



ZPulse™ Doppler Current Sensor

4420/4420R, 4830/4830R, 4520/4520R, 4930/4930R

1 st Edition	23 October 2007
2 nd Edition	06 May 2011
3 rd Edition	15 September 2012 Frame Work 3 update, please refer Product change notification AADI Document ID: DA-50009-01, Date: 09 December 2011 (Appendix 2).
4 th Edition	27 September 2013 Updated with images and new Appendix 1

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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 ZPulse™ Doppler Current Sensor 4420/4830/4520/4930-series. These sensors are described in a single manual since the measurement principle and electronics is the same for all sensors. 4420 and 4830 are shallow water units with maximum depth rating 300meter. 4520 and 4930 are available in two versions 200meter and 6000meter version. 4420 and 4520 are without temperature and are mainly used with the SeaGuard RCM to measure current. 4830 and 4930 also measure temperature as an extra parameter.

AADI Smart Sensors utilize common communication protocols at the RS-232 and RS-422 interface where the Smart Sensor Terminal protocol is a simple ASCII command string based protocol and the AADI Real Time is an XML based protocol. The common updates of these protocols are called framework 3, and is released August 2012 for most of the AADI smart sensors. (See Appendix 2)

The sensor is designed to fit directly on the top-end plate of SeaGuard or in a string system connected to SmartGuard or SeaGuard String logger using AiCaP. The sensor can also be used as stand-alone sensor using RS-232. The R-version of each sensor is only RS-422 output and is intended for stand-alone use with longer cables than can be used with the RS-232 version.

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

V9810/V9811	Assembly Drawing
Form 769	Test & Specification Sheet, ZPulse™ DCS 4420/4830/4520/4930
Form 726	Calibration Certificate, ZPulse™ DCS 4420/4830/4520/4930
Form 667	Pressure Certificate
D367	Data sheet, ZPulse™ DCS 4420/4830/4520/4930

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

The ZPulse™ DCS 4420/4830 has POM Housing and is depth rated to 300m; All 4830 sensors and 4420 sensors for stand-alone use has a POM housing but titanium base plate. ZPulse™ DCS 4520/4930 has a Titanium Housing and base plate and is depth rated to 6000m.

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 4420/4830/4520 and 4930 are AiCaP and RS-232, while the output format of the 4420R/4830R/4520R and 4930R are RS-422. The sensor can be used in polled mode when set to Smart Sensor Terminal mode

The ZPulse™ DCS 4420/4830/4520/4930 fits directly onto the Top-end plate of the Aanderaa SeaGuard data logger; the sensor is the used in AiCaP mode. When used with SmartGuard both AiCaP and RS-232 mode can be used. The sensor may also be used as a stand-alone RS-232 sensor for other applications.

The R-version cannot be used on a SeaGuard platform. This sensor is for use with SmartGuard or as stand-alone RS-422 sensor on longer cables.

Note! RS-422 must be enabled from the factory prior to delivery. Enabling RS-422 disables the CANbus and RS-232 interface, refer Chapter 4.

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.

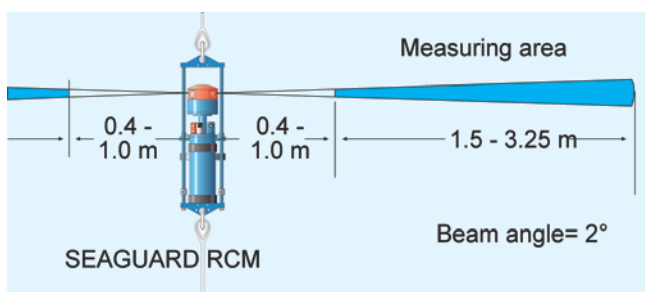


Figure 1-1 Measuring area of the ZPulse™ DCS

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; refer chapter 1.3 for details regarding sensor properties.

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
<i>Product Name</i>	String	31	AADI Product name	FC	Read Only
<i>Product Number</i>	String	6	AADI Product number		
<i>Serial Number</i>	Int	1	Serial Number		
<i>SW ID</i>	String	11	Unique identifier for internal firmware		
<i>Software Version</i>	Int	3	Software version (Major, Minor, Built)		
<i>HW ID X</i>	String	19	Electronic Identifier, X =1,2		
<i>HW Version X</i>	String	9	Electronic Identifier, X =1,2		
<i>System Control</i>	Int	3	For AADI service personnel only		
<i>Production Date</i>	String	31	AADI production date, format YYYY-MM-DD		
<i>Last Service</i>	String	31	Last service date, format YYYY-MM-DD, empty by default		
<i>Last Calibration</i>	String	31	Last calibration date, format YYYY-MM-DD		
<i>Calibration Interval</i>	Int	1	Recommended calibration interval in days		
<i>Interval¹</i>	Float	1	Sampling Interval in seconds. Default value is 30s.		
<i>Location</i>	String	31	User setting for location		
<i>Geographic Position</i>	String	31	User setting for geographic position		
<i>Vertical Position¹</i>	String	31	User setting for describing sensor position		
<i>Reference</i>	String	31	User setting for describing sensor reference	SC	High
<i>Mode¹</i>	ENUM	1	Sets the sensor operation mode (AiCaP, Smart Sensor Terminal, AADI Real-Time, Smart Sensor Terminal FW2)		
<i>Enable Sleep¹</i>	BOOL	1	Enable sleep mode. Default value is yes.		
<i>Enable Polled Mode</i>	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 <i>Do Sample</i> command). When set to 'no' the sensor will sample at the regular interval given by the <i>Interval</i> property. Default value is no.		

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

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

² Baud rates lower than 9600 may limit the sampling frequency

<i>Enable Comm Indicator</i>	BOOL	1	Enable communication sleep ('%') and communication ready (!) indicators
<i>Comm TimeOut</i>	ENUM	1	Time communication is active (Always On, 10 s, 20 s, 30 s, 1min, 2 min, 5 min, 10 min)
<i>Enable Spike Filter</i>	BOOL	1	Activate/deactivate spike filter; Set yes to activate. Default is yes. Spike filter tracks and eliminates spikes in measured data.
<i>Enable Axis Strength</i>	BOOL	1	Enables output of strength X and strength Y. Default is no
<i>Compass Deviation</i>	Float	1	Compass offset correction value (deg. M)
<i>Enable Magnetic Declination</i>	BOOL	1	Enables correction of compass reading to present true north instead of magnetic north. Default is no
<i>Declination Angle</i>	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

1.3 Sensor configuration

The sensor configuration consists of sensor settings, customized presentation of data, and typing fixed parameters. Refer chapter 1.2 for a list of all sensor properties and the input format. The next pages contain a more detailed description of the parameters.

The *Mode* property is used to set the sensor operation mode of the sensor. Set the mode property to **Smart Sensor Terminal**, **AADI Real-Time** or **Smart Sensor Terminal FW2** to enable the different sensor operations. **Note! The mode Smart Sensor Terminal FW2 brings the sensor into an operation mode where the output string is compatible with AADI framework 2.**

The *Ping Number* property describes the number of acoustic pulses (pings) transmitted by the sensor during one measurement interval; the received backscattered signal from these transmitted pulses are tilt/compass corrected and averaged into the final measured output.

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

When both the *Interval* and the *Ping Number* properties are set to a value other than zero, the interval timer is enabled and the sensor will perform repeated sampling and data presentation at regular intervals. This is called **non-pollled mode**. When configured to **non-pollled mode** the sensor can be used in systems with one-way communication.

The *Enable Burst mode* property describes the transmission of the acoustic pulses (pings). In **Burst mode**, the acoustic pulses (pings) are transmitted during the very last minute of the measurement interval; the measurement interval must be larger than 60s. The opposite of **Burst mode** is **Spread mode**; in **spread mode** the acoustic pulses are transmitted equally spaced in time over the entire measurement interval.

The *Start Distance* property describes the distance which the pulse propagates before the measurement starts, refer chapter 1.2.

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*. Setting a large *cell size* provides the best measurement results with lowest standard deviation (since more scatters are present within a larger area); a smaller cell gives a higher standard deviation. A 1.5m *cell size* is sufficient for most applications.

The *Enable single interval* property describes whether the sensor will perform one single measurement interval or keep measuring repeatedly until the power is switched off or the sensor has received a stop command.

Set the property *Enable Polled Mode* to *yes* for the sensor to present output data only on request. The *Polled Pingrate* setting controls the ping rate in polled mode. The number of measurements to be averaged is controlled by the *Ping Number* setting. Request measurement by sending a *Do sample* command; the sensor outputs data based on the last number of ping measurements.

Set the property *Enable Polled Mode* to *no* for the sensor to present output data on regular intervals.

The *interval* setting controls the time between every data output from the sensor. The number of current speed measurements done in one interval is controlled by the *Ping Number* setting. The sensor is set to non-polled operation by default.

Use *Fixed Heading* if e.g. the sensor is placed in a fixed known position for example close to a magnetic object which will interfere with the internal compass. *Fixed Heading* is set as the angle between transducer 1 and the Magnetic North. Rotating transducer 1 clockwise increases the heading angle. The compass heading is used to split the current speed into the East and North component.

The property *Enable Fixed Heading* must be set for the sensor to actual use the *Fixed Heading* instead of the compass reading.

The *Tilt Compensation* can be disabled if e.g. the sensor application is vertical measurements. When tilt compensation is enabled, the tilt measurements are used to derive the horizontal speed (assuming that the vertical speed is zero). When tilt compensation is disabled and a fixed reading is used, the sensor will still output the last compass reading (heading), tilt x and tilt y.

The property *Sound Speed* describes the speed of sound in the sea water. The value must be set as close to the true speed of sound as possible for most correct measurements of the current speed.

The *Enable ZPulse Operation* property describes whether the ZPulse™ technique is active or not. If the ZPulse™ is configured not active, the DCS transmits single-frequency acoustic pulses, refer chapter 3.1 for a description of the ZPulse™ technique.

The *Activation X-axis* and *Activation Y-axis* property describes which of the four transducers are enabled. Normally all four transducers should be enabled together with the property *Forward Ping*. Always enable at least one transducer on each axis, refer chapter 3.3 (e.g. transducer 1 and 2, or 2 and 3, or 3 and 4 or 1 and 4). Three transducers can also be enabled. If the sensor is deployed close to a known obstruction, e.g. a riverbank, wall, quay etc, the two transducers transmitting in the direction of the obstruction should be disabled.

Setting the property *Enable Forward Ping* to *Yes* will inactivate the transducers in the downstream direction (direct current) to avoid poor measurements due to e.g. local turbulence in front of the transducers. **Note! If you select to activate only single transducers along one or both axis the *Enable Forward Ping* setting does not inactivate these transducers.**

Examples:

1. Select all transducers:

Set Activation X-axis(1+3)

Set Activation Y-axis(2+4)

The sensor will ping simultaneously on one transducer on each axis, refer Figure 3-3. If **forward ping** is enabled the sensor selects the transducers in the upstream direction. If **forward ping** is disabled the sensor will alternate between the two transducers on each axis; the instrument will transmit/receive on transducers 1 and 2 simultaneously, next on transducers 3 and 4, and continue transmitting/receiving from these pairs every other time for the entire deployment.

2. Select single transducer on each axis:

Select either transducer 1 or 3 on X-axis, and either transducer 2 or 4 on Y-axis. The sensor will ping on the two transducers that have been selected. **Forward ping** will be disregarded.

Set Activation X-axis(1) (selects transducer 1 on X-axis).

Set Activation Y-axis(2) (selects transducer 2 on Y-axis)

3. Select three transducers:

The sensor can use any combination of three transducers. If **forward ping** is enabled the sensor will select the transducer in the upstream direction (of the two transducers along the same axis, refer Figure 3-3).

Set Activation X-axis(1+3) (selects transducer 1 and 3 on X-axis).

Set Activation Y-axis(2) (selects transducer 2 on Y-axis)

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).

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.

1.4 Specifications for ZPulse™ Doppler Current Sensor 4420/4830/4520/4930

Refer Datasheet D367 which is available on our web site <http://www.aanderaa.com> or contact aanderaa.info@xylem-inc.com

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

CHAPTER 2 Sensor parameters

Table 2-1 presents an overview of parameters provided by the ZPulse™ DCS 4420/4830/4520/4930-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 3 Measurement principle

3.1 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 scatterers 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.

3.2 Definition of terms

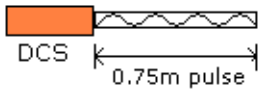
The transmitted pulse has a fixed length of 0.75m. Internal ringing in the transducers will always occur after transmitting acoustic pulses; the transducers cannot receive backscattered signal until the ringing stops.

For the DCS 4420/4830/4520/4930-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.

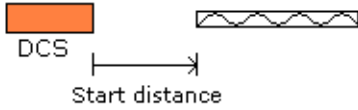
The total area from which the DCS receives backscattered energy is called the Measurement Area. Due to the shape of the pulse, the main contribution to backscattered energy is from particles that are present in an area around the Cell Centre.

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.



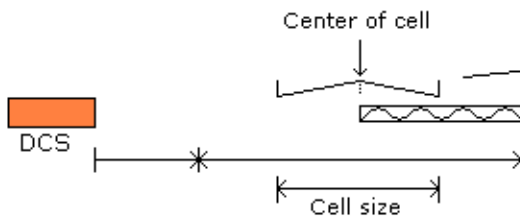
The pulse gives backscatter from a 0.75m long area after transmission.



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



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



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

Figure 3-1 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: $Start\ distance + \frac{Pulse\ Length}{2}$

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

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

3.3 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 3-2 for a block schematic illustration measurement process and Figure 3-3 for an illustration of the sensor orientation.

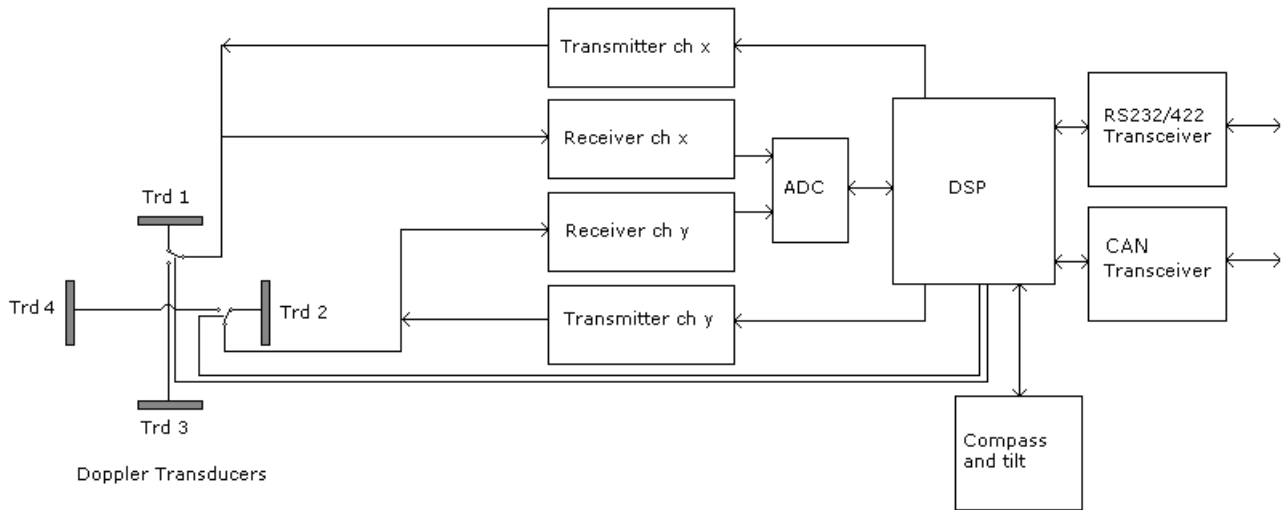


Figure 3-2 Block schematic illustration of the ZPulse™ DCS measurement process.

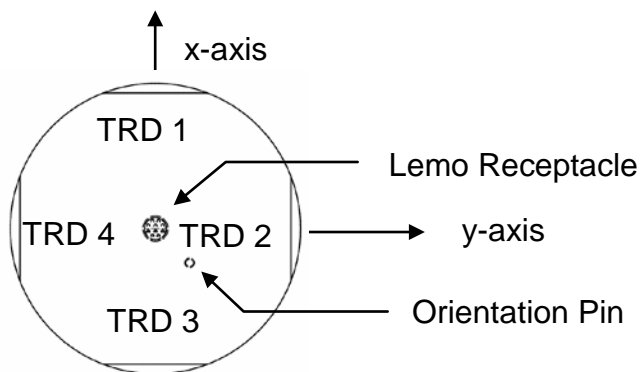


Figure 3-3 Orientation of DCS 4420/4830/4520/4930-series; top view.

CHAPTER 4 Operation mode

4.1 Standard ZPulse™ DCS with AiCaP and RS-232

The standard ZPulse™ DCS 4420/4830/4520/4930 can be used both with AiCaP protocol or Smart Sensor Terminal protocol. At delivery, the sensor is configured to AiCaP mode. Ensure that the sensor is configured for AiCaP mode when used in SeaGuard applications; refer chapter 1.2 for Mode property settings. The sensor must be configured to Smart Sensor Terminal mode before it can be used in RS-232 operations.

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

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

Example:

```
//Press Enter to start communicating with the sensor, refer chapter 8.2
↵ //press Enter
Stop ↵//Wait for ack #. Repeat if necessary
Set Passkey(1) ↵
Set Mode(Smart Sensor Terminal) ↵//wait for ack #
Save ↵// wait for ack #
Reset ↵// the sensor will restart with new settings
```

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

1. Connect the sensor to a PC using e.g. cable 3855.
2. Set the **Mode** property to **AiCaP**, refer chapter 1.2. Save the configuration and reset the sensor.
3. Mount the sensor to the SeaGuard Platform, refer Chapter 9.

4.2 R-version ZPulse™ DCS with RS-422

The ZPulse™ DCS 4420R/4830R/4520R/4930R wired for RS-422 operation cannot be used for AiCaP operations.

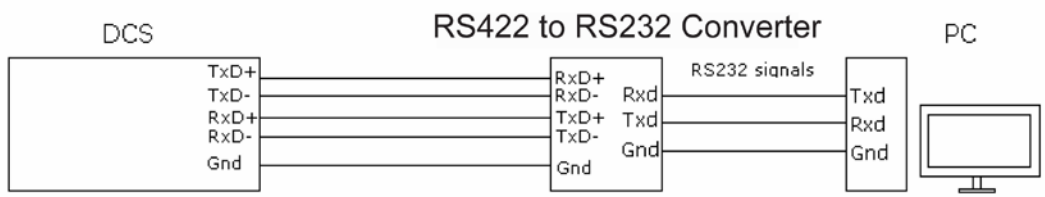


Figure 4-1 ZPulse DCS

4.3 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.

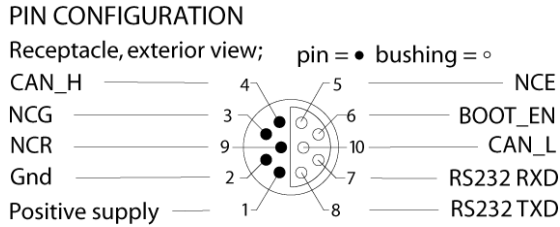


Figure 4-2 Pin configuration for the ZPulse™ DCS in AiCaP mode

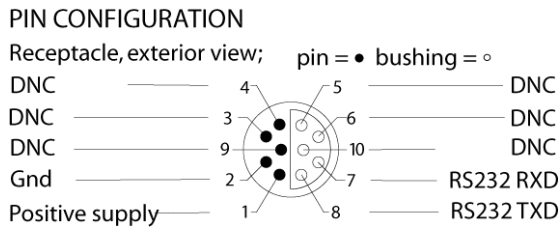


Figure 4-3 Pin configuration for the ZPulse™ DCS in RS-232 mode. Refer Table 4-1 for a description of the signal name.

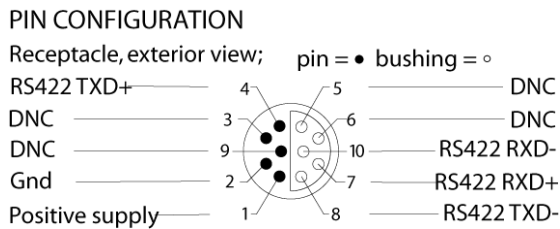


Figure 4-4 Pin configuration for the ZPulse™ DCS in RS-422 mode. Refer Table 4-1 for a description of the signal name.

Table 4-1 RS-232/RS-422 signal name and description.

Signal Name	Description
DNC	Do Not Connect
Gnd	Negative supply
RS-232 RXD	RS-232 Receive Signal
RS-232 TXD	RS-232 Transmit Signal
RS-422 TXD+	RS-422 Transmit signal+ (non-inverting output)
RS-422RXD-	RS-422 Receive signal- (inverting input)
RS-422 RXD+	RS-422 Receive signal+ (non-inverting input)
RS-422 TXD-	RS-422 Transmit signal- (inverting output)

4.4 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-.

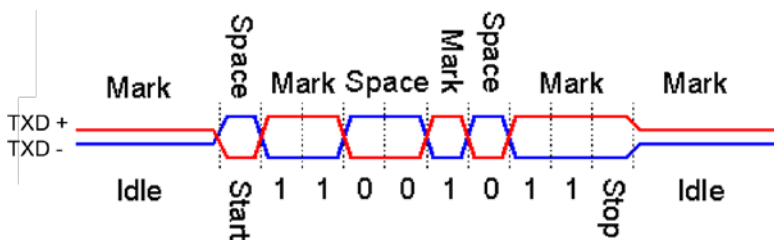


Figure 4-5 Example of a RS-422 signal.

CHAPTER 5 SeaGuard applications

The CANbus interface ensures easy plug and play connection to all Aanderaa SeaGuard dataloggers.

Refer chapter 9 for installation of the sensor on your SeaGuard instrument.

When connected to a CANbus network the sensor will report its capabilities and specifications to the datalogger at power up.

The datalogger assembles the information and provides the user with the possibility to configure the instrument based on the present node. The solution provides for great flexibility in both use and design of the different elements within the system.

Note! Refer the SeaGuard RCM Operating Manual, TD 262b, and the SeaGuard Platform Operating Manual, TD262a, for configuring the ZPulse™ DCS for SeaGuard applications.

CHAPTER 6 Sensor configuration using AADI Real-Time Collector

The sensors that are updated with Sensor Framework version 3 can be configured as stand-alone sensors using AADI Real-Time Collector.

Open the sensor connection as described in TD 268 AADI Real-Time collector operating manual.

When the connection is established you can start and stop recordings or configure the device, refer Figure 6-1. Open Device Configuration and press Get Current Configuration. Check Include User Maintenance to view maintenance settings. **The password is 1000.**

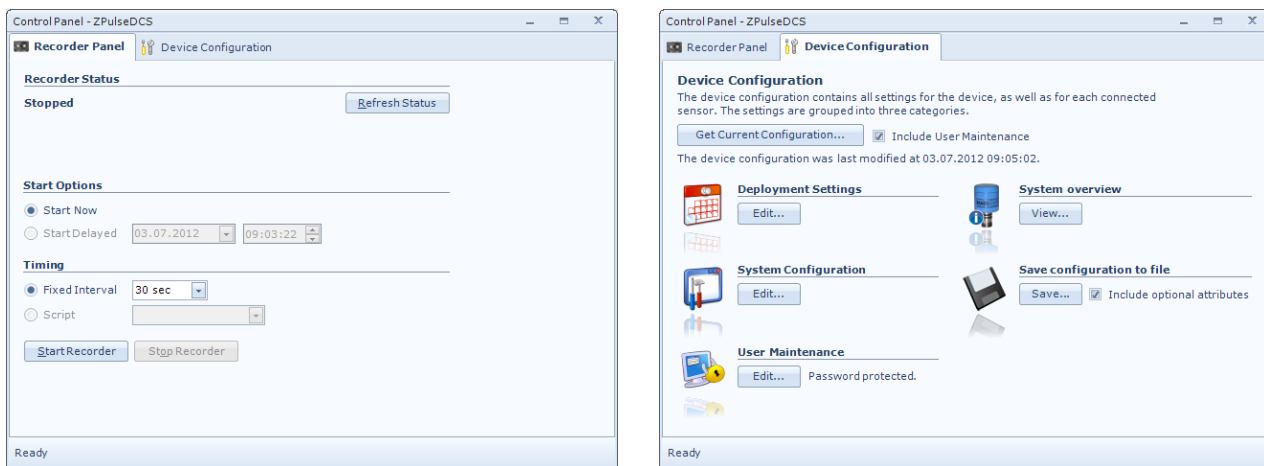


Figure 6-1 AADI Real-Time Collector screen views

User accessible sensor properties are found in Deployment settings, System Configuration and User Maintenance. Refer Table 1-1 in chapter 1.2 for an overview of the properties. Refer chapter 1.3 for a description of sensor properties. To edit the configuration, click in the value-field and enter new value. Press *Next* to update sensor flash and store changes.

Figure 6-2, Figure 6-3, and Figure 6-4 presents screen views of AADI Real-Time Collector.

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

DeploymentSettings

DCS #34
Doppler Current Sensor (4930, Version 4)
Serial No: 34

Common Settings

Property	Value
Interval (Sec)	3.000000E+01

Site Info

Property	Value
Owner	AADI R and D
Location	
Geographic Position	60.31115,5.3494
Vertical Position	
Reference	

< Back Next > Cancel

Figure 6-2 Sensor deployment settings

System Configuration

DCS #38
Doppler Current Sensor (4830, Version 4)
Serial No: 38

Common Settings

Property	Value
Mode	AADI Real-Time
Enable Sleep	<input checked="" type="checkbox"/>

Terminal Protocol

Property	Value
Enable Polled Mode	<input type="checkbox"/>
Enable Text	<input checked="" type="checkbox"/>
Enable Decimalformat	<input type="checkbox"/>

Measurement

Property	Value
Ping Number	50
Polled Pingrate	10.0
Enable Burst Mode	<input checked="" type="checkbox"/>
Enable Single Interval	<input type="checkbox"/>

< Back Next > Cancel

System Configuration

DCS #38
Doppler Current Sensor (4830, Version 4)
Serial No: 38

Common Settings

Enable Single Interval	<input type="checkbox"/>
Start Distance	0.50
Cell Size	1.00
Enable ZPulse Operation	<input checked="" type="checkbox"/>

Compensation

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

Transducers

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

< Back Next > Cancel

Figure 6-3 Sensor system configuration

User Maintenance

DCS #38
Doppler Current Sensor (4830, Version 4)
Serial No: 38

Mandatory

Property	Value
Node Description	DCS #38

Serial Port

Property	Value
Interface	RS232
Baudrate	9600
Flow Control	Xon/Xoff
Enable Comm Indicator	<input checked="" type="checkbox"/>
Comm TimeOut	1 min

Operation

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

Calibration

Property	Value
Compass Deviation (Deg)	0.000000E+00

< Back Next > Cancel

User Maintenance

DCS #38
Doppler Current Sensor (4830, Version 4)
Serial No: 38

Common Settings

Baudrate	9600
Flow Control	Xon/Xoff
Enable Comm Indicator	<input checked="" type="checkbox"/>
Comm TimeOut	1 min

Operation

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

Calibration

Property	Value
Compass Deviation (Deg)	0.000000E+00

Dependencies

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

< Back Next > Cancel

Figure 6-4 Sensor user maintenance

CHAPTER 7 Connection to PC

A 1.5 meter cable, Set up and configuration Cable 3855 (refer Figure 7-1), is used for connection between the Sensor and the PC in the office/lab. A drawing of Sensor Cable 3855 is given in Appendix1.

By using a Cable Coupler 3472 and a standard Connecting Cable 3282 this connection can be extended to 15 meters.

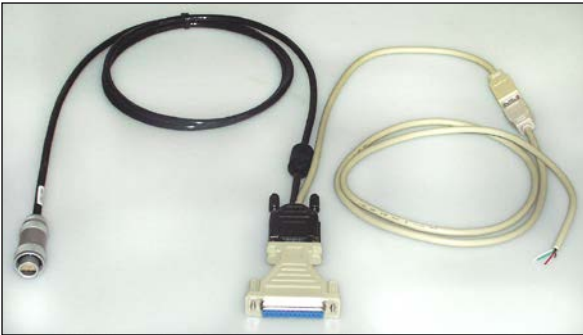


Figure 7-1 Sensor Cable 3855

The 10-pin receptacle from the DCS mates with an Aanderaa 3216A plug. When used with the ZPulse™ DCS, the cable cannot be fastened to the sensor. Press the cable onto the sensor foot. Only for use in dry environments! An additional USB plug is used for providing power to the sensor. Power may also be connected to an included extension to the USB plug.

For use in water select one of the subsea cables with 10 pin plug and sensor stud. Maximum cable length depends on output format and baud rate.

See Appendix 1 for an overview of all available cables.

CHAPTER 8 Smart Sensor Terminal operation

8.1 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.**

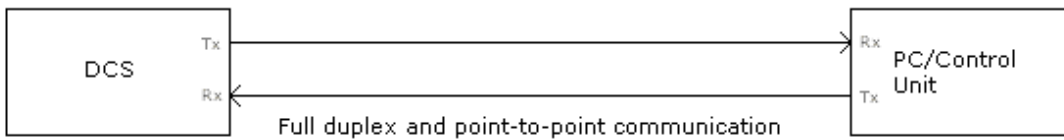


Figure 8-1 Point-to-Point Communication.

8.2 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.

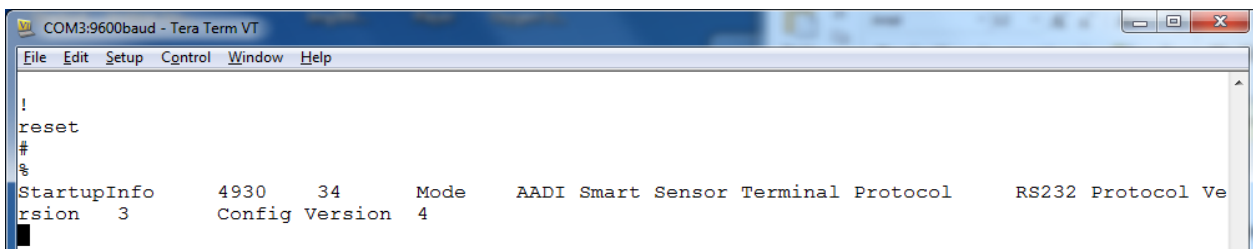


Figure 8-2 Sensor Startup Information

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

8.3 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 if 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.

8.4 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 8-3 for 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.

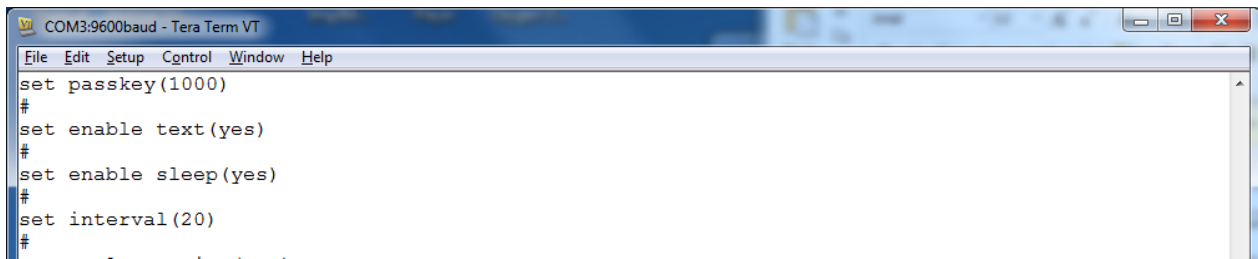


Figure 8-3 Examples of typing Set commands.

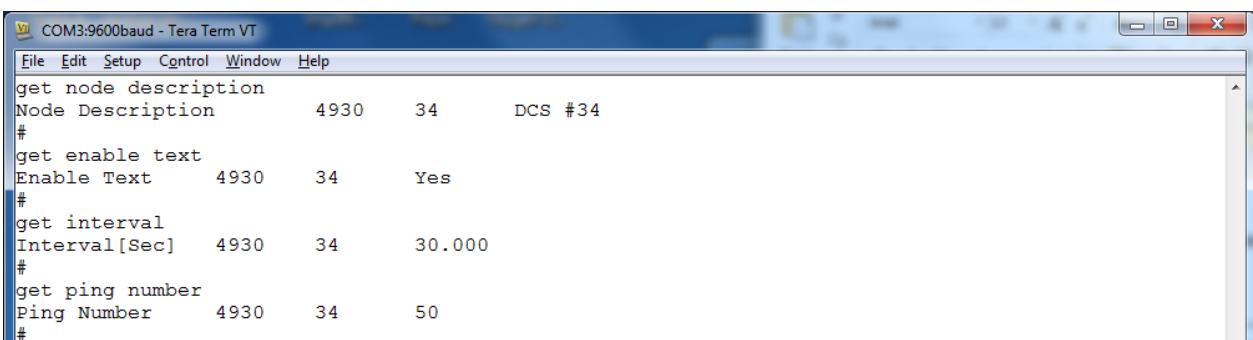


Figure 8-4 Examples of typing Get commands.

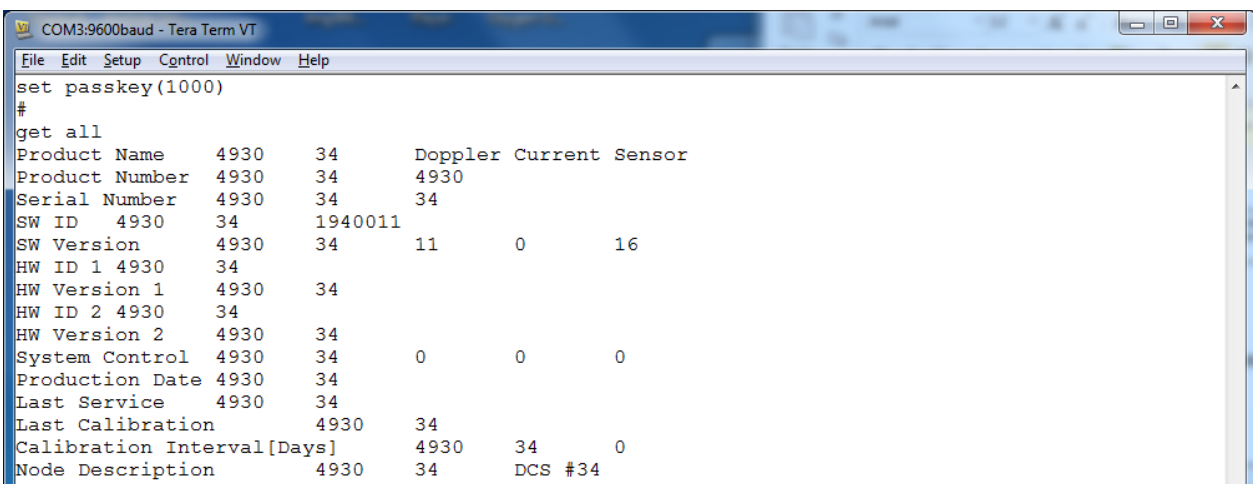


Figure 8-5 Sensor response to a Get all command.

```

COM3:9600baud - Tera Term VT
File Edit Setup Control Window Help
get configXML
<NodeConfig ID="4930-34" SerialNo="34" ProdNo="4930" ProdName="Doppler Current Sensor" Descr="DCS #34" Adr="816128" Is
Sensor="true" ProtocolVer="6" ConfigVer="4" 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</Pro
perty>
      <Property ID="1" Descr="Product Number" Type="VT_BSTR" Access="R1W4">4930</Property>
      <Property ID="2" Descr="Serial Number" Type="VT_I2" Access="R1W4">34</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">1;0;16</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">DCS #34</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" ResetRequired="true">1</Property>
      <Property ID="1" Descr="Enable Sleep" Type="VT_BOOL" Access="R1W2" StandAlone="true">true</Pro
perty>
    </PropertyCategory>
    <PropertyCategory ID="2" Descr="Terminal Protocol">
      <Property ID="2" Descr="Enable Polled Mode" Type="VT_BOOL" Access="R1W2" StandAlone="true">fal
se</Property>
      <Property ID="0" Descr="Enable Text" Type="VT_BOOL" Access="R1W2" StandAlone="true">true</Prop
erty>
      <Property ID="1" Descr="Enable Decimalformat" Type="VT_BOOL" Access="R1W2" StandAlone="true">f
alse</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;450=450;500=500;550=550;600=600">50</P
roperty>
      <Property ID="1" Descr="Polled Pingrate" Type="VT_R4" Unit="p/s" Format="%0.2f" Min="0" Max="6
00" Access="R1W1" StandAlone="true" Enum="0.1=1.000000E-01;0.5=5.000000E-01;1.0=1.000000E+00;2.0=2.000000E+00;5.0=5.0
00000E+00;10.0=1.000000E+01;15.0=1.500000E+01;20.0=2.000000E+01;25.0=2.500000E+01">1.000000E+01</Property>
      <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>
    </PropertyCategory>
  </ConfigCategory>
  <ConfigCategory ID="3" Descr="Deployment Settings">
    <PropertyCategory ID="1" Descr="Common Settings">
      <Property ID="0" Descr="Interval" Type="VT_R4" Unit="Sec" Format="%0.3f" Min="1" Max="7200" Ac
cess="R1W1" StandAlone="true">2.000000E+01</Property>
    </PropertyCategory>
    <PropertyCategory ID="0" Descr="Site Info">
      <Property ID="0" Descr="Owner" Type="VT_BSTR" Access="R1W1">AADi R and D</Property>
      <Property ID="1" Descr="Location" Type="VT_BSTR" Access="R1W1" />
      <Property ID="2" Descr="Geographic Position" Type="VT_BSTR" Access="R1W1">60.31115,5.3494</Pro
perty>
      <Property ID="3" Descr="Vertical Position" Type="VT_BSTR" Access="R1W1" />
      <Property ID="4" Descr="Reference" Type="VT_BSTR" Access="R1W1" />
    </PropertyCategory>
  </ConfigCategory>
</NodeConfig>

```

Figure 8-6 Example of sensor response to Get ConfigXML

Figure 8-7 Example of sensor response to Get DataXML

8.5 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.

8.6 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 9 Installation on SeaGuard data logger

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

Note!

Mount the ZPulse™ DCS on the stud and connect the stud in sensor position 1, refer Figure 9-1 and Figure 9-2 .

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

Apply Tectyl 506 (included in Maintenance Kit) in the slit between the sensor and the Top-end plate to prevent crevice corrosion of the Top-end plate.

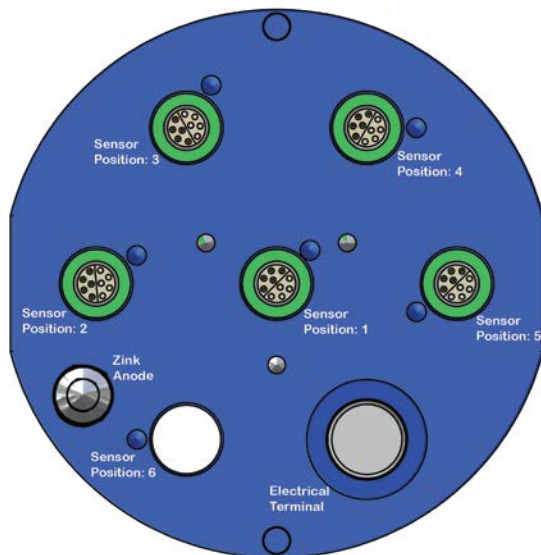


Figure 9-1 Illustration of the SeaGuard Top-end plate.



Figure 9-2 Drawing of an ZPulse™ DCS 4520/4930 mounted onto a Stud and Connected to the SeaGuard Top-end Plate.

Important!

Refer SeaGuard Quick Start, TN 301 or the SeaGuard Platform Operating Manual, TD 262a, for an illustrated sensor installation guide. TN 309 holds an extract of sensor connection/disconnection given in the SeaGuard Operating Manual

CHAPTER 10 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.

10.1 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.

10.2 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.

10.3 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.

10.4 SeaGuard applications

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

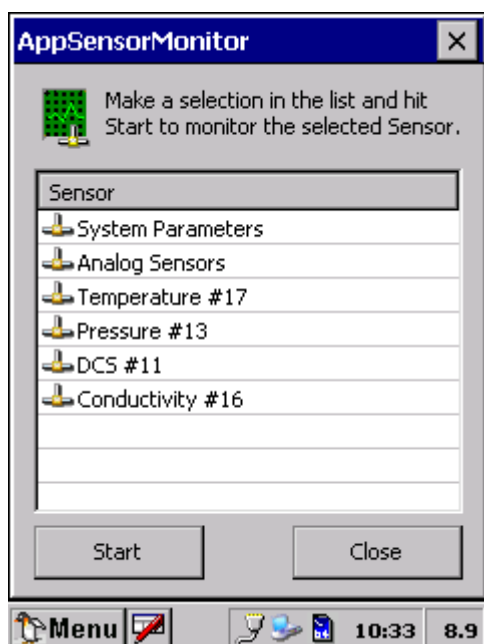


Figure 10-1 Select sensors to monitor

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.

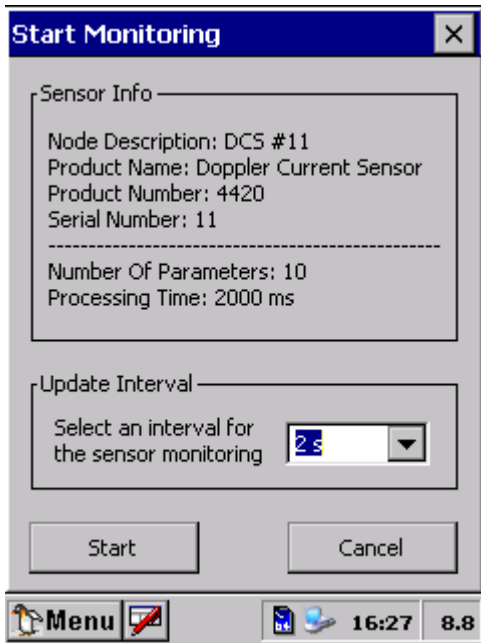


Figure 10-2 Set the update interval

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.

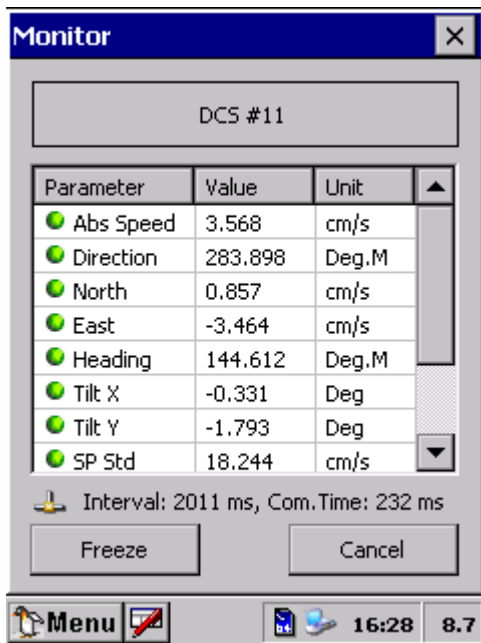


Figure 10-3 Monitor sensor readings.

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.

10.5 RS-232/RS-422 applications

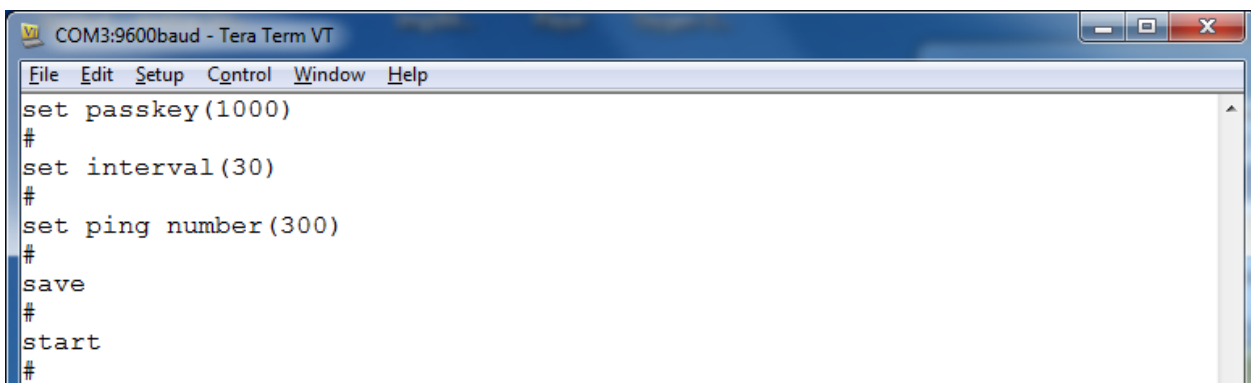
Connect the DCS to your PC using e.g. sensor cable 3855 (refer Figure 7-1). Use a RS-422/RS-232 converter between the sensor and your PC if necessary. Refer Chapter 4 for sensor operation mode. Refer Chapter 8 for RS-232/RS-422 operation of the sensor.

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

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

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

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

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

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

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.

10.6 Example of Test & Specification sheet and Certificates



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 groove.
- 4.2. Pressure tested.
- 4.3. Electrical isolation to flange after pressure test (only 4520).
- 4.4. Communication tested (AiCaP, Rs-232/RS-422).

5. Current Consumption

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

6. Compass and Tilt sensor

- 6.1. Compass calibrated and verified to be within $\pm 2.0^\circ$ at 0° tilt and $\pm 3.5^\circ$ at 30° tilt.

7. Tilt Compensation

- 7.1. Tilt sensor calibrated and verified to be within $\pm 1.0^\circ$ in the range from $+35^\circ$ to -35° 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, Production Engineer

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Figure 10-4 Example of Test and Specification sheet



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 10-5 Example of Calibration Certificate



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 10-6 Example of Pressure Certificate

Appendix1 Illustrations

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		

Table A 1 Access protection levels

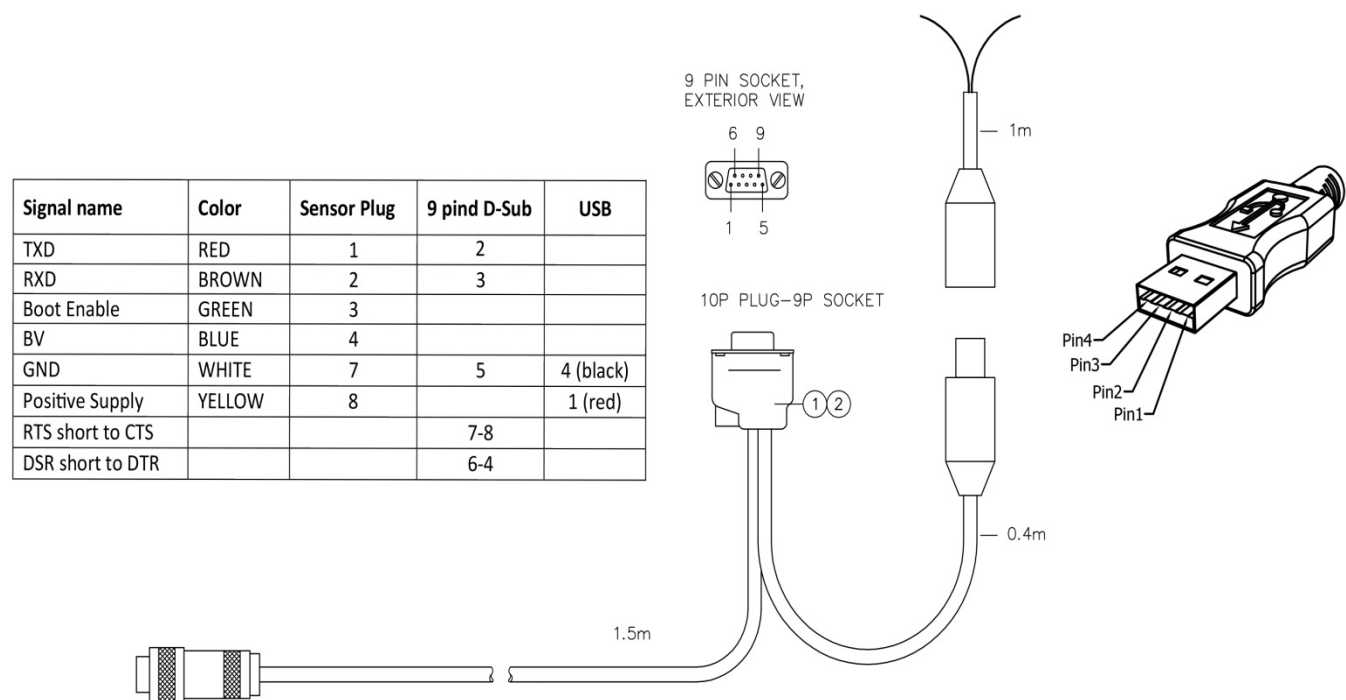


Figure A 1 Set up and configuration cable 3855, for laboratory use.

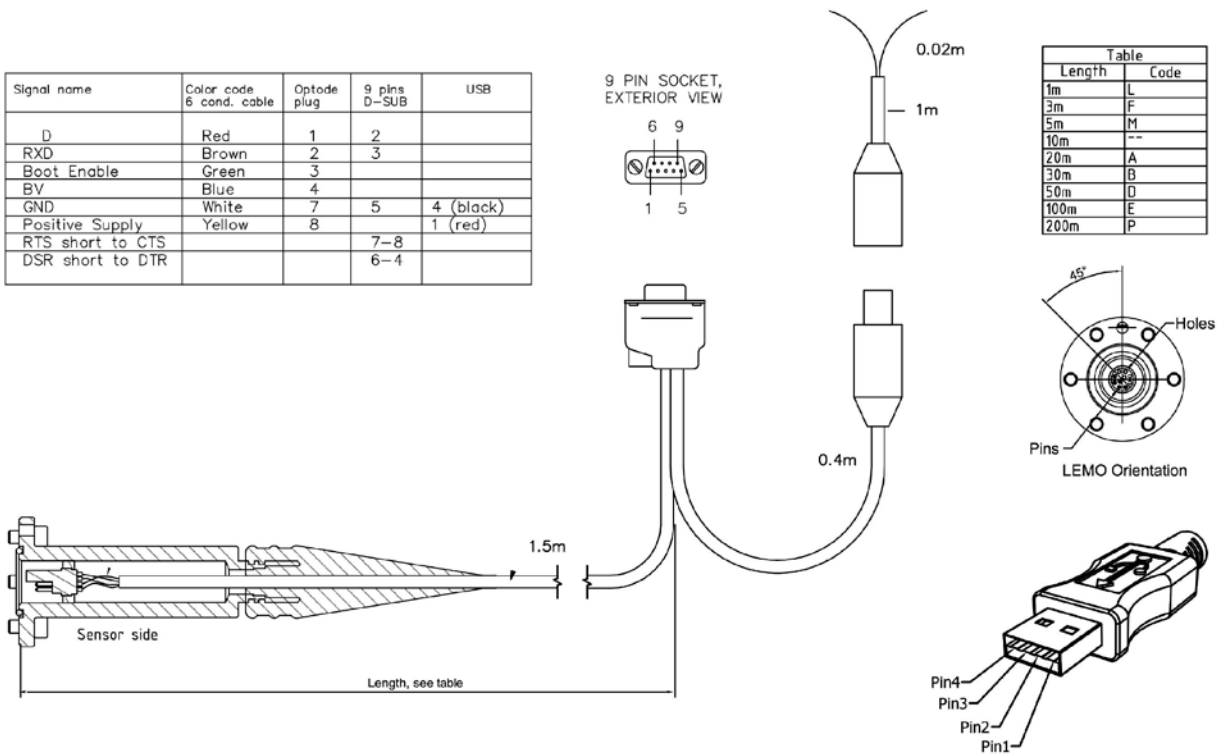
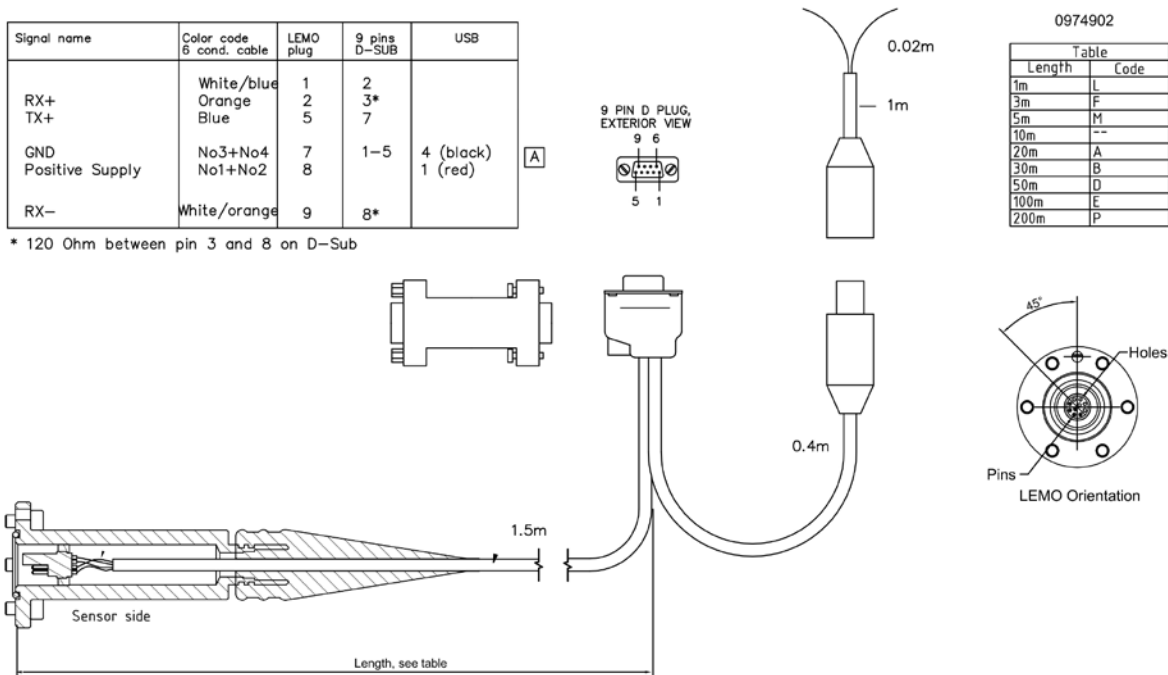


Figure A 2 Set up and configuration cable 4834, RS-232 for field use.



* 120 Ohm between pin 3 and 8 on D-Sub

Figure A 3 Set up and configuration cable 4902, RS-422 for field use.

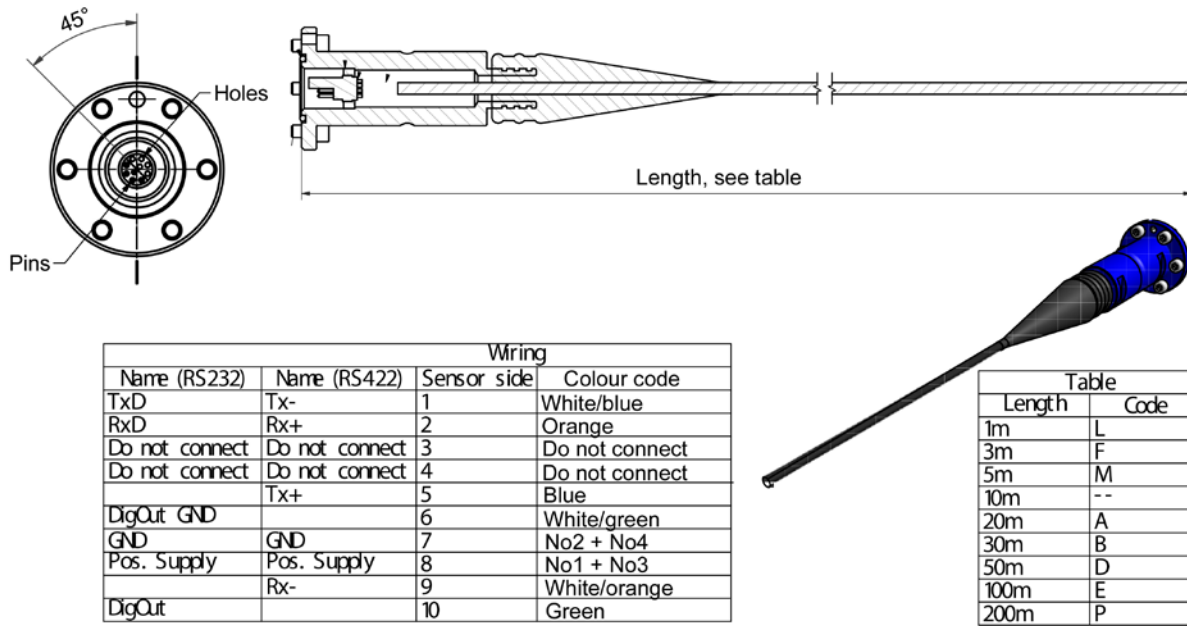


Figure A 4 Drawing Free end Cable 4680, RS-232/RS-422 with twisted pair.

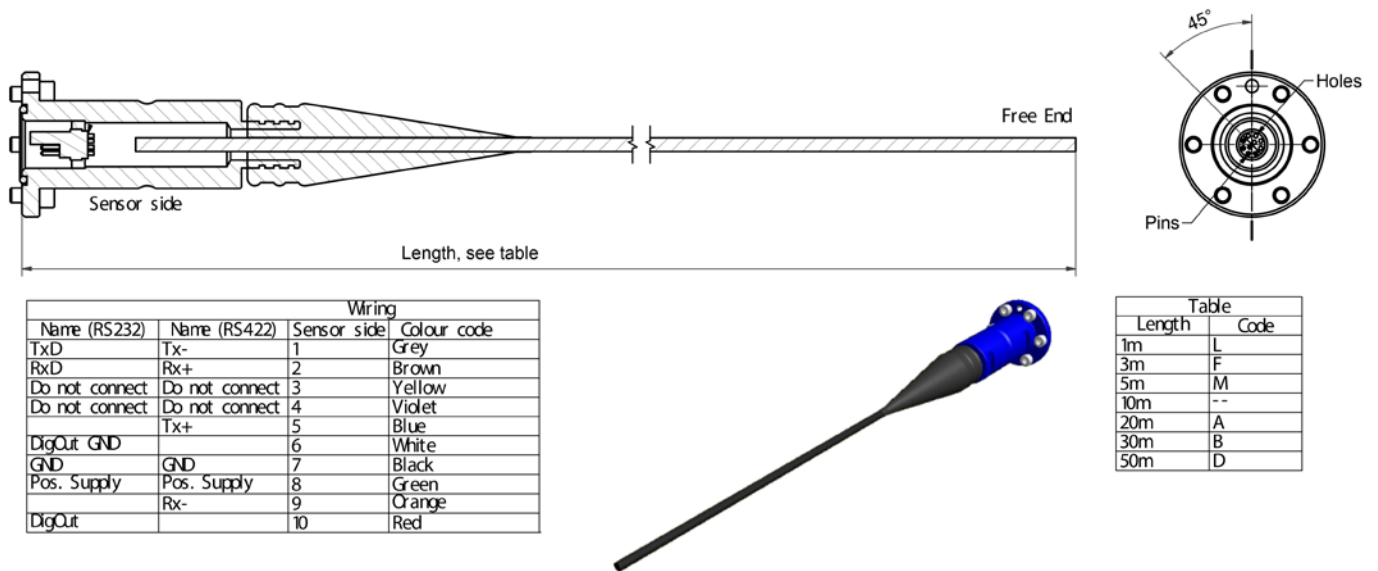


Figure A 5 Drawing Free end Cable 5282, RS-232/RS-422 without twisted pair, max 50 meter.

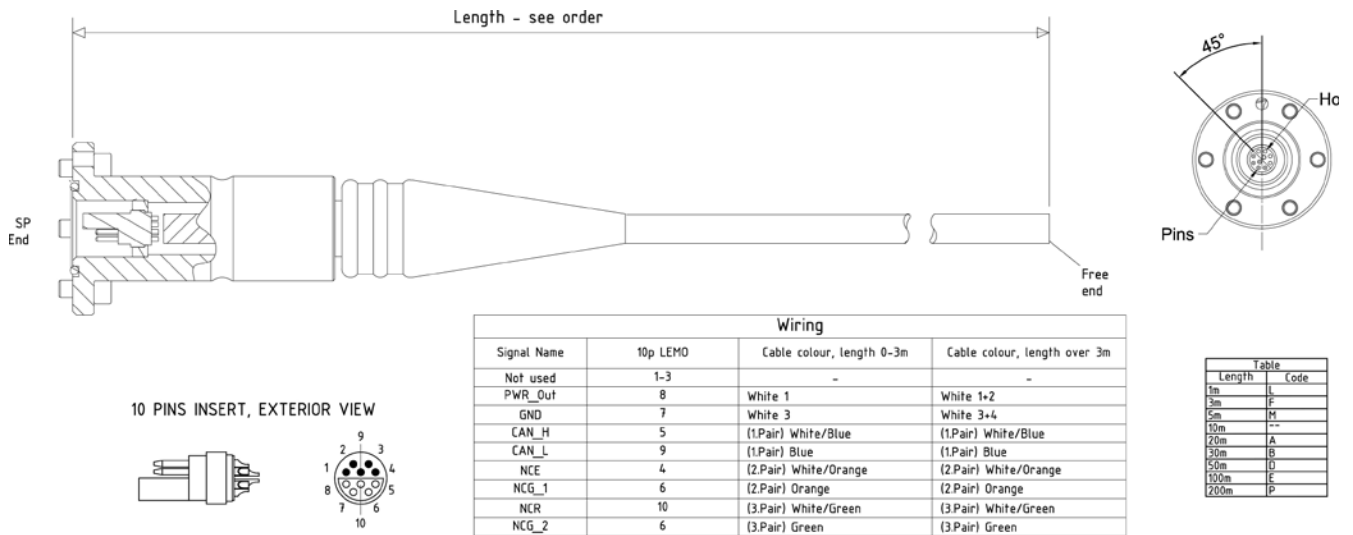


Figure A 6 Drawing Free end Cable 5414, AiCaP

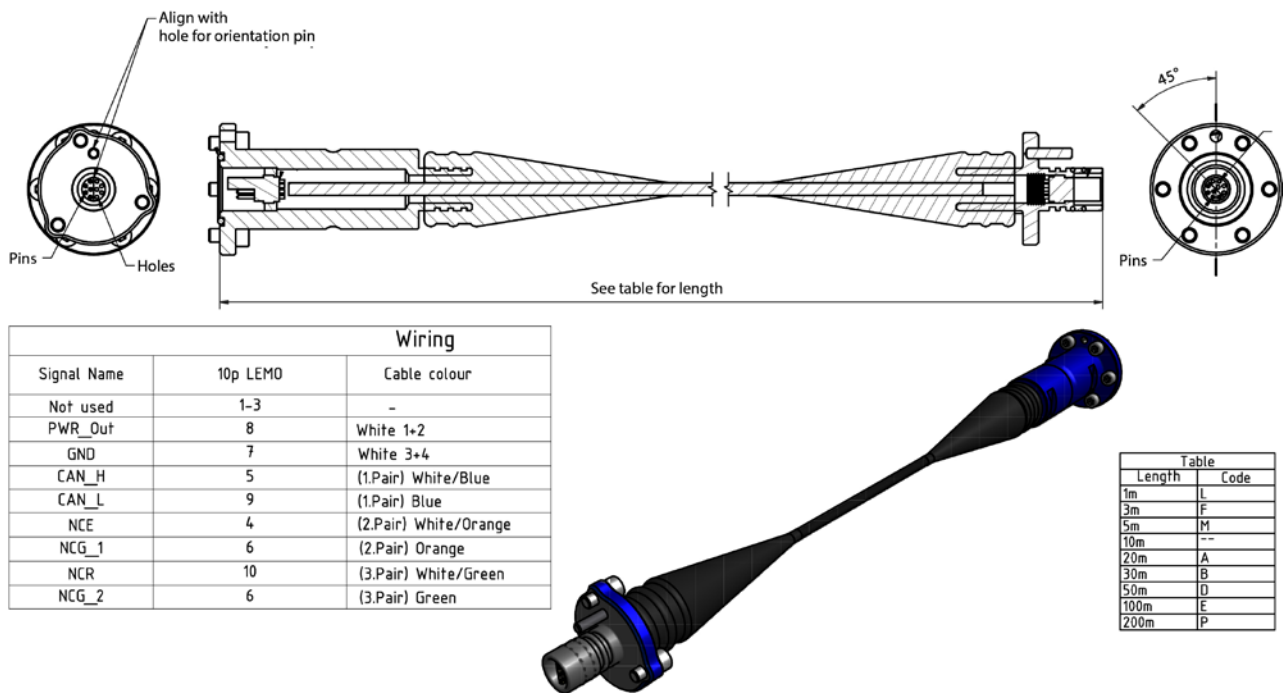


Figure A 7 Drawing Remote Sensor Cable 4838, AiCaP

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.

Appendix 2 Product change notification: Frame Work3

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

Product(s) Affected:

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

General Change Description:

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

Specific Changes:

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

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