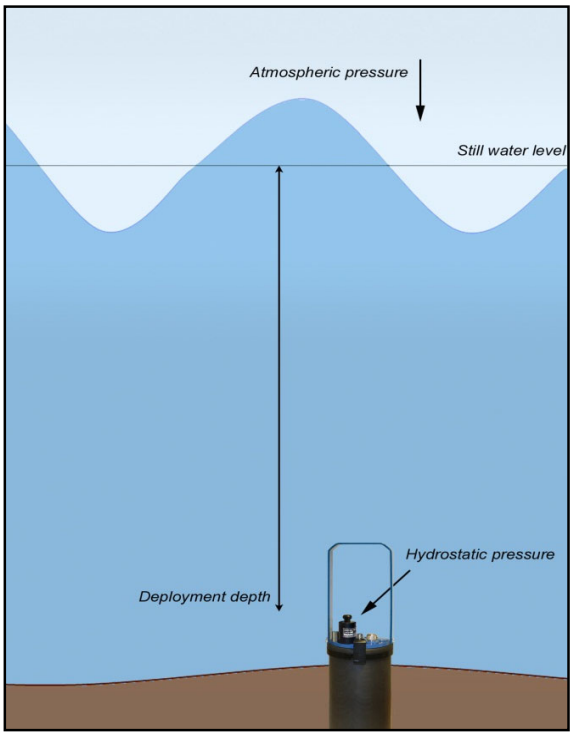


Figure 3-2 Illustration of the tide measurement situation.

The sensor measures the pressure at the installation depth. The tide pressure is the average of the measured hydrostatic pressure, refer Eq. 3-1:

$$P = \rho g h + P_{atm} \qquad \textbf{Eq. 3-1}$$

Where *P* is the measured average pressure, ρ is the water density[1], *g* is the local acceleration due to gravity, and *h* is the sensor deployment depth.
The tide level above the sensor deployment depth is calculated from Eq. 3-2:

$$h = \frac{P - P_{atm}}{\rho g} - h_0 \qquad \textbf{Eq. 3-2}$$

Where h_0 is the Installation Depth.

Note! P_{atm}, and *g* are sensor properties that must be set by the user prior to deployment. The water density, ρ, is calculated from the measured water temperature and the salinity[2] of the water. Pressure is set to 0. Salinity is set by the user. If you can find precise values for the input parameters at the deployment site, the sensor will calculate the tide level more accurately.

If P_{atm} can be measured at the site, the tide level can be calculated more accurately by means of post processing. The user of RS-232/RS422 sensor can update the property P_{atm} on request. P_{atm} will not be presented together with the measured data.

In AiCaP mode, parameter transfer from an Air Pressure sensor is possible.

[1] Equation of state 1980 UNESCO polynomial implementation. Density calculated with pressure = 0.

[2] IEEE Journal of Oceanic Engineering, Vol. OE-5, No. 1, January 1980, page 14

3.2.1 Understanding Tide Gauge Zero Level

A ***tidal datum*** is a reference point used to measure water levels. It provides a consistent baseline for all measurements taken by tide gauge sensors. ***Tidal datums*** are established relative to a known, stable benchmark, often related to mean sea level or another standard reference point. These datums are essential for navigation, coastal engineering, and understanding sea level changes.

3.2.2 Local Variability

Tidal datums are ***location specific***. They depend on local sea level conditions, tidal patterns, and geography. Therefore, a datum used in one harbor may not apply accurately to another.

3.2.3 How to Read Tide Measurements with Tidal Datums

If the offset between the sensor installation and the desired local datum is known, the property ***Installation depth*** can be used for referencing the ***Tide Level*** to this datum.
If the sensor is installed below the selected datum the ***Installation Depth*** should be positive and vice versa.

3.3 Wave measurements for sensors 5218/5218R

The wave measurements are calculated independent from tide, and you may choose from 256, 512, 1024 or 2048 samples performed at a default rate of 2 Hz or a higher sample rate of 4 Hz (both settings are user configurable). The pressure time series used to calculate wave statistics are therefore measured over a period of 64 seconds to 17 minutes (measuring time is the product of sample set size and sample frequency). The wave parameters are calculated according to the linear wave theory, refer ***CHAPTER 14*** for more info. Calculations of wave parameters (5218/5218R).

The wave parameter output values will be 0 at the beginning of the recording until the sensor has performed enough samples needed to calculate the wave statistics. When the sensor has sampled the required pressure samples, all output parameters will be calculated and updated for each output interval. This means that the first non-zero output from the sensor will be the smaller of the sample sets, i.e. tide pressure followed by wave statistics.

Note! The wave calculations are always based on the latest sample values in the time series. The first set of calculated parameters is presented sometime after the measurements start (at least 64 seconds), but the update interval is according to your settings for the output interval.

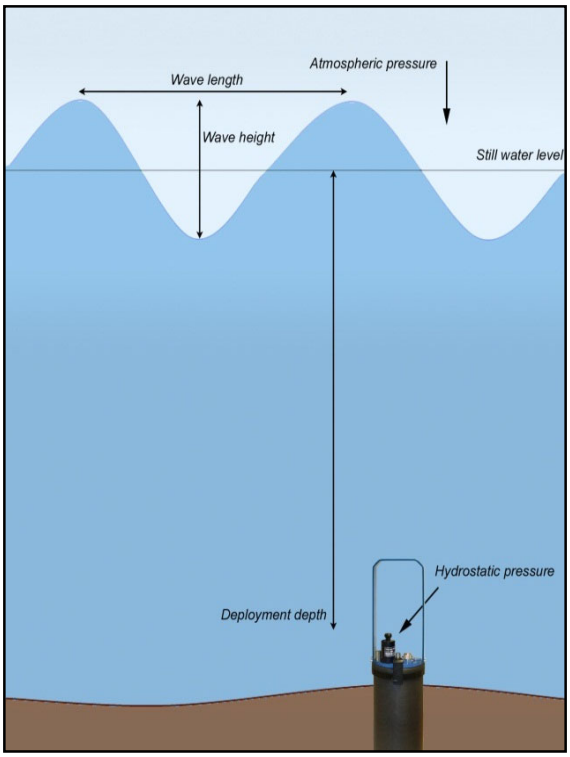


Figure 3-3 Illustration of the wave measurement situation.

P_{atm}(Atmospheric Pressure), and g(Local Gravity) are sensor properties that must be set by the user prior to deployment. The water density, ρ [3], is calculated from the measured water temperature and the salinity[4] of the water. Pressure is set to 0. The salinity is configured by the user. If you can find precise values for the input parameters at the deployment site, the sensor will calculate more accurately.
The Distance to seafloor is the distance between the sensor and the sea floor. This distance must be set by the user so that the sensor software selects the correct transfer function in the wave calculations.
If the distance is longer than 50m, you can still type 50 m since the measurement data will be processed using a “deep water”-transfer function,
If the wave measurements are calculated from 2048 samples, the software splits the sampled pressure points into two sets of 1024 samples in each set and calculates two wave spectrums.
Next, the two power spectrums are averaged and the sensor presents a single wave spectrum of 512 frequency components. This procedure increases the statistical reliability of the spectral estimates.

[3] Equation of state 1980 UNESCO polynomial implementation. Density calculated with pressure = 0.

[4] IEEE Journal of Oceanic Engineering, Vol. OE-5, No. 1, January 1980, page 14

CHAPTER 4 Configuration via Aanderaa Datalogger

4.1 Introduction

Pressure sensor 4117, ***Tide sensor 5217***, and ***Wave and Tide sensor 5218*** are equipped with a CAN bus interface supporting the ***Aanderaa AiCaP*** (Automated idle line CAN bus Protocol). This standard ensures easy plug and play connection to all Aanderaa ***SeaGuard/SeaGuardII*** and ***SmartGuard*** data loggers. The sensor needs to be in ***AiCaP*** mode before you connect it to the logger.

When connected to an ***AiCaP*** network the sensor will report its capabilities and specifications to the data logger at power up. The data logger assembles the information and provides the user with the possibility to configure the instrument based on the present node. The solution provides for great flexibility in both the use and design of the different elements within the system.

Note! This chapter describes the installation and the ***SeaGuardII/SmartGuard*** configuration of the ***Pressure sensor***, ***Tide sensor*** and ***Wave & Tide sensor***.

4.2 Installation of the Sensor to SmartGuard/SeaGuardII

This chapter only describes the software and configuration of sensors. For more information about the ***SmartGuard*** refer to TD 293 Operating manual for SmartGuard. For more information about the ***SeaGuardII*** refer to TD 303 Manual for SeaGuardII Platform.

4.2.1 Starting up with Real-Time collector

- Connect the sensor to your ***SeaGuardII*** using one of the sensor positions or using one of our sensor cables. For ***SmartGuard*** connect the sensor with cable to one of the ***AiCaP*** terminals.
- Connect the ***SeaGuardII/SmartGuard*** to your PC's USB port using a USB Cable.
- If the logger is connected via a RS-232/RS-422 real-time connection or via the LAN connection all configurations may also be done using this connection instead of the USB.
- Install and start the ***AADI Real-Time Collector*** software on your PC (provided on the memory stick delivered with the instrument/sensor) or from our website ***https://www.aanderaa.com/documents*** . For more information about the AADI Real-Time Collector, refer to TD 268 AADI Real-Time Collector Operating Manual
- Switch on the ***SeaGuardII/SmartGuard*** instrument by turning the power button to ***On.*** The startup procedure will take approximately 40 seconds.
- Please note that the ***SeaGuardII/SmartGuard*** needs a power reset after sensor is connected to find the sensor.
- To be able to control the Sensor via ***SeaGuardII*** or ***SmartGuard*** the sensor needs to be in ***AiCaP*** mode.

4.3 Installation of the Sensor on SeaGuardII

Note! Mount the sensor on the top-end plate in sensor position 5 if available, refer ***Figure 4-1***.

All sensor and sealing plugs except for the center position are secured by means of a setscrew in the side of the top end plate. Start by unscrewing the setscrew for the selected position. Pull out the sealing plug (or sensor) by inserting a screwdriver in the slot between the plug and the top end plate, see ***Figure 4-2.***

Make sure that the bore surface in the sensor mounting hole is clean and smooth and check that the O-rings on the sensor foot are free from dust and particles and greased with O-ring grease. Align the orientation pin in the sensor foot with the orientation hole in the top end plate and carefully insert the sensor.

Always replace O-rings when connecting a sensor or a sealing plug.

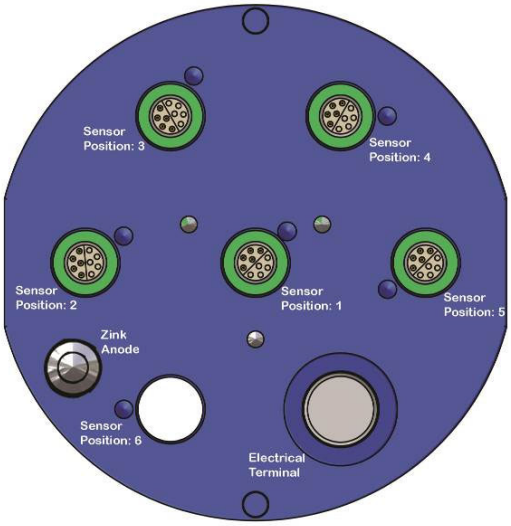


Figure 4-1: SeaGurdII Top End plate

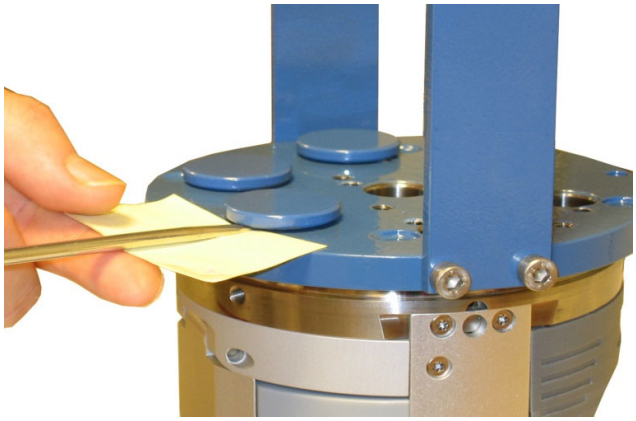


Figure 4-2: Removal of sealing plug

Warning: ***Please note that an AiCaP cable can be maximum 3 meters without termination. With termination the maximum length is hundreds of meters.***

4.4 Establish a new connection to SmartGuard/SeaGuardII

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.

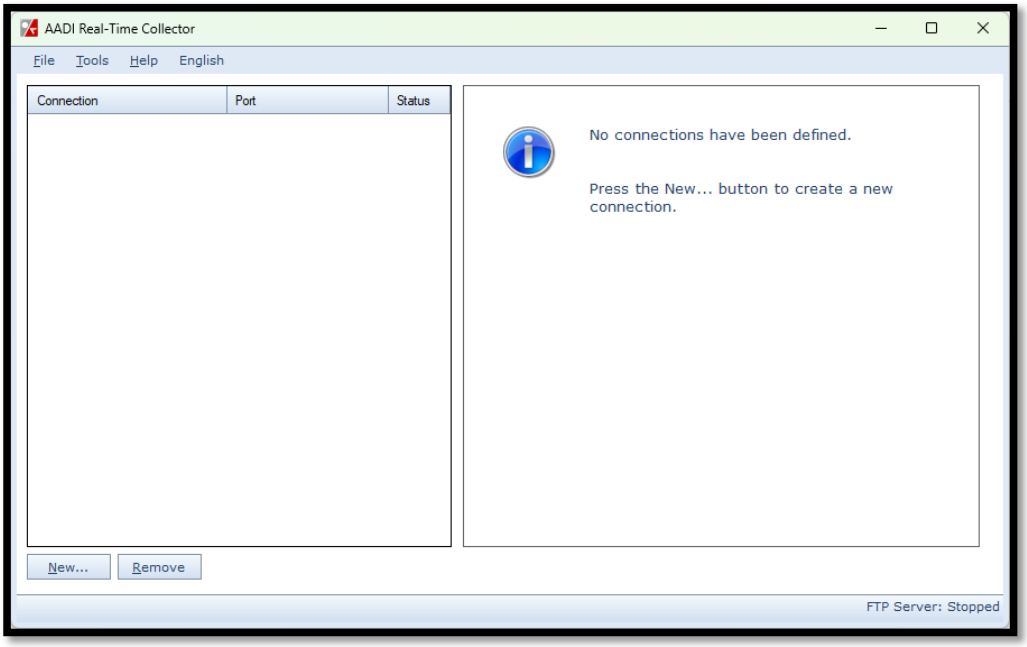


Figure 4-3: AADI Real-Time Collector start up menu

4.5 Windows Mobile Device Center(WMDC) replacement

Since the introduction of ***SmartGuard*** and ***SeaGuardII*** Aanderaa has used ***Windows Mobile Device Center*** for connection between logger and PC. This ***WMDC*** has been a part of Windows until Windows 10, and in June 2022 Microsoft removed the software from their download list. Based on this Aanderaa has developed a replacement for ***WMDC*** called ***USB Serial***.

This chapter describes the different alternatives for how to configure a ***SeaGuardII/SmartGuard*** via our ***AADI Real-Time Collector*** software either using the old ***WMDC*** if already installed on your PC or using ***USB Serial*** if using a newer version of Windows.

You may download the latest version of our software image from our webpage https://www.aanderaa.com/ select ***Support*** and then ***Document & Software*** or use the link below.

AADI- Real-Time Collector:
https://aanderaa1.xyleminc.com/AADI%20Real-Time%20Collector/

SeaGuardII Image:
https://www.aanderaa.com/media/software/seaguard-ii-latest-firmware

SmartGuard Image:
https://www.aanderaa.com/media/software/smartguard-latest-firmware

4.6 Installation using a USB connection

The most used connection for configuration of ***SmartGuard/SeaGuardII*** is via the USB port.

For the older version of Windows, before Win10 you may use the ***Windows Mobile Device Center***. This software will work fine on Win 10 and 11 as well if it was installed before you upgraded to the newer version.

If you don't have ***Windows Mobile Device Center*** installed, we recommend using the ***USB Serial*** connection described in ***chapter 4.6.2.*** To use this connection, you need ***AADI Real-Time Collector Version 7.0.11.0*** or newer and an updated ***SmartGuard/SeaGuardII*** image. For ***SmartGuard/SeaGuardII*** image upgrade see manual for each logger or ***chapter 4.5***.

4.6.1 Connection to USB ActiveSync

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:

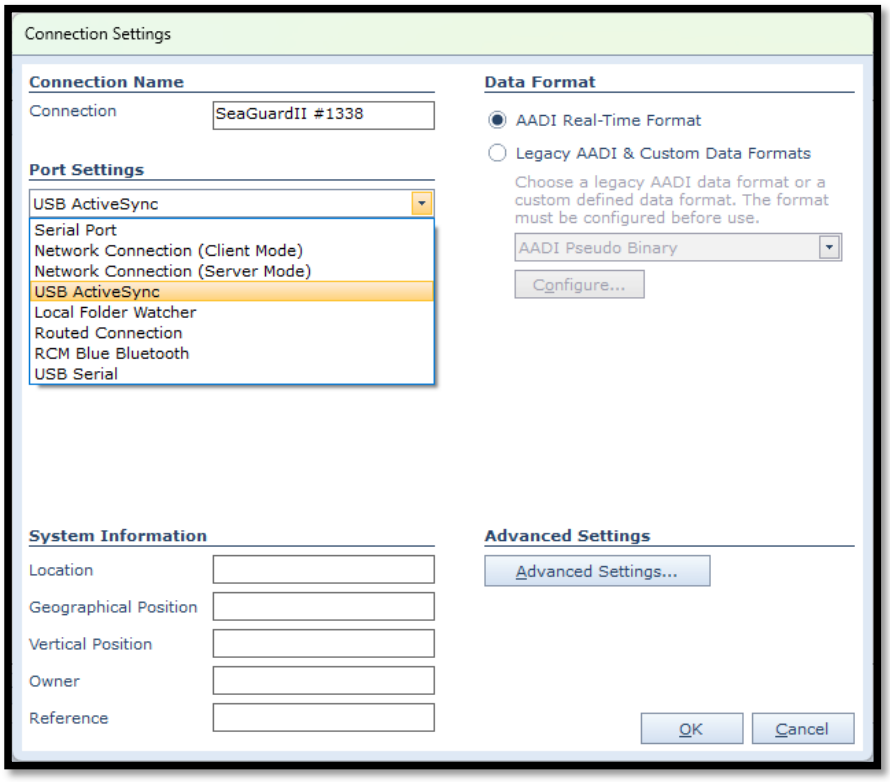


Figure 4-4: AADI Real-Time Collector connection settings using USB

In the ***Connection Name*** box write a name specific for this connection (e.g. SmartGuard/SeaGuardII and #serial number).

Select ***USB ActiveSync*** from the ***Port Settings*** drop down menu.

Select ***Serial Port*** if using the serial real-time connection or ***Network Connection*** if using LAN.

Then click on the ***Advanced Settings*** on the lower right side.

If you want to return to this menu later please close the port and then press ***Settings..*** in the main menu.

Figure 4-5: Windows Mobile Device Center

If your ***SmartGuard*** has previosly been used with ***USB serial*** you need to change the usbfunction setting. Create a text file with name ***StartupConfig.txt*** with content ***usbfunction= activesync*** and put it on the SD-card. Restart the ***SmartGuard*** with this SD-card installed. ***Windows Mobile Device Center*** starts up automaticly if it's installed on your computer. This alternative for switching between ***USB Active Sync*** and ***USB Serial*** is only for ***SmartGuard*** not for ***SeaGuarII***.

4.6.2 Connection to USB Serial Port

To use this connection, you need ***AADI Real-Time Collector Version 7.0.11.0*** or newer, ***SmartGuard image 2.1.216*** or newer, ***SeaGuardII image 3.0.224*** or newer.

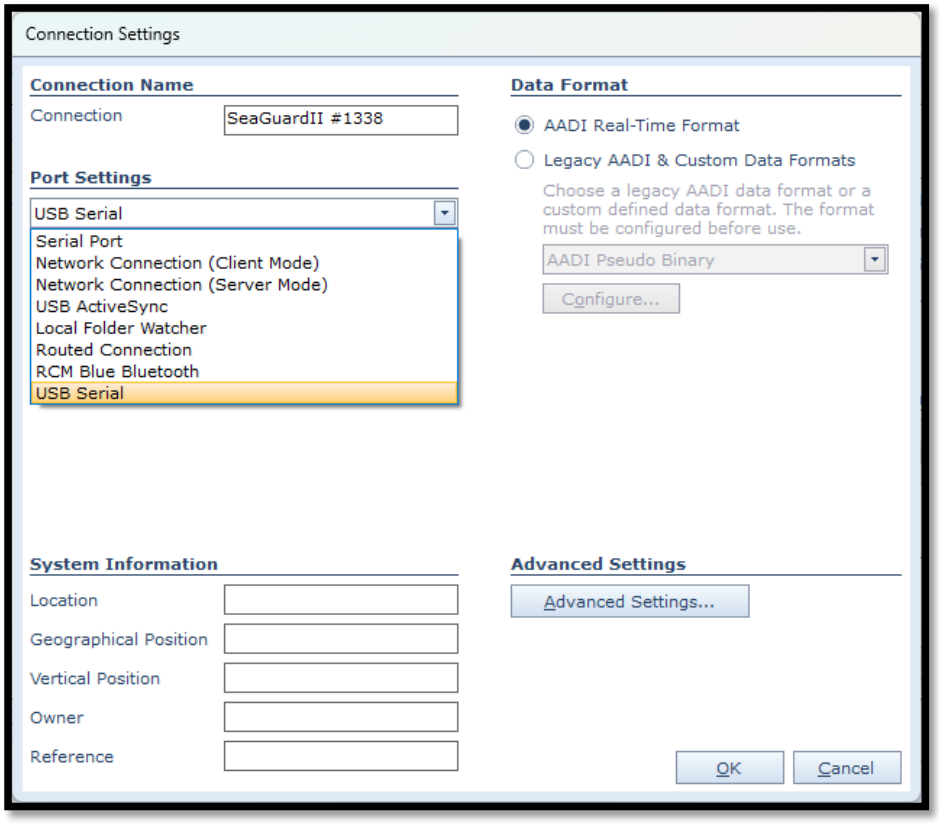


Figure 4-6: Connection Settings

In the ***Connection Name*** box write a name specific for this connection (e.g. SmartGuard/SeaGuardII and # serial number).

Select ***USB Serial*** from the ***Port Settings*** drop down menu.

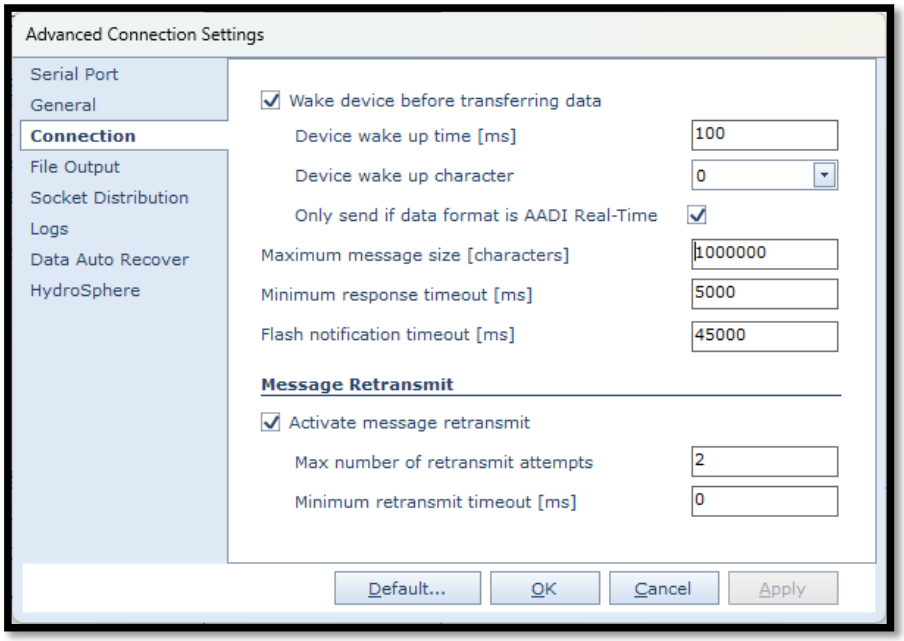
Select ***Serial Port*** if using the serial real-time connection or ***Network Connection*** if using LAN.

Then click on the ***Advanced Settings*** on the lower right side.

If this ***SmartGuard/SeaGuardII*** has previosly been used with ***USB ActiveSync*** you need to change the usbfunction setting. Create a text file with name ***StartupConfig.txt*** with content ***usbfunction=virtualcomport*** and put it on the SD-card. Restart the ***SmartGuard*** with this SD-card installed.
If you want to return to this menu later please close the port and then press ***Settings..*** in the main menu.

4.7 Advanced Connection Settings

In the ***Advanced Connection Settings*** window select ***Connection*** from the list on the left side.



AADI Real-Time Collector uses a default setting that fits most Smart Sensors. However, some sensors like DCPS may output a large amount of data and might have longer response time (depending on the configuration) than other smart sensors.

This example shows default settings normally used with standard Smart Sensors.

Figure 4-7: Advanced connection setting

After updating the ***Advanced Connection Settings***, click on ***Apply*** and ***OK*** and then ***OK*** to go back to the start screen.

The ***Advanced Settings*** are only accessible to change when the port is closed. If the settings are grey, then you first need to close the port.

4.8 Connection List

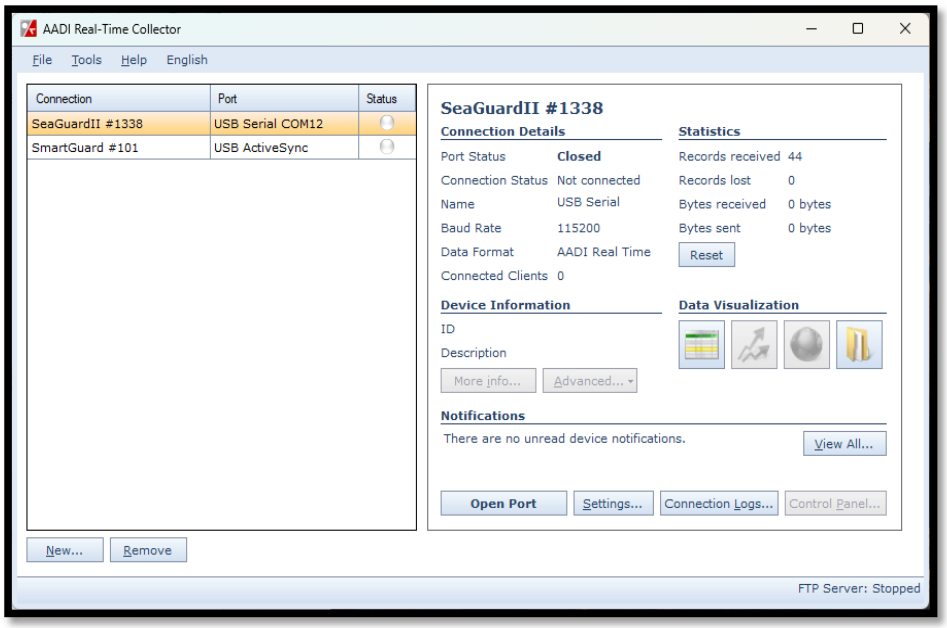


Figure 4-8: Connection list

The new connection is now shown in the ***AADI Real-Time Collector*** connection list. Choose the new connection and click on the ***Open Port*** button.
The connection list might contain different connections to other sensors as well. Then highlight your connection to proceed.
NOTE: This procedure only needs to be done once. This connection will be in the connection list at the next start-up.

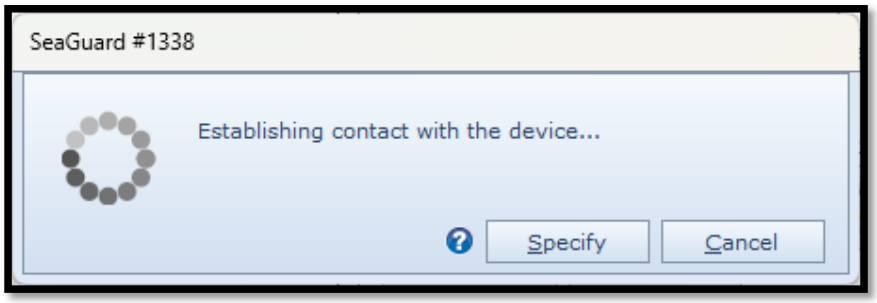


Figure 4-9: Establishing contact

A new window with a turning wheele will then show up waiting for contact. This might take a couple of seconds depending on the instrument configuration.

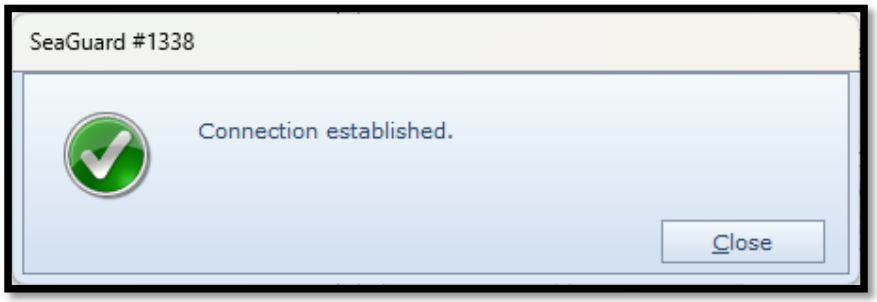
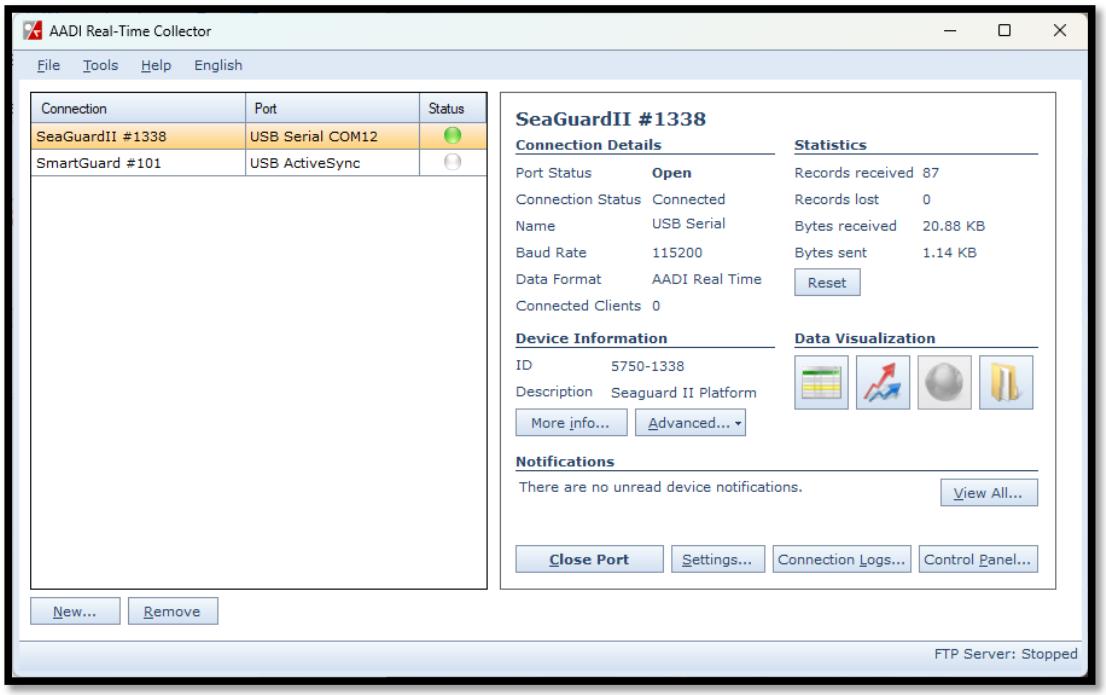


Figure 4-10: Connection established

When connection is established the status light will turn green.

If you are not able to open the port check that a com-port is connected to the USB Serial.



The selected connection has now changed to green status. Press ***Control Panel*** to continue.

Figure 4-11: AADI Real-Time Collector main menu

4.9 Control Panel

In the ***Control Panel*** window, you will find four tabs, ***Recorder Panel, Device Configuration, Device Layout*** and ***System Status.*** Please note that these tabs are controlling the ***SmartGuard/SeaGuardII***, and the sensor is controlled by the ***SmartGuard/SeaGuardII*** together with all other sensors and equipment connected to the same logger. Under the ***Recorder Panel*** you can start and stop recordings. If the recorder is running, you have only access to read the instrument and sensor configuration. If you want to make changes in sensor configuration first click on the ***Stop Recorder***. In ***Device Configuration*** you will be able to perform all configurations on the AiCaP sensors, ***SmartGuard/SeaGuardII*** and all other connected sensors. ***Device Layout*** is used to configure input from Non-Smart Sensors such as analog sensors and to configure output from the ***SmartGuard/SeaGuardII***. All AiCaP sensors are smart sensors, and you don't need to configure this under ***Device Layout***. ***System Status*** gives information about ***SmartGuard/SeaGuardII*** status including battery voltage, SD card status and Memory used. For more information about ***Device Layout*** and ***System Status*** please refer to TD293 Manual for SmartGuard/ TD303 Manual for SeaGuardII Platform.

4.10 Recorder Panel

In the ***Recorder Panel*** you will find 3 groups that are all controlled by the ***SmartGuard/ SeaGuardII***. Each group might have a different recording interval. Each group can contain different kinds of sensors with different outputs. Also 3rd party sensors connected to ***SmartGuard/SeaGuardII*** can be controlled by the logger. Each group can individually be either set to ***Start Now*** or ***Start Delayed***.

To check in which group your sensor is placed or move it to another group select the ***Device Configuration*** folder and then ***Get Current Configuration***. Select ***Multi Group Recorder*** under ***Device Nodes*** and then check ***Add/Remove Sensors*** for each group. See TD293 SmartGuard Manual/ TD303 Manual for SeaGuardII Platform for more information about ***Multi Group Recorder*** and how to place sensors in each group. The ***Fixed Interval*** or recording interval can be configured individual for each group either in ***Recorder Panel*** or in the ***Multi Group Recorder*** menu.

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

Depending on the configuration the sensor needs a given number of samples before ***Tide and Wave*** can be presented. The Recording Interval might be shorter than both the ***Tide integration time*** and the ***Wave sample number***.

For the first recording interval before it has collected enough samples it will not output these parameters. After this it will use the last needed number of samples to do a new calculation at every recording time

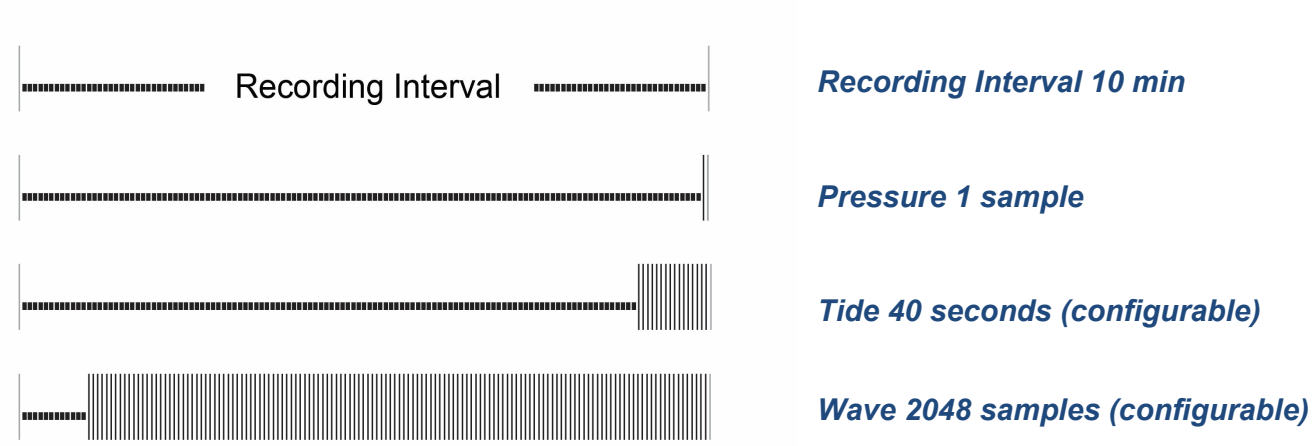


Figure 4-12: Typical Recording Interval Pressure Tide and Wave

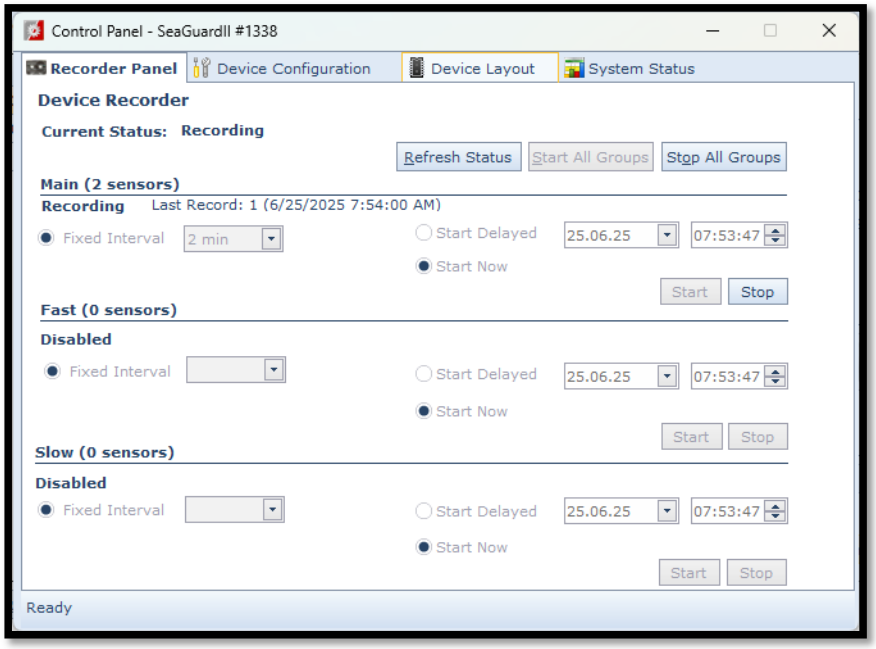


Figure 4-13: Recorder panel

Select ***Recorder Panel.***

Note! *The configuration cannot be changed during a recording session.*

If the instrument is recording, under ***Recorder Panel,*** press ***"Stop All Groups".***

Each recording group may be set to either ***Start Now*** or ***Start Delayed.***
Please note that the recorder panel controls the ***SmartGuard/SeaGuardII*** recording, and each sensor connected is controlled by the ***SmartGuard/SeaGuardII***.

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4.11 Changing Values

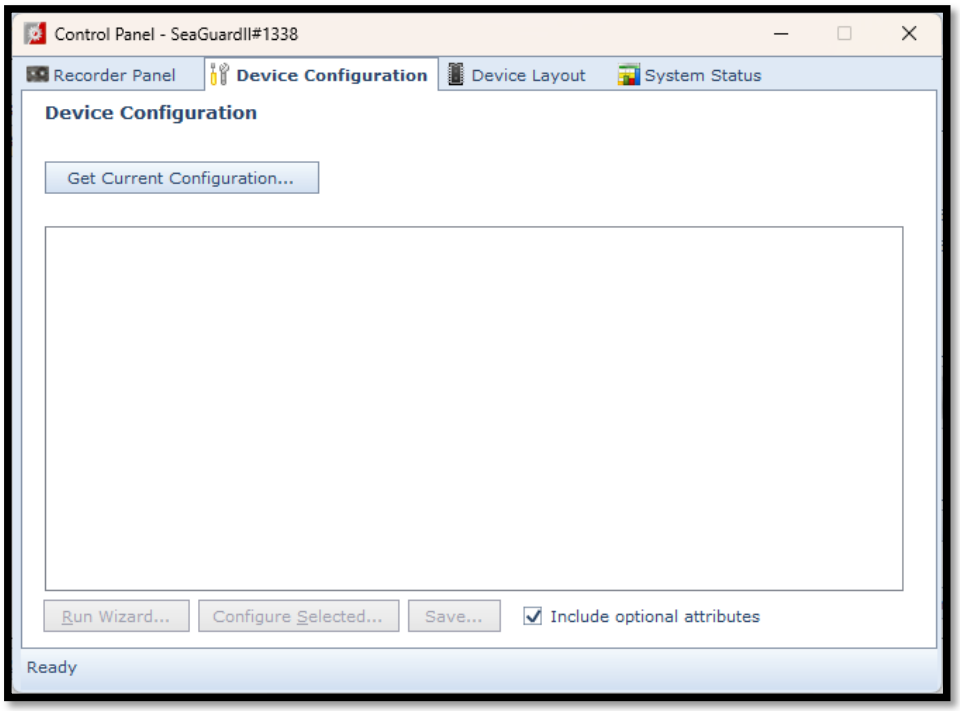


Figure 4-14: Change Value first step

In the following chapters we will learn more about the sensor configuration. Sometimes you will need to change the value of a property.

In the ***Device Configuration*** folder press ***Get Current Configuration.***

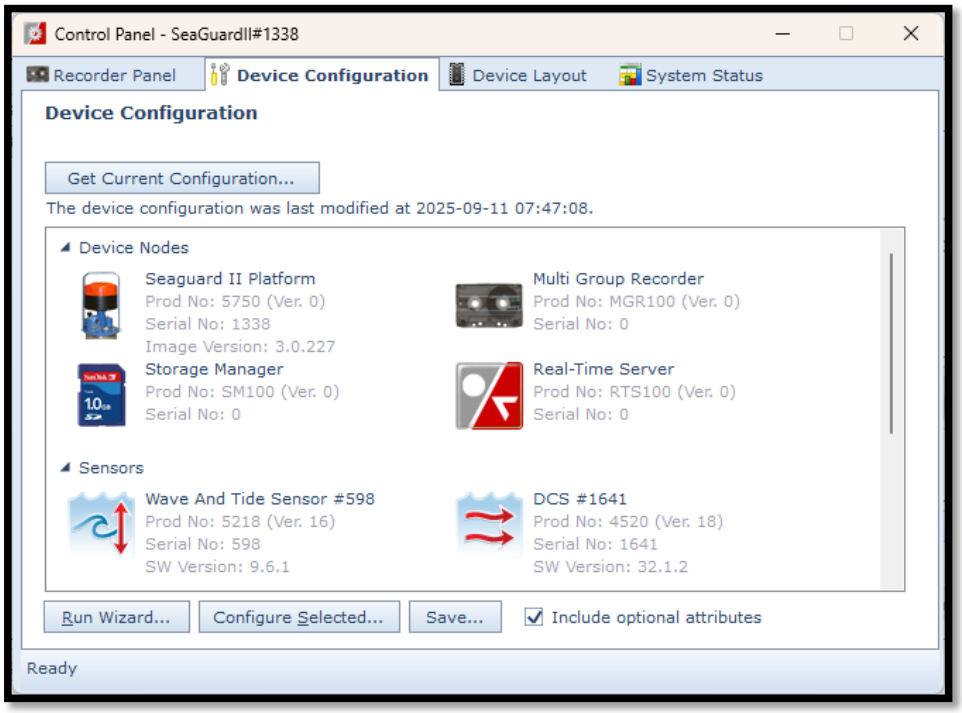


Figure 4-15: Change Value second step

First select the tab where the property is located. In this example: ***Device Configuration***.

Select by double clicking on the ***Pressure, Tide*** or ***Wave & Tide Sensor*** icon.

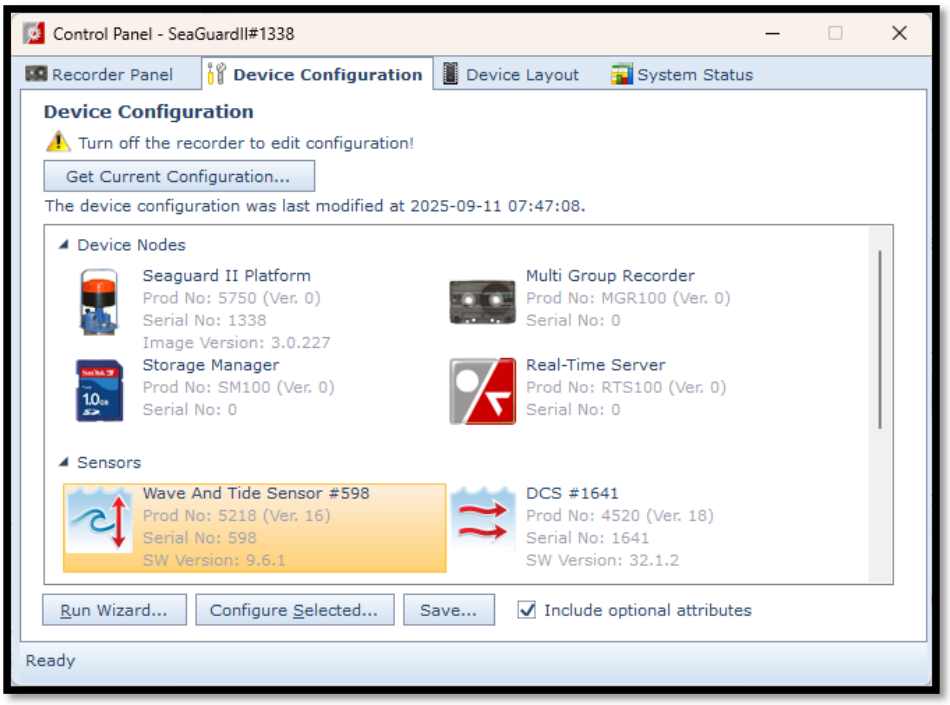


Figure 4-16: Warning if recorder are running

If a warning ***"Turn off the recorder to edit configuration!"*** under ***Device Configuration*** pop-up you need to stop the recorder in ***Recorder Panel*** to be able to change properties.

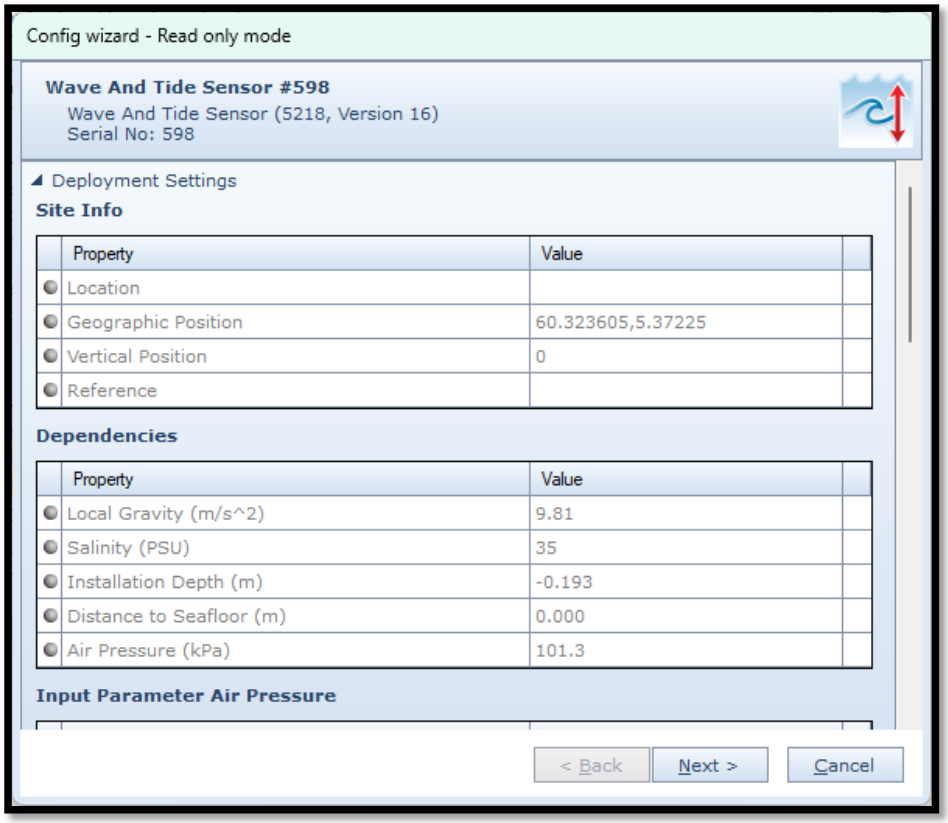
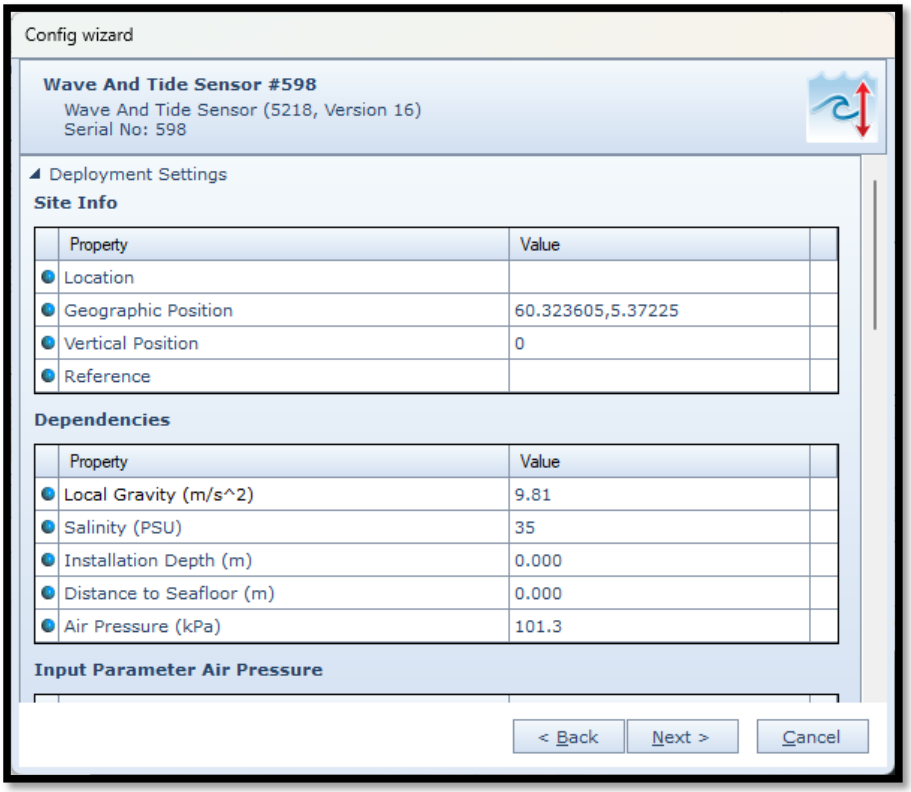


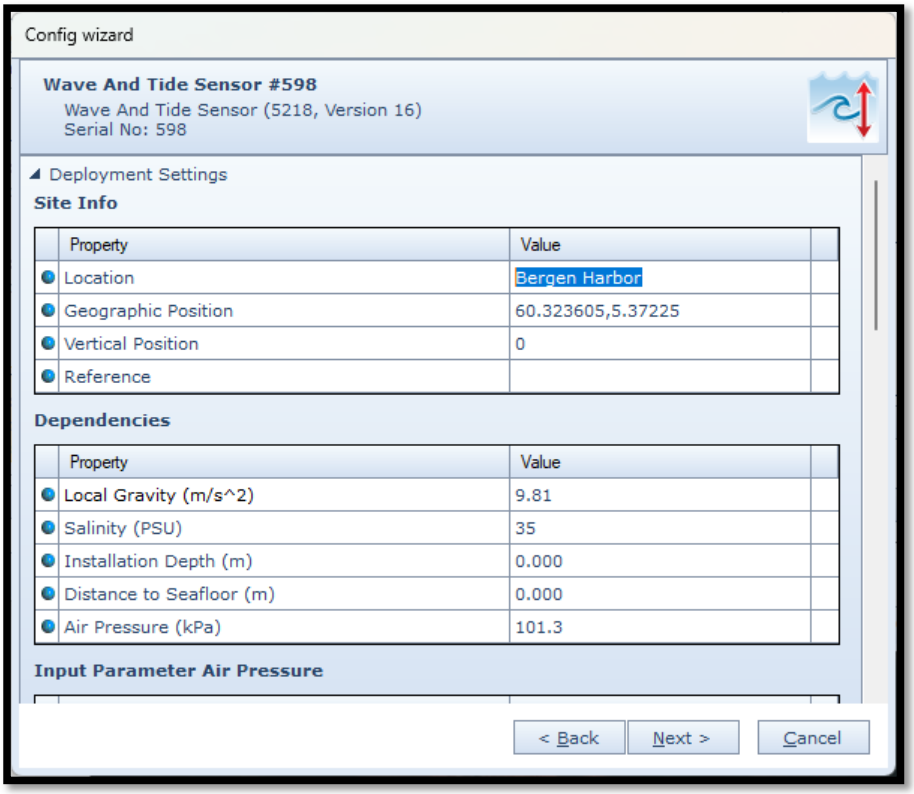
Figure 4-17: Properties are Read Only

If properties are grey you will need to press the ***Get Current Configuration*** in ***Device Configuration*** to be able to change any properties.



Then select the property you want to change by clicking the value box.

Figure 4-18 Select property



To change value, enter the new text or number in the value box and press ***Next.***

If the property you want to change is grey and impossible to update this is most likely due to a running recorder, ***Stop Recorder*** in ***Recorder Panel***, or an incomplete loading of sensor configuration, press ***Get Current Configuration*** in ***Device Configuration*** menu.

Figure 4-19: Insert new value

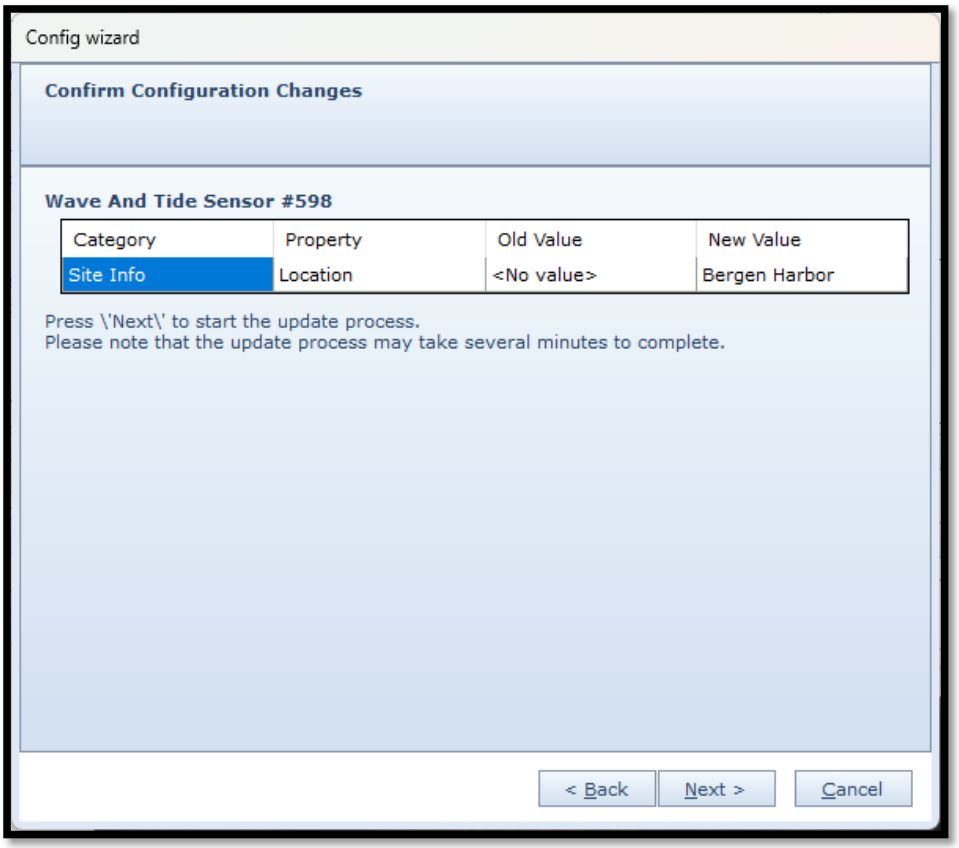


Figure 4-20 Confirm Configuration Changes

Some boxes are text and others are numbers. Some of the boxes only accept a specific set of options while others accept free text or any numbers. Check each property in ***chapter 2.15*** regarding accepted content for each property.

In the next window called ***Confirm Configuration Changes*** you will find a list of all changed properties with old and new values.

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

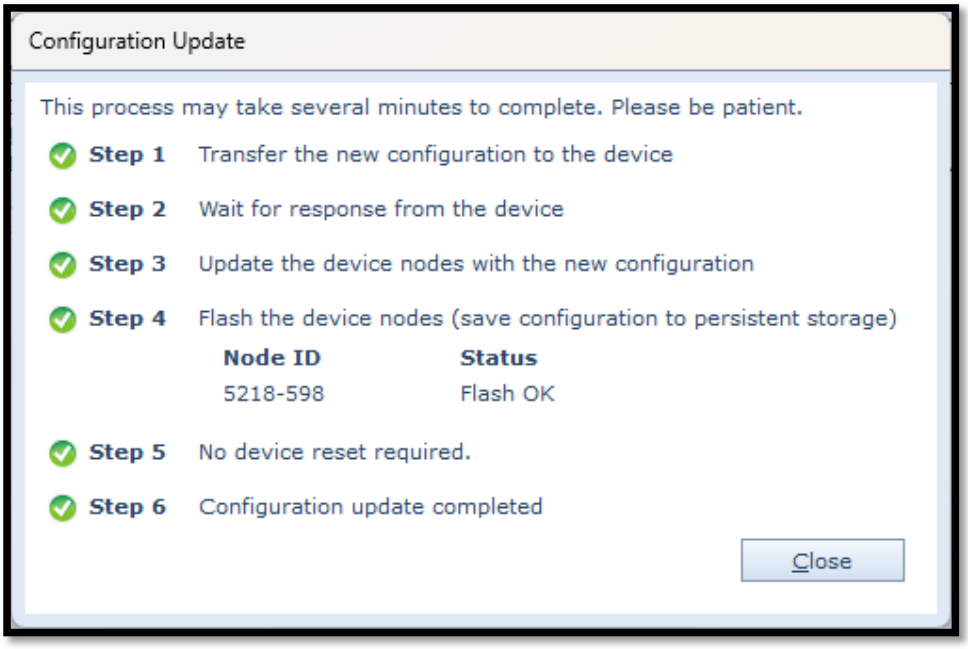
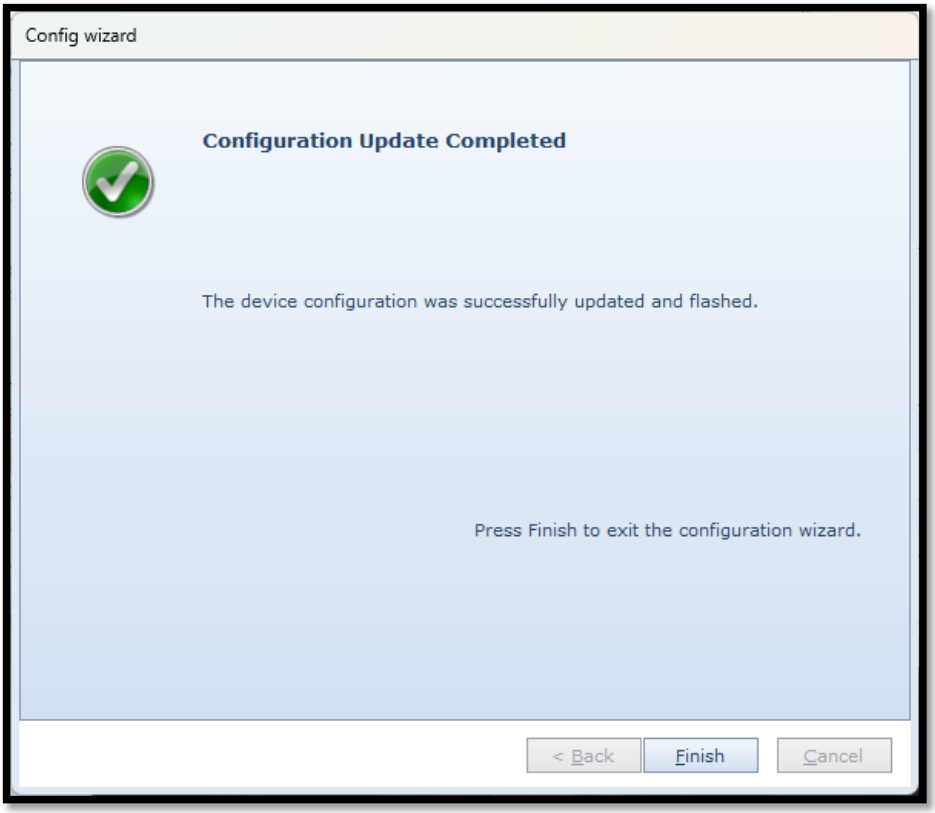


Figure 4-21 Configuration Update

An automatic process will start with 6 steps transferring and storing the new settings in the sensor Flash.

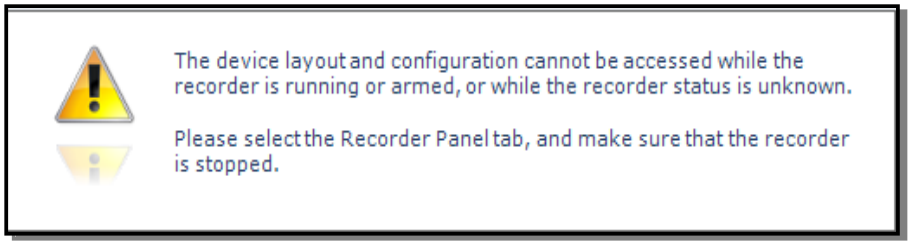
If necessary, a reset will be executed.

Do not close or disconnect before the entire process is completed.



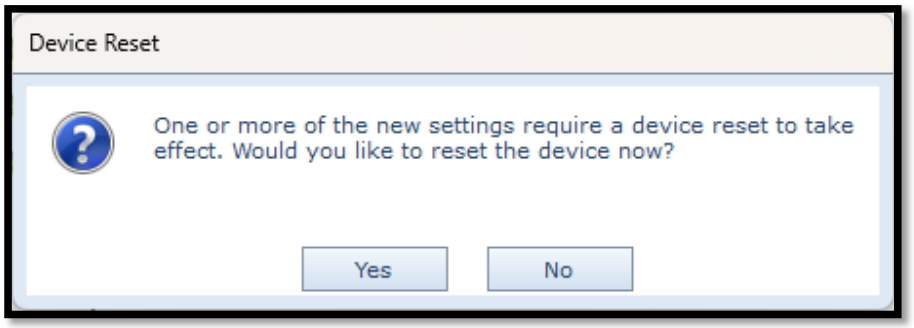
When the updating process is finished a confirmation will show up. Press ***Finish*** to continue.

Figure 4-22 Configuration Update Completed



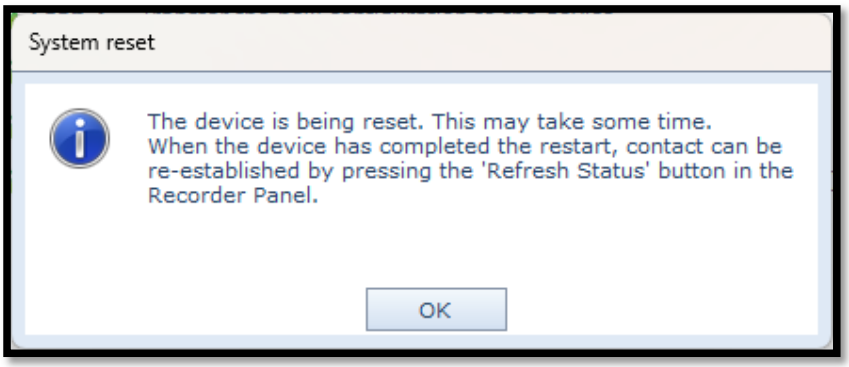
After ***Finish*** the following warning may show up. Then you need to open the ***Recorder Panel*** and select ***Stop*** or ***Stop All Groups*** and/or press the ***Refresh Status*** button.

Figure 4-23: Warning after changing values



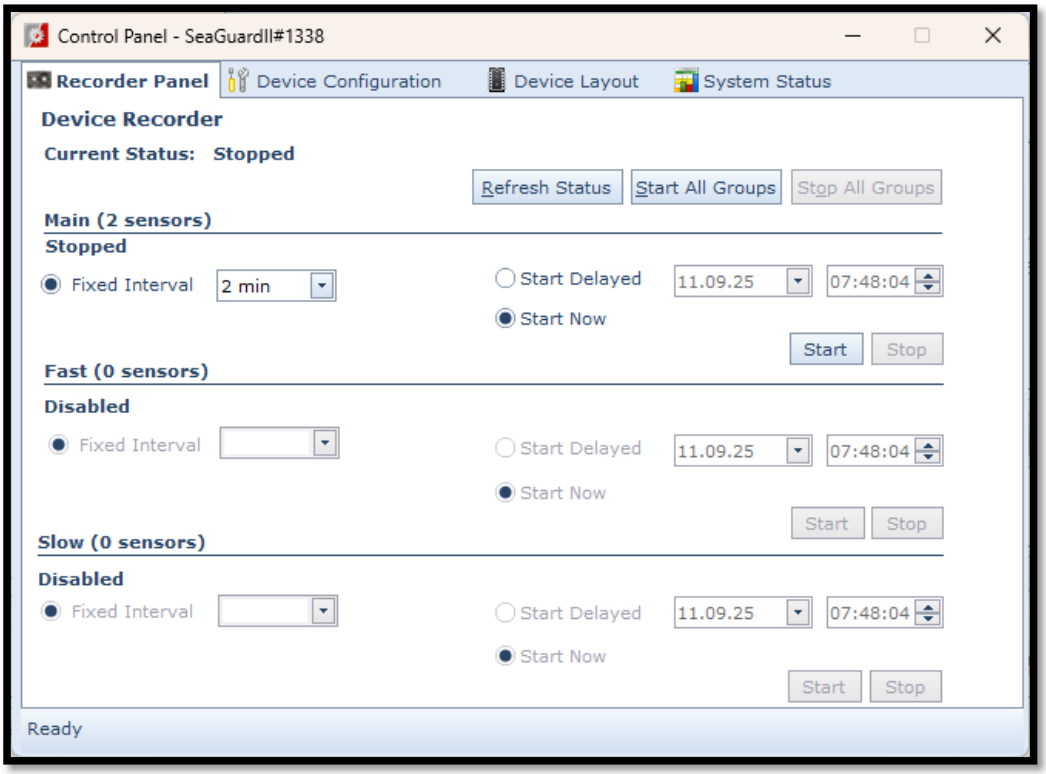
Accept the ***Device Reset*** by pressing ***Yes***.

Figure 4-24: Device Reset



Accept the ***System Reset*** by pressing ***OK***.

Figure 4-25: System Reset



Select ***Refresh Status*** to complete.

Figure 4-26: Refresh Status

4.12 Device Configuration

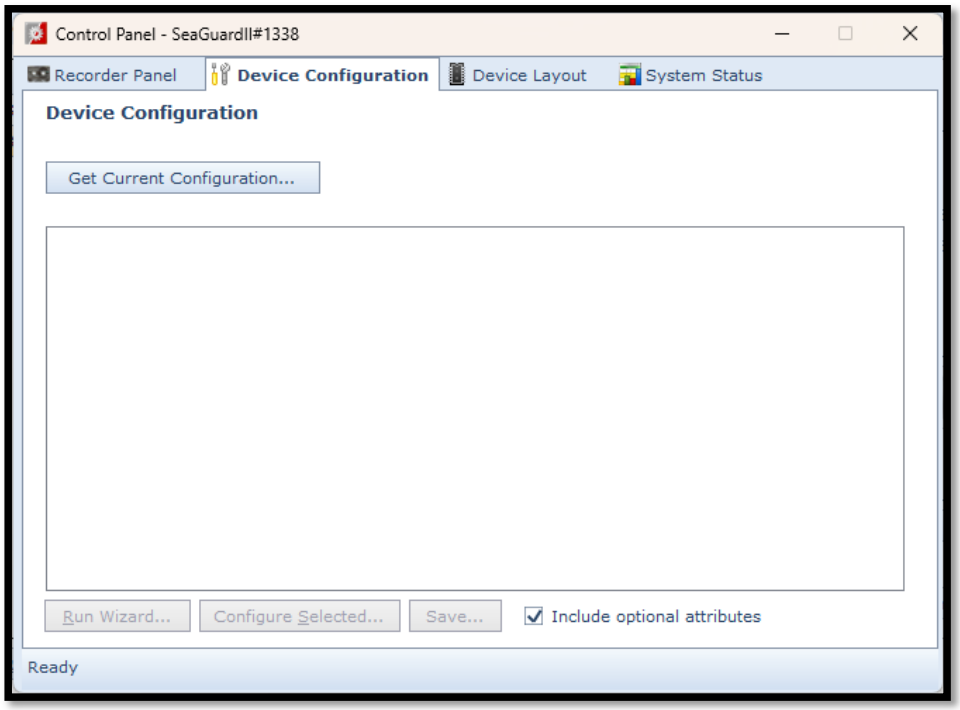


Figure 4-27: Device configuration without sensors

Click on the ***Device Configuration*** tab in the top row of the ***Control Panel*** to access the sensor property configuration.

Sensor might show up in the list if the sensor is recognized.

If not click on ***Get Current Configuration...*** to receive the current configuration from the sensor.

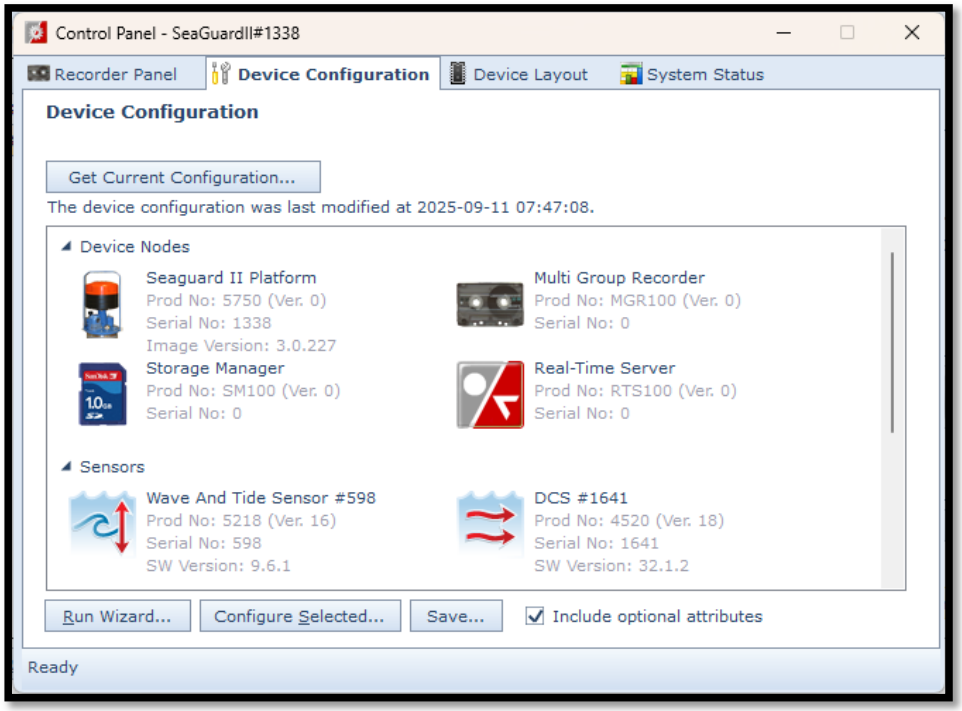


Figure 4-28: Device Configuration with sensors

Device Nodes and Sensors are available via the logger.

To select a sensor double-click on the sensor icon

If your sensor does not show up, make sure that sensor is set to AiCaP mode and that a power reset is done after connecting the sensor.

If you still can't find the sensor, check that the AiCaP termination is as recommended.

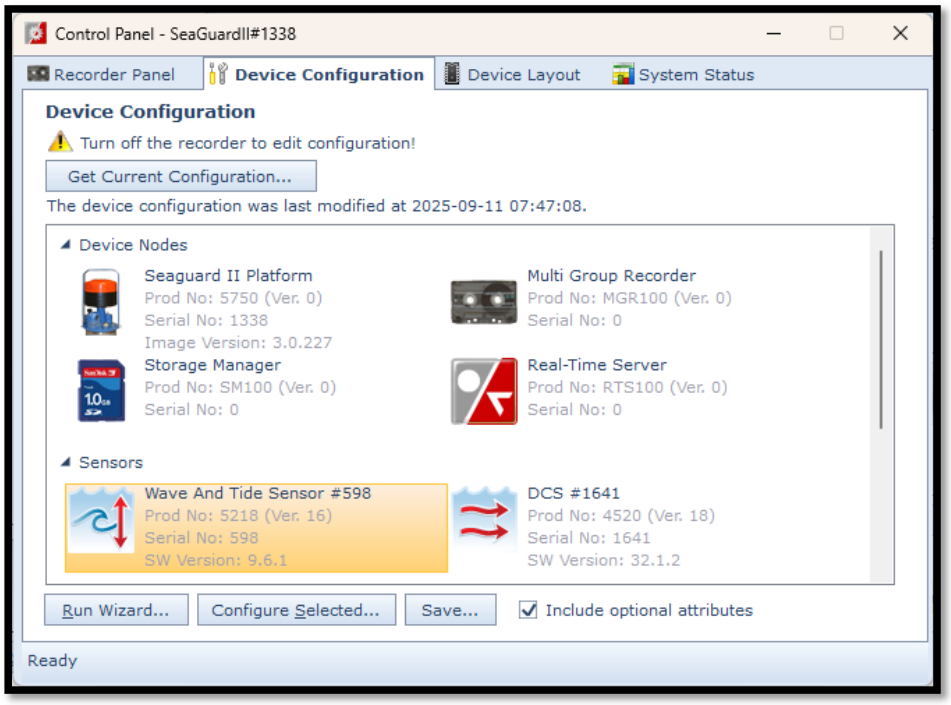


Figure 4-29: Device Configuration with recorder warning

If the recorder is running as shown with warning sign on top left end side, you will not be able to change any properties, but they will still be able to read.

If properties are grey (read only) you need to press ***Get Current Configuration*** under ***Device Configuration*** to reload the configuration.

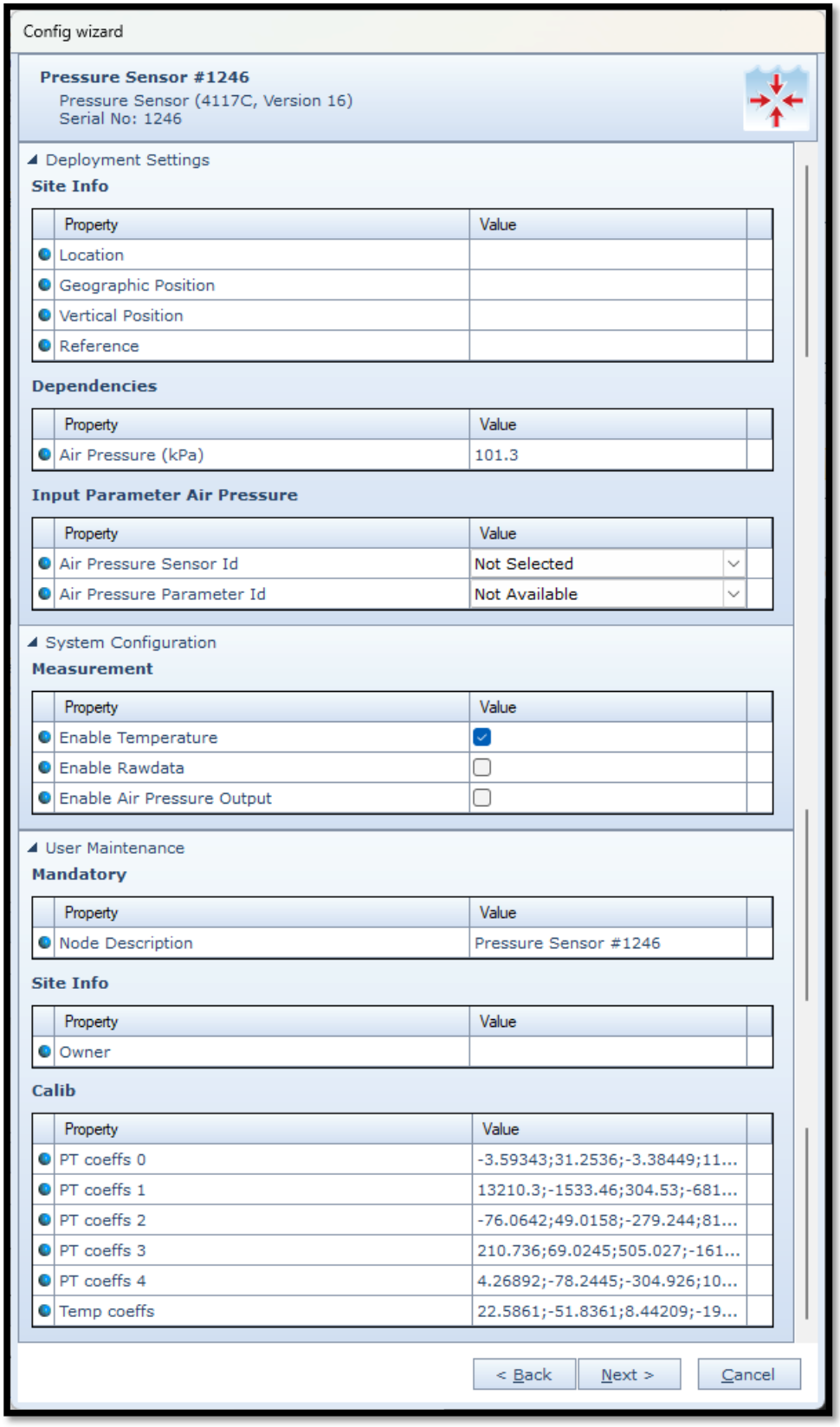
4.13 Sensor Configuration

In the next chapters we will show a typical ***Device Configuration*** menu for each of the three sensor versions. The first 3 chapters show typical configuration set-up for each sensor when connected to a SeaGuardII/SmartGuard with sensor in AiCaP mode. Some properties are not available for ***Pressure sensor 4117/4117R*** and/or ***Tide Sensor 5217/5217R*** and some are only available for ***Wave & Tide Sensor 5218/5218R***. Your view may differ from the screenshots due to different modes or configuration.

You may now proceed to the chapter covering your sensor type.

Please note that you need a power reset after connecting the sensor.

4.14 Pressure Sensor 4117/4117R



Pressure Sensor 4117/4117R consists of three main groups with sub-groups.

Deployment Settings with 3 sub-groups.

System Configuration with 1 sub-group

User Maintenance with 3 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of thr header name.

Each property is described in the following chapters under main menu and sub menus.

Figure 4-30: Pressure Sensor 4117/4117R

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4.15 Tide Sensor 5217/5217R

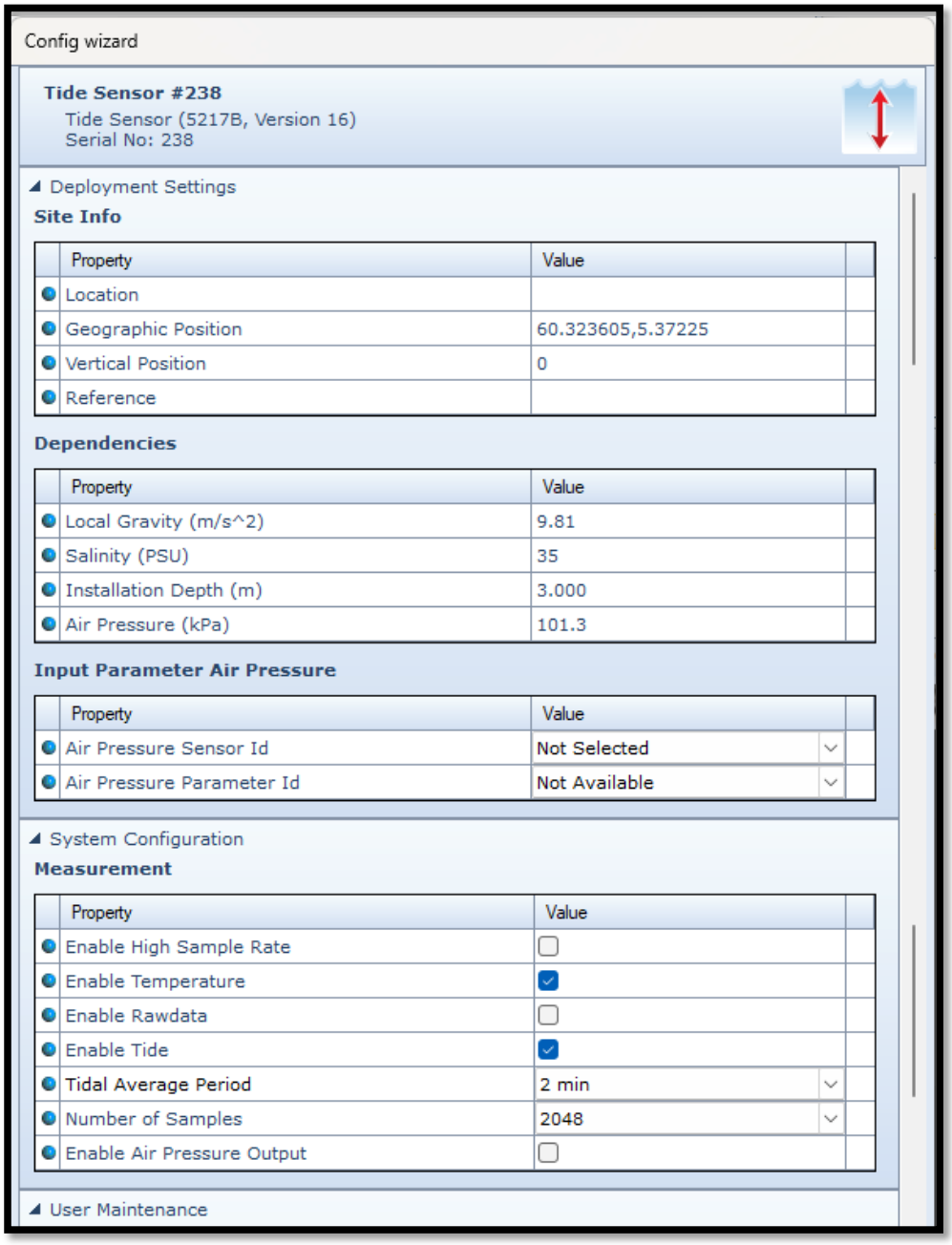

Figure 4-31: Tide Sensor 5217/5217R first part

Tide Sensor 5217/5217R consists of three main groups with sub-groups.

Deployment Settings with 3 sub-groups.

System Configuration with 1 sub-group

User Maintenance with 4 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of thr header name.

User Maintenance is shown in the next figure.

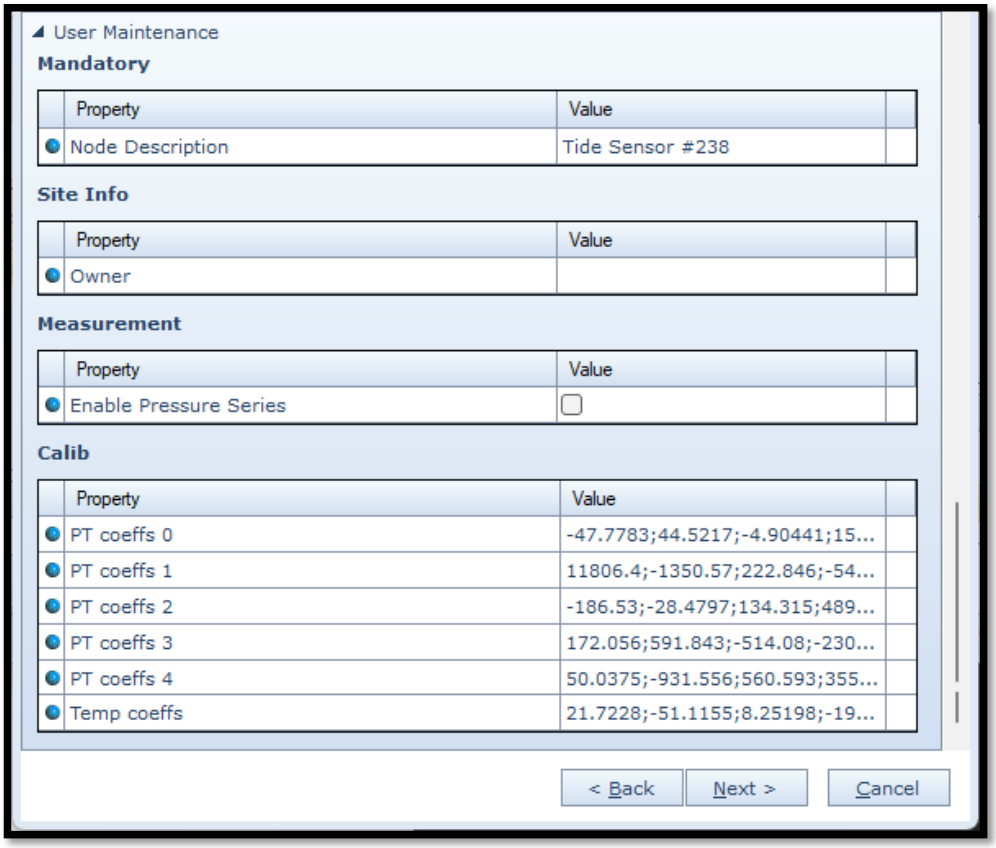

Figure 4-32: Tide Sensor 5217/5217R second part

User Maintenance with 4 sub-groups.

Each property is described in the following chapters under main menu and sub menus.

4.16 Wave And Tide Sensor 5218/5218R

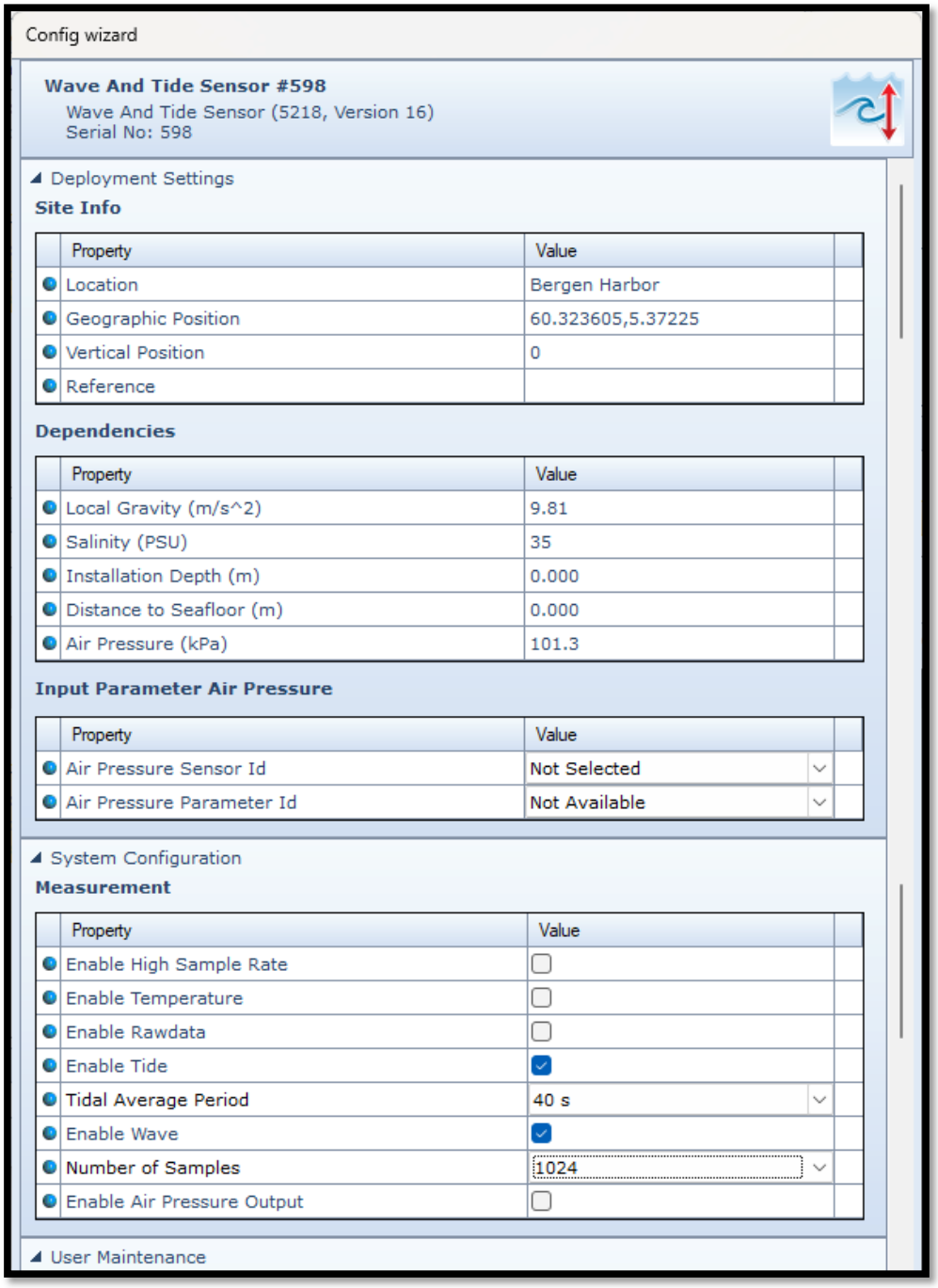

Figure 4-33: Wave And Tide Sensor 5218/5218R first part

Wave And Tide Sensor 5218/5218R consists of three main groups with sub-groups.

Deployment Settings with 3 sub-groups.

System Configuration with 1 sub-group

User Maintenance with 4 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of thr header name.

User Maintenance is shown in the next figure.

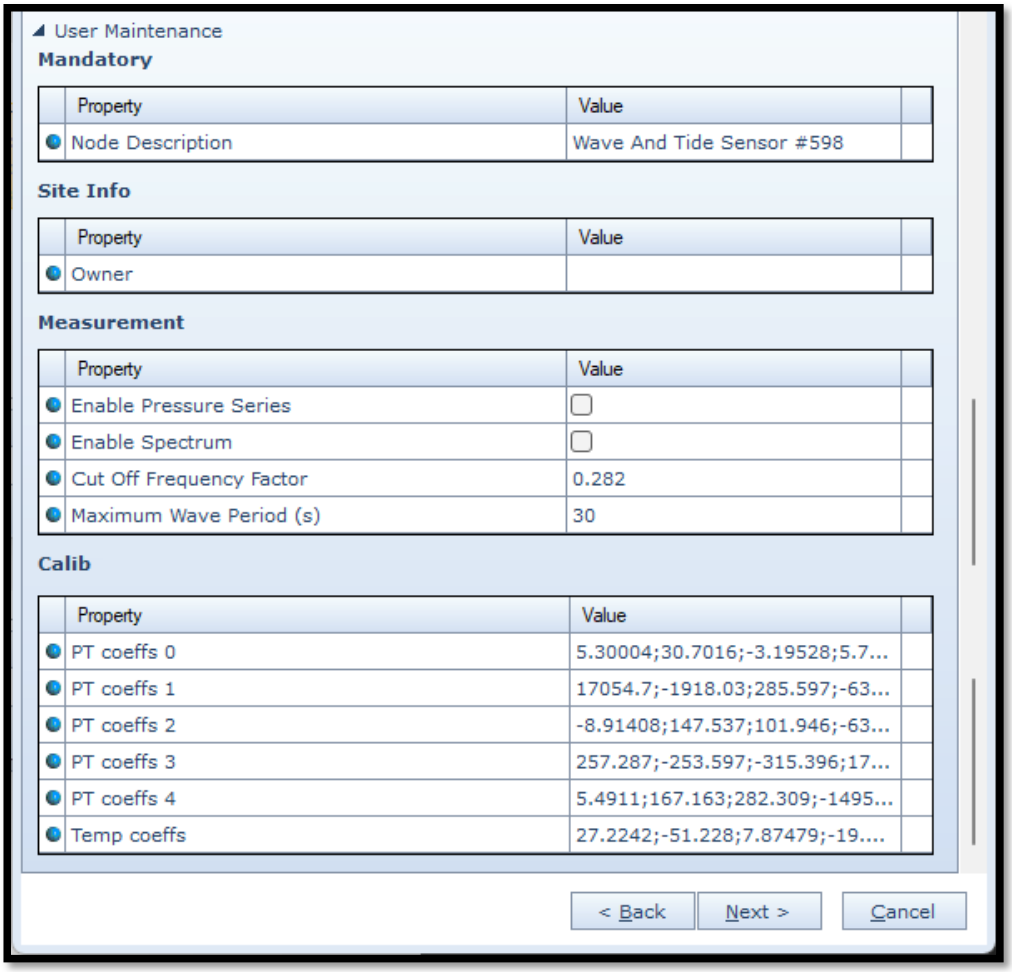

Figure 4-34: Wave And Tide Sensor 5218/5218R second part

User Maintenance with 4 sub-groups.

Each property is described in the following chapters under main menu and sub menus.

4.17 Deployment Settings

The ***Deployment Settings*** are separated into 3 groups. The settings in these groups are mainly used as information or values used in internal calculations.

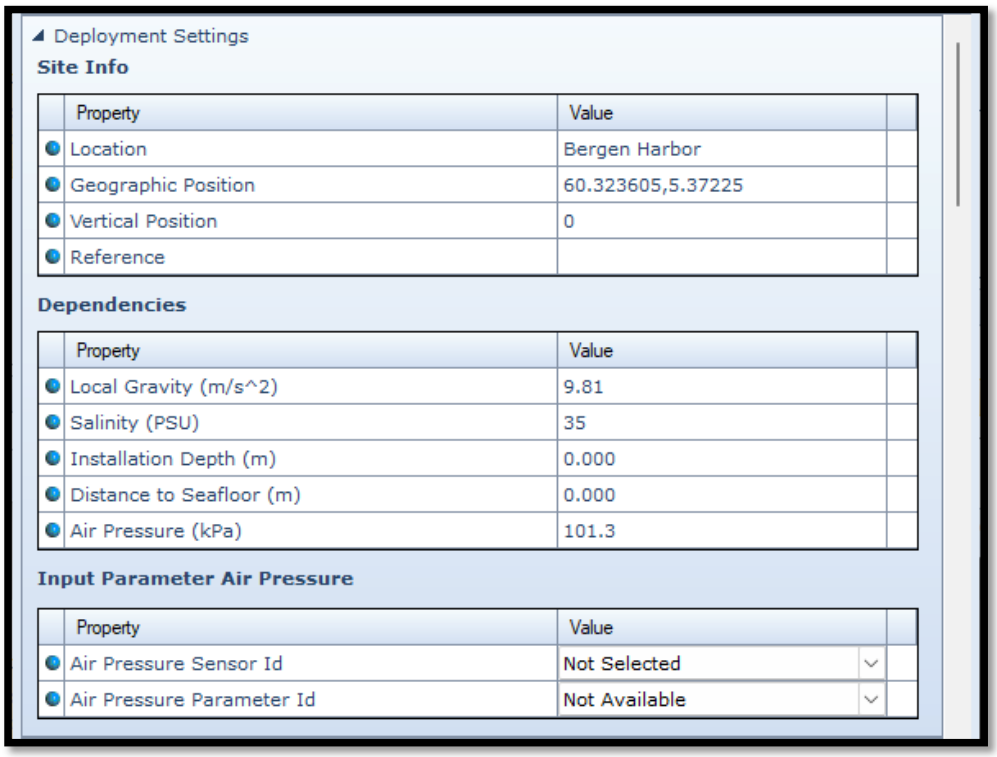

Figure 4-35: Sensor Deployment Settings

An input parameter will be used in calculation if available and selected.

NOTE!
Do not use the sensor itself as an Input Parameter Sensor ID even if it is available in the list.

See the following chapters for more information on each property.

4.17.1 Site Info

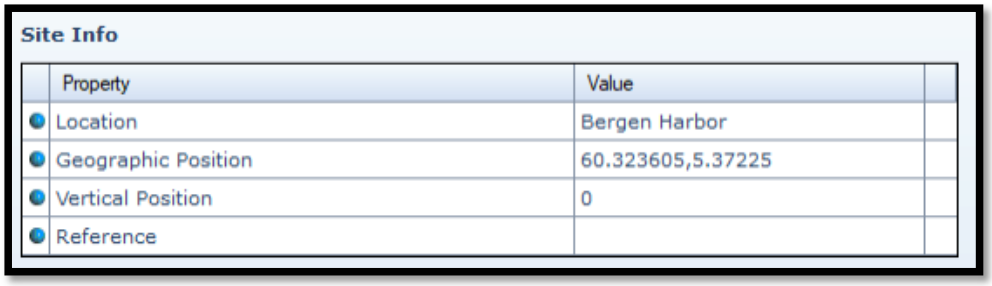

Figure 4-36: Site Info

Site Info contains four properties:

- ***Location:*** Name of location where the instrument is deployed.
- ***Geographic Position:*** GPS potion 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 where you can enter and store information about the deployment. This can be useful information to store together with a data set. These settings are not used in calculation. ***Geographical Position*** is used to give the map coordinates unless a GPS input is connected to the logger.

4.17.2 Dependencies

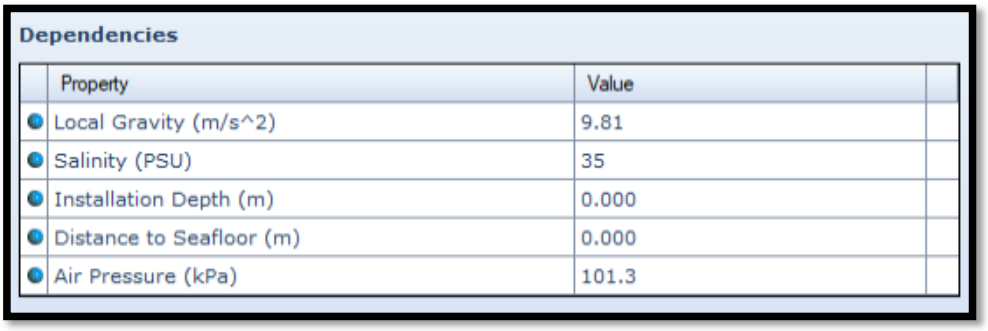

Figure 4-37: Dependencies

Dependencies as shown in **Figure 4-37** are settings used in internal calculation.

The first 4 properties are not available for ***Pressure sensor 4117/4117R.***

Distance to Seafloor is only available for ***Wave & Tide Sensor 5218/5218R.***

Local Gravity Constant (m/s^2) is the local gravity constant in ***m/s^2*** used to calculate depth and Cut-off frequency. The default value is ***9.81m/s^2***. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Salinity (PSU) is the Salinity in ***PSU*** used for calculation of density and depth. The value can be altered while sensor is running to compensate for variable salinity. Default value is set to ***35PSU.*** Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Installation Depth (m) in meter relative to chosen datum, default set to 0 = instrument referred. If the offset between the sensor installation and the desired local datum is known, the property ***Installation Depth*** can be used for referencing the ***Tide Level*** to this datum. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Distance to Seafloor (m) is the distance between the sensor and the sea floor. This distance must be set by the user so that the sensor software selects the correct transfer function in the wave calculations. Only available for ***Wave & Tide Sensor 5218/5218R.*** If the distance is longer than 50m, you can still type 50 m since the measurement data will be processed using a “deep water”-transfer function,

Air Pressure (kPa) is the barometric pressure in kPa used to compensate for air pressure. The default value is 101.3.

4.17.3 Input Parameter Air Pressure

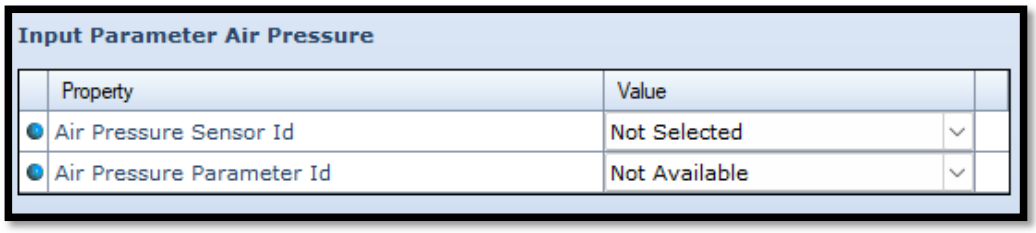

Figure 4-38: External Air Pressure Parameter Input

Air Pressure Sensor Id gives a list of available air pressure sensors connected to the same ***AiCaP*** bus. Only used if sensor is connected to a ***SeaGuardII*** or ***SmartGuard***. If connected, then select the parameter under ***Air Pressure Parameter Id. Air Pressure*** is used to compensate for variations in calculations like Absolute pressure and Absolute tide. If no sensor is selected the fixed value will be used. The ***hydrostatic pressure*** is calculated by subtracting the ***atmospheric pressure*** from the time series samples.

Air Pressure Parameter Id is used to select the correct output from any connected sensor with kPa output. Sometimes more than one alternative shows up from the same sensor. This might be because a sensor outputs more than one parameter with kPa as output.

4.18 System Configuration

Select ***System Configuration.*** These properties are used to control the output from the sensor and number of samples/period for calculations. ***Enable Temperature, Enable Rawdata*** and ***Enable Air Pressure Output*** are available for all sensor versions. ***Enable High Sample Rate, Enable Tide, Tidal Average Period*** and ***Number of Samples*** are available for both ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R*** while ***Enable Wave*** is only available for ***Wave & Tide Sensor 5218/5218R.***

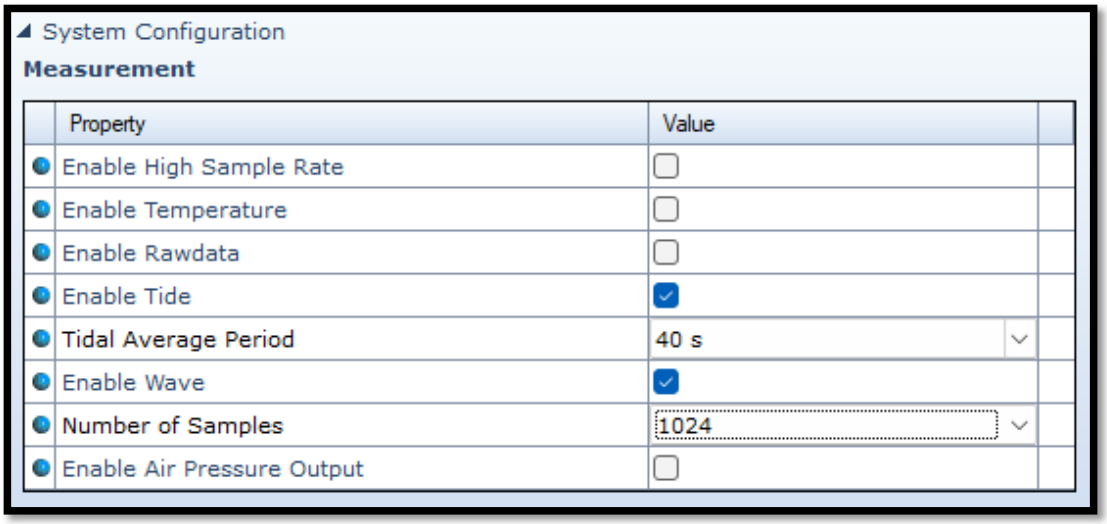

Figure 4-39: System configuration

4.18.1 Measurement

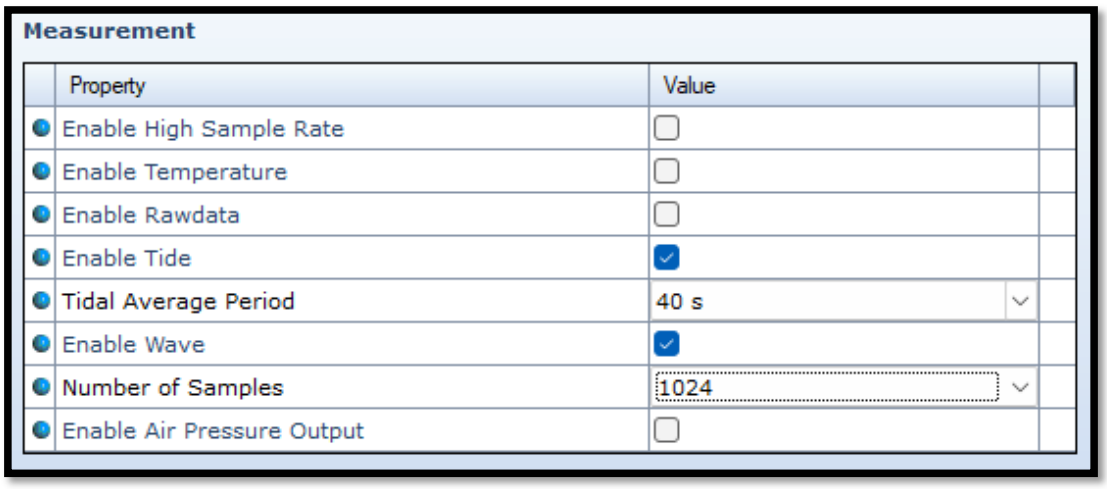

Figure 4-40: Measurement

Enable High Sample Rate sets the sample rate to ***4 Hz*** if set to ***Yes***. If not enabled, ***No***, the sample rate will be ***2 Hz.*** Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes***

Enable Temperature enables the output of Temperature from sensor. Default is ***Yes***.

Enable Rawdata enables the output of Rawdata, ***Rawdata Pressure*** and ***Rawdata Temperature***. Default is ***No***.

Enable Tide is used to switch on and off the ***Tide*** output parameters, ***Tide Pressure*** and ***Tide Level***. Sensor needs to run for at least one ***Tidal Average Period*** before these parameters are available. Please note that sensor configuration will influence how long this time will be and that the sensor does not collect data during output. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes*** for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Tidal Average Period sets the averaging interval for the tide measurements. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***40s.***

Enable Wave is used to switch on and off the ***Wave*** output parameters, ***Significant Wave Height, Max Wave Height, Mean Period, Peak Period, Energy Period, Mean Zero Crossing, Steepness, Irregularity, Cut Off Frequency High.*** Sensor needs after power on to run for a period to at least collect pressure measurement equal to ***Number of Samples*** before these parameters are available. Please note that sensor configuration will influence how long this time will be and that the sensor does not collect data during output. Only available for ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes.***

Number of Samples is the number of single pressure measurements used in the calculation of each wave parameter. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is 1024.

Enable Air Pressure Output enables the Air Pressure output from the sensor. Default is ***No***. Only if Air Pressure Sensor Id and Air Pressure Parameter Id are enabled.

4.19 User Maintenance

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

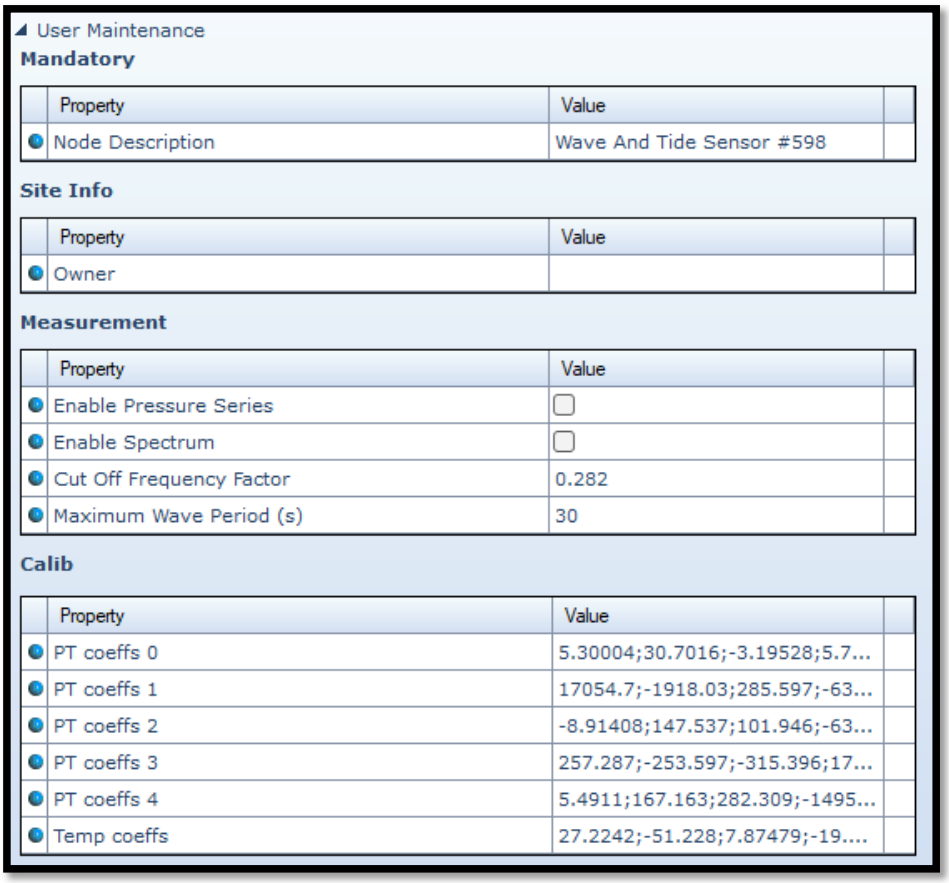

Figure 4-41: User Maintenance

User Maintenance holds 4 different sections:

- ***Mandatory***
- ***Site Info***
- ***Measurement***
- ***Calib***

Even small changes in any of the properties in this section will have a major influence on the calculated data from the sensor.

4.19.1 Mandatory

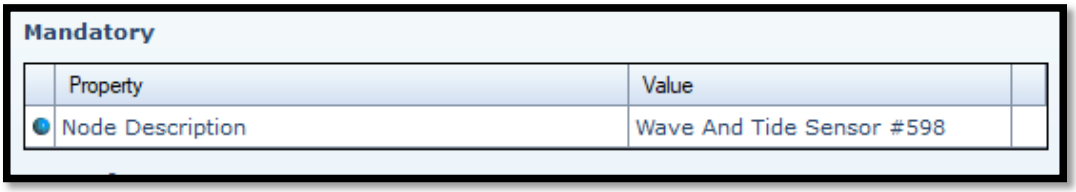

Figure 4-42: Mandatory in User Maintenance

All sensors are given a ***Node Description*** text like ***Wave And Tide Sensor #xxx*** (where 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 its configuration. If one of the sectors is corrupted, the other sector is used and saved to the corrupt sector.

4.19.2 Site Info

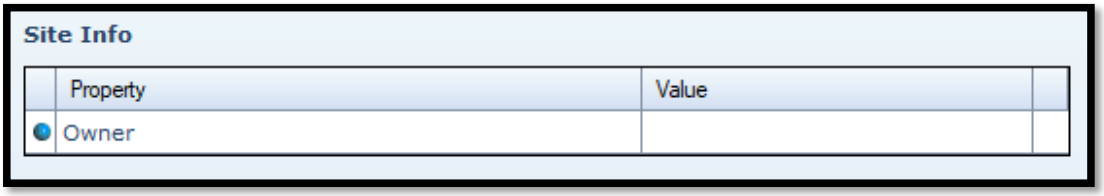

Figure 4-43; Site Info in User Maintenance

Site Info is optional information to be entered to store information about the ***Owner***. This setting is not used in any calculation.

4.19.3 Measurement

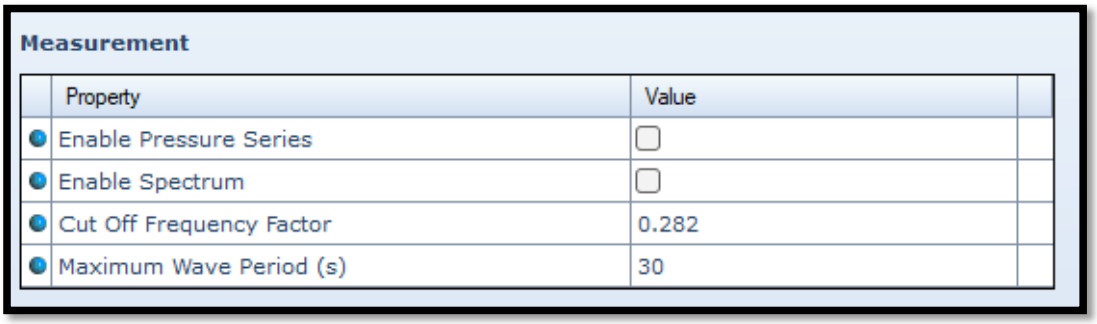

Figure 4-44: Measurement in User Maintenance

Enable Pressure Series are used to generate a file with all individual pressure measurements. Number of measurements depend on ***Number of Samples***. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R***

Enable Spectrum are used to generate a file with wave spectrum measurements. Only available for ***Wave & Tide Sensor 5218/5218R***

Cut Off Frequency Factor is a factor used to calculate Cut-Off Frequency with using this factor, Local Gravity and installation depth measured by sensor. Default 0.282. See ***chapter 14.1*** for more info. Only available for ***Wave & Tide Sensor 5218/5218R***

Maximum Wave Period (s) is used to set the upper Cut-off frequency. Default 30s. Only available for ***Wave & Tide Sensor 5218/5218R***

4.19.4 Calib

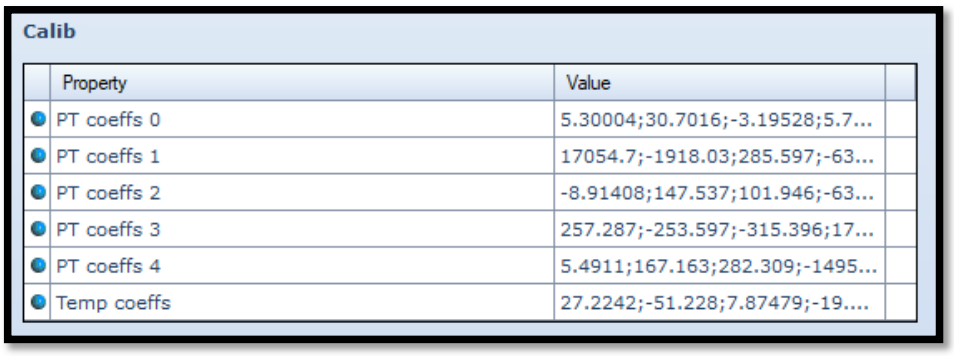

Figure 4-45: Calibration in User Maintenance

Pressure Coeffs. This property holds 5 coefficient sets obtained during a calibration process at factory. The calibration coefficients are available from the calibration certificate.

Temp Coeffs This property holds 4 coefficients. The calibration coefficients are available from the calibration certificate.

4.20 Save Configuration to file

The example below shows a small excerpt of a saved configuration. All information and settings related to both SeaGuardII and all connected sensors are found in the full file.

```
<?xml version="1.0" encoding="utf-8"?>
<Config ID="5750-1338-2025-09-11T07:47:08Z" Time="2025-09-11T07:47:08.223Z"
xmlns="http://www.aadi.no/RTConfigSchema">
  <NodeConfig ID="5750-1338" SerialNo="1338" ProdNo="5750" ProdName="SeaGuard II"
Descr="Seaguard II Platform" ProtocolVer="4" ConfigVer="0" NodeTypeID="100">
    <ConfigCategory ID="0" Descr="Factory Maintenance">
      <PropertyCategory ID="0" Descr="Mandatory">
        <Property Access="R1" Type="VT_BSTR" Descr="Product Name" ID="0">SeaGuard
II</Property>
        <Property Access="R1" Type="VT_BSTR" Descr="Product Number"
ID="1">5750</Property>
      </PropertyCategory>
      <PropertyCategory ID="1" Descr="Mainboard">
        <Property Access="R1" Type="VT_BSTR" Descr="Product Number"
ID="0">9344B</Property>
        <Property Access="R1" Type="VT_I2" Descr="Serial Number" ID="1">3627</Property>
        <Property Access="R1" Type="VT_BSTR" Descr="Version" ID="2" />
        <Property Access="R1W4" Type="VT_BSTR" Descr="Last Service" ID="3" />
      </PropertyCategory>
```

Figure 4-46: Example of saved .xml

CHAPTER 5 Configuration with AADI Real-Time collector

5.1 Sensor configuration

This chapter describes the sensor configuration using AADI Real-Time Collector when the sensor is used stand-alone with serial communication via the PC COM-port. All sensor versions are covered in the same chapter since most settings are identical. The sensor might be set to any mode when configured using AADI Real-Time Collector but if you want to use the included real-time display function then the sensor needs to be in AADI Real-Time mode. The menus shown here are slightly different from the menus shown when the sensor is set to AiCaP mode and configured either stand-alone or through a SmartGuard/ SeaGuardII Datalogger.

See ***chapter 2.9*** for sensor connection and ***chapter 15.1*** for available cables between sensor and PC. Please note that the sensor needs a steady power supply of 5-14VDC. Our standard stand-alone cables are normally supplied with a 9 pin D-sub plug for connection to PC. If your PC has no Serial Port, we recommend using FTDI Serial to USB adapter, see ***Figure 5-1***: This adapter can also be ordered from Aanderaa. After the sensor is connected and power are supplied then install and start the AADI Real-Time Collector software on your PC (license and software delivered on memory stick with the sensor). For more info refer to TD 268 AADI Real-Time Collector Operation Manual.

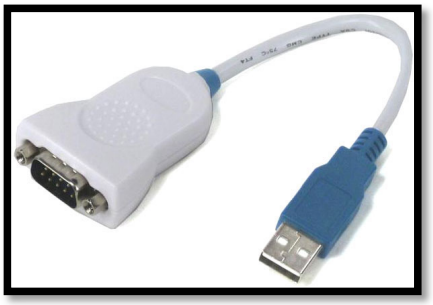

Figure 5-1: FTDI serial-USB adapter

Warning: Communication with Real-Time Collector may be slow or not possible if Flow Control is set to None. If set to Xon/Xoff the communication with sensor will be prioritized. If communication is not possible due to connection problems, we recommend using TerraTerm to stop the sensor before connecting the sensor to Real-Time Collector.

5.2 Establishing a new connection

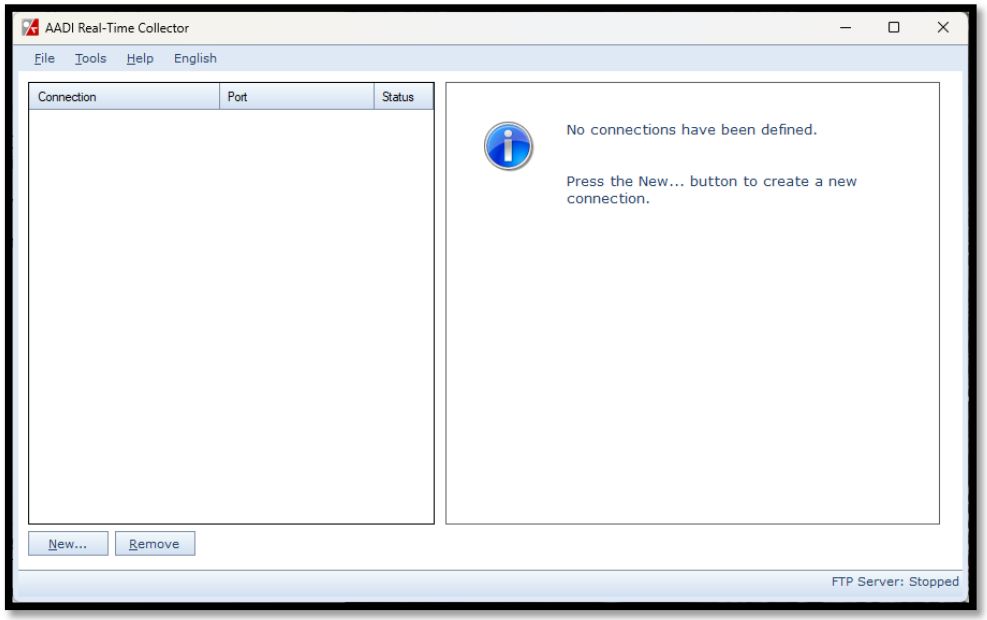

Figure 5-2: AADI Real-Time Collector start up menu

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.

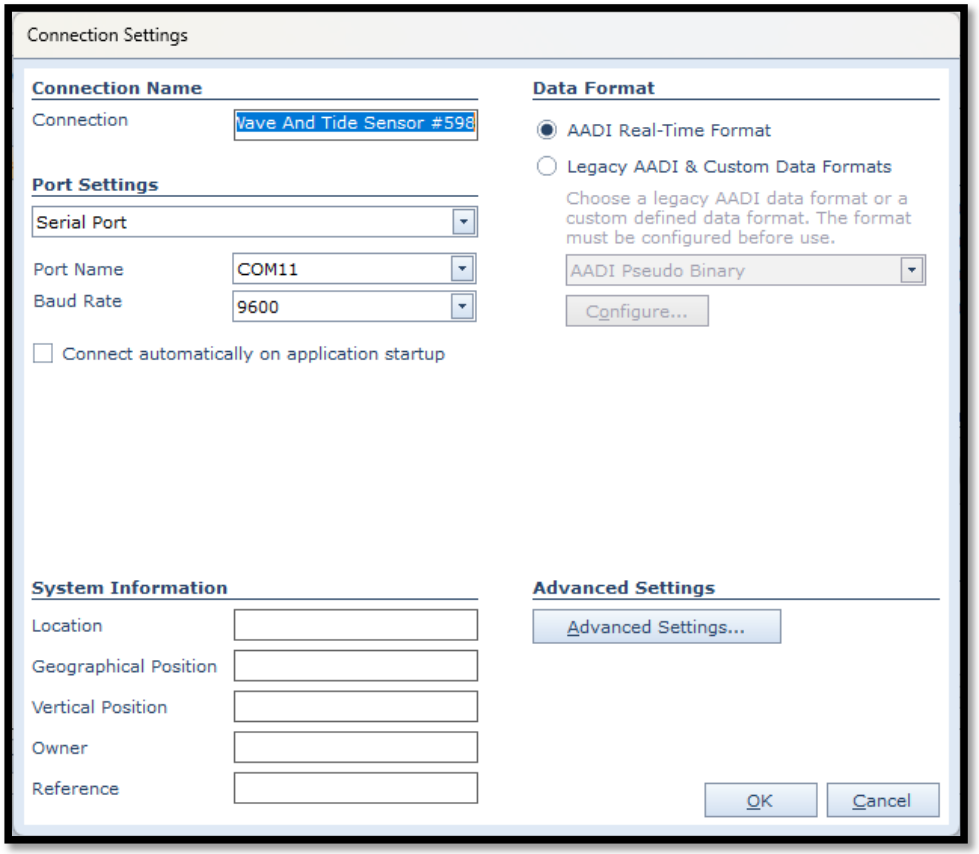

Figure 5-3: AADI Real-Time Collector connection settings

Type a descriptive name in the ***Connection Name*** box (e.g. Wave And Tide Sensor and #serial number).

Select ***Serial Port*** as ***Port Settings*** even if you use the serial to USB adapter, then select the correct ***COM#*** as ***Port Name*** and ***9600*** as ***Baud Rate***. This is the default baud rate set at the factory on all standard sensors.

Baud rate needs to be the same as set in sensor to obtain connection. Sensors used with RCM Blue are set to 57600.

Then click on the ***Advanced Settings*** on the lower right side.

If you want to return to this menu later please close the port and then press ***Settings..*** in the main menu.

If ***connect automatically on application startup*** is selected, then this connection will automatically open every time you start AADI Real-Time Connector.

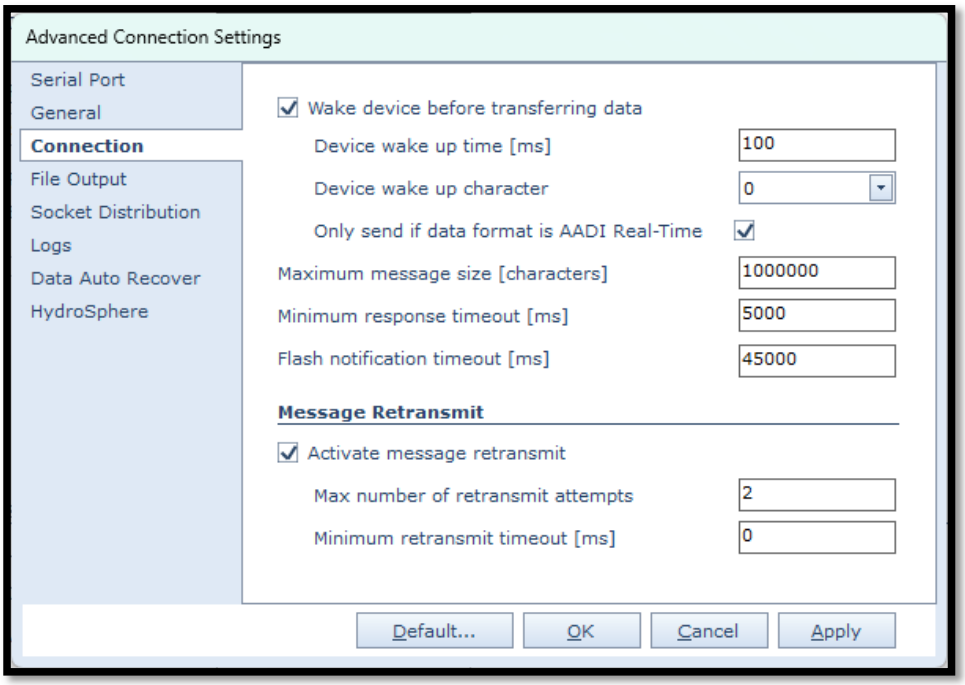

Figure 5-4: Advanced connection settings

In the ***Advanced Connection Settings*** window select ***Connection*** in the list on the left side, refer ***Figure 5-4.***

AADI Real-Time Collector uses a default setting that fits most Smart Sensors.

However, some sensors may output a large amount of data and therefore have much longer response time (depending on the configuration) than other smart sensors.

Figure 5-4. showing the default settings. After updating the ***Advanced Connection Settings***, click on ***Apply*** and ***OK*** and then ***OK*** to go back to the start.

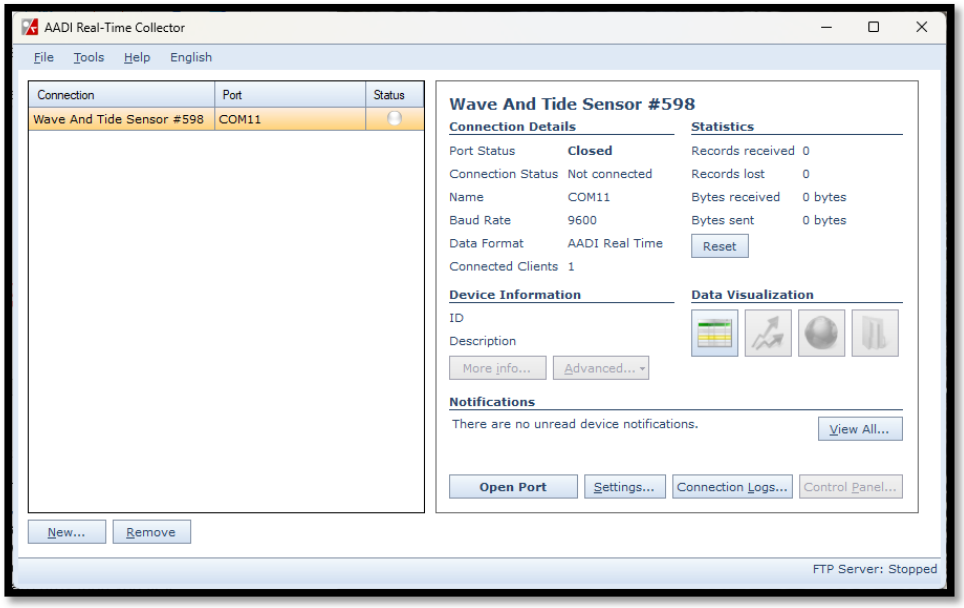

Figure 5-5: Connection list

The ***Advanced Settings*** are only accessible to change when the port is closed. If the settings are grey then you first need to close the port, refer ***Figure 5-5*** and press ***Close Port.***

The new connection is now shown in the AADI Real-Time Collector connection list. Choose the new connection and click on the ***Open Port*** button.

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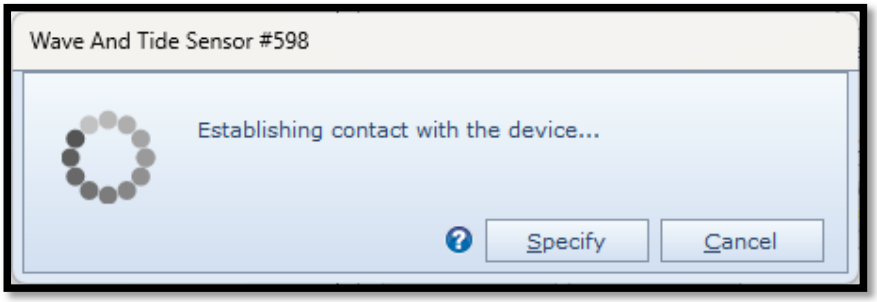
NOTE: This procedure only needs to be done once. This connection will be in the connection list at the next start-up.

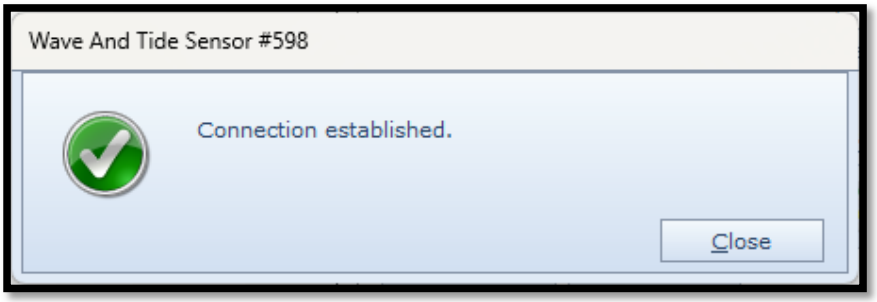
The connection list might contain different connections to other sensors as well.

Then highlight the connection you want to open before pressing the ***Open Port*** button.



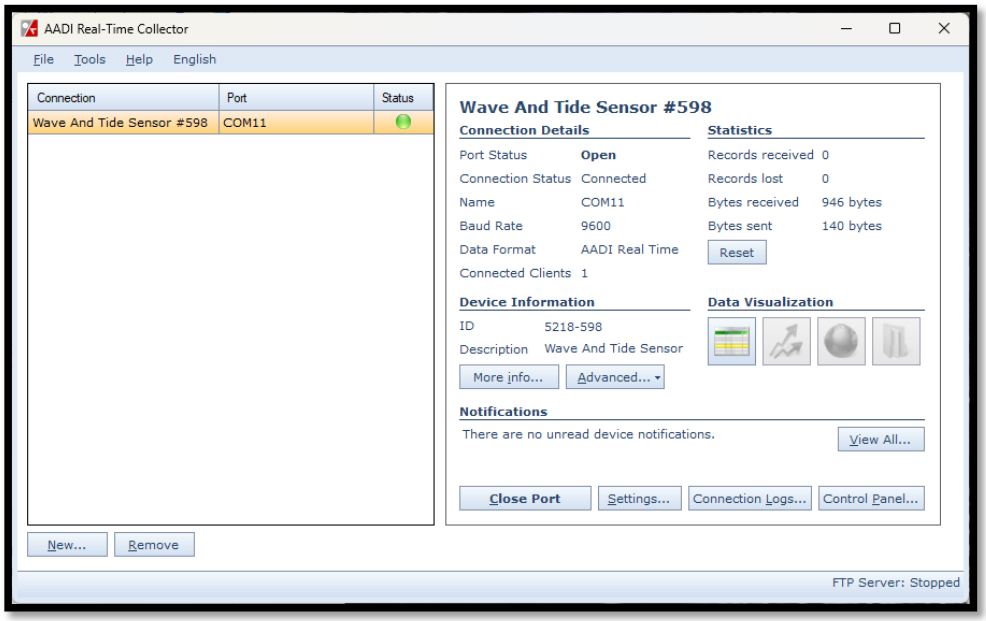
A new window with a turning wheel will then show up waiting for contact. This might take a couple of seconds depending on the sensor configuration.

Figure 5-6: Establishing contact



When connection is established the status light will turn green

Figure 5-7: Connection established



The selected connection has now changed to green status.

Press ***Control Panel*** in the right lower corner to continue.

Figure 5-8: AADI Real-Time Collector main menu

5.3 Control Panel

In the ***Control Panel*** window, you will find two tabs***, Recorder Panel*** and ***Device Configuration.*** In ***Recorder Panel*** you can start and stop recordings if the sensor is set to ***AADI Real-Time mode***. If the recorder is running, first click on the ***Stop Recorder*** as you are not allowed to configure the sensor when recording. In ***Device Configuration*** you will be able to perform all configurations of the sensor.

5.4 Recorder Panel

In the recorder panel you will be able to start and stop the recorder if the sensor is set to ***AADI Real-Time mode***. If the sensor is set to another mode, the sensor will not be controlled by the ***Recorder Panel*** and therefore all settings will be grey and not selectable. In AiCaP mode you need an Aanderaa logger to control the sensor. In all other modes the sensor will either start at power up in ***non-polled mode*** or when a ***do sample*** message is sent to the sensor ***in polled mode***.

Select ***Recorder Panel.***

This is only applicable if sensor is in ***AADI Real-Time mode***. For all other modes the alternatives will be grey, and a warning will be displayed under ***Device Notification.***

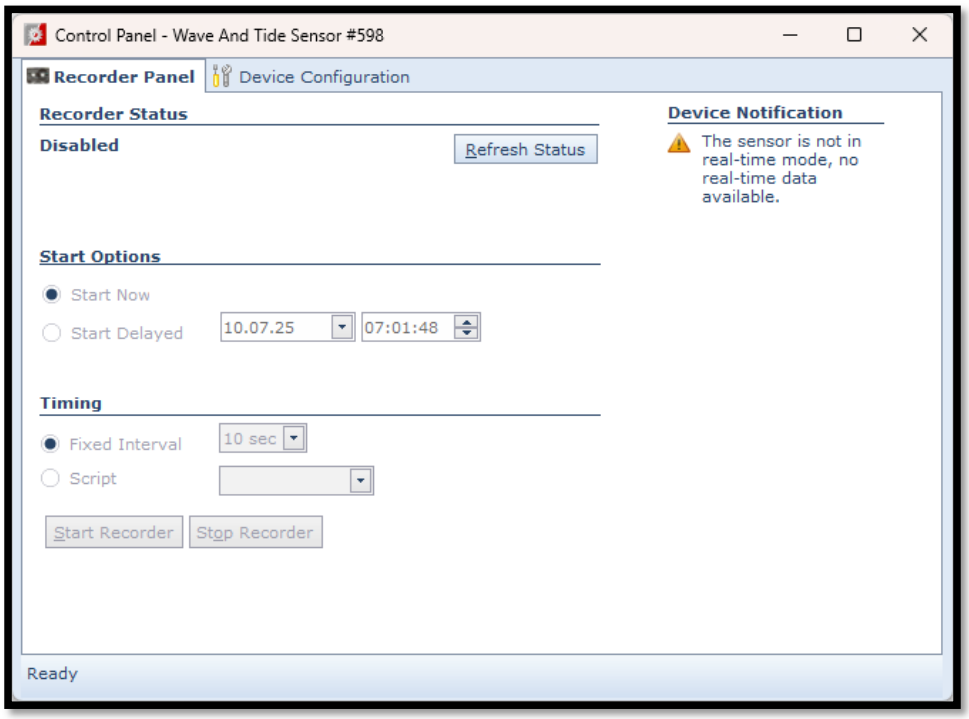


Figure 5-9: Control Panel for the Wave & Tide sensor

Click on the ***Stop Recorder*** button if the sensor is running since you are not allowed to configure the sensor when recording.

Under ***Start Options*** the only selectable choice is ***Start Now***.

Under ***Timing*** the only selectable choice is ***Fixed Interval*** where you might set the recording interval. This setting is also available from the ***Deployment Setting*** menu as ***interval(s)***,

5.5 Changing Values

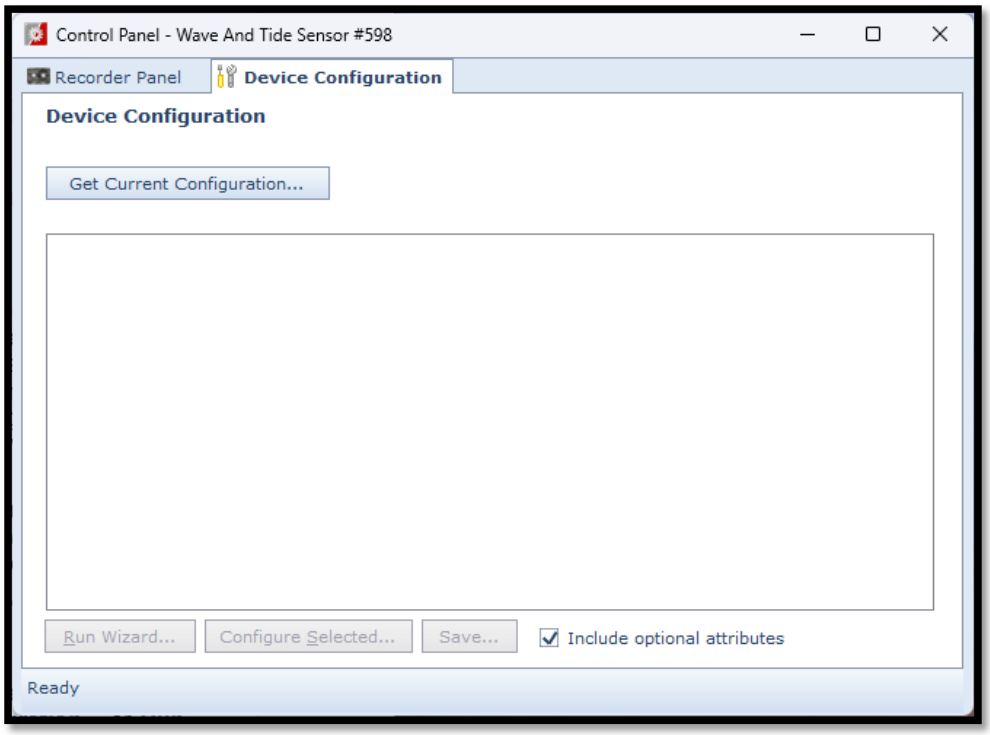


Figure 5-10: Changing Values

In the following chapters we will learn more about the sensor configuration. Sometimes you will need to change the value of a property.

First in the Control Panel select the ***Device Configuration*** tab where the property is located.

First time you connect a sensor the list will be empty.

Then press ***Get Current Configuration…*** or ***Run Wizard***

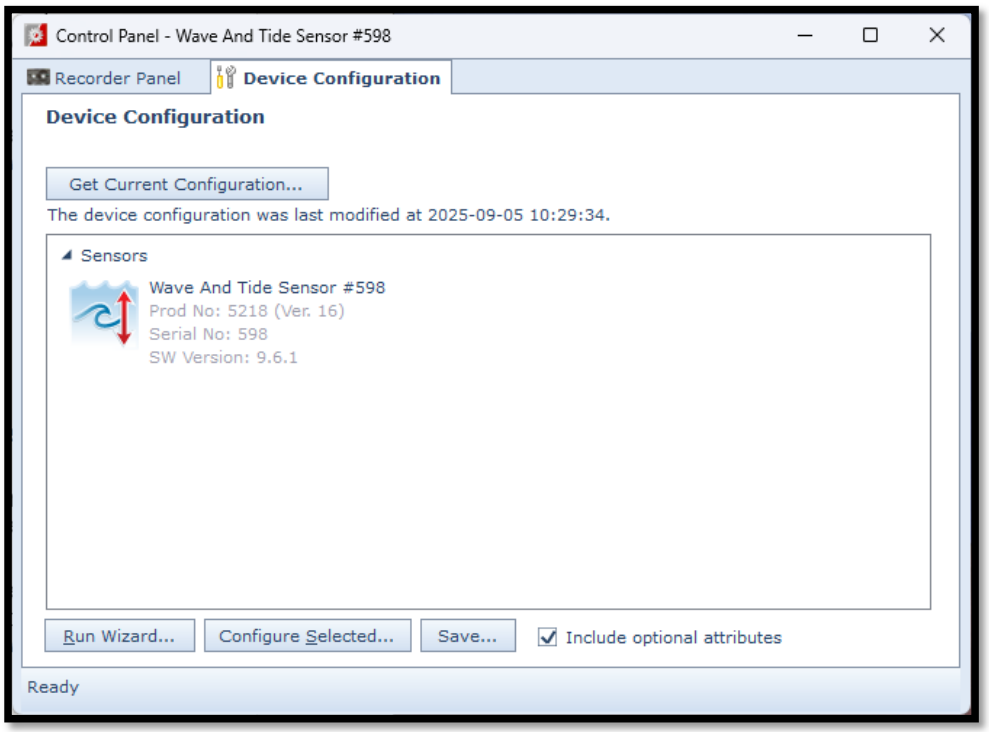


Figure 5-11: Connected Sensor

The connected sensor will now show up in the ***Sensors*** list.

This will also be the case if sensor was connected last time you opened the port.

Doubble click on the sensor or select ***Configure Selected…***

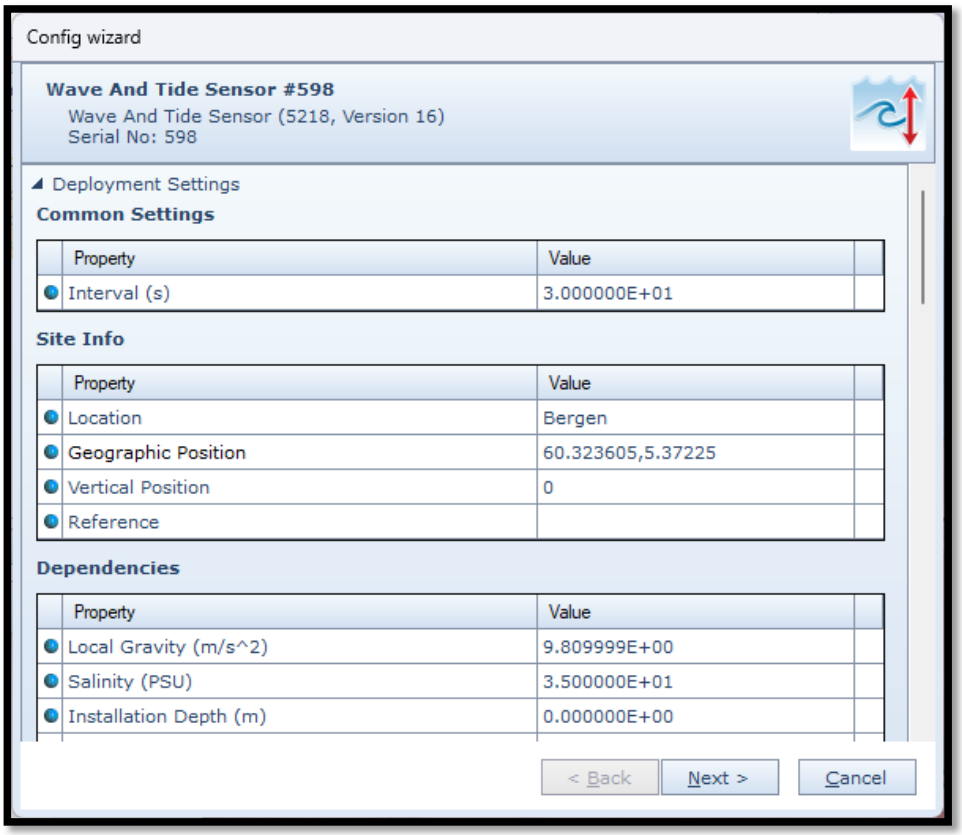


Figure 5-12: Find the data

A new separate window with all sensor configuration will show up. The different settings are devided in three groups.

- ***Deployment Settings***
- ***System Configuration***
- ***User Maintenance***

Select the property you want to change by clicking the ***Value*** box.

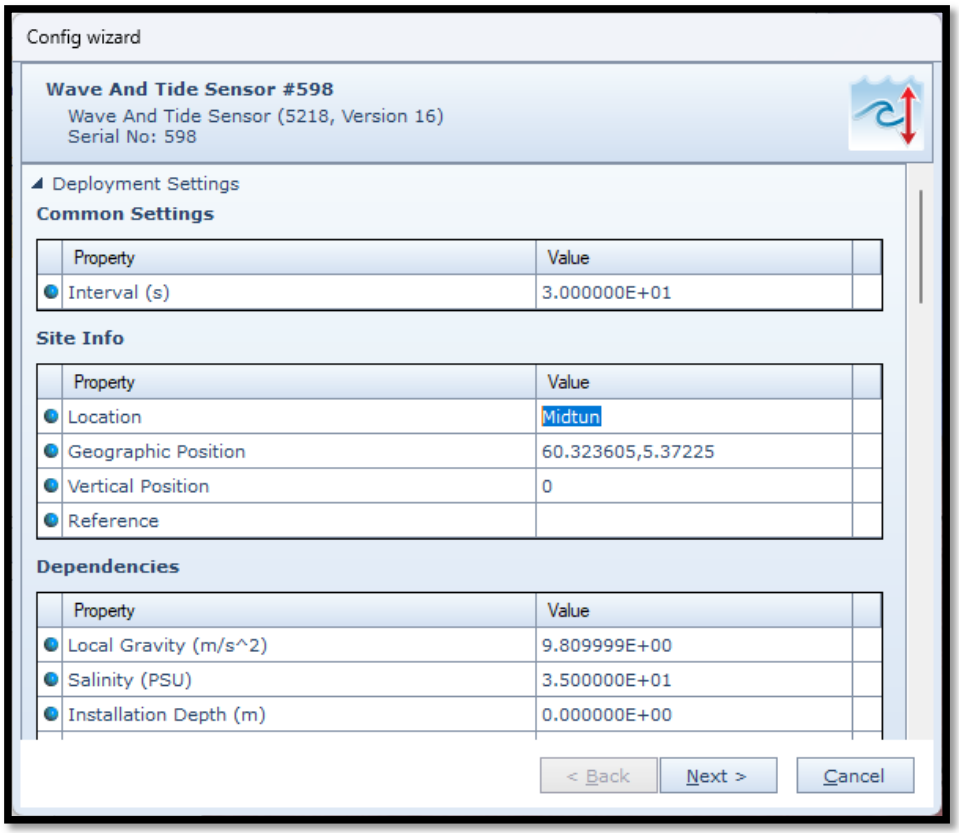


Figure 5-13: Change Value

To change values, enter the text or number in the value box and press ***Next.***

If some of the properties are grey you need to go back to ***Device Configuration*** and press ***Get Current Configuration…***

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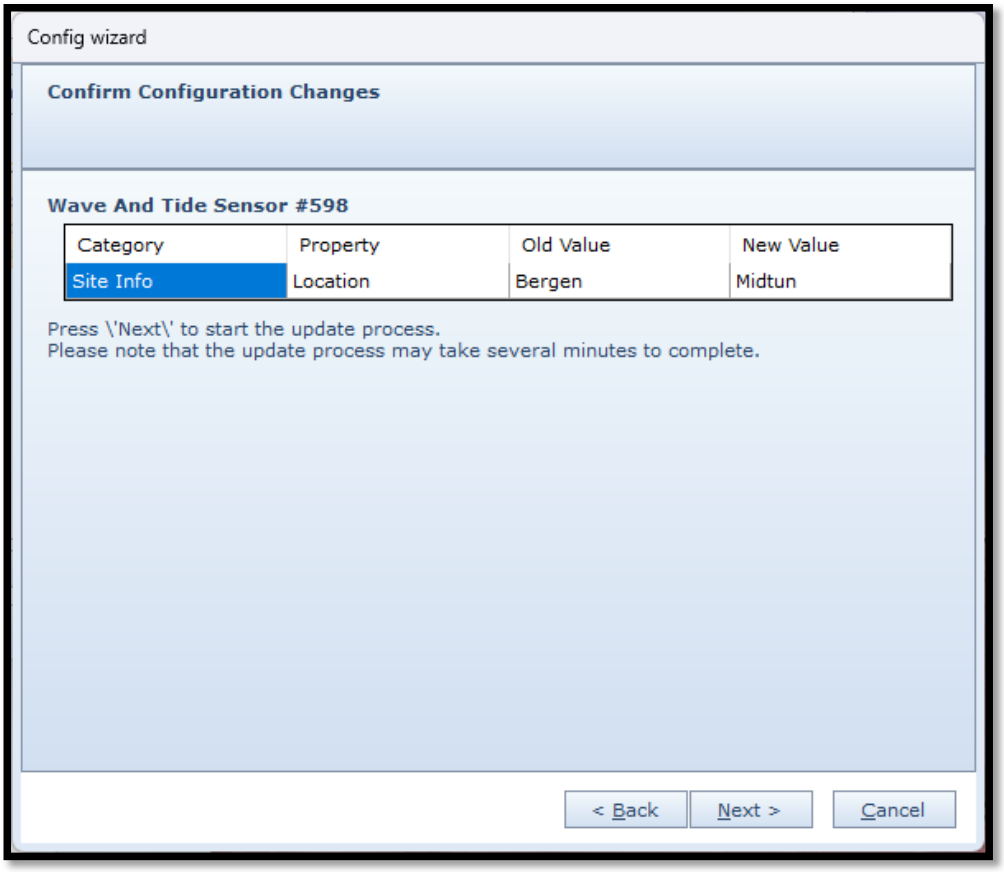


Figure 5-14 Confirm Configuration Changes

In the next window called ***Confirm Configuration Changes*** you will find a list of all changed properties with old and new values.
If the list of configuration changes is correct press ***Next*** to start the update process.

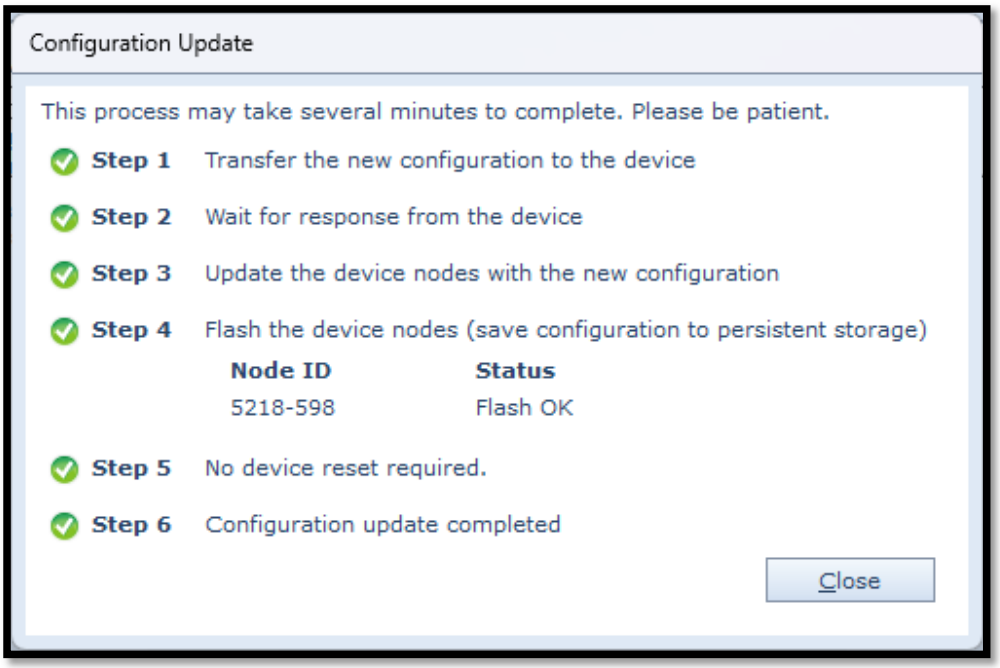


Figure 5-15 Configuration Update

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 the sensor before the entire process is completed.

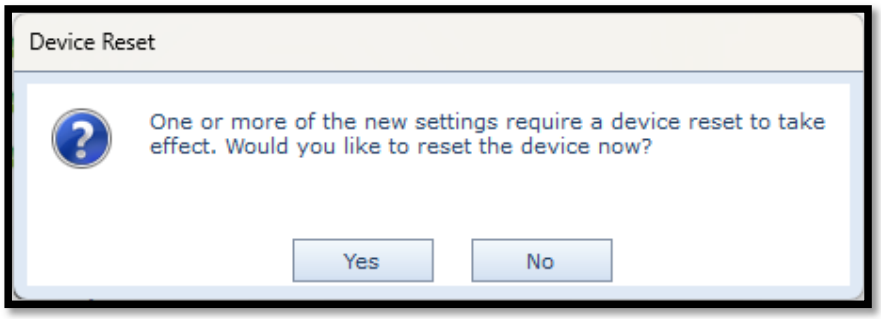


Figure 5-16: Device Reset

Depending on what property you are updating a reset warning may show up. If so, confirm with pressing Yes.

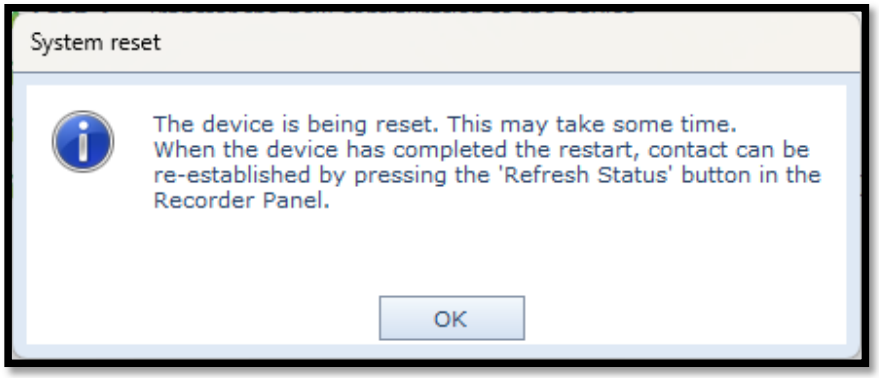
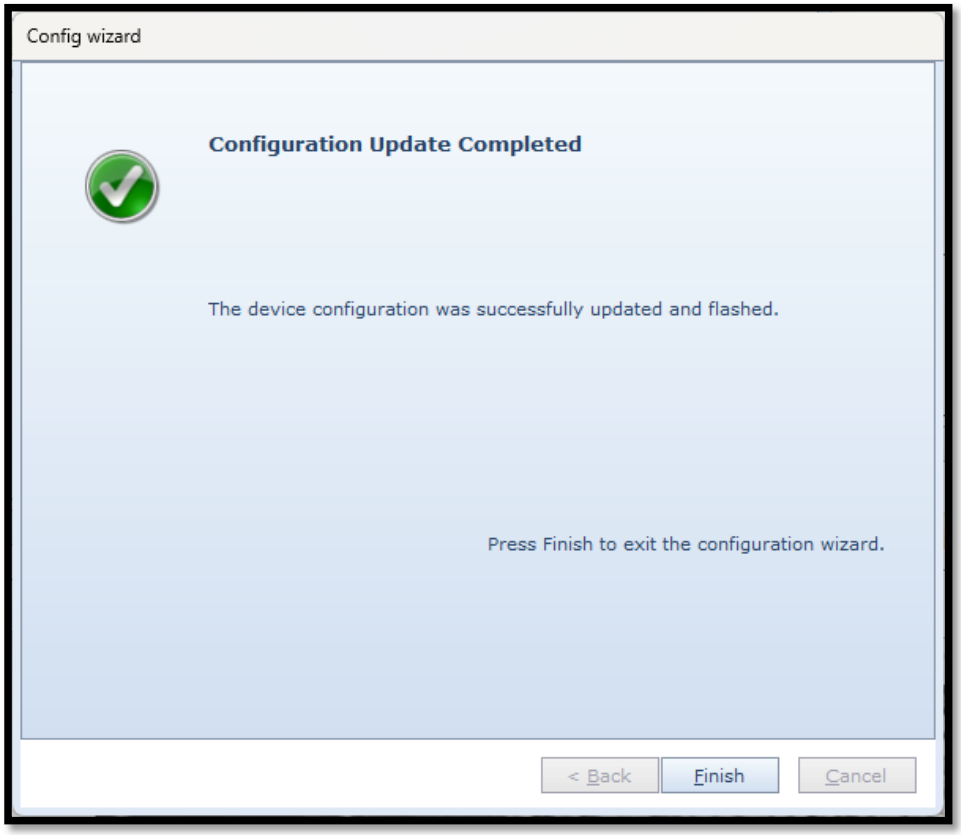
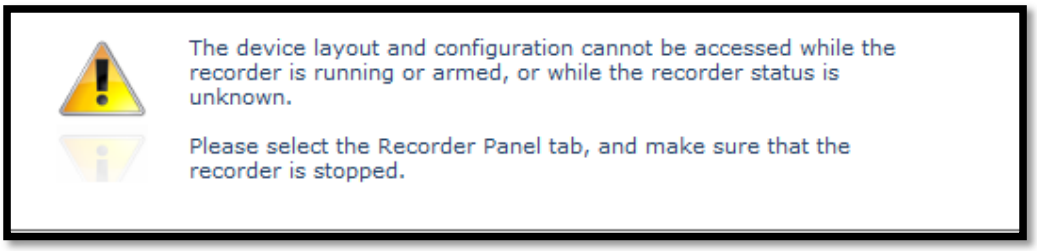


Figure 5-17: System Reset

This will then be followed by confirmation when the reset is finished. Press OK to confirm.

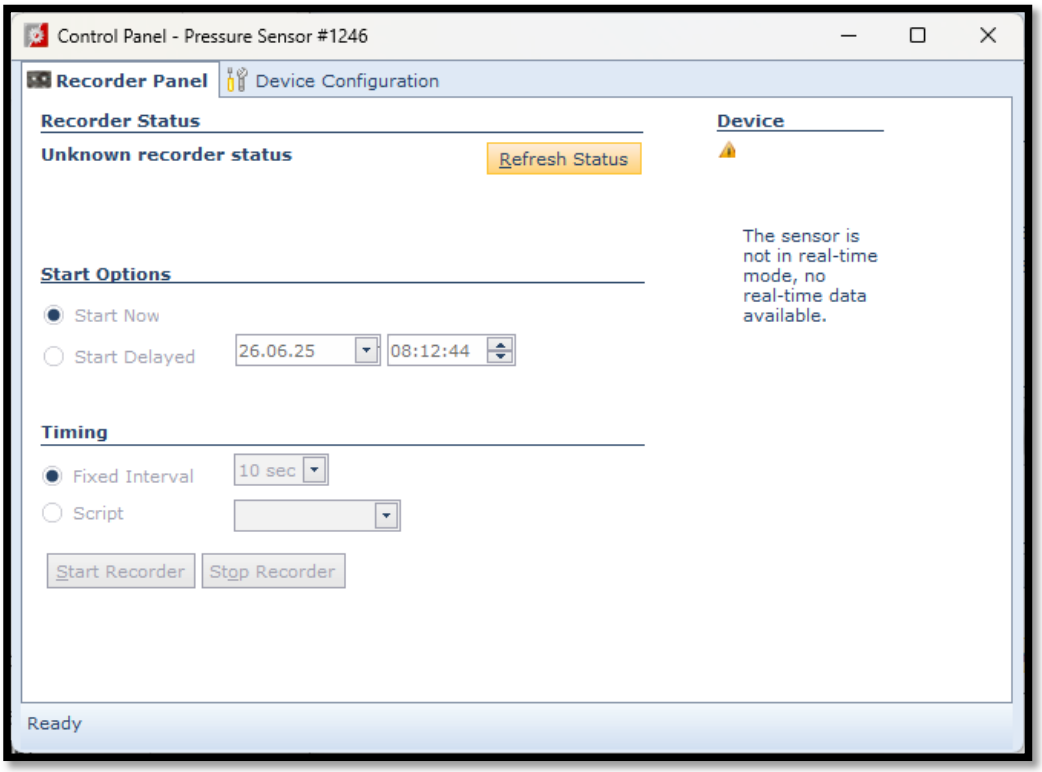


When the updating process is finished a confirmation will show up. Press ***Finish*** to continue.



When you click ***Finish*** the following warning may show up depending on what parameter you updated.

Figure 5-18: Warning after changing values



Then you need to open the ***Recorder Panel*** and press the ***Refresh Status*** button.

Figure 5-19: Refresh Status

5.6 Device Configuration

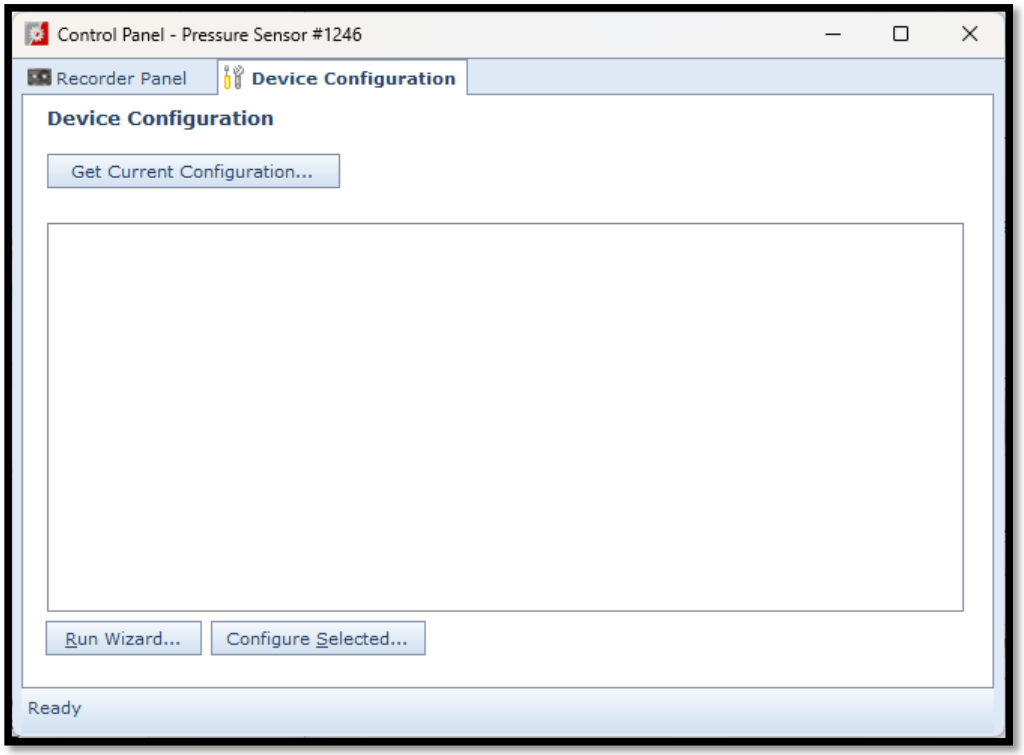


Figure 5-20: Device Configuration without Get Current Configuration

Click on the ***Device Configuration*** tab in the top row of the ***Control Panel*** to access the sensor property configuration.

Click on ***Get Current Configuration...***to receive the current configuration from the sensor.

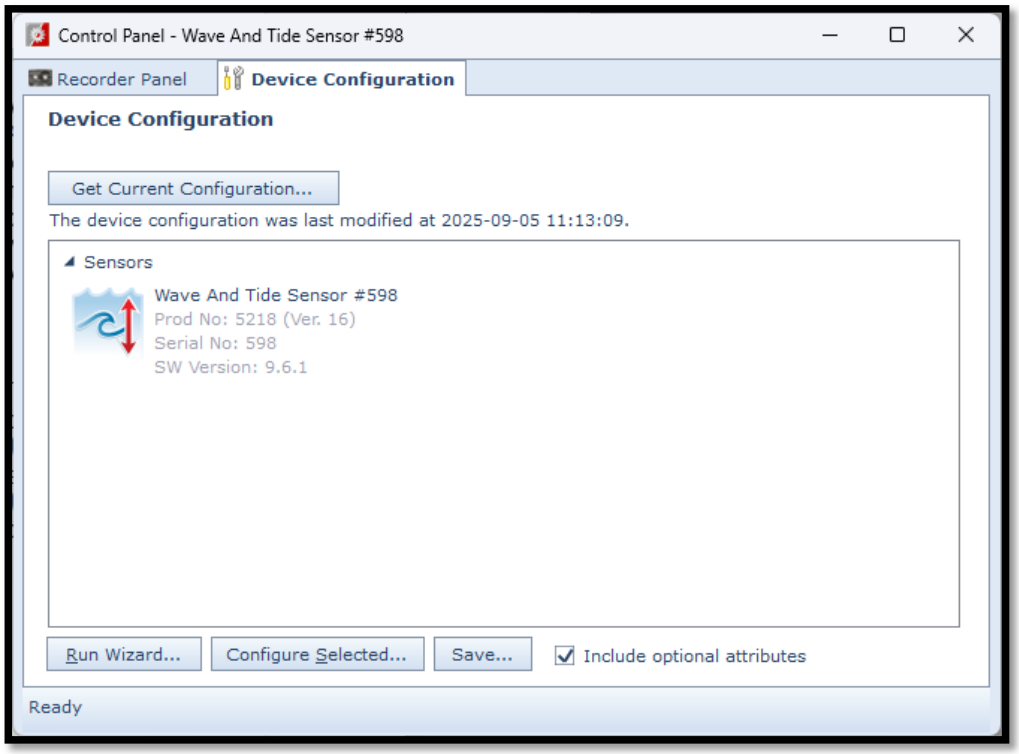


Figure 5-21: Device Configuration with Get Current Configuration

The connected sensor will now be avaiable in the ***Sensors*** list.

Double click on sensor or select ***Configure Selected*** to continue.

5.1 Sensor Configuration

In the next chapters we will show a typical ***Device Configuration*** menu for each of the three sensor versions. The first 3 chapters show a full list of available properties for each sensor. Some properties are not available for ***Pressure sensor 4117/4117R*** and/or ***Tide Sensor 5217/5217R*** and some are only available for ***Wave & Tide Sensor 5218/5218R***. Your view may differ from the screenshots due to different modes or configuration.

You may now proceed to the chapter covering your sensor type.

Please note that you need a power reset after connecting the sensor.

5.2 Pressure Sensor 4117/4117R

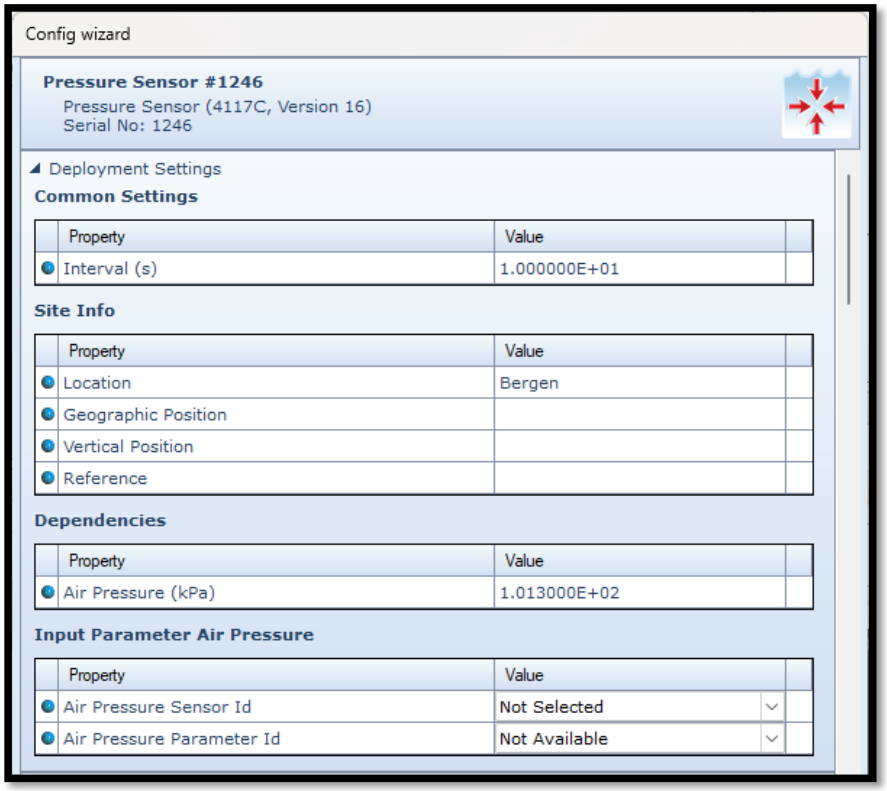


Figure 5-22: Pressure Sensor 4117/4117R first part

Pressure Sensor 4117/4117R consists of three main groups with sub-groups.

Deployment Settings with 4 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of the header name.

Each property is described in the following chapters under main menu and sub menus.

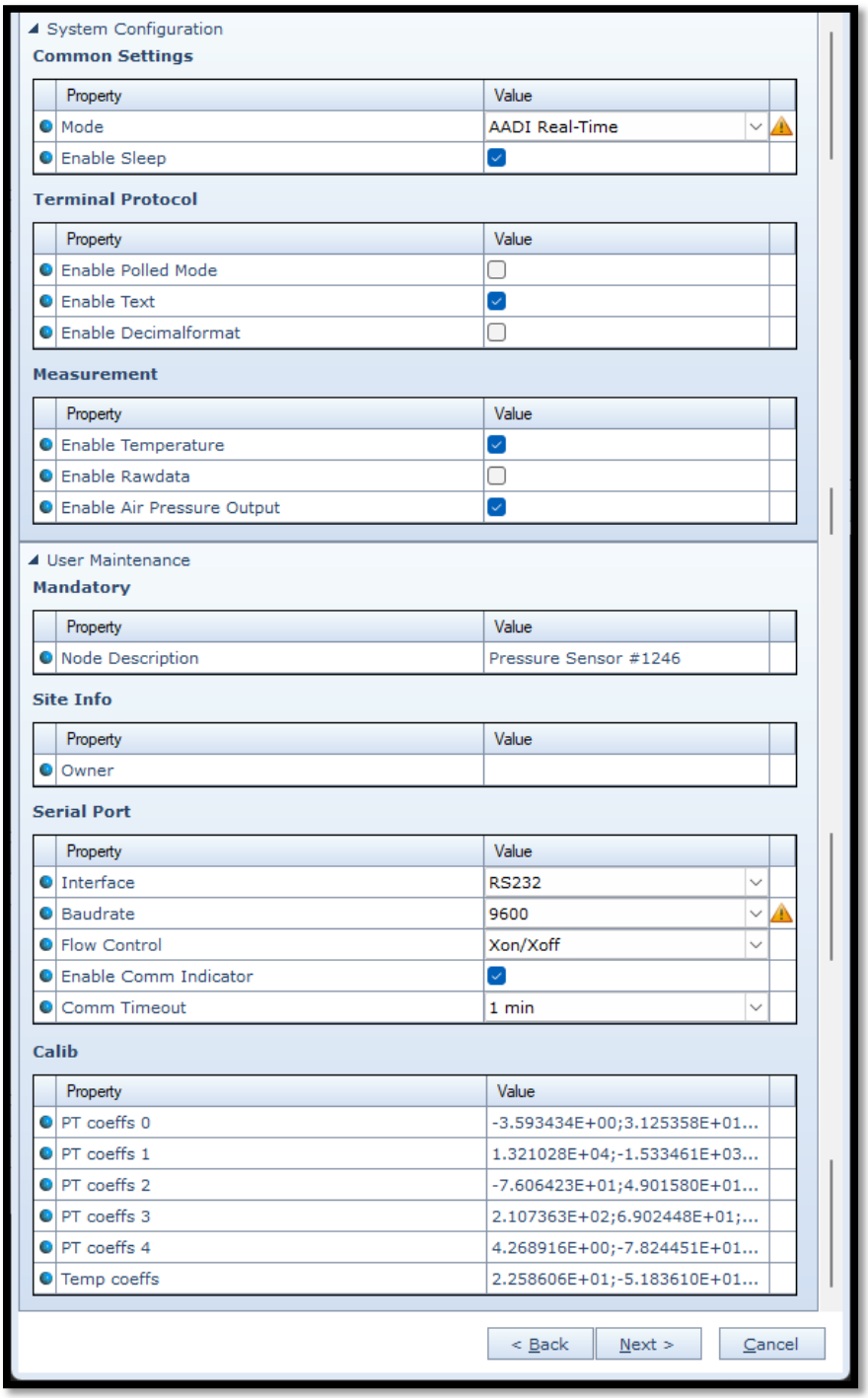


Figure 5-23: Pressure Sensor 4117/4117R second part

System Configuration with 3 sub-groups.

User Maintenance with 4 sub-groups.

If some of the properties are grey you need to go back to ***Device Configuration*** and press ***Get Current Configuration…***

5.8 Tide Sensor 5217/5217R

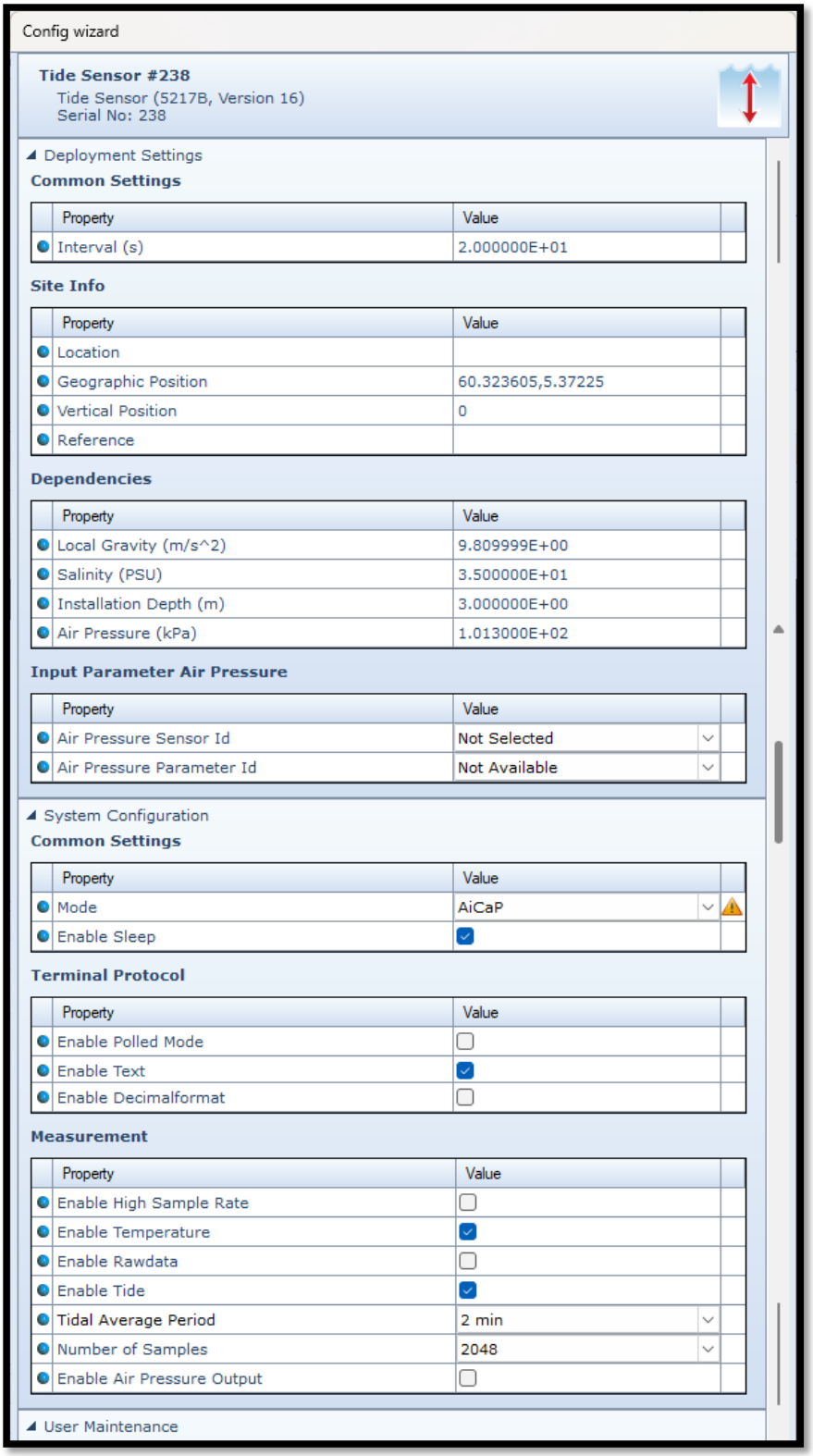


Figure 5-24: Tide Sensor 5217/5217R first part

Tide Sensor 5217/5217R consists of three main groups with sub-groups.

Deployment Settings with 4 sub-groups.

System Configuration with 3 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of the header name.

Each property is described in the following chapters under main menu and sub menus.

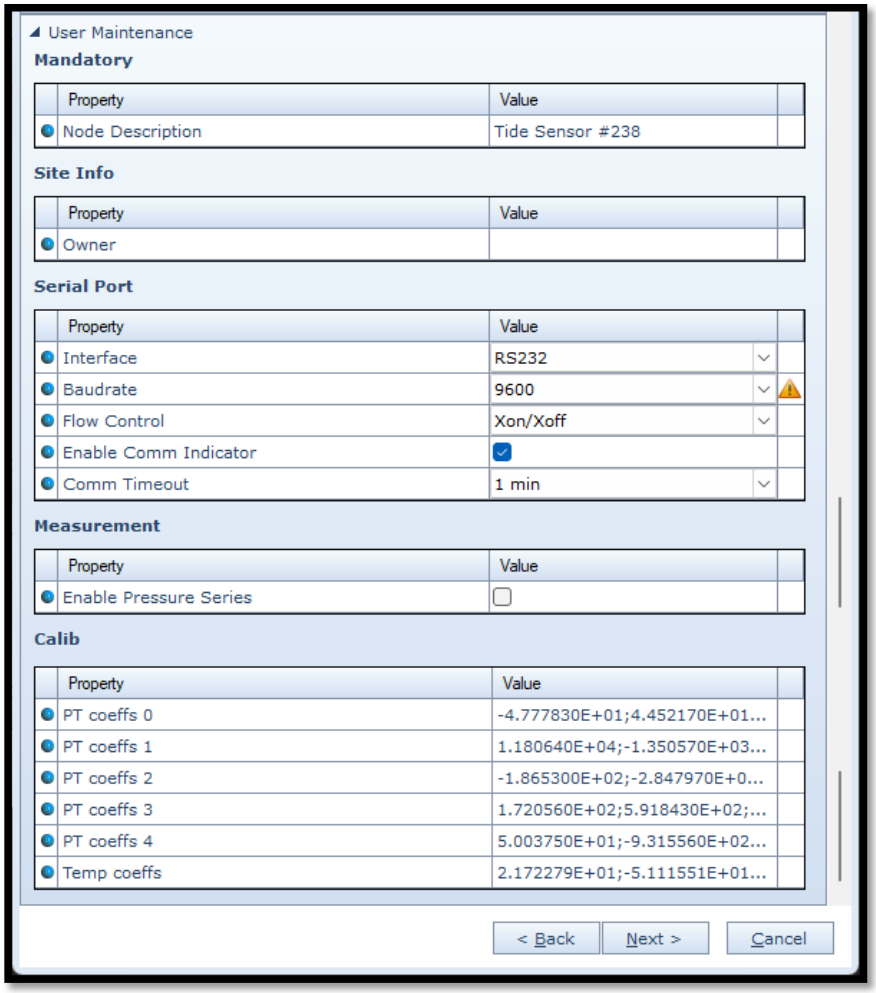


Figure 5-25: Tide Sensor 5217/5217R second part

User Maintenance with 5 sub-groups.

If some of the properties are grey you need to go back to ***Device Configuration*** and press ***Get Current Configuration…***

5.9 Wave and Tide Sensor 5218/5218R

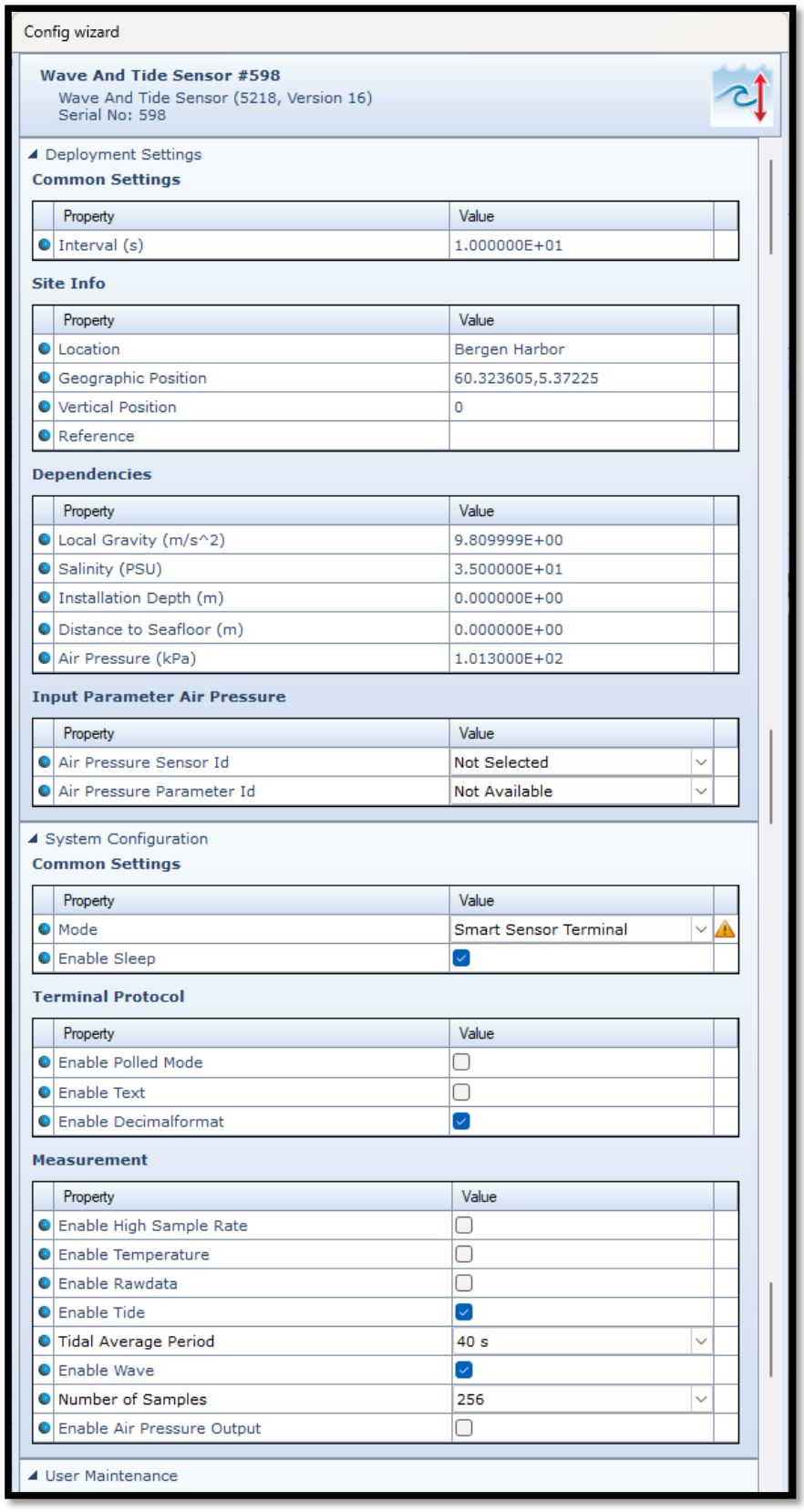


Figure 5-26: Wave And Tide Sensor 5218/5218R first part

Wave and Tide Sensor 5218/5218R consists of three main groups with sub-groups.

Deployment Settings with 4 sub-groups.

System Configuration with 3 sub-groups.

Each main groups may be collapsed or expanded by clicking the small arrow infront of the header name.

Each property is described in the following chapters under main menu and sub menus.

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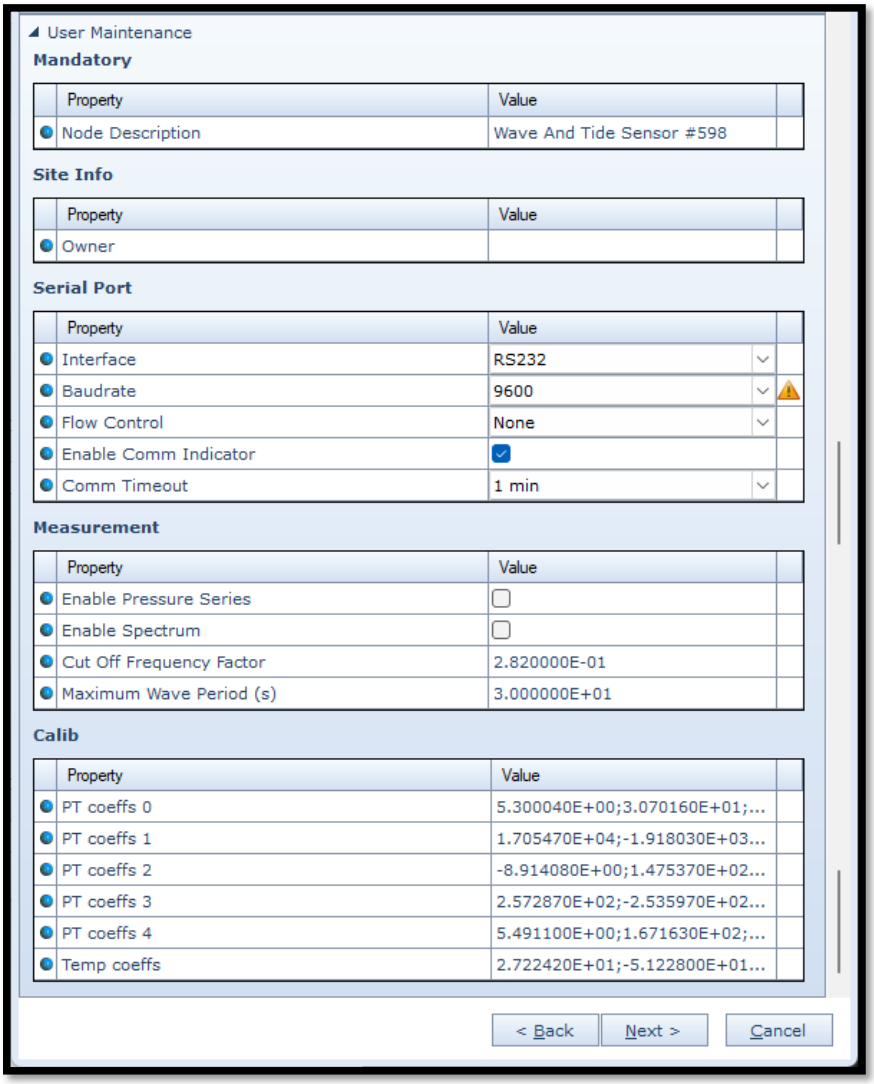


Figure 5-27: Wave And Tide Sensor 5218/5218R second part

User Maintenance with 5 sub-groups.

If some of the properties are grey you need to go back to ***Device Configuration*** and press ***Get Current Configuration…***

5.10 Deployment Settings

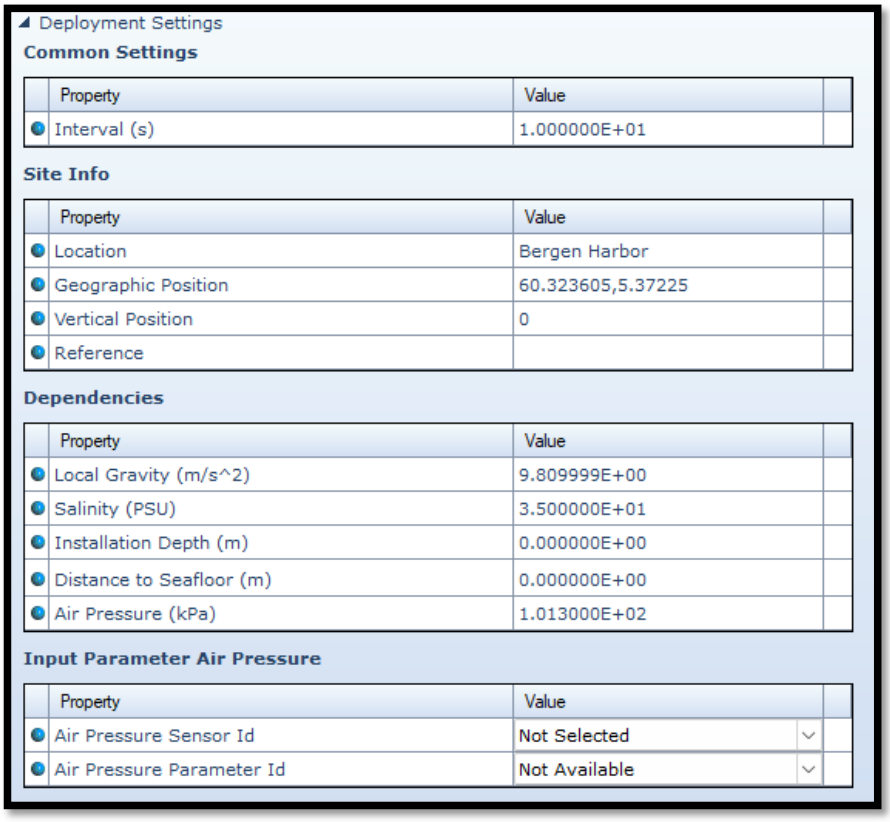


Figure 5-28: Deployment Settings

This menu has four different sections,

- ***Common Settings***
- ***Site Info***
- ***Dependencies***
- ***Input Parameter Air Pressure***

Each property is described in the following chapters.

5.10.1 Common Settings

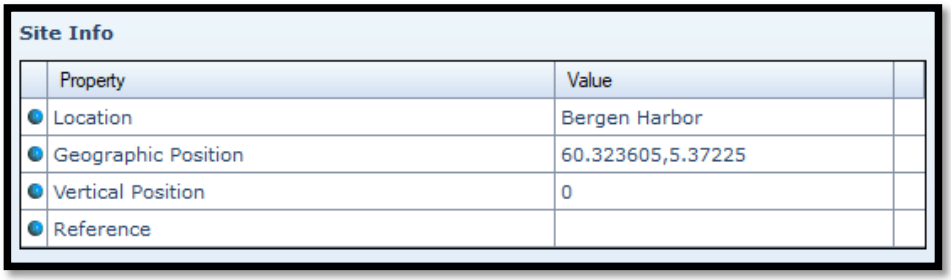
Figure 5-29: Deployment Settings

Interval is used to control the sensors recording interval, the number of seconds between each output. Please note that this setting will act different depending on mode.

The interval may also be set from ***Recorder Panel*** if sensor is set to ***AADI Real-Time*** mode. The last entered value will be used if properly is stored to flash.

If Time series are enabled this might also influence the interval setting since then 60 seconds is the shortest possible interval.

5.10.2 Site Info



Site Info

Property	Value
Location	Bergen Harbor
Geographic Position	60.323605,5.37225
Vertical Position	0
Reference	

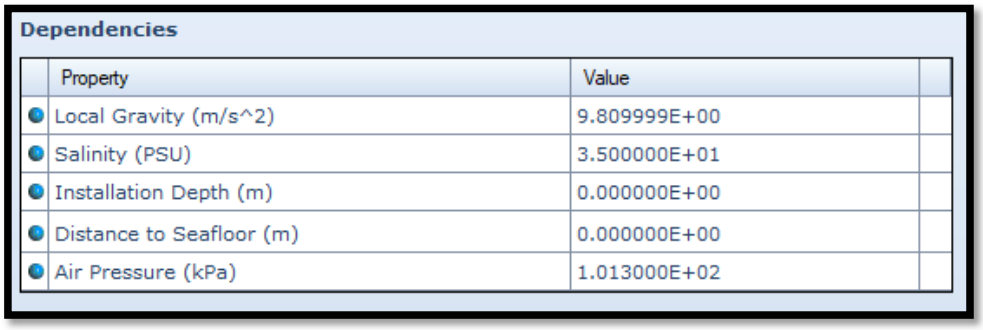
Figure 5-30: Site Info

Site Info contains four properties:

- ***Location:*** Name of location where the instrument is deployed.
- ***Geographic Position:*** GPS potion 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 fields where you may enter and store information about the deployment. These settings are not used in calculation. ***Geographical Position*** can be used to give the map coordinates either under the Data Visualization using AADI Real-Time collector and sensor in AADI Real-Time mode or it can be used in a display software to display position of sensor.

5.10.3 Dependencies



Dependencies

Property	Value
Local Gravity (m/s^2)	9.809999E+00
Salinity (PSU)	3.500000E+01
Installation Depth (m)	0.000000E+00
Distance to Seafloor (m)	0.000000E+00
Air Pressure (kPa)	1.013000E+02

Figure 5-31: Dependencies

Dependencies are settings used in internal calculation.

Local Gravity Constant (m/s^2) is the local gravity constant in m/s^2. The default value is 9.81m/s^2.

Salinity (PSU) is the Salinity in PSU used for calculation of density, sound speed and depth. The value can be altered while sensor is running to compensate for variable salinity.

Installation Depth (m) in meter relative to chosen datum, default set to 0 = instrument referred. If the offset between the sensor installation and the desired local datum is known, the property ***Installation Depth*** can be used for referencing the ***Tide Level*** to this datum.

Distance to Seafloor (m) is the distance between the sensor and the sea floor. This distance must be set by the user so that the sensor software selects the correct transfer function in the wave calculations. Only for Tide Sensor 5217/5217R and Wave And Tide Sensor 5218/5218R. If the distance is longer than 50m, you can still type 50 m since the measurement data will be processed using a “deep water”-transfer function,

Air Pressure (kPa) is the barometric pressure in kPa used to compensate for air pressure variations. The default value is 101.3.

5.10.4 Input Parameter Air Pressure

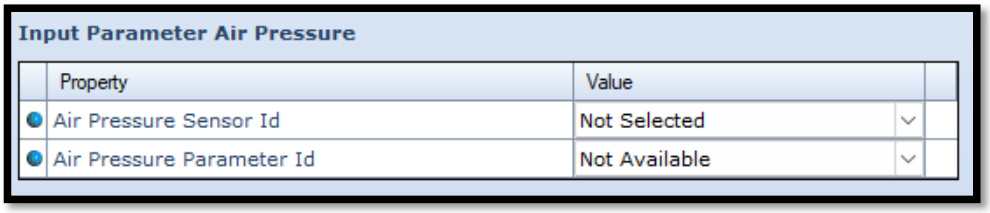


Figure 5-32: Input Parameter Air Pressure

Air Pressure Sensor Id gives a list of available air pressure sensors connected to the same AiCaP bus. If connected, then select the parameter under ***Air Pressure Parameter Id. Air Pressure*** is used to compensate for variations in calculations like ***absolute pressure*** and ***absolute tide***. If no sensor is selected the fixed value will be used. The ***hydrostatic pressure*** is calculated by subtracting the ***atmospheric pressure*** from the time series samples.

Air Pressure Parameter Id is used to select the correct output from any connected sensor with kPa output. Sometimes more than one alternative shows up from the same sensor. This might be because a sensor outputs more than one parameter with kPa as output.

5.11 System Configuration

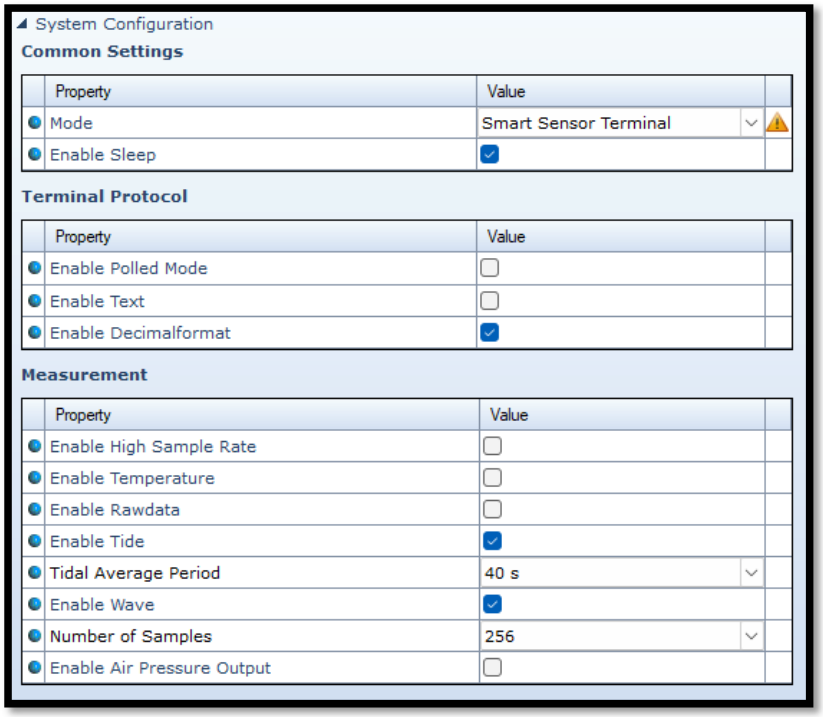


Figure 5-33: System Configuration

System Configurations has three different sections that are mainly controlling the output from the sensor. The sections are:

Common Settings are used to set the ***mode*** and to save power by allowing the sensor to go to sleep between measurements.

Terminal Protocol contains settings for Polled/Non-polled mode and output controls for Smart Sensor Terminal mode.

Measurement are properties used to control the output from the sensor and number of samples/periods for calculations.

5.11.1 Common Settings

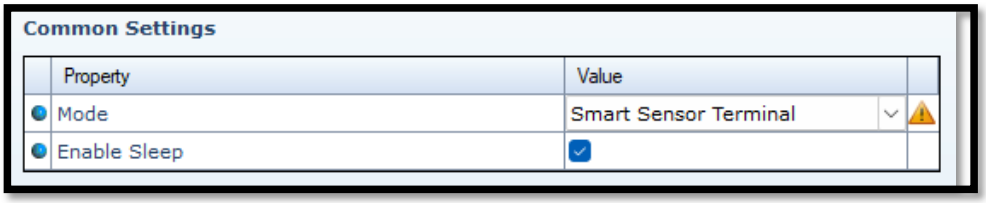


Figure 5-34: Common Settings

Mode: The communication protocol needs to be defined under "***Mode".*** There are four different choices:

- ***AiCaP*** is only used together with Aanderaa loggers. If the sensor is going to be used with an Aanderaa logger such as SmartGuard, the mode must be changed to ***AiCaP*** mode first and saved before connecting it to the logger.

- ***Smart Sensor Terminal*** mode is a simplified ASCII protocol which is easier to use together with a PC terminal program. This protocol is described in more detailed in ***CHAPTER 10*** . 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 must be reset when the protocol/mode has been changed.

- ***AADI Real-Time*** is the correct mode (protocol) when used together with Real-Time Collector. This is an xml-based protocol which includes more metadata in the data messages.

- ***Smart Sensor Terminal FW2*** is compatible with the older versions of Smart Sensor Terminal. This is normally only used if you need an output string like an older version of the sensor.

Enable Sleep: This setting gives lower power consumption in ***AADI Real-Time*** and ***Smart Sensor Terminal*** mode when the sensor is able to go to sleep between measurements. In ***AiCaP*** mode this is controlled by the logger.

5.11.2 Terminal Protocol

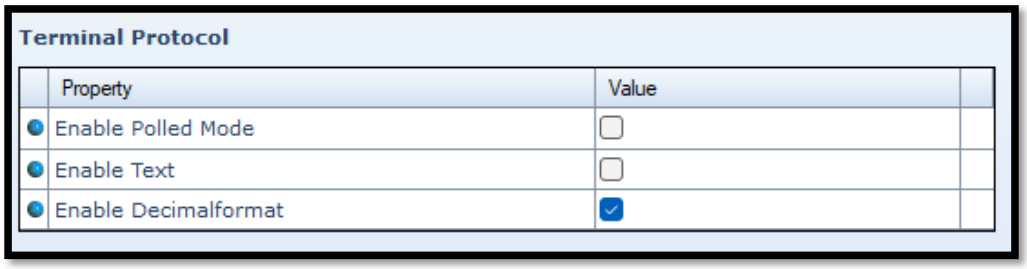


Figure 5-35: Terminal Protocol

The ***Terminal Protocol*** settings are used to control the output from the sensor.

Enable Polled Mode if set to ***(Yes)*** the sensor will output data every time the user/system polls for data with a ***Do Sample ()*** command. ***Do Sample*** trigger a calculation.

For ***Pressure Sensor 4117/4117R*** it will output the last measurement every time a ***Do Sample*** is received.

For ***Tide Sensor 5217/5217R*** it will output a string with newest pressure measurement, calculation of Tide parameters using the last number of pressure measurements given by the ***Tidal Average Period*** setting. Every time you send a ***Do Sample*** it will produce a new calculation using the newest pressure measurements.

For ***Wave and Tide Sensor 5218/5218R*** it will output a string with newest pressure measurement, calculation of Tide and Wave parameters using the last number of pressure measurements given by the ***Number of Samples*** setting.

Wave and Tide parameters and ***Pressure Time Series*** will be 0 until enough samples are collected. If power is turned off the sensor will erase the buffer and start collecting new data.

Enable Text controls the output string in Smart Sensor Terminal. When enabled the sensor will output a string with parameter name together with each reading, refer Figure 7-7 for an example where this command is toggled.

Enable Decimalformat toggle between decimal format like 0.10 and Engineering format like 1.000E-01.

5.11.3 Measurement

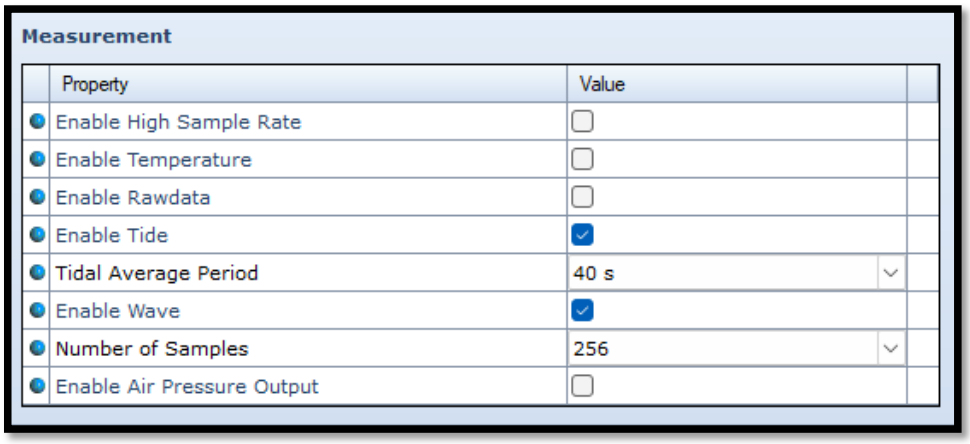


Figure 5-36: Measurement

Enable High Sample Rate sets the sample rate to ***4 Hz*** if set to ***Yes***. If not enabled, ***No***, the sample rate will be ***2 Hz.*** Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes***.

Enable Temperature enables the output of Temperature from sensor. Default is ***Yes***.

Enable Rawdata enables the output of Rawdata, ***Rawdata Pressure*** and ***Rawdata Temperature***. Default is ***No***.

Enable Tide is used to switch on and off the ***Tide*** output parameters, ***Tide Pressure*** and ***Tide Level***. Sensor needs to run for at least one ***Tidal Average Period*** before these parameters are available. Please note that sensor configuration will influence how long this time will be and that the sensor does not collect data during output. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes*** for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Tidal Average Period sets the averaging interval for the tide measurements. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is ***40s.***

Enable Wave is used to switch on and off the ***Wave*** output parameters, ***Significant Wave Height, Max Wave Height, Mean Period, Peak Period, Energy Period, Mean Zero Crossing, Steepness, Irregularity, Cut Off Frequency High.*** The sensor needs after power on to collect at least pressure measurements equal to Number of Samples before these parameters are available. Please note that sensor configuration will influence how long this time will be and that the sensor does not collect data during output. Only available for ***Wave & Tide Sensor 5218/5218R.*** Default is ***Yes.***

Number of Samples is the number of single pressure measurements used in the calculation of each wave parameter. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.*** Default is 1024.

Enable Air Pressure Output enables the Air Pressure output from the sensor. Default is No. Only if Air Pressure Sensor Id and Air Pressure Parameter Id are enabled.

5.11 User Maintenance

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

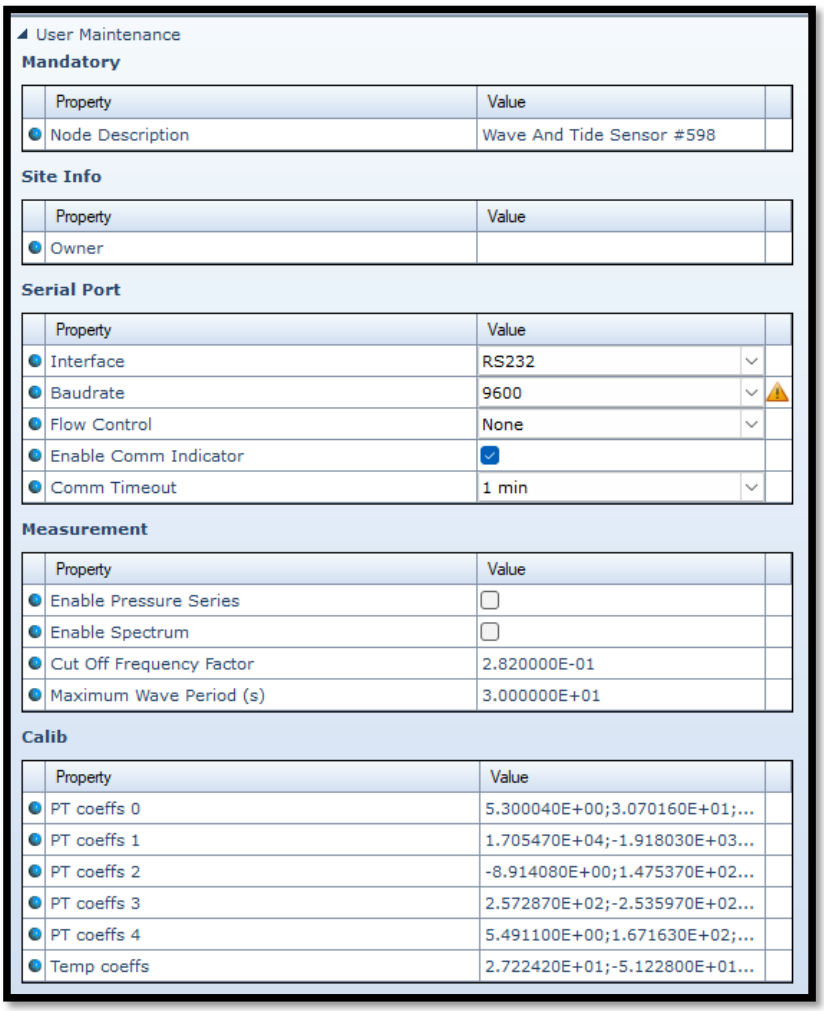


Figure 5-37: User Maintenance

User Maintenance holds 5 different sections:

- ***Mandatory***
- ***Site Info***
- ***Serial Port***
- ***Measurement***
- ***Calib***

Even small changes in any of the properties in this section will have a major influence on the calculated data from the sensor.

5.11.1 Mandatory

Figure 5-38: Mandatory in User Maintenance

All sensors are given a ***Node Description*** text like Wave and Tide Sensor #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 its configuration. If one of the sectors is corrupted, the other sector is used and saved to the corrupt sector.

5.11.2 Site Info

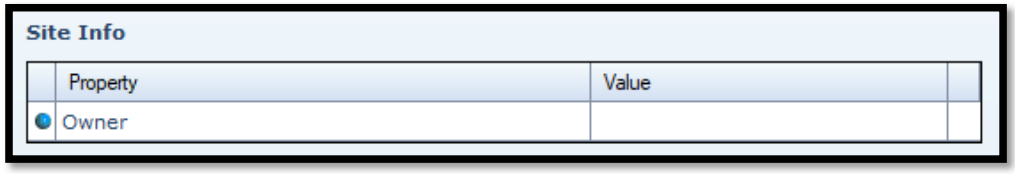


Figure 5-39; Site Info in User Maintenance

Site Info is optional information to be entered to store information about the ***Owner.*** This setting is not used in calculation.

5.11.3 Serial Port

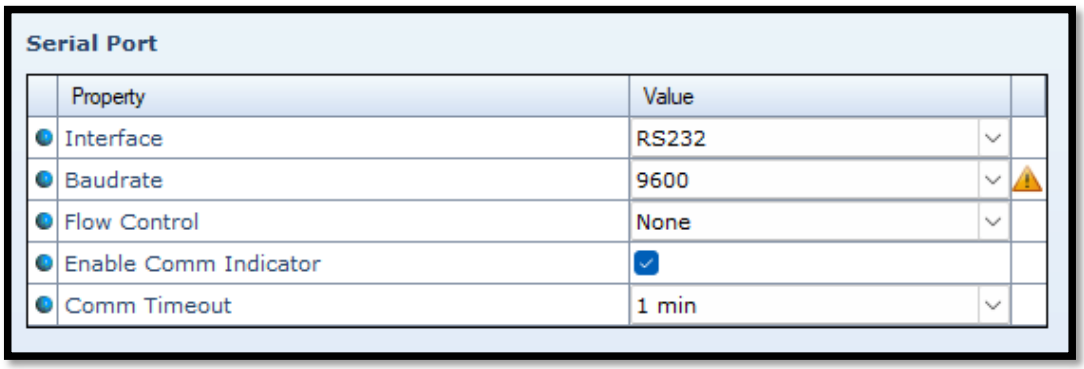


Figure 5-40: Serial Port settings in User Maintenance

The ***Serial Port*** group contains settings that deal with the RS-232 setup.

Interface is only available as RS-232. When using Smart Sensor Terminal make sure that the sensor setting is the same as terminal set-up. The default setting from factory for ***Baudrate*** is ***9600***.

Flow Control prevents data loss by coordinating when data can be sent. Default set to ***Xon/Xoff***.

Enable Comm Indicator is enabling communication sleep ('%') and communication ready ('!') indicators, when set to ***Smart Sensor Terminal*** mode. '!' indicates that the sensor is ready to communicate after sleep and '%' indicates that the sensor is going to sleep due to inactivity longer than the value/time set in ***Comm Timeout*.**

Comm Timeout is controlling 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 active communication. Default is 1min.

5.11.4 Measurement

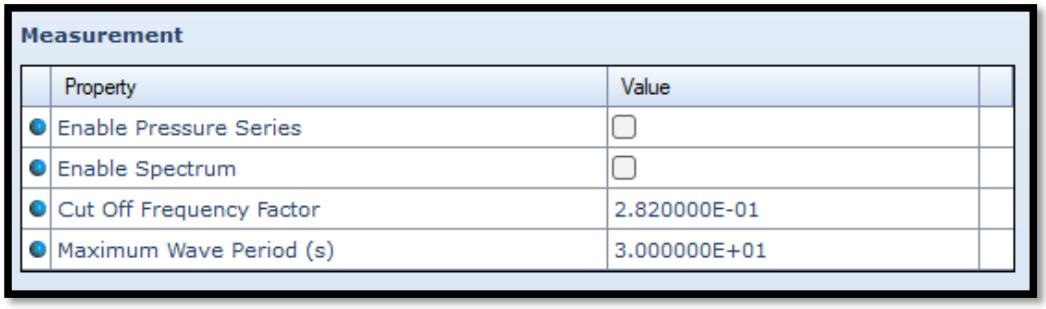


Figure 5-41: Measurement

Enable Pressure Series if set a file with all individual pressure measurements will be sent. Only available for ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R.***

Enable Spectrum if set a file with wave spectrum measurements will be sent. Only available for ***Wave & Tide Sensor 5218/5218R.***

Cut Off Frequency Factor is a factor used to calculate Cut-Off Frequency with using this factor, Local Gravity and installation depth measured by sensor. Default 0.282. See ***chapter 14.1*** for more info. Only available for ***Wave & Tide Sensor 5218/5218R.***

Maximum Wave Period (s) is used to set the upper Cut-off frequency. Default 30s. Only available for ***Wave & Tide Sensor 5218/5218R.***

5.11.5 Calib

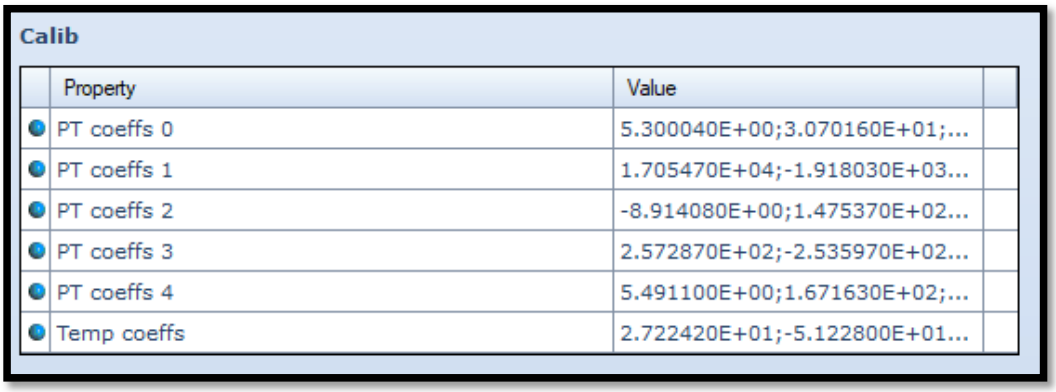


Figure 5-42: Calib in User Maintenance

Pressure Coeffs. This property holds 5 coefficient sets obtained during a calibration process at factory. The calibration coefficients are available from the calibration certificate.

Temp Coeffs This property holds 4 coefficients. The calibration coefficients are available from the calibration certificate.

5.12 Save Configuration to file

The example below shows a small excerpt of a saved configuration. All information and settings related to the connected sensor are found in the full file.


```
<?xml version="1.0" encoding="utf-8"?>
<Config ID="5218-598-9.6.1-0-194" Time="2025-09-11T08:22:21.906Z"
xmlns="http://www.aadi.no/RTConfigSchema">
  <NodeConfig ID="5218-598" SerialNo="598" ProdNo="5218" ProdName="Wave And Tide
Sensor" Descr="Wave And Tide Sensor #598" Adr="7809792" IsSensor="true" ProtocolVer="6"
ConfigVer="16" NodeTypeID="2010">
    <ConfigCategory ID="0" Descr="Factory Maintenance">
      <PropertyCategory ID="0" Descr="Mandatory">
        <Property Access="R1W4" Type="VT_BSTR" Descr="Product Name" ID="0">Wave And
Tide Sensor</Property>
        <Property Access="R1W4" Type="VT_BSTR" Descr="Product Number"
ID="1">5218</Property>
        <Property Access="R1W4" Type="VT_I2" Descr="Serial Number" ID="2">598</Property>
        <Property Access="R1" Type="VT_BSTR" Descr="SW ID" ID="6">1940008</Property>
        <Property Access="R1" Type="VT_ARRAY|VT_I2" Descr="SW Version"
ID="3">9;6;1</Property>
      </PropertyCategory>
      <PropertyCategory ID="4" Descr="Hardware">
        <Property Access="R3W4" Type="VT_BSTR" Descr="HW ID 1"
```


Figure 5-43: Saved file

CHAPTER 6 Logging data via AADI Real-Time Collector

6.1 Logging data on PC

The Real-Time Collector can save the incoming data to file, either to a txt-file or to xml-files. For instructions see the following chapters.

6.1.1 Enabling file output

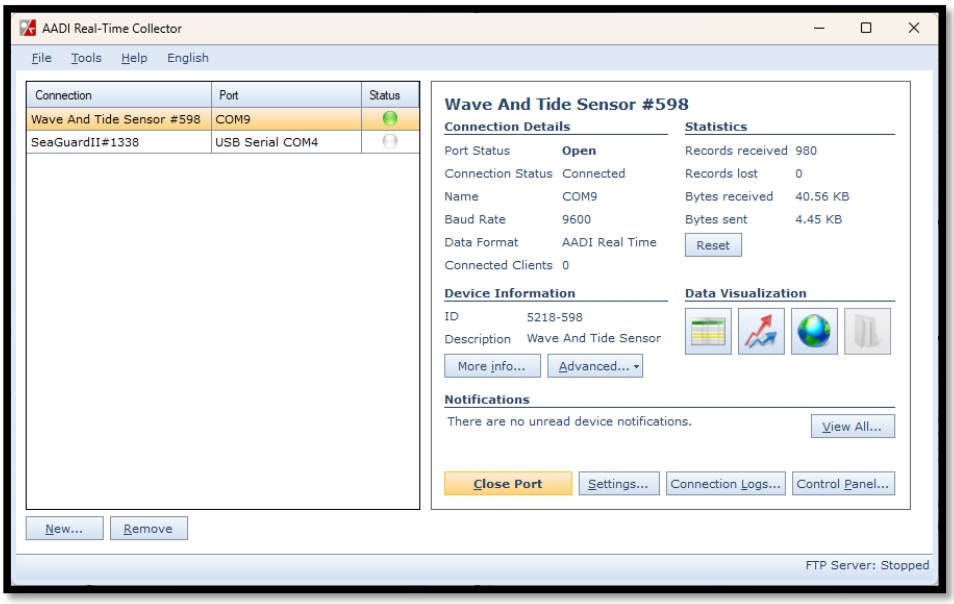


Figure 6-1: AADI Real-Time Collector start up menu

If your connection is open (status green in the AADI Real-Time Collector main menu) then first press ***Close Port***.

If you don't already have a connection select ***New***.

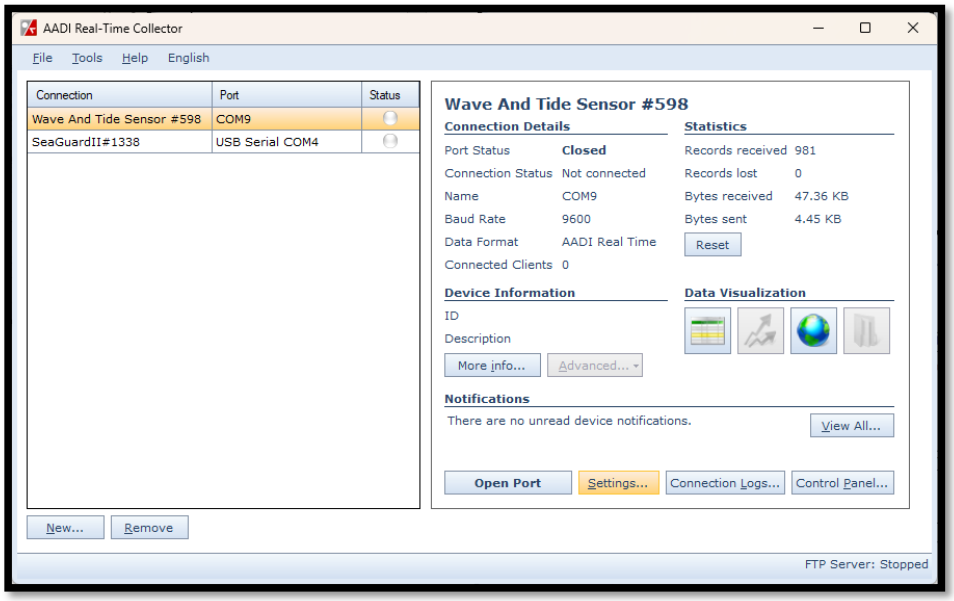


Figure 6-2: Settings

When the port is closed then highlight the sensor connection and click on the "***Settings…"*** button next to ***Close Port/Open Port***,

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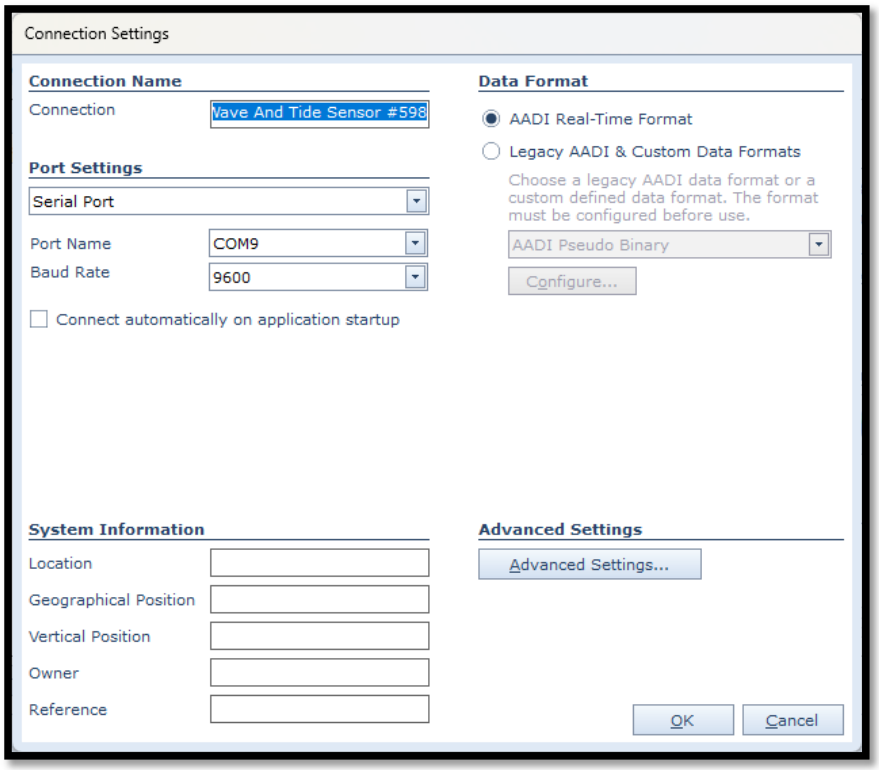


Figure 6-3: Connection settings menu

In the ***Connection Settings*** window either use the existing connection or select ***Connection Name*** and ***Port Settings. Connection Name*** you may select as you want either to make it general for more similar sensor or special for exactly this one.

Port Setting will be ***Serial Port*** for all sensors.

Port Name depends on the connection to your PC and ***Baud Rate*** must be equal to the sensor setting, default ***9600***.

Then click on the ***"Advanced Settings…"*** button.

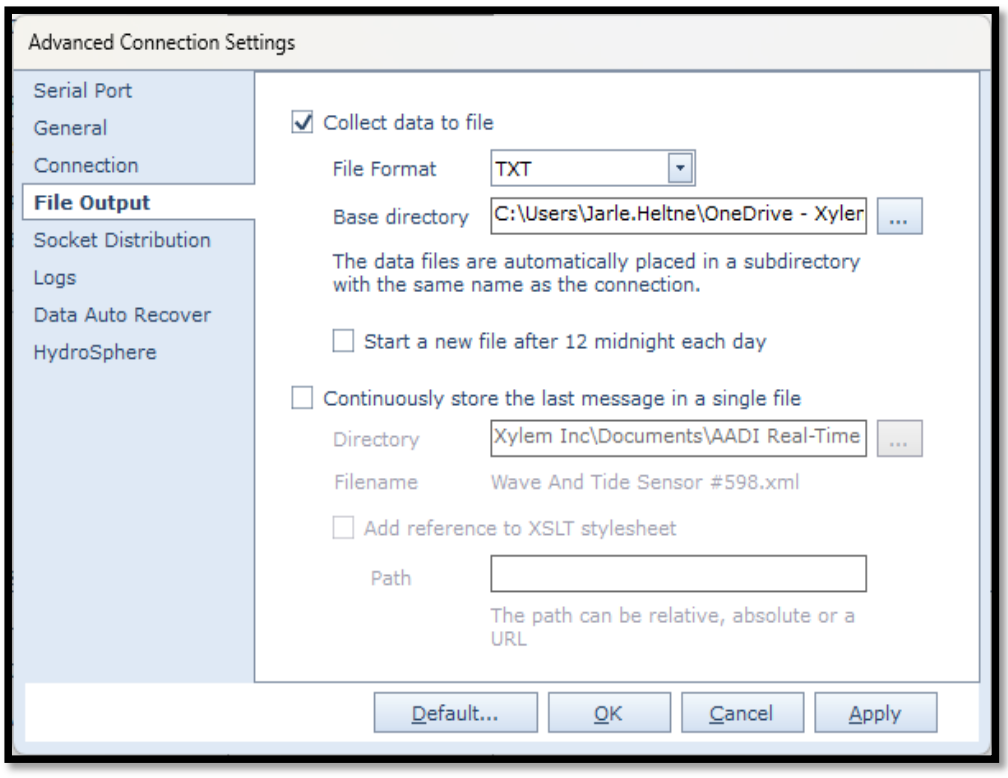


Figure 6-4: Advanced connection settings / File Output

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 and choose a base directory where you want to save the file.

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.

6.1.2 Starting the sensor and logging to file

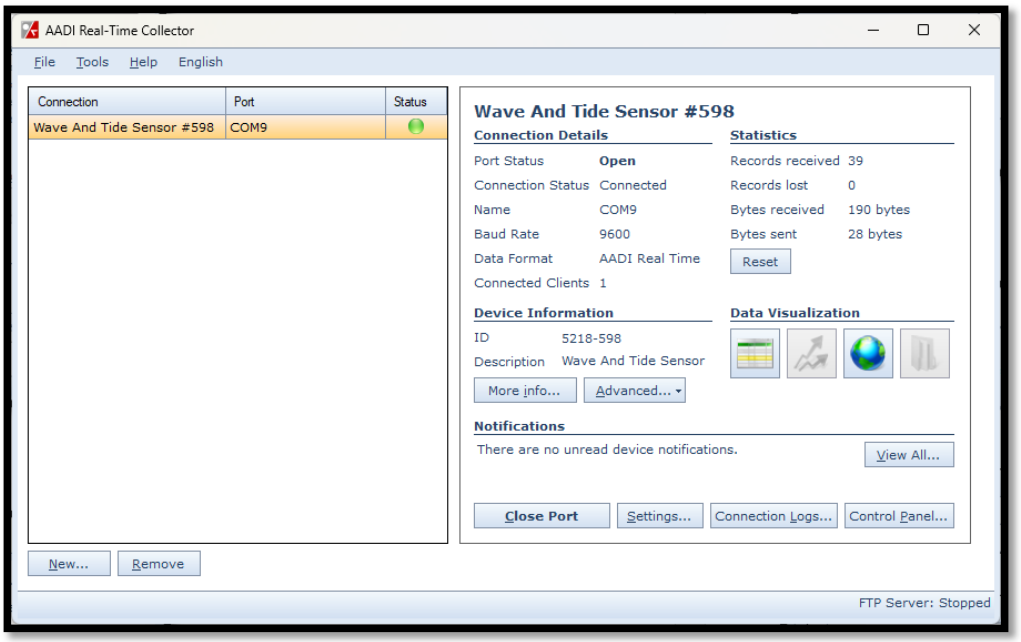


Figure 6-5: Open Port

In AADI Real-Time Collector start menu, click on the selected connection and ***"Open Port"***.

The Status turns green when the port is opened and connected.

Click on the ***"Control Panel…"*** button in the lower right corner.

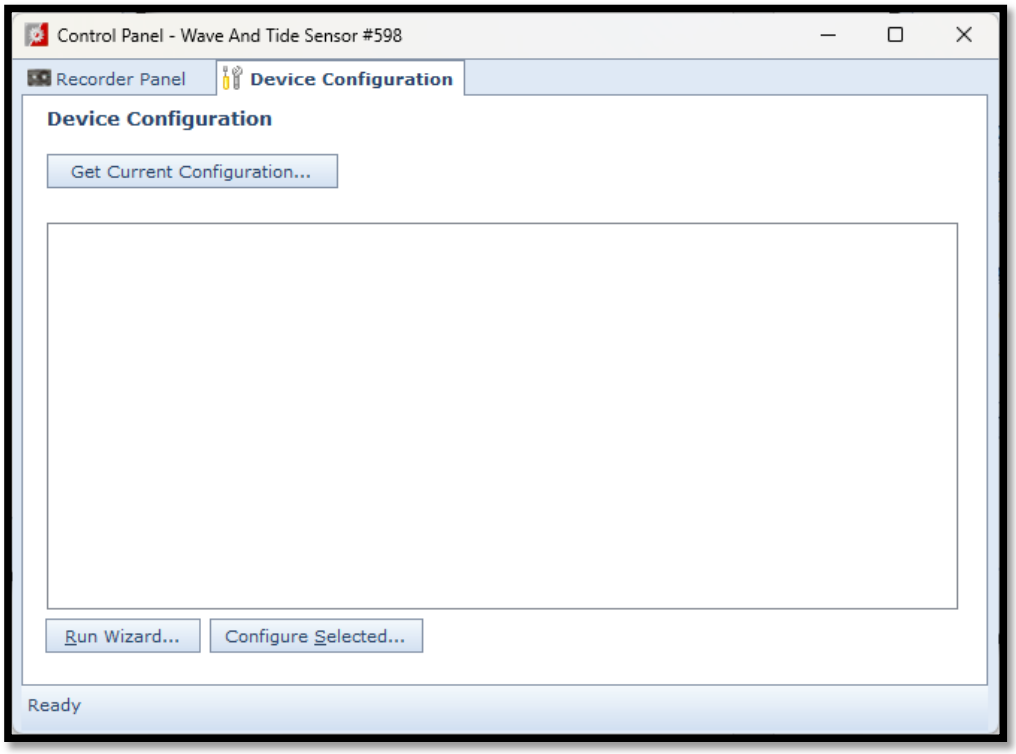
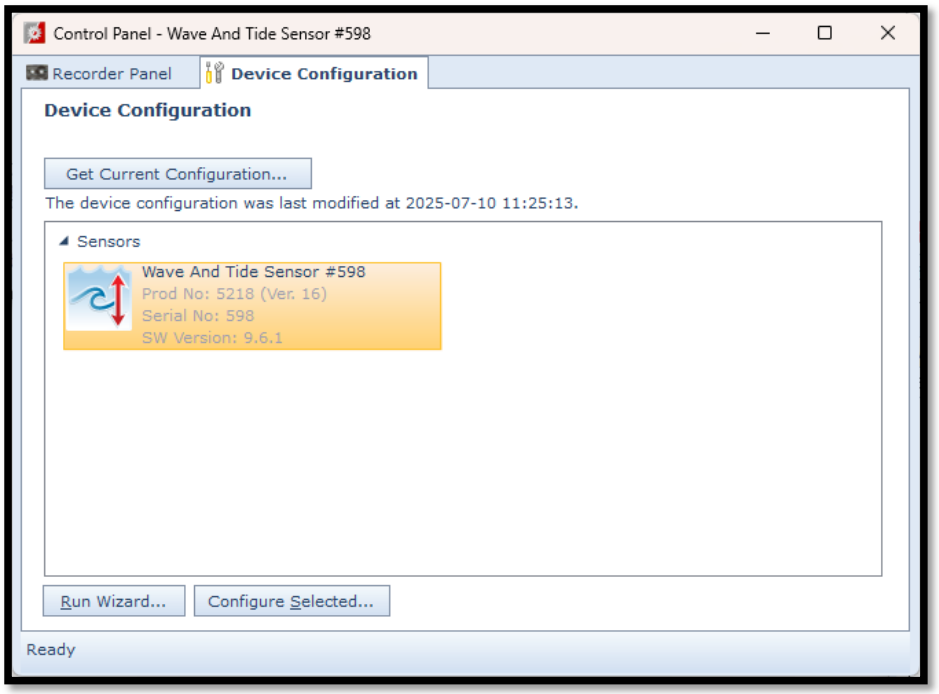


Figure 6-6: Device Configuration without sensor

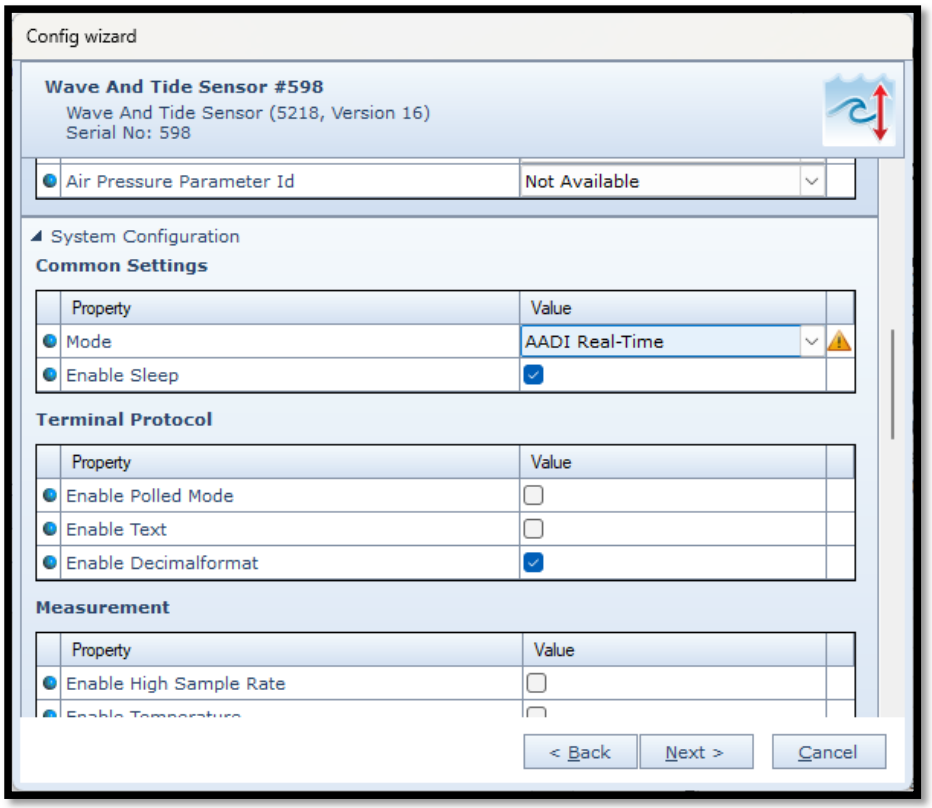
Then select ***Device Configuration***

If sensor do not show up press ***Get Current Configuration…***



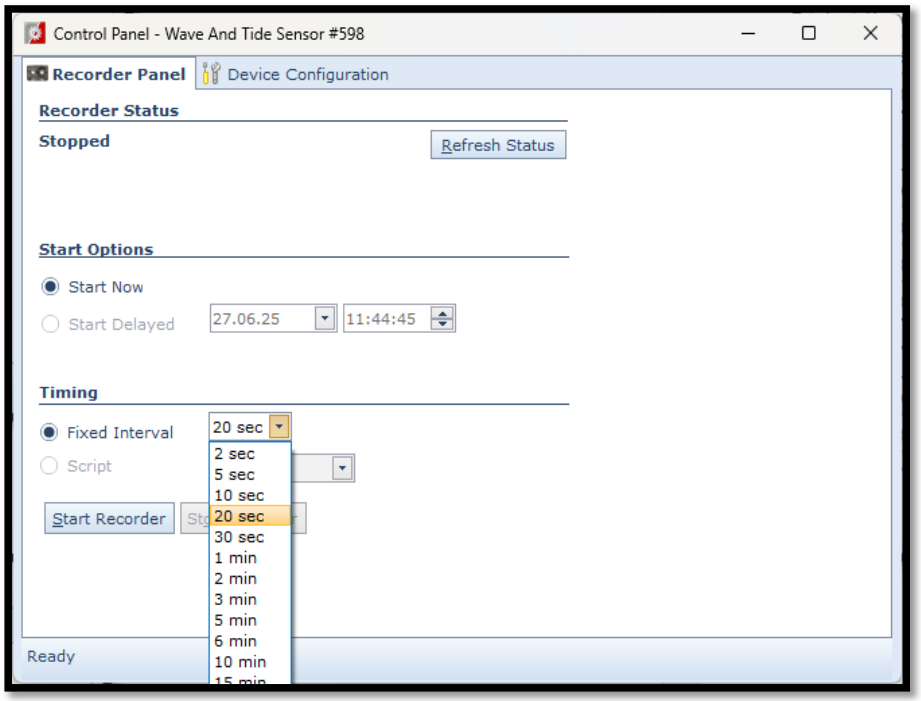
Double click on the sensor icon or select ***Configure Selected…*** to manage sensor settings.

Figure 6-7: Device Configuration with sensor



The sensor needs to be set to ***AADI Real-Time*** mode to be able to log real-time data.

Figure 6-8: Mode setting



In the ***Recorder Panel*** window select ***Start Now*** option and select ***Fixed Interval***.

If you want to change the interval, check the drop-down menu next to Fixed Interval

The interval available depends on the sensor configuration.
Then click the ***"Start Recorder"*** button.

Figure 6-9: 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, Notepad or similar.

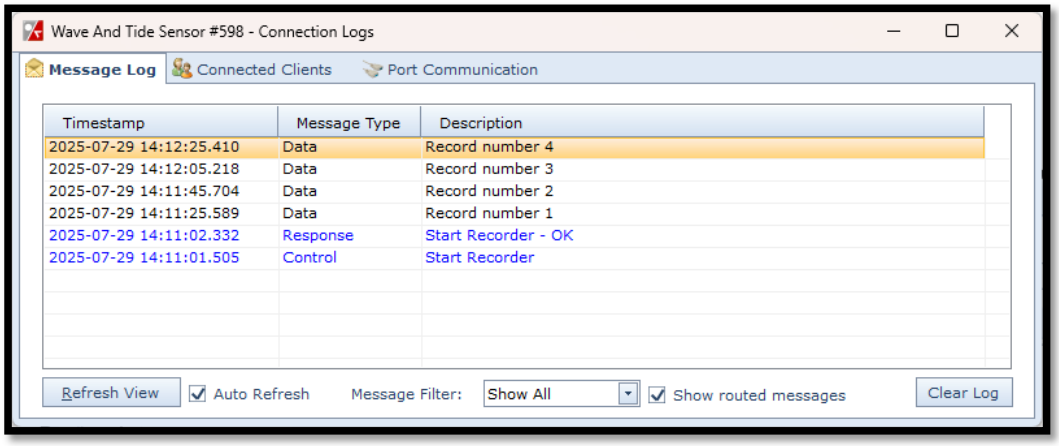
1	Description	Wave And Tide Sensor #598										
2	Product Name	Wave And Tide Sensor										
3	Product Number	5218										
4	Serial Number	598										
5	Device ID	5218-598										
6	Session ID	5218-598-9.6.1-0-151										
7	Location	Bergen										
8	Geographic Posi	60.323605,5.37225										
9	Vertical Position	0										
10	Owner											
11	Reference											
12												
13												
14			Wave And Tide Sensor #598									
15	Record Time	Record Nu	Sensor Status	Pressure [kPa]	Status	Temperature [DegC]	Status	Tide Pressure [kPa]	Status	Tide Level [m]	Status	Sign. Height [m]	Status
16	7/10/2025 13:14	1	(18) Parameter warning	1.01E+02		2.54E+01		1.01E+02		-6.65E-02		0.00E+00	(84) Warning, not ready
17	7/10/2025 13:17	2	(18) Parameter warning	1.01E+02		2.54E+01		1.01E+02		-6.55E-02		0.00E+00	(84) Warning, not ready
18	7/10/2025 13:20	3	(0) OK	1.01E+02		2.54E+01		1.01E+02		-6.41E-02		2.51E-02	
19	7/10/2025 13:23	4	(0) OK	1.01E+02		2.54E+01		1.01E+02		-6.38E-02		1.96E-02	
20													
21													
22													
23													
24													

Figure 6-10: Example of a txt-file obtained from the sensor using RT Collector

This example shows output with a standard configuration including Pressure, Tide and Wave. The different parameters are organized in columns.

6.2 Viewing incoming data in real-time

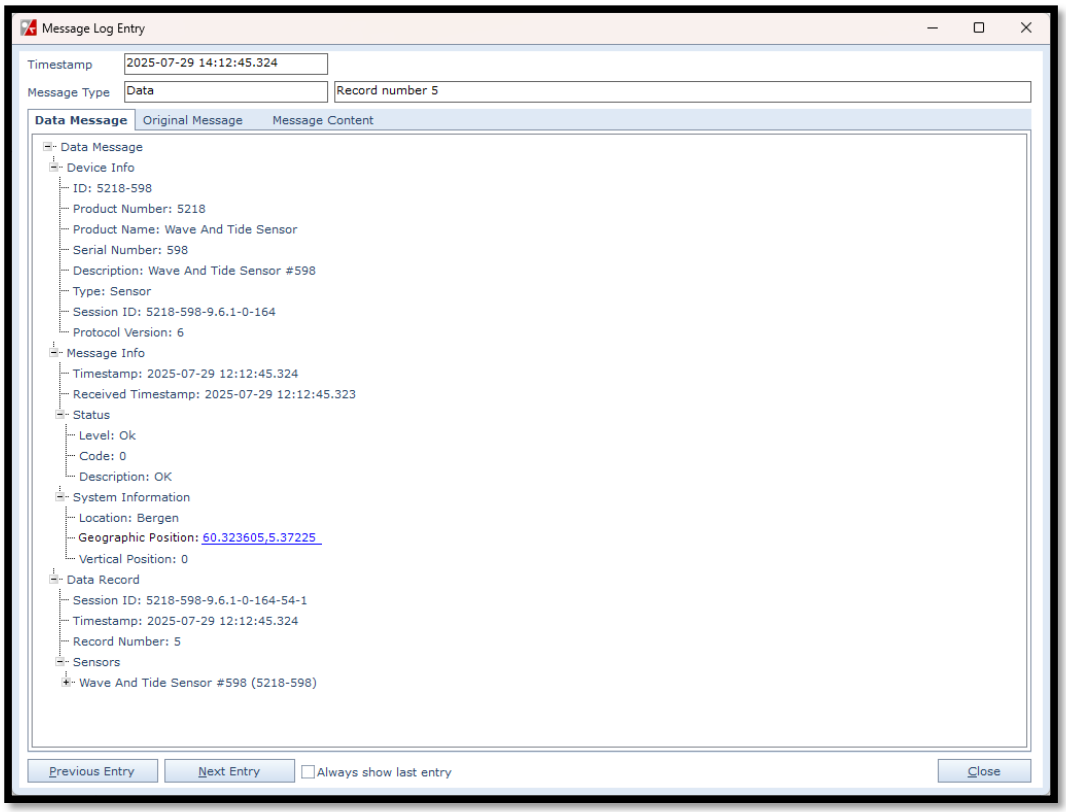
When the sensor is running, the incoming data can be viewed by selecting ***"Connection Logs…"*** in the AADI Real-Time Collector start menu,



Each Record number contains data from one recording period.

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

Figure 6-11: Connection Logs



Open or close each section by clicking on the +/- sign.

Figure 6-12: 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.

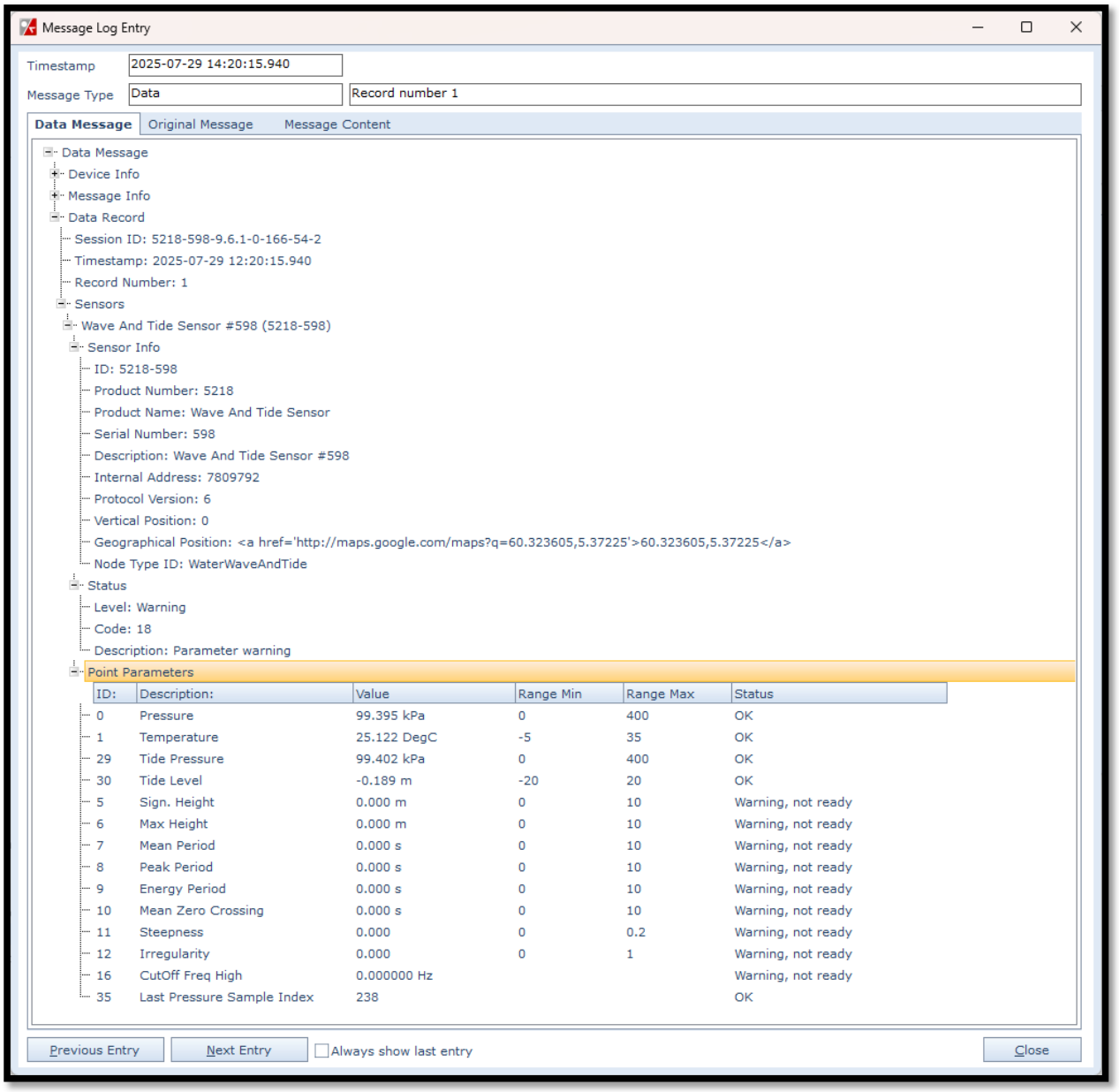


Figure 6-13: Sensor Data

The Sensor Data is separated into Point Parameters that are common for all cells and Cells that are given with an index number. Number of cells and parameters depends on the configuration.

Select the Original Message to see the .xml message

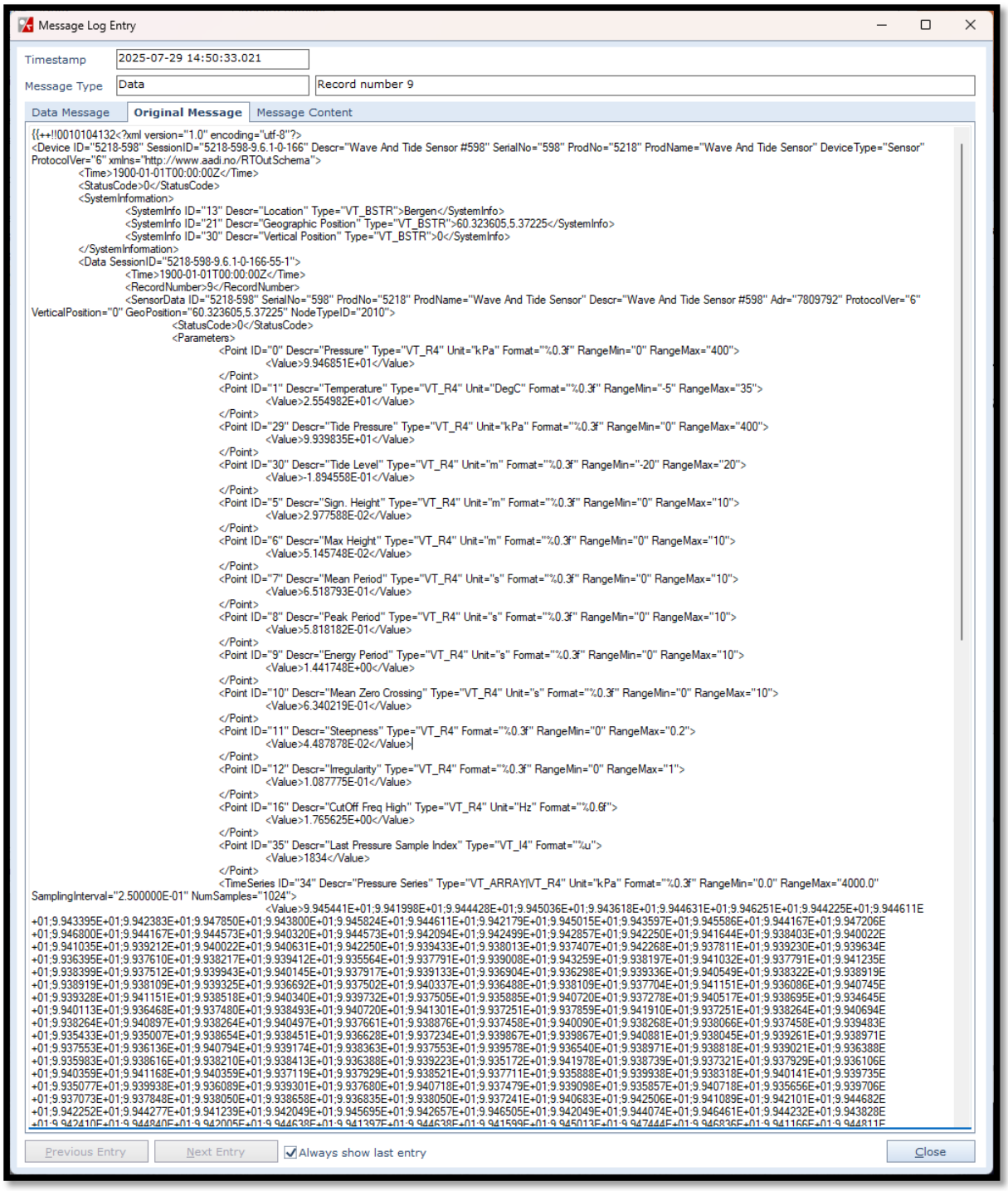


Figure 6-14: Original Message

CHAPTER 7 Stand-alone Sensor configuration using Terminal Software

This chapter describes how to communicate with the Pressure Sensor 4117/4117R, ***Tide Sensor 5217/5217R*** and ***Wave & Tide Sensor 5218/5218R*** using the RS-232 or RS-422 connection and Terminal Software. The sensor can be set to any mode but the mode setting and setting of the different properties will influence the output from the sensor.

Standard sensors can be used either with AiCaP protocol, AADI Real-Time protocol or Smart Sensor Terminal protocol. At delivery, the standard sensor is configured with 'AiCaP' mode. Ensure that the sensor is configured for AiCaP mode when used in SeaGuardII applications or SmartGuard with AiCaP connection. If the sensor is set in another mode, it will not be detected by the logger.

The sensor must be configured to Smart Sensor Terminal mode or AADI Real-Time mode before it can be used in RS-232 operations.

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

1. Disconnect the sensor from the SeaGuardII or SmartGuard Platform.
2. Connect the sensor to a PC using e.g. cable 3855/4865.
3. Open a terminal emulation program on your PC, copy and paste or write a text file in an ordinary text editor with command lines and save this file. This file can then be sent to the sensor in one operation. The first line in the example below is a user comment line that is disregarded by the Sensor. Strings starting with either ***'//'*** or ***';'*** are ignored by the software, and do not produce any errors nor are they acknowledged by the sensor.
4. Set the ***Mode*** property to ***Smart Sensor Terminal***. Followed by sending the ***Save*** and ***Reset*** commands to Save the configuration and reset the sensor.

Example:

```
//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 #
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 3855/4865.
2. Set the ***Mode*** property to ***AiCaP***. Save the configuration and reset the sensor.
3. Mount the sensor to the SeaGuardII or SmartGuard Platform.

Identical to example above except the set Mode line. Replace this with:

```
Set Mode(AiCaP) ↵//wait for ack #
```

7.1 R-version sensors

The R-version sensor supports only RS-422.
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 use an expansion card or you can use an RS-232 port and an RS-232/RS-422 converter. Aanderaa and or partners can provide such a cable: sensor cable 4799 to PC (with RS-232/RS-422 converter included).
Note! It is possible to receive data from the 'R' sensor using sensor cable 3855 to PC, but it is not possible to transmit commands to the sensor when connected to cable 3855.

7.2 Sensor versions and interface.

The 4117, 5217 and 5218 sensors can be used on a SeaGuardII and SmartGuard (AiCaP) Dataloggers or connected to a RS-232 com-port (PC or other devices with RS232 com-port).

The 4117R, 5217R and 5218R sensors can be used connected to an RS-422 com-port or connected with an RS-422 to RS-232 converter to an RS-232 com-port.

7.3 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 use 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 7-1 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-.

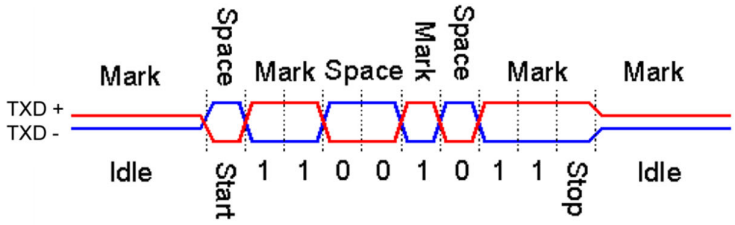


Figure 7-1: RS-422 transmission of a byte

7.4 Communication setup

Most terminal programs can be used for RS-232 communication with the sensor when connected to a PC. For this description we have used TerraTerm.
The following setup is recommended:

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

IMPORTANT! The terminal program must send a Line Feed after each Carriage Return.

Note! If using Tera Terminal Pro, after setting up the com port according to settings above please select "Terminal" in the "Set up" menu and click "Local echo" also select "CR+LF" for both "Receive" and "Transmit" under "New line".

Note! If using Hyper Terminal the options "Send line ends with line feeds" and "Echo line ends with line feeds" in the HyperTerminal ASCII setup must be selected.

7.5 Sensor startup

You will be able to communicate with the sensor via the Terminal software regardless of which mode the sensor is set to. However, the output string from the sensor will depend on the mode setting. The final structure of the output string will also depend on settings like Enable Text, Enable Decimal Format, Enable Raw Data, and so on. The sensor may continue to output measurements after the first startup info depending on the configuration. The output frequency will be according to the interval setting. Some properties will not have any effects in all modes, but they will still be available. Some properties may also have different effects depending on the mode.

7.5.1 AiCaP mode

In ***AiCaP*** mode the sensor will output ***StartupInfo*** with ***Product Number***, ***Serial Number***, ***Mode***, ***AiCaP Version***, ***Protocol Version*** and ***Config Version***. In this mode the sensor will not output any measurement since it needs an Aanderaa Datalogger as Master. The sensor can be configured for ***AiCaP*** use via the Terminal software.

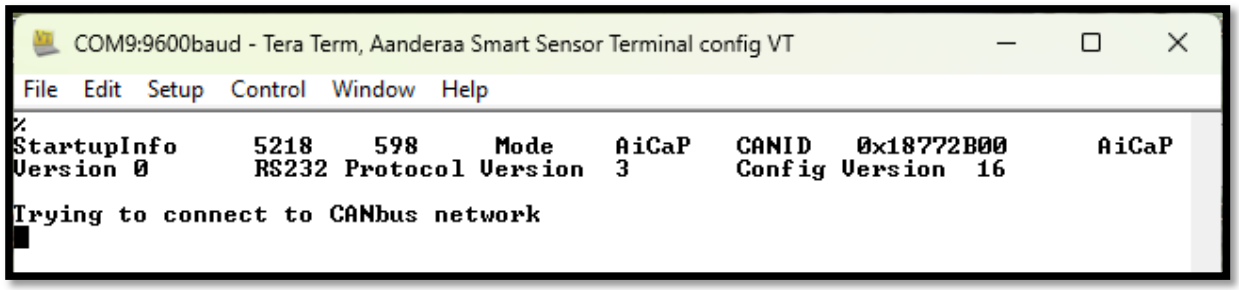


Figure 7-2: Typical power-up output for sensor set to AiCaP mode with enable text set to Yes

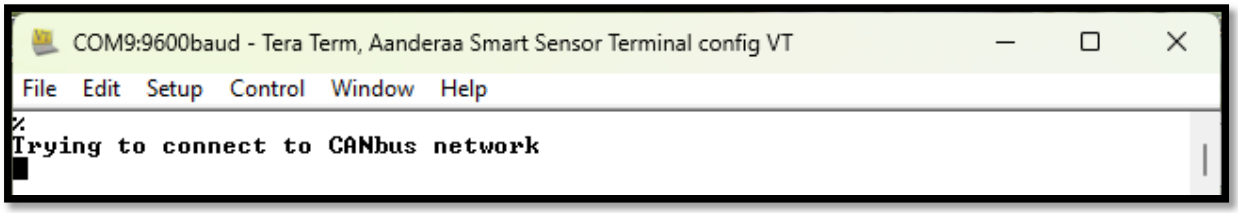


Figure 7-3: Typical power-up output for sensor set to AiCaP mode with enable text set to No

7.5.2 AADI Real-Time mode

AADI Real-Time mode is a Serial output with ***.xml***. This is the mode used with ***AADI Real-Time Collector*** and also preferd by some integrators when sensor is connected to 3rd party loggers or interface. The text shown is just a start-up meassage and do not contain any measurements. It will also output a first measurement x second, minute or hour after power- up and then a new measurement every x second, minute or hour, where x is the interval set by ***Interval(x)***. The number of parameters in the output string depends on the sensor configuration.

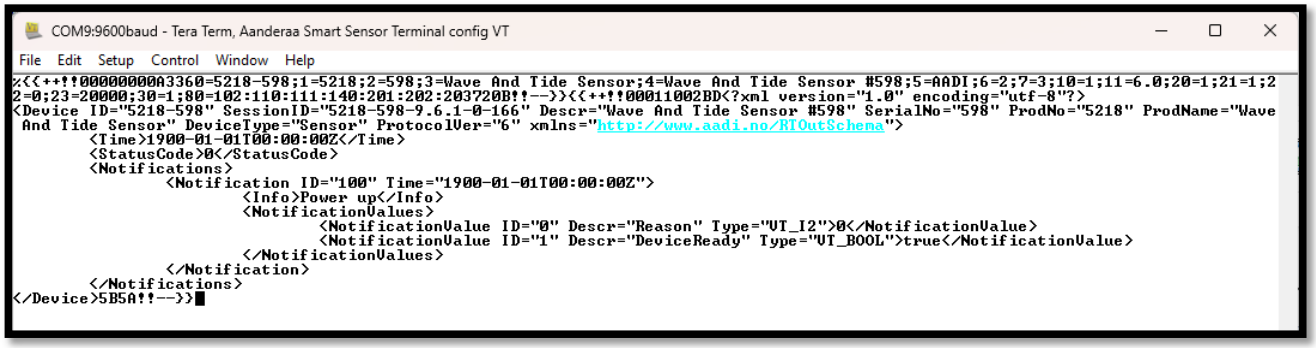


Figure 7-4: Typical power-up output for sensor set to AADI Real-Time mode

7.5.3 Smart Sensor Terminal mode

Smart Sensor Terminal mode is a Serial output with ASCII. In Smart Sensor Terminal mode the sensor will output ***StartupInfo*** with ***Product Number***, ***Serial Number***, ***Mode***, ***Protocol Version*** and ***Config Version***. It will also output a first measurement x second, minute or hour after power-up and then a new measurement every x second, minute or hour, where x is the interval set by ***Interval(x)***. The number of parameters in the output string depends on the sensor configuration.

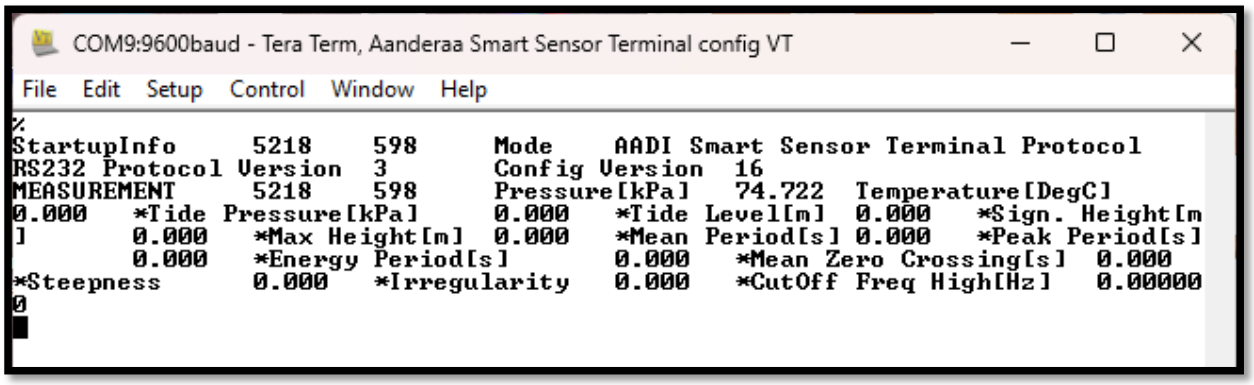


Figure 7-5: Typical power-up output for sensor set to Smart Sensor Terminal mode with enable text set to Yes

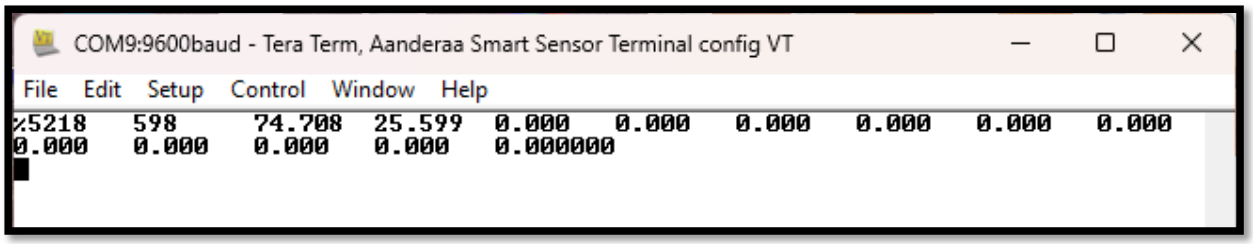


Figure 7-6: Typical power-up output for sensor set to Smart Sensor Terminal mode with enable text set to No

7.6 Controlling communication

To minimize the current drain the sensor normally enters a power down mode after each sampling; the sensor can be awake by any characters and will stay awake for a time set by the ***Comm TimeOut*** property after receiving the last character.

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.

The ***Communication Sleep Indicator***, ***'%',*** will be transmitted when the serial communication is deactivated, and the ***Communication Ready Indicator, '!'*** is outputted after 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.

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.
- 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.

7.7 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.

7.8 Passkey for writing protection

To avoid accidental change, most of the properties are write-protected. There are four levels of access protection, refer ***Table 7-1***.

A special property called ***Passkey*** must be set according to the protection level before changing the value of properties that are write-protected. 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 minute if the ***Comm TimeOut*** is set to ***Always On.***

Table 7-1: Passkey protection

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		The user has only read access
Factory Write	XXXX	Sensor specific code for factory level access

7.9 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 flash memory. The sensor always reads the configuration from the internal flash memory after resetting and power up. The ***Save*** command takes about 20 seconds to complete (indicated with the character '#' when finished).

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*** or ***AADi Real-Time.***

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. The number of parameters in the output depends on which parameters are enabled.

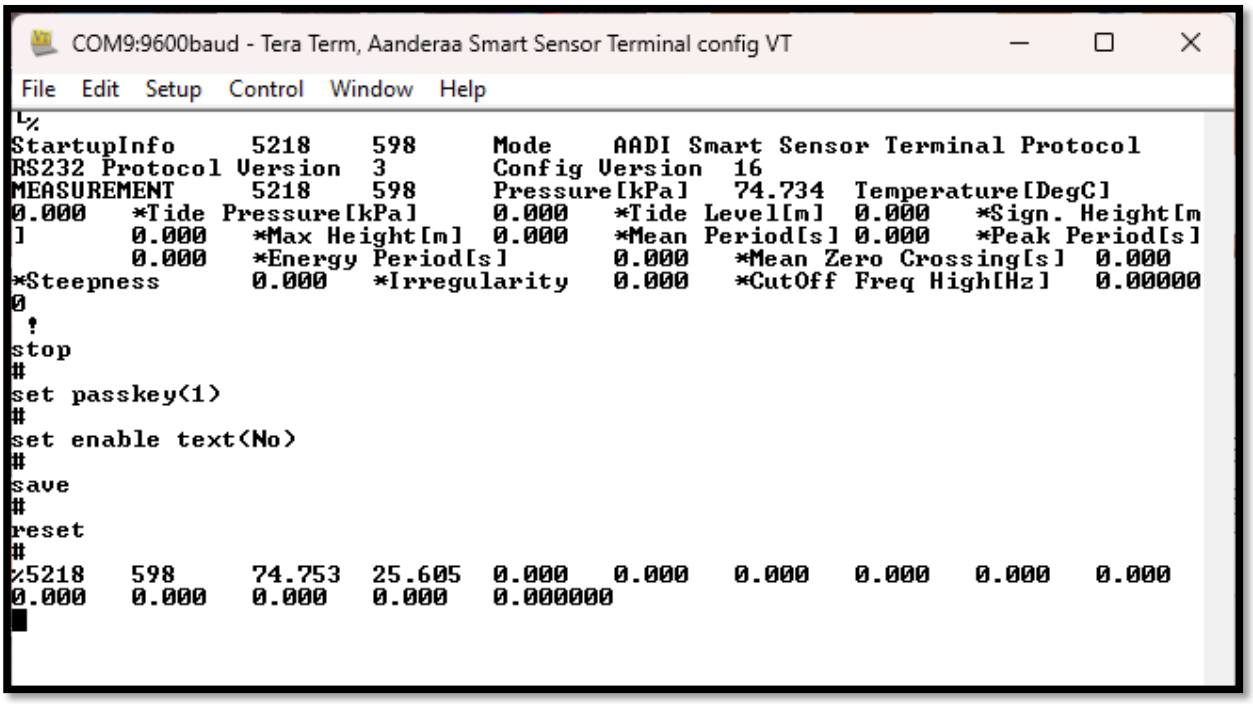


Figure 7-7: Save and reset in Tera Term

7.9.1 Polled mode

Sensors set to Smart Sensor Terminal mode can be used in Polled operation with third party hardware, where the sensor presents measurement data on user request only.

The ***Pressure sensor***:

- The ***Do Sample*** command updates pressure and temperature measurements.
- The ***Do Output*** command presents the last set of measured data.

Tide sensor and ***Wave and Tide sensor***:

- The ***Do Sample*** command starts a calculation and presents one set of output data.
- The ***Do Output*** command presents the last set of calculated data.

Enable Polled Mode if set to (***Yes***) the sensor will output data every time the user/system polls for data with a ***Do Sample ()*** command. ***Do Sample*** trigger a calculation.

For ***Pressure Sensor 4117/4117R*** it will output the last measurement every time a ***Do Sample*** is received.

For ***Tide Sensor 5217/5217R*** it will output a string with newest pressure measurement, calculation of Tide parameters using the last number of pressure measurements given by the ***Tidal Average Period*** setting. Every time you send a ***Do Sample*** it will produce a new calculation using the newest pressure measurements.

For ***Wave and Tide Sensor 5218/5218R*** it will output a string with newest pressure measurement, calculation of Tide and Wave parameters using the last number of pressure measurements given by the ***Number of Samples*** setting.

Wave and Tide parameters and ***Pressure Time Series*** will be 0 until enough samples are collected. If power is turned off the sensor will erase the buffer and start collecting new data.

Procedure to configure the sensor to Polled operations:

1. Connect the sensor to your PC.
2. Set the ***Enable Polled Mode*** property to ***yes***. Save the configuration and reset the sensor.

Example: //Press Enter to start communicating with the sensor.
↵ //press Enter
Stop ↵//Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Enable Polled Mode(yes) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

7.10 Available commands

Available commands and properties for the sensors are given in ***Table 7-2***.

Table 7-2 Available RS-232 commands.

Command	Description
Start	Start a measurement sequence according to current configuration and output data after one interval.
Stop	Stop a measurement sequence
Do Sample	Calculates and presents a new single set of measurement data.
Do Output	Presents the last set of calculated measurement data.
Get *ConfigXML*	Outputs information about the configuration properties in XML format
Get *DataXML*	Outputs information about available(enabled) parameters in XML format
Get *Property*	Output Property value, e.g get interval.
Get All	Output information about the configuration properties (same as shown on Get ConfigXML but without all the metadata)
Get All Parameters	Output information about all parameters value
Set *Property(Value,…, Value)*	Set Property to Value,…, eg set interval(60)
Set *Passkey(Value)*	Set passkey to change access level
Save	Store current settings
Load	Reloads previous stored settings
Reset	Resets the sensor with last saved new configuration
Help	Print help information
;	Comment string, following characters are ignored
//	Comment string, following characters are ignored

7.10.1 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.
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).***

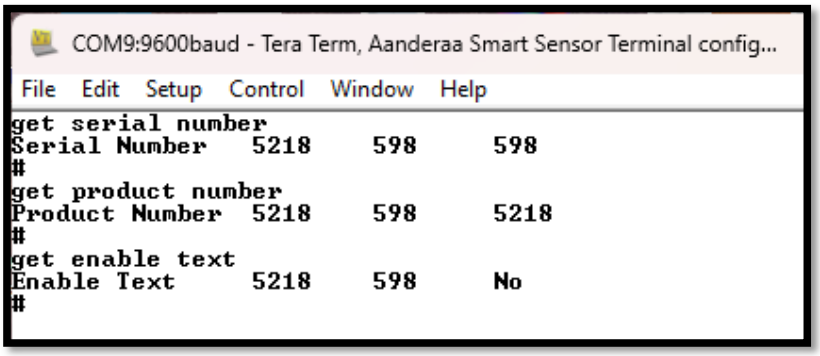


Figure 7-8: The Get Command

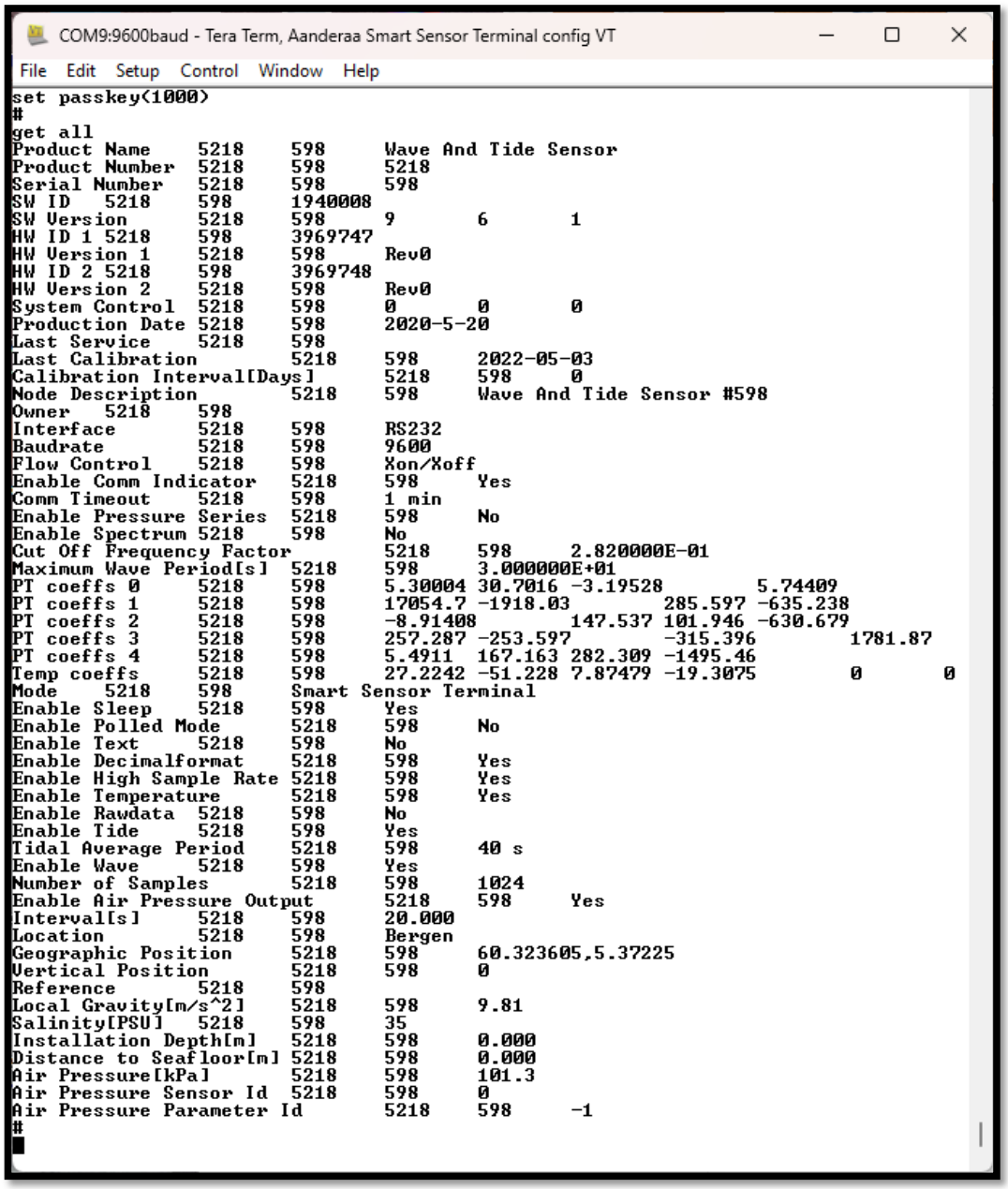


Figure 7-10: The Get All Command

7.10.2 The Set command

The ***Set*** command is used for changing property. The corresponding ***Get*** command can be used to verify the new setting. Please note depending on the configuration a too short interval will give an error message.

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 all user accessible property settings.

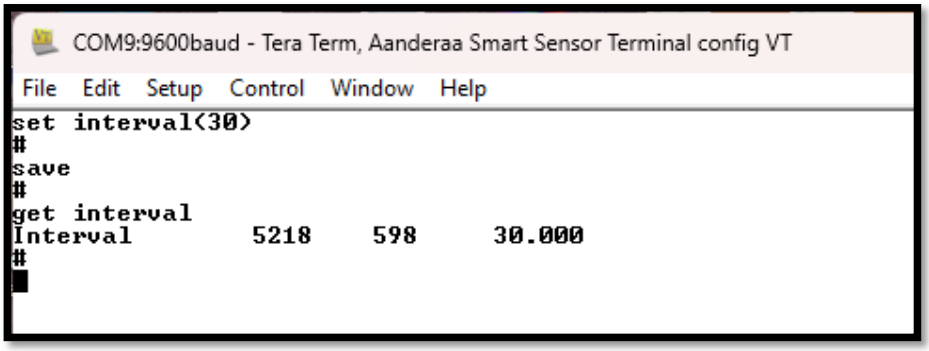


Figure 7-11: The Set Command

7.10.3 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.

7.11 Examples of Smart Sensor Terminal communication

Use a terminal program e.g. Teraterm or Hyperterminal.
In the following examples the sensor update interval is 5 seconds. They illustrate several configuration changes. The command ***Stop*** is recommended to avoid output strings while configuring the sensor.

Example 1: Enable Rawdata

//Press Enter to start communicating with the sensor.
↵ //press Enter
Stop ↵//Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Enable Rawdata(yes) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

Example 2: Change Number of Samples to 2048

//Press Enter to start communicating with the sensor..
↵ //press Enter
Stop ↵// Stop current measurement. Wait for ack #. Repeat if necessary.
Set Passkey(1) ↵//wait for ack #
Set Number of Sample(2048) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

Example 3: Disable wave measurement

//Press Enter to start communicating with the sensor.
↵ //press Enter
Stop ↵// Stop current measurement. Wait for ack #. Repeat if necessary.
Set Passkey(1) ↵//wait for ack #
Set Enable Wave(no) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

Example 4: Set Comm TimeOut to 20 sec

//Press Enter to start communicating with the sensor..
↵ //press Enter
Stop ↵// Stop current measurement. Wait for ack #. Repeat if necessary.
Set Passkey(1000) ↵//wait for ack #
Set Comm TimeOut(20 s) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

Example 5: Set Tidal Average Period to 1 min

//Press Enter to start communicating with the sensor.
↵ //press Enter
Stop ↵// Stop current measurement. Wait for ack #. Repeat if necessary.
Set Passkey(1) ↵//wait for ack #
Set Tidal Average Period(1 min) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings

7.12 Scripting -sending a string of commands

Often it may be useful to include more than one command in a text file. For example, the instructions below can be written in an ordinary text editor and saved as a text file, which can be sent to the sensor.

Example of text file:

// Set sampling interval to 30 seconds
Stop ↵// Stop current measurement. Wait for ack #. Repeat if necessary.
Set Passkey(1) ↵//wait for ack #
Set Interval(30) ↵//wait for ack #
Set Enable Wave(Yes) ↵//wait for ack #
Set Enable Rawdata(No) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings
Get All ↵

Note! The last line, Get All, reads out available properties for the sensor.

The first line is a comment line that is disregarded by the sensor. Strings starting with either '//' or ';' are ignored by the software, and do not produce errors or acknowledgements.
Always press Enter before sensing a script file.

7.15 Help command output.

Please note that some of the alternative values might be different with your sensor due to a different configuration or mode.

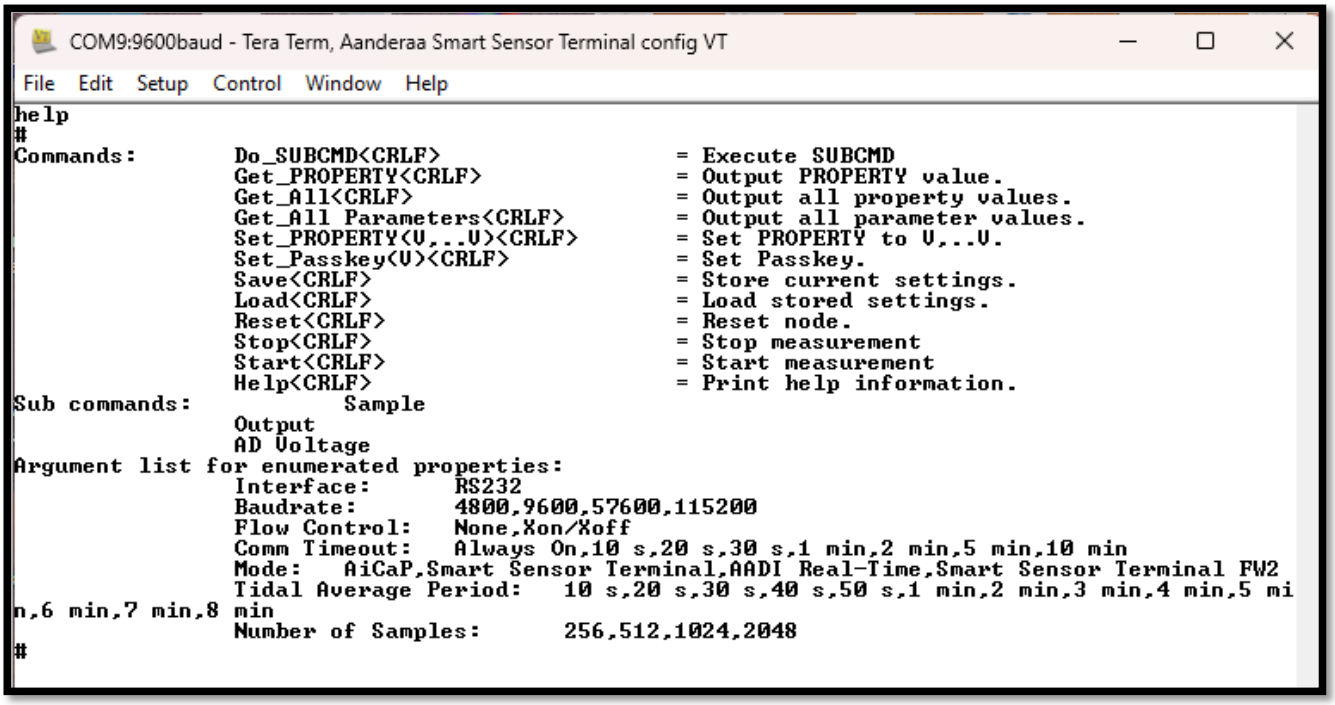


Figure 7-12: Help menu

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 setting.
Reset<CRLF>	= Reset node.
Stop<CRLF>	= Stop measurement
Start<CRLF>	= Start measurement
Help<CRLF>	= Print help information.

Sub commands:

Sample
Output
AD Voltage

Argument list for enumerated properties:

Interface:	RS-232/RS-422
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
Mode:	AiCaP, Smart Sensor Terminal, AADI Real-Time, Smart Sensor Terminal FW2
Tidal Average Period:	10 s, 20 s, 30 s, 40 s, 50 s, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 7 min, 8 min
Number of Samples:	256, 512, 1024, 2048

The available sub commands (***Do Sample***, ***Do Output***, ***Do AD Voltage***) are listed next. All available values on the enumerated properties are also shown here. Some of the enumerations will change depending on configuration (Interval property).

CHAPTER 8 Current drain

The sensors current drain depends on several property settings and the configuration of output parameters.
Assumptions about the presented current drain:

- ***Enable Sleep*** is set to ***Yes***
- ***Comm TimeOut*** is given another input than ***Always On***
- ***Enable Pressure Series*** is set to ***No*** (Tide/Wave and Tide sensor only)
- ***Enable Spectrum*** is set to ***No*** (Wave and Tide sensor only)

Other factors that influence the current drain:

- The total number of enabled output parameters.

Note!

Refer TD277 for a spread sheet calculating the current drain.

The current drain will decrease when the sensor is connected to a lower voltage power supply (less than 9V)

8.1 Pressure sensor 4117/4117R

The pressure sensor current drain depends on the output interval (S), and the sensor operation mode, refer to ***Table 8-1*** for current drain in each mode.

Table 8-1: Power consumption of the Pressure Sensor 5217/5217R when the assumptions stated in the beginning of CHAPTER 8 are true.

Operation Mode	Current drain@9V
AiCaP	0.4 mA + (5.4/S) mA
RS-232	0.4 mA + (24/S) mA
RS-422	1.1 mA + (22/S) mA

8.2 Tide sensor 5217/5217R

The sensor current drain depends on the sampling interval, the output interval (S), the tidal averaging period (T), and the sampling frequency (Fs) refer to ***Table 8-2*** for current drain in each mode.

*Note! If **Enable Tide** is **No** (Tide output parameter is disabled), then the sensor power consumption is like the power consumption of the Pressure sensor 4117/4117R, refer **CHAPTER 8.***

Table 8-2: Power consumption of the Tide Sensor 5217/5217R when Enable Tide is Yes, and the assumptions stated in the beginning of CHAPTER 8 are true.

Operation Mode	Current drain@9V	
	T/S ≤ 1	T/S > 1
AiCaP	0.4 mA + (2.2*Fs*T/S) mA	**Fs = 2 Hz:** 4.65 mA + (1.5/S) mA
		Fs = 4 Hz: 9.2 mA + (1.5/S) mA
RS-232	0.4 mA + (2.5*Fs*T/S) mA	**Fs = 2 Hz:** 5.5 mA + (13/S) mA
		Fs = 4 Hz: 10 mA + (13/S) mA
RS-422	1.1 mA + (2.4*Fs*T/S) mA	**Fs = 2 Hz:** 5.5 mA + (13/S) mA
		Fs = 4 Hz: 10 mA + (13/S) mA

8.3 Wave and Tide sensor 5218/5218R

The sensor current drain depends on the sampling interval (Fs), the output interval (S), the number of samples for wave calculations (N), and the tidal averaging period (T), refer to ***Table 8-3.*** for current drain in each mode.

*If **Enable Wave** and **Enable Tide** are **No** (Wave and Tide output parameter are disabled), then the sensor power consumption is like the power consumption of the Pressure sensor 4117/4117R, refer **chapter CHAPTER 8***
*If **Enable Wave** is **No** but **Enable Tide** is **YES** (Wave output parameters are disabled), then the sensor power consumption is like the power consumption of the Tide Sensor, refer **chapter 8.2***

IMPORTANT! If both Enable Wave and Enable Tide are Yes (both Wave and Tide output parameter are enabled), then the correct power consumption will be the greater of the consumption given in Table 8-2 and** Table 8-3**.

Table 8-3: Power consumption of the Wave Sensor 5218/5218R when *Enable Wave* is Yes, *Enable Tide* is *No*, and the assumptions stated in the beginning of CHAPTER 8 are true. If both Wave and Tide output parameters are enabled, the correct power consumption will be the greater of the consumption given in Table 8-2 and Table 8-3.

Operation Mode	Current drain@9V	
	N/(Fs*S) ≤ 1	N/(Fs*S) > 1
AiCaP	0.4 mA + (2.2*N/S) mA	**Fs = 2 Hz:** 4.65 mA + (6.5/S) mA
		Fs = 4 Hz: 9.2 mA + (5.0/S) mA
RS-232	0.4 mA + (2.5*N/S) mA	**Fs = 2 Hz:** 5.5 mA + (28/S) mA
		Fs = 4 Hz: 10 mA + (28/S) mA
RS-422	1.1 mA + (2.4*N/S) mA	**Fs = 2 Hz:** 5.5 mA + (28/S) mA
		Fs = 4 Hz: 10 mA + (28/S) mA

CHAPTER 9 Using 5383 Pressure Inlet w/membrane

For all sensors up to 400kPa range we recommend using 5383 Pressure Inlet with membrane instead of the standard black pressure inlet. This is done to prevent the oil from leaking out of the sensor port. Without the membrane it's normal that oil is washed out and replaced with sand and other particles that, especially if dried out may cause a blocking of the pressure port and consequently a wrong reading. A blocked pressure port will require factory maintenance to clean and recalibrate the sensor. By using the membrane, you will both extend the service interval and reduce the maintenance cost.

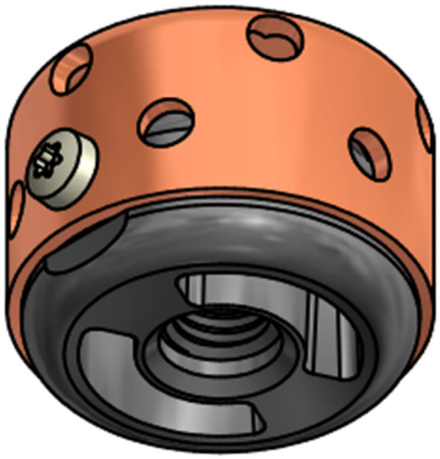


Figure 9-1: 5383 Pressure Inlet w/membrane

Figure 9-2: Mounting Pressure Inlet w/membrane to sensor

Do not remove the pressure inlet. Before assembly the pressure inlet to the sensor make sure that the port is oil filled and free of sediment. Screw the inlet port almost all the way but leave it resting before the final turn.

CHAPTER 10 **Electro Magnetic Compatibility and Cables**

For a manufacturer to legally produce and sell a product, it must apply for CE marking. This means that the commercialized product conforms to the CE applicable standards and can freely circulate within the EFTA (European Free Trade Association) & European Union countries. The applicable directive for the Pressure, Tide and Wave sensor is the EU EMC (2014/30/EU) (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. And addresses the different cables available for use with the sensor.

10.1 EMC Testing

The Pressure, Tide and Wave sensor has been tested at an accredited test laboratory to verify that the sensor fulfils the requirements in the EU EMC directive (2014/30/EU) and RoHS directive 2011/65/EU amended by Directive 2015/863.

10.2 Cables

Different cables are available for stand-alone use with free end and connectors. The cables have both power and signal lines RS-232. See ***chapter 15.1*** for more information on cables that are 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).

10.3 Power – Voltage range

The input voltage range is from 6 to 14Vdc.

CHAPTER 11 **Maintenance**

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.
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.

11.1 Retrieval of the sensor

Note!
Do not use any sharp objects to clean inside the pressure port, as this will damage the pressure 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 precautions for such acids.

When removing or disconnecting the sensor from attached cables always protect connectors on sensor and cables with appropriate dummy plugs. Always apply grease on connectors and sealing plugs if earlier applied grease is dried out.

Figure 11-1: Grease for Subconn plug

11.2 Factory service

Factory service is offered for maintenance, repair or calibration.

Before returning the sensors to factory please contact Aanderaa.support@xylem.com for an RMA number and needed paper.

When returning Pressure, Tide or Wave and Tide Sensor, always include the Instrument Service Order, Form No. 135; see our web pages under ‘Support and Training’.
Normal service 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.

Aanderaa Instruments’ established routines and quality checks throughout the production process are based on a relentless QC program of continuous monitoring to maintain the highest standards of reliability.
To ensure the quality of this sensor, critical properties are tested and documented during production. A special form, named “Test and Specification Sheet” (refer chapter 11.5 for examples) lists the required tests and the result of these tests and checkpoints.

11.3 Maintenance

The Pressure sensor, Tide sensor, and Wave and Tide sensor require modest maintenance. For deployments where the water contains high concentrations of sediment or where the organic fouling is extensive it is important to check that the pressure port is not clogged. If a Pressure Inlet with membrane is used do not remove the cap. Otherwise unscrew the pressure port cap, inspect the holes of the cap and clean it if necessary. Do not use any hard or sharp tools since this may damage the pressure transducer. Before replacing the pressure port cap, inspect that there is silicon oil in the pressure port.

To avoid clogging the pressure port is filled with high viscous silicon oil. After a long time use this oil may vanish. If no oil can be seen in the pressure port, we recommend that the sensor is returned to the factory for refilling.

The sensor housing is easily cleaned if exposed to a vinegar solution (5%) overnight. Carefully remove barnacles and similar fouling the next day.

11.3.1 Maintenance procedure prior to every deployment

- Inspect the O-rings.
- Make sure that the surfaces of the O-ring seatings are clean and smooth.
- Replace the O-rings if necessary.
- Lubricate the O-ring with silicon grease.

11.4 Calibration

Each sensor is calibrated using highly accurate instruments that are traceable to international standards.

For most versions of the sensor this involves 5 pressure points at 4 different temperatures.

From this calibration the 20 calibration coefficients are calculated and stored in each sensor.

11.5 Example of Test & Specification sheet and Calibration certificate

AADI a xylem brand

TEST & SPECIFICATIONS

Form No. 764, Dec 2005

Layout No:
Circuit Diagram No:
Program Version: 4.2.1

Product: Wave and Tide Sensor 5218R
Serial No: 27

---

1. **Visual and Mechanical Checks**:
   - 1.1. Soldering quality
   - 1.2. Visual surface
   - 1.3. Galvanic isolation between housing and electronics

2. **Voltages and Current Drain performance**:

2.1. DSP IO voltage, Tp3 (3.3±0.07V)	3.28	V
2.2. DSP core voltage, Tp2 (1.9±0.04V)	1.91	V
2.3. Analog voltage, Tp7 (3.3±0.15V)	3.35	V
RS232 / RS422		
2.4. RS232 Average current at 2Hz(Max: 6mA / 7mA)	3.79	mA
2.5. RS232 Peak current (Max: 50mA)	31.12	mA
2.6. RS232 Sleep current (Max: 400µA / 1100µA)		µA
2.7. AiCaP Average current at 2 Hz (Max: 6mA)		mA
2.8. AiCaP Peak current (Max: 50mA)		mA
2.9. AiCaP Sleep current (Max: 400µA)		µA

3. **Electronic performance test:**

3.1. Raw data pressure reading at air pressure (-500000 to +1000000)	605099	LSB
3.2. Raw data temp. reading in room temperature (6500000 to 10000000)	8564967	LSB
3.3. Noise on pressure raw data (Max: 400LSB)	127	LSB
3.4. Noise on temperature raw data (Max: 5000 LSB)	520	LSB

Date: 31 Jul 2013

Sign:

Lene Magnussen

Lene Magnussen, Production Engineer

AANDERAA DATA INSTRUMENTS AS

5851 BERGEN, NORWAY Tel. +47 55 60 48 00 Fax. +47 55 60 48 01 E-mail: info@aadi.no Web: http://www.aadi.no

Figure 11-2: Example of Test and Specification Sheet

AADI a xylem brand

CALIBRATION CERTIFICATE

Form No. 765, Oct 2008

Certificate No:5218_27_41500
Range: 0-400 **kPa**

Product: Wave and Tide Sensor 5218R
Serial No: 27
Calibration Date: 14 Aug 2013

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

Calibration Bath model FNT	321-1-40
Pressure Controller PPC3 10M	Serial: 673
ASL Digital Thermometer model F250	Serial: 6792/06

Parameter: Temperature

Calibration points and readings:

Temperature (°C)	0.98	13.95	26.99	39.99
Reading (LSB)	12251976.77	10184700.17	8021015.03	6057902.16

Giving these coefficients

Index	0	1	2	3
TempCoef	2.47323E01	-5.12022E01	8.01822E00	-1.91647E01

Parameter: Pressure

Giving these coefficients

Index	0	1	2	3
R1Coef0	1.81362E01	3.58064E00	-2.53511E-01	1.36888E00
R1Coef1	1.13475E03	-1.25197E02	1.99698E01	-4.33252E01
R1Coef2	-2.13844E01	1.39107E01	1.66381E01	-3.57935E01
R1Coef3	3.03291E01	1.60961E01	-7.60110E01	1.90096E02
R1Coef4	3.38603E01	-3.96332E01	1.08305E02	-2.83762E02

Date: 14 Aug 2013

Sign:

Tor-Ove Kvalvaag, Calibration Engineer

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Figure 11-3: Example of Calibration Certificate.

CHAPTER 12 **Status Codes**

The sensor produces some status codes if there are some errors with the sensor or with the quality of collected data. These status codes are either shown in the data string or when using post-processing software. Each status code has both a hexadecimal value and a decimal value shown in table below. The status codes are separated into three groups. ***Ok*** is when everything is normal and this status code will not be visible. An ***Error*** status code is critical and requires normally a service and repair on the sensor. ***Warnings*** are more temporary errors that may reduce the data quality for a shorter period and normally don't need a factory service but it is still important to investigate and remove the cause.

OK

Parameter	***Hex value***	***Status Code***	***Description***
Ok	0	0	Ok

Errors

Parameter	***Hex value***	***Status Code***	***Description***
Error, corrupt configuration	3	3.	Internal storage of settings is corrupt
InvalidVectorError	41	65	Internal use only
AccessError	42	66	Access error
RequestTimeError	43	67	Input time is shorter than the processing time
NotValidError	44	68	Some internal fails
CopyDataError	45	69	Recorder error

Warnings

Parameter	***Hex value***	***Status Code***	***Description***
Warning, watchdog detected	10	16	Reset generated by software
Warning, reset detected	11	17	Reset generated by reset command or power loss/low voltage
Parameter warning	12	18	Data set contains parameter(s) that is not reliable
OutOfMeasureRange	51	81	Data outside range. The data is not reliable
OutOfCalibRange	52	82	Data Outside Calibration range. The data can be reliable, but out of calibration range

ReducedQuality	53	83	e.g. supply voltage to low
NotReady	54	84	e.g. too few samples to perform calculation
NotImplemented	55	85	Not a valid parameter
StoredDataWarning	56	86	e.g. Storing data that reduce precision
LowQuality	57	87	Indicates lower quality than reduced quality
DiscardData	58	88	Data useless, can be discarded

Each data set has a common status code. If the common status code is Parameter warning (18), then one or more of the parameters will have a Parameter Warning status code.

In RS-232, RS-422 and Polled operation errors and warnings will be indicated with a * in front of the parameter name when the property *Enable Text* is enabled.
In AiCaP mode, the Status Codes will be collected by the SeaGuardII Platform or SmartGuard and can be presented in Data Studio or Data Studio 3D. The status codes will be shown in the *Status* column under the Data List tag. Recordings containing warnings are marked with blue text. Recordings containing errors are marked with red text. The status field will have a *Common* status code. The *Common* status code indicates whether there exist problems within the data set. By right clicking the *Status* field, details and the status codes for each parameter will be shown.
In addition to the listed status codes from the sensor, the SeaGuardII platform and SmartGuard logs status codes for communication errors.

Error, corrupt configuration (3) indicates internal flash error. Parts of the sensor configuration are lost. Contact AADI Service department for new setting file for the specific sensor with further instructions.

CHAPTER 13 **Calculating engineering values from raw data**

Sensor calibration coefficients, Temp coeffs, PT coeffs 0, PT coeffs 1, PT coeffs 2, PT coeffs 3 and PT coeffs 4 are stored inside the sensor. The coefficients are available as output from the sensor.

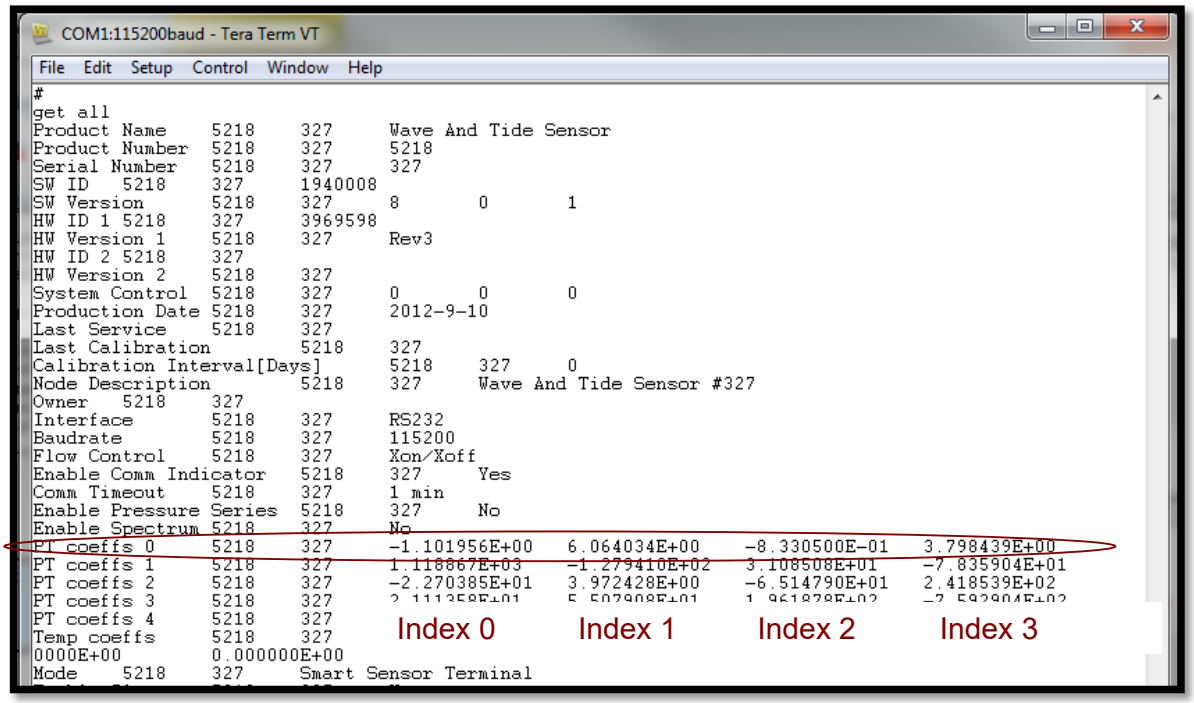

Figure 13-1: Sensor calibration coefficients properties are available as sensor output.

Each coefficient holds a set of 4 values, e.g. PT coeffs 0_1, PT coeffs 0_2, PT coeffs 0_3, PT coeffs 0_4. The engineering data are calculated from the raw sensor readings and these calibration coefficients using the following equations:

Temperature:

$Temperature = TempCoeffs_0 + TempCoeffs_1 \cdot T_{Norm} + TempCoeffs_2 \cdot T_{Norm}^2 + TempCoeffs_3 \cdot T_{Norm}^3$, where

T_{Raw} = RawdataTemp

$$T_{Norm} = \frac{T_{Raw}}{8388608} - 1$$

Pressure:

$Pressure = C_0 + C_1 \cdot P_{Norm} + C_2 \cdot P_{Norm}^2 + C_3 \cdot P_{Norm}^3 + C_4 \cdot P_{Norm}^4$

where

P_{Raw} = RawdataPressure

$$P_{Norm} = \frac{P_{Raw}}{8388608}$$

$C_0 = PTCoeffs0_0 + PTCoeffs0_1 \cdot T_{Norm} + PTCoeffs0_2 \cdot T_{Norm}^2 + PTCoeffs0_3 \cdot T_{Norm}^3$

$C_1 = PTCoeffs1_0 + PTCoeffs1_1 \cdot T_{Norm} + PTCoeffs1_2 \cdot T_{Norm}^2 + PTCoeffs1_3 \cdot T_{Norm}^3$

$C_2 = PTCoeffs2_0 + PTCoeffs2_1 \cdot T_{Norm} + PTCoeffs2_2 \cdot T_{Norm}^2 + PTCoeffs2_3 \cdot T_{Norm}^3$

$C_3 = PTCoeffs3_0 + PTCoeffs3_1 \cdot T_{Norm} + PTCoeffs3_2 \cdot T_{Norm}^2 + PTCoeffs3_3 \cdot T_{Norm}^3$

CHAPTER 14 Calculations of wave parameters (5218/5218R)

Raw Wave data are simply the pressure measured at the location of the instrument.
The pressure changes according to changes in distance between the surface and the instrument. As the distance increases, the pressure increases. As the distance decreases, the pressure decreases.
The wave parameters are calculated from wave records containing 2^N samples where N = 8, 9, 10, 11. The pressure is sampled at either 2 or 4 Hz so that the duration of the wave records ranges from 64 seconds to 17 min (1024 seconds)

14.1 Processing raw data

In general, the measured water pressure consists of hydrostatic and dynamic components:

$$P = (\rho g h + P_{atm}) + P_{dyn}$$

The dynamic part is due to surface wave motion. To reveal the dynamic pressure, the measured time series are pre-processed in a two-step manner:
First, the contribution from the atmospheric pressure, P_{atm}, to the absolute pressure is subtracted from the samples. In AiCaP CANbus mode, the sensor uses the fixed atmospheric pressure set by the user in *Sensor Configuration* or atmospheric pressure from a barometric sensor connected to the same AiCaP logger. In RS232/RS422 the atmospheric *Air Pressure* is a property that must be set by the user.
Second, the hydrostatic pressure is calculated by subtracting the atmospheric pressure from the time series samples. The hydrostatic pressure is used to calculate the deployment depth.

14.1.1 Calculation of Wave Spectrum:

The dynamic pressure time-series are used to calculate the wave spectrum. This involves Fourier transformation of the time series using a Fast Fourier Transform (FFT) algorithm and scaling of the power spectrum to compensate for the damping of the dynamic pressure.

14.1.2 Power Spectrum Scaling:

The wave motion at the sea surface causes a dynamic pressure that can be measured using a pressure sensor deployed somewhere between the seabed and the sea surface. The magnitude of the observed dynamic pressure depends on the surface wave period and the sensor deployment depth.

The deeper the sensor is deployed the more the dynamic pressure is damped. The shorter the surface wave period the faster the damping of the dynamic pressure. Hence, the power spectrum must be scaled to correct for the difference between the true dynamic pressure and the observed dynamic pressure before the wave parameters can be calculated.

The damping of the dynamic pressure can be described by the Linear Wave Theory (sometimes known as the Airy Wave Theory). ***Figure 14-1***illustrates the damping of the dynamic pressure as a function of the wave period in [m] and of the deployment depth. A small damping factor means that the dynamic pressure is significantly damped, while less damped when the damping factor is larger; as the damping factor approaches 1, the observed dynamic pressure approaches the true dynamic pressure.

To compensate for the damping of the dynamic pressure, the power spectrum is multiplied with a transfer function that is the inverse of the function describing the damping of the dynamic pressure.

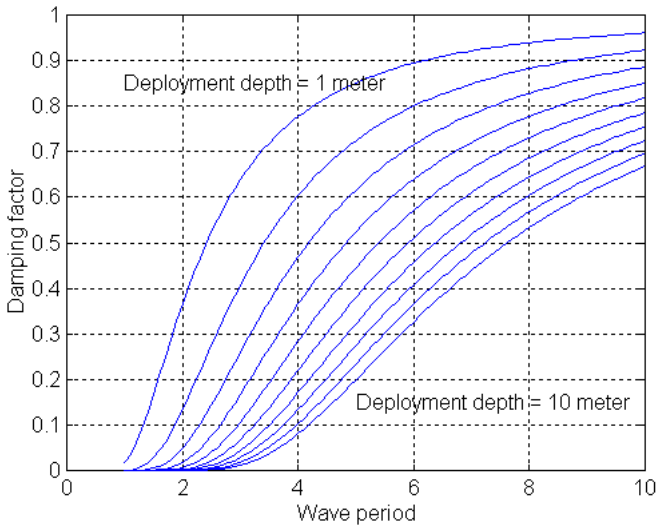

Figure 14-1: Damping of the dynamic pressure in deep water as a factor of wave period and deployment depth.

14.1.3 Linear Wave Theory:

The Linear Wave Theory provides several equations that can be applied to compute wave properties, e.g. significant wave height, mean zero crossing and mean wave period.

14.1.4 Wave Spectrum*:*

The magnitude of one frequency component of the power spectrum is proportional to the square of the amplitude of the signal with the very same frequency. That is, if the wave is a pure sine wave with amplitude *a*, the magnitude of the spectrum component with the same frequency as the sine wave, is a^2. The wave energy is given as:

$$E = \frac{\rho g H^2}{8} = \frac{\rho g a^2}{2}$$

where ρ is the medium density, *g* is the gravitational coefficient and *H* is the wave height. The wave spectrum calculated by the Wave and Tide Sensor is scaled in this manner.

14.1.5 Spectral Moments*:*

Several *spectral moments* are calculated based on the wave spectrum. Next, these spectral moments are used to compute wave parameters. The spectral moments are defined as follows:

$$m_n = \sum_{i=0}^{N} f_i^n S(f_i)$$

where f_i is a specific frequency and $S(f_i)$ is the wave spectrum component at that frequency. Hence, the moment of order zero, m_o, is found by summing the wave spectrum components from zero frequency up to the cut-off frequency.
Based on the above considerations and the definition of the spectral moments, the moment of order zero is equal to:

$$m_0 = \sum_{i=0}^{N} \frac{a_i^2}{2}$$

Assuming that X is a simple sinusoidal wave with amplitude a, the sampled values X_i are:

$$X_i = a\sin(y_i)$$

The variance, σ, of X is:

$$\sigma^2 = E(X_i - \mu)^2 = E(a \cdot \sin(y_i))^2 = \frac{a^2}{2}$$

where E denotes the expectation and μ is the average of X (μ =0 for an ideal sine wave). The wave motion can be modelled as a superposition of simple sinusoidal waves. Hence, the individual spectral components in the wave spectrum can be seen as the variance of individual sinusoidal waves with different frequencies. The zero order spectral moment, m_0, which then is the sum of the variances of the individual spectral components, can be seen as the total variance of the wave record.

14.1.6 Cut-off Frequency*:*

The Wave and Tide Sensor is applicable for studies of waves with wave period as small as 1 second without aliasing, according to the Nyquist theorem. However, the dynamic pressure caused by waves with short wave period is damped rapidly with depth, see, hence the Wave and Tide Sensor calculates a cut-off frequency based on the deployment depth as measured by the pressure sensor[5]:

$$f_{Cut-Off} = 0.282 \cdot \sqrt{\frac{g}{d}}$$

[5] IEEE Journal of Oceanic Engineering, VOL 26, No2, April 2001, p 171-180

where *g* is the gravitational coefficient and *d* is the deployment depth.

14.2 Calculation of Wave parameters

The sea conditions can be described by several wave parameters, like e.g.

- Significant Wave Height
- Maximum Wave Height
- Mean Zero Crossing
- Peak Wave Period
- Mean Wave period
- Energy Wave Period
- Irregularity
- Wave Steepness

These parameters are provided by the Wave and Tide Sensor and will be described below. For more information regarding the wave parameters, see the '*Guide to Wave Analysis and Forecasting*', World Meteorological Organization (WMO) report number 702.

14.2.1 Significant Wave Height:

Originally, Significant Wave Height, $\bar{H}_{1/3}$, was defined as the average height of the 1/3 highest waves in a wave record. $\bar{H}_{1/3}$ should be roughly approximate to visually observed wave heights. The wave energy for a superposition of sinusoidal waves is given as:

$$E = \frac{\rho g}{8}\sum_{i=0}^{N} H_i^2 = \rho g \sum_{i=0}^{N} \frac{a_i^2}{2}$$

Comparing this equation with the expression for the moment of zero order, m_0, it is easily seen that an expression for the wave height can be estimated.
For historical reasons a parameter that corresponds close to $\bar{H}_{1/3}$ has been defined:

$$H_{m0} = 4\sqrt{m_0}$$

Note that both $\bar{H}_{1/3}$ and H_{m0} are called Significant Wave Height. The parameter provided by the Wave and Tide Sensor is H_{m0}.

14.2.2 Maximum Wave Height:

The expected Maximum Wave Height is estimated based on the statistical distribution of the wave height parameter. Assuming that the sea surface can be modelled as a narrow-banded Gaussian Process, the standard model is a wave amplitude distribution based on the Rayleigh's distribution. This yields the following estimate of the Maximum Wave Height:

$$H_{Max} = C_1\sqrt{\ln(R_{MD})} = \sqrt{0.5 \cdot \ln(R_{MD})}$$

where C_1 is a scaling parameter and R_{MD} is equal to the ratio of the *Mean Wave Period* and the *Duration of wave record (*the number of waves in the wave record). The Wave and Tide Sensor use the above expression for calculation of the maximum wave height.
NOTE! The assumptions regarding the scale parameter, C_1, and the statistical distribution will influence the estimate of the maximum wave height.

14.2.3 Mean Zero Crossing Period:

The Mean Zero Crossing Period is originally directly computed from the wave records. It is defined as the record length divided by the number of down-crossings (or up-crossings) in the record.
The Mean Zero Crossing Period is defined as:

$$T_{m02} = \sqrt{\frac{m_0}{m_2}}$$

According to WMO, the wave period T_{m02} is sensitive to the cut-off frequency in the calculations of the spectral moments.

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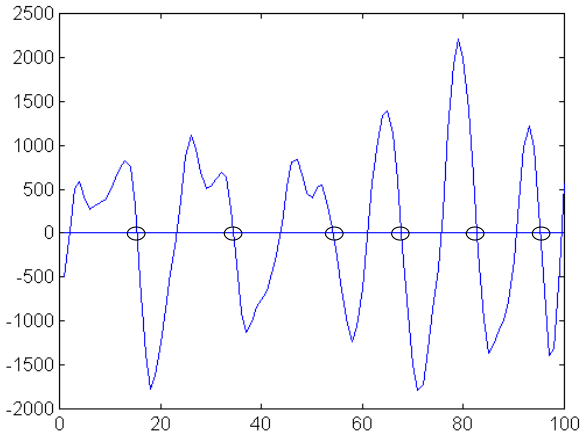


Figure 14-2: Part of a wave record. Zero down-crossings are circled.

14.2.4 Peak Wave Period:

The Peak Wave Period, T_{Wp}, is equal to the inverse of the frequency of the peak of the wave spectrum:

$$T_{Wp} = \frac{1}{f_{Wp}}$$

where f_{Wp} is the frequency of the peak of the wave spectrum. Hence, the Peak Wave Period is the period of the wave that dominates the wave motion, assuming that the wave motion can be modelled as a superposition of waves..

14.2.5 Mean Wave Period:

The Mean Wave Period is defined as:

$$T_{m01} = \frac{m_0}{m_1} = \frac{\sum_i S(f_i)}{\sum_i f_i S(f_i)}$$

From this equation it can be seen that the mean wave period, T_{m01}, is the inverse of the weighted average frequency of the spectrum and hence a measure of the average period of the wave motion.

14.2.6 Energy Wave Period:

The Energy Wave Period is defined as:

$$T_{m-10} = \frac{m_{-1}}{m_0}$$

The Energy Wave period is used in calculations of the wave power in [kW/m] of wave fronts. The wave power is given as:

$$J = 0.49 \cdot H_{m0}^2 \cdot T_{m-10}$$

14.2.7 Regularity:

When studying the wave parameters provided e.g. by the Wave and Tide Sensor, note that the motion of the sea surface caused by the waves is a random process.
Significant wave height is for example a measure of the average wave height. The height of many, if not most, of the waves in a record will differ from the significant wave height. The more irregular the sea state, the broader the wave spectrum. A measure of the peakedness of the spectrum, and correspondingly of the regularity of the sea is:

$$Q_p = \frac{2}{m_0^2}\int_0^\infty f \cdot S^2(f)df \approx \frac{2}{m_0^2}\sum_0^N f_i \cdot S^2(f_i)$$

Generally, a calm sea gives a narrow/peaked spectrum and a high Q_p factor; an irregular sea will give a broader spectrum and a lower Q_p value.

14.2.8 Wave Steepness:

Wave Steepness is generally defined as:

$$\xi = \frac{H}{\lambda}$$

where H is wave height. Replacing wavelength with wave period using the equation given by the linear wave theory the wave steepness becomes:

$$\xi = \frac{2\pi H}{gT^2}$$

The Wave and Tide Sensor use H_{m0} and T_{m01} for wave height and wave period.

According to Stokes theory, waves cannot attain heights of more than 1/7 of the wavelength without breaking.

Note! Additional information about the four parameters Mean Zero Crossing Period, Peak Wave Period, Mean Wave Period and Energy Wave Period*: If the pressure variations caused by the waves are smaller than what can be measured by the pressure sensor, the estimated wave periods will approach 1/$f_{Cut\text{-}Off}$. This will happen e.g. if the instrument is deployed too deep to monitor the current sea state.*

14.3 Spectrum and pressure series

The spectrum is presented as the value of each frequency component in the wave spectrum. Spectra components outside of the calculated *cut-off* frequencies are set to 0. The first frequency component in the spectrum is 0 Hz.

Table A 1 Access protection levels

Number of Samples	Number of freq. components	Resolution at 2 Hz sampling	Resolution at 4 Hz sampling
256	128	0.0078125 Hz	0.015625 Hz
512	256	0.00390625 Hz	0.0078125 Hz
1024/2048	512	0.001953125 Hz	0.00390625 Hz

The pressure series can be used as raw data input for e.g. other spectra or wave calculations. The Last Pressure Sample Index parameter is the index of the last element in the pressure series. It tells how many continuous samples the sensor has collected. Depending on the recording Interval setting there can be overlap between the pressure series. The parameter makes it easy to remove duplicated data (overlap) and generate continuous pressure samplings at 2 or 4 Hz. Continuous pressure samplings can be used for e.g. tsunami warning systems. If samplings are not performed during the entire recording interval, the Last Pressure Sample Index will be reset for each recording, and the value will be the Number of Samples setting plus a few samples in the beginning that are not used.

14.4 Parameter calculation

Significant Wave Height is defined traditionally as the mean wave height (trough to crest) of the highest third of the waves ($H_{1/3}$). A modern definition of significant wave height is usually defined as four times the standard deviation of the surface elevation. The symbol H_{m0} is usually used for that latter definition. The significant wave height may thus refer to H_{m0} or $H_{1/3}$; the difference in magnitude between the two definitions is only a few percent.
Significant Wave Height, $H_{1/3}$ is the mean of the highest third of the waves in a time-series computed based on a spectrum and is referred to as $H_{1/3}$.

Wave Mean Period, T_{m02} is the mean wave period calculated from the spectrum.

$$T_{m02} = \sqrt{\frac{m_2}{m_0}},$$

where:

m_n is the n order moment calculated from the Energy spectrum as;

$$m_n = \int_0^\infty f^n E(f) df$$

14.5 Other wave descriptions

Wave Crest is the point on a wave with the maximum value or upward displacement within a cycle.

Wave Troughs is the point on a wave with the minimum or lowest point in a cycle.

Wavelength is the distance from a certain point on one wave to the same point on the next wave
(e.g. distance between two consecutive wave crests or between two consecutive wave troughs).

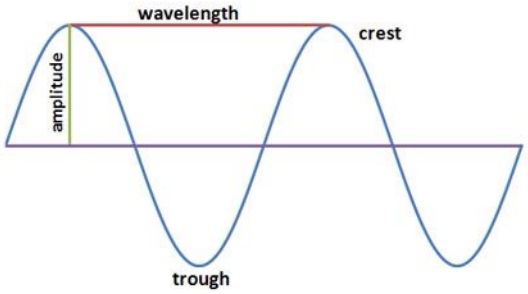


Figure 14-3: wave descriptions

Wave amplitudes are one half the distance from the crest to the trough. Wave amplitude is a more technical term for wave height and is used in engineering technology.

Wave frequency is the number of waves passing a fixed point in a specified period. Frequency has units of waves per second or cycles per second. Another unit for frequency is the Hertz (abbreviated Hz) where 1 Hz is equivalent to 1 cycle per second.

Wave period is the time it takes for two successive crests (one wavelength) to pass a specified point.

Wave speed is the distance the wave travels divided by the time it takes to travel that distance. Wave speed is determined by dividing the wavelength by the wave period. In symbols c = λBB; / T, where c is the wave speed, λ (lambda) is the wavelength, and T is the period.

Wave Steepness is the ratio of height to wavelength. When wave steepness exceeds 1:7, breakers form. If a wave has height of one foot and a length from crest to crest of 8 feet, then the ratio is 1:8 and this wave is not going to break. But if the height is 1 foot and the length decreases to 5 feet, then the ratio is 1:5 and this wave has now become so steep that the crest topples and the wave breaks.

CHAPTER 15 **Installation**

Please refer Table 15-1 for the most important installation and deployment considerations.

Table 15-1 Installation considerations for the Pressure, Tide and Wave and Tide sensors.

Description	Measurement Parameters:		
	Pressure/ Temperature	Tide	Wave
Install the sensor with the top up	x	x	x
Install the sensor in a fixed installation		x	x
The deployment depth must be at least 1 meter below the water surface (at the lowest tide level)			x
We recommend that the deployment depth is less than 15 m			x

Install the sensor with top up because the pressure inlet is filled with silicone oil. The sensor is calibrated for top-up installations; other positions will produce a small zero offset.

Valid measurements of tide and wave parameters require a fixed installation on a vertically stable structure to avoid movements of the sensor due to water conditions or settling.

For wave measurements the sensor should always be deployed at least 1 meter below the water surface to ensure valid measurements. Low water levels require more internal calculations. If the water level becomes less than 0.25 meters, the water level will be set to 0.25 meters.

The data quality of the wave measurements is reduced with increasing installation depth due to wave attenuation. The pressure variations generated by waves are damped, and the cut off frequency reduces the frequency range in the wave spectrum. At depths larger than 20 meters the dampening is difficult to compensate for because of a weak signal. The frequency range is also very limited.

If the Wave and Tide Sensor or the Tide Sensor is attached to a floating device, the sensor cannot measure tide but can compute draft of the structure.
If the Wave and Tide sensor is attached to a very large floating device so that the sensor will be relatively steady in relation to the mean sea level, then the sensor can measure waves with reduced quality. Such a large floating device can be e.g. a floating fish farming facility or oil rig. We recommend installation on the sea floor or attached to a fixed pillar. Installation on a string is not recommended because there will always be some movement of the string/sensor.

IMPORTANT! Do not deploy the sensor deeper than the pressure rating of the pressure element.

15.1 Connecting Cables

Aanderaa offers a wide range of standard cables.

15.1.1 Set-up and configuration cable 3855.

Set-up and configuration cable 3855 are designed for laboratory use only. The cable is used to configure a sensor using either AADI Real-Time Collector or a Terminal software such as Terra Term. If you don't have any COM ports on your computer it can be used in combination with a RS-232 to USB converter such as Tripp-lite Keyspan Model USA -19HS. The sensor can either be powered from a USB port or using a power supply connected to the USB extension cable.

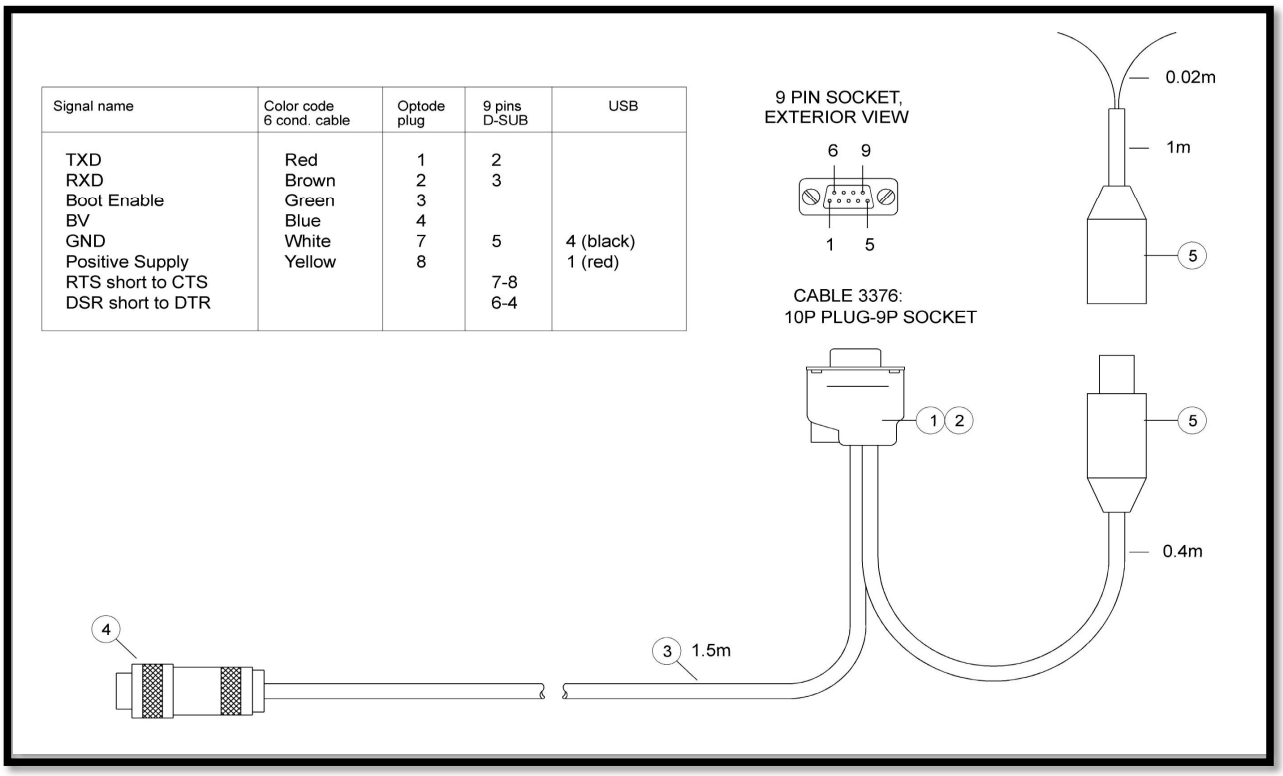


Figure 15-1: Set-up and configuration cable 3855

15.1.2 Set-up and configuration cable 4865.

Set-up and configuration cable 4865 are like the previous 3855 cable but with a watertight SP plug for use in field. The cable is used to configure a sensor using either AADI Real-Time Collector or a Terminal software such as Terra Term. If you don't have any COM ports on your computer it can be used in combination with a RS-232 to USB converter such as Tripp-lite Keyspan Model USA - 19HS. The sensor can either be powered from a USB port or using a power supply connected to the USB extension cable. The cable can also be used for deployments with real-time data to a computer or a logger.

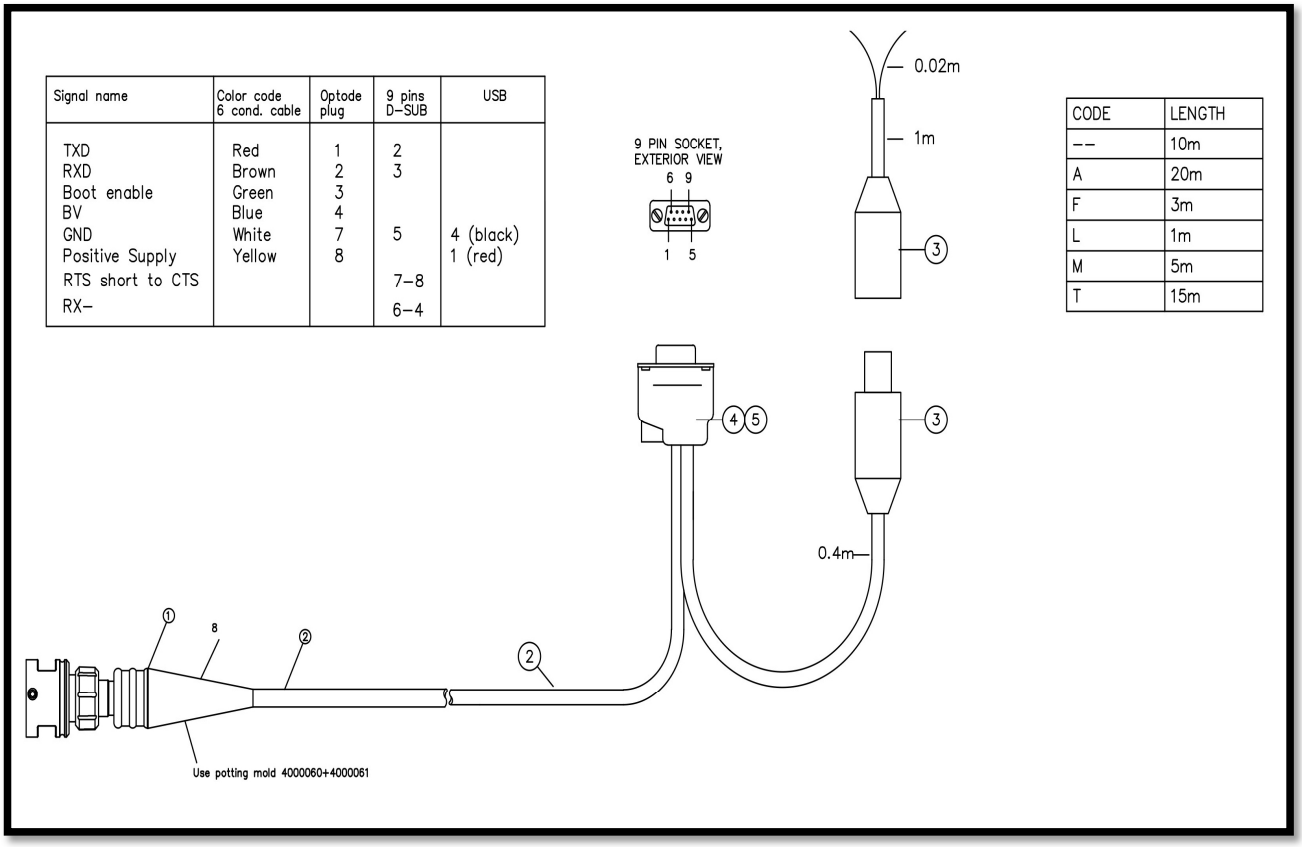
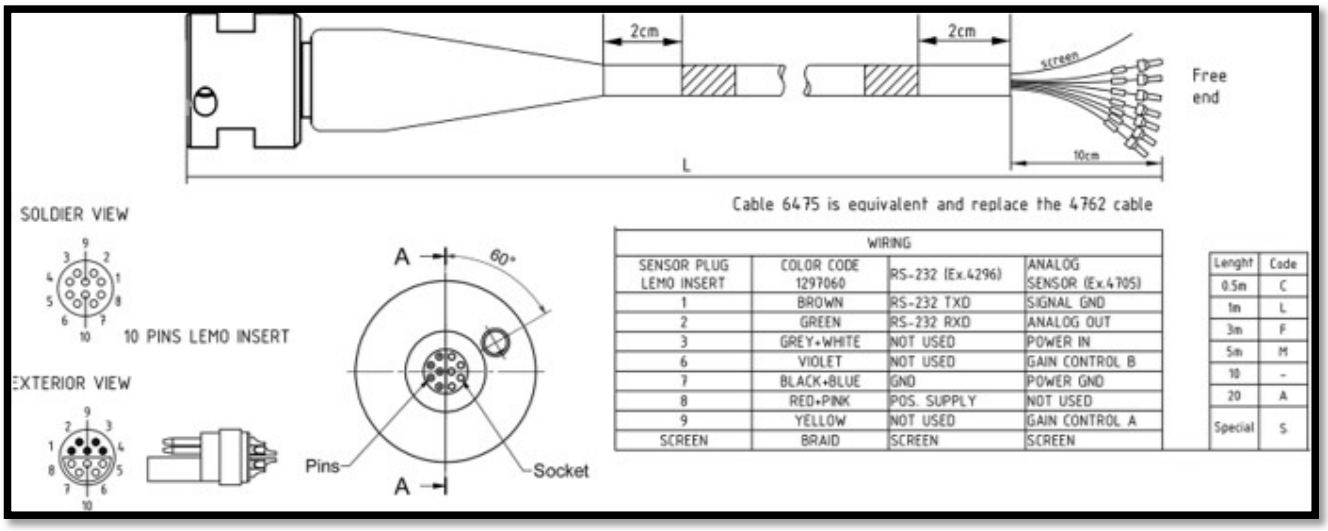


Figure 15-2: Set-up and cnfiguration cable 4865

15.1.3 Free end cable 6475

Free end cable 6475 is designed for use with RS-232 output. Please make sure that the cable is terminated properly before power is switched on. Please also note that the lemo plugs are not 1 to 1 but 1 to 8. This means that pin 1 on the sensor is connected to pin 8 on the cable etc.



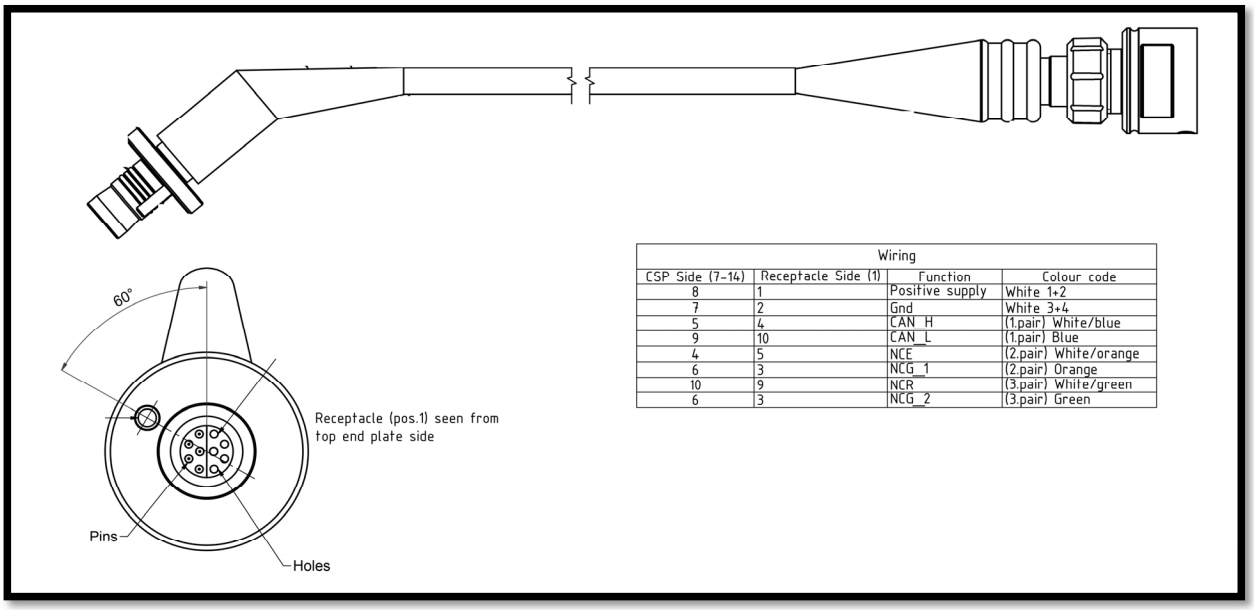
WIRING			
SENSOR PLUG LEMO INSERT	COLOR CODE 1297060	RS-232 (Ex.4296)	ANALOG SENSOR (Ex.4705)
1	BROWN	RS-232 TXD	SIGNAL GND
2	GREEN	RS-232 RXD	ANALOG OUT
3	GREY+WHITE	NOT USED	POWER IN
6	VIOLET	NOT USED	GAIN CONTROL B
7	BLACK+BLUE	GND	POWER GND
8	RED+PINK	POS. SUPPLY	NOT USED
9	YELLOW	NOT USED	GAIN CONTROL A
SCREEN	BRAID	SCREEN	SCREEN

Lenght	Code
0.5m	C
1m	L
3m	F
5m	M
10	-
20	A
Special	S

Figure 15-3: Free end cable 6475

15.1.4 Remote cable 4793 for connecting sensor to SeaGuard/SeaGuardII

Remote cable 4793 is used when you want to mount the sensor away from the instrument top-end plate. This is used if you want to measure gradients and one sensor is located on the top end plate and the second sensor is mounted in the water column away from the instruments.



Wiring			
CSP Side (7-14)	Receptacle Side (1)	Function	Colour code
8	1	Positive supply	White 1+2
7	2	Gnd	White 3+4
5	4	CAN_H	(1.pair) White/blue
9	10	CAN_L	(1.pair) Blue
4	5	NCE	(2.pair) White/orange
6	3	NCG_1	(2.pair) Orange
10	9	NCR	(3.pair) White/green
6	3	NCG_2	(3.pair) Green

Figure 15-4: Remote sensor cable 4973

15.1.5 Patch cable 4999

Patch cable 4999 are used if sensor is mounted in position 6 on the top-end plate or if the instrument is without a hub-card, then the patch cable is used to connect the sensor to the instrument main board.

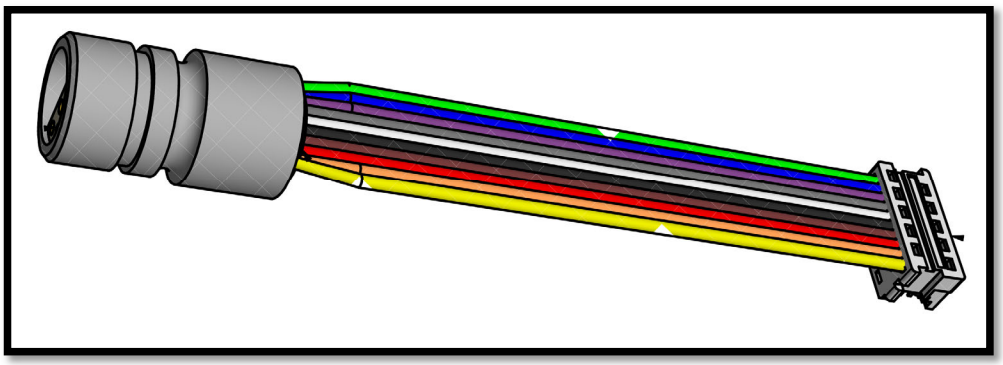
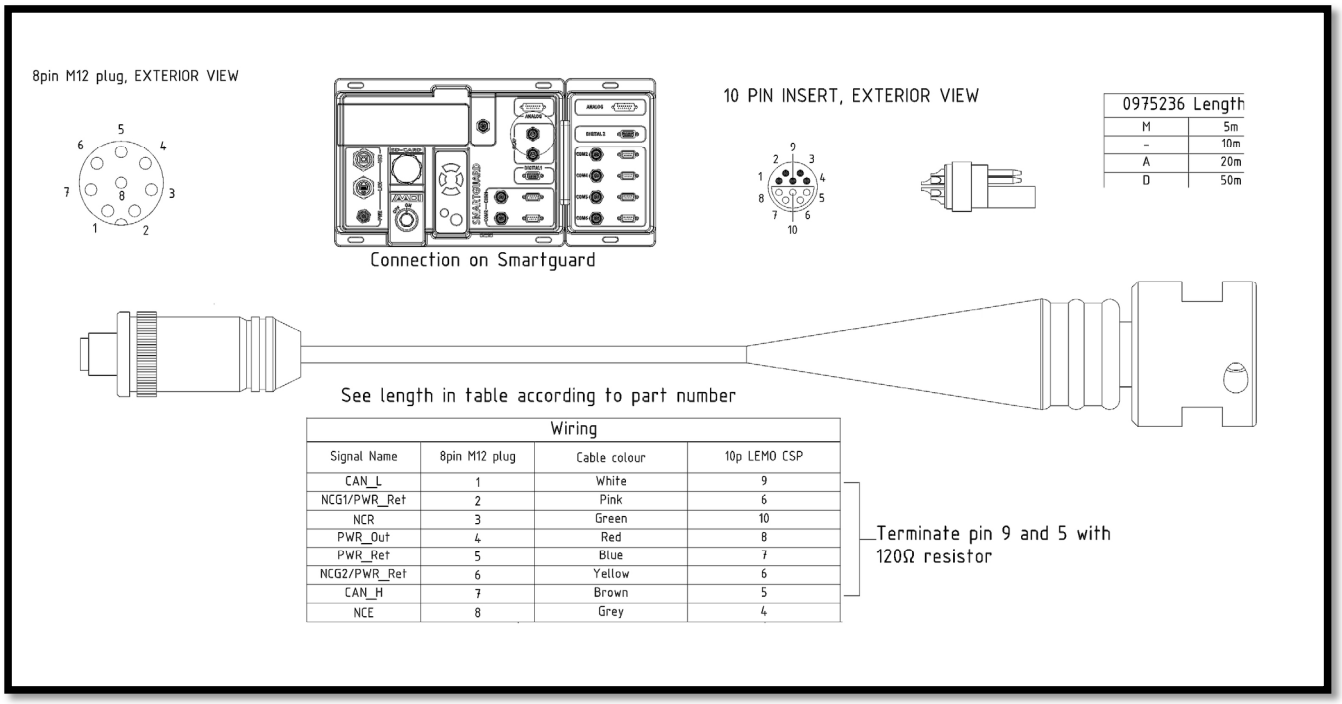


Figure 15-5: Patch cable 4999

15.1.6 Cable 5236 for connection to SmartGuard using AiCaP



Wiring

Signal Name	8pin M12 plug	Cable colour	10p LEMO CSP
CAN_L	1	White	9
NCG1/PWR_Ret	2	Pink	6
NCR	3	Green	10
PWR_Out	4	Red	8
PWR_Ret	5	Blue	7
NCG2/PWR_Ret	6	Yellow	6
CAN_H	7	Brown	5
NCE	8	Grey	4

Figure 15-6: 5896 Sensor cable to SmartGuard

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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