VmDas
User's Guide

RD Instruments

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VmDas User's Guide

1 Introduction

VmDas is a software package for use with RDI Vessel Mount Acoustic Doppler Current Profilers. This software package supports the Broadband, Workhorse, and Ocean Surveyor PD0 Binary Output Data Formats for data collection and replay.

1.1 System Requirements

VmDas requires the following:

- Windows 95® (see "Using Windows 95," page 2), Windows 98®, or Windows NT 4.0® with Service Pack 4 installed (see "Using Windows NT," page 2)

- Pentium class PC 233 MHz (350 MHz or higher recommended)

- 32 megabytes of RAM (64 MB RAM recommended)

- 6 MB Free Disk Space plus space for data files (A large, fast hard disk is recommended)

- One Serial Port (two or more High Speed UART Serial Port recommended)

- Minimum display resolution of 800 x 600, 256 color (1024 x 768 recommended)

- CD-ROM Drive

- Mouse or other pointing device

- An Ethernet card if network I/O is desired

> **NOTE.** *VmDas* can use up to six serial ports in some configurations.

1.1.1 Using Windows 95

To use *VmDas* with Windows 95 you must have the ws2_32.dll file installed on your computer. To determine if you have this file, click **Start**, **Find**, **Files or Folders**. In the **Named** box, type **ws2_32.dll** and click **Find Now**. If the file is included on your system, then proceed with the *VmDas* software installation. If the file is not on your computer, do the following.

a. Go to http://www.Microsoft.com/windows95/downloads/

b. It is highly recommended that you download and install all of the critical and recommended updates, and the service releases for Windows 95.

c. Scroll down the list of files on the Windows95 download page and select the **Windows Socket 2 Update** link**.** Click the **Download Now** button. This will download the **w95ws2setup.exe** file. Double-click the file to install it.

d. You will also need to download and install the **Microsoft DUN 1.3 and Winsock2 Year 2000 Update**. Use the link on the **Windows Socket 2 Update** page to get the **y2kvdhcp.exe** file. Double-click the file to install it (install the **w95ws2setup.exe** file first if you have not already done so).

1.1.2 Using Windows NT

You must have Windows NT 4.0® Service Release 4 or higher installed before attempting to install *VmDas*. *VmDas* cannot install on the computers running Windows NT 3.0 or earlier versions.

1.2 Software Installation

To install *VmDas*, do the following.

a. Insert the compact disc into your CD-ROM drive and then follow the browser instructions on your screen. If the browser does not appear, complete Steps "b" through "d."

b. Click the **Start** button, and then click **Run**.

c. Type **<drive>:launch**. For example, if your CD-ROM drive is drive D, type **d:launch**.

d. Follow the browser instructions on your screen.

2 Quick Start Guide

The *VmDas* User's Guide is divided into two main sections:
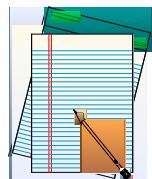
1. Quick Start Guide to collecting data with *VmDas*

    • Simple instructions to begin collecting data

2. *VmDas* Tutorial

    • Create a User Option file

    • Collecting data

    • How to reprocess data

    • How to play back a data file

Making accurate profile measurements is less difficult than you probably believe now. You will soon see that you need to use only a few keystrokes on the computer to collect data in the field.

Please take the time to read this entire manual. It will be useful to have the ADCP and a computer available to follow along. You may also want to keep the ADCP Technical manuals handy for reference when you want more detail.
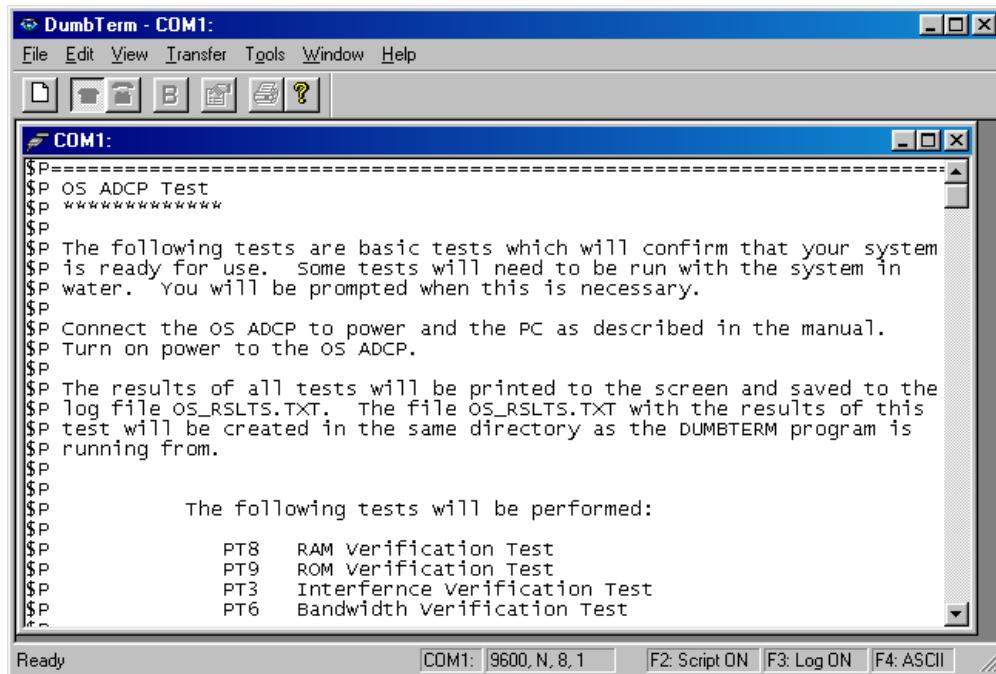
2.1 ADCP Setup

Step 1. Connect the ADCP and computer as shown in your ADCP Technical Manual. If you have not already installed *VmDas* and the RDI Tools CD, do so as outlined in "Software Installation," page 2.

Use this area for notes.

2.2   Test the ADCP

Step 2. Run *DumbTerm* to verify the ADCP is functioning properly. Select a script file from the table below. The results of the tests will be saved to an ASCII text log file.
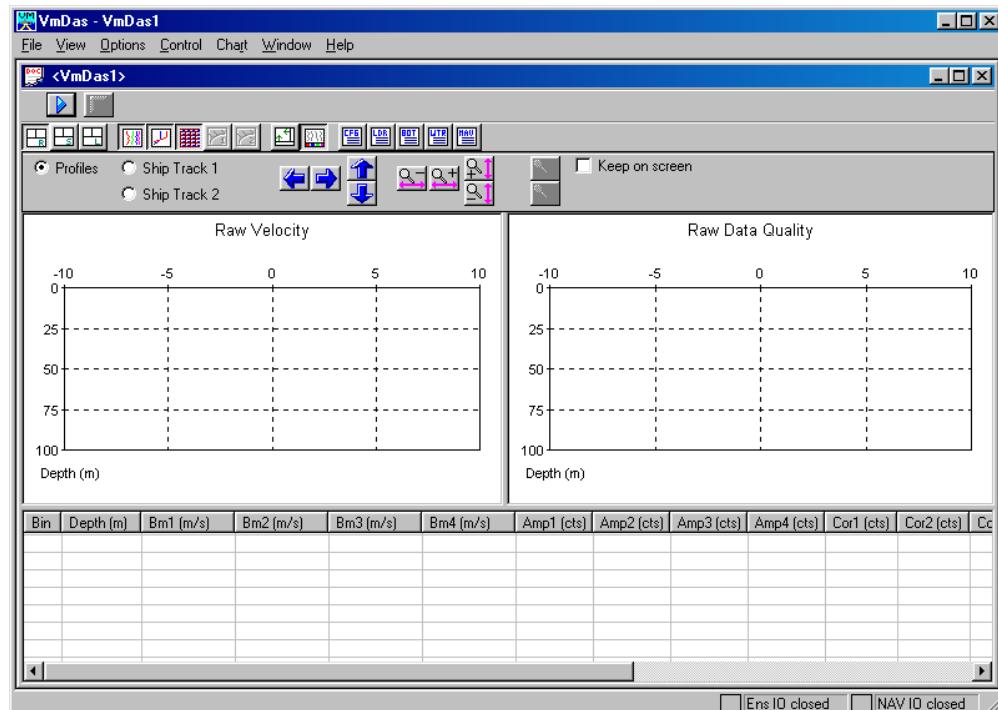
Script File Name	ADCP Type	Results Saved to
BBtest.txt	Broadband	BB_RSLTS.txt
OStest.txt	Ocean Surveyor	OS_RSLTS.txt
WHtest.txt	Workhorse	WH_RSLTS.txt

These text files (*.txt) were copied into the same directory as *DumbTerm* when you installed the RDI Tools software CD sent with your system.
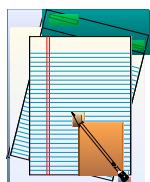
Use this area for notes.

2.3   Start *VmDas*
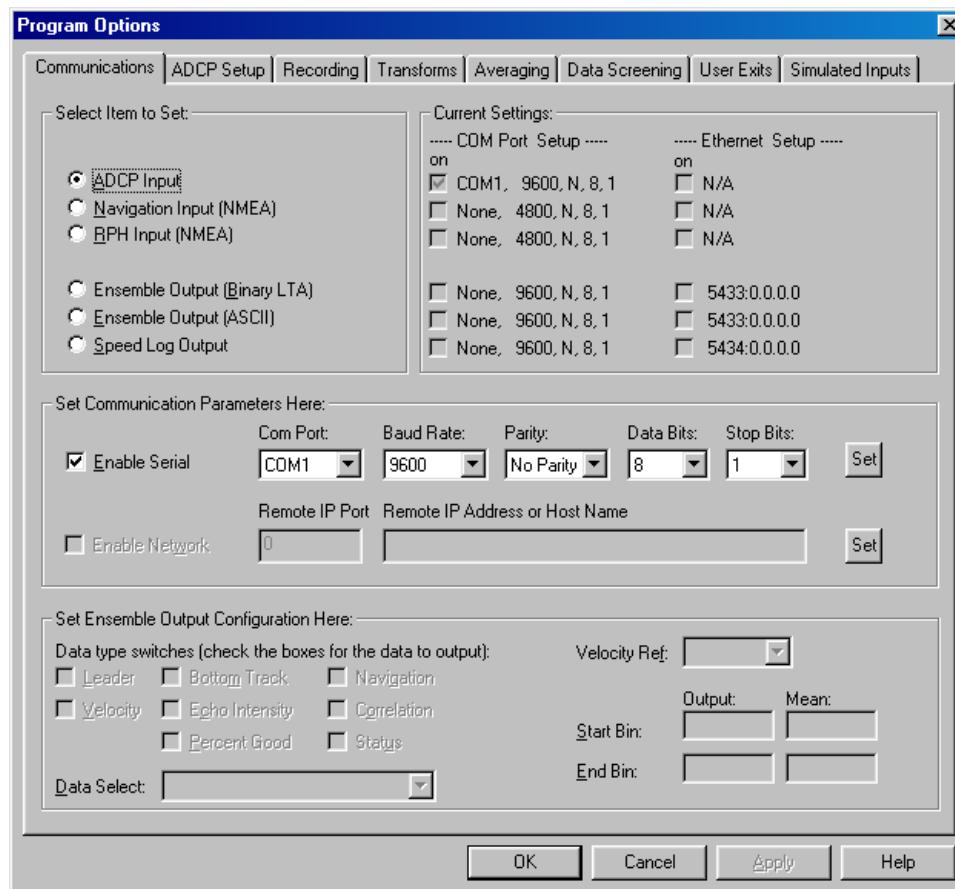
Step 3.   Start *VmDas*.   On the **File** menu, click **Collect Data**.

On the **Options** menu, click **Load**.   Select the Default.ini file and click **Open**. This will set *VmDas* to the factory default options.
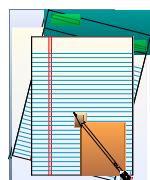
	Use this area for notes.

2.4   Setup Communications
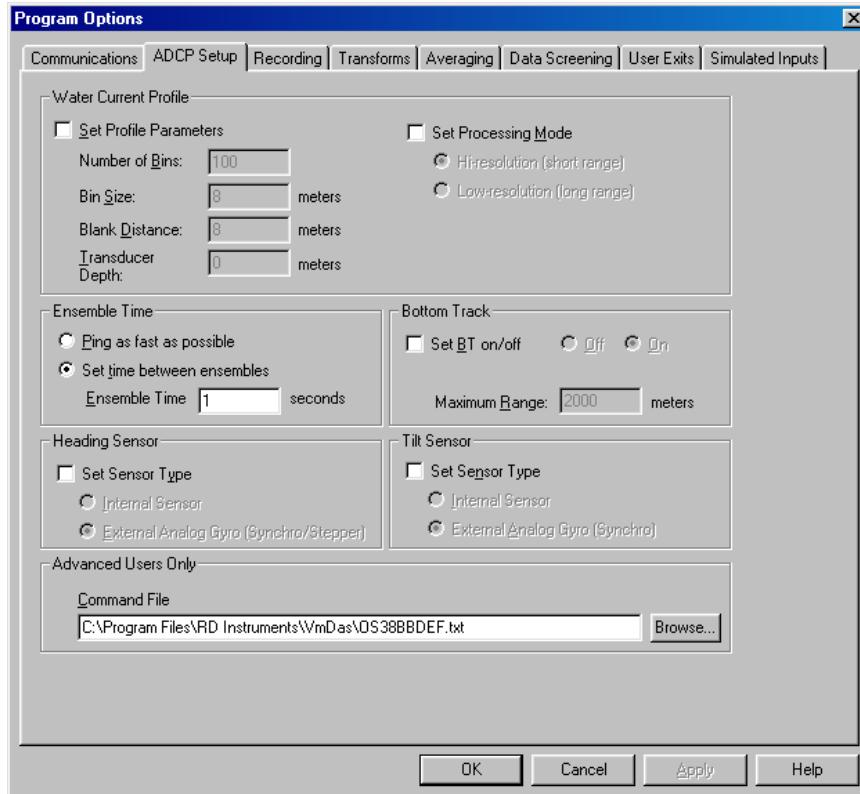
Click the **Communications** tab and set the communications settings with the ADCP and NMEA ports.

	Use this area for notes.

2.5   Load a Command File

Step 4. On the **Options** menu, click **Edit Data Options**. Click the **ADCP Setup** tab. Make sure that *all* boxes in the **ADCP Setup** tab are *unchecked*. Set the **Ensemble Time** to the value shown in Table 1.

Table 1:   Ensemble Time

Frequency (kHz)	With Bottom Track (sec)	Without Bottom Track (sec)
38	6	3
75	3	1.5
150	2	1
300	1	1
600	1	1
1200	1	1

Use Table 2, page 8 to choose a command file for your ADCP, and load it into *VmDas* using the **Browse** button. These text files (*****.txt) were copied into the same directory as *VmDas* when you installed it from the CD sent with your system.

> **NOTE.** See "VmDas ADCP Initialization," page 31 for details on how ADCP commands are generated a d in which order they are sent to the ADCP.

> ⚠️ **CAUTION.** The commands from the command file are sent **before** the commands set by the **ADCP Setup** tab. It is possible to have a conflict if both the **ADCP Setup** tab items and a command file are used. RDI recommends using a command file only and ensuring that all boxes in the the **ADCP Setup** tab are unchecked.

Table 2: Example User Option Files
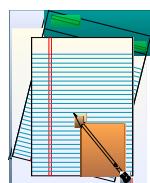
File Name	Description
OS38BBDEF	Default setup for an OS 38kHz ADCP in the highest precision (broad bandwidth) but reduced range profiling mode.
OS38NBDEF	Default setup for an OS 38kHz ADCP in the lowest precision (narrow bandwidth) but extended range profiling mode.
OS75BBDEF	Default setup for an OS 75kHz ADCP in the highest precision (broad bandwidth) but reduced range profiling mode.
OS75NBDEF	Default setup for an OS 75kHz ADCP in the lowest precision (narrow bandwidth) but extended range profiling mode.
OS150BBDEF	Default setup for an OS 150kHz ADCP in the highest precision (broad bandwidth) but reduced range profiling mode.
OS150NBDEF	Default setup for an OS 150kHz ADCP in the lowest precision (narrow bandwidth) but extended range profiling mode.
BB75DEF	Default setup for a BB 75kHz ADCP to provide the most range with the optimal precision.
BB150DEF	Default setup for a BB 150kHz ADCP to provide the most range with the optimal precision.
BB300DEF	Default setup for a BB 300kHz ADCP to provide the most range with the optimal precision.
BB600DEF	Default setup for a BB 600kHz ADCP to provide the most range with the optimal precision.
WH1200DEF	Default setup for a Workhorse 1200kHz ADCP to provide the most range with the optimal precision.
WH300DEF	Default setup for a Workhorse 300kHz ADCP to provide the most range with the optimal precision.
WH600DEF	Default setup for a Workhorse 600kHz ADCP to provide the most range with the optimal precision.

> 📝 **NOTE.** These text files (*.txt) were copied into the same directory as *VmDas* when you installed it from the software CD sent with your system.
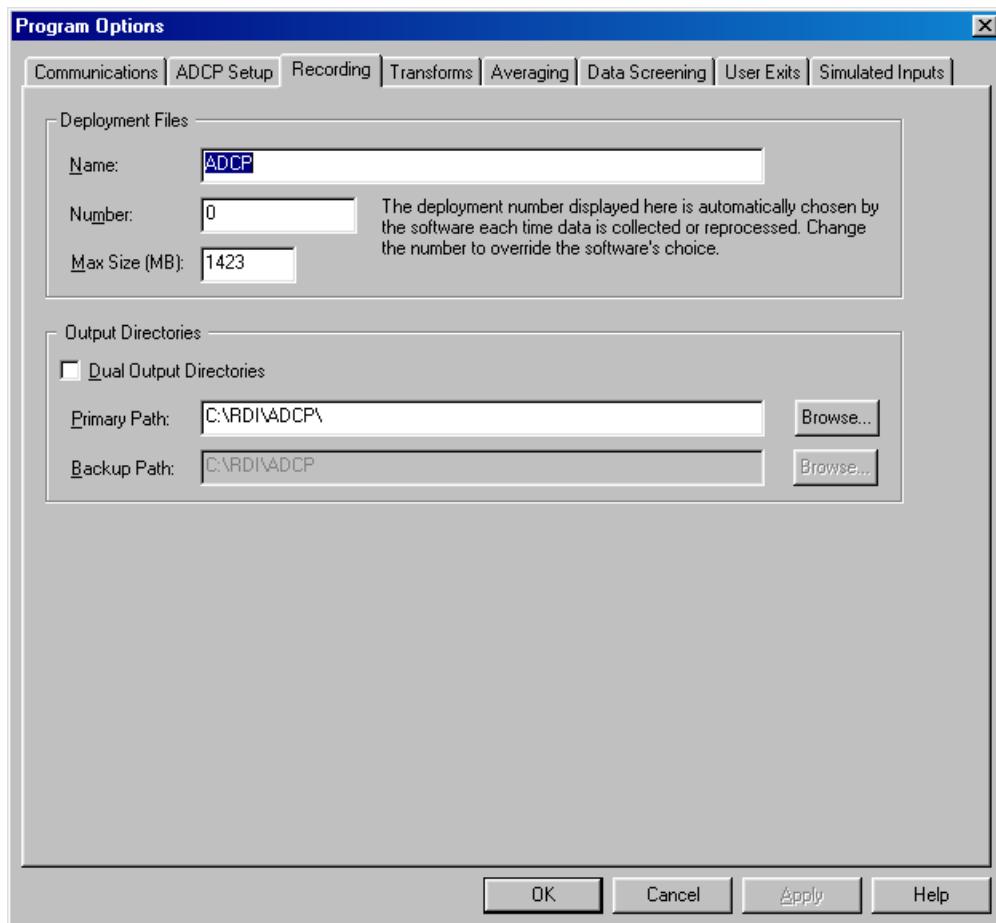
> 📝 **NOTE.** These files can also be used for stationary systems (such as Oil Rig platforms) but you must first open the file (right click on file and select open) and modify the EZ command from EZ1020001 to EZ1111111. This new setting will enable the use of the internal heading, pitch, and roll sensors.

Use this area for notes.
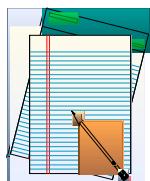
2.6   Set Recording Options

The Recording property page allows you to set the deployment name and path to where the data files are recorded.
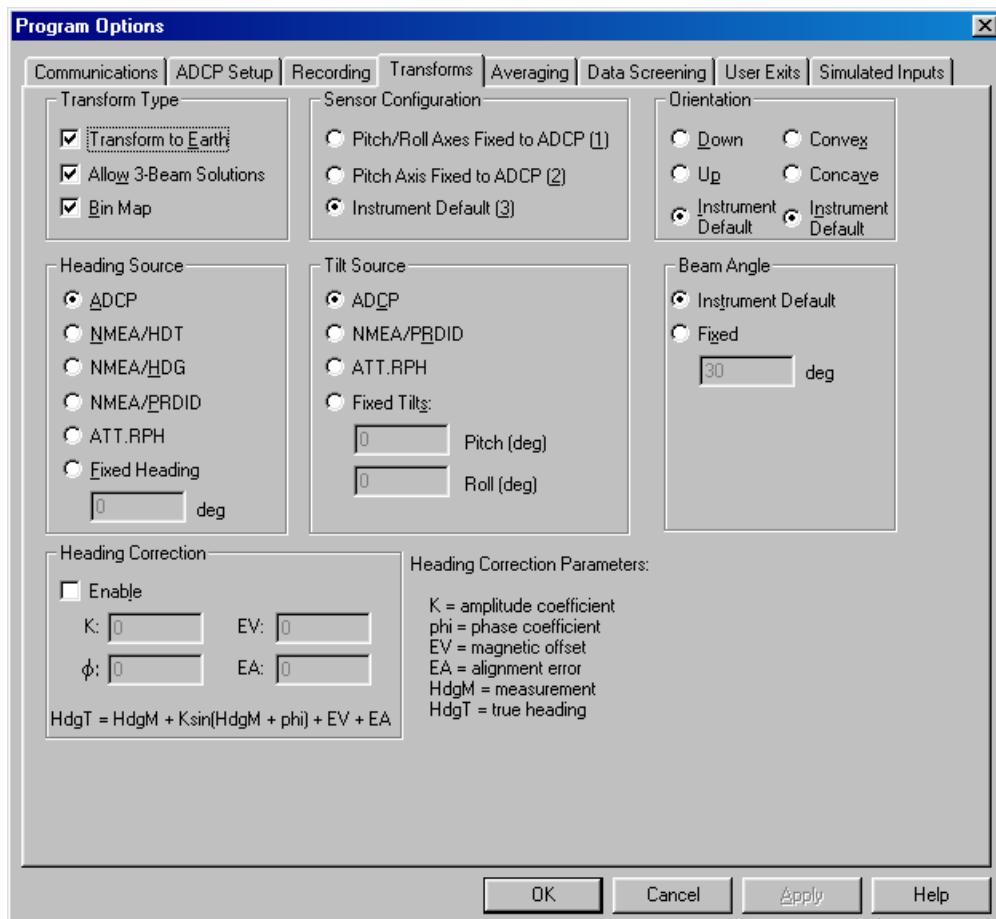
Enter a name in the **Name** box that identifies your deployment. This name will be used as part of the filename for each file that is part of this deployment (see "File Naming Conventions," page 55). For testing, "Test" or "Practice" are good choices.

In the **Primary Path** box, enter the drive and directory where you would like to store the files of collected data. Use the **Browse** button or enter the path manually.

Use this area for notes.

2.7   Setup the Transforms Screen
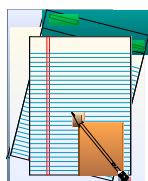
Click the **Transforms** tab and verify that the **Transform Type**, **Sensor Con-figuration**, **Orientation**, **Heading Source**, **Tilt Source**, **Beam Angle**, and **Heading Correction** are set to your input.

Click **OK** to save the changes made to the **Program Options** tabs.
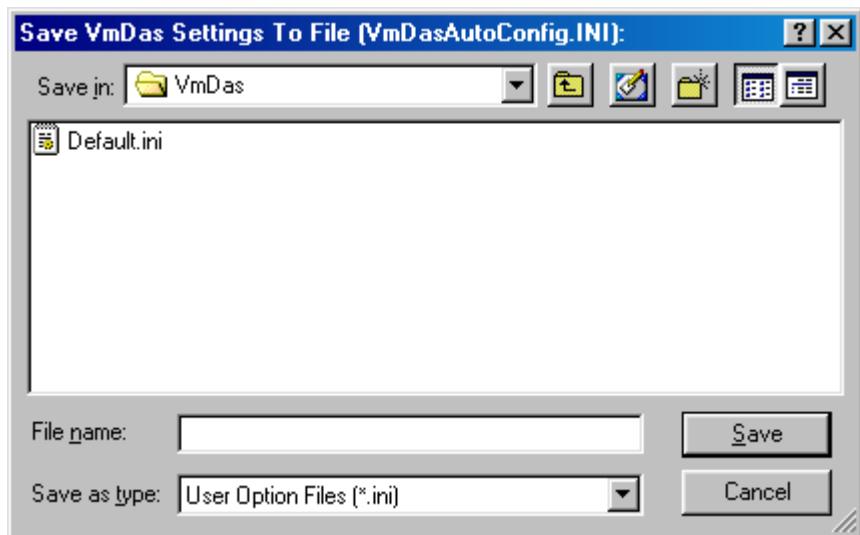
> **NOTE.** If you have the vessel's gyro connected to the electronic chassis or your ADCP has an internal compass, then select **ADCP**. If you have heading data coming into the serial port on the computer, select **NMEA/HDT** or **NMEA/HDG** depending on your device output.

Use this area for notes.
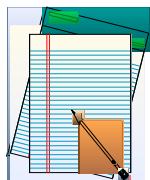
2.8 Save the User Option File

Step 5. On the **Options** menu, click **Save As**. The options may be saved to a file for later retrieval. You may wish to save several sets of options, to be used as starting points for different deployments. Option files that are created this way may have any name you choose.
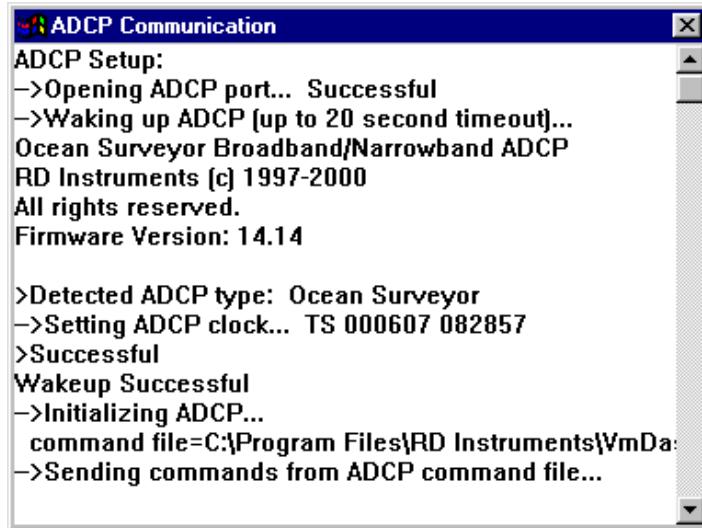
NOTE. The *.ini file includes the path to the command (*.txt) file you choose. This allows you to create a *.ini file for each command file or have different *.ini files with different processing parameters (averaging screens, etc.) pointing to the same command file.

Use this area for notes.

2.9   Collect Data

```
ADCP Communication                          ☒
ADCP Setup:
->Opening ADCP port...  Successful
->Waking up ADCP (up to 20 second timeout)...
Ocean Surveyor Broadband/Narrowband ADCP
RD Instruments (c) 1997-2000
All rights reserved.
Firmware Version: 14.14

>Detected ADCP type:  Ocean Surveyor
->Setting ADCP clock...  TS 000607 082857
>Successful
Wakeup Successful
->Initializing ADCP...
  command file=C:\Program Files\RD Instruments\VmDa
->Sending commands from ADCP command file...
```

Step 6. On the **Control** menu, click **Go** to begin collecting data. The ADCP Communication window will open and show the commands from the command file being sent to the ADCP and the ADCP's response. Once all of the commands have been sent, the window will close automatically. See "VmDas ADCP Initialization," page 31 for details on how the ADCP commands are generated and sent to the ADCP.

> **NOTE.** You can review the ADCP Communication window by selecting **View**, **ADCP Communication**.

Use this area for notes.

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3 *VmDas* Tutorial

The first section of this User's Guide presented a Quick Start to collecting data. The default Command files presented in that section will work for most conditions. There may be specific sites where you will need to create your own User Option files and Command files (see "Command Files," page 30) if you want to change some of the sampling parameters. The tutorial will go through a step-by-step procedure for creating a site-specific User Option file for collecting data. The tutorial will also go through the reprocessing data (see "Reprocessing Data with VmDas," page 39) and data playback (see "Playback a Data File," page 40).

> ⚠ **CAUTION.** If you edit the default command files with a text editor, be sure to back them up first, and save the file in plain text format when you have finished editing. Extra formatting characters inserted for other document file formats will make the file unreadable by *VmDas*.

3-1 Creating a User Option File

In the following, you will be creating a User Option file that will be used to program both the ADCP and *VmDas* software processing.

The *VmDas*, *WinADCP*, and *RDI Tools* software should be installed on your computer as outlined in your ADCP Technical Manual. Connect the ADCP to a computer as shown in the Read This First book, and apply power to the ADCP.

a. Start *VmDas*. Click **File**, **Collect Data**.

b. Click **Options**, **Load**. Select the Default.ini file. Select **Open**.

c. Click **Options, Edit Data Options.** See "User Options Screens," page 14) for details on each tab. Once you have set all the parameters, click **OK** to exit the **Edit User Options** screens. When **OK** is clicked, *VmDas* checks the new options for consistency. For example, it is not allowed to use the same serial port twice on the **Communications** tab. If *VmDas* finds an error, it will display an error message box and refuse to close the **Edit Data Options** dialog box. You may either correct the error(s), or use **Cancel** to abandon all changes to the options.

d. Save the User Option file by clicking **Options**, **Save As**. Enter a file name for the *.ini file that you have just created. This *.ini file will save the setup in all of the tabs including the path to the command text file. You can use this same method in case you wish to create several different setup files for the same machine. As an example, you could create a command text file that has a 6-meter bin size. You might save this to a text file with the name BB150BIN6M.TXT and call the *.ini file 6METER.INI. You could then create another command file and *.ini file with a 16-meter bin size

with the same concept. Then when you want to actually use the proper command file you just have to select the *.ini file you intend to use.

3.1.1   User Options Screens

The Edit Data Options tabs determine how data is collected or processed.

- They must be set for modes that generate data (collect and reprocess data).

- They must be set *before* collection or reprocessing starts, and cannot be changed until it ends or is interrupted.

- Changes to these options make changes to data.

- In playback mode, the options that were in effect when data was generated can be viewed.

Click **Options**, **Edit Data Options** to display a tabbed dialog box from which you can change the program options.

- Communications (see "Communication Tab," page 15)

- ADCP Setup (see "ADCP Setup Tab," page 17)

- Recording (see "Recording Tab," page 19)

- Transforms (see "Transforms Tab," page 21)

- Averaging (see "Averaging Tab," page 23)

- Data Screening (see "Data Screening Tab," page 25)

- Users Exits (see "Users Exits Tab," page 27)

- Simulated Inputs (see "Simulated Inputs Tab," page 29)

3-1.2   Communication Tab

When you click the **Communications** tab in the **Program Options** dialog box, the following communications settings are displayed and may be changed and set the communication parameters to match those of the device.
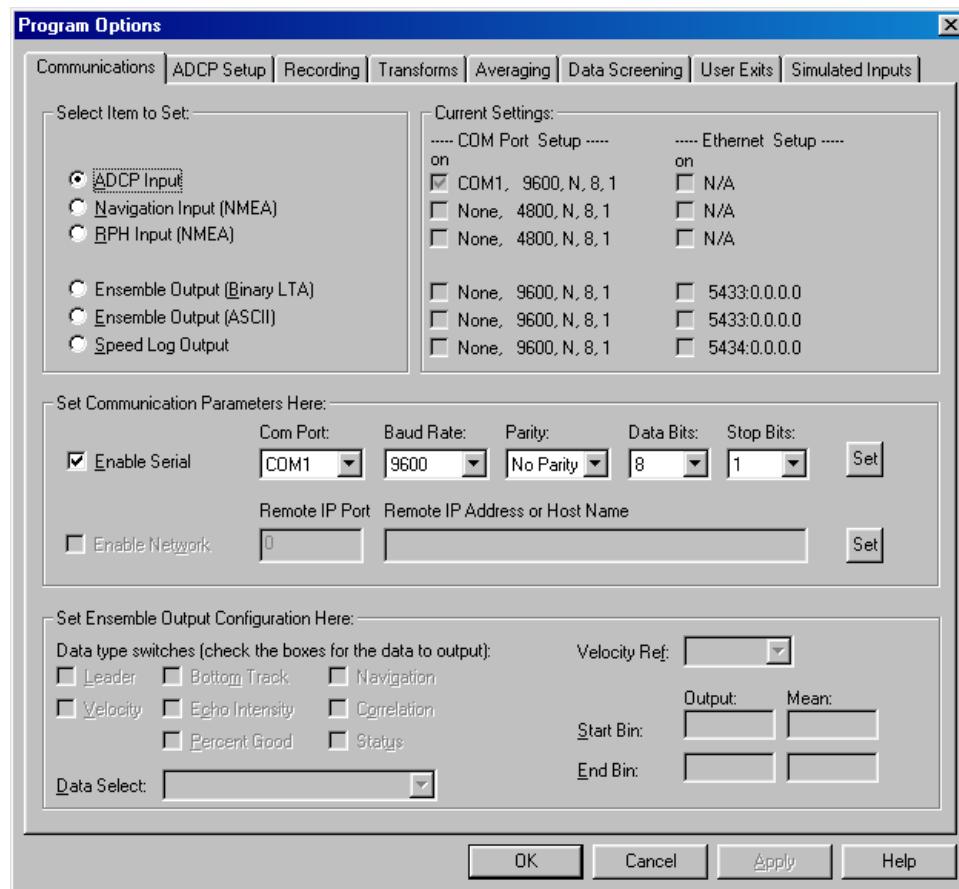
Figure 1.   Communications Tab

The section labeled **Select Item to Set** has several radio buttons. Select one of these buttons to choose which input/output you want to configure.

The section labeled **Set Parameters Here** allows you to enable or disable the selected input/output, and configure the serial port or network port that will be used for that input/output. Click the checkbox to enable or disable the port for the selected item, then set the port parameters as desired and click the **Set** button to apply the new configuration. Your new settings will be reflected in the **Current Settings** section after the **Set** button is clicked.

The section labeled **Current Settings** shows which inputs/outputs are currently enabled, and what their current port configurations are.

The term ensemble-out refers to sending ASCII-formatted ADCP data ensembles out a serial port to a receiving device. The receiving device could be another program or a dumb terminal. The **Set Ensemble Output Configuration Here** box lets you select the following.

- **Data Type Switches** - Select the type of data to send to the ensemble-out device during data collection. Check the appropriate checkbox for each type of data you want sent to the ASCII ensemble-out port.

- **Data Select** - Lets you select between single-ping beam data, single-ping transformed data, or averaged data as the output source.

- **Velocity Ref** - Lets you select the reference velocity to subtract from the profile output. None causes raw profile velocity data to be output. Mean sets the reference velocity to the average of the user-defined bin range in the "Mean" column, and causes the reference velocity to be subtracted from the profile before data output. Bottom sets bottom track as the reference velocity, and causes the reference velocity to be subtracted from the profile before output.

- **Mean Start/End Bin** - Lets you select the bin (depth cell) range for the Mean velocity reference.

- **Output Start/End Bin** - Lets you select the portion of the ADCP profile (depth cell range) to send to the ASCII ensemble-out port.

NOTE. If the start and end bins are out of range (e.g., the ADCP ensemble contains 40 bins, and you set the Output Start Bin = 1 and the Output End Bin = 50), *VmDas* automatically adjusts the output bin range to the ADCP ensemble (i.e., Output End Bin = 40).

Suggested Setting.

Setup the communications with each device as needed.

3.1.3   ADCP Setup Tab

Use this dialog box to setup the ADCP. These commands will *override* any duplicate commands set in the command file specified in the **Advanced Users Only** section. See "VmDas ADCP Initialization," page 31 for details on how the ADCP commands are generated and sent to the ADCP.
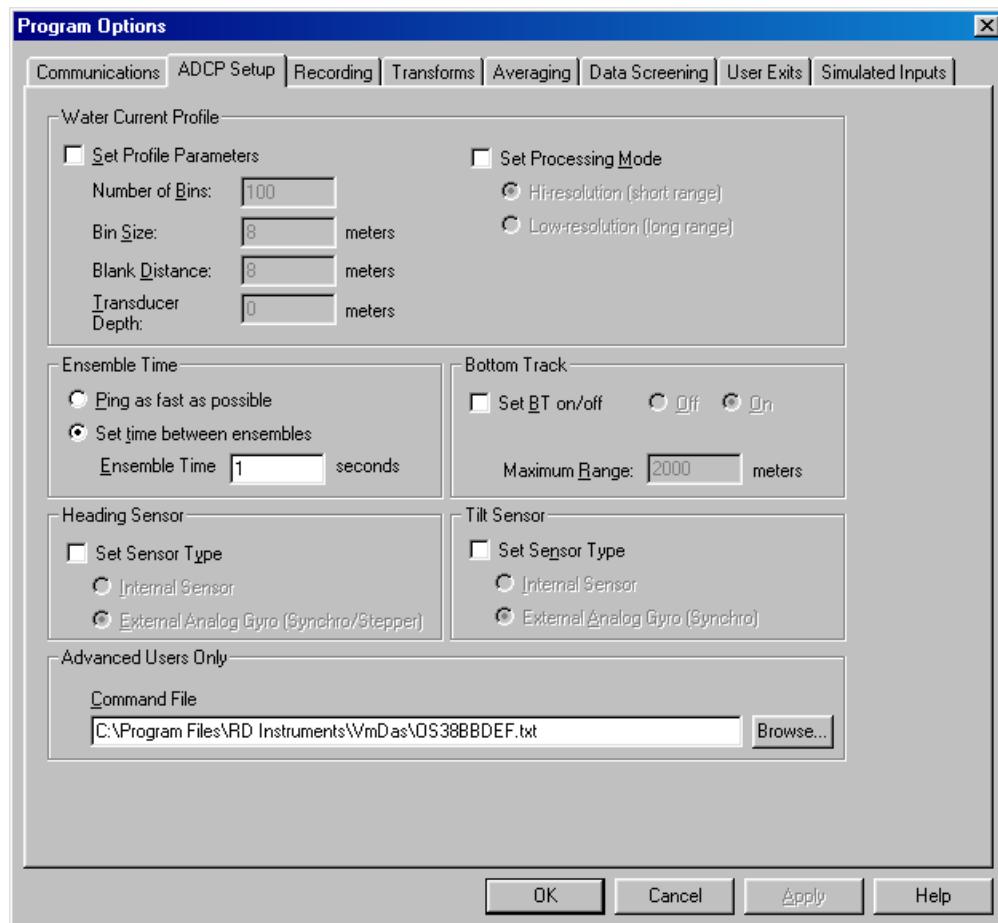
Figure 2.   ADCP Setup Tab

Select the **Set Profile Parameters** box in the **Water Current Profile** section to set the following parameters. When this box is checked, commands will be sent to the ADCP to set the **Number of Bins** (WN), **Bin Size** (WS), **Blank Distance** (WF), and **Transducer Depth** (ED). When this box is not checked, the commands from the **Command file** will be used.

Select the **Set Processing Mode** box to switch between high and low resolution modes. When this box is not checked, the commands from the **Command file** will be used.

Select the **Set time between ensembles** button to specify a ping interval. Select the Ping as fast as possible button to let the processing and I/O time dictate the ping rate (see Table 1, page 7).

Select the **Set BT** on/off box to enable or disable bottom track pings (BP1) and set the maximum search range (BX command). When this box is not checked, the commands from the **Command file** will be used.

Select the **Heading Sensor Set Sensor Type** box in this section to switch between using the ADCP's internal sensor or an external analog gyro (synchro/stepper) (EZ command). When this box is not checked, the commands from the **Command file** will be used.

Select the **Tilt Sensor Set Sensor Type** box in this section to switch between using the ADCP's internal sensor or an external analog gyro (synchro) (EZ command). When this box is not checked, the default ADCP setup will be used.

Enter the name of an ADCP command file in the **Command File** box, or click the **Browse** button to navigate to a file using a **File Open** dialog box. This should be a text file with one ADCP command per line, and can have any valid ADCP commands. The contents of this file will be sent to the ADCP during initialization and before the boxes above.

NOTE. The commands from the command file are sent **before** the commands set by the **ADCP Setup** tab. It is possible to have a conflict if both the **ADCP Setup** tab items and a command file are used. RDI recommends using a command file only and ensuring that all boxes in the the **ADCP Setup** tab are unchecked (see "VmDas ADCP Initialization," page 31 for details on how *VmDas* sends commands to the ADCP).

Suggested Setting.

Click the **Browse** button under the **Command File** window and select one of the default command files (see "Command Files," page 30) and click **Open**.

Be sure to *uncheck* the **Water Current Profile**, **Heading Sensor**, **Bottom Track**, **Tilt sensor**, and the **Set Processing Mode** boxes. *These parameters are set in the command file.* It should be noted that the **ADCP Setup** tab items would *overwrite* the settings in the command file. Use the contents of the command files for your configuration.

Select the ensemble time as shown in Table 1, page 7.

NOTE. The ADCP automatically increases the Time per Ensemble if ((WP + NP + BP) x TP > TE). See the TE-command in the Command book for more details.

3.1.4 Recording Tab

The Recording property page allows you to set the deployment name and path to where the data files are recorded.
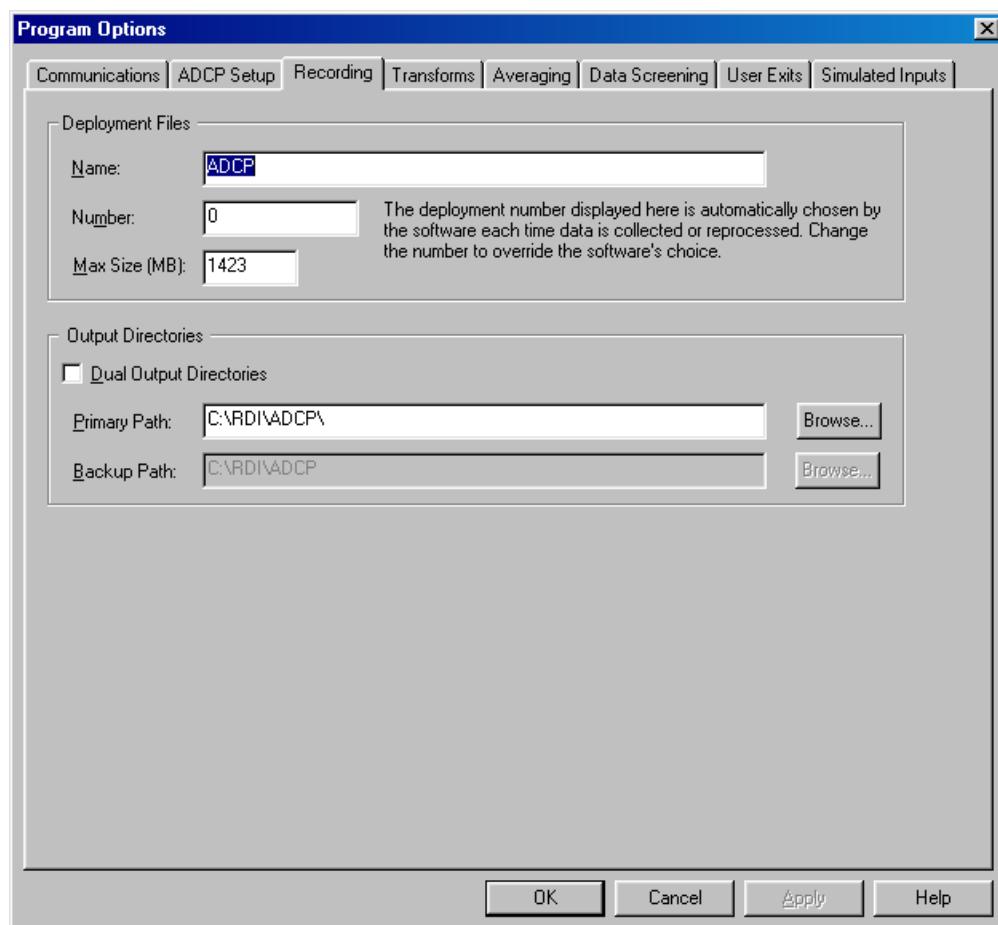
Figure 3.   Recording Tab

Enter a name that identifies your deployment. This name will be used as part of the filename for each file that is part of this deployment.

Normally, you do not need to enter a **Starting Number** as the software handles it automatically. This deployment number is used to identify the specific data collection run, and also becomes part of the filename of each data file recorded for the deployment. If you do not enter a deployment number, the software will automatically assign one for each deployment.

Enter the desired **Maximum File Size**. Each file type in your deployment will be limited to the specified size. Each file has a sequence number as part of the filename, and as each recorded file reaches the specified size limit, the sequence number will be incremented and a new file started.

Enter the **Primary Path** where the raw, intermediate, and processed data files are to be stored. Clicking the **Browse** button to the right of the Path edit box will allow you to browse your computer to select a folder to record to. You will be presented with a File Open dialog box, which will have the default file-name of '**select_path_only**.' You do not need to change the filename here, as it is only the folder name you select that is being used.

Check the **Duel Output Directories** box to create two copies of the raw data files and to allow a backup path to be entered. If this box is not checked, only the primary path is enabled.

Enter the **Backup Path** where optional backup copies of raw data and option files are stored. These files are not used for data processing. They are made available in case the primary files are lost. If the backup copies are needed, copy them to the primary directory and reprocess them to create intermediate and processed data files.

Suggested Setting.

Enter a file name that identifies your deployment.

Select the primary path (note the directory must exist already; *VMDAS* does not create it, except for the default path already entered).

3.1.5   Transforms Tab

Use this screen to select the Transform Type, Sensor Configuration, Orientation, Heading Source, Tilt Source, Beam Angle, and Heading correction.
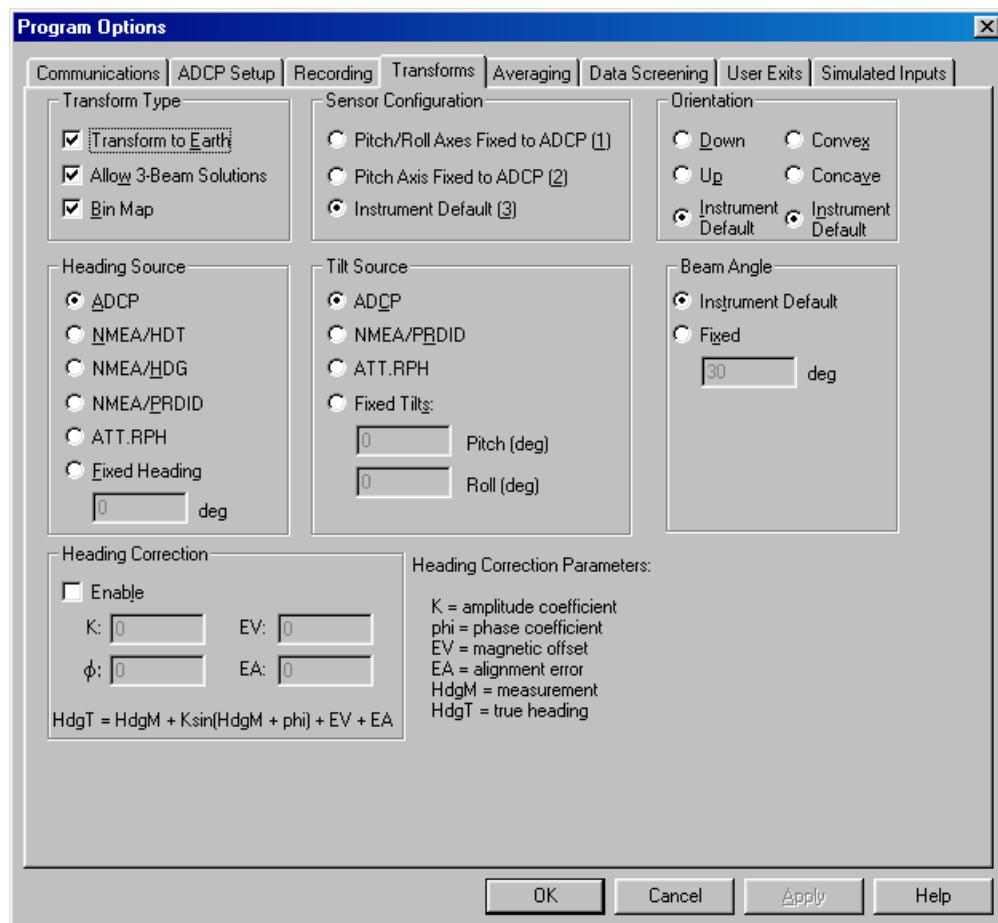
Figure 4.   Transforms Tab

Click the **Transform Type** checkboxes to enable or disable beam-to-Earth transformation, three-beam solutions, or bin mapping. At present, *VmDas* averages ADCP data in the Earth frame. Therefore, if the Earth transformation is disabled, no averaged data will be produced. Raw data will still be recorded.

Select the appropriate **Sensor Configuration** radio button to indicate your sensor configuration. Select **Instrument Default** to have the software get the configuration from the ADCP leader data.

In the **Orientation** box, select **Instrument Default** to have the software get the orientation from the ADCP leader data. Otherwise, by selecting the other radio buttons you may force a particular orientation for processing.

In the **Heading Source** box, select the **ADCP** radio button to have the software get heading data from the ADCP leader (internal compass or external synchro/stepper analog gyro). Otherwise, select the radio button for the NMEA message type that you wish to decode heading data from, or select the **Fixed Heading** radio button and enter a fixed heading value to use for the processing. Heading data from the selected source will be written into the ADCP variable leader in the processed data files.

In the **Tilt Source** box, select **ADCP** to have the software get tilt data from the ADCP leader data. Select NMEA to have the software get tilt data from the $PRDID string on the NMEA port, or select Fixed Tilts to enter fixed values for pitch and roll to use for processing.

In the **Beam Angle** box, select **ADCP** to have the software get the ADCP nominal transducer beam angle from the ADCP leader data. Select **Fixed Beam Angle** to enter a fixed beam angle to use for processing.

In the **Heading Correction** box, click the **Enable** checkbox if heading correction is desired. Enter magnetic offsets such as magnetic variation in the **EV** edit box. Enter transducer alignment offsets in the **EA** edit box. Enter coefficients for the sin correction function in the **K** and **phi** edit boxes.

Suggested Setting.

Leave the settings for the transform type, sensor configuration, orientation, and beam angle as selected (default is **ADCP**).

The Heading source needs to be selected for the input you intend to use. If the gyro heading is being fed into the ADCP real time, then leave it selected to ADCP.

The tilt source needs to be selected for the input you intend to use

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3.1.6   Averaging Tab

The Averaging property page allows you to set the Ensemble Averaging interval and Reference Layer Averaging properties.
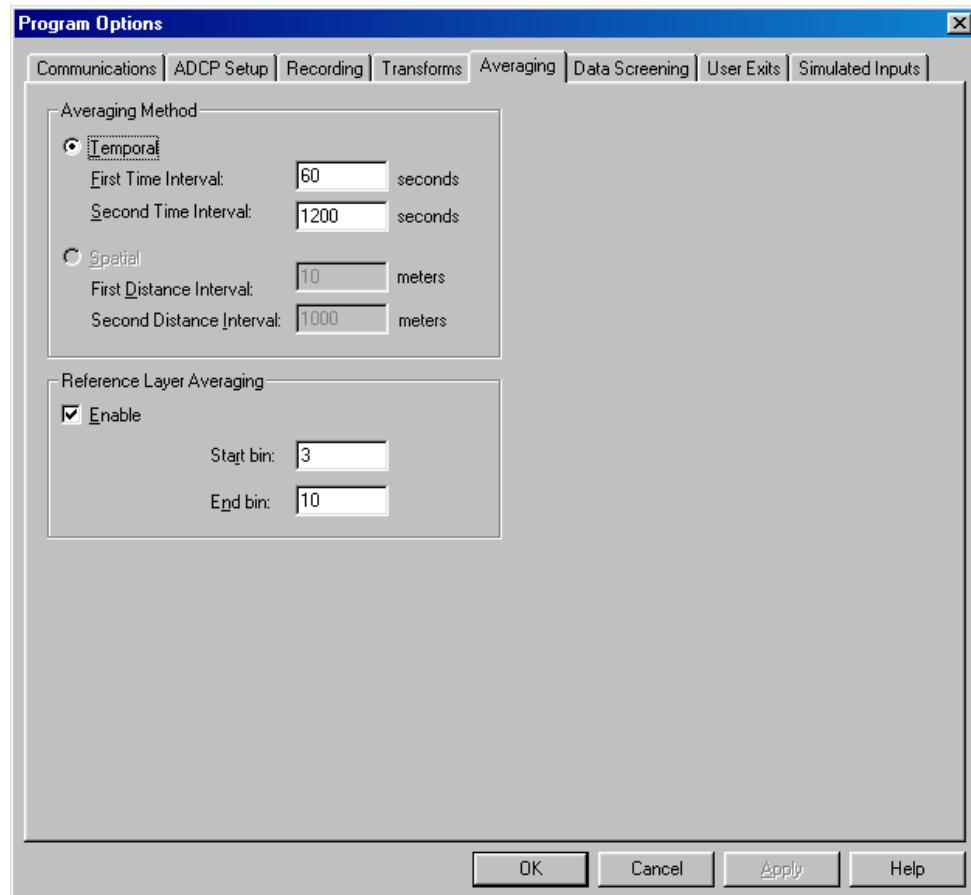
Figure 5.   Averaging Tab

Enter the **Temporal Averaging** short-term averaging in the **First Time Interval** box. Use the short-term average to get more frequent updates for a data quality check. The **First Time Interval** is what we refer to as the Short Term Average (which will become file name with a *.STA extension).

Enter the long-term averaging period in the **Second Time Interval** box. Use the long-term average to get your intended results. The **Second Time Interval** is what we refer to as the Long Term Average (which will become file name with a *.LTA extension).

Enable the **Reference Layer Averaging** checkbox to turn on or off the reference layer averaging feature. Reference layer averaging does not affect profile data that is 100% good, but improves the quality of the data near the end of the profile where the percent good is lower. Enter the **Start Bin** and **End Bin** number at the start of the desired reference layer.

> **Suggested Setting.**
>
> You will be collecting three different files and will be able to view all three during real time data collection. The first file is the raw data input, which is *single ping* data. The selections for the other two files are based on your time input values here. The **First Time Interval** is what we refer to as the Short Term Average (which will become file name with a *.STA extension). The **Second Time Interval** is what we refer to as the Long Term Average (which will become file name with a *.LTA extension). You can set these to any times you like and they may even be the same value.

3.1.7   Data Screening Tab

Click the checkboxes for the data screening options you wish to enable. When a box is checked, its associated edit box becomes enabled, and you may enter a threshold value for screening the data.
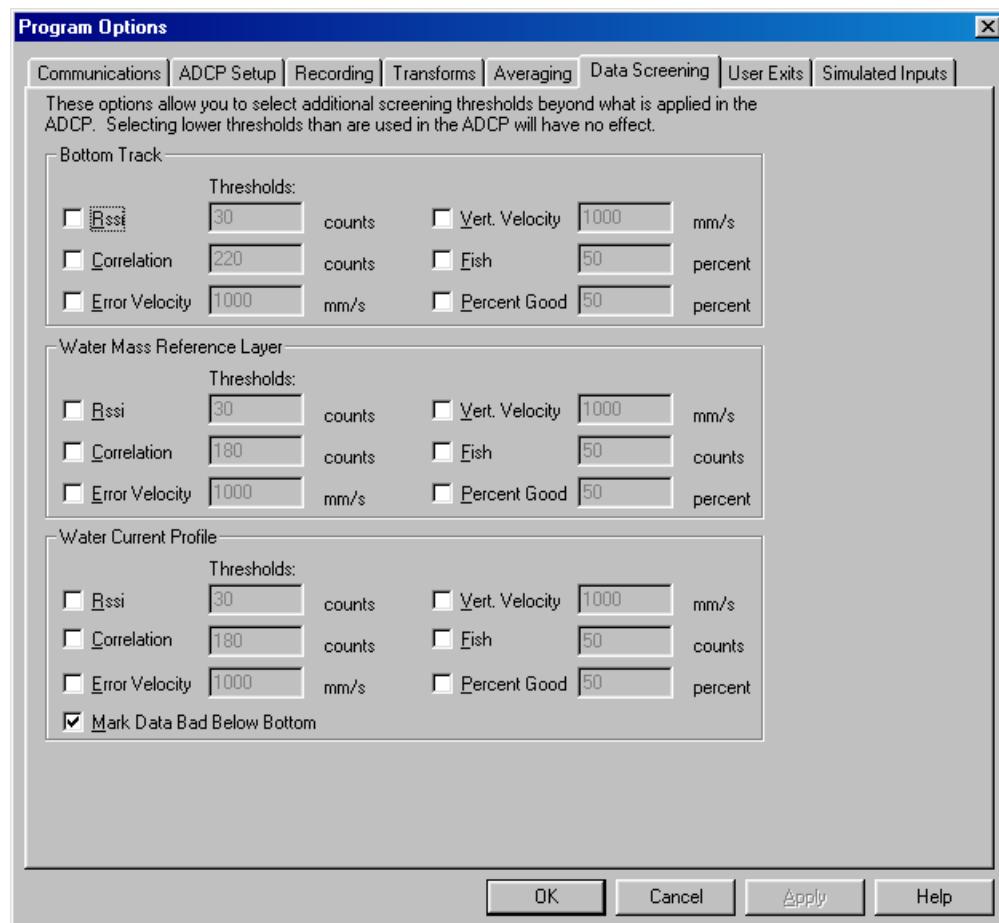
Figure 6.   Data Screening Tab

For **RSSI** (amplitude), **Correlation**, and **Percent Good** screening, the threshold value represents a minimum allowed value. For example, if you set the RSSI threshold to 35 counts, then any beam with an RSSI value below 35 counts will be discarded and not used in the processed data. RSSI and correlation screening for each beam are performed on the raw data. Percent good screening is performed on the averaged data.

For **Error Velocity** and **Vertical Velocity** screening, the threshold value represents a maximum allowed value. For example, if you set the **Error Velocity** threshold to 1500 mm/s, then any transformed ensemble that has an error velocity greater than 1500 mm/s will be discarded and not used in the processed data. **Error Velocity** and **Vertical Velocity** screening are performed

data. **Error Velocity** and **Vertical Velocity** screening are performed on the transformed data, before averaging.

For **Fish** screening (also known as false-target detection), the threshold used for bottom track has a different meaning than that used for the water track ping or the profile ping. In screening water data, the amplitudes of all the beams are compared, and if the amplitude of the weakest beam differs from the amplitude of the strongest beam by more than the specified number of counts (i.e. the threshold value), then the weaker beam is discarded. The process is repeated with the remaining beams until either the test passes with three or more good beams, or two beams have been marked bad, in which case the profile bin is discarded.

In fish screening bottom track data, the depths of all four beams are compared. If the depth of the shallowest beam is less than the average depth of the remaining beams by more than the specified percentage (i.e. the threshold value), then the shallowest beam is discarded. This process is repeated until either the test passes with three or more good beams, or more than one beam has been marked bad, in which case the measurement is discarded.

Check the box labeled **Mark Data Bad Below Bottom** to have the software mark bad all profile bins that fall below the sea bottom. The formula is Last-GoodBin = (ShallowestBeam) * (COS (BeamAngle)) + (1BinLength).

> **NOTE.** The ADCP has its' own internal thresholds, and setting thresholds on this page that are lower than those used by the ADCP will have no effect. Also, while it is possible for advanced users to modify the ADCP command file to disable some of the internal thresholds, this practice is not recommended as the *VmDas* program is designed to do those checks and allows you to change them when you reprocess the data. This gives you the maximum flexibility.

> **Suggested Setting.**
>
> You are able to screen data based on the items in this menu and the thresholds you decide. This screening will affect what is displayed on the screen and what data is recorded to the *.STA and *.LTA files. *The original raw data will be unaffected by what is setup here.* You can reprocess data later and change the settings in this screen to see what the effect is.

3.1.8 Users Exits Tab

User exits are hooks at various points in the processing where the user can modify the data with an external program. The external user application needs to be written so that it will keep trying to look for the appropriate file names, which will not exist until *VmDas* creates them some time after starting the program. It then needs to monitor the file size to determine when new data is available, and it has to observe the same file size limits specified for *VmDas* and automatically advance to the next file in the sequence when the size limit is reached.
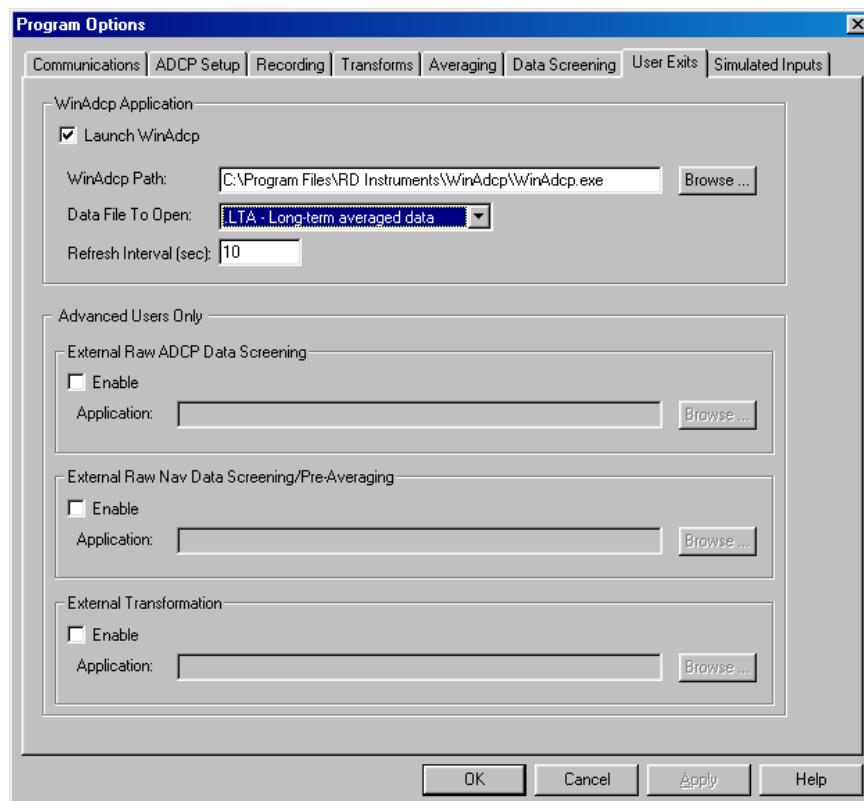
Figure 7.   Users Exits Tab

Click the **Launch WinADCP** checkbox to have *VmDas* automatically start the *WinADCP* application in monitor mode when data collection is started. When in monitor mode, *WinADCP* will periodically refresh its displays from the data recorded by *VmDas*, and will allow you to view time series and contour graphs of the data. From the *WinADCP* application menu, you can exit the monitor mode to change the *WinADCP* setup, and then reenter the monitor mode to continue the data updates. The *WinADCP* application must be installed on the computer for this option to work.

Enter the *WinADCP* program file name in the **WinADCP Path** box, including the entire path for the directory in which it resides. *VmDas* uses this information to find the *WinADCP* application. Alternatively, you may click the **Browse** button to navigate using the **File Open** dialog.

Select which type of data to view with *WinADCP* using the **Data File to Open** box. Choose from single-ping beam data, single-ping Earth data, short-term averaged data, or long-term averaged data. Once data collection has started, you can use the *WinADCP* application menu to open a different file type if desired. Just remember to exit the monitor mode in order to make the change, then reenter monitor mode to continue the automatic data refreshing.

Enter the number of seconds that WinADCP should wait between screen refreshes in the **Refresh Interval (sec)** box.

> **NOTE.** When you press **Stop**, *VmDas* leaves WinADCP open so that your data screen does not disappear. A consequence of that is if you have WinADCP enabled as a User Exit, and click **Go**, **Stop**, **Go** in *VmDas*, it will cause a second instance of WinADCP to run.

Click the **External Raw ADCP Data Screening** checkbox (see "VmDas User Exits," page 49 and Figure 10, page 54) to give an external user-supplied program access to the raw ADCP data before the initial screening. The user-supplied program is expected to read raw ADCP ensemble data from the .ENR file and write the modified ensembles to an .ENJ file. This occurs before *VmDas* performs its data screening (does not bypass it), and if additional screening by *VmDas* is desired, it may be enabled.

Click the **External Raw Nav Data Screening** checkbox (see "VmDas User Exits," page 49 and Figure 10, page 54) to give an external user-supplied program access to the raw NMEA data. Normally the *VmDas* NMEA data screening logic reads data from the .NMR raw NMEA data file, screens the data and averages the data between ADCP time stamps, then writes the averaged data out in binary format to a .NMS file. When this user exit option is enabled, the user-supplied program is expected to read data from the .NMR files, and write the modified data to a .NMJ text file with the same NMEA format. The *VmDas* NMEA data screening and averaging functions will then read the NMEA data from the .NMJ file instead of the .NMR file.

> **Suggested Setting.**
>
> If you want to view the data using *WinADCP*, select the **Launch WinADCP** box. Enter the path to the *WinADCP* program using the **Browse** button. *VmDas* will automatically enter the default path.
>
> Select what file you want to view in the **Data File to Open** drop-down list.
>
> Select a **Refresh Rate**. The *WinADCP* program will check *VmDas* for new data based on the **Refresh Rate.**

3.1.9 Simulated Inputs Tab

Use the simulated data files to help learn how to use *VmDas* or to test the User Exits.

> **NOTE.** Enabling the simulated data will automatically disable the serial port communications setting for the corresponding items on the communication setup tab.
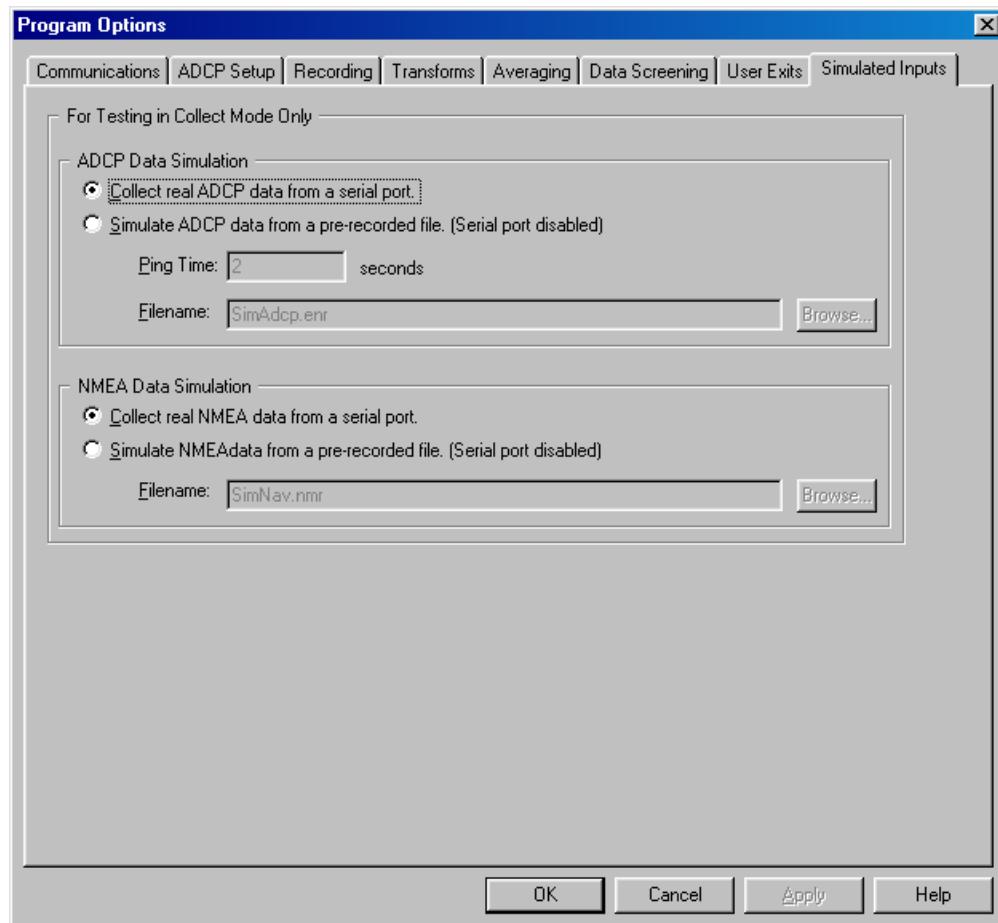
Figure 8.   Simulated Inputs Tab

3.2 Command Files

This page shows the direct ADCP commands that correspond to the fields set in the **Edit User Options**, **ADCP Setup** tab. You can refer to the ADCP Technical Manual for more information on these direct ADCP commands. See "VmDas ADCP Initialization," page 31 for details on how the ADCP commands are generated and sent to the ADCP.

To create your own command file, do the following.

a. Open one of the default command files (see Table 2, page 8) in NotePad or a similar type of text editor.

b. On the **File** menu, click **Save AS**. Give the command file a unique name.

c. Edit the commands as needed. Refer to the ADCP Technical Manual for detailed information on each command. You may want to *add* commands, but *do not delete* any command. The commands shown in the default command file are all *required*.

> **NOTE.** The commands from the command file are sent **before** the commands set by the **ADCP Setup** tab. It is possible to have a conflict if both the **ADCP Setup** tab and a command file are used. RDI recommends using a command file only and ensuring that all boxes in the the **ADCP Setup** tab are unchecked (see "ADCP Setup Tab," page 17).

> **NOTE.** The default command files have comments that explain what each command is used for. It is a good idea to keep the comments and edit them when you make command changes.

> **CAUTION.** In order for *VmDas* to perform correctly, your command file must use **single ping** (WP1, BP1) **beam** data (EX00000). See "*VmDas* ADCP Initialization," page 31 for details on how commands are sent to the ADCP.

The following shows the printout of the default command file OS38BBDEF.txt.

```
;--------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     38 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    High resolution, short range profile(broadband)
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (eg. courier).
;--------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1
```

```
; set the data collection baud rate to 115200 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb811

; Set for broadband profile mode, single-ping ensembles,
; forty 24 meter bins, 10 meter blanking distance, 390 mm/s ambiguity vel
NP0
WP00001
WS2400
WF1000
WN040
WV390

; Enable single-ping bottom track,
; Set maximum bottom search depth to 2000 meters
BP001
BX20000

; Output velocity, correlation, echo intensity, percent good
WD111100000

; Three seconds between bottom and water pings
TP000300

; Six seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas ADCP Setup tab
TE00000600

; Set to calculate speed-of-sound, no depth sensor,
; External synchro heading sensor, use internal
; transducer temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer depth to zero
ED00000

; save this setup to non-volatile memory in the ADCP
CK
```

> **NOTE.** For stationary systems such as oil platforms but you must modify the EZ command from EZ1020001 to EZ1111111. This new setting will enable the use of the internal heading, pitch, and roll sensors.

3.2.1   *VmDas* ADCP Initialization

The following section explains how *VmDas* sends the commands to the ADCP.

3.2.2   Choosing Setup Parameters

When *VmDas* **Collect** mode starts, one part of the process is to initialize the ADCP. Sending commands to the ADCP is a major part of the process.

Some commands are generated by *VmDas* from setup data taken from various tabs of the **Edit User Options** dialog box. Others are read from a command file. This can lead to conflicts and confusion.

Exactly which commands must be sent depends on the type of ADCP being initialized. *VmDas* currently recognizes the following types of ADCPs: Broadband (**BB**), Workhorse (**WH**), Ocean Surveyor (**OS**), and Unknown (**UN**).

> **NOTE.** For *VmDas* purposes, a Navigator is a BroadBand ADCP.

3.2.3 Options Dialog

VmDas presents an easy interface for making some setup choices in the **Edit User Options** dialog. Most of them are on the **ADCP Setup** tab. The serial port settings are on the **Communications** tab.

The **ADCP Setup** tab options are used only to initialize the ADCP. They do not have anything to do with how *VmDas* processes or displays data. They only help control what data the ADCP makes available.

> **NOTE.** The options dialog does not completely control initialization.

3.2.4 Using a Command File

Advanced users can define a command file in the **ADCP Setup** tab for more flexibility in initializing the ADCP.

> **NOTE.** The command file does not completely control initialization.

3.2.5 Interactions

VmDas generates some required commands without input from the **Edit User Options** dialog or a command file.

VmDas sends the commands from the command file first, and then the **ADCP Setup** tab commands and required commands. *These override the command file settings*.

If a command file is not sent to the ADCP, the setting the ADCP had on wakeup are used.

3.2.6 Automatically Generated Commands

Some commands must be sent to the ADCP for proper functioning of *VmDas*. *VmDas* always generates these commands.

Manual pinging

VmDas generates a CF 0111x command, where x indicates that the last bit is unchanged from its current setting. This bit controls the recorder.

This setup places the ADCP in a Manual Ensemble mode. A Manual Ensemble mode means that *VmDas* will control the timing of ADCP ensembles and therefore the ADCP TE command is ignored. *VmDas* sets up the ADCP for single ping Water Profile and single ping Bottom Track (if Bottom Track is required). Because of this setting, the ADCP ensemble can be thought of as a ping and thus manual pinging.

Beam coordinates

VmDas generates an EX00000 command. This places the ADCP in Beam Coordinates. With the ADCP in Beam Coordinates, *VmDas* is able to perform the transformations to Earth Coordinates. The advantage of this is *VmDas* can interface with external Heading, Pitch, and Roll sensors and therefore it can be setup to use either the internal or external input for this information.

Magnetic corrections

VmDas generates an EA0 and EB0 command (for an Ocean Surveyor, an EV0 command will be generated instead of the EB0 command).

To set the Magnetic Offset or transducer Alignment Error offsets you must use the **Transforms** tab.

3.2.7   Commands and How They are Generated

The **ADCP Setup** tab can generate some commands, but only generates the command if the proper check boxes are checked. If the boxes are checked then the commands created will be sent *after* the command text file commands.

If the **ADCP Setup** tab does not generate the commands, it is important to put them in the command file correctly. Several default command files are provided with *VmDas*. If you change or add commands refer to your ADCP Technical Manual for proper command syntax. Some of the problems that can arise are not obvious. For example, since data is in beam coordinates, it is important not to average data in the ADCP unless the ADCP is in a fixed orientation. This means that the WP command must be WP1. The BP command must be BP0 to disable bottom tracking, or BP1 to enable it.

If a command generates an error in the ADCP, the rest of the command file will not be processed. *VmDas* will warn the user and restart initialization.

The commands that can be generated by each check box in the **ADCP Setup** tab are listed below.

Set Profile Parameters

> **NOTE.** These commands are only generated if the **Set Profile Parameters** box is checked (see "ADCP Setup Tab," page 17).

The WN (Number of Bins), WS (Bin size), WF (Blank Distance), and ED (Transducer Depth) commands are generated from data in the **Set Profile Parameters** controls. For an Ocean Surveyor in Narrowband mode, this would be the NN, NS, NF, and ED commands instead.

Set Processing Mode

> **NOTE.** These commands are only generated if the **Set Processing Mode** box is checked (see "ADCP Setup Tab," page 17).

If Hi-resolution (short range) option is selected,

- For Workhorse ADCPs, WP1, WM1, WB0, and WV480 are generated.

- For BroadBand ADCPs, WP1, WM1, WB0, and WV650 are generated.

- For Ocean Surveyor ADCPs, NP0 and WP1 are generated. This sets the Ocean Surveyor to broadband mode.

- For all others, no commands are generated

If Low-resolution (long range) option is selected,

- For Workhorse and BroadBand ADCPs, WP1, WM1, WB1, and WV330 are generated.

- For Ocean Surveyor ADCPs, NP1 and WP0 are generated. This sets the Ocean Surveyor to narrowband mode.

- For all others, no commands are generated

Set BT On/Off

> **NOTE.** These commands are only generated if the **Set BT On/Off** box is checked (see "ADCP Setup Tab," page 17).

If **Off** is selected, a BP0 command is generated. If **On** is selected, a BP1 command is generated and a BX command is generated from data in the control box.

Some Workhorse ADCPs do not support bottom tracking. The BP command will fail on those Workhorses. This is OK if the **ADCP Setup** tab generates the BP command, but a failed command in the command file aborts processing of

the command file. The BP command should be removed from the command file in this case.

Heading/Tilt Sensor

> **NOTE.** These commands are only generated if the **Set Sensor Type** box is checked (see "ADCP Setup Tab," page 17).

If either check box is checked, an EZ command is generated. The current EZ setting is read and used to generate the new command. Only the heading and tilt source are changed.

3.2.8 Serial Port Setup

The port settings on the **Communications** tab control only the PC serial port, not the ADCP serial port. The PC serial port parameters must be set to match the settings the ADCP will use when it wakes up.

It is possible to change the ADCP serial port settings in a command file with a CB command. *VmDas* will detect this command and hold it until all other command file commands are executed. Then *VmDas* sends the CB command and makes the same change in the PC serial port.

This is done because the command file might include a CK command to store the ADCP current settings in non-volatile memory. This makes sure that the CB command is done after any CK command. The next time the ADCP wakes up, it will have the same serial port settings as before, and the current *VmDas* serial port options will still work.

> **NOTE.** Typically the ADCP internal serial port settings is set to 9600 Baud, no parity, 8 data bits, and 1 stop bit.

3.2.9 Detailed ADCP Initialization Procedure

a. Open the serial port using the settings from the **Communications** tab.

b. Send a break.

c. Interpret the ADCP's response to the break to determine what kind of ADCP is present.

d. For **OS**, Initialize the ADCP time to the PC time with a TS command.

e. If a command file is selected, copy it to the ADCP one line at a time with the following caveats.

- Letters are converted to upper case.

- Comments (lines starting with ;) are removed.

- CS (Start Pinging) and CZ (Power Down) commands are not sent.

- Baud rate commands (CB) are held until all other commands in the file have been sent

- After each line, a check is done for an error message from the ADCP. If one is found, no further commands from the file are sent. Initialization will start over.

- Immediately after sending a CB command, change the PC serial port parameters to match the new ADCP parameters.

f. For **BB** and **WH**, read the beam-to-instrument transformation matrix. Write it to a log on the hard disk.

g. Send commands from the **ADCP Setup** tab and a few that must be sent in any case. Each check box on the **ADCP Setup** tab enables choices to configure a particular set of commands. If the check box is unchecked, the **ADCP Setup** tab will not generate the commands, and the current ADCP settings will be used.

- Bottom track

    - If the **Set BT On/Off** check box is unchecked, nothing is sent.

    - If **Off** is selected, BP0 is sent.

    - If **On** is selected, BP1 and a BX command created from the **ADCP Setup** tab maximum range is sent.

- Processing Mode

    - If the **Set Processing Mode** check box is unchecked, nothing is sent.

    - Different commands are sent to different types of ADCP, as shown in the tables below.

    - If Hi-resolution (short range) option is selected, the following commands are sent

Command	Command Description	ADCP Type
NP0	NB mode Pings per Ensemble	OS
WP1	Pings per Ensemble	OS,BB,WH
WM1	WT Profiling Mode	BB,WH
WB0	Mode 1 WT Bandw	BB,WH
WV650	WT Mode 1 Ambiguity Velocity	BB
WV480	WT Mode 1 Ambiguity Velocity	WH
<none>		All others

- If Low-resolution (long range) option is selected, the following commands are sent

Command	Command Description	ADCP type
WP0	Pings per Ensemble	OS
NP1	NB mode Pings per Ens	OS
WP1	Pings per Ensemble	BB,WH
WM1	WT Profiling Mode	BB,WH
WB1	Mode 1 WT Bandw	BB,WH
WV330	WT Mode 1 Ambiguity Velocity	BB, WH
<none>		All others

- Profile Parameters

  - If the **Set Profile Parameters** check box is unchecked, nothing is sent,

  - For Ocean Surveyor only, no commands are sent unless it is in either NP1 or WP1 mode.

  - For Ocean Surveyor in NP1 mode, the following commands are constructed and sent.

Command	ADCP setup tab data source
NN	Number of Bins
NS	Bin Size
NF	Blank Distance
ED	Transducer Depth

  - For Ocean Surveyor in WP1 mode or any other type of ADCP, the following commands constructed and are sent.

Command	ADCP setup tab data source
WN	Number of Bins
WS	Bin Size
WF	Blank Distance
ED	Transducer Depth

- CF command

  - This command is always sent.

  - The current CF setting is read. A new command is generated using the last bit (the recorder bit) of the current setting.

  - CF 0111x is sent.

- Remaining commands

  - Heading and Tilt Sensor Source

    - If either the Heading or Tilt **ADCP Setup** tab check box is checked, the current EZ command is read. A new EZ command is generated and sent with the heading and tilt characters set from the **ADCP Setup** tab settings.

    - Otherwise, nothing is sent.

  - Heading alignment. EA0 is always sent.

  - Heading bias.

    - This is always sent.

    - For all non-Ocean Surveyor type ADCPs, EB0 is sent.

    - For Ocean Surveyor ADCPs, early versions use the EB command others use the EV command. EV0 is sent. If that generates an error, EB0 is sent.

  - Beam coordinates. EX00000 is always sent.

3.3   Reprocessing Data with *VmDas*

a. Start *VmDas*. Click **File**, **Reprocess Data**.

b. Browse and locate the *.vmo file for the data you wish to reprocess. Click **Open** (see "File Naming Conventions," page 55).

c. Click **Options**, **Edit Data Options**.

d. Click the **Recording** tab (see "Recording Tab," page 19).

    *   Enter the Name of the data set you wish to reprocess.

    *   Enter the Number of the data set you wish to reprocess.

e. Click the **Transforms** tab (see "Transforms Tab," page 21).

    *   Leave the settings for the **Transform Type**, **Sensor Configuration**, **Orientation**, and **Beam Angle** as selected.

    *   The **Heading Source** needs to be selected for the input you intend to use. If you will use the gyro heading being fed into the ADCP real time then leave it selected to ADCP.

    *   The **Tilt Source** needs to be selected for the input you intend to use.

f. Click the **Averaging** tab (see "Averaging Tab," page 23).

    *   Enter a time value for the **First Time Interval.** This is the Short Term Average (which will become file name with a *.sta extension). Enter a time value for the **Second Time Interval.** This is the Long Term Average (which will become file name with a *.lta extension). You can set these to any times you like and they may even be the same.

g. Click the **Data Screening** tab.

    *   You are able to screen data based on the items in this menu and the thresholds you decide. This screening will affect what is displayed on the screen and what data is recorded to the *.sta and *.lta files. The original raw data will be unaffected by what is setup here.

h. Save the User Option file by clicking **Options**, **Save As**.

    *   Enter a file name for the *.ini file that you have just created.

i. To start data reprocessing, on the **Control** menu, click **Go**.

3.4   Playback a Data File

a. Start *VmDas*. Click **File**, **Playback Data**.

b. Browse and locate the data file for the data you wish to view. Click **Open**.

> **NOTE.** *VmDas* will automatically search for *.enr, *.enx, *.sta, and *.lta files.
>
> In order to view files that use other naming conventions, the user can either type the file name directly into the **File name** field of the **Open File** dialog box, or click in the **Files of type** box to select the **All files (*.*)** filter from the drop-down list.

c. On the Playback Tool Bar, click **Play**.
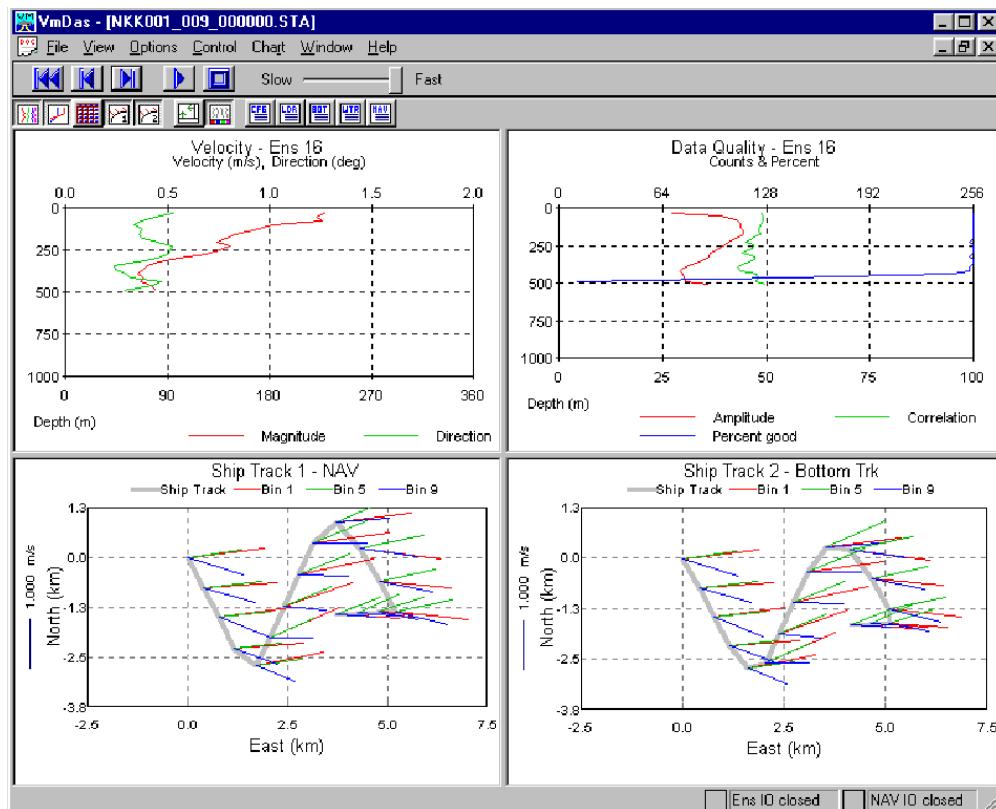
Figure 9.   Playing Back a Data File

4   *VmDas* and NMEA Data

VmDas can read in, decode, and record ensembles from an ADCP and NMEA data from some specific (i.e. GPS and attitude sensors) external devices. *VmDas* stores this data in both raw data files (leaving all original data input in its original format) and in a combined, averaged data file. *VmDas* uses all of this data to create different displays for the user.

As well as being able to input NMEA strings to *VmDas*, it can produce NMEA output strings of speed log information. The speed log contains VDVBW (ground/water speed) and VDDBT (depth).

> **NOTE.** VDZDA (Time/Date) and VDHDT (True Heading) will be added soon to match the output produced by TRANSECT.

4.1   General NMEA Data Format

Much of the following information was abstracted from the NMEA 0183 standard. Discussion is limited to NMEA strings that *VmDas* understands. All NMEA messages are ASCII strings with the general format as shown in Table 3.

Table 3:   NMEA Data Format

String	Description
$	HEX 24 – start of sentence
<Address field>	Approved address fields consist of five characters defined by the NMEA 0183 standard. The first two characters are the TALKER identifier. The next three characters identify the message.
	The proprietary address field consists of the proprietary character "P" followed by a three-character Manufacturer's Mnemonic Code, used to identify the TALKER issuing a proprietary sentence, and any additional characters as required.
	(*VmDas* accepts any two valid characters as the TALKER identifier in approved address fields.)
	(RD Instruments uses the RDI Mnemonic Code for proprietary address fields, even though it is assigned to Radar Devices. *VmDas* also uses the unassigned ADC Mnemonic Code for its own data files).
[","<data field>] . . . [","<data field>]	Zero or more data fields, each preceded by a "," (comma, HEX 2C) delimiter.
	The number of data fields and their content are determined by the address field.
	Data fields may be null (contain no characters). The comma delimiter is required even when a data field is null.
["*"checksum field]	Optional checksum
	The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," delimiters, between but not including the "$" and the "*" delimiters.
	The hexadecimal value of the most significant and least significant 4 its of the result are converted to two ASCII characters (0-9, A-F) for transmission, The most significant character is transmitted first.
<CR><LF>	HEX 0D 0A – End of sentence

Data Fields

Detailed descriptions of each message *VmDas* uses are provided below. These descriptions use format specifiers for data fields. The meanings of some of the format specifiers are listed here.

Table 4:   Data Fields

Field	Description
hhmmss.ss	A mixed fixed/variable length time field. 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds, and a variable number of digits for decimal-fraction of seconds.
	Leading zeros are always included for hours, minutes, and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
x.x	A variable length integer or floating numeric field with optional leading and trailing zeros. The decimal point and associated decimal-fraction are optional if full resolution is not required. (example: 73.10 = 73.1 = 073.1 = 73).
	A negative sign "-" (HEX 2D) is the first character if the value is negative. The sign is omitted if value is positive.
hh	A fixed length HEX number. The most significant digit is on the left.
a aa aaa etc.	A fixed length alpha field. This type of field contains a fixed number of upper-case or lower-case alpha characters.
	In all strings recognized by *VmDas*, all these fields have a length of one character.
x xx xxx etc.	A fixed length numeric field. This type of field contains a fixed number of numeric characters (0 - 9).
	Some fields allow negative values. If needed, a negative sign "-" (HEX 2D) is the first character, increasing the length of the field by one. The sign is omitted if value is positive.
A	A single character status field.
	A = Yes, Data Valid, or Warning Flag Clear.
	V = No, Data Invalid, or Warning Flag Set.
Other single letter	A single character field with fixed content. The letter is the content of the data field.
	When used below, the HEX value of the letter is also given.

> **NOTES.** Spaces should not be used anywhere in these NMEA strings. Spaces may only be used in variable text fields. No NMEA string recognized by *VmDas* uses a variable text field.
>
> If data is not available or unreliable, a null field is used. A null field is a field with no characters in it. When a null field is present, two delimiters (comma, *, or <CR>) are found side by side. A null field does NOT contain the zero character (HEX 30), the ASCII NUL character (HEX 00), a space (HEX 20), or other character.
>
> *VmDas* ignores some fields when it decodes messages. The fields it reads are explained in "NMEA Input," page 43.

4.2   NMEA Input

The messages *VmDas* reads are standard GGA, HDG, HDT, VTG messages, and a proprietary PRDID message.

VmDas data files may contain the proprietary PADCP message. *VmDas* generates this message and uses it internally. It is expected to be of no use externally, and is not transmitted to other devices. It is stored in the *.N1R and *.N2R data files.

4.2.1   GGA – Global Positioning System Fix Data

Time, position and fix related data for a GPS receiver.

$__GGA,hhmmss.ss,llll.ll,a,yyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

Table 5:   GGA NMEA Format

Field		Description
1*	hhmmss.ss	UTC of position - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds, and a variable number of digits for decimal-fraction of seconds. Leading zeros are always included for hours, minutes, and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
2*	llll.ll	Latitude - Two fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 4 chars. The decimal point and associated decimal-fraction are optional if full resolution is not required.
3*	a	Latitude hemisphere. N or S.
4*	yyyy.yy	Longitude - 3 fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 5 chars. The decimal point and associated decimal-fraction are optional if full resolution is not required.
5*	a	Longitude hemisphere. E or W.
6	x	GPS Quality indicator: 0 = fix not available or invalid 1 = GPS fix 2 = Differential GPS fix
7	xx	Number of satellites in use, 00 – 12, may be different from the number in view
8	x.x	Horizontal dilution of precision
9	x.x	Antenna altitude above/below mean-sea-level (geoid)
10	M	HEX 4D. Units of antenna altitude, meters
11	x.x	Geoidal separation. The difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid), "-" = mean-sea-level below ellipsoid.
12	M	HEX 4D. Units of geoidal separation, meters
13	x.x	Age of Differential GPS data. Time in seconds since last SC104 Type 1 or 9 update, null field when DGPS is not used.
14	xxxx	Differential reference station ID, 0000-1023

* This field is used by *VmDas*.

4.2.2   HDG – Heading, Deviation, and Variation

Heading (magnetic sensor reading), which if corrected for deviation, will produce Magnetic heading, which if offset by variation will provide True heading.

$__HDG,x.x,x.x,a,x.x,a*hh<CR><LF>

Table 6:   HDG NMEA Format

Field		Description
1*	x.x	Magnetic sensor heading, degrees
2*	x.x	Magnetic deviation, degrees
		This field and the following direction field are null if deviation is unknown.
3*	a	Direction of magnetic deviation. E or W.
4*	x.x	Magnetic variation, degrees
		This field and the following direction field are null if variation is unknown.
5*	a	Direction of magnetic variation. E or W.

* This field is used by *VmDas*.

To obtain Magnetic Heading:

a. Add Easterly deviation (E) to Magnetic Sensor Reading.

b. Subtract Westerly deviation (W) from Magnetic Sensor Reading.

To obtain True Heading:

a. Add Easterly variation (E) to Magnetic Heading.

b. Subtract Westerly variation (W) from Magnetic Heading.

4.2.3   HDT – Heading – True

Actual vessel heading in degrees True produced by any device or system producing true heading.

$__HDT,x.x,T *hh<CR><LF>

Table 7:   HDT NMEA Format

Field		Description
1*	x.x	Heading, degrees True
2	T	HEX 54

* This field is used by *VmDas*.

4.2.4   VTG – Track Made Good and Ground Speed

The actual track made good and speed relative to the ground.

$__VTG,x.x,T,x.x,M,x.x,N,x.x,K*hh<CR><LF>

Table 8:   VTG NMEA Format

Field		Description
1*	x.x	Track, degrees true
2	T	HEX 54
3*	x.x	Track, degrees magnetic
4	M	HEX 4D
5	x.x	Speed, knots
6	N	HEX 4E
7*	x.x	Speed, km/hr
8	K	HEX 4B

* This field is used by *VmDas*.

4.2.5 $PRDID

RDI defines a proprietary NMEA message that contains heading, pitch, and roll data.

$PRDID,x.x,x.x,x.x,*hh<CR><LF>

Table 9:   PRDID NMEA Format

Field		Description
1*	x.x	Vessel Pitch, degrees. + = bow up.
2*	x.x	Vessel Roll, degrees. + = port up.
3*	x.x	Vessel Heading, degrees True

* This field is used by *VmDas*.

4.2.6   Reading NMEA Data

NMEA input is not required. *VmDas* can just collect ensembles from an ADCP. If NMEA data is to be used, options must be set in the communications tab to configure the serial ports to read the data (up to two serial ports are available).

Each enabled port logs all data that arrives, whether it processes the data or not. The NAV port logs raw data to a file with a N1R extension. The RPH port logs data to a file with a N2R extension. The ports are not interchangeable. When two ports read data, it is always possible for similar data to arrive at both ports. *VmDas* must decide what to keep. *VmDas* does this by not processing messages that arrive at the wrong port.

The NAV port is intended for decoding either or both GPS data and Attitude Sensor data (Roll, Pitch, and Heading). If GPS only or GPS and Attitude data are available on one port, then use the NAV port.

The RPH port is intended for decoding only Attitude Sensor data (Roll, Pitch, and Heading data). If the GPS data and Attitude data are on separate ports then use the NAV port for decoding the GPS input and the RPH port for decoding the sensor data.

4.3 NMEA Output

4.3.1 $VDDBT – Depth Below Transducer

Water depth referenced to the transducer

$VDDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>

Table 10: VDDBT NMEA Format

Field		Description
1	x.x	Water depth, feet
2	f	HEX 66
3	x.x	Water depth, Meters
4	M	HEX 4D
5	x.x	Water depth, Fathoms
6	F	HEX 46

4.3.2 $VDHDT – Heading – True

Actual vessel heading in degrees True.

$VDHDT,x.x,T*hh<CR><LF>

Table 11: VDHDT NMEA Format

Field		Description
1	x.x	Heading, degrees True.
2	T	HEX 54

4.3.3 $VDVBW – Dual Ground/Water Speed

Water referenced and ground referenced speed data.

$VDVBW,x.x,x.x,A,x.x,x.x,A*hh<CR><LF>

Table 12:   VDVBW NMEA Format

Field		Description
1	x.x	Longitudinal water speed, knots. "-" = astern.
2	x.x	Transverse water speed, knots. "-" = port.
3	A	Status: water speed, A = Data valid, V = Data invalid.
4	x.x	Longitudinal ground speed, knots. "-" = astern.
5	x.x	Transverse ground speed, knots. "-" = port.
6	A	Status: ground speed, A = Data valid, V = Data invalid.

4.3.4 $VDZDA – Time and Date

UTC, day, month, year, and local time zone.

$VDZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Table 13:   VDZDA NMEA Format

Field		Description
1	hhmmss.ss	UTC
2	xx	Day, 01 – 31.
3	xx	Month, 01 – 12.
4	xxxx	Year
5	xx	Local time zone description. –13 to 13 hours.
		The number of whole hours added to local time to obtain GMT. Zone description is negative for East longitudes.
6	xx	Local time zone minutes description. –59 to 59 minutes.
		The number of whole minutes added to local time to obtain GMT. This permits a finer resolution time zone description than is possible using hours alone. The sign is the same as the hour time zone description.
		VmDas produces a null field here.

4.3.5   Writing NMEA Data

VmDas writes strings formatted as described in the NMEA 0183 standard to a serial port, a TCP/IP port, or both.

> **NOTE.** This is not in keeping with NMEA standards. The NMEA 0183 standard specifies that strings are to be transmitted through a serial port. The NMEA 2000 standard is being developed for transmitting similar data over a network. *VmDas* does not support the NMEA 2000 standard.

4.4   Internal NMEA Messages

RDI defines a proprietary NMEA message for *VmDas* internal use only that contains *VmDas* internal timing information.

4.4.1 $PADCP

This message is stored in *VmDas* N1R and N2R extension data files as a time stamp. It is not transmitted over any I/O port.

$PADCP, ens,yyyy,xx,xx,xx,xx,ss.ss,x.x*hh<CR><LF>

Table 14:   PADCP NMEA Format

Field		Description
1	ens	Ensemble number. A variable length integer numeric field without leading zeros.
2	yyyy	Year, 4 digits, PC local time.
3	xx	Month, 01 – 12, PC local time.
4	xx	Day, 01 – 31, PC local time.
5	xx	Hours, 00 – 23, PC local time.
6	xx	Minutes, 00 – 59, PC local time.
7	ss.ss	Seconds and hundredths, 00.00 – 59.99, PC local time.
8	x.x	PC clock offset from UTC in seconds. –86399.99 to 86399.99.
		VmDas keeps track of the date/time of GGA messages by recording the date/time according to the PC clock when the message is read, and calculating the offset between the times in the PC clock and the GGA message. If the clock offset is added to a GGA message time, the result is a local PC time, The offset corrects for the difference in time zone between local PC time and GGA time (UTC) and any errors because the two clocks are not perfectly synchronized.
		If no GGA messages have been read, this field is null.

> **NOTES.** This message is used to synchronize ensemble data and NMEA data.
>
> The year, month, day, hour, minute, and second fields describe the time that a ping command was sent to the ADCP.
>
> The ens field contains the number of the ensemble generated by the ping command.

4.5   Further Information About NMEA Strings

Users who need full details about NMEA data strings can find more information in the NMEA 0183 standard, available from the National Marine Electronics Association at.

P O Box 3435	252-638-2626 (voice)	nmea@coastalnet.com (e-mail)
New Bern, NC	252-638-4885 (fax)	http://www.nmea.org/ (web site)
28564-3435		

5　*VmDas* User Exits

The User Exit options in *VmDas* are hooks at various points in the processing where the user can modify the data with an external program.

- The first User Exit option selects a *VmDas* data file to be displayed using WinADCP.

- The second User Exit option allows a program to adjust RAW ADCP data that *VmDas* put in the *.ENR file.

- The third User Exit option allows a program to adjust RAW NMEA data that *VmDas* put in the *.N1R file.

- The fourth User Exit option allows a program to perform coordinate transformations.

For example, a User Exit could be used to translate all or part of a non-supported NMEA string (e.g. Ashtech's $GPPAT position and attitude NMEA string) into a supported string (e.g.. RD Instruments $PRDID NMEA string).

> **NOTE.** The last three user exits are enabled by clicking on their associated checkboxes in the **User Exits** tab. However, *VmDas* does not currently support automatic launching of these user exits. They must be launched independently before selecting **Go** on the **Control** menu in *VmDas*.

5.1　Tips and Tricks to Creating User Exit Programs

There are many non-supported NMEA string formats for position, heading, and pitch/roll devices. In order to use a non-supported NMEA string with *VmDas*, the user needs to create a User Exit program. The User Exit program needs to do the following:

- Opens the .N1R (or .N2R) file for input (the file may not exist right away, so it must clear the error condition and keep trying).

- Creates the .N1J (or .N2J) file for output.

- Reads characters from the file until an end of line is found (it has to handle the fact that it will often see an End-Of-File condition, because the data may not be there yet, but it must clear the error condition and keep trying. The best way to do this might be to check the file status in a loop to get the current file size and detect when it changes.

- Each time it has read a complete line, decode and convert the non-supported NMEA string into a $xxHDT string (the first two letters could be anything, as *VmDas* doesn't care about the device ID).

- Write the new $xxHDT string out to the .N1J (or .N2J) file

- Repeat

This program can be written in any of several ways:

- DOS-type program written using Borland C, or Turbo Pascal, or other programs.

- Windows console program

- Visual Basic program

- Visual C++ program

In other words, you can use any development tool that can create a program that will read and write disk files.

5.2   Example 1 - Modifying Raw ADCP Data

VmDas writes the ADCP raw data into a file with the naming convention *.ENR. The format of this data is the ADCP raw binary data.   The data file *.ENR is normally read in by the *VmDas* screening and filtering stage of the software. The output of this screening and filtering is then written into a file with the naming convention of *.ENS. A customer can set an option (via the **User Exit** tab) that will instruct the *VmDas* program to read in a file with the naming convention of *.ENJ instead of the *.ENR file.

This allows the customer to write their own program which can modify the data inside the *.ENR file in anyway as long as they write the data back out into a file with the same original data format as the *.ENR file except they rename the file *.ENJ. The *VmDas* program will read in the *.ENJ file and screen and process it as it would have the *.ENR file.

An example of why a customer may want to do this is that the customer wishes to screen the heading data that is read directly by the ADCP gyro interface board and output to the *.ENR data file. The customer could write a program that would read the heading data from the *.ENR file compare that heading data to the heading in the NMEA data file *.N1R (or *.N2R) and compare them. The customer can then decide based on an algorithm they write which heading is more accurate to use. The customer would then take the heading they chose to use and write this new heading value into the raw ADCP ensemble file *.ENJ, being sure to modify the ADCP checksum for that ensemble as required. The *VmDas* would read in the *.ENJ file because the user had selected the User Exit Option for RAW ADCP Data Screening.

5.3   Example 2 - Modifying Raw NMEA Data

VmDas writes the NMEA raw data into a file with the naming convention *.N1R or *.N2R (depending on which NMEA device we are working with). The format of this data is ASCII and is in the same format as what is transmitted by the customers NMEA device (with one exception). That exception being we add an ADCP mark (or time tag) string $PADCP. The *.N1R (or *.N2R) data file is normally then just converted to binary and stored in a file with the naming convention *.NMS. A customer can set an option (via the **User Exit** menu) that will instruct the *VmDas* program to read in a file with the naming convention of *.N1J (or *.N2J) instead of the *.N1R (or *.N2R) naming convention.

This allows the customer to write their own program which can modify the data inside the *.N1R (or *.N2R) in anyway as long as they write the data back out into a file with the same original data format as the *.N1R (or *.N2R) file except they rename the file *.N1J (or *.N2J). When the user turns on the **User Exit** option **External Raw Nav Data Screening/Pre-Averaging** the *VmDas* program will read in the *.N1J (or *.N2J) file convert it into the binary file with the naming convention of *.NMS.

An example of why a customer may want to do this is that the customer wishes to decode pitch and roll data from a NMEA string that the *VmDas* does not currently decode. The customer can write a program that would read in the data from the *.N1R file (or *.N2R) and create a string that is read by the *VmDas* program from the data available in the NMEA strings.

An example of this is seen when using an Ashtech device that outputs pitch and roll data in the string $GPPAT and $GPASHR. *VmDas* does not currently decode this proprietary NMEA string. The user could write a program that would take the data from either of these Ashtech NMEA strings and write them into the RDI propriety NMEA string $PRDID. This RDI NMEA string contains heading, pitch, and roll data and is decoded by the *VmDas* program.   The format for this string is as follows:

```
$PRDID,ppp.pp,rrr.rr,hhh.hh@    or
$PRDID,-ppp.pp,-rrr.rr,hhh.hh@
```

Where:

@ = carriage return
h = heading
p = pitch
r = roll

5.4 Example 3 - Transformation

The *VmDas* program normally reads in the contents of the binary file *.ENS and performs a beam to earth coordinate transformation. This beam to earth coordinate transformation is performed using the users selections for where to obtain attitude information such as heading, pitch, and roll (the choices being either the raw ADCP leader data or the raw NMEA data). Using this attitude information *VmDas* will transform the data from beam to earth using RDI's standard matrix table conversion and then writes this data to the file *.ENX.

The *VmDas* program does allow however allow the user to perform their own coordinate transformation routine. The user would select the **User Exit** option of **External Transformation**. This choice would disable the *VmDas* coordinate transformation routine and the user would have to create their own being sure to write the data out in correct format to a data file with the *.ENX naming convention. This is important as the next routines of the *VmDas* program will be reading in the *.ENX data for averaging, displaying, and recording in the *.STA and *.LTA files.

An example of why a customer may want to do this is that the customer may have purchased a special RDI ADCP that does not have the standard 4-beam Janus configuration. Many times these systems do not come with a coordinate transformation algorithm built into them. The user is responsible for this conversion.

Special Notes. Included in the **Transformation** routine are the following functions. If the customer chooses to perform their own Transformation they must ensure that these functions are also covered. A description of how RDI performs this transformation is included in the Coordinate Transformation Booklet.

- Selection of the attitude sensor (based on the user input during Edit Data Options)

- Apply Heading Corrections

- Apply Beam Angle Corrected Matrix table (read from the ADCP)

- Bin Mapping

- Three Beam Solutions

- Mark Data Bad Below Bottom

- Error Velocity Screening

- Vertical Velocity Screening

- Percent Good Calculations and Screening

5.5   User Displays

The *VmDas* program has its own display modules built in. The *VmDas* program reads in the raw ADCP files (*.ENR), short-term average files (*.STA), and long term average files (*.LTA) and displays this data in either a Tabular, Profile, or Ship Track plot.

The files *.ENR, *.STA, and *.LTA are available to be read by other programs such as *WinADCP* during real time data collection. This allows a user to create their own software package to display, or output the data in any way they would like. The only restriction is that when reading in the data file they must leave the data file open (or in a shared condition) so that *VmDas* may continue to access the file and update it with the new ensembles.
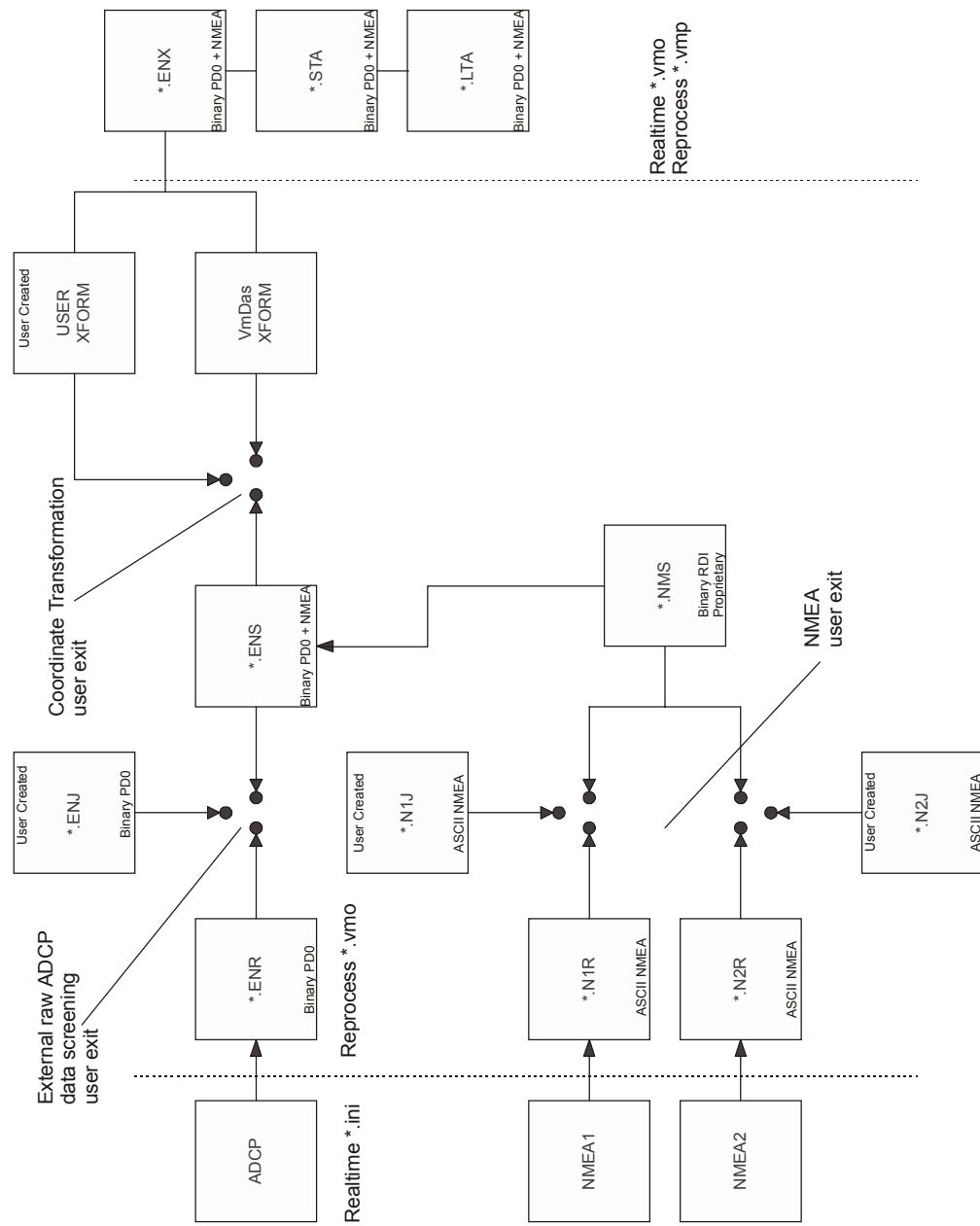
Figure 10.   User Exits

6 File Naming Conventions

Data files produced by *VmDas* during **data collect** mode has the following filename format: DeployName000_000000.Ext,

Where:

DeployName   is a user-entered name for the deployment (up to 128 characters),

000   is the deployment number (changes with each stop/restart),

000000   is the file sequence number, which is incremented when the specified maximum file size is reached, and

Ext   is the file extension, and reflects the type of data in the file

Reprocessed files have a similar format: DeployName000_000_000000.Ext,

Where:

000   Represents the reprocessing number, and gets incremented each time the same raw data is reprocessed. The other fields are the same as for the data collect mode format, and identify the raw data source that was reprocessed.

The file extensions have the following meaning:

.ENR   Raw ADCP data file

.LTA   ADCP (plus NAV) data that has been averaged using the long time period specified in the **Options**, **Edit Data Options**, **Averaging** tab.

.STA   ADCP (plus NAV) data that has been averaged using the short time period specified in the **Options**, **Edit Data Options**, **Averaging** tab.

.ENS   ADCP data after having been screened for RSSI and correlation by *VmDas*, or adjusted by the customer via a User Exit. Also has NAV records merged into the ensembles from the .NMS file.

.ENX   ADCP single-ping data (plus NAV) after having been bin-mapped, transformed to Earth coordinates, and screened for error velocity, vertical velocity, and false targets. This data is ready for averaging.

.N1R, .N2R   Raw NMEA data files - text files; includes ADCP time stamps with the following format: $PADCP,eeeee,yyyymmdd,hhmmss,-nnnnn.nn<CR><LF>

Where:
eeeee = ADCP ensemble number
yyyymmdd = Year, Month, Day (date of ADCP ping)
hhmmss.ss = Hour, minute, seconds.hundredths (Time of ADCP ping)
-nnnnn.nn = (signed) PC clock offset from UTC in seconds; includes time zone difference).

The .N1R extension is used for single-port NMEA data collection, or for GPS position data (Nav) in dual-port collection mode. The .N2R extension is used for Roll/Pitch/Heading (RPH) data collection when using two serial ports for NMEA data collection.

.NMS   Binary format NAV data file after having been screened and pre-averaged.

.VMO   The option settings used for collecting the data (text file).

.VMP   The option settings used for reprocessing the data (text file).

.ENJ   ADCP raw data after adjustment by a user-exit application.

.N1J, .N2J   Raw NMEA data after being adjusted by a user-exit application.

<u>NOTES</u>