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# Quick Start Guide for
# Teledyne RD Instruments Workhorse Mariner
# 600 kHz ADCP on RV ‘Heincke’

Source: Teledyne RDI Workhorse Mariner Datasheet

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# Contents



# Document history

| Version | Date | Description |
|---|---|---|
| 1 | 2012-04-03 | First version of this manual |
| 2 | 2015-03-18 | 600 kHz ADCP added |
| 3 | 2016-06-22 | 600 kHz ADCP and Saab DGPS changes |
| 4 | 2016-08-15 | Separate manual for 150 kHz and 600 kHz ADCPs |
| 5 | 2017-02-17 | Complete removal of 150 kHz ADCP information; new wiring chart added; configuration of WinRiver II added |
| 6 | 2019-02-27 | Communication settings changed, BBTalk result added |

# 1 ADCP Installation Overview

## *1.1 Sensor Equipment*

The following sensors are installed on the RV 'Heincke' (Table 1).

**Table 1: Sensor specification**

| Sensor | Model | Details from Manufacturer |
|---|---|---|
| **ADCP 600 kHz - vessel mounted -** | Teledyne RDI Workhorse Mariner | Range: 50 m<br>Vertical resolution cell size: 0.5 - 4 m<br>Velocity accuracy: 0.3 % of the water velocity relative to the ADCP ± 0.3 cm/s<br>Velocity resolution: 0.1 cm/s<br>Number of depth cells: 1 - 128 |
| **Inertial Navigation System (INS)** | IXSea Phins | Heading accuracy: 0.05 deg (without aiding)<br>Roll, Pitch accuracy: 0.01 deg<br>Heave accuracy: 5 cm or 5% |
| **Primary Positioning Unit** | Trimble SP461 | Primary Positioning system DGPS<br>0.5 - 3 m accuracy |
| **Backup Positioning Unit** | Saab R5 | Secondary Positioning system DGPS<br>1 - 3 m accuracy |

## *1.2 Sensor Structure*

Table 1 shows the sensor structure of the ADCP hardware and shows the installation in the laboratory. The 600 kHz transducers are hull mounted. The deck units of both ACDPs (Teledyne RDI Ocean Surveyor 150kHz and Teledyne RDI Workhorse Mariner 600 kHz) are permanently installed in the server rack next to the operator PC. The operator PC receives ADCP data from one ADCP deck unit at a time (no parallel operation!), position information from the Trimble DGPS receiver as well as attitude data (heading) from the IXSea PHINS III Inertial navigation system (INS). Recorded data should be regularly copied to the network shares of the XDC storage server.

Figure 1 and Figure 2 show active connections for using different software (VmDas or WinRiver II) with the Teledyne RDI Workhorse Mariner 600 kHz. Figure 3 shows the installation in the laboratory.

## Setup using the 600 kHz ADCP and VmDas

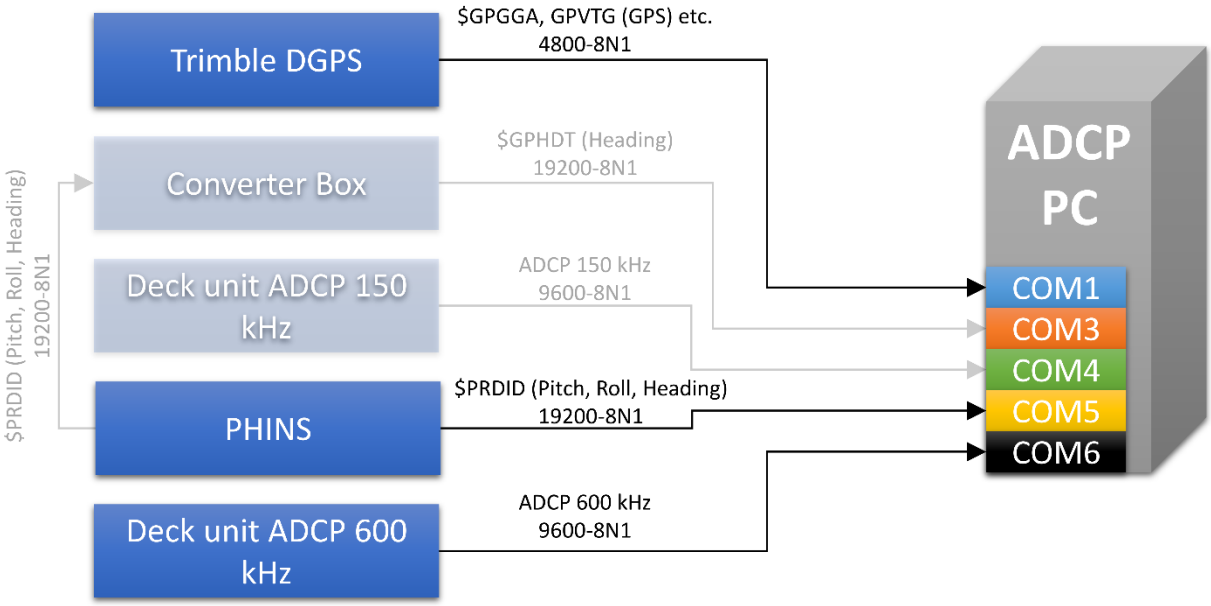


**Figure 1: Wiring diagram for using the ADCP with VmDas**

## Setup using the 600 kHz ADCP and WinRiver II

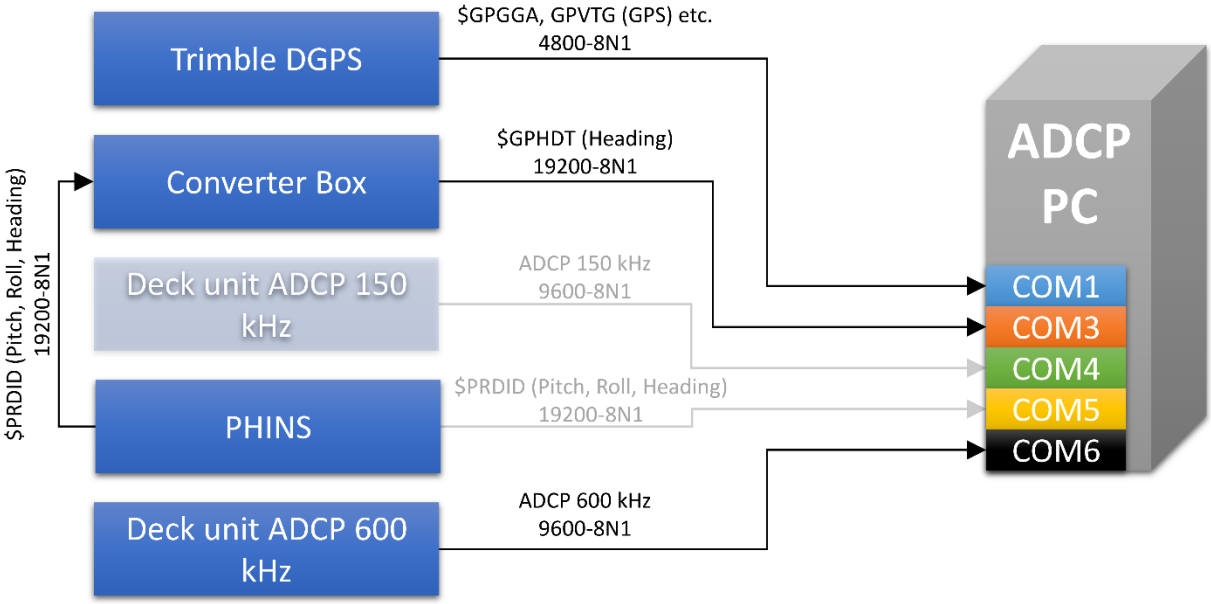


**Figure 2: Wiring diagram for using the ADCP with WinRiver II**

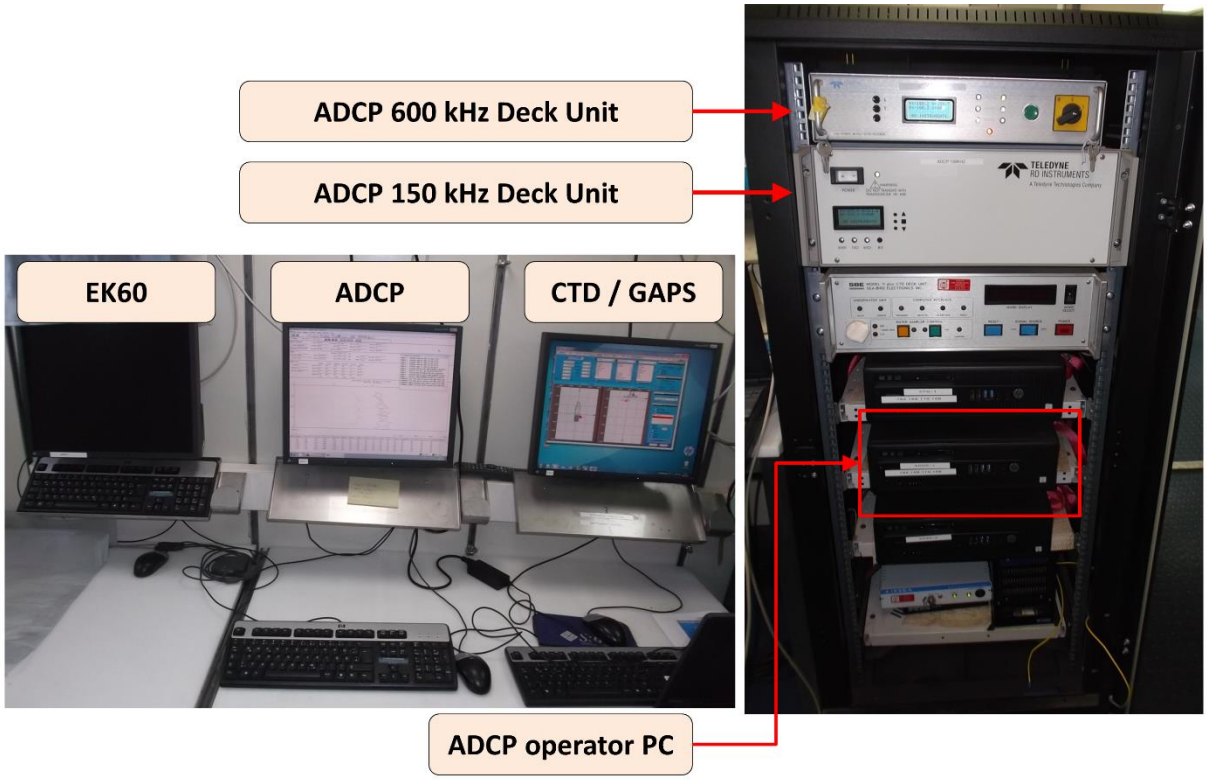


**Figure 3: Photo showing the system in the lab**

## *1.3 Software*

The software *VmDas* (Vessel-mount data acquisition system) is used for data acquisition and configuration of the ADCP. The software *WinADCP* can be used for visualization and export of recorded raw data. Both software packages are installed on the ADCP operator PC.

Alternatively, the software WinRiver II is installed. In the following, startup and storage is described for the recommended application VmDas. A short reference to the WinRiver II software can be found at the end of this manual.

# 2 System Start-up

This manual is created for the specific use of the Teledyne Workhorse Mariner 600 kHz ADCP on RV 'Heincke' and focuses on the most important parameters to be looked after during data acquisition. We recommend taking a look at the ***VmDas Quick Start Guide*** and ***VmDas User Guide*** additionally.

## *2.1 Switch on ADCP*

1. Power up the ADCP operator PC (Figure 3, right)
2. Power up the deck unit in the server rack (Figure 3, right)

## 2.2 System Test (BBTalk)


Before you start a survey, you should perform a hardware system test.

1. Start the BBTalk program from the desktop of the operator PC.
2. Connect to the ADCP unit by selecting the settings:

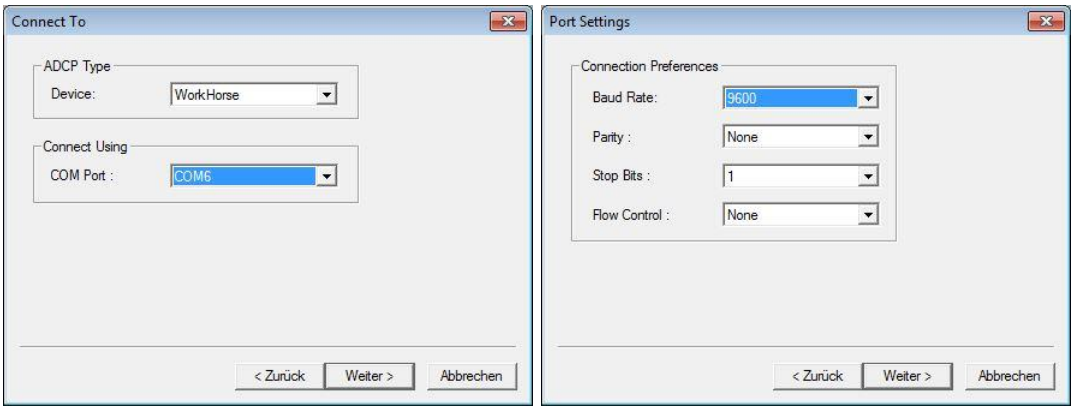


**Figure 4: Define COM port and serial connection settings in BBTalk**

3. Select Options as shown below:

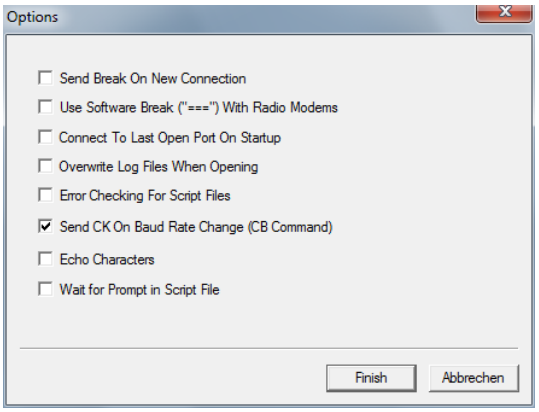


**Figure 5: Program settings in BBTalk**

4. To run the test, several commands need to be sent to the ADCP.
5. Select the menu ***File → Send script file*** or press ***<F2>***.
6. Select the file ***C:\Program Files (x86)\RD Instruments\RDI Tools\TestWH.rds.***
7. This file contains the following set of commands for the ADCP which is now executed one after another (The Enter button can be pressed to skip the delays.):

   ***CR1, TS?, PS0, PS3, PA, PC2, PC1***

   The results can be saved to a text file via copy & paste (see Appendix).

# 3 VmDas Acquisition Software


The software VmDas is used for data acquisition and playback.

1. Start the VmDas program from the desktop of the operator PC
2. Select ***File → Collect Data*** and then import the default configuration settings using ***Options → Load***. The default configuration is ***C:\ADCP\600kHz_WorkhorseMariner\config\600kHz_WorkhorseMariner_TCPIP.ini***.
3. The configuration settings should be checked before data acquisition. Enter the menu ***Options → Edit Data Options*** and edit the settings as described in the section 3.1 to 3.11.
4. After checking the settings carefully, **start the data acquisition**. Select the menu ***File → Collect Data*** or press the button at the upper left of the main window. The data recording starts immediately and the screen looks about the same as the screenshot in Figure 6.

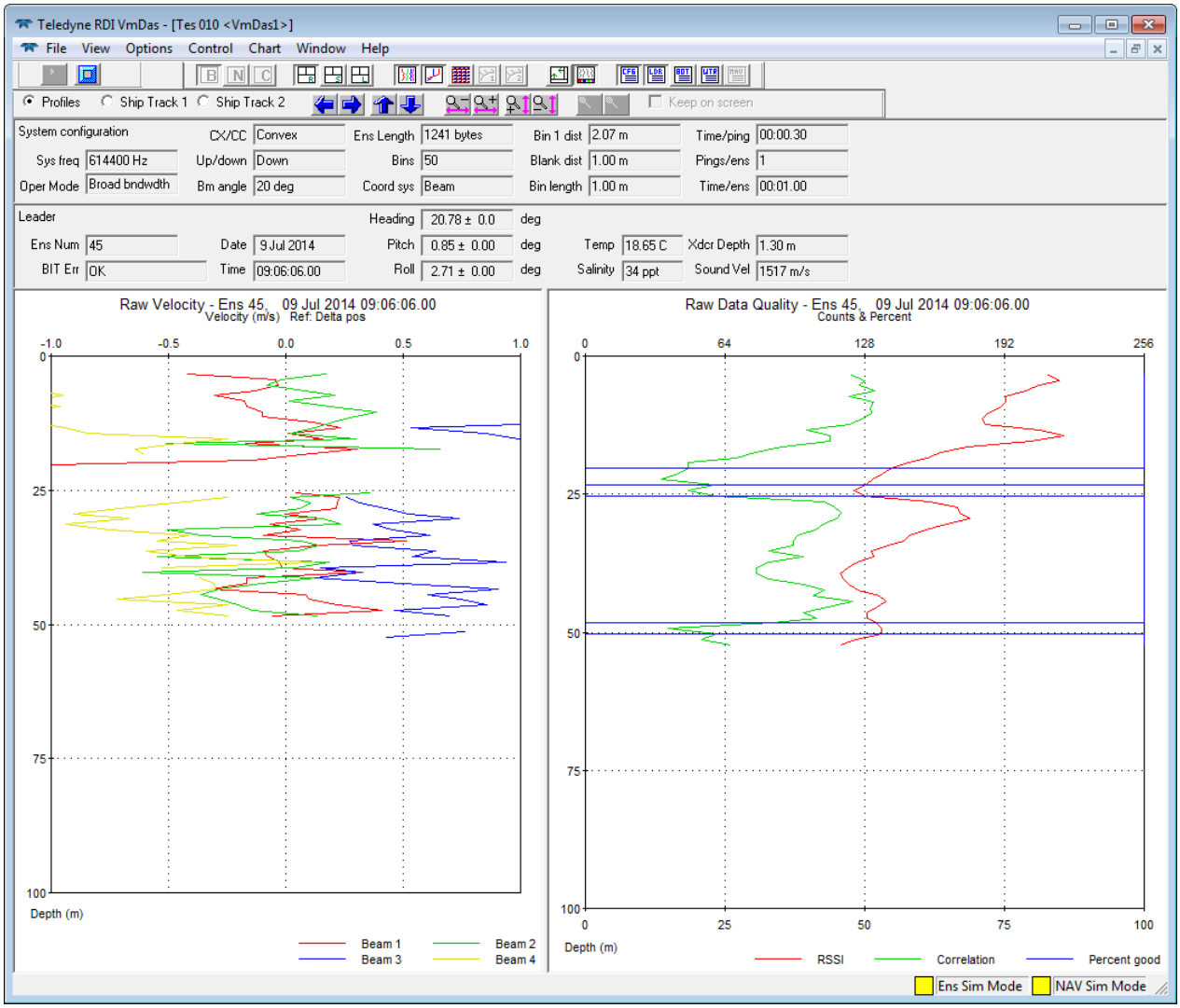


**Figure 6: VmDas screen layout during data collection (raw display mode)**

## *3.1 Communications Settings*

The Communications tab (in menu ***Options → Edit Data Options***) configures the serial and network connections to the ADCP, the GPS, and the motion sensor. Make sure that the inputs correspond to those in Figure 7 (red rectangle).

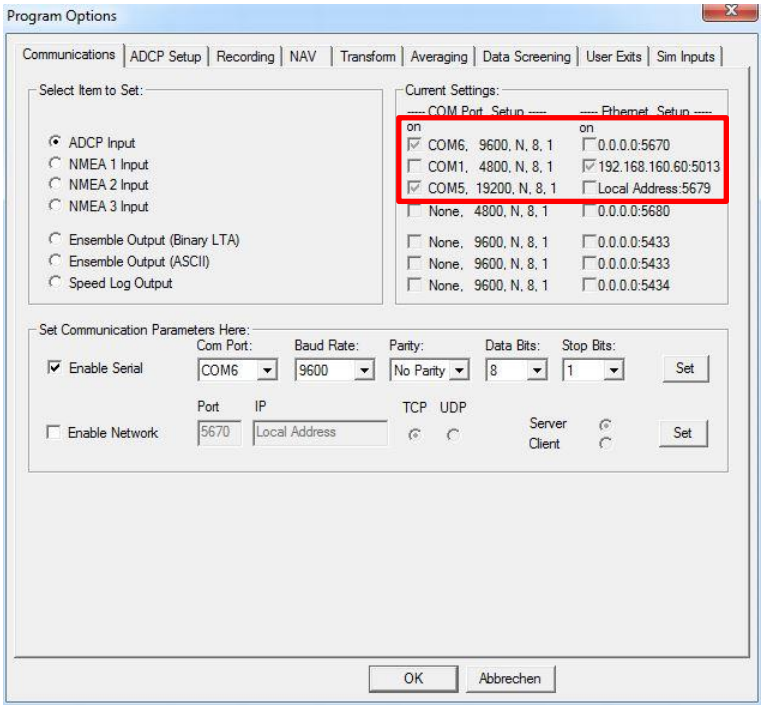


**Figure 7: Required communication settings for 600 kHz ADCP (red circle)**

Please note: Due to several problems with the COM1 Port, the NMEA 1 Input (GPS input) has now been changed to TCP/IP (Figure 8).

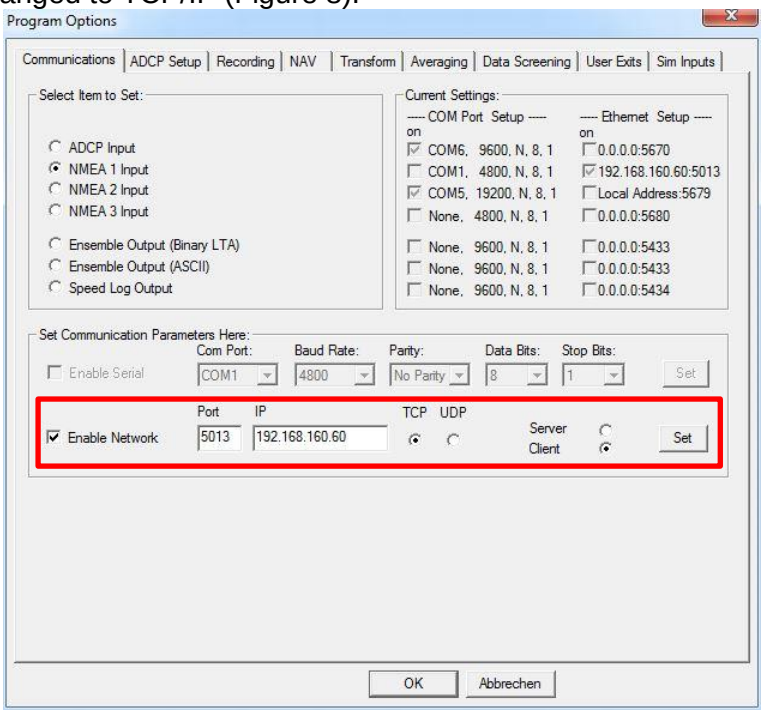


**Figure 8: Changed NMEA 1 Input (GGA, VTG from Trimble DGPS)**

## 3.2 ADCP Settings

For the 600 kHz ADCP, only the option ***ADCP Setup from File*** is supported by VmDas. That means, changes to the desired resolution must be made in a text file (please do not overwrite the default file ***WH600_default_settings.txt***). If bottom tracking is activated (default setting and recommended), the ***Ensemble Time*** should be set to ***Ping as fast as possible*** (Figure 9).

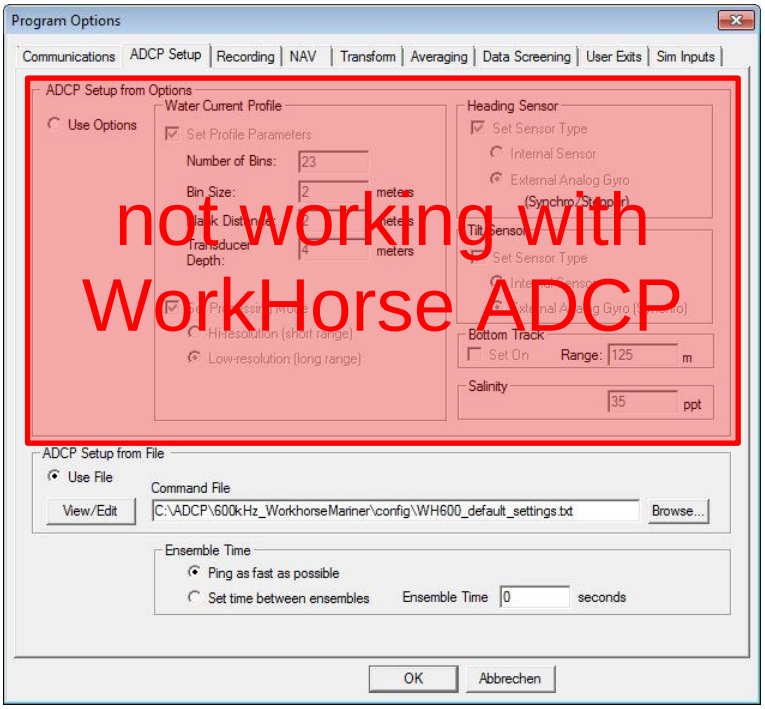


**Figure 9: ADCP and auxiliary sensor setup**

## 3.3 Changes in the ADCP Setup File

The setup file contains the following commands (Table 2) that can be modified by the user:

**Table 2: command description**

| Command | Description | Default |
|---|---|---|
| CR | Retrieve Parameters | CR1 |
| CF | Flow Control | CF11110 |
| BM | Bottom Track Mode | BM5 |
| BP | Bottom-Track Pings Per Ensemble | BP1 |
| BX | Maximum Tracking Depth | BX1500 |
| EA | Heading Alignment | EA03400 |
| EB | Heading Bias | EB0 |
| ED | Depth of Transducer [decimeter] | ED40 |
| ES | Salinity [PSU] | ES35 |
| EX | Coordinate Transformation | EX11111 |
| EZ | Sensor Source | EZ1111101 |
| WA | False Target Threshold Maximum | WA50 |
| WB | Mode 1 Bandwidth Control | WB0 |
| WD | Data Out | WD111100000 |
| WF | Blank after Transmit [centimeter] | WF200 |
| WN | Number of Depth Cells | WN23 |
| WP | Pings Per Ensemble | WP1 |
| WS | Depth Cell Size [centimeter] | WS200 |
| WV | Ambiguity Velocity | WV175 |
| TE | Time Per Ensemble | TE00:00:01.46 |
| TP | Time Between Pings | TP00:00.73 |
| CK | Keep Parameters | CK |
| CS | Start Pinging (Go) | CS |

Only the settings marked red should be modified according to the desired range and resolution. WB0 stands for wide bandwidth with a high sample rate and a low profiling range, WB1 should be chosen for narrow bandwidth with a low sample rate and a high profiling range. Blank after transmit specifies the space between the transducer and the first depth cell.

## 3.4 Recording Settings

The Recording tab (in menu ***Options → Edit Data Options***) configures the recording options for your survey/expedition. Choose an adequate name for your survey/expedition. Set the primary path for recorded files to ***C:\ADCP\600kHz_WorkhorseMariner\data*** as shown below. If a backup is desired, check ***Dual Output Directories*** and provide a path (***H:\Scientist\data\ADCP***).

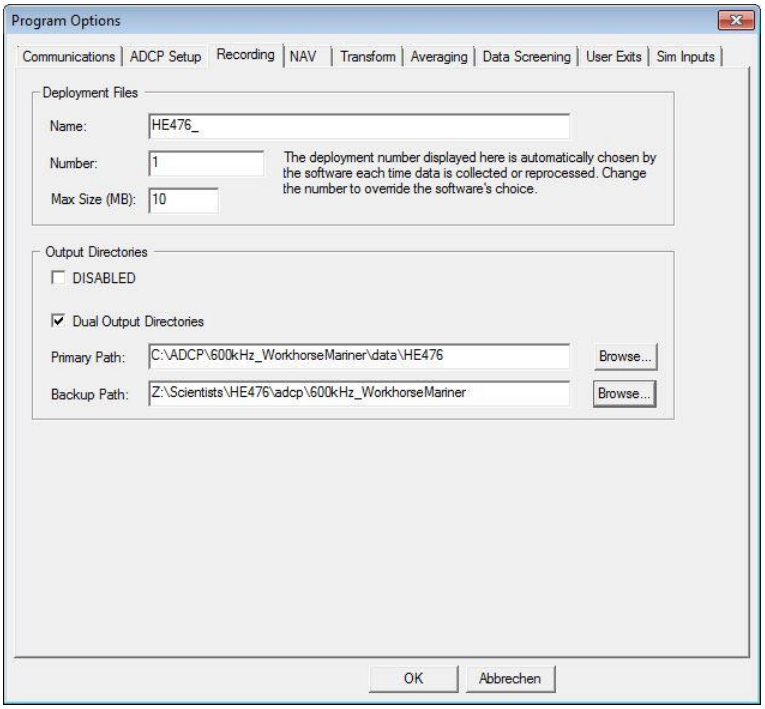


**Figure 10: Recording settings; make sure to set correct output and backup directories.**

## *3.5 Navigation Settings*

This tab configures the navigation input sources for the ship's position and the ship's speed over ground. Ensure the settings are as shown below:

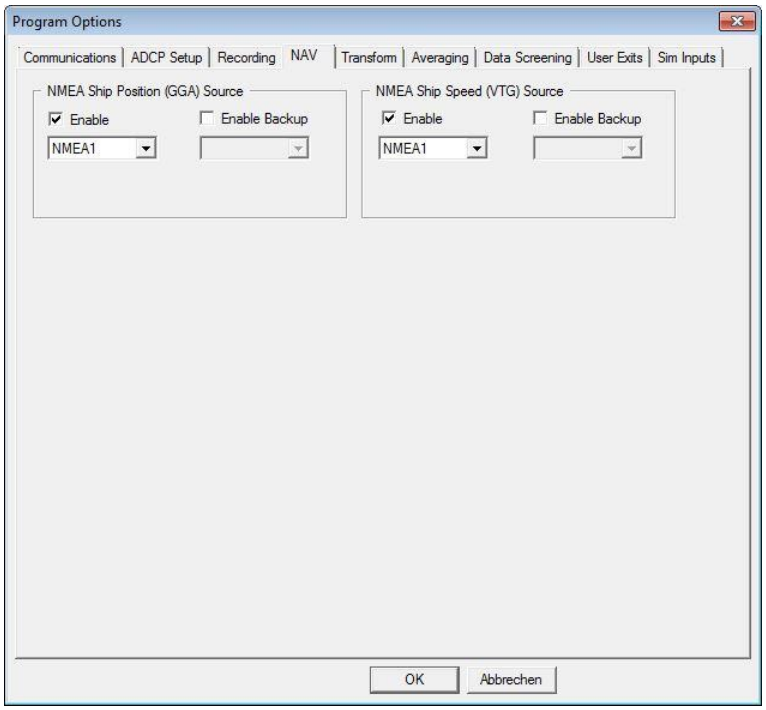


**Figure 11: Required navigation input settings**

## 3.6 Transformation Settings

The reference beam 3 of the ADCP is mounted 45° relative to the ship's longitudinal axis which has been detected by a bottom and water track measurement. Ensure this offset is given as the EA Heading Alignment Error in the configuration!

The Transform tab configures heading and roll/pitch input sources as well as angular offsets for each parameter. Please ensure all settings are as shown in Figure 12.

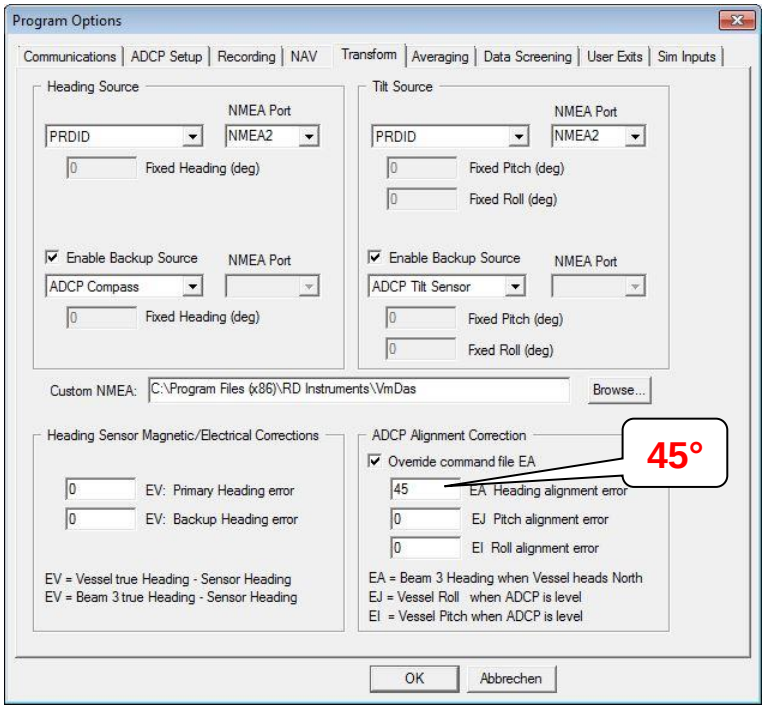


**Figure 12: Required transformation settings**

## 3.7 Averaging Settings

This tab (in menu ***Options*** → ***Edit Data Options***) configures the averaging of the ADCP raw data. Configure as shown in Figure 13 or adjust the settings according to your requirements. The settings will not affect the raw data.

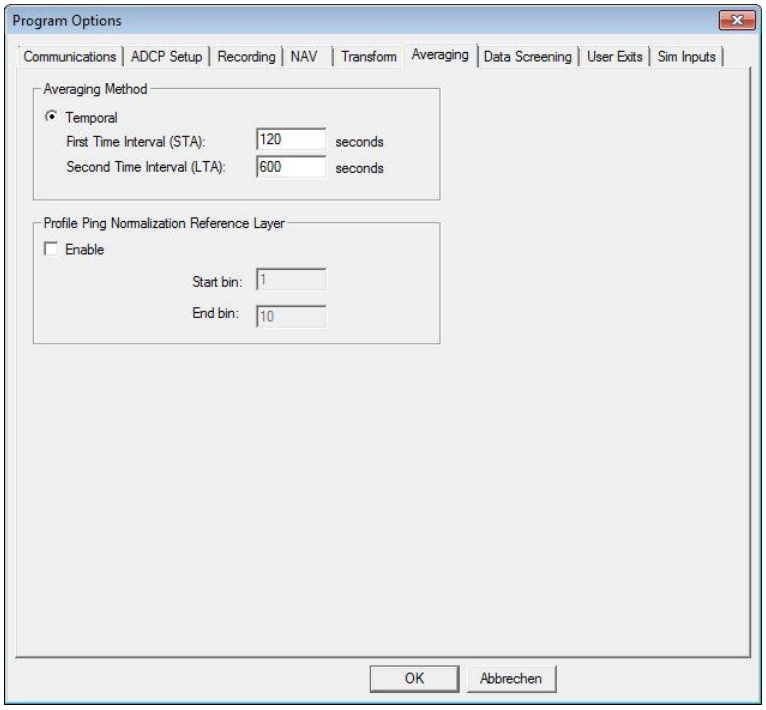


**Figure 13: Averaging settings, adjustable to your requirements**

## 3.8 Data Screening Settings

The Data Screening tab (in menu ***Options*** → ***Edit Data Options***) configures the screening settings for the visualization of the ADCP raw data. Adjust these settings according to your requirements.

You can set limits for RSSI (amplitude), correlation, percent good, error velocity, vertical velocity and fish screening. If the raw values are below the selected minimum limits the values will not be displayed nor included in the short time and long-time averages. The raw data is of course not affected by these settings.

## 3.9 User Exits

In this tab it is recommended to check the ***Launch WinAdcp*** box as shown in Figure 14.

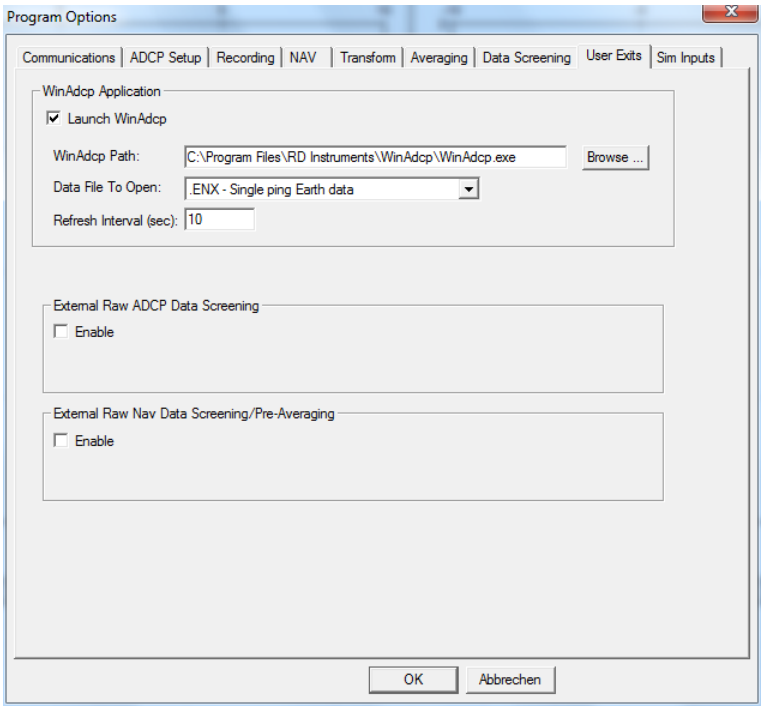


**Figure 14: Recommended User Exits settings**

## 3.10 Sim Inputs

This tab shows options to replay already recorded data. For data collection (default) it should be configured as shown in Figure 15.

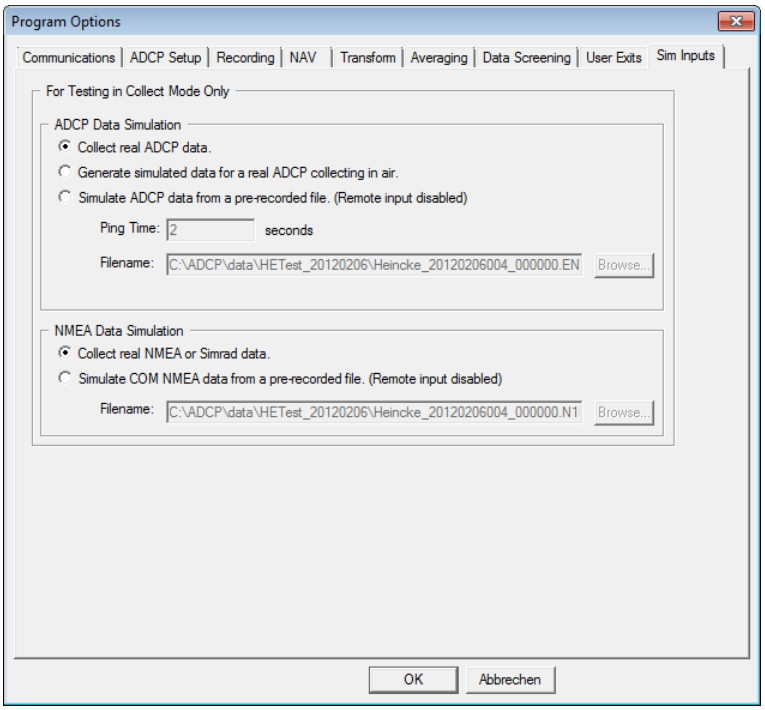


**Figure 15: Configuration for data collection**

## 3.11 Short Term Averages (STA) in VmDas

VmDas offers the possibility to display already averaged velocities (according to the averaging settings, Figure 13) on a map including the ship movement on a map (screenshot in Figure 16). Therefore, press the tab  in the toolbar. You can change the references / displayed velocities under ***Options → Edit Display Option*** (this will not affect the raw data collection).

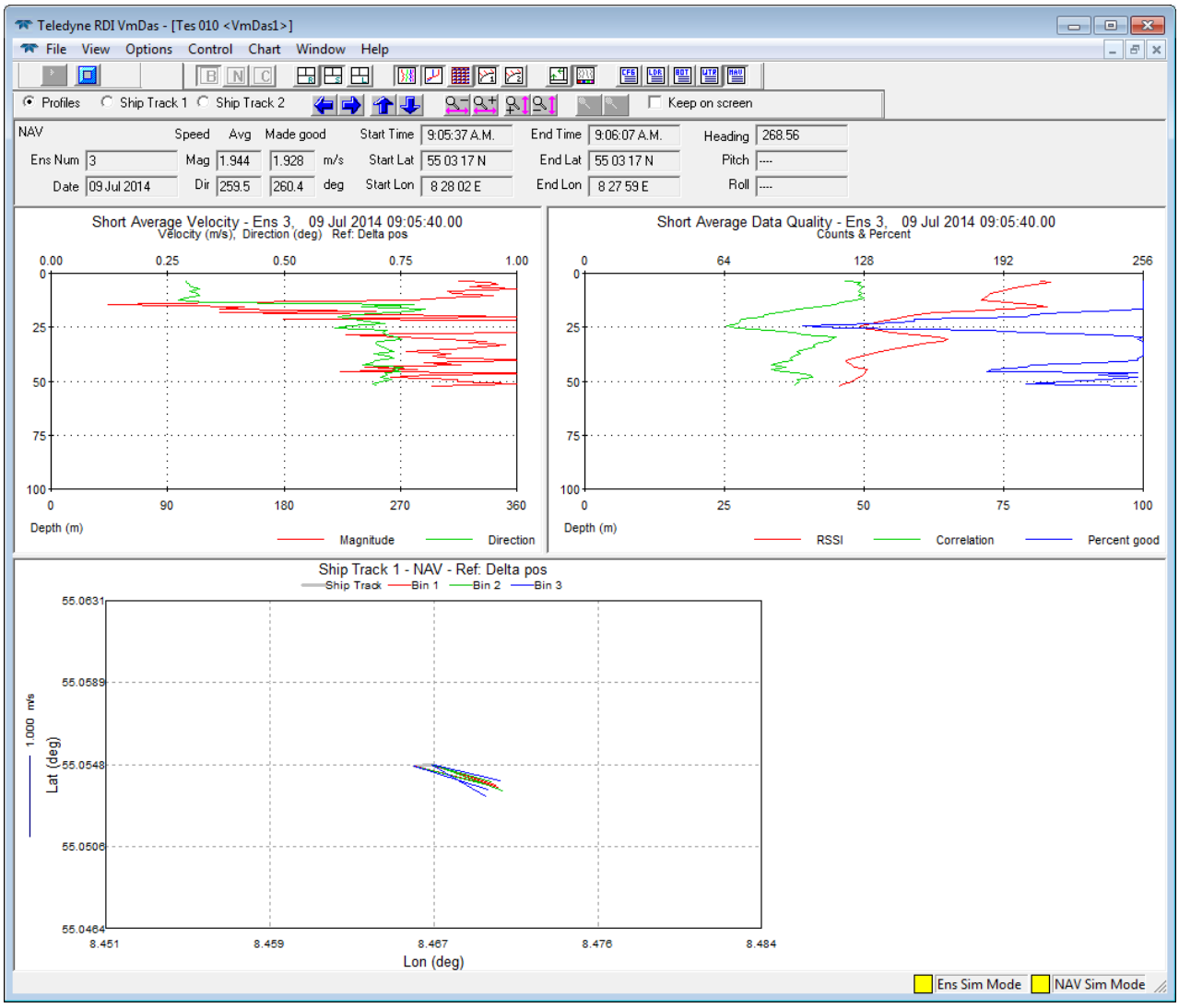


**Figure 16: Screenshot of VmDas during data replay**

# 4 WinADCP


The WinADCP software can be used for visualization and export of the recorded ADCP data (screenshot in Figure 17). For a detailed description, please read the ***WinADCP User Manual*** for help on how to use the software. Load the *.ENX-File which contains all information.

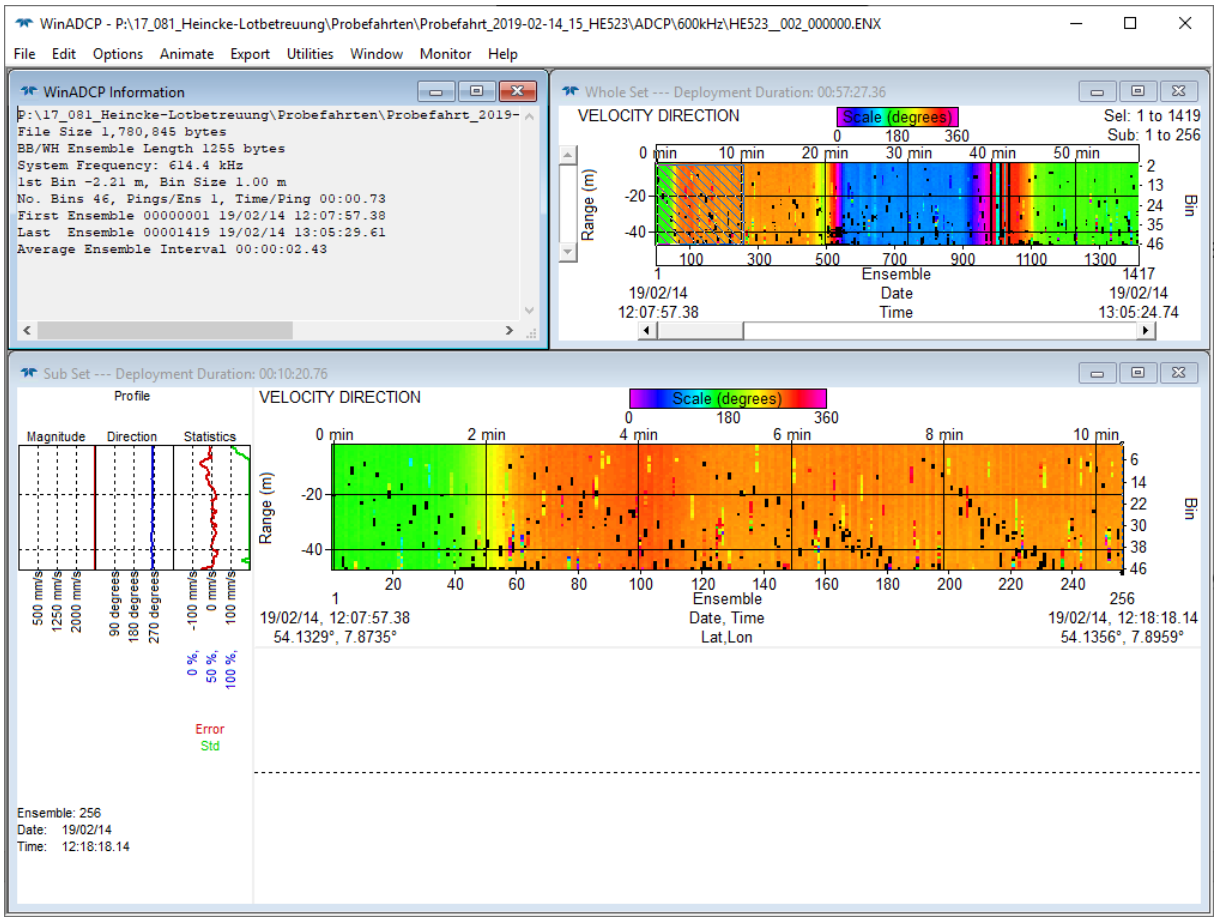


**Figure 17: Screenshot of WinADCP during data replay**

## *4.1 Exporting Data*

Besides several displaying and replay features of the collected data, WinADCP is used to Export the data to ASCII-format. Before that, open the ***WinADCP Chart Options*** with a right-mouse-click in either the ***Whole Set*** or ***Sub Set*** window (Figure 18). Here you can choose under ***Processing*** if the velocity is already corrected using the ***Bottom Track*** or the ***Navigation (VMDAS)***, or if it is not corrected (***None***). We recommend the not-corrected output, so you can choose during further processing the most suitable correction.

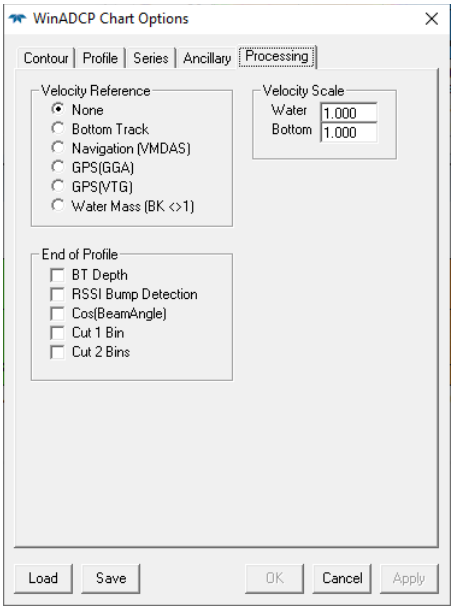


**Figure 18: WinADCP Chart Options window**

The ASCII-export is done choosing ***Export*** in the menu and then select ***Series/Ancillary*** (Figure 19). Here, a selection can be made which bins should be exported and which primary data types (typically the zonal, meridional, and error velocities) and which ancillary data types should be exported (typically Bottom Track and Navigation data). If bottom track has been chosen as velocity reference, the exported velocities are already representing the true water velocities (i.e. ship movement corrected).

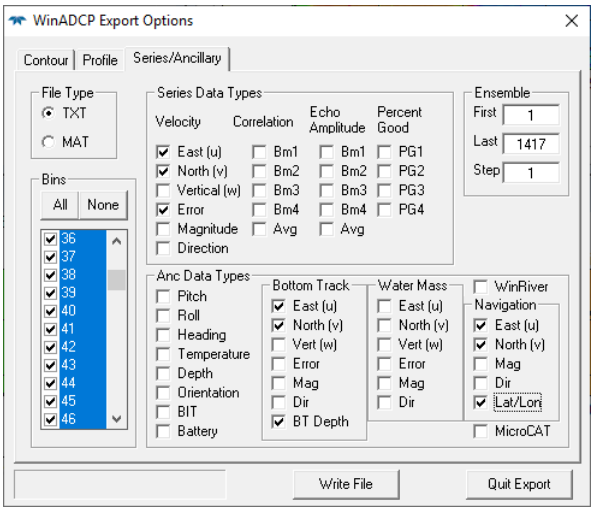


**Figure 19: Data export in WinADCP**

# 5 WinRiver II

For using WinRiver II, please refer to the manual stored on the operator PC. Here, only the communication setup is shown in the following figures.

First, make sure the correct serial connections are set in the ***Peripheral Configuration Dialog*** (Figure 20). Select the COM-Port according to Figure 21 to Figure 23.

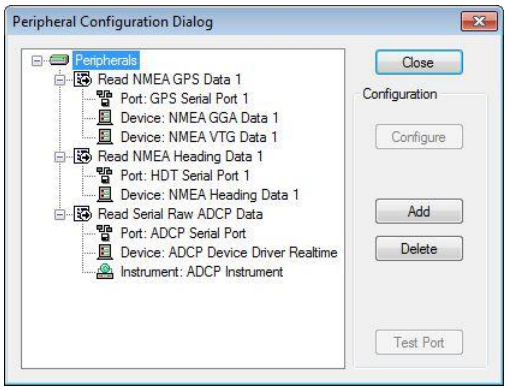


**Figure 20: Peripheral Configuration Dialog settings to connect GPS, external heading, and ADCP**

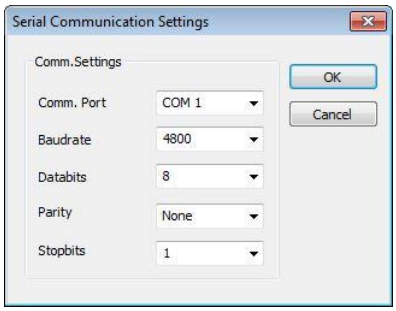


**Figure 21: COM 1 settings (GPS)**

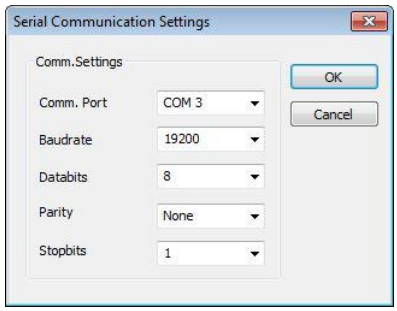


**Figure 22: COM 3 settings (external heading)**

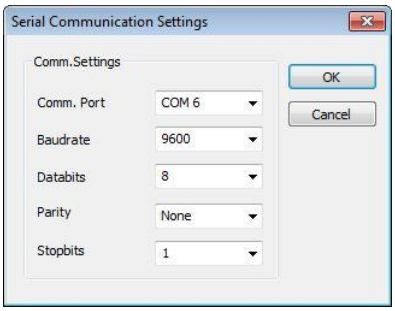


**Figure 23: COM 6 settings (ADCP)**

After this, make sure to enter the Beam 3 misalignment of 45° in the ***Offsets*** window (Figure 24 and Figure 25).

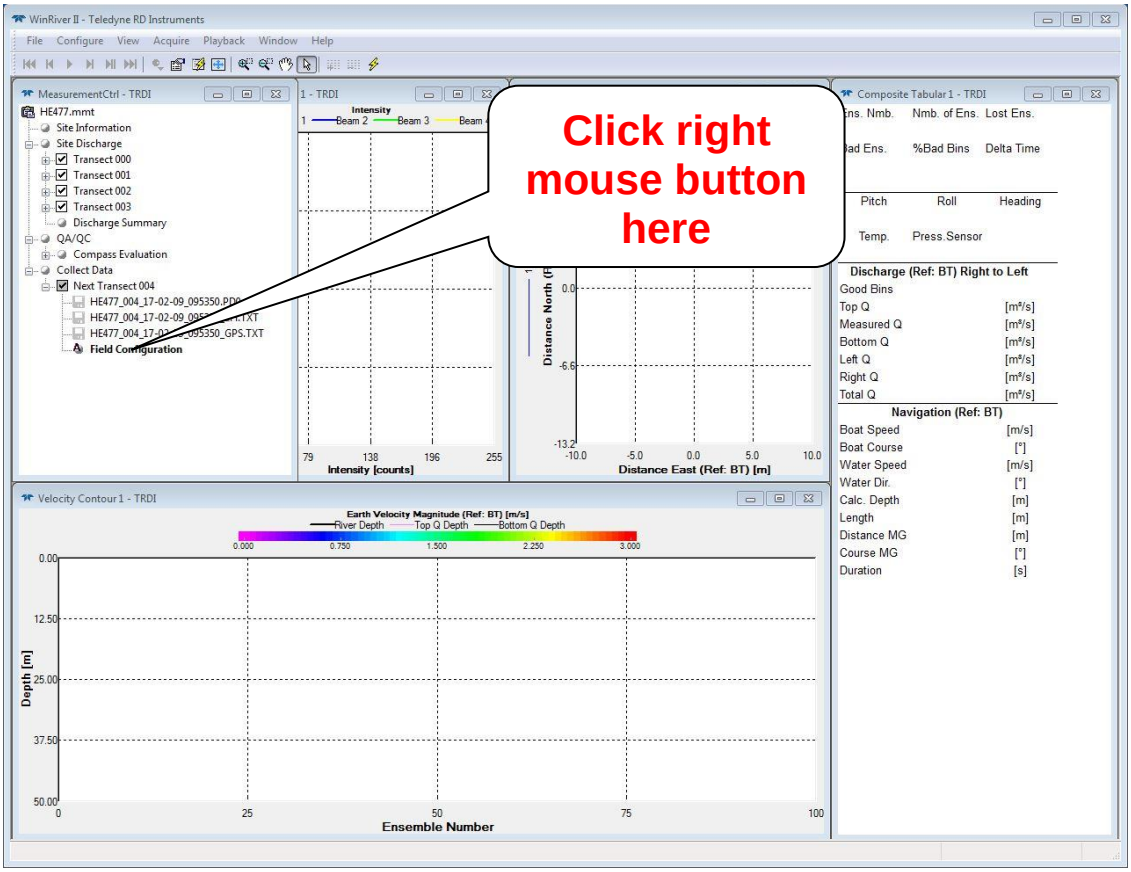


**Figure 24: WinRiver II main window. Please check beam 3 misalignment and transducer depth (cf. next figure) for correct measurements**

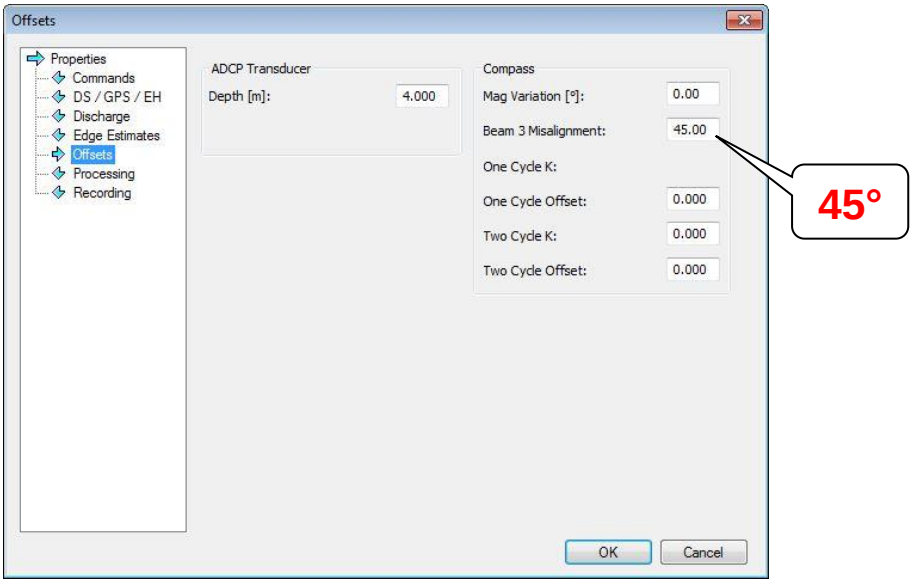


**Figure 25: WinRiver II properties window**

# Appendix

## *BBTalk Test Result*

```
[BREAK Wakeup B]
WorkHorse Mariner ADCP Version 52.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>TS?
TS 19/02/14,09:39:20 --- Time Set (yr/mon/day,hour:min:sec)
>PS0
  Instrument S/N:  22500
       Frequency:  614400 HZ
   Configuration:  4 BEAM, JANUS
     Match Layer:  10
      Beam Angle:  20 DEGREES
    Beam Pattern:  CONVEX
     Orientation:  DOWN
       Sensor(s):  HEADING  TILT 1  TILT 2  TEMPERATURE
Temp Sens Offset:  -0.13 degrees C

    CPU Firmware:  52.40 [0]
   Boot Code Ver:  Required:  1.16   Actual:  1.16
    DEMOD #1 Ver:  ad48, Type:  1f
    DEMOD #2 Ver:  ad48, Type:  1f
    PWRTIMG  Ver:  85d3, Type:   7

Board Serial Number Data:
   82  00 00 07 BE E1 3D  09 DSP727-2001-03H
   C4  00 00 07 BE DA 3B  09 PIO727-3000-00G
   17  00 00 07 BE AA 57  09 REC727-1000-03E
   48  00 00 07 BE E2 BF  09 CPU727-2011-00E
>PS3
Beam Width:   3.7 degrees

Beam     Elevation     Azimuth
  1         -70.14      270.14
  2         -70.06       90.13
  3         -70.01      359.87
  4         -69.99      179.86

Beam Directional Matrix (Down):
  0.3398   -0.0008    0.9405    0.2417
 -0.3412    0.0008    0.9400    0.2408
  0.0008   -0.3419    0.9398   -0.2416
 -0.0008    0.3424    0.9396   -0.2413

Instrument Transformation Matrix (Down):    Q14:
  1.4667   -1.4701   -0.0021    0.0047       24031  -24086     -35      77
  0.0030   -0.0039   -1.4609    1.4620          49     -64  -23935   23954
  0.2666    0.2655    0.2661    0.2657        4368    4350    4359    4353
  1.0376    1.0335   -1.0369   -1.0355       17000   16933  -16989  -16965
Beam Angle Corrections Are Loaded.
>PA
PRE-DEPLOYMENT TESTS

CPU TESTS:
  RTC.....................................PASS
  RAM.....................................PASS
  ROM.....................................PASS
RECORDER TESTS:
  PC Card #0..............................NOT DETECTED
  PC Card #1..............................NOT DETECTED
DSP TESTS:
  Timing RAM..............................PASS
  Demod  RAM..............................PASS
  Demod  REG..............................PASS
  FIFOs...................................PASS
SYSTEM TESTS:
  XILINX Interrupts... IRQ3  IRQ3  IRQ3 ...PASS
  Wide Bandwidth.........................***FAIL***
  Narrow Bandwidth.......................PASS
```

```
  RSSI Filter.........................***FAIL***
  Transmit.............................PASS
SENSOR TESTS:
  H/W Operation.........................PASS
>PC2

Press any key to quit sensor display ...

All Sensors are Internal Only.
Heading   Pitch    Roll   Up/Down    Attitude Temp   Ambient Temp   PRESSURE
 46.26ø  -0.04ø  -0.41ø    Down          5.97øC          4.14øC         0.0 kPa
>PC1


BEAM CONTINUITY TEST

When prompted to do so, vigorously rub the selected
beam's face.

If a beam does not PASS the test, send any character to
the ADCP to automatically select the next beam.

Collecting Statistical Data...
  61  66  61  64

Rub Beam 1 = PASS
Rub Beam 2 = PASS
Rub Beam 3 = PASS
Rub Beam 4 = PASS
```