HorizonADV

User Guide

Contents

1. Getting Started

1.1 Overview

This document is a reference guide to using SonTek's *HorizonADV* software (v1.20) with your ADV system(s). The topics covered here include a description of system requirements, software installation, program overview, data collection, and data review. For details about the ADV instrument itself, ADV principles of operation, or other ADV software, refer to the *ADV Field Technical Manual*.

The *HorizonADV* program offers a flexible and dynamic user interface designed to easily guide you through the data collection and display process. The program can be used with either a single ADV or with several ADVs working in parallel.

HorizonADV requires the use of either Windows 2000 or XP and is designed to combine a high degree of flexibility, allowing you to use a single package for all your ADV requirements.

HorizonADV can be used to:

- Collect data using a single ADV instrument.
- Collect data using multiple ADVs connected to a MultiPort system (Appendix A).
- Configure ADV systems.
- Display data files collected using ADV systems.

1.2 System Requirements

HorizonADV requires the following to operate efficiently.

- SonTek ADV Field system (standard ADV, MicroADV or ADVOcean) for real-time data collection
- Microsoft Windows 2000/XP (XP recommended)
- 700-MHz processor (1-GHz recommended)
- 128-MB physical memory (256-MB recommended)
- 200-MB available disk space (500-MB recommended)
- Monitor capable of 1024 x 768 resolution, 16-bit color

Computer systems that do not meet the listed minimum requirements will experience a decrease in performance that could result in a loss of data.

1.3 Software Installation

To install the HorizonADV software, insert the ADV Field/Hydra software distribution CD into your CD-ROM drive. After a few seconds, an installation menu should appear (Figure 1). If not, use Windows Explorer to navigate to the CD drive and double click **setup.exe**.

Figure 1. Installation Menu

Click *HorizonADV Setup* to begin program installation.

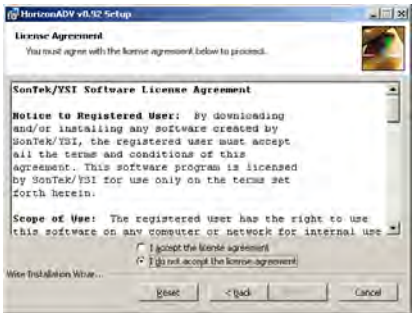


Figure 2. License Agreement

The HorizonADV Installation will start and the **License Agreement** screen (Figure 2) will be displayed. Follow the on-screen instructions to complete installation of the software.

Other items available in the **Installation Menu** include:

- Online documentation.
- Installation of *SonUtils* (general utilities and diagnostics software).
- Installation of other ADV software (e.g., *ViewHydra*, *WinADV*).
- Links to the SonTek/YSI website.

2. Starting HorizonADV

Important Note – Ensure all other software programs that access the serial ports are closed before starting *HorizonADV*.

Start *HorizonADV* using either the HorizonADV desktop shortcut or **Start | Programs | SonTek Software | HorizonADV**.

The software will load and display the *HorizonADV* **Start Screen** (Figure 3). This screen serves as the launch point for all other functions of the program. To activate an option, click the underlined blue text.

The options available on the **Start Screen** include:

Connection Options – Select this option for real-time data collection using either a single ADV (connected to your computer's serial port), or multiple ADVs connected to a MultiPort interface box that uses the computer's network connection.

- **Serial Connection** (for single ADV operation) – Automatic and manual options are available to connect to a single ADV. If you are new to ADV systems or to this

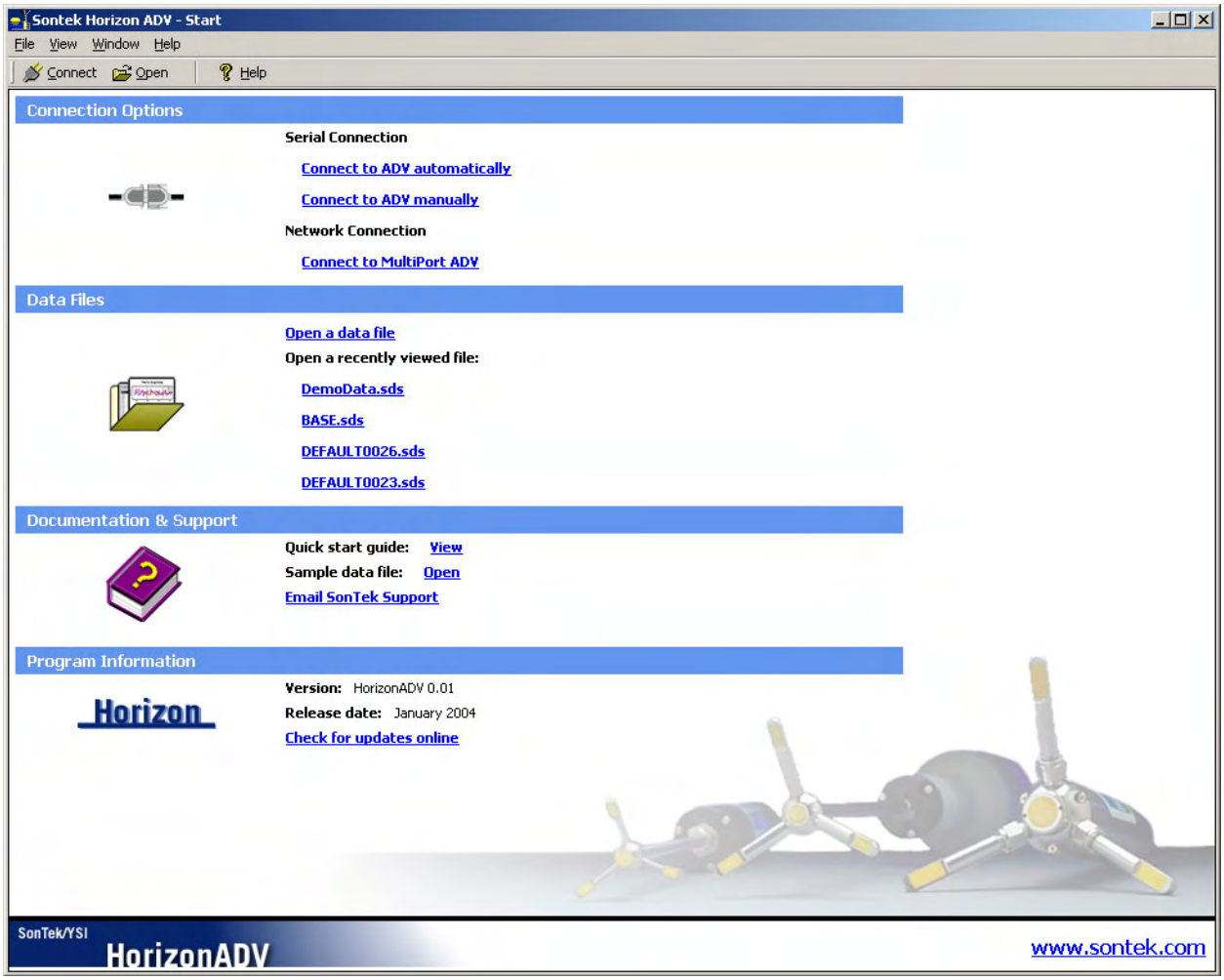


Figure 3. HorizonADV Start Screen

software, we recommend you use the **Connect to ADV automatically** option to connect to your system. As you gain experience, or have special needs, you can then use the **Connect to ADV manually** option.

- **Network Connection** – To connect to several ADVs, use the **Connect to MultiPort ADV** option. The MultiPort connection must have the MultiPort interface box connected to the local network (see Appendix A).

Data Files – The options listed here let you open **.adv** or **.sds** (SonTek Data Session) data files. *HorizonADV* uses SDS files for its processing operations, so any raw **.adv** data files from the instrument are automatically converted to the SDS format when opened (Note: the original **.adv** data files are never modified or deleted by *HorizonADV*). The last four files opened in *HorizonADV* are displayed for easy access. Click the file name to open the file directly, or use the **Open a data file** option to open a file that is not listed.

Documentation & Support – Links to the online Quick Start guide (this document) and a sample ADV data file are displayed here. A link is also available to send email to the SonTek Support team if you have questions.

Program Information – The *HorizonADV* version information and a link to check for program updates on the SonTek website can be found here.

Toolbar Options – The **Connect to ADV manually** and **Open a data file** options are also on the toolbar.

3. Software Layout and Features

This section briefly describes the parts of the screen and some of the more advanced features and aspects of *HorizonADV* that are available during data collection and/or display.

The *HorizonADV* screen consists of several controls and displays (Figure 4). Each of these items are shown and described below:

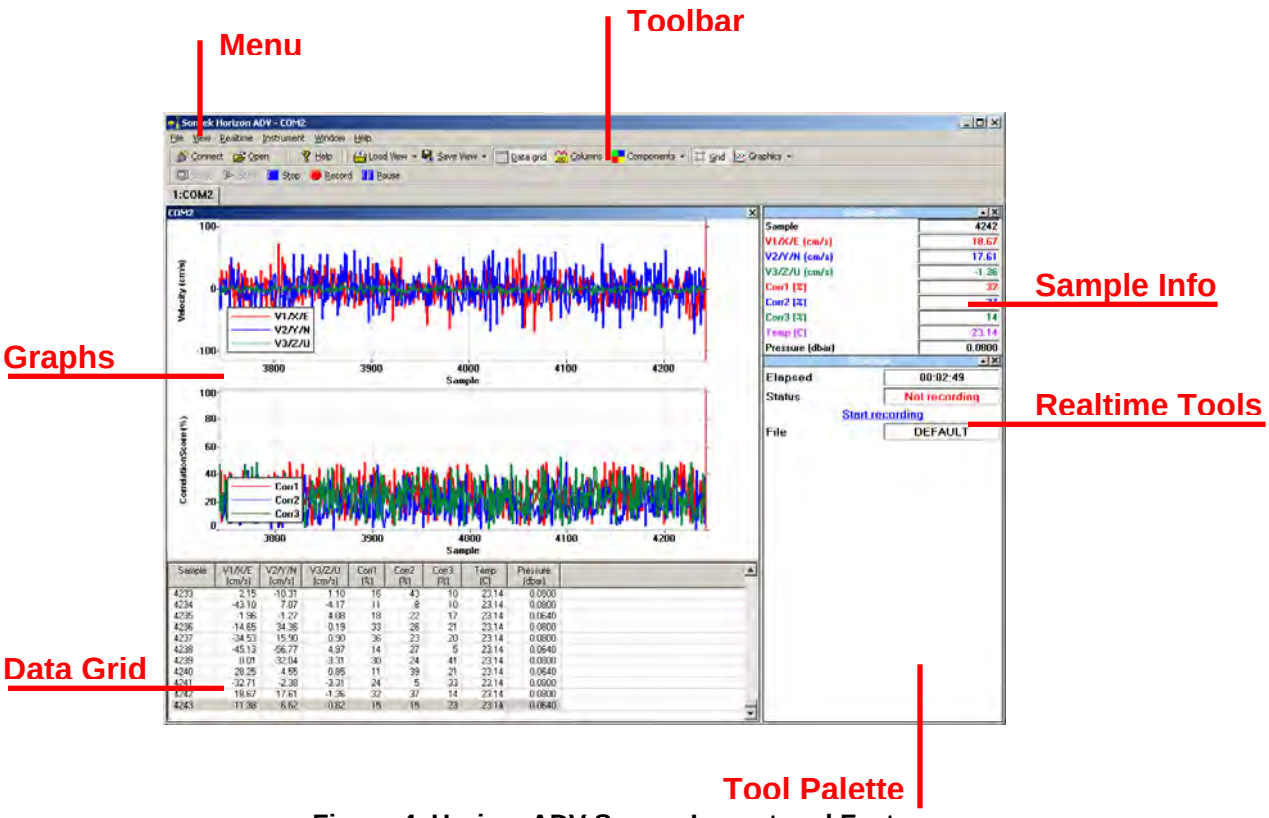


Figure 4. HorizonADV Screen Layout and Features

Menu

The **Menu** is used to access all the commands and available features. Clicking a menu item opens a submenu that typically displays several options.

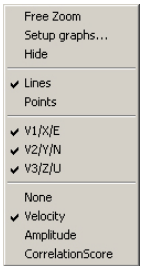
Toolbar

The **Toolbar** provides quick access to some of the more commonly used menu commands. Buttons on the toolbar are grouped into categories (Standard, Data, and Data View). Each button group can be repositioned on the toolbar by dragging it.

Graphs

The **Graphs** show a time-series of one or more variables as they change with time. Up to five graphs can be shown at one time by clicking the **Graphics** button on the toolbar or by selecting **View | Graphics** from the menu.

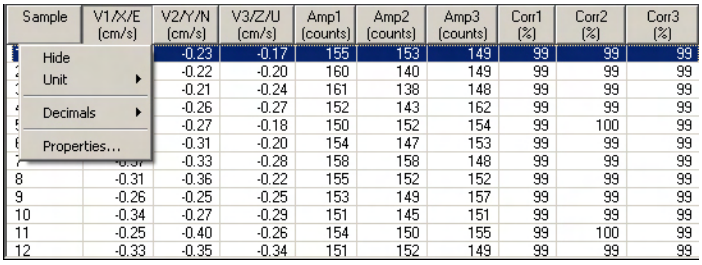
Each graph has several features that can be customized:



- **Left-click on the plot area** to zoom in on the graph.
- **Left-click and drag** to select a specific area of interest on the graph.
- **Right-click on the plot area** to zoom out to the full extent of the data.
- **Double-click on either vertical axis** to change the scale of the axis.
- **Right-click on either vertical axis** to display a popup menu that allows you to modify the graph settings/format, change the displayed parameter, or hide the graph (menu shown at right).
- **Right-click on the horizontal axis** to select a variable to display against the currently displayed parameter. A graph may also display one variable against another. This can be used to show correlation between two parameters. This feature is not available during data collection.

Data Grid

The **Data Grid** (shown below) shows the entire data set in a spreadsheet format. Samples are displayed in the rows, and parameters are displayed in the columns. The selected sample will be highlighted on the grid. The **Data Grid** can be shown or hidden by clicking the **Data Grid** button on the toolbar.



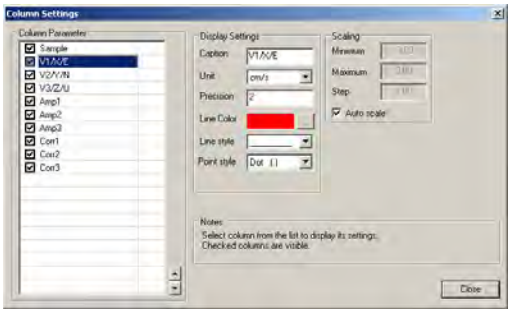
Left-click on a specific parameter to change its status, display properties, or units. Right-click on the column headings to select the variables that will be displayed in the grid.

Tool Palette

The **Tool Palette** displays the **Sample Info** (values for the current or selected sample) and the **Realtime Tools** categories. The Tool Palette is visible by default and can be shown/hidden by selecting **View | Show Tool Palette** from the menu.

Data Columns

Each parameter can be thought of as an individual column in the Data Grid. Each column (or parameter) has its own individual settings related to its display in the time-series graphs, units, and scaling range. These settings affect the way each parameter is displayed in all parts of the program (from the graphs, to the Data Grid and data display). The column settings are displayed by clicking the **Columns** button in the toolbar.



View Templates

View Templates are used to save or restore all display settings. These settings include the screen layout, displayed parameters, and column settings. Use templates to quickly switch between different preset views of your data.

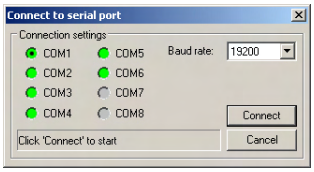
4. Collecting Data

There are a few important points to consider before collecting ADV data. For details about these items, refer to the *ADV Field Technical Manual*.

- Make sure the serial, power, and sync cables (for MultiPort systems only) are connected and not disrupted during the measurement.
- The instrument(s) must be fix-mounted (i.e., rigid) during data collection – particularly for systems without an internal compass.
- The transducers must be submerged during data collection. Though the ADV will not be damaged if it operates out of the water, the velocity data reported by the ADV during this time will be meaningless.
- The sampling volume (Section 6) must be free from obstruction and clear of any boundaries.
- Ideally, the transducers should be clean (i.e., free of biofouling).
- Ensure the correct probe configuration is loaded into the ADV.
- Ensure an appropriate data collection/sampling strategy has been selected.

4.1 Connecting to a Single ADV

Connect to your ADV by clicking the **Connect to ADV automatically** option. This option will scan each serial port on your computer to find a connected ADV. This is the recommended option for beginning users.



Click the **Connect to ADV manually** option to enter manually the serial port and baud rate (speed of data transmission) of your system. This will display the **Connect to serial port** dialog (shown at left). The default settings are COM1 at 19200 baud.

After establishing communications with the system, HorizonADV will display the data collection screen (Figure 5). Note: If your system is unable to either open the port or connect to the system during the connection or data collection phases, check your cables and communication settings, and then try again.

The data collection screen (Figure 5) has options for starting data collection, configuring the ADV, and some additional tools and diagnostic options. To close this screen and return to the Start Screen click the **Disconnect** button or select **File | Close** from the menu.

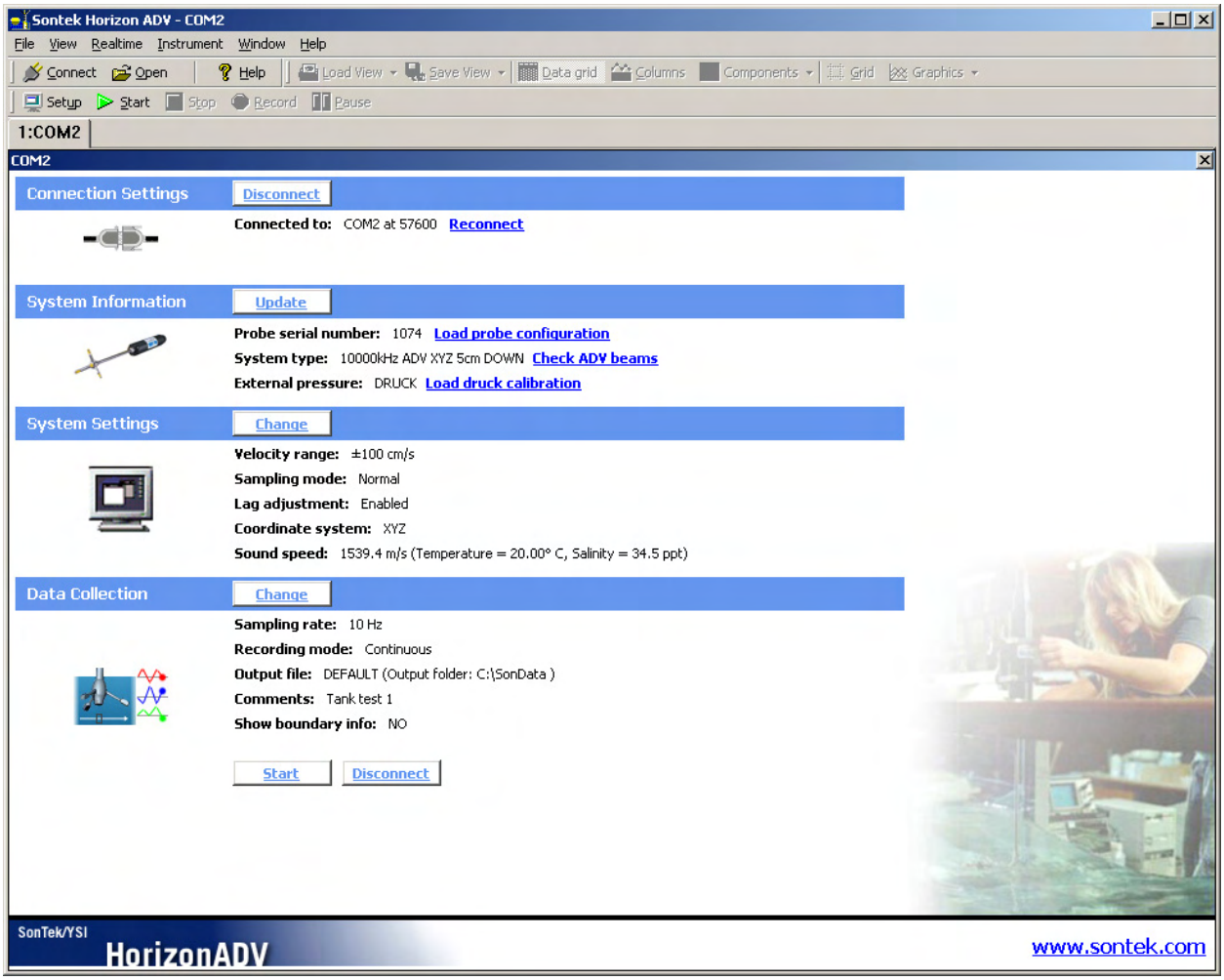


Figure 5. HorizonADV Data Collection Settings Screen

4.2 ADV Probe Configuration & Diagnostics

Before starting data collection it is strongly recommended that you (1) verify you have the correct probe configuration loaded into your system, and (2) run the **Beam-Check** diagnostics module.

To load the probe configuration select the **Load probe configuration** option from the **System Information** category. Select the probe configuration file that matches your system, and then click the **Open** button.

The Beam Check diagnostics module (Figure 6) can be started by clicking **Check ADV beams** under the **System Information** category.

It is good practice to run Beam Check both at the start and end of a data collection session. This can assist in locating any problems should they occur.

Collect Beam Check diagnostic data by clicking the **Start** button. Log this data to a file by clicking the **Record** button.

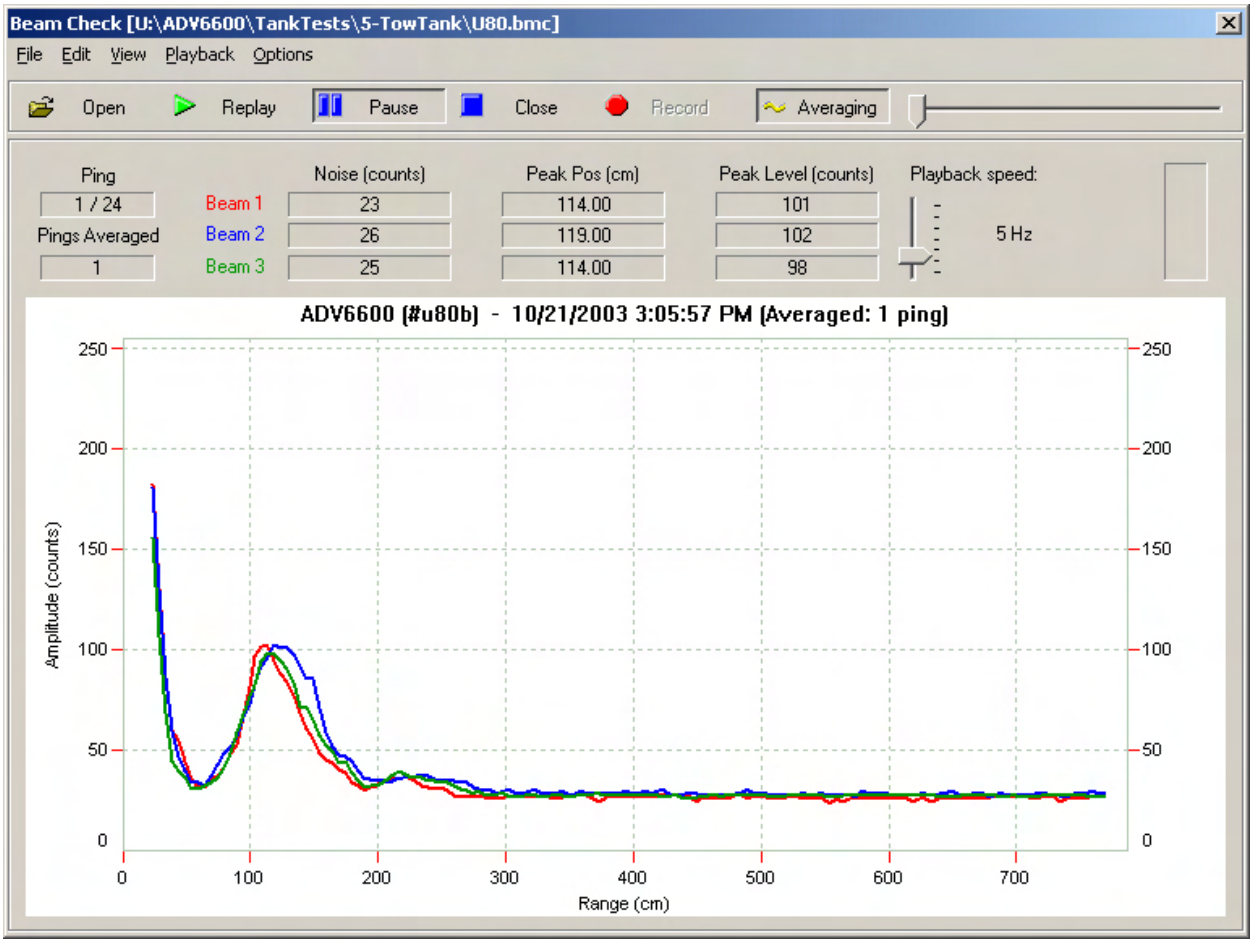


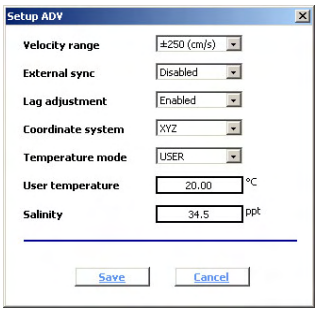
Figure 6. HorizonADV Beam Check Diagnostics Module

Typical examples of hardware and environment problems include:

- **No signal for all three beams (receivers) or a blank graph** – The signal-conditioning module is not connected or the high-frequency cable is damaged.
- **No response after initial pulse (peak)** – The probe is not connected or the transmitter has malfunctioned. Position near a boundary to confirm problem.
- **Small or non-existent peak for sampling volume** – There is insufficient scattering material in the water (very clear, quiet water).
- **One beam is significantly different from the other(s)** – The receivers should have a similar response and signal strength. Clean the transducers.
- **The horizontal location of the sampling volume is different for each beam** – One of the receiver arms may be bent. Contact SonTek for repair.
- **Excessive noise past the boundary** – This may be caused by excessive acoustic noise in the tank. Commonly seen in small glass or acrylic tanks.

For more information on Beam Check, refer to the *ADV Field Technical Manual*.

4.3 Changing the ADV Settings



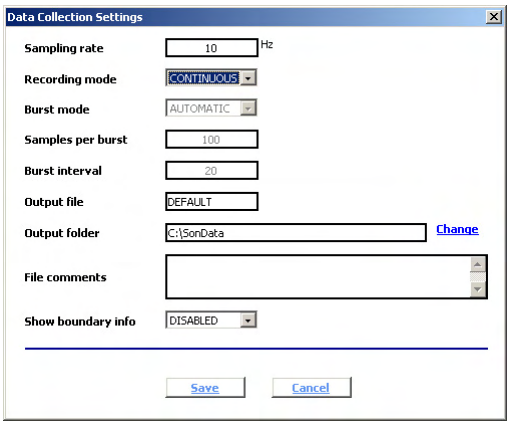
To change your ADV settings, click the **Change** button in the **System Settings** category (Figure 5). The **Setup ADV** dialog will be displayed (shown at right). Please refer to the *ADV Field Technical Manual* for a detailed description of each parameter and how to use them.

Some general guidelines:

- **Velocity range** – Determines the maximum velocity that can be measured by the ADV. Remember that a higher velocity range setting will have higher variability for any low velocities that are measured. In general, you should select the lowest velocity range setting that will include the maximum expected velocity.
- **External sync** – By default, this should be disabled.

Other settings – In most situations you will not need to change any of the parameters in this dialog, however it is important to review the settings prior to data collection. Click the **Save** button to save your settings or **Cancel** to discard any changes.

4.4 Changing the Data Collection Settings



The **Data Collection** category (Figure 5) contains the settings related to the frequency, mode, and method of data collection. These settings can be changed by clicking the **Change** button. This will display the **Data Collection Settings** dialog (shown at right). The settings include:

Sampling Rate

This is the rate at which the velocity data will be collected. The maximum sampling rate is 25 Hz for the ADV and ADVOcean, and 50 Hz for the MicroADV.

Recording Mode

The Recording Mode can be set to either **Continuous** or **Burst**. Continuous mode is used for sampling regularly without any breaks or interruptions. Beginning users should start with the **Continuous** sampling option, as it is the standard mode of operation. Burst mode is used to collect samples in sets (or bursts) at regularly timed intervals. Burst mode requires the input of additional parameters: Samples per burst and **Burst interval**. More information on burst mode data collection can be found in the *ADV Field Technical Manual*.

Output File and Output Folder

These parameters are used to select the name and destination of the output file that will be created during real-time data collection.

File comments

These lines of text are used to describe briefly the details of your data collection parameters, location, environment, etc.

Show boundary info

With this option enabled when data collection begins, the ADV(s) will first continuously scan the region in front of each probe to detect the presence of a solid or surface boundary. For each ADV in operation, the probe number, the distance from the tip of the probe to the boundary, the distance from the center of the sampling volume to that boundary, and the velocity range setting is displayed. If no boundary is detected, **NOT DETECTED** is shown.

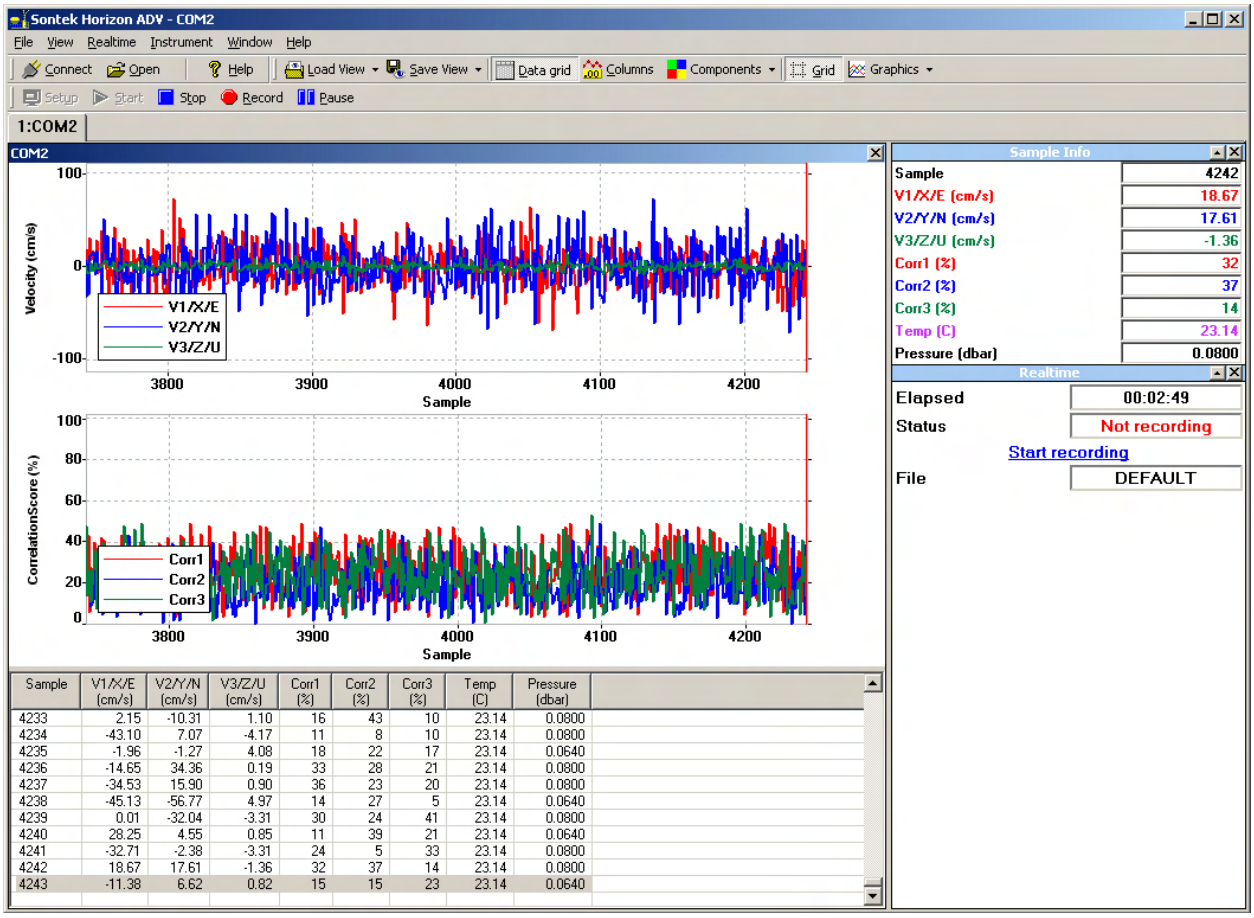
Save / Cancel

Click **Save** to save your settings or **Cancel** to discard any changes.

4.5 Starting Data Collection

Click the **Start** button in the **Data Collection** category (Figure 5) to begin real-time data collection or the **Disconnect** button to return to the Start Screen. If the **Show boundary info** option is enabled (Section 4.4), a dialog will be shown with the boundary information displayed.

The main screen will change to show several graphs that are now regularly updating as data are received from the ADV (Figure 7).



Sample	V1/X/E (cm/s)	V2/Y/N (cm/s)	V3/Z/U (cm/s)	Corr1 (%)	Corr2 (%)	Corr3 (%)	Temp (C)	Pressure (dbar)
4233	2.15	-10.31	1.10	16	43	10	23.14	0.0800
4234	-43.10	7.07	-4.17	11	8	10	23.14	0.0800
4235	-1.96	-1.27	4.08	18	22	17	23.14	0.0640
4236	-14.65	34.36	0.19	33	28	21	23.14	0.0800
4237	-34.53	15.90	0.90	36	23	20	23.14	0.0800
4238	-45.13	-56.77	4.97	14	27	5	23.14	0.0640
4239	0.01	-32.04	-3.31	30	24	41	23.14	0.0800
4240	28.25	4.55	0.85	11	39	21	23.14	0.0640
4241	-32.71	-2.38	-3.31	24	5	33	23.14	0.0800
4242	18.67	17.61	-1.36	32	37	14	23.14	0.0800
4243	-11.38	6.62	0.82	15	15	23	23.14	0.0640

Figure 7. HorizonADV Realtime Data Collection Screen

4.6 Recording Data

To start recording to a data file click the **Record** button on the toolbar or select the **Start recording** link in the **Realtime** display (Figure 7).

The **Realtime** display will update as the samples are collected and the data file increases in size. Controls for recording data and starting burst collection are also displayed here.

The **Pause** button on the toolbar will freeze the current display, but will not interrupt the data collection process. This feature is useful when observing events before they scroll off the side of the graph.

To stop recording, click the **Record** button on the toolbar again. This will stop writing samples to the data file. However, the system will continue to sample data and the collected data will be displayed to the screen; the data just will not be recorded.

To collect samples to additional data files, click **Record** again to repeat the data collection process. Remember, each time **Record** or **Start recording** is clicked, a new data file will be created and named automatically.

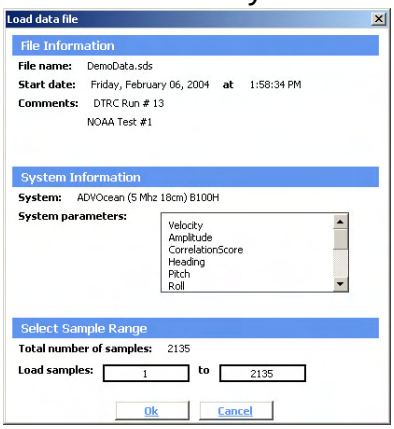
Click the **Stop** button or the **Stop recording** link to end the data collection process. This will stop the display of real-time data to the screen.

Data files (by default) will be stored in the C:\SonData folder. Section 5 describes how to open and view these data files.

5. Viewing Data Files

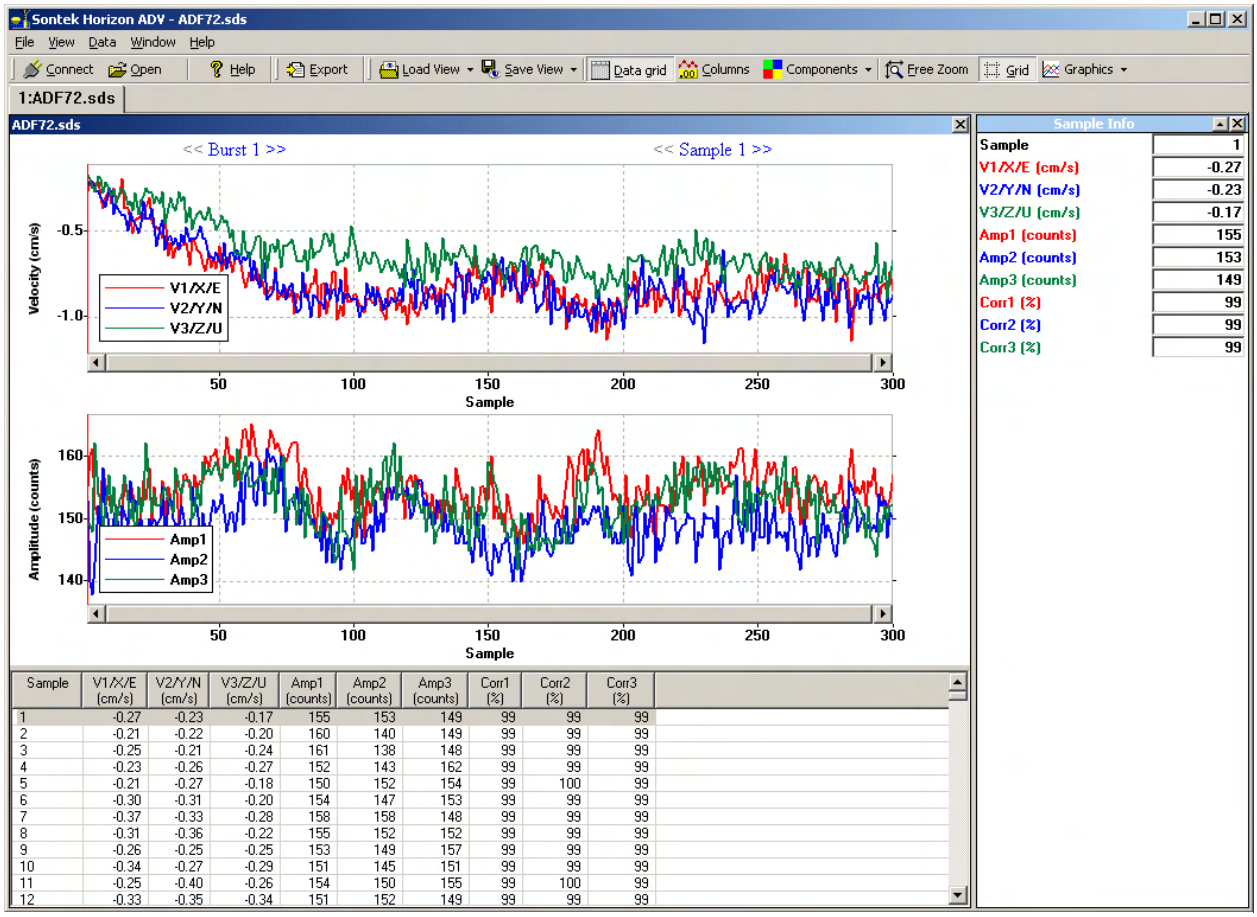
This section describes the opening, viewing, and export of ADV data files.

Click **Open a data file** on the **Start Screen** (Figure 3) or the **Open** button on the toolbar. An **Open ADV File** dialog will be displayed, asking you to select either an **.adv** or **.sds** (SonTek Data Session) data file. ADV data files contain the raw (unprocessed) data. SDS files contain the fully processed data and any settings. The ADV file always contains the original data and is never altered. Select a file to open and click **Open**.



The **Load data file** dialog (right) will be displayed. This dialog shows the time of the measurement as well as the system information and parameters stored. Select the range of samples or bursts you would like to load. By default, all samples or bursts will be loaded. Click **OK** to open this file.

The screen will change to one similar to the real-time data collection screen. A series of graphs will be displayed, and a tabular display of the values for the current selected sample will be shown on the right side of the screen (Figure 8).



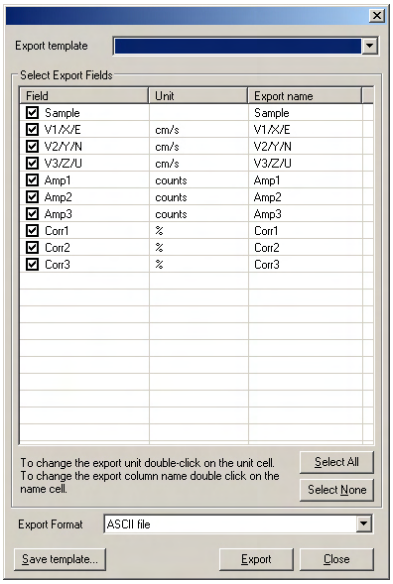
Sample	V1/X/E (cm/s)	V2/Y/N (cm/s)	V3/Z/U (cm/s)	Amp1 (counts)	Amp2 (counts)	Amp3 (counts)	Corr1 (%)	Corr2 (%)	Corr3 (%)
1	-0.27	-0.23	-0.17	155	153	149	99	99	99
2	-0.21	-0.22	-0.20	160	140	149	99	99	99
3	-0.25	-0.21	-0.24	161	138	148	99	99	99
4	-0.23	-0.26	-0.27	152	143	162	99	99	99
5	-0.21	-0.27	-0.18	150	152	154	99	100	99
6	-0.30	-0.31	-0.20	154	147	153	99	99	99
7	-0.37	-0.33	-0.28	158	158	148	99	99	99
8	-0.31	-0.36	-0.22	155	152	152	99	99	99
9	-0.26	-0.25	-0.25	153	149	157	99	99	99
10	-0.34	-0.27	-0.29	151	145	151	99	99	99
11	-0.25	-0.40	-0.26	154	150	155	99	100	99
12	-0.33	-0.35	-0.34	151	152	149	99	99	99

Figure 8. HorizonADV Data Review Screen

The range of samples displayed in the graphs can be changed by left-clicking in the plot area, or by clicking and dragging over a range of samples. Right click in the plot area to zoom out.

You can change the scaling of each parameter displayed in the graphs by double-clicking the vertical axis, and then selecting either an automatic (default) or a manual (user-selected) scaling range.

To export data, click the **Export** button on the toolbar or **Data | Export** from the menu. The **Select export options** dialog (at right) will be displayed. By default, all parameters stored in the file will be exported in ASCII format. To change the fields that will be exported, check or uncheck the boxes. Click **Export** to export the data. An **Export ASCII file** dialog will prompt you to select the output style, options, and path for the exported files.



More in-depth processing and analysis tools are also available within *HorizonADV*. For assistance in using the **Processing Toolbox** (**View | Show Processing Toolbox**), refer to Appendix B. For assistance in using the **Analysis** toolbox (toolbar icon), refer to Appendix C.

6. ADV Principles

An ADV (or Acoustic Doppler Velocimeter) is a single-point current meter that accurately measures the three components of water velocity in both high and extremely low flow conditions. Velocities are measured in a sampling volume located a distance away from the probe head (shown below, right).

The probe head is made up of a single transmitter located in the center of the probe head and either two or three receivers mounted on arms. The transmitter generates a narrow beam of sound that is projected through the water. Reflections from particles or "scatterers" (such as suspended sediment, biological matter, or bubbles) in the water are reflected and sampled by the highly sensitivity receivers. The intersection of the receiver axes designates the location of the sampling volume. More information on the working of ADVs can be found in the **ADV Manual – Principles of Operation** section.

There are three types of ADVs supported by the HorizonADV software:

10-MHz ADV
The 10-MHz ADV is suitable for a wide range of applications ranging from laboratory, to field, to full oceanographic applications. Sampling rates may be as high as 25 Hz and several probe configurations are available to accommodate most application requirements. The sampling volume is located 5 or 10 cm from the probe.

16-MHz MicroADV
The MicroADV is optimal for use in the laboratory. High frequency sampling (up to 50 Hz) combined with a tiny sampling volume makes this system perfect for measuring low flow conditions. This system excels in applications such as the measurement of turbulence, orbital velocities in a wave field, and precise flow field studies. The sampling volume is typically 5 cm from the probe.

ADVOcean
A rugged and robust housing combined with a reinforced probe head makes the ADVOcean suitable for a wide range of environments including such hostile conditions as the surf zone. The ADVOcean can be integrated with other sensors. The sampling volume is 18 cm from the probe.

7. Support & Contact Information

Technical support is available to all ADV users.

Please refer to the *ADV Technical Manual* first before contacting Technical Support. Most of the frequently asked questions are answered in the manual.

You can contact SonTek Technical Support by mail, telephone, fax, or email.

In any correspondence, or before contacting SonTek Technical Support, you should have the following information available:

- ADV serial number
- ADV firmware version (found in System Report; **Data | System Report**)
- HorizonADV version (select **Help | About** from the menu)
- Windows platform you are using (Windows 2000/XP)

Mailing Address:

SonTek/YSI, Inc.
9940 Summers Ridge Road
San Diego CA 92121-3091
USA

Telephone:

USA +1-858-546-8327

Fax:

USA +1-858-546-8150

Support Email:

support@sontek.com

General Inquiry and Sales Email:

inquiry@sontek.com

SonTek Website:

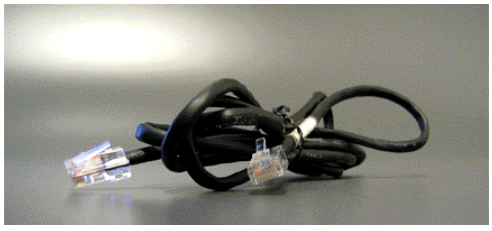
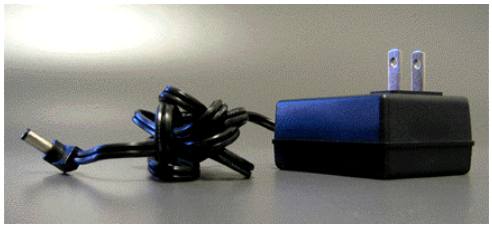
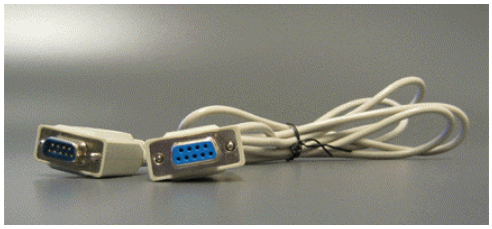
www.sontek.com

Appendix A. MultiPort Interface Box

A.1. Overview

The MultiPort interface box is an optional hardware addition that lets you connect, synchronize, and operate several SonTek Acoustic Doppler Velocimeters (ADVs) simultaneously. The *HorizonADV* software has a built-in interface for communicating with and displaying real-time data from each of the ADVs connected to the MultiPort.

Up to 16 ADVs may be connected to a MultiPort at one time. Each ADV is connected to a MultiPort through a serial cable. This cable is used for both data transmission and sync. The MultiPort is connected to a LAN (Local Area Network) using a standard Ethernet cable. The network connection permits higher data transfer rates and the ability for the MultiPort and/or the computer to collect data remotely.

Quantity	Part Name	Photo
1	MultiPort Interface Box	
1	Ethernet LAN cable (typically black or beige)	
1	Crossover cable (red, green, or yellow depending on manufacturer)	
1	Power supply (5 VDC)	
1	Configuration cable	

Note: The RS232 serial cable that comes standard with each ADV is used to connect the ADV to the MultiPort and is not included in the MultiPort package.

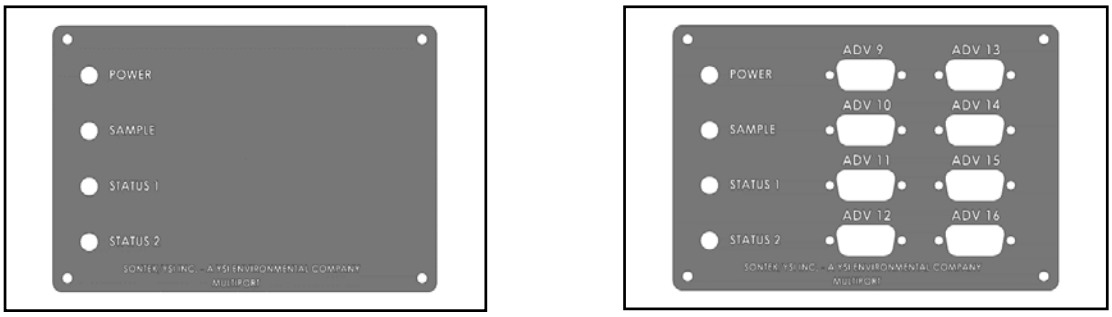
A.2. The MultiPort Box

The MultiPort box is the central point of communication between your computer and the ADVs. It accumulates and then transmits the synchronized ADV data to the host computer where the data are displayed in the *HorizonADV* software.

A MultiPort is available in either an 8- or 16-serial port configuration. The 16-serial port version has 8 additional serial ports on the front panel, enabling it to connect to a maximum of 16 ADVs.

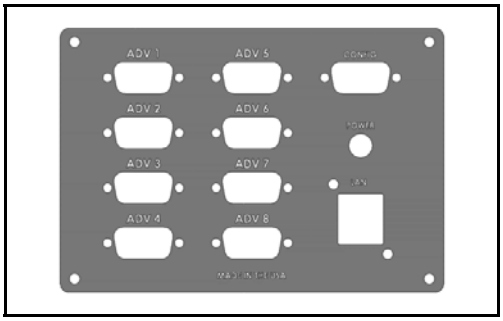
On the front panel of the MultiPort are four indicator lights. These lights show the current status of the MultiPort and the attached ADVs.

- **POWER** – This lamp is green when power is available to the MultiPort.
- **SAMPLE** – This lamp flashes green as it collects data from the ADVs and transmits it to *HorizonADV*.
- **STATUS 1** – This lamp is green when *HorizonADV* is connected.
- **STATUS 2** – This lamp is red when there is an error in the system.



The front panel of the standard 8 serial port MultiPort (left) and the 16 serial port MultiPort (right)

The back panel is the same for both configurations and has 8 serial ports for connecting to the SonTek ADVs, a port for configuring and upgrading the MultiPort (**CONFIG**), a 5 VDC input power connector (**POWER**), and a LAN jack for the Ethernet cable.



The MultiPort back panel (the same for both 8 and 16 serial port configurations)

A.3. Installation and Setup

Software Installation

HorizonADV provides an interface for configuration, communication, and data collection with the MultiPort. The software must be installed before setting up the ADVs on the MultiPort. *HorizonADV* version 1.03 or later is required for use with a MultiPort.

1. Insert the ADV software distribution CD in the computer's CD-ROM drive.
2. The ADV software installation menu will appear (or use Windows Explorer to locate and run the Install.exe application in the root directory of the CD).
3. Select **HorizonADV Setup** from the installation menu. Follow the on-screen instructions. Use the default paths for the installation.
4. Both the *HorizonADV* and *MultiPort Setup* programs will be installed.

Network Setup

Before you can configure the MultiPort box, you must establish the type of computer-to-MultiPort network interface you will be using. There are three interface options: LAN, single computer via router/hub, and single computer via crossover cable.

Option 1: Local Area Network (LAN) – Allows multiple computer use

1. The controlling computer must have a network card installed.
2. Connect the computer to the LAN via a LAN cable.
3. Contact your System Administrator for assistance. The Administrator will need to assign an IP address to the MultiPort based on your organization's policies.
   - This same IP Address will be entered in Step 9 of the **Configure the MultiPort Box** procedure (below).
   - The MultiPort **Subnet mask** will be set to **255.255.0.0** and the **IP port** to **4040**.

Option 2: Single Computer Connected to MultiPort via a Router or Hub

1. The controlling computer must have a network card installed.
2. If a modem or cable connection is used to connect to the Internet, we recommend it be disconnected from the computer before you connect to the MultiPort system and during any data collection.
3. Connect the computer to a standard network router/hub using a LAN cable (one is usually provided with the router/hub).
4. Connect the MultiPort to the router/hub using the LAN cable provided with the MultiPort.
5. Set up the network connection for your computer (the following example is for computers running Windows XP).
   a. Click **Start**, and then **Run**.
   b. Type **ncpa.cpl**, and then click **OK**.
   c. A **Network Connections** dialog box will be displayed.
   d. Right-click on you primary **Local Area Connection**, and then select **Properties** from the dropdown context menu.
   e. On the **General** tab, select **Internet Protocol (TCP/IP)**, and then click **Properties**.
   f. Switch to the **Alternate Configuration** tab, and then select **User configured**.
   g. Enter an **IP address** of **192.168.0.2** and a **Subnet mask** of **255.255.0.0**. No other values are required on this tab.

h. Click **OK** to close the **Internet Protocol (TCP/IP) Properties** box.
i. Click **OK** to close the **Local Area Connection Properties** box.

6. Your computer is now ready for use with the MultiPort box.

Option 3: Single Computer Connected to MultiPort via a Crossover Cable – Similar to Option 2, but uses a crossover cable instead of a router/hub. The crossover cable acts as a null-modem and is used for both configuring the MultiPort and collecting data.

1. The controlling computer must have a network card installed.
2. If a modem or cable connection is used to connect to the Internet, we recommend it be disconnected from the computer before you connect to the MultiPort system, and also during any data collection.
3. Connect the crossover cable to the computer's LAN jack.
4. Connect the other end of the crossover cable to the MultiPort.
5. Set up the network connection for your computer (the following example is for computers running Windows XP).
   a. Click **Start**, and then **Run**.
   b. Type **ncpa.cpl**, and then click **OK**.
   c. A **Network Connections** dialog box will be displayed.
   d. Right-click on you primary **Local Area Connection**, and then select **Properties** from the dropdown context menu.
   e. On the **General** tab, select **Internet Protocol (TCP/IP)**, and then click **Properties**.
   f. Switch to the **Alternate Configuration** tab, and then select **User configured**.
   g. Enter an **IP address** of **192.168.0.2** and a **Subnet mask** of **255.255.0.0**. No other values are required on this tab.
   h. Click **OK** to close the **Internet Protocol (TCP/IP) Properties** box.
   i. Click **OK** to close the **Local Area Connection Properties** box.
6. Your computer is now ready for use with the MultiPort box.

Configure the MultiPort Box

The following procedure is used to set up a new MultiPort box or to move the MultiPort to a new LAN. You may need assistance from your Network Administrator to follow some of the steps required to configure the MultiPort.

1. The computer must first be connected to the LAN that will be used for communication with the MultiPort box.
2. If you are connecting either via a LAN or via a router/hub, connect the Ethernet cable from the LAN jack on the back panel of the MultiPort to the LAN or router/hub. If you are connecting via a crossover cable, connect the crossover cable from the LAN jack on the back panel of the MultiPort to the computer.
3. Start the *MultiPort Setup* software; click **Start|Programs|SonTek Software|MultiPort Setup**.
4. Connect the configuration cable from the **CONFIG** port on the back panel of the MultiPort to the serial port on the computer.
5. Connect the 5 VDC input power supply to the MultiPort **POWER** connector and the AC end of the power supply to an AC outlet. The **POWER** lamp on the front panel of the MultiPort should light up. *If the MultiPort was already on, it must first be unplugged and then reconnected to the power supply*. There are no power switches to turn on/off either the MultiPort or power supply.

6. Click the **Connect** button in the *MultiPort Setup* software.
7. The *MultiPort Setup* software will automatically locate the MultiPort box connected to the serial port on your computer. If the MultiPort box is not found, check all your connections and try again.
8. The *MultiPort Setup* software (Figure 9) should now display the network address of the MultiPort box. Change these settings only if necessary or if they are empty.
9. Enter the IP address based on the **Network Setup** option you chose (above):
   a. Option 1 (LAN) – The IP address is the same as the one your System Administrator assigned to the MultiPort.
   b. Option 2 (router/hub) – The IP address for the MultiPort should be set to **192.168.0.3**.
   c. Option 3 (crossover cable) – The IP address for the MultiPort should be set to **192.168.0.3**.
10. The other recommended settings are a **Subnet mask** of **255.255.0.0** and an **IP port** of **4040**.
11. Click **Submit** to save these settings. If the MultiPort cannot be located, or if an error has occurred, check all your cable connections and network settings, and then try again from Step 1.
12. After the MultiPort has been configured successfully, click **Close**. Note that the MultiPort firmware can also be upgraded using this same utility. The Peripheral Test option is used for diagnostics only.
13. Disconnect only the configuration cable from both the MultiPort and your computer. Both the power supply cable and Ethernet cable (or crossover cable if Option 3 was used) must remain connected to the MultiPort.
14. The MultiPort is now ready to collect data.

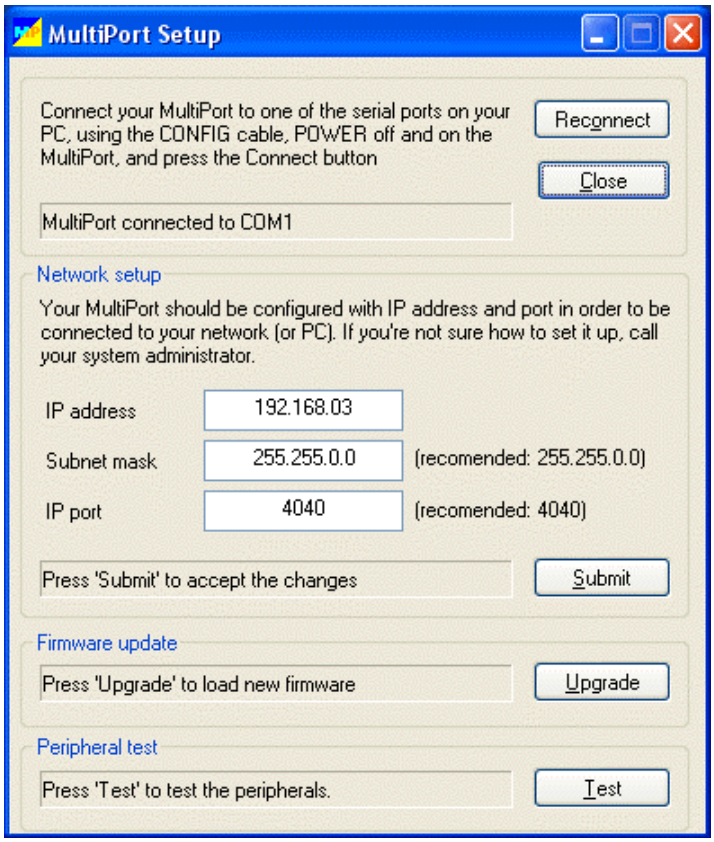


Figure 9. MultiPort Setup Screen

Connect the ADVs to the MultiPort

All ADVs connected to the MultiPort must be configured to communicate at a baud rate of 57600. Refer to the *ADV Field Technical Manual* for details.

Connect one end of the RS232 serial cable provided with each ADV to one of the ADV serial ports on the MultiPort; connect the other end to an ADV.

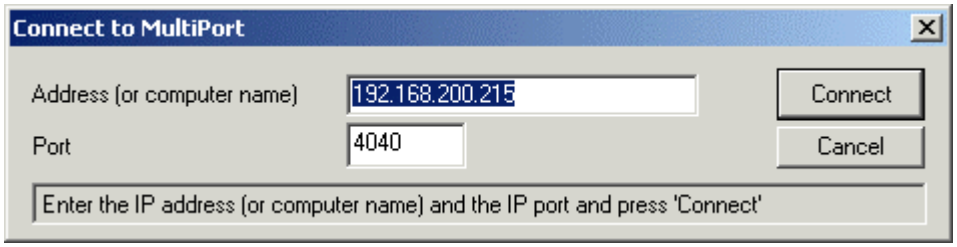
A.4. Collecting Data with the MultiPort

At this point, all ADVs should be connected to the MultiPort, the MultiPort connected to the LAN, and all lights should be green. You are now ready to start collecting data.

Start *HorizonADV* (Section 2).

Connect to the MultiPort by clicking the **Connect to MultiPort ADV** option. This option will display the **Connect to MultiPort** dialog (below). The network **Address** and **Port** from the MultiPort configuration step will be automatically displayed. Make any changes to the **Address** or **Port** only if necessary.

Click **Connect**.



The data collection screen will now be displayed (Figure 5).

This screen and settings are exactly the same when using a MultiPort as the screen described in Section 4.1 with a few exceptions:

- The **Connection Settings** category now displays the network address and port instead of the serial port settings.
- The **System Information** category shows multiple ADVs under **Probes**. Each ADV serial number is prefixed with the MultiPort serial port number to which it is connected. The **System Type** for each of the ADVs may be displayed by selecting the appropriate serial number from the **Probes** section.
- The **Sampling Mode** is automatically set to **Sample on Synch**.
- The **System Settings** and **Data Collection** settings will be the same for all ADVs connected to the MultiPort.

We recommend you run a separate **BeamCheck** on each ADV connected to the MultiPort before starting data collection. **BeamCheck** can be started by first selecting an ADV from the **Probes** list by serial number, and then selecting **Check ADV beams**.

All changes to the **System Settings** and **Data Collection** parameters will be automatically transferred to all ADVs attached to the MultiPort.

Click **Start** in the **Data Collection** category to begin real-time data collection or **Disconnect** to return to the **Start Screen**.

During the data collection process, data are being collected from all the ADVs attached to the MultiPort even though only data from one ADV is being displayed at any time. To display data from a different ADV, click the **Probe** button on the **Data Collection** toolbar, and then select a different ADV.

When the **Start Recording** button is clicked, data from all the connected ADVs is simultaneously stored to a single data file. This data file can later be opened in *HorizonADV* to view the data from each of the individual probes.

A.5. MultiPort Troubleshooting Guide

I cannot connect to the MultiPort in the HorizonADV software.

- Check all connections and cables.
- Check that the MultiPort is powered by the 5 VDC power supply. Make sure both the **POWER** and **NETWORK** lights are on (green).
- Check the Ethernet cable. Replace it if necessary.
- Check the MultiPort network configuration. Make sure the address does not conflict with your network settings. Make sure the **Subnet mask** is the same for both the MultiPort and your LAN. Verify these settings with your system administrator.
- Check your personal network firewall software (e.g., *ZoneAlarm*). If you are using firewall software, contact your system administrator for information on how to enable the software to access the MultiPort.

I cannot connect to the MultiPort in the MultiPort Setup software.

- Close all other applications as they may interfere with the search for the MultiPort or totally block some of the serial ports.
- Check that the MultiPort is powered. Make sure the **POWER** lamp is on.
- Check the RS232 cable. Replace it if necessary.
- Check that the **CONFIG** cable is properly connected from the PC to the MultiPort.
- Power the MultiPort off, and then on.

I pressed the Start button but HorizonADV does not collect any data.

- Make sure all the ADVs are MultiPort compatible. Note: DSP must have firmware version 4.1 or later (use *SonUtils* **Show Config** to view DSP version).
- Contact SonTek Customer Support for more information.

I connected to the MultiPort but it does not display all (or any) of the ADVs that I connected to it.

- Make sure all ADVs are running at a baud rate of 57600.
- Check your cables (some low-quality or very long cables may not be able to transfer data adequately at a baud rate of 57600).
- On the setup screen in *HorizonADV*, note the ADVs (and the serial ports) that are not displayed. Connect those ADVs directly to your PC and make sure that you can communicate with them using either *SonUtils* or *HorizonADV*. If some of the ADVs still do not appear to be working, contact SonTek Support.

I connected to the MultiPort, and the list of ADVs is displayed, but the Start button is disabled.

- All ADVs must have the same hardware options (compass, temperature, etc.).
- Contact SonTek Customer Support for more information.

Appendix B. Processing Toolbox

B.1. Overview

This appendix provides a detailed explanation of the *HorizonADV* Processing Toolbox (**View | Show Processing Toolbox**). The features in this toolbox let you perform post-processing functions on your ADV data set. In addition to the tools described in this appendix, the following controls are common to all the processing tools:

- **History** – Lists all the processing changes you have applied to your data set.
- **Apply** – Applies the equations, formulas, or filtering to the selected parameters.
- **Back** – Performs an "undo" of the last process applied to the data set. In other words, this action removes the last Apply that was made.
- **Reset** – Removes all processes applied to the data set.

B.2. Transform Values

- Description: Applies a quadratic transformation to the original data for the selected Field (parameter).
  - Good for removing:
    - Nonlinearity (quadratic) errors: `y = ax*x +bx + c`
    - Slope: `y = bx + c; a=0`
    - Offset: `y = x + c; a=0, b=1`
  - Not good for removing exponential or logarithmic terms
- "X" Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Coefficients:
  - A – Quadratic constant
  - B – Slope
  - C – Offset
- Formula: `y = a*x*x + b*x + c`

B.3. Interpolate Missing Values

- Description: Replaces bad values in the data series "X" fields using linear interpolation.
  - Good for removing presenting data without gaps; filtering; spectral analysis.
  - Not good for precise statistical analysis (interpolation over large gaps may affect your data statistics).
- "X" Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Formula: `yi = [x(i-1) + x(i+1)] / 2`

B.4. Filter Signal

- Description: Used to filter a measured data series. Uses window FIR filter design.
- Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Settings:
  - **Window type**: Hamming, Triangle, Box Car, Bartlett, Hann, Blackman
  - **Window length**: Determines length and roll off of the filter (filter order). Longer windows produce steeper roll off (better filtering), but take longer to compute.
  - **Filter type**:
    - **Low pass**: Filters out high frequency noise above **High cutoff**.
    - **High pass**: Filters low frequency noise below **Low cutoff**.
    - **Band pass**: Filters high and low frequency below **Low cutoff** and above **High cutoff**.
    - **Band stop**: Filters frequencies between **Low cutoff** and **High cutoff**.
- References:
  - Oppenheimer and Schafer: Discrete time signal Processing. Englewood cliffs, NJ, Prentice Hall, 1989, pgs 311-312
  - Matlab signal processing toolbox

B.5. Screen Values

- Description: Screens data field "X" based on criteria applied to data field "Y". Screened data samples are internally marked with an **INVALID DATA** flag that is used by the display function to determine whether to display data. Since resulting screened data series Y will contain gaps, it needs to be run through interpolation in order to perform any filtering or spectral analysis. All other simple transforms, histograms, and velocity manipulations do not require interpolation.
- "X" Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Conditions:
  - "Y" Fields: Sample, Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, Pressure, SNR, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, and Mean Correlation
  - Criteria:
    - **Value is less than**: Requires a **Max** value entry.
    - **Value is greater than**: Requires a **Min** value entry.
    - **Value is between**: Requires **Max** and **Min** entries.
    - **Value is not between**: Requires **Max** and **Min** entries.

B.6. Remove Single Spikes

- Description: Searches and removes single outliers (spikes) in the data series. Replaces bad values in the data series "X" field using linear interpolation.
  - Good for removing single spikes, presenting data without gaps, filtering, spectral analysis.
  - Not good for removal of complex spikes (more than one sample long).
- "X" Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Settings:
  - **Threshold**: Number of standard deviations (that are computed over the entire data series)
- Formula:

```
If abs[x(i)-x(i-1)]>Thres) Then x(i) = (x(i-1) + x(i+1)]/2
```

B.7. Clean Complex Spikes

- Description: Uses median filtering to identify and remove spikes (outliers) that are further than the threshold from the median value. Replaces bad values in the data series "X" Field with the median of the window.
  - Good for removing spikes of variable length and height.
  - May be difficult to use; more than one pass may be required.
- "X" Fields: Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, and Pressure
- Settings:
  - **Window length**: Length of the window for median and Maximum Absolute Deviation (MAD) computations. The longer the spikes in the data, the longer the filter length should be.
  - **Threshold**: Number of MADs; describes the height of the outlier.

B.8. Change Velocity Coordinate System

- Description: Converts velocity data from XYZ (Cartesian) to ENU (East-North-Up) coordinate system and vice-versa. Also applies user rotation as needed.
- Fields: Velocity only
- Settings:
  - **Coordinate system**: Select XYZ or ENU. ENU is present only if the system had a compass installed.
  - **User rotation**: Allows the user to rotate the velocity data in XY (EN) plane.

B.9. Correct Velocity for Sound Speed

- Description: Designed to correct velocity values when salinity and temperature have been misconfigured or are not working properly.
- Fields: Velocity only
- Theory:

  Velocity values are calculated based on the sound speed in the water. However, sound speed in the water depends on three components: salinity, temperature, and depth. When there is error in any of these components, the error is reflected in the velocity values.

- Settings:
  - **Salinity** – Select whether to use a fixed value (**Use user value**) or to use the CTD salinity sensor's value (when installed). If a fixed value is used, you will need to enter the **User salinity** value in parts per thousand (ppt).
  - **Temperature** – Select whether to use a fixed value (**Use user value**), or to use the value from the built-in temperature sensor (**Use sensor value**), or to use the CTD sensor's value (when installed). If a fixed value is used, you will need to enter the **User temp** value.
  - **Depth** – Select whether to use a fixed value (**Use user value**) or to use the value from the built-in pressure sensor (when installed). If a fixed value is used, you will need to enter the **User depth** value.
- Formula (for each sample):

  $k = \text{SoundSpeed}(S_{new}, T_{new}, D_{new}) \;/\; \text{SoundSpeed}(S_{old}, T_{old}, D_{old})$

  $V = V * k \text{ (for each beam or dimension)}$

Appendix C. Analysis Tools

C.1. Overview

This appendix provides a detailed explanation of the *HorizonADV* Analysis tools (**Analysis** button Data toolbar; **View | Toolbars | Data**). The features in this toolbox let you perform post-processing functions (histograms, spectral analysis) on your ADV data set. In addition to the tools described in this appendix, the following controls are common to all the analysis tools:

- Zoom – Right-click or click-and-drag the mouse cursor in any graph to zoom-in on data. Left-click on any graph to zoom-out.
- **Apply** – Applies your selected settings to the analysis graphs.
- **Export** – Lets you export the data results of your analysis settings into a comma-delimited file (**.csv**) for use in such programs as Microsoft Excel.

C.2. Histogram

- Description: Displays a bar graph of a frequency distribution in which the widths of the bars are proportional to the classes into which the variable has been divided, and the heights of the bars are proportional to the class frequencies.
- Settings:
  - **Column** – X-axis parameters (V1/X/E, V2/Y/N, V3/Z/U, Amplitude 1/2/3, Correlation 1/2/3, Heading, Pitch, Roll, Temperature, Pressure, Signal-to-Noise Ratio 1/2/3, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, Mean Correlation).
  - **YAxis** – Frequency or Density
  - **Bars** – Number of bars to display. Default is 20.
  - **Use limits** – If selected, entries are required for the minimum and maximum limits of the selected parameter.

C.3. Spectral Analysis

Four types of spectral analysis can be performed: auto-spectra, cross-spectra, transfer, and coherence.

C.3.1. Auto-Spectra

- Description: Estimates the Power Spectral Density of a measured variable “X” (**Field**) using Welch’s averaged, modified periodogram method [S(X,X)]. Can be applied to any measured value (**Field**). Data are divided into overlapping section of window length points.
  - Each section is detrended (mean removed).
  - Each segment is windowed by the **WindowType** parameter.
  - Each following segment is overlapped with the previous by Window Length/2 samples.

- Power spectral density is computed for each window and all the estimates averaged together.
- The final estimate is scaled such that the magnitude corresponds to the units^2/Hz, where units are the original units of the data.

- Settings:
  - **Field** – Sample, Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, Pressure, SNR, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, and Mean Correlation
  - **Window type**: Hamming, Hann, Bartlett, Blackman
  - **Window length**: 128, 256, 512, 1024, 2048, 4096
- References:
  - Oppenheimer and Schafer: Discrete time signal processing. Englewood Cliffs, NJ, Prentice Hall, 1989, pgs 311-312
  - Jenkins and Watts: Spectral analysis and its applications. Holden Day, 1968, chap 6
  - Matlab signal processing toolbox

C.3.2. Cross-Spectra

- Description: Estimates the Power Cross-Spectral Density of two variables "X" (**Field**) and "Y" (**2nd Field**) using Welch's averaged, modified periodogram method [S(X,Y)].
- Settings:
  - **Field** / **2nd Field**– Sample, Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, Pressure, SNR, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, and Mean Correlation
  - **Window type**: Hamming, Hann, Bartlett, Blackman
  - **Window length**: 128, 256, 512, 1024, 2048, 4096
- References:
  - Oppenheimer and Schafer: Discrete time signal processing. Englewood Cliffs, NJ, Prentice Hall, 1989
  - Jenkins and Watts: Spectral analysis and its applications. Holden Day, 1968, chap 9
  - Matlab signal processing toolbox

C.3.3. Transfer

- Description: Estimates the transfer function of the system with input "X" (**Field**) and output "Y" (**2nd Field**) using Welch's averaged periodogram method [Txy=T(X,Y)].
  - X and Y are divided into overlapping sections of length WindowLength and overlap of WindowLength/2, each of which is detrended, and then windowed by WindowType.

- The magnitude squared of the length WindowLength DFTs of the sections of X are averaged to form Pxx, the Power Spectral Density of X. The products of the length WindowLength DFTs of the sections of X and Y are averaged to for Pxy, the Cross-Spectral Density of X and Y.

- Settings:
  - **Field** / **2nd Field**– Sample, Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, Pressure, SNR, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, and Mean Correlation
  - **Window type**: Hamming, Hann, Bartlett, Blackman
  - **Window length**: 128, 256, 512, 1024, 2048, 4096
- References:
  - Oppenheimer and Schafer: Discrete time signal processing. Englewood Cliffs, NJ, Prentice Hall, 1989
  - Jenkins and Watts: Spectral analysis and its applications. Holden Day, 1968, chap 8
  - Matlab signal processing toolbox

C.3.4. Coherence

- Description: Estimates the coherence of "X" (**Field**) and "Y" (**2nd Field**) using Welch's averaged periodogram method [Cxy=C(X,Y)].
  - Coherence is a function of frequency with values between 0 and 1 that indicate how well the input X corresponds to the output Y at each frequency. X and Y are divided into overlapping sections of length WindowLength and overlap of WindowLength/2, each of which is detrended, and then windowed by WindowType.
  - The magnitude squared of the length WindowLength DFTs of the sections of X and the sections of Y are averaged to form Pxx and Pyy, the Power Spectral Densities of X and Y respectively. The products of the length WindowLength DFTs of the sections of X and Y are averaged to for Pxy, the Cross-Spectral Density of X and Y.
  - The coherence Cxy is given by: `Cxy = (abs(Pxy)^2)/(Pxx*Pyy)`
- Settings:
  - **Field** / **2nd Field**– Sample, Velocity, Amplitude, Correlation Score, Heading, Pitch, Roll, Temperature, Pressure, SNR, Mean SNR, Speed, Direction, Mean Velocity, Mean Amplitude, and Mean Correlation
  - **Window type**: Hamming, Hann, Bartlett, Blackman
  - **Window length**: 128, 256, 512, 1024, 2048, 4096
- References:
  - Oppenheimer and Schafer: Discrete time signal processing. Englewood Cliffs, NJ, Prentice Hall, 1989
  - Jenkins and Watts: Spectral analysis and its applications. Holden Day, 1968, chap 8
  - Matlab signal processing toolbox