SonoConfig Installation and Operation Manual

VORTEK INSTRUMENTS

Table of Contents

Application Installation and Update

Pre-Loaded Kit

If the SonoConfig kit is purchased from Azbil Vortek, the application will come pre-loaded on the tablet with the latest version at the time of kit assembly. In a case where the application is out of date, it can be updated using one of the methods below. As of this writing, the latest App file can be found on the Azbil Vortek website or from you sales representative.

From Flash Drive

After acquiring the latest .apk file, place it on a flash drive. Attach the supplied OTG (On the Go) cable to the tablet if using a purchased kit. Otherwise an OTG cable can be purchased from a Best Buy store or Amazon. Make sure that the device end of the OTG cable matches the serial port type on the tablet (i.e. USB Micro or USB C). Plug the flash drive (containing the App) into the other end of the OTG cable. The tablet (or phone) should recognize the flash drive as an external memory source. Using a file browser on the device, browse to the flash drive and the App's .apk file should be present with the SonoConfig icon. Select the App file and the device should provide the necessary prompts for installing the App.

From Internal Memory

This method is like the flash drive install with the exception that the App file is placed directly on the device. Connect the device to a computer via the serial cable supplied with the device or in the kit. After acquiring the Apps .apk file, use the file explorer on the computer to place the .apk file directly on the tablet or phone. A good location to place this file is in the internal directory of the device either in the DOWNLOAD or APPLICATION folder if it exists. Next, on the tablet, browse to the folder where the SonoConfig App was placed and select it. The device should provide the necessary prompts for installing the App.

From Playstore

At the time of this writing, the SonoConfig application is not available on the Google Play Store.

SonoPro Connections

The device that runs the SonoConfig App has two methods available to talk to the SonoPro meter; via the USB serial port, or through the built in Bluetooth (if available).

USB Connection

This method of connection requires the use of an OTG cable as well as a USB cable that has a USB Micro on one end and USB A on the other. If a kit was purchased, both are provided in the kit. Otherwise, these cables will have to be purchased for your device. To connect to the SonoPro, connect the OTG cable to the tablet or phone, plug the USB cable into the OTG cable, and then connect the other end of the USB cable to the port on the side of the SonoPro.

Bluetooth Connection

This method requires no cable to connect to the SonoPro. This is helpful for applications where the SonoPro is not easily accessible or a cable is not available. There is a limitation of the physical distance

between the SonoPro and the tablet. This distance is typically limited to about 300 feet under ideal conditions and can vary greatly.

Storage Locations

The SonoConfig application can store certain information within the tablet or phone for future retrieval. This stored information consists of, but is not limited to log waveforms, screen captures, and setup configurations. The two areas of the tablet memory that are used for data storage are described below.

Internal Storage

All tablets and phones will have internal storage. However, depending on the number of apps and files loaded, there may not be guaranteed space for storage by the SonoConfig App. If the device has an expansion slot for an SD card, and one is not installed, the App will default to internal storage.

External (SD) Storage

In the case where an SD card is installed, the App will default to the external storage on the SD card.

Data Locations

All data associated with the SonoConfig App is stored under the applications dedicated directory on the tablet or phone. This location will vary slightly depending on use of internal vs. external memory space. When browsing to the filesystem on the tablet with a connected computer, the internal and external storage may be shown as something like Figure 1.

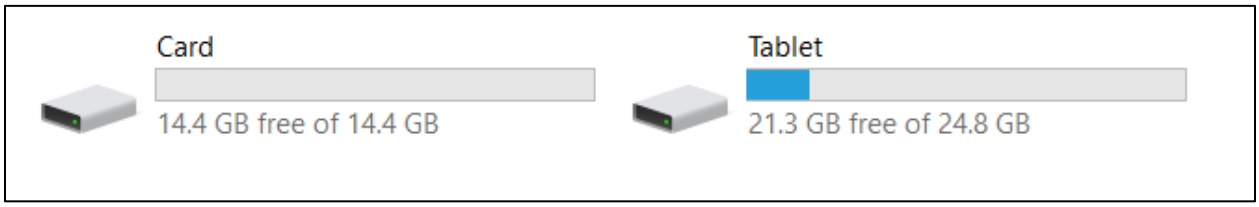


Figure 1: Browsing Internal and External Tablet Storage

In this case, the card is the external SD card installed, and the tablet is the internal memory. An example of the full path for the card and tablet are shown below:

Card/Android/data/com.vortek.sonoconfig/files OR *Tablet/Android/data/com.vortek.sonoconfig/files*

This path will contain the folders where Logs, Setup, Screenshots, and Output files are kept. An example of these paths is shown in Figure 2. The path will be the same for the internal storage starting from the Tablet folder.

It is important to note that the com.vortek.sonoconfig folder is exclusively associated with the SonoConfig App. If the App is uninstalled from the tablet, all data under this folder will be removed as well. Updates to the App will retain all the data in this directory.

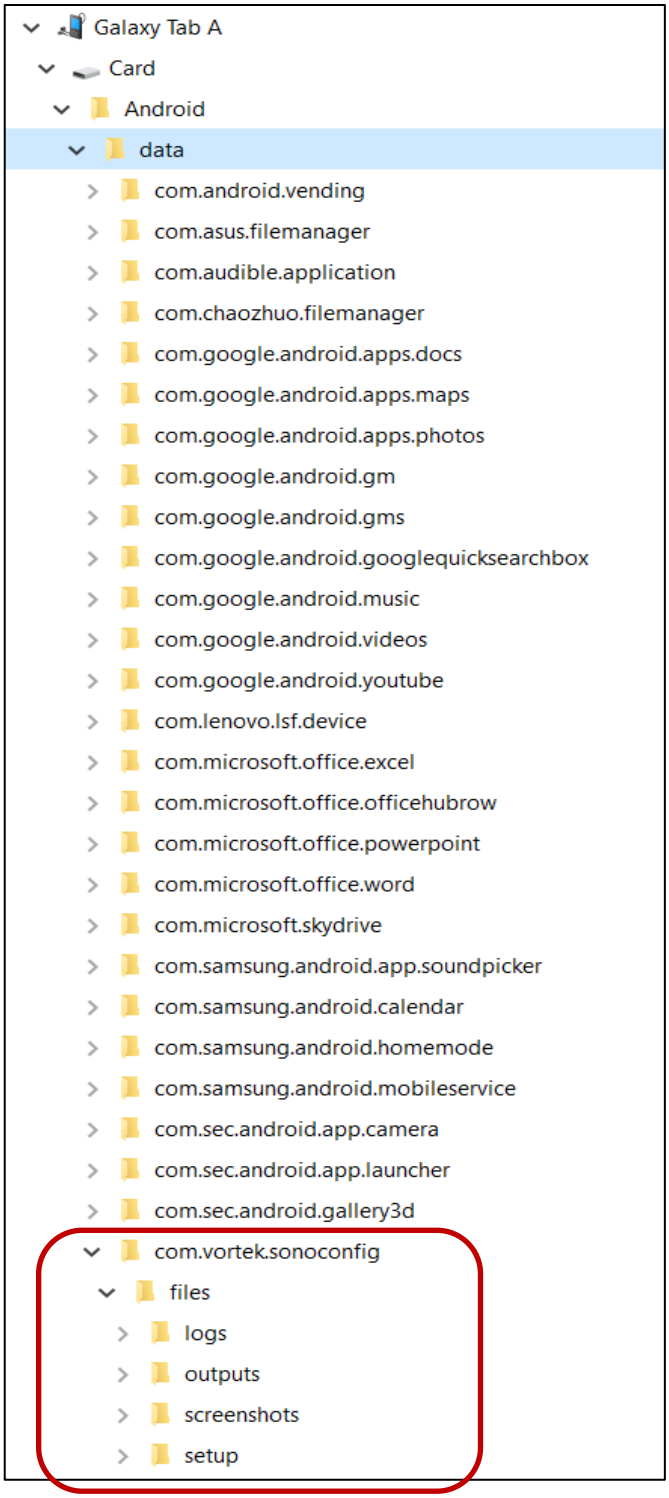


Figure 2: SonoConfig File Path

Action Bar

The green bar at the top of the SonoConfig App is used for global controls and indicators that are visible from any screen in the app. An example of the action bar is shown in Figure 3.

Figure 3: Action Bar

About

The about button is used to display various information about the SonoPro that is connected to the device as well as the SonoConfig application itself. The version number directly below the About title is the version for the SonoConfig app. Clicking OK will close the dialog. The SonoPro information will only show after the connection procedure has been completed.

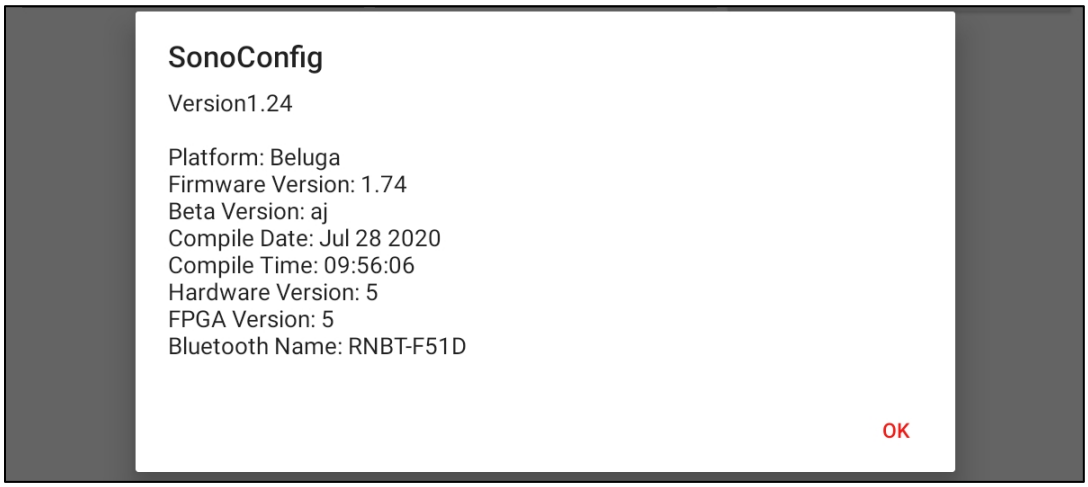


Figure 4: About Dialog

Refresh Config

The Refresh Config button is used to synchronize all configuration information between the SonoPro and the SonoConfig application. This action will over-write any configuration settings not saved from the App to the SonoPro. When the configuration is successfully brought from the SonoPro to the SonoConfig App, a notification will appear to indicate this as shown in Figure 5.

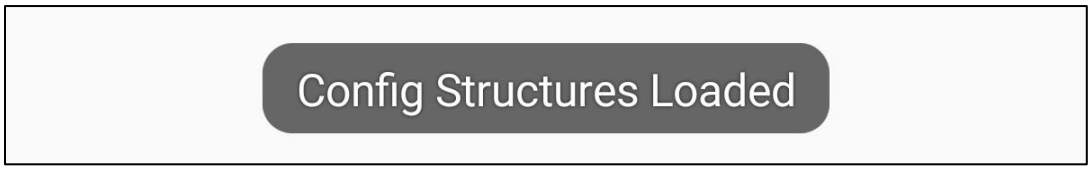


Figure 5: Config Refresh Notification

Indicators

The status indicators shown in the Action Bar (Figure 3) to the left of the refresh button are used to indicate the status of the communication connection with the SonoPro as well as the status of Energy Mode on the SonoPro. When the "E" is present, the SonoPro is in energy measurement mode. The "B" shown in the example in Figure 3 indicates that the SonoConfig App is connected to the SonoPro via Bluetooth. If the App is connected via USB cable, an "S" will appear here. When there is no connection, this indicator is blank. When the "C" is present, this indicates that the Config Structures have loaded.

Page Organization

The organization of the tabs within the SonoConfig App are designed to help the user navigate portions of the App in a similar fashion to the menu system on the SonoPro itself.

Parent Tabs

The parent tabs as shown in Figure 6 represent the parent pages of the App. The description with the thick blue line below is the currently viewed tab. The user may switch between tabs by clicking on another tab or swiping right or left when page swiping is enabled.

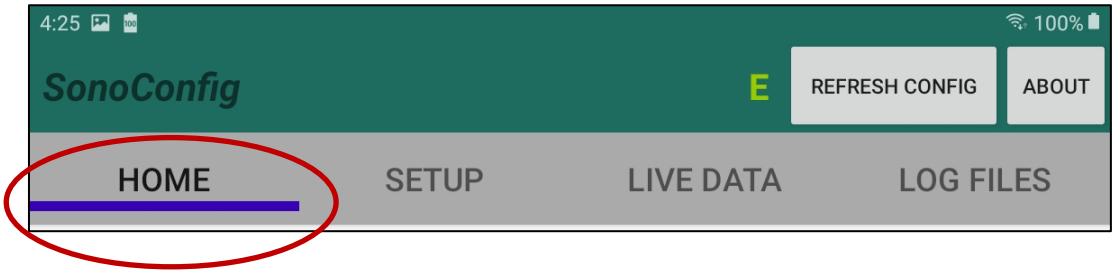


Figure 6: Parent Tab Example

Child Tabs

Child tabs are sub-screens that can appear under a parent tab, like nested folders in a file structure. The Setup parent tab is an example of this and is shown in Figure 7. The child tabs are indicated by a thin blue line below the currently selected tab. Changing between tabs can be accomplished by swiping right or left. A tab can also be selected by touching the tab name.

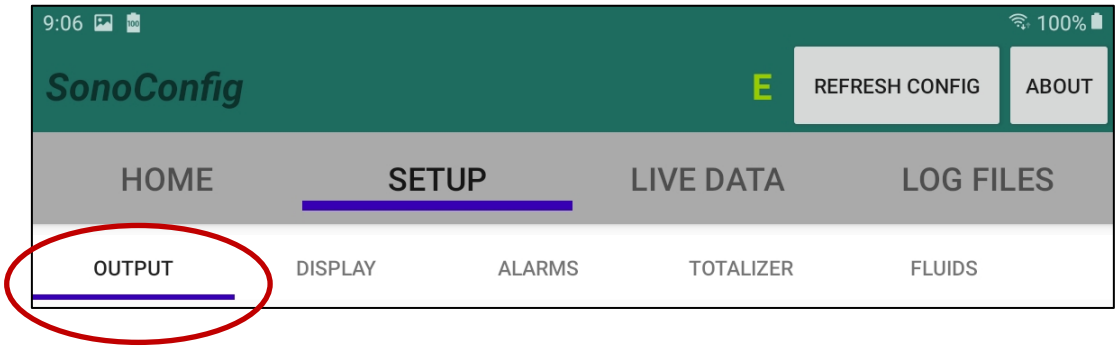


Figure 7: Child Tab Example

Home Screen

The Home screen is the default screen that appears upon startup of the SonoConfig application. This is where the connections to the SonoPro are established and monitored. The default state is disconnected and ready to connect through the serial cable.

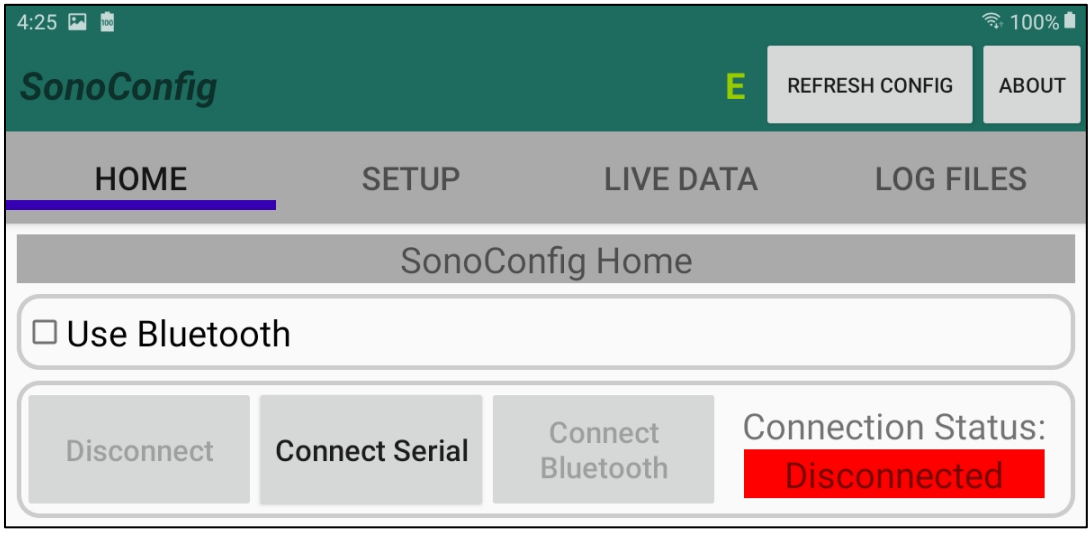


Figure 8: Default Home Screen

Bluetooth Checkbox

This checkbox is used to change the method of connection to the SonoPro from Serial to Bluetooth. When this checkbox is checked, only the “Connect Bluetooth” button will be usable. When it is unchecked as shown in Figure 6, only the “Connect Serial” button is available for use.

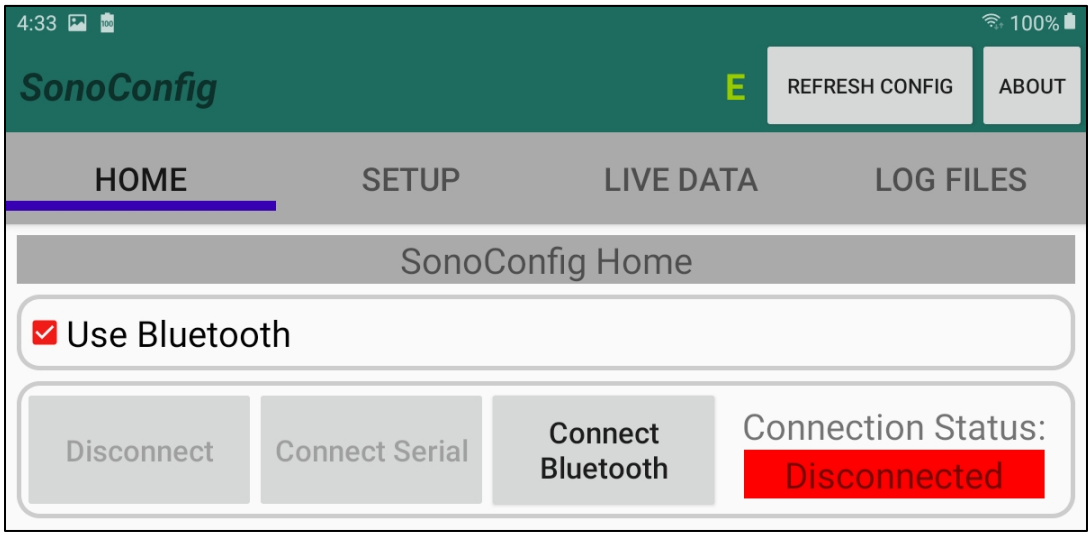


Figure 9: Bluetooth Connection

Connect Buttons

These buttons are used to make the data connection to the SonoPro. Either the Serial or the Bluetooth button will be enabled depending on the status of the Use Bluetooth Checkbox.

Disconnect Button

Once a connection has been established with the SonoPro (either through Bluetooth or Serial) the Disconnect button will be enabled. This allows the user to stop the current connection with the SonoPro. This is necessary for situations where the same tablet is being used to communicate with multiple SonoPro units, especially for Bluetooth communication. The SonoConfig App is only able to connect to a single SonoPro at a time.

Connection Status

The Connection Status block is used as an indicator for the current status of a serial or Bluetooth connection.

Connecting SonoConfig App to SonoPro

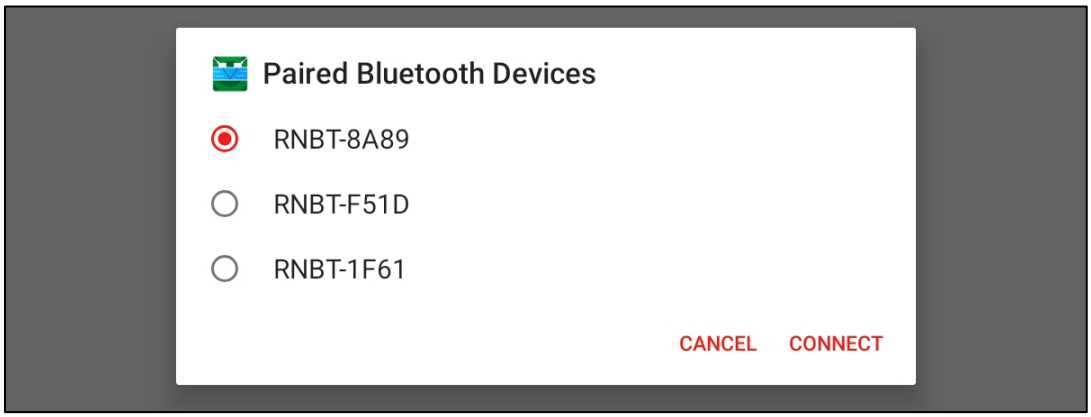
Connecting to the SonoPro through Bluetooth or USB will provide the same functionality in the App. The main advantage of the Bluetooth connection is the wireless aspect. No cables are needed, and the tablet can be charged while using the Bluetooth Connection. The serial USB connection has an advantage of being slightly faster with data transfer. This can be helpful for transferring larger Log files from the SonoPro to the App. There is also less risk of any radio interference while using the USB connection. The best method will depend on the environment of the install and user preference.

Serial USB Connection

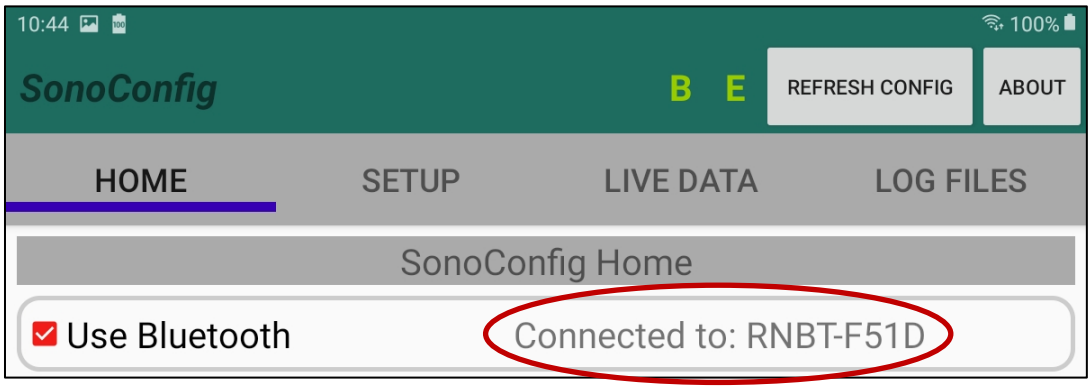
- Connect the micro end of the USB cable to the port on the side of the SonoPro, and the other end to the tablet or phone through the OTG cable.
- If the App is running at the time, it will flash a message that a USB device has been connected.
- From the Home page, ensure that the Use Bluetooth option is UNCHECKED.
- Press the Connect Serial Button.
- If a dialog appears to allow access to the UART, select OK.
- Connection status should change to Connected, and an “S” will appear in the action bar.
- A message will also briefly appear to indicate that data structures have been loaded.
- The App is now ready to be used with the SonoPro.

Bluetooth Connection

- Ensure that USB devices and cables are disconnected from the SonoPro as well as the tablet.
- Determine the Bluetooth ID of the SonoPro being connected to. This can be done in one of two ways:
    - On the SonoPro, scroll through the hidden diagnostics menu to find the radio ID, it will be shown as RNBT- and a four-digit Hex number for the radio ID on the second line of the display. Refer to the SonoPro user manual to get to the diagnostic menu.
    - While connected to the SonoPro through the USB cable, click the ABOUT button on the action bar. A dialog like the one in Figure 4 will be displayed. If a Bluetooth radio is present in the SonoPro, the “Bluetooth Name” will be displayed in this dialog.
- From Settings on the tablet, turn on Bluetooth and pair the radio ID found in one of the steps above. The tablet can be paired to several different SonoPros.
- From the Home page, check the Use Bluetooth checkbox.
- Click the Connect Bluetooth button. A dialog will appear with all paired devices.



- Select the ID of the SonoPro Bluetooth radio to be connected to. Press the Connect button in the dialog.
- If the connection is successful, the Connection Status will indicate “Connected”, and “B” will appear on the action bar. If the connection was not successful, a message will flash on the screen to indicate this. Connect Bluetooth may be pressed again to re-try connecting.
- When the connection is established, the connected radio ID will be displayed as shown.



- The App is now ready to be used with the SonoPro.

SonoPro Setup Pages

The “SETUP” parent tab contains all the child tabs necessary to configure the SonoPro for basic operation. These tabs closely follow the progression of the menu structure in the SonoPro.

Each page detailed below has a set of buttons to ***See Current Settings*** and ***Save New Settings***.

- Clicking the See Current Settings button will populate only that displayed page with values and settings that are in the configuration structure that was loaded into the App at the time of connection to the SonoPro. ***In the event the config data is not loaded, there will be a notice***.
- Changes made to values and settings on a page will only exist on that page until the Save New Settings button is clicked.
- Value changes will turn red to indicate that they have not been saved.
- If See Current Settings button is clicked prior to saving new settings, the page will be re-populated with the settings prior to changes.
- When the Save New Settings button is clicked, any changes to the settings or values on the page will be sent to the SonoPro, and changed in the data structures in the App. ***At this time, the SonoPro and SonoConfig data structures are synchronized***.

Output

The output page is used for setting up analog outputs on the SonoPro.

- As defined by the SonoPro, each output variable can only be represented once for a value. For example, both 4-20 outputs can be set to Mass, but they cannot have different values for min and max current. If two outputs are set to the same variable, the values of the second one will be used.
- When the units associated with a variable are changed, the App will perform the conversion real-time for the values. ***If these new units are saved to the SonoPro, it will then change the units associated with that variable to the new unit***. This eliminates the need to change the units in the Units page if a different unit is desired for the outputs.
- Time constants may be different for outputs that are set to the same variable and min/max values.
- If "None" is chosen as the variable, no variable will be associated with that output, min and max will be set to zero.
- Energy will not be available as a variable when the SonoPro is ***not*** in energy mode.

Display

The display page is used to set parameters for the display screen on the SonoPro.

- All value parameters that have a checkmark will be available for display on the SonoPro.
- Cycle Time is used to automatically cycle through the values on the SonoPro screen. Each value will dwell for the number of seconds set in this drop-down. If set to zero, the values will have to be manually cycled through using the SonoPro keypad.
- The Display Digits drop-down is used to set the number of digits after the decimal displayed on the SonoPro screen.
- The Display Smoothing checkbox is used to enable smoothing on the SonoPro display. This can help avoid "bouncing" in the value displayed on the SonoPro.
- When the SonoPro is not in energy mode, the energy option will not be shown in the display list.

Alarms

The Alarms page is used to set the trigger info for both alarms available on the SonoPro. Alarm logs can also be viewed from this page.

- The trigger variable is used to set what will be monitored for the alarm
- If trigger variable is set to "None", that alarm is disabled.
- Trigger mode is used to determine if the alarm will be triggered ***above*** or ***below*** the Alarm Level setpoint. High Alarm will trigger above, Low Alarm will trigger below the set point.
- When a trigger variable is set, the units for that variable will be shown, and cannot be changed in this page.
- When current settings are loaded, the number of available alarm logs will be displayed. These logs can then be displayed by pressing the View Logs button. Logs can be cleared by pressing the Clear Logs button. Keep in mind, this will erase ALL alarm logs.

Totalizer

This page is used to set the variables for the totalizer(s) on the SonoPro as well as the pulse out parameters.

- The second totalizer will be displayed only when the SonoPro is in energy mode.
- The Totalizer Variable determines which flow will be totalized. If the variable is set to None, that totalizer will not accumulate.
- The Reset button is used to clear the totalizer back to zero.
- The pulse output function is only available for Totalizer #1. The unit for the pulse output is determined by the variable chosen and cannot be changed on this page.
- The pulse output value is used to set accumulated flow between each pulse.

Fluids

This page is used to set what fluid is being measured for flow. As of this writing, allowed fluids are water and ethylene glycol mixtures.

- When Ethylene Glycol is set as the fluid, a percent by volume of glycol must be entered in the Percent Volume field.

Units

This page is used to set the global units for the SonoPro.

- The units selected on this page will be displayed on other pages where a unit is shown for a variable.
- The energy units are selectable only when energy mode is enabled on the SonoPro.
- Temperature, Length, and Density do not have a time denominator.

Time

This page is used to set the time and date on the SonoPro.

- When See Current Settings is pressed, the current time and date on the SonoPro is displayed.
- When Set Time or Set Date is pressed, the values displayed will be written to the SonoPro.

Diagnostic

This page is used to set simulated flow, view system logs, and setup parameters for logging.

Simulated Flow

- A simulated flow rate can be entered for diagnostic purposes. The flowrate is fixed at a volume flow unit of cubic feet per second.

System Logs

- All present system logs may be viewed by clicking the View Logs button.
- Logs may be cleared by clicking the Clear Logs button.

Log Settings

- There are four Logging variables that can be set individually.
- The Log Interval sets the time interval in Seconds between each log data point.
- The variables set will be logged internally on the SonoPro at the log interval in seconds.
- The minimum interval is 1 Second. This setting should be used sparingly as it creates large log files, and subsequently will take longer to download to the SonoConfig App.

Energy Mode

- The Energy Mode checkbox is used to enable and disable energy mode on the SonoPro.
- This box, along with the “E” indicator on the action bar will indicate state of the energy mode on the SonoPro after See Current Settings is clicked.
- When saving settings for the Diagnostic page, a checked Energy Mode will put the SonoPro into energy mode.

Calibration

This page is used to enter the pertinent information about the flow application. This information will enable the SonoPro to make accurate flow calculations as well as providing the user with the spacing for the transducers.

Pipe Units and Material

- When beginning to enter the information for the pipe, select the units that the pipe has been measured in. This is important for the manual pipe dimension method. When selecting standard pipes, this will be set automatically.
- Select the material of the pipe that is being measured. This is critical for the speed of sound calculations and consequently the flowrate.

Manual vs Standard Selection

These radio buttons, shown in Figure 10 will determine where the final dimensions are coming from.

- When Manual is selected, the pipe dimensions will be entered in the Manual Pipe Input box as shown. Only two of the three dimensions should be entered. The third is calculated by pressing the Calculate button.

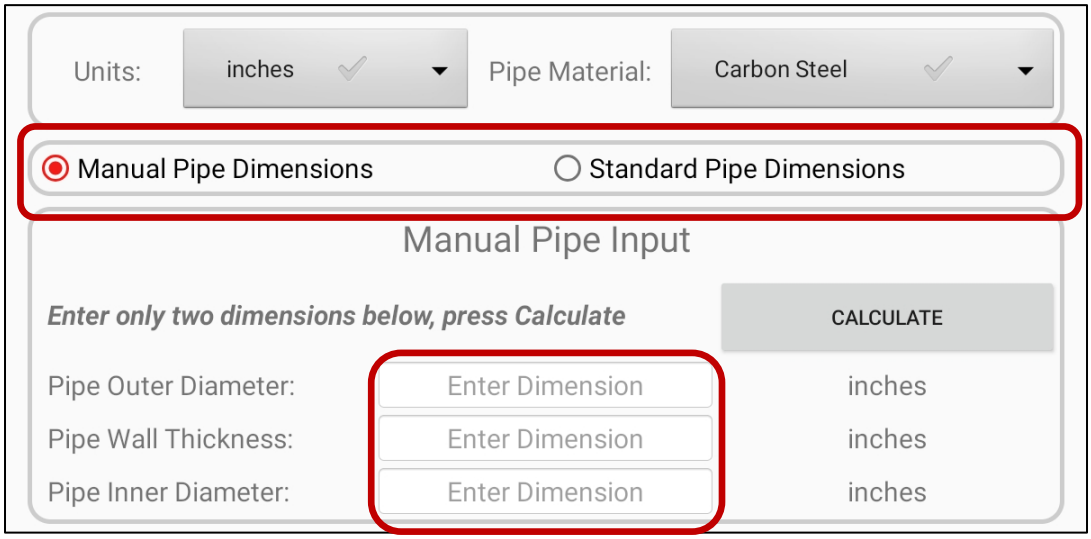


Figure 10: Manual Pipe Information Input

- When Standard is selected, these dimensions will come from the Standard Pipe Selection section. When a pipe is chosen while in Standard mode, the dimensions will be automatically filled in. The units will also be automatically set according to the standard associated with the pipe (i.e. ANSI vs DN).

Manual Pipe Input

This is where manual pipe dimensions will be entered (Figure 10), or auto populated by the Standard Pipe Selection (Figure 11).

- In the case where all three dimensions are entered, if the Calculate button is pressed and entered dimensions do not match the calculations, the App will ask to recheck the dimensions.
- In this case, it is best to clear the dimension that has the least amount of confidence (i.e. the other two are known dimensions), and press calculate.

Standard Pipe Selection

This section is for picking pipes using standard types.

- When the appropriate type is selected, drop down selections will be enabled as needed for sizes and schedules.
- If the Standard radio button is selected, the dimensions for the selected pipe will automatically be populated in the manual pipe section and will change with each selection change.
- If the Manual radio button is selected, the dimensions for a Standard Pipe Selection can be forced into the dimension section by pressing the Get Dimensions button.

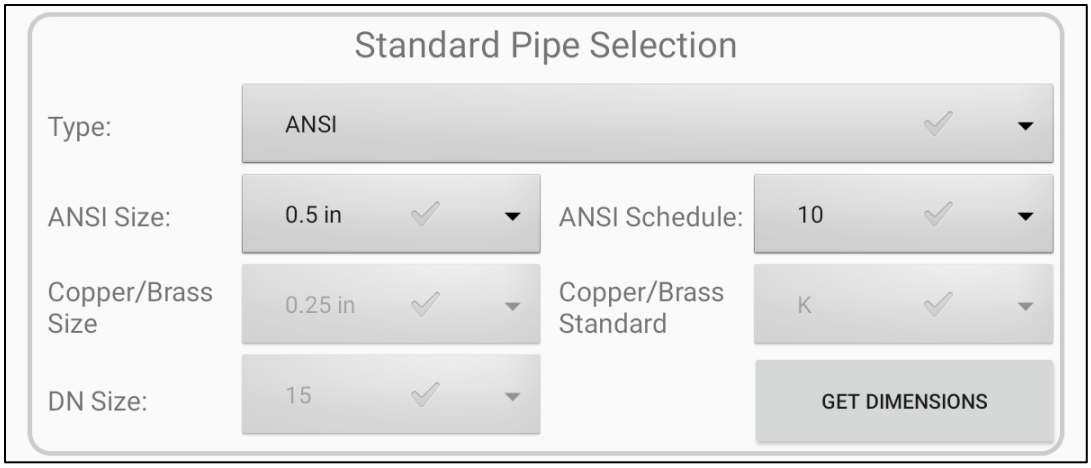


Figure 11: Standard Pipe Section

Pipe Liner Information

At the time of this writing, pipe liners are not supported on the SonoPro. These settings will be ignored. Look for this feature to be enabled in future releases.

Transducer Information

This section is for entering information about the ultrasonic transducers connected to the SonoPro.

- The three transducer choices are 0.5MHz, 1MHz, and 2MHz. The transducer setting MUST match the physical transducers for the flow calculations to be correct.
- The traverses relate to the path of the ultrasonic signal through the fluid between the transducers. A “Z” is a single path between transducers on opposite sides of the pipe. A “V” is a single bounce between the transducers on the same side of the pipe. A “W” is a double bounce through the fluid between the transducers on the same side of the pipe.
- The configuration chosen will affect the distance between the transducers.

Speed of Sound Temp Source

The Speed of Sound section is used to determine the source of the temperature used in the speed of sound calculation. Choices are Spacing Temp, Fluid Temp 1, or TOF Calc. These options are shown in Figure 12

- Spacing Temp can be an estimate or a measured temperature of the fluid in the pipe. ***This temperature is intended to only be used in the calculation of the transducer spacing***. It can however be chosen as the speed of sound temperature source, but may cause inaccuracies.
- If Fluid Temp 1 is chosen as the Speed of Sound Temp Source, calculations for the speed of sound will be based on the input from the RTDs connected to the SonoPro, or a fixed value. This will be covered further in the Fluid Temps section.
- If TOF Calc is chosen for the speed of sound temp source, the time of flight of the ultrasonic signal is used for the speed of sound calculation. Clean waveforms are required for this option to be accurate.

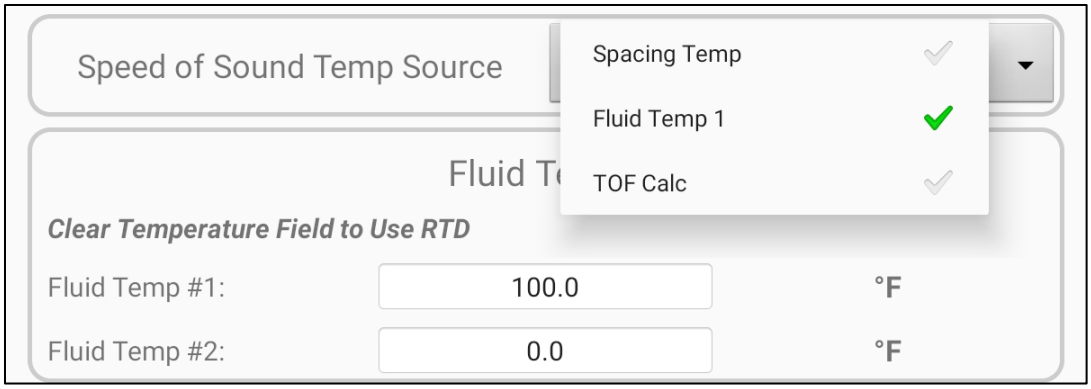


Figure 12: Speed of Sound Temp Settings

Fluid Temps

This section can be used in conjunction with the settings in the Speed of Sound Temp section. When the Speed of Sound Temp Source is set to Fluid Temp 1, either the value in Fluid Temp #1 or RTD inputs are used in the speed of sound calculation.

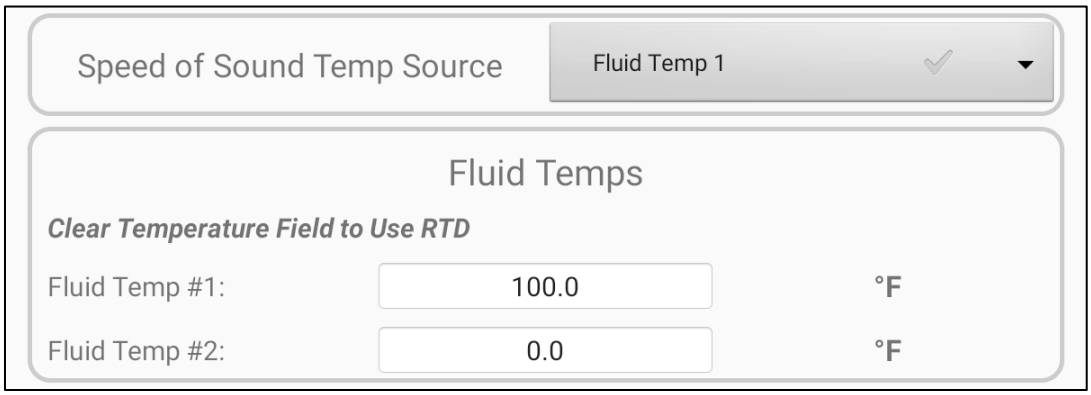


Figure 13: Estimated Operating Temp Example

- If no RTDs are connected to the SonoPro, values can be placed into the Fluid Temp #1 and #2 fields as an estimate of the fluid temperature. This will likely be less accurate than using RTDs as it is an estimate and not a direct measurement. An example of this is shown in Figure 13.
- If RTDs are connected to the SonoPro, the estimated temperature values can be cleared from Fluid Temp #1 and #2 as shown in Figure 14. This will force speed of sound calculations to use the RTD measurements.
- Fluid Temp #2 is only used for energy calculations. All speed of sound calculations will be based on Fluid Temp #1.

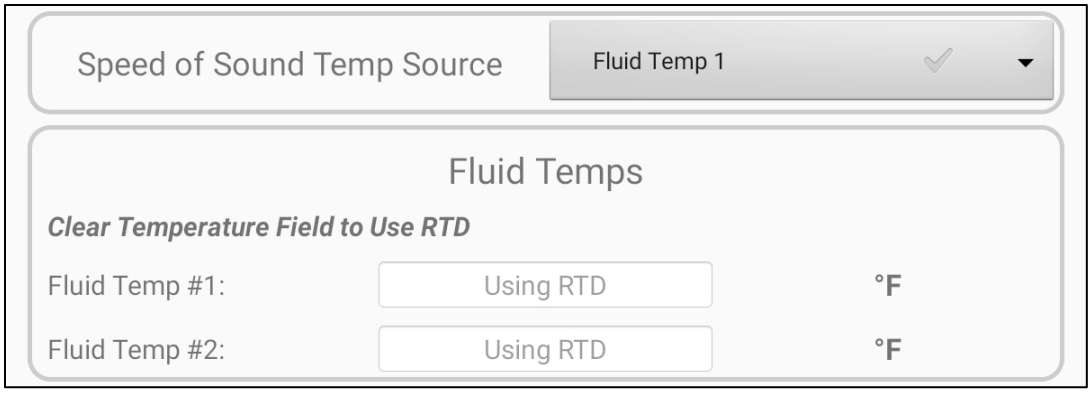


Figure 14: RTD Operating Temp Example

Zero Setting

This setting is used to account for any minor error in the up and down time of flight at no-flow. It is important that this calculation is performed while there is ***No Flow*** in the connected pipe.

- If up and down time of flight measurements are perfectly matched, the ideal value for the Zero Cal is 1023.
- To force the SonoPro to make this calculation, press the Calculate Zero button. The SonoPro will take an average of several time of flight measurements. This takes approximately 4 seconds to complete.
- After Zero Flow Calibration is performed, the data structures on the App will have to be updated using the Refresh Config button. This is because this parameter has been changed on the SonoPro, and the App is not aware of the change. After refreshing, the new zero value can be seen by pressing the See Current Settings button.
- If there is flow in the pipe during calibration and an erroneous Zero Cal is obtained, the Reset Zero button is provided to reset the Zero Cal back to 1023. At this time, when no-flow has been established, the Zero Cal can then be re-calculated.

Spacing

When the parameters of the pipe, fluid, transducers, and Spacing Temp are complete, the spacing between the transducers can now be calculated. This spacing is important for the proper operation of the SonoPro system.

- As previously mentioned, the Spacing Temp parameter is only used for the initial transducer spacing calculations.
- Although the Speed of Sound Temp Source can be set to Spacing Temp, it is not recommended for best accuracy.
- The minimum information needed to measure flow with the SonoPro can be found on the Calibration page of the SETUP pages.
- After correct pipe, transducer, fluid, and Spacing Temp information is saved to the SonoPro, the Get Spacing button will provide the correct transducer spacing in inches and millimeters.
- If settings have not been saved prior to getting the spacing info, the spacing could be incorrect for the current setup.
- An example of the Spacing section is shown in Figure 15.

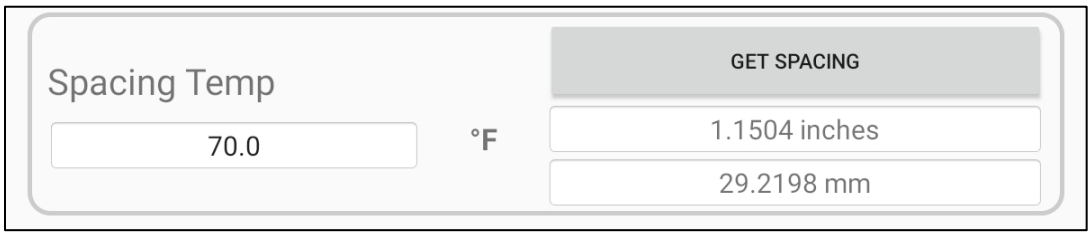


Figure 15: Spacing Temp and Calculation Results

Live Data

The Live Data tab is used for situations where the user wants to see certain live parameters displayed during operation of the SonoPro.

Data Stopped/Running

This button is used to start and stop the flow of data from the SonoPro to the App. This data must be started prior to selecting data to display so the App knows what data is available to show.

Data will be sent from the SonoPro at a rate of about once every Second when using a USB cable, and every 1.5 Seconds when using Bluetooth connection.

Data Selection

After the data stream is running, clicking this button will bring up a dialog with a checklist of all parameters that are available to display. Any number or combination of parameters can be selected. These selections will be remembered while the App is running its current session.

If the list of displayed values exceeds the height of the screen, it will become scrollable.

Log Files

The Log Files tab is used to retrieve log files from the SonoPro as well as from log files that may be saved on the tablet. Saved log files on the tablet may also be deleted from here. The general procedure for this is as follows:

- If logs are to be downloaded from the SonoPro, enter the date range of the logs of interest. Click the “Get SonoPro Logs” button.
- If logs are to be downloaded from the SD card, click the “Get SD Card Logs” button.
- Select a file from the logs list (If any).
- Click “View Selected Log”
- After file is downloaded, the log data will be displayed on the Log Charts page.

Log Source

This will indicate if the log file list is coming from the SonoPro or from the SD card. *Figure 17-1*

Log List

This is a list of either all the log files saved on the SD card, or a list of the log files from the SonoPro within the date range provided in the Get SonoPro Logs section. *Figure 17-2*

Get SonoPro Logs

This section is where the user enters a date range of desired log files to be retrieved from the SonoPro. The SonoPro creates a single log file for each day. The log data Starts at midnight and continues until 23:59:59 on the same day. *Figure 17-3*

- When a "From" and "To" date is applied, the SonoPro will provide all log files that exist within those dates, including the "From" and "To" dates. The Current Log Source will indicate that the list is from the SonoPro.

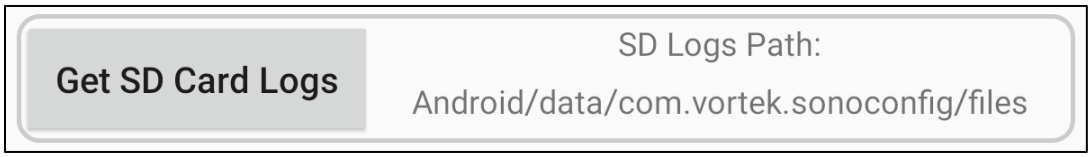
- If there are no log files available within that range, nothing will be returned, and the list will indicate that there are no logs in that date range.
- If a log file from a single date is desired, the date only needs to be entered in the From field.

Get SD Card Logs

This button will retrieve all log files present in the logs folder for the App as described earlier. Shown in *Figure 17-4.*

- When these log files are loaded into the list, the Current Log Source will indicate that the list is from the SD card.

- The SD Logs Path will also display the path to get to the logs folder where the logs are stored.



- Saved log files are named with the date of the log file being viewed and are saved in a CSV format.

View Selected Log

- After the log list has been retrieved from the SonoPro or the SD card, and are displayed in the log list box, this button is used to download and display a selected file.
- When downloading a log file from the SonoPro, the download time depends on the resolution of the log file (time interval in the log settings). For example, a file with a full day of data every minute can take up to 20 seconds to download to the tablet. The approximated time for download will be shown as in Figure 16. The user can then decide to download or cancel.

- Files can be selected from the list for download by clicking on the log file name. Only one file can be selected at a time as shown in Figure 17.
- Log file download progress is shown in the progress bar at the bottom of the Log Files page. *Figure 17-5*
- When log file download is complete the page will automatically switch to the Log Charts page to view the data.
- Downloading log files from the SD card will take approximately 1 Second to perform.

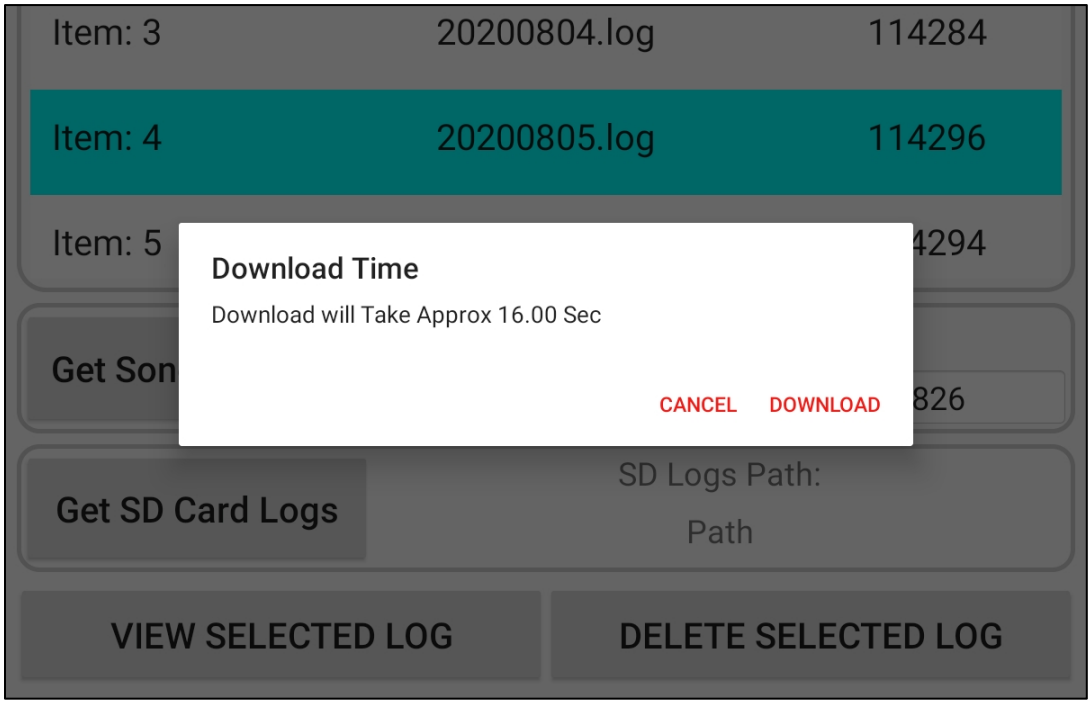


Figure 16: Download Time Dialog

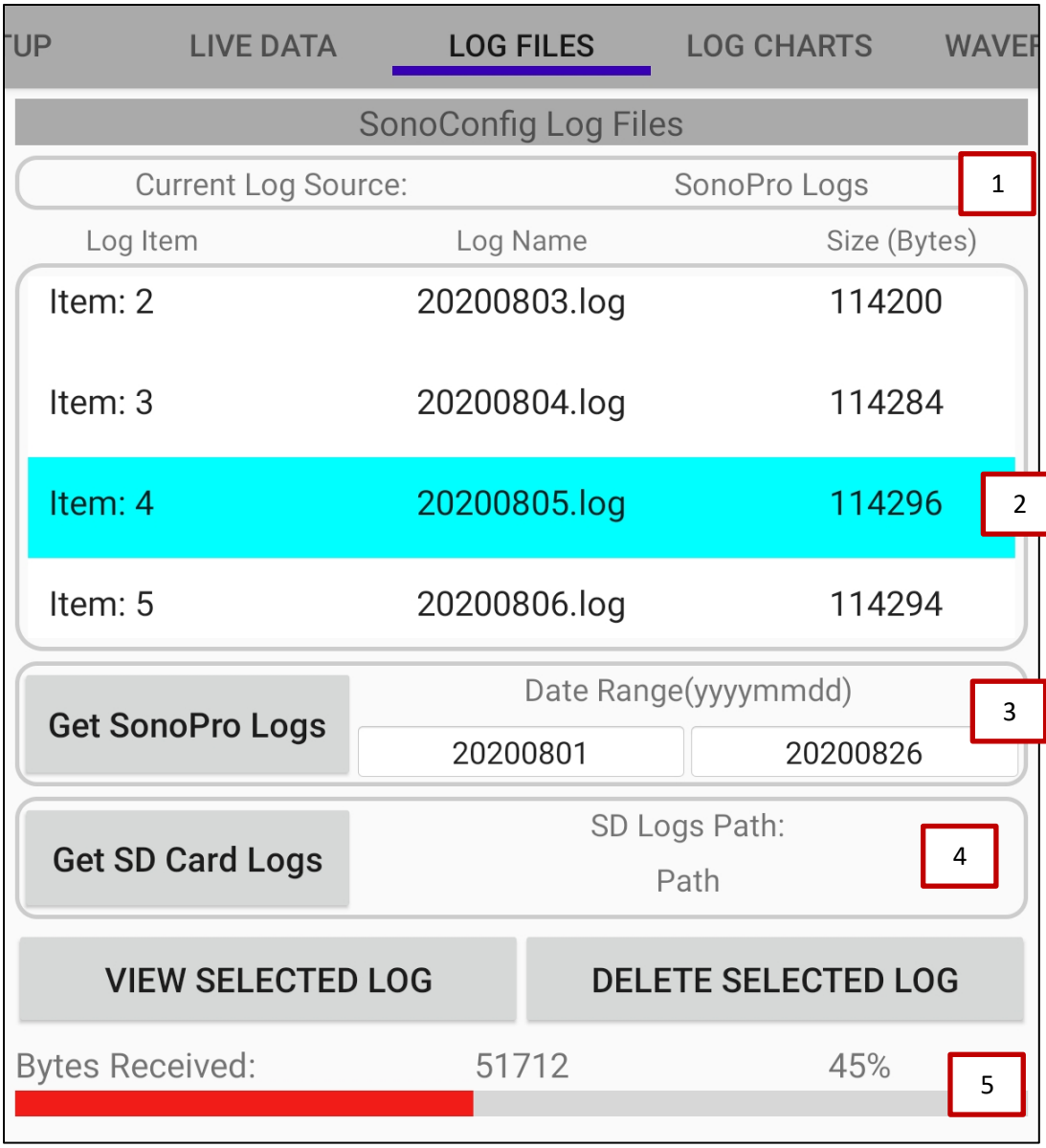


Figure 17: Log File Selection and Download

Delete Selected Log

When working from log files on the SD card, the user can delete a file. This can be done by getting the SD card logs, selecting one from the log list, and pressing the Delete Selected Log button.

Log files on the SonoPro cannot be deleted.

Log Charts

After the selected log file is download from the SonoPro or SD card, the log data is viewed on the Log Charts page.

- Every log file contains data from four variables that are chosen in the Log Settings on the Setup-Diagnostic page. Each logged variable has its own chart to show the data that was logged.
- The user may scroll up and down between these charts.

Log File Name

The log file data that is currently displayed is shown in the box near the top of the page.

Screenshot

This button will take a JPG image of the displayed screen on the tablet. This can be helpful for capturing an image of a chart with a data marker.

File will be named the same as the log file the data is from, which is the date of the log data. Multiple screenshots from the same data will be successively named _0, _1, _2 and so on.

Save CSV

This feature will save the downloaded data from the SonoPro into a CSV formatted file on the tablet. When the Get SD Card Logs button on the Log Files page, it is these saved files that are listed.

The CSV format allows the user to copy the saved log file from the logs path within the tablet to a computer for import into a spreadsheet program. This allows more advanced data analysis of the data if desired.

Reset Zoom

While viewing the log data on the Log Charts page, the user can use standard pinch and zoom gestures on the screen to shrink and expand the X and Y axes on the charts.

The Reset Zoom button will bring all four charts back to the original non zoomed proportions.

Clear Markers

Markers can be placed on the charts by touching anywhere within the chart area. This will place a red crosshair at the X position of the location touched. The location of the marker is then displayed at the top of the chart. The X position is the time of datapoint, and the Y position is the datapoint value. Y axis units are indicated at the upper left corner of the chart. Marker shown in Figure 18.

The use of the DOT display as described below can make it easier to pick a specific data point on the chart with the markers.

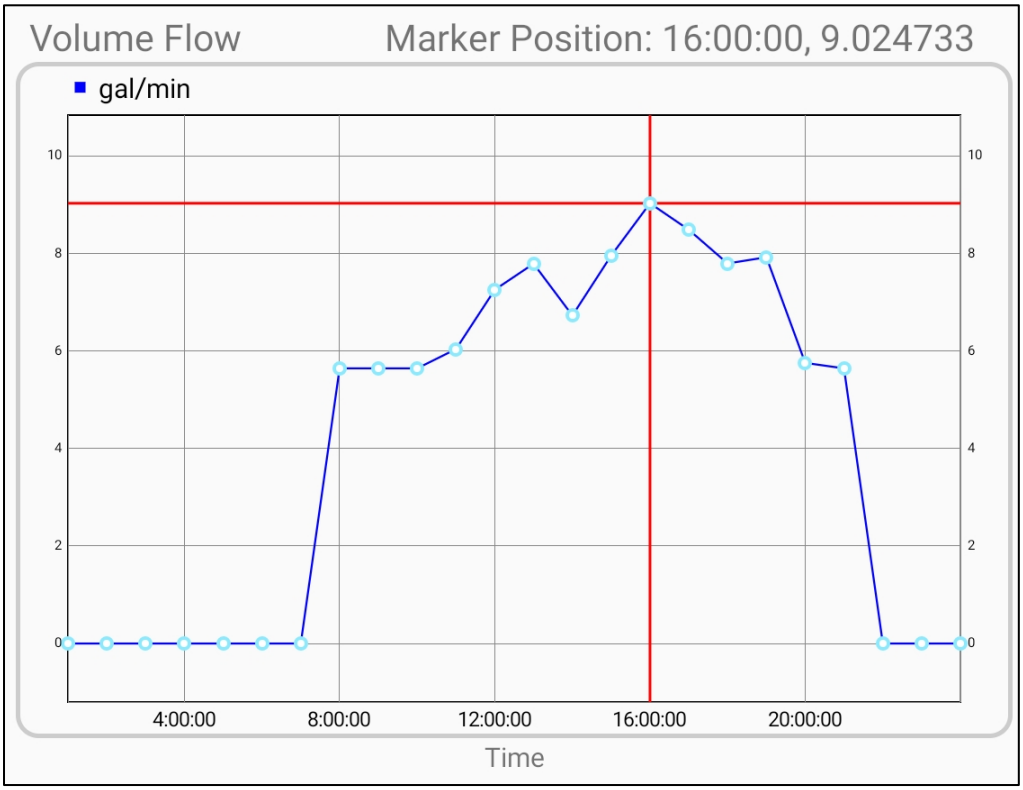


Figure 18: Log Chart Data with Dots and Marker

Dots

By default, the data shown on the charts is drawn without markers for each datapoint. By pressing the Dots button, the user can toggle between having the data points displayed with a dot or without a dot. The button indicates the current mode of On or Off. Shown in Figures 19 and 20.

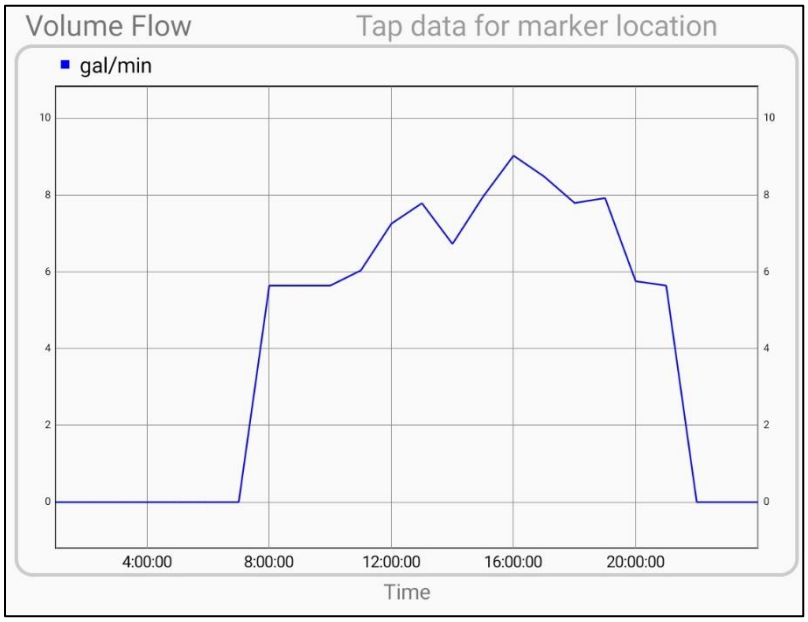


Figure 19: Log Chart Data – Dots Off

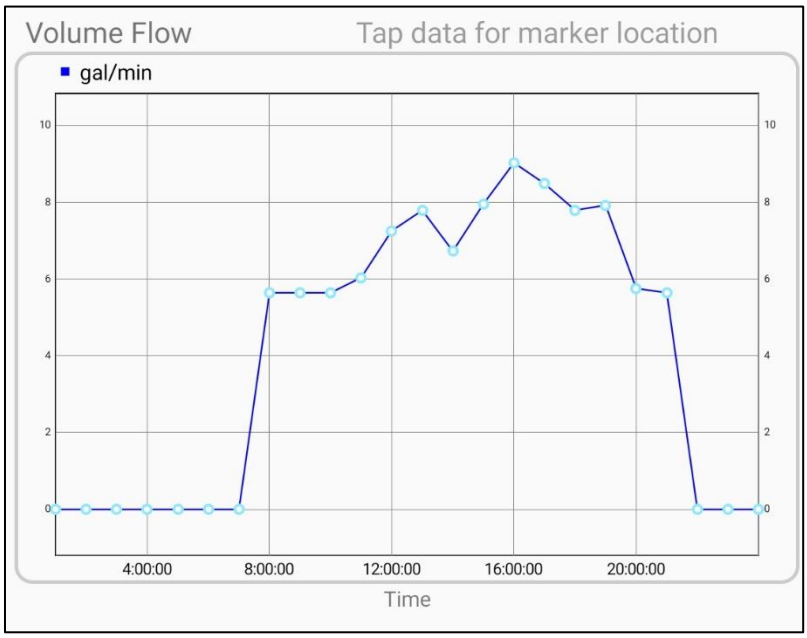


Figure 20: Log Chart Data - With Dots On

Scaling

The scaling section of the Log Charts page is used to gain a more useful depiction of the data. The data by default is auto scaled and may not show the best detail depending on the data.

X Scaling

- The X scaling feature is useful for log files that have a large amount of data and the graph is packed with information. Rather than zooming out and scrolling, the X scaling can be used to only display every n^{th} data point. For example, if the X scaling is set to 4, the chart will display every 4^{th} data point in the data set. The graph will interpolate between the points.
- The limits of the X scaling are 1-10. A value of 1 will display every data point, and 10 will display every 10^{th} point.
- The original data set remains intact and can be scaled back to 1 at any time.

Y Scaling

- The Y scaling is useful for cases where the data bounces a small amount above or below a nominal value. The auto scaling can make this appear as noisy data, and difficult to follow a trend.
- Increasing the Y scaling will rescale the chart's Y axis to have a min and max that is a multiple of the Y scale value and min and max data values.

Examples of the X and Y scaling are shown In Figures 21, 22, and 23 below.

- Figure 21 shows a data set that appears to have a lot of noisy data. In reality, the value is bouncing slightly above and below zero. This chart is at the default scaling values.
- Figure 22 shows the same data set with the Y scaling expanded to 10 to increase the limits of the Y axis on the chart. It can now be seen that data is nominally at zero with a slight bit of noise above and below.
- Figure 23 shows the same data set with the Y scaling set to 5 and the X scaling set to 4. The X scaling now shows only every fourth data point from the original data set in Figure 20. This is useful where the data is packed too tightly on the X axis. This provides an X axis "zoom" effect that still allows viewing of the entire graph at once.
- Be aware that using the X axis scaling can possibly eliminate individual points that are of interest. In this case, switching to a different scaling value can avoid this.

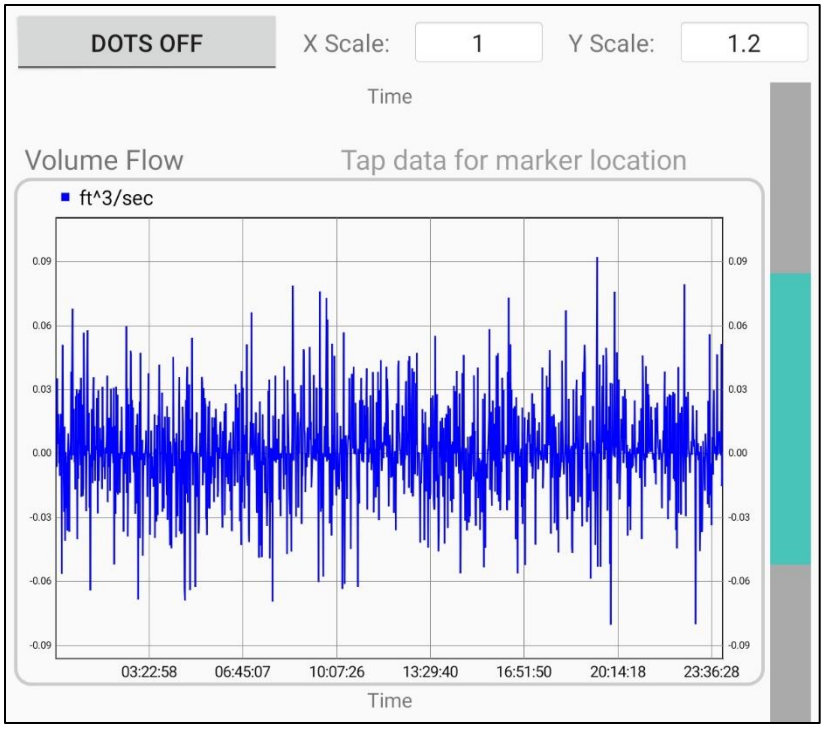


Figure 21: Log Chart Data - Default Scaling

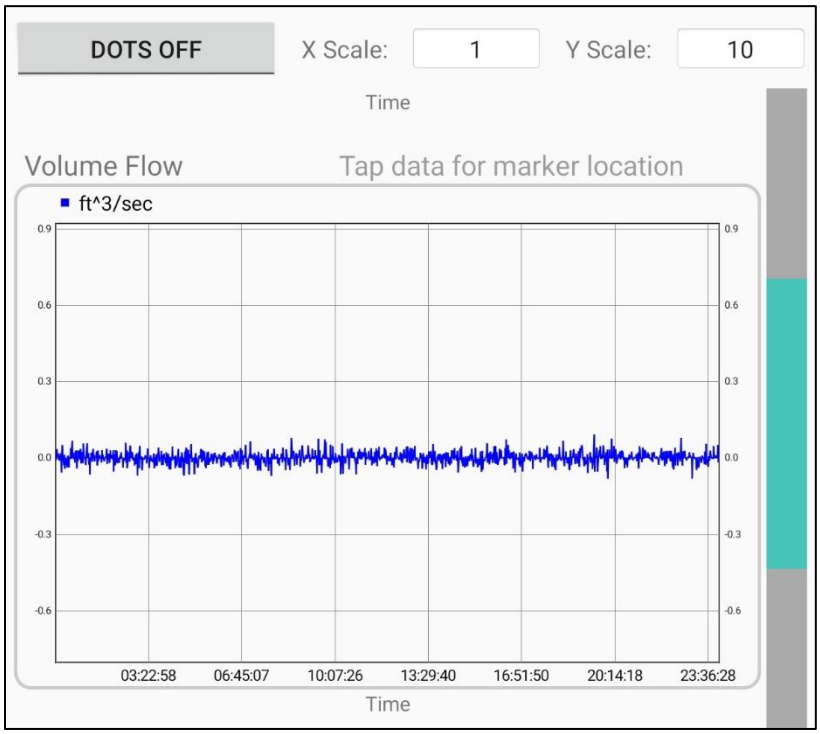


Figure 22: Log Chart Data – Increased Y Scaling

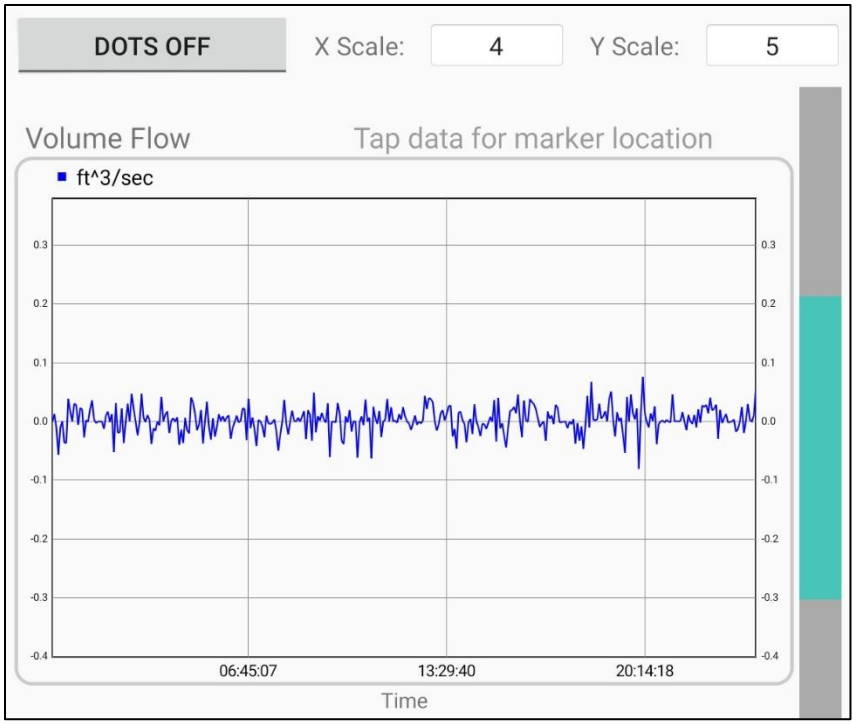


Figure 23: Log Chart Data - Increased X and Y Scaling

Waveforms

This page is used for viewing the raw data waveforms from the transducer up and down transmissions. This feature allows the user to see a set of waveforms every second on USB or every 1.5 Seconds on Bluetooth communication. This is an important diagnostic tool for verifying that the ultrasonic signals are transferring correctly between the transducers.

Waveform Stopped/Running

This button will start and stop the flow of the waveform data from the SonoPro. When on, there should be waveforms showing in the UP and DOWN waveform boxes at the bottom of the screen.

Dots Off/On

This feature is the same as the Dots feature for the Log Chart data page. When the button is enabled, every data point on the waveform will be denoted with a dot. Again, this is useful for picking individual data points to inspect when zoomed in.

Clear Markers

This button is used to clear the crosshair markers that are used for inspecting the waveforms. Like the feature for the Log Charts, markers can be placed by touching within the waveform box.

Data Selection

This button provides the same functionality as the Live Data page. After the waveforms have been started, clicking this button will bring up a dialog with all the choices for live data display. This can be useful if some live data needs to be monitored along with the waveforms. The data will be displayed above the waveform panes and will update along with the waveforms.

Override Frequency

This feature is used to tune the pulse frequency of the transducers. It can be helpful for cases where the standard frequency for the selected transducer does not allow the transducer to resonate properly.

- Clearing this field will pulse the transducer at the frequency selected by the transducer model on the Setup-Calibration page. (i.e. 0.5MHz, 1.0MHz, or 2.0MHz)
- The frequency range is limited to 0.2MHz to 2.5MHz.
- ***After changing the override frequency, the Save Settings button must be clicked to activate***. The waveforms will momentarily stop and restart with the new frequency.

Keyed

The keyed feature will apply an altered pulse train to the transducers.

- Checking the Keyed checkbox will enable this feature.
- ***After checking the Keyed box, the Save Settings button must be clicked to activate***. The waveforms will momentarily stop and restart with the new keyed waveform.

Cycles

This feature will allow the user to change the number of pulse cycles sent to the transducer. The default is eight cycles.

- Cycles can be set to one through eight.
- When the SonoPro is set to Keyed, the cycles will automatically default to eight, and cannot be changed until keying is turned off.
- ***After changing cycles, the Save Settings button must be clicked to activate***. The waveforms will momentarily stop and restart with the new number of cycles.

FFT

This feature allows the user to perform a Fast Fourier Transform on the waveforms. This can allow the user to see the resonant frequencies of the transducer, thus how efficiently it is transferring energy.

- This feature has a real-time response. After the FFT box is checked, the next and following waveforms will be FFTs of the waveform data.
- Unchecking the box will resume normal waveform display.
- An example of an FFT with a single resonant frequency is shown in Figure 24.

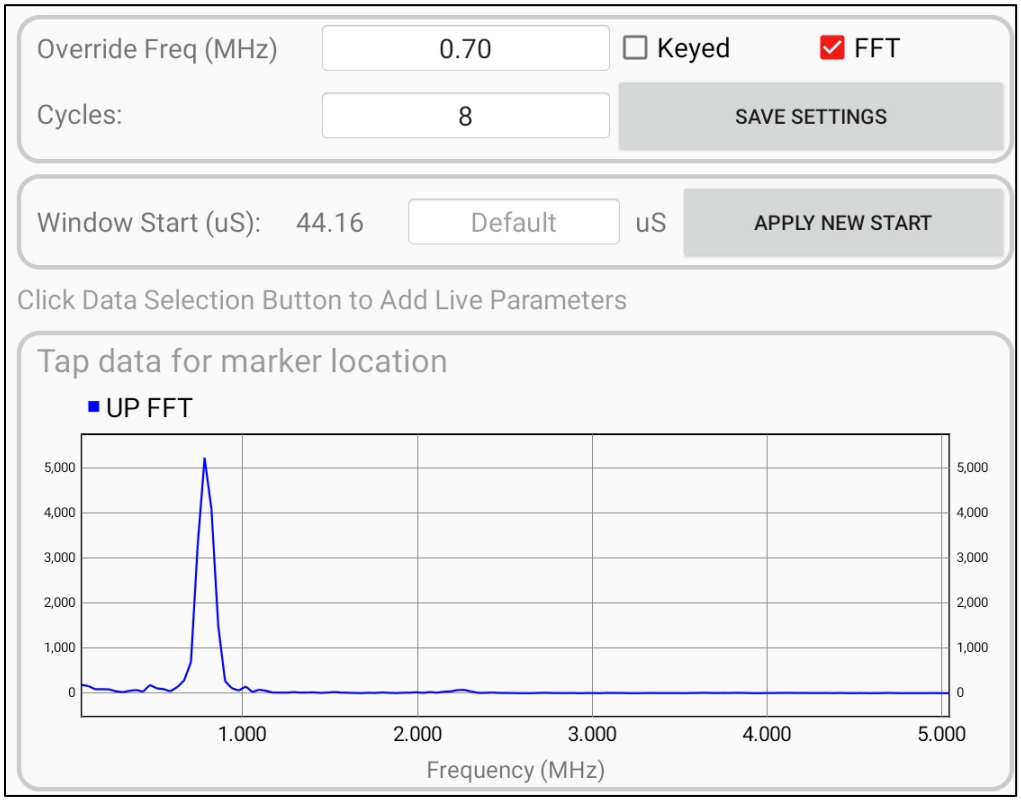


Figure 24: Example of FFT Waveform

Window Start

This parameter is used to shift the waveform within the waveform window. The entire waveform must be visible within the window for time of flight calculations to be most effective. For example, if there is waveform data off the right side of the waveform window, the waveform may be shifted left to see it.

- The current start of the window in uS is shown as Window Start.
- If the default window start value is being used, the entry box will display “Default” as shown in Figure 25.

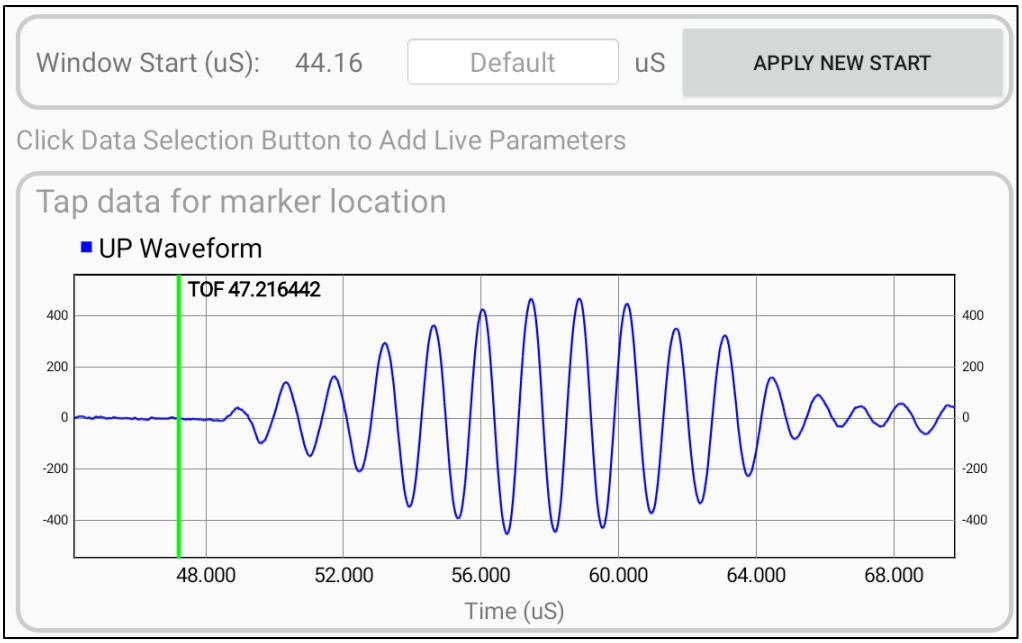


Figure 25: Window Start Example

- If it is desired to move the waveform within the display window, a new start value can be entered in the input box and applied. For example, to shift the waveform left, a new window start can be entered as 46uS and applied. This is shown in Figure 26.
- Deleting the value from the input box will add “Default” as the value. When this is applied, the window start will return to the default value.
- When shifting left, ensure that the green time of flight marker is still visible in the window.

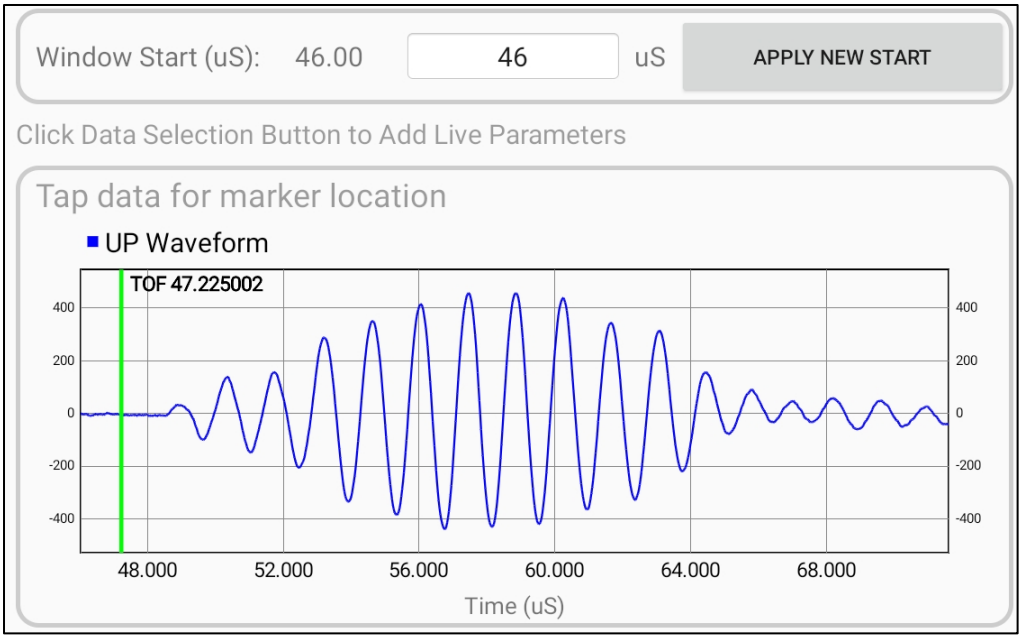


Figure 26: Waveform Start Shifted to 48uS

Application Configuration

This page is for settings related to the operation of the SonoConfig application.

Page Swiping

This checkbox, when enabled, will allow the parent tabs to be changed by swiping left or right. It may be desirable to leave this disabled as the App is navigated into the child tabs within Setup, or while zooming on Log Charts or waveforms.

Configuration Setup Save/Recall

This section of the config page is used to save and recall SonoPro setups on the tablet. This can be especially useful for situations where a SonoPro is being used as a spot-check device on several pipes and is being moved.

Rather than entering the information for the setup every time, the user can save a configuration file for a pipe and recall it later. Functions include:

- Saving the current setup to the SD card
- Recall a saved setup
- Send a saved setup to the SonoPro
- Modify a recalled setup and save as another setup
- Delete setup from the SD card

View All Saved Setups

This button allows the user to see a list of the setups saved on the tablet or phone. An example is shown in Figure 27.

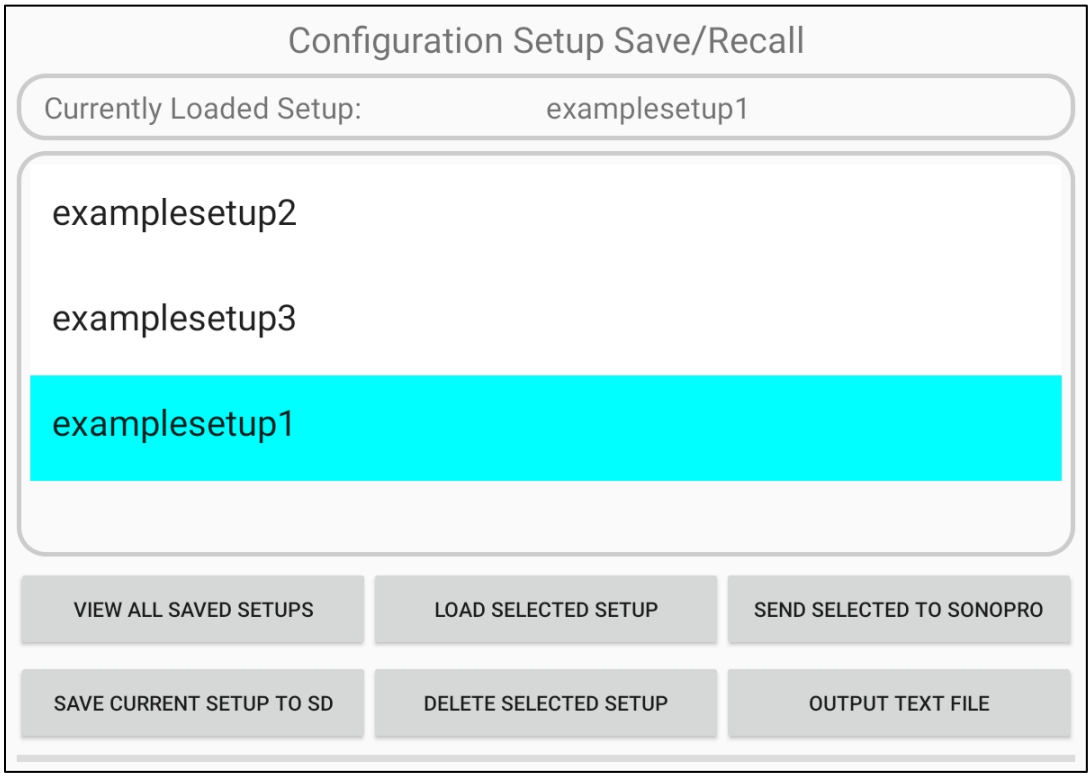


Figure 27: Saved Setup Recall

Load Selected Setup

After selecting one of the saved setups (as shown) this button will load the setup files into the config structures of the tablet.

- Currently the configuration only exists on the tablet. ***The setup on the tablet pages and the SonoPro do not match at this point. If the user wishes to make the App match the SonoPro, select a file, click Load Selected and then Send Selected. The App and SonoPro will now be in sync***.
- The setup that was loaded is indicated at the top of the section.
- The user now can view all the settings in the Setup pages.

Send Selected to SonoPro

After viewing the saved setups, this button will allow the user to send a selected setup directly to the SonoPro. This will send the setup as it is saved.

Save Current Setup

Once the user is satisfied with the setup on the tablet by verifying operation on the SonoPro, this button will bring up a dialog for the user to enter a name for the setup and save it. ***It is suggested that the user verify the setup on the SonoPro prior to saving to avoid saving a setup that may not work correctly***.

Delete Selected Setup

Any selected setup file from the setup list may be deleted by using this button.

Output Text File

This button will output the setup structure files in a JSON format to the output folder. This is primarily used as a troubleshooting tool at the factory.

Waveform Interval

This setting relates to the viewing of waveforms or real-time data while using Bluetooth. It is the amount of time in mS between each waveform update. The responsiveness of different tablets can vary when using Bluetooth. If waveforms are not coming through regularly, it may be necessary to alter this setting.

The default setting is 1500mS. This will be adequate for most devices. If waveform streaming is problematic, this value can be increased by 100mS at a time until waveforms are smoothly streamed.

Bootload

This page is used to update the operating software on the SonoPro through a bootloader mechanism. The file that is used to update the SonoPro can be obtained from VorTek Instruments. This file is stored in the “applications” folder located in the path detailed in the ***Storage Locations*** section of this manual.

It is important to note that there should only be one file in this directory at a time. This is to avoid confusion about what file is being loaded. A warning will be displayed if there are no files or more than one file in this folder.

At this time, the bootloader function will only operate through the USB connection between the tablet/phone and the SonoPro.

The application file can be added to the “applications” folder by copying the file via a connection to a PC with a USB cable. The file can also be added directly to the SD card from the tablet by removing it and using an adapter to a PC.

Bootloader Procedure

- Connect the tablet to the SonoPro with a USB and OTG cable.
- Turn SonoPro OFF by holding down the POWER button on the keypad until the display goes off.
- Start the SonoConfig App, connect to the SonoPro by pressing the Connect Serial button on the HOME page. (***Bluetooth connection cannot be used for this function***)
- After the SonoPro is connected, swipe to the BOOTLOAD page in the App.
- Press the SET PORT button. This will configure the USB port for bootloading communication.
- The name of the file to be sent to the SonoPro is highlighted in Figure 28. This should match the name of the file in the applications folder on the SD card.
- ***The next step requires a timed response. When the SonoPro is turned on, the user has approx. 4-5 Seconds to respond with a button press. After the SonoPro is turned on, the screen will look similar to Figure 28.***

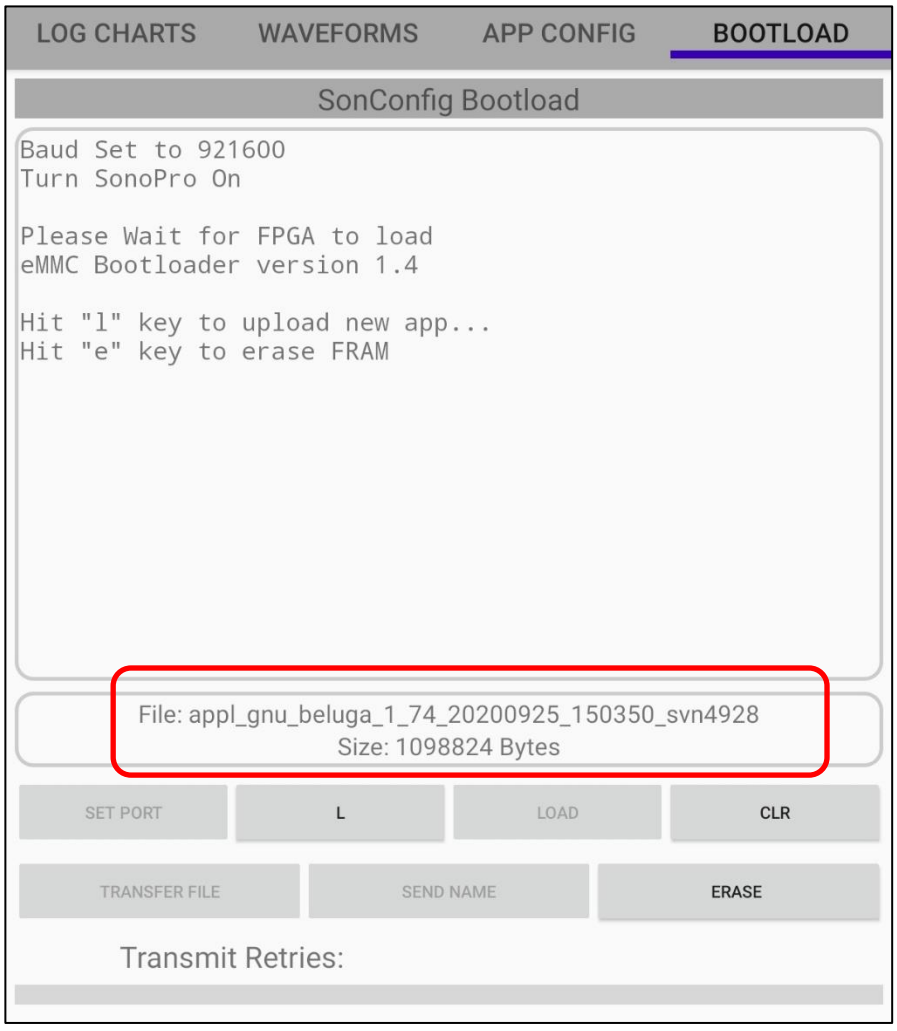


Figure 28: Bootload After SonoPro Turned On

- If the user misses the button-press time frame, the SonoPro will boot up as normal, and the power will have to be cycled to start over.
- Turn the SonoPro on. The screen should look similar to Figure 28.
- To load the new application file, the “L” button should be pressed within 4-5 Seconds. Confirmation will be indicated by the text as shown in Figure 29.

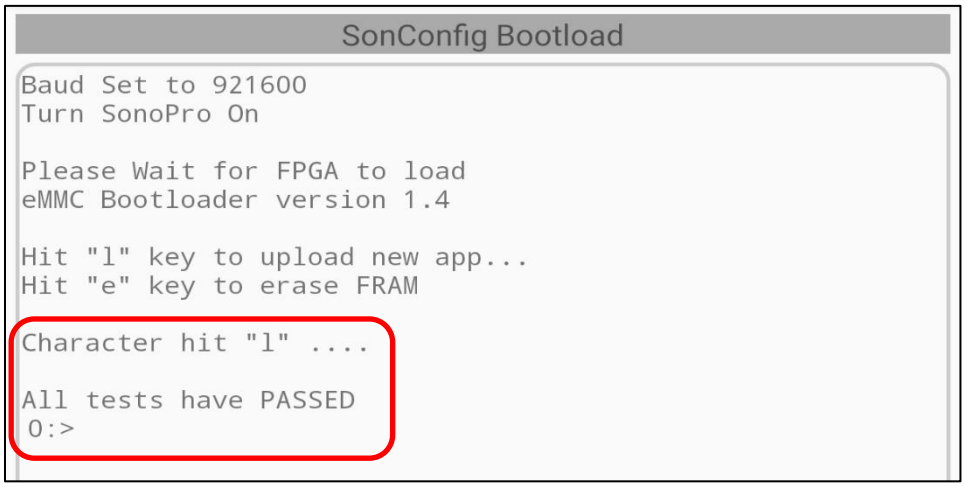


Figure 29: L Button Pressed

- In some rare instances, the “ERASE” button will be used to clear the memory on the SonoPro. If this button is accidentally pressed, a dialog will show to ask if you are sure. The cancel button can be clicked if this is not the intended action.
- The SonoPro can now be told to expect the new application file by pressing the “LOAD” button. Confirmation will be indicated by the text as shown in Figure 30. A series of “C” characters will be displayed one at a time while the SonoPro is waiting for the file to be transferred.

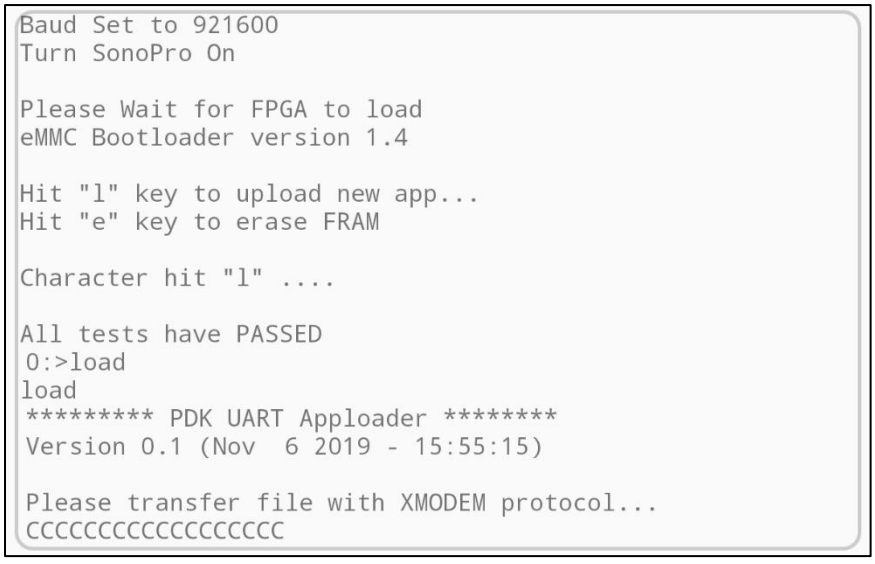


Figure 30: SonoPro Waiting for File Download

- At this time, the “TRANSFER FILE” button can be pressed to send the file over to the SonoPro. Progress is shown in the bar below the buttons. If there are no transmit retries logged at the end of the file transfer, the dialog will then ask for the file name as shown in Figure 31.

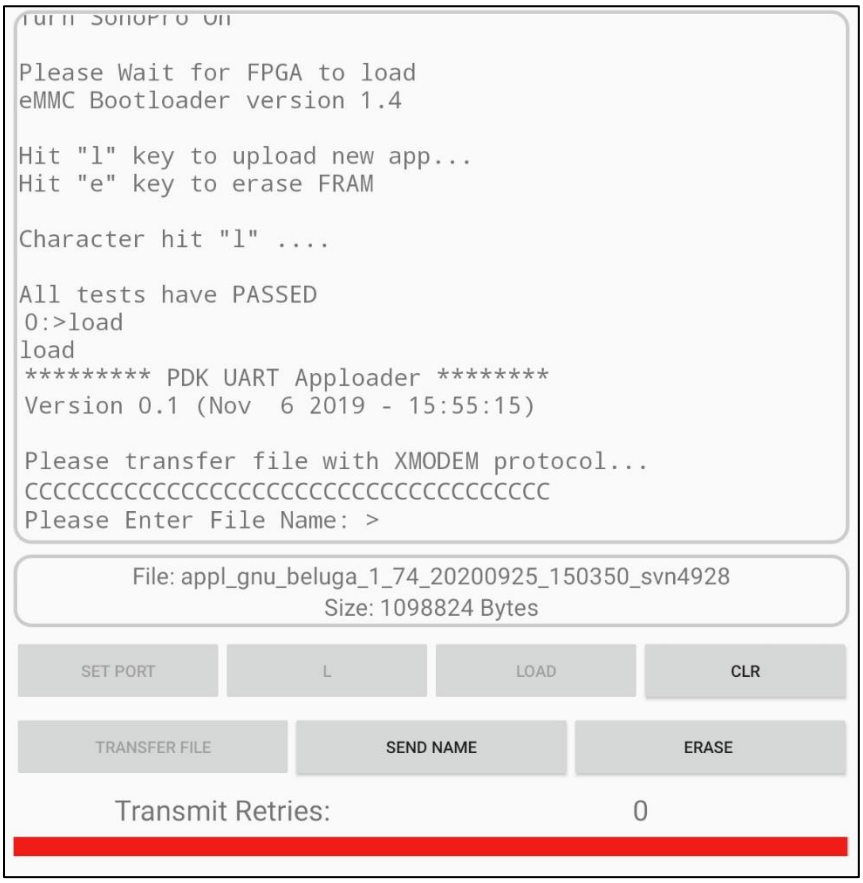


Figure 31: File Naming

- The file name can be sent to the SonoPro by pressing the “SEND NAME” button. A confirmation of the process being complete will be sent from the SonoPro as shown in Figure 32.

Figure 32: File Transfer Complete

- At this time, the SonoPro can be turned off, and then, back on. The new application software is now running.
- The user should close the SonoConfig App, and restart to resume normal operation of the App.

Transmit Failure

In the event of a transmit failure, the App will indicate this instead of asking for the file name as shown in Figure 31. The transfer can be made again by turning the SonoPro off, clicking the CLR button and starting the bootload process over.