



Doppler Current Meter RCM 11

- *Insensitive to fouling*
- *Well suited for measurements of low currents*
- *Easy functional verification using an external Test Unit*
- *Low Power Consumption*
- *Well proven Pressure Case and Data Storage Units*

AADI Aanderaa Doppler Current Meter RCM 11 is a state-of-the-art Recording Current Meter, designed for deep sea operation down to 6000 meters. Unless specified, standard and optional sensors are also rated for 6000m operating depth.

The standard measurement parameters are:

- Current Speed.
- Current Direction.
- Temperature.

Optional measurement parameters are:

- Conductivity.
- Instrument Depth.
- Turbidity (depth rating 2000m).
- Oxygen.
- Signal Strength and Instrument Tilt (free and included but not coupled. You are available to couple them if needed.)

Data are stored internally in the standard Data Storage Unit DSU 2990. Data can be transmitted in real-time via cable.

RCM 11 is especially well suited for:

- Operation down to 6000 m depth.
- Monitoring Low Current Speeds in very clear water (No moving parts)

Examples of Deployments:

- Fixed bottom frame mooring.
- In-line string mooring.
- Direct Reading using a small boat.
- Long term/short term deployment.

Specifications

Measuring system: A self balancing bridge with sequential measurement of 10 channels and solid state memory. 10-bit binary word for each channel.

Number of Channels: Selectable from 2 to 10 channels. The standard parameters are given in channels 1-4¹, optional parameters are given in channels 5-10. There is only space for 4 sensors in channels 5-10 on the top end plate. If more sensors are needed, please contact factory.

Ch.1 Reference is a fixed reading to check the RCM's performance and to identify individual instruments.

Ch.2 and Ch.3, Current Speed and Direction:

Speed Sensor Type: Doppler Current Sensor 3820
Range: 0 to 300 cm/s
Resolution: 0.3 cm/s
²Accuracy:
Absolute: ±0.15 cm/s
Relative: ±1% of reading
Statistic precision: < 0.45 cm/s (standard deviation)
Direction Sensor : Magnetic compass, Hall effect type
Resolution: 0.35°
Accuracy: ±5° for 0-15° tilt and
±7.5° for 15-35° tilt

Acoustic Frequency: 2 MHz
Power: 25 Watt in 1 ms pulses
Beam Angle: ±1° (Main Lobe)
Installation distance: Minimum 0.5 m from the bottom
(to the DCS head) Minimum 0.75 m from the surface

Ch.4 Temperature: Temperature Sensor 3621
Sensor type: Thermistor (Fenwall GB32JM19)
Resolution: 0.1% of selected range
Accuracy: ±0.05°C

Response time: 12 seconds (63%)
Selectable Ranges:
Wide range: -0.64 to 32.87°C
Low range: -2.70 to 21.77°C
High range: +9.81 to 36.66°C
Arctic range: -3.01 to 5.92°C

Channels 5-10 are available for optional sensors for measurement of turbidity, conductivity, oxygen, pressure and temperature (with improved accuracy). Ref B154.

External Triggering: A positive 5 volt pulse to the Watertight Receptacle, PDC-4 output pin, will trigger one measurement cycle.

1 Channels 2-4 may have alternative configurations, please contact factory.
2 Assumes speed of sound is 1500m/s. Actual speed of sound can be corrected using the DRP 5059 program.

Data Storage Units DSU 2990 and 2990E

are standard data storage devices for Aanderaa data collecting instruments. They are rugged, waterproof and have an LCD that shows the total number of data words stored. The 2990 version can store 65 000 10-bit data words and the 2990 E version can store 262000 data words.

A built-in quartz clock allows the time of the first measurement to be recorded in the DSU as every first measurement after midnight.

Recording Intervals: 1,2,5,10,20,30,60 and 120 minutes Continuous.(4 s x no.of ch. + 2s) and Remote Start only

Recording System: Data Storage Unit 2990 or 2990E
Data storage in EEPROM

Storage Capacity: DSU 2990: 9000 records (7 ch.)
(2 months at 10 minute interval)
DSU 2990E: 36100 records (7 ch.)
(8 months at 10 minute interval)

Battery: Alkaline Battery 3614, 9 V 15 Ah or Lithium Battery 3677, 7.2 V 30 Ah for 1 year, respectively 2 years and 4 months operation at one hour interval, or 92, respectively 220 days at 10 minute interval

Average Current Consumption (mA): 0.50 + (50 divided by the recording interval in minutes)

Depth Capability: 6000 meters
Dimensions: 595 mm High
128 mm OD

Weight (kg): in air in water
Net (with frame): 26.5 18.0
Gross (with frame): 37.5

Packing: Plywood case: 190x 250x 650 mm

External Materials: Stainless acid proof steel, OSNISIL, Titanium, Durotong DT 322 polyurethane

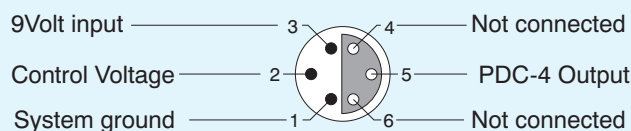
Accessories:
(Included) Mooring Frame 3824 with Sensor
Protecting Ring 966278
(Optional) Recommended Spares
Maintenance kit 3813A
Tools kit 3986
Base Brackets 3627(2) for Frame
Additional Protecting Rods 3783
Vane Plate 3681
DCS Test Unit 3731
PDC-4/RS-232 Converter 3818

Warranty: Two years against faulty materials and workmanship. For subsurface cables contact factory.

Watertight Receptacle

PIN CONFIGURATION

Receptacle, exterior view; pin = ● ; bushing = ○



General Description

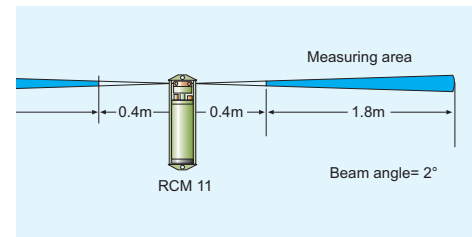
RCM11 is a unique new self-contained instrument that can be moored in the sea for long periods of time. In standard version it measures the horizontal current speed and direction, as well as temperature. Optional sensors for measuring conductivity, turbidity of the water, dissolved oxygen as well as instrument depth are also available. Optional Output from the Doppler Current sensor is Instrument Tilt and Signal Strength (those are free and included, but have to be coupled by the customer).

The instrument can operate continuously or in eight intervals from 1 to 120 minutes. At 60-minute recording interval the operating time is more than two years. This can easily be estimated by the Power Calculator (contact factory).

The RCM Doppler Current Sensor is furnished with a new Hall effect compass and a two-axis tilt sensor that compensates for the effect of inclination. This feature allows

the instrument to be used in a mooring line with an inclination up to 35° from vertical. The instrument has a depth capacity of 6000 meters. The current speed and direction are averaged over the measuring interval.

The RCM Doppler Current Sensor on the instrument sends out 150, 300 or 600 pings during each recording interval. The pings are normally distributed equally in time over the whole measuring interval but it is also possible to select a Burst Mode.



Comparing the RCM 11 with a WMCM in a short mooring

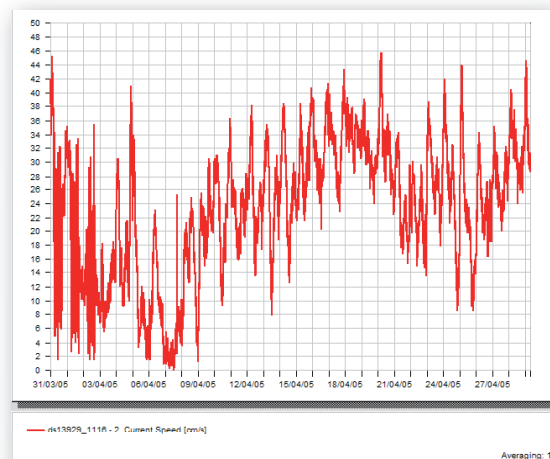
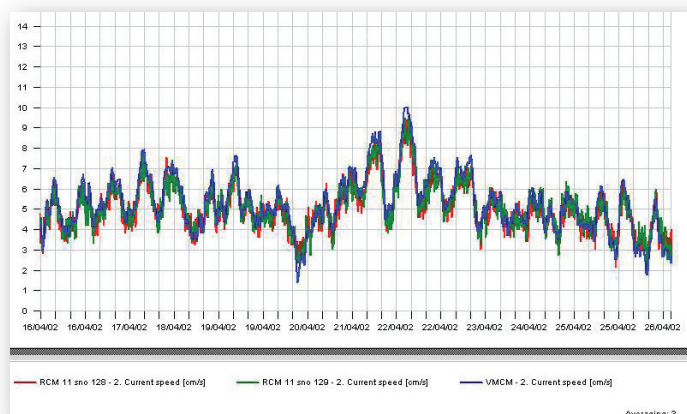
Measurements are often performed repetitively to track changes in the sea current situation at the same location. For these applications, it is important that new measurements may be compared to older measurements.

The graph on the left side below show measurement results from a deployment south of Bermuda. This place was chosen because of its clear water with a minimum of back scatters. The deployment time lasted 2 months (April - May 2002), at a depth of 4000m with a short mooring of 300m with the instruments located at the top of the mooring to prevent increased scatter level from the bottom sediments. More results and details about this deployment is found in various publications from Woods Hole.

Two separate tests were performed with this single deployment. The first was to compare measurement made by the RCM 11 and the WMCM. The second test was performed to compare burst and normal sampling schemes when the mooring movements were expected to be low.

The graph on the left side below shows the comparison of the current speed [m/s] measured with two RCM 11s and one WMCM (blue line). It is clearly seen that the current speeds measured by the instruments are very similar.

The illustration below is an example of the instruments insensitiveness to fouling. The instrument was deployed at Ennore on the East Coast of India. Although the measurement conditions were very difficult, the instrument gave data with high accuracy, refer the graph on the right side below.



The instrument can be used in the sea, in oceans, in lakes and in rivers and its special technical features, such as the narrow beam, compact design and type of integration makes it especially well suited for deep sea operation in very clear waters. An arctic temperature range ensures proper operation in the Polar Regions.

In-line Mooring

The most common way to use the RCM 11 is in an in-line mooring configuration as shown to the right. 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. The illustration shows an anchoring where retrieval of the instrument is done simply by activating the acoustic release. The glass float will bring the mooring line and the instrument package to the surface.

Reading of Stored Data

Data can be transferred from the DSU to a PC using the DSU Reader 2995 and a suitable communication program. The reader is an RS 232 interface between the PC and the DSU. For illustration, refer picture below (DRP 5059).

Data Reading Program 5059

is a software program from Aanderaa used to download DSU 2990 data to a Personal Computer using DSU Reader 2995. The program is based on the latest software technology and is designed for use with Windows 95, Windows 98 and Windows NT.

In addition to downloading and exporting of DSU data, it can also be used for data analysis. The 5059 includes extensive charting and analysis facilities, and the resulting analysis graphs may be exported to programs such as Microsoft Word and Excel. The modern user interface, including drag & drop facilities, and an extensive built-in Help system makes the 5059 easy to use.

A sensor, station and instrument library allows you to build up a library holding configuration and calibration sets for all your Aanderaa instruments. A limited version of this program is supplied free of charge. The full version is available at a moderate cost. Please contact the factory or visit our web site to obtain a 30 day fully functional trial version. The program is delivered on a CD with a comprehensive operating manual.

The 5059 Database file is following every instrument containing sensor configuration and calibration coefficients.

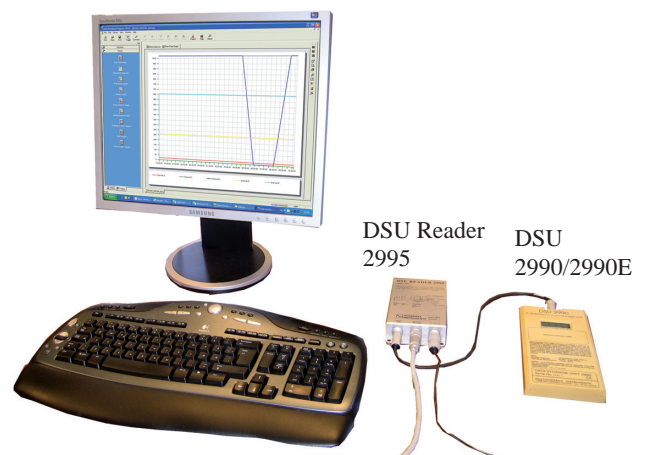
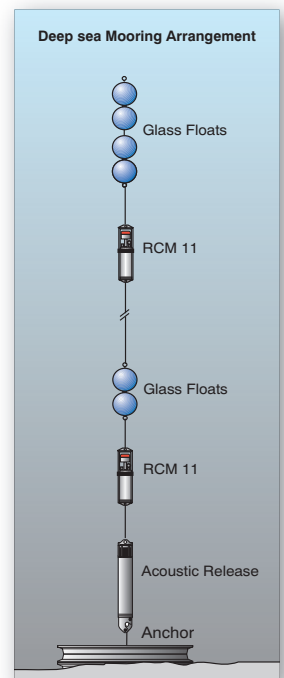


Illustration of DRP 5059: Data are read from DSU 2990 using DSU Reader 2995.

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Representative's Stamp

RCM 11s provide multiparameter platforms

Doppler Current Meter RCM 11 down to 6000 meter depths reliably and accurately



DOPPLER CURRENT SENSOR 3820

- Current speed, current direction, signal strength and tilt of instrument
- More than 1500 in use
- No drift
- No calibrations
- No/low fouling sensitivity
- DSP technology with multiple outputs



TEMPERATURE SENSOR 3621

- Thermistor (Fenwall GB32JM19)
- Resolution: 0.1% of selected range
- Accuracy: $\pm 0.05^{\circ}\text{C}$
- Selectable Ranges: Wide, Low, High and Arctic range

SUITE OF OPTIONAL SENSORS AVAILABLE



NEW TEMPERATURE SENSOR 4050

- Thermistor (Fenwall)
- Resolution: 0.001°C
- Improved Accuracy: $\pm 0.03^{\circ}\text{C}$
- Ranges: A: 0 to 36°C ; B: -4 to 36°C



NEW PRESSURE SENSOR 4017

- Compact fully integrated sensor measuring water pressure
- Easy integration as OEM sensor in most measuring system
- Up to 60MPa range
- Accuracy: $\pm 0.04\%$ FSO, Resolution: $\pm 0.02\%$ FSO(2)
- ASCII RS-232 and Aanderaa SR10
- Programmable confining of range to increase resolution



NEW CONDUCTIVITY SENSOR 3919

- Long-term stability/minimal maintenance
- Better accuracy and resolution
- Not pressure sensitive
- Selectable multiple parameter outputs (cond/sal)
- Built-in temperature sensor for compensation
- Accuracy: 3919A $\pm 0.005\text{S/m}$, 3919B $\pm 0.0018\text{S/m}$
- Resolution: 0.0002S/m
- Programmable Range: Zoom to obtain best resolution



NEW OXYGEN OPTODE 3830

- Show excellent user results
- Similar accuracy to Winkler titration
- Long-term stable (years)
- Low fouling sensitivity
- DSP technology with multiple outputs
- Built-in temperature sensor for compensation
- Selectable outputs ($\mu\text{m}/\%s$)



TURBIDITY SENSOR 3612*

- Long-term stability
- More than 1100 in use
- Accurate and reliable
- Ideal for sediment transport studies
- Ranges: 0 - 20/0 - 100/0 - 500/0 - 2000 NTU
- Accuracy: 2% of full scale

*Maximum 2000 meters depth

DOPPLER CURRENT METER RCM 11

— More than 600 in use

- Robust, reliable, accurate and easy to operate (no PC needed to set-up and start)
- Temperature sensor included
- Tilt and backscatter included
- Data Reading Program 5059 software for post processing data



RCM 11 Including:

Current Speed, Current Direction, Sea Temperature, Signal Strength, Tilt, Burst mode and Alkaline Battery (9V/15Ah),