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SEAGUARD® Recording Current Meter

The SeaGuard RCM series is based on the SeaGuard data logger platform and the ZPulse Doppler Current Sensor. Modern computer technology combined with advanced digital signal processing provides accurate and detailed measurements with almost unlimited resolution. Optional parameters are available through a wide range of smart sensors that include temperature, pressure, conductivity, oxygen, wave and tide. The SeaGuard RCM series come in 300m, 3000m and 6000m depth ranges. 7000m and 10000m versions available on request.

Advantages:

- *Large storage capacity on SD card*
- *Broadband ZPulse multi-frequency technology reduces power consumption and improves quality*
- *Down to 2 second recording interval*
- *Low current drain*
- *Smart sensor topology based on a reliable semi-high speed CANbus interface (AiCaP)*
- *Up to 4 Analog sensor input (0-5V)*
- *Windows CE based datalogger with TFT based color touch panel for local configuration*
- *SeaGuard Studio visualization software*
- *For use in sea and fresh water*
- *Real-Time XML Output (optional)*

The SeaGuard RCM series replaces the industry standard RCM 9 and RCM 11 series. It has been completely redesigned from bottom up and employs modern technology in the datalogger section and in the different sensor solutions.

The SeaGuard architecture is based on a general data logger unit and a set of autonomous smart sensors. The data logger and the smart sensors are interfaced by means of a reliable CANbus interface(AiCaP), using XML for plug and play capabilities. During power-up, each of the sensors that are connected to the bus will report their capabilities and specifications to the data logger. The data logger then assembles the information and provides the user with the possibility to configure the instrument based on the present nodes. The solution provides for great flexibility in both use and design of the different elements within the system.

The autonomous sensor topology also gives the sensor designer flexibility and opportunities where each sensor type may be optimized with regard to its operation, each sensor may now provide several parameters without increasing the total system load. Data storage takes place on a Secure Digital (SD) card. The current capacity for this card type is up to 2GBytes, is more than adequate for most applications.The SeaGuard also has a built-in power calculator which gives an etsimated deployment lenght bases on selected interval, battery type and current drain information, obtained from each smart sensor.

The SeaGuard RCM comes standard with the ZPulse multi-frequency Doppler current sensor. The current sensor comprises acoustic pulses of several frequency components to lower the statistical variance in the Doppler shift estimate. The advantage of this is reduced statistical error with fewer pings, providing increased sampling speed and lower power consumption.

The Doppler Current Sensor also incorporates a robust fully electronic compass and a tilt sensor. The SeaGuard RCM may also be delivered with new smart sensor solutions for Temperature, Pressure, Conductivity and Oxygen. All sensors have increased resolution compared with the older models. The temperature sensor also has decreased settling time to utilize the increased sampling speed provided by the SeaGuard platform. There is also an analog Turbidity Sensor available for direct connection on the top end plate.

Specifications

Top-end Plate capability:	Up to 6 sensors can be fitted onto the Top-end Plate, of which 4 can be analog sensors (0-5V)
Recording System:	Data Storage on SD card
Storage Capacity:	≥ 2GB
Battery:	
Alkaline 3988:	9V, 15Ah (nominal 12.5Ah; 20W down to 6V at 4°C)
or Lithium 3908:	7V, 35Ah
Recording Interval:	From 2s, depending on the node configuration for each instrument
Recording settings:	Fixed interval settings or Customized Sequence setting
Protocol:	AiCaP CANbus based protocol
Depth Capacity:	300m/3000m/6000m, 7000m and 10000m on request
Platform Dimensions:	
300m version (SW):	H: 356mm OD: 139mm
2000m version (IW):	H: 352mm OD: 140mm
6000m version (DW):	H: 368mm OD: 143mm
External Materials:	
300m version:	PET, Titanium, Stainless Steel 316, Durotong DT322 polyurethane
3000/6000m version:	Titanium, Stainless steel 316, Durotong DT322 polyurethane

Weight:	In Air	In Water
300m version (SW):	7.6 kg	2.0 kg
2000m version (IW):	11.5 kg	5.2 kg
6000m version (DW):	12.4 kg	7.2 kg

Supply Voltage:	6– 14 Volts
Operating Temperature:	-5 to +50°C

ZPulse Doppler Current Sensor (DCS) Specifications

Current Speed:	(Vector averaged)
Range:	0-300 cm/s, higher range on request
Resolution:	0.1 mm/s
Mean Accuracy:	± 0.15 cm/s
Relative:	± 1% of reading
Statistic variance (std):	0.3 cm/s (ZPulse mode), 0.45 cm/s [1]
Current Direction:	
Range:	0 – 360° magnetic
Resolution:	0.01°
Accuracy:	±2°
Tilt Circuitry:	
Range:	0-90°
Resolution:	0.01°
Accuracy:	±1.5°[2]
Acoustics:	
Frequency:	1.9 to 2.0 MHz
Power:	25 Watts in 1ms pulses
Beam angle (main lobe):	2°
Installation distance:	
From surface:	0.75m
From bottom:	0.5m
Accessories Included:	SeaGuard Studio SD card: 2 GB Alkaline Battery 3988 Documentation on CD Carry handle 4132
Optional Accessories:	Carry handle 4032,3965
Mooring frame:	In-line 4044[3]/3824A[3] Clamp on frame Bottom 3448R Protecting Rods 3783 Sub-surface floats 2211,2212
Battery/Power:	Internal Lithium 3908 Internal Alkaline 3988 Internal Battery Shell 4513 Electrical terminal 4784C AC/DC adapter, lab. use 4908
Other:	Real Time licence and collector Offline Configuration 4811 Analog cable/license 4564/4802 Maintenance Kit 3813/3813A Tools kit 3986A Vane Plate 3781,3681 Hardcopy Documentation

Optional Sensors:

Temperature Sensor 4060

Range:	-4-36°C (32-96.8°F)[4]
Resolution:	0.001°C (0.0018°F)
Accuracy:	±0.03°C (0.054°F)
Response Time 63%):	< 2 seconds

Conductivity Sensor 4319

Range:	0-7.5 S/m
Resolution:	0.0002 S/m
Accuracy	
4319 A:	±0.005 S/m
4319 B:	±0.0018 S/m
Response Time:	<3s[5]

Wave and Tide Sensor 5217/5218

Tide:	Range: 0-60MPa (0-8700psia) wave max: 1000kPa (145psia) Resolution : <0,0001% FSO Accuracy: ±0,02% FSO
Wave:	Sampling rate: 2Hz, 4Hz No. of samples: 256, 512, 1024, 2048

Pressure Sensor 4117

Resolution:	<0.0001% FSO
Accuracy:	±0.02° FSO
4117A Range:	0 – 1000kPa (0 – 145 psia)[6]
4117B Range:	0 – 4000kPa (0 – 580 psia)
4117C Range:	0 – 10000kPa (0 – 1450 psia)[6]
4117D Range:	0 – 20000kPa (0 – 2900 psia)
4117E Range:	0 – 40000kPa (0 – 5800 psia)[6]
4117F Range:	0 – 60000kPa (0 – 8700 psia)

Turbidity Sensor 4112: 0-5V Analog Output

4112 Range:	0-25	FTU
4112A Range:	0-125	FTU
4112B Range:	0-500	FTU
4112C Range:	0-2000	FTU[7]

Oxygen Optode 4835/4330:

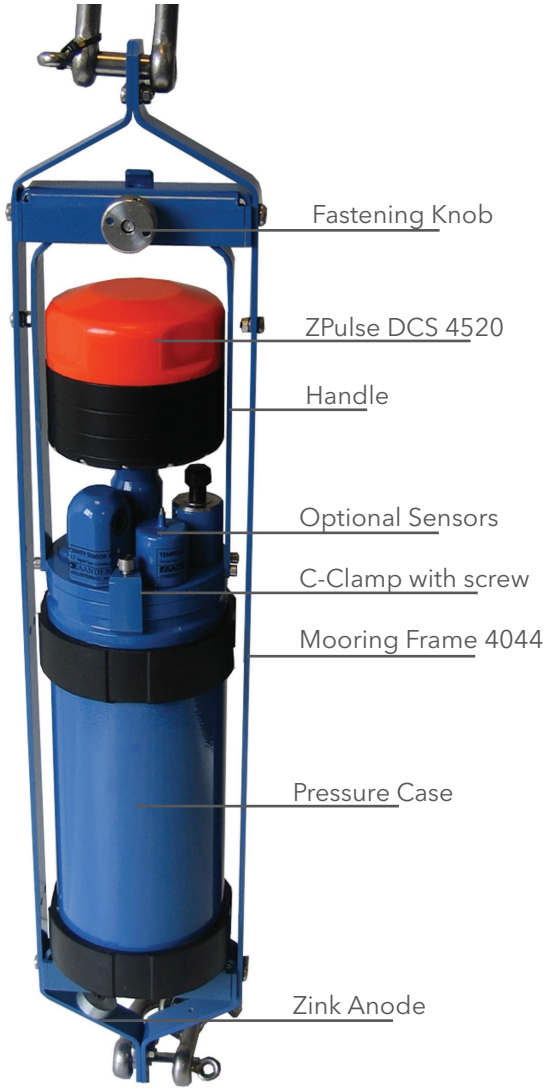
	O_2-Concentration	Air Saturation
Measurement Range:	0 – 500 mM	0 - 150%
Resolution:	< 1 mM	0.4 %
Accuracy:	<8 mM or 5%[8] whichever is greater	<5 %[9]
Response Time (63%):	4330F (with fast response foil) <8 sec 4835/4330 (with standard foil) <25 sec	

[1] Based on 300 pings
[2] Calibrated range 0-35°
[3] Breaking strength 4044: 800 kg, 3824A: 8000kg
[4] Extended range available on request.
[5] Dependent on flow through cell bore
[6] Available on request
[7] Sensor is non-linear above 750 FTU
[8] Requires salinity compensation for salinity < 1mS/cm
[9] Within calibrated range 0-120%

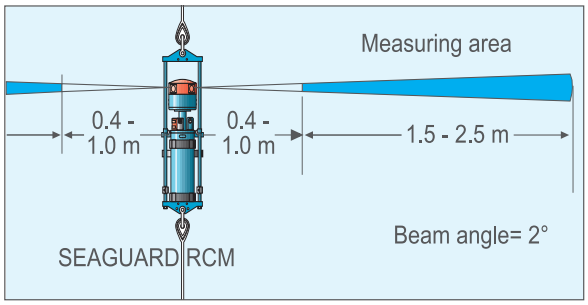
Illustrations and Descriptions

The ZPulse Doppler Current Sensor (DCS) is the standard sensor on the SeaGuard RCM. The sensor outputs Absolute Current Speed and Direction, Speed in east and north direction, Ping count, and extensive readout of quality control parameters such as Single-ping Standard deviation, Heading, Tilt in X- and Y-direction, and Signal Strength.

The SeaGuard RCM utilizes the wellknown Doppler Shift principle as basis for its measurements.



Note!
If application requires breaking strength of more than 800 kg, mount the SeaGuard RCM in an in-line mooring frame 3824A. Remember to change the handles.

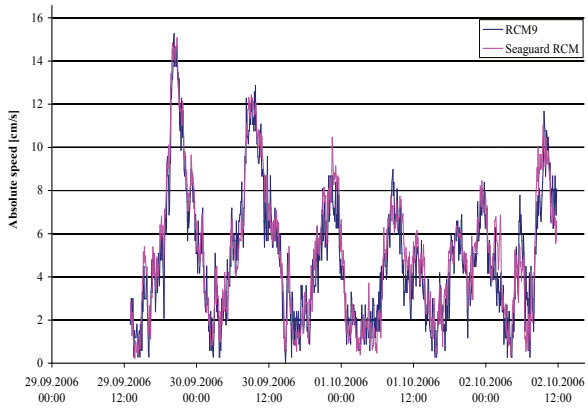


Four transducers transmit short pulses (pings) of acoustic energy along narrow beams (600, 300, 150, or 50 pings in each recording interval). The same transducers receive backscattered signals from scatteres that are present in the beams, which are used for calculation of the current speed and direction.

The scattering particles are normally plankton, gas bubbles, organisms and particles stemming from man-made activity.

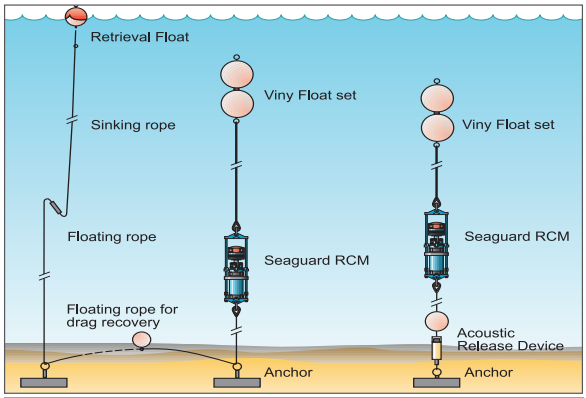
To minimize the effect of marine fouling and local turbulence, the ZPulse DCS starts measuring the horizontal current in an area of 0.4 to 1.0 meter from the instrument, see figure above.

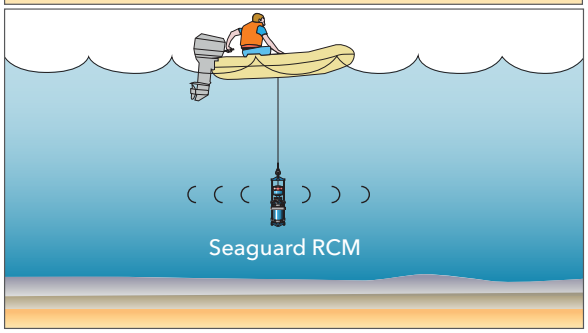
The SeaGuard RCM has been tested together with a RCM 9 to compare the measurement results. The deployment was performed during a weekend in a fjord outside Bergen. The graph below shows the absolute speed of both instruments. The pink graph represents the SeaGuard RCM, while the blue represents the RCM 9. In this test the SeaGuard was set to transmit 150 ping during each recording interval, while the RCM 9 was set to transmit 300 ping. Although the SeaGuard only transmitted half as many pings compared to the RCM 9, the two instruments gave very similar results. Lower ping count reduces power consumption.



Comparision between data measured by a SeaGuard RCM (pink) and a RCM 9 (blue). The graph is showing absolute speed measured in a fjord outside Bergen, Norway.

Applications





SEAGUARD Studio

- Import deployment data collected by the SeaGuard RCM from a SD card.
- Display configuration setting used in the depoyment.
- Display listed data.
- Possible to show data from several instruments at the same time for comparative studies.
- Export data to Matlab.
- Export data to ASCII text files.
- Print or export graphs in different formats.
- Copy graphs to the clipboard for inclusion into other programs such as Word, Excel or similar.
- Save edited sessions.
- Calculate virtual parameters.

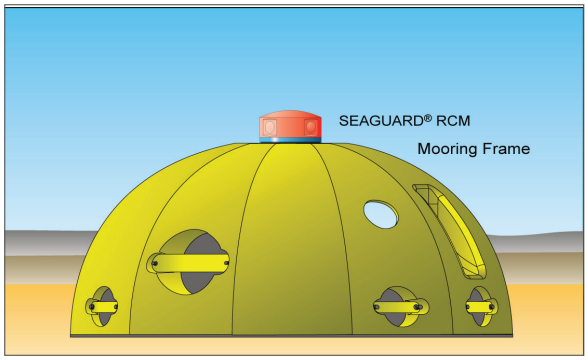
Aanderaa Real Time

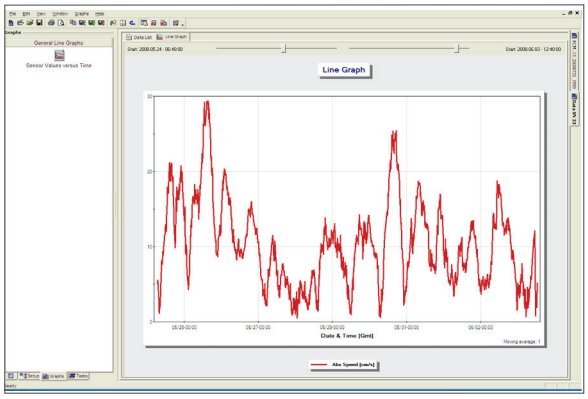
The data message from the instrument is in XML format. A user application can access the Aanderaa Real-Time Collector over the Internet or Intranet. Each user application will experience an individual connection to the instrument data due to a queue management system in the collector. One license per SeaGuard instrument serves multiple user applications. Including Aanderaa Real-Time Collector, Aanderaa Real-Time Viewer, Style Sheets and example application (See B163)

The most common way to use the SeaGuard RCM is in an in-line mooring configuration. As it operates under a tilt up to 35° from vertical, it has a variety of in-line mooring applications by use of surface buoy or sub surface buoy. The instrument is installed in a mooring frame that allows easy installation and removal of the instrument without disassembly of the mooring line.

Drop line is conveniently done due to its compact design, low drag force and easy handling. The instrument can be lowered into the sea from a small boat using a simple winch.

Data can be stored internally and read after retrieval. SeaGuard RCM can also be used in a bottom frame mooring (non-magnetic).





Example of SeaGuard Studio presenting absolute speed data measured with a SeaGuard RCM.

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