SonTek/YSI Triton
Software Manual

ViewTritonPro (Windows) Version 1.20
SonUtils (Windows) Version 2.20

INTRODUCTION

Thank you for buying a Triton from SonTek/YSI. Included with your Triton is the following software.

- ViewTritonPro Windows Software
- SonUtils Windows Software

The software is intended to be easy to use, and it is our hope that this manual should be needed only as a reference.

- **Section 1 – Software Summary**
  This gives an overview of all Triton software.

- **Section 2 – Software Installation**
  This gives instructions for installing Triton software from the software CD.

- **Section 3 – ViewTritonPro Windows Software**
  This is the primary Triton software and provides the following functions.

  - System diagnostics (*Diagnostics*)
  - Autonomous deployment (*Deployment*)
  - Recorder data extraction (*Recorder*)
  - Data postprocessing (*Processing*)

- **Section 4 – SonUtils Windows Software**
  These utility programs can be used with all SonTek instruments.

  - Terminal Emulator (*SonTerm*)
  - Compass calibration (*CompCal*)
  - Recorder data extraction (*SonRec*)

- **Section 5 – Additional Support**
  This section provides contact information for additional customer support.

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Section 1. Software Summary

The Triton software includes Windows-based programs for all common Triton functions. All software is written for operation on PC compatible computers. Windows software is Windows 95/98/2000/NT compatible.

The Windows software consists of one main program that is used to launch different modules, each of which performs a specific Triton function.

ViewTritonPro – see Section 3
- System diagnostics (*Diagnostics*)
- Autonomous deployment (*Deployment*)
- Recorder data extraction (*Recorder*)
- Data postprocessing (*Processing*)

SonUtils – see Section 4
- Terminal emulator (*SonTermW*)
- Compass calibration (*CompCalW*)
- Recorder data extraction (*SonRecW*)

Section 2. Software Installation

All Triton software comes on a single CDROM. Also included on this CDROM are electronic copies of the Triton documents in PDF format.

To install the software to your PC compatible computer, use the following steps.

1. Insert the CDROM in your drive. After a few seconds, the Triton installation menu should appear (Figure 1). If not, run the Install.exe file that is on the CD.

2. To install *ViewTritonPro*:

    - Click ViewTritonPro Setup on the installation menu (Figure 1).
    - Follow the on-screen instructions for installation. We recommend using the default installation settings, especially if other SonTek programs will be used on your computer.

3. To install *SonUtils*:

    - Click SonUtils Setup on the installation menu (Figure 1).
    - Follow the on-screen instructions for installation. We recommend using the default installation settings, especially if other SonTek programs will be used on your computer.

4. The software installation is now complete; there is no need to restart the computer.
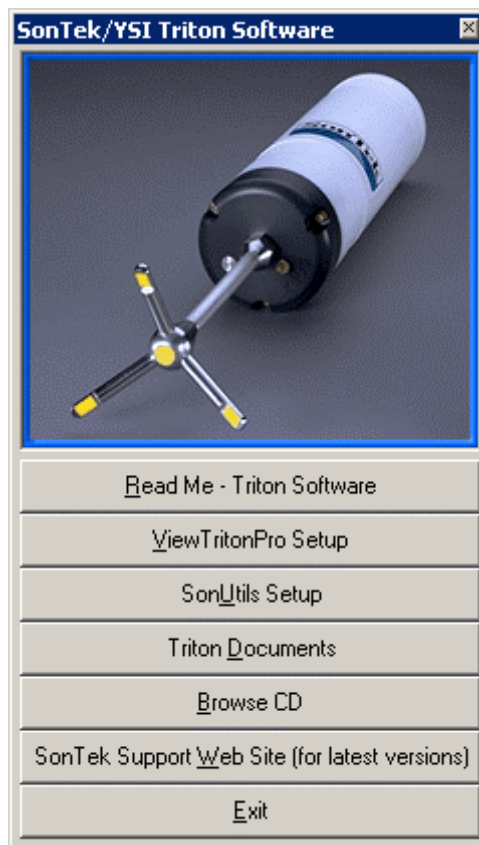
Figure 1 – Triton Software Installation Menu

Section 3. ViewTritonPro Windows Software

3.1.   Overview

To start *ViewTritonPro*, click `Start|Programs|SonTek Software|ViewTritonPro`. Upon startup, *ViewTritonPro* displays the main menu shown in Figure 2. From the *ViewTritonPro* main menu, you can start the following programs.

- *Diagnostics* – Diagnostic/Testing software (§3.2)
- *Recorder* – Recorder extraction software (§3.3)
- *Deployment* – Autonomous deployment software (§3.4)
- *Processing* – Postprocessing software for reviewing and analyzing data (§3.5)

Figure 2 – *ViewTritonPro* **Main Menu**

3.2. Diagnostics Software

Diagnostics is a program used to verify Triton performance and to identify most problems.

- This is the same diagnostic program used by SonTek technicians. It provides you with a powerful tool for understanding and verifying system performance.
- We recommend that you become familiar with this software and use it on a regular basis during data collection.
- Checking the Triton with this program before every experiment can identify problems that might otherwise be undetected, thereby reducing the potential for lost or corrupted data.

To run *Diagnostics*:

- For ideal testing conditions, mount the Triton such that the probe is submerged in water and there is a boundary (surface, side, or bottom) within view. Ideally, the boundary should be placed about 20 to 30 cm (8 to 12 in) from the probe.
- Connect the Triton to the PC and apply power to the system.
- Start *ViewTritonPro* (**Start|Programs|SonTek Software|ViewTritonPro**).
- Click **Diagnostics** on the *ViewTritonPro* menu.
- Click **Connect**, verify your communications parameters are correct, and then click **Go!**.

At this point, the software will do the following.

- Establish communication with the Triton and download system operation parameters.
- Start special *Diagnostics* operating mode.
- Initialize a continually updating display of signal strength versus range from the transducers. The display is updated about once every five seconds.
- See the *Triton Principles of Operation* for information about the signal strength profiles displayed by *Diagnostics*.

Diagnostics includes the ability to record the displayed data to a file.

- Recording data provides a record of system performance.
- SonTek customer support may request a recorded *Diagnostics* file. *Diagnostics* data is a very effective way to evaluate system performance.
- See Section 3.2.3 for instructions regarding data recording and a description of the recorded data file.

3.2.1. Sample Program Output

Diagnostics operates in the following manner (Figure 3; Note that the layout of your display may differ from that shown in the figure, but the same basic displays and controls will be the same).

- The Triton sends a pulse of sound (transmit pulse), and then outputs the returned signal strength for each of the three receivers as a function of time following the transmit pulse.
- Features in the returned signal strength profile are used to verify different aspects of system performance.
- *Diagnostics* also plots sine and cosine channels versus time for each receiver. These are used for internal diagnostics at SonTek and are not needed for user diagnostics. The sine and cosine outputs are not discussed in this manual.
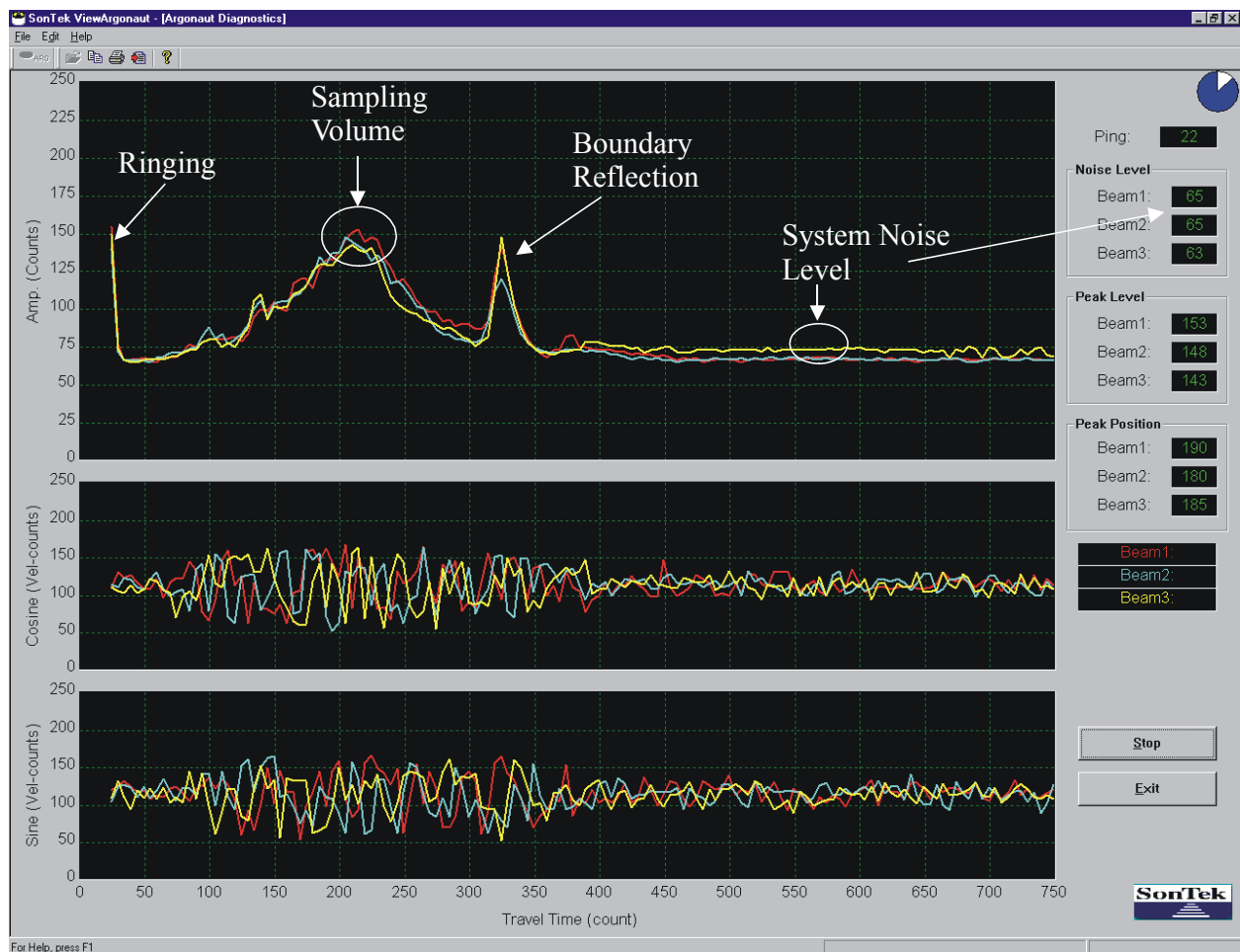

Figure 3 – *Diagnostics* Sample Output

The plot of signal strength versus time shows several features (Figure 3).

- Ringing from the transmit pulse
- Increased signal strength in a bell-shaped curve corresponding to the sampling volume
- A sharp spike from the boundary reflection if within range
- Signal strength leveling to the electronic noise level past the boundary
- The display is updated about every five seconds, and each plot is the average of a number of samples.
- The horizontal axis is scaled in Triton timing units; time corresponds to the distance from the transmitter. One count-axis equals 0.06 cm (0.15 in).
- The vertical axis is scaled in Triton signal strength units called counts; these are the same units used for measured signal strength during data collection. One count equals 0.72 dB.

Each feature of the typical *Diagnostics* signal strength plot is described in detail below.

- The first ≈20 counts of the horizontal axis is ringing following the transmit pulse. The transmit pulse is generated by a strong electrical signal, and requires some time for the electronics and transducers to recover.

- If there is sufficient scattering material in the water, there will be an increase in signal strength in a bell-shaped curve that corresponds to the transmit pulse passing through the focal point of the receivers. The peak of this curve corresponds to the center of the sampling volume. The location of the center of the sampling volume will vary from probe to probe, but will typically be in the range of 175-195 counts. All three receivers should see the peak in the same location, although there will be variation in the height and shape of the curve.

- If the probe is close to a boundary (bottom, surface, or side), a sharp reflection should be seen. The size and shape of this reflection will vary depending on the nature of the boundary, its distance from the Triton, and the acoustic conditions of the water. We can estimate the distance from the probe to the boundary by the location of the boundary reflection. In Figure 3, this occurs at about 320 counts or 19 cm from the probe.

- After the boundary reflection, the signal strength flattens out in the region where there is no reflected signal from the water. The value at which it flattens out is the electronics noise level. This noise level is typically 60 to 70 counts; it is also shown in the tabular display on the right side of the screen. An easy way to measure the instrument noise level is to run *Diagnostics* when the probe is not in the water. In this case, the entire plot should show a constant return at the instrument noise level.

- When using *Diagnostics* it is important to understand that the output plot will vary considerably because of the nature of acoustic scattering. The shape and height of the return signal, particularly the bell curve for the sampling volume, will show considerable variation between updates. When using the program for diagnostics, look at the general shape of the curve and for features that are consistently present.

Description of *Diagnostics* controls:

- **Pause/Stop/Resume** – Used to pause and restart the display of data.
- **Open Existing Diagnositc Log File** – Opens and replays a previously recorded diagnostic log file. This file can also be sent to SonTek/YSI for analysis.
- **Save Log File** – Allows you record the diagnostic data to a log file.
- **Close Log File** – Stops the recording of diagnostic data to a log file.
- **Print** – Sends the displayed data to a printer.
- **Copy** – Sends the displayed data to the clipboard for use in other programs.
- **Help** – Displays the on-line help file.
- **Step Forward/Backward** – Lets you review a series of pings.
- **Zoom X / Zoom Y** – Changes the plot axis scales.
- **Averaging** – Lets you plot a running average of sequential pings. This can be very useful in removing the natural variability in successive samples. The display will be a running average of pings until this button is pressed a second time.
- **Close** – Exits *Diagnostics*.

Description of *Diagnostics* displays/readouts:

- **Ping #** – Identifies the currently displayed ping.
- **Noise** – Displays the electronics noise level for each beam, which is determined by the signal strength when the Triton is not receiving any return reflection from the water. This should match the signal strength for the flat portion of the graph beyond the boundary.
- **Cos Min/Max** and **Sin Min/Max** – Used for factory tests at SonTek and are not described here.
- **Peak Pos** - This is the location of the center of the peak for the sampling volume for each of the three receivers. The position should be about the same for each receiver; variations of 5 to 10 counts are typical.
- **Peak Level** - This is the height of the peak for the sampling volume for each of three receivers. Peak level varies depending on the amount of scattering material in the water.
- **Sig Amp** – The primary output of the *Diagnostics* program is a plot of signal strength versus range from the instrument. This is used to determine the effective measurement range of the instrument, and to look for interference from boundaries and underwater structures. Signal strength data are given in internal units called counts; one count equals 0.43 dB.
- **Sine / Cosine** – Used for factory testing at SonTek and not described here.

See Section 3.2.2 for information about using the *Diagnostics* output for system diagnostics.

3.2.2. Diagnosing Hardware Problems

Diagnostics can be used to detect almost any problem that can occur with a Triton. This section describes the program output for some of the most common situations.

Probe not connected

If the probe cable is not connected to the Triton processor, the program shows zero signal strength across the entire profile for all three receivers. This appears as a blank graph in *Diagnostics*, although there may be some noise at low signal strengths (less than 25 counts). This can also occur if the high-frequency cable has been damaged.
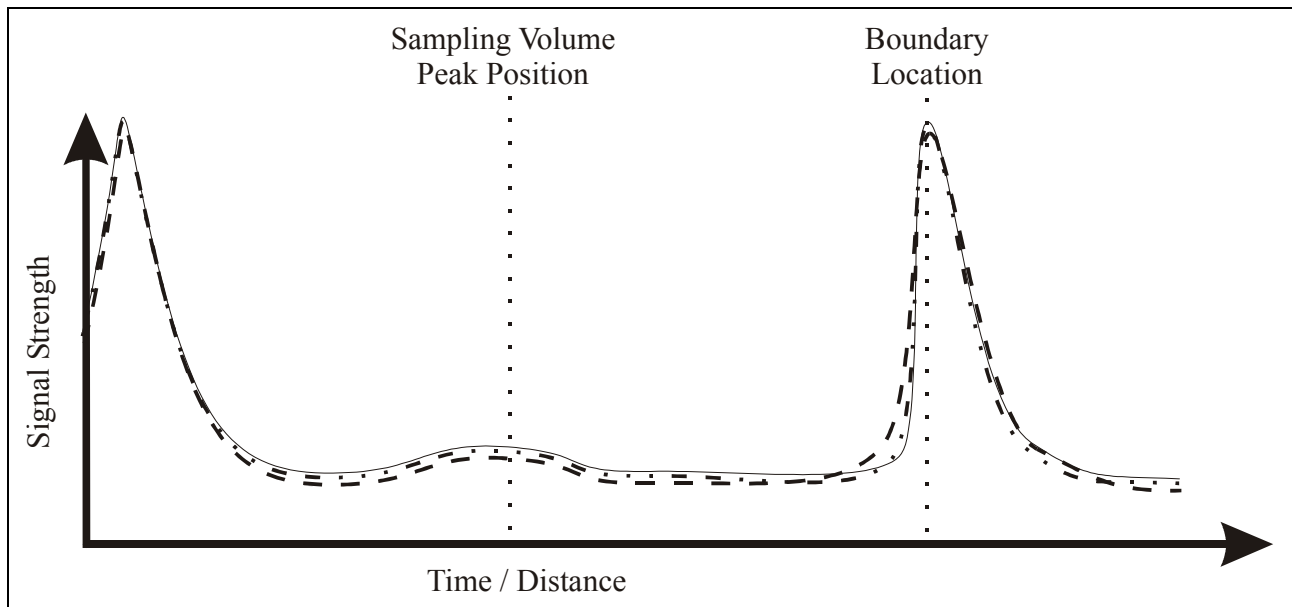

Figure 4 – *Diagnostics* Output with Low Scattering Strength

Low scattering strength (Figure 4)

If there is insufficient scattering material (e.g., very clear water), the sampling volume peak will be small or non-existent. This situation can be confused with a malfunctioning transmitter (Figure 5) unless the boundary is in view.
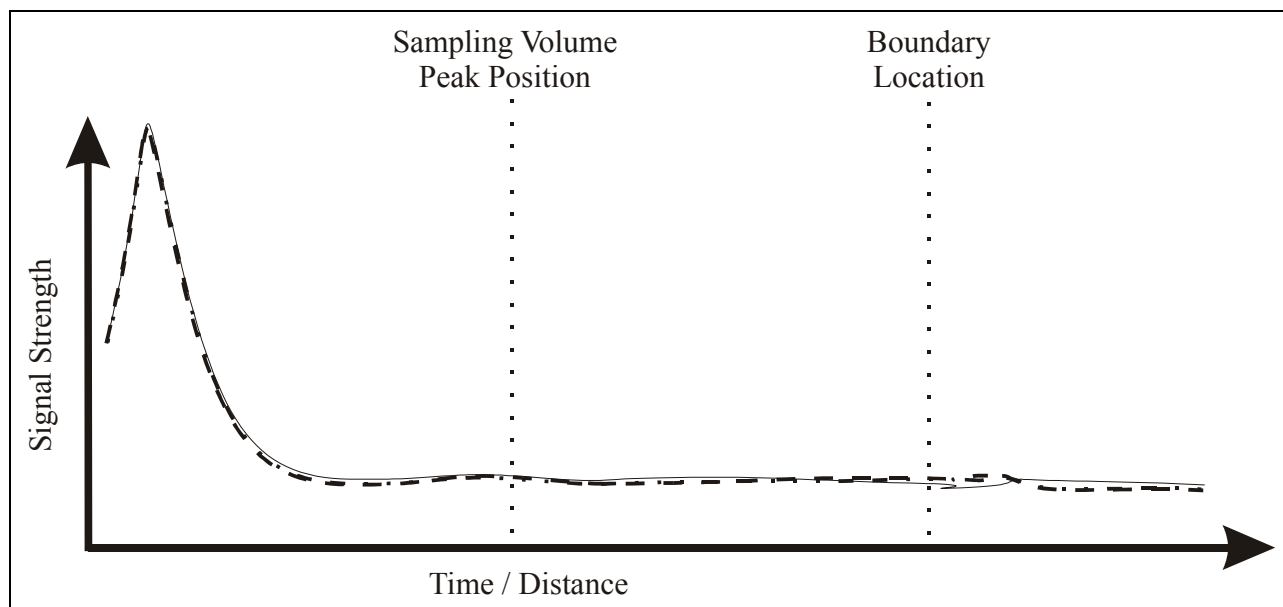
Figure 5 – *Diagnostics* Output with Malfunctioning Transmitter

Malfunctioning transmitter (Figure 5)

This appears as a flat response with signal strength at the normal noise level. This can be confused with a disconnected probe or low scattering levels (Figure 4). Note the absence of a boundary reflection to distinguish this from low scattering levels.

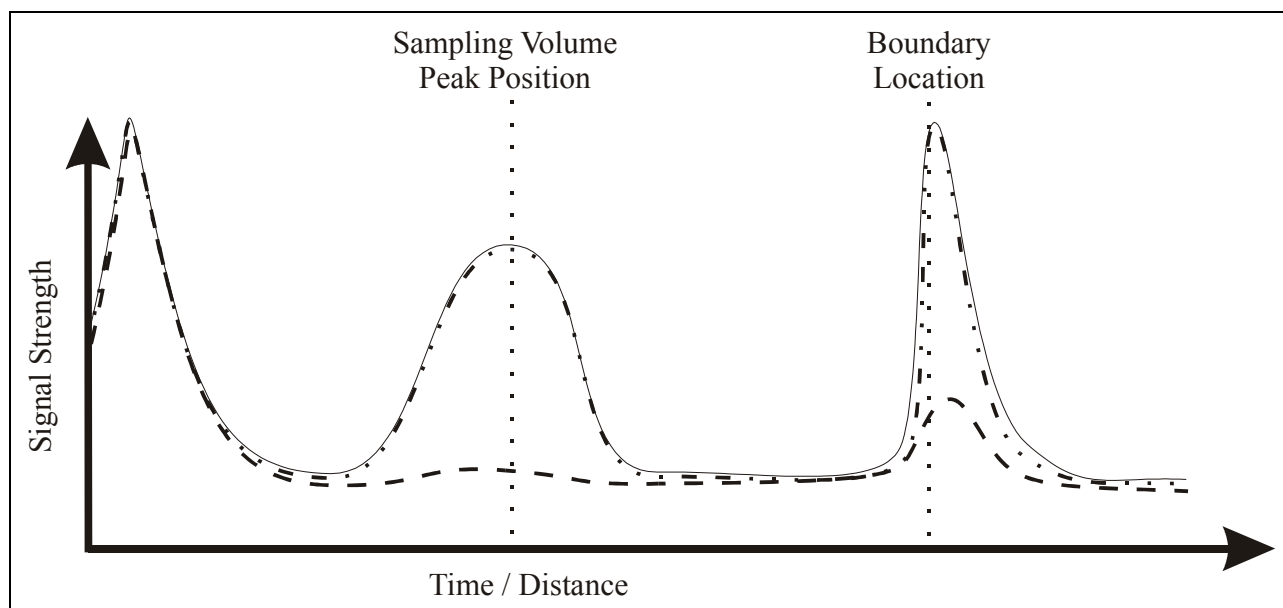**Figure 6 – *Diagnostics* Output with Malfunctioning Receiver**

Malfunctioning receiver(s) (Figure 6)

The signal from each receiver should have about the same strength as the sampling volume. If the differences exceed 10 to 20 counts, try the following before contacting SonTek: (1) Clean each transducer, and (2) Make sure the beams are not physically blocked.
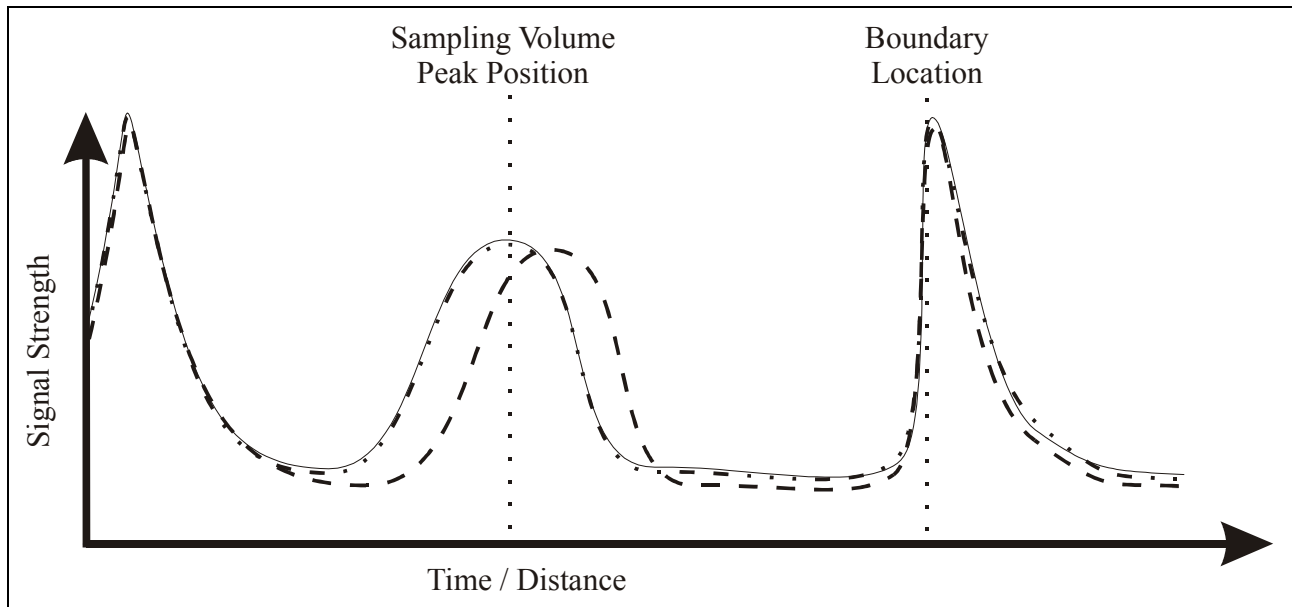
Figure 7 – *Diagnostics* **Output with Damaged Receiver Arm**

Damaged receiver arm (Figure 7)

If the sampling volume in one receiver is offset along the horizontal axis, the receiver arm is has been bent. Often, bent probes can be repaired quickly by unbending the arm and recalibrating the probe. Contact SonTek if you have a damaged probe for details about repair options.

Excessive noise

If the electronics noise level is more than 10 counts above its normal level (60-70 counts), it may be a sign that something is wrong. The noise level may also be higher than normal because of external electromagnetic interference, or because water has condensed on the receiver electronics. Coil any extra probe cable to minimize the noise and keep the electronics dry by putting a fresh bag of desiccant inside the underwater housing.
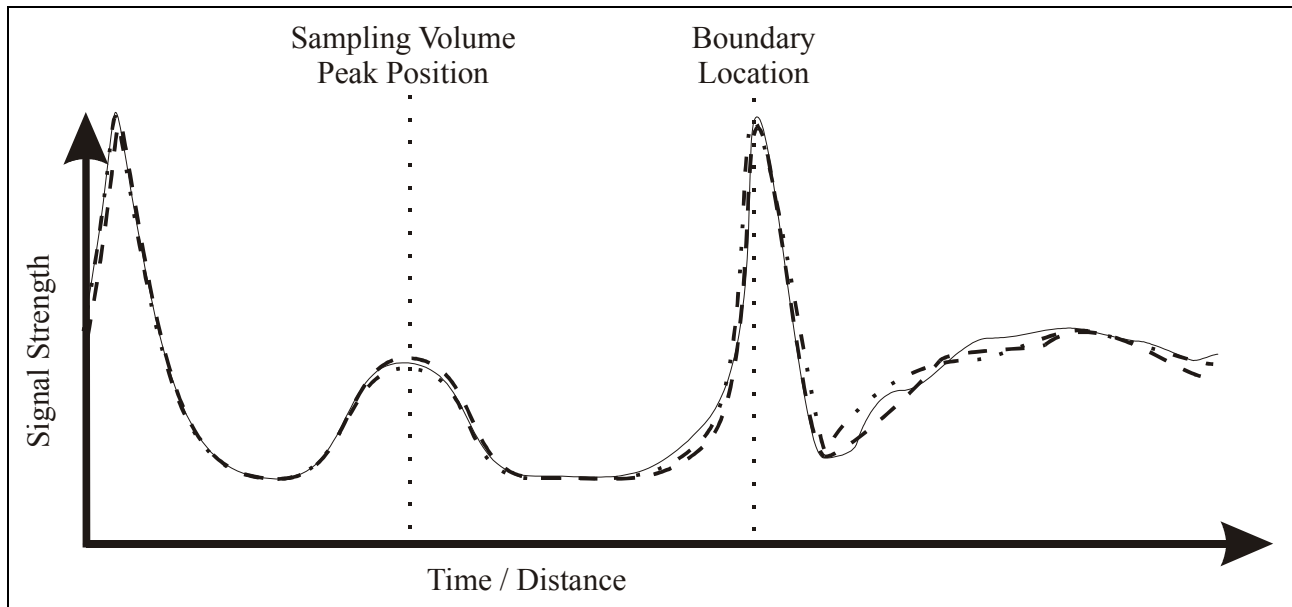
Figure 8 – *Diagnostics* Output with Noise Past Boundary

High signal strength past the boundary (Figure 8)

If the signal strength does not fall off rapidly past the boundary, the additional acoustic noise can potentially increase the noise in velocity measurements. This additional acoustic noise is most commonly seen in small tanks, particularly those made of acrylic or glass. To improve the readings, cover the boundary with a piece of cloth, a rubber mat, or a sheet of acoustic-absorbing material.

3.2.3. Recording Diagnostics Data

To record *Diagnostics* data to an ASCII file:

- Click **Save Log File**.
- Select a directory and specify a file name for the data. The software automatically adds the extension **.ckg** to the file.
- Click **OK** to start recording. All profiles will be written to this file until the program is stopped.
- When sending data to SonTek for analysis, record at least 5 to 10 profiles for reference.

Diagnostics uses a simple ASCII format with 11 values on each line, as shown below.

Column	Value	Units
1	Sample number	
2	Sample location	Counts (= 0.06 cm / 0.15 in)
3	Signal strength, receiver 1	Counts (= 0.72 dB)
4	Signal strength, receiver 2	Counts (= 0.72 dB)
5	Signal strength, receiver 3	Counts (= 0.72 dB)
6	Sine channel, receiver 1	Counts (internal)
7	Sine channel, receiver 2	Counts (internal)
8	Sine channel, receiver 3	Counts (internal)
9	Cosine channel, receiver 1	Counts (internal)
10	Cosine channel, receiver 2	Counts (internal)
11	Cosine channel, receiver 3	Counts (internal)

Diagnostics outputs about 150 samples (i.e.; 150 lines) for each recorded signal strength profile. Successive profiles are appended to the same ASCII file.

3.3. Recorder Data Extraction Software

Recorder is used to download binary data files from the internal recorder to your computer. *Recorder* works as follows.

- It establishes communication with the Triton (default baud rate is 9600).
- It displays a directory of the files on the internal recorder.
- It allows you to select which files to download.
- It enters a special download mode at a high baud rate (usually 115200), and downloads the specified files to a user-specified directory.

To run *Recorder*:

- Connect the communication cable from the Triton to your computer and apply power.
- Start *ViewTritonPro* (**Start|Programs|SonTek Software|ViewTritonPro**).
- Click **Recorder** on the main menu.
- If necessary, set/verify the communication parameters (**Settings**).
- Click **Connect**.
- *Recorder* will establish communication with the Triton and display the recorder's directory (Figure 9).
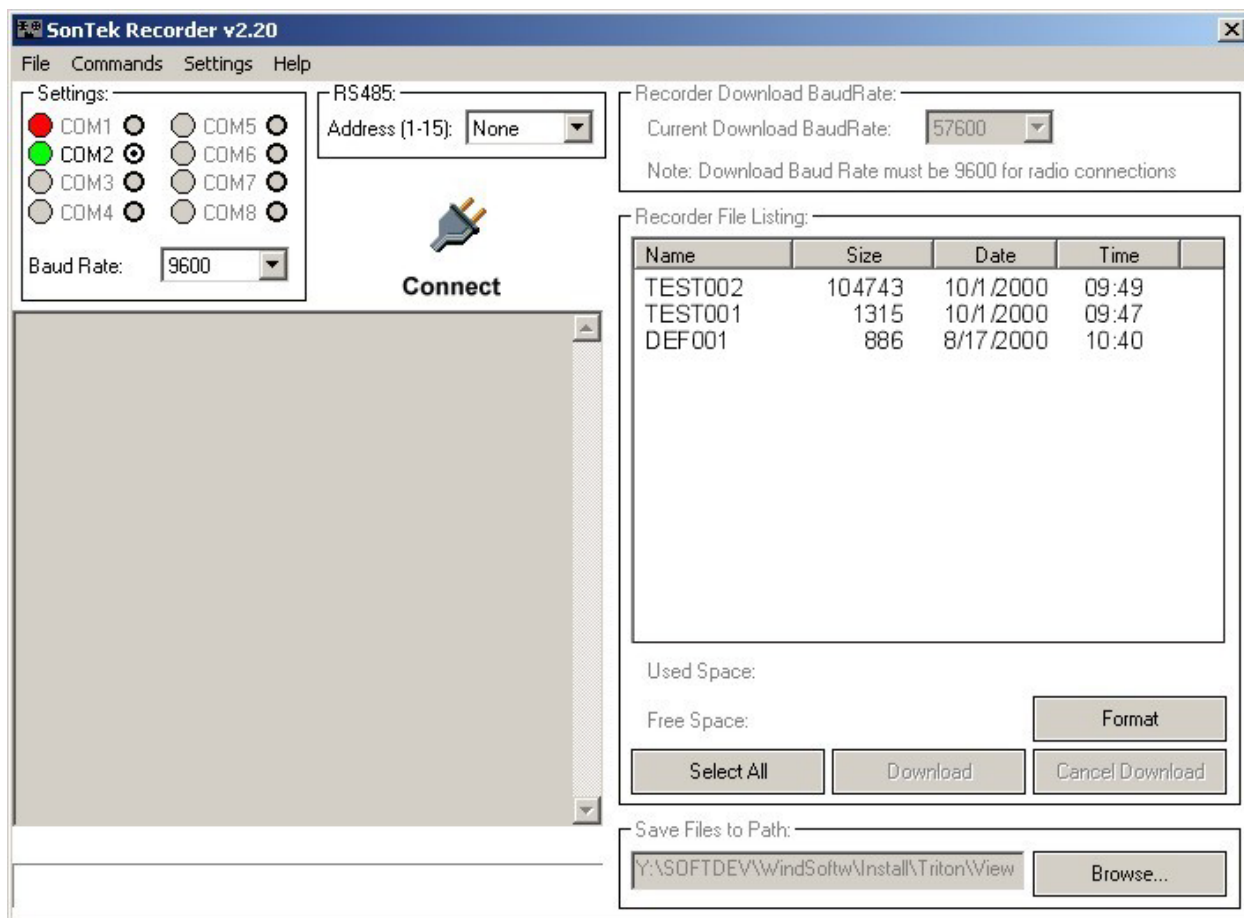

Figure 9 – ViewTritonPro Recorder Module

Basic Downloading Instructions

- Set the **Current Download Baud Rate** (default is 115200).
- Select one or more files from the display list. Files can be selected several ways.
  - Click a file to select a single file.
  - Hold the Control or Shift key, and click a series of files to select more than one file.
  - Click **Select All** to select all files on the recorder.
- Use **Save Files to Path** or **Browse** to enter the download directory location.
- Click **Download**. Note: if the extraction process fails, it may be because the instrument returned to sleep mode because of an extended period of inactivity. To wake the system, press **Connect** again, and then repeat the data extraction process.
- When download is complete, you can select additional files to download, format (erase) the recorder, or exit the program.

Formatting (Erasing) the Internal Recorder

- Be certain that all files have been downloaded and backed up before formatting (erasing) the recorder. Files cannot be recovered after the recorder has been formatted.
- Click **Format**.
- At the warning prompt, confirm your decision with OK or abort the process with Cancel. Note: if the extraction process fails, it may be because the instrument returned to sleep mode because of an extended period of inactivity. To wake the system, press **Connect** again, and then repeat the data extraction process.
- Exit the program.

Baud Rate Notes

- For short cables (less than 30 m), the default extraction rate of 115200 baud provides the fastest downloading time. For longer cables, you may need to use a slower baud rate.
- If several communication errors occur during downloading, you may need to use a slower baud rate.
- Some older laptops may require a slower baud rate.
- Experienced users who desire extremely fast downloads (up to 100 times faster than the Recorder program can provide) may be interested in using our special SonRecP program. This program downloads recorder data from a PCMCIA slot on your computer. This program is NOT for everyone as it requires you to open your instrument to remove/replace the internal recorder (i.e., the PCMCIA recorder memory card). For details about this program, visit our web site at: www.sontek.com/support.htm.

3.4. Deployment

Upon execution, the ViewTritonPro *Deployment* software does the following.

- Prompts you for the measurement system to use (Metric, English)
- Prompts you for communication parameters
- Establishes communication with the Triton
- Prompts you for deployment parameters
- Displays final deployment instructions

3.4.1. Basic Triton Deployment Instructions

- Connect the Triton to the PC.
- Connect the Triton to the power source that will be used for deployment.
- Start *ViewTritonPro* (**Start|Programs|SonTek Software|ViewTritonPro**).
- Before every deployment, run *Diagnostics* as described in §3.2.
- Click **Deployment**.
- Select the **Unit System** (Metric, English) in which you wish to collect data.
- Click **Connect**.
- If necessary, select the desired COM port and baud rate (default=9600) for the computer serial port to which the Triton is connected. COM port color code: Green=COM port available; Red=COM port in use/not available; Gray=COM port not found.
- Click **Go!**. This should awaken and establish communications with the Triton. If not, check your interconnections and COM port settings. If you still cannot establish communications, see the *Triton Operation Manual*.
- In the **System Deployment** dialog box (Figure 10), enter the appropriate settings for your application (§3.4.2).
- Check the **Advanced Settings**.
- Check **Recorder Status** to ensure there is sufficient space for your application.
- View your system's **Hardware Configuration** for correctness.
- Verify/Set the Triton's **System Time**.
- Click **Deploy**.
  - The appropriate setup commands will be sent to the Triton.
  - A status screen will be displayed showing you various remarks about the deployment. If data collection has begun, an output of the collected data will also be sent to the status screen. When you click **OK**, you will be instructed to disconnect the communications cable from the Triton system for deployment.
- Deploy the system.

3.4.2. System Deployment Parameters

Figure 10 shows the autonomous deployment setup window.

<u>User Settings</u>

Averaging Interval
- This specifies the averaging time for Triton data.
- The acceptable range of values is from 1 to 3600 seconds.
- The minimum effective averaging interval is 3 seconds. Settings less than 3 seconds give data output at 3-second intervals. Settings above 3 seconds give data output at the specified time (or at the sample interval, if higher).
- Systems with external sensors (CTD) have a minimum averaging interval of 10 seconds.
- See the *Triton Operations Manual* for a description Triton sampling.

Sampling Interval
- This specifies the time from the start of one sample to the start of the next sample.
- The acceptable range of values is from 1 to 43200 seconds.
- If the **Sample Interval** < **Averaging Interval**, then **Averaging Interval** takes precedence.
- See the *Triton Operations Manual* for a description Triton sampling.

Figure 10 – *ViewTritonPro* **System Deployment Parameters**

Coordinate System
- This specifies the coordinate system used for velocity data: **BEAM**, **XYZ**, and **ENU**.
- **ENU** is normally recommended for systems with the internal compass/tilt sensor.
- **XYZ** is recommended for systems without the internal compass/tilt sensor.
- **BEAM** is for specialized applications only and is not commonly used.
- See the *Triton Operations Manual* for a description of velocity data coordinate systems.

Velocity Range
- This specifies the expected water velocity range.
- The following table shows the maximum velocity range corresponding to each setting.
- Except for severely power-limited applications, we recommend using the automatic velocity range (index value 5).
- If the velocity range is set too low, data may become corrupted and unrecoverable.
- See the *Triton Principles of Operation* for more information about velocity range settings.

VR Index	10-MHz Triton Velocity Range
0	±3 cm/s
1	±15 cm/s
2	±50 cm/s
3	±200 cm/s
4	±600 cm/s
5	Automatic (0 to 600 cm/s)

Deployment Parameters

Deployment Name
- This specifies a root file name for data files recorded on the internal recorder.
- Up to five letters and/or numbers can be specified.
- A 3-digit termination is added to the specified file name, starting with 001 and incrementing (002, 003, …) each time data collection is stopped and started.
- The file names use the extension **.TRI**. For example, if the file name is **TEST**, the first file will be **TEST001.TRI**, followed by **TEST002.TRI**, etc.

Comments
- Up to three comment lines are provided for you to document the data set.

Sound Speed Settings

Sound speed settings are used in Doppler velocity calculations (see *Triton Principles of Operation*).

Temperature Mode
- This determines the source of temperature data used for sound speed calculations.
- **MEASURED** uses the Triton temperature sensor and is recommended for most applications.
- The **USER** setting uses the user-supplied value shown in the menu.

Water Temperature
- This sets the user-supplied default temperature value used for sound speed calculations.
- This value is used, and can be changed, only if **Temperature Mode** is set to **USER**.
- This value is ignored during operation if **Temperature Mode** is set to **MEASURED**.

Water Salinity
- This sets the salinity value used for sound speed calculations, and should be specified as accurately as possible (ideally, to ±1 ppt or better).

Speed of Sound
- Sound speed used by the Triton is calculated based on user-input salinity and data from the Triton temperature sensor (if **Temperature Mode** is **MEASURED**) or the user-input temperature (if **Temperature Mode** is **USER**).
- The displayed sound speed is calculated based on the user-supplied temperature and salinity values shown in the setup window.

Power Management
- Not available in this release.

Wave Series Settings

Record Wave Series
- This controls the collection/recording of the pressure series data. The pressure data will be collected every **d** profiles. Note that the time between successive pressure records will be **d** $\times$ **ProfilingInterval** (seconds).
- Parameter range: **1** to **255** profiles. If set to **0**, no wave data is collected.

Wave Series Rate
- This specifies the sampling rate for the wave (P or PUVW) time series collection.
- Default parameter: **1** Hz
- Parameter range: **1**, **2**, or **4** Hz (Note: If the Velocity Range setting is 5, the Wave Series Rate can be **1** or **2**; if Velocity Range is 0 through 4, Wave Series Rate can be **1**, **2**, or **4**.)

Wave Series Length
- This sets the length of the wave time series (in samples). The length of the wave series in seconds equals (Wave Series Length / Wave Series Rate).
- Parameter range: **128** to **4096** samples; default is 1024 samples.
- Without parameter: returns its current setting.
- The extraction software included with the Triton uses 128-second data segments. As such, we recommend that Wave Series Length be a multiple of that number. For more accurate wave parameter estimation, we also recommend a minimum length of 1024 seconds; however, you may choose to use a smaller value if desired.

Wave Series Type
- This specifies the wave series type.
  - **P_SERIES** – Tells system to collect pressure series data only (2 bytes/sample).
  - **PUV_SERIES** – Tells the system to collect pressure, U, V, and W data (6 bytes/sample).

Wave Spectra
- Not available in this release.

Water Depth
- Not available in this release.

Recorder Status
- Shows the total recording time based on the setup and deployment parameters.
- Click **Close** to exit the configuration window.

Hardware Configuration
- Shows the Triton system's hardware parameters.
- Click **Close** to exit the configuration window.

System Time
- Lets you set the Triton clock to match either the PC clock or a user-supplied date and time.
- The clock should be checked, and reset if necessary, before every autonomous deployment.

Advanced Settings

Data Format
- This is the data format written to the internal recorder and output over the serial port.
- **LONG** includes complete system diagnostic data and is recommended for all applications that do not have data storage limitations.
- **SHORT** uses an abbreviated data format with minimal diagnostic data, and is intended for applications with data storage limitations.
- See the *Triton Operation Manual* for information about data storage format.

Burst Mode
- This enables or disables burst sampling mode.
- Burst sampling is not commonly used; this parameter is typically **DISABLED**.
- See the *Triton Operation Manual* for a description of burst sampling.

Burst Interval
- When burst-sampling mode is enabled, this sets the time from the start of one burst to the start of the next burst.
- This parameter can only be modified when burst sampling is enabled.
- See the *Triton Operation Manual* for a description of burst sampling.

Samples Per Burst
- When burst-sampling mode is enabled, this sets the number of samples per burst.
- This parameter can only be modified when burst sampling is enabled.
- See the *Triton Operation Manual* for a description of burst sampling.

3.5. Processing

ViewTritonPro's *Processing* module is used to display Triton data and to export data in ASCII format. To load a file, use the following steps.

- Start *ViewTritonPro* (**Start|Programs|SonTek Software|ViewTritonPro**).
- Click **Processing**.
- Click the **File** icon (or use **File|Open** or Ctrl+O). Select the directory and data file to open.
- A summary of the data file is shown. Click **OK** to load the entire file, or specify a range of samples to load and then click **OK**. Note: If you have previously opened this file, you will be asked if you want to reload the previous workspace (i.e.; settings).
- The software will then plot and display the data similar to that shown in Figure 11.

Figure 11 shows the *Processing* screen with key features labeled.

- The menu bar provides access to all processing commands and parameters.
- The tool bar contains buttons for major processing functions.
- The top plot shows water velocity data versus time.
- The lower two plots can show either user-selected Sample data or Wave data versus time.
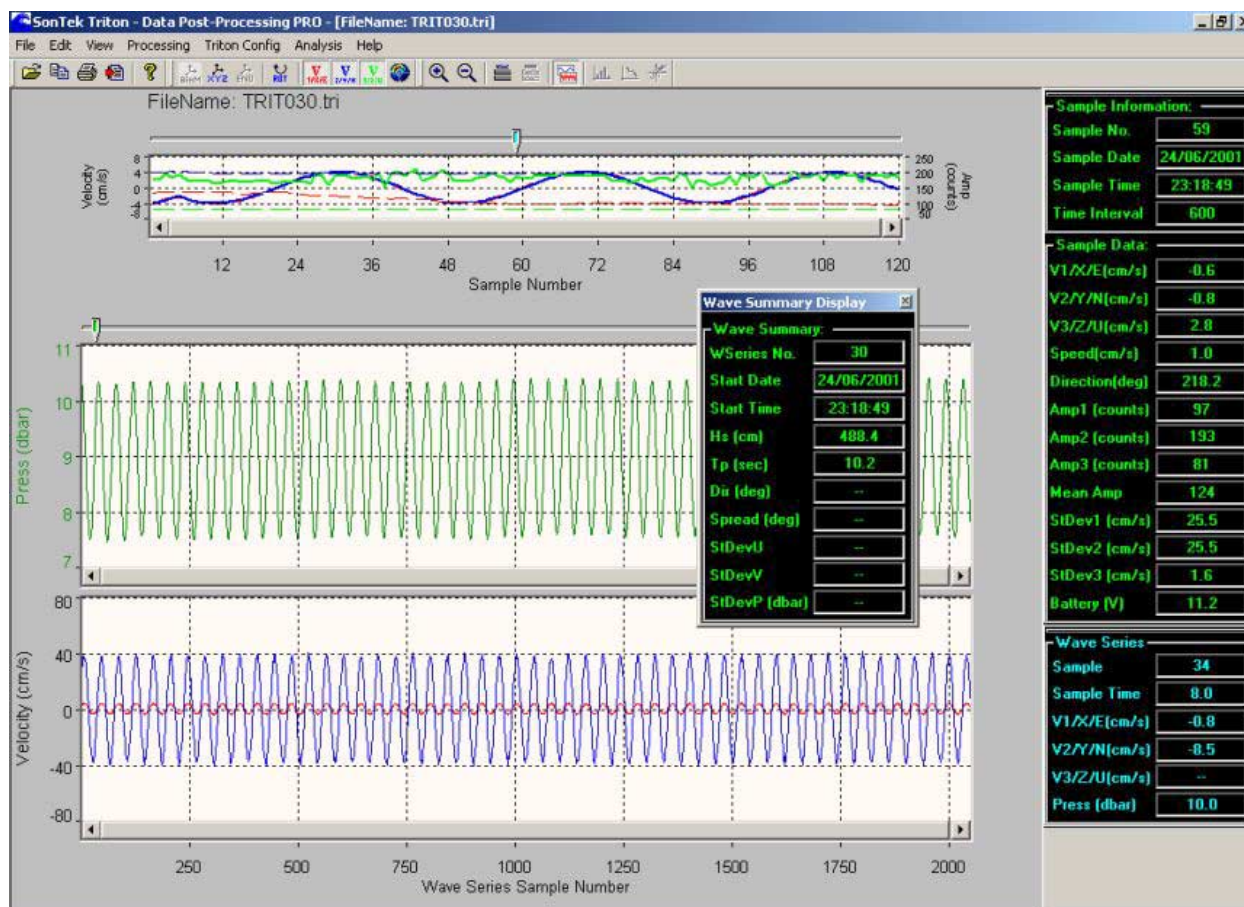- The right side of the screen shows a tabular display data.

Figure 11 – ViewTritonPro Processing Module

Velocity Plot (upper graph)

- The plot displayed at the top of the screen is usually used to display water velocity data. However, several different user-selected parameters can be displayed. Use **View|Select Top Graph Variable** (or its tool bar icon) to select the parameter(s) to be displayed. The variables are arranged in "tabs" and include the following items. Note: Depending on your system's configuration, all tabs and/or variables may not be available.
    - o Velocity – Velocity, Speed, Direction
    - o Diagnostics – Signal Amplitude, Mean Signal Amplitude, Standard Deviation, Mean Standard Deviation
    - o Sensors – Temperature, Temperature Standard Deviation, Pressure, Pressure Standard Deviation, External Pressure, External Pressure Standard Deviation
    - o Compass – Heading, Heading Standard Deviation, Pitch, Pitch Standard Deviation, Roll, Roll Standard Deviation
    - o Waves – Hs, Tp, Direction, Spread
    - o CTD – CTD Salinity, CTD Temperature, CTD Conductivity, CTD Depth
    - o Misc – Battery Voltage, Noise Level
- Moving the Sample Data time-series marker (top graph, green pointer) will set the lower graphs (Wave Series or additional Sample Data) to the range of data contained in the selected sample. This marker also set the Tabular Data displays.
- Left-axis variables are displayed using a solid line; right-axis variables are displayed using a dashed line. The axis scale can be changed by double-clicking on the appropriate axis scale.
- To magnify an area of the Sample Time-Series Graph: (a) Select the Zoom-In icon from the tool bar, (b) Click and drag your cursor from the desired starting point to the desired ending point on the Sample Time-Series Graph, (c) Release the cursor. You can now use the horizontal scroll bar to view data to the left and right of the current position. To return the graph to its full size, select the Zoom-Out icon from the tool bar. Note: Before zooming-in, set the marker to the expected middle of the zoom area.
- The velocity plot shows the three components of velocity in the user-specified coordinate system (**BEAM**, **XYZ** or **ENU**) versus time.
- To change the displayed and exported coordinate system, click the desired coordinate system button on the tool bar.
- You can turn on/off the plotting of individual velocity components using any of the three **Select Components** buttons on the tool bar.
- To change the velocity plot axis (vertical), double-click on the axis. A small window will appear that allows you to change the vertical plot scale.
- To change the horizontal plot axis scale, use the zoom icons on the tool bar.
- To change the horizontal plot units between sample numbers and date/time, use **View|X Display As**.

Wave/Sample Plots (lower graphs)

- The two bottom graphs can be used to display wither Wave Series Data or additional Sample Data Variables. You can toggle between these two displays using **View|Toggle Display of Samples/Wave Series** (or **Ctrl+T**).
- Wave Series Data
  - o The middle graph shows wave series pressure data and the bottom graph shows wave series velocity data. No other graph variables are available.
  - o A wave-series marker (middle graph, light blue pointer) appears that lets you view Wave Series Tabular Data based on the selected wave series sample number.
- Additional Sample Data Variables
  - o Both the middle and bottom graphs allow you to select two different variables to display (for a total of six variables – two on the top graph, two on the middle graph, and two on the bottom graph).
  - o The variables that are available are the same ones described for the Sample Data Time-Series Graph.
- Left-axis variables are displayed using a solid line; right-axis variables use a dashed line. The axis scale can be changed by double-clicking on the appropriate axis scale. This applies to the lower graphs only when Sample data are displayed (i.e., not wave series data).
- To magnify an area of the Wave Series Graph: (a) Select the Zoom-In icon from the tool bar, (b) Click and drag your cursor from the desired starting point to the desired ending point on the Wave Series Graph, (c) Release the cursor. You can now use the horizontal scroll bar to view data to the left and right of the current position. To return the graph to its full size, select the Zoom-Out icon from the tool bar. Note: Before zooming-in, set the marker to the expected middle of the zoom area.

Tabular Data

- The far right portion of the screen shows a tabular display of the selected Triton data. Detailed information about each sample, wave series data, wave summary data, and compass data can be displayed in a tabular format.
- The tabular dialog boxes (described below) can be turned on/off using the appropriate selection in the **View|Show…Display** (where **…** is the name of the tabular display).
- Sample Information / Sample Data box:
  - o Sample Number – The sample currently selected by the time-series marker (top graph, green pointer).
  - o Sample Date/Time – Date/Time the selected sample began.
  - o Time Interval
  - o $V_{1/X/E}$, $V_{2/Y/N}$, $V_{3/Z/U}$ – Shows the velocity components of the selected sample in cm/s. The specific component depends on the selected velocity coordinate system.
  - o Speed – Shows the averaged water-current speed for the selected sample in cm/s.
  - o Direction – Shows the averaged water-current direction for the selected sample in degrees.
  - o Amp1/2/3 – Shows the signal amplitude components of the selected sample in counts.
  - o Mean Amp – Shows the mean of the signal amplitude components of the selected sample in counts.
  - o StDev1/2/3 – Shows the velocity standard deviation components of the selected sample in cm/s.
  - o Battery – Shows the averaged battery voltage for the selected sample.

- Wave Series Data box:
  - Sample – Shows the wave series sample number currently selected by the wave-series marker (middle graph, light blue pointer).
  - Sample Time – Shows the time in seconds at which the currently selected wave series sample was collected.
  - $V_{1/X/E}$, $V_{2/Y/N}$, $V_{3/Z/U}$ – Shows the velocity components of the selected wave series in cm/s. The specific component depends on the selected velocity coordinate system.
  - Press – Shows the averaged pressure reading in dbar for the currently selected wave series sample.
- Wave Summary Data box:
  - WSeries No. – Shows the wave series number currently selected by the sample data marker (top graph, green pointer).
  - Start Date/Time – Shows the starting date and time at which the currently selected wave series data was collected.
  - Hs – Shows the Hs summary data in cm.
  - Tp – shows the Tp summary data in seconds.
  - Dir – Shows the wave direction data in degrees.
  - Spread – Shows the wave spread data in degrees.
  - StDevU/StDevV – Shows the standard deviation of U and V data.
  - StDevP – Shows the standard deviation of pressure data in dbar.
- Compass Data box (optional compass must be installed to view valid compass data):
  - Heading – Shows the averaged heading for the selected sample in degrees.
  - Pitch/Roll – Shows the averaged tilt values for the selected sample in degrees.
- You can move any tabular data dialog box by clicking on and dragging the title bar (or "gripper") located at the top of the box.

Processing Functions

The following buttons are shown on the tool bar, from left to right, to access processing functions. Functions can also be also be accessed through the menus at the top of the screen.

- **Open File** – The folder icon is used to open a new file for postprocessing.
- **Copy Screen** – The copy icon copies the current postprocessing window to the clipboard for pasting into other programs.
- **Print Screen** – The print icon prints the current postprocessing window (a print dialog box will open to verify printer settings).
- **Export Data** – The export data function opens a dialog box to export data to an ASCII file (§3.5.2).
- **Help** – Opens the on-line help file.
- **Select Coordinate System** – The three coordinate system icons (**BEAM**, **XYZ**, **ENU**) select the velocity data coordinate system displayed and exported. **ENU** can only be selected if the system has an internal compass/tilt sensor and the **LONG** data format was enabled. See the *Triton Operation Manual* for information about coordinate system settings.
- **Rotate Velocity Data** – The rotate icon (**ROT**) is used to rotate the velocity data relative to the vertical axis (**Z** for **XYZ** data, **U** for **ENU** data). **BEAM** velocity data cannot be rotated. A dialog box prompts you for the rotation angle and to activate the rotation. The rotation affects both displayed and exported data.
- **Select Components** – The three **V** buttons turn on/off the display of velocity components on the velocity plot. There is one button for each component, based on the user-specified coordinate system (**BEAM**, **XYZ**, **ENU**). You can display from 0 to 3 velocity components.
- **SonWave Processing** – Lets you set the parameters used to process wave data.
- **Zoom In**/**Out** – The zoom icons specify what portion of the data set is displayed.

Additional Menu Functions

- To change the horizontal plot axis unit between sample numbers and date/time, use **View|X Display As**.
- To view the hardware configuration parameters for this file, use **Configuration|Hardware**.
- To view the user setup parameters for this file, use **Configuration|User Setup**.

3.5.2. *Exporting Data*

The export data function is used to convert Triton data from the binary format (used by the internal recorder) to an easily accessible ASCII format. The following steps show how to export data.

- Load the desired file into the processing software (§3.5).
- Verify the measurement unit (Metric, English), select the desired coordinate system, and perform any desired rotation of velocity data.
- Click **Export Data**.
- In the dialog box, specify the file path, range of samples to export, and variables to export.
- Click **Export Selected Variable** to export the data specified in the dialog box, or click **Export All Variables** to export all data types.

Several types of data files can be exported.

- System configuration data (.ctl)
- Sample data (.dat)
- PUVW data (.puv)
- Wave data (.swv)

System Configuration Data

- System configuration data contains all hardware and user configuration data required to define system-operating parameters.
- Configuration information is stored in a file using the same name as the data file but with a `.CTL` extension.
- Configuration information is presented in a self-explanatory, ASCII-text format using the units system specified in the export data dialog box.

Sample Data

- Sample data represents all data stored with each sample.
- Sample data are stored in a file using the same name as the data file but with a `.DAT` extension.
- Sample data is extracted using the units system specified in the export data dialog box.
- The output ASCII file stores one line for each sample in the file. The file is in ASCII-text format with tab-delimited columns. This format can be easily loaded by most analysis programs (spreadsheets, MatLab, etc.).
- The number and contents of the columns in the output file depends on the setting of the **Data Format** parameter (**LONG** or **SHORT**) during data collection. See Section 3.4 and the *Triton Operation Manual* for more details about data format parameters.
- The real-time software always uses the **LONG** data format.
- The contents and units of each column of the `.DAT` file for both formats (**LONG** or **SHORT**) are shown in the table below.
- See the *Triton Principles of Operation* for a description of different data types.

Triton **LONG** Sample Format (*.DAT)

Column	Contents	Units
1	Year (Sample dates/times are for start of averaging interval)	
2	Month	
3	Day	
4	Hour	
5	Minute	
6	Second	
7	Velocity 1 (Beam 1 / X / East)	cm/s or ft/s
8	Velocity 2 (Beam 2 / Y / North)	cm/s or ft/s
9	Velocity 3 (Beam 3 / Z / Up)	cm/s or ft/s
10	Standard error 1 (Beam 1 / X / East)	cm/s or ft/s
11	Standard error 2 (Beam 2 / Y / North)	cm/s or ft/s
12	Standard error 3 (Beam 3 / Z / Up)	cm/s or ft/s
13	Signal strength (Beam 1)	counts
14	Signal strength (Beam 2)	counts
15	Signal strength (Beam 3)	counts
16	Percent good pings	%
17	Heading	°
18	Pitch	°
19	Roll	°
20	Standard deviation heading	°
21	Standard deviation pitch	°
22	Standard deviation roll	°
23	Mean temperature	°C
24	Mean pressure	dBar or psi
25	Standard deviation of pressure	dBar or psi
26	Input power level	volts
27	Reserved for future use (set to 0.0)	
28	Range to boundary from probe tip, if detected. With the real-time software, boundary range is measured and recorded only if averaging interval is greater than 5 seconds	m or ft
29-32	CTD data if installed – see below	

Triton **SHORT** Sample Format (*.DAT)

For the **SHORT** data format, several values are combined to reduce data storage requirements.

- Reported signal strength is the mean of all beams (3 for 3D probes, 2 for 2D probes).
- Reported standard error is defined based on the coordinate system.
  Beam coordinates $\sigma V = \sqrt{(\sigma V1^2 + \sigma V2^2 + \sigma V3^2)}$
  XYZ coordinates $\sigma V = \sqrt{(\sigma Vx^2 + \sigma Vy^2)}$
  ENU coordinates $\sigma V = \sqrt{(\sigma VE^2 + \sigma VN^2)}$

Column	Contents	Units
1	Year (Sample dates/times are for start of averaging interval)	
2	Month	
3	Day	
4	Hour	
5	Minute	
6	Second	
7	Velocity 1 (Beam 1 / X / East)	cm/s or ft/s
8	Velocity 2 (Beam 2 / Y / North)	cm/s or ft/s
9	Velocity 3 (Beam 3 / Z / Up)	cm/s or ft/s
10	Standard error (see above)	cm/s or ft/s
11	Signal strength (see above)	counts
12	Mean temperature	°C
13	Mean pressure	dBar or psi
14	Input power level	volts
15-18	CTD data if installed – see below	

CTD Data Format

The CTD sensor data (if present) are given immediately following the sample data. The data format is as follows:

- CTD temperature (°C or °F)
- CTD conductivity (Siemens per meter)
- CTD pressure (dBar or psi) [Note: The CTD may not include a pressure sensor.]
- CTD salinity (ppt)

Section 4. SonUtils Windows Software

4.1. Overview

Figure 12 – *SonUtils* **Main Menu**

Upon startup, *SonUtils* displays the opening menu shown in Figure 12. From this menu, you can start the following programs.

- *SonTermW* – Terminal emulator (§4.2)
- *CompCalW* – Compass calibration (§4.3)
- *SonRecW* – Recorder data extraction (§4.4)

4.2. SonTermW Terminal Emulator

SonTermW is a terminal emulator used for direct communication with the Triton.

- All major Triton functions can be accessed from a terminal or terminal emulator.
- The Triton uses a simple, text-driven command interface described in detail in the *Triton Operation Manual*.

Communication Settings   Quick Commands   Instrument Output

Show Commands   User Commands
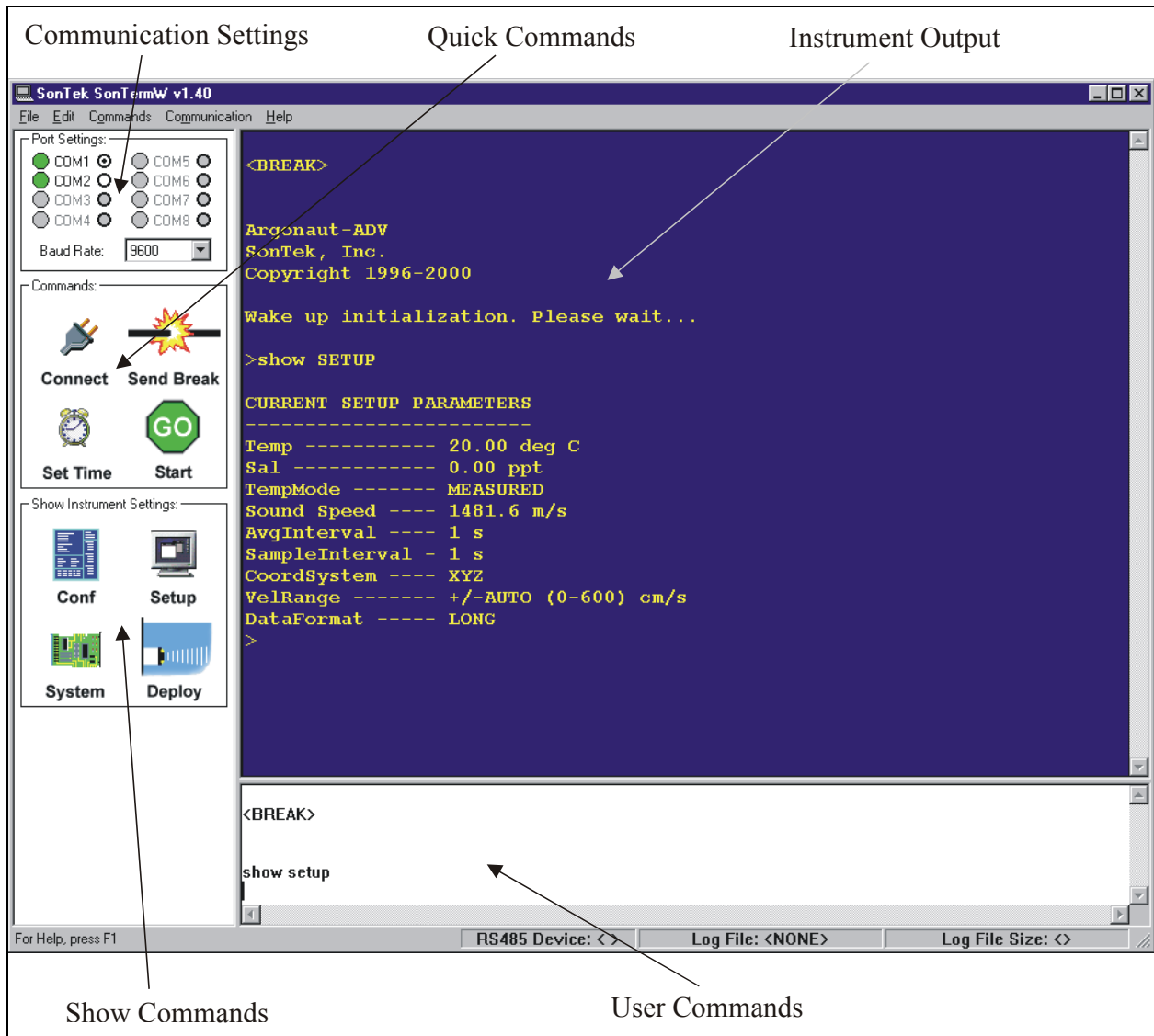
Figure 13 – *SonTermW* (Terminal Emulator) Main Window

The *SonTermW* window is divided into several sections (Figure 13).

- The top-left area is used to set basic communication parameters.
- The middle-left area contains a few of the most used commands that can quickly be sent to the instrument with a click of the button.
- The large blue area at the upper right shows instrument output. The Triton echoes all commands as they are received.
- The white area at the lower right is used for manually entering commands.

Communication parameters

- COM port and baud rate settings can be modified in the upper left area of the screen.
- Access to all communication settings (data bits, stop bits, etc.) can be set using **Communication|Settings** (Alt+S).

Quick Command Icons

- **Connect** establishes software control of the PC serial port.
- **BREAK** sends a break (transmit line held high for >300 ms) to wake the system up and place it in command mode.
- **Set Time** opens a window with the PC date and time displayed. The user can press **OK** to set the Triton clock to this time, or modify the displayed time and press **OK** to set the Triton clock to the desired time.
- **Start** sends the command to begin real-time data collection and place the system in data acquisition mode.
- **Conf** sends the command to show hardware configuration parameters.
- **System** sends the command to show system parameter settings.
- **Setup** sends the command to show setup parameter settings.
- **Deploy** sends the command to shows deployment parameter settings.

Log Files and Command Files

- Use **File|Log File** (Alt+L) to specify a log file in which to record all instrument output. All information shown on the blue screen is written to an ASCII text file.
- Use **File|Command File** (Alt+C) to specify a command file to send to the instrument. The file should be an ASCII text file with one command per line. This option lets you automate system configuration and deployment.

RS485 Multiple System Operation

- Use **File|Select RS485 Device** to specify the RS485 address used for multi-system operation.
- An address setting of 0 indicates RS485 is not being used. An address setting of from 1 through 15 prefaces all commands with that system address.
- See the *Triton Operation Manual* for details on RS485 multi-system operation.

4.3. CompCalW Compass Calibration

CompCalW is used to calibrate the internal compass/tilt sensor for the effects of ambient magnetic fields.

- *CompCalW* establishes communication and starts a display of compass data.
- *CompCalW* gives calibration instructions and displays compass data.
- At the end of calibration, *CompCalW* reports a calibration score. See the *Triton Operation Manual* for information about compass operation and calibration.
- *CompCalW* records all compass calibration data and results to a log file.
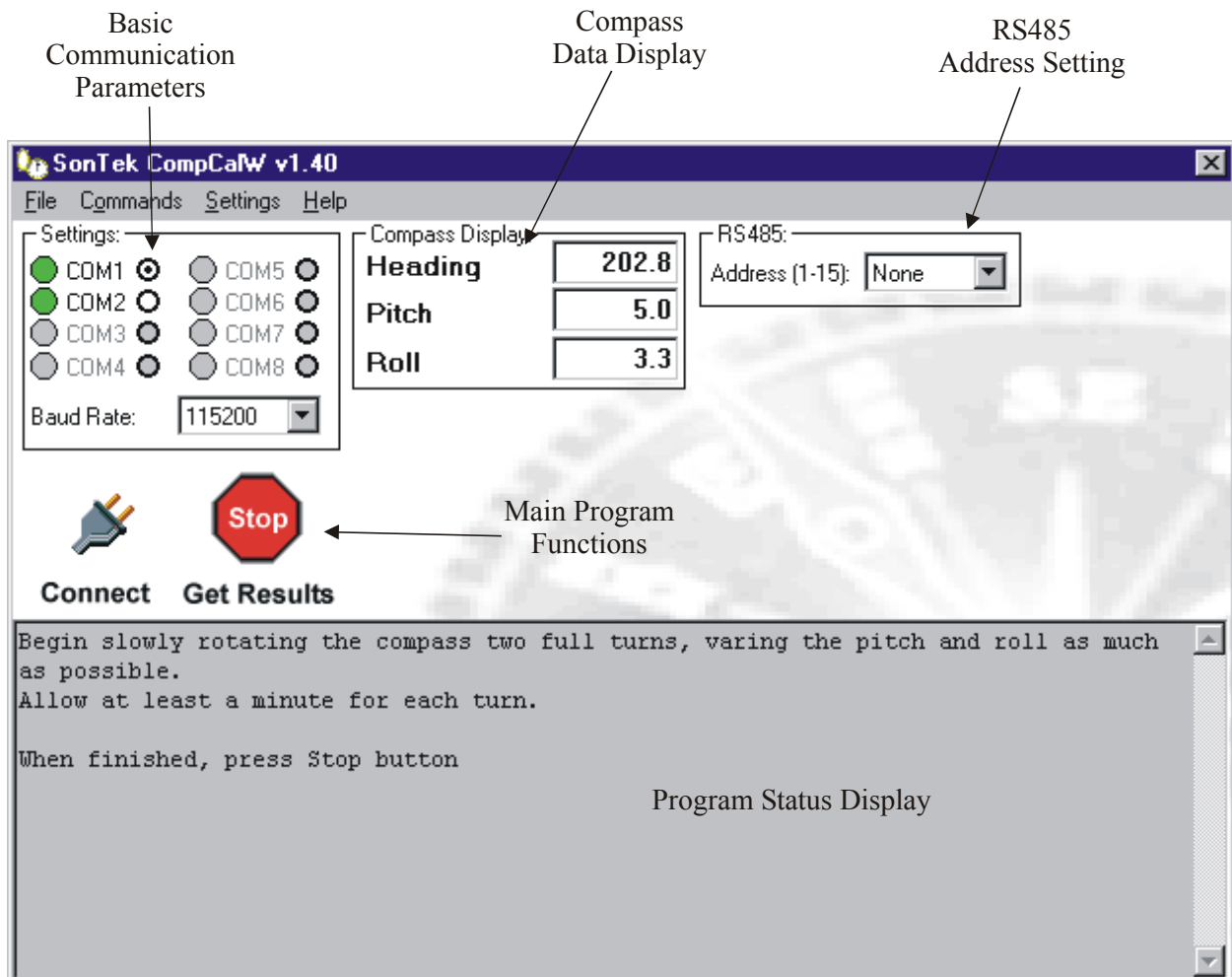
Figure 14 – *CompCalW* (Compass Calibration) Main Window

The *CompCalW* window is divided into several areas (Figure 14).

- The top area contains communication controls and parameters. This area also displays compass and tilt sensor data.
- The gray area at the bottom displays calibration instructions and program status.
- The **Connect** icon establishes communication with the Triton and starts the display of compass data.
- The **Go** icon starts the compass calibration procedure; **Stop** ends calibration.

Communication Parameters

- COM port and baud rate settings can be modified in the upper left portion of the screen.
- Access to all communication settings (data bits, stop bits, etc.) can be set using the **Settings|Port Settings** menu.

RS485 Multiple System Operation

- The top right of the screen specifies the RS485 system communication address.
- An address setting of 0 indicates RS485 is not being used. An address setting of from 1 through 15 prefaces all commands with that system address.
- See the *Triton Operation Manual* for details on RS485 multi-system operation.

Basic Calibration Instructions

- Start *CompCalW*.
- Click **Connect** to establish communication.
- Click **Go** to start the compass calibration and the display of compass data.
- Follow the instructions for calibration.
    o The Triton should be rotated through at least two complete rotations, varying pitch and roll as much as is practical (within the ±50° sensor limit).
    o If possible, calibration should be performed with the Triton installed in the mounting frame that will be used during deployment.
- At the end of calibration, press **Stop**. *CompCalW* reports a calibration score. See the *Triton Operation Manual* for information about the calibration score.
- *CompCalW* records all compass calibration data and results to a log file. These log files are generally used for quality assurance purposes, but are not essential to program operation (i.e., you can delete them). The log file name is in the format of year/month/day/ hour/minute.cmp. For example, 0011061311.cmp stores data that was collected on November 6, 2000 at 13:11 (1:11 pm). The file can be viewed with any ASCII text editor.

4.4. SonRecW Recorder Data Extraction

SonRecW is used to download binary data files from the internal recorder.

- *SonRecW* establishes communication and displays a directory of the files currently stored on the Triton's internal recorder.
- You select the files you wish to download and where to place them.
- *SonRecW* enters a special download mode at a higher baud rate (usually 115200) and downloads the specified files.
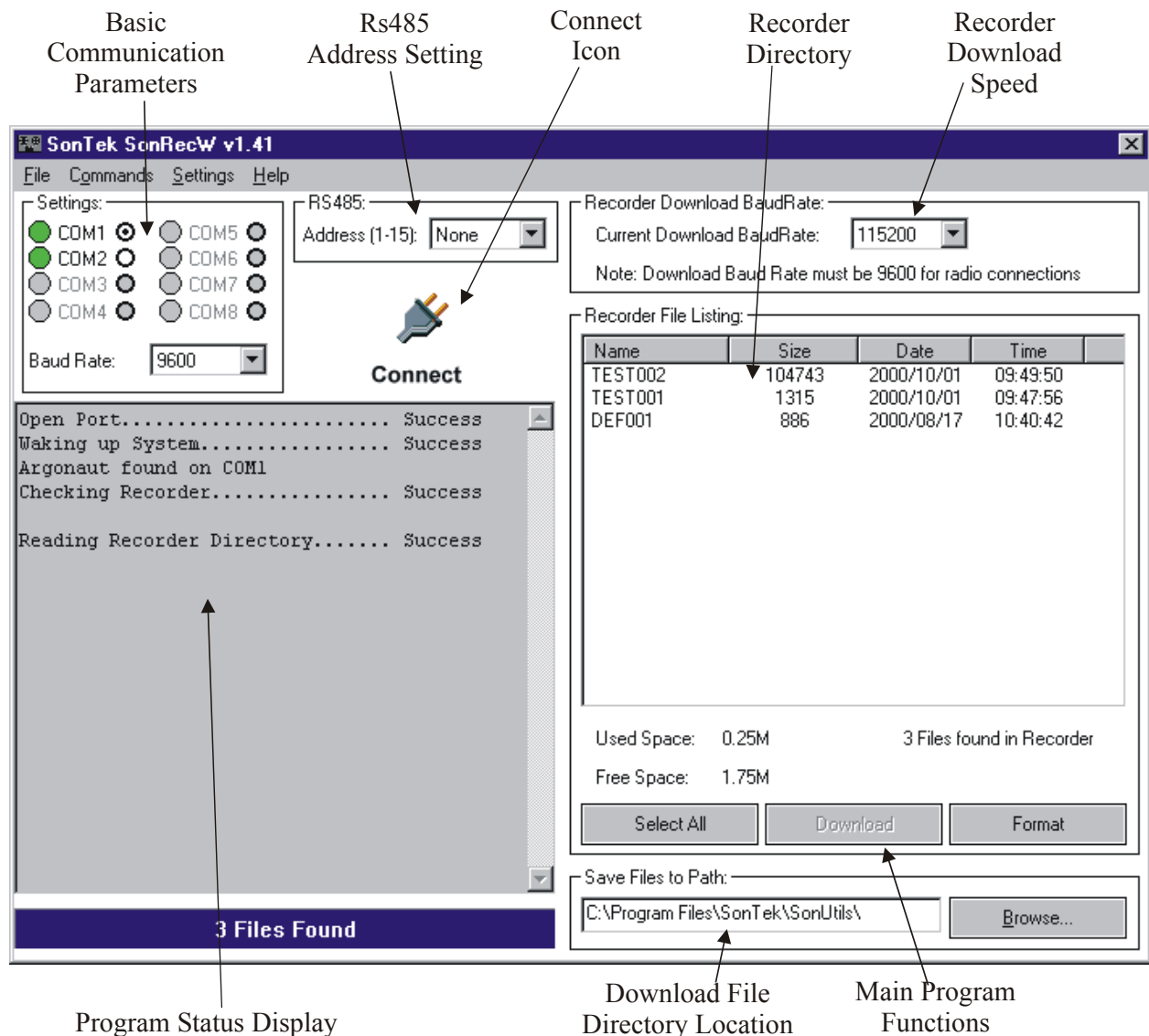

Figure 15 – *SonRecW* (Recorder Data Extraction) Main Window

The *SonRecW* window is divided into several areas (Figure 15).

- The top area shows communication parameters.
- The gray area on the left displays program status.
- The white area on the right displays a directory of the files on the internal recorder.
- The area on the lower right contains control buttons and shows the destination path.

Basic Downloading Instructions

- Click **Connect** to establish communication and display the recorder's directory.
- Specify a destination directory on the bottom right (or use the **Browse** button).
- Select one or more files from the display list. Files can be selected several ways.
    - o Click a file to select a single file.
    - o Hold the Control or Shift key and click a series of files to select more than one file.
    - o Click **Select All** to select all files on the recorder.
- Click **Download** to copy all selected files to the specified directory.
- Watch the program status area on the left as files are downloaded.

Formatting the Internal Recorder

- The **Format** button on the bottom right erases the internal recorder.
- Be certain that all files have been downloaded and backed up before erasing the recorder.
- Files cannot be recovered after the recorder has been erased.
- To erase the recorder, click **Format**, and then **OK** to confirm your decision when the warning window appears.

Download Baud Rate

- *SonRecW* uses a higher baud rate to download data files (compared to the one used for standard system communication). The default download baud rate is 115200.
- High baud rates can only be used with high-quality, relatively short cables (such as the cables normally supplied with the Triton).
- If you have trouble downloading data, try using a slower download baud rate.

Communication parameters

- COM port and baud rate settings can be modified in the upper left area of the screen.
- Access to all communication settings (data bits, stop bits, etc.) can be set using the **Settings|Port Settings** menu.

RS485 Multiple System Operation

- The top center area of the screen specifies the RS485 system communication address.
- An address setting of 0 indicates RS485 is not being used. An address setting of from 1 through 15 prefaces all commands with that system address.
- See the *Triton Operation Manual* for details on RS485 multi-system operation.

Section 5. Additional Support

Any additional questions can be directed to SonTek by phone, FAX, or email. Regular business hours are 8:00 a.m. to 5:00 p.m., Pacific Standard Time, Monday through Friday.

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World Wide Web	http://www.sontek.com

See our web site for information concerning new products and software / firmware upgrades.

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