TD 314 OPERATING MANUAL
In-line Doppler Current Sensor
5800/5810
September 2016

In-line Doppler Current Sensor 5800/5800R/5800RR/5810/5810E

AANDERAA
a xylem brand

1st Edition 10 February 2016
2nd Edition 12 September 2016 Pin configuration for AiCaP fixed

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Introduction

Purpose and scope

This document is intended to give the reader knowledge of how to operate and maintain the Aanderaa In-line Doppler Current Sensor 5800/5810-series. These sensors are described in a single manual since the measurement principle and electronics is the same for all sensors. 5800 only measure current speed and direction. 5810 also has the option to include other parameters such as Oxygen, Conductivity, Temperature, Pressure, Tide and Wave in addition to the Current measurement. 5800 are available in three versions, 5800 with AiCaP output, 5800RR with Rs-232 output and 5800R with Rs-422 output. 5810 are available in two versions, 5810 with AiCaP output and 5810E is available in a version with customized wiring for combinations of Analog, AiCaP, Rs-232 and Rs-422 sensors. For configuration and other information on sensors connected to 5810 please refer to the individual Operation Manual for each sensor.

5810E is an engineering version and the combination of sensors and output is based on the customer specified setup. See system drawing for an overview of each sensor outputs. Each sensor is treated as individual sensors with separate connections or connected to the internal AiCaP bus. For configuration and other information on each sensor connected please refer to the individual Operation Manual for.

Aanderaa Smart Sensors utilize common communication protocols at the RS-232 and RS-422 interface where the Smart Sensor Terminal protocol is a simple ASCII command string based protocol and the AADI Real Time is an XML based protocol. The sensor is designed to fit directly in a string system connected to SmartGuard or SeaGuard String logger using AiCaP. The sensor can also be used as stand-alone sensor using RS-232. The R-version with RS-422 output and is intended for stand-alone use with longer cables than can be used with the RS-232 version.

Document Overview

Chapter 1 gives a short description of the ZPulse™ Doppler Current Sensor

Chapter 2 gives an overview of sensor output parameters,

Chapter 3 gives a description of the measurement principle.

Chapter 4 gives a description of the sensor operation mode.

Chapter 5 describes SeaGuard applications.

Chapter 6 describes configuration of the ZPulse DCS using AADI Real-Time Collector.

Chapter 7 presents sensor connection to PC.

Chapter 8 describes RS 232/422 operation.

Chapter 9 describes sensor installation on a SeaGuard.

Chapter 10 describes maintenance issues.

Appendix 1 gives illustrations of available cables

Appendix 2 is a copy of Product Change Notification: Framework 3.

Applicable Documents

Form xxx	Test & Specification Sheet, In-line DCS 5800/5810
Form xxx	Calibration Certificate, In-line DCS 5800/5810
Form 667	Pressure Certificate
D 412	Data sheet, In-line DCS 5800/5810
TD 268	AADI Real-Time collector operating manual
TD 269	Oxygen Sensor 4330, 4835 operating manual
TD 302	Pressure 4117, Tide 5217 and Wave 5218 operating manual
TD 263	Conductivity 4319 operating manual

Abbreviations

ADC	Analog to Digital Converter
AiCaP	Aanderaa Protocol: Automated idle Line CANbus Protocol
ASCII	American Standard Code for Information Interchange
CAN	Controller Area Network - sometimes referred to as CANbus
DAC	Digital to Analog Converter
DSP	Digital Signal Processor
EIA	Electronic Industry Alliance
EPROM	Erasable Programmable Read Only Memory
EMC	Electromagnetic compatibility
MSB	Most significant bit
RTC	Real Time Clock
UART	Universal Asynchronous Receiver and Transmitter
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USB	Universal Serial Bus

CHAPTER 1 Short description and specification

1.1 Description

The Aanderaa In-line Doppler Current Sensor is a single point current sensor based on the Doppler Shift principle. The sensor transmits acoustic pulses into the water and samples the backscattered (echo) signal. The sampled data from the received signal is processed to find the Doppler shift and calculate the current.

The current measurements are compensated for instrument tilt and referred to magnetic north by using an internal solid state compass. A DSP computes vector averaged speed and direction over the last sampling interval.

The In-line DCS 5800/5810 has a Titanium Housing and base plate and is available in three different depth ratings. SW is down to 300meter, IW is down to 3000 meter and DW is down to 6000 meter. The 5810 is equipped with a base plate with room for 6 additional sensors with Aanderaa sensor foot.

To minimize the effect of marine fouling and local turbulence, the ZPulse™ DCS is measuring the horizontal current at least 0.4 meter away from the instrument, refer Figure 1-1. The sensor can also be configured to only measure using the transducer in front of the sensor and not in the wake of the sensor where turbulence may interfere.

The current measurements are compensated for instrument tilt and referred to magnetic north by using an internal solid state compass. A DSP computes vector averaged speed and direction over the last sampling interval.

The output format of the 5800/5810 are AiCaP, while the output format of the 5800R are RS-422, and for 5800R the output is RS-232 The sensor can be used in polled mode when set to Smart Sensor Terminal mode

When used with SmartGuard and SeaGuard II both AiCaP and RS-232 mode can be used. When used with SeaGuard or SeaGuard String logger AiCaP mode is used. The sensor may also be used as a stand-alone RS-232 or RS-422 sensor for other applications.

In-line DCS and optional sensors are assembled prior to shipment according to order. To add additional sensors please contact factory,

RS-422 is based on differential data transmission, which makes it more insensitive to noise than RS-232. RS-422 was designed for greater distances and higher Baud rates than RS-232.

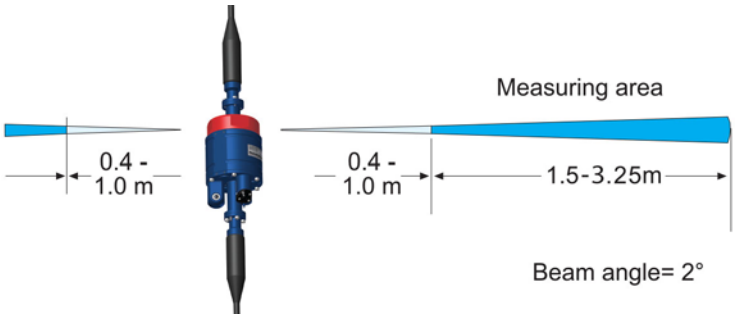


Figure 1-11-2 Measuring area of the ZPulse™ DCS In-line

1.2 User accessible sensor properties

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

Table 1-1 FC = Factory Configuration, DS = Deployment Setting, SC = System Configuration, UM = User Maintenance. ENUM=Enumeration, INT =Integer, BOOL=Boolean('yes'/'no')

Property	Type	No of elements	Use	AiCaP Category	Access Protection
Product Name	String	31	AADI Product name	FC	Read Only
Product Number	String	6	AADI Product number		
Serial Number	Int	1	Serial Number		
SW ID	String	11	Unique identifier for internal firmware		
Software Version	Int	3	Software version (Major, Minor, Built)		
HW ID X	String	19	Electronic Identifier, X =1,2		
HW Version X	String	9	Electronic Identifier, X =1,2		
System Control	Int	3	For AADI service personnel only		
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		
Interval[1]	Float	1	Sampling Interval in seconds. Default value is 30s.	DS	Low
Location	String	31	User setting for location		
Geographic Position	String	31	User setting for geographic position		
Vertical Position[1]	String	31	User setting for describing sensor position		
Reference	String	31	User setting for describing sensor reference		
Mode[1]	ENUM	1	Sets the sensor operation mode (AiCaP, Smart Sensor Terminal, AADI Real-Time, Smart Sensor Terminal FW2)	SC	High
Enable Sleep[1]	BOOL	1	Enable sleep mode. Default value is yes.		
Enable Polled Mode	BOOL	1	Enable polled mode for Smart Sensor Terminal mode. When set to 'yes' the sensor will read the last measured data on request only (use the *Do Sample* command). When set to 'no' the sensor will sample at the regular interval given by the		

			Interval property. Default value is no.		
Enable Text[1]	BOOL	1	Controls the insertion of descriptive text, i.e. parameter names. Default value is yes.		
Enable Decimalformat[1]	BOOL	1	Controls the use of decimal format in the output string. Set No for scientific number format. Default value is no.		
Ping Number	ENUM	1	Sets the integer number of pings required in one measurement interval. The maximum ping number is 600. Default value is 150.		Low
Polled Pingrate	ENUM	1	Sets the number of pings per second. Default value is 10. Use the help command to find selectable values.		Low
Enable Burst Mode	BOOL	1	Set yes to enable Burst mode; set no for spread mode. Default value is no.		High
Enable Single Interval	BOOL	1	Set yes to perform only one single measurement interval. Default is no		Low
Start Distance	ENUM	1	Set the distance for the pulse propagation before measurements starts. Default value is 0.50		
Cell Size	ENUM	1	Set the cell size. Default value is 1.50		
Enable ZPulse Operation	BOOL	1	Activate/deactivate ZPulse operation; Set yes to activate. Default value is yes		
Sound Speed	Float	1	Sets the speed of sound in water. The sound speed is approximately 1500m/s in seawater. Default value is 1500.0.		
Enable Fixed Heading	BOOL	1	Enable/disable fixed heading; set yes to enable fixed heading. Set no for the sensor to use the measured compass heading as reference. Default value is no.		
Fixed Heading [2)]			Sets the fixed heading to be used as reference. Default value is 0.0.		
Enable Tilt Compensation	BOOL	1	Enable/disable tilt compensation to correct the measured current speed according to the sensor tilt.Default valus is yes		
Activation X-axis	ENUM	1	Controls active transducers on the X-axis: 1, 3, 1+3. Default is 1+3		
Activation Y-axis	ENUM	1	Controls active transducers on the Y-axis: 2, 4, 2+4. Default is 2+4		
Enable Forward Ping	BOOL	1	Set yes to enable forward ping to improve the current speed accuracy, The sensor will try to measure upstream to reduce problems related to turbulence. Default value is yes.		
Node Description	String	31	User text for describing node, placement etc	UM	High
Owner	String	31	User setting for owner		
Interface	ENUM	1	Factory use only, RS-232 for standard version, RS-422 for R-version		
Baudrate [3)]	ENUM	1	RS-232/RS-422 baudrate: 4800, 9600, 57600, or 115200. Default baudrate is 9600		
Flow Control	BOOL	1	RS-232/RS-422 flow control: ‘None’ or ‘Xon/Xoff’. *Note! Do not use None at high baudrates above 9600*		
Enable Comm Indicator	BOOL	1	Enable communication sleep (’%’) and communication ready (‘!’) indicators		

Comm TimeOut	ENUM	1	Time communication is active (Always On, 10 s, 20 s, 30 s, 1min, 2 min, 5 min, 10 min)		
Enable Spike Filter	BOOL	1	Activate/deactivate spike filter; Set yes to activate. Default is yes. Spike filter tracks and eliminates spikes in measured data.		
Enable Axis Strength	BOOL	1	Enables output of strength X and strength Y. Default is no		
Compass Deviation	Float	1	Compass offset correction value (deg. M)		
Enable Magnetic Declination	BOOL	1	Enables correction of compass reading to present true north instead of magnetic north. Default is no		
Declination Angle [4)]	Float	1	Sets the correction angle when magnetic declination is enabled; use a value between ±180. The declination angle is positive when the magnetic north is east of true north Default is no		

[1)] The property is not applicable/visible when the sensor is connected to a SeaGuard instrument.

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

[3)] Baud rates lower than 9600 may limit the sampling frequency

[4)] Magnetic declination (variation) is the angle between the magnetic north and true north. This angle varies depending on the position on the Earth's surface and alos varies over time. Declination is positive when magnetic north is east of true north and negative when it is to the west (input angle value ±180°). Magnetic declination at the deployment location can be found for i.e. on NOAA website: http://www.ngdc,noaa.gov/geomag-web/

1.3 Specifications for In-line Doppler Current Sensor 5800/5810

Refer Datasheet D 412 which is available on our web site http://www.aanderaa.com or contact aanderaa.info@xyleminc.com

You will find the latest versions of our documents on the web.

CHAPTER 2 Measurement principle

2.1 Short introduction to the ZPulse™ DCS technology

Four transducers transmit short pulses (pings) of acoustic energy along narrow beams. The same transducers receive backscattered signals from scatters that are present in the beams which are used for calculation of the current speed and direction.

Complex acoustic pulses comprising several distinct frequencies are combined into a single acoustic pulse which is sent out in two orthogonal directions at regular time intervals. The ZPulse™ based DCS separates the received signal into different frequency bands, one for each frequency in the transmitted signal. Further it analyses the frequency shift using a high speed Digital Signal Processor. An ARMA based parametric model processing algorithm is used to find the Doppler frequency.

The current speed is derived from the measured frequency shift, the correct speed of sound of the sea water, the measured Instrument Tilt and the Compass Heading. The current speed components are: absolute speed (horizontal speed), the current speed in the North direction and the current speed in the East direction (the north and east speeds are saved for later average calculations).

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

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

2.2 Definition of terms

The transmitted pulse has a fixed length of 0.75m. Internal ringing in the transducers will always occur after transmitting acoustic pulses; the transducers cannot receive backscattered signal until the ringing stops.

For the In-line DCS 5800/5810-series the pulse must have travelled at least a distance of minimum 0.4m before backscattered signals from the pulse can be received by the transducers. This is called the Start Distance. The transducers continue to receive backscattered signal from particles present in the beam until the pulse has propagated a distance equal to the Cell Size (configured by the user). Refer Figure 3-1 for an illustration.

The total area from which the DCS receives backscattered energy is called the Measurement Area. Due to the shape of the pulse, the main contribution to backscattered energy is from particles that are present in an area around the Cell Centre.

The measurement area outside the cell contributes very sparsely to the measured Doppler frequency shift.

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

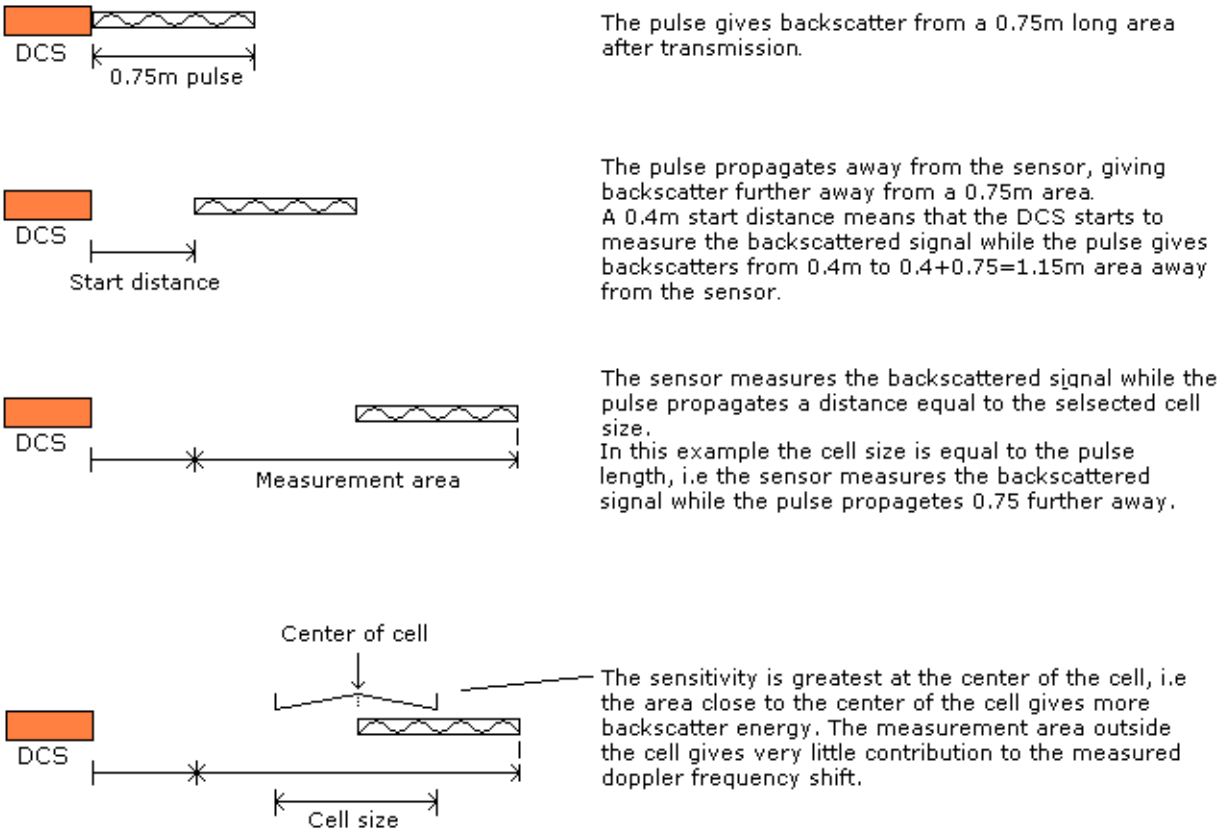


Figure 2-1 Illustration of Pulse, Cell and the Measurement area.

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

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

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

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

2.3 Block schematic of ZPulse™ DCS

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

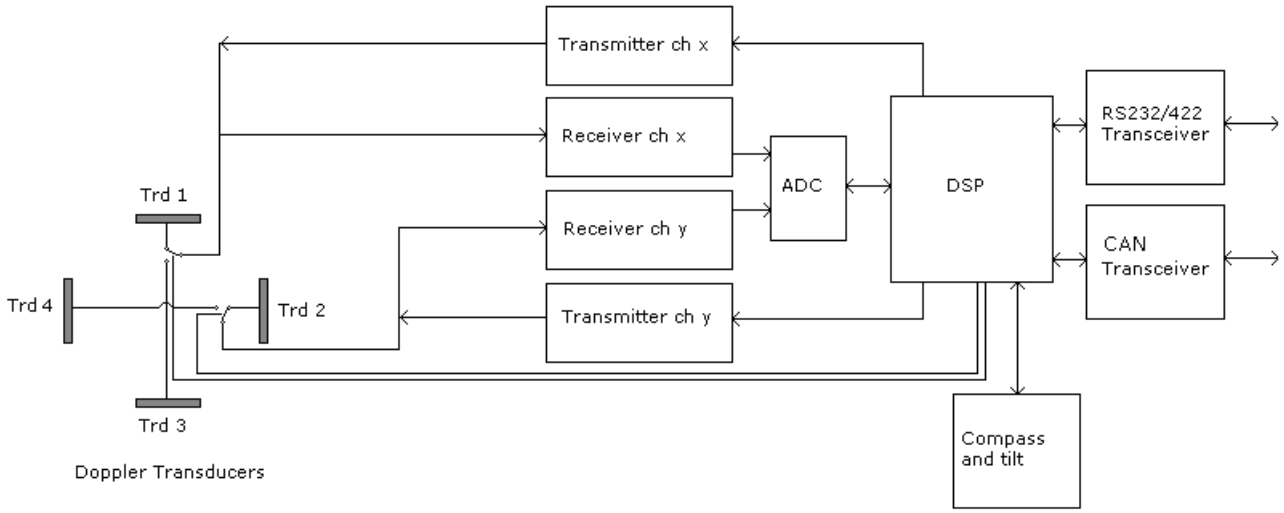


Figure 2-2 Block schematic illustration of the ZPulse™ DCS measurement process.

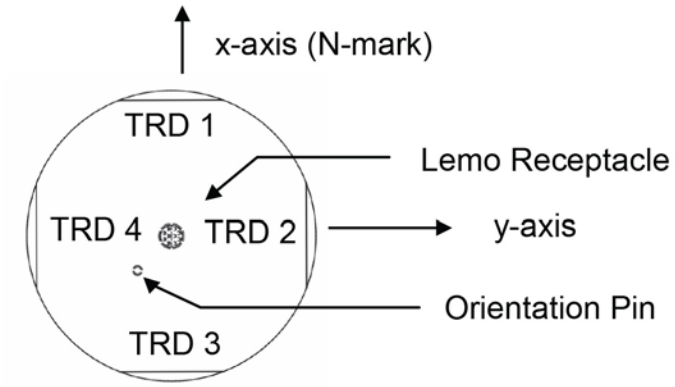


Figure 2-3 Orientation of In-line DCS 5800/5810-series; top view.

CHAPTER 3 Operation mode and version

3.1 Standard ZPulse™ DCS In-line with AiCaP

The standard ZPulse™ In line DCS 5800 and 5810 are used with AiCaP protocol. At delivery, the sensor is configured to AiCaP mode. Ensure that the sensor is configured for AiCaP mode when used in SeaGuard applications; refer chapter 1.2 for Mode property settings.

3.2 R-version ZPulse™ DCS In-line with RS-422

The ZPulse™ DCS In-line 5800R are wired for RS-422 operation and cannot be used for AiCaP operations.

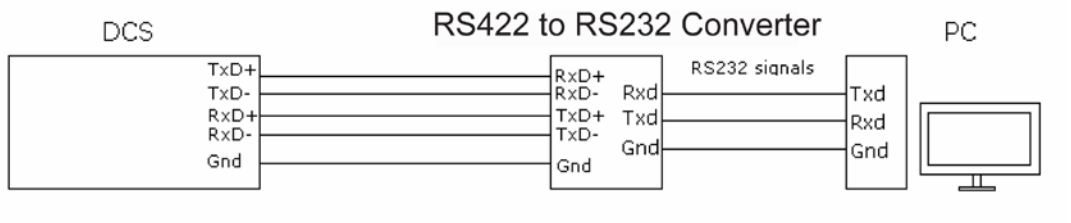


Figure 3-1 ZPulse DCS

3.3 RR-version ZPulse™ DCS In-line with RS-232

The ZPulse™ DCS In-line 5800RR are wired for RS-232 operation and cannot be used for AiCaP operations.

3.4 Sensor pin configuration

Refer Figure 4-2, Figure 4-3 and Figure 4-4 for the Sensor Pin Configuration in CANbus mode, RS-232 mode, and RS-422 mode, respectively. Refer Table 4-1 for a description of the RS-232/RS-422 sensor signals.

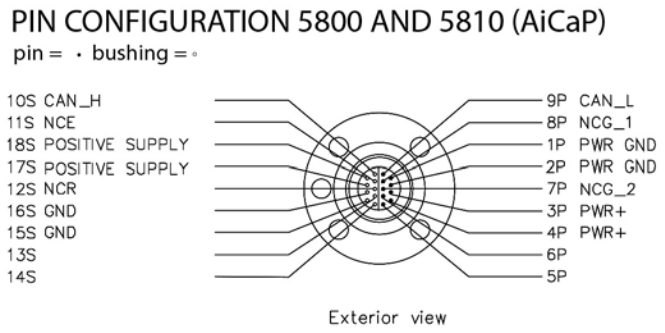


Figure 3-2 Pin configuration for the ZPulse™ DCS In-line AiCaP mode

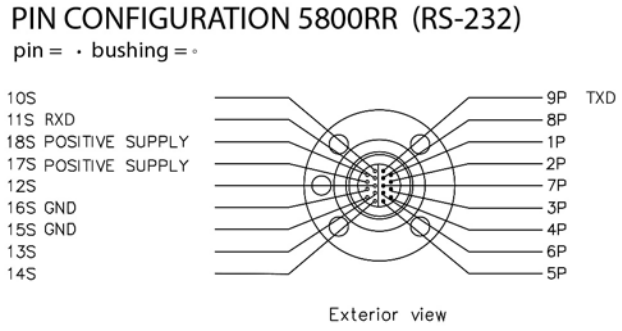


Figure 3-3 Pin configuration for the ZPulse™ DCS In-line in RS-232 mode. Refer Table 3-1for a description of the signal name.

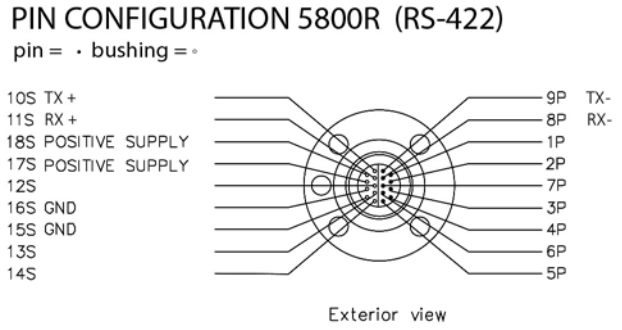


Figure 3-4 Pin configuration for the ZPulse™ DCS In-line in RS-422 mode. Refer Table 3-1for a description of the signal name.

Table 3-1 RS-232/RS-422 signal name and description.

Signal Name	Description
GND	Negative supply
POSITIVE SUPPLY	Positive supply
RS-232 RXD	RS-232 Receive Signal
RS-232 TXD	RS-232 Transmit Signal
RS-422 TX+	RS-422 Transmit signal+ (non-inverting output)
RS-422RX-	RS-422 Receive signal- (inverting input)
RS-422 RX+	RS-422 Receive signal+ (non-inverting input)
RS-422 TX-	RS-422 Transmit signal- (inverting output)

Table 3-2 AiCaP signal name and description.

Signal Name	Description
GND	Negative supply
POSITIVE SUPPLY	Positive supply
CAN H	CANbus line (dominant high)
CAN L	CANbus line (dominant low)
NCR	Node Communication Request
NCE	Node Communication Enable
NCG_1	Node Communication Ground 1
NCG_2	Node Communication Ground 2
PWR GND	Power trough sensor to other equipment i.e SeaGuard
PWR +	Power trough sensor to other equipment i.e SeaGuard

3.5 RS-422 transmission line

RS-422 has differential transmission lines with twisted pairs; the sensor signals are less influenced by external noise than a sensor with RS-232 serial communication.

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

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

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

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

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

Figure 4-5 illustrates the balanced signals of an RS-422 line during transmission of a RS-232 byte. The non-inverting signal is called TxD+ while the inverting signal is called TxD-.

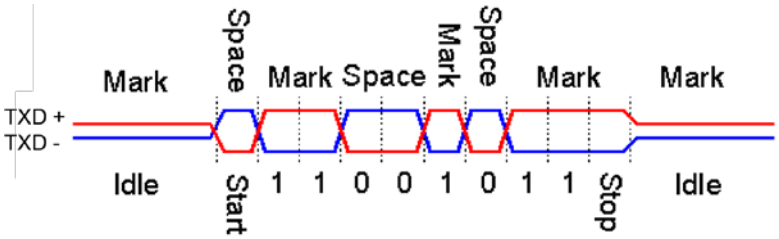


Figure 3-5 Example of a RS-422 signal.

CHAPTER 4 Stand-alone sensor configuration using AADI Real-Time Collector with serial communication

This chapter describes the sensor configuration using AADI Real-Time Collector when the sensors is used as stand-alone with serial communication via the PC COM-port. The menus shown here are slightly different from the menus shown when the sensor is working in AiCaP mode and configured through a data logger via a USB connection to the PC (described in Chapter 4). Install and start the AADI Real-Time Collector software on your PC (provided on the CD delivered with the instrument). For more information about the AADI Real-Time Collector, refer TD 268 AADI Real-Time Collector Operating Manual.

4.1 Establishing a new connection

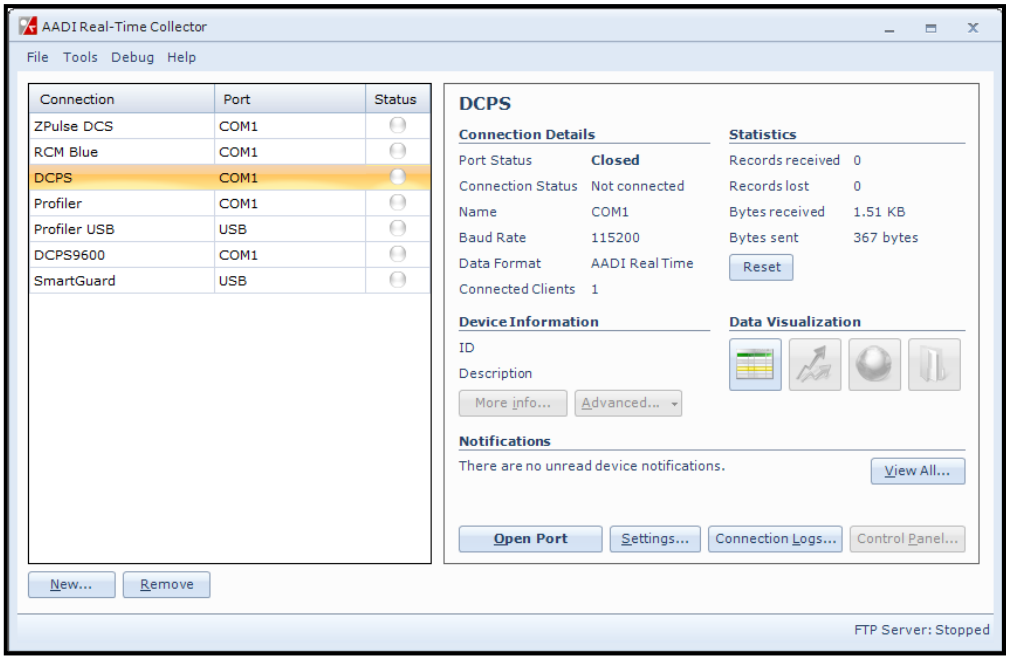
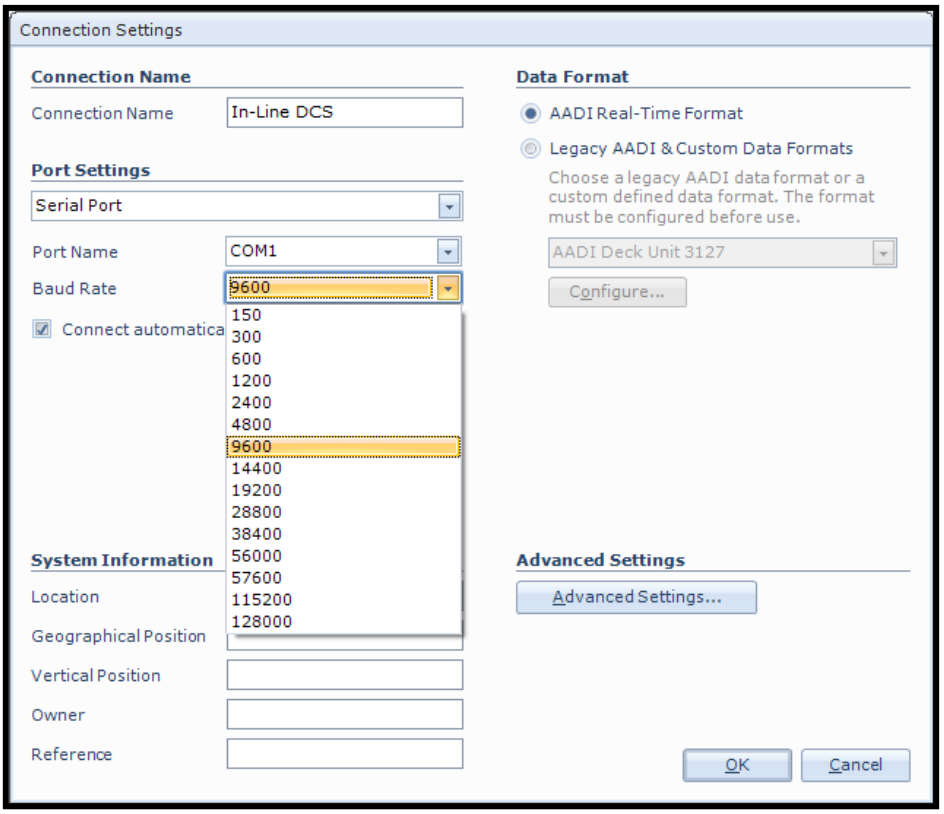


Figure 4-1 AADI Real-Time Collector start up menu.

If the AADI Real-Time Collector program is being used for the first time, the connection list will be empty. Click on the ***New*** button in the lower left corner to create a new connection (refer Figure 4-1).

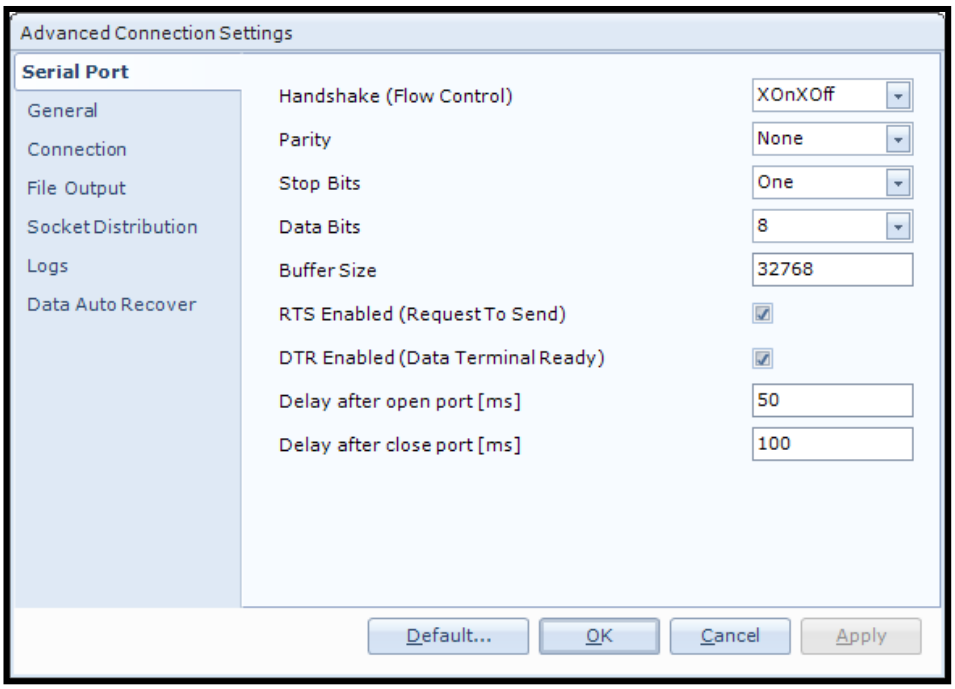
NOTE: This only needs to be done once. AADI real time Collector will automatically reconnect to the sensor at next connection.



Refer Figure 2-2: Give a ***new Connection Name***, choose ***Serial Port***, and choose the correct COM-port on your computer. Select 115200 as baud rate. This is the baud rate set at factory on all DCPS sensors.

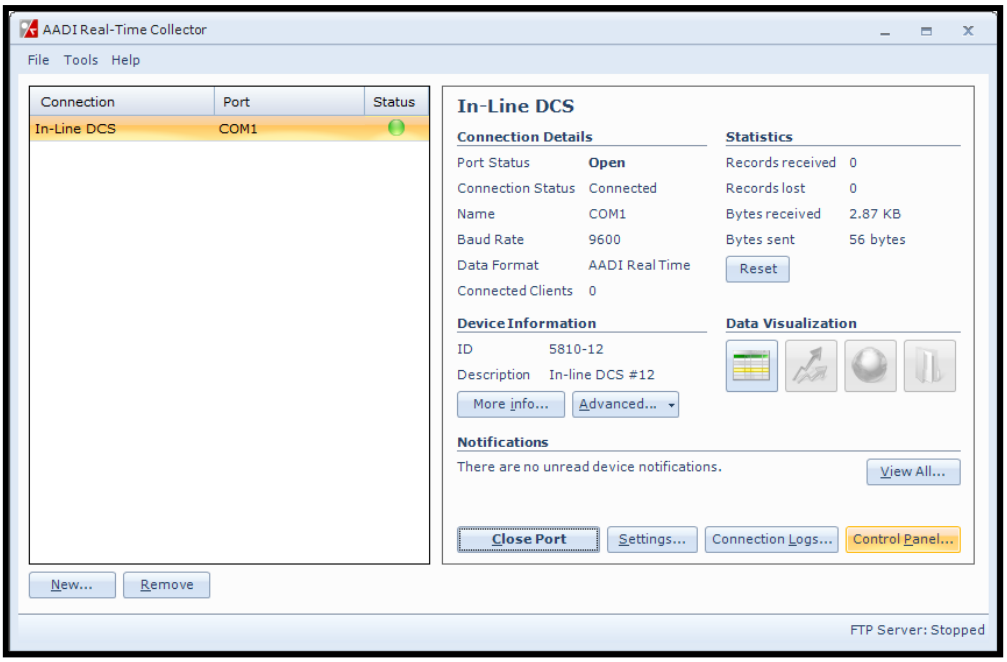
Click on the ***Advanced Settings*** down to the right and select Connection in the list on the left side in the Advanced Connection Settings window as shown below

Figure 4-2 AADI Real Time Collector connection settings.



Under advanced settings as shown in the Figure 2-3: Real-Time collector uses default settings if these are not changed.

Figure 4-3 Advanced connection settings



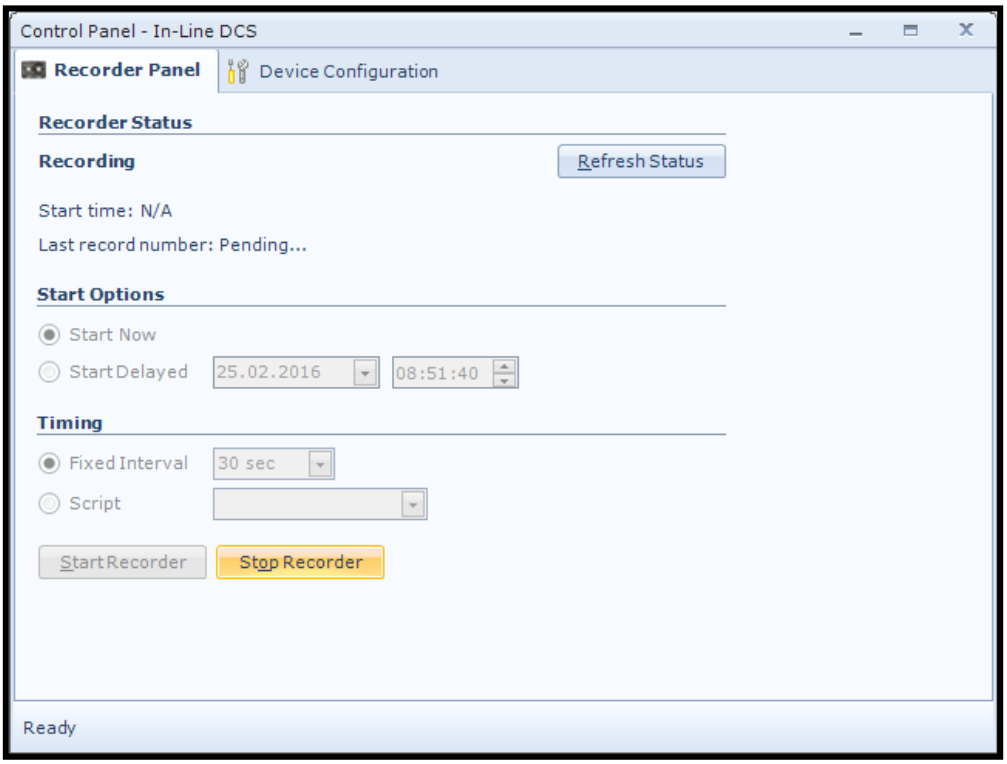
When needed changes in the Advanced Connection Settings have been performed, click on ***Apply*** and ***OK*** in the Advanced Connection Settings window and ***OK*** in Connection Settings Window.

The new connection is now shown in the AADI Real-Time Collector connection list. Choose the new connection and click on the ***Open Port*** button (refer Figure 2-1). The status changes to green when the port is opened.

Figure 4-4 Port Status

4.2 Configuration in the Control Panel

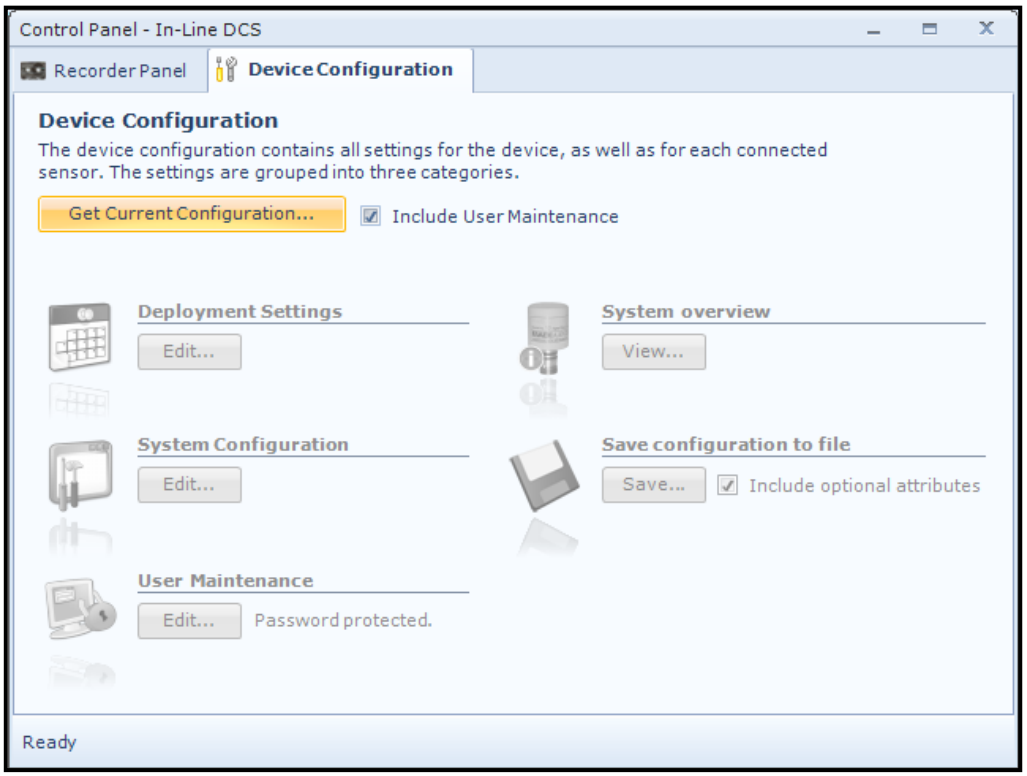
. Click on the ***Control Panel*** button in the lower right corner.



In the **Control Panel**, under the **Recorder Panel**, you can start and stop recordings (refer Figure 2-4)
Click on the ***Stop Recorder*** button if the sensor is running as you are not allowed to configure the sensor when recording.

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

Figure 4-5 Control Panel for the In-line



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

The device configuration is separated into ***Deployment settings***, ***System Configuration***, ***User Maintenance*** and ***System overview***. You can save current settings to a backup file by pressing ***Save…*** under the heading ***Save configuration to file***.
Edit the name for your file and press ***Save…*** to save the new configuration to file in .xml format.

Figure 4-6 Control Panel > Device configuration

Check *Include User Maintenance* to view maintenance settings. ***The password is 1000***.

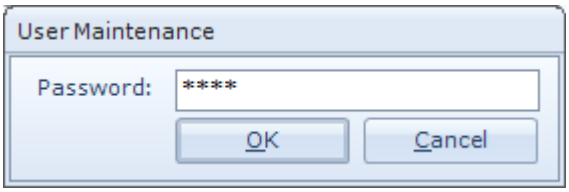


Figure 4-7 Password

User accessible sensor properties are found in Deployment settings, System Configuration and User Maintenance. Refer **Table 1-1** for an overview of the properties. To edit the configuration, click in the value-field and enter new value. Press ***Next*** to update sensor flash and store changes.

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.

4.3 Deployment Settings

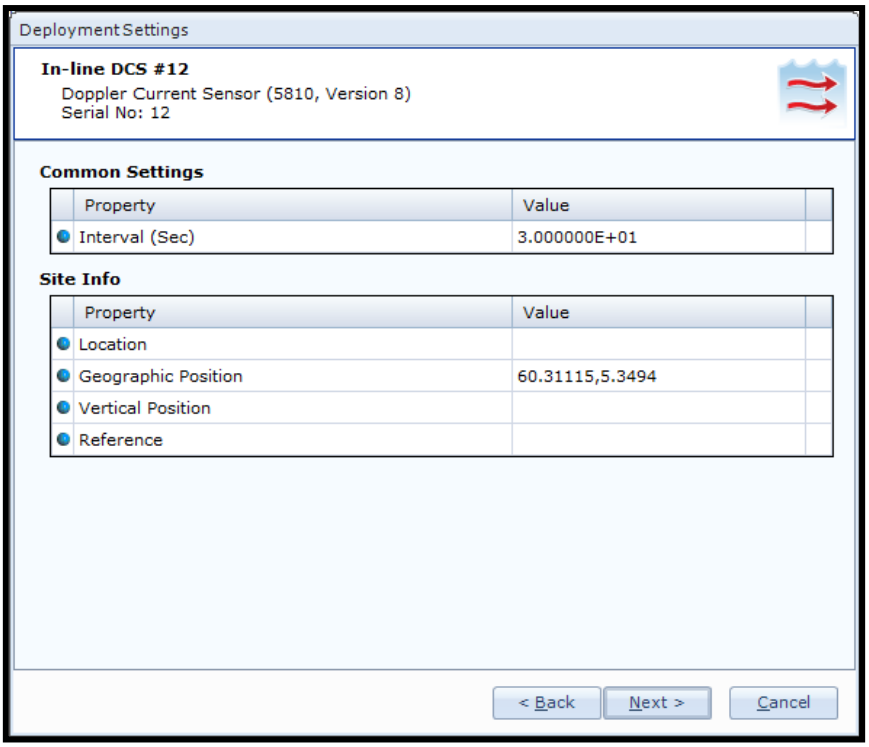


Figure 4-8 Control Panel > Device configuration > deployment settings

As shown in the figure 2-5: under the **Control Panel > Device Configuration** press "***Edit…***" under **Deployment Settings**.
The deployment settings can be configured using a wizard which steps you through the settings.

Refer Figure 2-6: The interval can be changed in the **Deployment Settings** but can also be defined in the Control Panel in the **Recorder Panel** before starting the sensor. It can be changed here also if for example the sensor is going to be used without Real-Time Collector to collect data while running. Explanation of settings is found in table 1-1, Chapter 1.

4.4 System Configuration

The Figure 2-8 shows the properties that can be changed under system configuration. For explanation of settings refer to table 1-1, chapter 1. For configuration details, refer to Chapter 2.4.1 to 2.4.10.

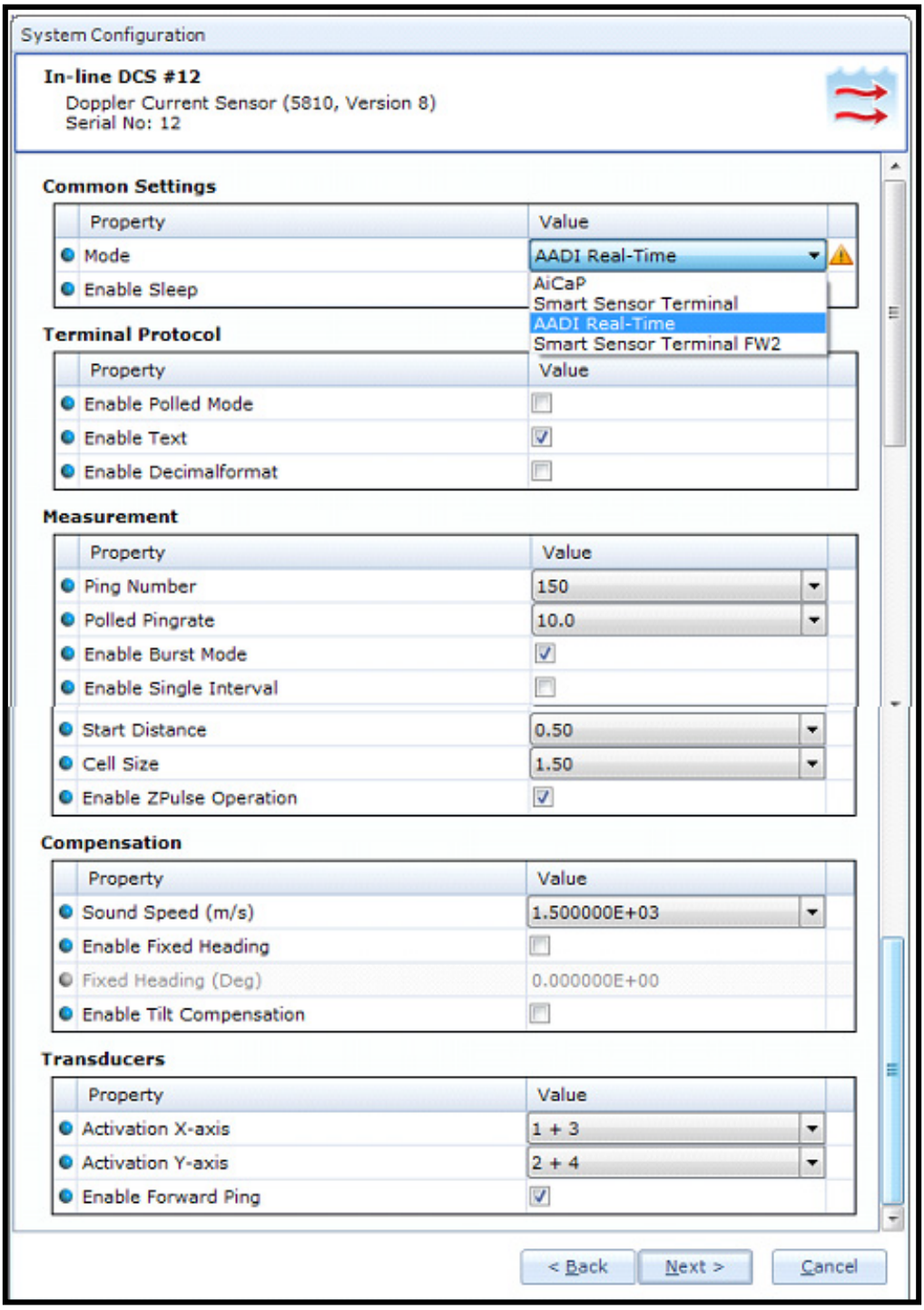


Figure 4-9 Control Panel > Device Configuration > System Configuration

4.4.1 Common settings

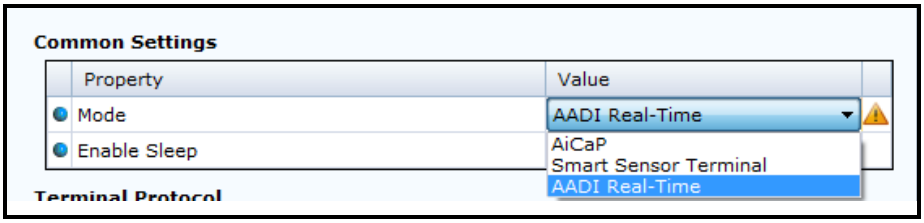


Figure 4-10 Common settings configuration in Control Panel > Device Configuration > System Configuration

Refer to Figure 2-9: the communication protocol has to be defined under "**Mode**". There are three different choices:

- **AADI Real-Time** is the correct mode (protocol) when used together with Real-Time Collector. This is an xml based protocol which includes more metadata in the data messages.
- The **Smart Sensor Terminal** protocol is a simplified protocol which is easier to use together with a PC terminal program. This protocol is described more detailed in **Chapter 3**. It is possible to configure the sensor even if it is set to AiCaP or Smart Sensor Terminal mode when it is connected via RS-232 to the PC, but it is not possible to run and log data with Real-Time Collector unless the sensor is set to AADI Real-Time. Notice that the sensor always has to be reset when the protocol/mode has been changed.
- If the sensor is going to be used on a SeaGuardII or SmartGuard data logger, the mode has to be changed to **AiCaP** mode first and saved before connecting it to the data logger.

4.4.2 Terminal Protocol settings

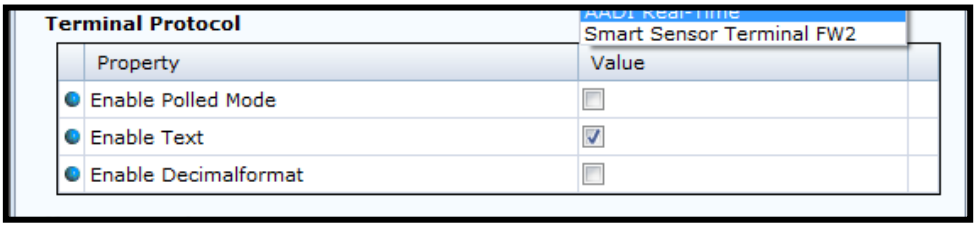


Figure 4-11 Smart Sensor Terminal protocol settings in Control Panel > Device Configuration > System Configuration

The Terminal Protocol settings are available as shown in the Figure2-10 but are only used if the sensor is set to Smart Sensor Terminal protocol. See **Chapter 3** for more details. This mode also opens up for a polled mode where the sensor is pinging on the selected ping rate and outputs data when the user/system polls for data (Do Sample() command).

4.4.3 Measurement settings

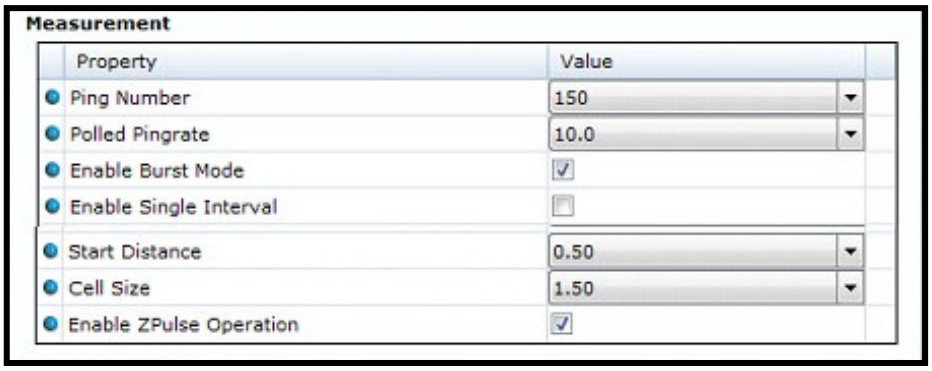


Figure 4-12 Sensor measurement settings in Control Panel > Device Configuration > System Configuration

The sensor can run in burst mode or spread mode. When burst mode is enabled the sensor performs all ping measurements at the end of the recording interval. If it is disabled the ping measurements are evenly spread out during the recording interval. The instrument activates sleep mode between each measurement, which reduces the power consumption. Power consumption in spread and burst mode is about the same. Refer Figure 2-13

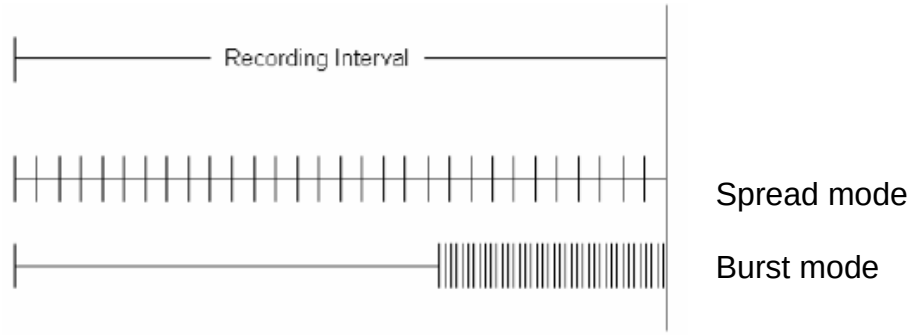


Figure 4-13 Spread mode and burst mode ping distribution during the recording interval

4.4.4 Compensation

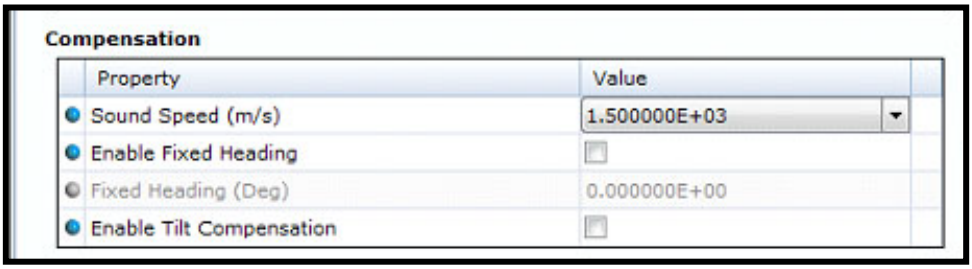


Figure 4-14 System parameter output

The sensor can also calculate some virtual parameters. These are probably more interesting when the sensor is used on a data logger where the sensor can receive external sensor input via the data logger (from external pressure, conductivity and temperature) to calculate a more accurate speed of sound, depth and salinity.

4.4.5 Output enabling – Virtual Sensors

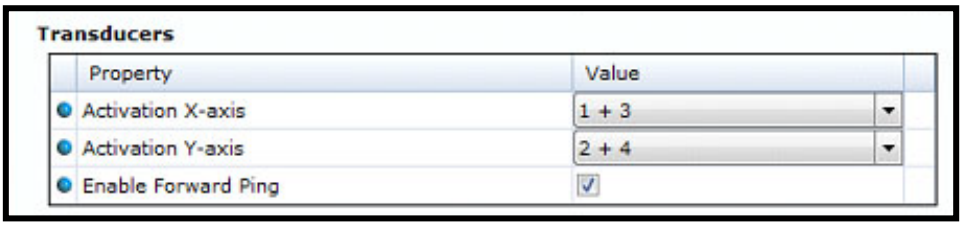


Figure 4-15 Virtual sensors output, additional calculated values

The sensor can also calculate some virtual parameters. These are probably more interesting when the sensor is used on a data logger where the sensor can receive external sensor input via the data logger (from external pressure, conductivity and temperature) to calculate a more accurate speed of sound, depth and salinity.

4.5 User Maintenance settings

Under ***Control Panel > Device Configuration > User Maintenance***, you find properties that are password protected and are set/altered by a **trained** user. **It is not recommended to change properties unless instructed**. To access these, check the "***Include User Maintenance"*** box in the device configuration before clicking on the "***Get Current Configuration…***" button. The password is: **1000**. The user maintenance settings are accessible by clicking the "***Edit…***" button under User Maintenance (refer to Figure 2-5).

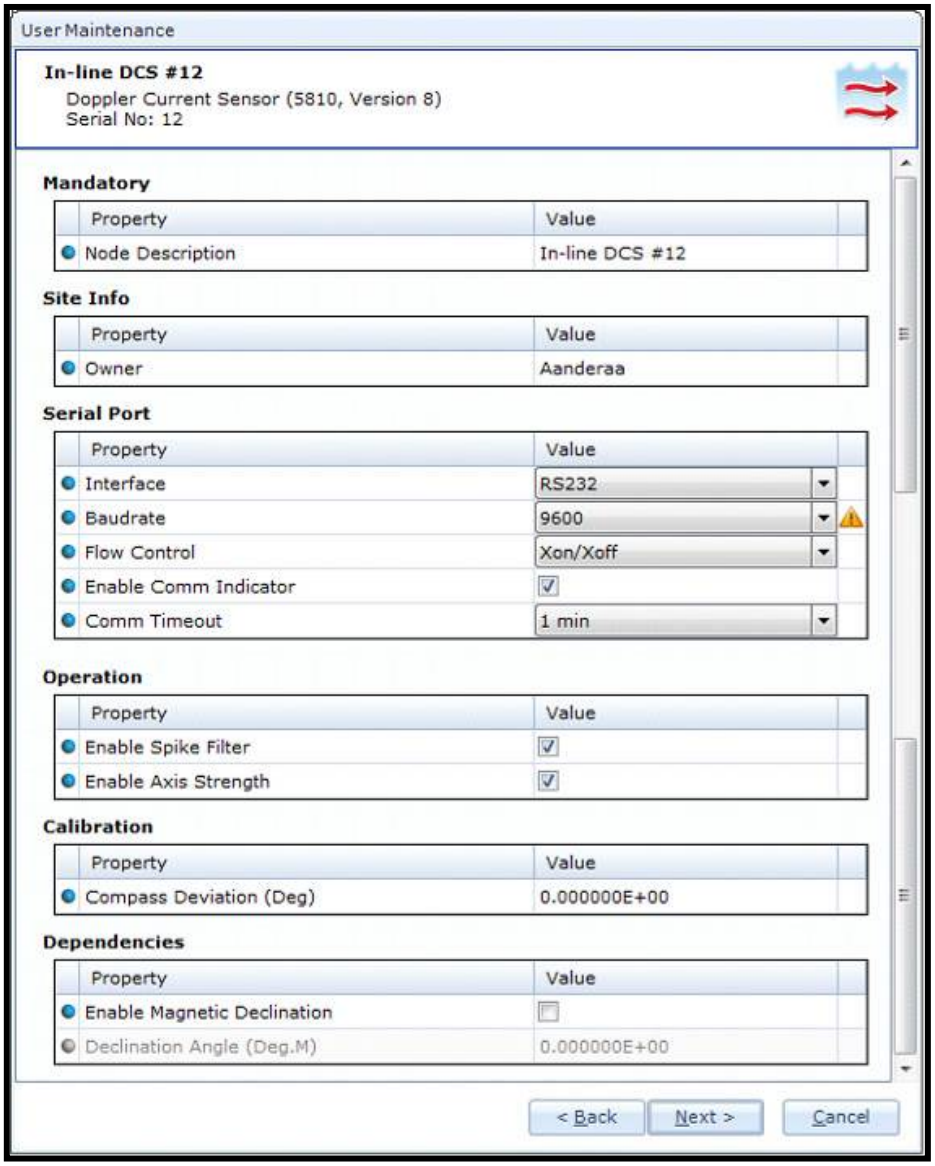


Figure 4-16 Control Panel > Device configuration > User maintenance

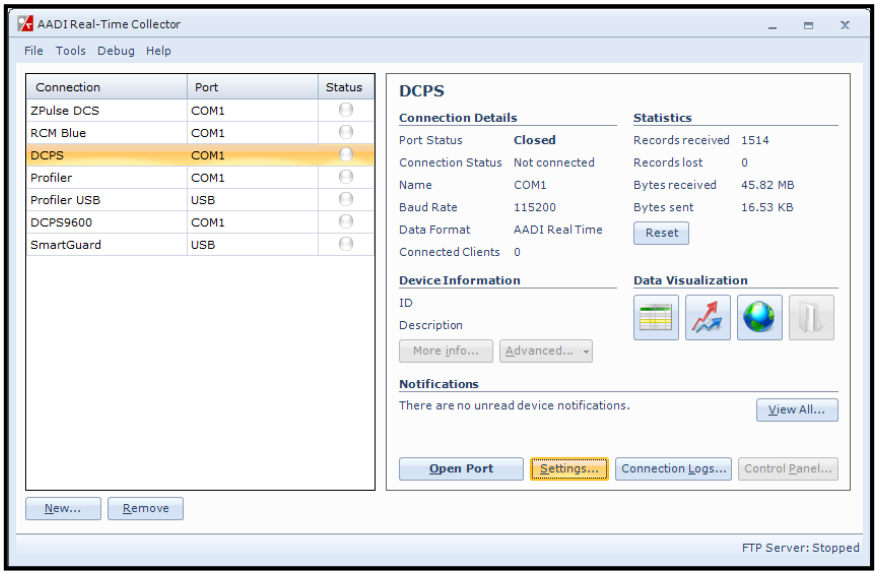
All sensors are given a node description text like DCPS #xxx (xxx is the serial number of the sensor). The user can modify this node description text if required. Be aware that the node description changes to *Corrupt Configuration if it has lost the configuration in flash. Contact the factory if this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

If the sensor is going to be used on longer cables it may be necessary to lower the baud rate. The default setting from factory is 9600.

4.6 Logging data on PC

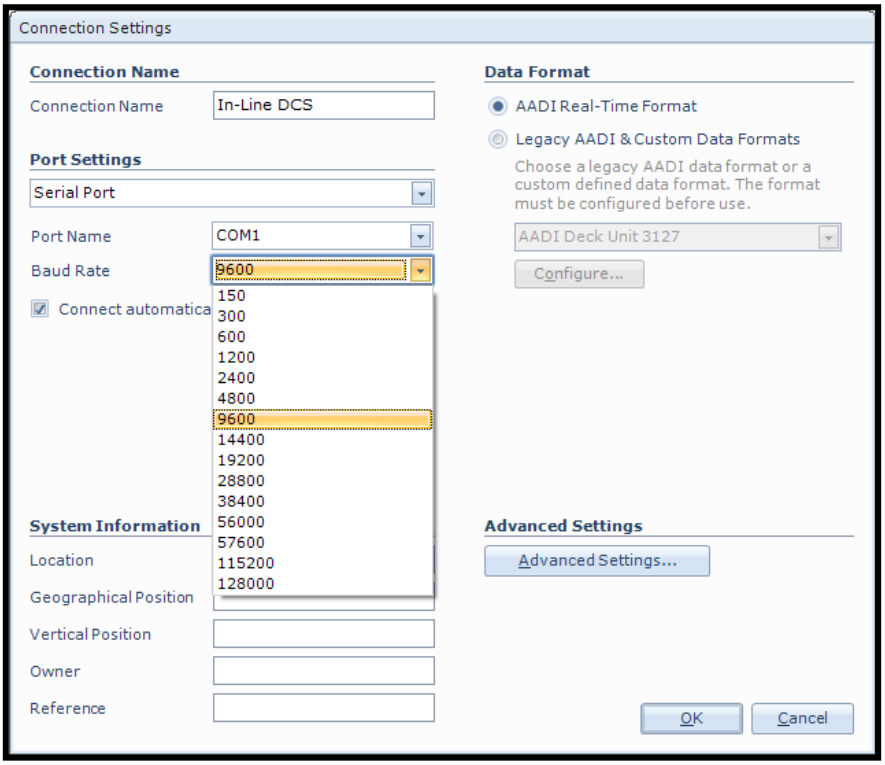
The Real-Time Collector can save the incoming data to file, either to a txt-file or to xml-files. For instructions refer to Chapter 2.6.1 to 2.6.2.

4.6.1 Enabling file output



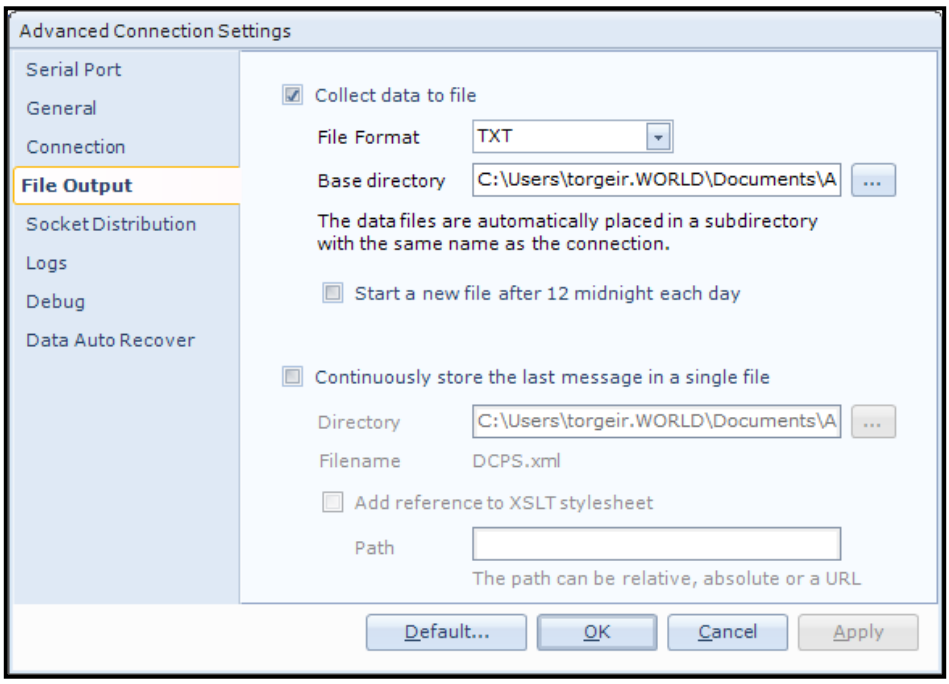
If your connection is open (port open, status green in the AADI Real Time Collector main menu; refer to Figure 2-22), close the port first to be able to change the file output settings. Click on the connection you are using. Click on the "***Settings…"*** button, as shown in Figure 2-22.

Figure 4-17 AADI Real-Time Collector start up menu



Then click on the "***Advanced Settings…"*** button in the Connection Settings window; figure 2-23.

Figure 4-18 Connection settings menu



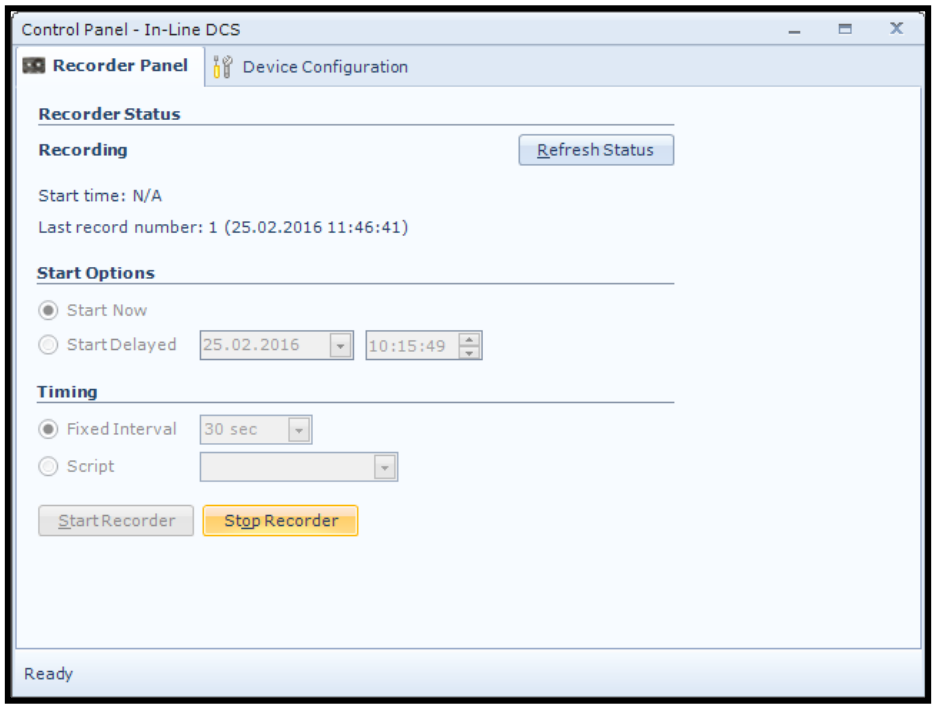
Choose ***File Output*** from the list on the left side. Check the "***Collect data to file"*** box to enable file output. Select a file format and choose a base directory where you want the file to be saved.

Click "**OK"** in the Advanced Connection Settings window, and "**OK"** in the Connection Settings window.

Figure 4-19 Advanced connection settings / File Output

4.6.2 Starting the sensor and logging to file

Click on the connection and "***Open Port***". The Status turns green when the port is opened and connected.Click on the "**Control Panel…"** button in the lower right corner.



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

Figure 4-20 Recorder panel

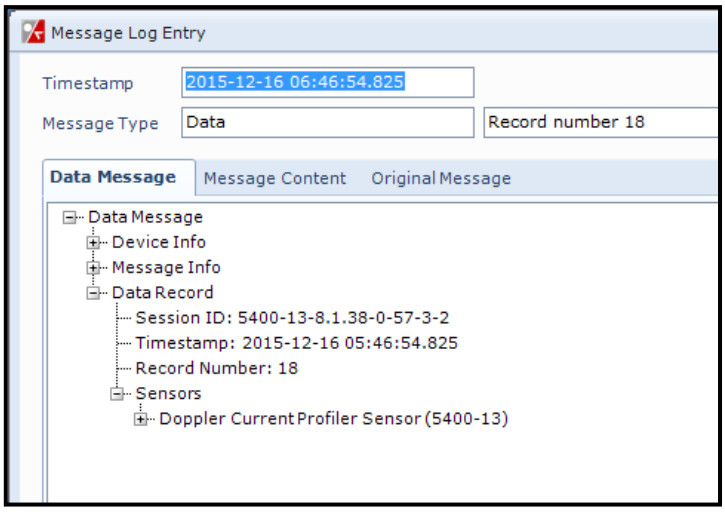
Data will start logging in the defined directory. If it is a txt-file, the easiest way to view it is in Excel. Figure 2-27 gives an example of obtained data file. The different parameters are organized in columns.

	A	B	C	D	E	F	G	H	I	J	K
1	Description	Doppler Current Profiler Sensor									
2	Product Name	Doppler Current Profiler Sensor									
3	Product Number	5400									
4	Serial Number	13									
5	Device ID	5400-13									
6	Session ID	5400-13-8.1.38-0-54									
7	Location										
8	Geographic Posit	60.323605,5.37225									
9	Vertical Position										
10	Owner	Aanderaa									
11	Reference										
12											
13											
14			Doppler Current Profiler Sensor								
15											
16											
17											
18	Record Time	Record Number	Sensor Status	Heading [Deg.M]	Status	Std Dev Heading	Status	Pitch [Deg]	Status	Roll [Deg]	Status
19	11.12.2015 15:50	1	(0) OK	2.89E+02		1.08E+00		7.63E-01		8.67E-03	
20	11.12.2015 15:51	2	(0) OK	2.90E+02		8.54E-01		7.45E-01		2.47E-03	
21	11.12.2015 15:51	3	(0) OK	2.90E+02		9.68E-01		7.67E-01		-5.71E-03	
22	11.12.2015 15:52	4	(0) OK	2.89E+02		9.11E-01		7.61E-01		-5.52E-03	
23	11.12.2015 15:52	5	(0) OK	2.89E+02		8.76E-01		7.76E-01		5.02E-03	
24	11.12.2015 15:53	6	(0) OK	2.88E+02		9.46E-01		7.69E-01		5.51E-03	
25	11.12.2015 15:53	7	(0) OK	2.89E+02		9.20E-01		7.84E-01		1.76E-02	

Figure 4-21 Example of a txt-file obtained from the sensor using RT Collector

4.7 Viewing incoming data in real-time

When the sensor is running, the incoming data can be viewed under "**Connection Logs…**" in the main AADI RT Collector menu (refer to Figure 2-25).



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

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

Figure 4-22 Message Log Entry

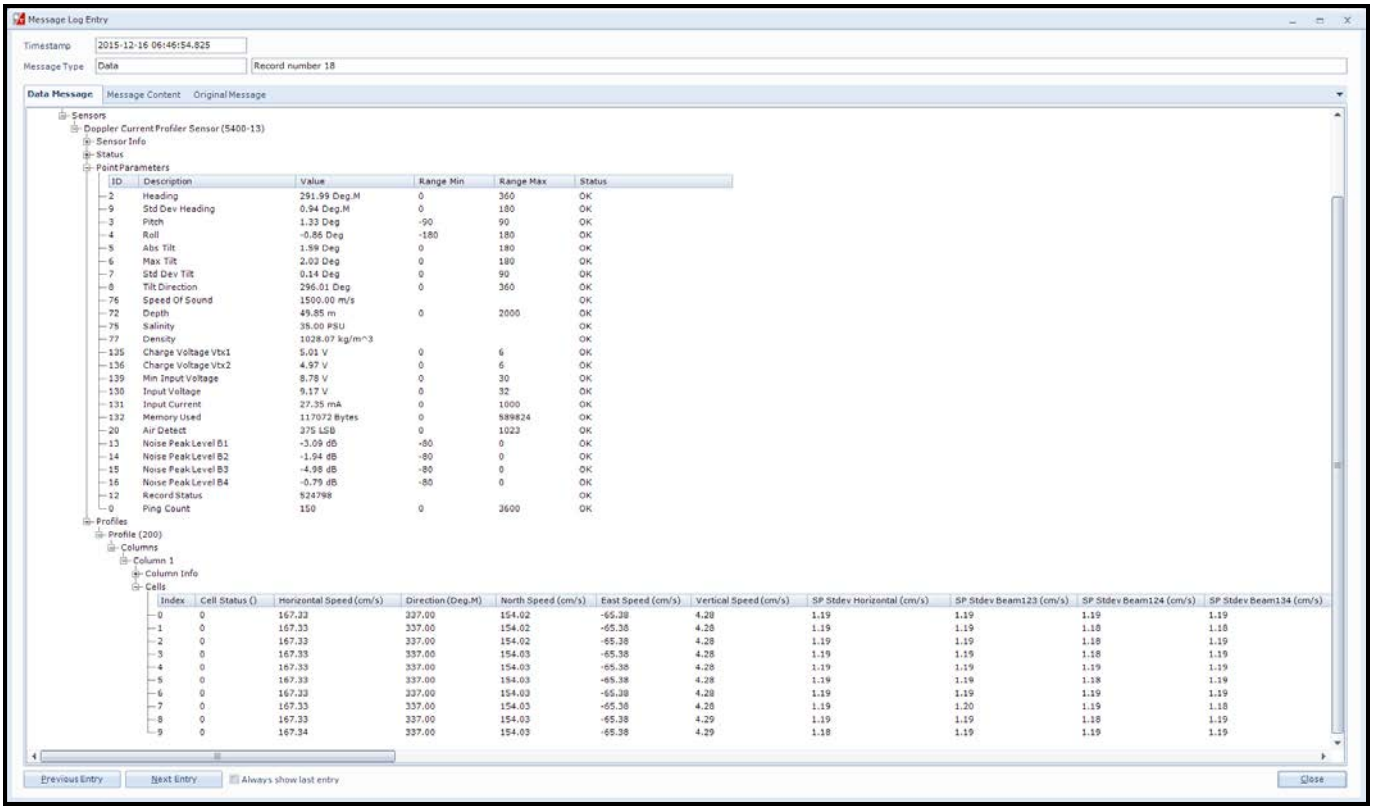


Figure 4-23 Vizualization of incoming data from the sensor in real time

Previous records or newer records (Figure 2-28) can be viewed by clicking on ***Previous Entry*** button or ***Next Entry button***. An automatic update to the last data message can be enabled by checking the Always show last entry check box.

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

CHAPTER 5 Smart Sensor Terminal operation

5.1 Smart Sensor Terminal communication setup

The Sensor communication is a point-to-point full duplex system; the ZPulse™ DCS can transmit output data and receive commands simultaneously (this feature requires that the connected PC can handle Xon/Xoff correctly), refer Table 1-1.

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

9600 Baud

8 Data bits

1 Stop bit

No Parity

Xon/Xoff Flow Control

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

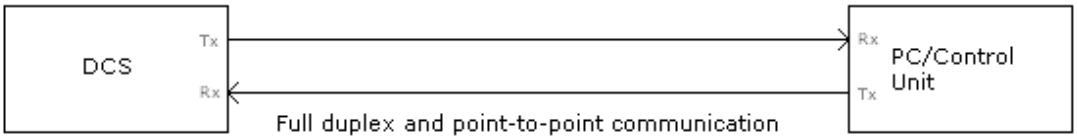


Figure 5-1 Point-to-Point Communication.

5.2 Sensor startup

When property ***Enable Text*** is set to ***Yes***, ***StartupInfo*** is displayed at sensor power up or after reset. ***StartupInfo*** contains this information about product number, serial number, current mode setting, Protocol version for RS-232 operation and Config Version.

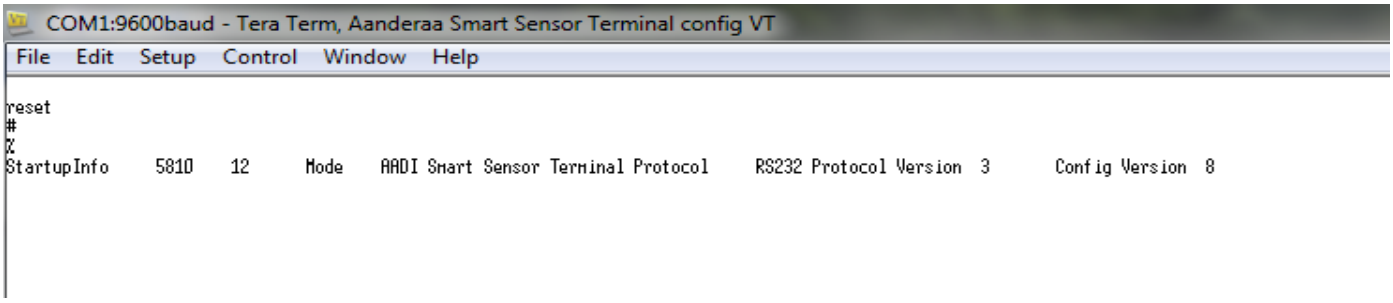


Figure 5-2 Sensor Startup Information

In order to minimize the current drain the sensor normally enters a power down mode after each sampling; the sensor can be awakened by any characters on the RS-232 input, and will stay awake for a time set by the ***Comm TimeOut*** property after receiving the last character, refer chapter 1.2

5.3 Smart Sensor Terminal protocol

The character '%' indicates that communication with the sensor is not possible (communication sleep).

Any character will cause the electronics to return to normal operation; when the sensor has responded with the communication ready indicator, '!', 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 (controlled by the ***Comm TimeOut)*** since the last command.
- If the sensor is in communication 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.

All communication is ASCII coded with the following syntax rules:

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

  MainCmd SubCm or ***MainCmd Property(Value.., Value)***

- 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 a space ' ' character.
- When entering new settings the Property is followed by parentheses containing comma-separated values.
- The command string must be terminated by a 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 the character '*' indicates an error. Both are followed by Carriage Return/Line Feed (CRLF). For most errors a short error message is also given subsequent to the error indicator.
- There are also special commands with short names and dedicated tasks, as save, reset and help.

Available commands for the ZPulse™ Doppler Current Sensor are listed in Table 8-1.

Table 8-1 Available commands for the ZPulse™ DCS 4420/4830/4520/4930.

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

The ***Get*** command is used for reading the value/values of a property.

The command name ***Get***, is followed by Property and returns a string on following format, refer Figure 8-4:

Property ProductNo SerialNo Value, ..Value

#

The string starts with the name of the property (Property), continues with the product number and serial number of the sensor, and finally the value or values of the property.

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).

A special version, ***Get All***, reads out all available properties in the sensor, refer Figure 8-5. Set the passkey to 1000 to read all sensor properties.

The ***Set*** command is used for changing a property, refer Figure 8-3.

Float values may be entered in normal decimal form or exponential form, either with ‘e’ or ‘E’ leading the exponent. Extra spacing in front or after a value is allowed.

Refer chapter 1.3 for a description of available sensor properties for the ZPulse™ DCS.

After changing one or more of the sensor properties, send the ***Save*** command to store the new configuration in the internal flash memory.

The ***Stop*** command stops the sensor measurements e.g. when writing input commands and waiting for acknowledge from the sensor or simply when a measurements series is complete.

The Start command starts the sensor measurements.

To avoid accidental change, most of the properties are write-protected with a Passkey. There are five levels of access protection, refer Table 8-2. After a period of inactivity at the serial input, the access level will revert to default. This period corresponds to the ***Comm TimeOut*** setting, or 1 minutes it the ***Comm TimeOut*** is set to ***Always On***.

Table 8-2 Access protection levels

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

5.4 Set/Get property

Table 1-1 describes the available properties and property settings for the ZPulse™ DCS 4420/4830/4520/4930. Refer next pages for user examples.

Examples of Set/Get Property, Get ConfigXML, Get DataXML

Refer Figure 8-3for an example of setting sensor properties. Type the passkey for the highest access level when setting several properties.

The sensor properties can be read one by one by typing the ***Get*** command for each property as shown in Figure 8-4, or list all properties by typing the ***Get all*** command, refer Figure 8-5; set the Passkey to 1000 to see all available properties. The sensor responds to ***Get all*** command by sending a # (followed by CR+LF); next the sensor outputs the property name followed by the product number, serial number and the property setting. Each field is separated by a tabulator character, and each property is listed in separate lines.

The ***Get ConfigXML*** command outputs all available properties in XML-format, refer Figure 8-6. The ***Get DataXML*** command outputs all available parameters in XML-format, refer Figure 8-7.

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

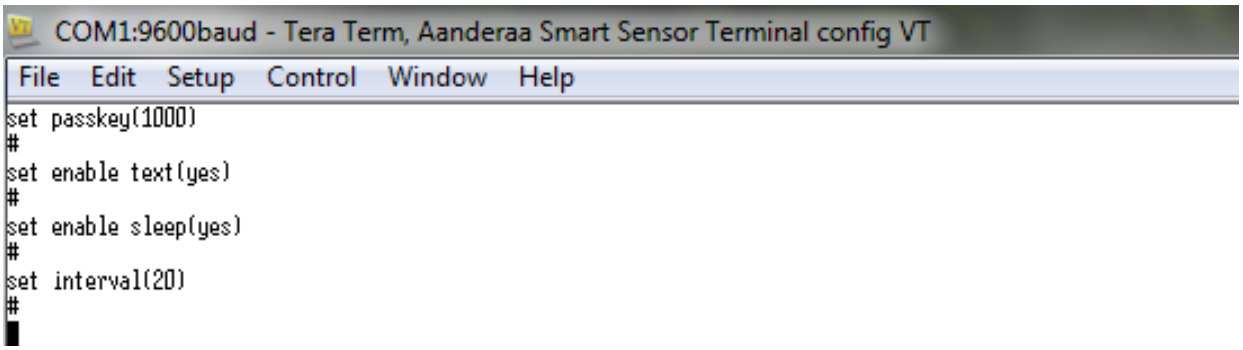


Figure 5-3 Examples of typing Set commands.

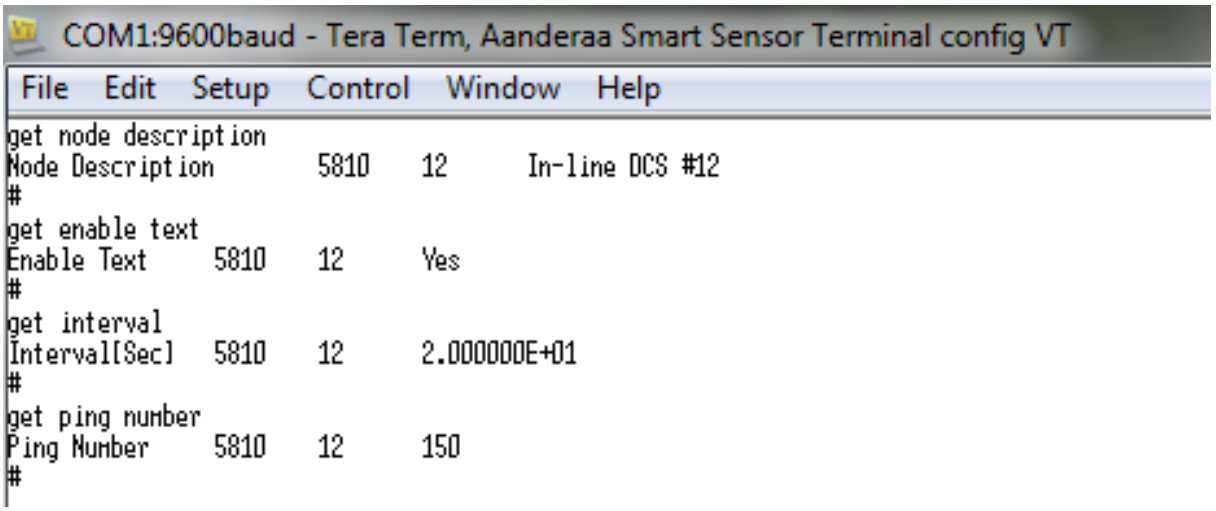


Figure 5-4 Examples of typing Get commands.

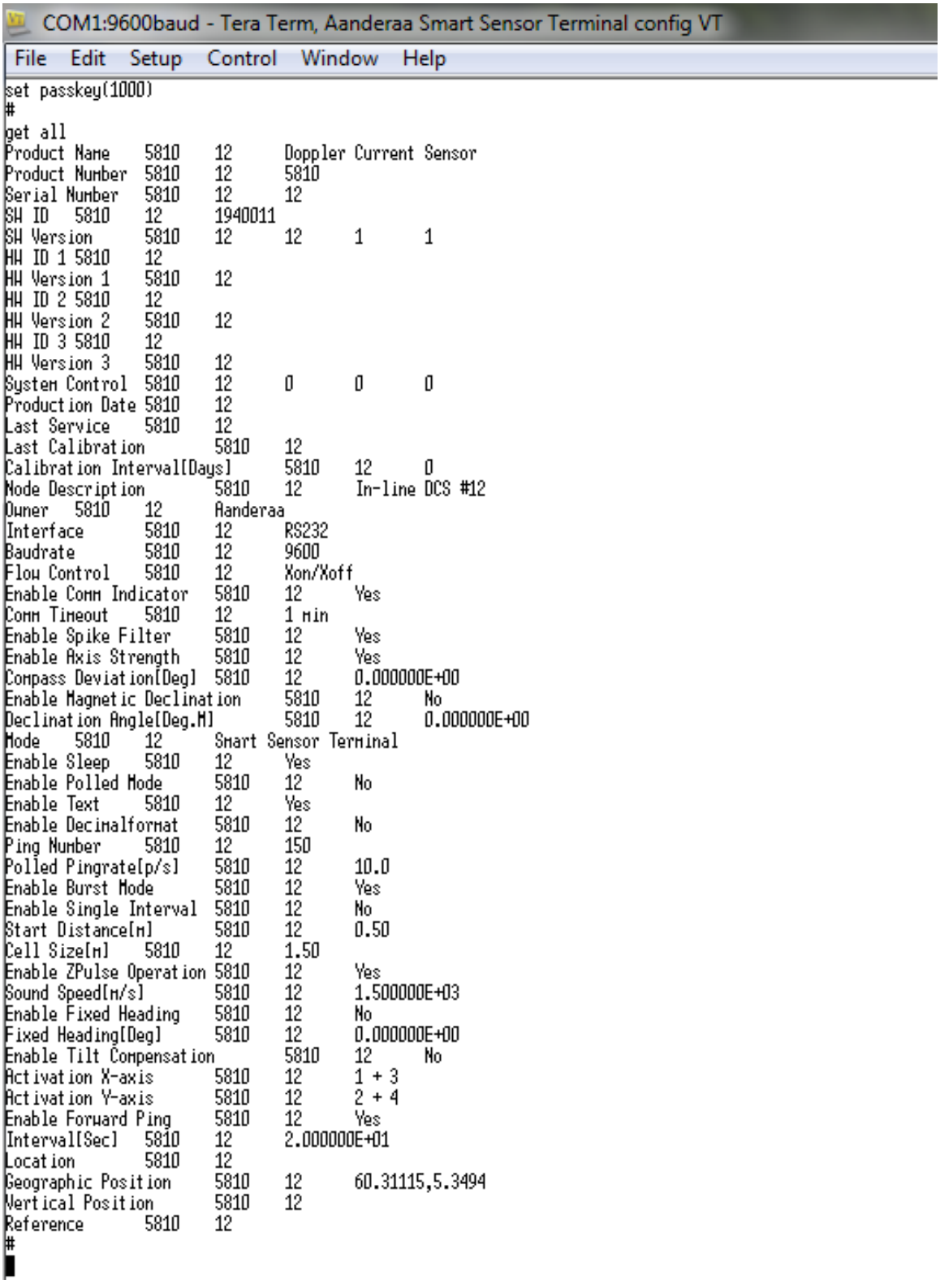


Figure 5-5 Sensor response to a Get all command.

COM1:9600baud - Tera Term, Aanderaa Smart Sensor Terminal config VT

File Edit Setup Control Window Help

```
get configXML

<NodeConfig ID="5810-12" SerialNo="12" ProdNo="5810" ProdName="Doppler Current Sensor" Descr="In-line DCS #12" Adr="511" IsSensor="true" ProtocolVer="6" ConfigVer="8" NodeTypeID="2000">
        <ConfigCategory ID="0" Descr="Factory Maintenance">
                <PropertyCategory ID="0" Descr="Mandatory">
                        <Property ID="0" Descr="Product Name" Type="VT_BSTR" Access="R1W4">Doppler Current Sensor</Property>
                        <Property ID="1" Descr="Product Number" Type="VT_BSTR" Access="R1W4">5810</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">1940011</Property>
                        <Property ID="3" Descr="SW Version" Type="VT_ARRAY|VT_I2" Access="R1">12;1;1</Property>
                </PropertyCategory>
                <PropertyCategory ID="4" Descr="Hardware">
                        <Property ID="0" Descr="HW ID 1" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="1" Descr="HW Version 1" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="2" Descr="HW ID 2" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="3" Descr="HW Version 2" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="4" Descr="HW ID 3" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="5" Descr="HW Version 3" Type="VT_BSTR" Access="R3W4" />
                </PropertyCategory>
                <PropertyCategory ID="1" Descr="System Control">
                        <Property ID="0" Descr="System Control" Type="VT_ARRAY|VT_I2" Access="R3W4">0;0;0</Property>
                </PropertyCategory>
                <PropertyCategory ID="2" Descr="Service Info">
                        <Property ID="0" Descr="Production Date" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="1" Descr="Last Service" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="2" Descr="Last Calibration" Type="VT_BSTR" Access="R3W4" />
                        <Property ID="3" Descr="Calibration Interval" Type="VT_I4" Unit="Days" Access="R3W4">0</Property>
                </PropertyCategory>
        </ConfigCategory>
        <ConfigCategory ID="1" Descr="User Maintenance">
                <PropertyCategory ID="0" Descr="Mandatory">
                        <Property ID="0" Descr="Node Description" Type="VT_BSTR" Access="R1W2">In-line DCS #12</Property>
                </PropertyCategory>
                <PropertyCategory ID="1" Descr="Site Info">
                        <Property ID="0" Descr="Owner" Type="VT_BSTR" Access="R1W3">Aanderaa</Property>
                </PropertyCategory>
                <PropertyCategory ID="2" Descr="Serial Port">
                        <Property ID="2" Descr="Interface" Type="VT_I4" Access="R3W3" Enum="RS232=0">0</Property>
                        <Property ID="0" Descr="Baudrate" Type="VT_I4" Access="R3W3" StandAlone="true" Enum="4800=4800;9600=9600;57600=57600;115200=115200" ResetRequired="true">9600</Property>
                        <Property ID="3" Descr="Flow Control" Type="VT_I4" Access="R3W3" StandAlone="true" Enum="None=0;Xon/Xoff=2">2</Property>
                        <Property ID="4" Descr="Enable Comm Indicator" Type="VT_BOOL" Access="R3W3" StandAlone="true">true</Property>
                        <Property ID="1" Descr="Comm Timeout" Type="VT_I4" Access="R3W3" StandAlone="true" Enum="Always On=0;10 s=10;20 s=20;30 s=30;1 min=60;2 min=120;5 min=300;10 min=600">60</Pro
                </PropertyCategory>
                <PropertyCategory ID="16" Descr="Operation">
                        <Property ID="0" Descr="Enable Spike Filter" Type="VT_BOOL" Access="R3W3">true</Property>
                        <Property ID="1" Descr="Enable Axis Strength" Type="VT_BOOL" Access="R3W3">true</Property>
                </PropertyCategory>
                <PropertyCategory ID="10" Descr="Calibration">
                        <Property ID="0" Descr="Compass Deviation" Type="VT_R4" Unit="Deg" Format="%0.3f" Access="R3W3">0.000000E+00</Property>
                </PropertyCategory>
                <PropertyCategory ID="11" Descr="Dependencies">
                        <Property ID="0" Descr="Enable Magnetic Declination" Type="VT_BOOL" Access="R3W3">false</Property>
                        <Property ID="1" Descr="Declination Angle" Type="VT_R4" Unit="Deg.M" Format="%0.3f" Min="-180" Max="180" Access="R3W3" EnableDependencyID="0">0.000000E+00</Property>
                </PropertyCategory>
        </ConfigCategory>
        <ConfigCategory ID="2" Descr="System Configuration">
                <PropertyCategory ID="1" Descr="Common Settings">
                        <Property ID="0" Descr="Mode" Type="VT_I4" Access="R1W2" StandAlone="true" Enum="AiCaP=0;Smart Sensor Terminal=1;AADI Real-Time=2;Smart Sensor Terminal FW2=3" ResetRequired=
                        <Property ID="1" Descr="Enable Sleep" Type="VT_BOOL" Access="R1W2" StandAlone="true">true</Property>
                </PropertyCategory>
                <PropertyCategory ID="2" Descr="Terminal Protocol">
                        <Property ID="2" Descr="Enable Polled Mode" Type="VT_BOOL" Access="R1W2" StandAlone="true">false</Property>
                        <Property ID="0" Descr="Enable Text" Type="VT_BOOL" Access="R1W2" StandAlone="true">true</Property>
                        <Property ID="1" Descr="Enable Decimalformat" Type="VT_BOOL" Access="R1W2" StandAlone="true">false</Property>
                </PropertyCategory>
                <PropertyCategory ID="50" Descr="Measurement">
                        <Property ID="0" Descr="Ping Number" Type="VT_I4" Format="%d" Min="0" Max="600" Access="R1W1" Enum="50=50;60=60;75=75;100=100;150=150;200=200;250=250;300=300;350=350;400=400
                        <Property ID="1" Descr="Polled Pingrate" Type="VT_R4" Unit="p/s" Format="%0.2f" Min="0" Max="600" Access="R1W1" StandAlone="true" Enum="0.1=1.000000E-01;0.5=5.000000E-01;1.0
                        <Property ID="5" Descr="Enable Burst Mode" Type="VT_BOOL" Access="R1W2">true</Property>
                        <Property ID="6" Descr="Enable Single Interval" Type="VT_BOOL" Access="R1W1" StandAlone="true">false</Property>
                        <Property ID="2" Descr="Start Distance" Type="VT_R4" Unit="m" Format="%0.2f" Access="R2W2" Enum="0.40=4.000000E-01;0.50=5.000000E-01;0.60=6.000000E-01;0.70=7.000000E-01;0.80
                        <Property ID="3" Descr="Cell Size" Type="VT_R4" Unit="m" Format="%0.2f" Access="R2W2" Enum="0.75=7.500000E-01;0.90=9.000000E-01;1.00=1.000000E+00;1.10=1.100000E+00;1.20=1.20
                        <Property ID="4" Descr="Enable ZPulse Operation" Type="VT_BOOL" Access="R2W2">true</Property>
                </PropertyCategory>
                <PropertyCategory ID="51" Descr="Compensation">
                        <Property ID="0" Descr="Sound Speed" Type="VT_R4" Unit="m/s" Format="%0.2f" Min="1350" Max="1600" Access="R2W2" Defaults="1.473000E+03;1.500000E+03;1.525000E+03">1.500000E+0
                        <Property ID="2" Descr="Enable Fixed Heading" Type="VT_BOOL" Access="R2W2">false</Property>
                        <Property ID="3" Descr="Fixed Heading" Type="VT_R4" Unit="Deg" Format="%0.3f" Access="R2W2" EnableDependencyID="2">0.000000E+00</Property>
                        <Property ID="1" Descr="Enable Tilt Compensation" Type="VT_BOOL" Access="R2W2">false</Property>
                </PropertyCategory>
                <PropertyCategory ID="22" Descr="Transducers">
                        <Property ID="0" Descr="Activation X-axis" Type="VT_I4" Access="R2W2" Enum="1 + 3=0;1=1;3=2">0</Property>
                        <Property ID="1" Descr="Activation Y-axis" Type="VT_I4" Access="R2W2" Enum="2 + 4=0;2=1;4=2">0</Property>
                        <Property ID="2" Descr="Enable Forward Ping" Type="VT_BOOL" Access="R2W2">true</Property>
```

Figure 5-6 Example of sensor response to Get ConfigXML

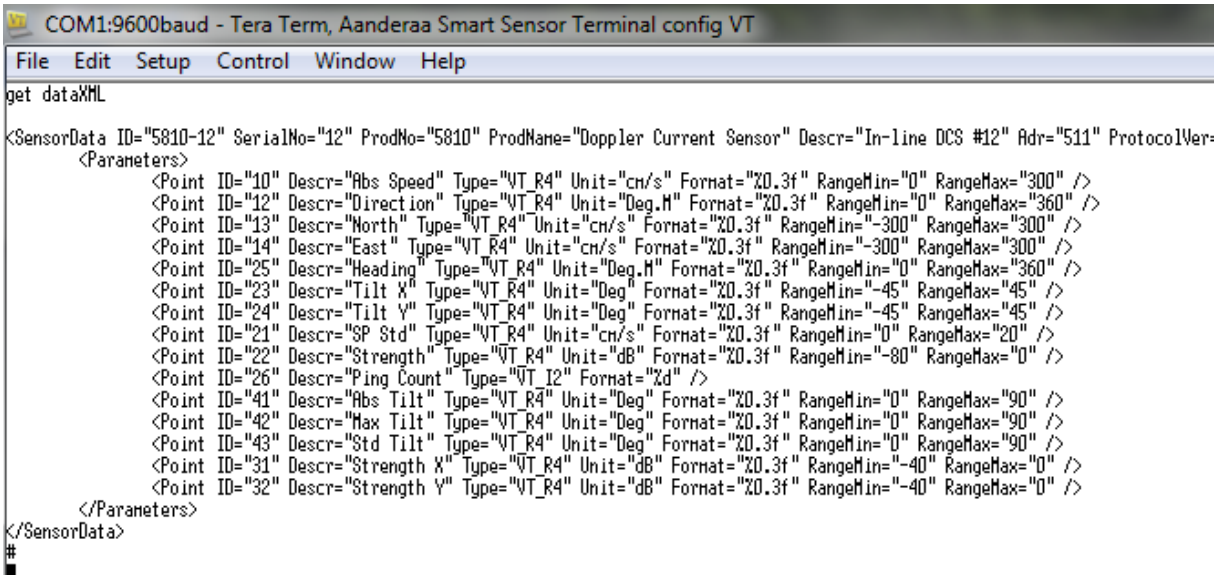


Figure 5-7 Example of sensor response to Get DataXML

5.5 Scripting –sending a string of commands

Often it may be useful to collect more than one command in a text file e.g. the following text can be written in an ordinary text editor and saved as a text file.

// Set sampling interval to 30 seconds

Set Passkey(1)

Set Interval(30)

Save

Get All

This file can then be sent to the sensor in one operation. The first line is a user comment line that is disregarded by the sensor. Strings starting with either '//' or ';' are ignored by the software, and do not produce any errors or acknowledge.

5.6 Sleep

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 character do not interfere with the command syntax. The serial interface will then be active until a period of input inactivity specified by the ***Comm TimeOut*** value (10 s,20 s,30 s,1 min,2 min,5 min,10 min).

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

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.

CHAPTER 6 Sensor parameters

Table 2-1 presents an overview of parameters provided by the In-line DCS 5800/5810-series.

Data are normally output in the same order as listed in Table 2-1 (in Smart Sensor Terminal mode). Each parameter can be read with a Get command using the RS-232 Protocol, refer chapter 8.

Table 2-1 Overview of available data parameters for ZPulse™ DCS 4420/4830/4520/4930

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

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.

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

7.1 Retrieval of the sensor

Clean the Transducer Head after each deployment.

Note!

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

Always leave the Transducer Head uncoated.

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

Be sure to follow the safety precaution for such acids.

7.2 Factory service

Factory service is offered for maintenance, repair or calibration.

When returning the ZPulse™ DCS for service, always include the Instrument Service Order, Form No. 135, see our web pages under 'Support and Training'.

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

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

7.3 Test of ZPulse™ DCS 4420/4830/4520/4930

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

Sensor readings when operating in air:

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

7.4 SeaGuard applications

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

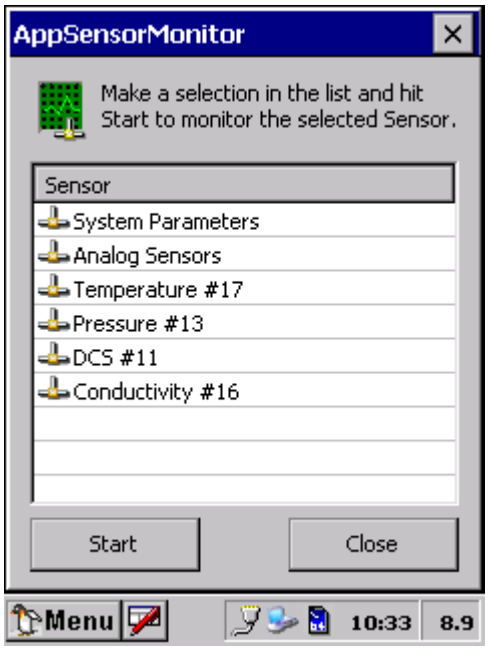


Figure 7-1 Select sensors to monitor

Open Administrative Tools -> Sensor Monitor.

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

Select the DCS from the list and press Start, refer Figure 10-1.

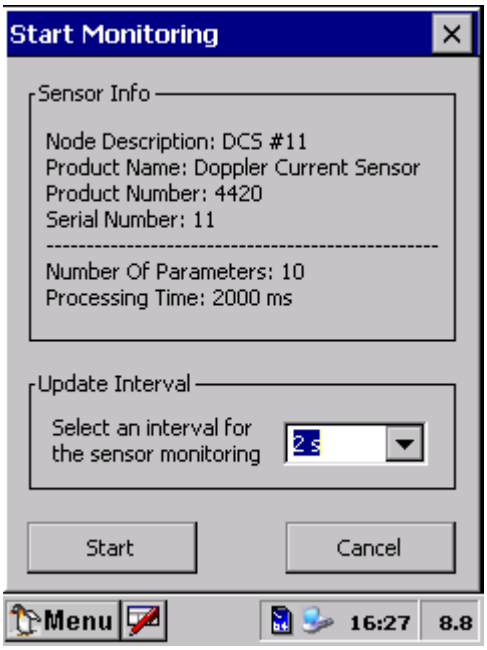


Figure 7-2 Set the update interval

The next window shows sensor information like the Node Description, Product name and number and Serial number, refer Figure 10-2.

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

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

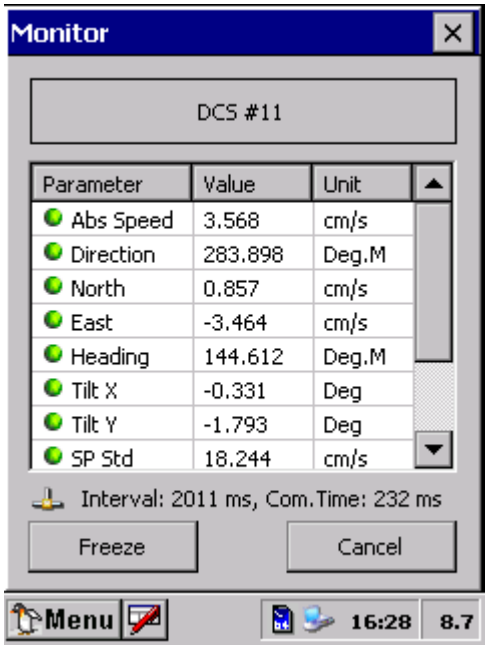


Figure 7-3 Monitor sensor readings.

The parameter reading in engineering units is shown as illustrated in Figure 10-3. The reading updates according to the update interval.

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

Press Cancel to stop the monitoring.

The sensor readings should be according to the description in chapter 10.3.

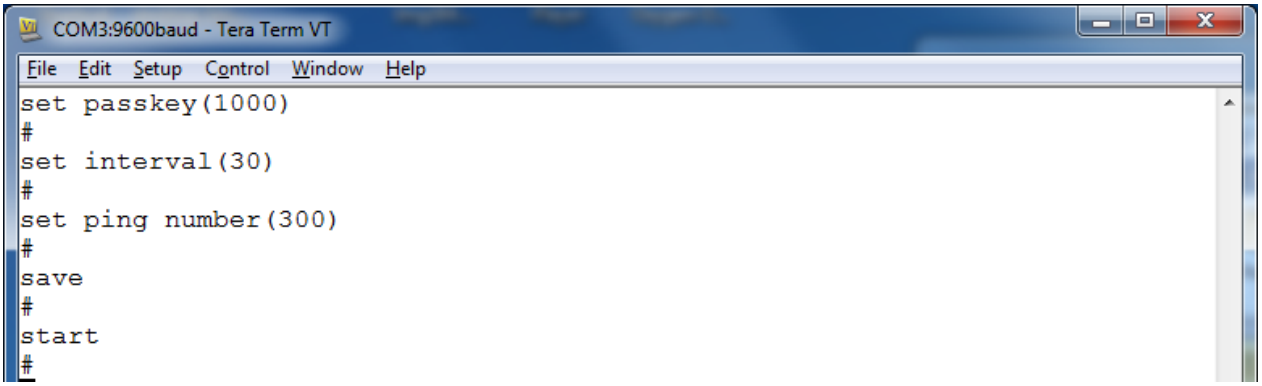
Procedure for test of the ZPulse DCS sensor 4420/4830R/4520/4930R:

1. Connect power to the sensor.
2. Wake up the sensor.
3. Set the interval in seconds.

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

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

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



After the ***Start*** command the sensor starts the first 10s measurement interval. A ticking can be heard from the transducer head. After 10s the sensor outputs all the measurement parameters, as illustrated in chapter 8.2.

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

The sensor readings should be according to the description in chapter 10.3.

7.5 Example of Test & Specification sheet and Certificates

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TEST & SPECIFICATIONS

Form No. 769, Jun 2008

Layout No: **Product:** DCS 4830R
Circuit Diagram No: **Serial No:** Demo

Digital Board
1. Tested according to Test Procedure Form 754.

Analog Board
2. Tested according to Test Procedure Form 757.

Complete Sensor
3. Tested according to Test Procedure Form 759.

Performance test and results from Test Procedure Form 759

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

5. Current Consumption

5.1.	Quiescent, no ping (maximum 220 µA)	222.00µA
5.2.	Total with one ping each second (maximum 14.5 mA)	12.40mA

6. Compass and Tilt sensor
- 6.1. Compass calibrated and verified to be within ±2.0° at 0° tilt and ±3.5° at 30° tilt.

7. Tilt Compensation
- 7.1. Tilt sensor calibrated and verified to be within ±1.0° in the range from +35° to -35° on both axes.

8. Performance test
- 8.1. The sensor is tested with Test Unit 3731 during climatic tests to control sensor performance over the whole temperature range.
- 8.2 The direction data is also controlled by changing the direction of the Test Unit 3731.

Date: 22 Jan 2013

Sign:
Halvard Skurve
Halvard Skurve, Production Engineer

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

Figure 7-4 Example of Test and Specification sheet

AADI a xylem brand

CALIBRATION CERTIFICATE

Form No. 726, June 2007

Product: DCS 4830R **Serial No:** Demo
Calibration Date: 04 Apr 2013

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

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

Calibration points and readings:

Parameter: Temperature

Calibration points and readings

Temperature (°C)	0.981	11.952	24.002	35.995	0.000	0.000
Reading (LSB)	2561282	5175800	8207958	11048399	0	0

Giving these coefficients

Index	0	1	2	3	4	5
TempCoef	2.47292E01	3.38582E01	3.47376E00	5.67984E00	0.00000E00	0.00000E00

Date: 04 Apr 2013 Sign:

Tor-Ove Kvalvaag, Calibration Engineer

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Figure 7-5 Example of Calibration Certificate

AADI
a xylem brand

PRESSURE CERTIFICATE

Form No. 667, Sept 2009

Product: DCS 4830R
Serial No: Demo
Date: 02.05.2013

Certificate No: 83053255101

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)
30	1

Date: 02 May 2013

Sign:

Ragnhild Eide Ure

Ragnhild Eide Ure, Production Engineer

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Figure 7-6 Example of Pressure Certificate

Appendix1 Illustations

Figure no.	Description	For use with	
		4420,4830, 4520,4930	4420R,4830R, 4520R,4930R
Figure A 1	Set up and configuration Cable 3855, RS-232		
Figure A 2	Set up and configuration Cable 4834, RS-232		
Figure A 3	Set up and configuration Cable 4902, RS-422		
Figure A 4	Free end Cable 4860, RS-232/RS-422		
Figure A 5	Free end Cable 5282, RS-232/RS-422		
Figure A 6	Free end Cable 5414, AiCaP		
Figure A 7	Remote Sensor Cable 4838, AiCaP		

Figure A 1 Drawing Free end Cable 5282, RS-232/RS-422 without twisted pair, max 50 meter.

Please note that this is just a selection of available cables for DCS. All string cables and SmartGuard cables are not included. Refer to our webpage http://aanderaa.com or contact aandreaa.info@xyleminc.com for further information.

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