TD 220a DEPLOYMENT GUIDE
Recording Doppler Current Profiler
RDCP600

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INTRODUCTION

Purpose and scope

This operating manual describes the Recording Doppler Current Profiler, RDCP 600, how it is used, maintained and serviced.

The RDCP 600 is an important member of the family of Aanderaa Recording Current Meters.

Together they cover the whole range of sea current measurements from the surface down to 6,000 meters depth.

Besides Doppler technology, the RDCP 600 retains several standard features of the Aanderaa recording instruments, such as the pressure case, compass, Windows CE interface and the electronic board.

The RDCP 600 is one of the most advanced product of Aanderaa Data Instruments AS to date.

RDCP 600 has been designed for use in bottom-mounted installations as well as in ordinary string moorings where it may replace multiple single-point current meter installations.

The instrument consists of a triple processor system capable of up to 650 MIPS, advanced signal processing algorithms and an embedded real-time, multithread, multi-process operating system.

The combination of such resources produces superior data quality as well as unsurpassed flexibility and easy operation.

Although the RDCP 600 is primarily a self-contained current profiling device which stores data internally on the MMC or CF card, it can also be used to supply data in real-time to e.g. port offices or vessel traffic centres.

The RDCP comes in three versions: the 300m standard POM version (Shallow Water), the 2000m Titan version (Intermediate Water), and the 4000m Titan version (Deep Water) .

Document Overview

TD220a describes the deployment configuration of the instrument, maintenance and installation/retrieval procedures. Please refer TD220b for RDCP Studio information and TD220c for RDCP Primer.

References

TD220b	RDCP Studio
TD220c	RDCP Primer
D343	RDCP Data Sheet
TD257	RDCP Power Consumption
B146	RDCP External Battery
TN289	RDCP Installation Considerations
TN294	RDCP Bottom mooring frame
TN293	Usage Considerations
TN297	RDCP Quick Start
TD218	Operating Manual Oxygen Optode 3830/3835
TD222	Operating Manual Conductivity Sensor 3919/4019/4120
TD258	Operating Manual Pressure Sensor 4017/4117
TD260	Operating Manual Temperature Sensors 4050/4060
TD208	Operating Manual Data Reading Program 5059
TN236	Calibration Accuracy for Aanderaa DCS products
TN300	Import of data from RDCP Studio to MATLAB
TN302	Transducer axes, heading and tilt of the RDCP 600
TN306	RDCP Wave Analysis Program
TD270	Users Manual RDCP Acoustic Wave Analysis

Abbreviations

AAI SP	AAI Standard RS-232/485 based protocol
ASCII	American Standard Code for Information Interchange
CF card	Compact Flash Card
LCD	Liquid Crystal Display
MIPS	Millions of Instructions Per Second
MMC	Multi Media Card
PDC-4	Pulse Duration Code 4 seconds
RDCP	Recording Doppler Current Profiler
SR-10	This signal corresponds to the digital signal obtained when the contents of a 10-bit shift register are clocked out in serial format. This signal is used when the parameter to be measured is digital, e.g. a frequency or a number of pulses.

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Definition of terms

<CRLF>	Carriage Return Line Feed. These are the two ASCII character values 0x0D and 0x0A
<TAB>	Tabulator character (ASCII number 0x09)
0xNNNN..NNN	A number denoted with 0x is a hexadecimal integer

Front view of the RDCP 600

Transceiver Head

Transceiver Head connections

LCD Display

Stylus

Main Board

On/Off Switch

Multimedia Card Slot

MMC cover

Terminal Cover
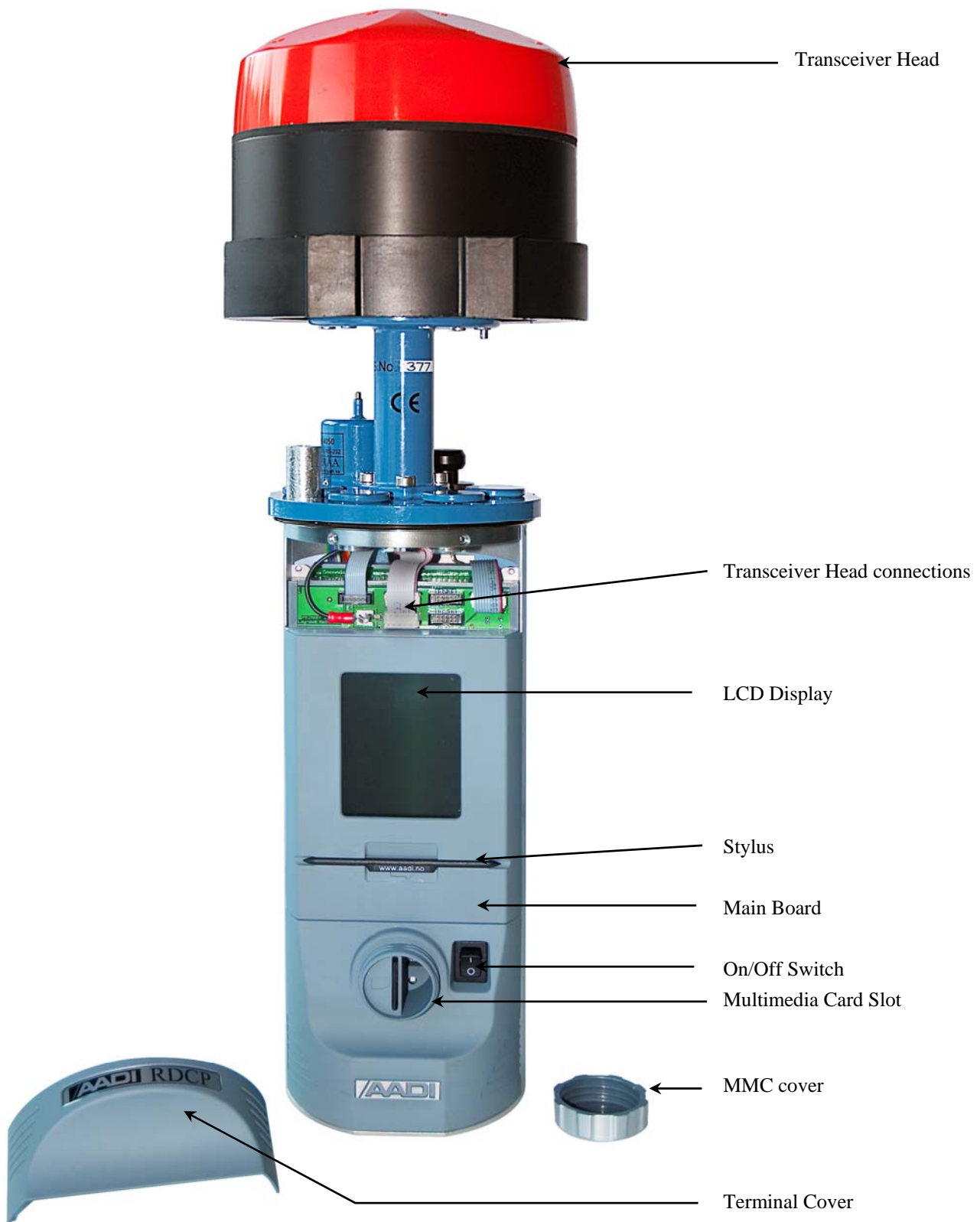
Fig. 0-1 Front View of the instrument

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Rear view of the Instrument

- Transceiver Head
- Top End Plate
- Sensor board
- Battery latch
- Battery
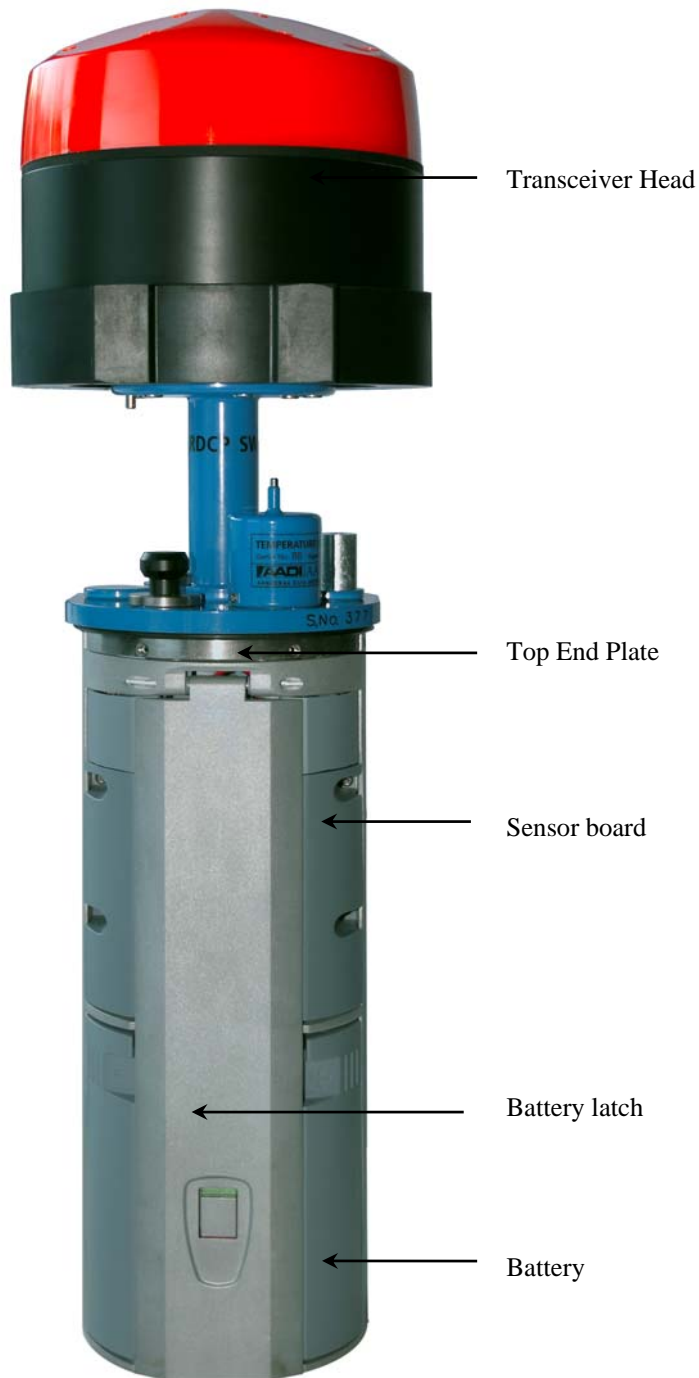
Fig. 0-2 Rear View of the instrument, Cover on

Battery terminal

Sensor Board

Sensor Board cover

Compass

Sensor Board connector cover

RDCP inner frame
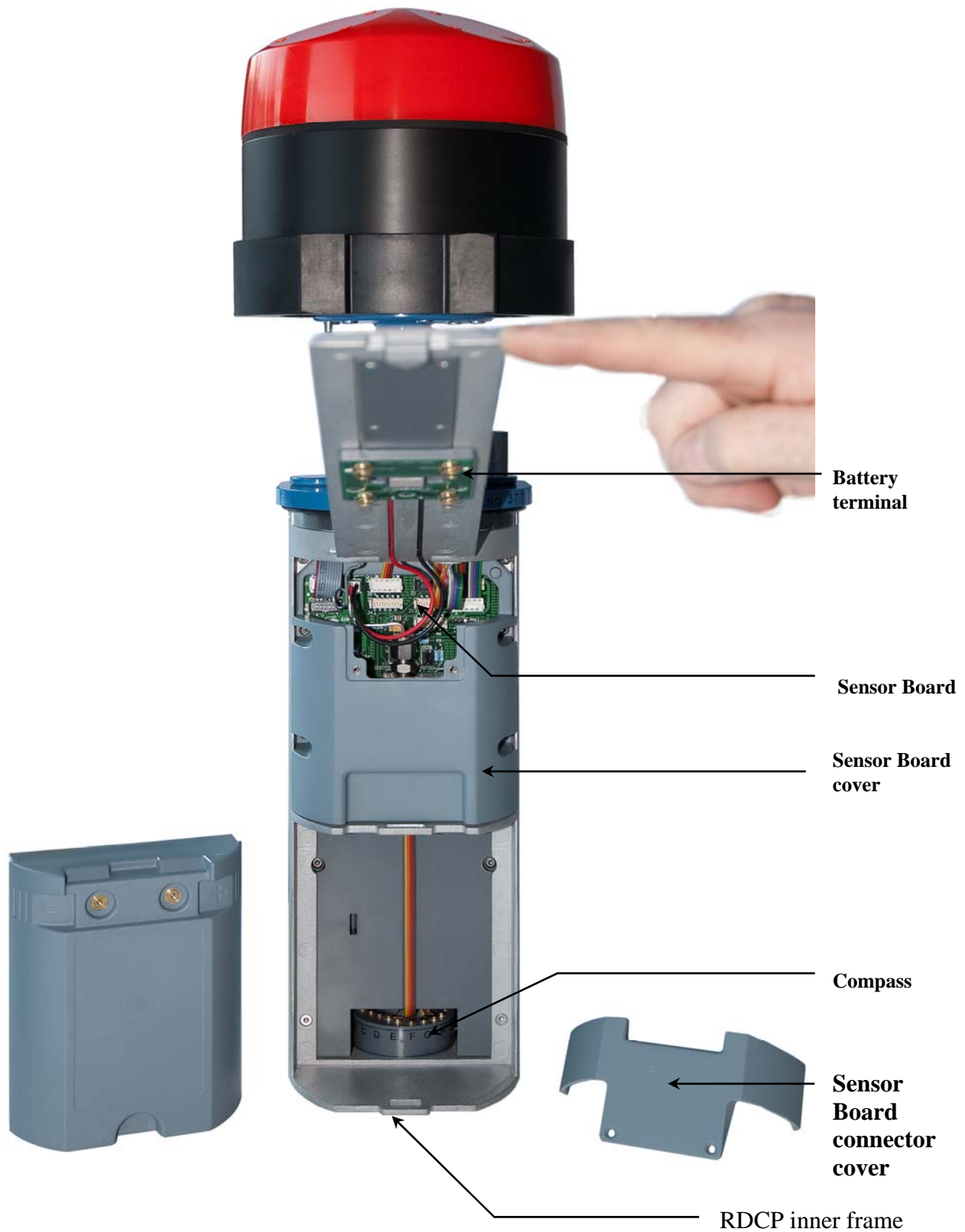
Fig. 0-3 Rear View of the instrument, Cover off

Basic Description of RDCP600

The RDCP 600 is a 600kHz, medium range self recording Acoustic Doppler Current Profiler.

It is designed using the latest advances within the telecom and computer industry and employs a high performance, low-power digital signal processing system, state-of-the-art 32-bit embedded central processing system and Windows Embedded real-time operating system.

The complete firmware in the RDCP 600 may be upgraded by means of the MMC or CF slot.

The modern processor system employs an easy to use graphical user interface that allows the user to set up the instrument without the need of an external computer.

An advanced beam compensation system corrects instrument tilt and provides true horizontal current at the desired location even when the instrument is tilted.

This feature allows the instrument to be used in easy to deploy in-line string moorings, in fixed bottom installations as well as in upside-down buoy deployments.

The RDCP 600 also allows for concurrent measurements of multiple profile columns with different cell size and reference.

This enables the user to monitor bottom currents as well as currents around floating installations without any need for post deployment cell manipulation.

Data may be stored on high-capacity storage cards and/or sent out in real-time on RS-232, RS-485 or PDC-4 ports.

Currently, the supplied MMC card stores 512 Mbytes. MMC cards of higher storage

capacities that are delivered from other suppliers are not tested together with the MMC reader for use on the RDCP 600. The CF can store up to 2 Gbytes.

Fig. 0-4 RDCP 600 Internal View

A modern Windows based post- processing system for PC, RDCP Studio, comes with the RDCP 600. RDCP Studio includes 3D visualization of current speed data.

This powerful graphical presentation gives the user a compressed view of the current profile in a single picture with a quick overview of the current situation during the deployment period.

Multiple Columns

The RDCP 600 may be configured to deal with several columns (profiles) simultaneously for optimum flexibility.

Each column may be set-up with individual cell size and cell overlap, and may further be defined as being either instrument referred or surface referred.

When a column is instrument referred, the distance from the instrument to the start of the column is kept constant; a setting which is usually used in deep waters where the surface is distant or when bottom currents are to be monitored.

Surface referred columns are defined as having constant distance from the surface to the column. In order to achieve this, the RDCP 600 uses the high accuracy pressure sensor (which must be installed on the RDCP) to calculate the distance to the surface. It then uses this information to move the column up and down to hold the distance to the surface constant.

Surface referred columns are especially powerful when you are measuring currents close to the surface or want to monitor current speeds at a certain depth.
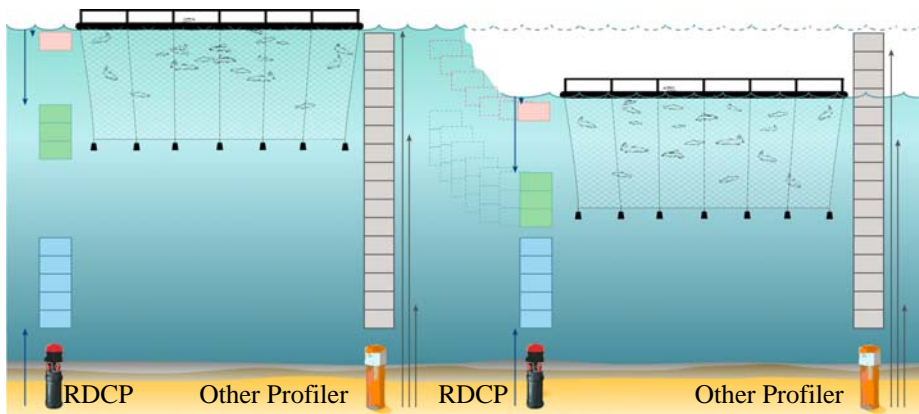
Cell and Cell overlap

Cell overlap is a feature that allows the extension of one cell to overlap its neighbouring cells (refer to the illustration to the right). This feature improves the vertical resolution of the sea column without sacrificing data quality.

Another advantage is the possibility to fine-tune the upper or lower cell position so that measurement may be performed as close to the surface or bottom as possible without facing problems with side lobe contamination. Cell overlap may range from 0% (no overlap) to 90% (adjacent cells overlap 90%).

By using a high cell overlap, you achieve improved near surface measurements
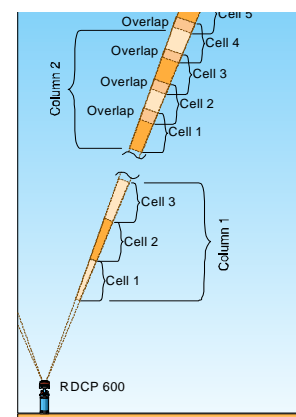
Standard Features of RDCP600

- ❑ 300 meter depth capability
- ❑ Current profile data
  - o Horizontal speed and direction
  - o Vertical speed
  - o Signal strength and single ping standard deviation
  - o Beam speeds
- ❑ Heading, pitch and roll
- ❑ Instrument referred multiple profile columns
- ❑ Real-time output, RS-485, PDC-4
- ❑ Windows based embedded configuration

Standard Sensors and Accessories

- ❑ Transceiver Head (300m POM version).
- ❑ Compass and Tilt sensor. *Part no. 3777*
- ❑ MMC card 512 MB
- ❑ Stylus. *Part no. 3972*
- ❑ RDCP Studio data reading and processing software package
- ❑ Shipping container
- ❑ Wrench for C-clamp

Optional Features of RDCP600

- ❑ 2000 meter depth capability
- ❑ 4000 meter depth capability
- ❑ Power supply, 12V/3A. *Part no. 4908*
- ❑ Tool Kit. *Part no. 3986*
- ❑ Battery (Alkaline) 9V/15Ah for test purposes only. *Part no. 3988, low magnetic.*
- ❑ MMC card Reader for USB port
- ❑ RS-232 Real Time Output
- ❑ Pressure, depth and tide measurements
- ❑ Conductivity, temperature, turbidity, dissolved oxygen
- ❑ Wave parameters (pressure based and acoustic based)
- ❑ Surface referred columns
- ❑ Mooring frames
  - o In-line frame
  - o Fixed bottom frame
  - o Trawl resistant bottom frame

Optional Sensors and Accessories

- ❑ Temperature Sensor. *Part no. 4050*

- ❑ Conductivity Sensor. *Part no. 3919/4019*

- ❑ Oxygen Optode. *Part no. 3830, 3835*

- ❑ Pressure sensor. *Part no. 4017*

- ❑ Quartz Pressure sensor. *Part no. 3187*

- ❑ Turbidity sensor. *Part no. 4705/3612*

- ❑ Bottom Mount Frame. *Part no. 3448*

- ❑ In-Line Mooring Frame. *Part no. 3910A, 4110*

- ❑ Protective Rods (2ea). *Part no. 3967*

- ❑ Signal and Power cable. *Part no. 4937, 5071, 5072*

- ❑ Galvanic isolator. *Part no. 3945*

- ❑ External Battery case *Part no. 4062, 5062, 4219, 5219*; ref B146

- ❑ Cable for external battery case. *Part no. 4619*

- ❑ Watertight receptacle with Sub-Con. *Part no. 4949*

- ❑ Battery pack for external Battery case

- ❑ Test Battery (Alkaline) 7V/15Ah. *Part no. 3988.*

- ❑ Battery (Lithium) 7V/30Ah. *Part no. 3908*

- ❑ Battery 150Ah. *Part no. 3999*

- ❑ Battery (rechargeable). *Part no. 4021*

- ❑ Deck Unit (PDC-4 test unit). *Part no. 3127*

- ❑ Maintenance kit. *Part no. 3813*

- ❑ AAIRdcpCOMServer (an ActiveX based interface software component for RS-232 and RS-485 real-time output). *Part no. 4027*

Illustration of sensors

Sensors from left: Pressure sensor 4017, Turbidity sensor 4705, Conductivity sensor 3919/4019, Turbidity sensor 3612, Temperature sensor 4050, Oxygen Optode 3830, , Oxygen Optode 3835, Quartz Pressure sensor 3187.

CHAPTER 1 Deployment Guide

Start the instrument by pressing the power button at the rear of the instrument. Wait for approximately 20 seconds before the LCD display at the front of the instrument is activated.

We recommend that you power the instrument from an AC/DC source when working with the instrument in the office to avoid unnecessary drain of battery. Connect the AC/DC power cable to the electrical terminal on the Top end plate.

IMPORTANT! Ensure that the protective cap is fitted and tightened to the electrical terminal before deployment.

1.1 RDCP600 Primary Menu System

The RDCP 600 menu system holds the key entries for the configuration and use of the instrument. Tapping the *Menu* button in the lower left corner of the LCD display activates the menu.

The two primary menu items for configuration and use of the instrument are:

❑ Deployment Setup

❑ Recorder
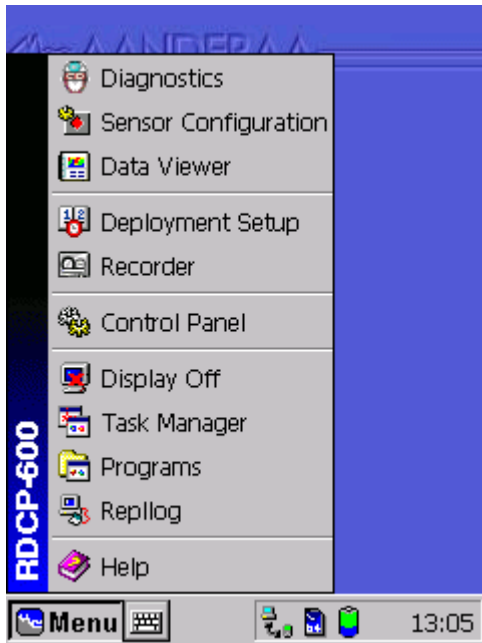
Deployment Setup is used to configure how and how often the instrument should measure a current profile, and the *Recorder* menu is used to start a measuring session.

Other menu items, such as *Sensor Configuration, Control Panel* and *Diagnostics* are used for maintenance.

Tap the *Help* menu item to activate the online help and select topics from the book list.

Repllog is a feature used for direct connection between the instrument and your PC and is primary used for service.

Data Viewer is a feature that has not yet been implemented.

Figure 1-1 Deployment Setup Menu

IMPORTANT!

Always scan through all the options in each page to make sure your configuration is correct.

Always tap the 'X' in the upper right corner of the Deployment Configuration and the Sensor Configuration page to store settings after configuration; a message appears on the LCD screen telling you: 'Storing. Please wait'. If power is lost during settings or during storage of the settings, the configuration must be repeated and stored.

1.2 Deployment Configuration

The Deployment Configuration holds an overview of the current configuration, a library system and a set of sub-configuration menus. For parameter settings we recommend that you use the Configuration Wizard (refer page20). Alternatively you may set the configuration for each sub-section manually (refer page **Error! Bookmark not defined.**) or use an already stored configuration (refer page 19). The items that are set up in the sections are:
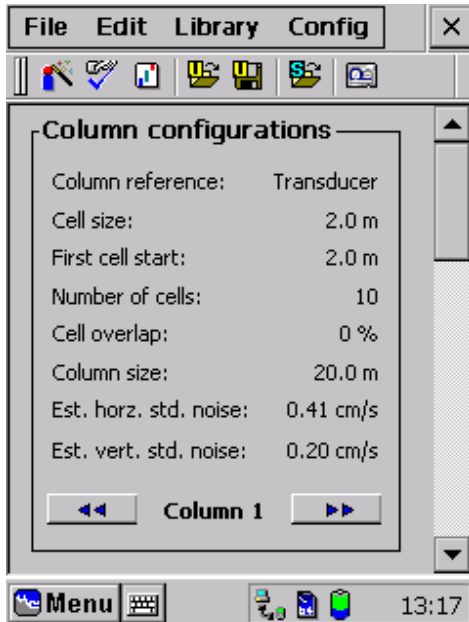
- ❏ Site

- ❏ Profile

- ❏ Startup mode

- ❏ Wave (if installed, ref. CHAPTER 2)

- ❏ Timing

- ❏ Storage

- ❏ Real-time output (RS-232, PDC-4, RS-485)

Figure 1-2 Deployment Configuration Menu

A library system allows you to store and retrieve configurations from earlier sessions. It comprises a User and a Stock part.

 Tap these icons to retrieve configurations from User library or Stock library respectively.
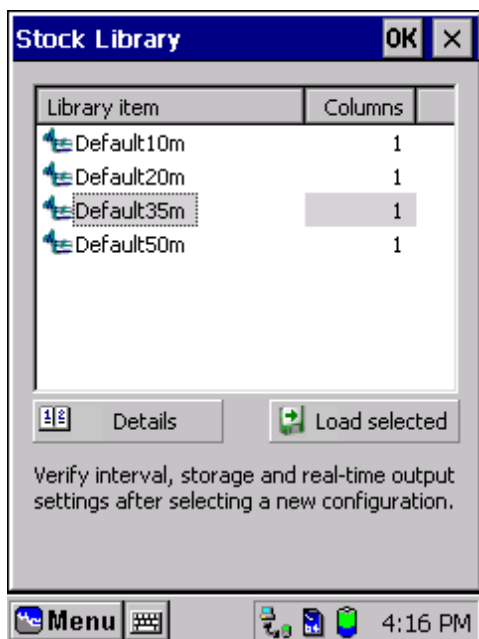
Figure 1-3 Stock library, default factory configurations.

In the Stock library there are some factory pre made configurations available for the user to download:

Default10m: no surface cell, 1.5m cell and pulse size, Low power level, -6dB pulse attenuation, 300 pings in record, burst mode.

Default20m: no surface cell, 2.0m cell and pulse size, Low power level, -3dB pulse attenuation, 300 pings in record, burst mode.

Default35m: no surface cell, 2.0m cell and pulse size, Low power level, 0dB pulse attenuation, 300 pings in record, burst mode.

Default50m: no surface cell, 2.0m cell and pulse size, Low power level, 0dB pulse attenuation, 300 pings in record, burst mode.

Download from the library by tapping *Load selected,* once the preset configuration has been selected
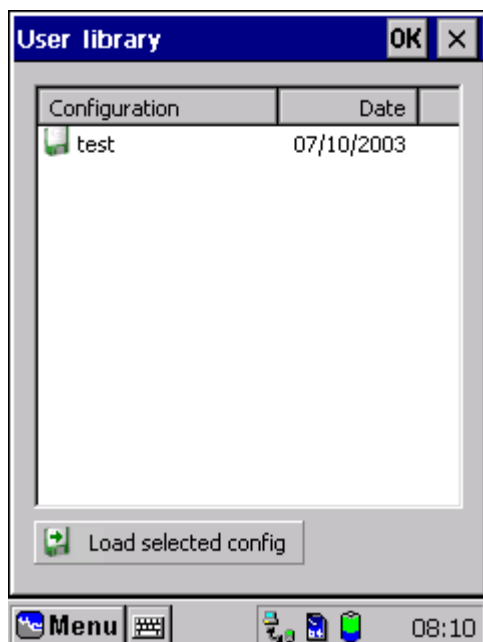
Figure 1-4 User Library

 Tap this icon if you want to store your configuration in User library

.

Figure 1-5 Keyboard Function

Tap the *keyboard* icon in the bottom left corner to activate the keyboard.

Next, tap the letters one by one to write an appropriate file name.

Hide the Keyboard function by tapping the *Keyboard* icon once more.

Figure 1-6 Configuration Wizard

Tap the [Wizard icon] *Wizard* button to set up the configuration, refer to Figure 1-2.

The Wizard will take you through each sub-configuration step-by-step.

Initially, the wizard shows a list of all steps required to complete the process in a *grey colour*.

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Figure 1-7 Wizard Initial Steps

As you progress with the steps, the completed steps will turn *black* and a check mark will be inserted next to it.

Tap *Go* to start the first step, perform the sub-configuration and tap *Go* again until all steps are completed and the button shows *Finished*.

Then tap *OK* in the top right corner to complete the session.
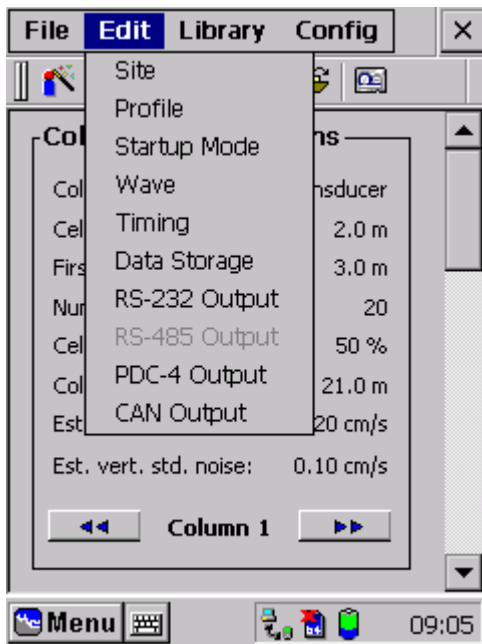
Figure 1-8 Wizard Alternate Configuration

Alternatively, the configuration can be set up for each sub-section manually:

Tap the *Edit* button above the icons or the icon.

Start with the *Site* section and continue with each section as laid out in the overview.

The setup program monitors your settings and prevents you from picking illegible settings.

IMPORTANT! Perform the configuration steps in the sequence laid out in the menu: Top to bottom, left to right. This ensures that the system has relevant information when it checks for invalid configurations.

The *Site* menu holds site-specific information about the *location* of the deployment. Check that the *fixed parameters* are relevant for the location and enter other parameters as required. In the *installation page*, check the *instrument is looking downwards* if the deployment is a downward installation, and choose the anticipated installation depth from the drop-down menu.

Make sure that the estimated installation depth and transducer direction are properly set at this stage. The instrument will use this information later when calculating maximum ping rate etc.

Note! If you use fixed pressure you might not be able to set the instrument depth. This is because the instrument depth is only used to do calculations that are needed when you have surface-referred cells and columns, which you are not supposed to choose if you use fixed pressure.

The *Profile* menu, *Timing* menu, *Data Storage* menu and the different *Real–time output* menus are described in the next sections.

In the *Startup Mode* menu the user specifies if the instrument should start when the Recorder application's *Start* button is tapped, when power is applied or start at a remote command, refer chapter 1.6.

The first setting is the common one, while the second is typically used in fixed installations with power supply from ashore; if power is lost for a period of time, the instrument needs to restart automatically when the power supply is regained.

NOTE! After completing a session or a sub session tap OK in the upper right corner to save new settings and continue with the configuration.

1.3 Profile Setup, Multiple Columns
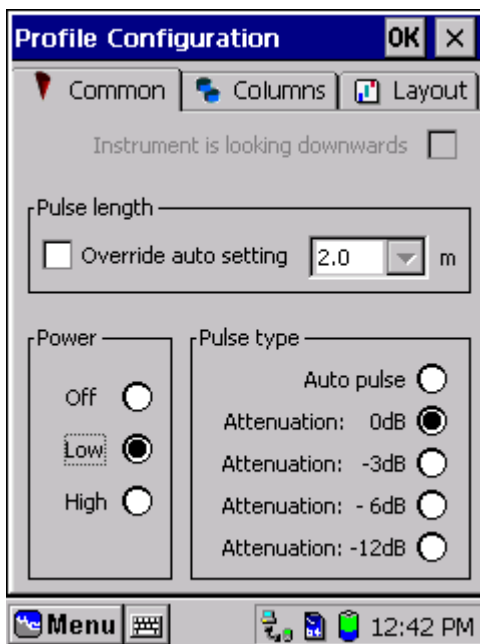
Figure 1-9 Profile Configuration Common

The Profile configuration consists of three pages; *Common, Columns* and *Layout*.

Set the Common elements first and proceed with the Columns and Layout.

If *Override auto setting* is unchecked the pulse length is automatically set to the shortest cell size in the configuration. Refer to subchapters on page 25 to 27 for our recommendations regarding profile settings and limitations.

Use *Low* power and *Auto pulse* as the standard power setting.

High power should only be used in fixed installations with power supply from ashore.

- ❑ Low Power: 20 Watt

- ❑ High Power: 80 Watt

IMPORTANT! Use 'Off' when testing the instrument in air. When recovering the instrument after deployment in the sea, switch OFF the instrument as soon as possible to reduce aging of the transducers (due to operation in air). When power is 'Off', pulse type settings can not be selected.

The attenuated pulse types may be used to reduce power consumption. This setting may be used when the range is not set to full range. The optimum setting depends on e.g. the pulse length and scattering conditions, but as a general guide with a 2m pulse and Low Power: -3dB can be used up to 25m; -6dB can be used up to 15m; -12dB can be used up to 10m.

If the Auto Pulse setting is checked, the instrument will automatically select the proper attenuation based on the signal strength. Auto pulse will use either 0 dB, -3 dB or –6 dB Attenuation.

Figure 1-10 Profile Configuration Columns
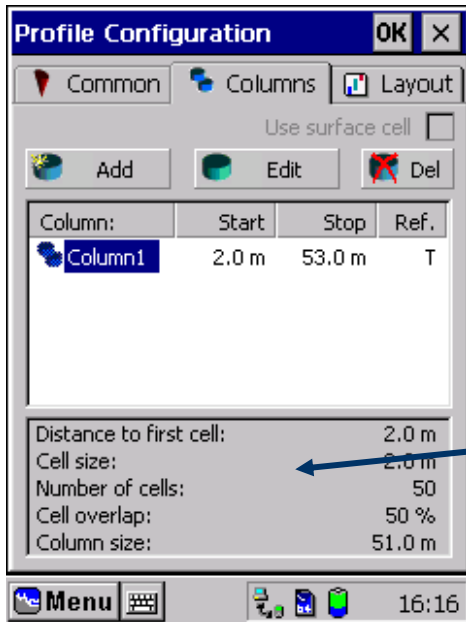
The *Columns* page is used to configure each column.

Add a new column by tapping the *Add* button.

Select an existing column and edit or delete that specific column as required by tapping the *Edit* or the *Del* button.

The option *Use Surface Cell* is only available if a quartz pressure sensor is installed.

Information about each configured column is found at the bottom of the page.
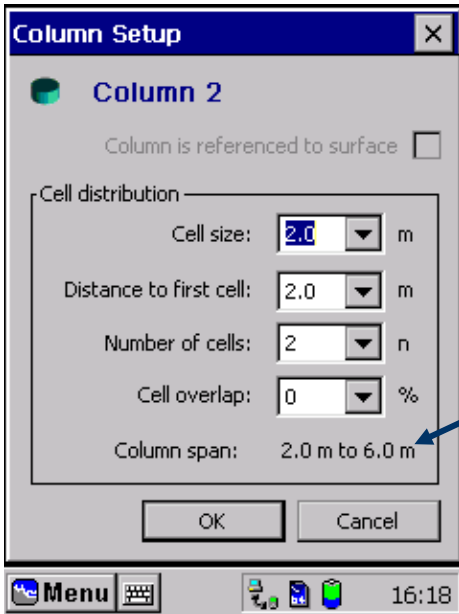
Figure 1-11 Profile Configuration, Column Setup

Adding/Editing a column:

The columns are by default set to be transducer referred. Check the *Column is referenced to surface* button to achieve a surface referred column –only available when the quartz pressure sensor is installed.

Type in the Cell size, Distance to first cell, Number of cells and Cell overlap as laid out in the menu.

The column span is given at the end of the page.

Please note that the surface cell and surface referred columns may not be available in your instrument version, as this feature requires that the RDCP 600 is equipped with a high accuracy pressure sensor, and the deployment must be an upward facing deployment.

Guidelines to *Columns and Cells* are given over the next pages.

IMPORTANT! Do not use surface referred columns if the installation depth exceeds 100m! The profiler is not capable of collecting data from a water column larger than 100m and will provide faulty measurements when attempting to place the surface referred column/cells outside of this profiler range. The instrument will prevent you from choosing surface referred columns if you have already set the installation depth in the Site section to more than 100m, but the problems will arise if you have forgotten to set this correctly.
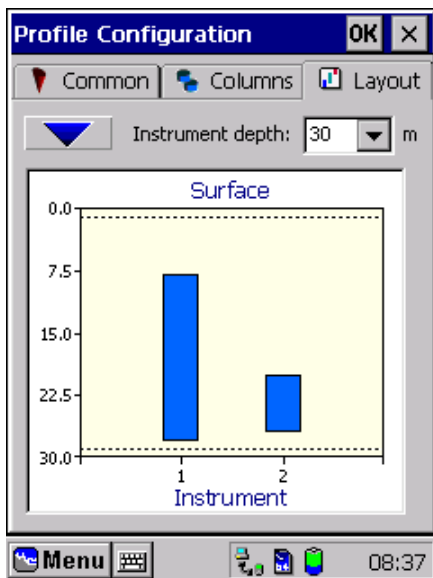
Figure 1-12 Profile Configuration Layout

Tap the *layout* button to view a graphical illustration of your columns setting.

Select an instrumentation depth that best matches your preferences for optimal viewing of the columns.

NOTE! This is for viewing purposes only and will not affect the true instrument deployment depth.

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1.4 Recommended Settings and the effect of changing parameters

As a starting point for your deployment, we recommend the following setup:

- ❑ *Pulse Length:* 2 m

- ❑ *Cell size:*   2 m (equal to Ping Length)

- ❑ *Power Level:*   Low Power, Auto pulse

- ❑ *Ping Count:*   300 pings

- ❑ *Cell overlap:*   50 %

The RDCP 600 may use a *cell size* ranging from 1 to 10 meters.

The advantage of a small *cell size* is high resolution, but at the expense of a more noisy measurement.

If the *cell size* and the *pulse length* is doubled, the statistic noise halves.

Doubling either the *cell size* or the *pulse length* (keeping the other unchanged) yields an improvement of the noise by the square root of two.

Increasing the *Ping count* will improve the noise.

Doubling the *Ping count* also yields an improvement in the order of the square root of two.

Cell overlap does not yield more information, but may smooth the vertical resolution of the sea column. However at a slight increase in Power drain.

Increasing the *Ping Power Level* increases the measurement range.

NOTE! Increasing the Ping Power Level, the Ping count or the Pulse length increases the Power drain.

1.5 Column Types

One of the unique features of the RDCP 600 is the ability to work with several profile columns in the same configuration, Refer to *basic description of the RDCP600*.

The columns suite may comprise a mix of different or similar column types.

There are essentially three column types available, refer to page 12:

❑ Instrument referred: An *instrument referred* column starts at a certain distance from the instrument and extends above the instrument to a certain range.

Instrument referred columns are not influenced by tidal variations.
This is the normal column type that we are used to from other current profilers.

❑ Surface referred: A *surface referred* column starts at a certain distance from the surface and extends down in the sea.

The instrument utilizes the high accuracy pressure sensor to measure the distance from the instrument to the surface and uses this information to maintain the column starting position.

❑ Surface cell: A *surface cell* is a special version of a surface referred column.

The surface cell is one single cell that is aligned so that the centre of the cell is located at the surface. The surface cell is only available if the quartz pressure sensor is installed.

IMPORTANT! Surface referred cells and surface cell is one available on RDCP with quartz pressure sensor 3187 installed.

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1.5.1 Column Limitations

Surface referred columns are only available when a high accuracy quartz pressure sensor 3187 is installed, and when the distance from the instrument up to the surface is below maximum range, refer TD220b *RDCP Studio* and Technical specifications in TD220c *RDCP Primer*.

There may be only one surface cell, but several of the other column types.

Instrument referred columns and surface referred columns can both be set up in the same deployment. This is an advantage when certain parts of the water column are monitored with respect to the surface as e.g. in harbour and fish farming installations.

A surface referred column will automatically compensate for tidal variations.

Different cell sizes may be used in different columns in the same deployment, but keep in mind that the pulse length will be the same for all columns.

NOTE!

Refer to page 29 for considerations and recommendations regarding cell size and pulse length.

Surface referred columns that extend below the instrument are skipped and padded with zeros in the data.
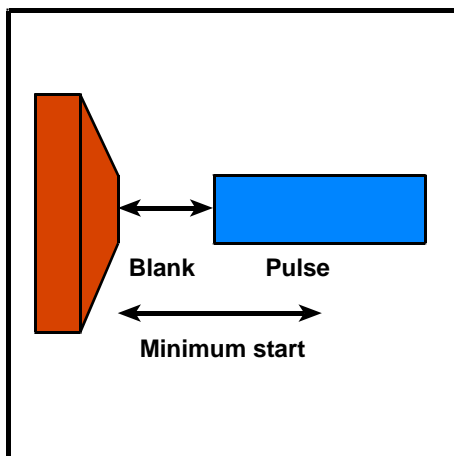
Figure 1-13 Minimum Distance to First Cell

a single column is 100.

The minimum distance to the first cell for an instrument referred column is the instrument blanking distance plus half the pulse length, ref. **Error! Reference source not found.** and **Error! Reference source not found.**, page **Error! Bookmark not defined.** (the blanking distance is 1m for the 300m version, and 2m for the 2000-6000m versions).

The minimum distance to the first cell for a surface referred column is half the pulse length.

The current maximum number of cells set up in one deployment is 150. The maximum number of cells in

1.5.2 Memory Limitations –number of Cells and Pings

The RDCP 600 includes 6Mbytes of total SRAM memory. Some of this memory is used by the operating system itself, while the remaining amount may be used for measuring purposes. The amount of memory used is a function of the number of total cells (all columns) and the number of pings used in the deployment configuration.

The graph below shows this memory constraint as a function of number of pings and number of total cells.
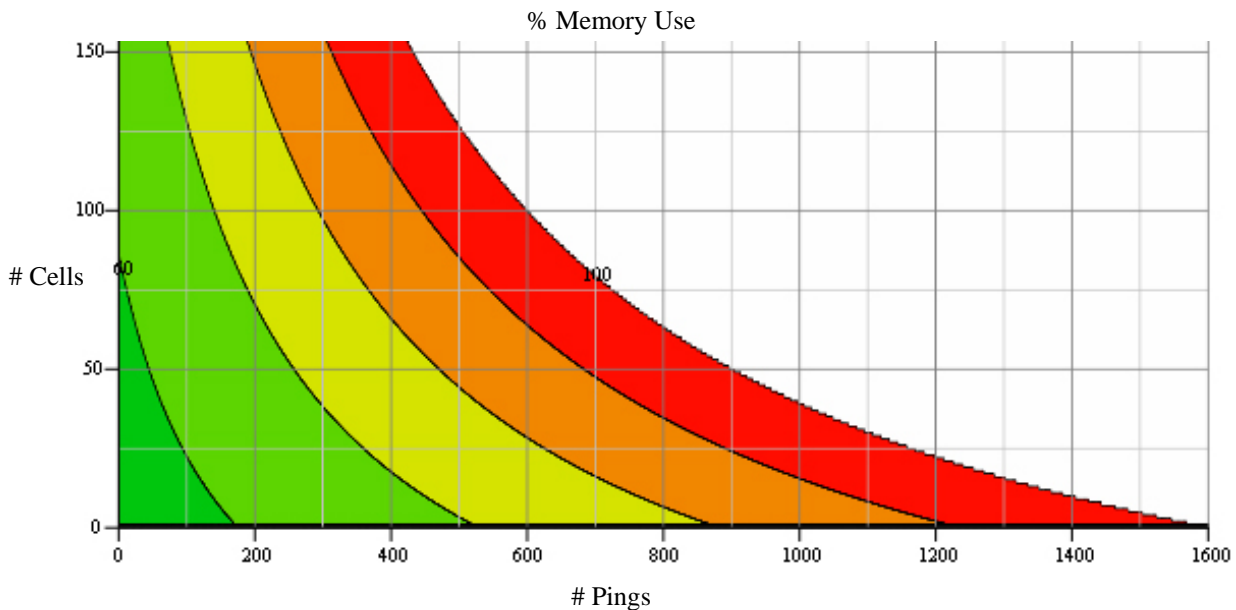
The colour shading is divided into 10% steps of total memory available where green is 50%, light green is 60%, yellow is 70%, orange is 90% and red is 100%.

Any combination above the red area will cause the system to malfunction. A warning will be given in the Deployment Configuration application if this limit is exceeded.

Looking at some examples we find that:

❑   If the number of total cells is 150, the maximum number of pings is about 400.

❑   If the number of total cells is 100, the maximum number of pings is 600.

Usually this memory constraint does not impose a problem in practical use. Limitations may come in, however, when very high quality data is wanted and the number of pings is increased. If e.g. the number of pings is increased to 800, the maximum number of cells that may be configured is reduced to about 60.

Note! When configuring the RDCP 600 it is a good practice to stay away from the entire 'red zone'.

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1.5.3 Cell Size and Pulse Length -Considerations and Recommendation

For the user to decide which cell size to use in the configuration, several factors must be considered, like e.g. the noise/accuracy in the measurements and the measurement range. One parameter can be improved by sacrificing the property of one other.

By default, the pulse length is equal to the smallest cell size in the configuration, but this can be overridden by the user.

If the cell size is smaller than the pulse length, the behaviour of scatters in adjacent cells will influence the current measurements of the cell in question (this is called leakage). Even if the cell size and the pulse length are equal, a slight leakage is present due to the physical property of the acoustic pulse.

A short pulse length means more noisy measurements since integration in space takes place over a shorter distance.

If the cell size is larger than the pulse length, the measurement noise will be higher than if they are of equal size.

The length of the acoustic pulse decides the transmitted energy into the sea, which again influences the measurement range; a long pulse generates more backscattered energy, which implies a longer measurement range.

NOTE! The cell size establishes the vertical resolution of the sea column. The smaller the cell size the better the vertical resolution but at the expense of properties discussed above.

Assuming equal cell size and pulse length, the statistic uncertainty noise will double if the cell size is halved; quadrupling the ping count may to a certain degree compensate for this.

We recommend that you set a cell size of 2m (and 2m pulse length) for most applications.

Increase the cell size to 2.5 - 4 meters if long range is needed or if the backscatter level is low.

Cell sizes of 1 m should only be used if you just want a rough estimate of the current speeds. A higher vertical resolution can in practice be obtained by using a greater cell overlap for the column, see below.

1.5.4 Cell overlap; Considerations and Recommendations
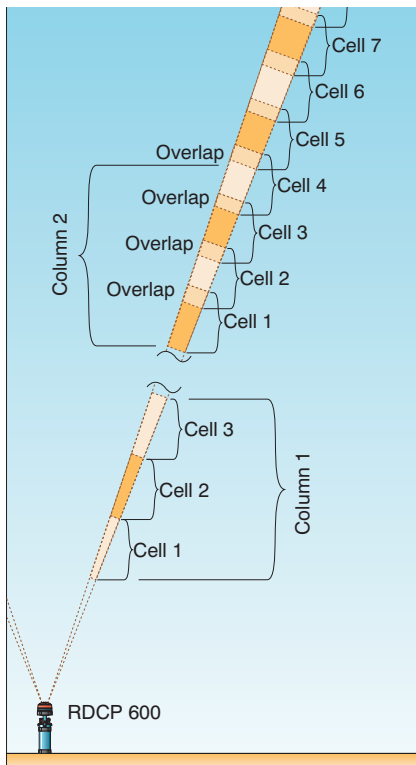
Figure 1-14 Cell Overlap

The user can configure the cells in one column to expand into adjacent cells. This is called cell overlap. The cells can overlap as much as 90%.

The advantage of using cell overlap is that the distance between each cell centre is shorter compared to no overlap, refer to Figure 1-14. Hence, the vertical resolution of the water column is improved without the need of a smaller cell size (a smaller cell size increases the noise level).

Cell overlap serves as a kind of averaging in the vertical direction, and may be used to *fine-tune* cell positions when working close to the surface.

When cells overlap, one cell includes information from adjacent cells as well as from its own. However, cell overlap does not introduce new information.

Since the RDCP 600 only needs a modest increase in time to process the additional cells (due to cell overlap, keeping the same column length), it is recommended to allow some cell overlap as this will improve later processing while still leaving the opportunity to skip overlapping cells if so desired later.

The contribution from adjacent cells decreases as the distance reaches 50% of the pulse length. At this point the contribution is zero.

NOTE! We recommend a 50% cell overlap if space allows it, due to the averaging feature in the vertical direction.

At 50% cell overlap and 2 meters cell size, the centre of each cell is only 1m apart.

NOTE! When sending data in real-time using PDC-4, the amount of extra data produced when using cell overlap (keeping the same column length) can be a problem due to the very slow PDC-4 interface. The extra information can limit the amount of data transferred.

1.5.5 Measuring Close to the Surface

When the acoustic pulse reaches the surface, several things happen. First the surface is a huge reflector representing a big step in acoustic impedance and as a result, the echo level is large.

Next, the sudden change in echo strength also produces a large phase shift.

Another problem is linked to the transducer's side lobes. Due to the slant angle of the transducers, side lobes will reach the surface before the main lobe. Although echoes from the first side lobe are almost 30dB lower than the main lobe for the RDCP 600, the large difference in echo strength between the surface and ordinary scatters will cause the side lobe to influence near surface measurements.

The problem area around the surface could be loosely found as the surface, d, multiplied by the difference between 1 and cos(25°), refer to TD220c *RDCP Primer*:

$$d\left(1 - \cos\left(25°\right)\right)$$

The entire cell should be further from the surface than the calculated distance. E.g. if the cell size is 2 meters, and the distance between the instrument and the surface is 20 meters, the calculated distance is:

$$20 \cdot \left(1 - \cos\left(25°\right)\right) \approx 1.9$$

Hence the problem area spans from the surface and 1.9 meters down in the water. The centre of the cell closest to the surface should therefore not be closer to the surface than 2.9 ($\approx$ 3) meters (for a 2 m cell).

Another problem is due to the integration in space that takes place over the pulse length. This causes reflections from the three neighbouring pulses to reflect energy to the fourth transducer.

The result is therefore that irrelevant high current speed estimates with a high degree of statistic noise are produced. For practical purposes it is therefore necessary to disregard close to surface measurements when the standard deviation noise increases close to the surface.

However, recent observations show that the surface current itself could be estimated if the distance from the instrument to the surface exceeds a certain range. This is possibly a range that prevents adjacent beams from interfering.

For practical purposes, a surface referred column should therefore start a few meters below the surface.

IMPORTANT! If your deployment requires measurements near the surface, as typically in harbour installations with fixed bottom mooring, we recommend that you align the mooring so that the instrument is approximately vertical. This makes the near surface zone as short as possible, since the beams will reach the surface at approximately the same time.

1.5.6 Limitations for the surface cell

The surface cell is positioned so that the centre of the cell lies at the level of the surface. Usually one would think that this would cause all sorts of problems, but initial tests have shown that for some configurations the surface speed measurements do make sense.

At the water surface, reflections from the main lobe dominate reflections from the lower energy side lobes; hence the measurements are most often valid. Best results are obtained in a fixed bottom mooring since the instrument does not tilt.

However, care must be taken regarding surface cells. We have indications that at situations with steep, rapid changing waves the surface cell holds inaccurate data. Pay special attention to the direction measurement. Standard deviation noise is usually higher for surface current.

1.5.7 Measuring close to the Instrument

The instrument's blanking distance and the pulse length limit measurements of current speed and direction close to the instrument. The minimum start distance is defined as the blanking distance plus half the pulse length.

The blanking distance depends in general on how fast the electronics and acoustic system settles after the high power acoustic pulse is switched off.

In the RDCP 600 this settling time is controlled by the acoustic settling time of the transducer housing.

The 300m-version housing is made of a material that will settle when the pulse has propagated 1m, while the deep-water housing is made of a material that settles when the pulse has propagated 2m.

Since the position measured is defined as the centre of the pulse, the minimum start distance will also increase with larger pulse lengths.

Potential problems arise when a surface referred column extends below the minimum start distance, which could e.g. happen during low tide periods.

In these cases the RDCP 600 will set the influenced cells to zero speed and tag them as invalid.

NOTE! The cell position is taken as the position of the centre of the cell.

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Table 1-1 300m, examples of minimum start distance

300m RDCP version - examples of minimum start distance from the instrument			
Blanking cell [m]	Cell size [m]	Pulse length [m]	Minimum start [m]
1	2	2	2
1	5	5	3.5
1	10	10	6

Table 1-2 2000m and 6000m, examples of minimum start distance

Deep-water RDCP version - examples of minimum start distance from the instrument			
Blanking cell [m]	Cell size [m]	Pulse length [m]	Minimum start [m]
2	2	2	3
2	5	5	4.5
2	10	10	7

1.6 Startup

The *Startup Page* holds the last deployment settings. Note however that the instrument is armed from the recording menu in the main menu page.
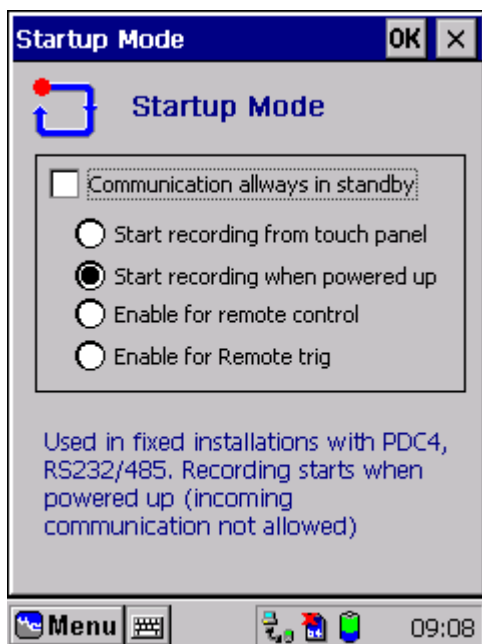
Figure 1-15 Startup Mode

Check *Don't sleep between recordings* if this suits your deployment.

NOTE! We recommend that the instrument goes to sleep between recordings.

Choose startup mode; either start up from touch panel (1), start up when powered up (2), enable for remote control (3), or enable for remote trig (4).

The lower part of the window holds a short descriptive text regarding the selected startup mode.

NOTE! If selecting the 'start recording from touch panel', the instrument must not be switched off or disconnected from its power source before deployment.

IMPORTANT! If using an external battery or power from ashore via cable, always use 'start recording when powered up'.

If the RDCP600 looses power during a recording session, then gains power later, this will affect the recording of data and the data storage differently, depending on the recording setting.

Note!

Information about a delayed start, refer CHAPTER 3, will be lost when the instrument looses power.

The RDCP has implemented a watchdog that restarts the recording when a non-critical situation stops the recording. The RDCP continues to store measurement data in the same folder without erasing previous data.

Start recording from touch panel:

When the recording is set to start from touch panel, the instrument must be restarted manually after power is re-gained. The storage card must be erased before starting a new session; transfer data from the card to a permanent storage medium for later use before stating a new session.

Start recording when power up:

When the recording is set to start at power up, the instrument will restart recording when power is re-gained. The RDCP generates a new data session folder at the storage card. There will be created a link from the previous folder to the new folder (RDCP studio uses data from both/all folders when presenting the data from that recording session).

IMPORTANT! We do not recommend inserting a backup battery when recording is set to start at power up, since the battery will provide power until empty.

Enable for remote control:

When instrument is set to be enabled for remote control, the instrument can be remotely started when power is re-gained. The RDCP generates a new data session folder at the storage card. There will be created a link from the previous folder to the new folder (RDCP studio uses data from both/all folders when presenting the data from that recording session).

1.7 Timing

The *Timing* menu holds three pages. Configure the *Ping* page before continuing with the *Recording* and the *Pressure* page.
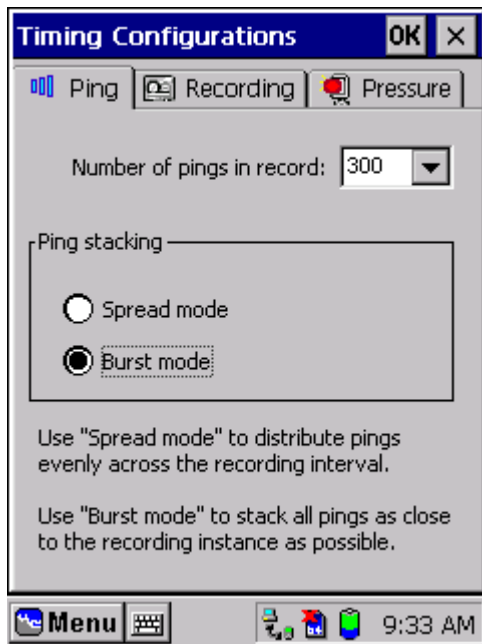
Figure 1-16 Timing configurations, Ping

Select the *Ping* page to set the number of pings used as base for averaging each current profile recording.

The default setting is 300 pings.

Increasing the ping number will enhance data quality at the expense of longer recording intervals (ocean current duration) and higher current drain.

In *Spread* mode, the pings will be evenly distributed during the ocean current duration, while all pings are distributed close to the recording instance in *Burst* mode.

In *Burst* mode, the instrument activates sleep mode between each measurement interval; hence the instrument consumes less power in burst mode.

NOTE! We recommend using Burst Mode as default.
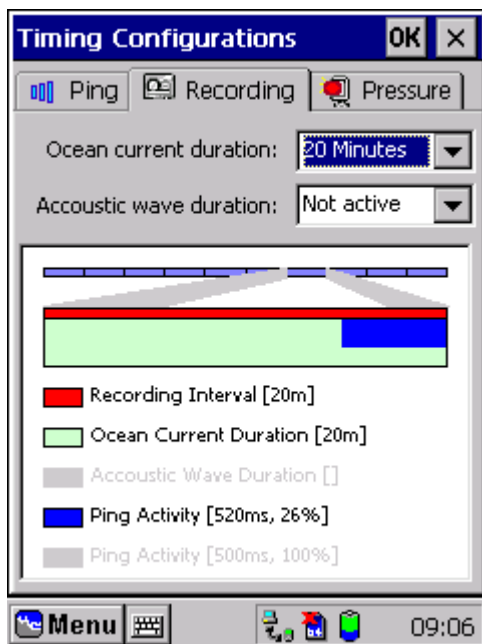
Figure 1-17 Timing configurations, Recording

Select the *Recording* page to set the recording intervals.

The minimum allowable intervals will vary according to profile configuration and number of pings used in each deployment.

Select the *Ocean current duration* and optionally the *Acoustic wave duration* (refer CHAPTER 2) from the drop down lists.

The *Ping activity* illustrates the amount of time, in percent, that the instrument is actually pinging during one recording interval.

For the recommended setting (see page 25), the ping activity takes 4.5 minutes.

Figure 1-18 Timing configurations, Pressure

Select the Pressure page to set the update interval of the pressure measurements.

Choose between *Read only at recording instance*, *Read continuously*, and *Use custom update interval* for the different settings. When choosing the latter also specify the update interval.

When the deployment is configured without surface referred columns, only the first option is available.

When surface referred columns are configured, it will be an advantage to update the pressure more often than the current measurements are taken for optimum positioning of the cells; an increased pressure update results in increased current drain.

1.8 Data Storage

Figure 1-19 Data Storage, Device

In the *Device* page of the Data storage configuration, select the medium and the path for where the instrument should store the data.

The default setting is *MMC* to a directory named *RDCP*.

Make sure the *Store data to file* is checked, or else the instrument will not store data at all.

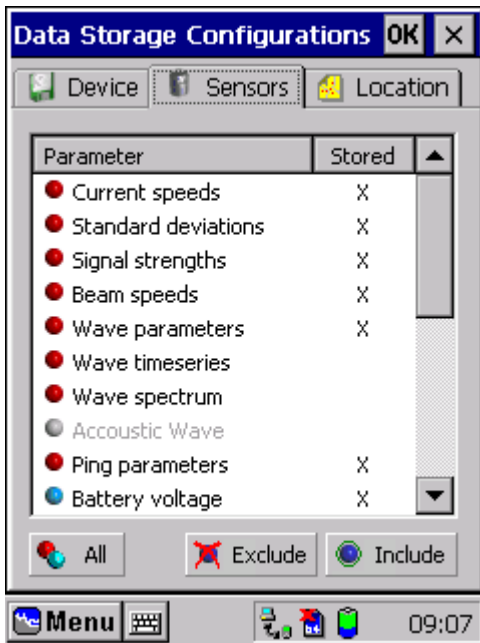*NOTE! Hardware for Network Connections is not available.*

Figure 1-20 Data Storage, Sensors

In the *Sensors* page, check the items you require to be stored or sent in real-time by selecting the parameter in question and tap the *include* button.

Tap *All* for a quick selection of all sensors and their parameters –not including the wave timeseries and wave spectrum, refer chapter 2.1.2.

The more parameters that are stored the more memory capacity is needed in the storage device.

The *Location* page is a read-only copy of the information that is stored together with the data: coordinates and altitude of the deployment area. The information is entered in the Site menu.

1.9 Real-Time Output

Optional Real-Time output is available via RS-485, RS-232 or PDC-4. Descriptions of the RS protocols and PDC-4 are given in TD220c *RDCP Primer*. The PDC-4 code can not be used to configure the RDCP 600; PDC-4 real-time output must be configured before deploying the RDCP 600. The CANbus option is not yet available. RS-485 is the default connection (in the watertight receptacle).
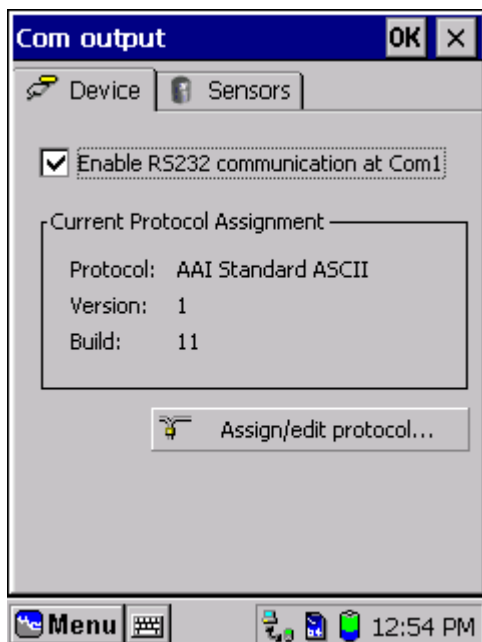
Figure 1-21 RS-232 Device Page

The RS-232, RS-485 and the PDC-4 configuration menu hold two pages:

❑ Device

❑ Sensors

RS-232 configuration: In the Device page, check the Enable RS-232 communication at Com1.

Next, assign/edit protocol, refer to Figure 1-22, and tap *Properties* to set communication settings (e.g. HyperTerminal settings).

In the *Sensors Page*, choose parameters to be sent real-time.

Figure 1-22 RS-232 Protocol Assignment
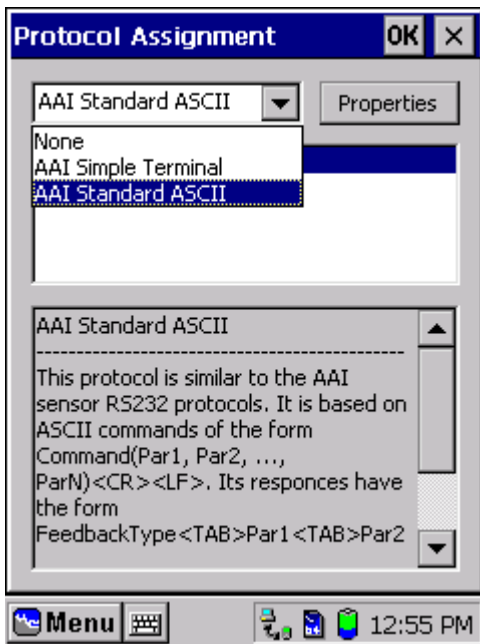
Refer to TD220c *RDCP Primer* for information about Aanderaa RS protocols.
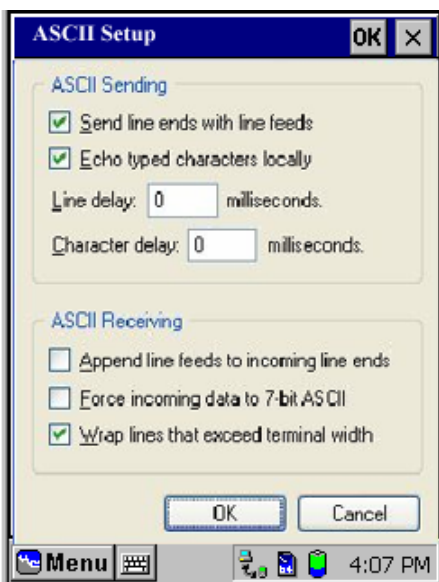
IMPORTANT! Check the "Send line ends with line feeds" when HyperTerminal is used towards DCS.
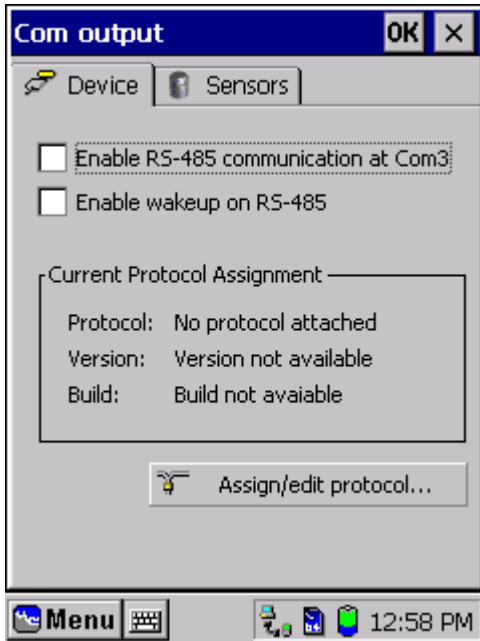
Figure 1-23 RS-485 Device Page

RS-485 configuration: In the *Device page*, check the *Enable RS-485 communication at Com3*.

Check the *Enable wakeup on RS-485* if this suits your application (enabling wakeup drains more power).

Next, assign/edit protocol, refer to Figure 1-22, and tap *Properties* to set communication settings (e.g. HyperTerminal settings).

In the *Sensors Page*, choose the required parameters to be sent real-time.
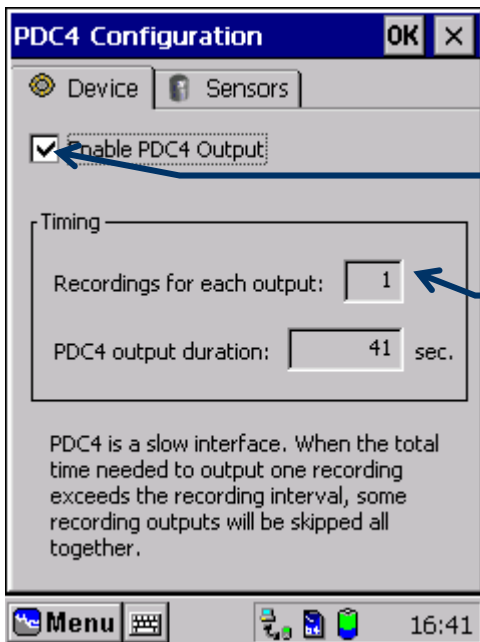
Figure 1-24 Real Time output, PDC-4

Refer to TD220c *RDCP Primer* for information about PDC-4.

PDC-4 configuration: In the *Device page*, check the *Enable PDC-4 output*.

The number of records for each output, and the PDC-4 output duration updates automatically.

The PDC-4 real-time output is slow, and situations may occur where one record is not completely transmitted before a new one becomes available. In that case the RDCP 600 will skip the transmission of the next records until the current one is transmitted. Data storage still takes place.
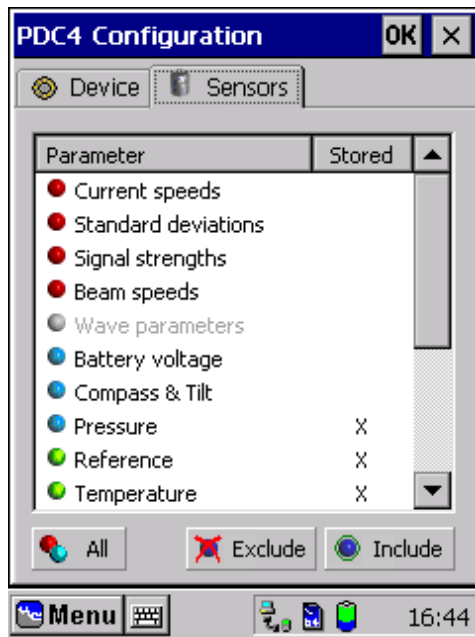
In the *Sensors page*, select the required parameters

NOTE! For PDC-4 real-time output: Select only the required elements, as each parameter takes 4 seconds to transmit.

Figure 1-25 Real-Time output, Sensors

PDC-4 recording and transmitting: The RDCP 600 starts recording 1 min before the first recording interval begins; then the records are transmitted at the end of each recording interval.

The order in which the channels are transmitted is pre-determined for PDC-4 and can be found in the PDC-4 export utility (refer to **Error! Reference source not found.**). The first channel is the reference channel. For current measurements all the data from column 1 will be sent before the data from column 2. The first channel in a column is here always the channel nearest the transducer. If a surface cell is defined this becomes column 0 and will be transmitted before the current measurements.

Before sending data in real-time using PDC-4, the RDCP 600 must create artificial coefficients and convert the measurements into PDC-4 binary code format (except for the SR10/VR22 sensors connected to the Top end plate; here the coefficients are entered manually into the instrument). The coefficients are scaled by the sensor range, and can vary dependent on which sensors are used. Within the sensor range the coefficients are fixed.

The stored coefficients and other information about the PDC-4 output can be found in the PDC-4 export utility, as described below.

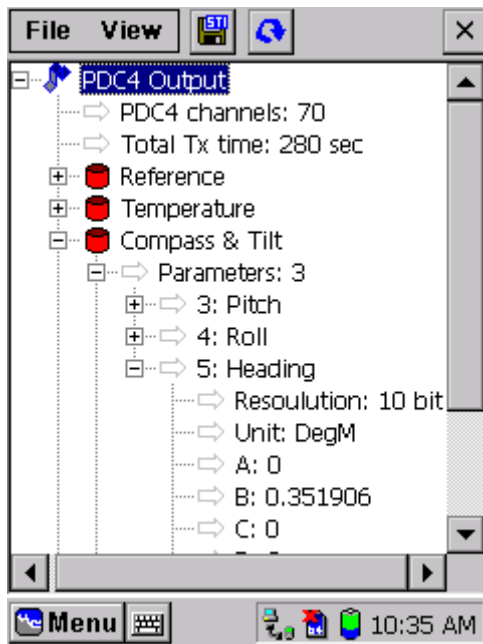In the *Deployment Setup page*, tap *File* and *Export PDC4 configuration file*. After some seconds the parameter channels will be listed in the order that they will be sent.

Tap the plus sign next to each of the parameters to get more information about the various channels, like the coefficients A, B, C and D and whether the resolution is 10 or 20 bit (refer TD220c *RDCP Primer)*.

The coefficients can then be put into the Display Program 3710.

To make the transfer of information to the PC easier, the data can be stored as Station Info to MMC by tapping the STI- image. You can save the .sti-file in the *File* directory.

Figure 1-26 The PDC-4 export utility

Because of the slow PDC-4 transfer rate we advise that you limit the number of channels (e.g. by reducing the amount of column cells) and avoid using a large cell overlap when configuring PDC-4 real-time output. The PDC-4 transfer can however work satisfactory in many situations, for instance in harbour installations. Some application examples are included in TD220c *RDCP Primer*.

1.9.1 Real-Time Clock System

The RDCP 600 employs a two-clock system comprising a main Real-time Clock (RTC) and a backup RTC. The reason behind this scheme is that the main RTC is embedded within the main StrongARM processor and loses power when the instrument is switched off. The backup RTC, on the other hand, includes an embedded lithium battery that is activated when the instrument is switched off to supply power to the clock system during down periods. The lithium battery has sufficient capacity for 10 years of operation.

The main RTC is the more accurate of the two. It comprises an advanced pulse skipping mechanism that allows the system to skip or add one or more pulses from the 32768 Hz base oscillator during a 1024 seconds period to compensate for small errors in the oscillator base.

At power-up, the instrument will read the backup RTC and copy its time base into the main RTC. From there on the system uses the main RTC as time base. The result is that the more accurate main RTC is used during a deployment until

 power again is switched off.

1.9.2 Synchronization

The two RTCs are synchronized either when the time is adjusted or when the instrument enters sleep mode between recording intervals. When an updated time is entered using the Date & Time adjustment feature in the Control Panel or when connected to a PC using ActiveSync, the updated time is entered into both the main and the backup RTC.

IMPORTANT! Please note the latter case using ActiveSync. If you use ActiveSync to access the RDCP 600 file system from an external PC, ActiveSync will automatically synchronize the clock of the RDCP 600 with that of the PC. This will lead to an incorrect time setting if the clock within the PC is not correct.

Since the main RTC is more accurate than the backup RTC, the backup RTC is synchronized with the main RTC at regular intervals when power is on. This occurs when the system enters the low power *Sleep* mode in between recordings.

1.9.3 Manual Synchronization

The backup RTC has a maximum error of 1.53 minutes per month. It is therefore advisable to synchronize the RDCP 600 clock system if the instrument has been switched off for a longer time period before deployment. Use the Date & Time adjustment feature in the Control Panel for this purpose. Accurate time bases may be found on the Internet.

1.10 Power Consumption

The average power drain for the current configuration, is given in the *Deployment Setup* main page (scroll down almost to the end of the page to the *Resource use* section, see Figure 1-27).

Power consumption is an issue when powering the RDCP 600 from a battery.

In these cases care should be taken to limit current drain by using configurations that drain less power.
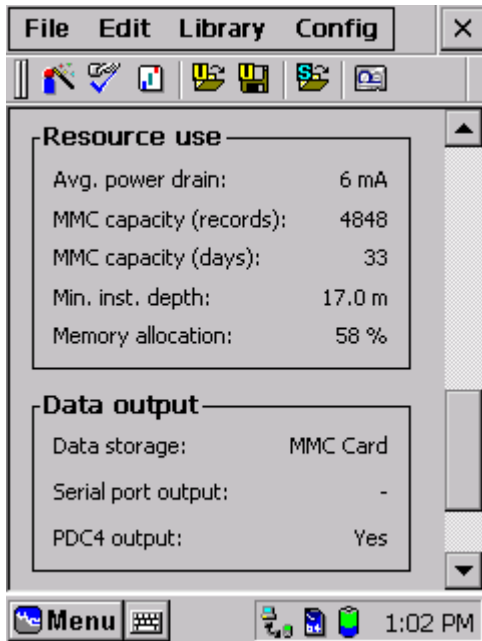
Figure 1-27 Deployment Configuration; Resource use

The following items influence power drain:

❑ Power Level. The instrument consumes less power in low power mode.

❑ Averaging Scheme. When the instrument is in Burst mode, the ping ensemble will take place as quickly as it can close to the recording session. In between, the instrument will be in sleep mode and drain only a few hundred microamperes.

❑ Pulse Length. Longer pulses consume more power.

❑ Pulse Type. Attenuated settings (-3dB, -6dB and -12dB) drain less power than 0dB.

❑ Number of Pings. The more pings in an ensemble the more power drained.

❑ Wave. When wave is activated, there is continuous activity that prevents the instrument from entering sleep mode.

1.11 Battery Capacity

The user can check the battery capacity by looking at the battery icon at the lower right end of the LCD screen. A more accurate reading is presented in the *Battery Menu* in the *Control Panel* in the *Main Menu*; select the correct battery type in the menu.

IMPORTANT! The Power Menu *in the* Control Panel *is a standard menu in the Windows CE program, but holds no specific information about the RDCP instrument nor the battery capacity.*

1.12 List of Settings

We recommend that you follow the *Deployment Wizard* for parameter settings as the setup program monitors your settings and prevents you from picking illegible settings. Perform the configuration steps in the sequence laid out in the menu: Top to bottom, left to right. This ensures that the system has relevant information when it checks for invalid configurations.

However, if it is necessary to change some settings, select the correct menu and edit the parameter. Table 1-3 gives a brief summary of where some of the parameters can be set.

Table 1-3 Where to change a parameter setting

Parameter	Setting

Activate Sensors:
    Profiler, Compass/Tilt, Temp, Conductivity,
 	
    Quartz Pressure Sensor
	Sensor Configuration, sensor icon

Oxygen Optode, Turbidity , Temp,Conductivity, Pressure	Sensor Configuration, SR10-VR22 menu, channel icon
Arm the instrument	Recorder, tap Record

Calibration coefficients:
    Profiler, Compass/Tilt, Temp, Conductivity,
 	
    Quartz Pressure Sensor
	Sensor Configuration, sensor icon

Oxygen Optode, Turbidity Temp,Conductivity, Pressure	Sensor Configuration, SR10-VR22 menu, channel icon
Switch off transducer pinging when the water depth is less than 1.5m	Sensor Configuration, Profiler
Compass misalignment	Sensor Configuration, Compass/Tilt, Internal
Cell size	Deployment Setup, profile configuration menu, columns pane. Edit or Add column
Data Storage	Deployment Setup, data storage menu
Fixed Air Pressure	Sensor Configuration, Pressure Sensor, Compensation Page
Fixed Sound Speed	Sensor Configuration, Current Sensor Configuration, Source page
Instrument depth	Deployment Setup, site menu, Installation page
Instrument orientation	Deployment Setup, site menu, Installation page
Ping mode	Deployment Setup, Timing setting menu, ping page
Pings in record	Deployment Setup, Timing setting menu, ping page
Power level	Deployment Setup, profile configuration menu, common page
Pulse length	Deployment Setup, profile configuration menu, common page
Pulse type	Deployment Setup, profile configuration menu, common page
Real-Time output	Deployment Setup, Real-Time output menu
Recording intervals	Deployment Setup, Timing setting menu, recording page
Start immediately	Recorder, tap Record, tap Start Now
Stop Recording	Recorder, tap Stop

1.13 Sensor Configuration

The *Sensor Configuration* menu is usually preset from the factory. However, we recommend that you scan through the settings to ensure that nothing has been altered, or that your personal preferences have not changed. The type of sensors available will vary from instrument to instrument. Standard sensors are Profiler and Compass/Tilt. Other sensors are optional.

If a sensor is not installed, you have the option of using a fixed reading instead.

Fixed readings will then be used when the instrument derives virtual measurements such as Depth, Salinity and Speed of Sound.
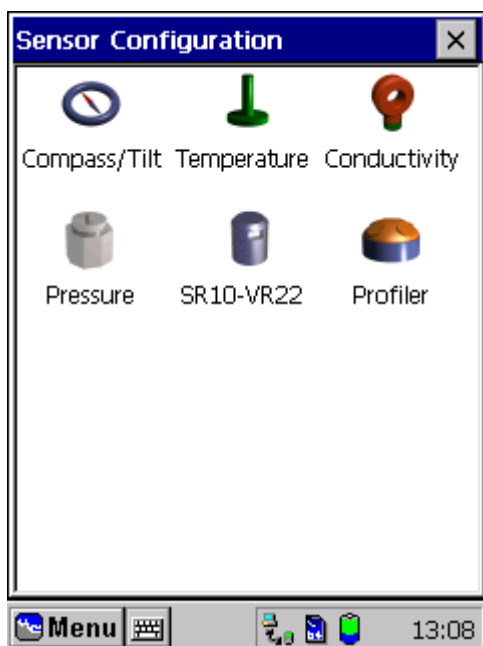
Figure 1-28 Sensor Configuration Menu

For in-situ measurement of sound speed, pressure, temperature and conductivity the respective sensors must be installed or else the fixed reading is used. The temperature sensor must be connected to the temperature channel to be used for compensation.

Some sensors, such as the Compass/Tilt sensor have built in check facilities that allow you to monitor their reading for verification.

The high accuracy pressure sensor is used for depth and wave measurements and allows for air pressure compensation. The *air pressure* parameter may be fixed, given as input from another sensor or sent to the instrument real-time.

The SR10-VR22 entry holds the configuration for general purpose Aanderaa oceanographic sensors such as the Oxygen Optode and the Turbidity sensor. This entry has its own sub menu that is acknowledge by the SR10 channel number.

Temperature may also be achived from the Conductivity sensor 3919 or Pressure sensor 4017 by using a aplit cable

Figure 1-29 Sensor Configuration, Compass/Tilt Sensor

The *Compass/Tilt* is a standard sensor in the RDCP 600.

In the *Source Page* you can read the magnetic correction and select the Compass/Tilt Source as either:

❑ Use Internal Compass

❑ Use Compass connected to CANbus

❑ Use fixed heading, pitch and roll

NOTE! Open the Internal tab to set the magnetic misalignment.

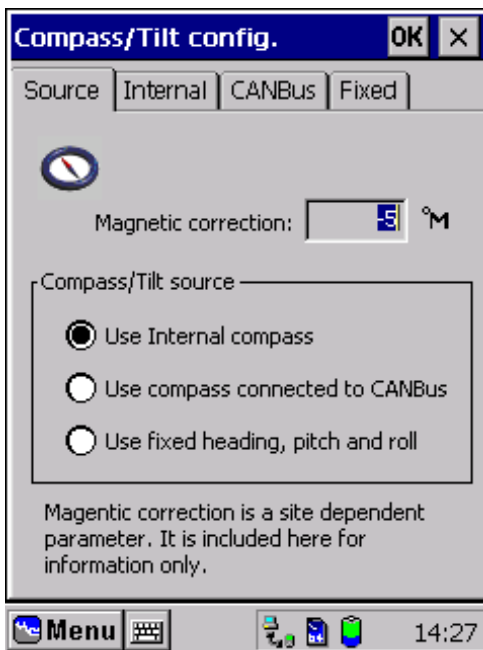Check the *Use Internal Compass* to use the standard RDCP Compass/Tilt Sensor.

Check the *Use fixed heading, pitch and roll* to use fixed values for these parameters instead of measured values. This feature is very useful if the instrument is deployed a fixed bottom frame mooring in highly magnetic areas. The fixed values are set in the *Fixed* tab, refer Figure 1-30.

The use of an external Compass/Tilt sensor with CANbus is not yet available.
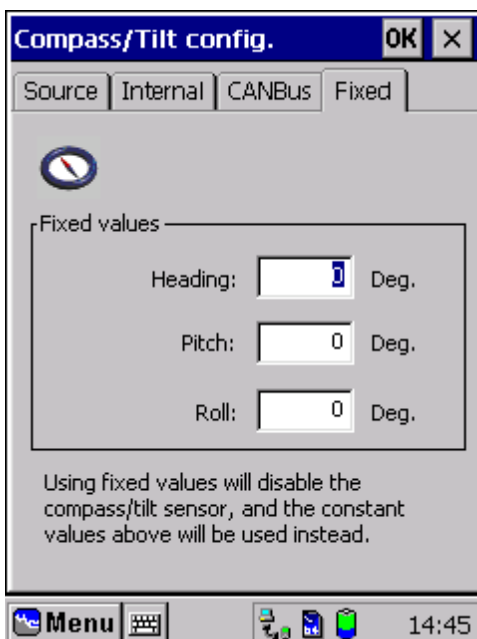
Figure 1-30 Compass/Tilt config.

In the *Internal Page* you can find the serial number of the standard Compass/Tilt sensor, set the compass misalignment, and perform a test of the Compass/Tilt sensor.

In the *Fixed page*, insert fixed values for Heading, Pitch and Roll. Fixed values will be used if the option *Use fixed heading, pitch and roll* is checked in the menu above, refer to Figure 1-29.

The Sensor Configuration for the *Temperature Sensor* and the *Conductivity Sensor* is very similar and is illustrated with the conductivity sensor only.

NOTE! The sensor must be installed for the menu to be active.

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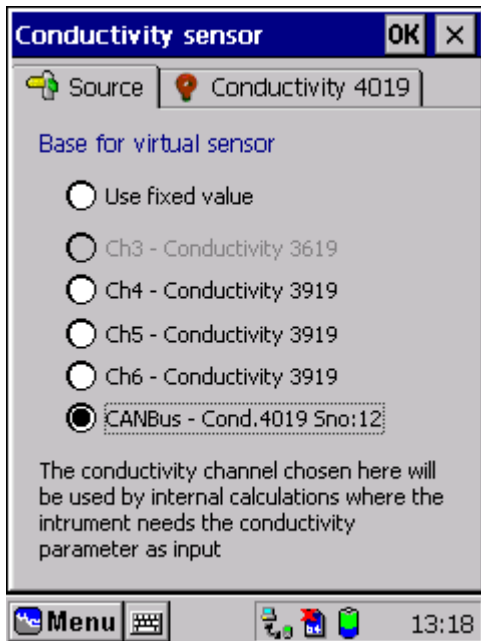
Figure 1-31Select Conductivity sensor.

We recommend that you use the Conductivity sensor 4019 as this sensor gives full resolution. The 4019 sensor can be tested in the Diagnostics menu. Conductivity sensor 3919 is an SR-10 sensor with temperature as second parameter. This sensor has output with 10-bit resolution; you can zoom in the range to obtain better resolution.

❑ The 3919 must be installed in either Ch4, Ch5 or Ch6. Ch is dedicated for Temperature

❑ Ch4, 5 and 6. This means that the range of the 3919 must be programmed by means of the RS-232 interface before it is installed, use the sensor cable 4865.

❑ In order for the RDCP 600 to use the correct channel for conductivity measurements when calculating virtual values (like Salinity, Depth and Speed of Sound), you must tell the RDCP 600 in which channel the conductivity is installed. For this purpose a new submenu is used under the *Conductivity* section in the *Sensor Configuration* menu. The submenu is shown in the Figure 1-31.

To take full advantage of both parameters from 3919 or 4017 use path cable xxxx and connect temperature to channel 2.

When using 3919, select Ch4, Ch5 or Ch6 (depending on which channel it is physically installed), and proceed to the setup for this channel (open the SR10-VR22 submenu in the Sensor Configuration menu) to setup the sensor with calibration coefficients etc, refer **Error! Reference source not found.** and Figure 1-38.

Figure 1-32 Configuring the Conductivity cell 3619
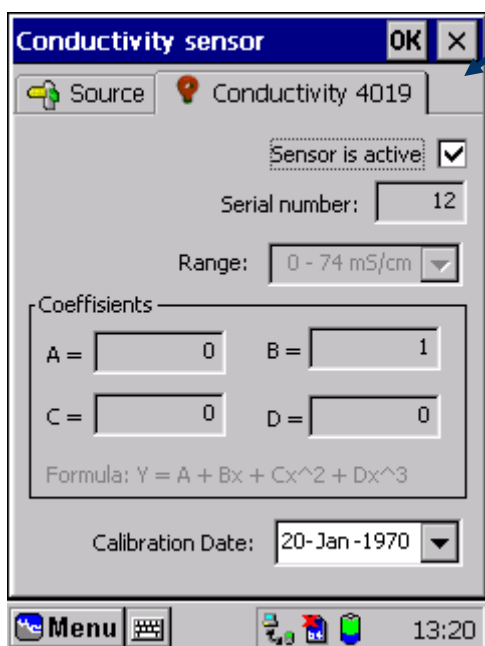
When using our conductivity sensor 4019 you must check the *Sensor is active* to activate the sensor.

Tap *OK* in the top right corner to save new settings.

Figure 1-33 Sensor Configuration, Quartz Pressure Sensor
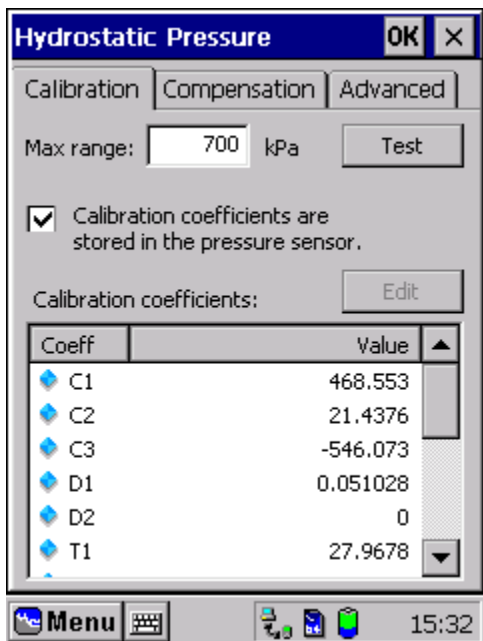
Hydrostatic Pressure Sensor Configuration:

In the *Calibration page*, set the maximum Pressure Range for the Quartz Pressure sensor 3187.

Tap TEST for a performance check of the sensor.

IMPORTANT! Do not check or uncheck the option Calibration coefficients are stored in the pressure sensor.

If the option *calibration coefficients are stored in the pressure sensor* is not checked, calibration coefficients must be entered manually; tap Edit and enter the sensor values.

If the option *calibration coefficients are stored in the pressure sensor* is checked, the sensor coefficients are automatic read from the sensor Eeprom. Edit calibration coefficients if necessary (not recommended): Select the calibration coefficients to be edited. Tap edit and enter the new value. *IMPORTANT! We do not recommend that you edit the coefficients since the sensor calibration will then not be valid.*

The pressure sensor measures the total pressure at a sea depth (atmospheric and hydrostatic pressure). To estimate the hydrostatic pressure, the air pressure at the surface must be subtracted from the total pressure, either by using a fixed air pressure or by measurements of the air pressure.
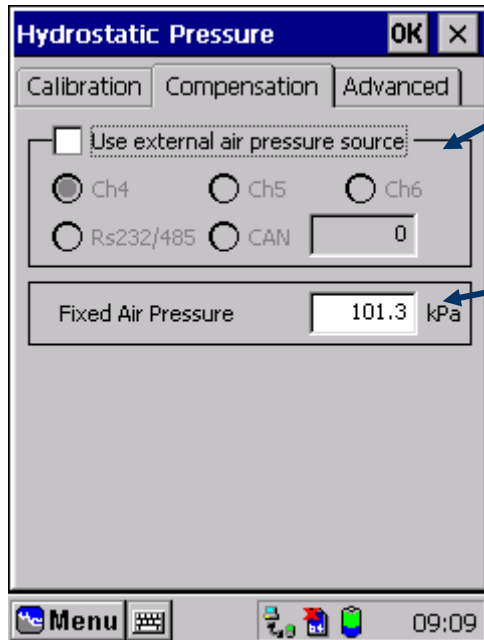
In the *Compensation page*, check the *Use external air pressure source* if the air pressure is measured at the sea surface with an optional Air Pressure sensor 2810. Check which channel the sensor is connected to.

Alternatively, type in the correct *Fixed Air Pressure* for your region if no external air pressure sensor is connected.

Figure 1-34 Sensor Configuration, Quartz Pressure Sensor.
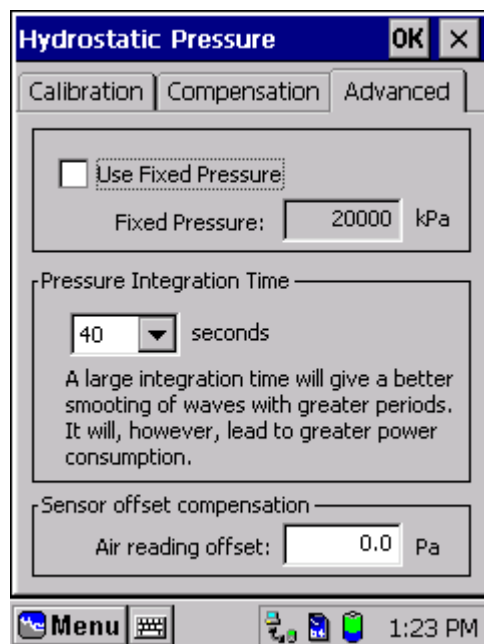
In the *Advanced Page*, check the *Use Fixed Pressure* if a high accuracy Quartz Pressure Sensor is not connected to the instrument. Also, type the fixed hydrostatic pressure value.

Next, type or select the *Pressure integration Time* and set the *Air reading offset* in Pa.

IMPORTANT! Air reading offset is only used for calibration purposes.

Figure 1-35 Sensor Configuration, Quartz Pressure Sensor.
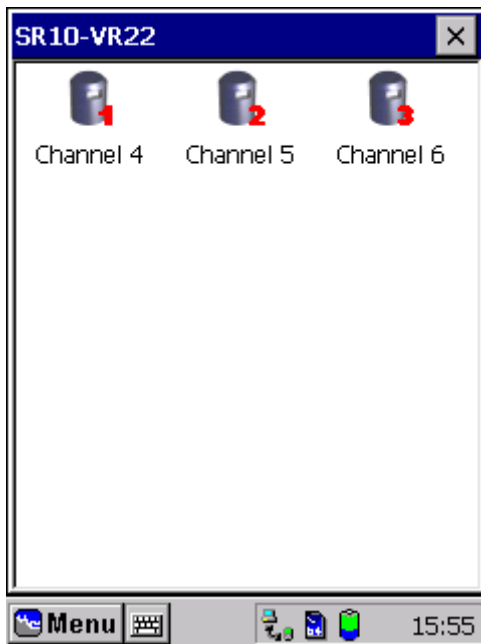
Figure 1-36 SR10-VR22

To activate SR10/VR22 sensors like the *Oxygen Optode*, the *Turbidity sensor* or the lower accuracy *Pressure sensor*, tap the SR10-VR22 icon shown in Figure 1-28. Next, tap the icon named channel 4, channel 5 or channel 6 depending on which channel the sensor is physically connected to.

SR10-VR22 sensors can only be used for independent measurements. Except for the air pressure sensor, data from the SR10-VR22 sensors are not included in calculations of other parameters.

Figure 1-37 SR10-VR22 information page
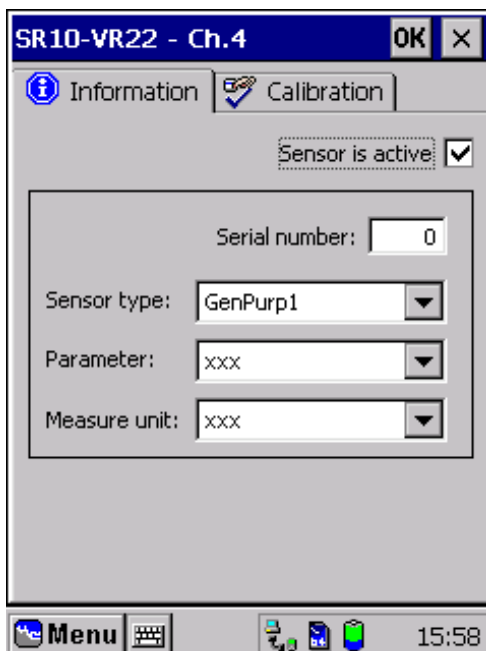
Check the *sensor is active* to activate the sensor.

Type in the sensor Serial number and choose the sensor type, parameter and measure unit from the drop-down menus. If the correct information is not preset in the menus, type the correct information using the virtual keyboard.
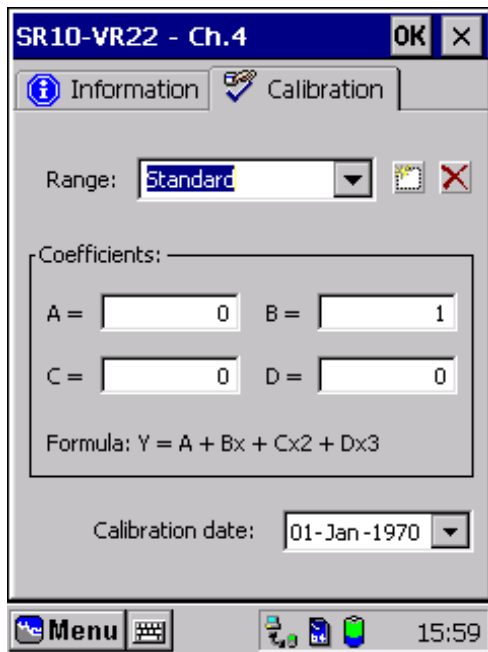
Figure 1-38 SR-VR22 Calibration page

Open the calibration page and choose the measurement *range* from the drop-down menu or enter a new range ID. Type the *calibration coefficients* (see the sensor calibration sheet) and the calibration date.
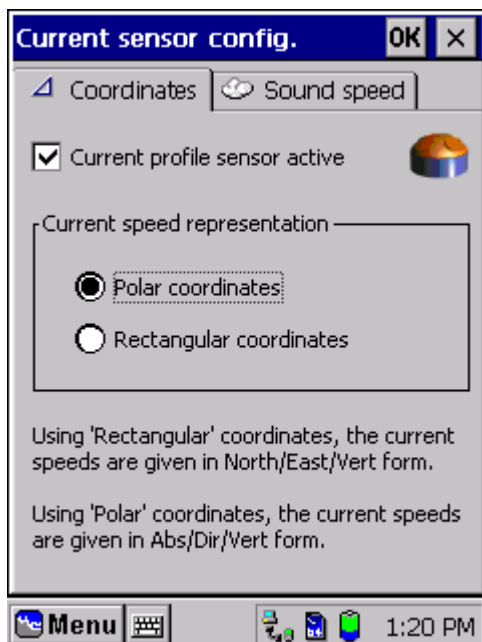
Figure 1-39 Current sensor configuration

Tap the *Profiler* icon, refer to Figure 1-28, to set the profiler configuration.

The profiler is by default activated. Uncheck for operation without the current sensor.

For *Current speed representation*, choose between

- ❑ Polar coordinates

- ❑ Rectangular coordinates

In *Polar coordinates*, the current speeds are given in the Magnitude of the speed, the Direction and the Vertical speed.

In *Rectangular coordinates*, the current speeds are given in the form of North speed, East speed and Vertical speed.
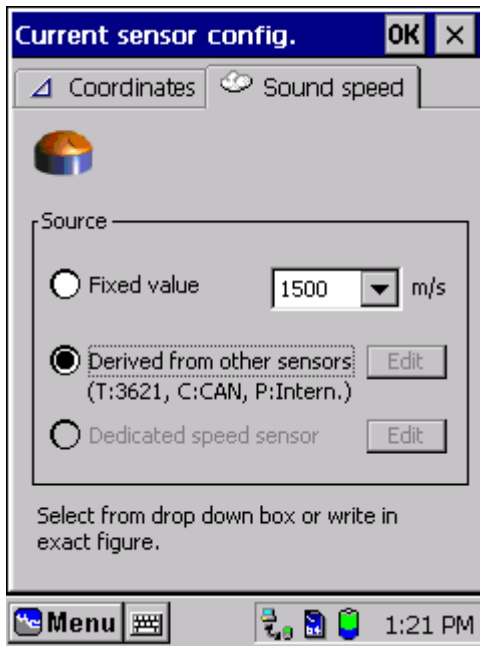
Figure 1-40 Current sensor configuration

Sound speed page: Choose the source of the sound speed as either

- ❑ A fixed value

- ❑ Derived from other sensors

- ❑ Dedicated speed sensor

Fixed value: select the sound speed from the drop-down menu or type in the exact sound speed using the virtual keyboard.

Derived from other sensor: Select this option if the sound speed is to be calculated based on measurements of pressure, temperature and conductivity.

Dedicated speed sensor: this feature is not yet implemented.

CHAPTER 2 Optional Feature: Wave Recording

Wave parameters calculated from Acoustic measurements and pressure measurements are optional features in RDCP600. If the configuration settings are written in grey font, the option is not available for you.

2.1 Pressure based wave measurements

Wave parameters calculated from pressure measurements are an optional feature only available in RDCP 600 instruments that has installed the:

❑   Quartz Pressure sensor, 3187

❑   Wave software for RDCP 600

2.1.1 Deployment Guide

When the Wave Software is installed in the RDCP 600, the *Deployment Configuration* includes Wave Configuration, refer to Figure 1-7.

We recommend that you go through the *Configuration Wizard* to configure the deployment.

Alternatively, the configuration can be set up for each sub-section manually, refer **Error! Reference source not found.**.

IMPORTANT! Perform the configuration steps in the sequence laid out in the menu: Top to bottom, left to right. This ensures that the system has relevant information when it checks for invalid configurations.

Figure 2-1 Wave Configuration.
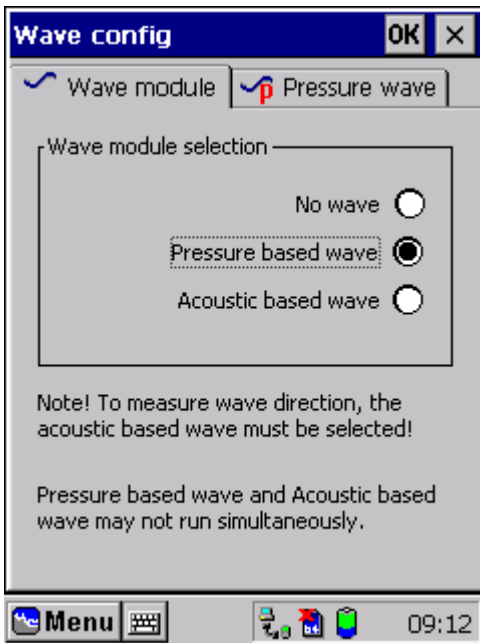
To enable pressure based *Wave Recording*, make sure to check the *Pressure based wave* in the wave module selection, refer Figure 2-1.

Figure 2-2 Pressure based wave.
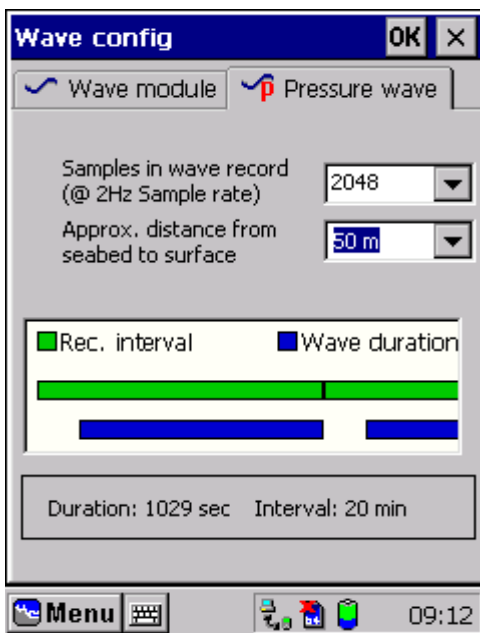
Open the *Pressure wave* tab and insert the *number of samples* in the wave record from the drop-down menu, refer Figure 2-2.

Note that the length of the wave record is specified as Samples in wave record. Thus, if the number of samples is set to 2048 the duration of the wave record is 1024 seconds since the pressure is sampled 2 times per second (2Hz sample rate).

A graphic view illustrates the recording interval (green cells) and the wave duration (blue cells), both in seconds.

From the drop-down menu, insert the *Approximate distance from the seabed to the surface*.

NOTE!

If the instrument is deployed in a fixed bottom frame mooring, it is recommended to enter zero in the Approximate *distance from seabed to surface field. The wave software will then calculate the deployment depth and use this value both as absolute water depth and deployment depth in the calculation of the wave parameters.*

The Recording Interval is set in the Interval Configuration.

2.1.2 Data Storage
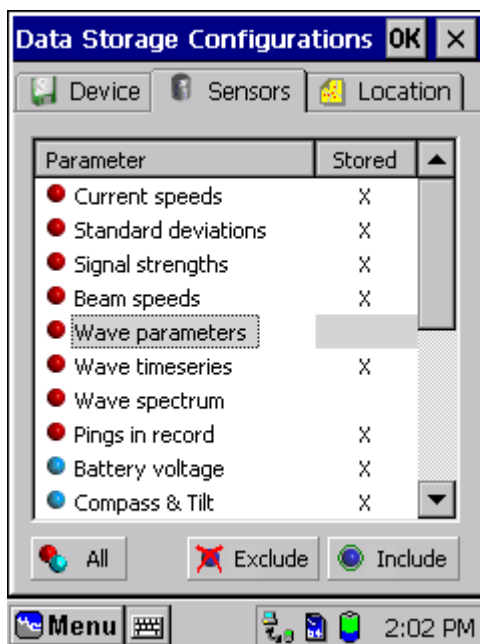
To store the Wave parameters, Wave Time series and/or the Wave Spectrum, check the parameters in the *Sensor* page of the *Data Storage Configuration*, refer Figure 2-3.

NOTE! The Wave timeseries/spectrum parameter holds a large amount of data, hence occupies a large part of the storage capacity. Storing the parameter consumes a lot of power. In some cases storage of wave time series/spectrum will slow down the system. Wave timeseries/spectrum should only be recorded in special occasions.

The Raw Wave data are given in [Pa], and are sampled at 2 Hz intervals.

Figure 2-3 Data storage.

2.1.3 Real-Time Output

Real-Time output of Wave spectrum and wave timeseries via PDC-4 is not possible (due to time consumption). Other wave parameters can be sent real-time via PDC-4.

Descriptions of the RS protocols (for real-time output) are given in TD220c *RDCP Primer*.

2.1.4 Operating Instructions

Mount the supplied pressure stopper to protect the Quartz pressure sensor if the RDCP 600 is deployed at depths greater than the specified maximum depth for the Quartz pressure sensor.

IMPORTANT! Higher pressure than normal at the specified maximum depth can destroy the Quartz Pressure sensor. Mount the supplied pressure stopper if the instrument is deployed at greater depths than specified by the sensor.

If the RDCP 600 is deployed to study waves with wave period as small as 2 seconds or less, the instrument should be deployed as close to the sea surface as possible (at depths of 2-3 meters).

If the RDCP 600 is deployed to study waves with wave period as large as 7-15 seconds, the RDCP can be deployed at greater depths.

According to the linear wave theory, the instrument is able to monitor the wave induced pressure variations at depths of at least 25 meters. Refer to the Wave Theory in TD220c *RDCP Primer*.

2.2 Acoustic based wave measurements

Acoustic based wave parameters are only available in RDCP 600 instruments that have the wave direction software installed.

Real-Time data can be received using the RDCP XML Data Service, refer TD270. Standard wave parameters and polar plot for wave direction can be calculated using the AADI Wave Analysis application.

Wave direction data can also be collected for later post processing, refer TN 306. Refer TD 220c RDCP PRIMER for primer regarding collecting data from the four acoustic beams.

Wave-recording instruments will often be configured differently from instruments used for current measurement. The collection of data is split into two independent parts, ocean current profiling and acoustic based wave recording, see illustration below:
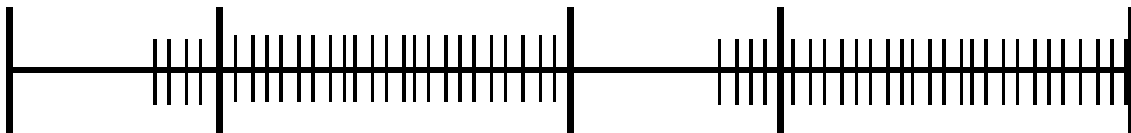
2.2.1 Deployment Guide
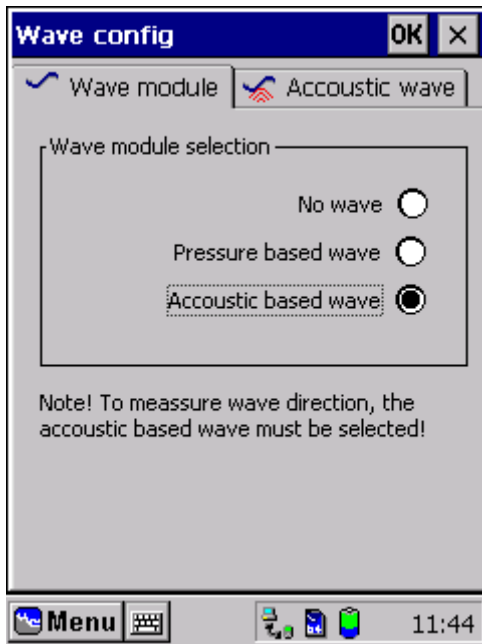
Figure 2-4 Acoustic based wave.

Tap the ![wizard] Wizard button in the *Deployment Setup* to set up the configuration or do the configuration in *Start menu → Deployment Setup → Edit → Wave*

Refer Figure 2-4 for an illustration of the Wave configuration.

Select *Acoustic based wave* from the Wave module selection.

Press the *Acoustic wave* tab for further setup.
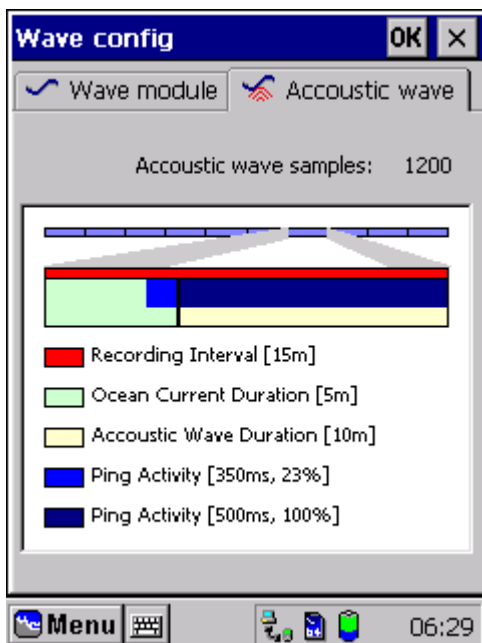
Figure 2-5 Recording interval.

Figure 2-5 shows an overview of the timing sequence and number of samples collected for a single wave measurement using the current timing scheme.

The *Acoustic wave samples* are changed according to the Acoustic wave duration, which is set in *Timing Configuration*, refer Figure 2-6.

It is common to set the acoustic wave duration to about 15-20 minutes (1800 – 2400 samples)

Number of samples equals can be calculated as the Acoustic wave duration in seconds x 2.
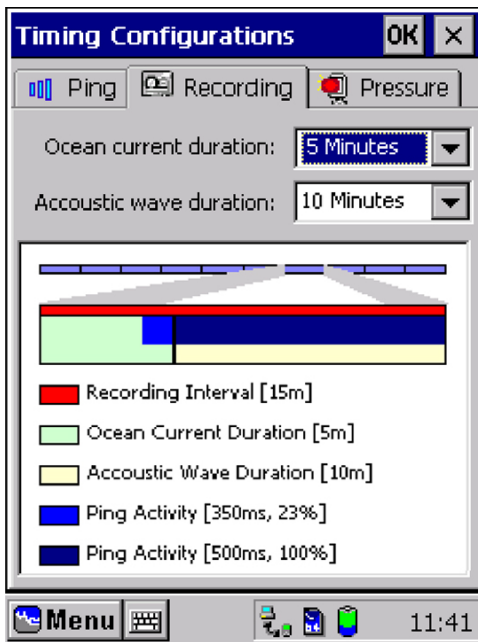
Figure 2-6 Acoustic wave duration.

For *Timing Configurations*, open *Start menu → Deployment Setup → Edit → Timing.*

Set the *Ocean current duration* and the *Acoustic wave duration*, refer Figure 2-6.

The *Recording Interval* will be the sum of the Ocean current duration and the Acoustic wave duration.

The instrument alternates between current measurements and wave measurements.

In the example above the current measurements are set up with a ping activity of 350ms (the instrument pings once every 350ms), while the Acoustic wave duration is set up with a ping activity of 500ms.

2.2.2 Important Considerations

The minimum wave period that the RDCP600 can measure is restricted by the design of the transceiver head and the Nyquist sampling theorem.

The Nyquist sampling theorem states that the minimum sampling rate required to avoid aliasing is twice the highest frequency contained within the signal, hence the length of the wave (in meters) must be at least twice the distance between two opposite transducer beams at the surface.

Relationship between the deployment depth and the wave period:

The RDCP600 transducers are tilted 25° off the vertical axis. The acoustic signal from each transducer propagates into the water, forming all together four propagation beams used as the basis for the current measurements, refer figure. Due to the transducer tilting, the distance between the four beams increases with the propagation distance; if the instrument is deployed 20 meters below the surface, the distance between two opposite beams is about 20 meters: $2 \cdot \tan(25°) \cdot 20 \approx 20m$.
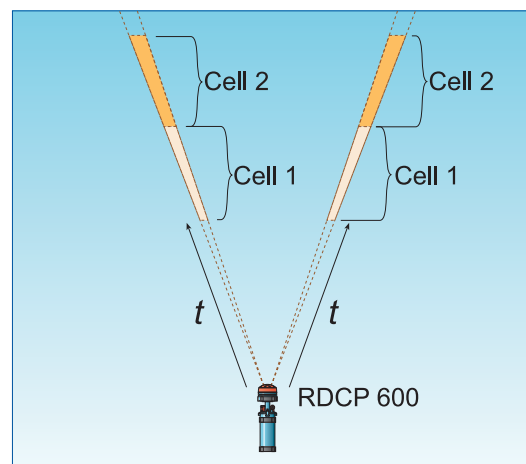
Table 2-1 Minimum wave period to be measured

Deployment depth [m]	Distance between transducer beams at the surface [m]	Minimum wave length, λ [m]	Minimum wave period, T [s] [1] $T = \sqrt{\dfrac{\lambda 2\pi}{g}}$
6	6	12	3
10	10	20	3.6
15	14	28	4.2
20	19	38	4.9
25	24	48	5.5
30	28	56	6

Deployment depth when measuring the Wave Height and Period:

- 6 to 30 meters
- More shallow installations preferable

Deployment depth when measuring the Wave Direction:

- 6 to 20 meters, however 6 to 12 meters is recommended
- Shorter wave periods requires more shallow installations
- Ocean swell can be pushed deeper (towards 20m)
- More shallow installations preferable

Memory Usage:

The wave recording file for each recording interval is approximately 9.5 kb/min acoustic wave duration (selected above). I.e. 10 minutes duration gives 95 kb per recording, while a 5 min duration and 20 min recording interval stores approx 3.5 Mb per day.

Power Consumption:

When configuring acoustic based wave, please note that the instrument pings evenly during the acoustic wave duration in 2 Hz intervals (2 samples per second). Hence, the longer the acoustic wave duration, the higher the power consumption. If power consumption is an issue, please reduce the acoustic wave duration.

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[1] g=9.81 m/s^2

On the other hand, decreasing the acoustic wave duration yields less data and hence more noise in the final results.

CHAPTER 3 Recording

The RDCP 600 is usually started from the *Recorder* application.

It may start directly when powered up (ref. Deployment Setup for more information), but this feature is not recommended for self-recording sessions.

After being armed or started, the instrument will go through a checking routine. If it finds that you have checked the storage facility, and a storage card is missing or old data exists, you will be prompted to overwrite the data or correct the situation.

After 30 seconds, a progress bar will appear informing you that the display will be turned off. Next, put the instrument into its pressure container and deploy. An armed instrument only drains 500 µA before it starts measuring data.

It is not recommended to run the instrument in air while the transducers are pinging. This may shorten the life of the transducer elements. In situations where it will take some time before the instrument is deployed we recommend that you use the arming feature and let the instrument start after it has been deployed, or set to ping at water depth below 1.5 meters.

Besides arming the instrument and stopping the current recording, the recorder menu holds 3 pages:

- ❑ Status

- ❑ Setup

- ❑ Monitor

The *Status page* holds information about the current recording.

When the system is armed, the *Current Status* gives information about the Activity and the Ping count.

Figure 3-1 Recorder, Status

The recording indicator turns red during recording.

Before the system is armed the Activity reads *Stopped*. At recording start up the Activity reads *start sequence* while the deployment configuration is set up. Next, the Activity reads *Idle* before and between measurements.

While recording, the Activity reads *Pinging*. At the same time the *Ping Counter* starts counting from 0 to number of pings in deployment.

After recording the Activity reads *Processing* before it goes back to Idle or pinging.

Check *Don't sleep between recordings* if this suits your deployment.

NOTE! We recommend that the instrument sleeps between records due to the power consumption. However, this feature may be used in the lab for test purposes and diagnostics.

The *Setup page* lists up the configuration of the current deployment.

The *Monitor page* shows the last reading of temperature, compass, pressure and conductivity. A graphic view illustrates the current speed.

Tapping the *Recorder* button activates the arming page. You have two options:

1. Start immediately

2. Start at a specific time

To start the instrument immediately, tap the *Start now* button.

To start at a later time select desired date and time in the date and time controls and tap *Arm*.
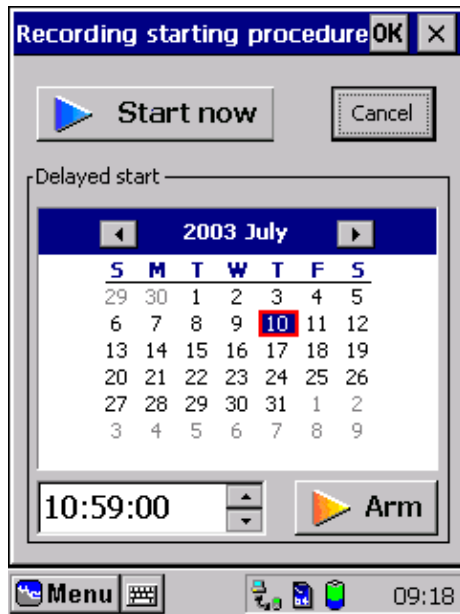
IMPORTANT!

If old data exist on the storage card when the instrument is armed or started you will be prompted to overwrite these data or correct the situation. Existing data on a storage card will be overwritten.

To save old data copy them to a safe location

Figure 3-2 Recording Starting Procedure

CHAPTER 4 Operating Instructions

IMPORTANT! During deployment, we recommend that you use the Lithium battery or external power. The Alkaline battery is only for test purposes.

4.1 Preparations for Use

❑ Perform deployment configurations and recording configurations (described in CHAPTER 1 and CHAPTER 3):

1. Scan through the *Sensor Configuration* menu to ensure that each available sensor is activated, and that the settings suit your personal preferences.

2. Configure the deployment specifications and timing requirements using the configuration wizard in the *Deployment Setup* menu.

3. Activate the *Recorder* menu and start the instrument instantly or at a later specific time.

4. After being armed, the instrument will automatically shut off the LCD display after 30 seconds.

    The LCD may be reactivated by tapping the display, or by setting the *Leave display on* check box.

    However, before putting the instrument into the pressure container, make sure the display is turned off to conserve power. If not done automatically, tap the *Display Off* menu item to turn it off.

    IMPORTANT!

    When disconnecting the instrument from external AC Power, remember always to tightly screw the Cover Cap onto the electrical terminal to avoid water infusing the instrument when deployed!

    Make sure the O-ring inside the Cover Cap is clean and undamaged. Always grease the O-ring before deployment.

    If your instrument is equipped with a pressure sensor, make sure you do not deploy the instrument at a greater depth than the maximum depth for the pressure sensor, unless a pressure stopper is installed on the pressure inlet.

❑ Inspect O-ring grooves, and replace O-rings before deployment.
  Make sure that the O-ring on the top-end plate is clean and greased.

❑ Make sure that the protective cap is fitted on the electrical terminal.

❑ When the system is armed and ready for deployment, the main switch must stay switched on.

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❏ When putting back the instrument into its pressure case we recommend that you insert the instrument 90° off orientation mark. When the instrument is resting on the O-ring, spin the instrument towards orientation.

❏ Tighten the C-clamps until the top-end plate rests against the top of the case.
Avoid over tightening, as this will damage the clamp.

4.2 Retrieval of the Instrument

When the instrument is retrieved after deployment, remove marine growth and barnacles from the sensor(s) using a hand scrub. To remove sea seashells or corals use plastic handle or similar tools. The sensor housing will tolerate most cleaning agents. Be sure to follow the safety precaution for such acids.

Note! Do not use any form of steal brush or any sharp objects; this might damage the acoustic elements.

When inspecting, look for corrosion on connector's cracks on the back potting of connectors and scratches on protecting cable(s) jacket.

Rinse the instrument in fresh water and dry it. The unit can then be opened and the instrument removed from its pressure container.

After opening, the following procedure must be carried out:

Figure 4-1 Multi Media Card, MMC

❏ Wait until the instrument has completed the current recording cycle (see CHAPTER 3); *Ping activity reads Idle.*

❏ Stop the recorder if any battery capacity is left. Wait until the progressing bar have completed.

❏ Write down the time of the last recording.

❏ Turn off the power switch at the back of the instrument.

❏ Remove the data storage unit from the recording unit by releasing the screw cover below the display.

Figure 4-2 MMC reader

❑ Pull out the MMC and insert the MMC in the MMC reader or keep the MMC card in a safe position until it can be copied to a permanent location.

❑ Connect the MMC reader into your PC's USB port

❑ Start up the RDCP Studio Software and import your data as described in TD220b *RDCP Studio*.

IMPORTANT! When stopping the recorder, wait until the progressing bar has completed before the instrument is switched off.

4.3 Mounting

The instrument may be deployed using:

❑ A fixed bottom frame mooring.

❑ A trawl resistant bottom mount with popup buoy.

❑ An in-line string mooring.

❑ A downward facing buoy.

Figure 4-3 Fixed Bottom Mooring Frame 3448. The picture is taken during a test deployment.

The fixed bottom frame mooring is typically used in fixed deployment situations i.e. for harbour surveillance systems.

The bottom mounted frame supports extended battery capacity in the form of external battery package or external power by means of a cable to the shore.

Data may be output in real time as RS-232, RS-485 or PDC-4 packages.

Due to slow data rate on the PDC-4 output, only a limited set of current speed cells and other sensor data may be sent.
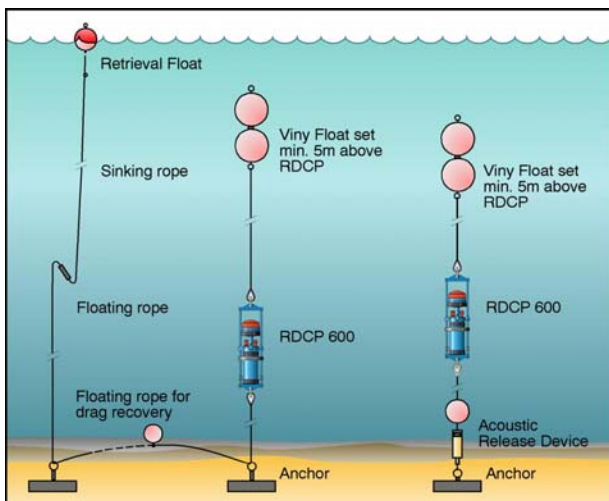
Figure 4-4 In-line Mooring Frame

The in-line frame may be pre-installed in the mooring string, allowing the instrument to be inserted into the frame just-in-time by means of two hand-operated screws.

The in-line frame together with the fully electronic compass and tilt sensor, allow for upwards as well as downwards looking deployments.

For long-term deployments a separate special battery container may be used to prolong the deployment period.
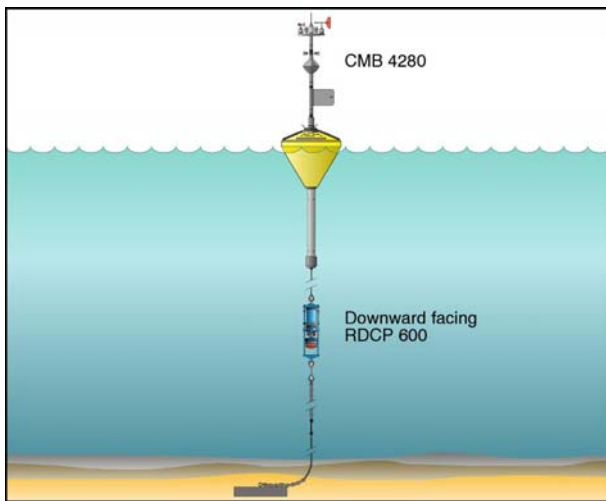
Figure 4-5 Downward Facing Buoy Mounting

The RDCP 600 may also be used in a downward facing application.

Since the surface referred column topology relies on pressure measurements, this feature is not available when using the downward facing configuration.

NOTE!

Detailed installation guides for these different deployments will soon be available as technical notes on our web site. We recommend that you follow these instructions.

For more information about the available mooring frames, refer to TD220c *RDCP Primer.*

4.4 Deploying the Bottom Mooring Frame for fixed Installations

A boat equipped with a winch is needed when installing the RDCP 600 in a mooring frame.

An illustration of the RDCP deployed in a fixed mooring frame is given in Figure 4-3.

The mooring frame should be mounted to a concrete foundation of:

❑   110 x 110 x 30cm = 363000cm^3 = 363 liter.

The weight of concrete is approximately 2.4kg per litre giving a total weight of approximately 871kg.

NOTE! Be sure to use non-magnetic reinforcing rods in the concrete foundation for correct functioning of the compass.

If a concrete foundation is used, lower the instrument using a wire fastened to the block and not the instrument itself.

If a concrete foundation is not used, the instrument can be lowered to the seabed using the underwater signal/ Power cable or a rope.

When the RDCP 600 is in place, give out the rest of the cable and bring ashore.

Make sure that the cable rests on the bottom and is not stretched as the boat moves to the shore.

In general, the cable must be secured to the concrete block, the seabed, and in the brake water zone to the ground.

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When a concrete block is used, laying the cable should be done from land.

In the brake water zone, the best way to protect the cable is to thread it through a durable plastic tube that is bolted to the ground.

On the seabed, place sand bags or concrete blocks over the cable at strategic places to secure it to the bottom.

In harsh environment it may be necessary to bury the entire cable in the bottom.

During operation, it is recommended to use a diver to ensure that the instrument and cable are safely installed on the seabed.

For future service, write down the site position from a GPS receiver.

4.5 Deploying the Trawl resistant Bottom Mooring Frame

Alternatively may a trawl resistant bottom mount with popup buoy be used, refer to TD220c *RDCP Primer*.

4.6 Deploying the Inline Frame

An illustration of the RDCP deployed in an in-line mooring frame is given in Figure 4-4. A mooring string is connected to a Viny Float set in one end and an anchor in the other end.

NOTE!

Calculations of stability and buoyancy must be carried out for the individual mooring.

The anchor must be of suitable size and weight to keep the instrument in one position.

The instrument and optionally other sensors are connected to the mooring string at desired depths.

For convenience a frame can be connected to the mooring string, and the RDCP 600 can be placed into the frame at deployment.

The minimum distance between the RDCP 600 and the Viny Float set is 5 meters.

Several in-line frame systems can be linked together using a floating rope or a sink rope between two anchors.

Also, a bottom anchor can be connected to a two-parted string of floating rope and sinking rope with a retrieval float at the upper end to ease the retrieval of the system.

4.7 Buoy Deploying: Downwards facing RDCP600

An illustration of the RDCP deployed using a buoy is given in Figure 4-5.

An anchor chain with an anchor at the end is mounted to the buoy cable to keep the instrument in one position.

The anchor dimension and weight must be suitable to match the conditions at the location.

We recommend an anchor of about 450kg for deployments in rough conditions.

Prepare the anchoring equipment and the length of the mooring line according to the deployment depth.
Lower the anchor and chains gently until the anchor rests on the bottom.

1. Let the buoy go overboard.

2. Be careful not to harm the superstructure in this operation.

Aanderaa offers a number of communication devices for communication with the Buoy: UHF/VHF, GSM, GPRS, Radio Modem, Argos Satellite, OrbCom Satellite and Iridium Satellite system. Refer to our Brochure B136 and/or contact our Engineering department for detailed information.

4.8 Connection and Disconnection of Sensors

An illustration of the Top end plate with all standard and optional sensors connected to it is given in TD220c *RDCP Primer*. Except for the borehole for the Zink Anode, the other 7 boreholes in the top end plate are all equal in diameter, allowing the user to connect a sensor in a user-optimal location. However, there are some restrictions:

Temperature sensor 4050 and Temperature from Conductivity 3919 or Pressure 4017: Need to be connected to connector named *channel, 2* on the sensor board if you want to use it for compensation.

Conductivity sensor 4019: Conductivity sensor 4019 must be connected to the internal bus.

Turbidity sensor, Oxygen optode, Conductivity 3919 and Pressure sensor: These sensors are used in channels 4,5, or 6.

An illustration of the Electronic Board is given in Figure 4-7.

4.8.1 Procedure for Connecting a Sensor

The Compass Tilt Sensor and the Quartz Pressure Sensor must be connected at the manufacturer due to calibration procedures and to prevent water infusing the instrument. For connections of other sensors, please follow the listed procedure (steps 1 to 8):

1. Remove the instrument from the pressure case by releasing the two c-clamps at the top end plate and lift up the instrument.

2. Unscrew the correct sealing plug at the top end plate. Loosen the set screw that goes with the sensor position. Do not unscrew the set screw completely and remove it, as it might be lost.

3. Pull up the sealing plug. Clean the boreholes.

4. Inspect the O-rings of the new sensor.

5. Connect and tighten the new sensor.

6. Remove the sensor board connector cover from the instrument by unscrewing the two screws at the top of the sensor board cover.

7. Plug the electronic cable into the correct channel at the electronic board

   ❑ If the new sensor is a *Temperature sensor*, it must be connected to connector channel 2

   ❑ If the new sensor is a *Conductivity sensor 3919, Pressure sensor 4017, Oxygen optode* or Turbidity sensor it must be connected to the connector named channel 4, 5 or 6 on the sensor board.

IMPORTANT!

Make sure that the sensors and the c-clamps are well tightened to ensure that no water will infuse the system. Do not over tight as this will damage the sensors and the clamps.

Always update the Calibration Coefficients and other sensor information when a new sensor is installed (Refer the Sensor Configuration page).

4.8.2 Procedure for disconnecting a sensor

The Compass Tilt Sensor and the Quartz Pressure Sensor must be connected at the manufacturer due to calibration procedures and to prevent water infusing the instrument. If your deployment does not need the Heading, Pitch and Roll parameters, we recommend that you set fixed parameters in the Compass/Tilt sensor configuration page. For disconnection of other sensors, please follow the listed procedure:

1. Remove the instrument from the pressure case by releasing the two c-clamps at the top end plate and lift up the instrument.

2. Remove the sensor board connector cover from the instrument by unscrewing the two screws at the top of the sensor board cover.

3. Unplug the electronic cable from the correct channel or terminal.

4. Unscrew the correct sensor at the top end plate. Loosen the set screw that goes with the sensor position. Do not unscrew the set screw completely and remove it, as it might be lost.

5. Pull up the sealing plug. Clean the boreholes.

6. Inspect the O-ring of the sealing plug.

7. Seal the borehole at the top end plate with the sealing plug.

8. Put the instrument back into the pressure case and tighten the c-clamps.

IMPORTANT! Make sure that the sealing plug and the c-clamps are well tightened to ensure that no water will infuse the system. Do not overtight as this will damage the sensors and the clamps.

4.8.3 Illustration of a sensor connection
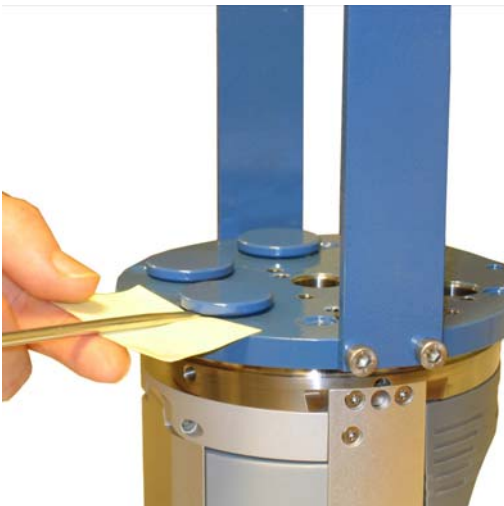
Figure 4-6 Removal of sealing plug. Loosen the set screw. Use a small bit of paper/cardboard to protect the top end plate.

![AADI logo]
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4.9 Sensor Board

The RDCP 600 has three electronic boards. One is named the *Main Board* and the one is named the *Sensor Board, and the thirds is named Display board*. The Main Board gives commands to the Sensor Board to collect measured data. The Sensor Board then collects these data and passes them on to the Main Board. The main tasks for the Sensor Board are to:

❑ Collect data from the SR10/VR22 Sensors

❑ Collect data from the internal CANbus system (Compass Tilt Sensor)

❑ Collect data from the Quartz Pressure Sensor

❑ Send PDC-4 data

Physically, the Sensor Board consists of 13 connectors, 4 SR 10 channel connectors, and mounting arrangement for the Quarts Pressure Sensor. An illustration of the Sensor Board is given in Figure 4-.

For Real Time Output using the PDC-4 interface: The PDC-4 output must be Galvanic Isolated if existing equipment is to be connected, refer to TD220c *RDCP Primer*.

The SR10/VR22 Sensor interface measures up to 6 channels. The first 3 channels are dedicated channels, while channel 4, 5 and 6 are channels for optional sensors.

Channel 1. Reference reading

Channel 2. Temperature

Channel 3. Conductivity cell 3619 (old version –not available)

Channel 4. Optional sensor

Channel 5. Optional sensor

Channel 6. Optional sensor

Power to Mainboard

Compass

Power/PDC4 to 4949 cable

Conductivity 4019

RS-232 to Mainboard

SR 10, channel 6

SR 10, channel 2, Temperatur

SR 10, channel 4

Jumper 1 Sensor board upgrad

SR 10, channel 5

Pressure sensor 3187
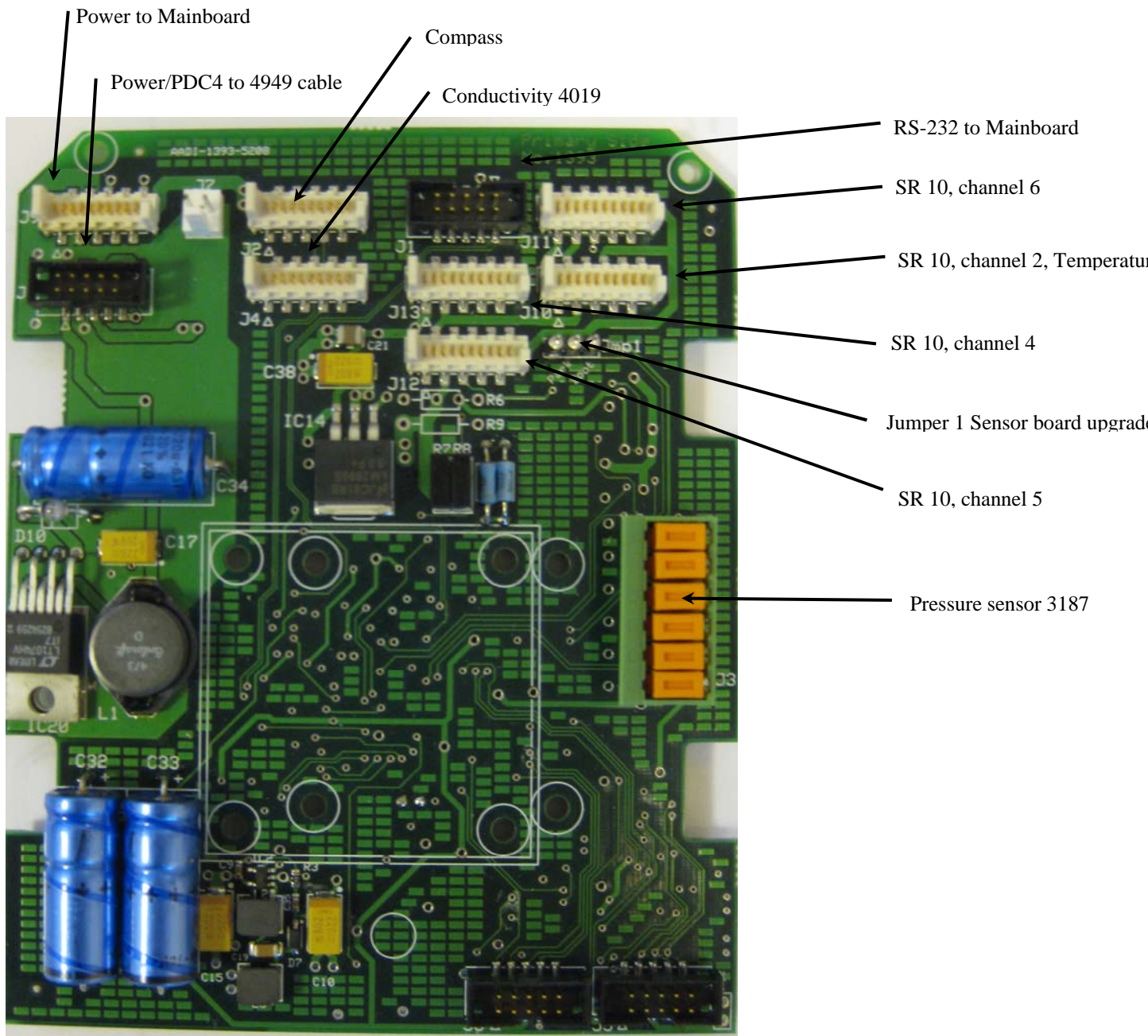
Figure 4-7 Illustration of Sensor board.

4.10 Battery

The battery is connected at the rear of the instrument, ref. Fig.0 -2.

4.10.1 Removal and Insertion of the Battery

To remove the battery from the RDCP instrument, follow the instructions below:

1. Place the instrument on the desk with the front facing down.

2. Push downwards the battery release button in the centre at the rear of the instrument.

3. Flip up the battery cover.

4. Lift the battery straight out.

To insert the battery, follow these instructions:

1. Place the instrument on the desk with the front facing down.

2. Open the rear cover and remove the battery to be replaced, refer the procedure listed above.

3. Place the battery with the connection pins towards the centre.

4. Let down the battery cover.

5. Make sure the battery release button is back in locked position..

Information about the batteries available is found in TD220c *RDCP Primer*.

4.11 MMC

Insert the *MMC card* by first unscrewing the MMC-cover at the front of the instrument, ref Fig. 0-1. Secondly insert the card with the terminals to the right.

4.11.1 Illustrations of deployment preparations
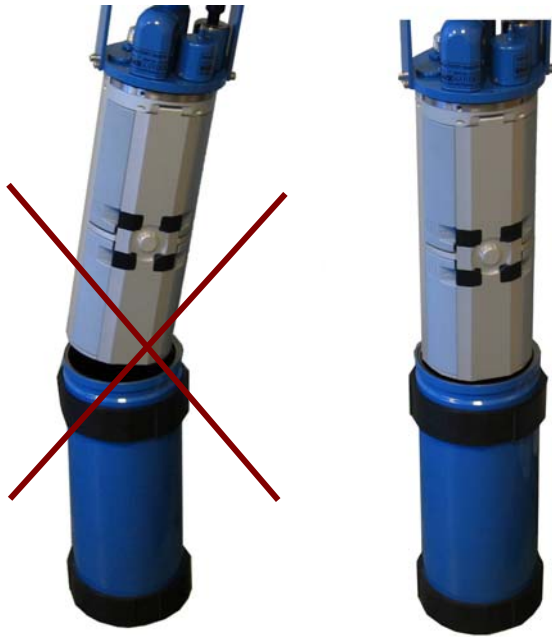
Figure 4-8 Insert Instrument into Pressure Case.

Note! Lower the instrument carefully straight down into the pressure case, do not pinch or nick O-ring. With the instrument Top-end plate seated into pressure case, sin the Top-end plate assembly 180° on the O-ring in order to seat the O-ring and remove any possible contamination from between the O-ring and its sealing surfaces.

Figure 4-9 Tighten C-clamps until the pressure case rotates on the floor. Avoid over tightening as this will bend the C-clamps.

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CHAPTER 5 Maintenance

5.1 General

As typical deployment depth of the RDCP 600 is between 5 and 50 meters, fouling will occur, especially at low latitudes. The use of anti-fouling paint must be considered based on your own experience.

The complete firmware in the RDCP 600 may be upgraded be means of the MMC slot.

NOTE!

Always leave the Transducer Head uncoated.

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

5.1.1 Yearly Maintenance

The procedure below indicates the minimum maintenance that must be carried out each year or every time the RDCP 600 has been retrieved, two to four times a year for fixed installations depending on the environmental conditions, and every 3 years for factory service:

1. Remove marine growth and barnacles from the sensor(s) using a hand scrub. To remove sea shells or corals use plastic handle or similar tools.

2. When inspecting, look for corrosion on connector's cracks on the back potting of connectors and scratches on protecting cable(s) jacket.

3. Rinse the exterior of the instrument in fresh water and let dry.

4. Clean the transducer head.

5. Open the instrument and check for leakage through the transducer head or in the pressure case.
    If leakage, locate the source of the leakage and correct for it.

6. Replace the zinc anodes and corroded parts as necessary.

7. Remove the O-rings.

8. Make sure that the O-ring seatings have a clean and smooth surface.

9. Lubricate the O-rings with silicon grease.

10. Replace the O-rings and pressure inlet.

11. If the transducer head has been disconnected, replace the silica gel bags.

12. Always install new O-rings on plugs that have been disconnected.

13. Check for deformation of the C-clamps. Replace if necessary.

14. Always apply TECTYL® on screws before installation to avoid crevice corrosion. Add also TECTYL® around sensors and sealing plugs.

15. Check for scars on the EPOXY coating, the Top end plate and the frame.

16.   Clean the scars with Acetone.

17.   Apply Repair Lacquer to repair the scars.

18.   Control that the Electrical terminal is securely tightened.

5.1.2 Replacements of Parts

The *Profiler*, the *Turbidity Sensor* and the *Oxygen Optode* are calibrated separately and can be changed without influencing the instrument performance. The Calibration of the Temperature sensor, Turbidity sensor and the oxygen optode is valid regardless of which Aanderaa Instrument it is installed in. This allows for factory supply of calibrated sensors for installation by the customer.

The *Pressure Sensor* and the *Conductivity Sensor* must be calibrated when connected to the instrument for optimum performance. If a new Electronic Board is installed, these sensors should be re-calibrated before deployment.

An *Electronic Board* can be ordered and installed without any adjustments or re-calibration of the Profiler, the Turbidity Sensor and the Oxygen Sensor.

5.1.3 Factory Service

Factory service is offered for maintenance, repair or calibration of instrument and parts.

When returning instrument or parts 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 two years.

5.1.4 Spare Parts and Accessories

The manufacturer always keeps a stock of spare parts, accessories and consumable parts for quick delivery. Orders may be placed by fax, telephone or mail.

The Oxygen Optode 3830 is optional, refer to TD200c *RDCP Primer* for information about calibration and maintenance.

Table 5-1 Spare parts for RDCP 600

Part. no	Description	Pieces
3625A	Sealing Plug for Top End Plate	1
963384	Pressure Inlet for Pressure Sensor (Protection)	1

5.2 Maintenance Kit for RDCP600

This kit, part no. 0973813, can be ordered from the manufacturer, refer to **Error! Reference source not found.**.

Table 5-2 Maintenance Kit 0973813 for RDCP 600

Part. no	Description	Pieces
7973738	O-ring grease, 10 ml	1
7972577	Tectyl 506. 10cl.	1
1260025	Repair Lacquer, Jotun Green	1
1260026	Repair Lacquer, Jotun Blue.	1
1260047	Repair Lacquer, Jotun Black.	1
1865000	O-Ring, SOR 72 (114.5x3.0mm)	1
1862006	O-Ring rm0131-16 (13.1 x 1.6) 2	2
1863013	O-Ring rm0216-24 (21.6 x 2.4)	1
1642103	Umbraco m5x16 din 912 A4	4
1642122	Umbraco m4x25 din 912 A4	1
3963352	Zink Anode, RCM 9/11	1
1963024	Zink Anode, half for spindel	4
1680037	Panduit sta-strap plt4i-co	4

5.3 Tool Kit for Doppler Instruments

Tools kit 0973986 for AADI Doppler Instruments can be ordered from the manufacturer, refer Table 5-3.

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Table 5-3 Tool kit for all AADI Doppler Instruments. Part no. 0973986

Part. no	Description	Pieces
1913002A	Allen Key, NV 4 mm (for 3620)	1
1913022	Allen Key, NV 3 mm	1
1913003	Wrench for C-clamp, dor 4/sd-5"	1
1913018	Wrench, nv 19 mm	1
1913015	Allen Key, NV 2 mm	1
1913009	Allen Key, NV 2.5 mm	1
1913033	Wrench, nv 24 mm	1

5.4 Calibration

Each RDCP 600 is calibrated at the factory prior to delivery.

Normally this calibration is valid for several years, unless changes have been made to the instrument, i.e. change of pressure sensor, compass or a major component.

5.5 Software update of Main Board

Instructions for uploading RDCP 600 Image and updating the Flash Registry are given in the subchapters on page 82 and 83. Description around the procedures is given below.

5.5.1 Updating RDCP600 Image and updating it with new Registry

This section covers the task of upgrading an RDCP 600 image (the main software of the unit) and the instrument database (the Registry).

The Registry is a vital part of the RDCP 600 software. It holds information that the software uses to obtain information about different software components the system loads and unloads during an execution. The Registry also holds information about default configurations, instrument configuration and current deployment configuration. Calibration information for the auxiliary sensors is also stored in the Registry.

There are actually three copies of the Registry in the system. One is stored together with the image and is called the ROM version. Another is stored in Flash and is called the Flash version. Both these are non-volatile. That is, they are not lost when power is switched off.

When the instrument is switched on, the operating system first looks for a Registry copy in the Flash. If it finds one, this version of the Registry is copied into RAM and becomes the working Registry. If it does not find a valid Registry in the Flash, it copies the default ROM version (which is always present) into RAM and makes this one the working Registry.

Modifications to the Registry takes place in the RAM copy as long as the instrument is operating. Occasionally the RAM version is copied to the Flash version when you have changed vital settings such as Deployment configuration. You will notice this as a short flashing message on the screen. You may also force the instrument to copy the current working Registry to Flash by means of the Flash Registry in the Control Panel.

The Flash version of the Registry is *not* erased when you upload a new image using a MMC card. In this way we preserve the instrument's settings even when the software itself is replaced. Uploading an image from a Compact Flash, however, will erase the Flash version of Registry and force the instrument to use the ROM version that came with the new image. In this way we may (by selecting to upload from a MMC or Compact Flash card) decide whether to replace the non-volatile Registry with a new one or not.

It is usually not necessary to replace the Registry when uploading a new image. However, sometimes new or modified components are included in the new software that needs information to be stored in the registry.

An application has been designed that updates the Flash version without erasing important settings and user data. The section 'Instructions for updating the Flash Registry' describes how to use this application.

NOTE! Be sure to install the new image according to the procedure outlined in the Instructions for uploading RDCP600 Image subchapter before updating the Flash Registry.

5.5.2 Instructions for uploading RDCP600 Image

If you already have a MMC card with a RDCP600 Image ready, skip to step 5.

1. Use a MMC card of at least 32 Mbytes. Preferably use the MMC card you received with the instrument.

2. Insert the MMC Reader into the USB slot. Make sure a disk named *Removable Disk* appears in *Explorer.*

3. Erase all content of the MMC card. If you prefer to erase the card using the F*ormat* command, use *FAT* file format (not FAT32 or NTFS).

4. Copy the file named *NK.nb0* to the MMC card.

    a) Select the file in the PC directory.

    b) Right-click and select *Copy.*

    c) Move to the *Removable Disk* folder, right-click and select *Paste.*

    d) The large file (16 MBytes) takes a while to transfer. However, *Explorer* will report *finish* before the complete transfer has taken place. Thus, monitor the yellow light on the MMC Reader for blinking. After the blinking stops, wait an additional minute.

    e) Remove the MMC card from the reader.

    f) Click *Refresh* in *Explorer* (or go to another directory and back to *Removable Disk*) and confirm that there is no card in the reader.

    g) Insert the MMC card again and confirm that the file *NK.nb0* actually exists on the card.

5. Install the MMC card in the RDCP 600 MMC slot.

6. Open the Compact Flash Card Housing in the RDCP 600.

7. Use the stylus to press and hold down the lower boot button in the MMC Housing; Switch *ON* the RDCP before releasing the boot button. Observe that the LCD screen turns on.

8. Release the boot button.

9. Tap the boot button once more; the LCD screen will now appear dark yellow.

10. Release the boot button once more and wait until the LCD screen turns dark red; the new image is about to be transferred. The image is large in size, and will take approximately 20 minutes to download

11. After a while the LCD screen will turn dark red, and the new image is about to be transferred. The image is large in size, and will take approximately 20 minutes to download.

12. When the download has finished, the ordinary start-up screen, with the *Menu* button appears.

13. Switch *OFF* the instrument using the power switch, and then switch it back *ON* to confirm that the new image has been installed.

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5.5.3 Instructions for updating the Flash Registry

1. *NOTE! This step is only required if the instrument is set to start the Recorder immediately when power is applied! Else proceed to step 2.* After the Recorder application window has appeared, tap the *Stop* button and Close the application by tapping the Close marker in the top right corner.

Tap the *Menu* button and select *Diagnostics*.

2. In the Diagnostics suite scroll down and tap the *Update Registry*.

3. When the Registry Update window appears, tab the *Update Registry* button. The instrument will then show a small window, which tells you that the instrument is flashing the updated Registry for approximately 2 seconds; next, the instrument will reset. It now takes the usually 10 seconds before the LCD again lights up with the main menu.

IMPORTANT!

Sometimes the updating takes place in two steps. If this is the case, the instrument will do another flashing of the registry after it has rebooted due to the action above. It will then reset again for a second reboot. When the instrument comes up after the second reboot, it will be ready for operation.

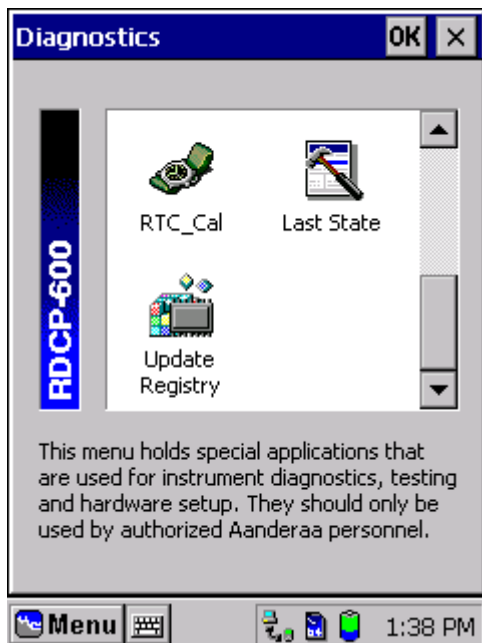*Do not switch off the power during flashing of the registry!*

Figure 5-1 Diagnostics Menu

Figure 5-2 Update Registry

Note! After updating RDCP 600 Image with New Registry, make sure to update the Sensor Board, refer to page 84.

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5.6 Sensor update of Sensor Board

1. *NOTE! This step is only required if Startup Mode is set to:*

   - *Start the Recorder when powered up, or*

   - *Enable for Remote start.*

   If Startup Mode is set to *Start Recording from touch panel*, proceed to step 2.

   - Tap the *Menu* button in the lower left corner of the LCD display to activate the menu.

   - In the RDCP 600 Menu list tap *Deployment Setup.*

   - In the Deployment Setup Configuration, select the *Edit* menu and then select *Startup Mode.*

   - Use *Start Recording from touch panel.*

   - Tap OK to return to the Deployment Setup Configuration Application and close the application (tap the **x** in the upper right corner) to save the Startup Mode settings.

   NOTE! Remember to set the Startup Mode back to the desired mode after the sensor board software is updated.

2. Switch *OFF* the instrument. Remove the Compact Flash card if connected. Open the connector cover on top of sensor board cover to access the sensor board. Move jumper 1 one step to the right,, refer to 4-7.

3. Start the instrument by pressing the power button at the rear of the instrument. Wait for approximately 10 seconds before the LCD display at the front of the instrument is activated.

4. Tap the *Menu* button in the lower left corner of the LCD display to activate the menu.

   - In the RDCP 600 Menu list tap *Diagnostics*.

   - In the Diagnostics menu tap *SB_FW_Inst* (SensorBoard Firmware Installer).

- Tap *Install Factory.*
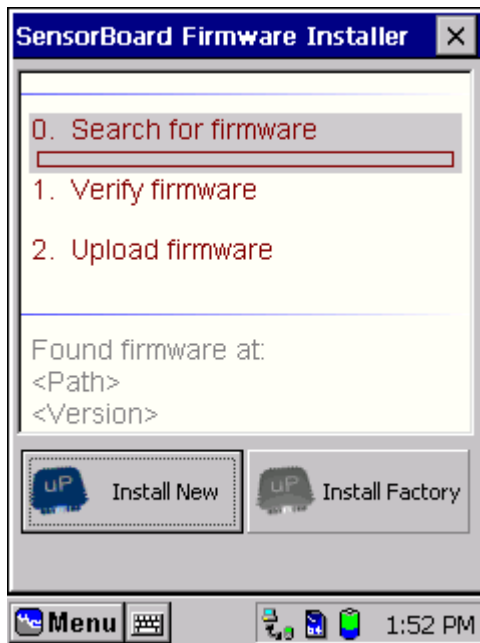
5. Wait for a complete programming dialog. This takes approximately 2 minutes.

6. Switch *OFF* the instrument and replace jumper 1 in original positon to the left.

The new software is now installed.

7. *If Startup Mode was changed as described in step 1, remember to set the Startup Mode back to the desired mode.*

5.6.1 Optional Feature: Setting the Clock Calibration Frequency

NOTE! This section holds an optional configuration item that may or may not be relevant for your instrument. Read through the item and check if it is relevant for you.
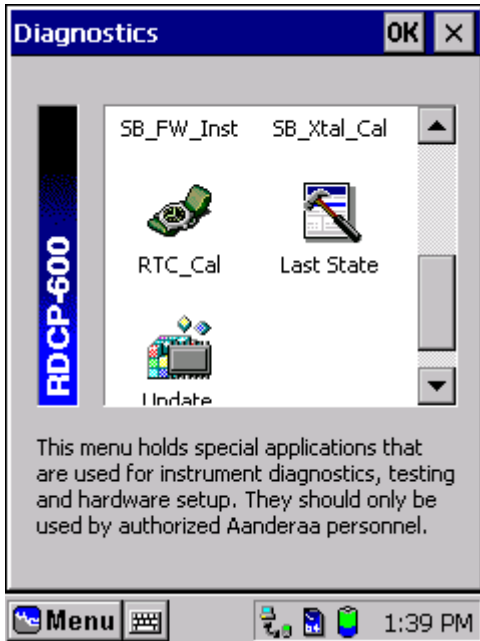
Figure 5-3 Diagnostics Menu

This procedure is only needed if the clock speeds after installing a new image:

1. Depending on the previous version of the software that was installed on the instrument, the new software may cause the Real-Time Clock to run out of proportions. If this is the case, the clock in the lower right corner will jump several minutes for each 5-second update.

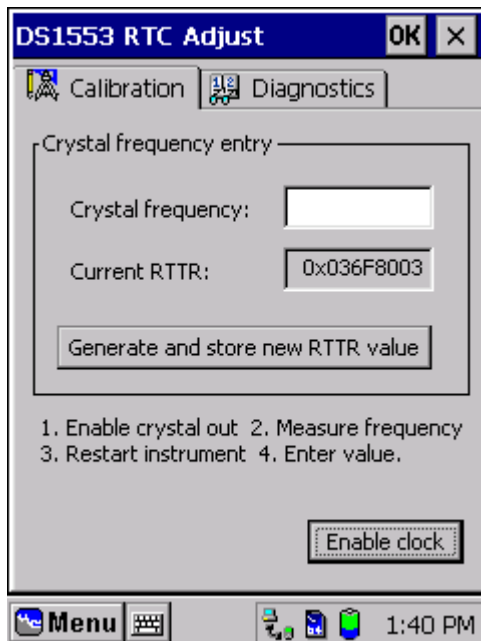2. If this is the case, tap the Diagnostics menu and select *RTC_Cal*, refer to Figure 5-3.

Figure 5-4 Real Time Clock Adjustment

3. In the Crystal Frequency field enter the number (using the virtual keyboard next to the menu button. Use *period* as separator): *32771.5*

4. Tap *Generate and store new RTTR value* to store the adjustment.

5.6.2 Optional Feature: Updating the Surface Cell Setting

NOTE! This section holds an optional configuration item that may or may not be relevant for your instrument. Read through the item and check if it is relevant for you.

This procedure is only required if your current Deployment Configuration uses a Surface Cell.

Earlier versions of the software did not setup the position of the surface cell properly if the cell itself was edited afterwards. To correct the surface cell setup do as follows:

1. Tap the *Deployment Setup* item in the main menu.

2. Tap the *Edit* menu in at top of the overview window and select *Profile*.

3. In the *Profile* window, tap the *Columns* page.

4. Uncheck the *Use surface cell* in the upper right corner. The surface cell should now disappear from the list and the check box should be unchecked.
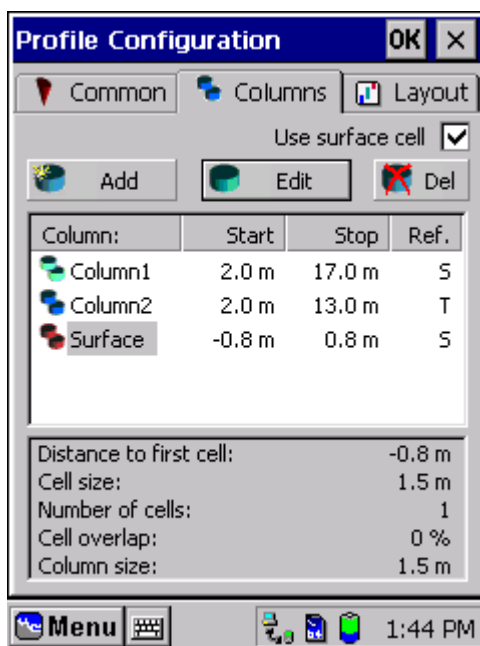
5. Check the *Use surface cell*. The surface cell should now be included in the list with a red icon. The numbers under the column *Start* and *Stop* should now be symmetrical with *Start* having a negative value, refer to Figure 5-5.

6. Press *OK* until the Deployment Setup application closes and the system flashes the new setup.

Figure 5-5 Surface Cell Update

Appendix 1 External Battery for RDCP600

External Batteries for the RDCP600 are optional accessories that can easily be used in in-line mooring frames, providing extended deployment time. Refer TD 261 Operating Manual External Battery for a full description of preparing external batteries for the RDCP, dimensions and voltage capacity.

Three battery cases are currently available; one short case and one long case for both 300m depth rating and for 2000m depth rating (refer TD 261 Operating Manual for External Battery). Each battery case can be used with either Alkaline, Lithium or rechargeable NiCd battery packs. The Battery Voltage and Capacity for the battery packs that we supply are given TD261. Battery case 5219 is available on request.

Note! You can buy battery packs from your local supplier to fit the battery cases.

Figure A- 1 left: Extended in-line mooring Frame 4110 with a complete battery case 4062 (300m version) and an RDCP600. Cable 3997S for connection. Right: Drawing of In-line mooring frame with Battery case 5062 and In-line mooring frame 3910A with RDCP600.

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The battery cases fits into an RDCP600 in-line mooring frame. The long battery case, 5062, fits into a standard RDCP 600 in-line frame, part no. 3910A, while the short battery case, 4062 and 4219, fits into an extended frame, part no. 4110, which holds both the instrument and the battery case, refer Figure A- 1.

The battery case is delivered with connection cards included (one connection card for Alkaline/NiCd, and one connection card for Lithium battery packs). If you order rechargeable NiCd battery packs, a charging cable for NiCd, part no. 3969455, is also part of delivery.

Note! If ordering rechargeable NiCd battery packs, do not detach the Lithium connection card from the pcb assembly board, as the Lithium connection card is used in the charging process and are best kept and used with the assembly board still attached to it.

The length of the extended in-line frame, 4110, is 1280mm. The weight of the frame with battery case 4062 (300m version) complete with battery packs is 19 - 21kg is air (depending on type of battery pack; NiCd cells have the highest weight) and 10 - 12.5kg in water.

The length of the in-line frame 3910A, is 824mm. The weight of the frame with battery case 5062 (300m version) complete with battery packs is 22 - 27kg in air and 8.5 - 13.5kg in water. The weight depends on type of battery pack; NiCd cells have the highest weight.

Note! Shackles in each end of the frame for mounting will add to the weight in air and water!

Appendix 2 Remote Communication using AAIRdcpCOMServer

One optional feature of the RDCP600 is remote communication with the instrument e.g. for 'Real-Time' data and changing configuration settings using the RS232 or RS485 protocol (two way communication).

An optional accessory of the RDCP600 is a package called AAIRdcpCOMServer which ease the data collection at the receiver end, the PC. The package includes RDCPRemoteLink and RDCP600 Data Reading Sheet.

AAIRdcpCOMServer is an ActiveX component. It is not a display program. When the AAIRdcpCOMServer package is installed, the component is available for all applications currently installed on the PC. The ActiveX component can be utilized in several application types, like e.g. MS Office Excel, Microsoft Visual C++, Microsoft Visual Basic and Lab View (from National Instruments).

Features of the AAIRdcpCOMServer:

- AAIRdcpCOMServer will ease the data collection on the receiver/PC side.

- The AAIRdcpCOMServer can be used to change instrument settings remotely.

- The AAIRdcpCOMServer handles the setting up of the COM ports and the correct SW protocol.

- The AAIRdcpCOMServer will significantly reduce your development time.

AAIRdcpCOMServer can be useful for:

- Customer who need Real-Time data.

- Customers who often need to change instrument settings.

- Customers who will use suitable transmitting device for communication:

    o Cable up to 1200m

    o GPRS modem

    o Radio modem, up to 30km

    o Acoustic modem

    o A communication of the above

- Customer who can not access the instrument easily, e.g. in harbours with heavy traffic.

RDCPRemoteLink is an example of how to communicate with the RDCP using the AAIRdcpCOMServer control. The software is developed in Visual Basic language and the source code is enclosed.

RDCP600 Data Reading Sheet has the same main features as the RDCPRemoteLink.

The ActiveX component provides xml output from the RDCP600. This xml can be used by the AADI Real-Time system for further handling into other user applications like e.g. databases and display systems, refer Figure A- 2.
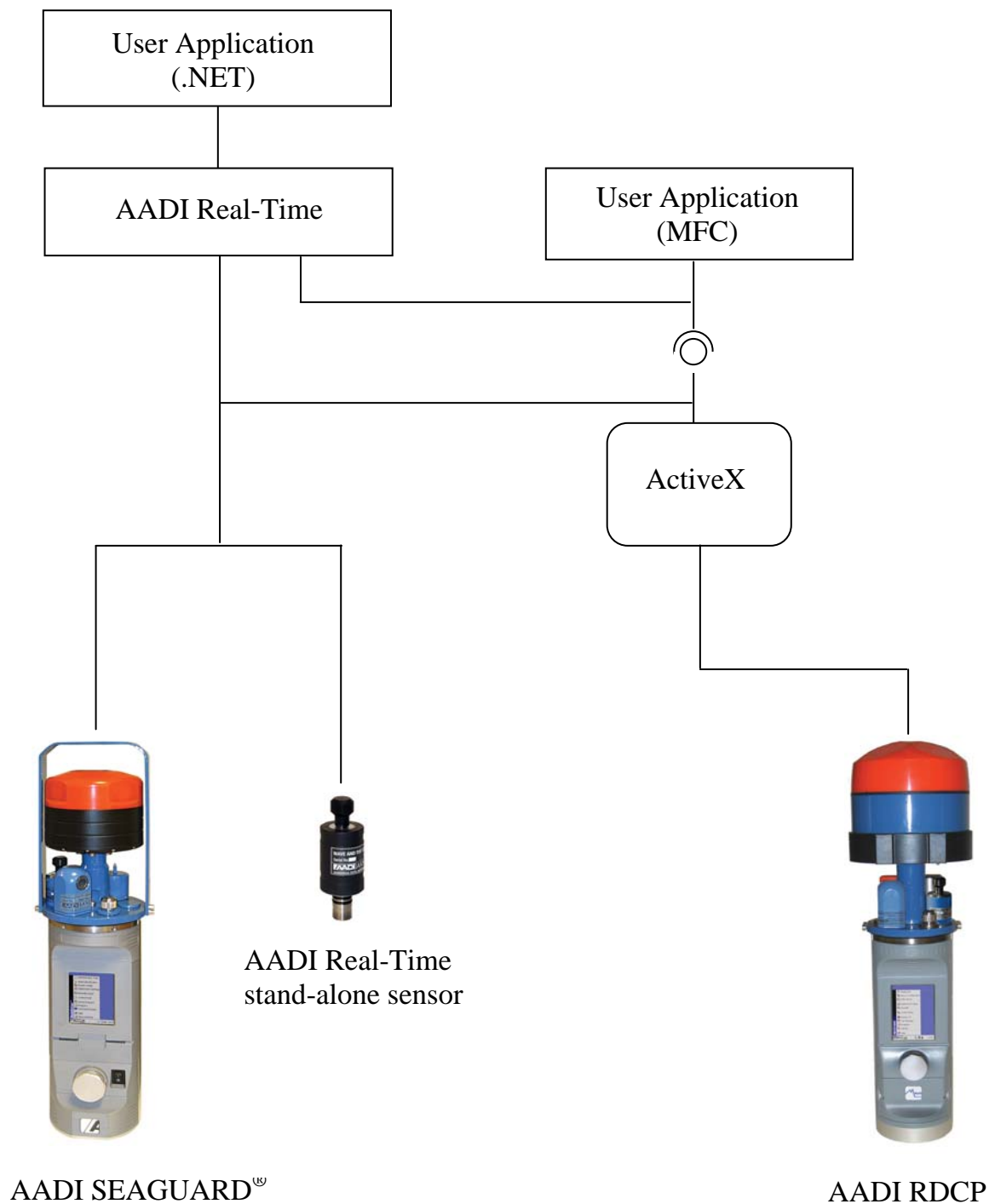

Figure A- 2 Example of system using the ActiveX component for Real-Time applications.