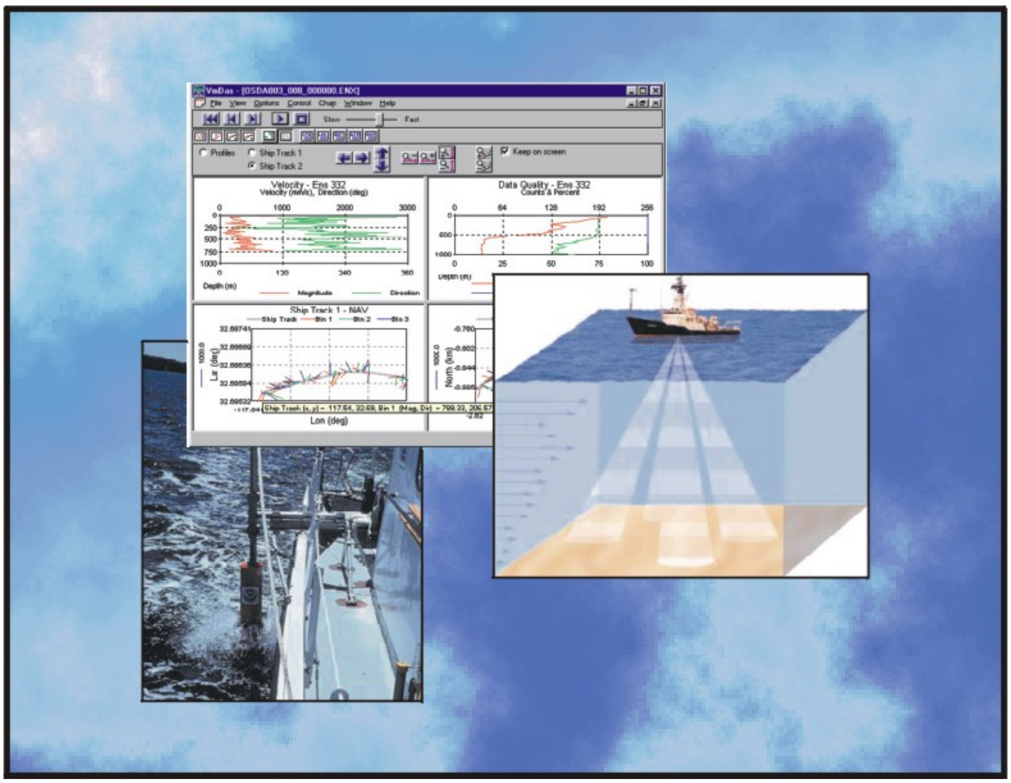
VmDas

User's Guide



P/N 95A-6015-00 (March 2001)

RD Instruments
Acoustic Doppler Solutions

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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.

> **NOTE.** This guide covers version 1.2.0.7 or higher.

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 Turnkey Mode

When *VmDas* is started in the turnkey mode, a message box appears to prompt the user to start collecting data. After 30 seconds, or on confirmation, *VmDas* begins collecting data automatically.

Syntax – *VmDas*.exe /autostart

For example, if a computer operating system has *VmDas* with the /autostart switch in the startup folder, *VmDas* will open with a message box asking if it is OK to start collecting data when the computer is started. The user clicks **OK** or waits 30 seconds for the message box to time out. *VmDas* will close the message box, open a document in data collect mode, and begin collecting data. If the user clicks **Cancel**, *VmDas* exits.

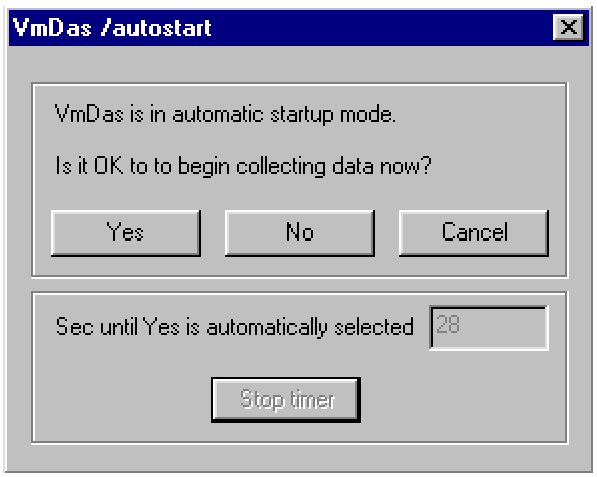


Figure 1. Autostart Dialog

NOTE. Turnkey mode only works on startup. Once data collection has started, *VmDas* reverts to normal operation. It will not enter turnkey mode again until closed and restarted with the /autostart switch. If a second document is opened with the **File**, **Collect Data** menu, the user must use the **Control**, **Go** menu item to start data collection. It will not happen automatically.

3 Quick Start Guide

The *VmDas* User's Guide is divided into two main sections:

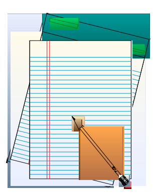
1. Quick Start Guide to collecting data with *VmDas*
   - Simple instructions to begin collecting data
2. *VmDas* Tutorial
   - Create a User Option file
   - Collecting data
   - How to reprocess data
   - How to play back a data file

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.

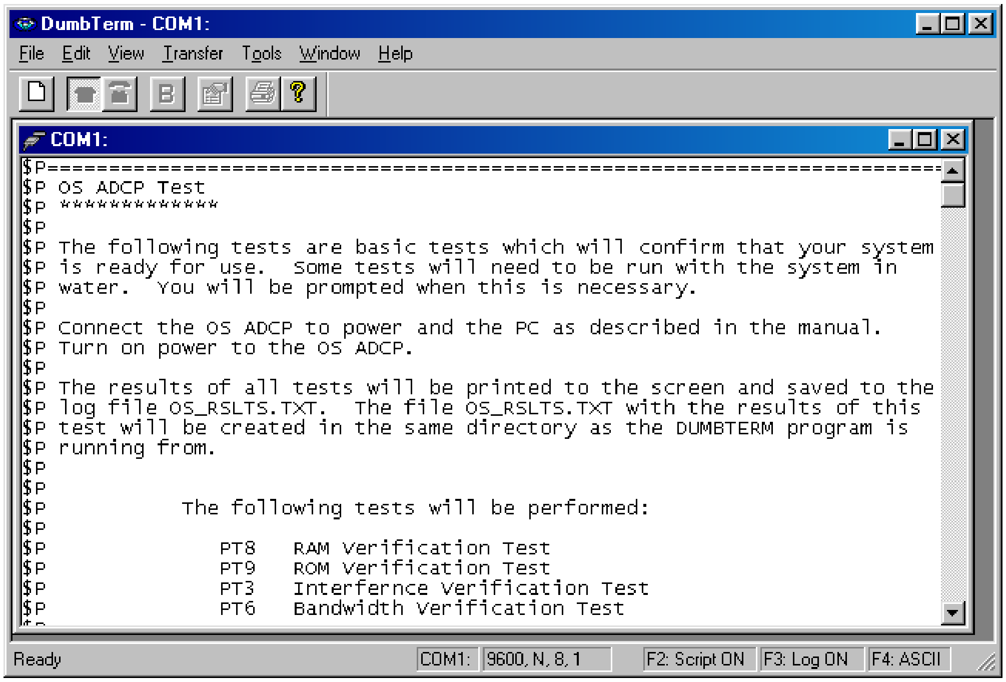
3.1 ADCP Setup

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.

3.2 Test the ADCP



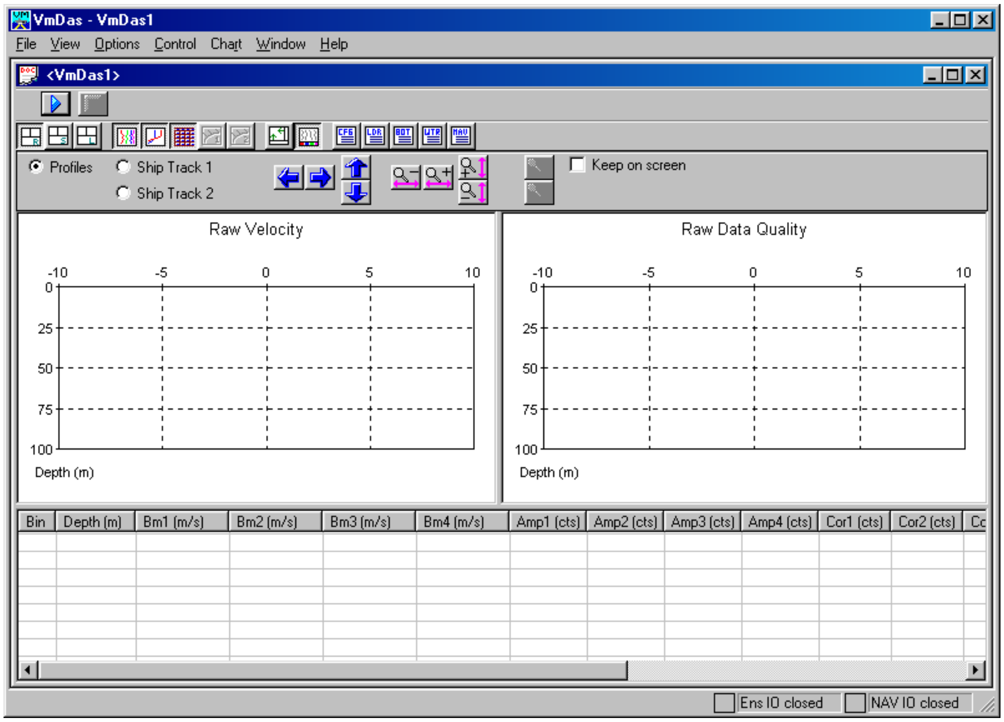
Step 2. Run *DumbTerm* to verify the ADCP is functioning properly. Select a script file from the table below. The results of the tests will be saved to an ASCII text log file in the same directory as the *DumbTerm* is running from.

Script File Name	ADCP Type	Results Saved to
testBB.txt	Broadband	BB_RSLTS.txt
testOS.txt	Ocean Surveyor	OS_RSLTS.txt
testWH.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.

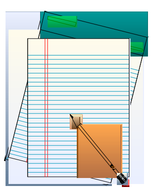
Use this area for notes.

3.3 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.



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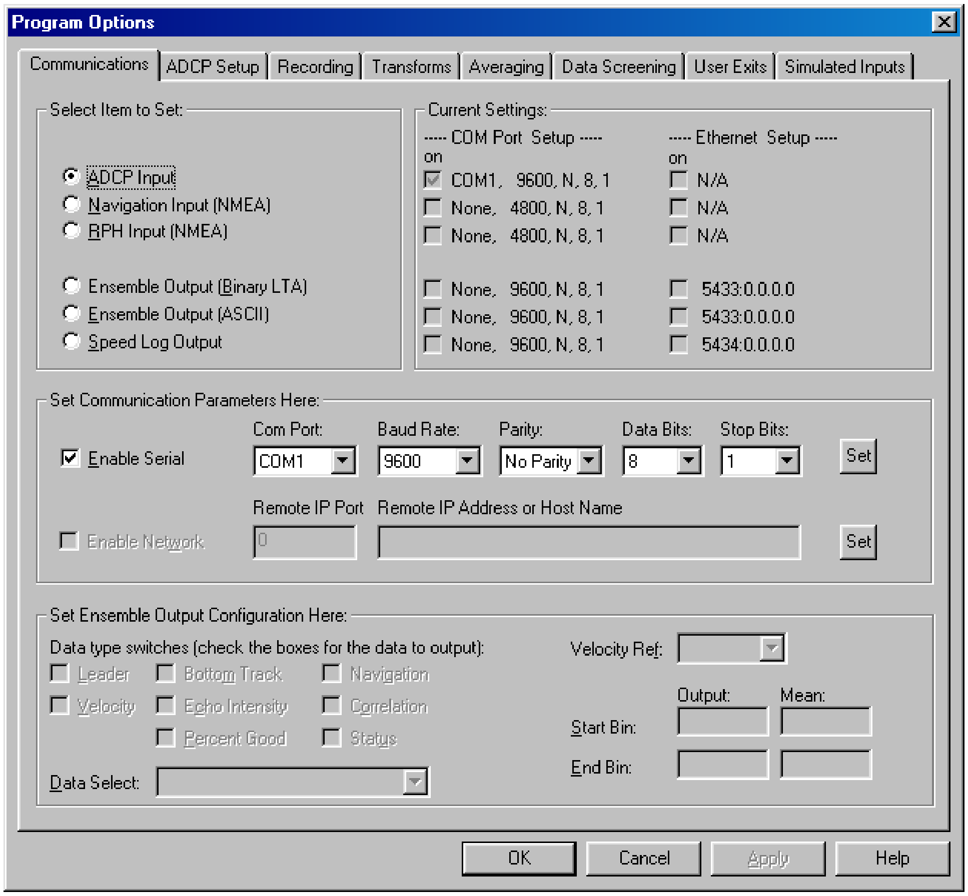
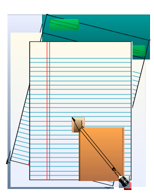
3.4 Setup Communications



Step 4. On the **Options** menu, click **Edit Data Options**. Click the **Communications** tab and set the communications settings with the ADCP and NMEA ports.



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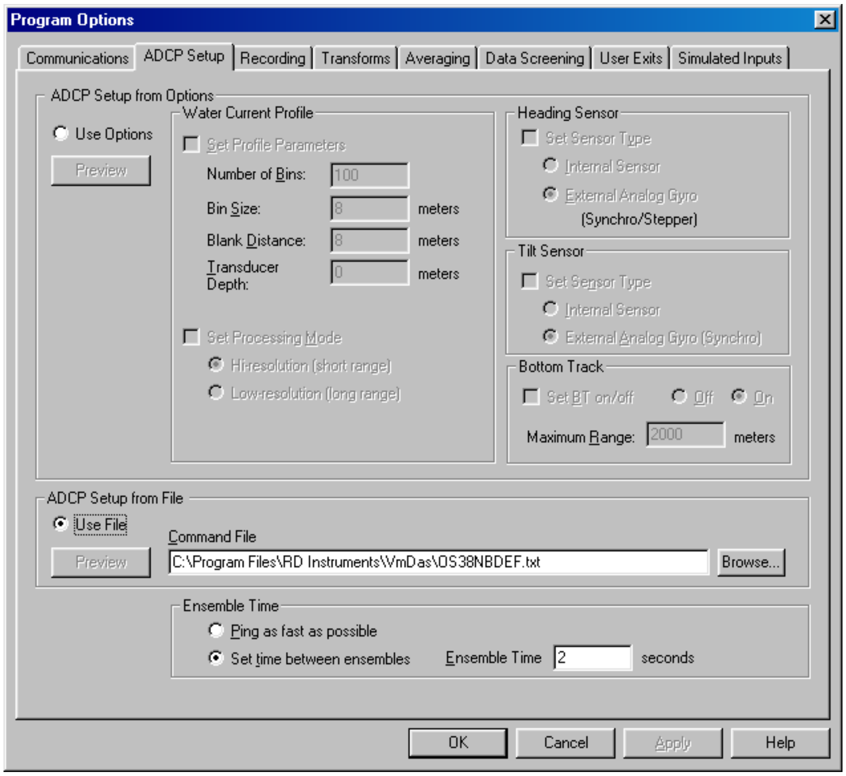
3.5 Load a Command File



Step 5. Click the **ADCP Setup** tab. Use the **ADCP Setup** tab to setup the ADCP. 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	4	2
75	2	1
150	1	1
300		
600	Select **Ping as Fast as possible**	
1200		

For this Quick Start example, select **Use File** in the **ADCP Setup file** area. Use Table 2 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.

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.

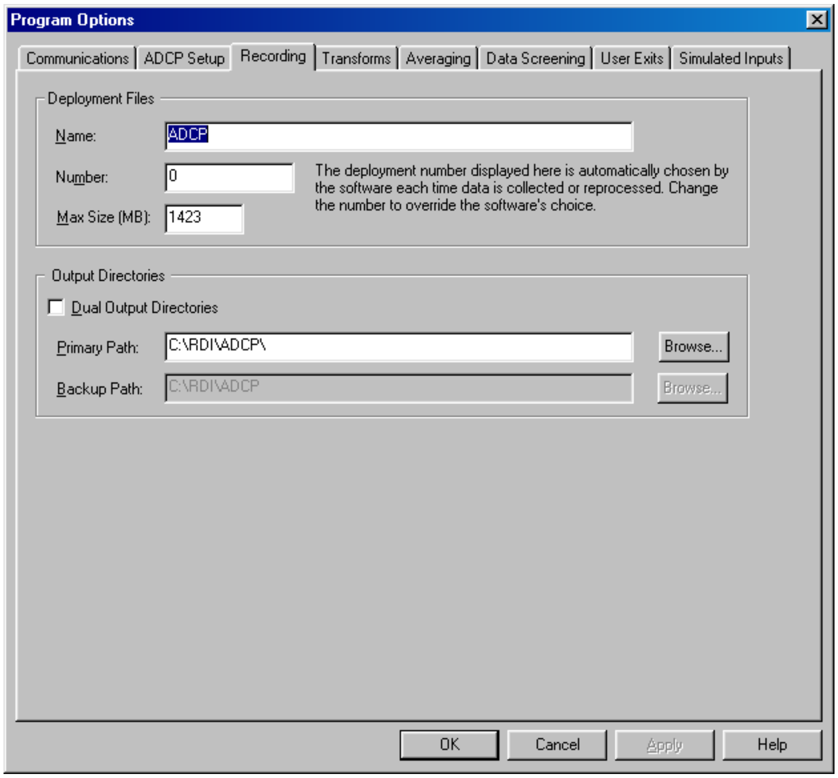
File Name	Description
OS38NBDEF	Default setup for an OS 38kHz ADCP in the lowest precision (narrow bandwidth) but extended range profiling mode.
OS75BBDEF	Default setup for an OS 75kHz ADCP in the highest precision (broad bandwidth) but reduced range profiling mode.
OS75NBDEF	Default setup for an OS 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.
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.
WH1200DEF	Default setup for a Workhorse 1200kHz 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 have been setup for shipboard use. They 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.

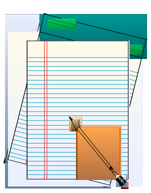
3.6 Set Recording Options



Step 6. The Recording property page allows you to set the deployment name and path to where the data files are recorded.

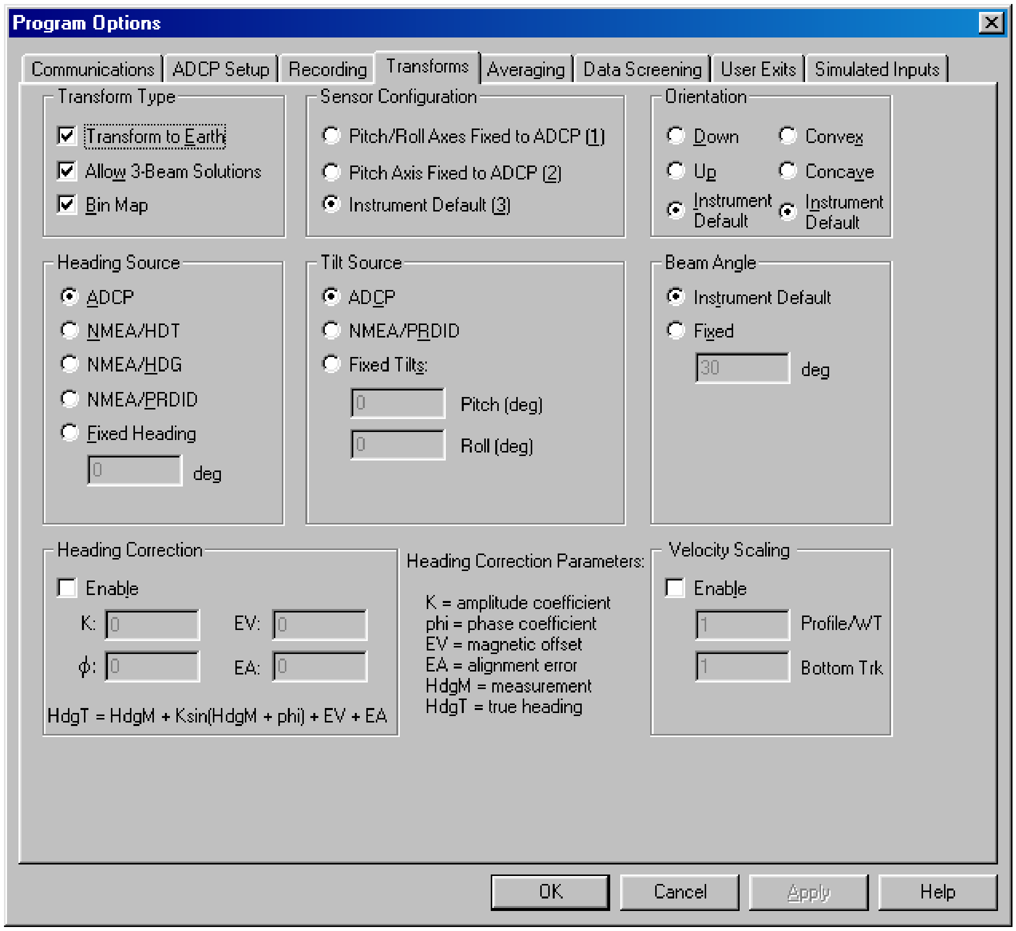
Enter a name in the **Name** box that identifies your deployment. This name will be used as part of the filename for each file that is part of this deployment (see "File Naming Conventions," page 73). For testing, "Test" or "Practice" are good choices.

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.

3.7 Setup the Transforms Screen



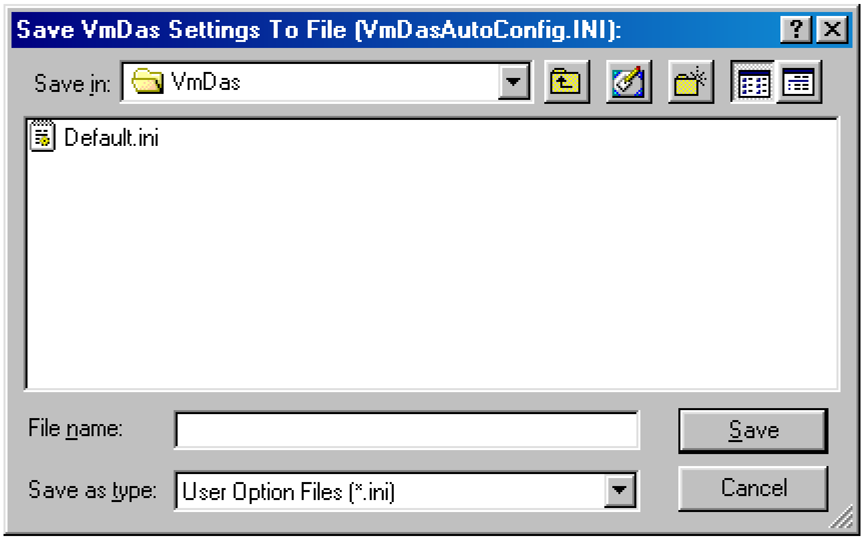
Step 7. Click the **Transforms** tab and verify that all selections in the **Transform Type** are checked. Set the **Sensor Configuration**, **Orientation,** and **Beam Angle** to **Instrument Default**. The **Heading Source** and **Tilt Source** should be set to **ADCP.** Set the **Heading Correction** to your input. The **Velocity Scaling** should be disabled.

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.

3.8 Save the User Option File

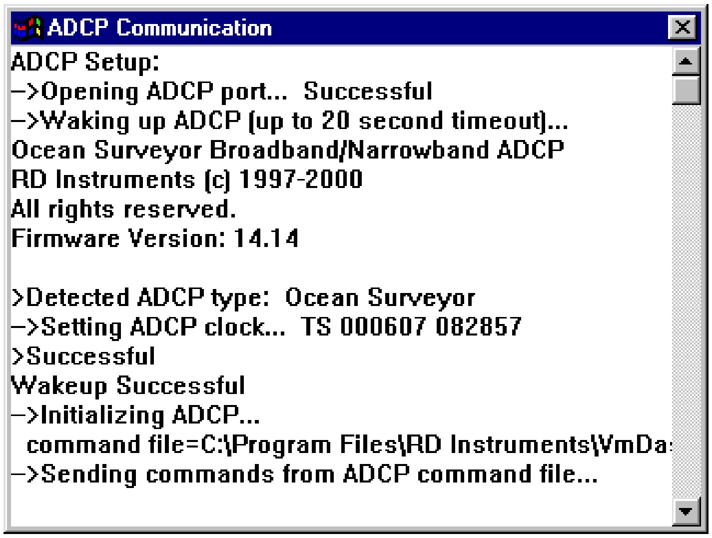


***Step 8*.** On the **Options** menu, click **Save As**. The options may be saved to a file for later retrieval. You may wish to save several sets of options, to be used as starting points for different deployments. Option files that are created this way may have any name you choose.

> **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.

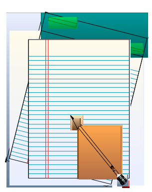
Use this area for notes.

3.9 Collect Data



Step 9**.** On the **Control** menu, click **Go** to begin collecting data. The ADCP Communication window will open and show the commands from the command file you selected (see "Load a Command File," page 8) being sent to the ADCP and the ADCP's response. Once all of the commands have been captured to the *.LOG file, the window will close automatically. See "VmDas ADCP Initialization," page 42 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.

4 *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 40) 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 49) and data playback (see "Playback a Data File," page 50).

> **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*.

4-1 Creating a Data Option File

In the following, you will be creating a Data 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 "Software Installation," page 2. Connect the ADCP to a computer as shown in the ADCP Technical Manual, 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 **"**Data Options Screens," page 23) 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 Data 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.

4.1.1 Setting up Data Options

When data collection or data reprocessing is started, the current data options tell *VmDas* how to collect and process data.

- Data options are not used for playing back data. Editing them is not allowed in playback mode.
- *VmDas* stores current data options. They persist until changed, even if *VmDas* is closed and restarted.
- If the current set of data options is not satisfactory, they must be changed before starting data collection or data reprocessing. Once collection or reprocessing has started, it must be stopped before changes can be made.
- Current settings can be viewed at any time when a mode is selected.
- The current data options can be replaced with a set of data options stored in an *.INI, *.VMO, or *.VMP file. The current options can be edited.

Saving Data Options

When the current data options are changed, the old version is overwritten. To keep from losing a set of options, they should be stored in a file by clicking **Options**, **Save As**.

- The **Save As** option is available only when options have been edited but not saved in a file.
- Choose a file name that suggests the purpose of this set of data options. *VmDas* will add the INI extension to the name. No extension should be supplied by the user.
- Whenever data collection starts, the current data options are automatically saved in a VMO file.
- Whenever reprocessing starts, the current data options are automatically saved in a VMP file.
- All of these files are stored as standard Windows INI files. They are easy to read with a text editor. Editing them directly is not recommended.

Error Messages

Some options or combinations of options are illegal. *VmDas* detects some of these bad settings and refuses to allow them to be saved or used.

- Clicking **OK** or **Apply** on the **Edit Data Options** dialog box causes *VmDas* to do a consistency check and save the new settings as the current data options if no errors are found.
- The check is also done when starting data collection.
- If an error is found, a message describing the error will pop up and no changes will be saved. The user can either correct the problem, or cancel editing and lose all changes made.

Loading Data Options

On the **Options** menu, click **Load**. By default, only INI files are displayed. VMO files can be displayed by choosing them in the **Files of type** box. To display VMP files, choose all files in the **Files of type** box.

NOTE. To return to the factory default setting, select the Default.ini file.

View the Current Data Options

On the **Options** menu, click **View Data Options**. The same dialog opens as when editing, but no changes can be made. You can view the data options in the Playback mode.

4.1.2 Setting up Display Options

The Display Options determine how data is displayed.

- They can be set for modes that display data (playback and collect).
- They can be changed at any time when one of those two modes is active, whether or not data is being played or collected.
- Graphs or charts may be erased and re-plotted because of changes to these options, but it makes no change to the data itself.
- In reprocess mode, data is not displayed, so there are no settings to determine how it is displayed.

Edit Display Options

Click **Options**, **Edit Display Options** to display a tabbed dialog box from which you can change the display options. Click the **Reference** tab to select the display units, or the velocity reference to use for profiles. Click the **Ship Track** tab to select the ship position source and the profile bins to use for the current stick plots.

Reference Tab

When you click the **Reference** tab (Figure 2) in the **Display Options** dialog box, the following display units and velocity reference settings are displayed and may be changed.

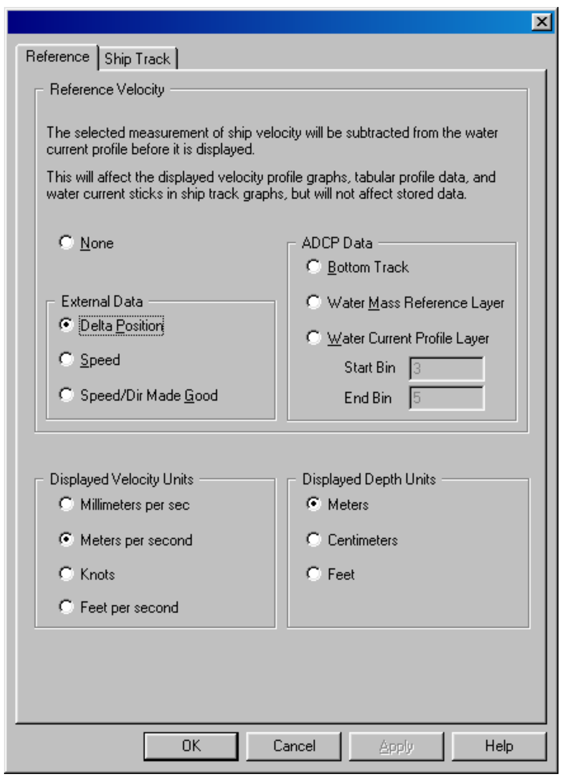


Figure 2. Reference Tab

Velocity Reference - Choose between **None**, **Bottom Track**, **Water Mass Reference Layer**, **Water Current Profile Layer**, **Delta Position**, **Speed**, and **Speed/Dir Made Good**.

- **Water Mass Reference Layer** refers to the water reference layer output that some ADCP instruments output along with the bottom track data. This layer is only available from the BroadBand and WorkHorse ADCPs. This data is collected and recorded by these ADCPs only when the BK command is set to collect Water Mass

Layer and the BL command has been set to select the section of water that will be measured to record a speed through the water. This speed through the water is stored in a separate location in the bottom track data. Enabling this feature will reference all of the profile velocities to this recorded speed through the water. This feature is typically enabled only when the bottom track is not possible and navigation data will not be collected.

- The **Water Current Profile Layer** is setup as a totally independent water layer to reference the averaged data in either the STA or LTA files. The user should set this to a number of consecutive bins that will represent only the vessel motion (i.e. that has as little real water motion as possible). The **Start** and **Stop** bins selected will all be averaged together to produce a single speed through the water. This speed through the water is stored in a separate location in computer RAM. If not used it is discarded and not recorded. Enabling this feature will reference all of the profile velocities to this recorded speed through the water. This feature is only used when there is no bottom track or navigation data available.
- **Delta Position** calculates a reference velocity as delta position divided by delta time, where the position data is obtained from the NMEA GGA message. The position used in the calculation is the last GGA position received in each ADCP data interval.
- **Speed** calculates a reference velocity from speed and direction, obtained from the NMEA VTG message, by resolving them into East and North components.
- **Speed/Dir Made Good** calculates a reference velocity from speed-made-good and direction-made-good, which is in turn calculated from the averages of position and time, as received in the NMEA GGA messages, for each ADCP data interval.

Velocity Units - Choose between millimeters per second, meters per second, knots, or feet per second for all displayed velocity data.

Depth Units - Choose between meters, centimeters, or feet for all displayed depth data.

Ship Track Tab

When you click the **Ship Track** tab (Figure 3) in the **Display Options** dialog box, the following settings are displayed and may be changed.

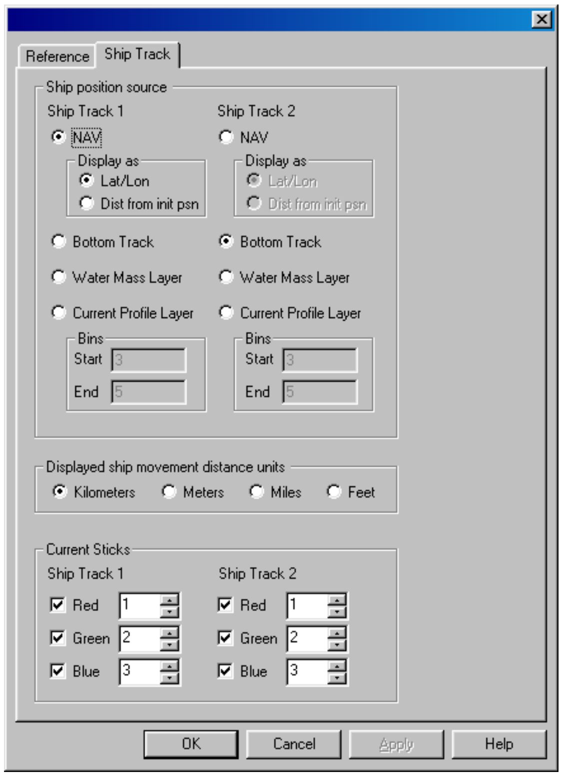


Figure 3. Ship Track Tab

Ship Position Source - For each ship track plot, choose between **NAV**, **Bottom Track**, **Water Mass Reference Layer**, and **Current Profile Layer**.

- If **NAV** is selected, the last NMEA GGA position received in each ADCP data interval is used to calculate the ship track, and can be displayed as a Lat/Lon position, or as a distance from the initial position. The initial position is the first valid GGA position received that also is the last position received within an ADCP data interval.
- If **Bottom Track** is selected, the ADCP bottom track velocity data are integrated to calculate a ship track.
- If **Water Mass Reference Layer** is selected, the ADCP water reference layer data are integrated to calculate a ship track. This layer is only available from the BroadBand and WorkHorse ADCPs. This data is collected and recorded by these ADCPs only when the BK command is set to collect Water Mass Layer and the BL command has been set to select the water depths to collect a speed through the

water. The delta speed and delta time between consecutive averaging intervals is then used to calculate a distance traveled and direction and plotted on the Ship Track graph. This feature is typically enabled only when the bottom track is not possible and navigation data will not be collected.

- If **Current Profile Layer** is selected, the layer velocity is defined to be the average of the range of profile bins selected as the velocity reference, and that velocity is integrated to calculate a ship track. This layer is setup as a totally independent water layer to reference the averaged data in either the STA or LTA files. The user should set this to a number of consecutive bins that will represent only the vessel motion (i.e. that has as little real water motion as possible). The **Start** and **Stop** bins selected will all be averaged together to produce a single speed through the water.

  The delta speed and delta time between consecutive averaging intervals is then used to calculate a distance traveled and direction and plotted on the Ship Track graph. This feature is typically enabled only when there is no bottom track or navigation data available.

> **NOTE.** If **Bottom Track**, **Water Mass Reference Layer**, or **Current Profile Layer** is selected, the ship track is shown as a distance from the initial position, where the initial position is 0,0.

Chart units for distances - Choose between Kilometers, Meters, Miles (statute), or Feet.

Current Sticks - Choose to display up to three current sticks at each ship position, and select which profile bin each stick represents.

> **NOTE.** Changes made to the **Ship Track** tab may require that the ship track be re-plotted. *VmDas* will issue a warning before accepting these changes. If the ship track must be re-plotted, the ship track is erased. Plotting continues from the current position.
>
> When collecting data, this means it is a good idea to settle on desired configurations early. Once erased from the display, the Ship Track cannot be redisplayed until the deployment files are played back.

Change Chart Properties

Whenever you right-click on any profile plot, a pop-up property menu (Figure 4) is displayed from which you can change many attributes for the profile graphs.

Profile Plots

- *How do I manually set the ranges for the plot axes?* Select the **Axes** tab. On the right, click the tab that contains the attribute that you want to change for the axis, in this case **Scale**. On the left, click on the label of the axis you want to change. On the right, enter new numbers for **Max** and **Min** and click **OK** or **Apply**.
- *How do I put symbol markers on my data points?* Select the **Chart Styles** tab. On the right, click the **Symbol Style** tab. On the left, click on the label for the series you want to mark (i.e. **Style1**, **Style2**, etc.). Click the box labeled **Shape** and select a shape for the symbol. Click the box labeled **Size** to set the size of the symbol. Click the **Name** box to set the desired color for the symbol. Click **OK** or **Apply**. Note that from the **Chart Styles** tab you can also set the line width, pattern, and color of each line in the graph.

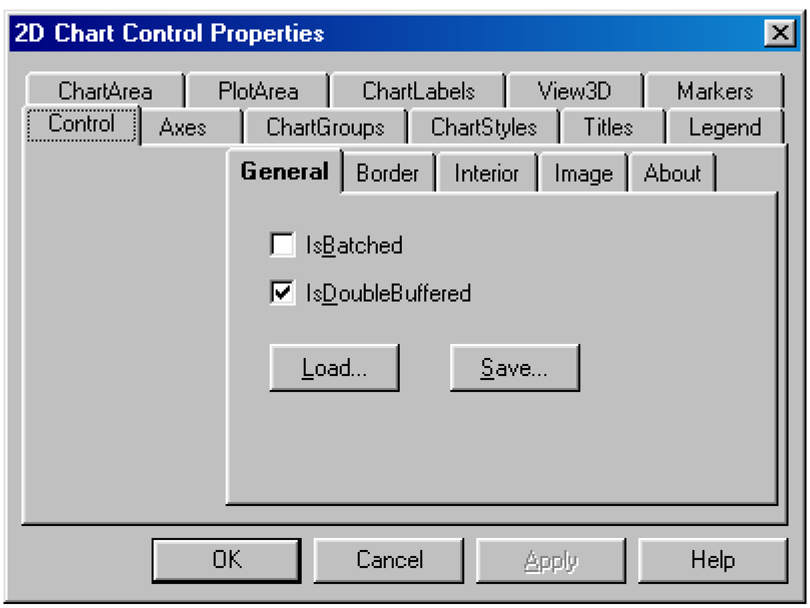


Figure 4. Chart Control Properties

Ship Track Plots

- *How do I manually set the ranges for the plot axes?* Right-click the ship track plot and click on **Properties** (Figure 5). Click the **Plot Area** tab. Manually enter values for **Left**, **Right**, **Top**, and **Bottom**. On this property page, you may also change the font, turn on or off the grid lines and set their style, and change the aspect ratio method. Click **OK**.

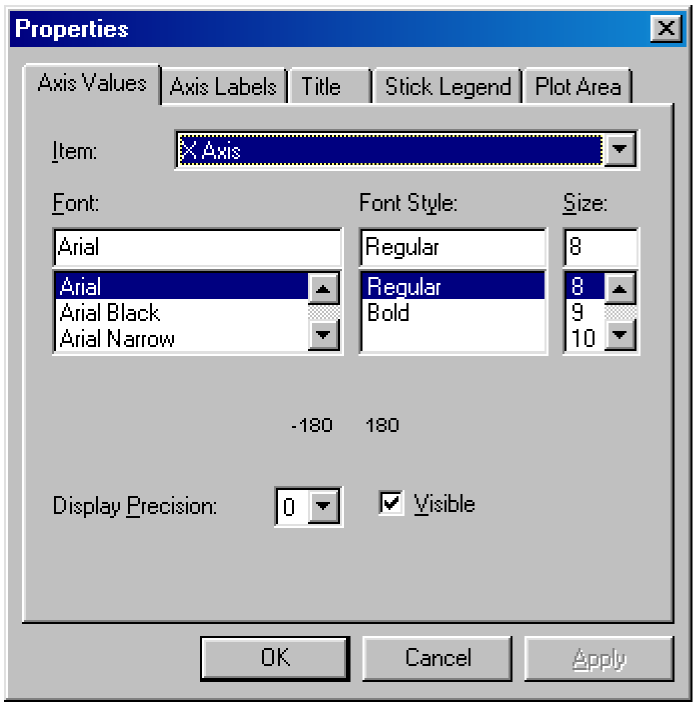


Figure 5. Ship Track Properties Dialog

4.2 Data Options Screens

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

- Communications (see "Communication Tab," page 24)
- ADCP Setup (see "ADCP Setup Tab," page 27)
- Recording (see "Recording Tab," page 29)
- Transforms (see "Transforms Tab," page 31)
- Averaging (see "Averaging Tab," page 33)
- Data Screening (see "Data Screening Tab," page 35)
- Users Exits (see "Users Exits Tab," page 37)
- Simulated Inputs (see "Simulated Inputs Tab," page 39)

4.2.1 Editing the Data Options

On the **Options** menu, click **Edit Data Options** to display a tabbed dialog box. Data Options can be edited only when collect or reprocess mode is selected, and collection or reprocessing is <u>*not*</u> in progress.

- Clicking **OK** or **Apply** causes *VmDas* to do a consistency check and save the new settings as the current data options.
- If an error is found, a message describing the error will pop up and no changes will be saved. The user can either correct the problem, or cancel editing and lose all changes made.
- Editing data options saves them as the current options, not in a file (see "Saving Data Options," page 15).

NOTE. If the save to a file step is skipped, the new current options still persist until changed, even if *VmDas* is closed.

4-2.2 Communication Tab

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

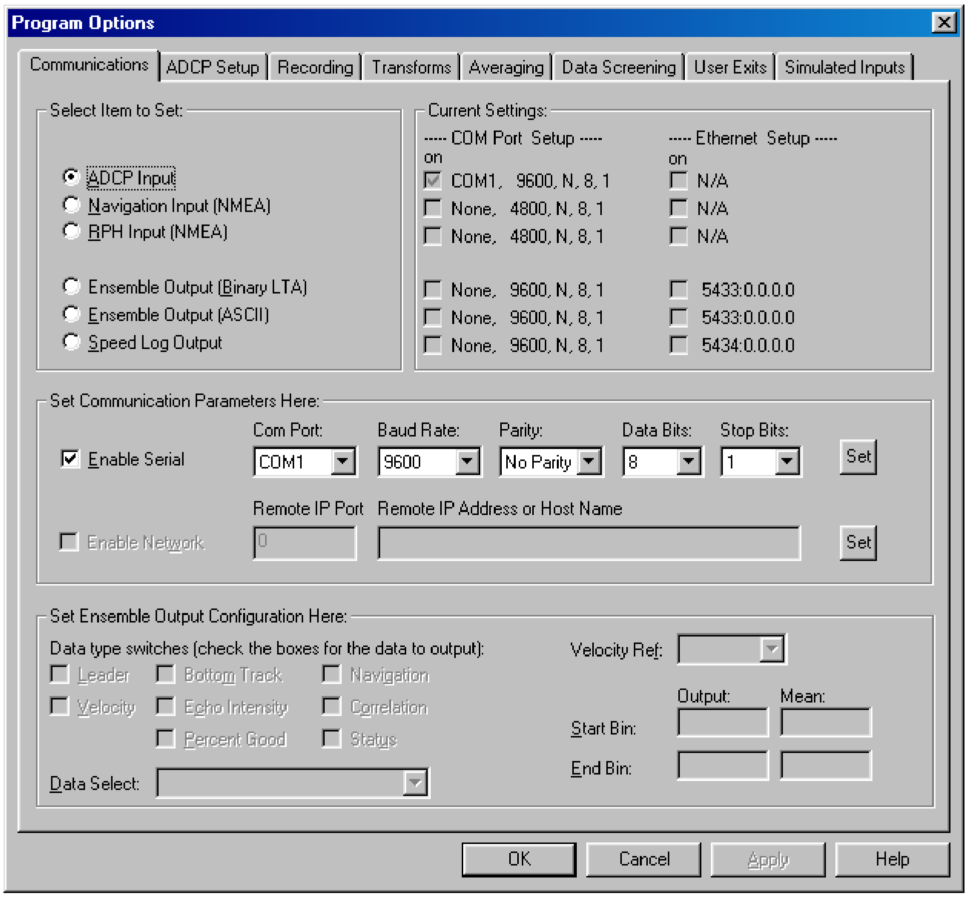


Figure 6. Communications Tab

VmDas can collect data from one to three input serial ports. When collecting data, ensembles must be read from the ADCP input port. The Navigation and RPH input ports can collect NMEA data if desired. If both NMEA ports are used see "Reading NMEA Data," page 55 for details on which sentences are accepted at which port.

Enabling an input port instructs *VmDas* to listen for data at that port, to log all data received to a file, and to generate error messages if data is not received. *VmDas* enforces some rules for input port options.

- Duplicate or invalid COM ports cannot be specified for active ports.

- If options on the **Transform** page use NMEA data, at least one input port must be configured to accept it.
- If only one NMEA port is enabled, it must be the Navigation port.

VmDas can write data to up to three output serial ports and up to three TCP/IP ports.

VmDas can provide up to three optional real time outputs through serial ports, Ethernet ports, or both.

Enabling an output port instructs *VmDas* to write data to that port whether or not anyone is listening.

Ensemble Output (Binary LTA) provides long term averaged ensembles. This output is a copy of the LTA output file.

Ensemble output (ASCII) converts binary ensembles to an ASCII format. If this port is enabled, the data to be written must be selected in the **Set Ensemble Output Configuration Here** box.

Speed Log Output produces NMEA messages containing ship speed information from short term averaged data.

Set Ensemble Output Configuration Here

The settings in the **Set Ensemble Output Configuration Here** box are needed only if **Ensemble Output (ASCII)** is enabled.

- **Data Select** - *VmDas* produces several output files with binary ensembles. **Data Select** chooses one of these files as the source of ensemble data for ASCII output. Some of the data in the binary source will be extracted, converted to an ASCII format (See "Output ASCII Ensemble Data," page 61), and written out the output port.
- **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. The **Navigation** box will have no effect if the **Data Select** box contains ENR. **Navigation** data comes from NMEA inputs. The navigation and ensemble data are merged to produce ENX, STA, and LTA files. Navigation data is not present in the raw ENR files.
- **Velocity Switch** - If the **Velocity** box is checked, the **Start Bin** and **End Bin** boxes in the **Output** column set the bins that will be added to the ASCII ensemble velocity data.
- **Velocity Ref** - If the **Velocity** box is checked, the **Velocity Ref** box can be used to remove ship velocity from the velocity profile. Other velocities, such as bottom track, are not changed.

  If **Velocity Ref** is set to **None**, velocities are unchanged.

If **Velocity Ref** is set to **Bottom**, the velocity from the bottom track field, if present, is subtracted from the velocity of each bin.

If **Velocity Ref** is set to **Mean**, the average velocity of a water layer is subtracted from the velocity of each bin. The **Start Bin** and **End Bin** boxes in the **Mean** column select the bins that make up the water layer.

- **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.

The parameters set in the ADCP input port should match the ADCP wakeup serial port settings. RDI recommends that the ADCP wakeup serial port settings be set at 9600 BAUD, no parity, 8 data bits, and 1 stop bit.

The Navigation Input and RPH input ports read NMEA data. The NMEA 0183 standard specifies 4800 BAUD, no parity, 8 data bits, and 1 stop bit. Never the less, many ships use 9600 BAUD, and some may use faster rates.

NOTE. Advanced users can change the ADCP serial port parameters with a command file. Those parameters are used only while collecting data. When data collection stops, the serial port settings the ADCP uses will return to their wakeup values.

VmDas automatically changes the PC serial port when the ADCP serial port changes.

4.2.3 ADCP Setup Tab

Use this dialog box to setup the ADCP. Select either **Use Options** to set the ADCP commands on this tab or select **Use File** to use a command file.

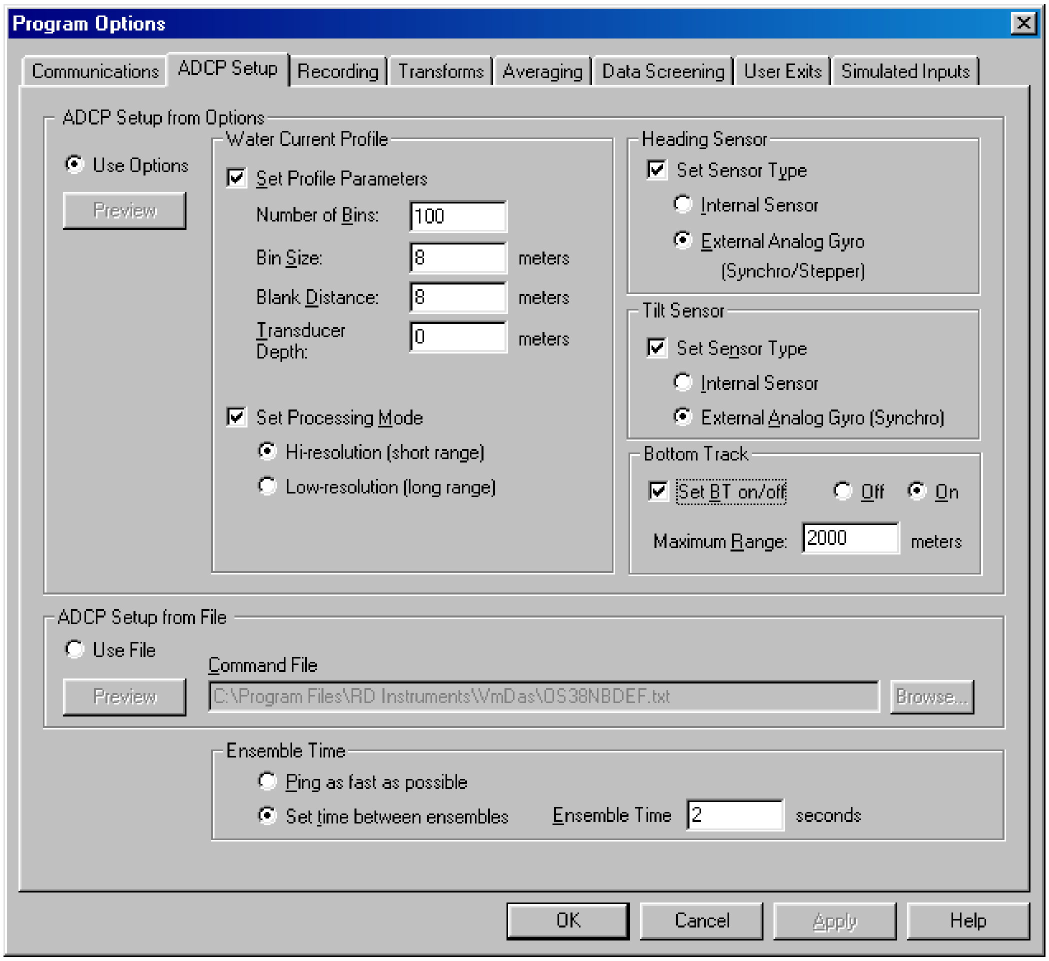


Figure 7. ADCP Setup Tab

Ensemble Time is set on this tab for both **Use Options** and **Use File**. Select the **Set time between ensembles** button to specify a ping interval (see Table 1, page 8). Select the **Ping as fast as possible** button to let the processing and I/O time dictate the ping rate.

NOTE. See "*VmDas* ADCP Initialization," page 42 for details on how the ADCP commands are generated and sent to the ADCP.

To set the ADCP commands using this dialog box, select the **Use Options** button.

- Select the **Set Profile Parameters** box in the **Water Current Profile** section to set the following parameters; **Number of Bins** (WN), **Bin Size** (WS), **Blank Distance** (WF), and **Transducer Depth** (ED).
- Select the **Set Processing Mode** box to switch between high and low resolution modes.
- Select the **Set BT on/off** box to enable or disable bottom track pings (BP1) and set the maximum search range (BX command).
- 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).
- 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.

To set the ADCP commands using a command file, select the **Use File** button. 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.

Suggested Setting for First Time Users.

Select the **Use File** button in the **ADCP Setup file** area and click the **Browse** button under the **Command File** window. Select one of the default command files (see "Load a Command File," page 8 and "Command Files," page 40) and click **Open**.

Set the **Ensemble Time** as shown in Table 1, page 8.

NOTE. The ADCP automatically increases the Time per Ensemble if ((WP + NP + BP) x TP > the setting in **Set time between ensembles** box).

4.2.4 Recording Tab

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

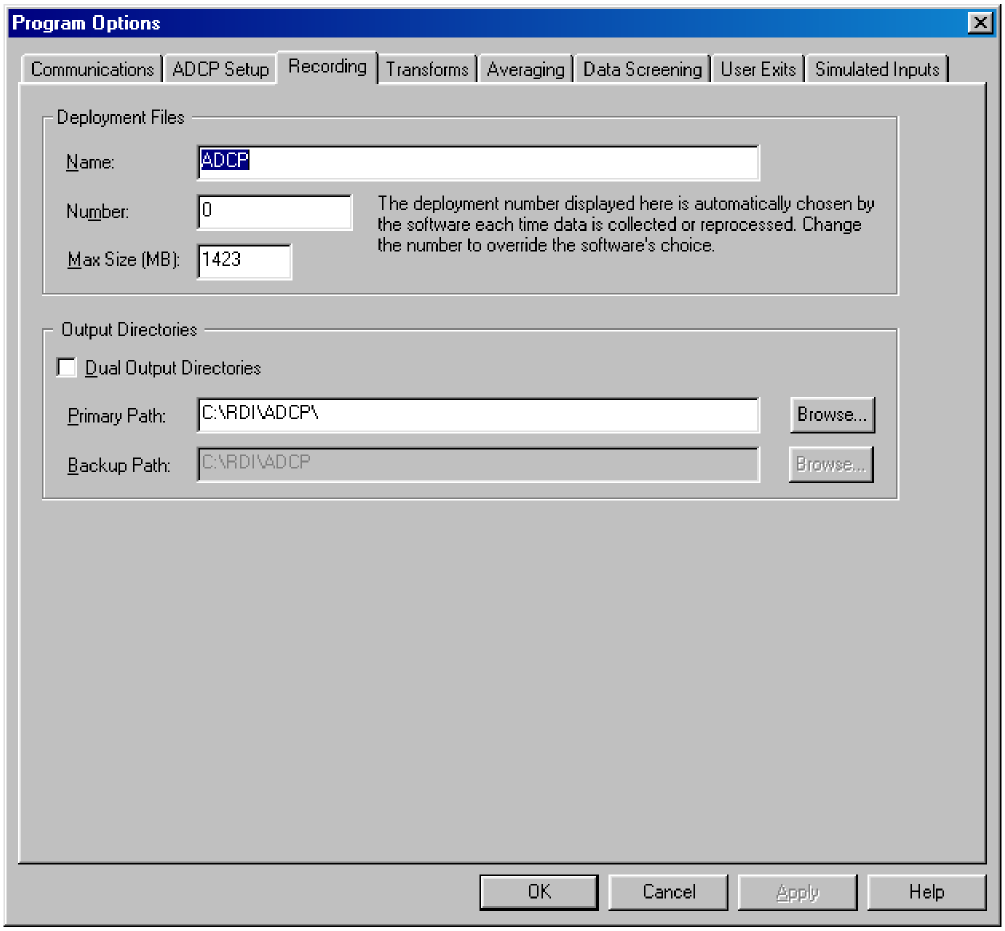


Figure 8. Recording Tab

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 (see "File Naming Conventions," page 73).

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 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 **Primary Path** edit box will allow you to browse your computer to select a folder to record to. You will be presented with a **Choose Directory** dialog box (see Figure 9), which will have the default path of C:\RDI\ADCP selected. Select the primary path (note the directory must already exist) and click **OK**.

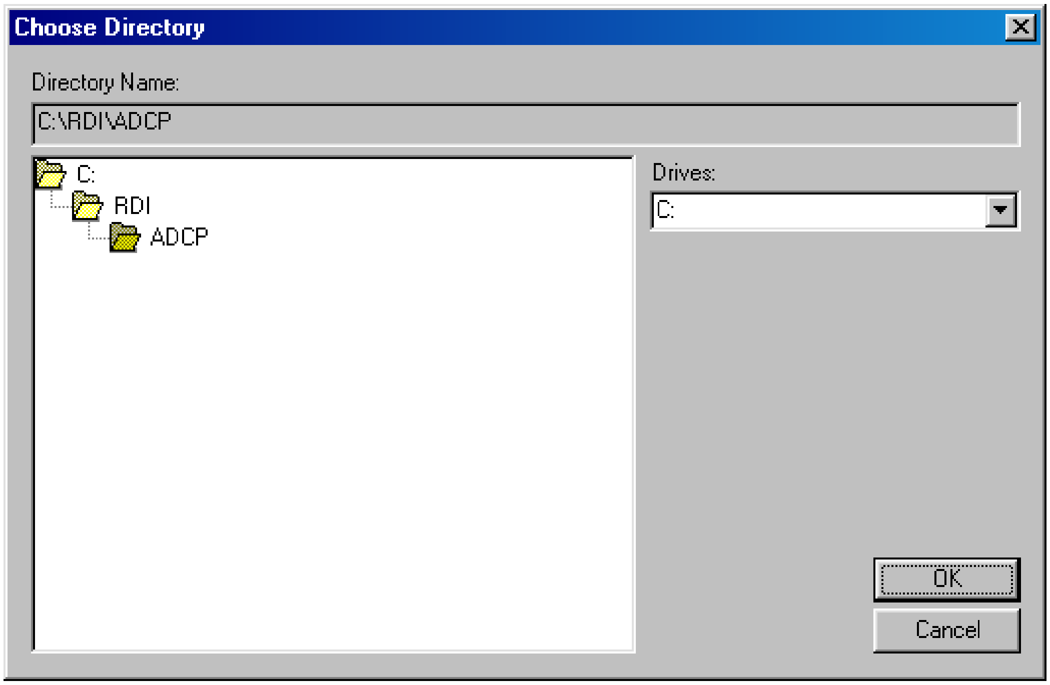


Figure 9. Choosing the Path

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).

4.2.5 Transforms Tab

Use this screen to select the **Transform Type**, **Sensor Configuration**, **Orientation**, **Heading Source**, **Tilt Source**, **Beam Angle**, **Heading Correction**, and **Velocity Scaling**.

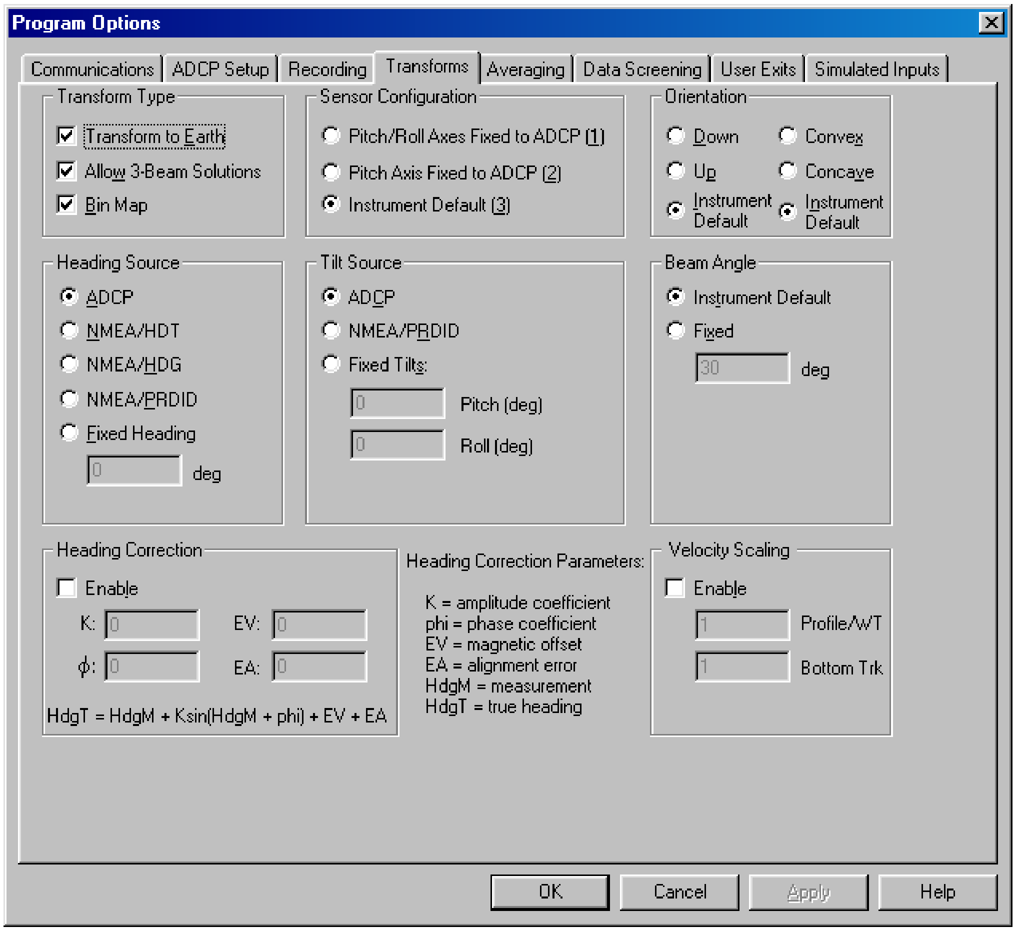


Figure 10. Transforms Tab

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 ENX, STA, and LTA 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 **Instrument Default** to have the software get the ADCP nominal transducer beam angle from the ADCP leader data. Select **Fixed** 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.

Use the **Velocity Scaling** box if you need to correct velocity data that was collected using the incorrect speed of sound, salinity, or temperature.

For example, the user collects data using the factory default salinity for his ADCP. Later, the user notices that this salinity value is wrong, causing an error in the velocities. Calculate a scale factor (in this case, the same for profile and Bottom Track data), and open *VmDas* in the Reprocess mode (see "Reprocessing Data with VmDas," page 49). Enter the scale factor, and click **OK** to save the options. Click **Control**, **Go** to reprocess the data.

VmDas opens a reprocessing document with the selected data, opens the options dialog, validates and saves the new options, and reprocesses the data to new files, multiplying the velocities and error velocity thresholds in all new files by the scale factor.

> **Suggested Setting.**
>
> Enable all selections in the **Transform Type**.
>
> Set the **Sensor Configuration**, **Orientation,** and **Beam Angle** to **Instrument Default**.
>
> The **Heading Source** and **Tilt Source** should be set to **ADCP.**
>
> Set the **Heading Correction** to your input.
>
> The **Velocity Scaling** should be disabled.

4.2.6 Averaging Tab

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

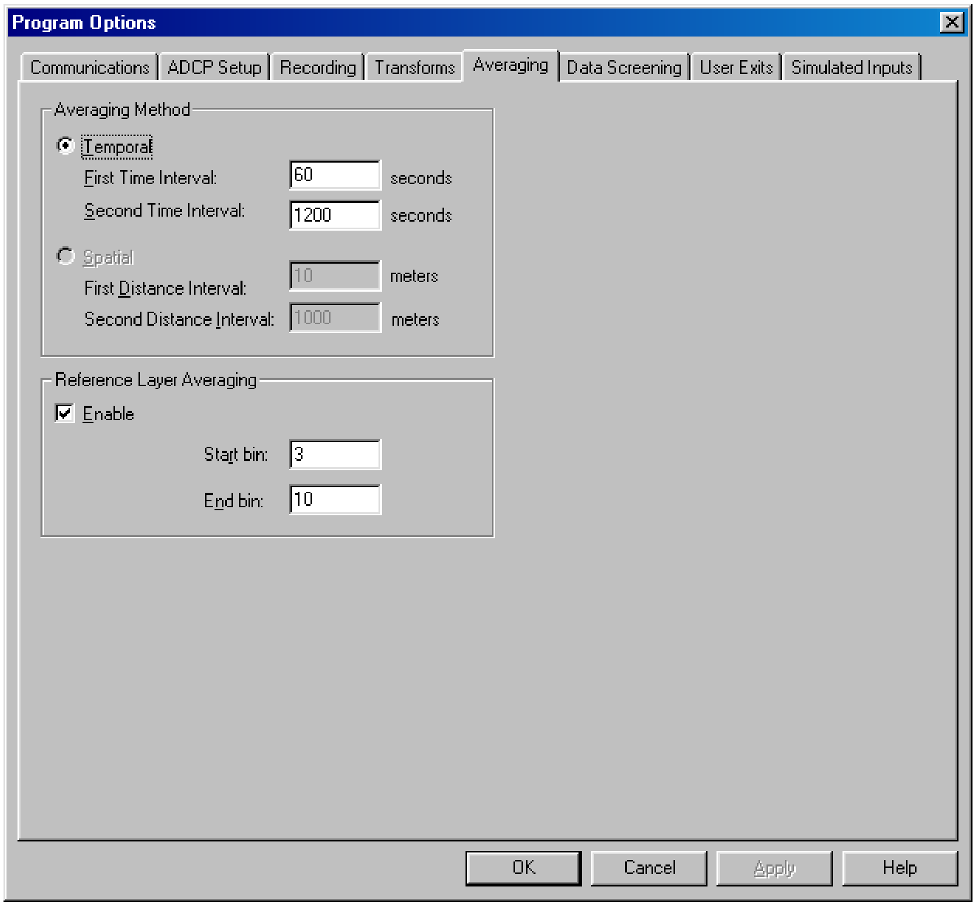


Figure 11. Averaging Tab

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. Using a Reference Layer helps removes biases caused from accelerations on platforms or ships. To set up a Reference Layer, you must set the **Start Bin** and the **End Bin** to be used as the “meaning” reference layer.

Noise, introduced by platform accelerations, can overwhelm the velocity measurements. We have found keeping track of velocities relative to a stable reference layer can improve the data in such Cases. As an example, suppose we have a four-ping ensemble. Because signal amplitude falls off with distance, the deeper bins will have more of the data flagged as bad. Bad data are not included in averages. As a result, the average profile might be erratic when the percent good is low. In the data below, a constant profile is assumed for bins 20 to 22, yet the average of good data shows it to be sheared.

	Ping #				
	1	2	3	4	
Bin	**Velocities**				**AVG #1**
1	5	6	18	19	12
2	3	4	16	17	10
↓	↓	↓	↓	↓	↓
20	bad	bad	bad	16	16
21	2	bad	bad	bad	2
22	bad	bad	15	bad	15

Bins 1 and 2 have all good data; and in this example, are used as the reference layer. Averaging these bins for each ping gives a reference velocity of:

```
       Ping #:              1    2     3     4
Layer Average:              4    5    17    18
Mean Layer Average = 11 : (4 + 5 + 17 + 18) / 4
```

When the layer average is subtracted from the velocities within each ping the data become:

Bin	**Velocities**				**Average #1**	**Average #2**
1	1	1	1	1	1	12
2	-1	-1	-1	-1	-1	10
↓	↓	↓	↓	↓	↓	↓
20	bad	bad	bad	-2	-2	9
21	-2	bad	bad	bad	-2	9
22	bad	bad	-2	bad	-2	9

The last column, Average #2, gives a better picture of the velocities at the deeper bins than the algorithm for obtaining Average #1.

NOTE. When using a reference layer, use bins in the upper part of the profile and bins that have a high percent good (more than 85%). If you select a bad bin range, the averages will be wrong and data will be bad.

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.

4.2.7 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.

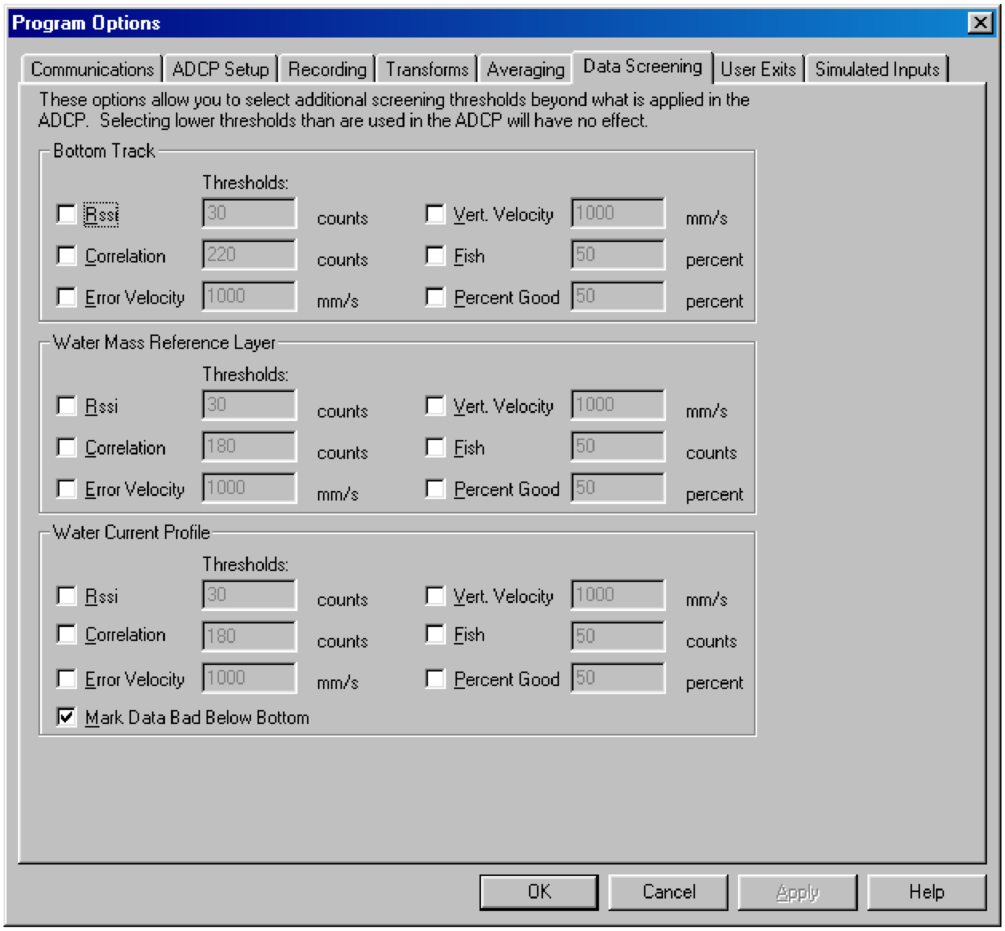


Figure 12. Data Screening Tab

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 two beams have 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)) + (BinLength).

NOTE. The ADCP has its own internal thresholds. Setting thresholds on this page that is lower than those used by the ADCP will have no effect.

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. *VmDas* is designed to do those checks. It 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 during real-time or when reprocessing. 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.* For real-time data collection, we recommend you only enable **Mark Bad Below Bottom**. You can reprocess data later and change the settings in this screen to see what the effect is.

4.2.8 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.

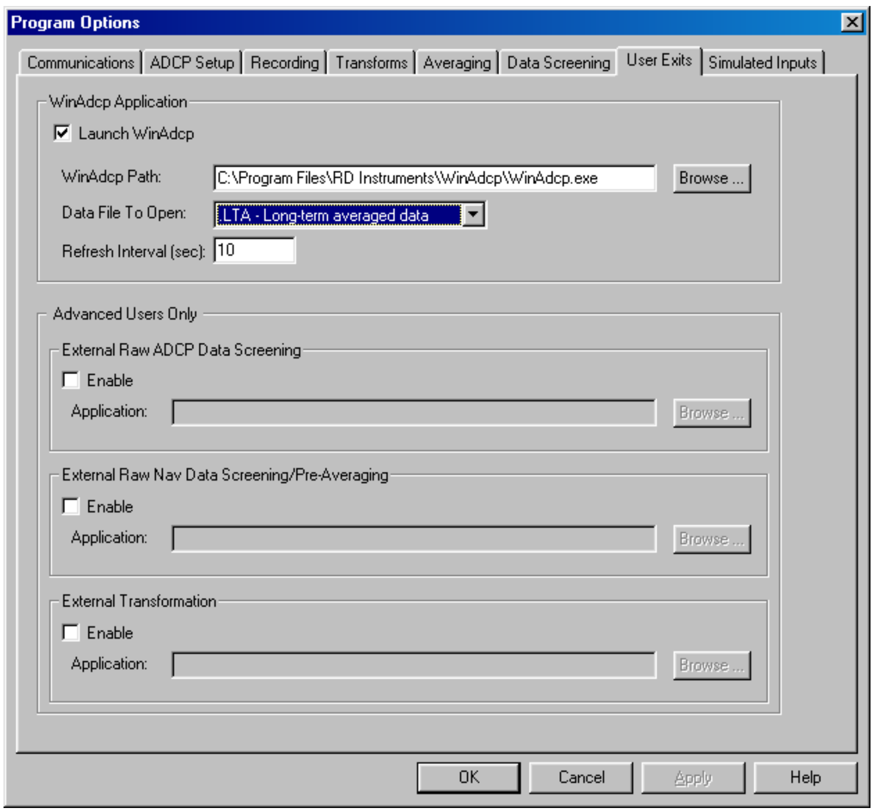


Figure 13. Users Exits Tab

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 67 and Figure 16, page 72) 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 67 and Figure 16, page 72) to give an external user-supplied program access to the raw NMEA data. Normally the *VmDas* NMEA data screening logic reads data from the .N1R/N2R 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 .N1R/N2R files, and write the modified data to a .N1J or N2J text file with the same NMEA format. The *VmDas* NMEA data screening and averaging functions will then read the NMEA data from the .N1J (or N2J) file instead of the .N1R (or N2R) 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.**

4.2.9 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.

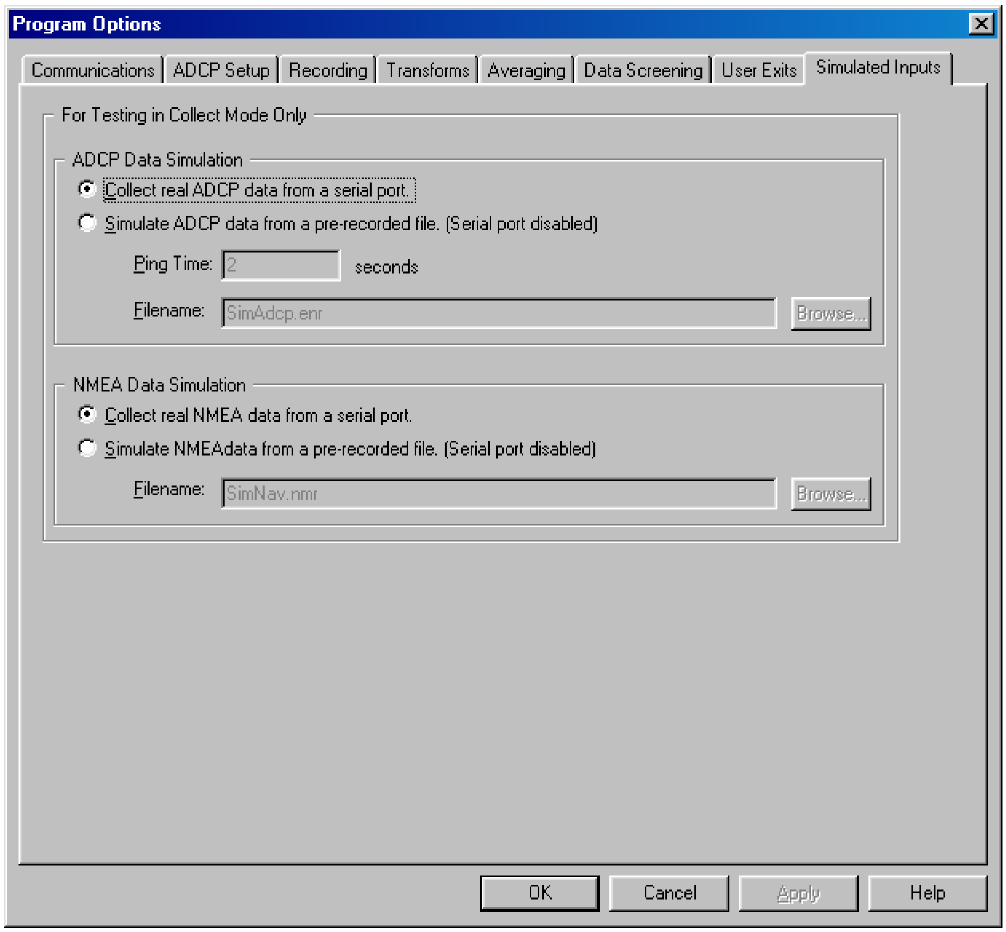


Figure 14. Simulated Inputs Tab

4.3 Command Files

This page shows the direct ADCP commands that correspond to the fields set in the **ADCP Setup Options**, on the **ADCP Setup** tab. You can refer to the ADCP Technical Manual for more information on these direct ADCP commands. See "VmDas ADCP Initialization," page 42 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. Use the **ADCP Setup** tab to set the ADCP commands. Select either **Use Options** to set the ADCP commands on this tab or select **Use File** to use a command file (see "Load a Command File," page 8).

Ensemble Time must always be set on this tab.

NOTE. The default command files have comments that explain the function of each command. 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, NP1, BP1) **beam** data (EX00000). See "*VmDas* ADCP Initialization," page 42 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, 16 meter blanking distance, 390 mm/s ambiguity vel
NP0
WP00001
WS2400
WF1600
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

; Two seconds between bottom and water pings
TP000200

; Four 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
TE00000400

; 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. These files have been setup for shipboard use. They 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.

4.3.1 *VmDas* ADCP Initialization

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

4.3.2 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**), and Ocean Surveyor (**OS**). If *VmDas* does not recognize the ADCP type but the data format is correct, it will display Unknown (**UN**).

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

4.3.3 Using the ADCP Setup Options

VmDas presents an easy interface for making some setup choices in the **ADCP Setup 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 control what data the ADCP collects and makes available.

NOTE. The options dialog does not completely control initialization.

4.3.4 Using a ADCP File Option

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.

4.3.5 Interactions

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

Use the **ADCP Setup** tab to setup the ADCP. Select either **Use Options** to set the ADCP commands on this tab or select **Use File** to use a command file (see "Load a Command File," page 8). **Ensemble Time** must always be set on this tab.

> **NOTE.** If a command is not sent to the ADCP through either the **Use Options** or **Use File**, the setting the ADCP had on wakeup are used.

4.3.6 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.

4.3.7 Commands and How They are Generated

The **ADCP Setup Options** 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.

If the **ADCP File Option** generates 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 or in the case of the Ocean Surveyor, a NP1 command may be used. 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 continue initialization.

The commands that can be generated by each check box in the **ADCP Setup Options** 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 27).

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 Narrow Bandwidth Profiling 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 27).

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 Broad Bandwidth Profiling 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 narrow Bandwidth Profiling 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 27).

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 Options** 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 27).

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.

4.3.8 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 the 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.

4.3.9 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.

<u>Bottom track</u>

- 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 Bandwidth	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 Ensemble	OS
WP1	Pings per Ensemble	BB,WH
WM1	WT Profiling Mode	BB,WH
WB1	Mode 1 WT Bandwidth	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 are constructed and 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.

4.4 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 73).

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

d. Click the **Recording** tab (see "Recording Tab," page 29).

- 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 31).

- 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 33).

- 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**.

4.5 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**.

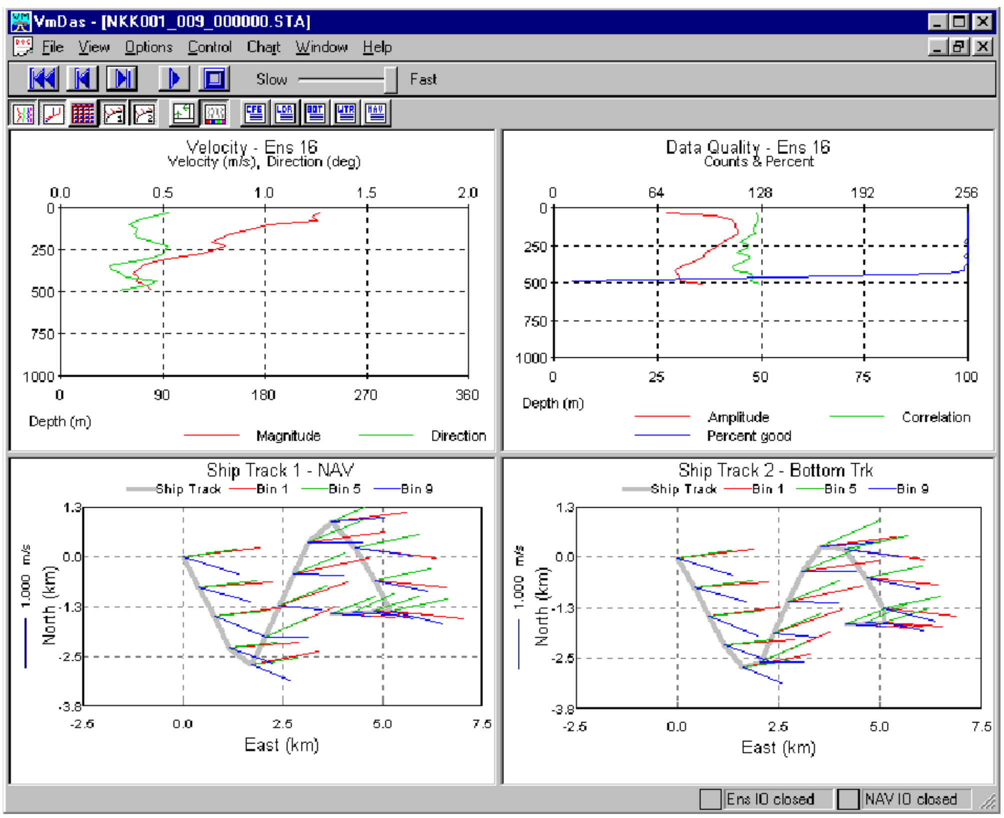


Figure 15. Playing Back a Data File

5 *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), VDDBT (depth), VDHDT (Heading True), and VDZDA (UTC Time and Date).

5.1 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>]	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 field>]	Data fields may be null (contain no characters). The comma delimiter is required even when a data field is null.
[“*”checksum field]	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 in Table 4.

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 53.

5.2 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.

5.2.1 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 3 = GPS PPS Mode, fix valid 4 = Real Time Kinematic. System used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers 6 = Estimated (dead reckoning) mode 7 = Manual Input Mode 8 = Simulator mode This shall not be a null field.
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*.

5.2.2 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.

5.2.3 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*.

5.2.4 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,a*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
9	a	Mode indicator A=Autonomous mode D=Differential mode E=Estimated (dead reckoning) mode M=Manual input mode S=Simulator mode N=Data not valid This shall not be a null field.

* This field is used by *VmDas*.

5.2.5 $PRDID

RDI defines a proprietary NMEA message that contains ship 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*.

5.2.6 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. The Navigation port logs to a file with an N1R extension. The RPH port uses an N2R extension. The ports are not interchangeable. *VmDas* expects certain data at each one. Any unexpected NMEA messages will be logged, but not processed further.

If only one port is enabled, it must be the Navigation port. When used alone, this port will process any GGA, HDG, HDT, VTG, and PRDID messages it receives.

If two ports are enabled, *VmDas* expects GPS data (GGA, VTG) at the Navigation port, and attitude data (HDG, HDT, PRDID) at the RPH port.

VmDas internally generates PADCP messages and adds them to both log files. These messages are expected to have meaning only to *VmDas*.

5.3 NMEA Output

5.3.1 $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

5.3.2 $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

5.3.3 $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.

5.3.4 $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.

5.3.5 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.

5.4 Internal NMEA Messages

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

5.4.1 $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.

5.5 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		

6 *VmDas* Outputs

VmDas can output Ensemble, Speed Log, and ASCII data out the serial port or through an Ethernet port.

6.1 Output Ensemble Data

Long term averaged ensemble data is output in the RDI standard binary ensemble (PD0) output format.

a. On the **File** menu, click **Collect Data**.

b. On the **Options** menu, click **Edit Data Options**. If you have created a User Option File, click **Load**.

c. On the **Communications** tab, select the **Long Term Avg Data Output** button.

d. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

e. To output the data to a network port, click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will be the server, and the local machine's IP address will be used automatically. After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

6.2 Output Speed Log Data

Speed log data output consists of the NMEA VBW and DBT messages, and is calculated from the short-term averaged data. Use the following procedure to enable speed log data output.

NOTE. Speed log data is not stored to a disk file. It is only sent to a serial port and/or an Ethernet port.

a. On the **File** menu, click **Collect Data**.

b. If you have created a User Option File, on the **Options** menu, click **Load**. Choose your file and click **OK**.

c. On the **Options** menu, click **Edit Data Options**.

d. On the **Communications** tab, select the **Speed Log Output** button. In the **Select Item to Set** box, choose **Speed Log Output**.

e. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section. Make sure the **On** box is checked.

f. To output the data to a network port, first choose an IP port number. *VmDas* uses 5434 by default, which should be fine for most users. Remote clients will need to know the IP port number and the IP address of the computer running *VmDas* to receive data.

   Click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will use the local machine's IP address automatically. Click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section. Make sure the **On** box is checked.

   After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

Tips for Advanced Users

Advanced users can get more control over the Speed Log data by using the following tips.

Speed Log data will only be output if the serial and/or Ethernet port(s) are configured for that purpose.

- If a port is configured for speed log output, speed log output will be produced. If there is no data or the data is invalid, the NMEA messages will indicate that they contain invalid data.

The data will only be received if something is listening to the port(s). This requires a cable and usually a second computer.

- One device may listen to a serial port. When sending speed log data out an Ethernet port, *VmDas* is a TCP/IP server and supports up to 100 clients.

Speed log data is calculated from ensembles in the short-term averaged data. There will be one VBW and one DBT message for each short-term average ensemble.

- To control the time between messages, on the **Options** menu, click **Edit Data Options**, choose the **Averaging** tab, and change the **First Time Interval**.

The speed log will contain valid data only if the ADCP is configured to produce the data. The data comes from the bottom track field in the short-term average data.

- The VBW message will contain water speed data only if the ADCP has been configured to produce water reference layer data. The BK and BL commands are useful here.

- The VBW message will contain bottom speed data only if the ADCP has been configured to produce bottom velocity data. The BP command is useful here.
- The DBT message will contain depth data only if the ADCP has been configured to produce bottom track range data. This data is present whenever bottom track data is being produced, and the bottom is in range. The BP and BX commands are useful here.
- The Options on the ADCP Setup tab can override the BP and BX commands in a command file. To use the ADCP defaults for these commands or to set them from a command file, the Set BT On/Off box must be unchecked.

6.3 Output ASCII Ensemble Data

ASCII-out files contain a fixed format of text. You can then use these files in other programs (spreadsheets, databases, and word processors).

a. On the **File** menu, click **Collect Data**.

b. On the **Options** menu, click **Edit Data Options**. If you have created a User Option File, click **Load**.

c. On the **Communications** tab, select the **Ensemble Output (ASCII)** button.

d. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

e. To output the data to a network port, click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will be the server, and the local machine's IP address will be used automatically. After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

f. In the **Set Ensemble Output Configuration Here** section, check the box for each type of data within the ensemble that you want output. In the **Data Select** box, select the desired data source. In the **Velocity Ref** box, select the desired reference velocity to be applied to the profile data. In the **Output** column, select the desired depth cell range to output by setting the **Start Bin** and **End Bin**. If **Mean** is selected as the velocity reference, then in the **Mean** column, select the desired depth cell range to use as the reference velocity by setting the **Start Bin** and **End Bin**.

6.3.1 ASCII Ensemble Output Format

This section explains the format of the data sent from the ADCP to the ensemble-out serial device after each ADCP ensemble. Sending ensemble-out data is an option in the **Options**, **Program Options**, **Communications Setup** menu. You set the communications protocol and select the data to send to the ensemble-out device through the **Communication** options. Ensemble-out data are in ASCII with fixed field lengths.

The transmission of ensemble-out data occurs after *VmDas* finishes recording ADCP data after each ADCP ensemble. The next section shows a sample ensemble-out data transmission. The first byte in the ensemble-out data stream is a START OF TEXT (^B) byte. This byte is also known as STX, ASCII character 2, or Control-B (^B). *VmDas* always sends the STX byte when data transmission begins. After the STX byte, *VmDas* sends a 2-byte flag that represents the data type that will be sent next. See "Ensemble-Out Data Format Description," page 63 for an explanation of all the flags and associated fields used in the ensemble-out data stream.

6.3.2 Sample Ensemble-Out Data Transmission

```
^B 0      96 91 10  2  9 54 30<CR/LF>
 1   4   4   1   4     0     0     0     0<CR/LF>
      6   -1375     -38      33<CR/LF>
    -23   -1453      -2      -3<CR/LF>
     85   -1465     -44     -52<CR/LF>
     49   -1464     -76      30<CR/LF>
 2   4 4   1   4<CR/LF>
    128     119     133     142<CR/LF>
    129     103     120     110<CR/LF>
    117     133     141     142<CR/LF>

    134     141     134     127<CR/LF>
 3   4 4   1   4<CR/LF>
    167     155     159     168<CR/LF>
    162     151     149     161<CR/LF>
    154     145     137     154<CR/LF>
    146     138     130     152<CR/LF>
 4   4 4   1   4<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>

 5   4 4   1   4<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 6  0  0  0  10  100  25  25  2  0  0  0  0  5000  25  0  0  0  2500  0  0  0  35  1480<CR/LF>
 7  2  4<CR/LF>
    -33   -1414     -62  -32768<CR/LF>
    833     878       0     783<CR/LF>
 8  13856000 -324937000    634   4786    425    470<CR/LF>

^C^B 0      97 91 10  2  9 55 00<CR/LF>
 1   4   4   1   4     0     0     0     0<CR/LF>
      7   -1373     -40      29<CR/LF>
    -19   -1456      -1      -4<CR/LF>
     89   -1462     -46     -51<CR/LF>
     48   -1466     -73      34<CR/LF>
 2   4 4   1   4<CR/LF>
    121     123     130     139<CR/LF>
    127     100     122     114<CR/LF>
    130     135     140     141<CR/LF>

    130     140     138     129<CR/LF>
 3   4 4   1   4<CR/LF>
    167     156     153     166<CR/LF>
    163     155     147     162<CR/LF>
    156     143     138     153<CR/LF>
    147     140     132     151<CR/LF>
```

```
4   4 4   1   4<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>
    100     100     100     100<CR/LF>

5   4 4   1   4<CR/LF>
-32678 -32678 -32678 -32678<CR/LF>
-32678 -32678 -32678 -32678<CR/LF>
-32678 -32678 -32678 -32678<CR/LF>
-32678 -32678 -32678 -32678<CR/LF>
6  0  0  0  10  100  25  25  2  0  0  0  0  5000  25  0  0  0  2500  0  0  0  35  1480<CR/LF>
7  2  4<CR/LF>
    -31   -1420     -58    -768<CR/LF>
    840     862     845     850<CR/LF>
8  13857000 -324938000    634   4787    426    471<CR/LF>

^C
```

6.3.3 Ensemble-Out Data Format Description

Each ASCII ensemble-out data stream begins with a **Start Of Text** code <^B> and ends with an **End Of Text** code <^C>. *VmDas* identifies each data type with an integer flag. At least one space separates the fields within each data type. Each line of data ends with a carriage return <CR> and line feed <LF> sequence.

Table 15: Ensemble-Out Data Format

Flag	Field	Description
0	1	Flag 0 identifies the ensemble number just processed by the ADCP and the date/time that data collection for the ensemble began. The fields identified by this flag contain:
	2	The ensemble number just processed by the ADCP.
	3	The year data collection began for this ensemble.
	4	The month data collection began for this ensemble.
	5	The day data collection began for this ensemble.
	6	The hour data collection began for this ensemble.
	7	The minute data collection began for this ensemble.
	8	The second data collection began for this ensemble.
1	1	Flag 1 marks the start of velocity data. *VmDas* scales the water current velocity data in millimeters per second (mm/s). A value of -32768 indicates bad or missing data. *VmDas* lists water profile velocity data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	The east(+)/west(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	7	The north(+)/south(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).

Continued Next Page

Table 15: Ensemble-Out Data Format (continued)

Flag	Field	Description
	8	The up(+)/down(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	9	The error velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	10	Column data for the east(+)/west(-) water-current velocities for the bin range selected in the Communication options.
	11	Column data for the north(+)/south(-) water-current velocities for the bin range selected in the Communication options.
	12	Column data for the up(+)/down(-) water-current velocities for the bin range selected in the Communication options.
	13	Column data for the error velocities for the bin range selected in the Communication options.
2	1	Flag 2 marks the start of correlation magnitude data. A value of -32768 indicates missing data. *VmDas* lists correlation data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 correlation data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 correlation data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 correlation data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 correlation data for the bin range selected in the Communication options.
3	1	Flag 3 marks the start of echo intensity data. *VmDas* scales echo intensity data in ADCP counts. A value of -32768 indicates missing data. *VmDas* lists echo intensity data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 echo intensity data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 echo intensity data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 echo intensity data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 echo intensity data for the bin range selected in the Communication options.

Table 15: Ensemble-Out Data Format (continued)

Flag	Field	Description
4	1	Flag 4 marks the start of percent-good data. *VmDas* scales percent-good data in percentage points (0-99). A value of -32768 indicates bad or missing data. *VmDas* lists percent-good data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 percent-good data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 percent-good data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 percent-good data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 percent-good data for the bin range selected in the Communication options.
5	1	Flag 5 marks the start of status data. See *VmDas* STA and LTA Output Data Format for information on how status data are scaled. A value of -32768 indicates bad or missing data. *VmDas* lists status data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 status data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 status data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 status data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 status data for the bin range selected in the Communication options.
6	1	Flag 6 marks the start of leader data. The fields identified by this flag contain:
	2	The minutes portion of the time between pings as set by the TP-command.
	3	The seconds portion of the time between pings as set by the TP-command.
	4	The hundredths of seconds portion of the time between pings as set by the TP-command.
	5	The number of pings per ensemble as set by the WP-command.
	6	The number of depth cells (bins) as set by the WN-command.
	7	The depth cell (bin) length in centimeters as set by the WS-command.
	8	The blank after transmit in centimeters as set by the WF-command.

Table 15: Ensemble-Out Data Format (continued)

Flag	Field	Description
	9	The ADCP profiling mode as set by the WM-command.
	10	The Built-In Test result code from the last ADCP ensemble.
	11	The sensor source as set by the EZ-command.
	12	The available sensors as read by the PS1-command.
	13	The low correlation threshold as set by the WC-command.
	14	The error velocity threshold in mm/s as set by the WE-command.
	15	The percent-good minimum as set by the WG-command.
	16	The average ADCP pitch (tilt 1, x-axis) angle in hundredths of degrees (e.g., -70 = -0.7°) during the ADCP data ensemble. This value comes from the internal pendulums or external gyrocompass.
	17	The average ADCP roll (tilt 2, y-axis) angle in hundredths of degrees (e.g., 430 = 4.3°) during the ADCP data ensemble. This value comes from the internal pendulums or external gyrocompass.
	18	The average ADCP heading angle in hundredths of degrees (e.g., 7707 = 77.07°) during the ADCP data ensemble. This value comes from the internal flux-gate compass or external gyrocompass.
	19	The average water temperature in hundredths of degrees C (e.g., 1711 = 17.11°C) at the transducer head during the ADCP data ensemble.
	20	The standard deviation (accuracy) of heading data in degrees during the ADCP data ensemble from the compass.
	21	The standard deviation (accuracy) of pitch (tilt 1, x-axis) data in tenths of degrees (e.g., 15 = 1.5°) during the ADCP data ensemble from the pendulum/gyrocompass.
	22	The standard deviation (accuracy) of roll (tilt 2, y-axis) data in tenths of degrees (e.g., 5 = 0.5°) during the ADCP data ensemble from the pendulum/gyrocompass.
	23	The salinity value in parts per thousand from the ADCP (ES or EZ-command).
	24	The speed of sound value in m/s from the ADCP (EC or EZ-command).
7	1	Flag 7 marks the start of bottom-track data. A value of -32768 indicates bad or missing velocity data. A zero indicates bad or missing beam range data. The fields identified by this flag contain:
	2	The number of lines of bottom-track data sent. This value corresponds to the number of ROWS of data beginning with the next output line.
	3	The number of beams used by the ADCP to collect the bottom-track data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The east(+)/west(-) bottom-track velocity in mm/s.
	5	The north(+)/south(-) bottom-track velocity in mm/s.
	6	The up(+)/down(-) bottom-track velocity in mm/s.
	7	The bottom-track error velocity in mm/s.
	8	The Beam #1 range in meters to the bottom/surface, excluding ADCP depth.
	9	The Beam #2 range in meters to the bottom/surface, excluding ADCP depth.
	10	The Beam #3 range in meters to the bottom/surface, excluding ADCP depth.
	11	The Beam #4 range in meters to the bottom/surface, excluding ADCP depth.

Table 15: Ensemble-Out Data Format (continued)

Flag	Field	Description
8	1	Flag 8 marks the start of external navigation data collected by *VmDas*. A value of 2147483647 indicates bad or missing latitude/longitude data. A value of -32768 indicates bad or missing data for all other fields. The fields identified by this flag contain:
	2	Navigation device latitude in thousandths of seconds.
	3	Navigation device longitude in thousandths of seconds (-324937000 = W90°15'37").
	4	Navigation device speed in mm/s.
	5	Navigation device course in hundredths of degrees (4786 = 47.86°).
	6	The east(+)/west(-) navigation device velocity in mm/s.
	7	The north(+)/south(-) navigation device velocity in mm/s.

7 *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 and *.N2R 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*.

7.1 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.
- Read 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 on a PC running the Microsoft Windows® operating system.

7.2 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 and compare that heading data to the heading in the NMEA data file *.N1R (or *.N2R). 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.

7.3 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 (and if collected *.N2R) file except they rename the file *.N1J (and if N2R is collected the file *.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

7.4 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 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

7.5 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.

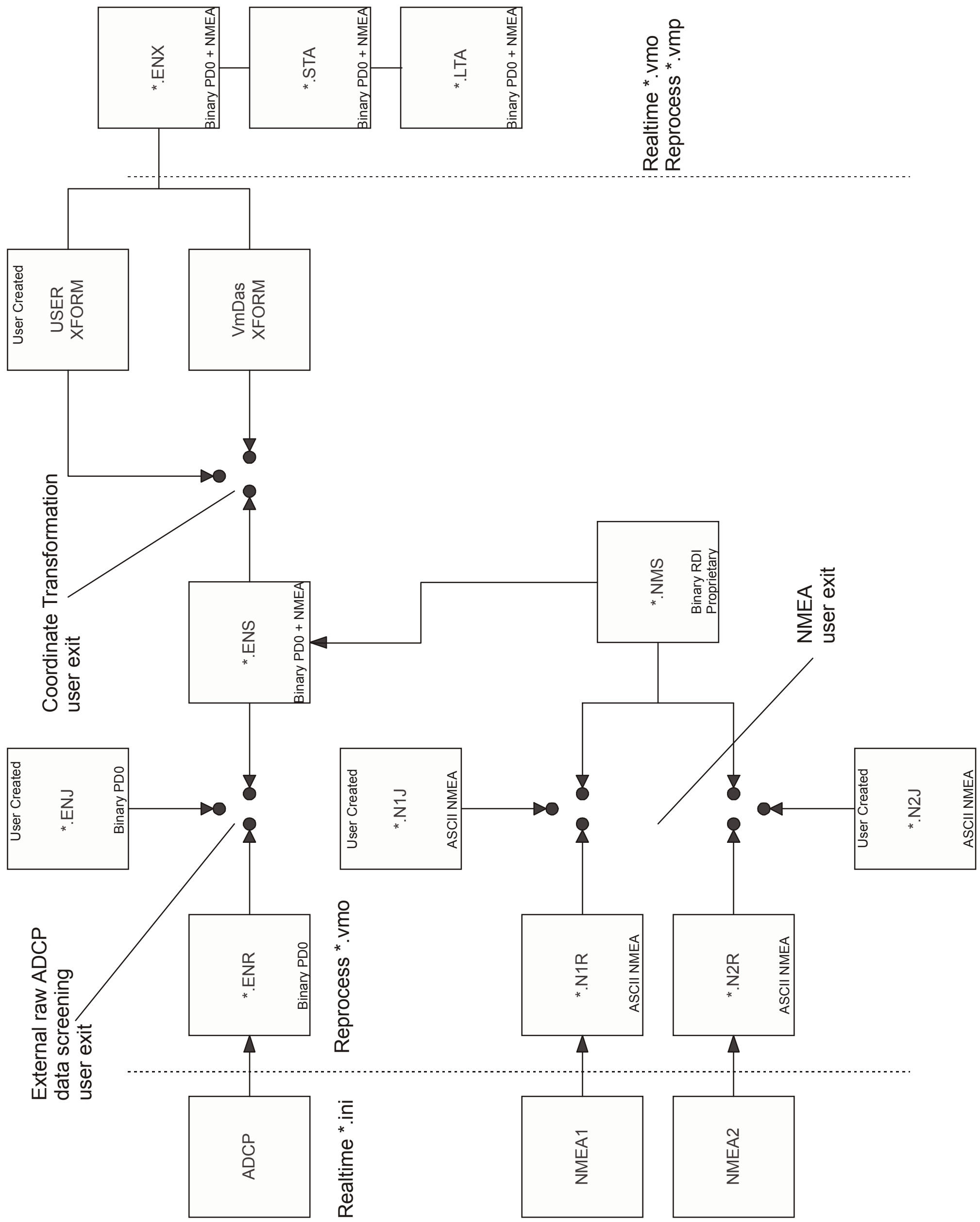


Figure 16. User Exits

8 File Naming Conventions

Data files produced by *VmDas* during **data collect** mode have 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 (see your ADCP Technical Manual for the output data format).
.LTA	ADCP (plus Navigation Data (see "Binary Navigation Data Format," page 75)) data that has been averaged using the long time period specified in the **Options**, **Edit Data Options**, **Averaging** tab.
.STA	ADCP (plus Navigation Data (see "Binary Navigation Data Format," page 75)) 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 Navigation Data (see "Binary Navigation Data Format," page 75) records merged into the ensembles from the .NMS file.
.ENX	ADCP single-ping data (plus Navigation Data (see "Binary Navigation Data Format," page 75) 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.
.LOG	ASCII file containing any errors found in NEA, ASCII Ensemble Output, or ADCP communications.

9 ADCP Output Data Format and *VMDAS*

This section shows the format of the *VmDas* Navigation data when using an ADCP. This output can only be binary.

The ADCP binary output data buffer contains header data, leader data, velocity, correlation magnitude, echo intensity, percent good, and a checksum. The ADCP collects all data in the output buffer during an ensemble. The *VmDas* program writes this ADCP output into the *.ENR files. The *.ENR file format is described in the ADCP Technical Manual.

The Navigation data is inserted before the checksum (and reserved bytes) when *VmDas* saves the STA and LTA files. Figure 17 show the sequence in which the *VmDas* program creates the STA and LTA files that make up the binary output buffer. Figure 18, page 75 shows the format of the binary Navigation Data. Table 16, page 78 lists the format, bytes, fields, scaling factors, and a detailed description of every item in the binary navigation output buffer.

Always Output	**HEADER**
	FIXED LEADER DATA
	VARIABLE LEADER DATA
WD-command	**VELOCITY**
	CORRELATION MAGNITUDE
WP-command	**ECHO INTENSITY**
	PERCENT GOOD
BP-command	**BOTTOM TRACK DATA**
See "Binary Navigation Data Format," page 75	**NAVIGATION DATA** (78 BYTES)
Always Output	**RESERVED**
	CHECKSUM

Figure 17. ENS, ENX, STA and LTA Binary Output Data Format

NOTE. For a full description of the STA and LTA Binary Output Data Format (i.e. Header, Fixed Leader Data, etc.), see the *VmDas* help file and your ADCP Technical Manual.

9.1 Binary Navigation Data Format

Figure 18. Binary Navigation Data Format

BIT POSITIONS

BYTE	7	6	5	4	3	2	1	0	
1	NAVIGATION ID								LSB 00h
2									MSB 20h
3	UTC DAY								
4	UTC MONTH								
5	UTC YEAR								LSB
6									MSB
7	UTC TIME OF FIRST FIX								LSB
8									
9									
10									MSB
11	PC CLOCK OFFSET FROM UTC								LSB
12									
13									
14									MSB
15	FIRST LATITUDE								LSB
16									
17									
18									MSB
19	FIRST LONGITUDE								LSB
20									
21									
22									MSB
23	UTC TIME OF LAST FIX								LSB
24									
25									
26									MSB
27	LAST LATITUDE								LSB
28									MSB
29									LSB
30									MSB

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Byte	Field	
31	LAST LONGITUDE	LSB
32		MSB
33		LSB
34		MSB
35	AVG SPEED	LSB
36		MSB
37	AVG TRACK TRUE	LSB
38		MSB
39	AVG TRACK MAGNETIC	LSB
40		MSB
41	SPEED MADE GOOD	LSB
42		MSB
43	DIRECTION MADE GOOD	LSB
44		MSB
45	RESERVED	
46		
47	FLAGS	
48		
49	RESERVED	
50		
51	ADCP ENSEMBLE NUMBER	LSB
52		
53		
54		MSB
55	ADCP ENSEMBLE YEAR	LSB
56		MSB
57	ADCP ENSEMBLE DAY	
58	ADCP ENSEMBLE MONTH	
59	ADCP ENSEMBLE TIME	
60		
61		
62		
63	PITCH	LSB
64		MSB

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65	ROLL	LSB
66		MSB
67	HEADING	LSB
68		MSB
69	NUMBER OF SPEED AVG	LSB
70		MSB
71	NUMBER OF TRUE TRACK AVG	LSB
72		MSB
73	NUMBER OF MAG TRACK AVG	LSB
74		MSB
75	NUMBER OF HEADING AVG	LSB
76		MSB
77	NUMBER OF PITCH/ROLL AVG	LSB
78		MSB

See Table 11 for description of fields

NOTE. This data is output in this format only by the *VmDas* program in the STA and LTA data files.

9.2 Navigation Data Format – Detailed Explanation

These fields contain the Navigation Data. This data is only recorded in the STA and LTA files created by the RDI Windows software program *VmDas*. The LSB is always sent first. The ADCP Technical Manual has descriptions of commands used to set these values.

Table 16: Binary Navigation Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the sum of velocities identification word (20 00h).
5-6	3	UTC Day	This field contains the UTC Day.
7-8	4	UTC Month	This field contains the UTC Month.
9-12	5,6	UTC Year	This field contains the UTC Year, i.e. i.e. 07CF = 1999
13-20	7-10	UTC Time of first fix	UTC time since midnight; LSB = 0.01 seconds
21-28	11-14	PC Clock offset from UTC	PC Time – UTC (signed); LSB = milliseconds

29-36	15-18	First Latitude	This is the first latitude position received after the previous ADCP ping.
			
			LSB = approx. 8E-8 deg (32-bit BAM)
			
			In the BAM (Binary Angular Measure) format, the most significant bit of the word has a weight of 180 degrees, and you keep dividing by 2 as you proceed to the right. The lease significant bit for a 32-bit BAM is about 8E-8 arc degrees ($180/2^{31}$), or just under 1 cm of longitudinal distance at the equator, where 1 arc minute = 1 Nautical mile. If you interpret the BAM word as an unsigned number, the range is 0 to (360-LSB) degrees, and if you interpret the BAM as a signed number, the range is –180 to 180-LSB) degrees. The least significant bit for a 16-bit BAM is about 0.0055 degrees ($180/2^{15}$). Some 32-bit BAM examples are:
			
			UNSIGNED
			`0x40000000   90 degrees`
			`0x80000000  180 degrees`
			`0xC0000000  270 degrees`
			`0xFFFFFFFF  360 degrees minus one LSB degrees`
			SIGNED
			`0x40000000   90 degrees`
			`0x80000000  minus 180 degrees`
			`0xC0000000  minus 90 degrees`
			`0xFFFFFFFF  minus one LSB degrees`

37-44	19-22	First Longitude	This is the first longitude position received after the previous ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)
45-52	23-26	UTC Time of last fix	Time since midnight UTC; LSB = 1E-4 seconds
53-60	27-30	Last Latitude	This is the last latitude position received prior to the current ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)

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Table 16: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
61-68	31-34	Last Longitude	This is the last longitude position received prior to the current ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)
69-72	35,36	Avg Speed	Average Navigational Speed mm/sec (signed)
73-76	37,38	Avg Track True	Average True Navigational Ship Track Direction LSB = approx. 0.0055 deg (16-bit BAM)
77-80	39,40	Avg Track Magnetic	Average Magnetic Navigational Ship Track Direction LSB = approx. 0.0055 deg (16-bit BAM)
81-84	41,42	Speed Made Good (SMG)	Speed calculated between navigation positions. LSB = one mm/sec (signed) The Speed Made Good (SMG) and Direction Made Good (DMG) quantities are calculated from the navigation fixes that enter the system between ADCP outputs, and are calculated as follows: IF: aLat(i) = the average of the latitudes of the nav fixes in interval I aLon(i) = the average of the longitudes of the nav fixes in interval I Ta(i) = the average of the time of validity of the nav fixes in interval I dLat = the difference in average latitude between averaging intervals dLon = the difference in average longitude between averaging intervals VelMGn (i) = the velocity made good in the East direction for interval I VelMGn (i) = the velocity made good in the East direction for interval I LatToDist (dLat) is a function that converts delta Latitude to a distance LonToDist (dLon) is a function that converts delta Longitude to a distance Smg (i) = speed made good in interval i Dmg (i) = direction made good in interval i THEN: dLat = (aLat (I-1) – aLat (i)) dLon = (aLon (i-1) – aLon (i)) VelMgn (i) = LatToDist (dLat) / (Ta(i-1) – Ta(i)) VelMge (i) = LonToDist (dLon) / (Ta(i-1) – Ta(i)) Smg(i) = sqrt(VelMgn(i)^2 + VelMGe(i)^2) Dmg(i) = atan(VelMge(i) / VelMGn(i))
85-88	43,44	Direction Made Good (DMG)	Direction calculated between navigation positions. LSB-= approx. 0.0055 deg (16-bit BAM)
89-92	45,46	Reserved	Reserved for RDI use.

Table 16: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
93-96	47,48	Flags	Describes the validity of the data. Each bit has represents a separate flag and has its own meaning 1=true, 0=false. The flag bits are defined as follows: bit 0 = Data updated bit 1 = PSN Valid bit 2 = Speed Valid bit 3 = Mag Track Valid bit 4 = True Track Valid bit 5 = Date/Time Valid bit 6 = SMG/DMG Valid bit 7 = Pitch/Roll Valid bit 8 = Heading Valid bit 9 = ADCP Time Valid bit 10 = Clock Offset Valid bit 11 = Reserved bit 12 = Reserved bit 13 = Reserved bit 14 = Reserved bit 15 = Reserved
97-100	49,50	Reserved	Reserved for RDI use.
101-108	51-54	ADCP Ensemble Number	This field contains the sequential number of the ensemble to which the data in the output buffer apply. Scaling: LSD = 1 ensemble; Range = 1 to 4,294,967,296 ensembles
109-112	55,56	ADCP Ensemble Year	This field contains the ADCP year, i.e. 07CFH = 1999
113-114	57	ADCP Ensemble Day	This field contains the ADCP day.
115-116	58	ADCP Ensemble Day	This field contains the ADCP month.
117-124	59-62	ADCP Ensemble Time	Number of seconds since midnight; LSB=1E-4 seconds
125-128	63,64	Pitch	Pitch angle. LSB- = approx. 0.0055 deg (16-bit BAM) Pitch is positive when bow is higher than stern.
129-132	65,66	Roll	Roll angle. LSB- = approx. 0.0055 deg (16-bit BAM) Roll is positive when the port side is higher than the starboard side.
133-136	67,68	Heading	Heading input. LSB- = approx. 0.0055 deg (16-bit BAM)
137-140	69,70	Number of Speed Samples Averaged	The number of speed samples averaged since the previous ADCP ping.
141-144	71,72	Number of True Track Samples Avg	The number of True Track samples averaged since the previous ADCP ping.
145-148	73,74	Number of Magnetic Track Samples Avg	The number of Magnetic Track samples averaged since the previous ADCP ping.

Table 16: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
140-152	75,76	Number of Heading Samples Averaged	The number of Heading samples averaged since the previous ADCP ping.
153-156	77,78	Number of Pitch/Roll Samples Averaged	The number of Pitch/Roll samples averaged since the previous ADCP ping.

NOTES