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CONDUCTIVITY SENSOR

5819/5819R/5990

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Contact information:

Aanderaa Data Instrument AS   Visiting address: TEL: +47 55 604800

PO BOX 103, Midttun   Sandalsringen 5b   FAX: +47 55 604801

5843 Bergen, NORWAY   5843 Bergen, Norway

EMAIL: aanderaa.support@xylem.com
WEB: http://www.aanderaa.com

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INTRODUCTION

Purpose and Scope

With this document, we will give the reader knowledge on how to operate, calibrate and maintain the Aanderaa Conductivity Sensor 5819, 5919R and 5990. It also aims to give insight on how the Conductivity sensor works and how we can use the conductivity measurement of water to determine other important seawater properties. We cover all sensor versions in one single manual since the operation and configuration is identical. The main difference is depth rating and serial output.
Each sensor version is available in three different versions, A-, B- and C- version, with different accuracy specification, see datasheet for more information.

The sensor is used either as part of a system or stand-alone. Chapter 2 to 5 covers different ways to connect and operate the sensor. Since each chapter describes the full operation you only need to read one of these chapters.

5819 is replacing the 4319 and 4419R sensor. 5990 replacing the old 5860 sensor, the main principle behind the sensors are equal but there are also some new features and a faster temperature sensor that is more exposed to the water.

With the release of Framework 3 in 2011, Aanderaa introduced a new firmware version to accommodate higher security and future expansion. Both the Smart Sensor Terminal protocol and the AADI Real Time protocol was updated with this version of the Smart Sensor firmware

Aanderaa Smart Sensors utilize communication protocols at the RS232 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.

Conductivity Sensor 5819 fits directly on the top-end plate of SeaGuard or in a string system connected to SmartGuard or SeaGuard String logger using AiCaP. In addition to AiCaP, the sensor has also RS-232 connection both for configuration of sensor and communication with logger or PC. The 5819R-version has only RS-422 used for stand-alone use with longer cables. Conductivity Sensor 5990 are fitted with an Subconn for easier connection to 3rd party equipment

The sensor is available in three different depth ratings, 300-meter, 3000-meter and 6000-meter.

Document Overview

Chapter 1 is a description of each sensor covered with pin configuration and properties.
Chapter 2 covers how to configure the sensor when connected to a SeaGuard with display
Chapter 3 covers how to configure a stand-alone sensor using AADI Real-Time Collector
Chapter 4 covers how to configure the sensor using SeaGuard without display, SeaGuardII or SmartGuard.
Chapter 5 describes how to configure and operate a stand-alone sensor using Terminal software.
Chapter 6 describes how to log data using AADI Real-Time Collector.
Chapter 7 describes maintenance need and recommendations
Chapter 8 describes the principle behind the Conductivity Sensor.
Chapter 9 describes Electromagnetic Combability.
Chapter 10 contains examples of all documents and available cables.

Applicable Documents

DID-060350	Assembly Drawing 5819
V-8700	Sensor Cable 3855, Sensor to PC, RS-232 for laboratory use
V-10501	Sensor Cable 4865, Sensor to PC, RS-232 for field use
V-10331	Sensor Cable 4762, Sensor to free end
V-10388	Sensor Cable 4793 for 5 remote sensor used on SeaGuard
Form 860	Test & Specification Sheet for Conductivity Sensor
Form 994	Calibration Certificate for Conductivity Sensor
D 425	Data sheet for Conductivity Sensor 5819

References

[1]   Fofonoff, Journal of Physical Oceanography JGR, Vol 90 No. C2, pp 3332-3342, March 20, 1985

Abbreviations

ADC	Analogue to Digital Converter
AiCaP	Automated idle line CAN bus Protocol: A modified communication protocol developed by Aanderaa for a distributed network of smart sensors when connected to SeaGuard, SeaGuardII or SmartGuard loggers.
ASCII	American Standard Code for Information Interchange
DSP	Digital Signal Processor
MSB	Most significant bit
PSU	Practical Salinity Unit
RTC	Real Time Clock
UART	Universal Asynchronous Receiver/Transmitter
UNESCO	The United Nations Educational, Scientific and Cultural Organization

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CHAPTER 1 Short Description and Specifications

1.1 Description

Specific conductivity is a property that describes how well a material can conduct an electrical current. For seawater, this property is mostly dependent on the inorganic dissolved solids and the temperature of the water.

Salinity is defined as the concentration of these dissolved solids, and by measuring both the Conductivity and Temperature (the Conductivity sensor 5819 has a built-in Temperature sensor) the salinity of the water can be determined.

Other important properties of seawater can be calculated based on the salinity measurements e.g., the density and the speed of sound.

For freshwater the conductivity can be used as a quality indicator. Increased conductivity of a stream will often indicate increased pollution, and increased conductivity of groundwater might indicate seawater intrusion.

The Conductivity Sensor 5819 is based on an inductive principle. This provides for stable measurement without electrodes that are easily fouled in the field.
Conductivity Sensor 5819 is available in two versions 5819A and 5819B where 5819B versions have enhanced accuracy compared to 5819A. See Data Sheet D425 for more information.
Each of these versions is also available in three different depth ratings SW (Shallow Water) is rated to 300meter, IW (Intermediate Water) is rated to 3000meter and DW (Deep Water) is rated to 6000meter.

The Conductivity Sensor 5819 interconnects with both RS-232 and CANbus (AiCaP).
The Conductivity Sensor 5819 fits directly on to the Top-end Plate of the Aanderaa SEAGUARD® datalogger. The sensor can also be used as a Stand-Alone RS-232 sensor for use with third party data loggers.

The Conductivity Sensor 5819R interconnects with RS-422 and are used as stand-alone sensor on longer cables. Most cables designed for use with this sensor except the free end cables also contains an RS-422 to RS-232 adapter. Maximum recommended cable length for RS-422 with 9600 baud-rate is 1200 meter compared to 30 meter for RS-232.

The Conductivity Sensor 5990 are supplied with an 8-pin Subconn connector and interconnects with RS-232 only.

1.2 Conductivity Sensor 5819

Conductivity Sensor is encapsulated in a Titanium housing and are available in three depth ratings 300-, 3000- and 6000-meter. The sensor is made for use on SeaGuard platforms but may also be used on cable. Standard version has AiCaP and RS-232 output. R-version has RS-422 output. Please note that the lemo plug used for this sensor are not a 1 to 1 plug. This means that e.g. pin 1 on sensor are connected to pin 8 on cable.
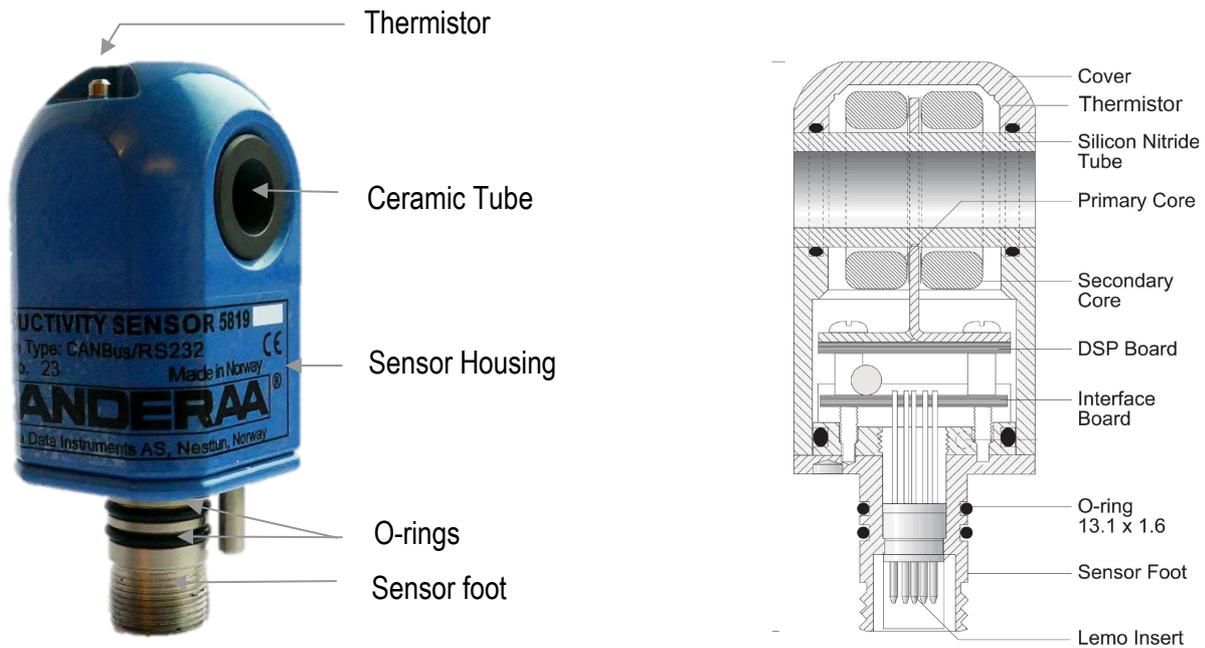
Figure 1-1 Illustration of the Conductivity Sensor 5819.

PIN CONFIGURATION

Receptacle, exterior view;   pin = • bushing = ○

CAN_H — 4   5 — NCE
NCG — 3   6 — BOOT_EN
NCR — 9   10 — CAN_L
Gnd — 2   7 — RS232 RXD
Positive supply — 1   8 — RS232 TXD
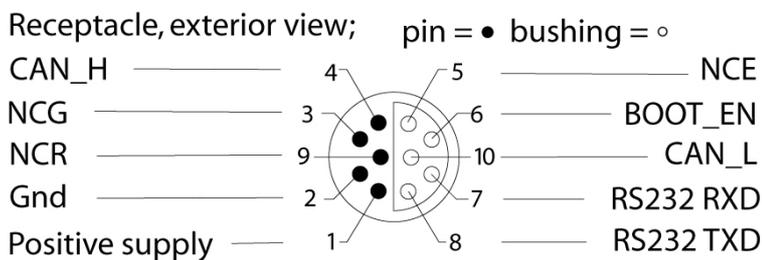
Figure 1-2: Conductivity Sensor 5819 Pin Configuration

1.2.1 Pin Configuration 5819

The Conductivity Sensor 5819 pin configuration is given in *Figure 1-2* above. A description of the receptacle notation is given in *Table 1-1.*

Table 1-1 Description of the Pin Configuration

Signal	Description	Input (I) Output (O)
CAN_H	CAN bus line (dominant high)	
NCG	Node Communication Ground	
NCR	Node Communication Request	
Gnd	Ground	
Positive supply / V+	5-14V positive supply	
NCE	Node Communication Enable	
BOOT_EN / Boot Enable	Boot Load Enable (do not connect)	I
CAN_L	CAN bus line (dominant low)	
RS232 RXD / RXD	RS232 Receive line	I
RS232 TXD / TXD	RS232 Transmit line	O

1.2.2 Lemo plug connection 5819

The 5819 sensor are using a lemo plug. This plug is not a 1 to 1 plug like eg. Subconn. See *Table 1-2* for a complete list of connections between sensor and cable plug or hub card plug.

Table 1-2: Lemo plug Pin Configuration 5819

Signal	Sensor pin	Cable pin
Positive supply / V+	1	8
Gnd	2	7
NCG	3	6
CAN_H	4	5
NCE	5	4
BOOT_EN / Boot Enable	6	3
RS232 RXD / RXD	7	2
RS232 TXD / TXD	8	1
NCR	9	10
CAN_L	10	9

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1.3 Conductivity Sensor 5819R

Conductivity Sensor 5819R is similar to 5819 except from the output signal. 5819R only output RS-422 and in most applications you need a RS-422 to RS-232 unless you have an RS-422 port available. 5819R is mainly used on longer cables.

Figure 1-3: Conductivity Sensor 5819R

PIN CONFIGURATION
Receptacle, exterior view;   pin = • bushing = ○

RS422 TXD+ — 4	5 —	DNC
DNC — 3	6 —	DNC
DNC — 9	10 —	RS422 RXD-
Gnd — 2	7 —	RS422 RXD+
Positive supply — 1	8 —	RS422 TXD-
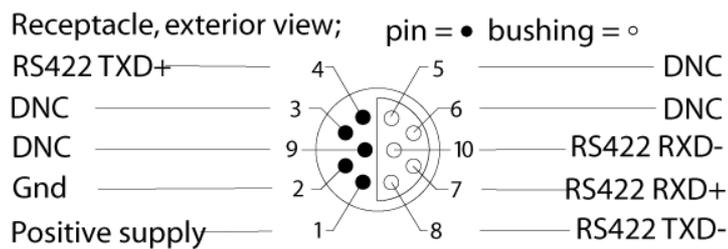
Figure 1-4: Conductivity Sensor 5819R Pin Configuration

1.3.1 Pin Configuration 5819R

The Conductivity Sensor 5819R pin configuration is given in *Figure 1-4* above. A description of the receptacle notation is given in *Table 1-3.*

Table 1-3 Description of the Pin Configuration 5819R

Signal	Description	Input (I) Output (O)
Positive supply / V+	5-14V positive supply	
Gnd	Ground	
DNC	Do Not Connect	
RS422 TXD+ / TX+	RS422 Transmit line+	O
RS422 RXD+ / RX+	RS422 Receive line+	I
RS422 TXD- / TX-	RS422 Transmit line-	O
RS422 RXD- / RX-	RS422 Receive line -	I

1.3.2 Lemo plug connection 5819R

The 5819R sensor are using a lemo plug. This plug is not a 1 to 1 plug like eg. Subconn. See *Table 1-4* for a complete list of connections between sensor and cable plug.

Table 1-4: Lemo plug Pin Configuration 5819R

Signal	Sensor pin	Cable pin
Positive supply / V+	1	8
Gnd	2	7
RS422 TXD+ / TX+	4	5
RS422 RXD+ / RX+	7	2
RS422 TXD- / TX-	8	1
RS422 RXD- / RX-	10	9

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1.4 Conductivity Sensor 5990

Conductivity Sensor 5990 is a special version with Subconn connection. This sensor is made to easily connect to any third-party equipment or installation where underwater meetable plugs are required. Output from this sensor is only RS-232. Except from the plug and the missing AiCaP this sensor is identical to 5819.

Figure 1-5: Conductivity Sensor 5990

Figure 1-6: Pin Configuration Conductivity Sensor 5990

1.4.1 Pin Configuration 5990

The Conductivity Sensor 5990 pin configuration is given in *Figure 1-6* above. A description of the receptacle notation is given in *Table 1-5.*

Table 1-5 Description of the Pin Configuration 5990

Signal	Description	Pin
Positive supply / V+	5-14V positive supply	8
Gnd	Ground	7
NC	Not Connected	6
NC	Not Connected	5
NC	Not Connected	4
TXD	RS232 Transmit line	3
RXD	RS232 Receive line	2
NC	Not Connected	1

1.5 Sensor Connection

Aanderaa offers a wide range of cables for different use of the sensors, both standard cables for use with loggers using AiCaP, RS-232 and RS-422 but also special customer specified cables for use in project. See *chapter 10.2* for an overview of standard cables or contact *aanderaa.sales@xylem.com* for more info. To configure the sensor it need 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.

1.5.1 Configure sensor using RS-232 configuration cable

Connect your sensor to one of the COM ports on your PC. If your PC comes without serial ports (COM ports) you may also use an USB to Serial Adapter. We then recommend the Tripp-lite Keyspan Model USA -19HS

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 USB port. 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.

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1.5.2 Configuration Cable 3855

Connection to the USB port for power supply

Connection to an external power supply (alternative2)

Connection to the PC serial Port

Connection to the sensor

Figure 1-7: Set-up and configuration cable 3855

Table 1-6: Cable 3855 pin configuration

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

1.5.3 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 an USB to Serial Adapter. We then recommend the Tripp-lite Keyspan Model USA -19HS

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 as well.
The cable is supplied with a USB port providing power to the sensor from the PC USB port. A USB extension is supplied with the cable if you want to use an external power source. 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 in other lengths.

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1.5.4 Configuration Cable 5618

Connection to the USB port for power supply

Connection to the PC serial Port

Connection to an external power supply (alternative2)

Connection to the sensor
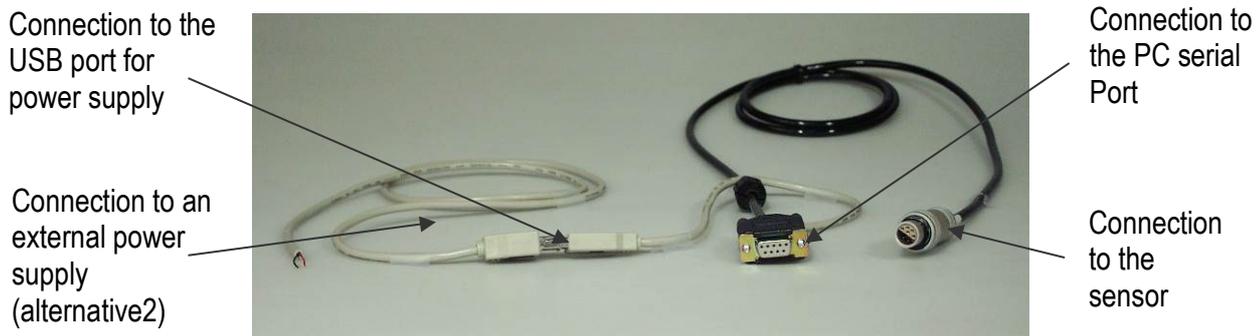
Figure 1-8: Set-up and configuration cable 5618

Table 1-7: 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		

1.6 Using PC without COM-port

If your PC comes without a COM-port we recommend to use a USB to serial converter.

Figure 1-9 shows one alternative, Keyspan USA-19HS.

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

Figure 1-9: Serial to USB converter

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

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

Get Interval	//When sending this string to the sensor, it will then return the value stored in this property.
Interval 5819 17 60.000	//Returned from sensor, where 5819 is the product number, 17 is the serial number of the sensor and 60 is the value stored as interval. To change the value you might send the following command:
Set Interval(30)	//This will change the value for this property to 30 seconds
Save	//Always end with save to store setting in flash

The interval will now be changed to 30 seconds. For more details see **CHAPTER 5**

1.8 Passkey for write protection

Table 1-8: 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

To avoid accidental change, most of the properties are write-protected. There are four levels of access protection, refer **Table 1-8** .

A special property called **Passkey** must be set according to the protection level before changing the value of properties that are write-protected, refer **Table 1-8**. After a period of inactivity at the serial input, the access level will revert to default. This period corresponds to the **Comm TimeOut** setting, or 1 minutes if the **Comm TimeOut** is set to **Always On.**

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1.9 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 3* and *CHAPTER 4.* Some properties of the 'AiCaP' sensor will not be applicable / visible when the sensor is connected to a SeaGuard, SeaGuardII or SmartGuard Datalogger, as the instrument will control these properties. All sensor properties are listed in *chapters 1.9.1* through *1.9.4* .

1.9.1 Factory Configuration

All properties in this section are Read Only, not possible to overwrite for the user. Only certified Aanderaa service personal can alter these settings. The access level for reading the status of this properties is however different for each property, see *Table 1-8* for more details. In this group we find information about Software and hardware settings, Production, Service and Calibration dates.

Table 1-9: Factory Configuration; Sensor Properties for Conductivity Sensor 5819, 5819R and 5990. ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Category	Access Protection Read/Write
Product Name	String	31	Aanderaa Product name	FC	No/ Read Only
Product Number	String	6	Aanderaa Product number		
Serial Number	INT	1	Serial Number		
SW ID	String	11	Software Identifier		
SW Version	INT	3	Software version (Major, Minor, Built)		
HW ID X	String	19	Hardware Identifier, X=1..3		High/ Read Only
HW Version X	String	9	Hardware Identifier, X=1..3		
System Control	INT	3	For internal use		
Production Date	String	31	AADI Production Date, format YYYY-MM-DD		
Last Service	String	31	Last service date, format YYYY-MM-DD, empty by default		
Last Calibration	String	31	Last calibration date, format YYYY-MM-DD		
Calibration Interval	INT	1	Recommended Calibration Interval in Days		
Sample Control	Float	14	Factory use only		
ARLim	Float	9	Factory use only. Automatic Range Limits		High/ High
Enable Conductivity	Bool	1	Controls inclusion of Conductivity in the output. Default set to 'Yes'		No/ Low

1.9.2 Deployment Settings

Deployment Settings contains settings for instruments metadata like position and owner, but also site dependent properties storing data that might influence the measurement.

Table 1-10: Deployment Settings; Sensor Properties for Conductivity Sensor 5819, 5819R and 5990. ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Category	Access Protection Read/Write
Interval	Float	1	Sampling Interval in seconds	DS	No/No
Location	String	31	Set the location		
Geographic Position	String	31	Set the geographic position		
Vertical Position	Float	1	User value for describing sensor position		
Reference	String	31	User setting for describing sensor reference, user definable.		
Pressure	Float	1	Water pressure in kPa	DS	No/ Low

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1.9.3 System Configuration

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

Table 1-11: System Configuration; Sensor Properties for Conductivity Sensor 5819, 5819R and 5990. ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Category	Access Protection Read/Write
Mode	ENUM	1	Operation Mode: 'AiCaP', 'Smart Sensor Terminal', 'AADI Real-Time', 'Smart Sensor Terminal FW2'	SC	No/ Low
Enable Sleep	BOOL	1	Enable sleep mode		
Enable Polled Mode	BOOL	1	Enable Polled Mode (for RS232), when set to 'No' the sensor will sample at the interval given by the *Interval* property, when set to 'Yes' the sensor will wait for the 'Do Sample' command.		
Enable Text	BOOL	1	Enable text, when set to 'No' the startup info and the parameter text is removed		
Enable Decimalformat	BOOL	1	Controls the use of decimal format in the output string		
Enable Temperature	BOOL	1	Controls inclusion of Temperature in the output		
Enable Derived Parameters	BOOL	1	Controls inclusion of Salinity, Density and Speed of sound in the output string		
Enable Rawdata	BOOL	1	Controls inclusion of raw data in the output string		

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1.9.4 User Maintenance

This group contains sensor settings that normally are not altered by the user. To access most of these properties you need to send passkey(1000) or with Real-Time Collector use password: 1000. These properties are used to configure serial port settings, communication to and from sensor, temperature and foil coefficients and properties used during calibration.

Table 1-12 Part 1 of 4: User Maintenance; ; Sensor Properties for Conductivity Sensor 5819, 5819R and 5990. ENUM=Enumeration, INT =Integer, BOOL=Boolean ('yes'/'no')

Property	Type	No of elements	Use	Category	Access Protection Read/Write
Node Description	String	31	User text for describing node, placement etc.		No/ Low
Owner	String	31	User setting for owners name		No/ High
Baudrate	ENUM	1	RS232 baudrate: 300,1200,2400,4800,9600,57600,115200 [1]		
Flow Control	ENUM	1	RS232 flow control: None or Xon/Xoff		
Enable Comm Indicator	BOOL	1	Enable the Communication Sleep ('%') and Communication Ready ('!') indicators		
Comm TimeOut	ENUM	1	RS232 communication activation timeout: Always On,10 s,20 s,30 s,1 min,2 min,5 min,10 min		
CellCoef	Float	1	Cell constant for converting mS to mS/cm	UM	
TempCoef	Float	6	Curve fitting coefficients for the temp measurements.		High/ High
R0Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 0		
R0Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 0		
R0Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 0		
R0Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 0		
R0Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 0		
R1Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 1		

R1Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 1	UM	High/High
R1Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 1		
R1Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 1		
R1Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 1		
R2Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 2		
R2Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 2		
R2Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 2		
R2Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 2		
R2Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 2		
R3Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 3		
R3Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 3		
R3Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 3		
R3Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 3		
R3Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 3		
R4Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 4		
R4Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 4		
R4Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 4		
R4Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 4		
R4Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 4		
R5Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 5		

R5Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 5		
R5Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 5		
R5Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 5		
R5Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 5		
R6Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 6		
R6Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 6		
R6Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 6		
R6Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 6		
R6Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 6		
R7Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 7		
R7Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 7	UM	High/ High
R7Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 7		
R7Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 7		
R7Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 7		
R8Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 8		
R8Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 8		
R8Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 8		
R8Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 8		
R8Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 8		
R9Coef0	Float	4	Temp Coefficients for Loop reading to Conductance, Range 9		

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R9Coef1	Float	4	Temp Coefficients for Loop reading to Conductance, Range 9	UM	High/ High
R9Coef2	Float	4	Temp Coefficients for Loop reading to Conductance, Range 9		
R9Coef3	Float	4	Temp Coefficients for Loop reading to Conductance, Range 9		
R9Coef4	Float	4	Temp Coefficients for Loop reading to Conductance, Range 9		
DACARange Values	Float	9	Factory use only. Setting ranges in raw data values.		
Range	INT	1	Range setting: -2=Factory use only, -1=Auto range, 0-9=range 0 to range 9. Default is -1.		
AiCaP Presample Time (sec.)	Float	1	Used to separate sampling if many sensors are connected to same bus		

[1] Baud rates lower than 9600 may limit the sampling frequency.

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1.10 Sensor parameters

The firmware's main task is to sample raw data, compute calibrated temperature compensated and linearized conductivity, and present the result at the different interfaces.
All calibration coefficients and settings are stored in the DSP flash-memory. These properties can be displayed and changed using the RS-232/RS-422 port.

- The Conductivity measurements are presented in mS/cm
- The ambient Temperature is presented in ºC.

1.10.1 Calculated parameters

Based on the measured parameters described above and a user selectable pressure setting (in kPa), the senor software also calculates other parameters:
- The Salinity in PSU
- The water Density in kg/m3
- The Speed of Sound in m/s

To enable these parameters select *Enable Derived Parameters(Yes)* and set *Pressure()* equal to deployment depth.

These calculations are made according to the UNESCO International Equation of State, IES 80, Unesco 27 [1].

The Conductivity raw data are

Conductance	Measurement in mS
RawCond0	Raw measurement in LSB
RawCond1	Raw measurement in LSB
ZAmp	Amplitude measurement in mV
RawTemp	Voltage from thermistor bridge in mV

To enable these parameters select *Enable Rawdata(Yes)*

Calibration coefficients are stored in the sensors flash and are updated when recalibrated. If raw data are not needed the user can select to turn off the delivery and logging of these.

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1.11 Specifications

For product specifications refer Datasheet D425 on our web site http://www.aaderaa.com or contact aanderaa.info@xylem.com

You will always find the latest versions of our documentation on the web.

On our website you will also find the latest version of product manuals, technical notes and software. Please contact aanderaa.info@xylem.com for guidance.

1.12 Manufacturing and Quality Control

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

We are an ISO 9001, ISO 14001, ISO 45001 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.

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CHAPTER 2 Configuration on SeaGuard with display

The 5819 Conductivity Sensor is equipped with a CAN bus interface supporting AADI AiCaP (Automated idle line CAN bus Protocol). This standard ensures easy plug and play connection to all Aanderaa SeaGuard, SeaGuardII and SmartGuard data logger. Make sure the sensor is set to AiCaP mode before you connect the sensor to the AiCaP bus. Default setting from factory is AiCaP.

When connected to an AiCaP bus 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 presented nodes. This solution provides for greater flexibility on both use and design of the different elements within the system.

Note! This chapter describes the configuration of the Conductivity Sensor 5819 when connected to a SeaGuard with display. Refer TD262a for a thorough description of how to configure the SeaGuard Instrument, and to perform Node Identification and Recorder settings.

For configuration on SeaGuardII or SmartGuard, see **CHAPTER 4.**

This is only valid for 5819 and not 5819R since this sensor has no AiCaP output.

2.1 Installation on SEAGUARD® Platform

The Conductivity Sensor 5819 are easily installed on AADI SeaGuard data loggers. Turn off power before connecting the sensor. We recommend that you install the Conductivity Sensor in sensor position 4 to secure free flow through the sensor bore and maximum distance from the zinc anode, refer *Figure 2-1*. If mounted in position 6, use patch cable to connect the sensor to the HUB card.
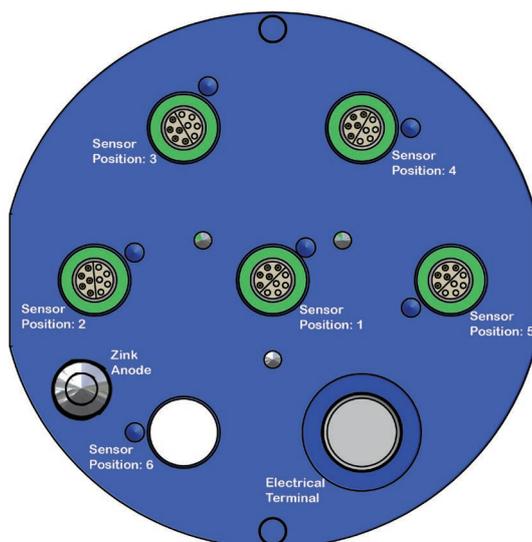

Refer SeaGuard Platform Operating Manual, TD262a, for an illustrated sensor installation guide. TN309 holds an extract of sensor connection / disconnection given in the SeaGuard Operating Manual.
Note!

Always replace O-rings when removing, exchanging, or installing a new sensor or a sealing plug.

If placed next to another sensor, the *CellCoef* calibration performed on the Conductivity sensor might be influenced. It is important that the Conductivity Cell is placed in the same position and with the same sensors surroundings as it was calibrated. For best accuracy, the *CellCoef* should be recalibrated after any changes in the surroundings.

Figure 2-1: SeaGuard Top-end plate

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 wanted position (the setscrew will stop when sufficiently extracted). Pull out the sealing plug (or sensor) by inserting a screwdriver in the slot between the plug and the top end plate, see *Figure 2-2*.
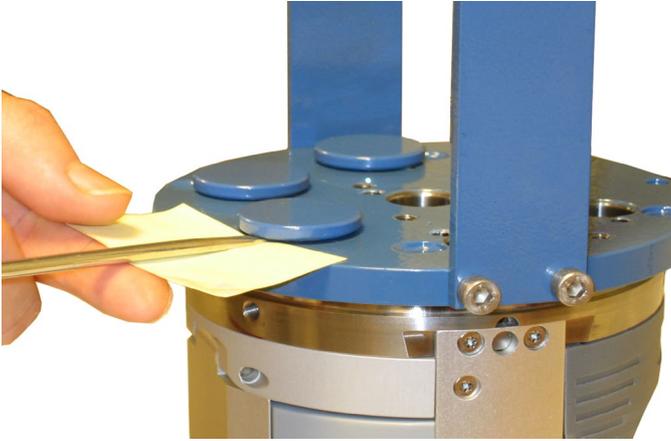

Figure 2-2: Removal of sealing plug.

Use a small piece of paper/cardboard to protect the lacquer of the top-end plate
Make sure that the surface in the hole is clean and smooth and check also that the O-rings at the sensor foot are free from dust and particles and greased with silicon grease. Align the orientation pin in the sensor foot with the orientation hole in the top end plate, and carefully insert the sensor. When fully seated at the top end plate, tighten the set screw with only moderate force.

Note! Always replace O-rings when moving a sensor or a sealing plug.

2.2 Sensor Cable for remote sensor

Sensor Cable 4793 is used for remote sensor connection on SeaGuard for example if you want to measure gradients. Instrument side fits directly on the top-end plate using the same connection as a standard AiCaP sensor.
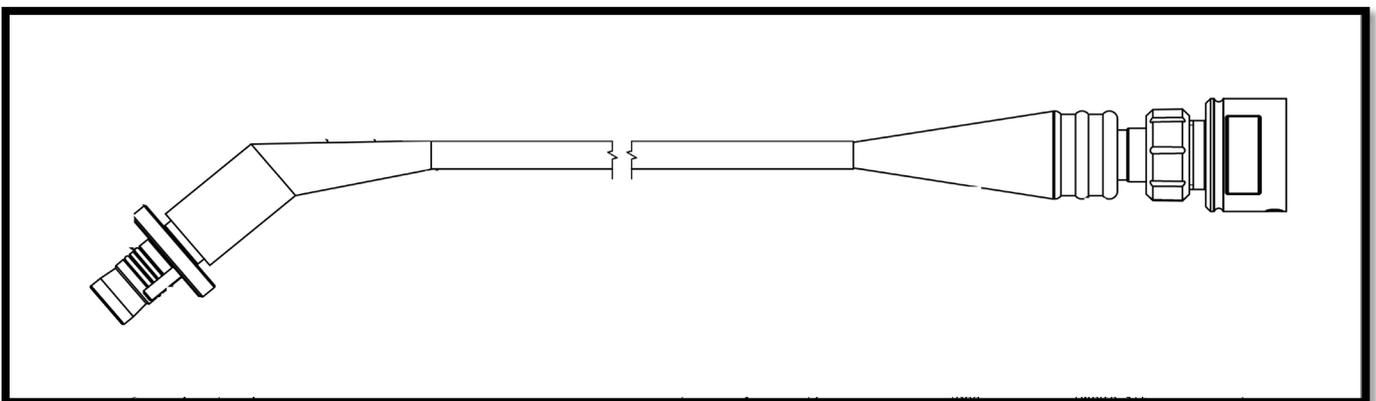

Figure 2-3: Remote sensor cable 4973

2.3 Sensor Configuration

In this section we will show you how to configure the sensor connected to a SeaGuard with display. If you have a SeaGuard without display or a SeaGuardII please proceed to *CHAPTER 4.* We will only cover the sections that are special for the conductivity sensor. Some of the screenshots might be different on your logger due to different setup and accessories connected. Some of the screenshots used are from other sensors but are then identical except from the sensor name.

After installing the sensor in one of the sensor positions turn power on and open menu by pressing the *Menu* button in the lower left corner. Four submenus contain properties for the Conductivity sensor.
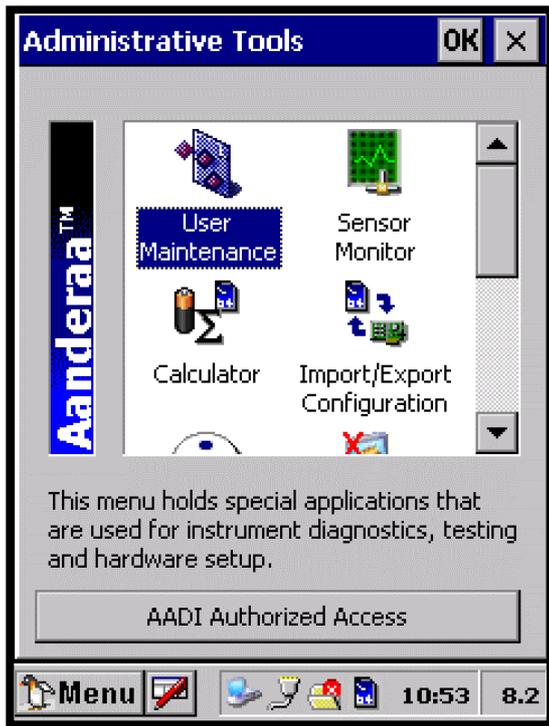
- *Administrative Tools*

- *Sensor Identification*

- *System Configuration*

- *Deployment Settings*

These menus are covered in this chapter. For information about the other menus see *SeaGuard Platform Operating Manual, TD262a.*

Figure 2-4: Select Menu to start

To enable/disable a parameter, change a value or change a text:

Select the output parameter from the list, press *View/Edit* or *Edit Description* in the lower part of the window, and change the setting by ticking the box or use the keyboard sign in lower left corner to type a new value or text, press *Ok* and *Save/Finish* to save and then close the window to finish the update.

2.3.1 Administrative Tools

Figure 2-5: Administrative Tools

Open *Administrative Tools* from the *Menu.*

This section contains more submenus. In chapter *2.3.5* we will cover *User Maintenance* and in chapter *7.1.1* we will cover the *Sensor Monitor menu*.

For all other submenus, please refer to *SeaGuard Platform Operating Manual, TD262a.*

2.3.2 Sensor Identification

Figure 2-6: Sensor Identification
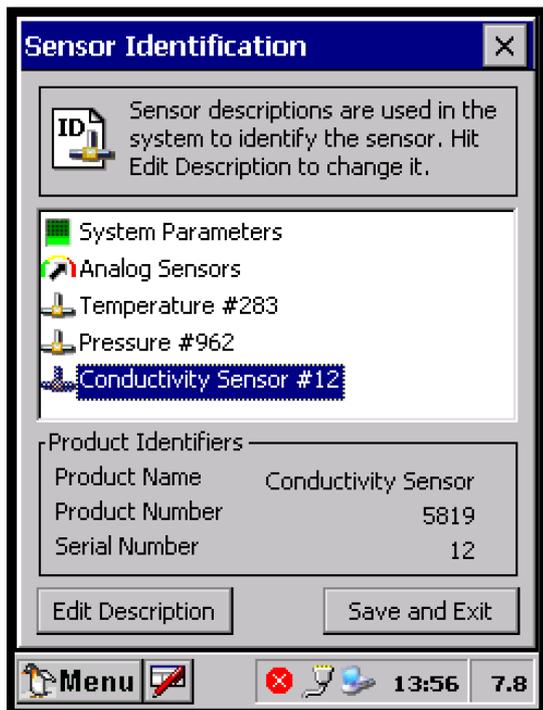
Open *Sensor Identification* from the main *Menu*. *Sensor Identification* is a list of all sensor connected to the logger. You may also change the description, using the *Edit Description* button, but the default will be *'Sensor Name' # 'Serial Number'*

When you select one of the sensors you will find *Product Name, Product Number* and *Serial Number* in the *Product Identifiers* section.

2.3.3 System Configuration

Figure 2-7: System Configuration menu

Open *System Configuration* from the main *Menu*. Under *System Configuration* you will find two tabs.

- *Instrument*

- *Sensors*

For more information about the Instrument tab and its submenus, see *SeaGuard Platform Operating Manual, TD262a.*

Select the *Sensors* tab to continue.

Figure 2-8: System Configuration Sensors selection

The **System Configuration** sensors tab holds a list of all Analog and AiCaP sensors connected to the logger. Select the newly installed *Conductivity Sensor* that should appear in the list of sensors, and tap *Configure* in the lower part of the window.

Alternatively, if you want to configure all sensors in the list you may select the *Run Wizard* button that will guide you through all the individual sensor configurations.

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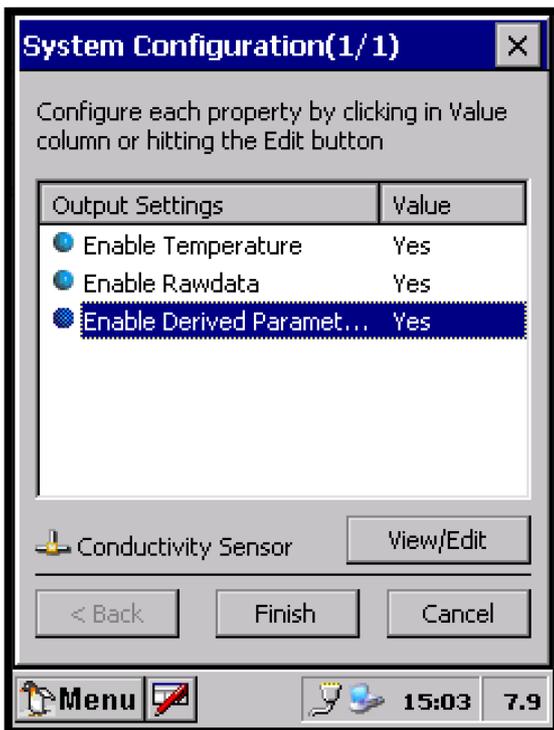
The **System Configuration** for the **Conductivity Sensor** holds a list of output parameters that can be enabled/disabled by the user. Enabled properties **(Yes)** are calculated and sent to the data logger:

- **Enable Temperature** in Deg. C.

- **Enable Raw data**, refer chapter **1.10.1**

- **Enable Derived Parameters**, refer chapter **1.10.1**

We recommend that you enable all parameters in case of later use. Storage capacity for the memory card is normally not a limitation for the SeaGuard. Raw data can be used to control calibration coefficients and perform quality control on the data.

Figure 2-9: System Configuration parameter enabling

2.3.4 Deployment Settings

Figure 2-10: Deployment Settings menu

Open *Deployment Settings* from the main *Menu*.
In *Deployment Settings* you will find two tabs.

- *Instrument*

- *Sensors*

For more information about the Instrument tab and its submenus, see *SeaGuard Platform Operating Manual, TD262a.*

Select the *Sensors* tab to continue.

Figure 2-11: Deployment Settings Sensor selection

*T*he *Sensors* tab holds a list of all Analog and AiCaP sensors connected to the logger. Select the newly installed *Conductivity Sensor* that should appear in the list of sensors, and tap *Configure* in the lower part of the window.

Alternatively, if you want to configure all sensors in the list you may select the *Run Wizard* button that will guide you through all the individual sensor configurations.

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Figure 2-12: Deployment Settings properties
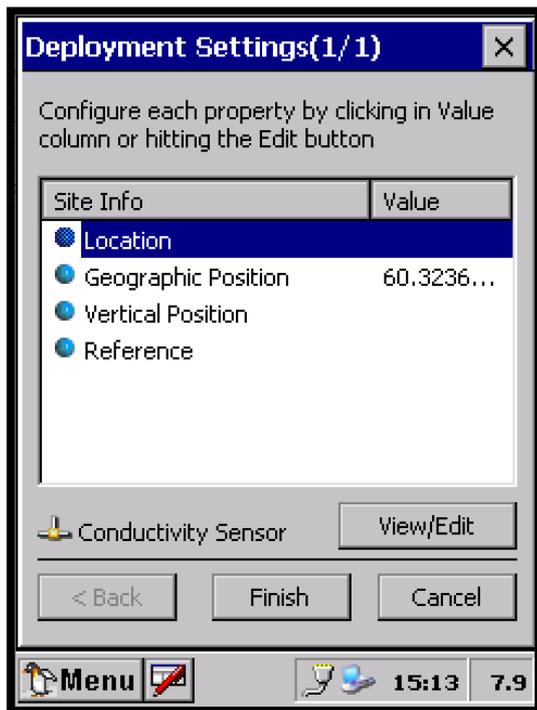
The *Deployment Settings* for the *Conductivity Sensor* hold a list of user defined inputs:

- *Location*

- *Geographic Position*

- *Vertical Position*

- *Reference*.

The values of these settings are not used in any calculations. To add information to one of these properties, select the property, press *View/Edit* and with the keyboard panel enter the text or numbers. Press *OK* and *Finish* storing the information.

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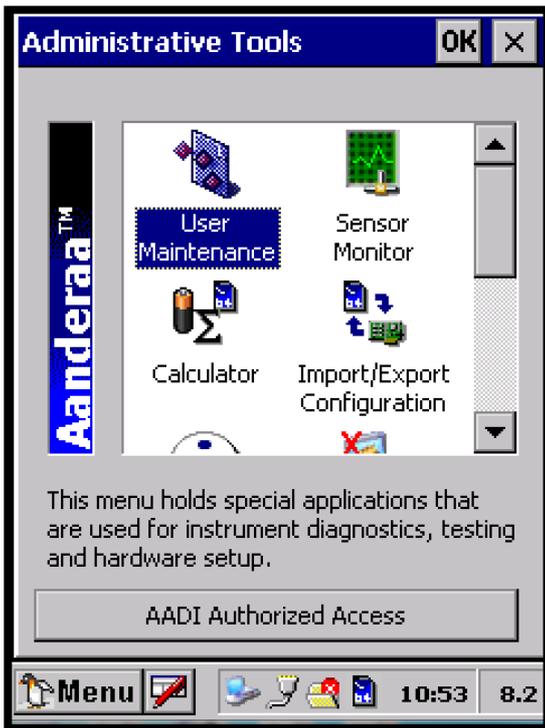
2.3.5 User Maintenance

Figure 2-13: User Maintenance menu

Special property settings and calibration coefficients are found in *User Maintenance.*

User Maintenance is a submenu under the *Administrative Tools* menu.

Open *Administrative Tools* from the *Menu* button and select *User Maintenance.*

Figure 2-14: User Maintenance menu

In *User Maintenance* you will find two tabs.

- *Instrument*

- *Sensors*

For more information about the Instrument tab and its submenus, see *SeaGuard Platform Operating Manual, TD262a.*

Select the *Sensors* tab to continue.

Figure 2-15: User Maintenance Sensors tab

The **User Maintenance** sensors tab holds a list of all Analog and AiCaP sensors connected to the logger. Select the newly installed *Conductivity sensor* that should appear in the list of sensors, and tap *Configure* in the lower part of the window.

Alternatively, if you want to configure all sensors in the list you may select the *Run Wizard* button that will guide you through all the individual sensor configurations.

Figure 2-16: User Maintenance password menu

In *User Maintenance* you find properties that are password protected and are set/altered by the 'advanced user'*, note! The password is 1000*. Enter the password using the keyboard activated in the lower left corner and the press *OK* to access. The properties in *User Maintenance* are normally not changed during normal operation

The user maintenance holds four submenus:

- *Mandatory*

- *Site Info*

- *Calibration*
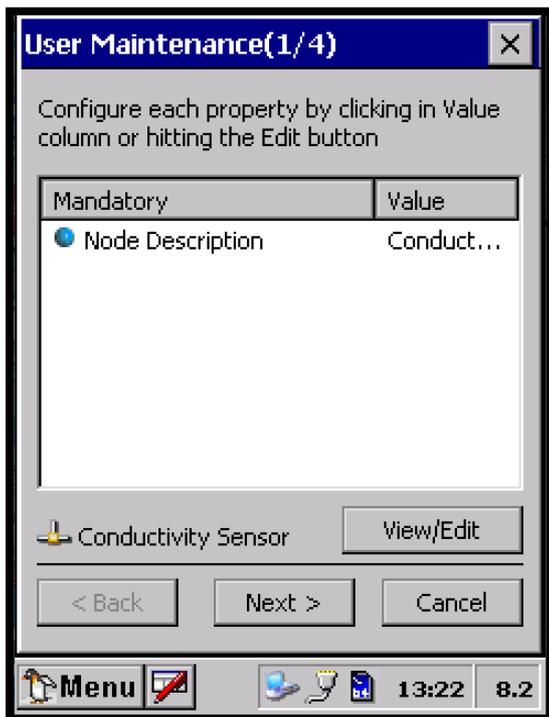
- *Sample Settings*

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Figure 2-17: Mandatory

First submenu is the Mandatory. Select the **Node Description** property, press **View/Edit** in the lower part of the window, if you want to change the value. Press **Save** to store the setting when completed.
Node Description is a user entered text describing the sensor, placement etc. If using for example a SeaGuard sensor string with multiple sensors connected; renaming the sensor can facilitate analyzing data. The text is by default set to the product name followed by product number and serial number, e.g. **Conductivity Sensor 5819#12.**

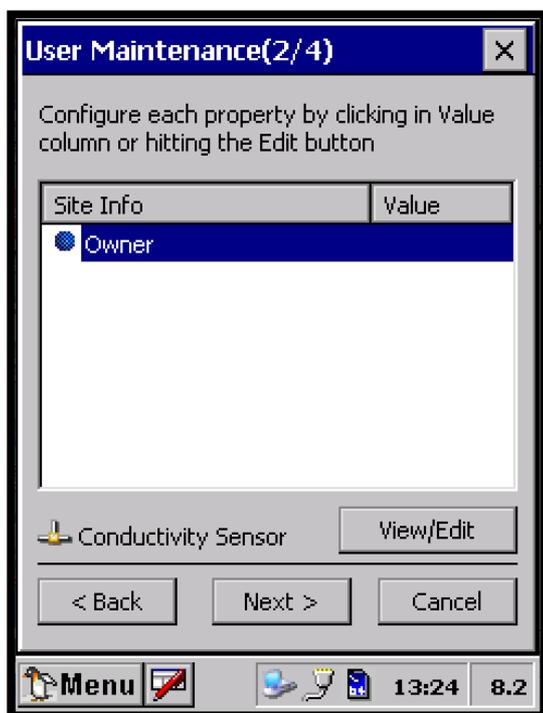Press **Next>** to continue with the next submenu.

Figure 2-18: Site Info

The second submenu in the **Conductivity Sensor User Maintenance** is **Site Info** and holds one setting for **Owner.**

This property is not used by the sensor and therefor optional. Typical value her is Name and contact info for **Owner**.

Select the **Owner** property, tap **View/Edit** and type your value. Press **Save** to store the setting.

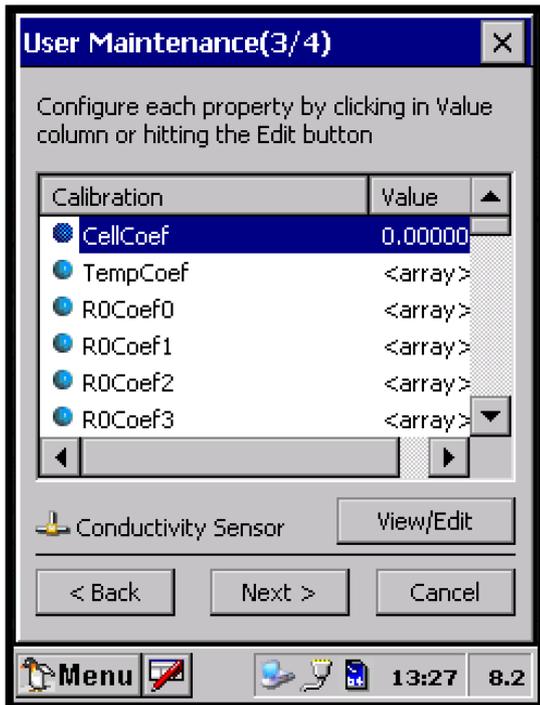Press **Next>** to continue with the next submenu.

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Figure 2-19: Calibration part 1 of 2.

The third submenu are *Calibration.* For each calibration property to be set first select the property then press *View/Edit* and type the correct value. Press *Save* to store the settings.

Except from the *CellCoef* all coefficients in this group should not be changed unless you are instructed by a certified Aanderaa representative.

Please refer to *chapter 7.2* for how to calibrate the *CellCoef* and to enter the new value.

TempCoef are Temperature calibration coefficients.

R0Coef0 to *R9Coef4* are Range calibration coefficients

Press *Next>* to continue with the next submenu.
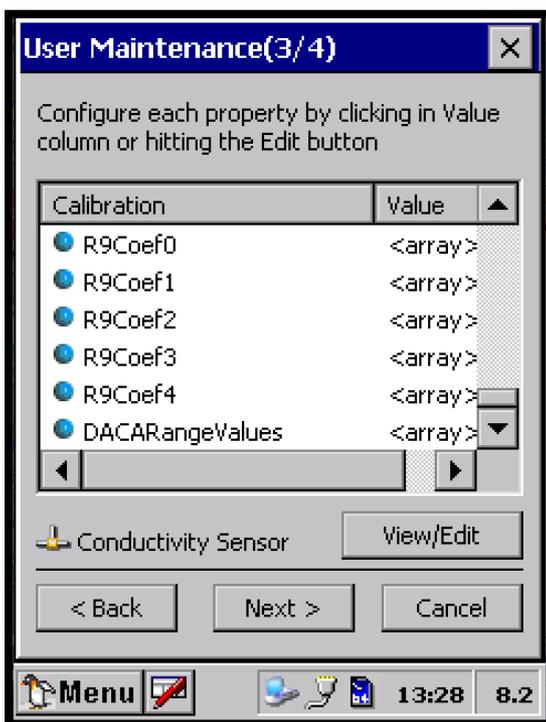

Figure 2-20: Calibration part 2 of 2.

DACARangeValues are factory settings used to set the limits for each of the 10 ranges.

Do not alter these values unless you are instructed by a certified Aanderaa representative.
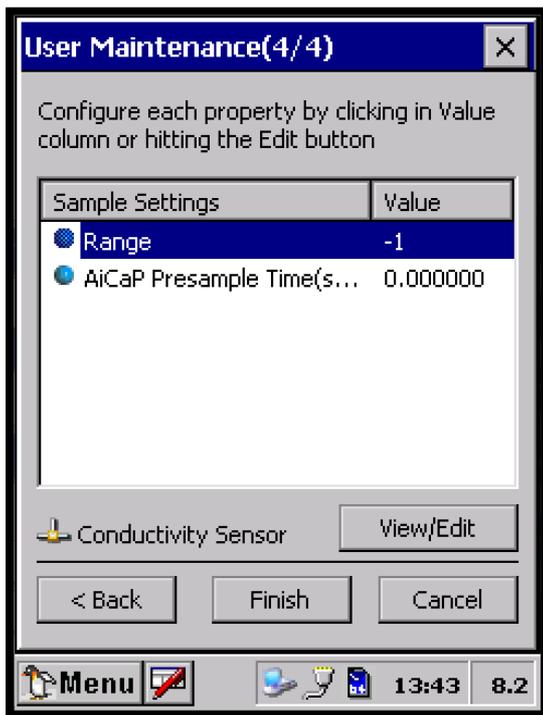
Figure 2-21: Sample Settings

The last submenu in the *Conductivity Sensor User Maintenance* is *Sample Settings* and holds settings for:

- *Range*

- *AiCaP Presample Time*

Range is used to either set one of the 10 ranges or automatic range. In most application we recommend using the default setting: -1 = auto range.

AiCaP Presample Time is used to separate in time if there is more than one Conductivity sensors connected to the same logger. This is used to avoid noise between the sensors especially if they are close. We recommend separating each sensor with 1 second. This means that the first sensor is set to *0 sec.*, Second sensor is set to *1 sec.* and third sensor is set to *2 sec*.

CHAPTER 3 Stand-alone Sensor configuration using Real-Time Collector

This chapter describes the stand-alone sensor configuration using AADI Real-Time Collector when the sensor is used as stand-alone sensor with serial communication RS-232. The menus shown here are slightly different from the menus shown when the sensor is working in AiCaP mode and configured through an Aanderaa Datalogger (described in *CHAPTER 4*).

It's also possible to use terminal software to configure a stand-alone sensor, refer *CHAPTER 6,* but then you need to enter all the commands and send them to the sensor. With Real-Time Collector it's much easier since the software will then let you configure the sensor using the available choices in each category.

Before connecting the sensor to your computer, you need to install and start the AADI Real-Time Collector software on your PC.

For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual. See *chapter 1.5* for more information about sensor connection.

3.1 Establishing a new connection

If this is the first time you start the software the connection list will be empty. You can then either generate a new general connection that can be used for different sensor with the same output protocol as a general Aanderaa Smart Sensor connection. However, you can also generate a special connection for one specific sensor like *Conductivity Sensor 5819 #12*.

3.1.1 Add new connection to the list
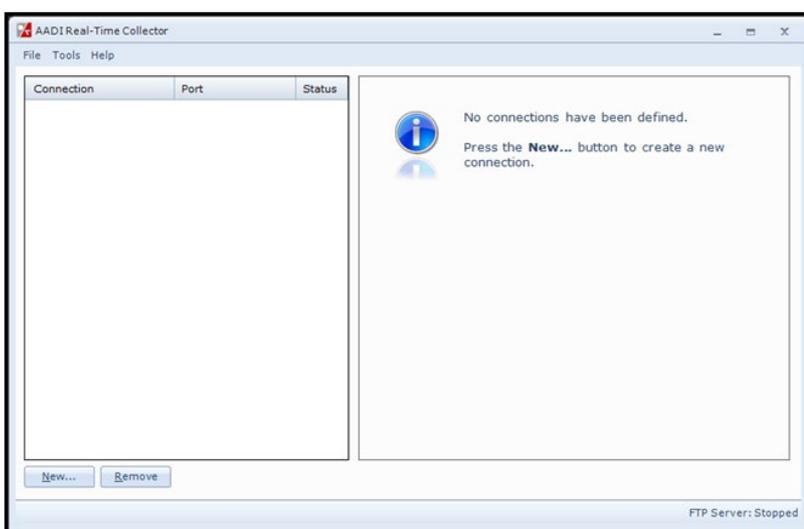
The first time you open the *AADI Real-Time Collector* program, the connection list will be empty.

Click on the *New* button in the lower left corner to create a new connection.

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

Figure 3-1: AADI Real-Time Collector start up menu

Figure 3-2: AADI Real Time Collector connection settings
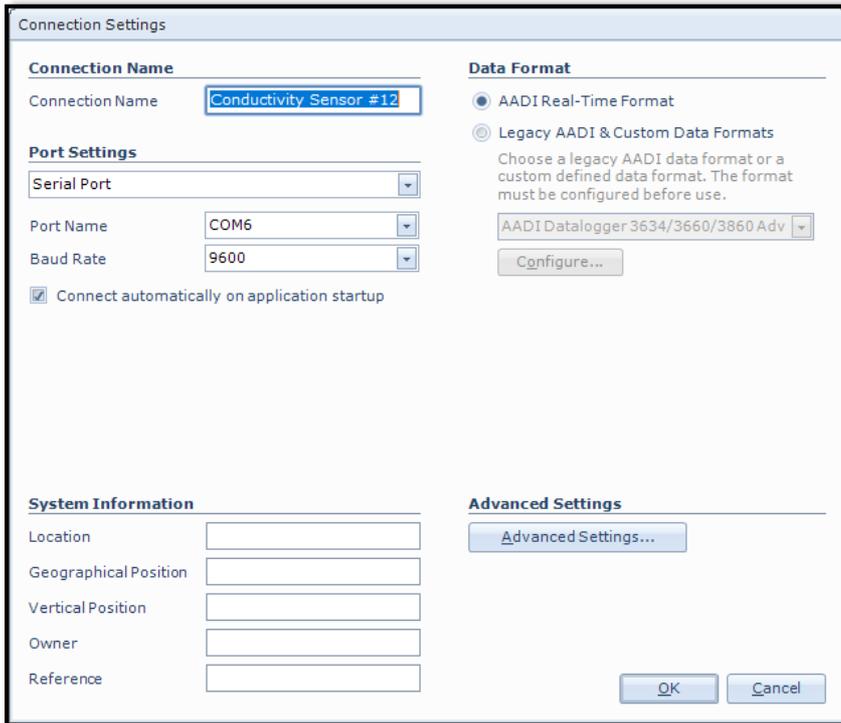
First enter a new *Connection Name*, we recommend using name and serial number or just the type of sensor if you want to use the same connection for multiple sensors.

Select **Serial Port** in the dropdown menu under *Port Setting* and choose the correct COM-port on your computer under *Port Name*. COM-port number may vary depending your connections.

Select *9600* as *Baud Rate*. This is the default baud rate on all Conductivity Sensors.

The *Baud Rate* needs to match the baud rate set in *User Maintenance*.

3.1.2 Establish contact with the sensor

Figure 3-3: New connection
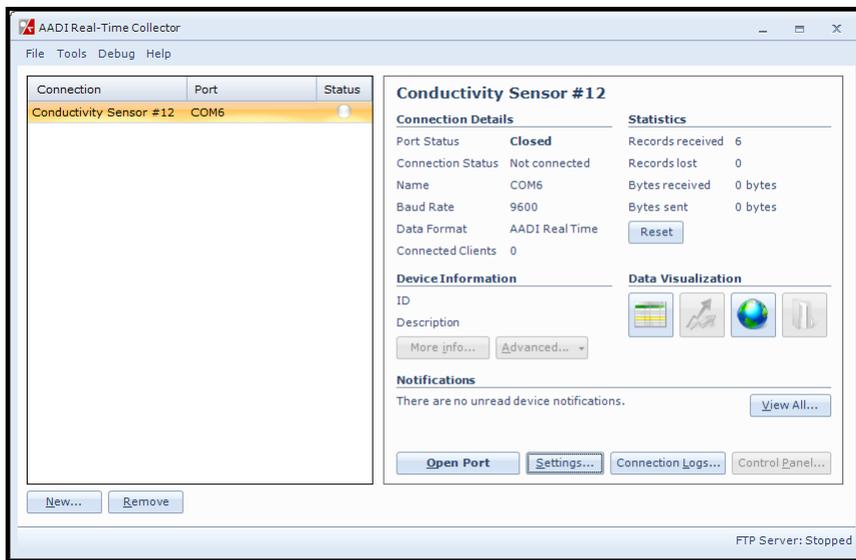
The new connection will then be available in the *AADI Real-Time Collector* connection list.

Click on the line with the new connection to highlight this connection and then click on the *Open Port* button.

If you have multiple connections in your list, then highlight the connection you want and then press *Open Port*.

It is possible to have multiple connections using the same port but only one of them can be open. This means that if you have another sensor connected to COM6 you need to close this port before you can open the new connection. Multiple connections can be open at the same time if they are connected to different ports.

Figure 3-4: Connection established
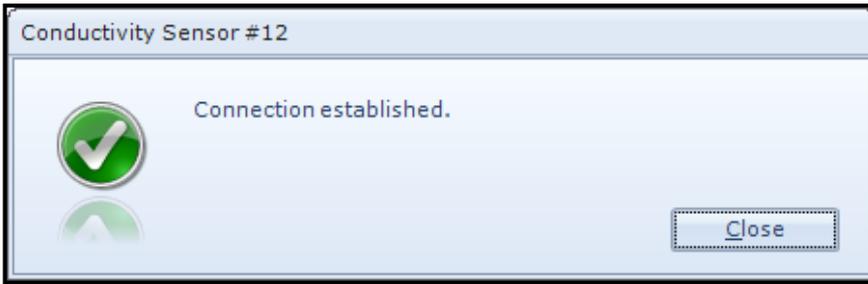
When the connection is established, a small window will show up with a green check mark confirming this.

Figure 3-5: Green Status

The status changes to green when the port is open.

Then click on the *Control Panel* button on the lower right corner to continue.
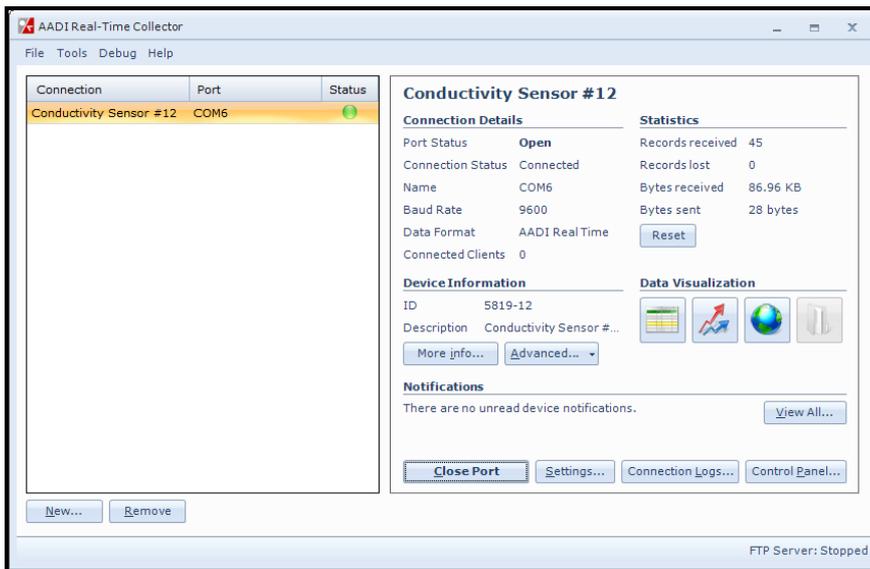
If the wheel continues to turn and you do not get the green status, please press *Close Port* and then *Open Port* again. If you still face a connection problem, then check the port setting with *Baud Rate* and *Port Name*. If you still cannot connect, check the cable connection and make sure that you have power to the sensor. If the sensor is running on a fast interval this connection can be a bit slower.

3.2 Control Panel

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

3.2.1 Recorder Panel

Figure 3-6: Recorder Panel
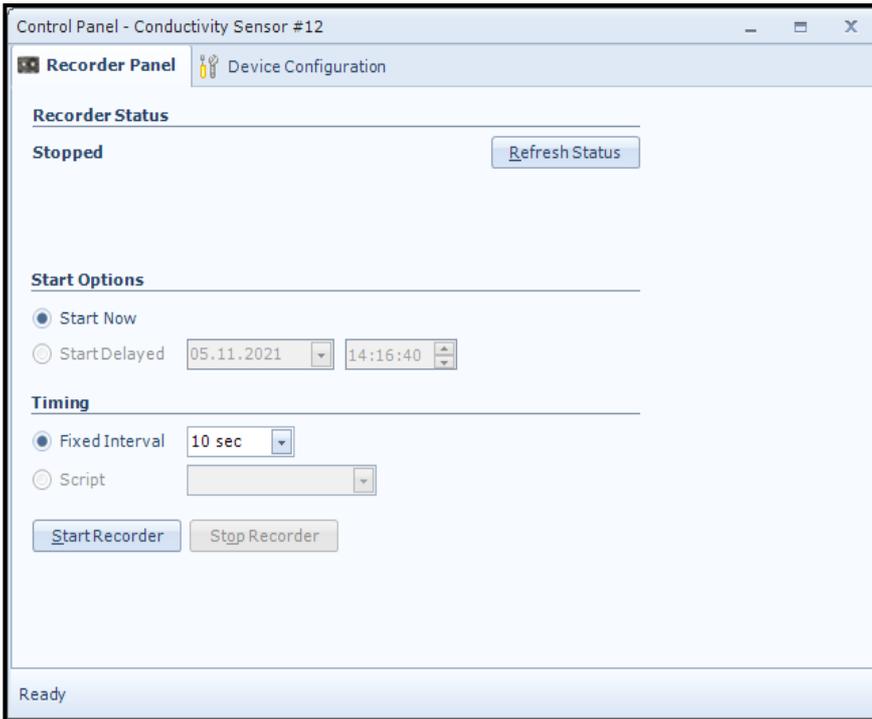
Under *Start Options* you can start the sensor immediately by *Start Now*. The *Start Delayed* option is possible for stand-alone sensors.

In the *Timing* session you may select the recording interval using *Fixed Interval*. The available interval will be dependent on the sensor configuration.

If you change the configuration it might cause a change in the *Fixed Interval,* so we recommend always checking the interval after configuration is finished.

The *Script* is not used for this sensor.

3.2.2 Device Configuration

Figure 3-7: Device Configuration
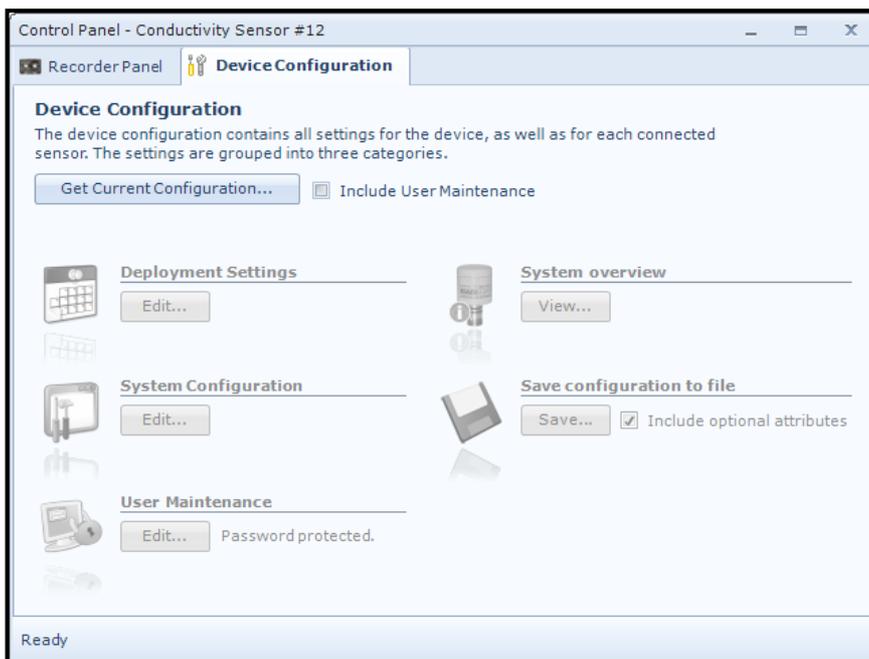
Click on the *Device Configuration* tab to continue and access the sensor property menus.

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

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

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The settings in *User Maintenance* are protected with a higher access level. To access this menu you will need to enter a *password.*

This *password is 1000* for all sensors.

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

You can save current settings to a backup file by pressing *Save…* under the heading *Save configuration to file*. Edit the name for your file and press *Save* to save the configuration to file in .xml format. Use *XML Config Documentation Generator* to convert from .xml to Word. This generator is available from our website. Converting from .xml shown below.

```
<PropertyCategory ID="0" Descr="Mandatory">
  <Property ID="0" Descr="Product Name" Type="VT_BSTR" Access="R1W4">Conductivity Sensor</Property>
  <Property ID="1" Descr="Product Number" Type="VT_BSTR" Access="R1W4">5819</Property>
  <Property ID="2" Descr="Serial Number" Type="VT_I2" Access="R1W4">12</Property>
  <Property ID="6" Descr="SW ID" Type="VT_BSTR" Access="R1">1940023</Property>
  <Property ID="3" Descr="SW Version" Type="VT_ARRAY|VT_I2" Access="R1">5;4;1</Property>
  </PropertyCategory><PropertyCategory ID="11" Descr="Output Settings">
<Property ID="0" Descr="Enable Conductivity" Type="VT_BOOL" Access="R1W2">true</Property>
```

Figure 3-8: Configuration file saved as .xml

to a more readable .doc format as shown below.

Conductivity Sensor #12 Configuration

Conductivity Sensor #12

Factory Maintenance

Mandatory	
Product Name	Conductivity Sensor
Product Number	5819
Serial Number	12
SW ID	1940023
SW Version	5;4;1
Output Settings	
Enable Conductivity	true

Figure 3-9: Configuration file converted to .doc

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

User accessible sensor properties are found in *Deployment settings, System Configuration* and *User Maintenance*. Refer *chapter 1.7.1* trough *1.7.4* for an overview of the properties.

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

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

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3.3 Changing Values
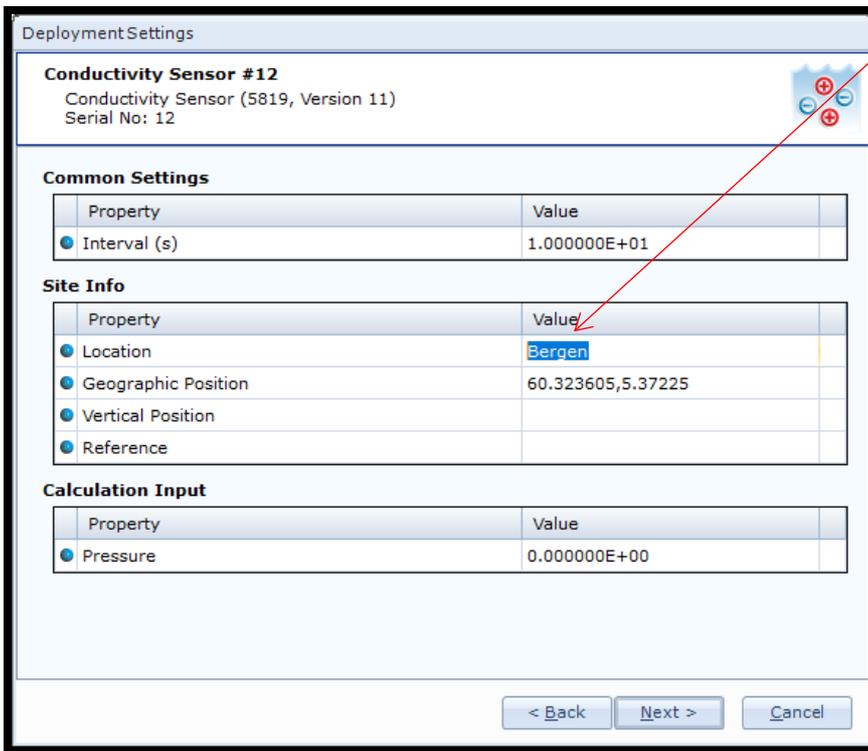
Figure 3-10: Change value

To change the content of a property first tick in the value box of the actual property and then enter the text or number before pressing *Next. See example in Figure 3-10,* where the text for *Location* has been changed.

The value is not changed before you have finished the full process. If you press *Cancel* or turn of the power then the changes will not be stored.
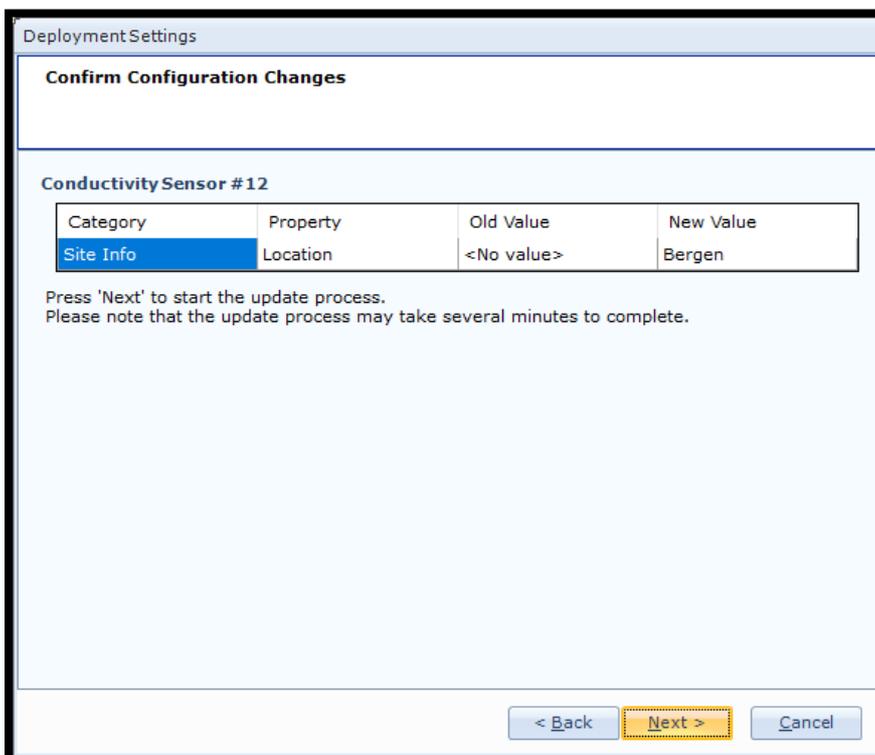
Figure 3-11: Confirm Configuration Changes

In the next picture a list of all properties that are changed will show up.
If the list of configuration changes is correct press *Next* to start the update process.
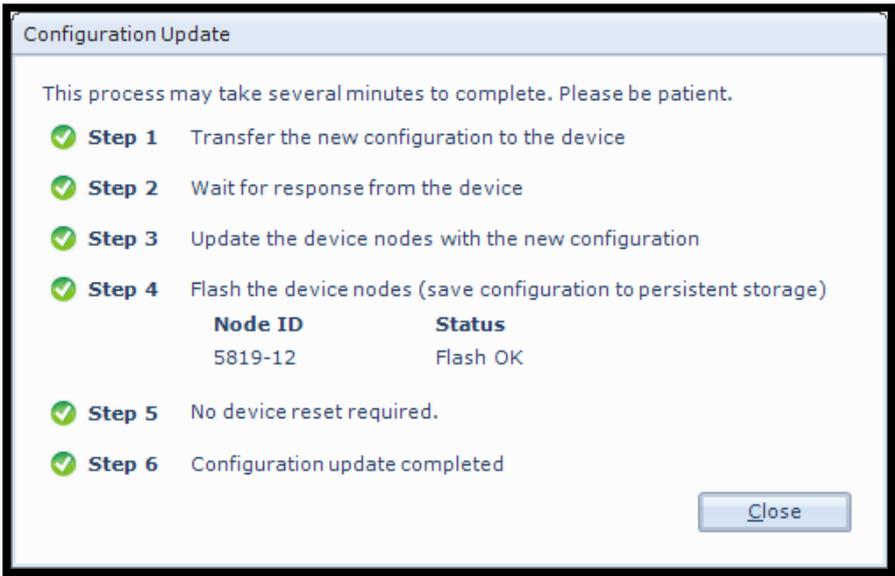
Figure 3-12 Configuration Update

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 before the entire process is completed.

Figure 3-13 Configuration Update Completed

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

Before you can continue you might need to go to the *Recorder Panel* and press *Refresh Status.*

Figure 3-14: Device Reset
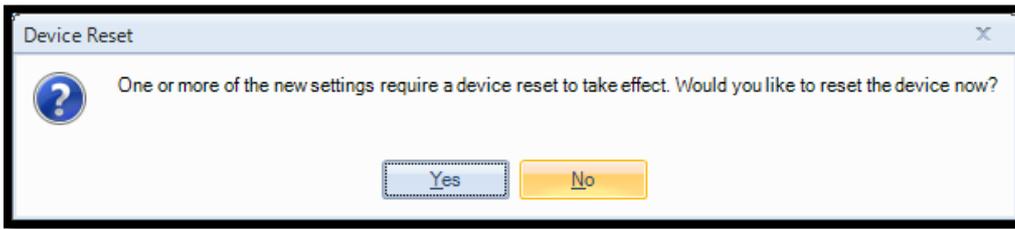
Some changes may require a device reset to take effect. Press *Yes* to continue.

Figure 3-15: Warning
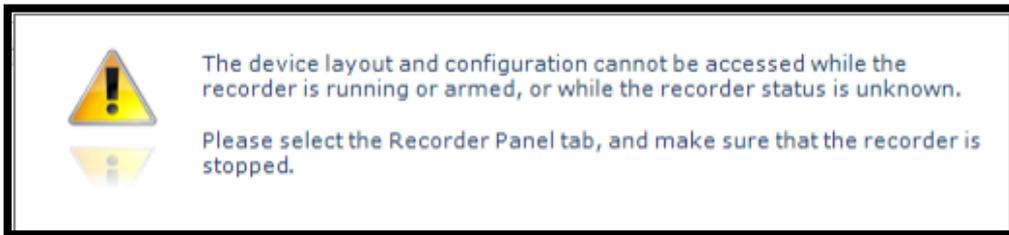
Some changes may require that you stop the recorder or refresh the status in *Record panel.*

3.4 Deployment Settings

In the Device Configuration window select Deployment Setting by ticking the Edit button following the header
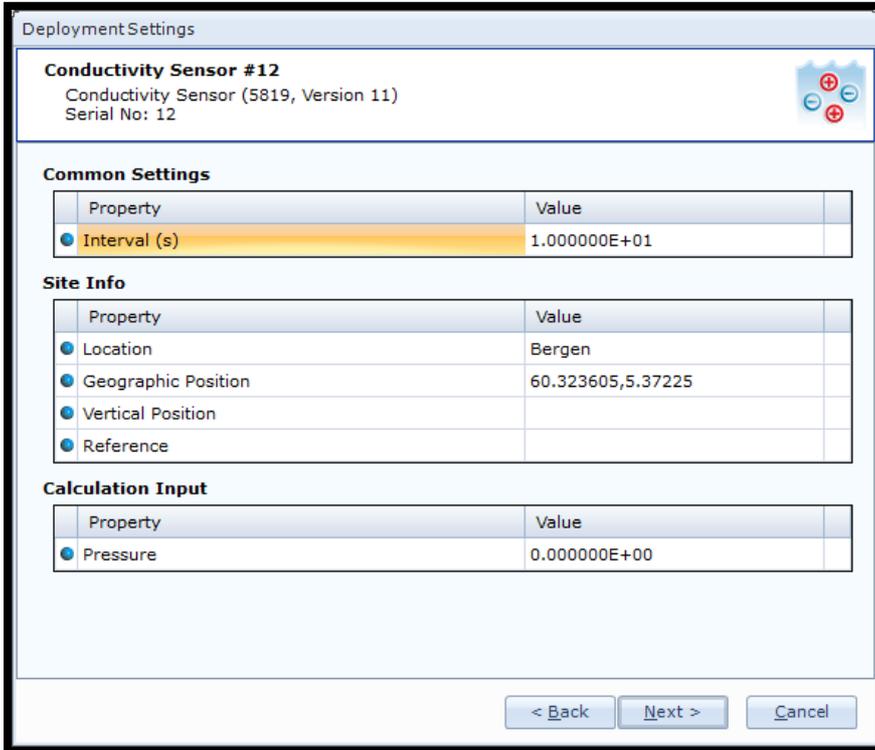
This menu holds three different sections, *Common Settings*, *Site Info* and *Calculation Input.*

See *chapter 3.4.1* to *3.4.3* for a explanation of each property,

All properties are also listed in chapter *1.9.2*

Figure 3-16: Deployment Settings

3.4.1 Common Settings

Figure 3-17: Common Settings

Under *Common Settings* you will find only one property, *Interval (s).* This setting is used to control the sensors recording interval, the number of seconds between each output.
This setting may also be set from *Recorder Panel*. The last entered value will be the valid one if properly stored to flash.

3.4.2 Site Info

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

Figure 3-18: Site Info

Site Info is optional information to be entered to store information about the deployment. These setting are not used in internal calculations only stored as a part of the sensor metadata. *Geographical Position* is however used to give the map coordinates to display software or post possessing software unless a GPS input is connected. The Properties under *Site Info* are:

- *Location*

- *Geographical Position*

- *Vertical Position*

- *Reference*

Location is typical the Site name or any name that can be used later to identify the location.

Geographical Position is normally the GPS Coordinates for the deployment. This might also be to reproduce position in an electronic map.

Vertical Position is used to set the deployment depth or position in a chain of sensors.

Reference is a field where you might add information to be stored in the sensor metadata.

3.4.3 Calculation Input

If you want to calculate *Salinity, Density* and *Sound Speed* you also need the installation depth for the sensor. Water depth or *Pressure* are given in kPa. To include Salinity in the sensor output also *Enable Derived Parameters* need to be set. You will find this parameter under *System Configuration.*

Calculation Input		
Property	Value	
● Pressure	0.000000E+00	

Figure 3-19: Calculation Input

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3.5 System Configuration

Figure 3-20: System Configuration
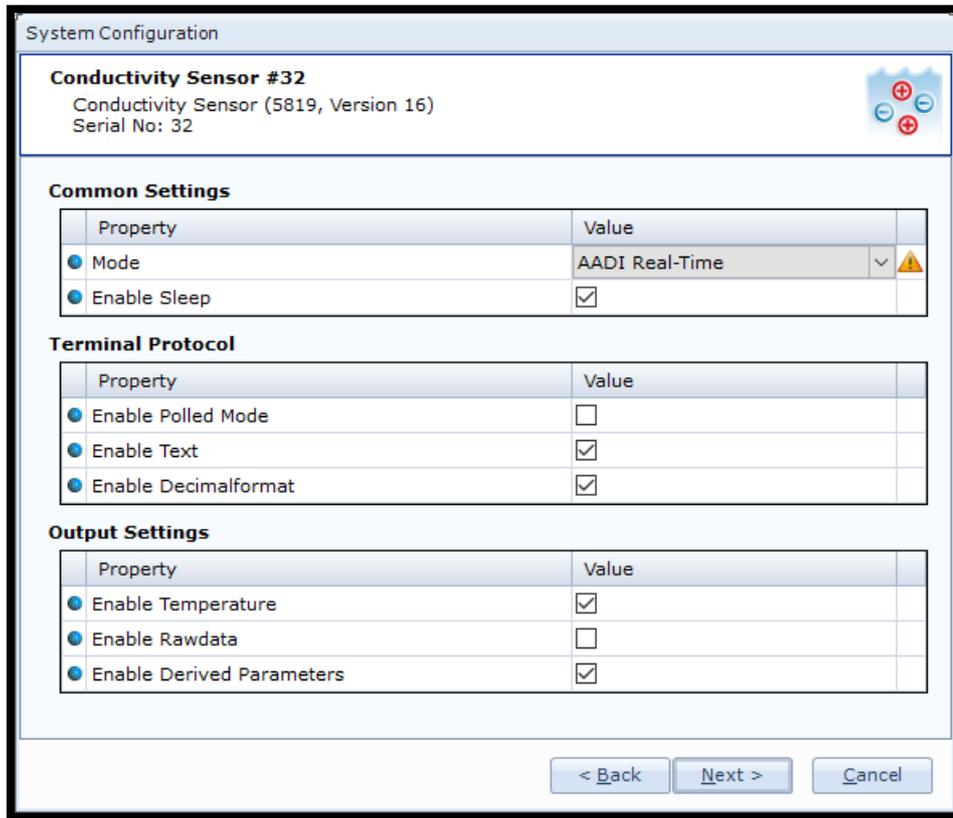
System Configurations holds three different sections that are controlling the output from the sensor. The sections are:

- **Common Settings**
- **Terminal Protocol**
- **Output Settings**

See *chapter 3.5.1 to 3.5.3* for a explanation of each property, Please note that some of the properties are linked to specific modes and has no influence if the sensors is set to a different mode.

All properties are also listed in *chapter 1.9.3*

3.5.1 Common Settings

Figure 3-21: Common Settings in System Configuration

The *Common Settings* are available as shown in *Figure 3-21*.

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

- *AiCaP* mode: If the sensor is going to be used on a SeaGuard, SeaGuardII or SmartGuard Datalogger, the mode must be changed to **AiCaP** mode first and saved before connecting it to the Datalogger.
- *AADI Real-Time* is the correct mode (protocol) when used together with AADI Real-Time Collector. This is an xml-based protocol which includes more metadata in the data messages. If the sensor is connected via RS-232 (RS-422 for R-version) to the PC it is possible to configure the sensor either it is set to AiCaP, AADI Real-Time or Smart Sensor Terminal, but it is not possible to run and log data with AADI Real-Time Collector unless the sensor is set to AADI Real-Time.
- The *Smart Sensor Terminal* protocol is a simplified ASCII protocol which is easier to use together with a PC terminal program. This protocol is described more detailed in *CHAPTER 5*.
- *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.

Notice that the sensor always must be reset when the protocol/mode has been changed.

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.

3.5.2 Terminal Protocol

Figure 3-22: Terminal Protocol settings in System Configuration

The properties in this menu are highly dependent on the mode setting. If sensor is set to *AiCaP* these properties have no influence on the sensor. In *AADI Real-Time* mode only *Enable Polled mode* will be active. In *Smart Sensor Terminal* and *Smart Sensor Terminal FW2* mode all three properties are used.

If the *Enable Polled Mode* is enabled, then the sensor only outputs data when the user/system polls for data with a *Do Sample* command.

Enable Text and *Enable Decimalformat* control the output string in Smart Sensor Terminal.

With *Enable Text* enabled the sensor will output a string with parameter name together with each parameter, refer *chapter 5.8.4* for an example where this command is toggled.

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

3.5.3 Output Settings

Output Settings

Property	Value	
● Enable Temperature	☑	
● Enable Rawdata	☑	
● Enable Derived Parameters	☑	

Figure 3-23: Output settings in System Configuration

Enable Temperature. This setting is used to enable or disable the *Temperature* output. The temperature reading is used to compensate for internal temperature drift when conductivity level is calculated independently of this setting.

Enable Rawdata. This setting toggles on and off a set of raw data readings from the serial output string. These rawdata readings are used internally in the calculation independently of this setting. The parameters are:

- *Conductance*   Measurement in mS
- *RawCond0*   Raw measurement in LSB
- *RawCond1*   Raw measurement in LSB
- *ZAmp*   Amplitude measurement in mV
- *RawTemp*   Voltage from thermistor bridge in mV

Enable Derived Parameters. This property is used to enable or disable some extra parameters calculated based on both measured parameters like temperature and Conductivity but also fixed values like Pressure and Gravity constant. If you want to postprocess these values, we recommend using zero as Pressure to avoid any confusion.

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3.6 User Maintenance

Figure 3-24: Control Panel - Device Configuration

To access the *User Maintenance* menu, you first need to tap *Include User Maintenance.*

Figure 3-25: Password
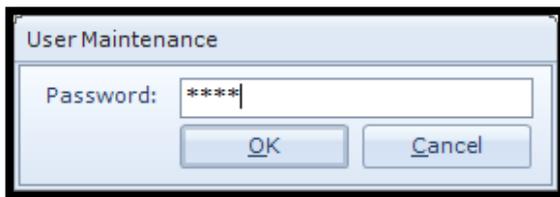
You then need to enter the password that is 1000 for all units. And press *OK*.

Figure 3-26: Device Configuration - User Maintenance
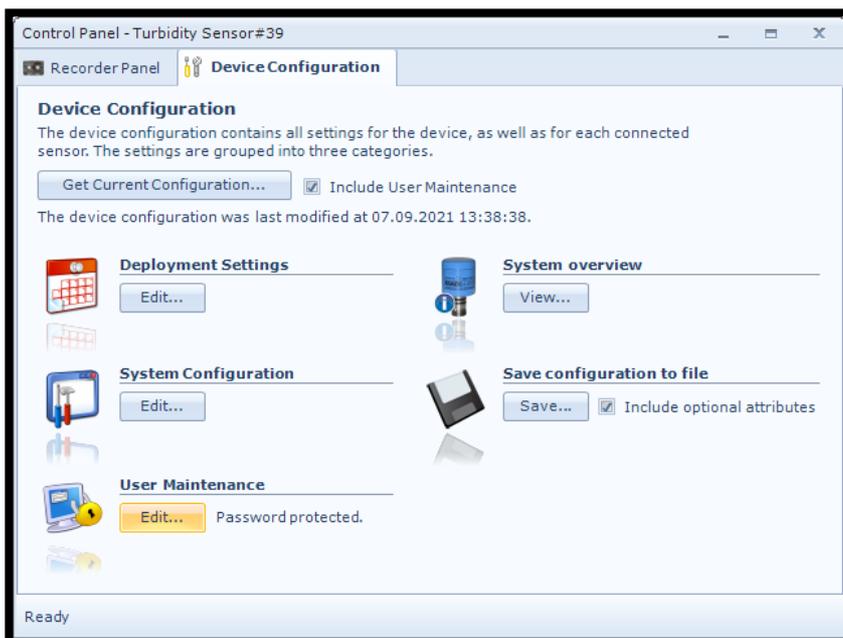
And then select *Edit* under the *User Maintenance*. If you don't tap the *Include User Maintenance* box and not enter the password the *User Maintenance* will stay grey and it will not be clickable.

User Maintenance

Conductivity Sensor #32
Conductivity Sensor (5819, Version 16)
Serial No: 32

Mandatory

Property	Value
● Node Description	Conductivity Sensor #32

Site Info

Property	Value
● Owner	

Serial Port

Property	Value
● Baudrate	9600
● Flow Control	Xon/Xoff
● Enable Comm Indicator	☑
● Comm Timeout	1 min

Calibration

Property	Value
● CellCoef	0.000000E+00
● TempCoef	2.502643E+01;-3.145365E-02...
● R0Coef0	1.246014E+00;-5.500373E-03...
● R0Coef1	1.324123E+00;5.639219E-04;...
● R0Coef2	-1.586892E-03;1.950253E-04;...
● R0Coef3	1.401169E-03;-6.425097E-04;...
● R0Coef4	7.397453E-04;-1.406793E-04;...
● R1Coef0	3.063323E+00;-4.655920E-03...
● R1Coef1	1.324407E+00;-2.731432E-04;...
● R1Coef2	7.330700E-05;1.267988E-04;-...
● R1Coef3	0.000000E+00;0.000000E+00...
● R1Coef4	0.000000E+00;0.000000E+00...
● R2Coef0	4.880310E+00;-5.093979E-03...
● R2Coef1	1.323120E+00;-6.125664E-05...
● R2Coef2	-7.324207E-04;1.137732E-03;...
● R2Coef3	1.332206E-03;1.746776E-03;-...
● R2Coef4	0.000000E+00;0.000000E+00...
● R3Coef0	6.697008E+00;-4.364585E-03...
● R3Coef1	1.322748E+00;8.764463E-04;...
● R3Coef2	-6.017499E-04;-7.325390E-04...
● R3Coef3	8.527043E-04;-1.665892E-03;...
● R3Coef4	0.000000E+00;0.000000E+00...

Figure 3-27: User Maintenance part 1 of 2

Under *User Maintenance*, you find properties that are password protected and are set or altered by a trained user. It is not recommended to change properties unless instructed. To access this menu, check the "*Include User Maintenance*" box in the *Device Configuration* before clicking on the "*Get Current Configuration…*" button. The password is: **1000**. This menu consists of five sessions:

- **Mandatory**
- **Site Info**
- **Serial Port**
- *Calibration*
- *Sample Settings*

For a full description of each property please refer to *chapter 3.6.1* to *3.6.5*

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R4Coef0	8.510303E+00;-3.546045E-03...
R4Coef1	1.321806E+00;8.314846E-04;...
R4Coef2	-6.180195E-04;-1.123731E-03...
R4Coef3	1.704725E-03;-1.668614E-03;...
R4Coef4	0.000000E+00;0.000000E+00...
R5Coef0	1.032342E+01;-2.536034E-03...
R5Coef1	1.320986E+00;1.221138E-03;...
R5Coef2	-7.633601E-04;-7.544517E-04...
R5Coef3	2.239498E-03;-2.972406E-03;...
R5Coef4	0.000000E+00;0.000000E+00...
R6Coef0	1.213681E+01;-1.907578E-03...
R6Coef1	1.320518E+00;2.041064E-03;...
R6Coef2	-5.304245E-04;4.370422E-04;...
R6Coef3	1.494687E-03;-3.538721E-03;...
R6Coef4	0.000000E+00;0.000000E+00...
R7Coef0	1.394673E+01;-7.963576E-04...
R7Coef1	1.320818E+00;1.833831E-03;...
R7Coef2	-9.279727E-04;2.091425E-03;...
R7Coef3	-2.840368E-04;-2.488593E-03...
R7Coef4	0.000000E+00;0.000000E+00...
R8Coef0	1.575656E+01;7.190868E-04;...
R8Coef1	1.318480E+00;2.212499E-03;...
R8Coef2	-1.751876E-03;3.182173E-04;...
R8Coef3	2.768138E-03;-2.824907E-03;...
R8Coef4	0.000000E+00;0.000000E+00...
R9Coef0	1.756449E+01;2.508378E-03;...
R9Coef1	1.318484E+00;-5.731857E-04;...
R9Coef2	8.626004E-04;-7.585876E-04;...
R9Coef3	2.408147E-04;2.081706E-03;...
R9Coef4	0.000000E+00;0.000000E+00...
DACARangeValues	0;6554;13107;19664;26214;3...

Sample Settings

Property	Value
Range	-1
AiCaP Presample Time (sec.)	0.000000E+00

< Back   Next >   Cancel

Figure 3-28: User Maintenance part 2 of 2

3.6.1 Mandatory

Figure 3-29: Mandatory in User Maintenance

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

3.6.2 Site Info

Figure 3-30; Site Info in User Maintenance

In the *Site Info* section you will find only one property. *Owner* is optional information to be entered to store information about the owner. This setting is not used in calculation. By default this setting is empty.

3.6.3 Serial Port

Serial Port

Property	Value
● Baudrate	9600 ▾ ⚠
● Flow Control	Xon/Xoff ▾
● Enable Comm Indicator	☑
● Comm Timeout	1 min ▾

Figure 3-31: Serial Port settings in User Maintenance

The *Serial Port* group contains setting that deals with the RS-232/RS-422 setup.RS-232 are used with standard sensors and RS-422 are used with R-version sensors indicated with a R following the product number. When using RS-232/RS-422 make sure that the sensor setting is the same as terminal software set-up. The default settings from factory for *Baudrate* are *9600* and *Flow Control* is set to *Xon/Xoff*. *Enable Comm Indicator* is enabling communication sleep *('%')* and communication ready *('!')* indicators, when set to *Smart Sensor Terminal*. *'!'* 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*. The default settings are *Enable Comm Indicator* enabled and *Comm Timeout* set to *1 min*.

3.6.4 Calibration

Calibration	
Property	**Value**
CellCoef	0.000000E+00
TempCoef	2.502643E+01;-3.145365E-02...
R0Coef0	1.246014E+00;-5.500373E-03...
R0Coef1	1.324123E+00;5.639219E-04;...
R0Coef2	-1.586892E-03;1.950253E-04;...
R0Coef3	1.401169E-03;-6.425097E-04;...
R0Coef4	7.397453E-04;-1.406793E-04;...
R1Coef0	3.063323E+00;-4.655920E-03...
R1Coef1	1.324407E+00;-2.731432E-04...
R1Coef2	7.330700E-05;1.267988E-04;-...
R1Coef3	0.000000E+00;0.000000E+00...
R1Coef4	0.000000E+00;0.000000E+00...
R2Coef0	4.880310E+00;-5.093979E-03...
R2Coef1	1.323120E+00;-6.125664E-05...
R2Coef2	-7.324207E-04;1.137732E-03;...
R2Coef3	1.332206E-03;1.746776E-03;-...
R2Coef4	0.000000E+00;0.000000E+00...
R3Coef0	6.697008E+00;-4.364585E-03...
R3Coef1	1.322748E+00;8.764463E-04;...
R3Coef2	-6.017499E-04;-7.325390E-04...
R3Coef3	8.527043E-04;-1.665892E-03;...
R3Coef4	0.000000E+00;0.000000E+00...
R4Coef0	8.510303E+00;-3.546045E-03...
R4Coef1	1.321806E+00;8.314846E-04;...
R4Coef2	-6.180195E-04;-1.123731E-03...
R4Coef3	1.704725E-03;-1.668614E-03;...
R4Coef4	0.000000E+00;0.000000E+00...
R5Coef0	1.032342E+01;-2.536034E-03...
R5Coef1	1.320986E+00;1.221138E-03;...
R5Coef2	-7.633601E-04;-7.544517E-04...
R5Coef3	2.239498E-03;-2.972406E-03;...
R5Coef4	0.000000E+00;0.000000E+00...
R6Coef0	1.213681E+01;-1.907578E-03...
R6Coef1	1.320518E+00;2.041064E-03;...
R6Coef2	-5.304245E-04;4.370422E-04;...
R6Coef3	1.494687E-03;-3.538721E-03;...
R6Coef4	0.000000E+00;0.000000E+00...
R7Coef0	1.394673E+01;-7.963576E-04...
R7Coef1	1.320818E+00;1.833831E-03;...
R7Coef2	-9.279727E-04;2.091425E-03;...
R7Coef3	-2.840368E-04;-2.488593E-03...
R7Coef4	0.000000E+00;0.000000E+00...
R8Coef0	1.575656E+01;7.190868E-04;...
R8Coef1	1.318480E+00;2.212499E-03;...
R8Coef2	-1.751876E-03;3.182173E-04;...
R8Coef3	2.768138E-03;-2.824907E-03;...
R8Coef4	0.000000E+00;0.000000E+00...
R9Coef0	1.756449E+01;2.508378E-03;...
R9Coef1	1.318484E+00;-5.731857E-04...
R9Coef2	8.626004E-04;-7.585876E-04;...
R9Coef3	2.408147E-04;2.081706E-03;...
R9Coef4	0.000000E+00;0.000000E+00...
DACARangeValues	0;6554;13107;19664;26214;3...

Figure 3-32: Calibration coefficients in User Maintenance

The *Calibration* section contains calibration coefficients and settings. These coefficients are calculated during a calibration process at the factory and except from the *CellCoef* they are not recommended to change by other than trained personal at Aanderaa certified calibration laboratories.

CellCoef is a user entered value which describes the relationship between the conductance (mS) in the seawater loop measured by the Sensor and the specific conductivity (mS/cm). A corrected *CellCoef* can be calculated using the procedure in *chapter 7.3.2* .

Note!

We recommend that you recalculate the CellCoef when the sensor is shifted between instruments or between sensor positions on the top-end plate. The CellCoef is either calibrated mounted on SeaGuard platform or if delivered stand alone on a standard cable.

TempCoef is a set of 6 coefficients used as curve fitting coefficient for temperature measurements. Together with *RawTemp* it is used to calculate the absolute temperature.

R0Coef0 to R9Coef4 are calibration coefficients for each of the 10 Ranges the full range is divided in.

DACA RangeValues are used to set the Range for each of the 10 ranges.
These are the values that help the sensor choice between the different calibration sets depending on the Rawdata reading.

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3.6.5 Sample Settings

Figure 3-33: Sample Settings in User Maintenance

Sample Setting contains two properties.

Range is used to select the range setting. You may either select one of the 10 ranges set by *DACARangeValues* but then the sensor will only work properly within in this smaller range or you can set range to *-1*. This is the default setting and makes the sensor to automatically select the correct range dependent on the Rawdata reading. This setting is strongly recommended to use.

AiCaP Presample Time (sec.) is only valid when sensor is used in AiCaP mode. *AiCaP Presample Time* is used to separate in time if there is more than one Conductivity sensors connected to the same logger. This is used to avoid noise between the sensors especially if they are close. We recommend separating each sensor with 1 second. This means that the first sensor is set to 0sec., Second sensor is set to 1sec. and third sensor is set to 2sec.

CHAPTER 4 Configuration via SmartGuard or SeaGuardII Datalogger

4.1 Introduction

The Conductivity Sensor 5819 can easily be installed on the Aanderaa SeaGuard or SeaGuardII platform or connected using a cable.
It can also be used with the SmartGuard Datalogger using a cable for surface buoy applications or placed on land.
For installation on SeaGuard with display see *CHAPTER 2*

To be able to control the Conductivity Sensor via SeaGuard, SeaGuardII or SmartGuard the sensor needs to be in AiCaP mode.

4.2 Installation of the Conductivity Sensor 5819 on SeaGuardII

Power should be turned off before connecting the sensor. We recommend that you install the Conductivity Sensor in sensor position 3, 4 or 6, refer *Figure 4-1.* If mounted in position 6 use patch cable to connect the sensor to the HUB card.
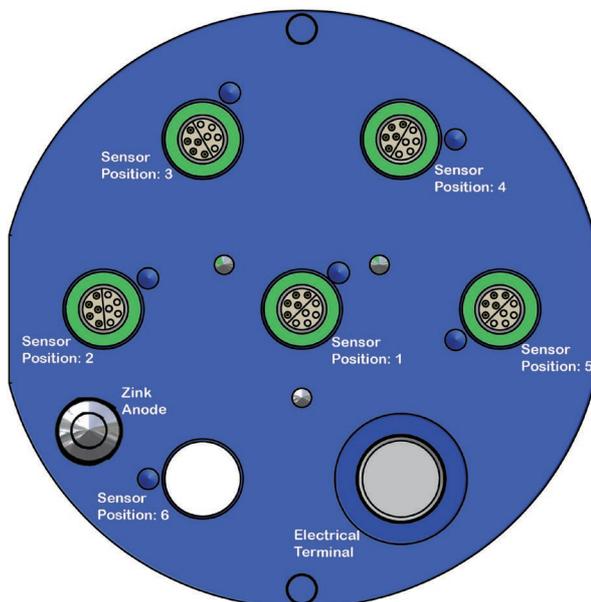
Important!

Refer SeaGuard Platform Operating Manual, TD303, for an illustrated sensor installation guide. TN309 holds an extract of sensor connection / disconnection given in the SeaGuard Operating Manual.
Note!

Always replace O-rings when removing, exchanging, or installing a new sensor or a sealing plug.

Figure 4-1: SeaGurdII Top End plate

4.3 Configuration with AADI Real-Time collector

In this chapter we will show you how to configure the sensor when connected to a Aanderaa Platform. This configuration can also be done via a real-time output but to do this the Platform first need to be set up with a two-way real-time output.

4.3.1 Connected via SeaGuardII

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

4.3.2 Connected via SmartGuard

- Connect the USB configuration cable to the USB connector on the left-hand side of the SmartGuard and to the PC
- Install and start the AADI Real-Time Collector software on your PC. For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual
- Switch on the logger by turning the power to the "ON"- position.
- Wait approximately 30 seconds before the logger starts up and connection is established.

4.4 Establish connection

NOTE!

When using a USB connection, you also need to install Windows Mobile Device Center if not already installed on your computer please contact <u>aanderaa.support@xylem.com</u> for further assistance.

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:

You may close this window after connection is established.

Figure 4-2: Windows Mobile Device Center
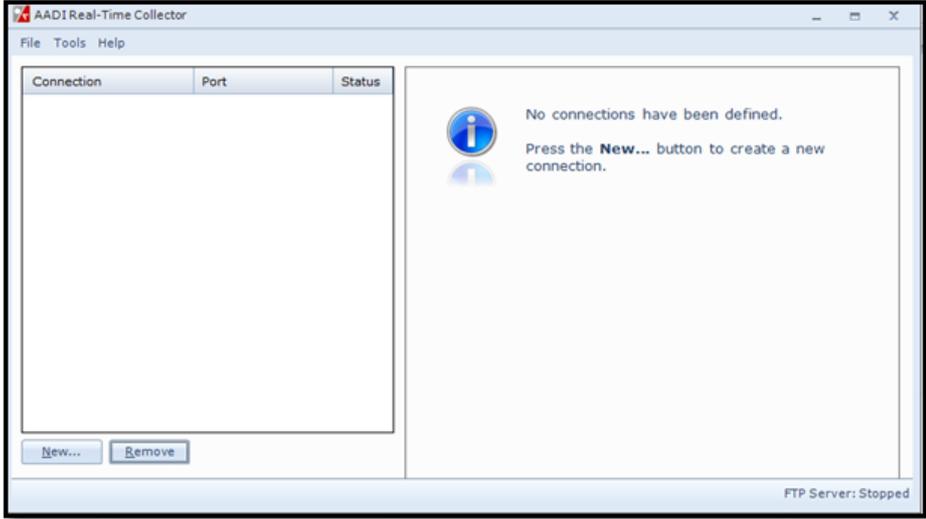
At first connection with AADI Real-Time Collector the connection list will be emty.

Click on the *New* button in the lower left corner to create a new connection

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

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

Figure 4-4: AADI Real-time Collector connection settings
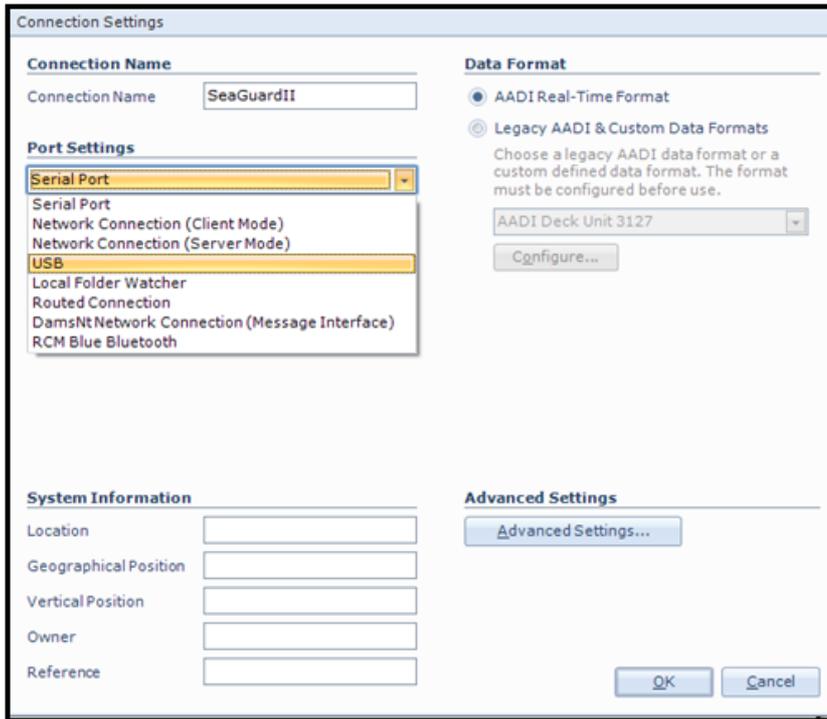
Select *USB* from the *Port Settings* drop down menu and write a name in the *Connection Name* box (e.g. SeaGuardII). We recommend using product name and serial number if you want to connect multiple instruments to the same software.

Figure 4-5: AADI Real-Time Collector main menu
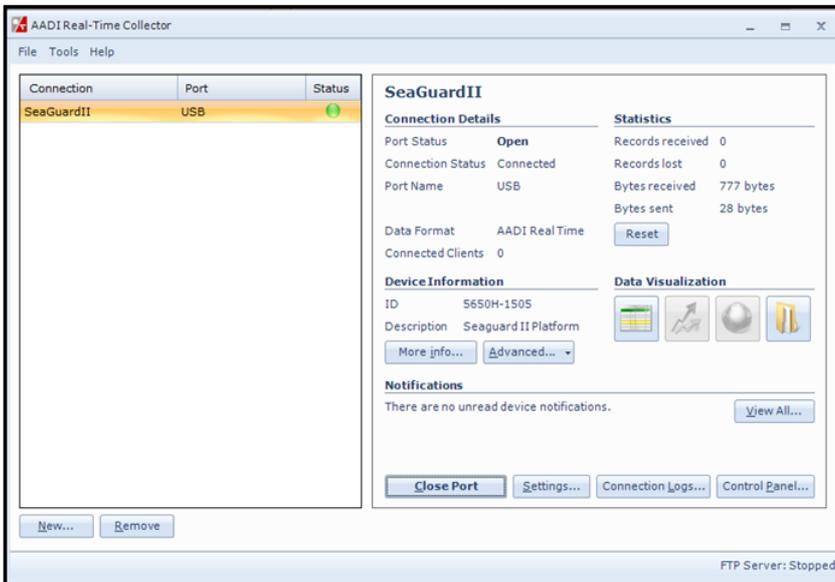
The new connection is now shown in the AADI Real-Time Collector connection list. Click on the line with the new connection to highlight the line and then click on the *Open Port* button. The connection to the SeaGuardII/SmartGuard should be established within a few seconds and the status turn to green. After power up it will take approximately 30 seconds before the logger is ready.

Open *Control Panel* in the lower right corner.

4.4.1 Control Panel

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

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

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

Under each group you can start the group immediately by *Start Now*, or start later using the *Start Delayed* option

Figure 4-6: Recorder Panel

The layout of this menu will vary depending on the *Recorder* status and selections done in the *Deployment Settings > Multi Group Recorder* menu

The *Fixed Interval* is the recording interval for each group. The configuration of sensors in each group will influence on the available recording interval. If you change the configuration of one sensor and this cause a longer processing time the *Fixed Interval* might be changed. We recommend that you always check the recording interval after any changes in configuration. *Fixed Interval* is not applicable in the *Recorder Panel* menu unless *Selectable in recorder panel* is selected in *Deployment Settings > Multi Group Recorder* menu.

Start Delayed is mainly used if you want to arm your instrument to start later. This can be useful if you configure the instrument in your office and don't want the instrument to record before the instrument is installed in water. *Start Delayed* can also be used to synchronize the start time for the three groups or between multiple instruments.

See Manual for SeaGuardII Platform TD303 or SmartGuard TD293 for more information about the *Multi Group Recorde*r menu.

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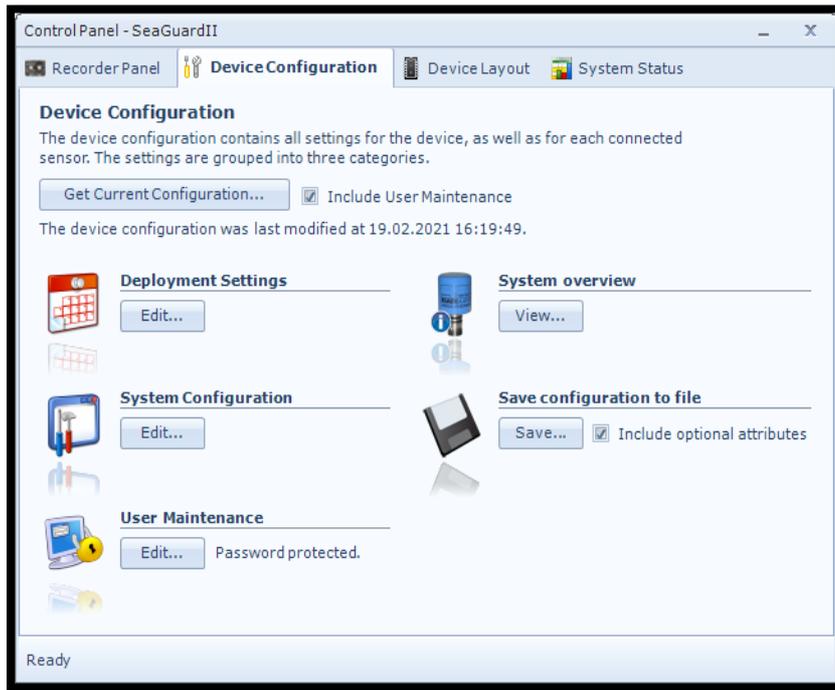
Figure 4-7: Device configuration

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

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

Settings related to the Conductivity Sensor can be configured under **Deployment Settings**, **System Configuration** and *User Maintenance.*

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

Under the heading *Save configuration to file* you can save current settings to a backup file by pressing *Save…*. Edit the name and location for your file and press *Save* to store the new configuration to file in .xml format.

User accessible sensor properties are found in *Deployment settings, System Configuration* and *User Maintenance*. Refer *Table 1-10* to *Table 1-12* for an overview of the properties.

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

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

4.5 Changing Values
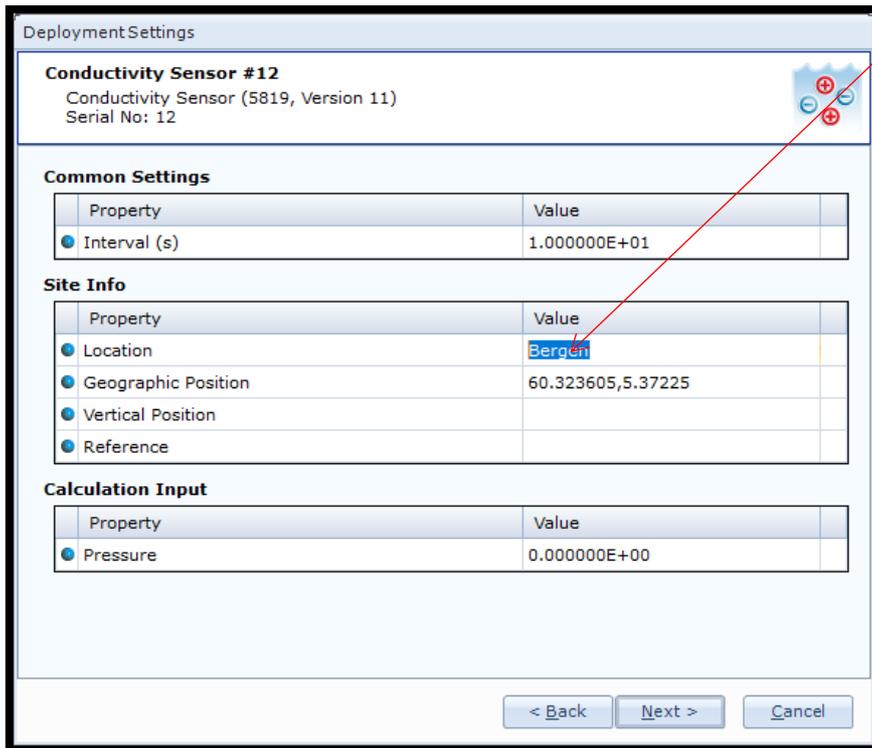
Figure 4-8: Change value

To change the content of a property first tick in the value box of the actual property and then enter the text or number before pressing *Next.* See example where the text for *Location* has been changed.

The value is not changed before you have finished the full process. If you press *Cancel* or turn of the power then the changes will not be stored.
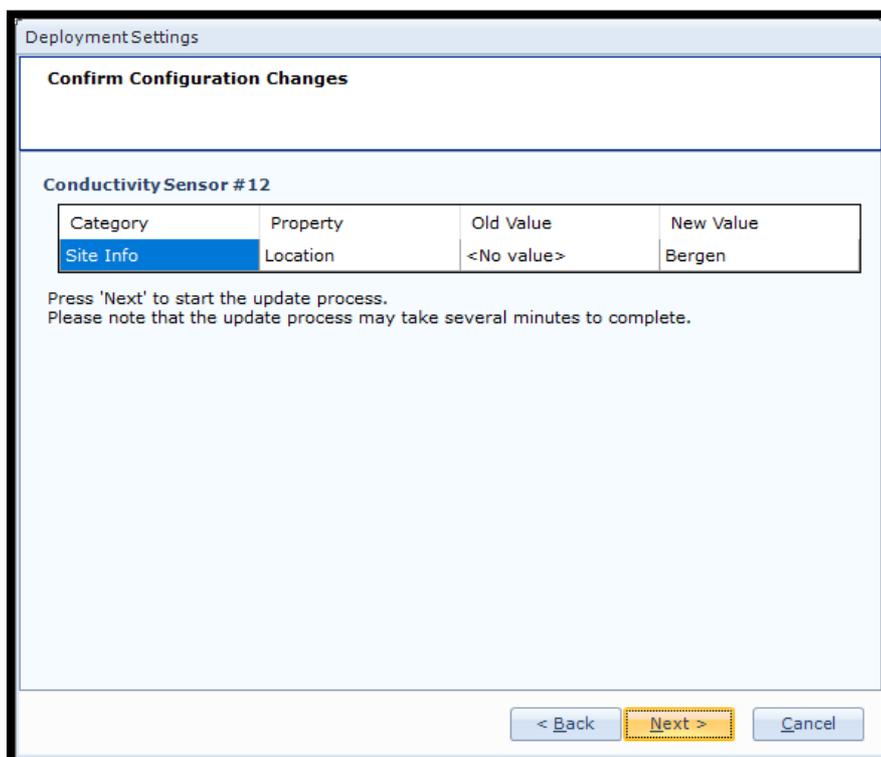
Figure 4-9: Confirm Configuration Changes

In the next picture a list of all properties that are changed will show up.
If the list of configuration changes is correct press *Next* to start the update process.
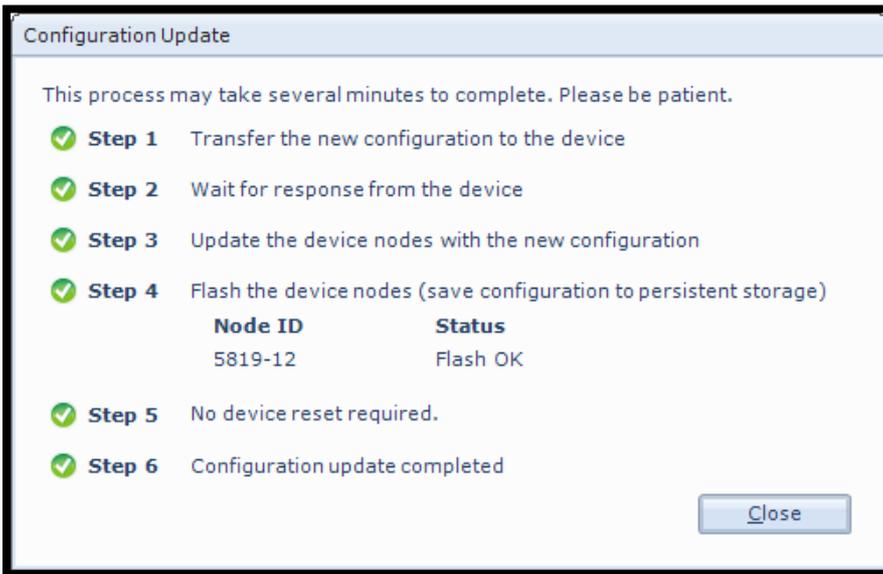
Figure 4-10 Configuration Update

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 before the entire process is completed.
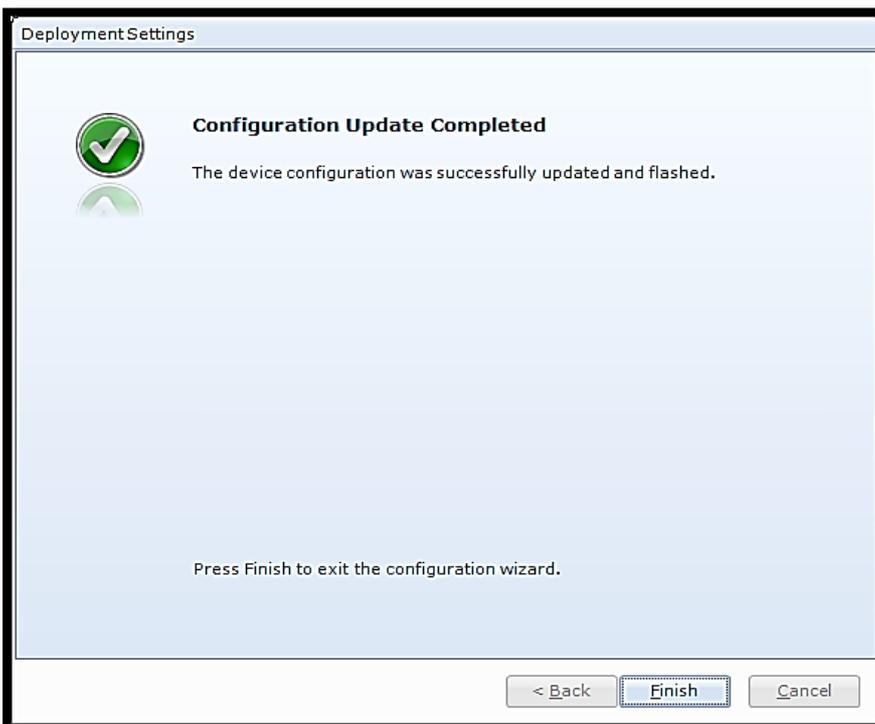
Figure 4-11 Configuration Update Completed

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

Before you can continue you might need to go to the Recorder Panel and press Refresh Status
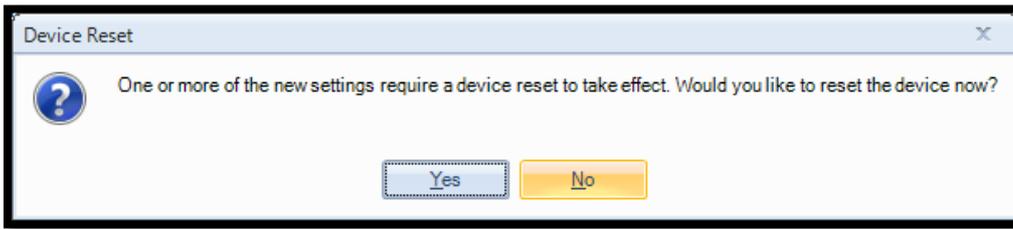
Figure 4-12: Device Reset

Some changes may require a device reset to take effect. Press Yes to continue.
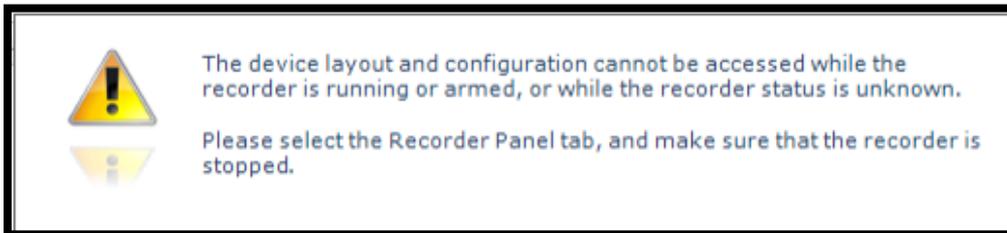
Figure 4-13: Warning

Some changes may require that you stop the recorder or refresh the status in Record panel.

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

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

4.6 Deployment settings
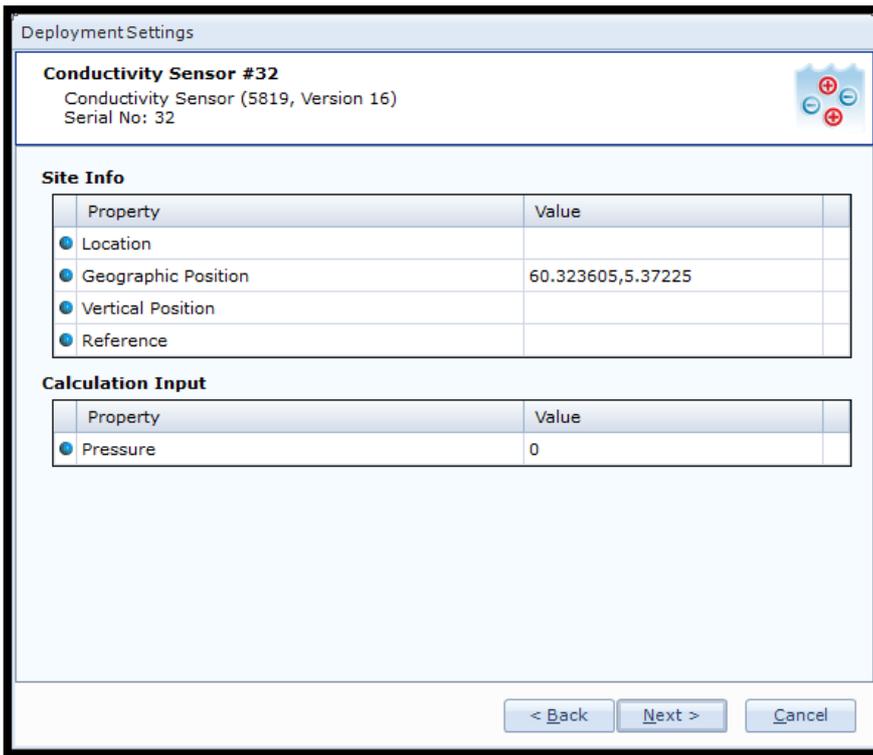
Figure 4-14: Deployment settings

Under **Control Panel** select the **Device Configuration** tab and press The **Get Current Configuration…** box.
Select **Edit…** underneath the **Deployment Settings** header.
Under **Sensors** all connected sensors will show up. All AiCaP sensors connected to the bus will automatically show up in the list after power-up.

Double-click on the **Conductivity Sensor** to select the sensor.

The **Deployment Settings** contains two groups: **Site Info** and **Calculation Input**.

4.6.1 Site Info
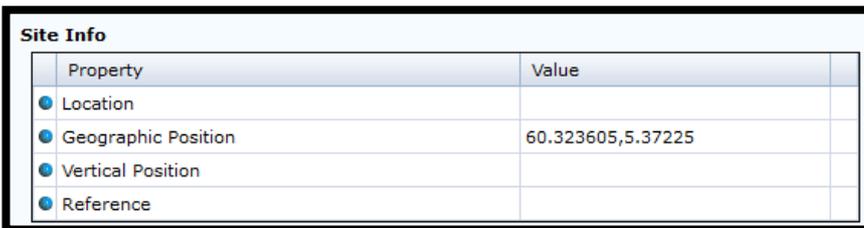
Figure 4-15: Site Info

Site Info is optional information to be entered to store information about the deployment. These setting are not used in internal calculations only stored as a part of the sensor metadata. **Geographical Position** is however used to give the map coordinates to display software or post possessing software unless a GPS input is connected. The Properties under **Site Info** are:

- *Location*

- *Geographical Position*

- *Vertical Position*

- *Reference*

Location is typical the Site name or any name that can be used later to identify the location.

Geographical Position is normally the GPS Coordinates for the deployment. This might also be to reproduce position in an electronic map.

Vertical Position is used to set the deployment depth or position in a chain of sensors.

Reference is a field where you might add information to be stored in the sensor metadata.

4.6.2 Calculation Input

Figure 4-16: Calculation Input

If you want to calculate *Salinity, Density* and *Sound Speed* you also need the installation depth for the sensor. Water depth or *Pressure* are given in kPa. To include Salinity in the sensor output also *Enable Derived Parameters* need to be set. You will find this parameter under *System Configuration.*

4.7 System Configuration

Figure 4-17: System configuration
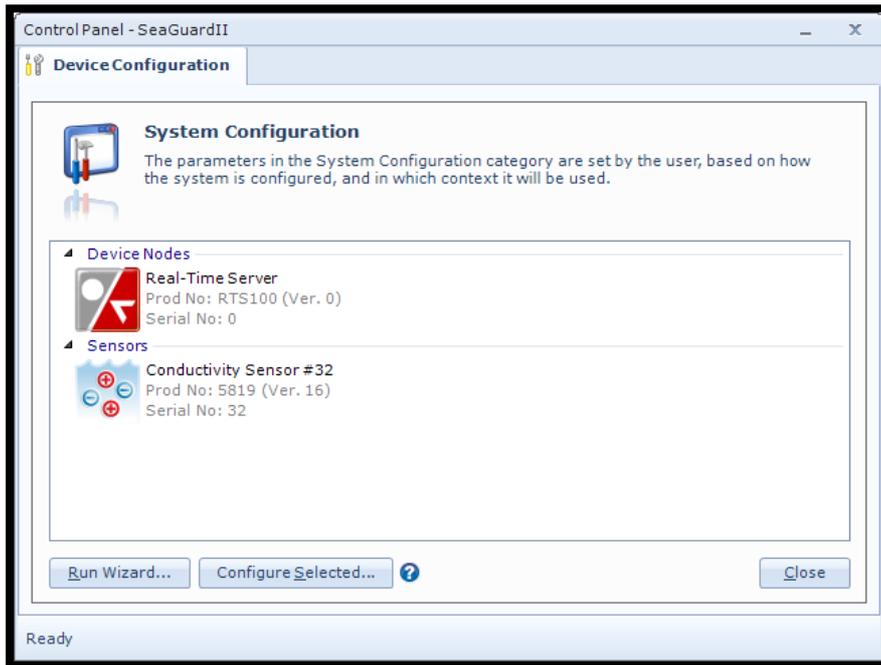
Select *System Configuration* under *Device Configuration* The different sensors connected to the same Datalogger will show up as selectable items,

Double-click on the *Conductivity Sensor* to start configuration.

Figure 4-18: System Configuration

System Configuration holds only one group: *Output Settings*.

4.7.1 Output Settings

Figure 4-19: Output Settings

Enable Temperature. This setting is used to enable or disable the *Temperature* output. The temperature reading is used to compensate for internal temperature drift when conductivity level is calculated independently of this setting.

Enable Rawdata. This setting toggles on and off a set of raw data readings from the serial output string. These rawdata readings are used internally in the calculation independently of this setting. The parameters are:

- *Conductance*   Measurement in mS
- *RawCond0*   Raw measurement in LSB
- *RawCond1*   Raw measurement in LSB
- *ZAmp*   Amplitude measurement in mV
- *RawTemp*   Voltage from thermistor bridge in mV

Enable Derived Parameters. This property is used to enable or disable some extra parameters calculated based on both measured parameters like temperature and Conductivity but also fixed values like Pressure and Gravity constant. If you want to postprocess these values, we recommend using zero as Pressure to avoid any confusion.

4.8 User Maintenance

Figure 4-20: User Maintenance part 1 of 2

Under *User Maintenance*, you find properties that are password protected and are set or altered by a trained user. It is not recommended to change properties unless instructed. To access this menu, check the "*Include User Maintenance"* box in the *Device Configuration* before clicking on the "*Get Current Configuration…*" button. The password is: **1000**. This menu consists of four sessions:

- **Mandatory**

- **Site Info**

- *Calibration*

- *Sample Settings*

The two first sessions contains only information and do not influence on the measurements when the two last sessions highly influence the measurements.

For a full description of each property please refer to *chapter 4.8.1* through *4.8.4*
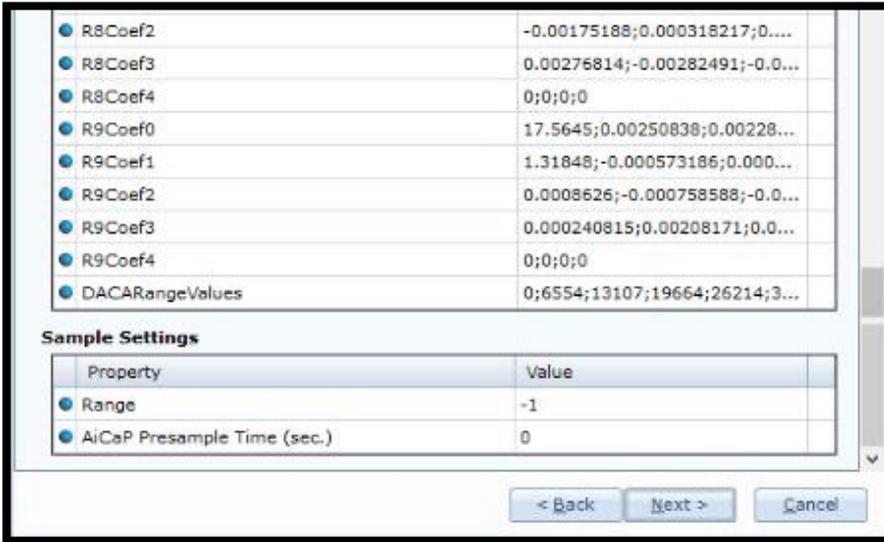
Figure 4-21 User Maintenance part 2 of 2

4.8.1 Mandatory

Figure 4-22: Mandatory in User Maintenance

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

4.8.2 Site Info

Figure 4-23; Site Info in User Maintenance

In the *Site Info* section, you will find only one property. *Owner* is optional information to be entered to store information about the owner. This setting is not used in calculation. By default, this setting is empty.

4.8.3 Calibration

Calibration	
Property	Value
CellCoef	-4.23761e+000
TempCoef	25.0264;-0.0314537;3.44935...
R0Coef0	1.24601;-0.00550037;-0.0082...
R0Coef1	1.32412;0.000563922;0.0012...
R0Coef2	-0.00158689;0.000195025;0....
R0Coef3	0.00140117;-0.00064251;-0.0...
R0Coef4	0.000739745;-0.000140679;-...
R1Coef0	3.06332;-0.00465592;-0.0063...
R1Coef1	1.32441;-0.000273143;0.000...
R1Coef2	7.3307e-005;0.000126799;-0...
R1Coef3	0;0;0;0
R1Coef4	0;0;0;0
R2Coef0	4.88031;-0.00509398;-0.0072...
R2Coef1	1.32312;-6.12566e-005;0.001...
R2Coef2	-0.000732421;0.00113773;0....
R2Coef3	0.00133221;0.00174678;-0.0...
R2Coef4	0;0;0;0
R3Coef0	6.69701;-0.00436459;-0.0057...
R3Coef1	1.32275;0.000876446;-0.000...
R3Coef2	-0.00060175;-0.000732539;-0...
R3Coef3	0.000852704;-0.00166589;0....
R3Coef4	0;0;0;0
R4Coef0	8.5103;-0.00354604;-0.00547...
R4Coef1	1.32181;0.000831485;0.0004...
R4Coef2	-0.000618019;-0.00112373;0....
R4Coef3	0.00170472;-0.00166861;0.0...
R4Coef4	0;0;0;0
R5Coef0	10.3234;-0.00253603;-0.0059...
R5Coef1	1.32099;0.00122114;0.00429...
R5Coef2	-0.00076336;-0.000754452;0....
R5Coef3	0.0022395;-0.00297241;-0.01...
R5Coef4	0;0;0;0
R6Coef0	12.1368;-0.00190758;-0.0047...
R6Coef1	1.32052;0.00204106;0.00264...
R6Coef2	-0.000530424;0.000437042;-...
R6Coef3	0.00149469;-0.00353872;-0.0...
R6Coef4	0;0;0;0
R7Coef0	13.9467;-0.000796358;-0.004...
R7Coef1	1.32082;0.00183383;-0.0009...
R7Coef2	-0.000927973;0.00209143;0....
R7Coef3	-0.000284037;-0.00248859;0...
R7Coef4	0;0;0;0
R8Coef0	15.7566;0.000719087;-0.004...
R8Coef1	1.31848;0.0022125;0.006026...
R8Coef2	-0.00175188;0.000318217;0....
R8Coef3	0.00276814;-0.00282491;-0.0...
R8Coef4	0;0;0;0
R9Coef0	17.5645;0.00250838;0.00228...
R9Coef1	1.31848;-0.000573186;0.000...
R9Coef2	0.0008626;-0.000758588;-0.0...
R9Coef3	0.000240815;0.00208171;0.0...
R9Coef4	0;0;0;0
DACARangeValues	0;6554;13107;19664;26214;3...

Figure 4-25: Calibration coefficients in User Maintenance

The *Calibration* section contains calibration coefficients and settings. These coefficients are calculated during a calibration process at the factory and except from the *CellCoef* they are not recommended to change by other than trained personal at Aanderaa certified calibration laboratories.

CellCoef is a user entered value which describes the relationship between the conductance (mS) in the seawater loop measured by the Sensor and the specific conductivity (mS/cm). A corrected *CellCoef* can be calculated using the procedure in *chapter 7.2.2 .*

Note!

We recommend that you recalculate the CellCoef when the sensor is shifted between instruments or between sensor positions on the top-end plate. The CellCoef is either calibrated mounted on SeaGuard platform or if delivered stand alone on a standard cable.

TempCoef is a set of 6 coefficients used as curve fitting coefficient for temperature measurements. Together with *RawTemp* it is used to calculate the absolute temperature.

R0Coef0 to R9Coef4 are calibration coefficients for each of the 10 Ranges the full range is divided in.

DACA RangeValues are used to set the Range for each of the 10 ranges. These are the values that help the sensor choice between the different calibration sets depending on the Rawdata reading.

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4.8.4 Sample Settings

Figure 4-26: Sample Settings in User Maintenance

Sample Setting contains two properties.

Range is used to select the range setting. You may either select one of the 10 ranges set by *DACARangeValues* but then the sensor will only work properly within in this smaller range or you can set range to *-1*. This is the default setting and makes the sensor to automatically select the correct range dependent on the Rawdata reading. This setting is strongly recommended to use.

AiCaP Presample Time (sec.) is only valid when sensor is used in AiCaP mode. *AiCaP Presample Time* is used to separate in time if there is more than one Conductivity sensors connected to the same logger. This is used to avoid noise between the sensors especially if they are close. We recommend separating each sensor with 1 second. This means that the first sensor is set to 0sec., Second sensor is set to 1sec. and third sensor is set to 2sec.

CHAPTER 5 Stand-alone Sensor configuration using Terminal Software

This chapter describes how to communicate with the Conductivity Sensor using the RS-232 or Rs-422 for R-version connection and Terminal Software. The sensor can be set to any mode but the mode setting and setting of the different properties will influence on the output from the sensor.

5.1 Sensor versions and interface

The 5819 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 5819R 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. Or directly to a RS-422 com-port.

The 5990 sensors can be used connected to an RS-232 com-port (PC or other devices with RS232 com-port).

5.2 Communication setup

Most terminal programs can be used for **RS-232** communication with the sensor when connected to a PC, e.g. TeraTerm.
The following setup should be used:

> 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.

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5.3 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 will continue to output measurements after the first startup info. 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.

5.3.1 Smart Sensor Terminal mode

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 immediately after power- up and then a new measurement every x seconds, where x is the interval in second set by *Interval(x)*.
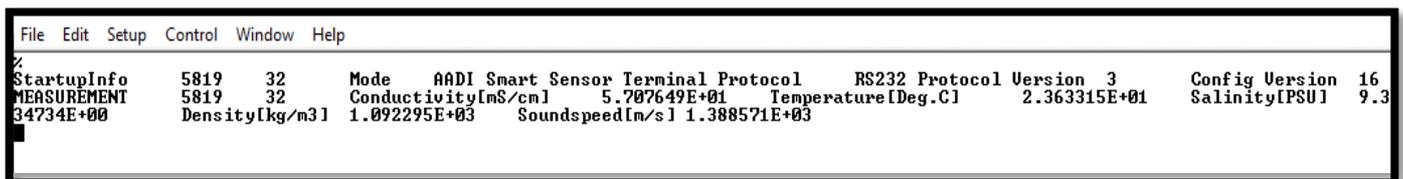
Figure 5-1: Typical power-up output for sensor set to Smart Sensor Terminal mode

5.3.2 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.
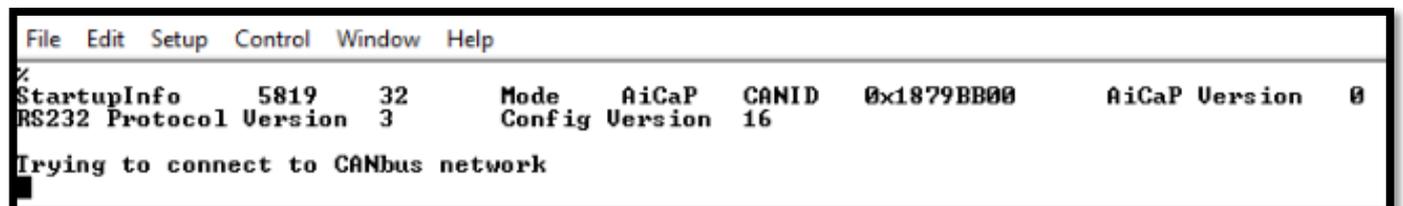
Figure 5-2: Typical power-up output for sensor set to AiCaP mode

5.3.3 AADI Real-Time mode

AADI Real-Time mode is also a Serial output but with *.xml* instead of *ASCII*. This is the mode used with *AADI Real-Time Collector* and also preferd by som integrators when sensor is connected to 3ʳᵈ party loggers or interface.

```
 File  Edit  Setup  Control  Window  Help
%{{++!!000000BEEF360=5819-32;1=5819;2=32;3=Conductivity Sensor;4=Conductivity Sensor #32;5=AADI
;6=2;7=3;10=1;11=6.0;20=1;21=1;22=0;23=12000;30=1;80=102:110:111:140:201:202:2033D1B!!--}}{{++!
!0001108F40<?xml version="1.0" encoding="utf-8"?>
<Device ID="5819-32" SessionID="5819-32-7.5.9-0-3051" Descr="Conductivity Sensor #32" SerialNo=
"32" ProdNo="5819" ProdName="Conductivity Sensor" DeviceType="Sensor" ProtocolVer="6" xmlns="ht
tp://www.aadi.no/RTOutSchema">
        <Time>1900-01-01T00:00:00Z</Time>
        <StatusCode>0</StatusCode>
        <Notifications>
                <Notification ID="100" Time="1900-01-01T00:00:00Z">
                        <Info>Power up</Info>
                        <NotificationValues>
                                <NotificationValue ID="0" Descr="Reason" Type="UT_I2">0</Notifi
cationValue>
                                <NotificationValue ID="1" Descr="DeviceReady" Type="UT_BOOL">tr
ue</NotificationValue>
                        </NotificationValues>
                </Notification>
        </Notifications>
</Device>AA1E!!--}}▮
```

Figure 5-3: Typical power-up output for sensor set to AADI Real-Time mode

5.4 Controlling communication

In order 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 subsequent to activation (electronics require up to 500ms start up time). When *Comm TimeOut* is set to '*Always On'* the communication (and microprocessor) will be kept active all time. The *Communication Sleep Indicator '%'* and the *Communication Ready Indicator '!'* are not followed by Carriage Return and Line Feed.

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

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.

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

5.5 Description of protocol

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

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

Eg. *Do Sample* or *Set Interval(10)*

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).

- 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 after 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.

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5.6 Passkey for write protection

To avoid accidental change of the sensor configuration, most of the properties are write-protected. There are five levels of access protection, refer *Table 5-1*.
A special property called *Passkey* must be set according to the protection level before changing the value of properties that are write-protected, refer *Table 5-1*. E.g.:

> *Set passkey(1000)*

Table 5-1 Access protection levels

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 give read access to factory properties that usually are hidden
Read Only		The user has only read access, no passkey needed
Factory Write	XXXX	Sensor specific code for factory level access

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*.

5.7 Save and Reset

When the required properties are set, you must send a *Save* command to make sure that the new configuration are saved internally in the flash memory. The Conductivity Sensor always reads the configuration from the internal flash memory after reset and power up.
When changing the *Mode* and *Baudrate* property a reset is required for the change to take effect.

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

5.8 Available Commands for the Conductivity Sensor

Available commands for the Conductivity Sensor are given in *Table 5-2*.

Table 5-2 Main RS232 commands available for the Conductivity Sensor.

Command	Description
Do Sample	Execute a conductivity measurement and presents the result
Start	Start a measurement sequence according to current configuration
Stop	Stop a measurement sequence
Do Test	Internal use
Get *ConfigXML*	Outputs info on available properties on XML format
Get *DataXML*	Outputs info on available(enabled) parameters on XML format
Get *Property*	Output Property value
Get All	Output all property values
Set *Property(Value,.. Value)*	Set Property to Value,… Value
Set *Passkey(Value)*	Set passkey to change access level
Save[1]	Store current settings
Load	Reloads previous stored settings
Reset	Resets the sensor with new configuration
Help	Print help information
;	Comment string, following characters are ignored
//	Comment string, following characters are ignored

· [1] Note that the Save procedure might require up to 20 seconds. Losing power during this period will cause loss of latest configuration change. Wait for acknowledge, '#', before powering down the sensor

5.8.1 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.

```
File   Edit   Setup   Control   Window   Help
get product number
Product Number   5819      32         5819
#
get serial number
Serial Number    5819      32         32
#
get mode
Mode      5819     32         Smart Sensor Terminal
#
get interval
Interval          5819      32         20.000
#
■
```

Figure 5-4: The Get Command

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

```
File   Edit   Setup   Control   Window   Help
set passkey(1000)
#
get all
Product Name     5819     32         Conductivity Sensor
Product Number   5819     32         5819
Serial Number    5819     32         32
SW ID    5819    32        1940051
SW Version       5819     32         7        5        9
HW ID 1 5819     32
HW Version 1     5819     32
HW ID 2 5819     32
HW Version 2     5819     32
```

Figure 5-5: Get all

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5.8.2 The Set commands

The *Set* command is used for changing a property. The corresponding *Get* command can be used to verify the new setting, as shown in *Figure 5-6.*

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.
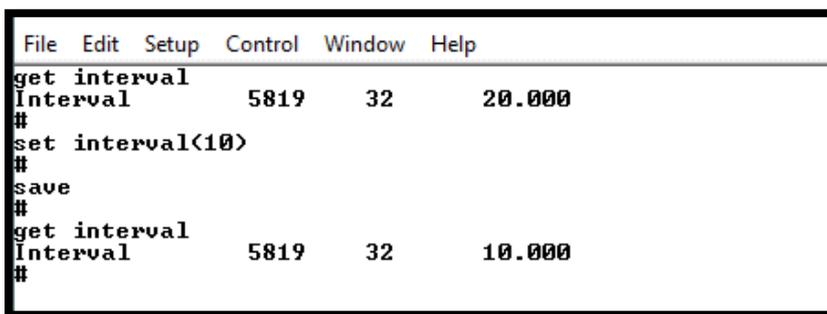

```
File   Edit   Setup   Control   Window   Help
get interval
Interval        5819      32        20.000
#
set interval(10)
#
save
#
get interval
Interval        5819      32        10.000
#
```

Figure 5-6: The Set Command

5.8.3 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.

5.8.4 Formating the Output String

The property called *Enable Text* controls the presentation of measured data. When the property is set to *(Yes)* the output string includes the descriptive parameter name. When the property is set to *(No),* the output parameters are presented without descriptive parameter names; the parameter order is the same.

The property called *Enable DecimalFormat* controls the format of the output values, either as decimal numbers *(Yes),* or in exponential format *(No).*

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5.8.5 Examples – How to configure sensor with Terminal Software

In the following examples, we will show you several configuration changes. We recommend using *Stop* if using a short interval to avoid output strings while configuring the sensor. If the sensor has started to transmit data when the user tries to communicate, it may take a few seconds before the sensor respond. This depends on the number of enabled parameters.

Example 1: In this example we turn of all parameters that are selectable and end up with a clean and simple ASCII output that is easy to use if you need to transmit the data using communication with limited bandwidth. It's then also easy to add other parameters like Raw Data by sending *Set Enable Rawdata(Yes)* to the sensor.

The output is*:   Product Number   Serial Number   Conductivity*

//Press Enter to start communicating with the sensor
↵ //press Enter
Stop ↵ //Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Interval(30) ↵ //wait for ack #
Set Mode(Smart Sensor Terminal) ↵ //wait for ack #
Set Enable Sleep(Yes) ↵ //wait for ack #
Set Enable Text(No) ↵ //wait for ack #
Set Enable Decimalformat(Yes) ↵ //wait for ack #
Set Enable Derived Parameters(No) ↵ //wait for ack #
Set Enable Rawdata(No) ↵ //wait for ack #
Set Enable Temperature(No) ↵ //wait for ack #
Save ↵ // wait for ack #
Reset ↵ // the sensor will restart with new settings
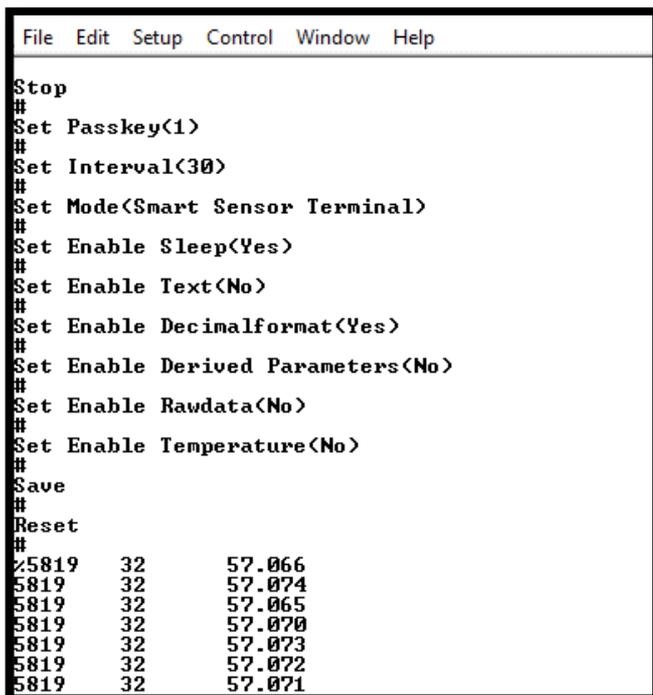
```
 File   Edit   Setup   Control   Window   Help

Stop
#
Set Passkey(1)
#
Set Interval(30)
#
Set Mode(Smart Sensor Terminal)
#
Set Enable Sleep(Yes)
#
Set Enable Text(No)
#
Set Enable Decimalformat(Yes)
#
Set Enable Derived Parameters(No)
#
Set Enable Rawdata(No)
#
Set Enable Temperature(No)
#
Save
#
Reset
#
%5819      32        57.066
5819       32        57.074
5819       32        57.065
5819       32        57.070
5819       32        57.073
5819       32        57.072
5819       32        57.071
```

Figure 5-7: Example 1

Example 2 is the oposite of Example 1. Here all selectable parameters and text is enabled. Decimal format is deselected and we end up with a output string with

MEASSUREMENT   Product Number   Seial Number   Conductivity   Temperature…

> //Press Enter to start communicating with the sensor
> ↵ //press Enter
> *stop* ↵//Wait for ack #. Repeat if necessary
> *set passkey(1)* ↵
> *set interval(10)* ↵//wait for ack #
> *set mode(smart sensor terminal)* ↵//wait for ack #
> *set enable sleep(yes)* ↵//wait for ack #
> *set enable text(yes)* ↵//wait for ack #
> *set enable decimalformat(no)* ↵//wait for ack #
> *set enable derived parameters(yes)* ↵//wait for ack #
> *set enable rawdata(yes)* ↵//wait for ack #
> *set enable temperature(yes)* ↵//wait for ack #
> *save* ↵// wait for ack #
> *reset* ↵// the sensor will restart with new settings

```
File  Edit  Setup  Control  Window  Help

stop
#
set passkey(1)
#
set interval(10)
#
set mode(smart sensor terminal)
#
set enable sleep(yes)
#
set enable text(yes)
#
set enable decimalformat(no)
#
set enable derived parameters(yes)
#
set enable rawdata(yes)
#
set enable temperature(yes)
#
save
#
reset
#
%
StartupInfo     5819    32      Mode     AADI Smart Sensor Terminal Protocol     RS232 Protocol Version  3
Config Version  16
MEASUREMENT     5819    32      Conductivity[mS/cm]    5.705790E+01    Temperature[Deg.C]      2.572956E+01
Salinity[PSU]   4.205435E+01    Density[kg/m3] 1.029999E+03   Soundspeed[m/s] 1.530907E+03   Conductance[mS]
       1.426441E+01    RawCond0[LSB]   45615   RawCond1[LSB]  0       0       0       0       0       0
0      45615   0       0       ZAmp[mV]       -3.091937E+03   ExRawTemp[mV]   -2.229858E+01   InRawTemp[mV]
2.055842E+01    UsedRange       7
MEASUREMENT     5819    32      Conductivity[mS/cm]    5.706580E+01    Temperature[Deg.C]      2.585598E+01
Salinity[PSU]   4.497810E+01    Density[kg/m3] 1.032991E+03   Soundspeed[m/s] 1.526608E+03   Conductance[mS]
       1.426638E+01    RawCond0[LSB]   45664   RawCond1[LSB]  0       0       0       0       0       0
0      45664   0       0       ZAmp[mV]       -3.104224E+03   ExRawTemp[mV]   -2.629543E+01   InRawTemp[mV]
1.779288E+01    UsedRange       7
MEASUREMENT     5819    32      Conductivity[mS/cm]    5.706902E+01    Temperature[Deg.C]      2.586414E+01
Salinity[PSU]   4.535057E+01    Density[kg/m3] 1.033364E+03   Soundspeed[m/s] 1.526097E+03   Conductance[mS]
       1.426719E+01    RawCond0[LSB]   45684   RawCond1[LSB]  0       0       0       0       0       0
0      45684   0       0       ZAmp[mV]       -3.095814E+03   ExRawTemp[mV]   -2.655330E+01   InRawTemp[mV]
1.746341E+01    UsedRange       7
```

Figure 5-8: Example 2

5.9 Help command output

The available/selectable values for each enumerated property can be found by sending the command *Help.* This gives a printout from the sensor showing a short help text from the sensor, refer *Figure 5-9*. Setting a value which is not shown here for enumerated properties gives an error message *(*ERROR ARGUMENT ERROR)*.

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

Figure 5-9: Output example from the Help command

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

Sub commands:
      Sample
      Output
      Argument list for enumerated properties:

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,

5.10 Scripting -sending a string of commands

Often it may be usefully to collect 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. In HyperTerminal click *send text file* in the *Transfer* menu and select the correct file. In Tera Terminal click "Send File" under "File" in main menu and select the file to be transferred.

Example of text file:

> // Set sampling interval to 30 seconds
>
> ***Set Passkey(1)***
> ***Set Interval(30)***
> ***Save***
> ***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.
When sending text file, the sensor can be awakened from sleep mode by sending a string of comment leads characters:

> ***///***
> ***///***
> ***///***
> ***// Wake up test***
> ***Get All***

This will provide time for the sensor to wake up and be ready before the next string appears. Note that higher baud rates might require more lines of '/' to provide sufficient delay. Communication wake-up will normally require less than 100mS.

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5.11 Sensor Configuration

The sensor configuration consists of sensor settings and customized presentation of data. Below follows a description of the properties that are typically set by the user prior to a deployment (RS232 application).

The *Mode* property is used to set the operation mode. Available modes are *AiCaP*, *Smart Sensor Terminal*, *AADI Real-Time* and *Smart Sensor Terminal FW2*.

- Set *Mode* to *AiCaP* when connected to AADI SeaGuard or to a SmartGuard logger that automatically detects and recognizes the sensor on CANbus(AiCaP).
- Set *Mode* to *AADI Real-Time* for use with AADI Real-Time Data Collector or third party software that can handle XML based protocol
- Set *Mode* to *Smart Sensor Terminal* for a simple ASCII command string based protocol when connected to PC or third party serial interface
- Set *Mode* to *Smart Sensor Terminal FW2* when sensor output need to be compatible with older sensors.

Note! As default the 5819 sensors are set to AiCaP communication while 5819R and 5990 is set to Smart Sensor Terminal (RS232). Please select the correct Output according to which type of logger/interface you plan to use.

Set the*, Enable Temperature*, *Enable Rawdata* and *Enable Derived Parameters* to (*Yes)* to include these parameters in the output string.

Enable Temperature. This setting is used to enable or disable the *Temperature* output. The temperature reading is used to compensate for internal temperature drift when conductivity level is calculated independently of this setting.

Enable Rawdata. This setting toggles on and off a set of raw data readings from the serial output string. These raw data readings are used internally in the calculation independently of this setting. The parameters are:

- *Conductance*   Measurement in mS
- *RawCond0*   Raw measurement in LSB
- *RawCond1*   Raw measurement in LSB
- *ZAmp*   Amplitude measurement in mV
- *RawTemp*   Voltage from thermistor bridge in mV

Enable Derived Parameters. This property is used to enable or disable some extra parameters calculated based on both measured parameters like temperature and Conductivity but also fixed values like Pressure and Gravity constant. If you want to postprocess these values, we recommend using zero as Pressure to avoid any confusion.

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Set the *Enable Text* to (*Yes)* for the sensor to output a detailed text string with the measurements, or (*No)* to output the measured values without the descriptive text, only valid I *Smart Sensor Terminal* mode.

Set the *Enable Decimalformat* to (*Yes)* to output the measured values in decimal format. Set the property to (*No)* to output the values in exponential format (higher resolution in the output parameter value).

The *Interval* property describes the measurement interval in seconds; the Conductivity Sensor provides a set of measured data for every measurement interval.

The *Pressure* property is set to 0 at the factory and the measurements must be post processed to compensate for the pressure variations at the measurement site. If you want to calculate *Salinity, Density* and *Sound Speed* you also need the installation depth for the sensor. Water depth or *Pressure* are given in kPa. To include Salinity in the sensor output also *Enable Derived Parameters* need to be set.

If the *Enable Polled Mode* is enabled, then the sensor only outputs data when the user/system polls for data with a *Do Sample* command.
.

Set the *Enable Sleep* to (*Yes)* for the sensor to go to sleep between recordings, or (*No)* for the sensor to stay continuously switched *on* between recordings (drains more power).

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 if the sensor is in AADI Real-Time mode, either to a txt-file or to xml-files.

6.1.1 Enabling file output
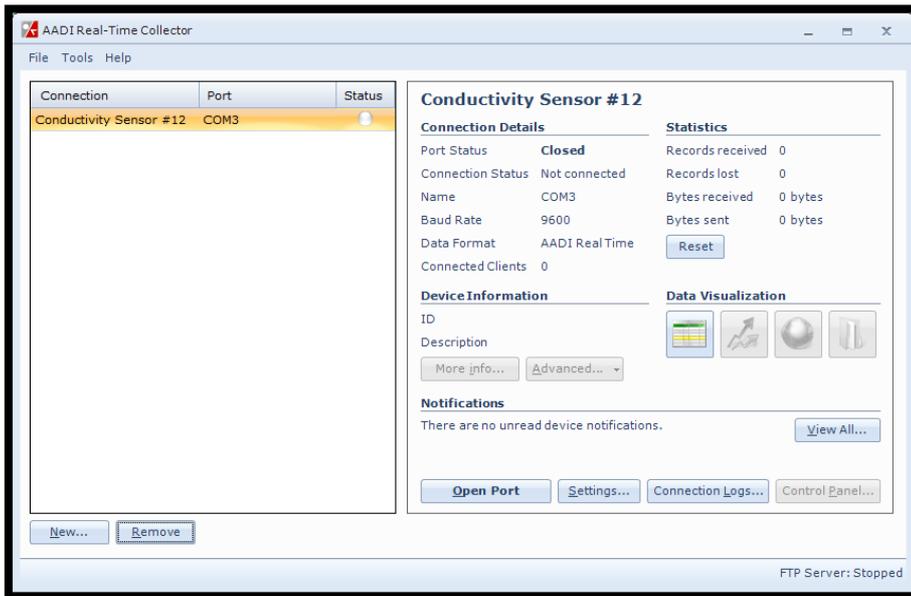
If your connection is open, status is green in the AADI Real Time Collector main menu please close the port first to be able to change the file output settings.

Click on the connection you are using. Then click on the *"Settings…"* button.

Figure 6-1: AADI Real-Time Collector start up menu
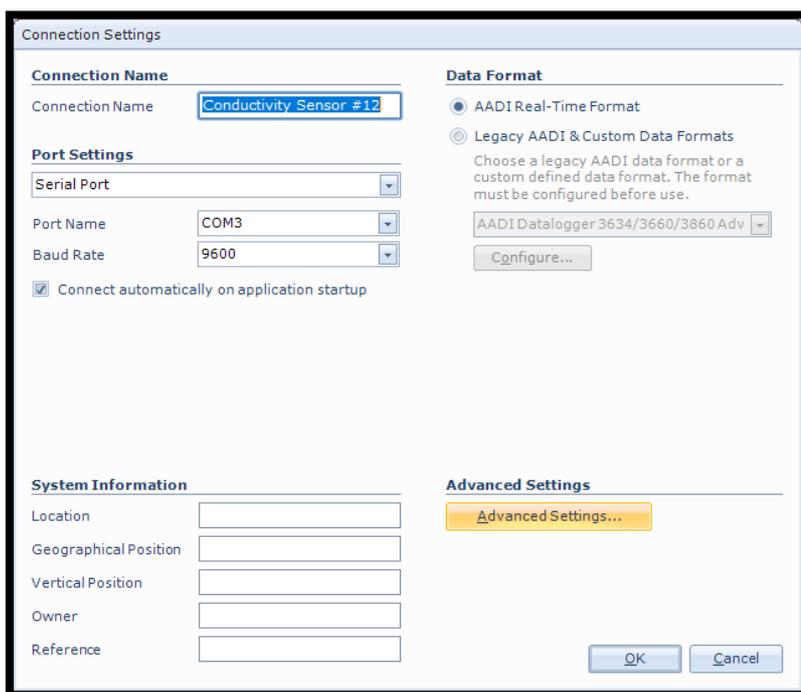
Then click on the "*Advanced Settings…"* button in the lower right corner of the *Connection Settings* window.

Figure 6-2: Connection settings menu

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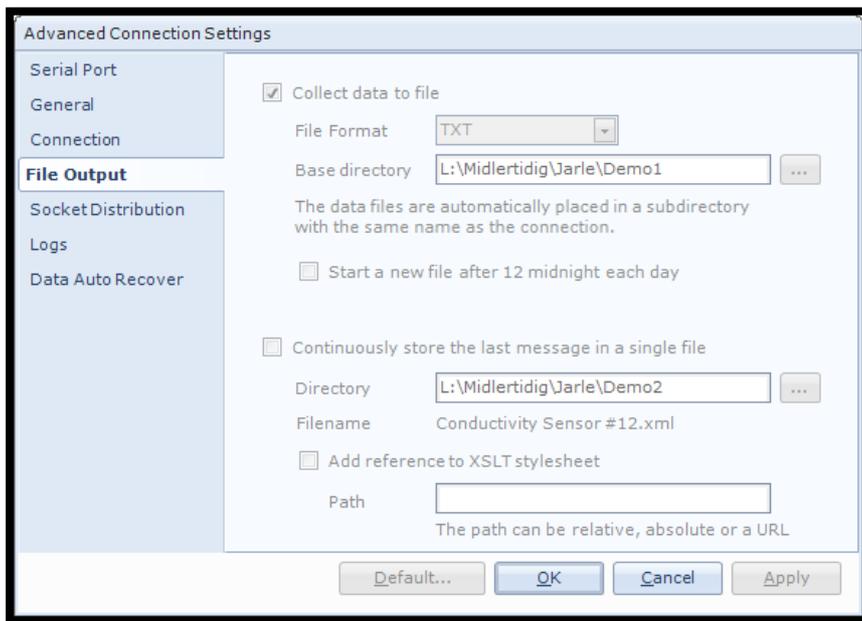
Figure 6-3: Advanced connection settings / File Output

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 either *XML* or *TXT* and choose a base directory where you want the file to be saved.

Alternatively, you may select *Continuously store the last message in a single file* if you want to continuously store the last message in a single file
Click *OK* in the *Advanced Connection Settings* window, and *OK* in the *Connection Settings* window to store settings.

6.1.2 Starting the sensor and logging to file
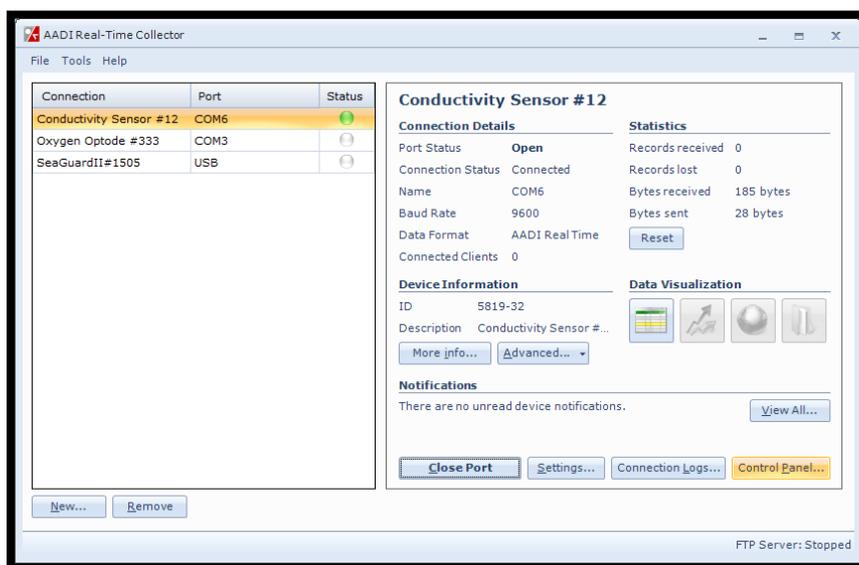
Figure 6-4: AADI Real-Time Collector start up menu

Select your connection in the connection list and then press *Open Port*. The Status turns green when the sensor is connected.

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

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Figure 6-5: Recorder panel
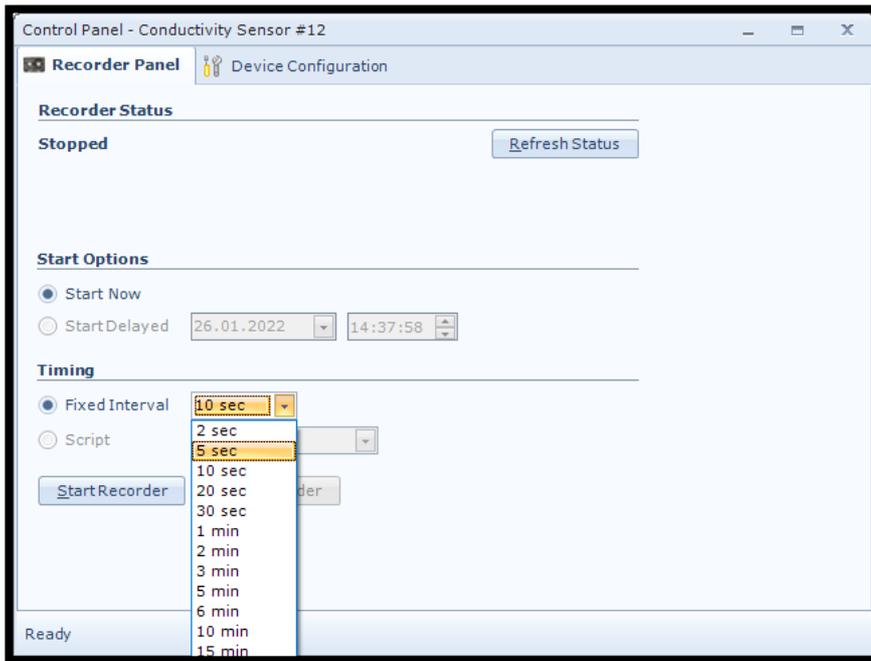
Select the interval duration and click the ***Start Recorder*** button. The shortest interval available depends on the sensor configuration.

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

To change mode please go to the ***System Configuration*** menu.

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

Data will start logging in the defined directory. If it is a txt-file, the easiest way to view it is in Excel. ***Figure 6-6*** gives an example of obtained data file. The different parameters are organized in columns. This picture might be different if your sensor has a different configuration. Refer to ***CHAPTER 4*** for how to configure the sensor.

6.2 Viewing incoming data in real-time
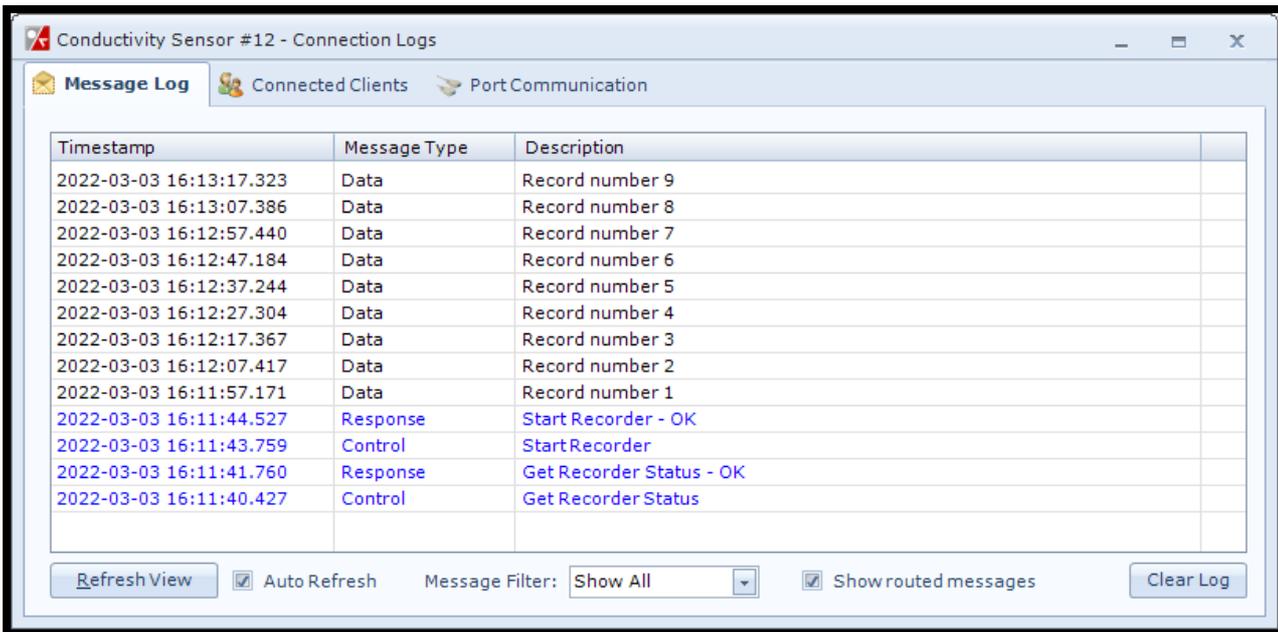
Figure 6-7: Connection Logs

When the sensor is running, the incoming data can be viewed under *Connection Logs…* in the main AADI Real-Time Collector menu.

Double-click on one of the Record numbers to view the data.
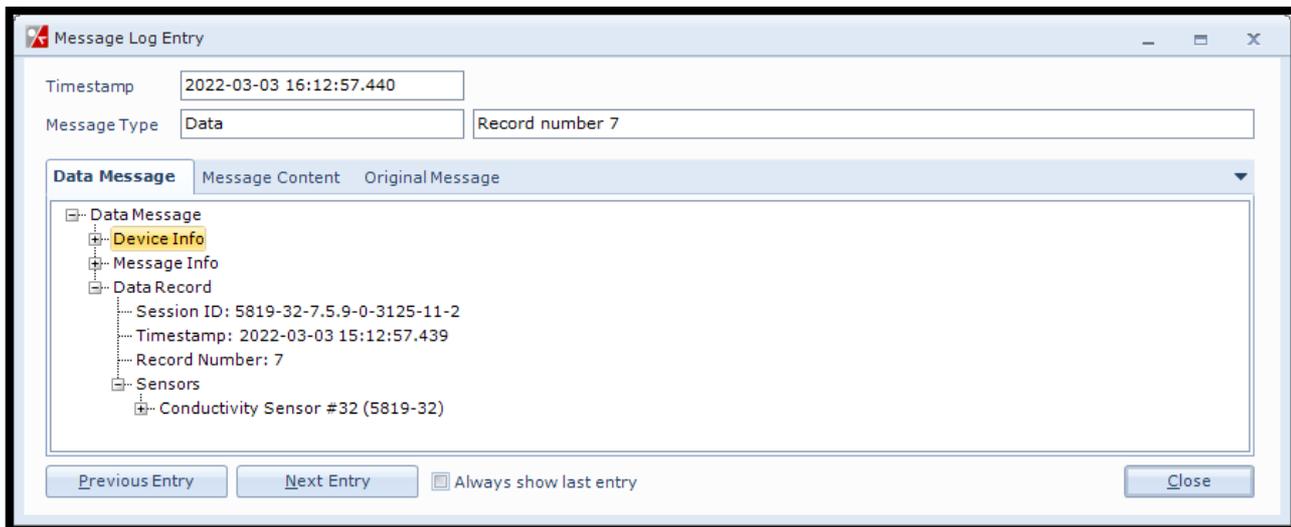
Figure 6-8: Message Log Entry

Click on the + signs to open and see all the data message content.
Some of the group also has under groups with more data. Measured data are found under *Point Parameters.*
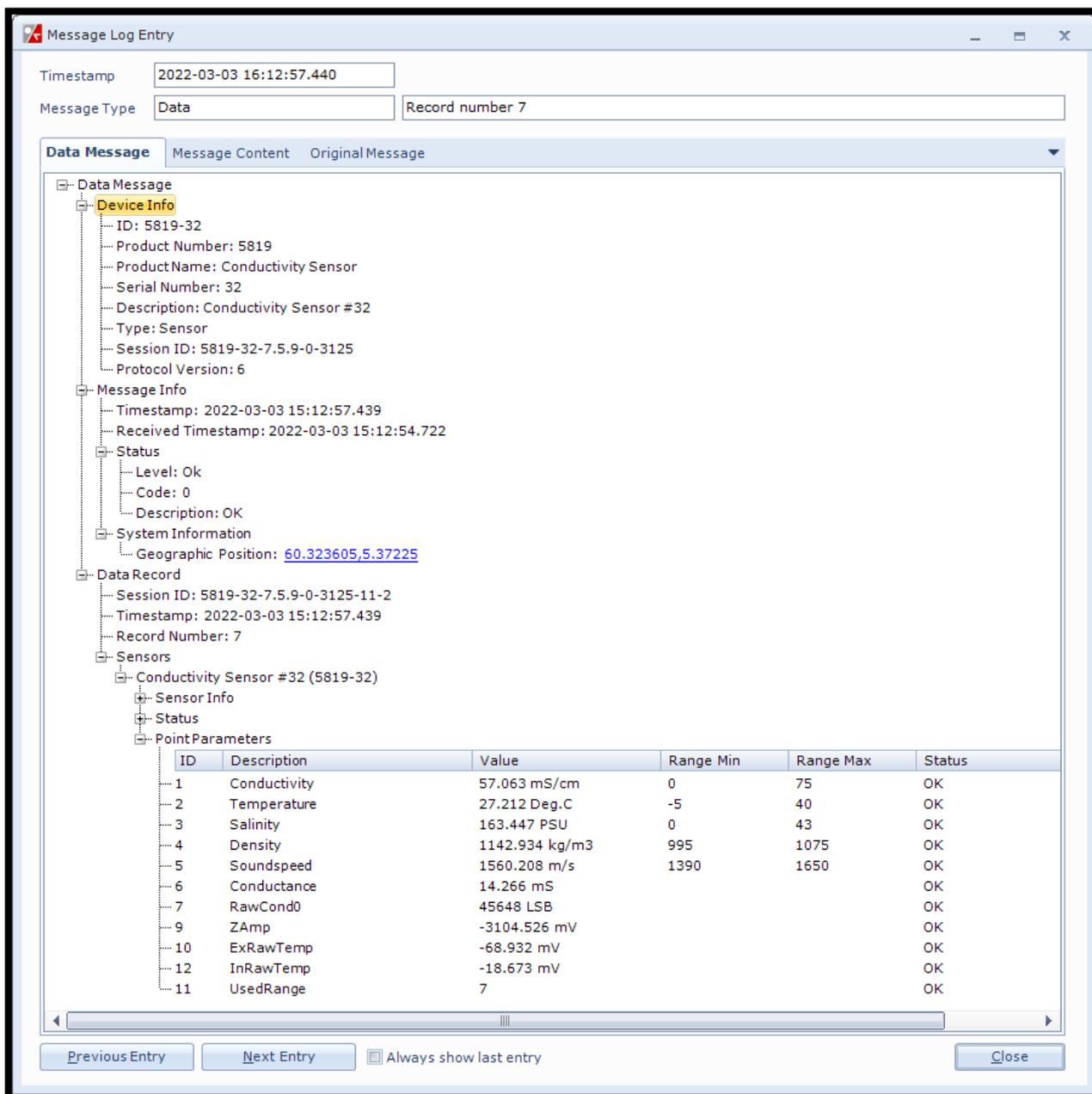
Figure 6-9: Visualization of incoming data from the sensor in real time

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 in .xml format can be seen if clicking on the Original Message tab.

CHAPTER 7 Maintenance

Aanderaa Data Instruments have Proven Reliability. With over 40 years of producing instruments for the scientific community 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 required tests and the result of these tests and checkpoints.

For performance check please refer to *chapter 7.1*

The Conductivity Sensor requires very little maintenance.

Compared to conductivity measurements with electrodes, the inductive principle of the Conductivity sensor is less sensitive to fouling. However, when used in the upper water region, fouling in the bore of the sensor is usually what limits the long-term accuracy of the sensor. To avoid this the sensor must be cleaned regularly depending on the local fouling conditions, and the required accuracy. The sensor can also be painted with anti-fouling paint to extend the deployment time.

Do not use painting with copper our other conductive material.

The ceramic hosing will tolerate most cleaning agents. Often 30% Hydrochloric acid (HCL) (Muriatic acid) will be useful for removing barnacles and similar fouling.
Be sure to follow the safety precaution for such acids.

We also recommend using repair lack on any scratches since this can affect the accuracy by making a shortcut for the seawater loop.

Fouling consisting of calcareous organisms (e.g. barnacles), can be dissolved by dipping the sensor/instrument in a weak acid solution (e.g. 7% Vinegar).

If severely damaged contact Aanderaa.support@xylem.com for assistance.

Annual recalibration is optimal and recommended by the factory (refer next section) although for many applications this may not be possible. In case where longer calibration intervals are expected use of a controlled reference can be adequate to QC the data.

Figure 7-1: Example of fouling

7.1 Function Test

We recommend that you perform a function test of the sensor operating in air with resistor set to verify the sensor readings. Refer *chapter 7.1.1, 7.1.2* and *7.1.3,* for a description of the function test procedure respectively for SeaGuard with display, AADI Real-Time Collector and Terminal software. The resistor loop test is just for function test and do not act as calibration.
The measured temperature should also agree with the ambient temperature.

7.2 Test of Conductivity Sensor with resistor loop

Connect the Resistor set 3719 to the Conductivity sensor, refer *Figure 7-2*, while the sensor is connected to an Aanderaa logger or a PC via sensor cable.
Resistor set 3719 has four resistor settings, refer *Table 7-1*. Perform one measurement series for each ohm setting. Perform the sensor readings and check that the conductance readings correspond with the values given in *Table 7-1*.

Note!

The sensor and resistor loop should be stabilized in room temperature prior to the test.

Figure 7-2: Conductivity Sensor with resistor set

Table 7-1: Resistor loop readings

Loop Resistance (Ohm)	Loop Conductance (mS)
70	14.29 ± 0.08
150	6.67 ± 0.08
680	1.47 ± 0.08
2000	0.50 ± 0.08

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7.2.1 SeaGuard with display applications

Figure 7-3: Sensor Monitor

Leave the Conductivity Sensor 5819 mounted onto the SeaGuard Platform. Power the instrument; refer TD262a and TD262b for operating instructions.

Enable *Rawdata* for your sensor in *System Configuration*, refer *chapter 2.3.3.*

Open *Administrative Tools-> Sensor Monitor*

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

.
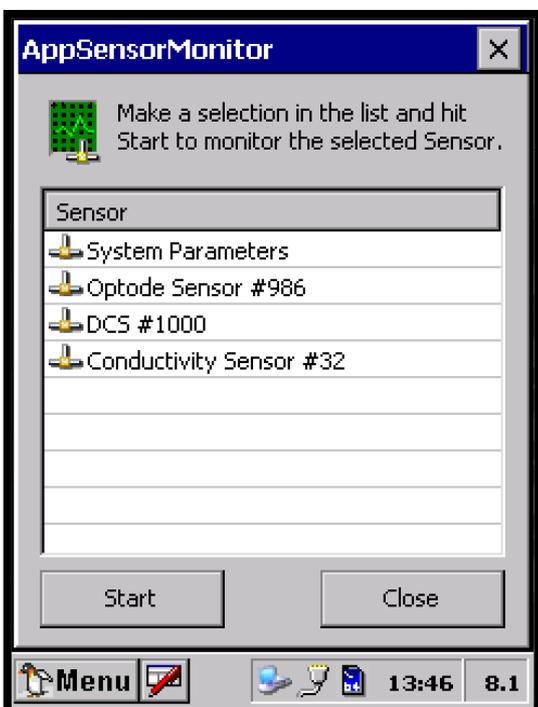
Figure 7-4: Available sensors

Select the Conductivity Sensor from the list and press *Start*,
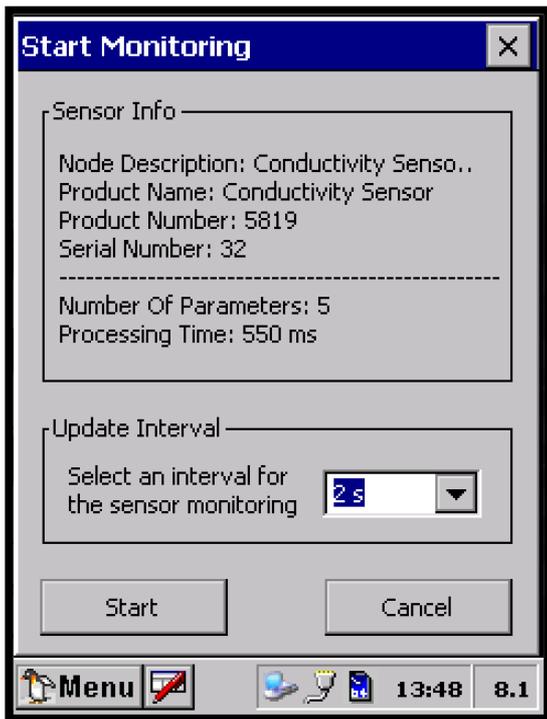
Figure 7-5: Start Monitoring

The next window shows sensor information like the *Node Description*, *Product Name*, *Product Number* and *Serial Number*.

Number Of Parameters and the *Processing Time* are also viewed in the window.

Select an *Update Interval* for the sensor monitoring.

Press *Start* to start monitoring the sensor readings.
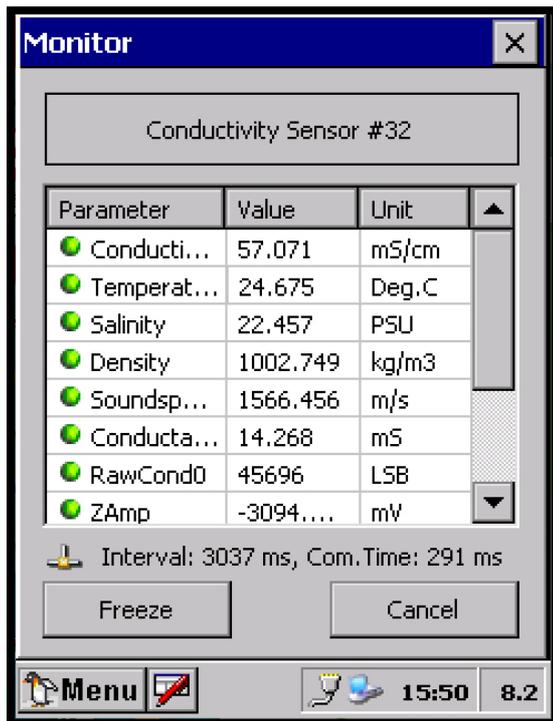
Figure 7-6: Sensor readings

The parameter reading in engineering units is shown in next window. The reading updates according to the update interval.

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

Press *Cancel* to stop monitoring.
The *Conductance* readings should be according to the description in *chapter 7.1* .

7.2.2 Function test with AADI- Real-Time collector

This chapter describes how to do a function test using *AADI Real-Time Collector*. The procedure is similar if you either connect the sensor directly with *RS-232/RS-422* to your computer or with *AiCaP* connected to a Aanderaa logger.
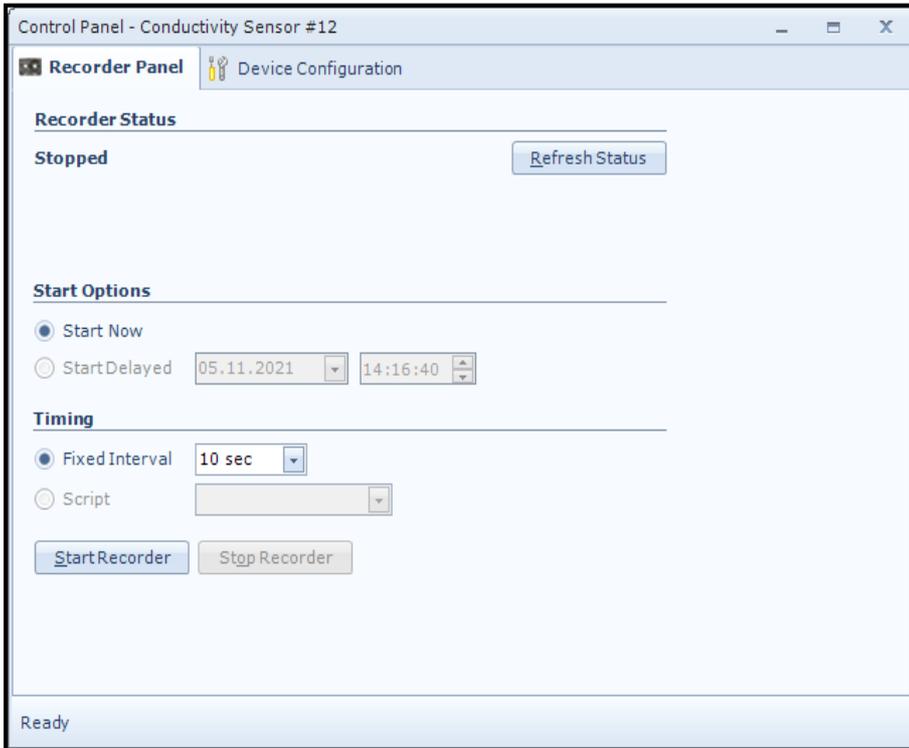
Figure 7-7: Recorder Panel

Make sure that the sensor is set to *AADI Real-Time* mode if connected stand-alone.

Enable Rawdata in *System Configuration*.

In the *Control Panel > Recorder Panel* set a faster recording interval and then start the *Recorder* or the *Recorder Group* including the *Conductivity Sensor*. For more information about how to start recording please refer to individual chapters for the different options.

Close the *Control Panel* by pressing the *X* in the top right corner
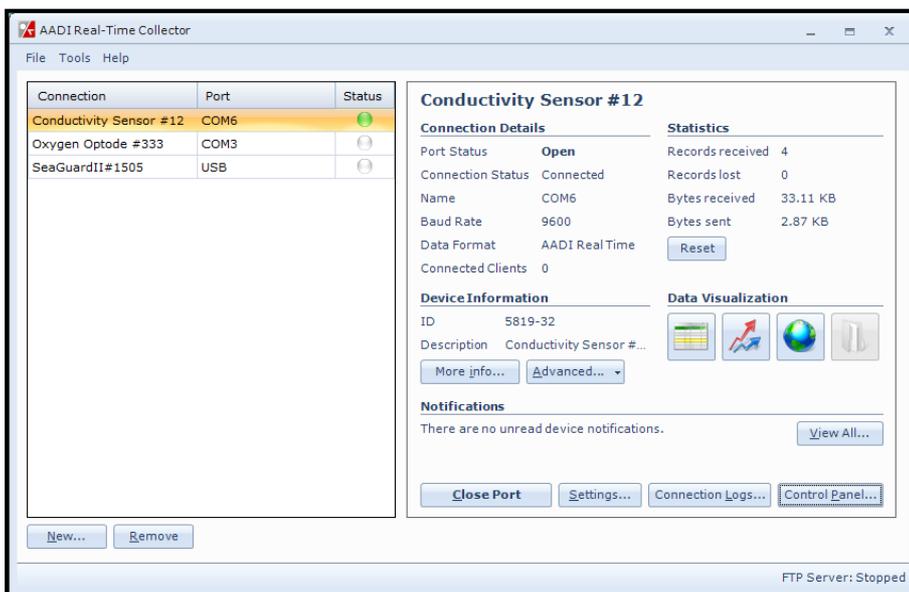
Figure 7-8: Data Visualization

Select *Text Viewer* under *Data Visualization*
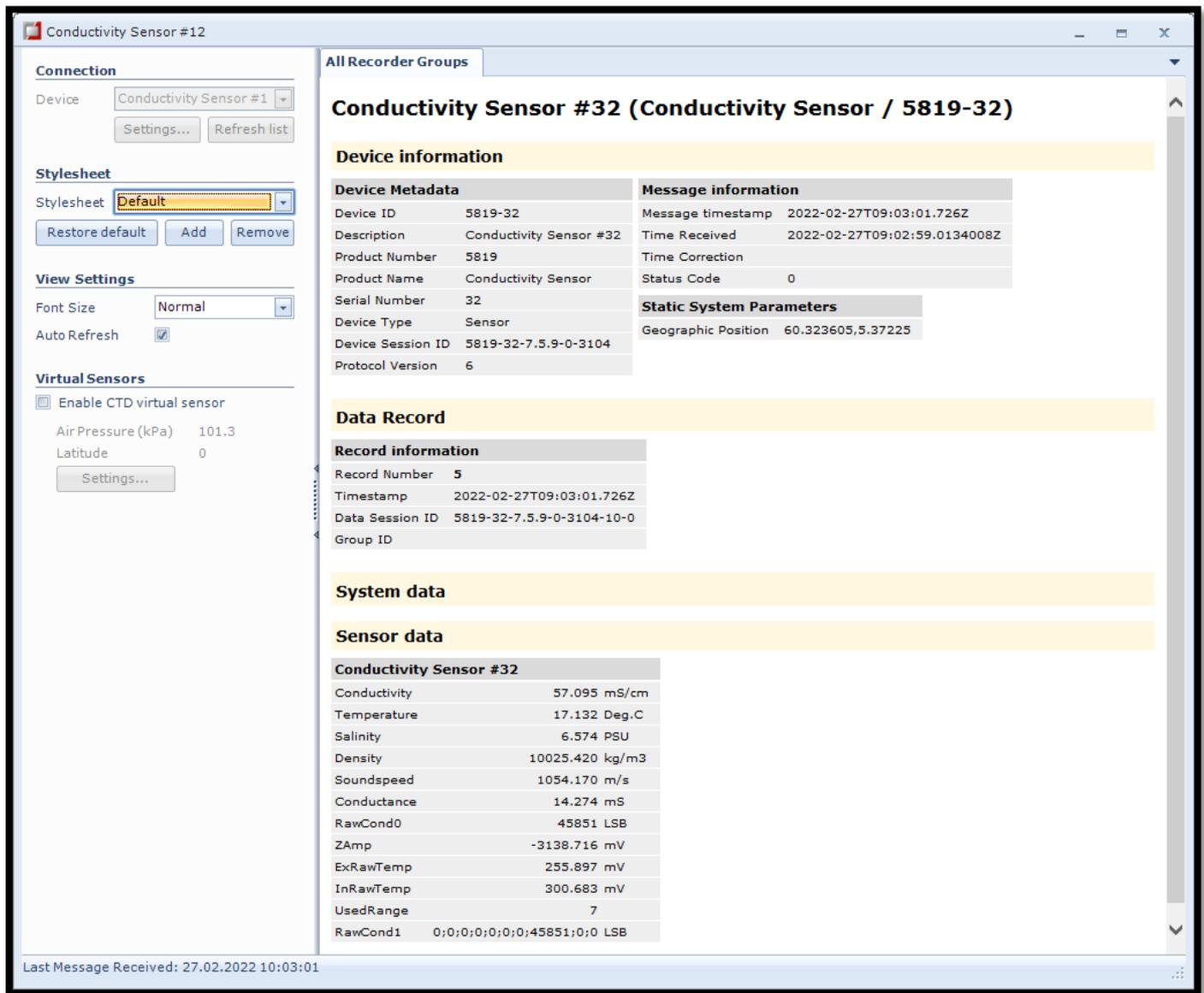
Figure 7-9: Text viewer

Check that ***Conductance*** reading is within specifications in ***Table 7-1***. ***Conductance*** is only available if ***Rawdata*** is enabled. The ***Conductance*** reading is not affected by fouling but anything that can act as a parallel resistor to the ***Resistor set*** can interfere with the reading. If the ***Conductance*** is outside specifications and you can't find a reason for this, please contact Aanderaa.support@xylem.com for assistance.

7.2.3 Function test with Terminal software

Connect the *Conductivity Sensor* to your PC via Sensor cable 3855/4865 or any real-time cable. Refer *CHAPTER 5* for connecting the sensor and how to configure the sensor in *Smart Sensor Terminal* mode.
Send the following properties to the sensor:

> *Stop*
>
> *Set Passkey(1)*
>
> *Set Mode(Smart Sensor Terminal)*
>
> *Set Enable Rawdata(Yes)*
>
> *Set Enable Text(Yes)*
>
> *Set Interval(2)*
>
> *Start*

Note! We recommend a 2 second interval.

The Sensor starts measuring and incoming data are shown on the screen. Let the sensor perform several measurements. Ensure that the *Conductance* readings are according to *Table 7-1*
Perform a measurement series for each ohm setting.

Figure 6-4: Example of Conductance readings when performing a function test of the sensor.

*Note! Type **save** if you want to store the settings. If you do not type* save*, these settings are not stored.*

7.3 Calibration

Each conductivity Sensor is linearized and temperature compensated by use of precision resistor loops. The temperature measurement is also calibrated in the same process. Each Sensor is then calibrated in a seawater bath with a reference sensor.

The reference sensor is calibrated against I.A.P.O. standard seawater using a National Ocean Technology Center's Model 5YA2-2 Laboratory Salinometer.

Even though most of the conductance of the seawater loop is determined by the water inside the center bore of the Sensor, large objects closer than 0.25m to the Sensor will influence the measurement.

*Note! We recommend that you recalculate the **CellCoeff** when the sensor is shifted between instruments or between sensor positions on the top-end plate.*

To obtain optimum accuracy the Sensor should be calibrated in the geometrical configuration it is to be used in. This can be achieved by placing the instrument in a stirred seawater-bath (minimum 0.5m diameter x 0.6m depth) with stable salinity and temperature.

The conductivity of the water must be measured by use of a reference such as a newly calibrated sensor from Aanderaa with no object closer than 0.25meter. This calibration only involves a correction of the sensitivity of the Sensor. A 'one point' calibration is therefore sufficient.

An internal setting in the **Conductivity Sensor** called **CellCoef** describes the relationship between the **conductance (mS)** in the seawater loop measured by the Sensor and the specific **conductivity (mS/cm)**. A corrected **CellCoef** can be calculated using the following equation:

Equation 1
$$CellCoef_C = CellCoef \frac{C_{ref}}{C_{read}}$$

where:

CellCoef$_c$ is the new corrected cell factor

CellCoef is uncorrected Sensor factor from sensor

C$_{ref}$ is reference reading (mS/cm)

C$_{read}$ is uncorrected conductivity reading from sensor (mS/cm)

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7.3.1 SeaGuard application: setting the CellCoef

Refer TD 262 for operating the SeaGuard Instrument.

Procedure for setting the new calculated *CellCoef*:

1. Open *Menu - Administrative Tools - User Maintenance*.
2. Select the *Conductivity sensor* from the list. You need to type correct password to enter this menu. Password is *1000* for all sensors.
3. Select the *CellCoef* property, and press *View/Edit* to change the value according to new *CellCoef$_c$* from *Equation 1.*
4. Press *Next* to view the other sensor calibration coefficients.

Note! Do not change the calibration settings. We recommend that a full recalibration of the sensor is only performed at the factory.

5. Press *Next* and *Finish* to store the settings.

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7.3.2 AADI Real-Time Collector application: setting the CellCoef

Procedure for setting the new calculated *CellCoef*:

1. Open *Control Panel – Device Configuration.*
2. Select the *Conductivity sensor* from the list if used on a logger.
3. Select *Include User Maintenance* and press *Get Current Configuration*
4. You need to type correct password to enter this menu. Password is *1000* for all sensors.
6. Select the *CellCoef* property and press the value box to type the new *CellCoef* according to new *CellCoef$_c$* from *Equation 1.*
5. Press *Next* and accept the new value.

Note! Do not change the calibration settings. We recommend that a full recalibration of the sensor is only performed at the factory.

6. Press *Next* and *Finish* to store the settings.

7.3.3 Smart Sensor Terminal application: setting the CellCoef

Connect the conductivity sensor to your PC via Sensor cable 3855/4865.

Commands for setting the updated *CellCoef:*

To read the existing *CellCoef*

> *Set Passkey(1000)*
> *Get CellCoef*

To update with new *CellCoef* according to new *CellCoef$_c$* from *Equation 1.*

> *Set Passkey(1000)*
> *Set CellCoef(CellCoef$_c$)*
> *Save*

CHAPTER 8 Theory of Operation
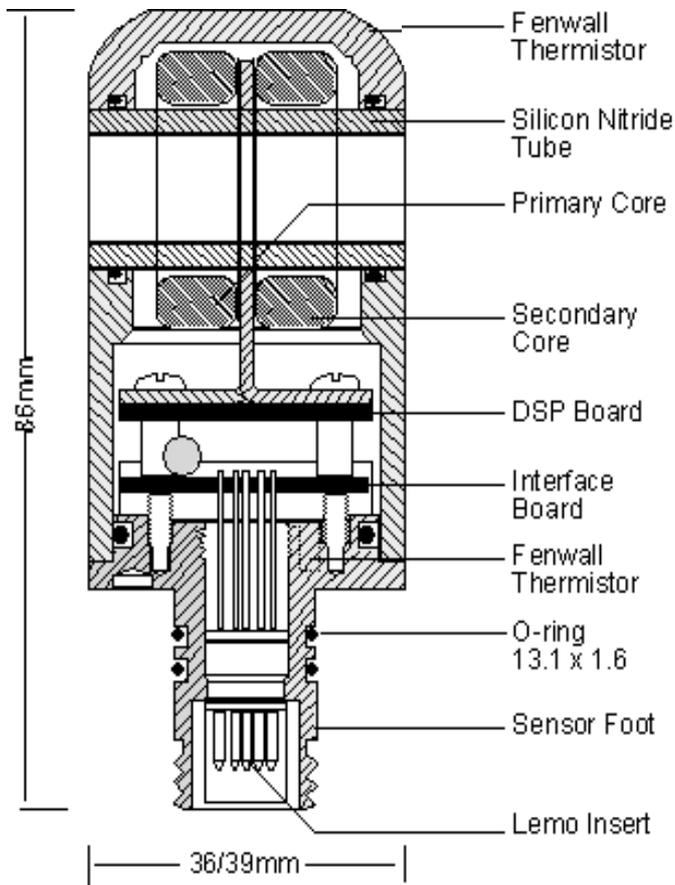
The Conductivity is a property that describes how well a material can conduct an electrical current.

For seawater, it is mostly dependent on the inorganic dissolved solids and the temperature of the water

Salinity is defined as the concentration of these dissolved solids and by measuring conductivity and temperature it is thus possible to determine the salinity of the water. Density and speed of sound are also parameters depending on the salinity and can be calculated by the sensor.

The conductivity measurement is based on an inductive principle. It is set up an alternating magnetic field which produces an electrical current in the water and the conductivity is then measured.

Figure 8-1: Sensor cross over

Figure 8-2: Sensor before final assembly
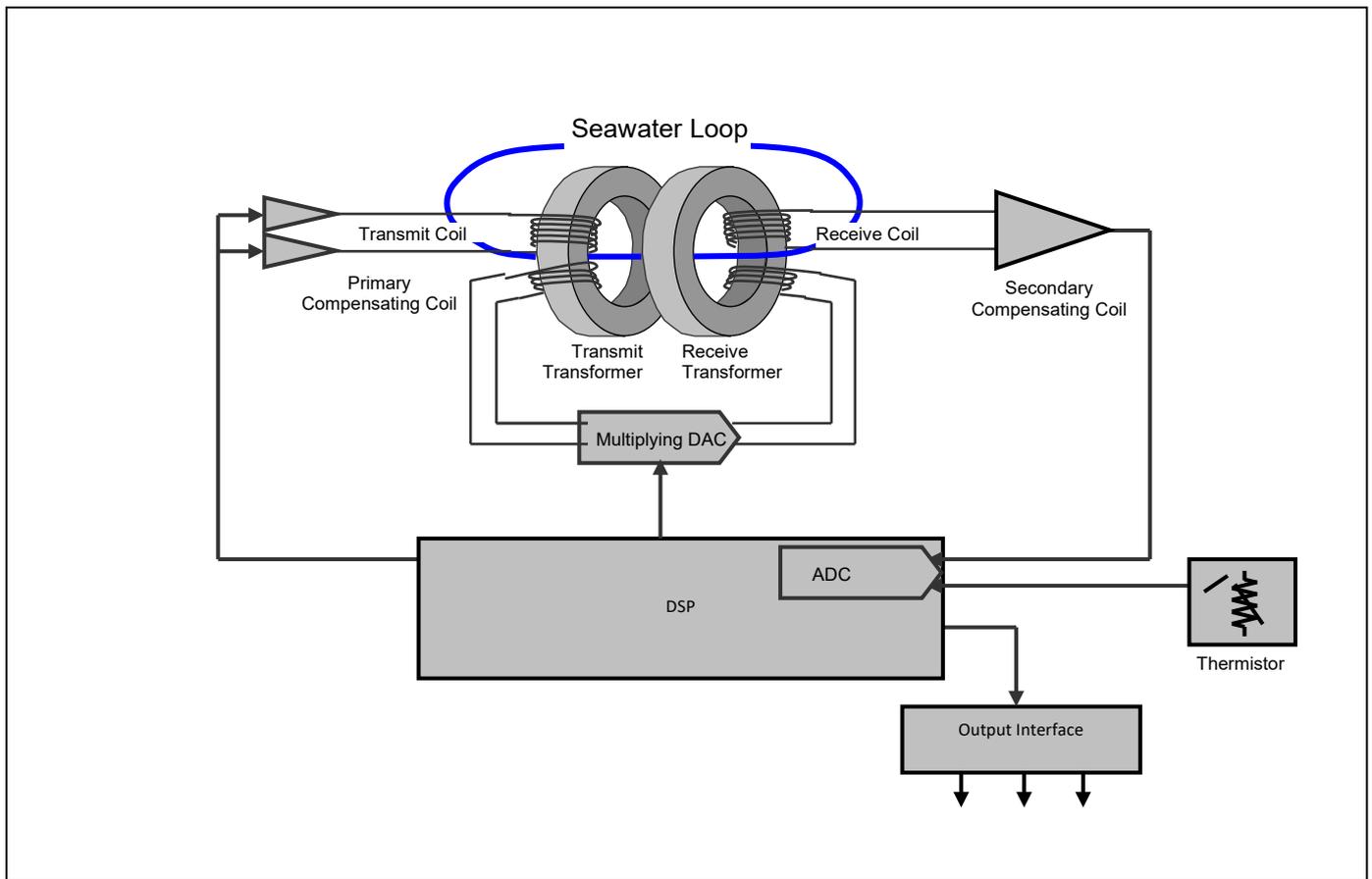
Figure 8-3: Sensor shematic
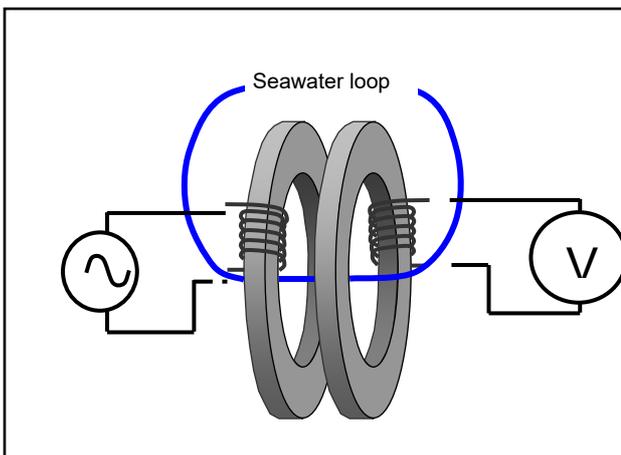
Figure 8-4: Seawater loop

CHAPTER 9 Electro Magnetic Compatibility

For a manufacturer to legally produce and sell a product, it must apply for CE marking. This means that the commercialized product is conform to the CE applicable standards and can freely circulate within the EFTA (European Free Trade Association) & European Union countries. This 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.

9.1 EMC Testing

The Conductivity Sensor has been tested at an accredited test laboratory to verify that the sensor fulfils the requirements in the EU EMC directive (EN 2014/30/EU)

Applied standards

- EN 61326-1 (2013)

Applied tests

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

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

9.2 Cables

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

9.3 Power – Voltage range

The input voltage range is from 5 to 14Vdc. When using longer cables the voltage should be as close to 14V as possible. The peak current while the sensor is measuring (after power on) is normally below 100mA, but it varies dependent on how high the input voltage is and how large the voltage drop is in the cable (lower voltage on the sensor gives higher peak current).

CHAPTER 10 Accessories and documents

In this section we show examples of sensor specific documentations that normally follow the sensor. You will also find description of cables that are normally used with the sensor.

10.1 Example of Test & Specifications sheet and Certificates

In this section we show samples of what documents included on the memory stick following the sensor. All calibration data are stored in the sensor, so these certificates is only used to prove the accuracy of the sensor and to document that testing and calibration are done following the standard procedure. If your sensor has been back for calibration or maintenance, please make sure that you also update your archive.

If you need a new certificate for one of your sensors, please contact support.aanderaa@xylem.com

- Operation Manual
- Data Sheet
- Test & Spec. Sheet
- Calibration Certificate Temperature
- Calibration Certificate Turbidity

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TEST & SPECIFICATIONS

Form No. 860, February 2020

Product: Conductivity Sensor 5819C
Serial No: Demo

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

2. **Current Drain and Voltages:**
   2.1. RS232 average current drain at 0.5Hz sampling (max: 43mA)   36.7 mA
   2.2. RS422 average current drain at 0.5Hz sampling (max: 43mA)   NA mA
   2.3. RS232 peak current drain at 0.5Hz sampling (max. 100mA)   72 mA
   2.4. RS232 quiescent current drain (max: 150µA)   107 µA
   2.5. RS422 quiescent current drain (max: 150µA)   NA µA
   2.6. AiCaP average current drain at 0.5Hz sampling (max: 43mA)   36.7 mA
   2.7. AiCaP quiescent current drain (max: 150µA)   80 µA
   2.8. DSP voltage, (3.3 ±0.15V)   3.31 V
   2.9. DSP core voltage,(1.9 ±0.05V)   1.91 V
   2.10. Excitation driver voltage, (3.3 ±0.15V)   3.31 V

3. **Electronic performance test:**
   3.1. Average of Receiver readings (0 ±400mV)   63 mV
   3.2. Standard Deviation of Receiver readings (max: 60mV)   14 mV
   3.3. Cross-talk voltage with open loop (0 ±400mV)   32 mV
   3.4. Amplification (ZAmp) with 0.2mS loop/5000 Ω (-1000 – 1000)   1664 mV
   3.5. Reading (RawCond0.0) with open loop/0mS (45– 1000)   1818 lsb
   3.6. Reading (RawCond0.7) with 14.286mS loop/70Ω (30000 – 60000)   40553 lsb
   3.7. CANBus Output test with 1 mS loop/1000   ☑

4. **Temperature cycling test:**
   4.1. Temperature cycling test in chamber (0-50°C)   ☑

5. **Temperature test (2 – 35°C):**
   5.1. Raw data temperature drift with 14.286mS loop/70Ω loop
        in High Range (max 500)   14 lsb

6. **Pressure test (0 – 60MPa):**
   6.1. Raw data drift with 14.286mS 70Ω loop in High Range (max 8)   ☑

Date: 23 Nov 2021   Sign:
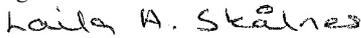
                                          Laila A. Skålnes

                                          Laila Skålnes, Production Engineer

Figure 10-1: Example of Test and Specification sheet

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CALIBRATION CERTIFICATE

Form No 994, December 2021

Certificate no: 185808

Product: Conductivity Sensor 5819C B
Serial no: Demo
Calibration date: 24.06.2021

This is to certify that this product has been calibrated and verified using the following reference equipment:

Reference Equipment	Serial
ASL Digital Thermometer model F250	2H1072/1
Calibration Bath model FNT 321-1-40	1
Platinum Resistance Thermometer	2H1072/1
Aanderaa Active Loop	47

Temperature:
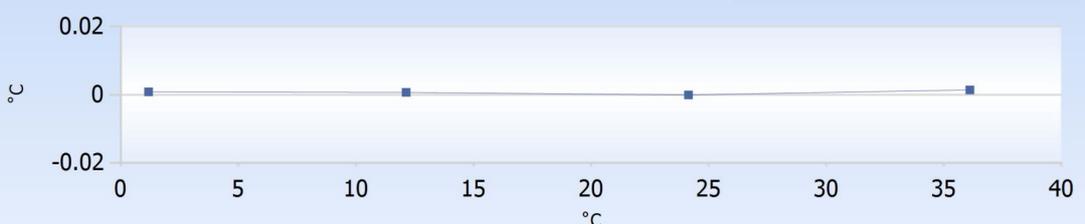
Calibration Points	0	1	2	3		
Temperature Reference(Deg.C)	1.17	12.13	24.13	36.10		
RawTemp(mV)	763.24	420.17	28.70	-334.86		

Calibration Coefficients	0	1	2	3	4	5
TempCoef	2.503294E+01	-3.141464E-02	3.458867E-06	-4.263542E-09	0.000000E+00	0.000000E+00

Conductance:
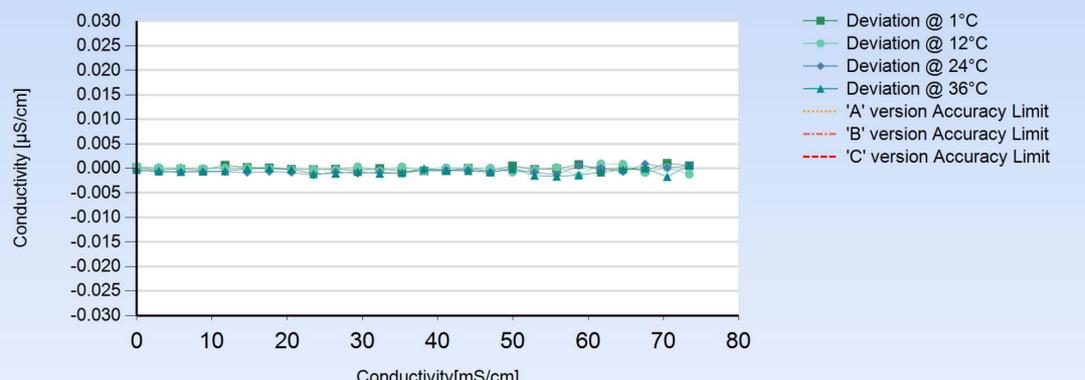
Page 1 of 3

Figure 10-2: Example of Calibration Certificate part 1 of 3

CALIBRATION CERTIFICATE

AANDERAA
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Form No 994, December 2021

Certificate no: 185808

Product: Conductivity Sensor 5819C B
Serial no: Demo
Calibration date: 24.06.2021

Calibration Coefficients	0	1	2	3
CondR0Coef0	1.265689E+00	-5.362596E-04	5.867222E-03	-1.332923E-02
CondR0Coef1	1.330901E+00	2.872102E-04	7.021902E-05	-4.174142E-04
CondR0Coef2	-3.872101E-04	1.044384E-04	-1.546566E-03	1.509157E-03
CondR0Coef3	1.232729E-03	-3.503425E-04	-3.537634E-04	7.251161E-04
CondR0Coef4	-5.762691E-04	-1.880006E-04	1.416937E-03	-9.220909E-04
CondR1Coef0	3.077769E+00	-8.204072E-04	4.145040E-03	-1.440674E-02
CondR1Coef1	1.332322E+00	-2.273214E-04	-1.064571E-04	8.456925E-05
CondR1Coef2	-3.649764E-04	5.127342E-05	-5.765115E-03	7.002317E-03
CondR1Coef3	8.074593E-04	-1.075830E-05	6.050440E-03	-7.025591E-03
CondR1Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR2Coef0	4.898991E+00	-2.011713E-04	6.045724E-03	-1.425033E-02
CondR2Coef1	1.329687E+00	-7.901998E-05	-7.812830E-04	1.351401E-03
CondR2Coef2	-1.863532E-04	-1.697897E-05	-2.966919E-03	3.977948E-03
CondR2Coef3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR2Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR3Coef0	6.714823E+00	-8.480022E-05	5.036036E-03	-1.276911E-02
CondR3Coef1	1.328790E+00	-1.511211E-04	-2.349708E-03	3.266188E-03
CondR3Coef2	-9.700944E-04	-5.362473E-04	2.051811E-03	-1.550922E-03
CondR3Coef3	7.873651E-04	-4.971938E-04	6.261643E-03	-6.577613E-03
CondR3Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR4Coef0	8.526084E+00	-2.971519E-04	5.396387E-03	-1.217928E-02
CondR4Coef1	1.327552E+00	3.447210E-04	1.139488E-03	-1.104577E-03
CondR4Coef2	-8.468484E-04	-4.552464E-04	1.970326E-03	-1.198432E-03
CondR4Coef3	1.874051E-03	-1.530823E-03	-2.575493E-03	4.811821E-03
CondR4Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR5Coef0	1.033675E+01	-6.526007E-04	6.875314E-03	-1.219611E-02
CondR5Coef1	1.327198E+00	-1.756828E-03	-1.497918E-03	4.906378E-03
CondR5Coef2	-8.488580E-04	5.372529E-04	-1.202729E-03	1.299108E-03
CondR5Coef3	4.159203E-04	3.255593E-03	2.308597E-03	-6.848325E-03
CondR5Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR6Coef0	1.214710E+01	-6.364476E-04	4.401939E-03	-7.862994E-03
CondR6Coef1	1.325989E+00	-1.049164E-03	-5.849275E-03	9.301879E-03
CondR6Coef2	-8.257164E-04	2.720602E-05	2.078871E-03	-2.260956E-03
CondR6Coef3	1.397513E-03	1.287594E-03	1.243578E-02	-1.637128E-02
CondR6Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00

Figure 10-3: Example of Calibration Certificate part 2 of 3

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CALIBRATION CERTIFICATE

Form No 994, December 2021

AANDERAA
a **xylem** brand

Certificate no: 185808

Product: Conductivity Sensor 5819C B
Serial no: Demo
Calibration date: 24.06.2021

Calibration Coefficients	0	1	2	3
CondR7Coef0	1.395408E+01	-7.212883E-04	5.936960E-03	-7.882937E-03
CondR7Coef1	1.326117E+00	-8.142643E-04	-8.852667E-03	1.068764E-02
CondR7Coef2	-5.217954E-04	-4.879502E-04	-1.806250E-03	2.143539E-03
CondR7Coef3	-1.178259E-03	4.152727E-04	2.110714E-02	-2.081770E-02
CondR7Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR8Coef0	1.576142E+01	-1.543977E-03	4.689052E-03	-3.327780E-03
CondR8Coef1	1.324198E+00	-3.297967E-04	2.036830E-03	1.906794E-04
CondR8Coef2	-7.975914E-04	1.507104E-03	1.305570E-03	-2.746639E-03
CondR8Coef3	1.317784E-03	-4.317535E-04	9.913151E-04	-2.408777E-03
CondR8Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
CondR9Coef0	1.756680E+01	-1.327518E-03	7.365789E-03	-4.539920E-03
CondR9Coef1	1.323315E+00	3.570835E-04	-1.103392E-02	1.553895E-02
CondR9Coef2	-4.450732E-04	-6.588026E-04	-6.124297E-03	8.778539E-03
CondR9Coef3	3.890768E-04	-1.212457E-03	3.158104E-02	-3.781405E-02
CondR9Coef4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00

Date:24.06.2021

Jostein Hovdenes, Product Manager, Sensors

Page 3 of 3

Figure 10-4: Example of Calibration Certificate part 3 of 3

AANDERAA
a **xylem** brand

CALIBRATION CERTIFICATE

Form No 995, April.2021

AANDERAA
a **xylem** brand

Certificate no:
Conductivity Sensor 5819C _Demo_190700

Product: Conductivity Sensor 5819C
Serial no: Demo
Calibration date: 24.11.2021

This is to certify that this product has been calibrated and verified using the following reference equipment:

Reference Equipment	Serial
ASL Precision Thermometer model CTR2000	Serial No.056784-01
Calibration Bath model FNT 321-1-40	1
Platinum Resistance Thermometer	Serial No.241012/1
Aanderaa Active Loop	47

Conductivity:

Conductance Reading [mS]
11.5141

Reference Reading [mS/cm]
53.7340

Conductance Calibration correction	Value
Residual (mS/cm)	6.93595E-5
Session ID	185808

Calibration Coefficient	0
ConcCoef	4.669

Date:24.11.2021

Tor-Ove Kvalvaag

Tor-Ove Kvalvaag, Calibration Engineer

Page 1 of 1

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Figure 10-5: Cell Coefficient Calibration Certificate

PRESSURE CERTIFICATE

AANDERAA
a **xylem** brand

Form No. 667, Sept 2009

Product: Conductivity Sensor 5819C   **Certificate No:** 19061933337
Serial No: Demo
Date: 23.11.2021

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

Autoklav 800 bar – sn: 0210005

Pressure readings:

Pressure (Bar)	Pressure time (hour)
600	16

Date: 23 Nov 2021   Sign:

Laila A. Skålnes

Laila Skålnes, Production Engineer

Figure 10-6: Pressure Test Certificate

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10.2 Connecting Cables

Aanderaa offers a wide range of standard cables.

10.2.1 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 I 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.

Signal name	Color code 6 cond. cable	Optode plug	9 pins D-SUB	USB
TXD	Red	1	2	
RXD	Brown	2	3	
Boot Enable	Green	3		
BV	Blue	4		
GND	White	7	5	4 (black)
Positive Supply	Yellow	8		1 (red)
RTS short to CTS			7-8	
DSR short to DTR			6-4	

9 PIN SOCKET, EXTERIOR VIEW

6 9

1 5

CABLE 3376:
10P PLUG-9P SOCKET

0.02m

1m

0.4m

1.5m
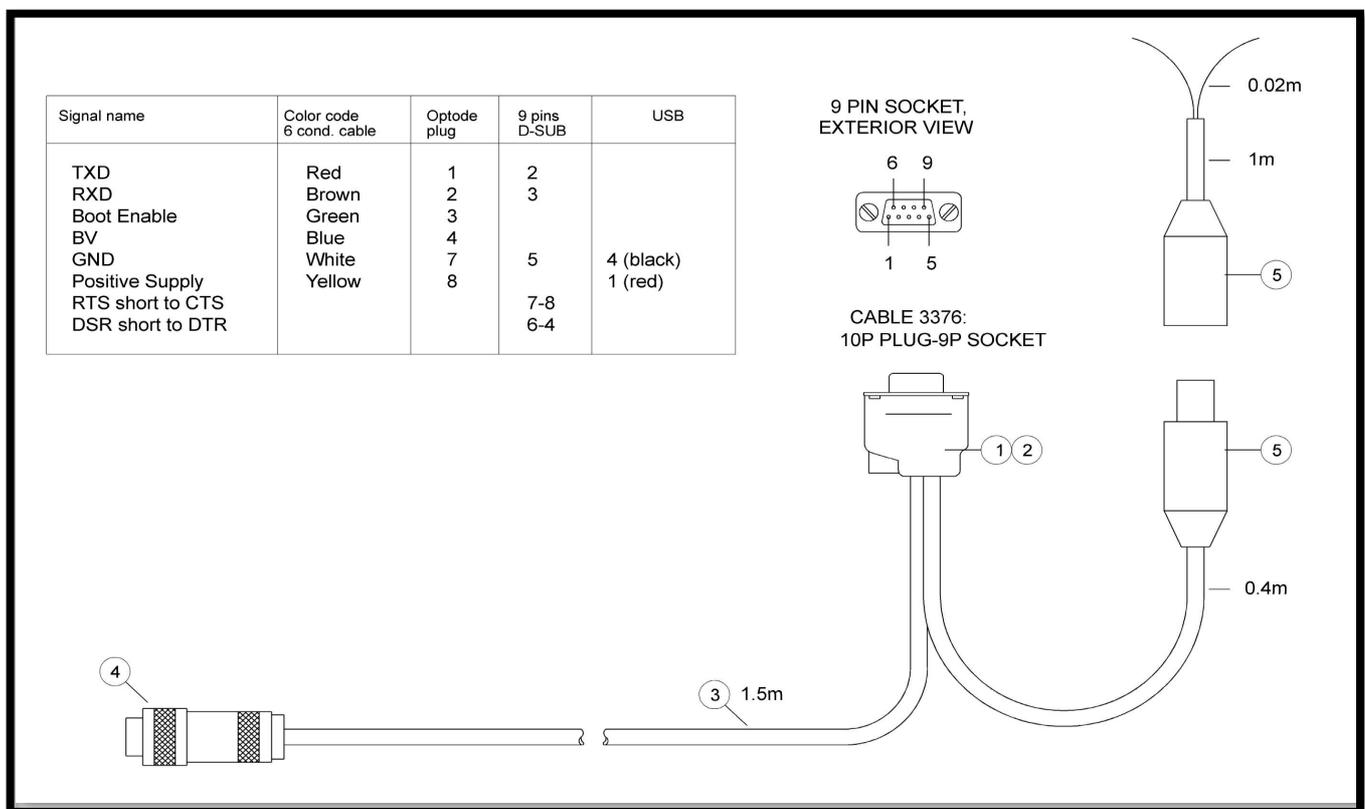
Figure 10-7: Set-up and configuration cable 3855

10.2.2 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 I 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.

Signal name	Color code 6 cond. cable	Optode plug	9 pins D–SUB	USB
TXD	Red	1	2	
RXD	Brown	2	3	
Boot enable	Green	3		
BV	Blue	4		
GND	White	7	5	4 (black)
Positive Supply	Yellow	8		1 (red)
RTS short to CTS			7–8	
RX–			6–4	

9 PIN SOCKET, EXTERIOR VIEW

CODE	LENGTH
––	10m
A	20m
F	3m
L	1m
M	5m
T	15m

Use potting mold 4000060+4000061
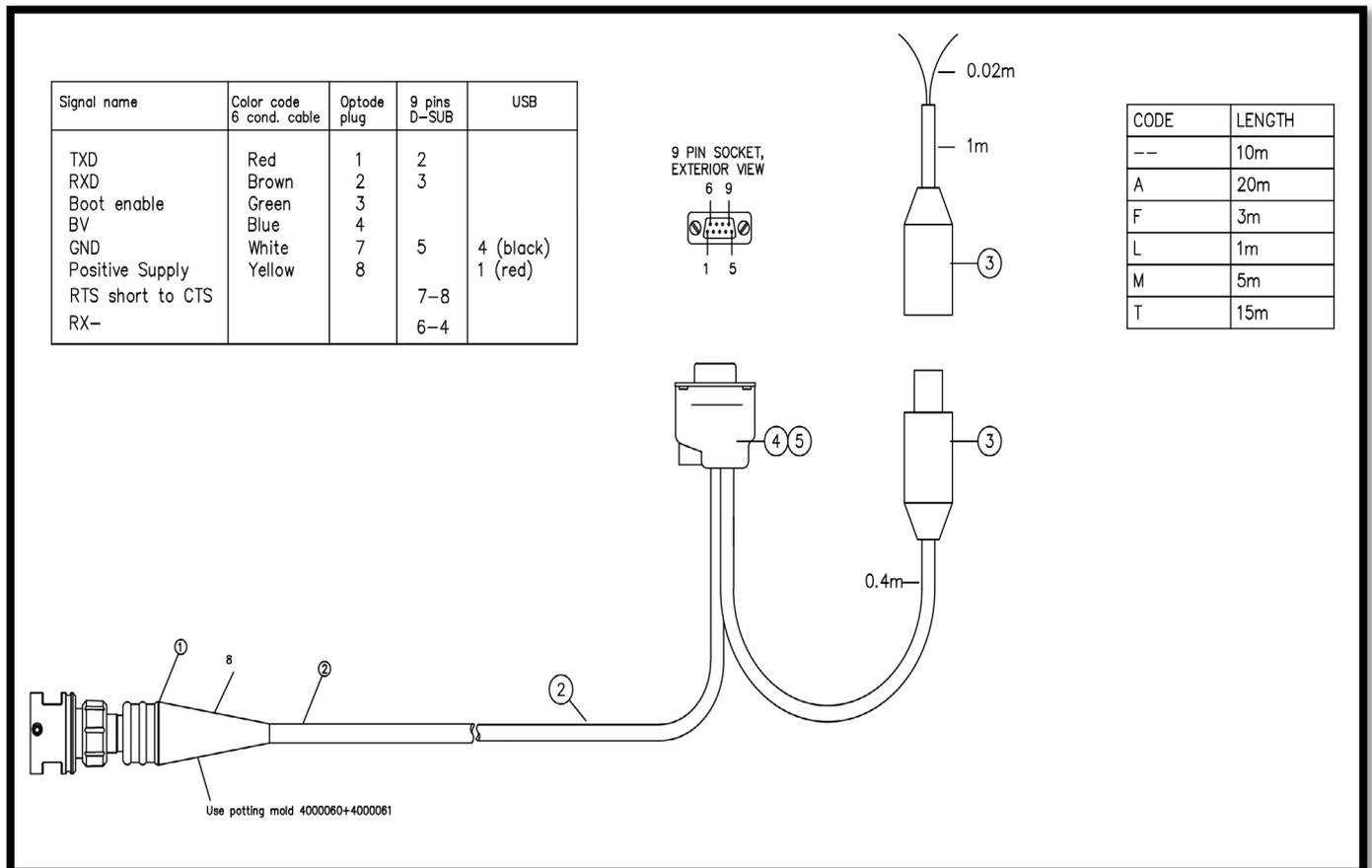
Figure 10-8: Set-up and cnfiguration cable 4865

10.2.3 Free end cable 4762

Free end cable 4762 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					
SR10/VR22 SENSOR	RS-232 AND DIGOUT	ANALOG ADAPTER	ANALOG SENSOR	SENSOR PLUG LEMO INSERT	COLOR CODE
NOT USED	RS-232 TXD	RS-232 TXD	SIGNAL GND	1	GREY
NOT USED	RS-232 RXD	RS-232 RXD	ANALOG OUT	2	BROWN
DO NOT CONNECT	NOT USED	ANALOG 2G	POWER IN	3	YELLOW
BRIDGE VOLTAGE	NOT USED	ANALOG 2	NOT USED	4	PURPLE
OUTPUT 2	NOT USED	ANALOG 1G	NOT USED	5	BLUE
-9V	DIGOUT GND	ANALOG 1	GAIN CONTROL B	6	WHITE
NOT USED	GND	GND	POWER GND	7	BLACK
SYSTEM GROUND	POS. SUPPLY	POS. SUPPLY	NOT USED	8	GREEN
OUTPUT 1	NOT USED	NOT USED	GAIN CONTROL A	9	ORANGE
CONTROL VOLTAGE	DIGOUT	NOT USED	NOT USED	10	RED

097 4762

Length	Code
1m	L
3m	F
5m	M
10m	--
20m	A

Figure 10-9: Free end cable 4762

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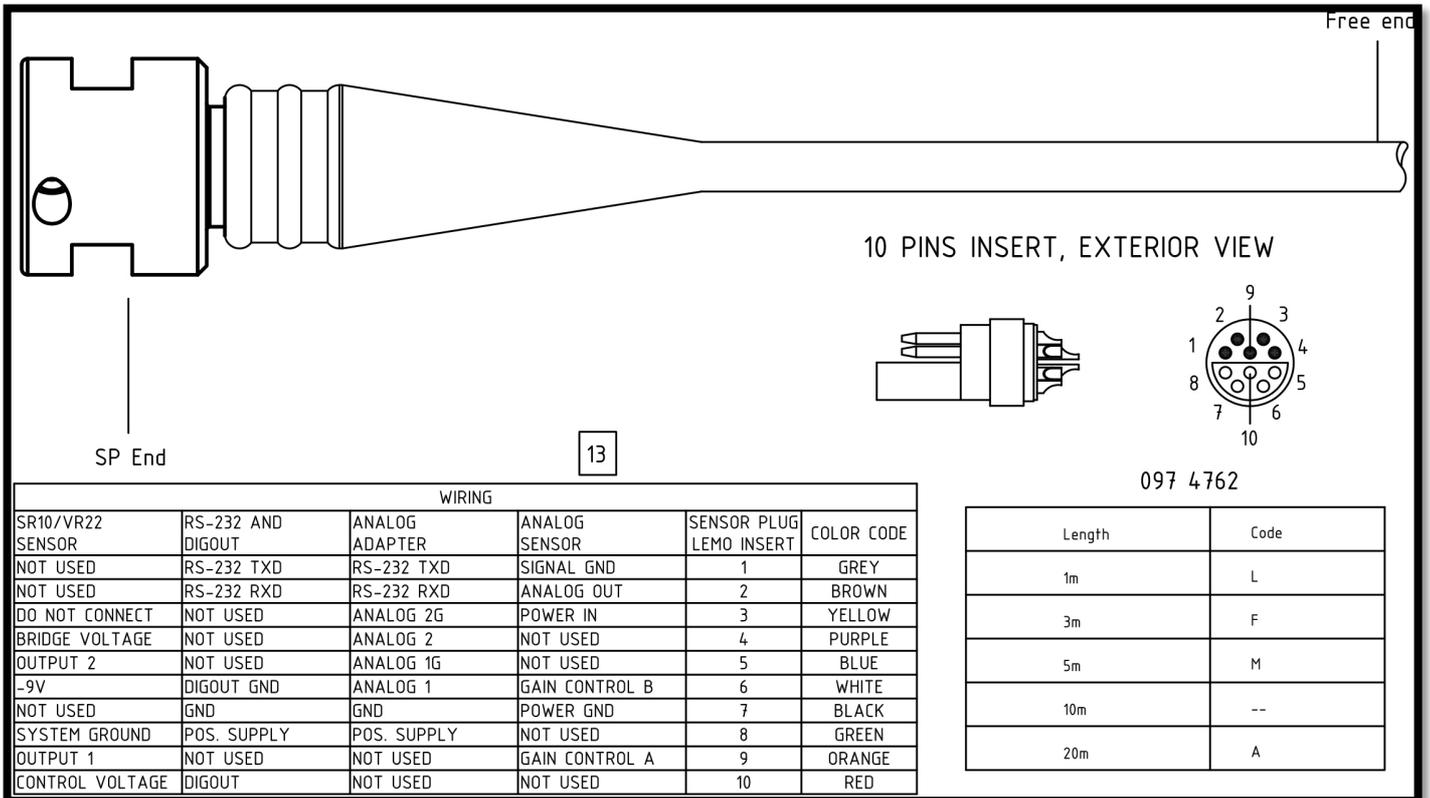
Remote cable 4793 is used when you want do mount the sensor away from the instrument top-end plate. This is used if you want to measure gradients and one sensor is located on the top end plate and the second sensor are mounted in the water column away from the instruments.
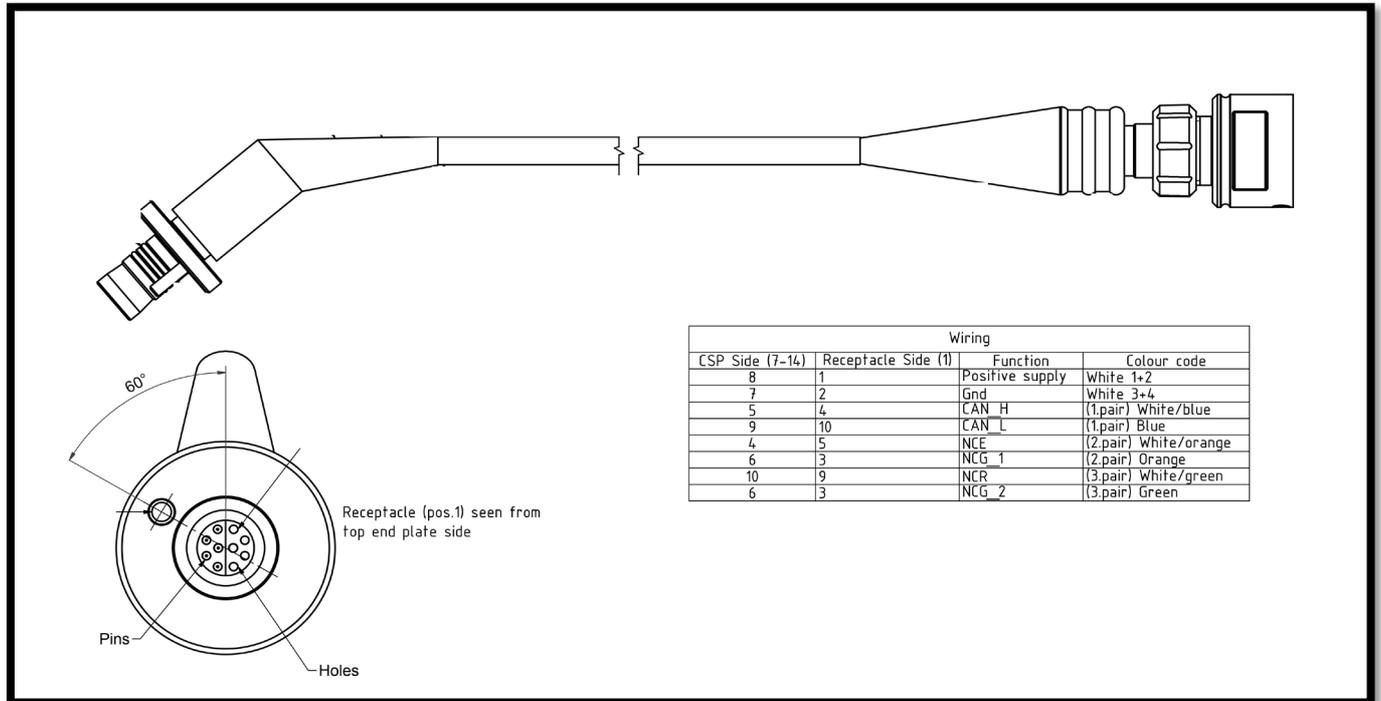

Wiring

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

60°

Receptacle (pos.1) seen from top end plate side

Pins

Holes

Figure 10-10: Remote sensor cable 4973

10.2.5 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.
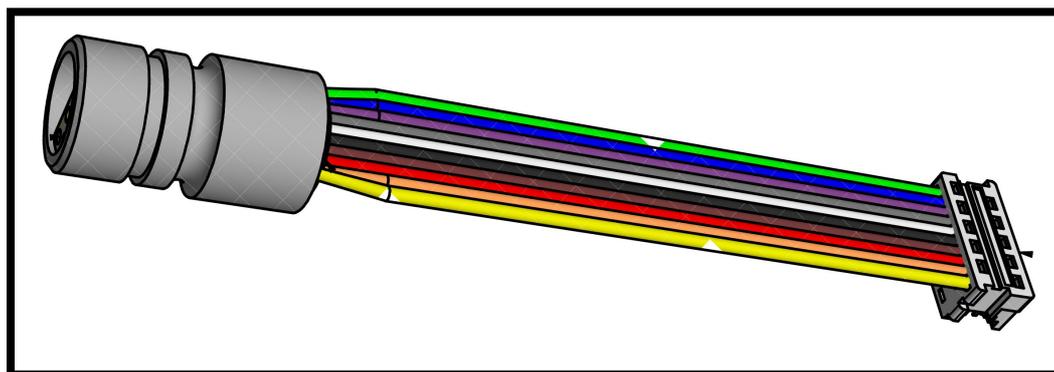

Figure 10-11: Patch cable 4999

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10.2.6 Cable 5236 for connection to SmartGuard using AiCaP

8pin M12 plug, EXTERIOR VIEW

Connection on Smartguard

10 PIN INSERT, EXTERIOR VIEW

0975236 Length	
M	5m
–	10m
A	20m
D	50m

See length in table according to part number

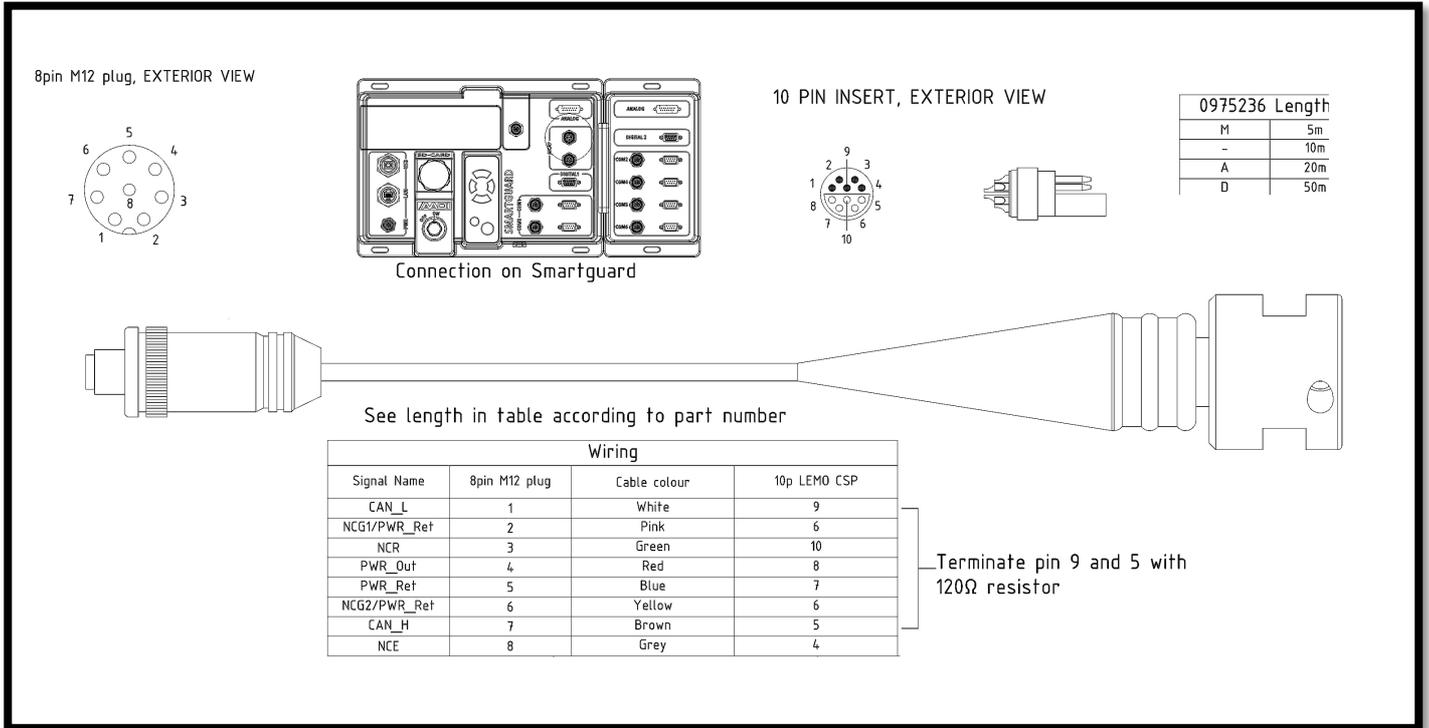| Wiring			
Signal Name	8pin M12 plug	Cable colour	10p LEMO CSP
CAN_L	1	White	9
NCG1/PWR_Ret	2	Pink	6
NCR	3	Green	10
PWR_Out	4	Red	8
PWR_Ret	5	Blue	7
NCG2/PWR_Ret	6	Yellow	6
CAN_H	7	Brown	5
NCE	8	Grey	4

Terminate pin 9 and 5 with 120Ω resistor

Figure 10-12: 5896 Sensor cable to SmartGuard

Xylem |ˈzīləm|

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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Let's Solve Water

Aanderaa Data Instruments AS
Sanddalsringen 5b, P.O. BOX 103 Midtun
N-5843 Bergen, Norway
Tel: +47 55 60 48 00 • Fax: +47 55 60 48 01
E-mail: aanderaa.info@xyleminc.com • Web: www.aanderaa.com

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