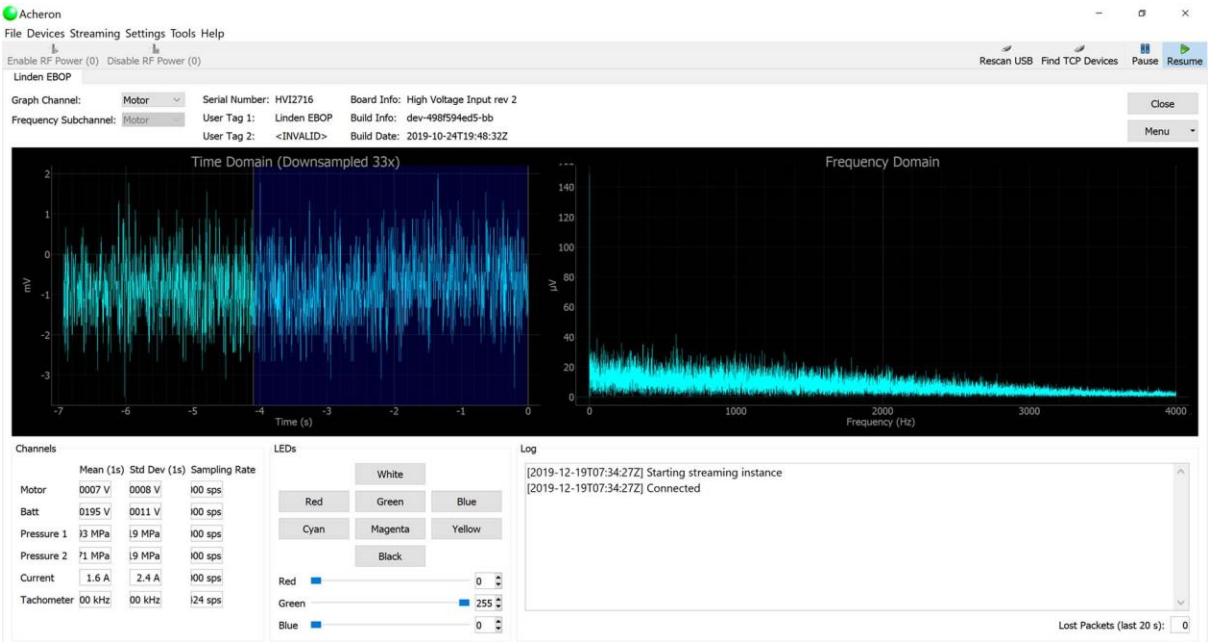
EBOP Manual

Contents

1. Getting Started

Open Acheron software, the supplied laptop has shortcuts on the desktop for SuprockTech software. Double click the Acheron icon and let the software start. Plug in USB cable from EBOP DAQ Unit to your PC, your screen should look like this:



If you do not see data streaming in this manner, click “Rescan USB” in the top right of the window. If all is well, data should begin to stream. The default condition of the software with connected telemetry is to record data. If you are still setting up equipment and the test is not ready to start, you may press “pause” in top right corner of the window.

If rescan USB does not yield desired result, ensure that USB connectors are seated properly and that the lights on the EBOP unit are lit. If connections are secure and lights are confirmed on, ensure that the software is not paused in the upper right hand corner.

If all settings and calibrations are in good standing, and the data is visibly transmitting in Acheron, this is all that is needed to record data for the EBOP test. All of the data is automatically recorded on the specified location on your PC.

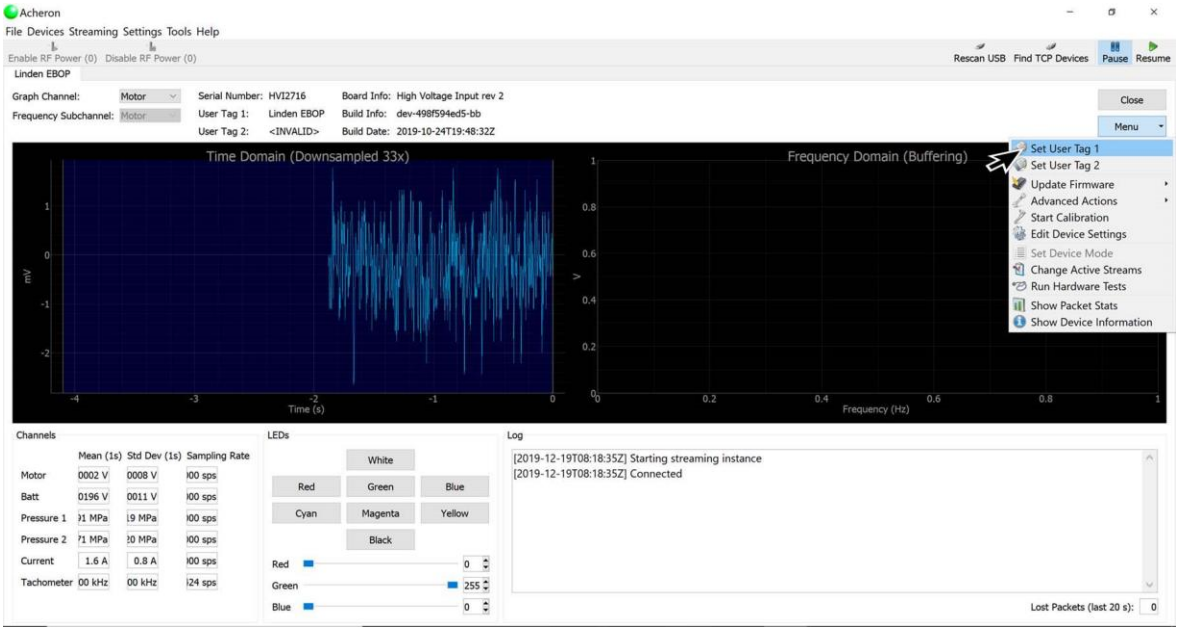
2. Acheron Data Acquisition Settings

The SuprockTech EBOP test kit was designed to test EBOP performance with minimal setup work for the user, but initial setup is crucial nonetheless. Pressure sensors are calibrated at Suprock but it is important to periodically check calibration of the pressure sensors.

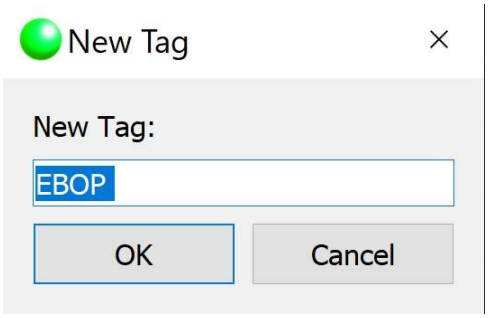
2.1 Name your device (set user tag)

If the PC you are using is monitoring more than one device other than the EBOP DAQ, it can be helpful to set easily identifiable tags on the devices being used. Procedure involves 3 quick steps:

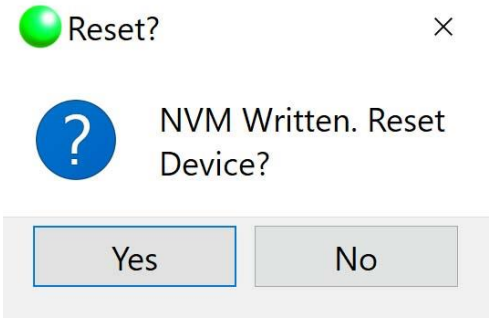
1. In the top right corner, click “Menu” then “Set User Tag 1” from the drop-down.



2. In the “New Tag” window, type in desired name. This name should be memorable and make it easy for plant personnel to identify the device. Click “OK” to confirm.



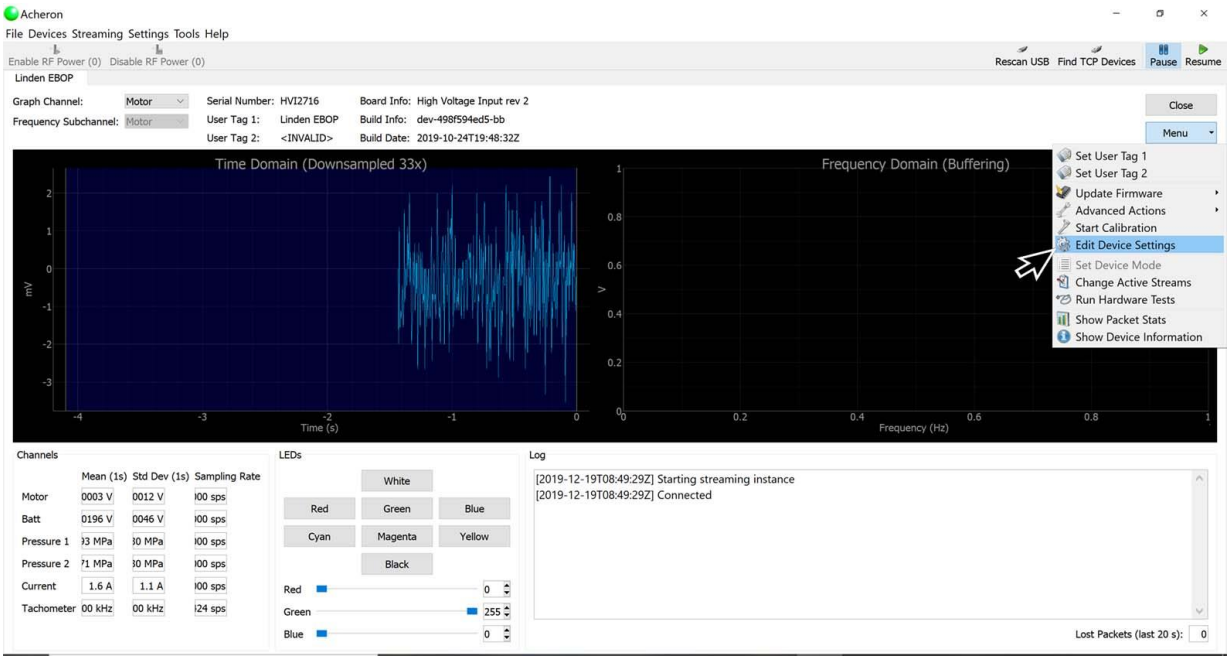
3. If you are satisfied with the name entered, click yes to save to NVM and reset device.



Confirm that the device name you entered appears in the device tab. If not, please repeat steps 1-3.

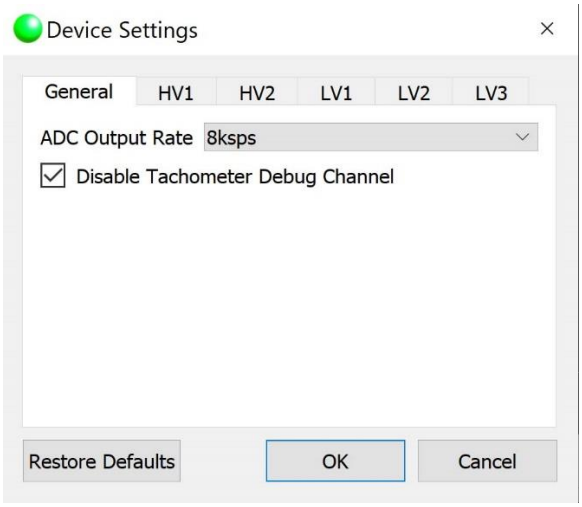
2.2 Device settings

The EBOP DAQ settings come preset from the factory but it can be good to know how the settings work in case any changes need to be made. The settings menu can be found in under Menu – Device settings



2.2.1 General settings

The general tab contains the output rate settings and tach debug toggle.



2.2.1.1 ADC Output Rate

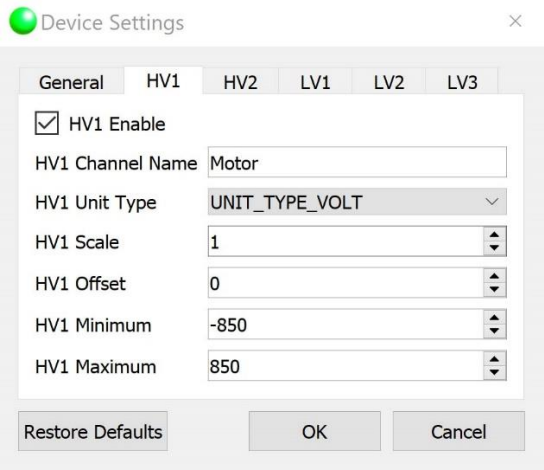
The optimal setting for preserving hard drive space and getting an accurate test result is the factory default of 8ksps. If the EBOP is set other than 8ksps please reset it to 8ksps.

2.2.1.2 Disable Tachometer Debug Channel

This setting is for factory use only, please ensure it remains checked.

2.2.2 Channel Settings

The channel setting tabs contain scale, name, unit, and parameters that govern how the data is read and recorded from the different channels.



2.2.2.1 HV1 (Motor) – HV2 (Battery)

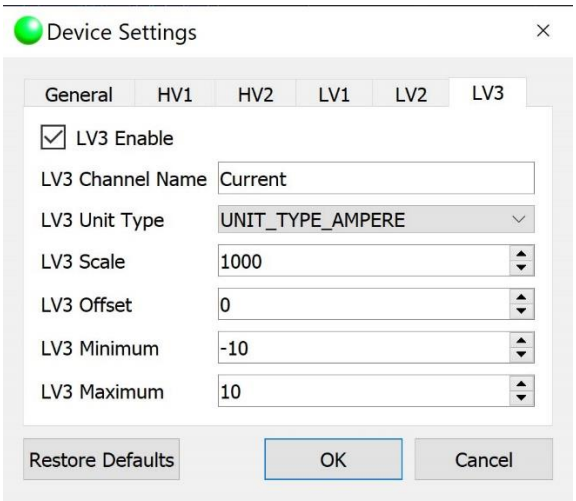
As HV1 and HV2 are direct voltage measurements, there is no need to scale or offset the data. Leave these settings at factory default values.

2.2.2.2 LV1 (Pressure 1) - LV2 (Pressure 2)

LV1 and LV2 correspond to the 2 pressure sensor inputs on the unit. The calibrations and scale will be displayed here. If calibration of pressure sensors is required, we recommend that this page is left alone and the calibration is done on the calibration wizard. For Calibration instructions please refer to the calibration section in this manual (See Section 3. Calibration).

2.2.2.3 LV3 (Current)

The Suprocktech EBOP test kit comes with a modified Fluke i1010 current clamp. Per Fluke's manual, the probe will output 1mV for every 1 amp measured. Thusly, the scale has been set to 1000, please make sure LV3 Current settings are as follows:



3. Calibration

3.1 Physical setup

The pressure sensors in the EBOP kit come pre-calibrated from factory but from time to time it is good to make sure the calibrations have held. Acheron software has a handy calibration wizard that makes this process a breeze.

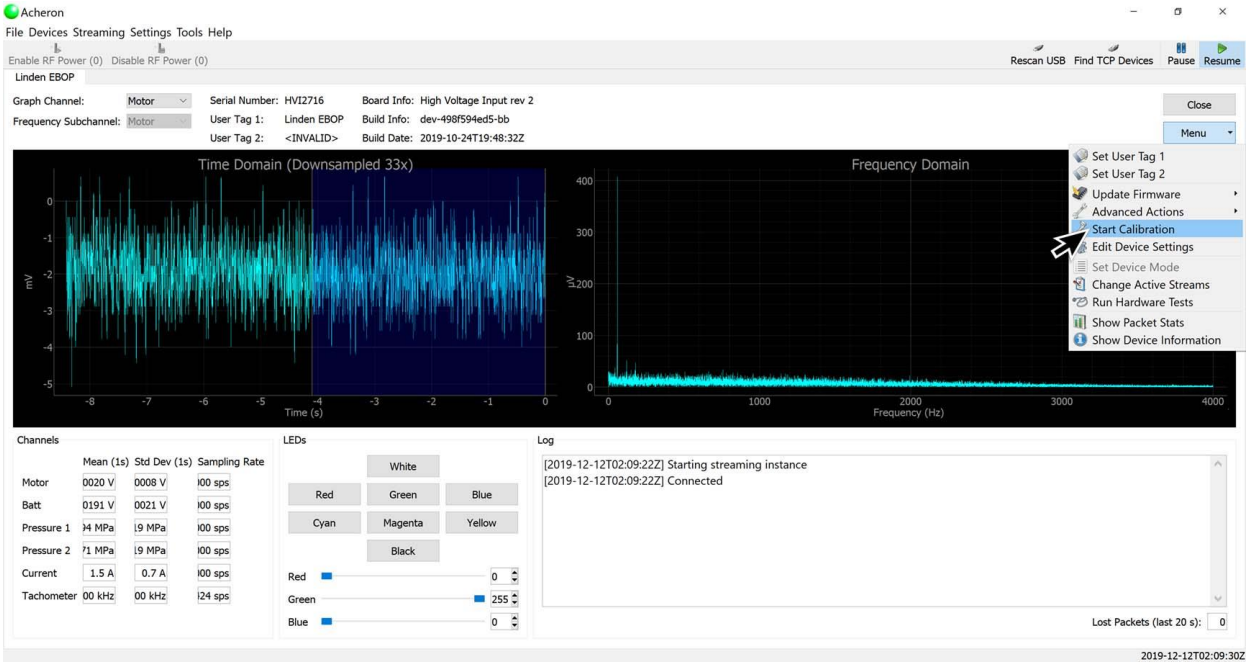
Required tools are:

1. Regulated source of compressed air
2. Known good air pressure gauge
3. Pressure sensor connection to air source

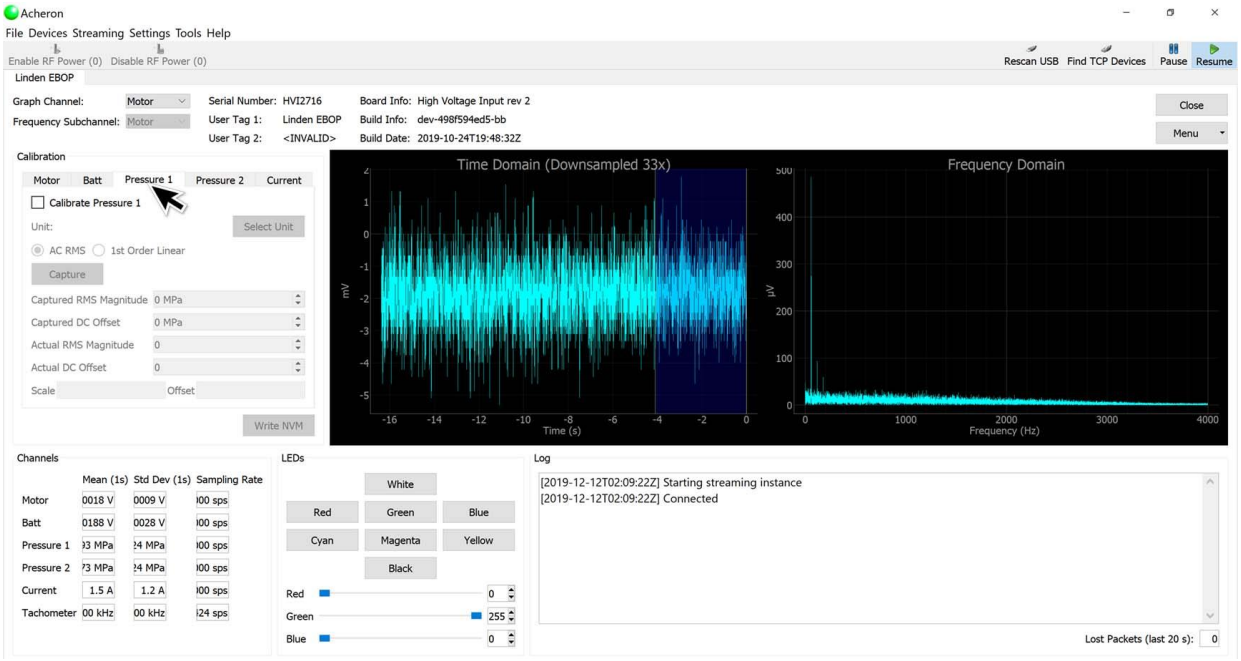
Since pressure is a linear variable, the wizard collects 2 data points at 2 set pressure points and uses that data to calculate the pressure from the corresponding voltages, and displays the pressures in the unit of your choice.

3.2 Calibration wizard software procedure

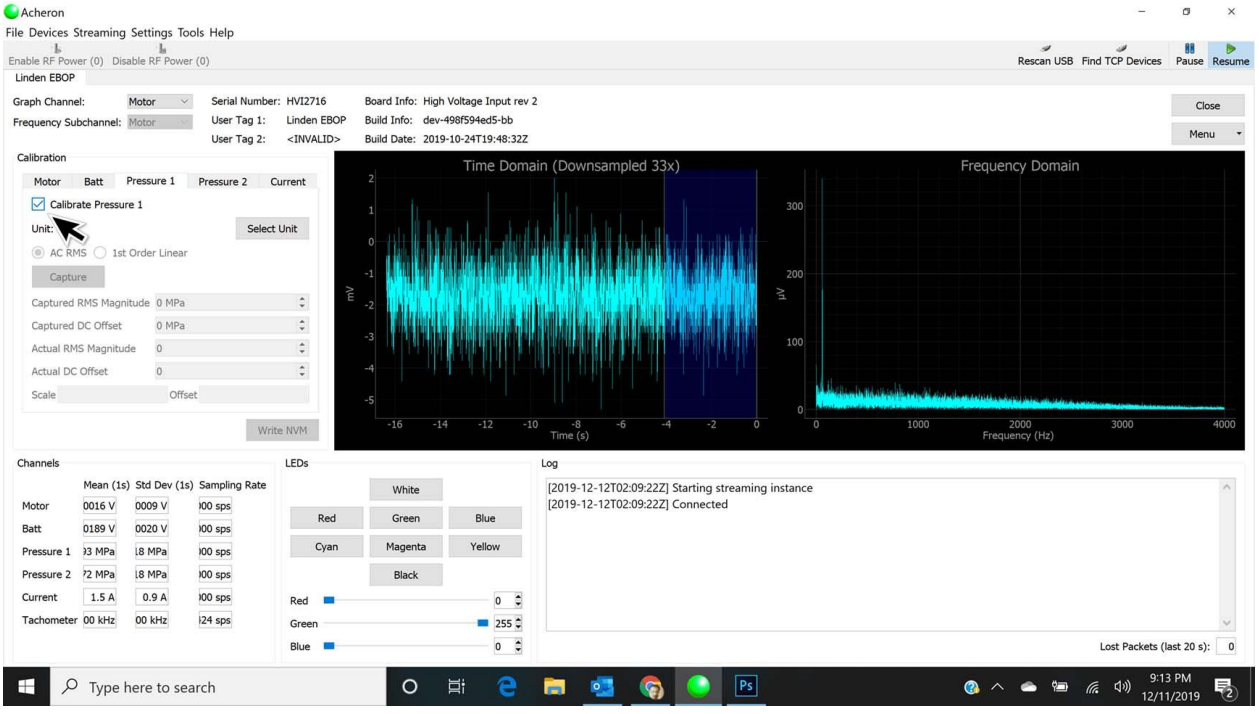
1. The calibration procedure starts by clicking menu -> start calibration



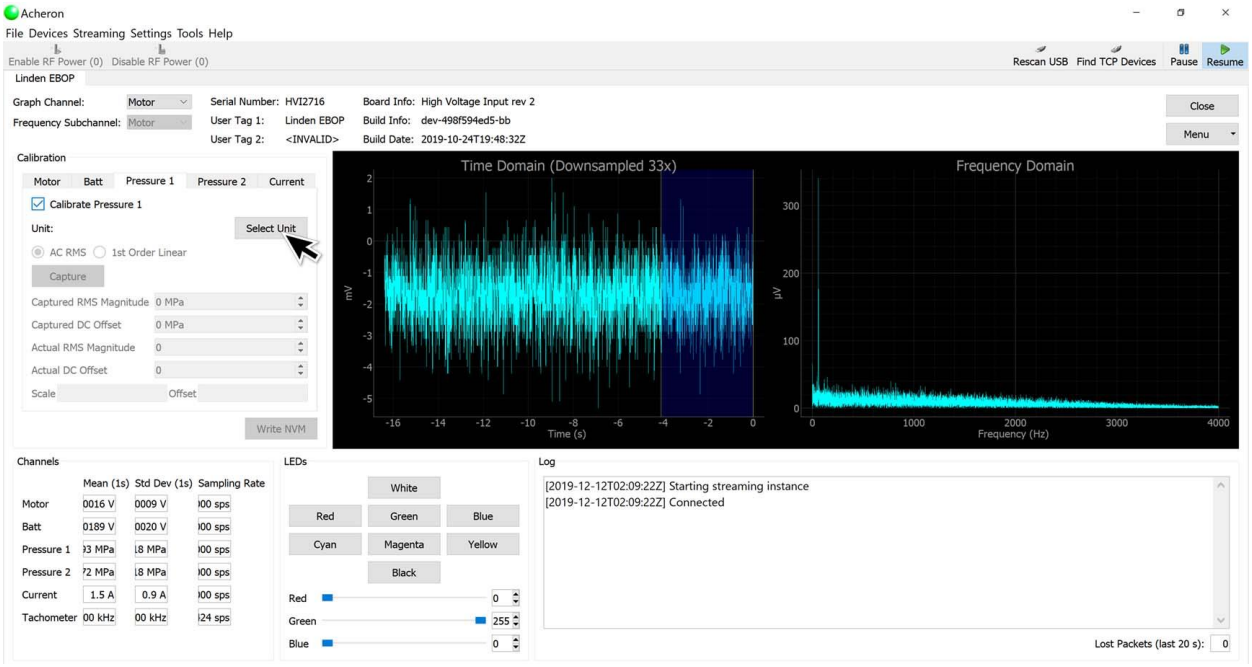
2. The calibration dialog box will open on the left.



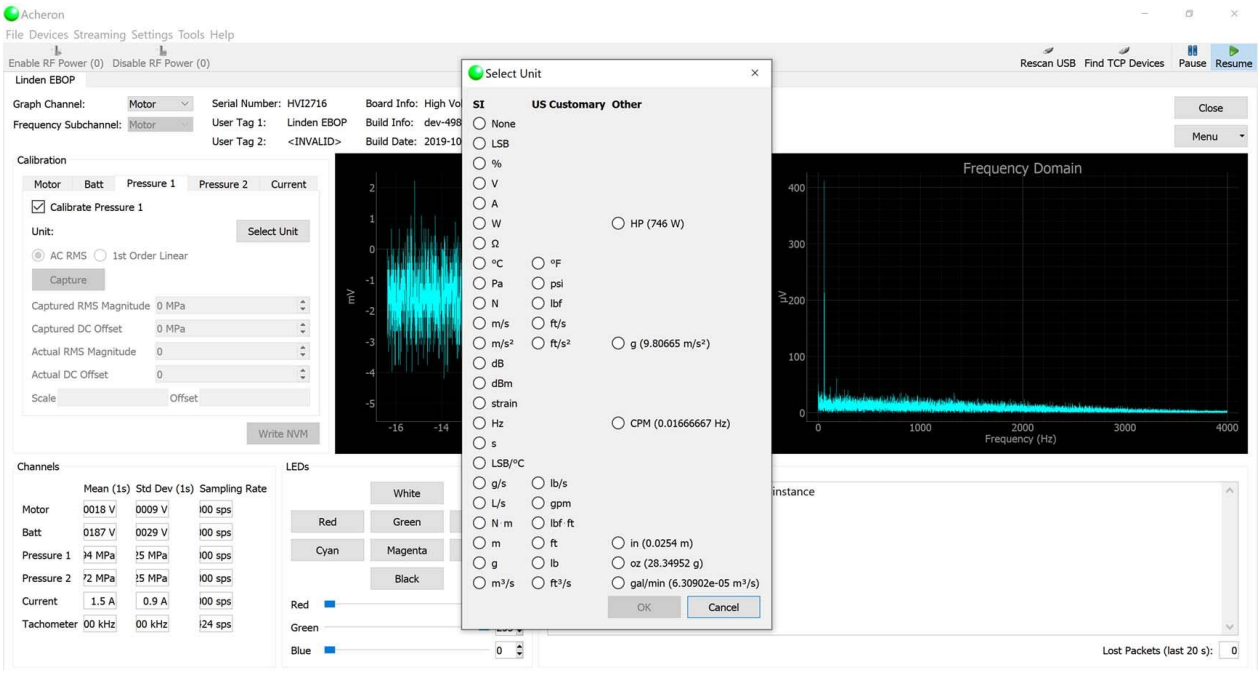
3. Choose the tab corresponding to the channel you would like to calibrate



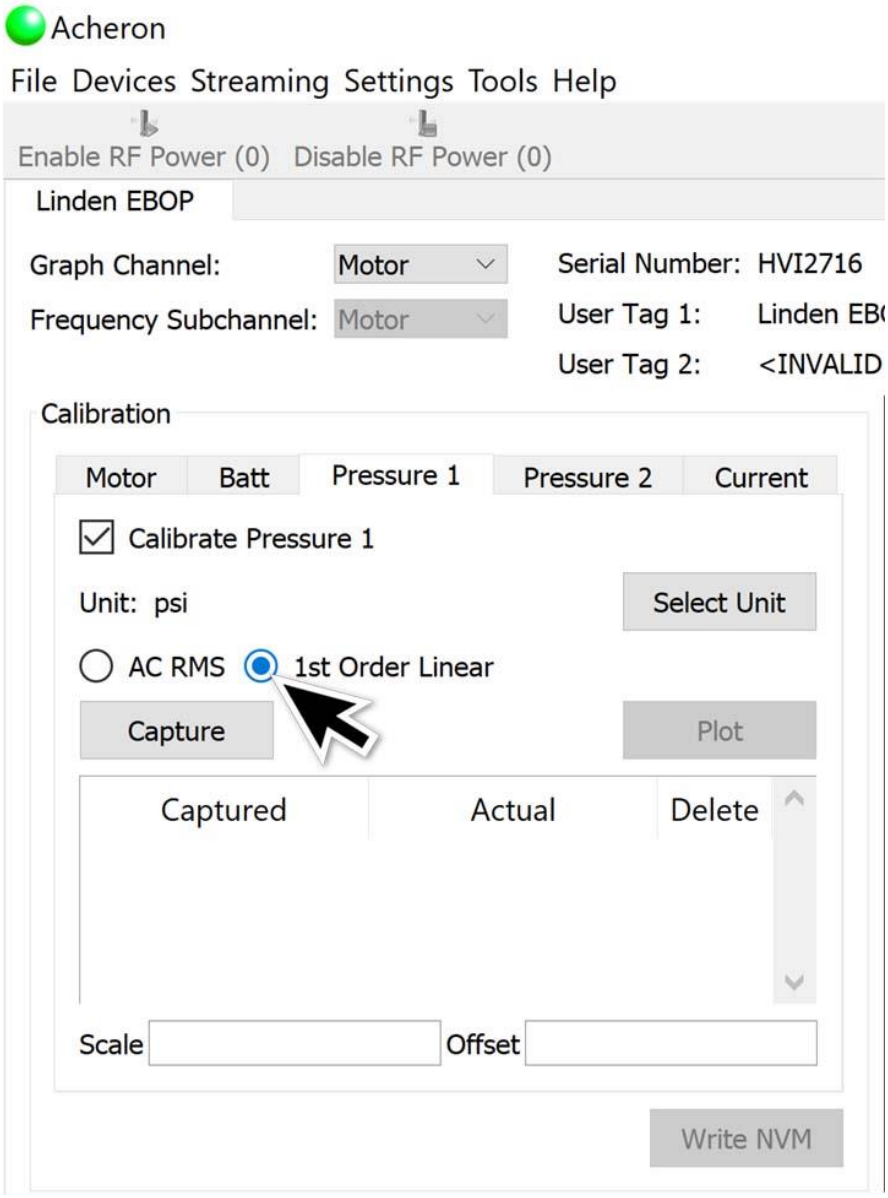
4. Click the check box corresponding to the calibration you wish to make.



5. Click “select unit”

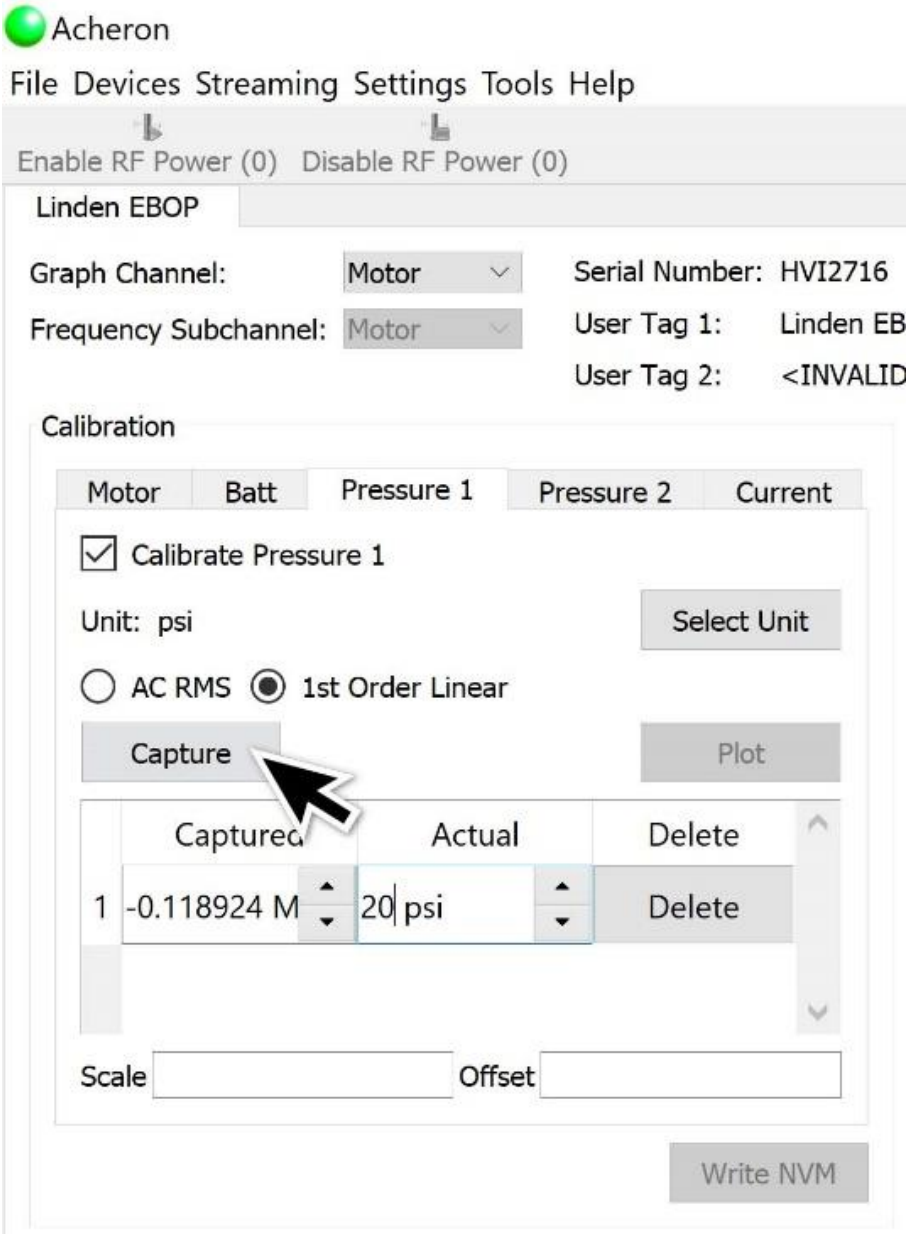


6. Select desired unit, in this case, psi

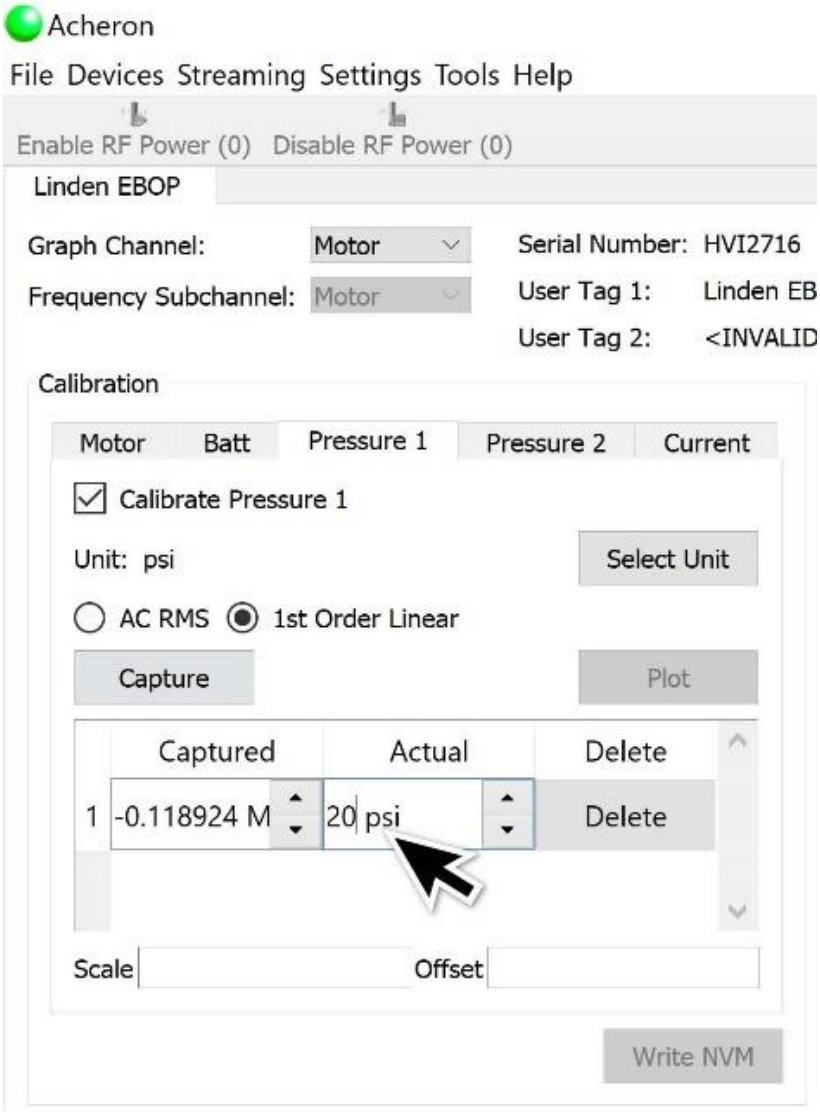


7. Be sure "1st order linear" is selected

8. You are now ready to calibrate, physically set calibration rig feeding the pressure sensor to a chosen pressure within range you wish to measure. In this example, let's use 20psi. With the test rig at 20psi, click "capture"

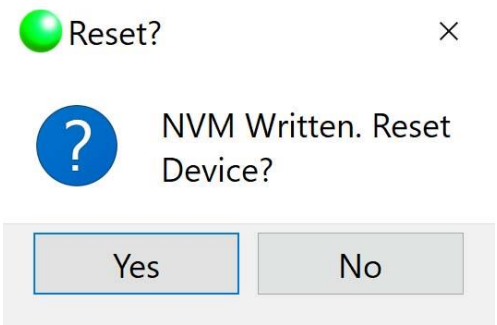


9. In the “Actual” section, type in the psi that corresponds to the physical pressure acting on the sensor.



10. Repeat steps 8 and 9 with a different physical pressure acting on the sensor, such as 80psi

11. Once you have 2 solid data points, click “Write NVM” to write the settings to the device.



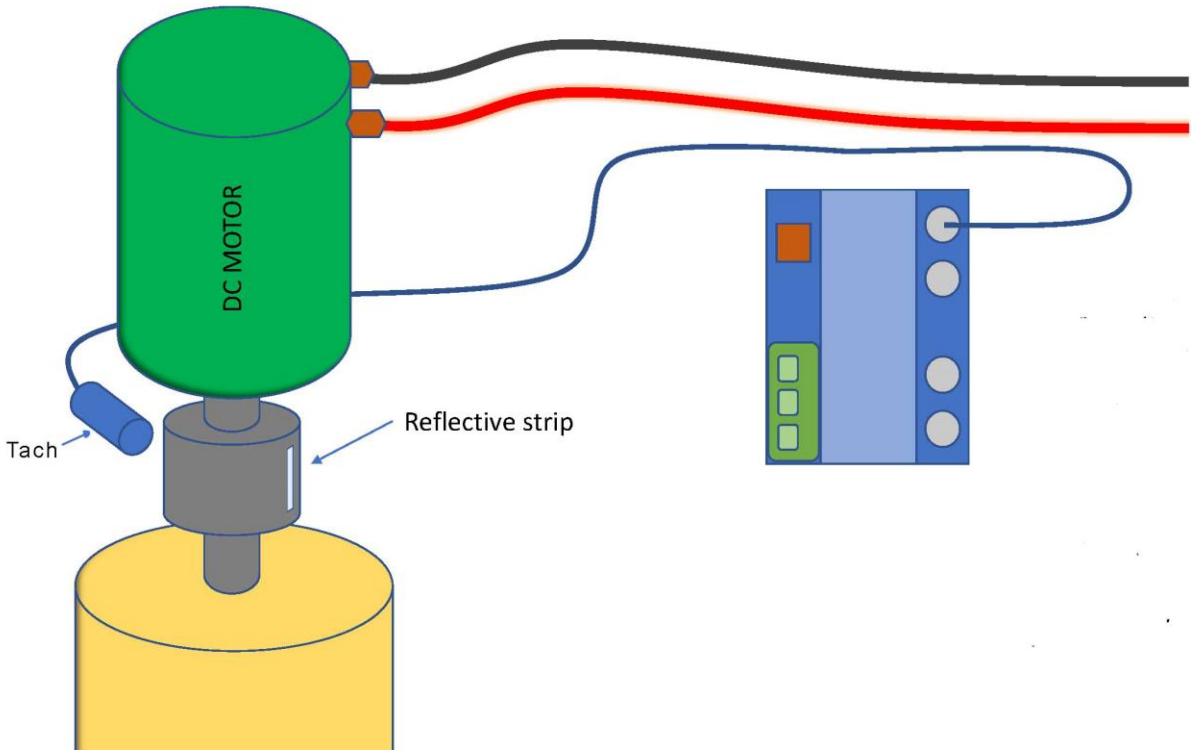
12. You will see “NVM written, reset device?” Click yes. Device will now restart and your calibration settings are now locked in.

4. Physical Installation

The SuprockTech EBOP test kit is designed to make installation as easy as possible with BNC connectors for data, twist connectors for sensor power, high voltage fused clamps, and easy to install optical tachometer.

4.1 Tachometer

The tachometer is a Monarch Instruments unit designed for sending a frequency pulse to the EBOP test kit. Ensure that the optical reflector is attached to the rotor along a visible part of the motor shaft or coupler. Misalignment will result in failure to read shaft speed. Using excess tape (long reflector) is advisable. If the shaft is highly reflective itself, it may interfere with tachometer readings. If this is the case, it is advisable to tape or paint the shaft with non-reflective paint (flat black spray is easiest) in order to ensure the tach gets a good clean pulse for RPM.

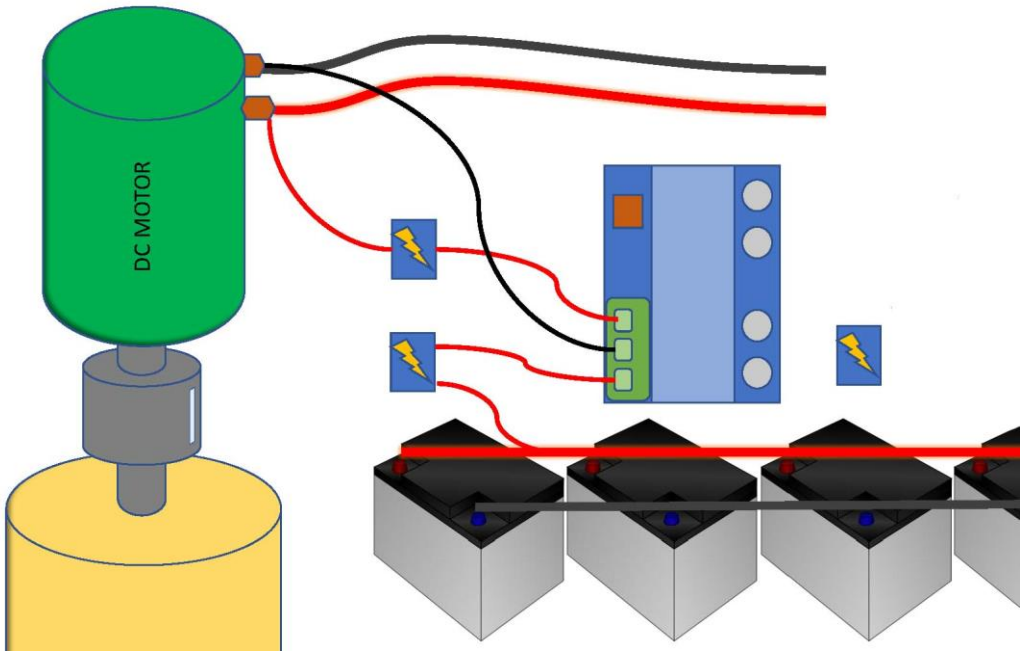


4.2 High Voltage DC Connection

Connect the common ground to the DC motor negative (GROUND) terminal. The HV DC connection should be connected to the input HV1 on the test kit.

HV2 Input may be optionally connected to the battery bank DC voltage source to validate battery voltage under load, as well as comparing the battery supply voltage to the DC control system steps.

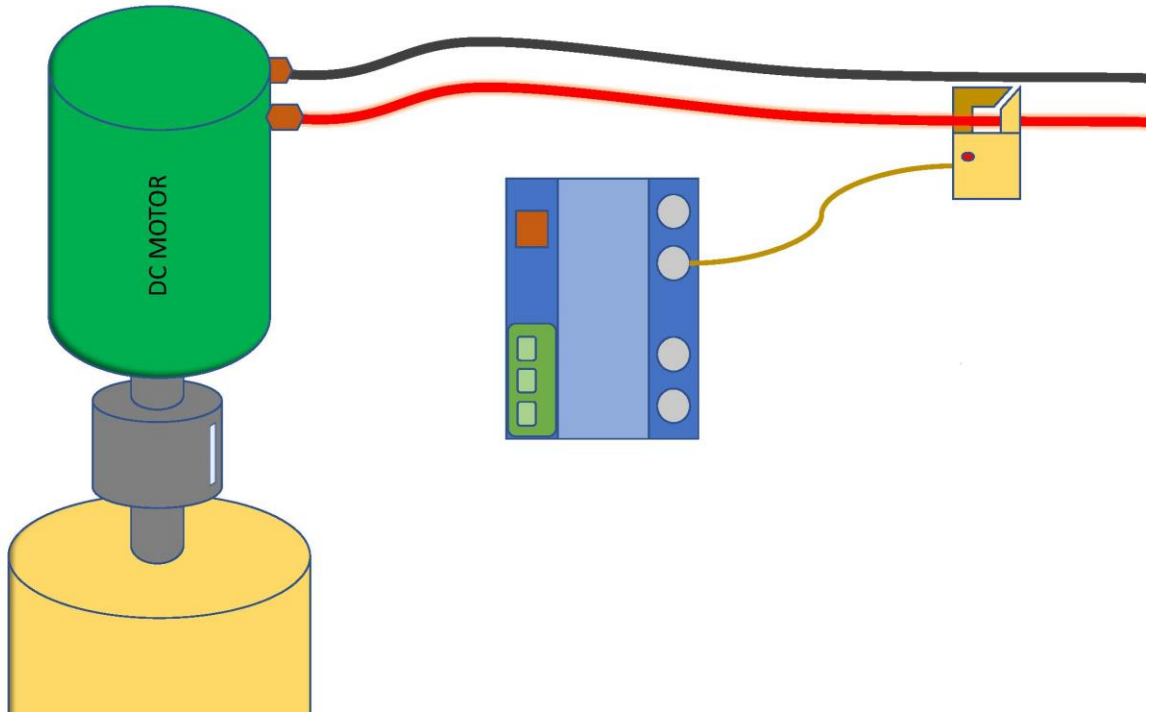
The provided safety breakers should be used for the HV DC connections and installed as close to the contact points as possible.



4.3 Current Measurement

The current probe is connected to LV3 on the EBOP test kit. This current probe is specially modified with an isolated DC supply capable of withstanding 4kV. The battery system and regulator has been replaced in the current probe to allow nonstop unattended operation.

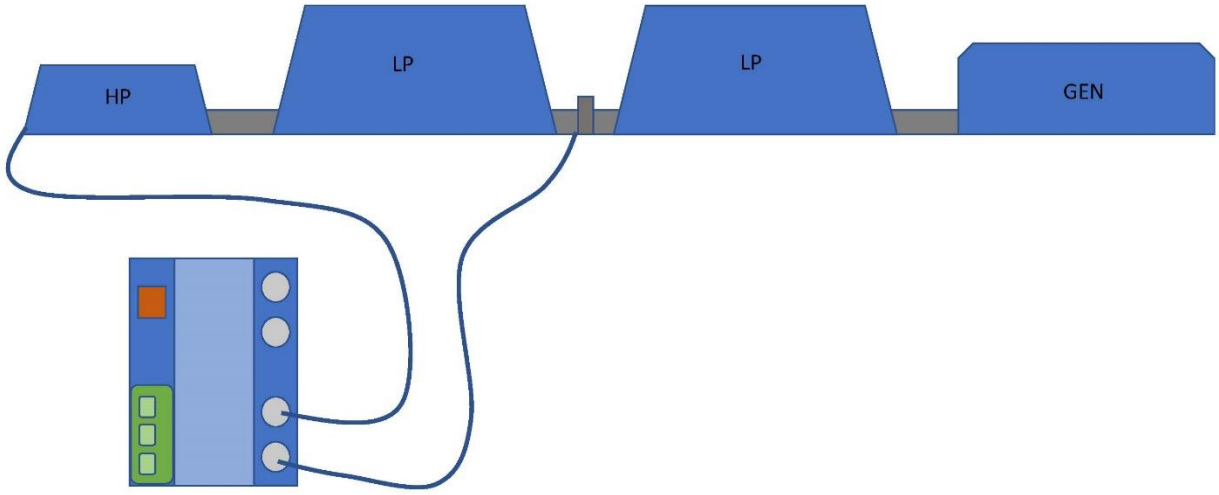
The current probe has been supplied with a BNC connector for unadulterated signal integrity.



4.4 Pressure sensors

The EBOP test kit is designed to take two pressure sensors. Typical tests consist of lube oil pressure at the rear turbine standard and optionally at bearing feed locations. Thrust bearing or journal bearing locations can be determined from operational data showing which bearings have the lowest feed pressure during normal operation of the unit.

The pressure sending unit is powered by an isolated DC supply that prevents ground loops and allows nonstop operation for unattended recording. The pressure sensor has been supplied with a BNC connector for unadulterated signal integrity.



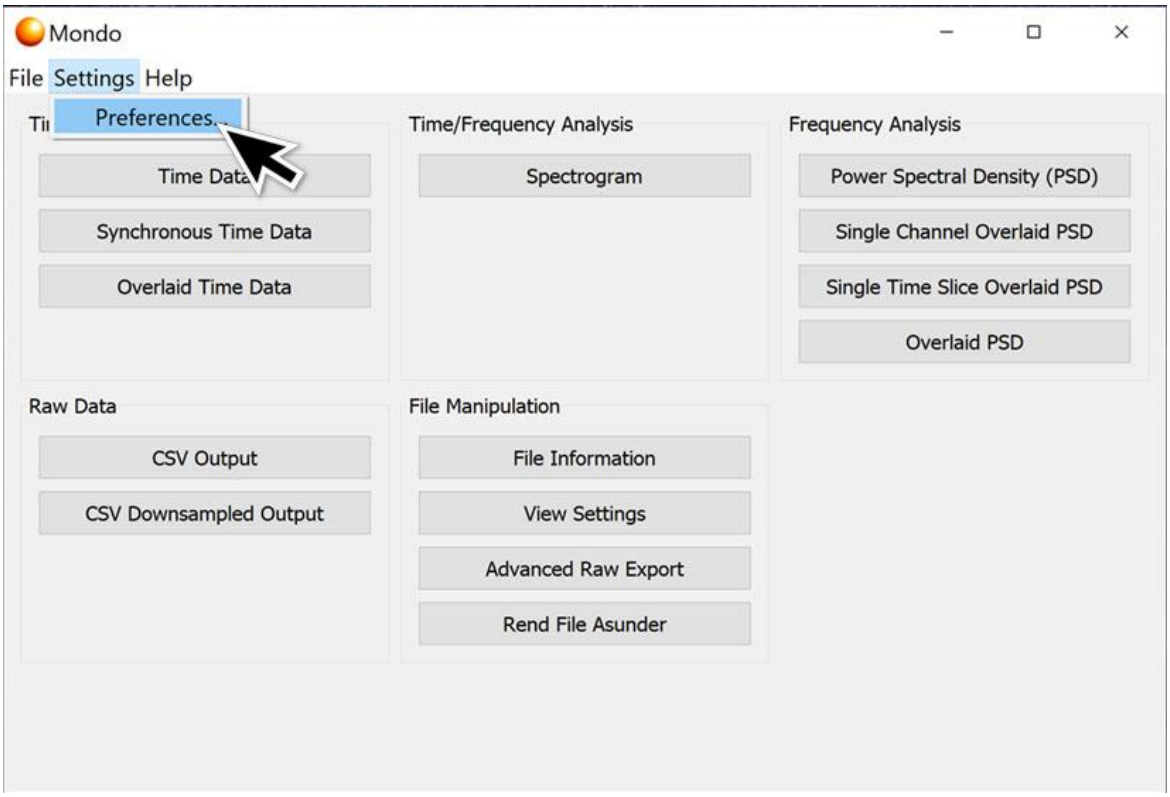
5. Mondo viewing/export software

The MON program is structured to load data and unpack the data from APD files. This data can be exported (unpacked to CSV) or graphically visualized/exported. For the purpose if this EBOP specific manual, we will focus on time data rather than options related to frequency content.

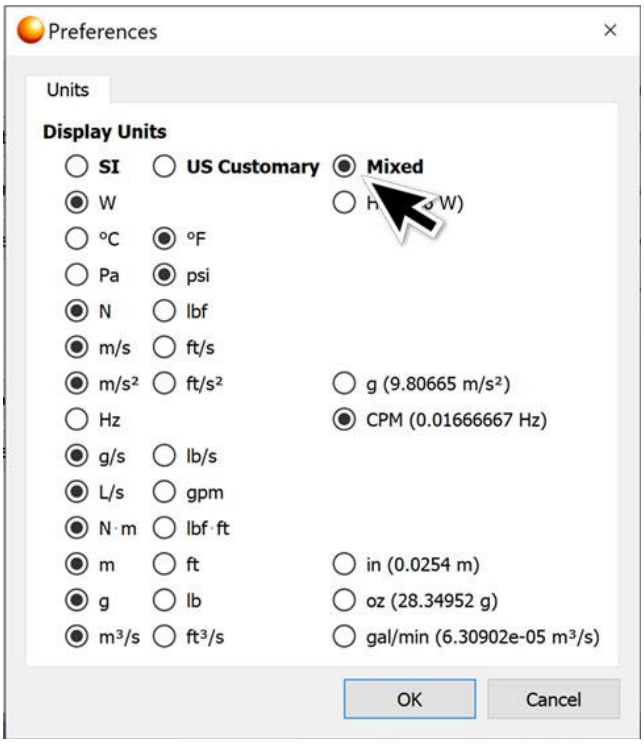
Preferences (display units)

The default display units for Mondo are all in metric. Many of our customers in the US have requested an option for pressure to be displayed in PSI. Also, the signal from the tachometer is set to Hz by default where traditionally RPM is preferable. Procedure is as follows:

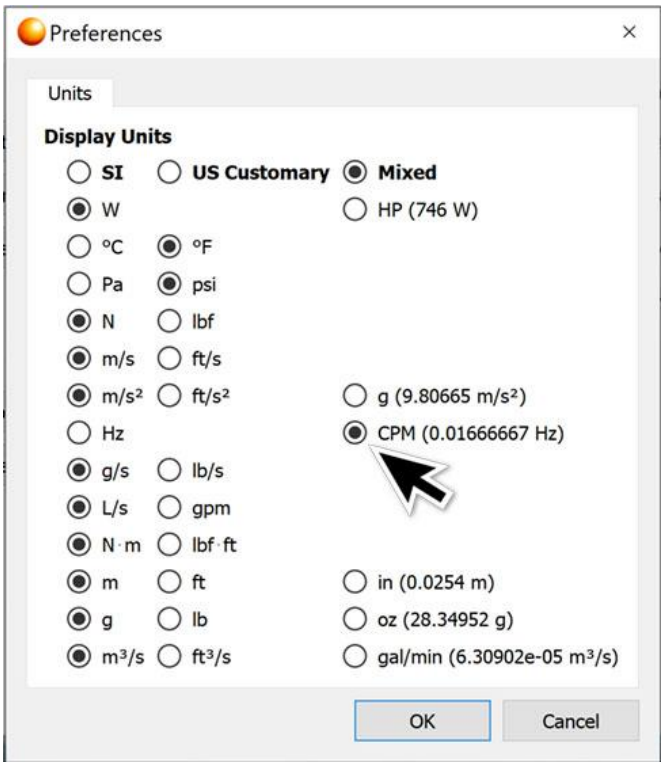
1. Click on Settings - Preferences



2. A dialog will pop up, for mixed units click “mixed”



3. The pressure unit chosen simply depends on the end user’s preference. Default unit is Pascals, if you want psi, click psi. When it comes to motor RPM, it is advisable to choose CPM over Hz. This will give a proper RPM number, which tends to be the standard for revolutions.



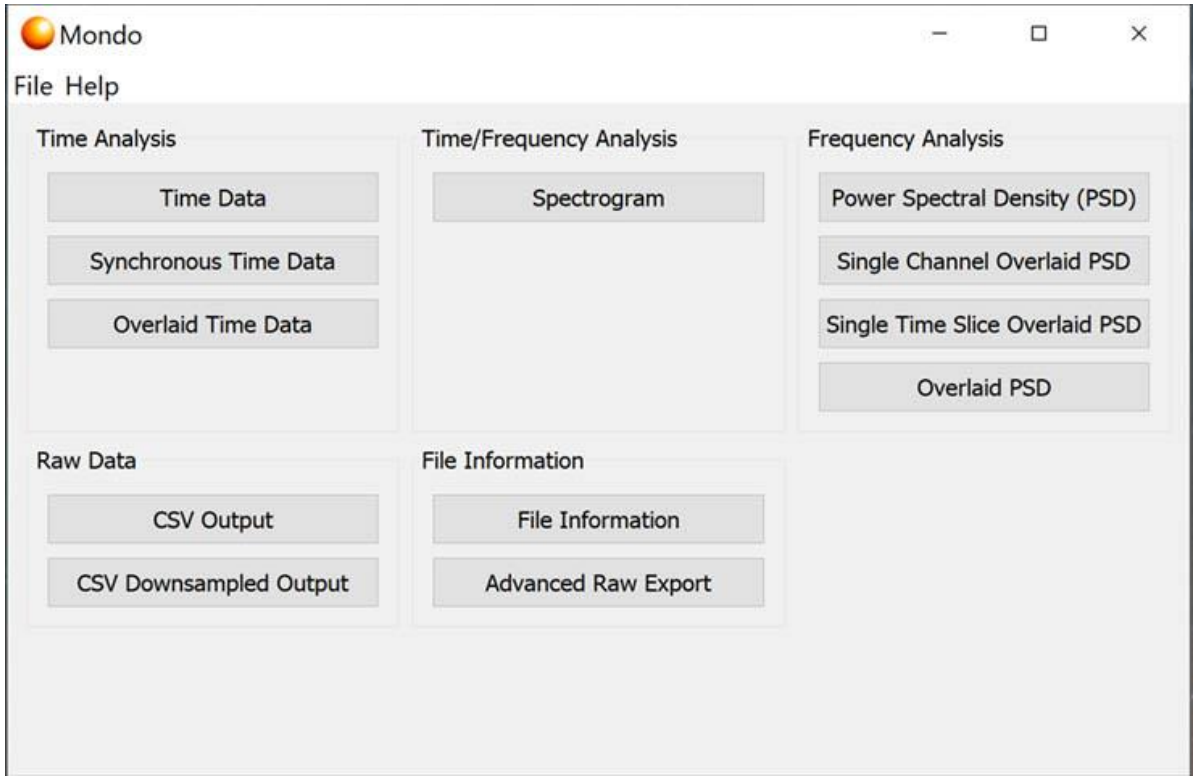
5.1 Viewing and exporting data in the form of image files

Mondo makes it easy to view and export data that has been collected from SuprockTech products:

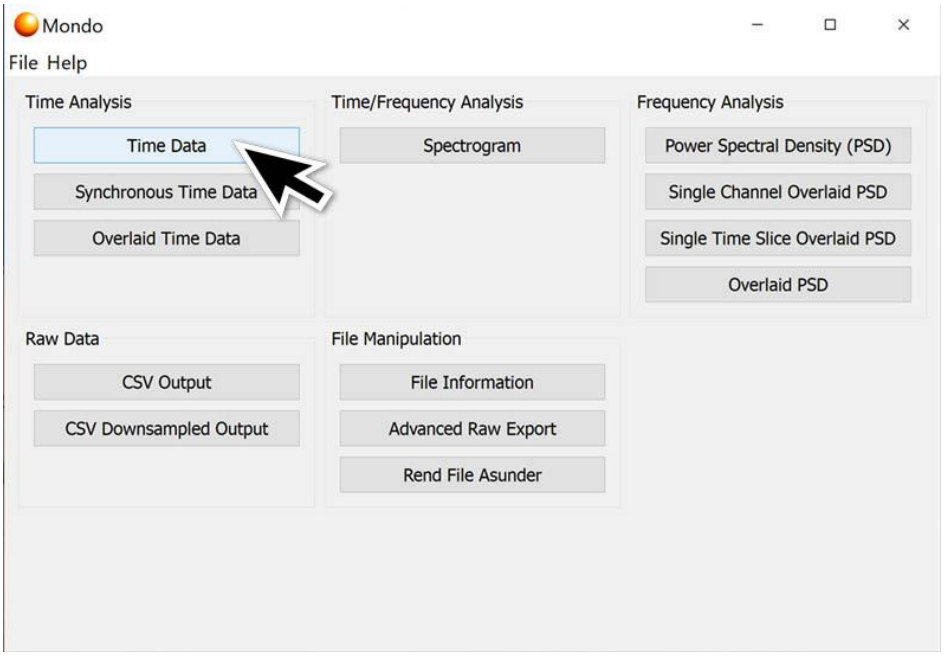
5.1.1 Opening files

The first operation is a standard file navigation to load files of interest into the MONDO software. A user should choose a file from this menu to begin the analysis, plot, or export process. The default location for saved files from the PLOT GUI data collection program is **X:/Users/*Username*/Documents/Acheron Data**. Steps for opening files is as follows.

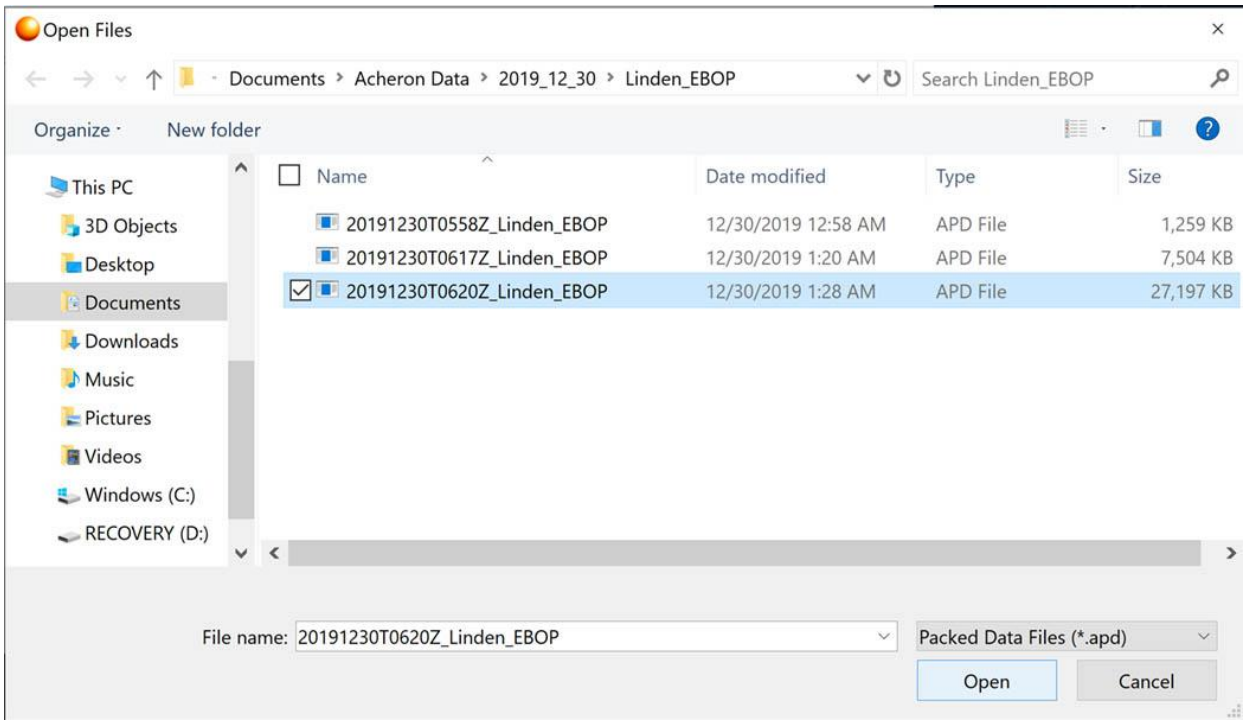
1. The provided laptop includes a shortcut to the MONDO app on the desktop. Locate the shortcut and double click to start the program. The software looks like this:



2. Under the time analysis section, click “Time Data”

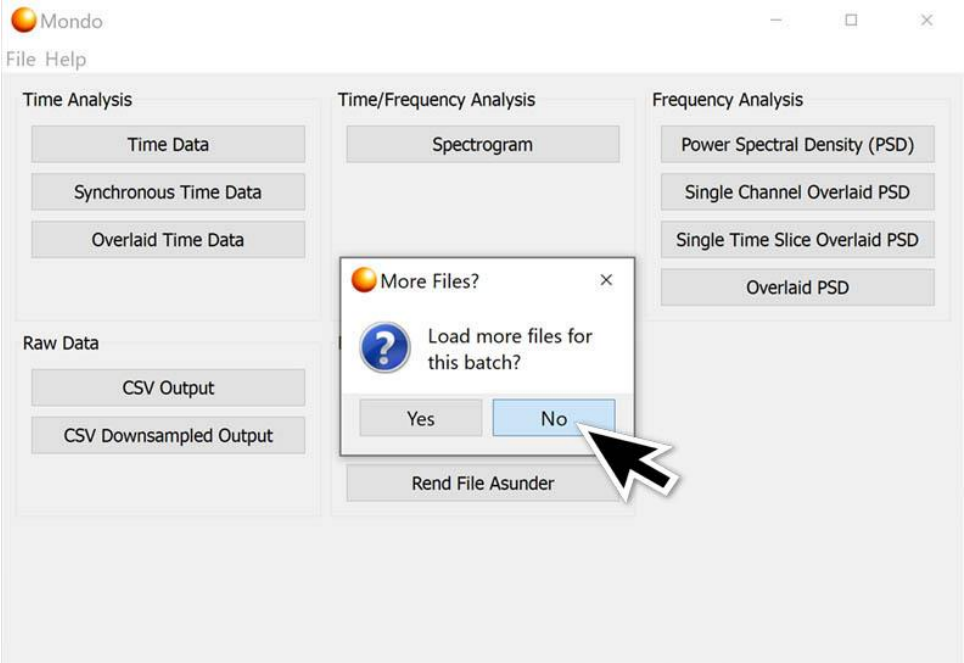


3. A dialog box will appear prompting you to choose your desired file. Unless you have chosen an alternate location in which to save your files under Acheron, the default location for SuprockTech Acheron data files is: **X:/Users/*Username*/Documents/Acheron Data**

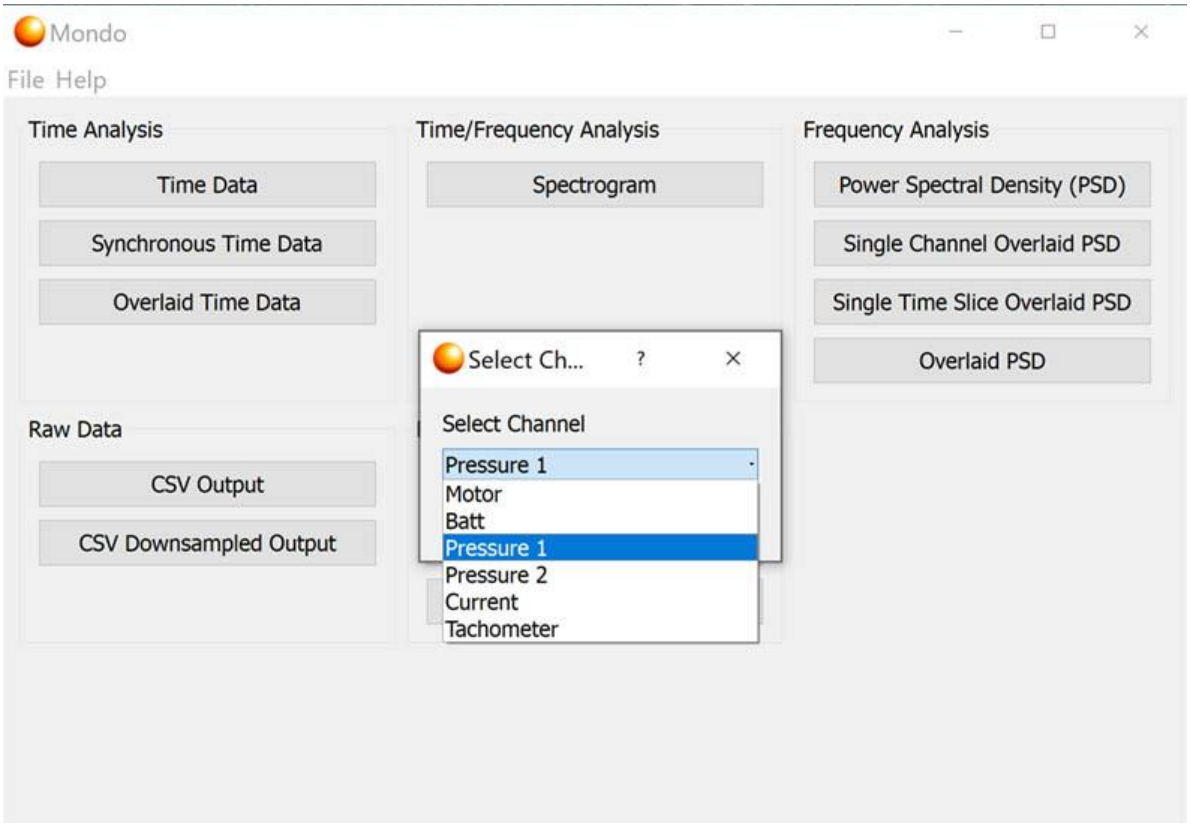


Choose your desired file and click “Open”

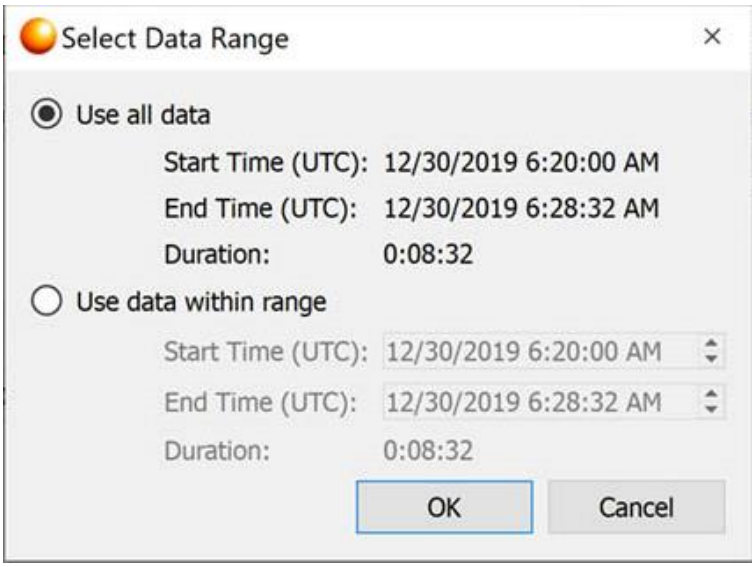
4. A dialog box will appear asking if you wish to load other files from this batch. In the case of the EBOP kit, all of the channels are contained in a single file. Choose “No”



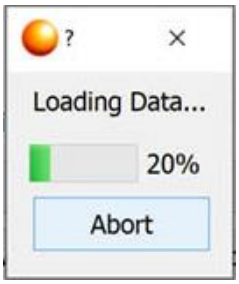
5. Select which channel you wish to visualize.



6. One more window will prompt you to choose whether you want to open the entire file or a certain time range. Times are in UTC.



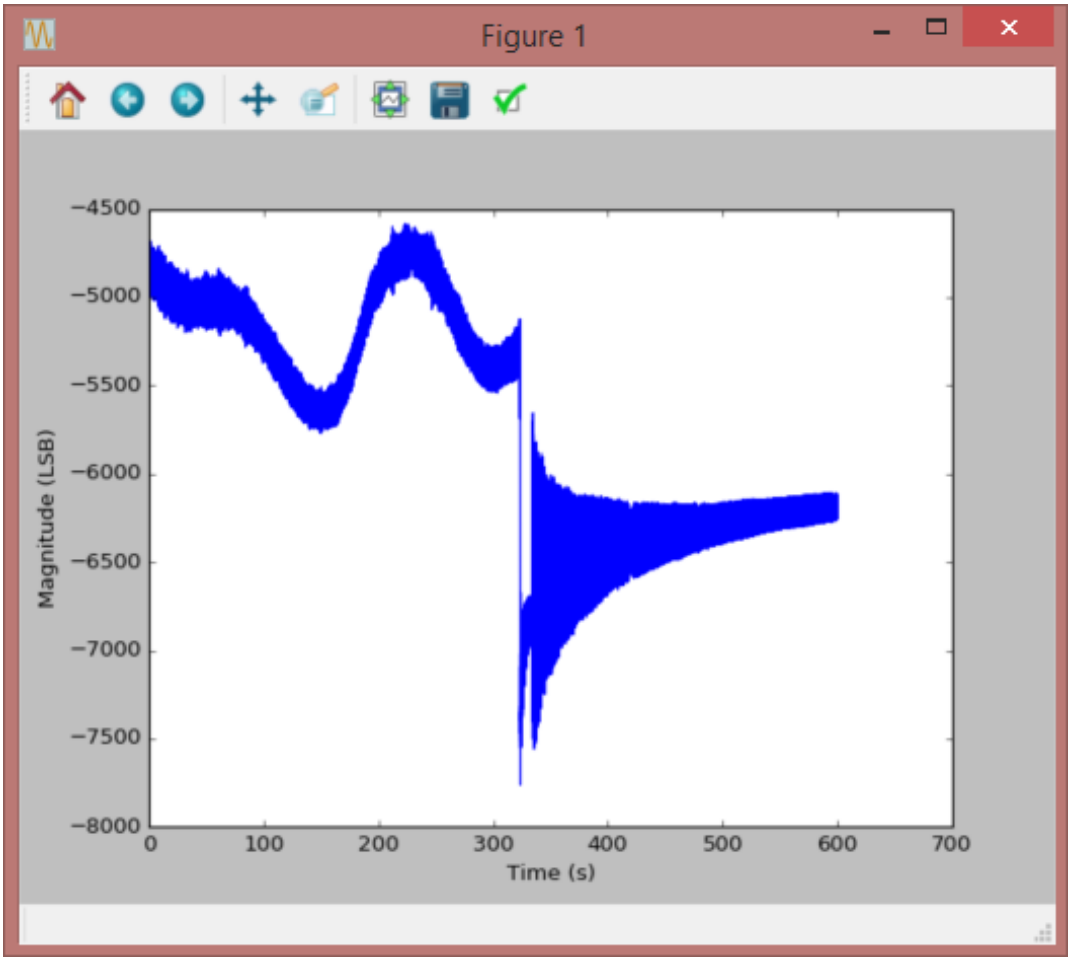
You will then see a progress bar loading the data:



When the progress bar is complete another window will open showing your data.

5.1.2 Plot Navigation

The viewing portion of the program looks like this:



The plot navigation window has a simple row of icons similar to what one would see in a document or image viewing program:

5.1.2.1 *Home Button*

The home button takes the plot back the default scale and view when it was first loaded.

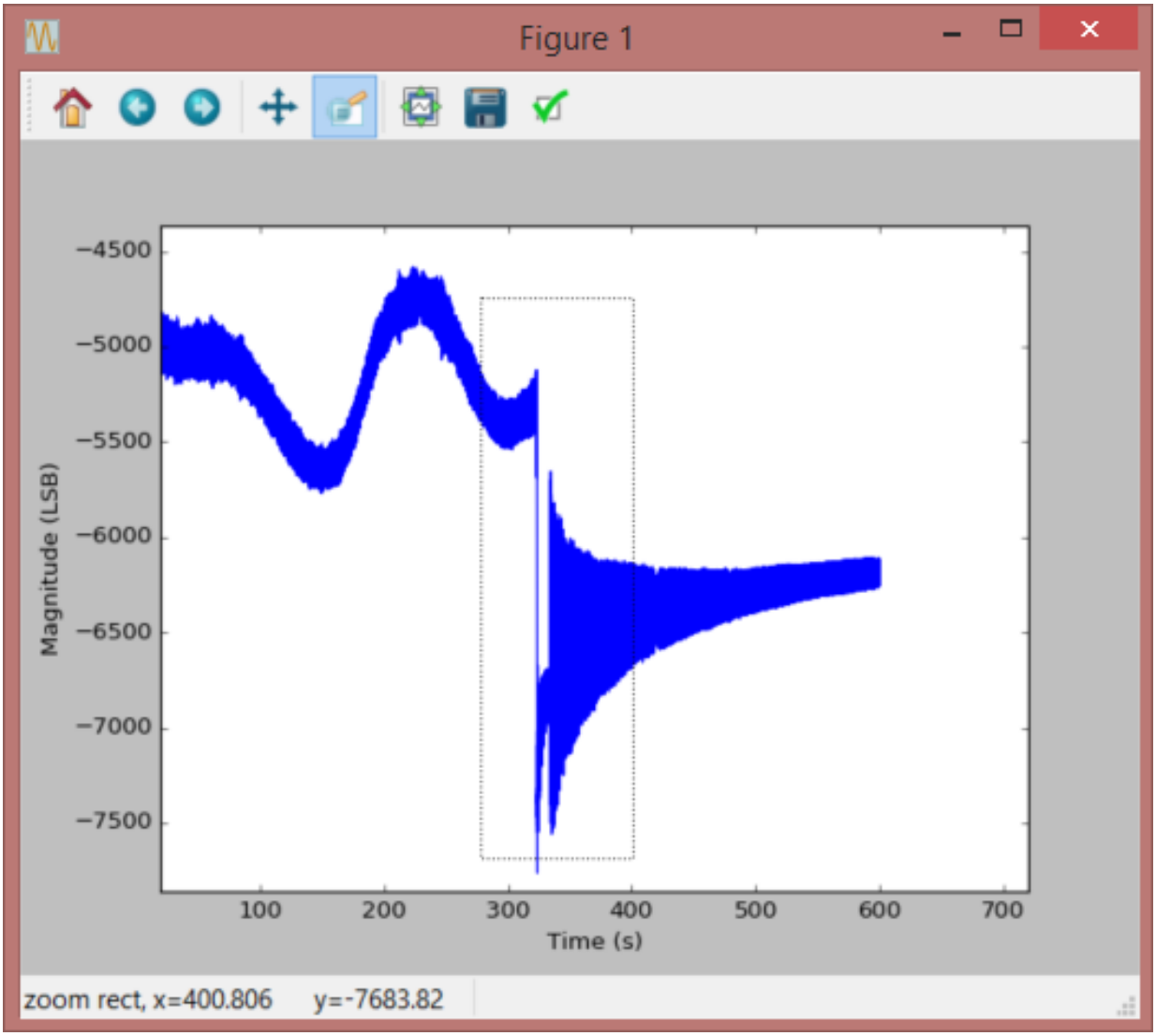
5.1.2.2 Back and Forward Buttons

The back and forward buttons work just the way they do on a web browser. Back to the previous, or forward to the next view.

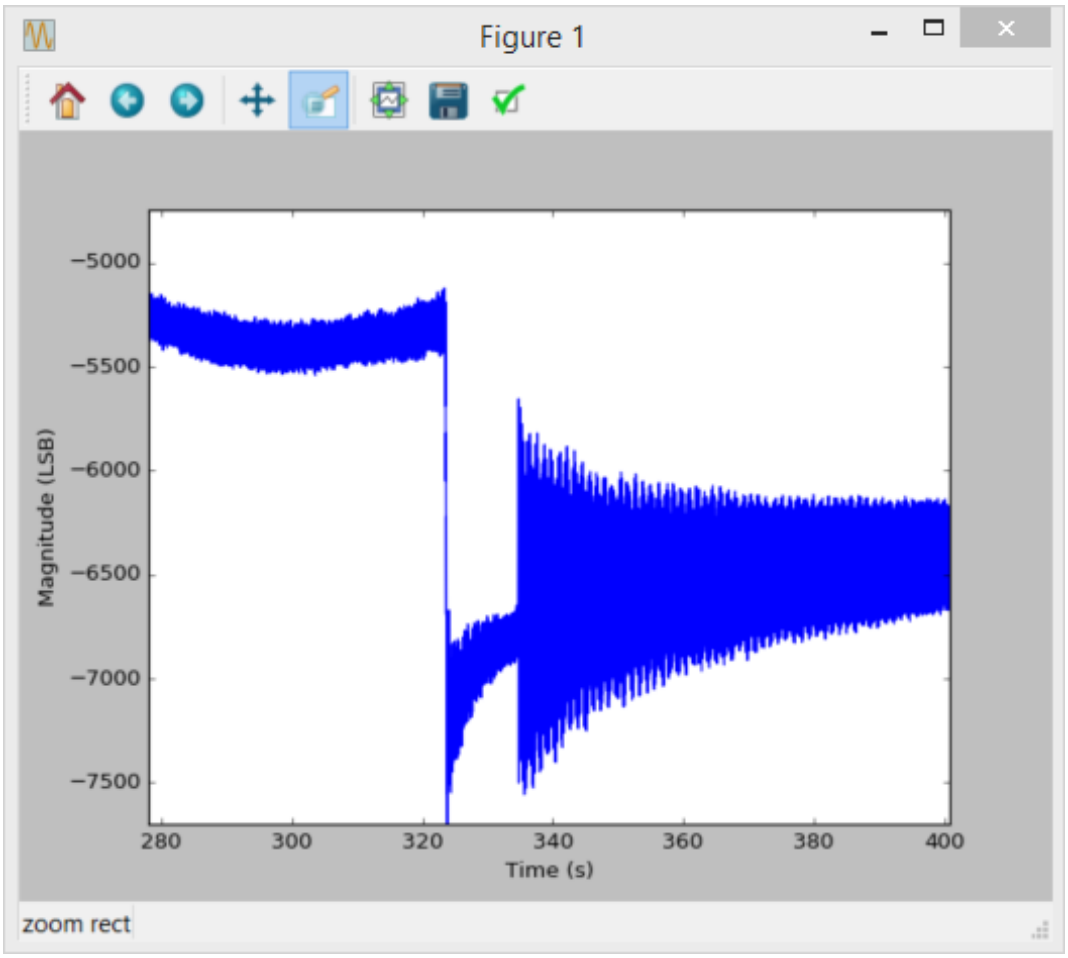
5.1.2.3 Pan Button

Clicking on the pan button enables panning of the plot though click and drag functionality. Clicking and dragging with the left mouse button pans the axes. This allows moving certain points through the visible area when zoomed in, for example. Clicking and dragging with the right mouse button affects axis zoom.

5.1.2.4 Zoom Button



Clicking on the zoom tool allows the user to use click and drag functionality to draw a rectangle wherever the user wishes the visible area to be. Any mistakes here can be cleared using the back or home buttons.



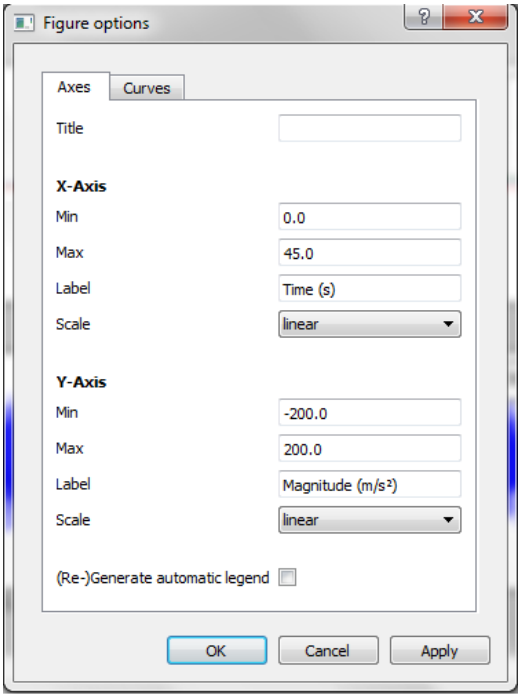
You are now zoomed into the selected area.

5.1.3 Figure Options

The figure options button brings up a dialog that allows the user to set parameters for the axes and the lines.

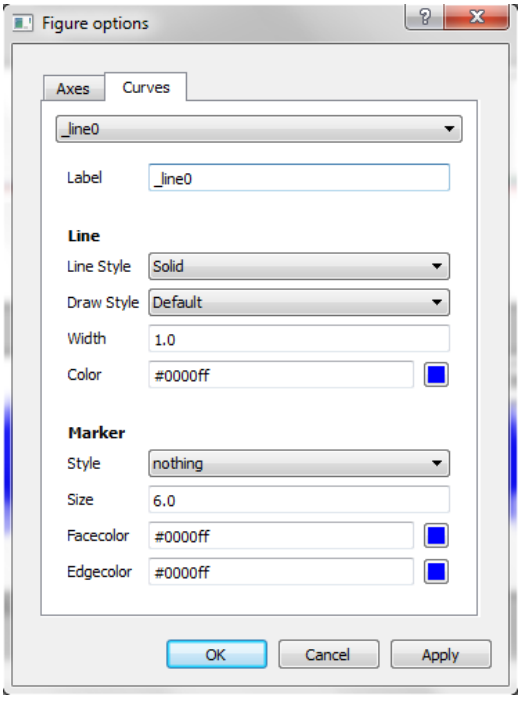
5.1.3.1 Axes

The Axes tab options allows the user to set a title for the plot, set min and max values for plotted data, rename the axes, and set whether the scale will be shown in linear or logarithmic terms.



5.1.3.2 Curves

The curves tab opens the possibility of changing the way plot lines and curves are displayed. In plots with overlaid data the drop down menu at the top is used to choose which line is being configured.

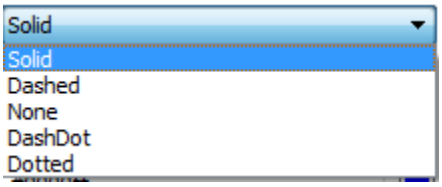


5.1.3.3 Label

Label is for changing line label for keeping track of specific lines.

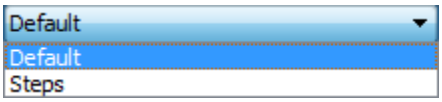
5.1.3.4 Line Style

The Line Style drop menu for choosing what style of line is desired



5.1.3.5 Draw Style

The Draw Style drop down determines whether the lines are drawn in the default curve style or stepped from data point to data point.

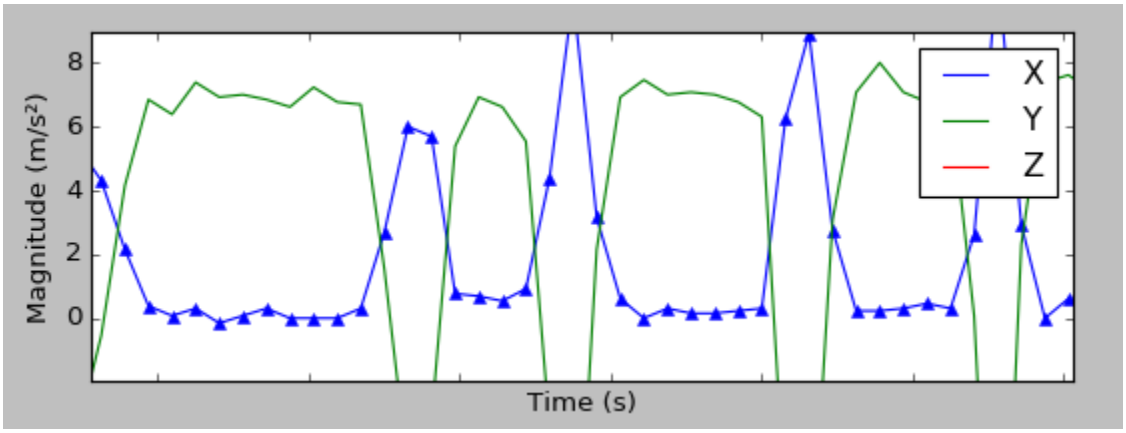


5.1.3.6 Color

Color Sets line color for selected line.

5.1.3.7 Markers

The marker section allows the user to set different types of display markers for relevant data points.



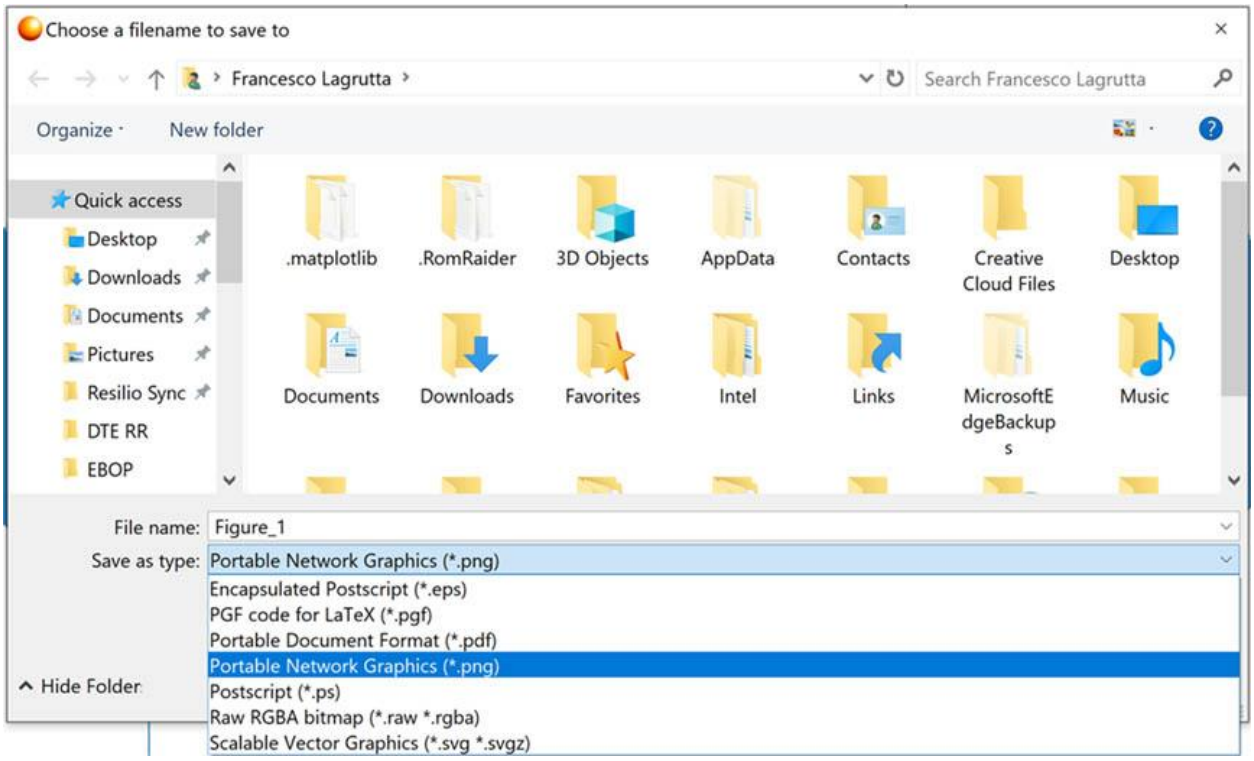
Sample data with markers

5.1.4 Saving plots as image files

Plots can be saved in a variety of vector and image formats for reporting purposes. It is a simple operation similar to other image program:

1. Click the Save button in the top menu row:

2. The user's selected view can be saved in a variety of image, vector and document formats. Just choose desired save location, name your file, and choose optimal format.

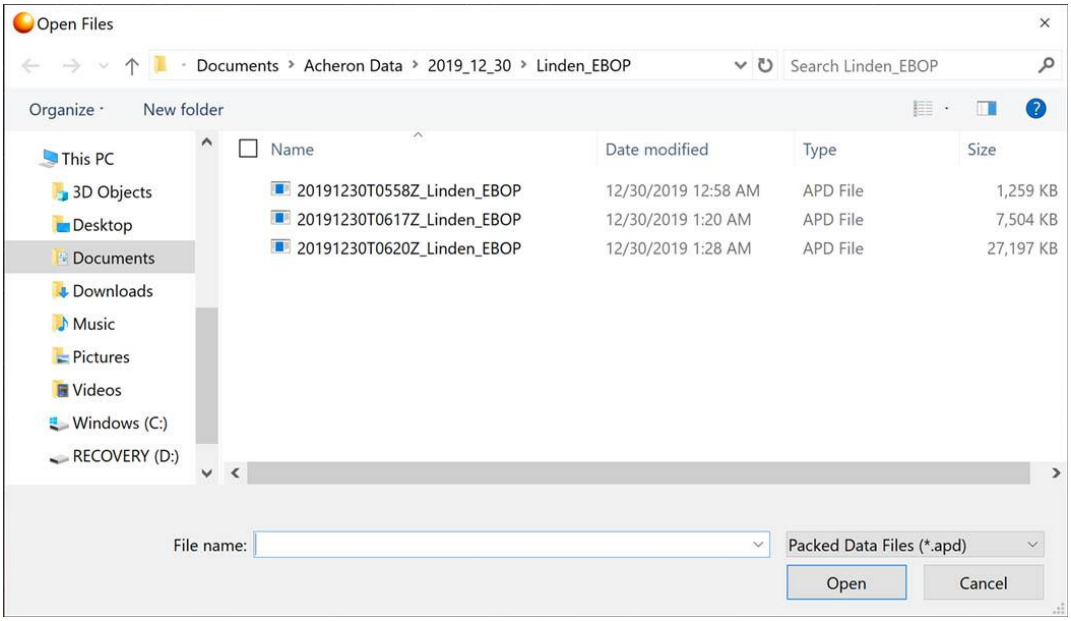


Click save and the file will be saved to your chosen location.

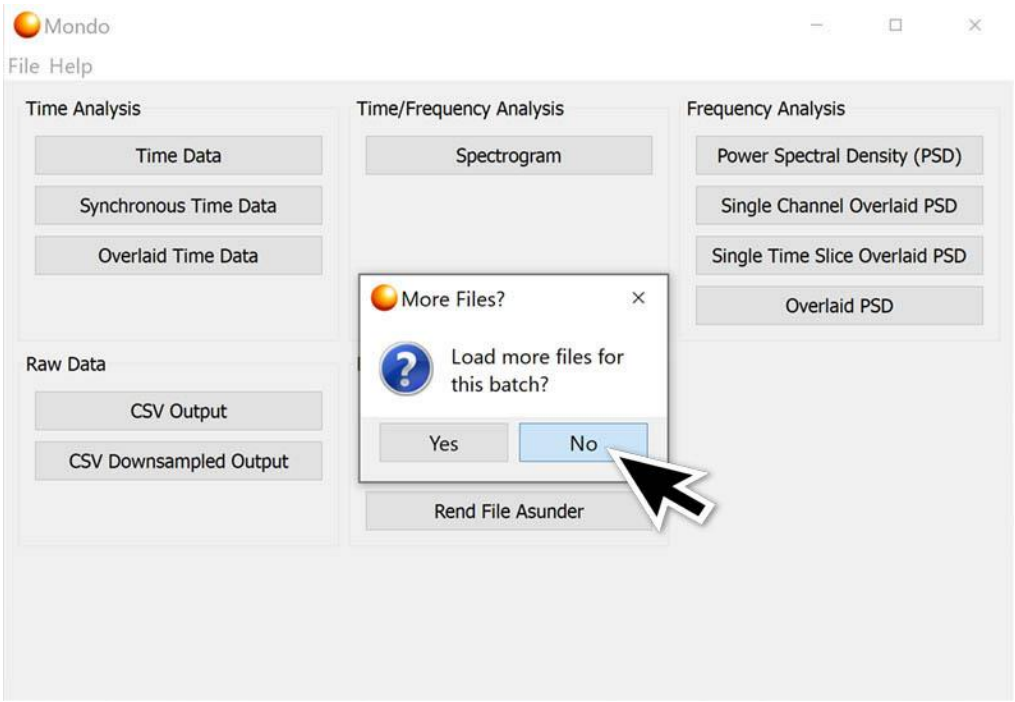
5.2 Saving and Exporting data files as CSV

Exporting CSV Data output is similar in procedure to opening files for view/saving as image:

1. Clicking the CSV Output button brings up a file opening dialog. Choose which file you would like to export then click open.

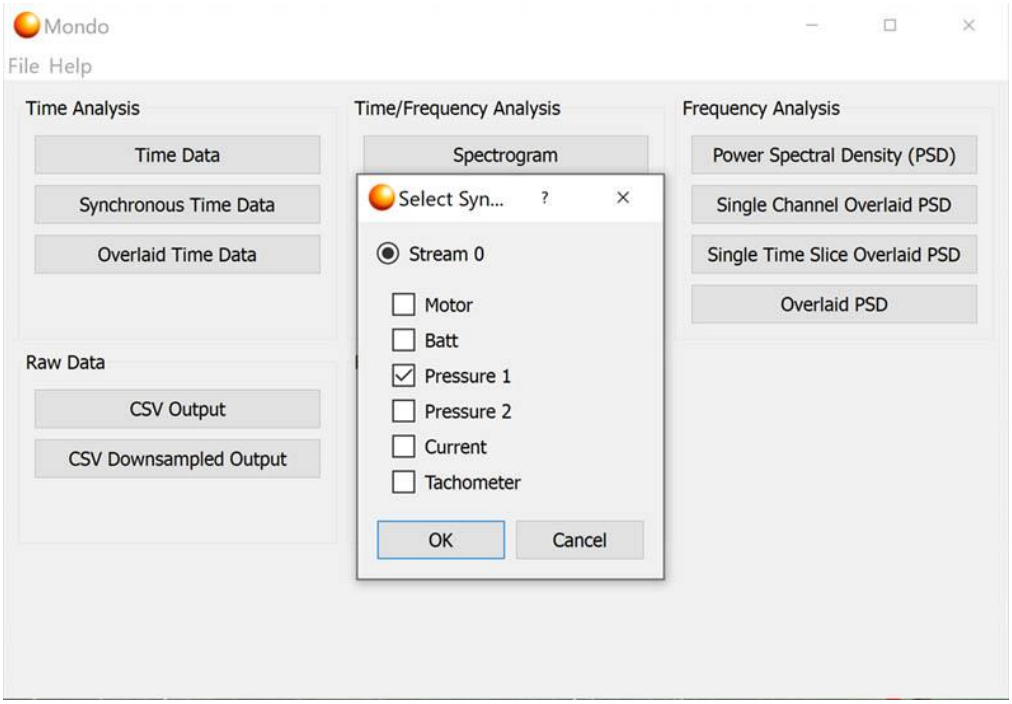


2. The software will ask if the user would like to add more files for concatenation:



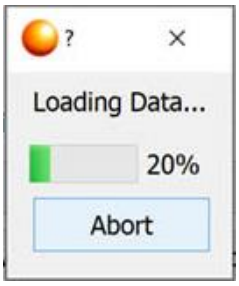
For the purposes of EBOP test, it shouldn't be necessary to link more than one file together. Please click "no"

3. A a dialog will pop up asking which synchronous channels the user wishes to include in the csv export file.

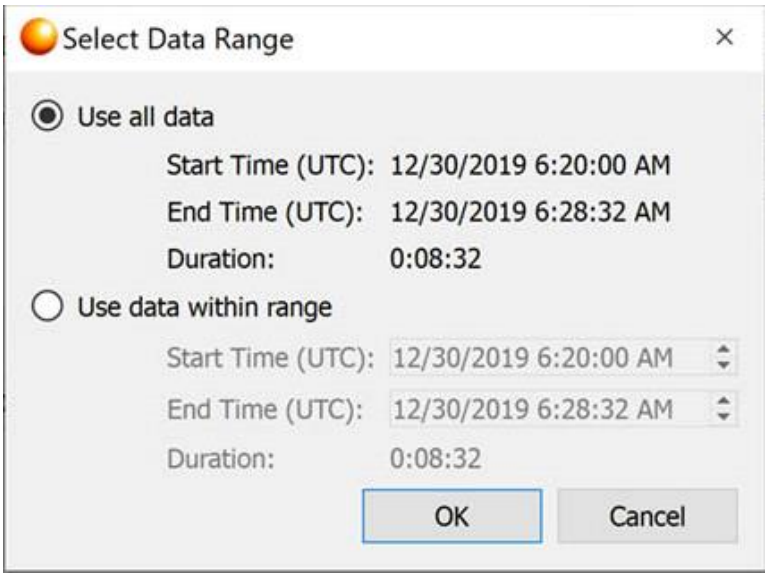


Check the boxes next to the channel(s) you would like to see in this CSV file in particular. Then click "ok"

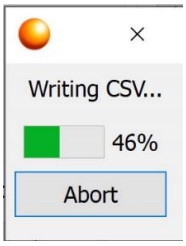
You will then see the loading progress bar:



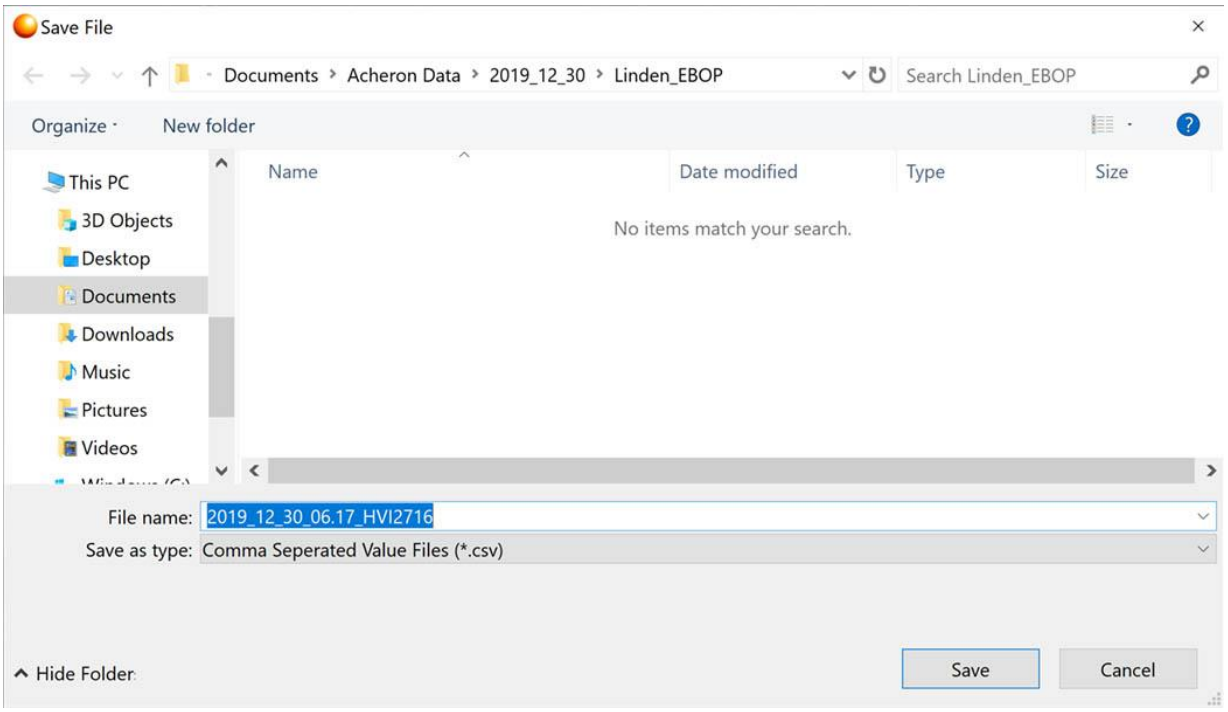
4. The next window will prompt you to choose whether you want to export the entire file or a certain time range. Times are in UTC.



Click ok, and a CSV file will be generated.



5. When the file is finished loading a dialog will prompt you to choose a filename and save location:



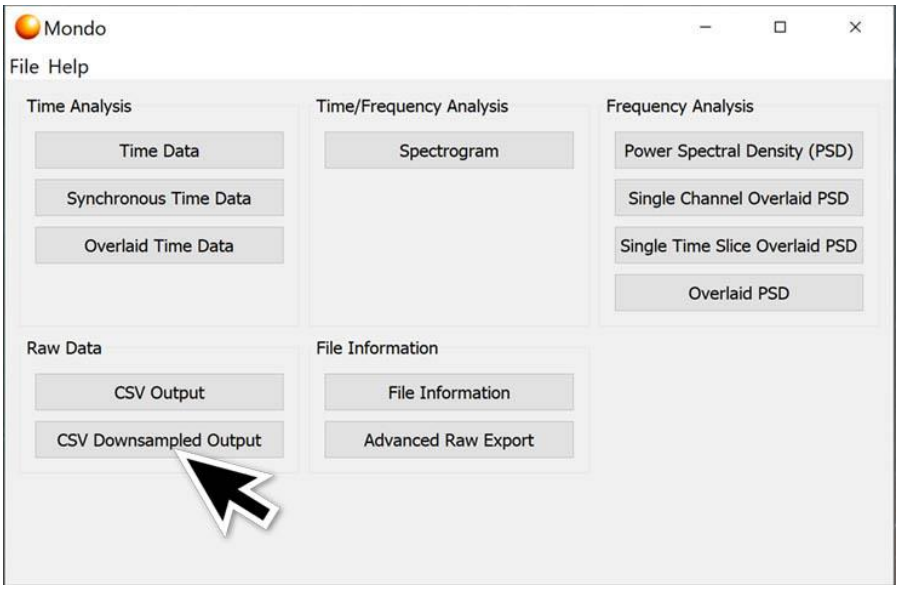
Type a name, choose a save location, then click “Save.”

Your file will save to your desired location.

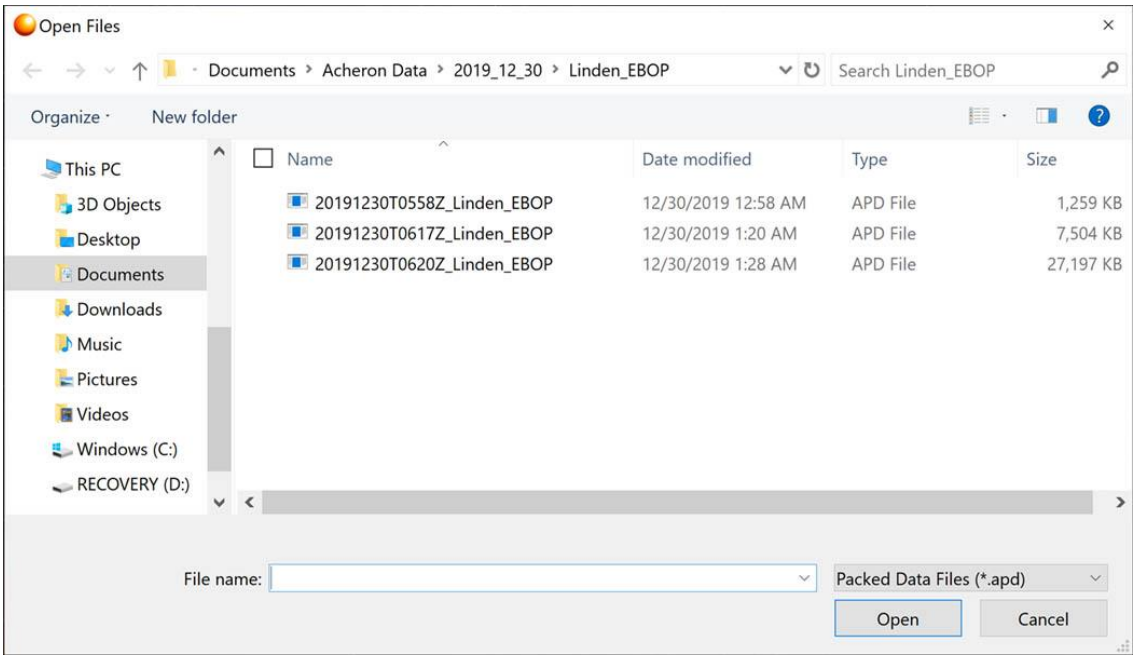
5.3 Downsampled CSV for Excel graphing

Mondo is capable of graphing .apd files created by the telemetry, however @8ksps, if one wishes to graph data using a spreadsheet program such as Microsoft excel, the number of datapoints can quickly overwhelm such programs. Enter the downsampled CSV feature on Mondo:

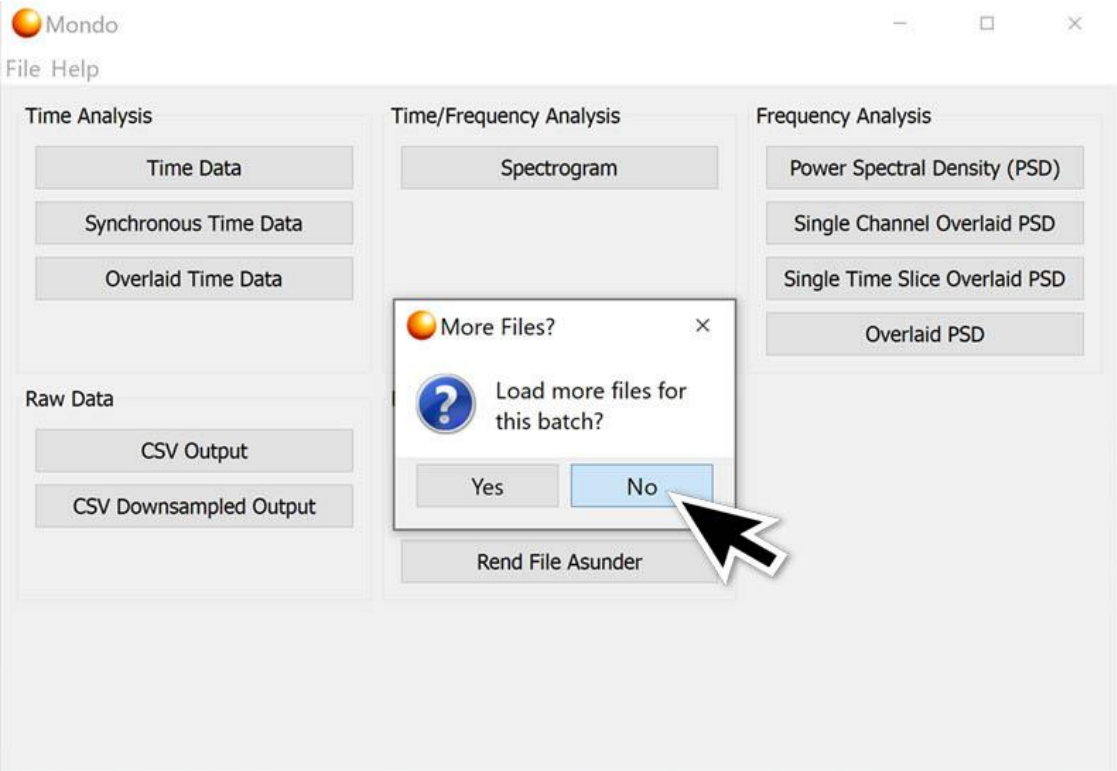
1. Open Mondo and click on “Downsampled CSV output”



2. Dialog box will pop up prompting the user to choose desired file. Choose your desired file and click “Open.”

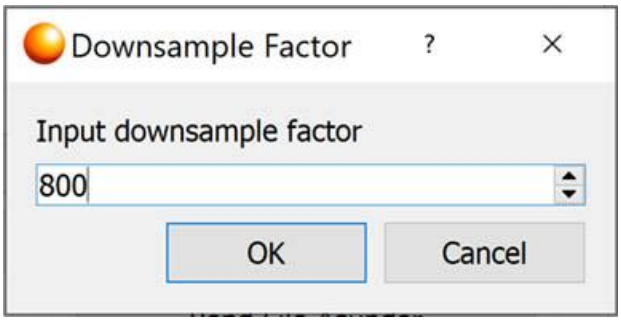


3. The software will ask if the user would like to add more files for concatenation:



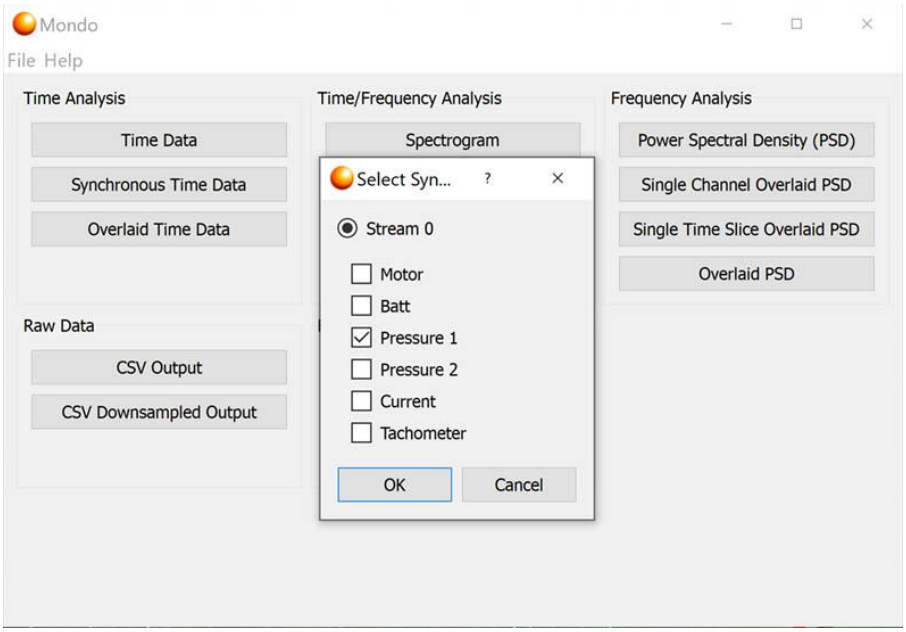
For the purposes of EBOP test, it shouldn't be necessary to link more than one file together. Please click "no"

4. A dialog box will pop up asking for the user to provide a "downsample factor" The downsample factor is a divisor that will be based on the default sample rate of 8ksps. For example, writing 2 results in an effective sample rate of 4ksps (8,000sps / 2 = 4,000sps). A factor of 800 would result in a sample rate of 10sps etc.



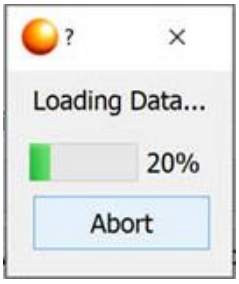
Once the user has calculated the factor and is satisfied, click "ok."

6. A a dialog will pop up asking which synchronous channels the user wishes to include in the csv export file.

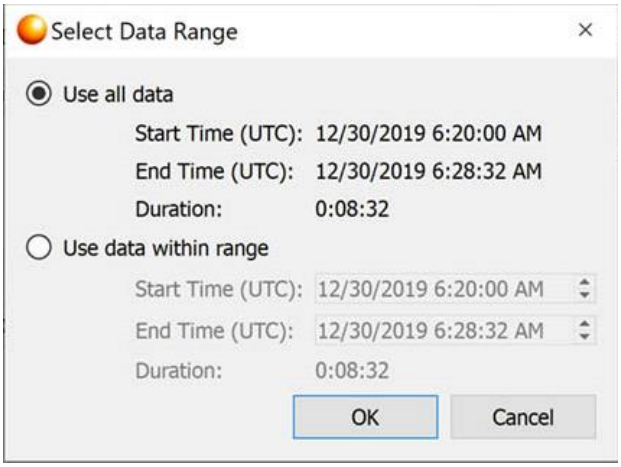


Check the boxes next to the channel(s) you would like to see in this CSV file in particular. Then click “ok”

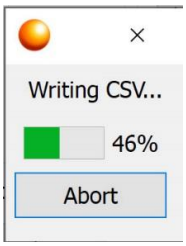
You will then see the loading progress bar:



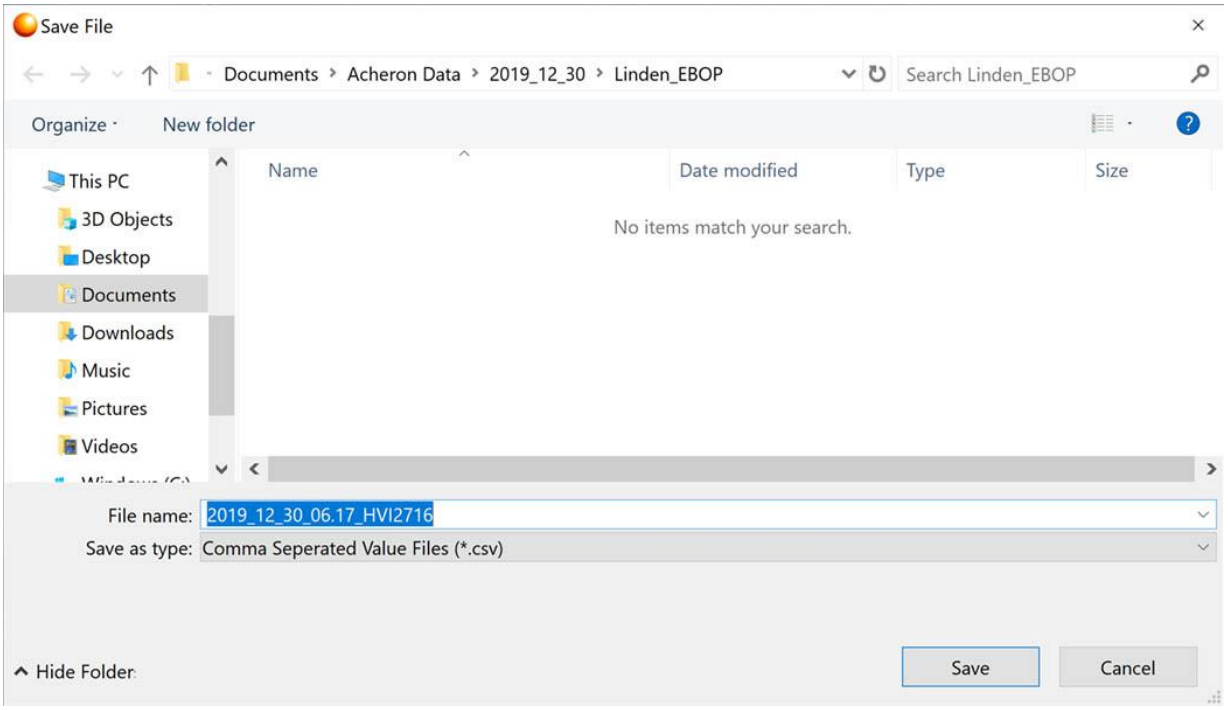
7. The next window will prompt you to choose whether you want to export the entire file or a certain time range. Times are in UTC.



Click ok, and a CSV file will be generated.



8. When the file is finished loading a dialog will prompt you to choose a filename and save location:



Type a name, choose a save location, then click “Save.”

Your file will save to your desired location.