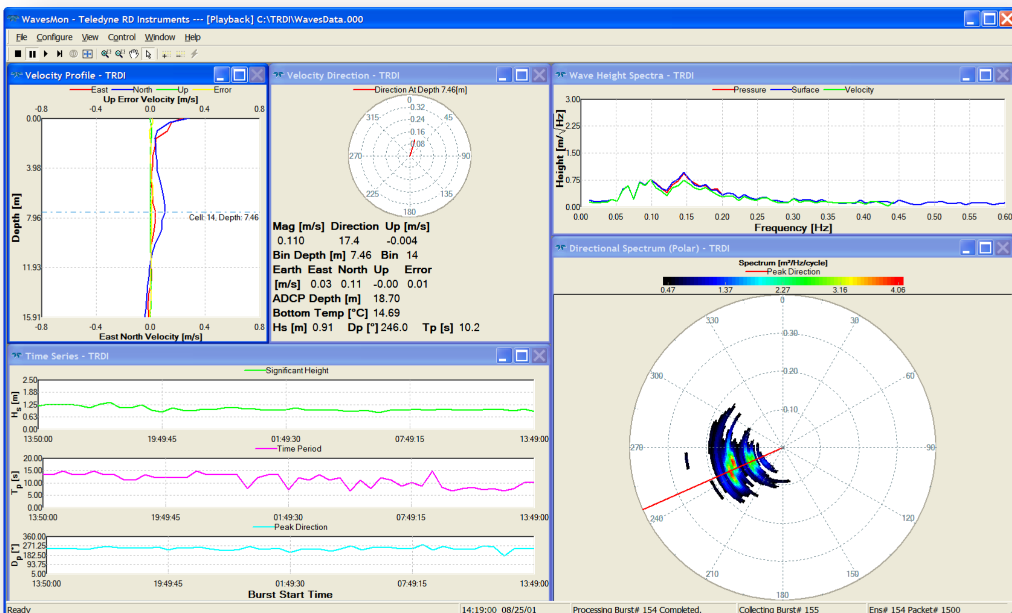
WavesMon v3.08

User's Guide



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Revision History

November 2011

- Updated Users Guide to version 3.08 software.
- Added Waves Parameters Log formats 12, 16, and 18.
- Corrected note on page 53. H_{mean} and T_{mean}, were repeated.
- Updated screen capture for Advanced Processing page. Frequency Bands default is now 64.
- Added how to output DSpec and Fourier Coefficients. See page 60.

May 2010

- Updated Users Guide to version 3.07 software.
- Added zero up-crossing parameters to log 9 format.

April 2009

- Updated Users Guide to version 3.06 software.

January 2009

- Updated Users Guide to version 3.05 software.

March 2008

- Updated Users Guide to version 3.04 software.
- Changed H_{Max} to $H_{1/10}$ in the Log Format Output.

December 2007

- Updated Users Guide to version 3.03 software.

June 2007

- Initial release

NOTES

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WavesMon User's Guide

1 Introduction

The *WavesMon* software is real-time waves-data collecting and processing software. *WavesMon* can collect real-time data for a four beam upward looking ADCP (Workhorse) as well as a narrow three beam horizontal ADCP with Waves enabled. *WavesMon* uses array processing and can distinguish waves from multiple directions at similar frequencies along with the current profiles.

WavesMon applications include:

- Coastal Protection and Engineering
- Port Design and Operation
- Environmental Monitoring
- Oil industry (oil platforms, LNG terminals, etc.)
- Shipping Safety

NOTE. This guide file covers WavesMon version 3.08. The latest version of our software can be downloaded through our Customer Support section on our web site (http://www.rdinstruments.com/support/support.aspx). You must register before you are able to download.

The technologies used in the horizontal wave measurement techniques are currently under patent protection (US patent # 7,768,874). TRDI will aggressively utilize its full rights under patent law to protect its interest in these technologies.

1.1 How to Contact Teledyne RD Instruments

If you have technical issues or questions involving a specific application or deployment with your instrument, contact our Field Service group:

Teledyne RD Instruments	Teledyne RD Instruments Europe
14020 Stowe Drive Poway, California 92064	2A Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude, France
Phone +1 (858) 842-2600	Phone +33(0) 492-110-930
FAX +1 (858) 842-2822	FAX +33(0) 492-110-931
Sales – rdisales@teledyne.com	Sales – rdie@teledyne.com
Field Service – rdifs@teledyne.com	Field Service – rdiefs@teledyne.com

Client Services Administration – rdicsadmin@teledyne.com

Web: http://www.rdinstruments.com

24 Hour Emergency Support +1 (858) 842-2700

1.2 Conventions Used in this Guide

Conventions used in the *WavesMon* User's Guide have been established to help you learn how to use these programs quickly and easily.

Windows menu items are printed in bold: **File** menu, **Import Mission**. Items that need to be typed by the user or keys to press will be shown as **<F1>**. If a key combination were joined with a plus sign (**<ALT+F>**), you would press and hold the first key while you press the second key. Words printed in italics include program names (*BBTalk*, *PlanADCP*) and file names (*dpl1_6.dpl*).

Code or sample files are printed using a fixed font. Here is an example:

```
WorkHorse Broadband ADCP Version 51.XX
TELEDYNE RD INSTRUMENTS (c) 1996-2010
ALL RIGHTS RESERVED
>
```

You will find three other visual aids that help you: Notes, Cautions and Recommended Settings.

NOTE. This paragraph format indicates additional information that may help to a void issues or things for considerations.

CAUTION. This paragraph format warns the reader of hazardous procedures (for example, activities that may cause loss of data or damage to the ADCP).

Recommended Setting. This paragraph format indicates additional information that may help you set command parameters.

1.3 System Requirements

The *WavesMon* software requires a Windows® compatible computer with the following specifications:

- Windows XP® or Windows 2000®
- Pentium III 400 MHz class PC (higher recommended)
- 2GB of RAM

CAUTION. Using less computer memory can cause the system to reset.

- 10 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 Ports are optional)
- Minimum display resolution of 1024 x 768, 256 color (higher recommended)
- CD-ROM Drive
- Mouse or other pointing device

1.4 WavesMon Requirements

WavesMon can only process raw data from an ADCP that meets the following criteria:

- The ADCP has to have the waves feature installed.
- The ADCP need 16.28 firmware or later and the horizontal ADCP 300k Hz narrow-beam needs 11.07 firmware or later.
- The ADCP has to have a pressure gauge installed.
- For ADCP deployed as Self-Contained units, the system needs sufficient memory and batteries. Use the *PlanADCP* software to plan wave-deployments.

1.5 Software Installation

To install *WavesMon*, 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 Software Overview

- *WavesMon* is a software package used to set up real-time applications as well as post processing data from a self-contained ADCP.
- By default *WavesMon* does array processing on ADCP data, but it can also do UVW processing by selecting Moored (Dynamic) Mounting.
- *WavesMon* can also process waves-data from a 3-beam 10-inch 300k Hz horizontal ADCP.
- *WavesMon* can process packet data as well as continuous profile data (ensembles data).
- *WavesMon* will output data to several files (see WavesMon Output Data Formats). It will output all the current-profile data to one file (*.PD0), all the wave-process data to one binary file (*.*wvs*) which can read by *WavesView*, several text output formats, PNG files, and to a binary file for DHI's *Mikeo* modeling software.

> **NOTE.** For step-by-step instructions on how to use *WavesMon*, see the Waves Quick Start Guide.

2.1 Create a Project File

WavesMon is setup to collect or process data using the **Project Wizard**. The **Project Wizard** gives the user the ability to setup the ADCP quickly by only entering the critical ADCP environment data and allowing the *WavesMon* program to set the other parameters, or the user can select to use the **Advanced Configuration** options. Once setup, the project can be saved and then later retrieved.

The idea behind the projects is to keep track of how data is processed. That means that once a project has been used to process data, it will be locked and cannot be changed. To change processing parameters, duplicate the project, make the changes, and then re-process the data (see Reprocessing Raw ADCP Data and Editing Projects).

2.1.1 Save Projects

Use the Project Wizard to setup *WavesMon* for either Realtime data collection (see Collecting Real-Time Data with WavesMon) or Reprocessing data (see Reprocessing Raw ADCP Data). Once the Project Wizard is completed, on the **File** menu, select **Save Project**. Enter the **File name** and select **Save**. *WavesMon* will automatically add the file extension **.prj*.

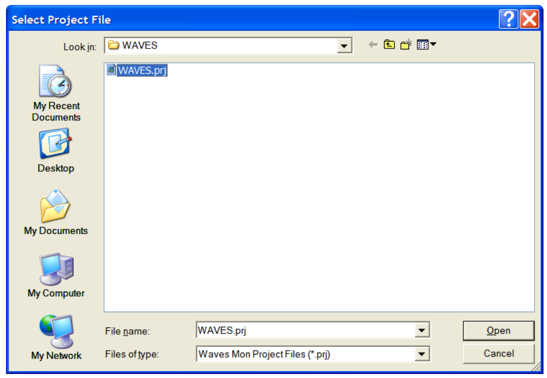


Figure 1. Saving a Project File

2.1.2 Open Projects

To open a project file, on the **File** menu, select **Open Project**. On the **Select Project File** dialog, select the project file and click **Open**.

Projects can contain multiple data files. To open a data file, use the **File** menu and select **Open Project Data Files**. Select the data file to open and click **Open**.

2.1.3 Project Management

The "heart" of *Waves* is the project file (**.prj*). A project file is created by running the **Project Wizard** (see Collecting Real-Time Data with WavesMon) or Reprocessing data (see Reprocessing Raw ADCP Data).

To open the **Project Management Window**, on the **View** menu, select **Project Management**. The **Project Management Window** gives the user a quick and easy way to manage the files. It uses a tree structure; click the + box to expand the list or – to collapse. Right clicking on a node will bring up menus to quickly access different functions.

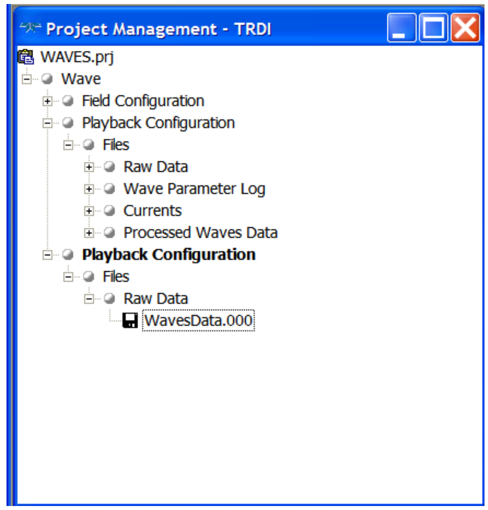


Figure 2. Project Management Window (Right-Click Menu)

To review the settings on the wizard screens, use the **Configure** menu and select **Properties**. Select either **Playback Configuration** or **Real-time Configuration**. This will allow you to review each screen setup during the wizard. Click **OK** to exit the screen.

Right-clicking on the **Field** or **Playback Configuration** node and selecting **Properties** will do the same thing as using the **Configure** menu.

NOTE. Stop data collection or playback before reviewing the configuration. If an item needs to be changed, make a duplicate and then change it. To change items, see Editing Projects.

2.2 Setting *WavesMon*'s Workspace

A Workspace is a collection of windows arranged and sized, as you prefer. To create a Workspace file, open all the windows you want to see during data collection. Open and arrange the views you are interested in. When you have the displays set up the way you prefer, on the File menu, click **Save Workspace**. When the program is restarted, the default workspace is displayed. To return to your workspace, use **File**, **Load Workspace**.

2.2.1 Changing Units

To change the units for all displays, on the **Configure** menu, select **Units**. You can change units to **All English**, **All SI** or use the **Advanced** menu and select each unit for **Velocity**, **Range/Depth**, and **Temperature**.

2.2.2 Changing the Coordinate System

To change the coordinate system, on the **Configure** menu, select **Coordinate System**. You can select **Earth** or **Raw-Beam**

2.2.3 Changing Global Parameters

To change the global parameters of the displays, select the **Configure** menu, and click **Global Parameters**. This menu allows changes to the number of sections on the X and Y axes, the Grid Lines (visible, style, and color), and Background Color.

To return to the factory defaults, check the **Reset to Factory Defaults** box and select **Apply**. Click **OK** to exit the screen.

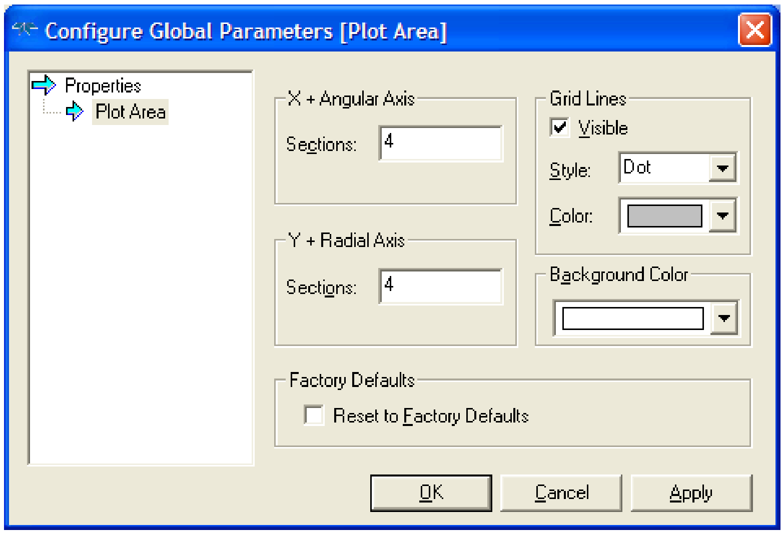


Figure 3. Global Parameters

2.2.4 Toolbars

Depending on what mode *WavesMon* is in (Data Collection, Playback, or ready mode), the toolbars will have different active buttons available.

Figure 4. Toolbars

Playback Controls – Use the **Playback Controls** to **Stop**, **Pause**, **Start Playback**, or **Play Next Burst**. The **Stop** button is active in both data collection and playback modes.

Go – A red **Go** button indicates *WavesMon* is waiting to start data collection.

When clicked or in Playback mode, it is grayed out. Use the **Stop** button to stop data collection.

Zoom to Data – click the blue title bar at the top of the window to select the graph and then click the **Zoom to Data** button on the toolbar ( ).

Zoom In – Click the Zoom In ( ) button on the toolbar. The cursor will change to a "+" magnifying glass. Hold down the left mouse button and drag over an area on the window to zoom in. The chosen region will be zoomed to the full plot width.

Zoom Out – Click the Zoom Out ( ) button on the toolbar. The cursor will change to a "-" magnifying glass. Hold down the left mouse button and drag over an area on the window to zoom out.

> **NOTE.** The **Time Series**, **Velocity Direction**, **Velocity Profile** and **Velocity Profile 2**, and the **Wave Height Spectra** views can use the zoom functions.

Pan – Use the **Pan** button on the toolbar ( ) to move the graph data as needed.

Arrow Cursor – Click the **Arrow Cursor** button on the toolbar ( ) and use it to identify values on the plots.

Show Wizard – Starts the **New Project Wizard** (see Collecting Real-Time Data with WavesMon or Reprocessing Raw ADCP Data)

2.2.5 Available Graphs

There are five main displays selected by default: the **Directional Spectrum (Polar)** view, **Time Series** view, the **Velocity Direction** view, the **Velocity Profile**, and the **Wave Height Spectra** view. The **Window** menu allows you to quickly choose the views that you would like to see and remove the ones that are not of interest.

There are three other displays that can be viewed – **Velocity Profile 2**, **Horizontal Velocity Profile**, and **Directional Spectrum (Cartesian).**

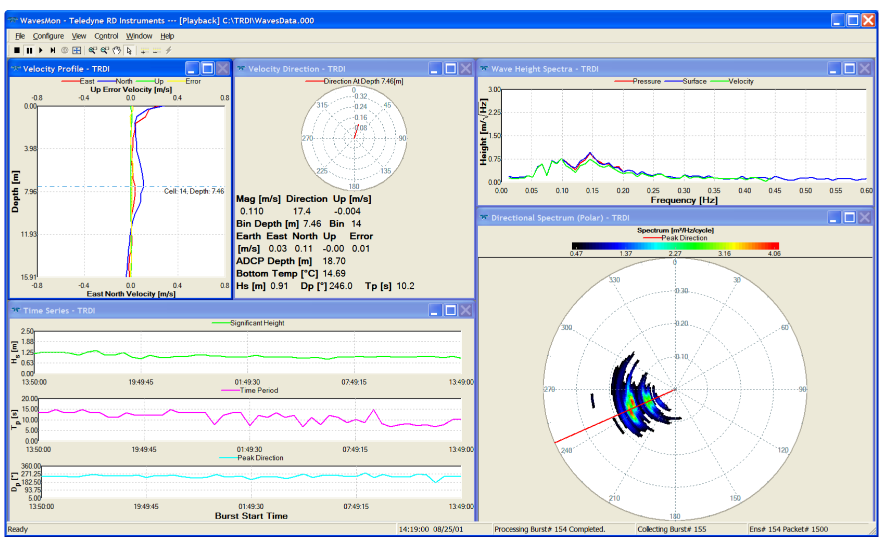


Figure 5. WavesMon Displays

Velocity Profile Plot

The profile view displays a current profile in the coordinate frame in which it is to be gathered by the ADCP, or it can convert the data to earth coordinates. The default scale for this plot is set in the **Configure** menu; however there are tool bar buttons ( ) that allow you to change it on the fly.

The dashed line indicates the location of the selected bin. To change the selected bin click the up/down ( ) toolbar buttons. **If the ADCP is configured for beam radial data, the magnitude and direction displays will be invalid.** The selection of beam coordinates in the profile display is for trouble-shooting purposes only. *WavesMon* can only convert from data gathered in other than earth coordinates to earth coordinates – it cannot convert data gathered in earth-coordinates to the other coordinate frames (because we allow transformations to earth coordinates when one beam is marked bad and when the ADCP uses this capability the reverse transformation is poorly defined).

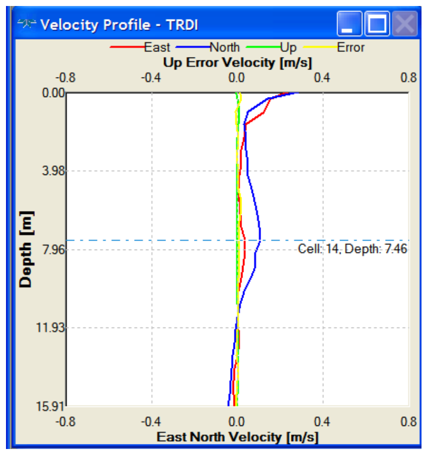


Figure 6. Velocity Profile Window

To change how the Velocity Profile Window is configured right-click on the window and click **Properties**. This screen allows changes to the Axis Values, Labels, Titles, Line Legend, and Colors. Click **OK** to exit the screen.

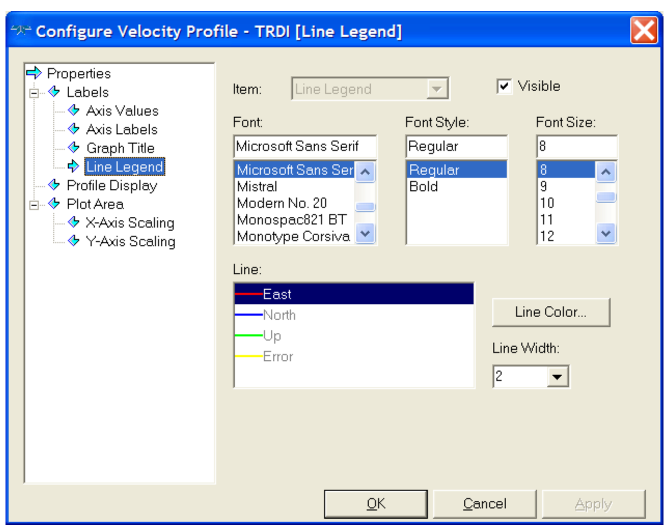


Figure 7. Configure Velocity Profile Window

To change the Bottom and Top X-Axis between **East**, **North**, **Earth Up**, and **Earth Error**, right-click on the Velocity Profile window and click **Data Selection**. Click **OK**.

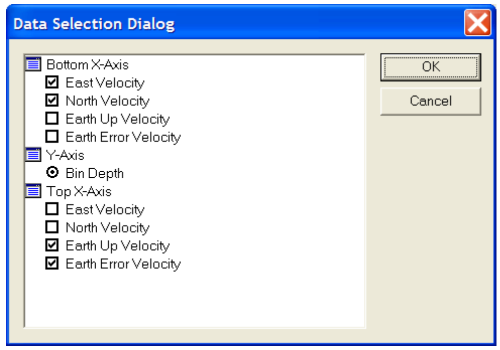


Figure 8. Data Selection Dialog – Velocity Profile

Directional Spectrum (Polar)

The default scale is set to dynamic. Red is maximum and black is minimum. If *WavesMon* is not able to process a directional spectra plot, *WavesMon* will leave the last good plot on the screen and a red dot in the lower right corner will indicate that the plot is not from the last collected waves-burst.

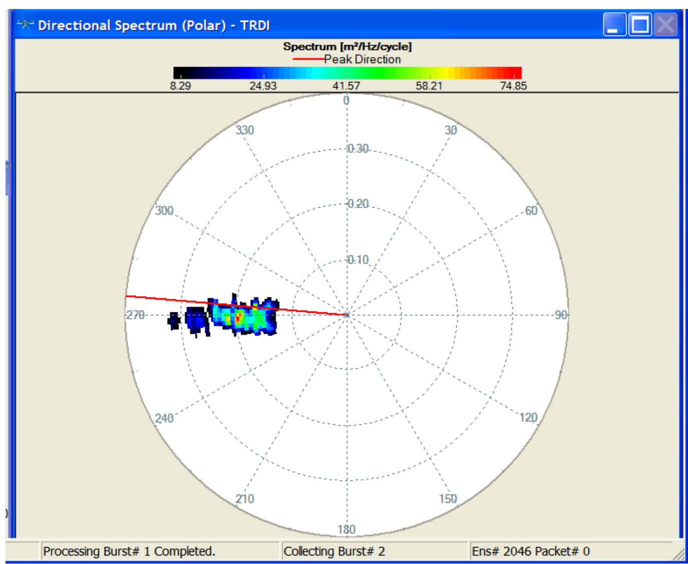


Figure 9. Directional Spectrum (Polar) Window

To change how the **Directional Spectrum** window is configured right-click on the window and click **Properties**.

This screen allows changes to the **Axis Values**, **Labels**, **Titles**, **Line Legend**, and **Colors**. Click **OK** to exit the screen.

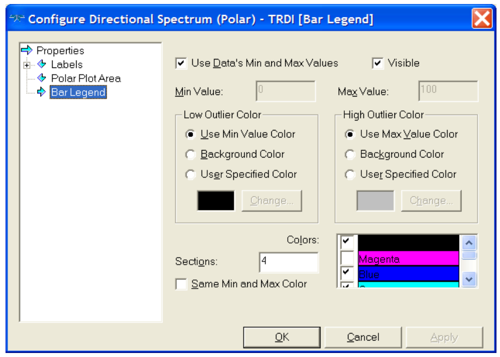


Figure 10. Configure Directional Spectrum (Polar) Window

Time Series

The **Time Series** window displays time series of significant wave height, peak period, peak direction, and water depth. Data that is missing or bad is not shown. To select a time in the series click the left mouse button over the data of interest.

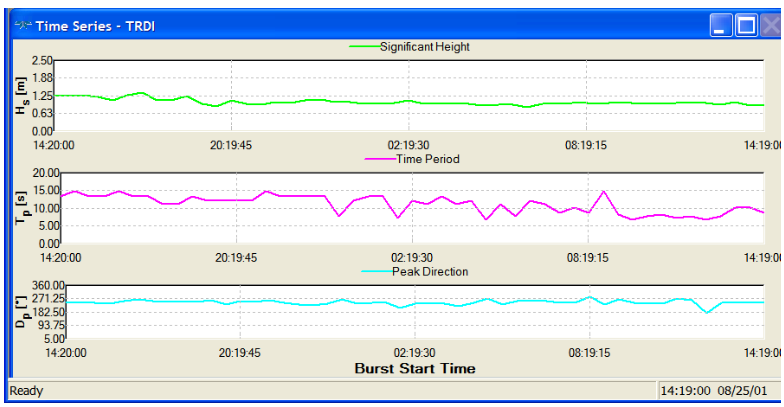


Figure 11. Time Series Window

To change how the Time Series Window is configured right-click on the window and click **Properties**. This screen allows changes to the Axis Values, Labels, Titles, Line Legend, and Colors. Click **OK** to exit the screen.

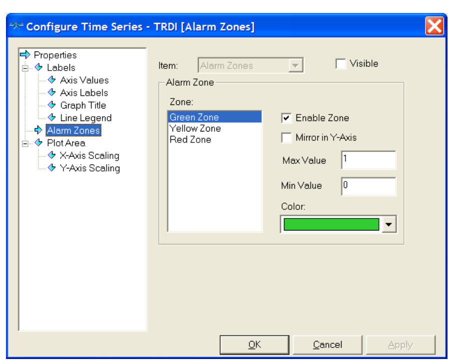


Figure 12. Configure Time Series Window

To change between **Burst Number** or **Burst Start Time,** right-click on the Time Series window and click **Data Selection**. Click **OK**.

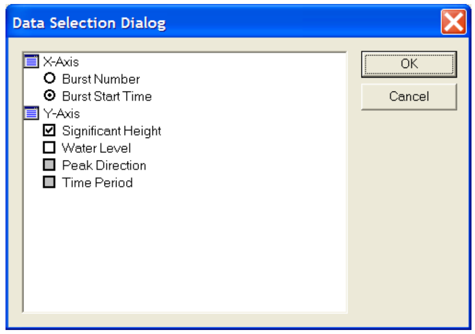


Figure 13. Data Selection Dialog – Time Series

Current Velocity Direction

This view displays the current magnitude and direction with an analog line. The length of the line is scaled the same as the scale selected for the profile plot.

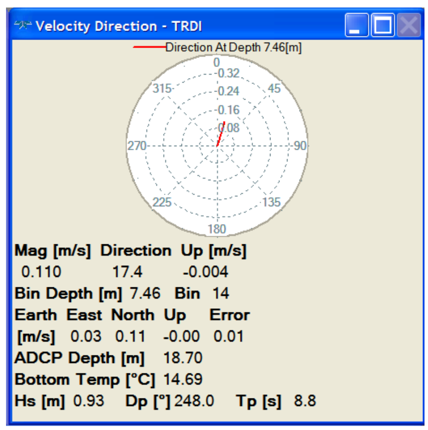


Figure 14. Velocity Direction Windows

To change how the Velocity Direction Window is configured right-click on the window and click **Properties**. This screen allows changes to the Axis Values, Labels, Titles, Line Legend, and Colors. Click **OK** to exit the screen.

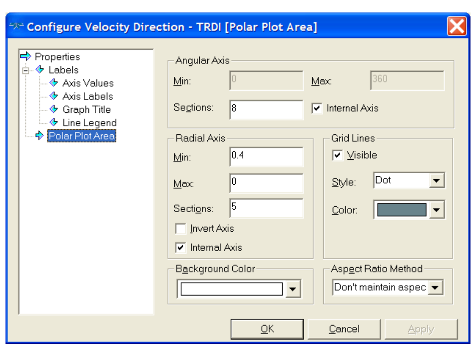


Figure 15. Configure Velocity Direction Window

To change from **Earth, Ship, or XYZ Velocity Directions.** Right-click on the Velocity Direction window and click **Data Selection**. Click **OK**.

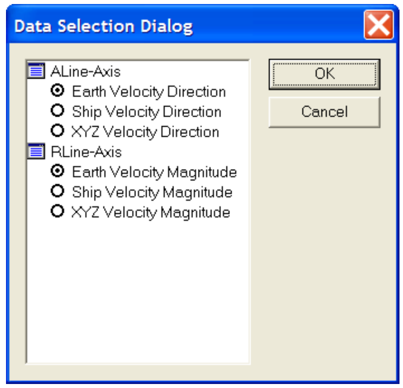


Figure 16. Data Selection Dialog – Velocity Direction

Wave Height Spectra

The Wave Height Spectra view displays height spectra in units of [$\frac{m}{\sqrt{Hz}}$] as calculated from the pressure sensor, orbital velocities, and surface echo location.

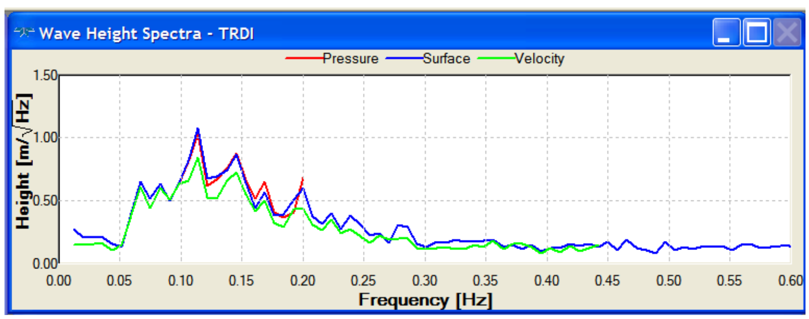


Figure 17. Wave Height Spectra Window

To change how the Wave Height Spectra Window is configured right-click on the window and click **Properties**. This screen allows changes to the **Axis Values**, **Labels**, **Titles**, **Line Legend**, and **Colors**. Click **OK** to exit the screen.

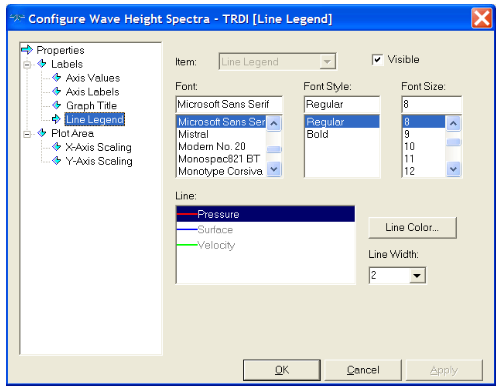


Figure 18. Configure Wave Height Spectra Window

Right-click on the Wave Height Spectra window and select **Data Selection**. You can change the X-Axis between **Pressure, Surface**, or **Velocity Frequency.** Individual plots on the Y-Axis may be turned on or off as desired. Click **OK**.

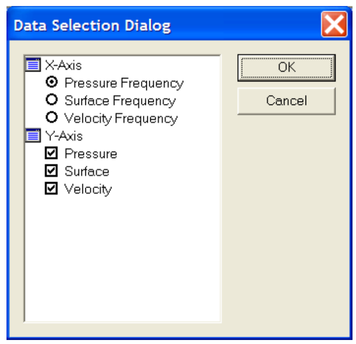


Figure 19. Data Selection Dialog – Wave Height Spectra

Current Profile 2 Plot

The Velocity Profile 2 window displays velocity magnitude and direction versus depth. The default workspace has this window hidden behind the Velocity Profile window. Use the Window menu to bring the window to the front.

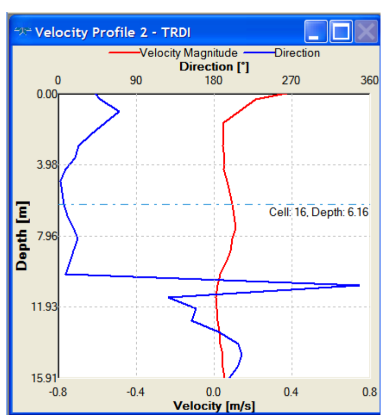


Figure 20. Velocity Profile 2 Windows

To change how the Velocity Profile 2 Window is configured right-click on the window and click **Properties**. This screen allows changes to the **Axis Values**, **Labels**, **Titles**, **Line Legend**, and **Colors**. Click **OK** to exit the screen.

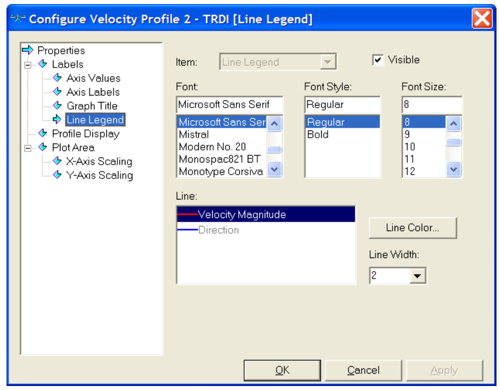


Figure 21. Configure Velocity Profile 2 Window

Horizontal Current Profile

These plots are similar to the **Velocity Profile** window, but in a horizontal format (see [Velocity Profile Plot]). Use the **Window** menu to view this plot.

NOTE. This plot is only for the 300k Hz 10 Inch 3 beam horizontal ADCP.

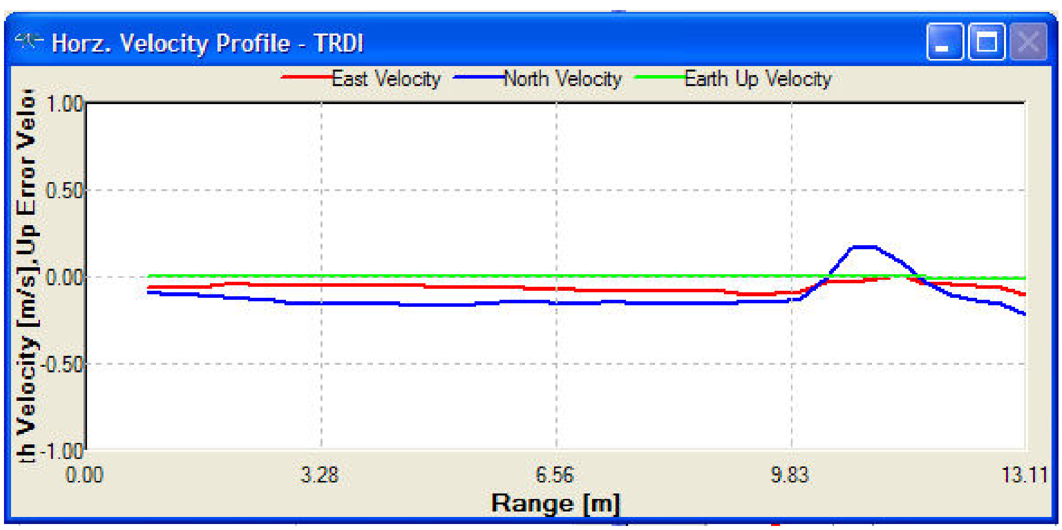


Figure 22. Horizontal Current Profile

Directional Spectrum (Cartesian)

These plots are similar to the **Directional Spectrum (Polar)** window, but in a Cartesian (see Directional Spectrum (Polar)). The units are [$\frac{Meters^2}{Hz \bullet cycle}$].

If the user changed units to English, then the plot has the units of [$\frac{Feet^2}{Hz \bullet cycle}$].

Use the **Window** menu to view this plot.

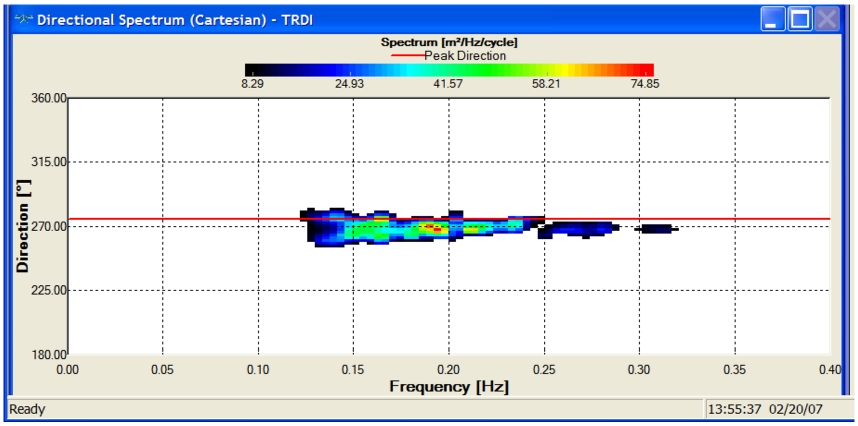


Figure 23. **Directional Spectrum (Cartesian)**

2.3 Collecting Real-Time Data with *WavesMon*

a. Start *WavesMon*.

b. On the **File** menu, click **New Project**.

c. At the **Select Input Type** dialog, choose one of the following:

- **Real-time: Direct ADCP Connection** – The ADCP is connected to the computer (see Figure 25).
- **Real-time: Polled Comm Port -** The **Polled Mode** configures *WavesMon* to listen to the COM port only.

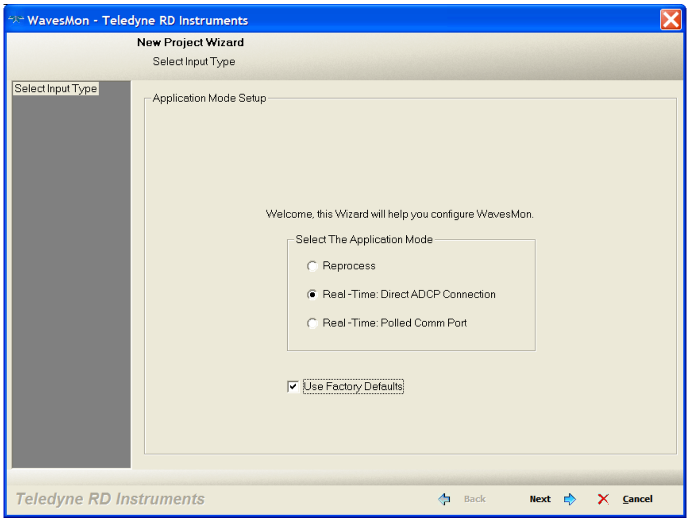


Figure 24. ADCP COM Port Setup

Use Factory Defaults box – If this box is checked, the wizard screens will be set to the factory defaults.

ADCP COM Port Setup

If **Real-time: Direct ADCP Connection** was selected, click on the **Auto Detect** button and *WavesMon* will find the baud-rate of the connected ADCP or enter the settings manually. Press the **Connect** button and then click **Next** and *WavesMon* will find a Workhorse or a Horizontal ADCP.

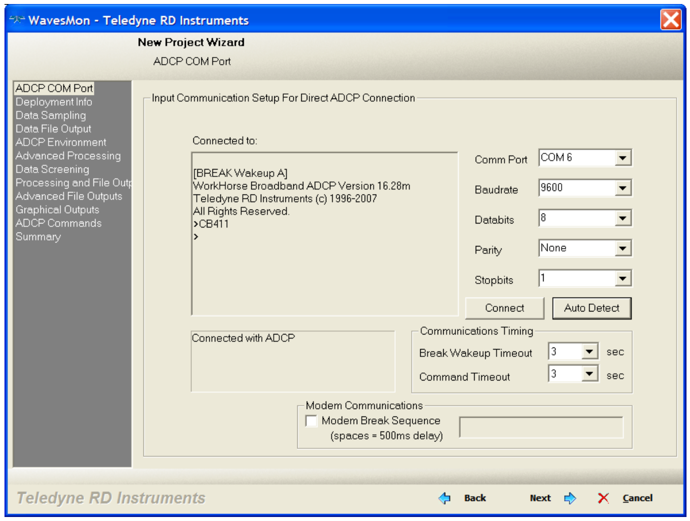


Figure 25. ADCP COM Port Setup

The box next to the **Modem Break Sequencing** Label allows the user to configure *WavesMon* for varying "Break Timeouts". This setting will prevent *WavesMon* from "timing out" due to a slow telemetry link to the ADCP. The command and break timeouts can be set larger than the defaults if someone is communicating through a slow telemetry link to the ADCP.

Real-Time: Polled Comm Port

The **Polled Mode** configures *WavesMon* to listen to a serial port. *WavesMon* will not configure or start the ADCP. The assumption is the ADCP is already configured and is already sending data to the serial port *WavesMon* is listening to.

d. Follow through the wizard screens by entering the needed information and than pressing **Next** to move to the next screen. For details on how to set each page, see the following sections.

- Deployment Info
- Data Sampling
- Data File Output
- ADCP Environment
- Advanced Processing
- Data Screening
- Processing and File Outputs
- Advanced File Outputs
- Graphical Outputs
- ADCP Commands
- Real-Time Data Collection Summary

e. Review the summary.

f. Click **Finish**.

g. Click the **GO** button on the *WavesMon* toolbar.

Figure 26. Data Collection Toolbar

h. If the results are not what you expected, click the **Stop** button on the toolbar. Select **Configure**, **Properties** and select **Realtime Configuration**. Select the page you wish to change. Enter your changes and click **OK**. Save the project file if you make changes by selecting **File**, **Save Project**. Start data collection again by clicking the **Go** button.

2.3.1 Deployment Info

WorkHorse ADCP deployed upward looking

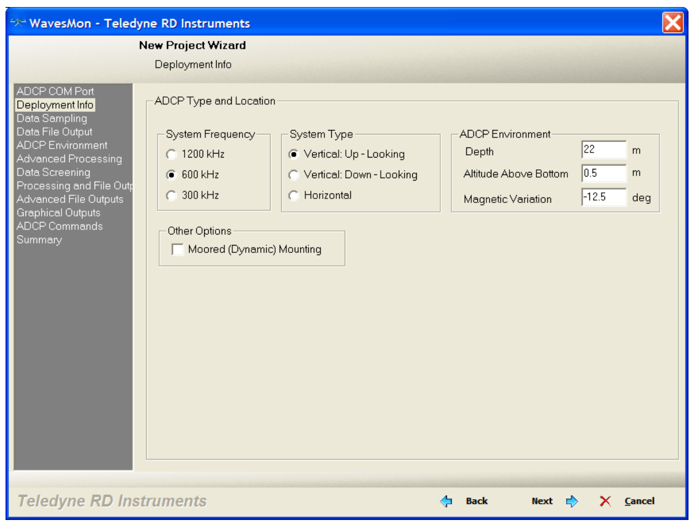


Figure 27. Deployment info – WorkHorse ADCP

In this example, a 600kHz WorkHorse ADCP is deployed at 22m, the altitude of the ADCP is 0.5m, and the magnetic variation is 12.5 deg west (-12.5 deg). The wizard will configure the ADCP to collect wave bursts in packets mode. For more details about this, see ADCP Environment.

> **NOTE.** The **Depth** is the estimated depth of water from the ADCP face to the surface. The **Altitude Above Bottom** is the distance of the ADCP face from the seafloor.

System Type and Altitude

Select the ADCP's **System Frequency**. Select the **System Type**.

Enter the **ADCP Environment** information. The **Depth** is the estimated depth of water from the ADCP face to the surface. The **Altitude** is the distance of the ADCP face from the seafloor.

Enter the **Magnetic Variation** to correct the data from magnetic north to true north. East degrees shall be entered as positive value and west should be entered as a negative value.

Other Options

If the **Moored (Dynamic) Mounting** checkbox is enabled, *WavesMon* will configure the ADCP to collect heading, pitch and roll data for every packet ensemble and do UVW rather than array processing for the wave parameters.

> **NOTE.** Moored (dynamic) mounting: (When HD111100000 is set). *WavesMon* requires at least one current profile in the waves-burst in order to apply the Magnetic Variation to the wave process data.

300k Hz Narrow-beam horizontal ADCP

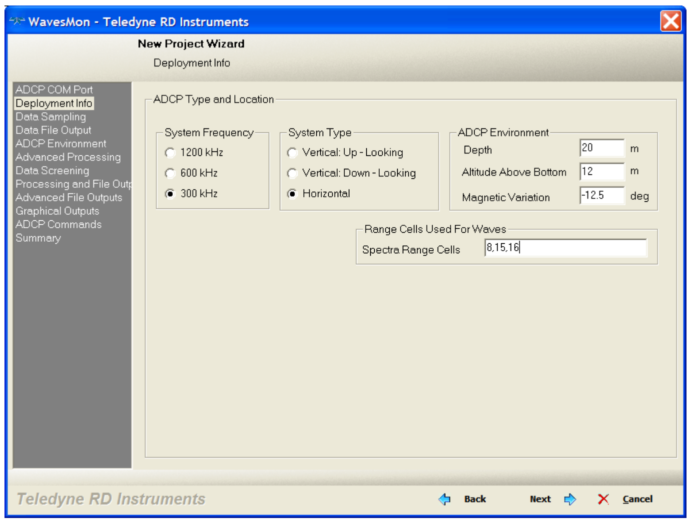


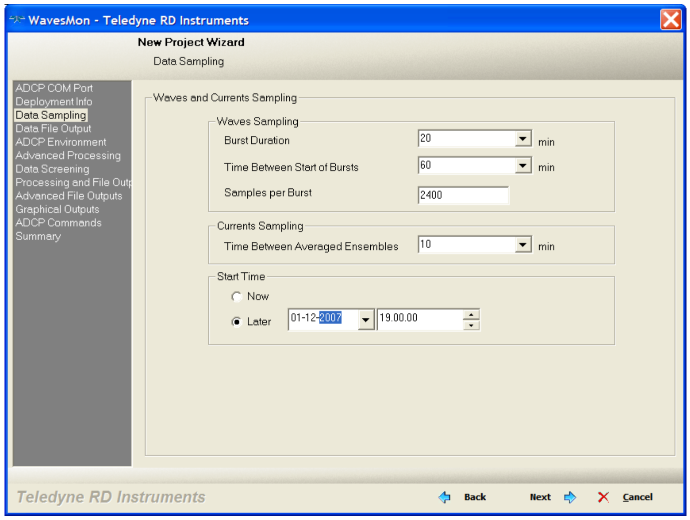
Figure 28. Deployment info – Horizontal ADCP

In this example, a 300kHz H-ADCP is deployed at 20m, the altitude of the H-ADCP is 12m and the magnetic variation is 12.5 deg west (-12.5 deg). *WavesMon* will configure the Horizontal ADCP in ensemble mode, as Horizontal ADCPs do not support packets mode at this time.

When **Horizontal** ADCP is selected for the **System Type**, enter the **Spectral Range Cells** in the **Range Cells Used For Waves** box.

> **NOTE.** The **Depth** is the estimated depth of water from the ADCP face to the surface. The **Altitude Above Bottom** is the distance of the ADCP face from the seafloor. **Altitude Above Bottom** is very important for the horizontal waves processing.

2.3.2 Data Sampling



Set the Waves and Currents Sampling parameters.

Waves Sampling

Enter the **Burst Duration** and the **Time Between Start of Bursts**. The recommended setting is 20 minutes **Burst Duration** with 60 minutes **Time Between Start of Bursts** and 2400 **Samples per Burst**.

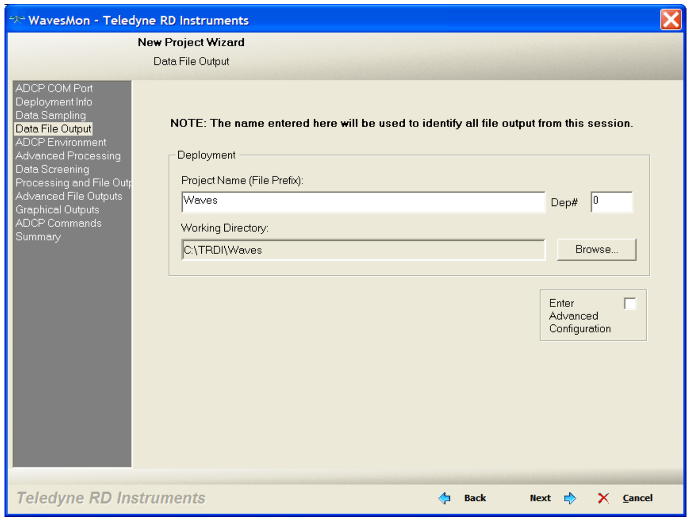
Currents Sampling

Enter the **Time Between Averaged Ensembles**. The recommended setting is 10 minutes.

Start Time – Click **Now,** to start pinging as soon as the GO button is pressed, or select **Later** for a desired start date and time.

NOTE. The Date and Time format depends on the settings in Windows®.

2.3.3 Data File Output



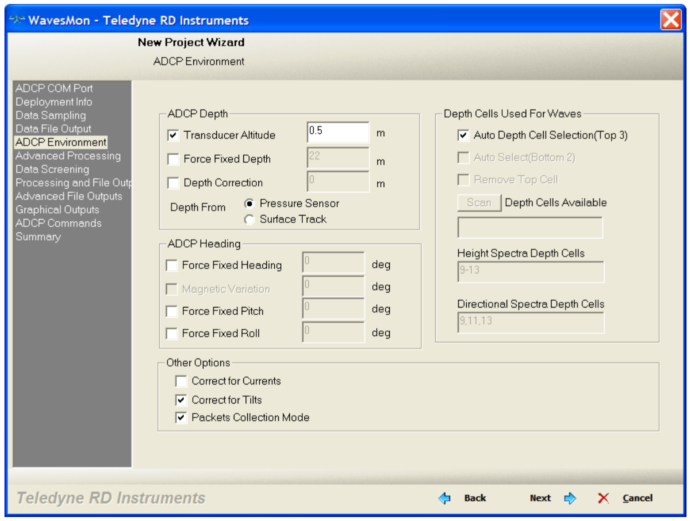
On the **Data File Output** dialog, name the Project file something meaningful. The output data files will be tied to the setup file name and path.

The **Dep#** (Deployment Number) is a file prefix used to indicate and track incremental data deployments and/or sessions in the same directory.

Click **Next**.

Leaving the **Enter Advanced Configuration** box unchecked will complete the wizard and display the summary page (see Real-Time Data Collection Summary). If the **Enter Advanced Configuration** button is selected, the wizard will continue to the next page.

2.3.4 ADCP Environment



ADCP Depth

Transducer Altitude. If the Transducer Altitude is un-checked, it is assumed zero. If it is checked, enter the altitude of the instrument face from the seafloor in meters. The altitude is used in the waves processing to apply the correct gain to the lower bins. An incorrect altitude will cause the pressure- and velocity-spectra not to match the surface track spectra.

Force Fixed Depth. If the box is un-checked, the software uses the instrument depth computed by the pressure sensor in each ensemble. These are averaged to calculate mean instrument depth. If no pressure sensor was available or the mean water depth was very large relative to tidal changes, or the pressure sensor failed, the nominal water depth can be forced to this value.

Depth Correction. The depth correction is to allow adding an offset to the ADCP's pressure readings. If for example, the instrument has been submerged for a long time and the pressure sensor depth consistently reads larger than the surface track depth, it is likely that the pressure sensor has drifted with time and needs to be zeroed at the surface again.

If the wave height spectra do not agree very closely between the velocity spectrum and the pressure or surface track spectrum, it may be because the pressure sensor is in error. An offset in the pressure measurement does not significantly affect the pressure spectrum; however, it does have an immediate affect on the velocity spectrum. The locations of the velocity bins below the surface are determined using the mean water depth from the pressure sensor. An overly large pressure sensor reading for depth will cause the velocity spectrum to be high as well. To correct for a pressure sensor reading e.g. if the sensor reads 2.0 meters too high, enter the –2.0 meters in **Depth Correction**.

ADCP Heading

Force Fixed Heading. The heading is normally measured by the ADCP's compass. If for some reason the compass readings were not valid (*e.g.* the instrument is mounted with a lot of steel nearby), the heading could be measured independently. Checking the box and entering a heading offset forces the software to use that heading always. The directional spectra algorithm must know the instruments heading to calculate wave direction.

Magnetic Variation. Enter the **Magnetic Variation** for your location in the world to have the direction information calculated relative to true North rather than magnetic North.

CAUTION. If you enter a magnetic variation value on the ADCP Environment page during reprocessing, it will be added to whatever value was initially set when data was collected.

NOTE. When reprocessing data to fix an incorrectly entered magnetic variation, enter the difference.

For example, data was collected using +12.0 for the magnetic variation when it should have been set to +14.0. Enter +2.0 for the correction when reprocessing the data.

Force Fixed Pitch. The pitch is normally measured by the ADCP's compass. Checking the box and entering a fixed pitch forces the software to always use that pitch.

Force Fixed Roll. The roll is normally measured by the ADCP's compass. Checking the box and entering a fixed roll forces the software to always use that roll.

Depth Cells Used For Waves

Select the **Auto depth cell selection (Top 3)** check box, and *WavesMon* will use the top three depth cells for a wave-processing.

Select **Auto Select (Bottom 2)** check-box, lets *WavesMon* use the bottom two depth cells for waves-processing (the first depth cell and the mid depth cell).

Select **Remove Top Cell** check-box, lets *WavesMon* use only the bottom two of the top 3 depth cells for waves-processing.

Height Spectrum Depth Cells. Several depth cells can be chosen, however, if high frequency data is of interest, it is recommended that you choose depth cells that are as close to the surface as possible. Make sure that the highest depth cell is below the surface at low tide.

Directional Spectrum Depth Cells. The direction spectrum algorithm must invert a sensor-by-sensor matrix at each frequency band. Empirically the algorithm appears to achieve good results with three or more depth cells. Theoretically, the depth cells should be chosen with some spread and farther up in the water column so that the array has as much aperture as possible. Be sure that you do not choose depth cells beyond the profiling range of the instrument.

Recommended Setting. It is recommended that you choose the **Auto depth cell selection (Top 3)** check box. If you want to select which bins are used manually this can be done as follows:

1. Choose **Height Spectra Depth Cells** that are nearer to the surface for better high frequency results. Make sure that the depth cells are not too close to the surface at low tide.
2. Choose three **Directional Spectra Depth Cells** that are higher in the water column. Less than three can cause the directional spectra algorithm to give poor results. More than three gives results that are more robust but has a dramatic affect on the speed of the algorithm. The point of diminishing returns is about three or four depth cells.

Other Options

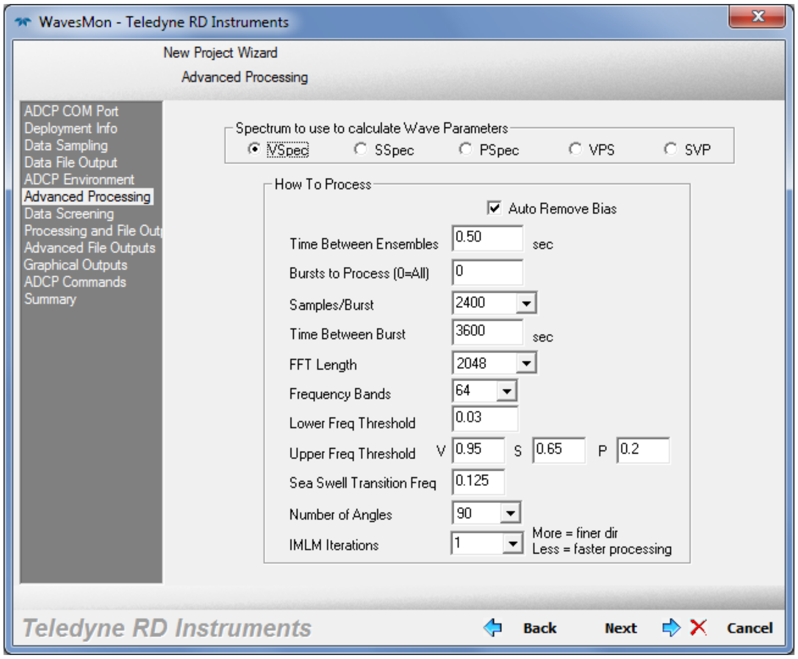
Correct for Currents – Uses the mean currents to correct the wave spectra for the effects of currents. A Doppler shifted dispersion relation is used to calculate wave number “k.” This should be applied if the currents near the measurement exceed 0.80 m/s.

Correct for Tilts. The tilts switch can partially correct for a badly tilted ADCP. This assumes that the tilt is fixed. If the pitch or roll is not greater than 10.0 degrees it is not recommended to turn this on. Note that the **Correct for tilts** should always be selected when using a Horizontal ADCP.

Packet Collection Mode. To use Packet data (i.e. H commands) check the **Packet Collection Mode** box to turn this option on. The packet mode by default collect three depth cells near the surface, one at the middle and one at the ADCP for the waves processing. The current profile will be collected independently of the packet mode. Note that packets mode is not available for Horizontal ADCPs at this time.

NOTE. For information on the H commands, see the WorkHorse Commands and Output Data Format Guide.

2.3.5 Advanced Processing



Spectrum To use to calculate Wave Parameters. Select one of the buttons to choose which non-directional spectrum to use to scale the directional spectrum and calculate wave parameters.

- **VSpec** = Velocity Spectrum
- **SSpec** = Speed Spectrum
- **PSpec** = Pressure Spectrum
- **VPS** or **SVP** (V = Velocity, P= Pressure, S = Surface Track)

The order is indicative of the priority for applying these sources to the calculation of wave parameters. For example: **VPS** means that orbital Velocity derived wave spectra will be used for the determination of Hs, Tp, etc. If, for some reason Velocity data is screened, then use spectra derived from Pressure to construct wave parameters. If pressure is also marked bad, then use Surface Track.

The value of these options is that it capitalizes on our redundant wave measurements to always create wave parameters. A time series (like that shown in the *WavesView* software) of wave parameters shows gaps or missing data. We found it better to fill in the gaps from our redundant measures. When Velocity is bad Pressure may still be good. The judgment call about what priority (VPS, SVP, etc.) to use involves reviewing the quality of these data sources for a specific deployment. One can change this by reprocessing the data with a new priority setting.

How to Process

This section tells the software how to setup the ADCP. In real-time, some of this information is used to generate commands to be sent to the ADCP, in addition to guiding the software in its processing.

Auto Remove Bias. This switch turns ON and OFF the automatic removal of rectification bias. The default is ON and the only reason to turn it OFF is if someone has collected data at less than 2Hz.

Each of the techniques for measuring wave height spectra (pressure, surface-track, and velocity) has its own set of error sources and its own measurement noise.

We assume that the measured time series is a superposition of the signal (waves) and the measurement noise and that the measurement noise is white. The Fourier transformation of white noise is white noise. This white noise has a zero mean distribution; however when we square the frequency spectrum to get power, the noise becomes always positive.

This biases the power spectrum by adding a positive offset. To measure this bias the software calculates the mean of the power spectrum at frequencies too high for environmental wave energy. By finding the noise floor of the power spectrum, it can then be removed. This process is done for each of the independent height spectra calculations and is required in order to get good agreement among the three, because the bias has been subtracted from the overall spectrum.

Time Between Ensembles. This is the sample rate (0.50 seconds) This sets the time between pings in the ADCP for real-time operation.

This sets the TP-command on the **ADCP Commands** tab, when collecting full profile at e.g. 0.5 sec or the HT-command when collecting in packet mode.

Recommended Setting. **Always** Set the Time Between Ensembles to 0.50 seconds.

NOTE. In packet mode, the TP command can be set to an integer number times the sampling rate. See the Workhorse Technical Manual for more details.

Bursts to Process (0=All). The software will process exactly this many bursts, then stop.

Samples/Burst. This is the number of ensembles accumulated into a burst for waves processing. Because of the statistical nature of ocean waves, it is recommended that this correspond to data spanning a range of 5 to 40 minutes.

Recommended Setting. Choose a **Samples/Burst** number so that more data is collected than required. For example, 2048 is the nearest power of two, 2400 samples allows some data to be potentially lost.

Time Between Bursts. *WavesMon* uses **Time Between Bursts** to handle real-time collection from an ADCP that is burst sampling. For example if an ADCP is collecting 20 minutes (2400 samples per burst) of data every hour on the hour, the time between bursts would be set to an hour.

The ADCP time of first ping command would start the sampling on the next hour. Set the **Time Between Bursts** accurately or the software may treat good data as discontinuous. Set the burst duration exactly if continuously running. This creates the TB-command in the **ADCP Commands** tab.

Recommended Setting. A recommended setup is 20 minutes of data every hour on the hour.

FFT Length. The **FFT Length** control lets one choose the exact number of samples in the time series to be Fourier transformed. This must be a power of two and less than or equal to the **Ensembles Per Burst**. If an erroneous value is chosen the software will pick the nearest power of two that is less than or equal to the value chosen and the **Ensembles per Burst**. This value would differ from the **Ensembles per Burst** if the ADCP were collecting bursts that are not a power two.

> **Recommended Setting.** Set the **Samples per Burst** to 2400 (20 minutes of data) so that the current profile will have 3 averaging intervals 6 minutes long and the FFT will have 2048 samples.

Frequency Bands. The number of frequency bands must be a power of two and the maximum is half the **FFT Length**. Band averaging smoothes the data by averaging adjacent frequency bands from the raw frequency spectrum. Band averaging also increases the number of degrees of freedom of the cross-spectral matrix because each frequency band is independent. Band averaging improves the results and speed of the directional spectra algorithm so it is recommended that at least some be done.

> **Recommended Setting.** The default setting is 64 Frequency Bands. Using 128 Frequency Bands gives nice frequency resolution and still smoothes the data by a factor of square root eight. If very long waves are of interest, less band averaging (512 Frequency Bands) will give greater frequency resolution at these frequencies. Environments that see 20 second period waves and larger should use at least 256 Frequency Bands.

Lower Frequency Thresholds. Set the Lower Frequency Threshold for all three spectra.

Upper Frequency Thresholds. The Frequency threshold is calculated automatically for each height spectrum type (pressure, surface track, velocity). However, if for some reason the algorithm is not handling some set of environmental conditions properly you can manually set the upper frequency cutoff. This becomes important to such calculations as significant wave height and determining the range of frequencies over which to search for a peak.

> **Recommended Setting.** The software automatically calculates the upper cutoff frequency. User input will be ignored.

Sea Swell Transition Frequency. The default value is 0.125 Hz. This number defines the boundary condition for searching for Sea and Swell. To display Sea and Swell parameters right-click on either the **Time Series** chart or the **Directional Spectrum (Polar)** chart, and select **Data selection…**. From there you can select the Sea and Swell parameters.

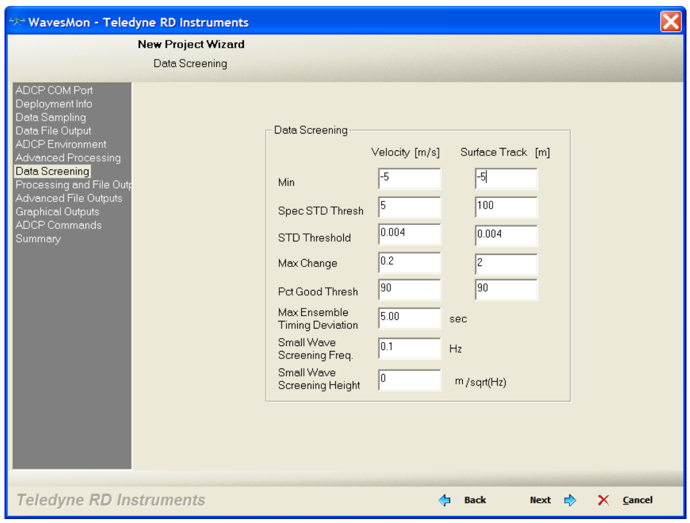
Number of Angles. The number of angles determines the angular resolution of the directional spectrum. Dividing the full circle into 90 pie slices gives good resolution without overkill.

> **Recommended Setting.** Set the number of angles to 90. This is the number of slices the 360-degree full circle is divided into for the directional spectra calculation. You can use as high as 360 slices of one-degree width, however, the resulting spectrum does not change much, and there is four times as much data to move and plot. Less than 90 angle divisions will also work fine, however poor angular resolution will begin to degrade or smear the data.

IMLM Iterations. The IMLM technique corrects MLM spectra for directional spreading caused by the MLM algorithm. It makes narrower, more true to life directional spectra. The point of diminishing returns is about 3 IMLM iterations. Each iteration makes the processing take longer. Three iterations or more appears to produce a directional spectrum that converges with the data. That is to say, 20 iterations yields a spectrum that is about the same as 3, yet three iterations is a huge improvement over the original MLM estimate (0 iterations).

Recommended Setting. Choose one IMLM iterations for best results. Each iteration makes the processing take longer. One iteration appears to produce a directional spectrum that converges with the data.

2.3.6 Data Screening



Data Screening

Minimum – This is the minimum change in the time-series data.

Spec STD Threshold – The allowed STD of the time-series.

STD Threshold – Velocity and surface time series are screened before being Fourier transformed. The primary screening is the wild point editor. It throws out and interpolates data points that are more than “n” standard deviations away from the mean. The **STD Threshold** default is set to four.

Max Change – This is the maximum change in the time-series data.

Percent Good Threshold – If the percent of good data in a burst is less then the threshold *WavesMon* will not processing the burst.

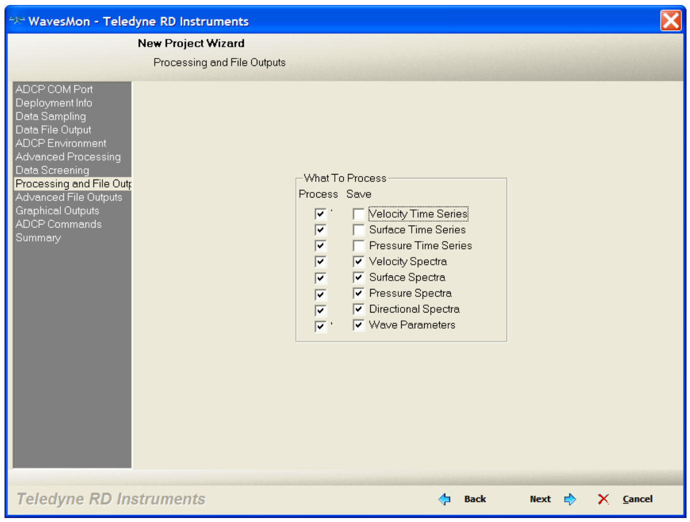
Max Ensemble Timing Deviation – In the event that data communication is unreliable, the software will accept deviations in the time stamps for individual ensembles (for example, some data was lost). If large gaps (greater than 5 seconds) occur in the data, it will reject the data as being discontinuous. This keeps the waves processing from averaging or “FFT'ing” data from two different periods yet allows small glitches.

Small Wave Screening Frequency – This allows the pressure sensor to improve the wave height spectrum at low frequencies. When the wave height is very small (e.g.

Hs < 0.20 m), the signal to noise ratio at very long wavelengths is poor for the orbital velocity based spectrum. Because long waves can be measured deeper, the pressure sensor can be used to measure this region of the spectrum. When waves are very small, if one sees spurious peak period (Tp) showing very long periods, this switch will improve the spectrum and the robustness of Tp.

Small Wave Screening Height – Screen all height data below the entered value. This option is useful when processing waves data from a horizontal system.

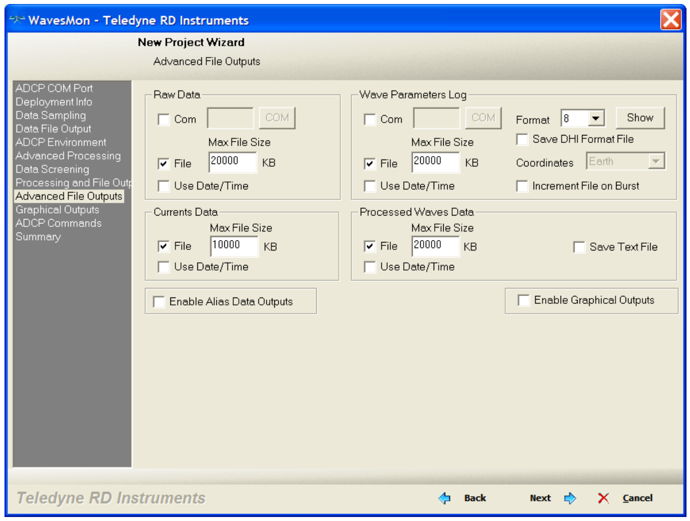
2.3.7 Processing and File Outputs



In the **What to Process** section, the **Process** and **Save** check boxes let you choose what data to process and what data to save in the Waves Record (*.wvs) file. Note there is some dependency between the selected data types. One cannot do a **Directional Spectrum** if no **Velocity Data** was processed in the first place. Likewise, one cannot save a **Surface Spectrum** if it was not processed to begin with. This allows the flexibility to process and display the data but just store spectra or wave parameters in the output file.

NOTE. Including **Velocity**, **Surface**, or **Pressure Time Series** in the saved Waves Record makes very large data files. If you do not require time series data to be output, do not select them in the **What to Process**, **Save** box.

2.3.8 Advanced File Outputs



The **Advanced File Outputs** page allows you to select what files to output.

Raw Data

Raw data can be saved to a file or sent to the COM port.

Wave Parameters Log

The **Wave Parameters Log** is a brief summary containing wave parameters (Hs, Tp, Dp, and averaged current profile data). Select any output options that you would like.

Check the **Save DHI Format File** check-box to save processed waves data to DHI's MIKE00 format.

To view the formats, click the **Show** button (see Wave Parameters Log Formats).

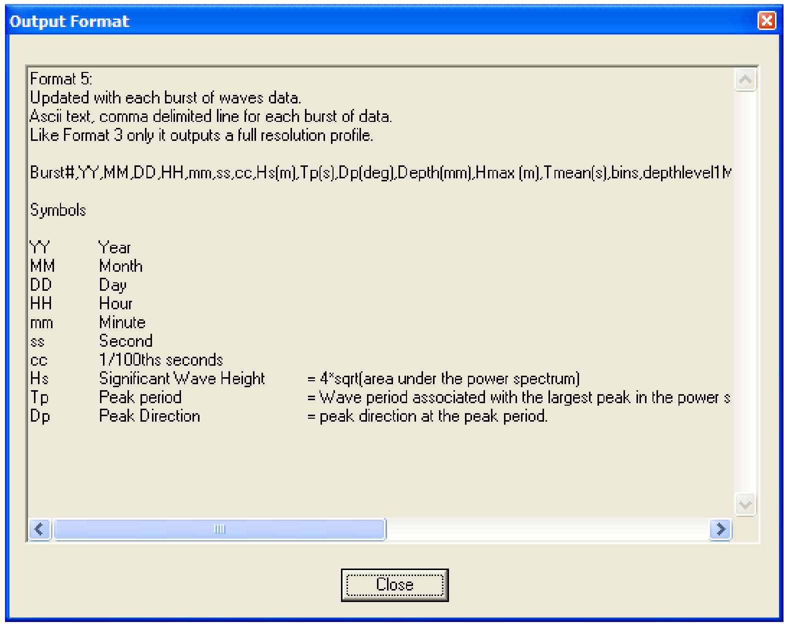


Figure 29. Wave Log Format

Processed Waves Data

Select the **Processed Waves Data** check box to create a waves record file (*.*wvs*).

Check the **Save Text File** to create an ASCII text file for each burst for each of the selected data types and DSpec and Fourier Coefficients. The text file has a header describing the contents of the file. These files can be loaded into *Matlab* or a spreadsheet for those who would like to process or analyze the data on their own. This option is recommended for users that would like to batch process text files for a whole data set. See DSpec and Fourier Coefficients Data for more information.

Currents Data

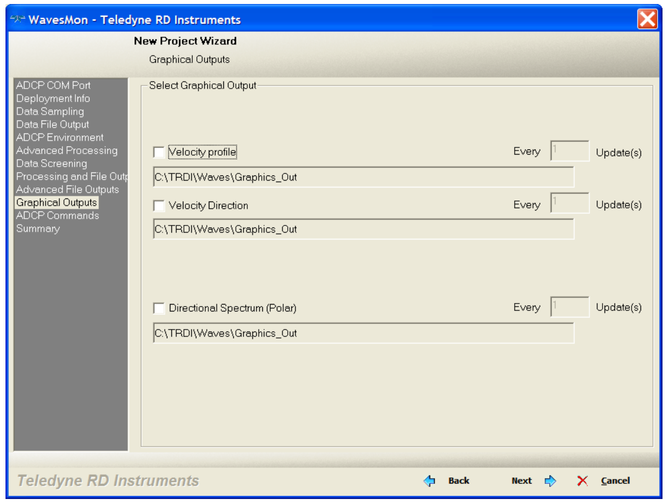
Select the **Currents Data** check box to create a data file with just the currents data.

> **Recommended Setting.** For Real-Time data collection, it is recommended that you select the **Raw Data File** box to save the ADCP raw data file.

Check the **Enable Graphical Outputs** box to enable saving image files (see Graphical Outputs).

Check the **Enable Alias Data Outputs** box to copy the processed waves, waves parameters log, current, and raw-data to another disk or shared disk.

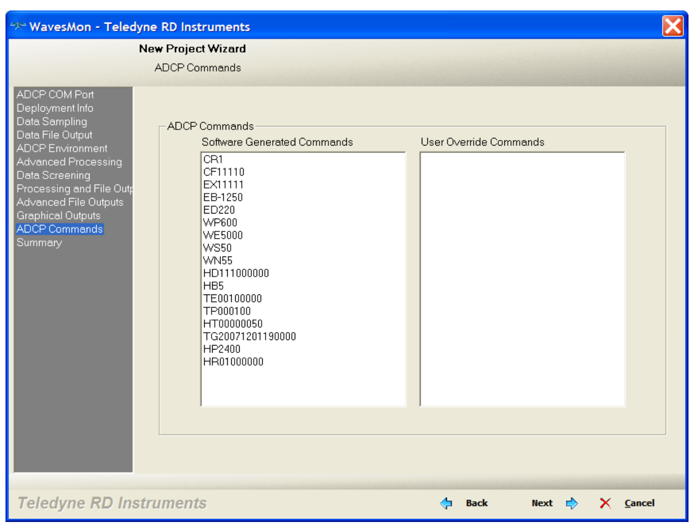
2.3.9 Graphical Outputs



Save Images – Saves the *WavesMon* screens (currents to the left, waves to the right) every time they are updated with new data, to PNG image files. This is used for saving and/or displaying of real-time data images (e.g. for a real-time web-pages).

NOTE. This page will be skipped unless the **Enable Graphical Outputs** box is selected on the **Advanced File Outputs** screen.

2.3.10 ADCP Commands

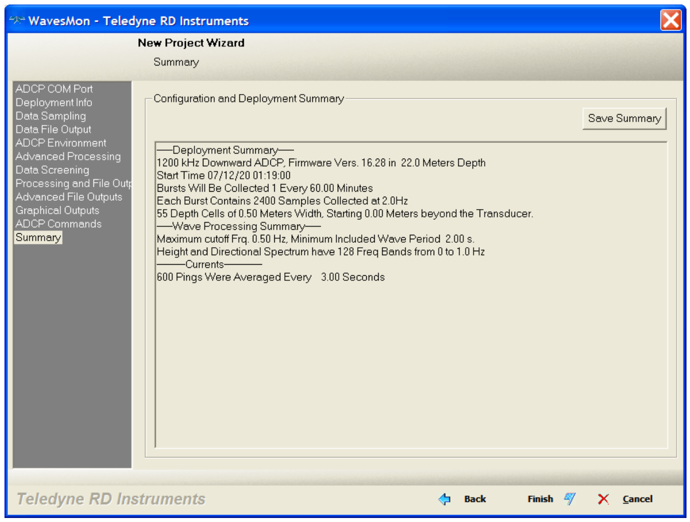


This shows you the **Software Generated Commands** in the window to the left generated by *WavesMon* based on the choices you made in the other dialogs. The **User Override** allows you to enter an ADCP command file for your own commands or to over-ride a program set command. The commands entered in the **User Override Commands** area will be sent to the instrument ***last*** so any commands that you choose will ***override*** the default commands generated by *WavesMon*. Edit if necessary and click **OK**.

Example: You are collecting data in Real Time (cabled) but you would like to also save data to the ADCP's internal recorder. The default CF command for real time does not enable the recorder. Enter CF11111 in the **User Override** window to enable both the serial port and the internal recorder.

NOTE. Commands preceded by a semicolon are ignored as commands and treated as comments.

2.3.11 Real-Time Data Collection Summary



Review the **Configuration and Deployment Summary**. To save the summary, click **Save Summary**.

Click **Finish** to exit the Project Wizard.

NOTE. The summary does not include or take into consideration any commands entered in the **User Override** column (see ADCP Commands).

2.4 Reprocessing Raw ADCP Data

Raw ADCP data can be reprocessed using *WavesMon* to create the Waves Record (*.wvs) file. In real-time, raw data is saved and processed. In Playback, previously recorded raw data is processed. Raw data files created by a self-contained ADCP can be stored separately on the ADCP recorder, downloaded to a PC file, and saved by *WavesMon* during processing.

> **NOTE.** A sample raw data file is included on the Waves CD. It is not copied to your hard drive during software installation.

a. Start *WavesMon*.

b. On the **File** menu, click **New Project**.

c. At the **Select Input Type** dialog, choose **Reprocess**.

d. Follow through the wizard screens by entering the needed information and then pressing **Next** to move to the next screen. For details on how to set each page, see the following sections.

- Select Raw File
- Deployment Info
- Data Sampling
- Data File Output

e. Review the summary.

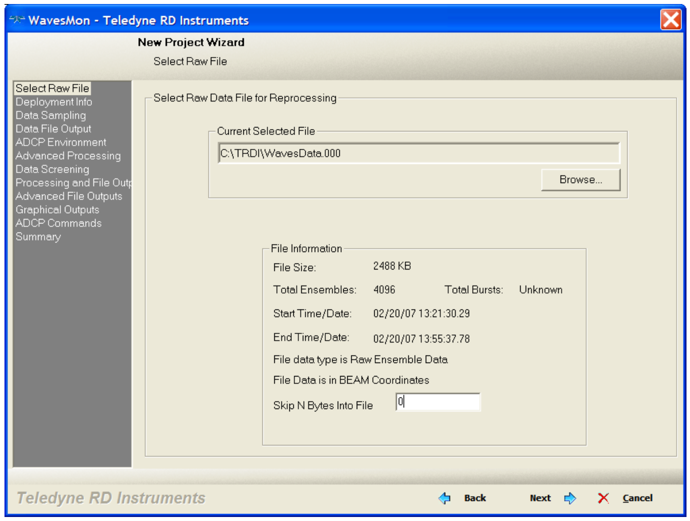
f. Click **Finish**.

g. Click the ▶ button on the *WavesMon* toolbar.

Figure 30. Processing Data Toolbar

h. If the results are not what you expected, click the **Stop** button on the toolbar and edit the project (see Editing Projects).

2.4.1 Select Raw File

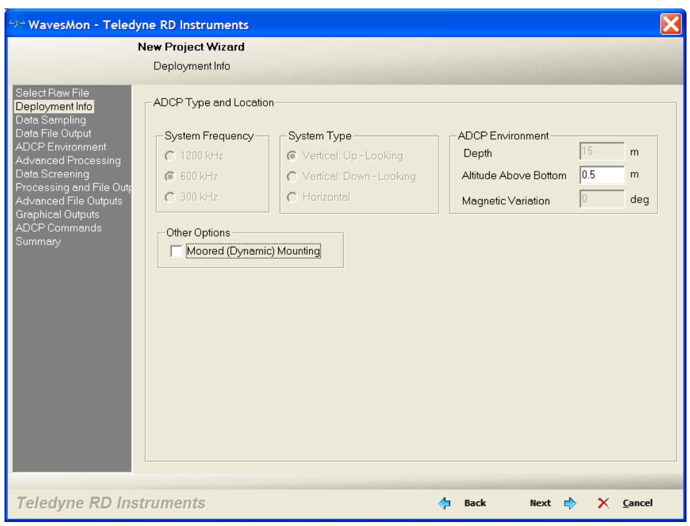


Select Raw Data File for Reprocessing – Use the **Browse** button to select the data file.

File Information – The **Data Type** will show **Ensembles** if the data file has raw ensemble data or **Packets** if the raw data file uses Packet data.

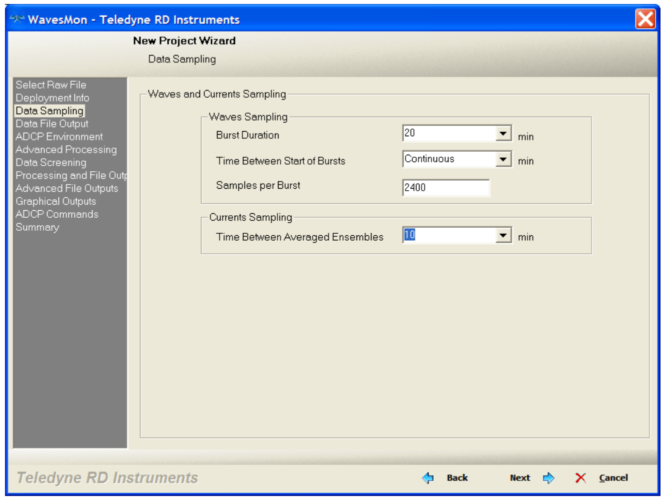
Skip N Bytes Into File or ***Skip N Bursts Into File*** – Use these functions to skip into the file to a specific location. For example, if the ADCP data collection started on the bench, then was deployed on the ocean bottom later, the starting data is bad. To skip this data, offset into the file to the good data. You may need to try a few times if the exact offset is important.

2.4.2 Deployment Info



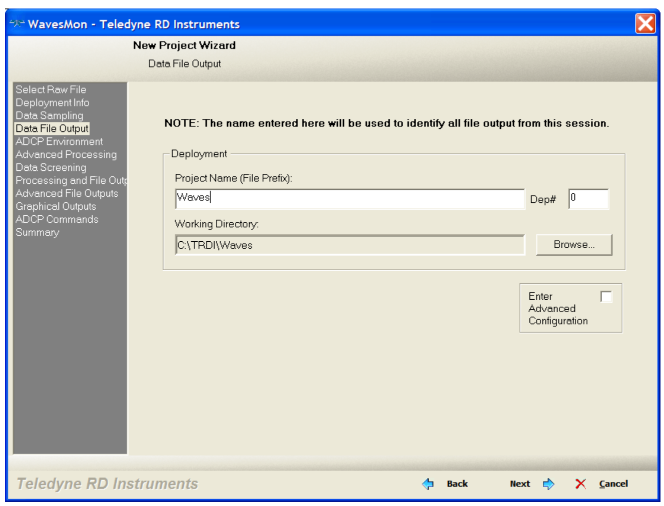
Enter the **Altitude Above Bottom** when the ADCP was deployed.

2.4.3 Data Sampling



The **Data Sampling** screen shows the **Waves and Currents Sampling** parameters used during data collection. No changes are allowed.

2.4.4 Data File Output

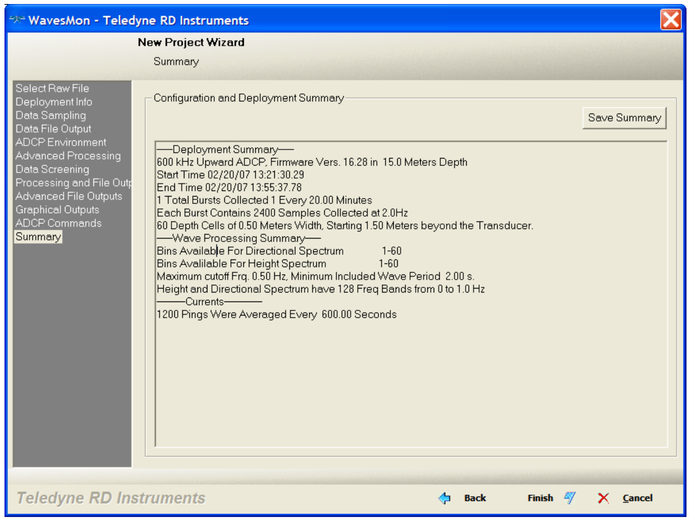


On the **Data File Output** dialog, name the Project file something meaningful. The output data files will be tied to the project file name and path.

Leaving the **Enter Advanced Configuration** box unchecked will complete the wizard and display the summary page (see Processing Summary). If the **Enter Advanced Configuration** button is selected, the wizard will continue to the next page.

NOTE. The rest of the wizard screens are the same as for Real-Time data collection. For more information on the screen settings, see the appropriate section in this manual.

2.4.5 Processing Summary



Review the summary.

To save the **Configuration and Deployment Summary**, click **Save Summary**.

Click **Finish**.

2.5 Editing Projects

Once you use the Project Wizard to process a data file (see Reprocessing Raw ADCP Data) *WavesMon* creates a **Playback Configuration** node. The **Playback Configuration** is a copy of the **Field Configuration** information used to collect the data. No changes can be made to the original **Field Configuration** or **Playback Configuration** nodes.

Configuration nodes can be **Duplicated**, **Deleted** (only the copies), and **Renamed** as needed. Any editing changes made to the configuration nodes are saved to the project file.

Right-clicking on a **Field Configuration** or **Playback Configuration** node will display the following menu.

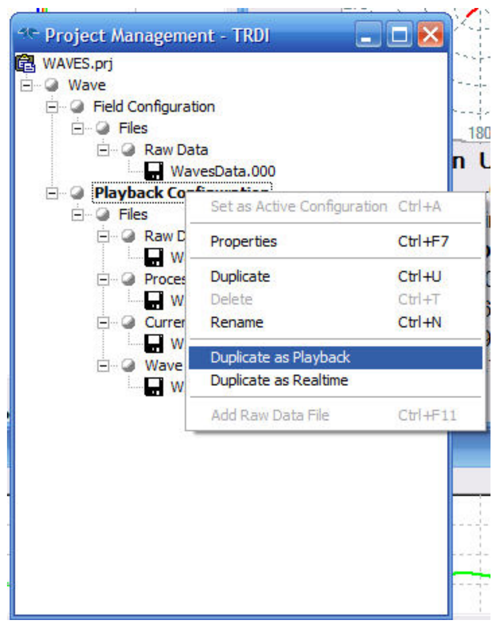


Figure 31. Project Management Window Menu

2.5.1 Duplicate

Use this function to duplicate the configuration node. If the **Field Configuration** node is duplicated, it will create a new **Playback Configuration** node.

2.5.2 Properties

Right-click on the duplicate **Playback Configuration** node and select **Properties**. Select the page you wish to change. Enter your changes and click **OK**. Save the project file if you make changes by selecting **File**, **Save Project**. Start playback again by clicking the ▶ button.

The following screens are the same as for Real-Time data collection. For more information on the screen settings, see the appropriate section in this manual.

- ADCP Environment
- Advanced Processing
- Data Screening
- Processing and File Outputs
- Advanced File Outputs
- Graphical Outputs
- ADCP Commands
- Real-Time Data Collection Summary

2.5.3 Set as Active Configuration

The active configuration node is in bold. To change between configuration nodes, right-click the on the configuration node name and select **Set as Active Configuration**. Only one configuration node may be active at a time.

2.5.4 Delete

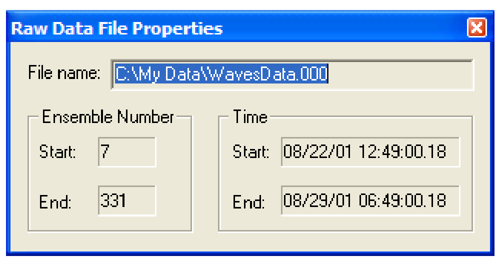
Use this function to delete a configuration node. The Field Configuration node and the original Playback Configuration node can not be deleted.

2.5.5 Rename

Use this function to rename the configuration node. To change the name of the node, right-click the on the configuration node and click **Rename**.

2.5.6 Data File

Right-clicking on a data file and selecting **Properties** will display the **Raw Data File Properties** box.



2.5.7 Adding Raw Data Files

If you have multiple data files that need to be processed, do the following.

a. Duplicate the original Playback Configuration node by right-clicking on the **Playback Configuration** node and select **Duplicate as Playback**.

b. Right-click on the duplicate Playback Configuration node and select **Add Raw Data File**.

c. Select the waves raw data file (*.000 or *.PD0).

d. Click **Open**.

e. Repeat steps "b" through "d" as needed to add multiple data files.

3 Command Line Options

To start *WavesMon* from a command line or in a batch file for data collecting/processing automatically, *WavesMon* needs following parameters: WavesMon.exe [*ProjectFileName.prj*] [**Auto**]

The software will open the setup file, collect and process the number of bursts requested in the setup, output processed data according to the setup file options.

The command line options for *WavesMon* are as follows:

WavesMon.exe [*ProjectFileName.prj*] [**Auto**]

- The primary command line argument is the setup file name. By passing the setup file name to the program one can automatically load a setup file without having to go through the file open dialog. Be sure to always pass a setup file name as the first command line option.
- The next argument is optional. If 2nd argument is "**Auto**" *WavesMon* will start automatically.

Example of a batch file:

```
@ECHO OFF
CD C:\Program Files\RD Instruments\WavesMon
WavesMon.exe C:\TRDI\WAVES\WAVES.PRJ Auto
```

NOTE. Some commands (MSDOS®) do not handle a space in a path in a batch file like Windows® does.

4 WavesMon File Formats

The file extensions have the following meanings.

Table 1: File Naming Conventions

Extension	Description
*.prj	Project files created by *WavesMon* based on how the program options are setup.
*.wvs	Waves Record file created by processing data using *WavesMon* and viewed with WavesView.
*.wsp	Workspace file for *WavesMon*. Saves how the screens looked when the file was saved.
*.txt	Text format waves output

4.1 *WavesMon* Input Data Formats

ADCP Ensemble or Packet Data. The program input is ADCP ensembles collected at 2 Hz. The ensembles must have un-transformed beam radial velocity data. This data can be read from the COM port or from files.

Project Files. The software determines its mode of operation and the way to process the data from the project file that is loaded at startup.

4.2 *WavesMon* Output Data Formats

The **Advanced File Outputs** page allows selecting what output files are created (see Advanced File Outputs).

Raw Data. *WavesMon* can write out the raw ADCP ensemble data to files and to a COM port. The file name must have a three digit numeric extension. If the file size exceeds the maximum, the numeric file extension will be incremented and a new file started. A new file is started automatically every time the software is run.

Waves Parameters Log. *WavesMon* can also output a waves parameters log file. This file contains an averaged transformed current profile, and wave parameters (Hs, Tp, Dp). This data can also be written to the COM port. This data is intended for integration with other systems or software. See Wave Parameters Log Formats for details.

Processed Waves Data. The main output of *WavesMon* is the waves record. A waves record (**.wvs*) is an extensible binary structure very much like an ADCP ensemble. The contents of the waves record can be selected in the **project wizard**. The waves record always contains the necessary information to interpret and process the waves data. The advantage of the waves record is that it condenses Giga-bytes of raw ensemble data into a compact waves data set.

The waves record can contain raw data and/or processed waves data. For example 400 Mega-bytes of raw ensemble data can be condensed to 3 megabytes of processed waves data. The *WavesView* software is designed to read and display waves records (*.wvs files).

Currents Data. Currents data files contain just currents data.

Text Files. Text files of the time series and spectra data can be output for each burst. For each item selected, a corresponding text file will be created for each burst. The file name includes the date and time. For those who would like to do their own analysis these files can be imported into MatLab or a spreadsheet program like Excel. To output DSpec and Fourier Coefficients, see DSpec and Fourier Coefficients Data.

```
HPR2008030316093134.txt
PSpec0803031609.txt
SSpec0803031609.txt
VSpec0803031609.txt
DSpec0803031609.txt
FCoeff0803031609.txt
```

Images. Turn on the **Save Images** function on the **Graphical Outputs** page (see Graphical Outputs). This allows you to save screen images to *.PNG format files.

4.3 Wave Parameters Log Formats

The **Waves Parameters Log** is a brief summary containing wave parameters (Hs, Tp, Dp, and averaged current profile data). There are 10 formats available (0 through 11, with formats 7 and 9 not available).

4.3.1 Format 0

Table 2: Waves Parameters Log: Format 0

String	Description
Header	(0x7f78)
YY MM DD HH mm ss cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Depth	Water level (from pressure sensor) (decimeters)
Coordinate system	(0 = beam, 1 = earth, 2 = ship)
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Reserved1	Reserved for TRDI use.
Reserved2	Reserved for TRDI use.
Bins	
bin1beam1 velocity	bin1beam1 velocity (mm/s)
bin1beam2 velocity	bin1beam2 velocity (mm/s)

NOTE. Format 0 is updated with every averaged current profile. Binary format with 16 bit signed fields.

4.3.2 Format 1

Table 3: Waves Parameters Log: Format 1

String	Description
Header	(0x7f78)
YY MM DD HH mm ss cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Depth	Water level (from pressure sensor) (decimeters)
Coordinate system	(0 = beam, 1 = earth, 2 = ship)
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Reserved1	Reserved for TRDI use.
Reserved2	Reserved for TRDI use.
Bins	
bin1beam1 velocity	bin1beam1 velocity (mm/s)
bin1beam2 velocity	bin1beam2 velocity (mm/s)
↓	

NOTE. Format 1 is like format 0 only in ASCII format with 16 bit signed fields. ASCII text uses twice as many bytes as the binary format. Format 1 is updated with every averaged current profile.

Example:

```
********
32632
378
1
8
22
12
49
0
18
↓
↓

********
```

4.3.3 Format 2

Table 4: Waves Parameters Log: Format 2

String	Description
Burst#	Burst number
YYMMDDHHmmsscc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.

NOTE. Updated with each burst of waves data. ASCII text, space delimited line for each burst of data.

Example:

```
 8 01082213190018 -0.00 -0.10 -1.0
 9 01082213490018 0.84 7.70 281.0
10 01082214190018 0.82 8.20 280.0
11 01082214490018 0.85 8.20 263.0
12 01082215190018 0.87 7.30 258.0
13 01082215490018 0.74 6.50 268.0
14 01082216190018 0.84 7.70 268.0
15 01082216490018 0.76 7.70 293.0
```

4.3.4 Format 3

Table 5: Waves Parameters Log: Format 3

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (decimeters)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevel5Magnitude	Depth level 5 Magnitude (m/s) (m/s)
depthlevel5Direction	Depth level 5 Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Format 3 always averages the profile into five depth levels.

Example:

```
 8,01,08,22,13,19,00,18,-0.00,-0.10,-1.0,18.700,5,0.036, 10,0.046,123,0.060,121,0.190, 59,0.041,118
 9,01,08,22,13,49,00,18,0.84,7.70,281.0,18.600,5,0.011, 71,0.062,122,0.071,126,0.216, 52,0.027,150
10,01,08,22,14,19,00,18,0.82,8.20,280.0,18.400,5,0.020, 21,0.068,141,0.067,144,0.188, 57,0.078,106
11,01,08,22,14,49,00,18,0.85,8.20,263.0,18.300,5,0.031,  6,0.070,159,0.066,155,0.168, 63,0.084, 97
12,01,08,22,15,19,00,18,0.87,7.30,258.0,18.200,5,0.030,342,0.068,165,0.079,147,0.189, 69,0.067,111
13,01,08,22,15,49,00,18,0.74,6.50,268.0,18.000,5,0.071, 10,0.066,194,0.087,165,0.205, 82,0.049,159
```

4.3.5 Format 4

Table 6: Waves Parameters Log: Format 4

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s) (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Format 4 is like Format 3 only it outputs a full resolution profile.

Example:

```
    8,01,08,22,13,19,00,18,-0.00,-0.10,-1.0,18781.000,43,0.077,310,0.078,316,0.066,329,0.059,  7,0.044,
38,0.048, 67,0.059, 80,0.063, 93,0.060,
95,0.060,101,0.048,108,0.043,120,0.045,132,0.046,139,0.050,146,0.044,155,0.043,152,0.035,145,0.029,145,0.0
44,139,0.060,122,0.076,116,0.084,114,0.135,100,0.108, 49,0.391, 23,0.525, 55,0.127, 63,0.197, 76,0.158,
90,0.099, 98,0.084,115,0.065,101,0.067,
83,0.052,107,0.039,103,0.045,127,0.049,159,0.045,140,0.021,205,0.048,222,0.078,249,0.112,208
    9,01,08,22,13,49,00,18,0.84,7.70,281.0,18682.000,43,0.065,287,0.072,295,0.043,311,0.019, 21,0.036,
98,0.058,105,0.072,109,0.077,108,0.080,109,0.079,111,0.070,114,0.058,114,0.060,126,0.050,134,0.057,139,0.0
54,143,0.045,156,0.043,152,0.046,143,0.055,143,0.069,134,0.086,131,0.098,124,0.165, 93,0.140, 25,0.457,
20,0.507, 53,0.118, 57,0.229, 71,0.180, 78,0.135, 83,0.117, 87,0.103, 83,0.073, 83,0.063,
96,0.046,110,0.027,204,0.058,234,0.078,226,0.092,219,0.115,249,0.100,237,0.134,194
```

4.3.6 Format 5

Table 7: Waves Parameters Log: Format 5

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Format 5 is like Format 3 only it outputs a full resolution profile and adds $H_{1/10}$ and Tmean.

Example:

```
    8,01,08,22,13,19,00,18,-1.00,-1.00,-1.0,18781.000,-1.00,-1.00,43,0.077,310,0.078,316,0.066,329,0.059,
7,0.044, 38,0.048, 67,0.059, 80,0.063, 93,0.060,
95,0.060,101,0.048,108,0.043,120,0.045,132,0.046,139,0.050,146,0.044,155,0.043,152,0.035,145,0.029,145,0.0
44,139,0.060,122,0.076,116,0.084,114,0.135,100,0.108, 49,0.391, 23,0.525, 55,0.127, 63,0.197, 76,0.158,
90,0.099, 98,0.084,115,0.065,101,0.067,
83,0.052,107,0.039,103,0.045,127,0.049,159,0.045,140,0.021,205,0.048,222,0.078,249,0.112,208
    9,01,08,22,13,49,00,18,0.84,7.70,281.0,18682.000,1.06,6.00,43,0.065,287,0.072,295,0.043,311,0.019,
21,0.036,
98,0.058,105,0.072,109,0.077,108,0.080,109,0.079,111,0.070,114,0.058,114,0.060,126,0.050,134,0.057,139,0.0
54,143,0.045,156,0.043,152,0.046,143,0.055,143,0.069,134,0.086,131,0.098,124,0.165, 93,0.140, 25,0.457,
20,0.507, 53,0.118, 57,0.229, 71,0.180, 78,0.135, 83,0.117, 87,0.103, 83,0.073, 83,0.063,
96,0.046,110,0.027,204,0.058,234,0.078,226,0.092,219,0.115,249,0.100,237,0.134,194
```

4.3.7 Format 6

Table 8: Waves Parameters Log: Format 6

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with every averaged current profile. ASCII text, comma delimited line for each burst of data. Format 6 is similar to Format 3, only it outputs a full resolution profile.

Example:

```
    8,01,08,22,13,49,00,18,-1.00,-1.00,-1.0,18781.000,-1.00,-1.00,43,0.065,287,0.072,295,0.043,311,0.019, 21,0.036,
98,0.058,105,0.072,109,0.077,108,0.080,109,0.079,111,0.070,114,0.058,114,0.060,126,0.050,134,0.057,139,0.054,143,0.045,1
56,0.043,152,0.046,143,0.055,143,0.069,134,0.086,131,0.098,124,0.165, 93,0.140, 25,0.457, 20,0.507, 53,0.118, 57,0.229,
71,0.180, 78,0.135, 83,0.117, 87,0.103, 83,0.073, 83,0.063,
96,0.046,110,0.027,204,0.058,234,0.078,226,0.092,219,0.115,249,0.100,237,0.134,194
    9,01,08,22,14,19,00,18,0.84,7.70,281.0,18682.000,1.06,6.00,43,0.043, 24,0.034,
8,0.035,348,0.037,338,0.019,344,0.015,
42,0.020,101,0.036,118,0.058,128,0.075,134,0.081,135,0.080,141,0.082,140,0.065,145,0.058,150,0.056,162,0.053,177,0.050,1
71,0.054,176,0.060,165,0.066,156,0.087,145,0.097,140,0.150, 95,0.180, 22,0.484, 29,0.343, 57,0.131, 71,0.179, 86,0.158,
90,0.120, 91,0.094, 95,0.073, 99,0.068,119,0.070,101,0.064,109,0.067,118,0.080,117,0.102,100,0.106, 95,0.120, 82,0.134,
81,0.067, 39
```

4.3.8 Format 7

NOTE. Format 7 is not available.

4.3.9 Format 8

Table 9: Waves Parameters Log: Format 8

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
Dmean	Mean Peak Wave Direction (degrees)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Like Format 3 only it outputs a full resolution profile.

Example:

```
   10,01,08,22,14,19,00,18,0.82,8.20,280.0,18553.000,1.04,5.90,260.0,43,0.043, 24,0.034,
8,0.035,348,0.037,338,0.019,344,0.015,
42,0.020,101,0.036,118,0.058,128,0.075,134,0.081,135,0.080,141,0.082,140,0.065,145,0.058,150,0
.056,162,0.053,177,0.050,171,0.054,176,0.060,165,0.066,156,0.087,145,0.097,140,0.150,
95,0.180, 22,0.484, 29,0.343, 57,0.131, 71,0.179, 86,0.158, 90,0.120, 91,0.094, 95,0.073,
99,0.068,119,0.070,101,0.064,109,0.067,118,0.080,117,0.102,100,0.106, 95,0.120, 82,0.134,
81,0.067, 39
   11,01,08,22,14,49,00,18,0.85,8.20,263.0,18424.000,1.08,6.00,260.0,43,0.072, 41,0.057,
28,0.051,
8,0.040,340,0.035,321,0.030,323,0.013,351,0.012,185,0.046,173,0.075,159,0.087,153,0.087,149,0.
076,154,0.070,155,0.065,164,0.059,176,0.052,193,0.057,205,0.060,195,0.071,177,0.085,167,0.100,
158,0.114,143,0.143, 82,0.229, 13,0.539, 38,0.146, 65,0.153, 98,0.175,103,0.148, 97,0.116,
95,0.098, 95,0.073, 99,0.056,106,0.049,102,0.059, 89,0.083, 94,0.101,104,0.116,100,0.136,
90,0.102, 88,0.095, 62,0.204, 18
```

4.3.10 Format 9

Table 10: Waves Parameters Log: Format 9

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Tp_Sea	Peak Sea Wave Period (seconds) - period associated with the largest peak in the sea region of the power spectrum. (see Note)
Dp_Sea	Peak Sea Wave Direction (degrees) - peak sea direction at the peak period in the sea region. (see Note)
Hs_Sea	Significant Wave Height in the sea region of the power spectrum.
Tp_Swell	Peak Swell Wave Period (seconds) - period associated with the largest peak in the swell region of the power spectrum. (see Note)
Dp_Swell	Peak Swell Wave Direction (degrees) - peak swell direction at the peak period in the swell region. (see Note)
Hs_Swell	Significant Wave Height in the swell region of the power spectrum.
Depth	Water level (from pressure sensor) (millimeters)
H_{max}	Maximum wave height (meters) as determined by Zero-Crossing analysis of the surface track time series.
T_{max}	Maximum Peak Wave Period (seconds) as determined by Zero-Crossing analysis of the surface track time series.
$H_{1/3}$	Significant wave height of the largest 1/3 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$T_{1/3}$	The period associated with the peak wave height of the largest 1/3 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
H_{mean}	The mean significant wave height of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
T_{mean}	The period associated with the mean significant wave height of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$H_{1/10}$	Significant wave height of the largest 1/10 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$T_{1/10}$	The period associated with the peak wave height of the largest 1/10 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
Dmean	Mean Peak Wave Direction (degrees)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTES.

The Sea and Swell parameters are calculated based on the Sea Swell Transition Frequency, which is set in the Advanced Processing page of the new Project Wizard.

Surface Track must be valid for the zero up-crossing parameters (H_{max}, T_{max}, $H_{1/3}$, $T_{1/3}$, H_{mean}, T_{mean}, $H_{1/10}$, $T_{1/10}$, Hs_Sea and Hs_Swell) to be calculated.

Log 9 format is not valid for Horizontal ADCP waves applications since there is no surface track for HADCP.

Example:

```
    1,07,06,25,18,43,24,39,1.03,9.40,283.0,7.29,294.0,0.80,9.44,283.0,0.65,
10388.000,1.73,6.75,1.11,7.26, 0.72,5.80,1.40,7.33,280.0,43,0.092, 13,0.092,
16,0.075, 11,0.043,
1,0.008,277,0.035,225,0.061,202,0.083,195,0.112,202,0.138,203,0.140,200,0.115,19
6,0.112,197,0.101,192,0.089,194,0.085,188,0.075,172,0.145, 91,0.308, 49,0.427,
57,0.229, 74,0.113,108,0.121,123,0.101,122,0.141,127,0.236,163,0.359,150,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,0.491,303,0.272,347,0.255, 22,0.253,
41,0.069, 73,0.172,211
    2,07,06,25,19,03,24,39,0.93,5.90,286.0,5.94,286.0,0.75,9.44,286.0,0.56,
10392.000,1.67,8.25,1.08,7.24,0.71,5.75,1.36,7.55,287.0,43,0.078, 19,0.059,
15,0.034,348,0.035,265,0.028,280,0.012,301,0.012,235,0.060,201,0.110,204,0.142,2
05,0.142,204,0.146,205,0.126,203,0.114,199,0.099,198,0.079,193,0.070,173,0.152,
92,0.295, 49,0.340, 52,0.195,
75,0.120,134,0.120,151,0.121,158,0.113,171,0.244,132,1.799,148,-32768.000,-
32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,0.275,333,0.296,348,0.200, 16,0.155, 38,0.051,113,0.219,201
```

4.3.11 Format 10

Table 11: Waves Parameters Log: Format 10

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
Dmean	Mean Peak Wave Direction (degrees)
Hs[0]	Height for frequency band 0 (meters)
Dp[0] ↓	Peak Wave Direction (degrees) for frequency band 0 - peak direction at the peak period.
Hs[6]	Height for frequency band 7 (meters)
Dp[6]	Peak Wave Direction (degrees) for frequency band 7 - peak direction at the peak period.
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction ↓	Depth Level 1 Direction (deg)
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Format 10 is like Format 8 except it also includes Hs and Dp results in seven frequency bands (0 to 6).

The seven bands reported are: [0] Longer than 8 seconds, [1] 7 to 8 seconds, [2] 6 to 7 seconds, [3] 5-6 seconds, [4] 4-5 seconds, [5] 3-4 seconds, [6] Shorter than 3 seconds.

Example:

```
10,01,08,22,14,19,00,18,0.82,8.20,280.0,18553.000,1.04,5.90,260.0,0.36,225,0.21,257,0.34,276,0.26,262,0.24,27
9,0.18,152,0.20,338,43,0.043, 24,0.034,  8,0.035,348,0.037,338,0.019,344,0.015,
42,0.020,101,0.036,118,0.058,128,0.075,134,0.081,135,0.080,141,0.082,140,0.065,145,0.058,150,0.056,162,0.053,
177,0.050,171,0.054,176,0.060,165,0.066,156,0.087,145,0.097,140,0.150, 95,0.180, 22,0.484, 29,0.343,
57,0.131, 71,0.179, 86,0.158, 90,0.120, 91,0.094, 95,0.073,
99,0.068,119,0.070,101,0.064,109,0.067,118,0.080,117,0.102,100,0.106, 95,0.120, 82,0.134, 81,0.067, 39

11,01,08,22,14,49,00,18,0.85,8.20,263.0,18424.000,1.08,6.00,260.0,0.37,263,0.20,280,0.32,288,0.30,293,0.27,20
0,0.16,168,0.16,189,43,0.072, 41,0.057, 28,0.051,
8,0.040,340,0.035,321,0.030,323,0.013,351,0.012,185,0.046,173,0.075,159,0.087,153,0.087,149,0.076,154,0.070,1
55,0.065,164,0.059,176,0.052,193,0.057,205,0.060,195,0.071,177,0.085,167,0.100,158,0.114,143,0.143, 82,0.229,
13,0.539, 38,0.146, 65,0.153, 98,0.175,103,0.148, 97,0.116, 95,0.098, 95,0.073, 99,0.056,106,0.049,102,0.059,
89,0.083, 94,0.101,104,0.116,100,0.136, 90,0.102, 88,0.095, 62,0.204, 18
```

4.3.12 Format 11

Table 12: Waves Parameters Log: Format 11

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Format 11 is updated with each burst of waves data. Binary format for each burst of data. Format 11 is the same as Format 5 only in DHI Water & Environment format.

4.3.13 Format 12

Table 13: Waves Parameters Log: Format 12

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Tp_Sea	Peak Sea Wave Period (seconds) - period associated with the largest peak in the sea region of the power spectrum. (see Note)
Dp_Sea	Peak Sea Wave Direction (degrees) - peak sea direction at the peak period in the sea region. (see Note)
Hs_Sea	Significant Wave Height in the sea region of the power spectrum.
Tp_Swell	Peak Swell Wave Period (seconds) - period associated with the largest peak in the swell region of the power spectrum. (see Note)
Dp_Swell	Peak Swell Wave Direction (degrees) - peak swell direction at the peak period in the swell region. (see Note)
Hs_Swell	Significant Wave Height in the swell region of the power spectrum.
Depth	Water level (from pressure sensor) (millimeters)
H_{max}	Maximum wave height (meters) as determined by Zero-Crossing analysis of the surface track time series.
T_{max}	Maximum Peak Wave Period (seconds) as determined by Zero-Crossing analysis of the surface track time series.
$H_{1/3}$	Significant wave height of the largest 1/3 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$T_{1/3}$	The period associated with the peak wave height of the largest 1/3 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
H_{mean}	The mean significant wave height of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
T_{mean}	The period associated with the mean significant wave height of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$H_{1/10}$	Significant wave height of the largest 1/10 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
$T_{1/10}$	The period associated with the peak wave height of the largest 1/10 of the waves in the field as determined by Zero-Crossing analysis of the surface track time series.
Dmean	Mean Peak Wave Direction (degrees)
Temperature	Temperature (deg C)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTES.

Format 12 is similar to Format 9, only it outputs temperature.

The Sea and Swell parameters are calculated based on the Sea Swell Transition Frequency, which is set in the Advanced Processing page of the new Project Wizard.

Surface Track must be valid for the zero up-crossing parameters (H_{max}, T_{max}, $H_{1/3}$, $T_{1/3}$, H_{mean}, T_{mean}, $H_{1/10}$, $T_{1/10}$, Hs_Sea and Hs_Swell) to be calculated.

Log 12 format is not valid for Horizontal ADCP waves applications since there is no surface track for HADCP.

Example:

```
1,07,06,25,18,43,24,39,1.03,9.80,285.0,7.50,276.0,0.80,9.80,285.0,0.66,10388.000,1
.73,6.75,1.11,7.26,0.72,5.80,1.40,7.33,284.0,15.65,43,0.092, 13,0.092, 16,0.075,
11,0.043,
1,0.008,277,0.035,225,0.061,202,0.083,195,0.112,202,0.138,203,0.140,200,0.115,196,
0.112,197,0.101,192,0.089,194,0.085,188,0.075,172,0.145, 91,0.308, 49,0.427,
57,0.229, 74,0.113,108,0.121,123,0.101,122,0.141,127,0.236,163,0.359,150,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,0.491,303,0.272,347,0.255, 22,0.253, 41,0.069,
73,0.172,211

2,07,06,25,19,03,24,39,0.94,9.80,286.0,6.08,277.0,0.75,9.80,286.0,0.57,10392.000,1
.67,8.25,1.08,7.24,0.71,5.75,1.36,7.55,282.0,15.53,43,0.078, 19,0.059,
15,0.034,348,0.035,265,0.028,280,0.012,301,0.012,235,0.060,201,0.110,204,0.142,205
,0.142,204,0.146,205,0.126,203,0.114,199,0.099,198,0.079,193,0.070,173,0.152,
92,0.295, 49,0.340, 52,0.195,
75,0.120,134,0.120,151,0.121,158,0.113,171,0.244,132,1.799,148,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,0.275,333,0.296,348,0.200, 16,0.155, 38,0.051,113,0.219,201

3,07,06,25,19,23,24,39,0.88,7.50,286.0,7.50,286.0,0.72,7.50,286.0,0.51,10408.000,1
.82,7.63,1.06,7.27,0.71,5.84,1.37,7.73,281.0,15.49,43,0.064, 21,0.064, 32,0.042,
35,0.018,354,0.001,135,0.008,247,0.027,208,0.060,201,0.098,204,0.106,211,0.108,213
,0.110,209,0.102,205,0.100,199,0.080,195,0.077,197,0.050,175,0.147, 94,0.258,
45,0.324, 42,0.191, 56,0.059, 86,0.055,131,0.045,149,0.081,163,0.068,
86,0.122,199,0.955,266,0.566,341,0.310, 33,0.398,  8,0.212, 22,0.228,
68,0.189,251,0.306,249,-32768.000,-32768,0.436,217,0.191, 17,0.324,340,0.225,
0,0.127, 33,0.089, 27,0.120,225

4,07,06,25,19,43,24,39,1.02,9.80,282.0,7.50,283.0,0.79,9.80,282.0,0.65,10435.000,1
.58,7.13,1.03,7.67,0.71,6.38,1.27,7.72,280.0,15.52,43,0.048,349,0.039,353,0.038,34
5,0.030,300,0.031,263,0.035,227,0.029,216,0.043,205,0.069,201,0.077,200,0.067,191,
0.055,176,0.046,156,0.038,155,0.035,147,0.043,134,0.039,128,0.150, 97,0.248,
67,0.340, 65,0.205, 61,0.092, 53,0.084, 55,0.079, 56,0.063, 53,0.099, 68,0.098,
83,0.086,323,0.995,315,0.613,319,0.165,161,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-
32768,1.141,153,0.459,338,0.206, 23,0.222, 48,0.179, 36,0.148,278

5,07,06,25,20,03,24,39,0.95,7.50,280.0,7.50,280.0,0.81,7.50,280.0,0.49,10463.000,1
.84,7.00,1.15,7.03,0.77,5.52,1.45,7.55,278.0,15.56,43,0.046, 10,0.045,
0,0.039,334,0.023,335,0.013,238,0.029,232,0.061,212,0.084,206,0.097,207,0.124,206,
0.118,199,0.106,190,0.078,181,0.064,172,0.046,173,0.042,163,0.043,150,0.148,
96,0.254, 61,0.396, 54,0.245, 66,0.115, 82,0.093, 94,0.081,
95,0.064,116,0.120,126,0.146,139,0.576,288,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,0.312,283,0.230,334,0.168,
7,0.188, 46,0.132, 60,0.135,228
```

4.3.14 Format 16

Table 14: Waves Parameters Log: Format 16

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
Temperature	Temperature (deg C)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with every averaged current profile. ASCII text, comma delimited line for each burst of data. Format 16 is similar to Format 6, only it outputs temperature.

Example:

```
0,07,06,25,18,43,24,39,-1.00,-1.00,-1.0,-1.000,-1.00,-1.00,15.79,43,0.122,  1,0.104,355,0.072,356,0.046,
6,0.008,277,0.031,211,0.046,204,0.086,194,0.108,196,0.119,191,0.118,192,0.103,186,0.087,181,0.076,177,0.065,1
73,0.059,160,0.057,149,0.154, 88,0.268, 41,0.391, 48,0.214,
67,0.122,105,0.104,114,0.109,116,0.076,114,0.131,153,0.366,177,1.192,294,-32768.000,-32768,-32768.000,-
32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-
32768,-32768.000,-32768,0.642,327,0.253,324,0.159, 24,0.223, 58,0.100, 70,0.130,235
    0,07,06,25,18,48,24,39,-1.00,-1.00,-1.0,-1.000,-1.00,-1.00,15.74,43,0.121,  5,0.093,356,0.075,351,0.036,
0,0.009,319,0.027,216,0.053,205,0.089,196,0.113,199,0.123,201,0.119,197,0.114,194,0.101,196,0.094,194,0.078,1
91,0.063,183,0.053,148,0.148, 88,0.287, 43,0.358, 45,0.215, 68,0.097, 89,0.072,115,0.063,126,0.016,
86,0.048,213,0.100,289,1.130,285,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-
32768,0.459,328,0.416,338,0.167, 17,0.129, 51,0.062, 45,0.160,246
```

4.3.15 Format 18

Table 15: Waves Parameters Log: Format 18

String	Description
Burst#	Burst number
YY,MM,DD,HH,mm,ss,cc	Date and time field. Leading zeros are always included to maintain fixed length. YY = 2 fixed digits for year, MM= 2 fixed digits for month, and DD= 2 fixed digits for day. HH = 2 fixed digits of hours, mm = 2 fixed digits of minutes, ss = 2 fixed digits of seconds, and cc = 2 fixed digits of 1/100th seconds.
Hs	Significant Wave Height (meters) $Hs = 4\sqrt{M_0}$
Tp	Peak Wave Period (seconds) - period associated with the largest peak in the power spectrum
Dp	Peak Wave Direction (degrees) - peak direction at the peak period.
Depth	Water level (from pressure sensor) (millimeters)
$H_{1/10}$	$H_{1/10}$ (10% highest waves) = 1.27 * Hs
Tmean	Mean Period (seconds) $T_{01} = T_{mean} = \frac{M_0}{M_1}$
Dmean	Mean Peak Wave Direction (degrees)
Temperature	Temperature (deg C)
#bins	Number of bins
depthlevel1Magnitude	Depth Level 1 Magnitude (m/s)
depthlevel1Direction	Depth Level 1 Direction (deg)
↓	
depthlevelNMagnitude	Depth Level N Magnitude (m/s)
depthlevelNDirection	Depth Level N Direction (deg)

NOTE. Updated with each burst of waves data. ASCII text, comma delimited line for each burst of data. Format 18 is similar to Format 8, only it outputs temperature.

Example:

```
1,07,06,25,18,43,24,39,1.03,9.80,285.0,10388.000,1.31,7.10,284.0,15.65,43,0.092,
13,0.092, 16,0.075, 11,0.043,
1,0.008,277,0.035,225,0.061,202,0.083,195,0.112,202,0.138,203,0.140,200,0.115,196,
0.112,197,0.101,192,0.089,194,0.085,188,0.075,172,0.145, 91,0.308, 49,0.427,
57,0.229, 74,0.113,108,0.121,123,0.101,122,0.141,127,0.236,163,0.359,150,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,0.491,303,0.272,347,0.255, 22,0.253, 41,0.069,
73,0.172,211

2,07,06,25,19,03,24,39,0.94,9.80,286.0,10392.000,1.19,6.90,282.0,15.53,43,0.078,
19,0.059,
15,0.034,348,0.035,265,0.028,280,0.012,301,0.012,235,0.060,201,0.110,204,0.142,205
,0.142,204,0.146,205,0.126,203,0.114,199,0.099,198,0.079,193,0.070,173,0.152,
92,0.295, 49,0.340, 52,0.195,
75,0.120,134,0.120,151,0.121,158,0.113,171,0.244,132,1.799,148,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-32768.000,-32768,-
32768.000,-32768,0.275,333,0.296,348,0.200, 16,0.155, 38,0.051,113,0.219,201
```

4.4 DSpec and Fourier Coefficients Data

To output DSpec and Fourier Coefficients, do the following:

a. Reprocess the data. See Reprocessing Raw ADCP Data.

b. Enable the **Moored (Dynamic) Mounting** option (this enables UVW processing).

c. On the **Advanced File Outputs** tab of the wizard, select **Save Text File**.

Example text files from a burst of data.

```
 % Directional Spectrum
% 90 Directions and 64 Frequencies
% Units are mm^2/(Hz) per cycle
% Frequency Bands are 0.01562500 Hz wide(first frequency band is centered at 0.00830078)
% The first direction slice begins at 0 degrees
 40727 34602 29558 25451 22125 19432 17241 15450 13978 12767 11767 10937 10247 9677 9209 8828 8519 8278
8099 7974 7896 7867 7887 7950 8061 8215 8418 8669 8973 9330 9740 10213 10744 11333 11980 12680 13423 14200
14982 15749 16473 17111 17637 18023 18240 18288 18172 17907 17521 17043 16512 15952 15397 14856 14354
13896 13500 13162 12887 12684 12549 12491 12506 12602 12786 13061 13442 13944 14577 15368 16343 17540
19003 20798 22989 25683 28984 33039 37976 43913 50834 58490 66169 72598 76203 75812 71444 64310 56047
47953
 8321 7742 7240 6809 6436 6120 5852 5627 5441 5297 5182 5101 5053 5029 5039 5077 5144 5245 5379 5546 5752
6001 6297 6647 7049 7522 8063 8685 9389 10183 11068 12040 13073 14150 15222 16236 17112 17787 18198 18313
18136 17691 17040 16255 15399 14518 13666 12867 12135 11475 10901 10403 9982 9633 9350 9130 8977 8881 8843
8862 8944 9077 9278 9542 9872 10274 10752 11312 11949 12671 13465 14317 15212 16107 16949 17681 18227
18519 18519 18208 17609 16777 15782 14700 13595 12518 11504 10570 9728 8982
```

```
 % Fourier Coefficients
% 9 Fields and 64 Frequencies
% Frequency(Hz), Band width(Hz), Energy density(m^2/Hz), Direction (deg), A1, B1, A2, B2, Check Factor
% Frequency Bands are 0.01562500 Hz wide(first frequency band is centered at 0.00830078)
 0.008789 0.015625 0.004356 330.665985 0.316510 -0.177864 0.295988 -0.191569 0.495597
 0.024414 0.015625 0.002304 238.123871 -0.074006 -0.119005 0.087026 -0.204614 0.495597
 0.040039 0.015625 0.001225 150.450287 -0.053727 0.030459 -0.068385 -0.313124 0.495597
 0.055664 0.015625 0.007056 283.523468 0.158111 -0.657392 -0.547678 -0.186301 0.495597
 0.071289 0.015625 0.072900 289.870941 0.318027 -0.879935 -0.643129 -0.623895 0.495597
 0.086914 0.015625 0.047961 294.374908 0.386976 -0.854078 -0.600311 -0.687461 0.495597
 0.102539 0.015625 0.062001 294.365570 0.397000 -0.876580 -0.616157 -0.725030 0.495597
 0.118164 0.015625 0.274576 285.256927 0.242309 -0.888357 -0.736189 -0.405672 0.495597
 0.133789 0.015625 0.338724 279.451233 0.154654 -0.929036 -0.822612 -0.316893 0.495597
 0.149414 0.015625 0.385641 279.886719 0.150083 -0.861115 -0.575937 -0.174322 0.495597
 0.165039 0.015625 0.470596 283.303955 0.207062 -0.875664 -0.630186 -0.427398 0.495597
 0.180664 0.015625 0.391876 278.979034 0.143333 -0.907118 -0.708062 -0.279645 0.495597
 0.196289 0.015625 0.427716 275.843353 0.087324 -0.853262 -0.591752 -0.158158 0.495597
 0.211914 0.015625 0.324900 275.192596 0.080641 -0.887369 -0.659991 -0.149560 0.495597
 0.227539 0.015625 0.209764 269.467621 -0.008063 -0.867769 -0.603813 0.024927 0.495597
 0.243164 0.015625 0.104976 271.425842 0.015684 -0.630130 -0.034787 -0.112206 0.495597
 0.258789 0.015625 0.094249 267.600922 -0.030704 -0.732870 -0.418687 0.133856 0.495597
 0.274414 0.015625 0.047961 267.326538 -0.031385 -0.672127 -0.402713 -0.034910 0.495597
 0.290039 0.015625 0.047961 291.991272 0.202282 -0.500884 -0.364967 -0.073918 0.495597
 0.305664 0.015625 0.024649 278.062531 0.098722 -0.696925 -0.645480 -0.164817 0.495597
 0.321289 0.015625 0.000000 264.768219 -0.042701 -0.466336 -0.334211 0.047322 0.495597
 0.336914 0.015625 0.000000 169.978363 -0.319044 0.056380 0.436184 -0.009445 0.495597
 0.352539 0.015625 0.000000 77.614601 0.045022 0.205019 0.405817 -0.018685 0.495597
```

4.5 Packets Data Definition

Wave packets data is similar to the TRDI Ensemble data except it is designed to reduce the total amount of data output for waves, which must be sampled at 2Hz. Wave Packets data has three main data types. A typical burst of data starts with a First Leader, is followed by 2400 Wave Ping Samples, and ends with a Last Leader. The First Leader data type contains information about how the data was sampled that will be needed later. The Wave Ping Samples contain orbital velocity data from a few selected depth cells, pressure, and surface track data sampled at 2Hz. The Last Leader contains averaged information that could not be determined until the last sample was taken, such as mean water depth.

FL, s1, s2,…….s2400, LL. If motion data has been selected, then each of the Wave Pings Samples (s1…) will also contain a HPR data type.

Expect Ensembles As Well: It should be noted that the ADCP Wave Gauge will output Ensembles containing averaged current profile data interleaved in the middle of a burst of Wave Packets. For example, if you were collecting current profiles every 6 minutes and waves for 20 minutes out of every hour you would expect to see the following.

During the first 20 minutes when waves are being sampled, the output will include Packets as described above with an Ensemble interleaved every six minutes. After the 20-minute wave burst the only output will be the ensembles every six minutes.

Packets Data Definition - Every packet has a Header, some data types and a checksum.

Table 16: Header

Field	# bytes	Description	Value	Units
ID	2	Packets mode ID word	0x7f79	
Checksum offset	2	Offset to checksum		
Spare	1	Spare		
# data types	1	Number of data types		
Offset [256]	2	Offset to each data type		

Table 17: First Leader Type

Field	# bytes	Description	Value	Units
ID	2	First leader ID word	0x0103	
Firmware Version	2	CPU firmware version, rev		
Configuration	2	Bitmap with sys freq, beam geometry		
Nbins	1	Number of depth cells in profile	max (128)	
WaveRecPings	2	# Samples per wave burst		
Bin length	2	Depth cell size		cm
TBP	2	Time between wave samples	50	hund. Sec.
TBB	2	Time between wave bursts		Sec.

Field	# bytes	Description	Value	Units
DistMidBin1	2	Distance to middle of first depth cell		cm
BinsOut	1	# Depth cells output		
SelectedData	2	Reserved		
DWSBins	16	Bitmap of bins for dir. waves		
VelBins	16	Bitmap of bins for non-dir waves		
StartTime	8	Start of burst (Cen,Yr,mo,day,hr,min,sec,sec100)		
Burst#	4	Burst number		
Serial#	8	Serial number		
Temp	2	Temperature		deg. C
Reserved	2	Reserved		

Table 18: Wave Ping Type

Field	# bytes	Description	Value	Units
ID	2	First leader ID word	0x0203	
Ping#	2	Sample #		
TimeSinceStart	4	Time since beginning of burst		hund. Sec.
Pressure	4	Pressure		deca Pa
Dist2Surf	16	Range to surface for 4 beams	(-1 = bad)	mm
Velocity	2*bins *4beams	Beam radial velocity for selected bins (–32768=bad)		mm/s

Table 19: Last Leader Type

Field	# bytes	Description	Value	Units
ID	2	First leader ID word	0x0303	
AvgDepth	2	Average Depth		dm
AvgC	2	Average Speed of Sound		m/s
AvgTemp	2	Average Temperature		0.01 deg C
Avg Heading(See Note)	2	Average Heading		0.01 deg
Std Heading	2	Standard Dev Heading		0.01 deg
AvgPitch	2	Average Pitch		0.01 deg
Std Pitch	2	Standard Dev Pitch		0.01 deg
AvgRoll	2	Average Roll		0.01 deg
Std Roll	2	Standard Dev Roll		0.01 deg

Table 20: HPR Ping Type (This data will only be saved when HDxxx1xxxx is set)

Field	# bytes	Description	Value	Units
ID	2	First leader ID word	0x0403	
Heading (See Note)	2	Heading		0.01 deg
Pitch	2	Pitch		0.01 deg
Roll	2	Roll		0.01 deg

NOTE. This heading is NOT corrected for magnetic variance even though the Average Heading in the Last Leader is corrected for magnetic variance.

5 ADCP Waves Performance Specification

System Frequency	1200 kHz	1200 kHz	600 kHz	600 kHz	300 kHz
Deployment Depth	5 m	10 m	20 m	40 m	80 m
Bin Size	0.35 m	0.35 m	0.5 m	1.0 m	2.0 m
Non-Directional Spectrum					
Surface Track Cut-Off Freq (Hz)	0.99	0.99	0.99	0.74	0.54
Surface Track Cut-Off Period (s)	1.01	1.01	1.01	1.35	1.85
Surface Track Min Wave Ht (m)	0.10	0.10	0.14	0.29	0.57
Velocity Cut-Off Freq (Hz)	0.60	0.56	0.50	0.38	0.36
Velocity Cut-Off Period (s)	1.67	1.79	2.00	2.63	2.78
Velocity Min Wave Ht. (m)	0.05	0.05	0.05	0.15	0.10
Pressure Cut-Off Freq (Hz)	0.39	0.30	0.23	0.16	0.10
Pressure Cut-Off Period (s)	2.56	3.33	4.35	6.25	10.00
Pressure Min Wave Ht (m)	0.03	0.03	0.03	0.05	0.1
Directional Spectrum					
Directional Cut-Off Freq (Hz)	0.58	0.42	0.30	0.21	0.14
Directional Cut-Off Period (s)	1.72	2.38	3.33	4.76	7.14
Directional Min Wave Ht. (m)	0.05	0.05	0.05	0.15	0.10

Assumes Hs of 2 meters at 10-second peak period, and a sample rate of 2 Hz: Exact cut-off frequency will vary with environmental conditions.

6 Software History

Version 3.08 (March 2011 - Present)

- Changed default number of frequency bands used in waves from 128 to 64.
- Improved PD0 decoder when working on data sets with lots of checksum errors.
- Added Water Temperature to three new Log output formats (Log12, Log16, Log18).
- Improved robustness of automated upper cut off frequency algorithm.
- Fixed a crash when data sample rate is less than 2 Hz.

Version 3.07 (May10 – Mar11)

- Added enhancement where upper cutoff frequency is being automatically calculated, no need for user input
- Now calculate all zero up-crossing parameters (Hmax, Tmax, H-1/3, T-1/3, Hmean, Tmean, H-1/10, T-1/10, Hmean, Tmean, Hs-Sea and Hs-Swell) for valid surfacetrack in a waveburst. Output is via log 9 only.
- Improved speed to reprocess a data set
- Improved robustness of data collection in real-time
- Made improvements to Magnetic Variation corrections
- Created ability to mask certain beams when calculating currents with HADCPs
- Changed/raised default lower frequency threshold to 0.03 to avoid processing erroneous data
- Corrected time slip when non-waves packets data was processed for horizontal waves
- Now able to handle files with excessive corrupted data (bad checksum)
- Removed erroneous error message during log data output
- Improved the auto-start routine and disabled non-critical user prompts during auto-start
- Enabled Wave Parameters log output during real-time data collection.

Version 3.06 (Jan09 – May10)

- Added capability for moving of project data and/or project file
- Allow calculation of both sea and swell in the one instance of the application.
- Fixed Submergence/Depth/Altitude for Horizontal ADCP in the Wizard Summary page.
- Fixed a case where if the first waves burst had a smaller than usual number of array bins, bursts with additional array bins would not process.
- Fixed WavesMon averaging and transforming Beam Coordinate for WH ADCP Ensembles to Earth Ensemble.
- Fixed FFT Bin averaging to no longer include the 1st term (the DC offset).

- Added ability to calculate Hmax via Zero-Crossing analysis of Surface Track.
- Fixed negative depth and bad Hs, Tp, Dp when using Surface Track for depth.
- Fixed a Bin Indexing error in Full-Ensemble FindSurface that was yielding an under-call of depth by one bin size.

Version 3.05 (January 2009 to present)

- Added Vista compatibility
- Fixed EB not updating EH during re-processing
- Fixed velocities and Directions marked BAD are getting MagVar corrections applied
- Fixed export Fourier Coefficients for UVW Processing
- Fixed UVW Processing yielding inconsistent Dp
- Fixed problem parsing customer Data
- Fixed problem where WavesMon does not sequentially number current profile ensemble numbers when it creates them from a HADCP.
- Fixed problem where WavesMon is not averaging all data types when averaging currents from a HADCP.
- Fixed problem when transforming Currents from HADCP, make WavesMon use the same transformations as are done in WH Horizontal ADCPs.
- Fixed EX not set when WavesMon outputs current profiles from HADCP.
- Fixed HADCP Averaged Current Output is not averaged.
- Fixed WP not set for HADCP average current output.

Version 3.04 (March 2008 to January 2009)

- Added Squelching of directional noise floor for Processing using Horizontal Wave Gages
- Fixed processing slow-downs when processing waves where Wave Gage is in deep water (deeper than 50m)
- When saving Wave Spectra Text files the Log files were limited to 1 burst. This has been fixed.
- Updated default directional range in Time Series from 5-360 degrees to 0-360 degrees.
- Added support to allow setting a fixed heading.
- Added support to allow overriding Magnetic Variation
- Fixed an algorithmic error in accumulation of Spectra
- Changed "H_{Max}" to "$H_{1/10}$" in the Log Format Output legends to accurately reflect that we are outputting $H_{1/10}$ not H_{Max}.
- Fixed hang-up when loading a project with a large number of files.

Version 3.03 (Dec-2007 – Mar-2008)

- Fixed setup problem when processing 40 min bursts for Horizontal ADCPs
- Fixed setup of number of bins and bin sizes for different Horizontal setup types
- Added WB0-command for all Horizontal setup types
- Changed default processing bins for Horizontal systems

Version 3.02 (Jun-2007 – Dec-2007)

- Initial Release

NOTES

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