Bird Power Viewer

Quick Start Guide v1.2.x.x

1. Introduction

The Bird Power Viewer is a Windows application that provides a user interface for configuring, acquiring, and viewing measurements from Bird Pulse Sensors.

The application is compatible with Windows 10 and 11 systems with NI VISA 19.0 or later installed. The application implements the following features:

- Works with Bird Model 7024 family USBMTC and Ethernet Pulse Sensors.
    - Includes 7024, 7025, 7027, 7036, 7037 models. See the manual for a list of all supported models.
- Displays model, serial number, and other information about the selected sensor.
- Enables full control of all the configuration settings of the selected sensor.
- Displays any user selected subset of the scalar measurements available in the selected sensor.
- Displays Time Domain Power Waveforms of the signal passing through the selected sensor.
    - Provides 4 data markers for precise time and power measurements on the plot.
- Optionally logs scalar measurements to a CSV file at a user selected rate.

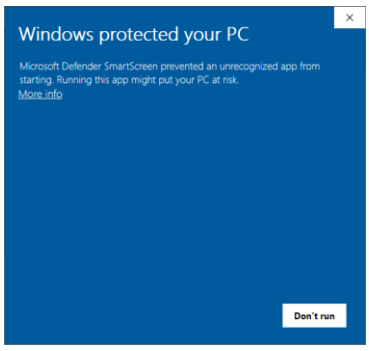
This document is intended for use with version 1.2.x.x of the Bird Power Viewer application.

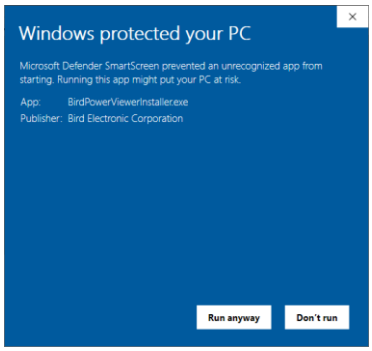
2. Installation

The Bird Power Viewer is compatible with 64 bit versions of Windows 10 & Windows 11 with National Instruments version 19 or later installed.

To install the Bird Power Viewer run BirdPowerViewerInstaller.exe and follow the prompts to complete the installation.

- *Note*: The installer is digitally signed, but you may still see a Windows Defender SmartScreen warning since this is a new Application and the SmartScreen algorithm has not encountered it enough times to accumulate data on it. If you see this warning, click the "***More Info***" link, and then the "***Run Anyway***" button.





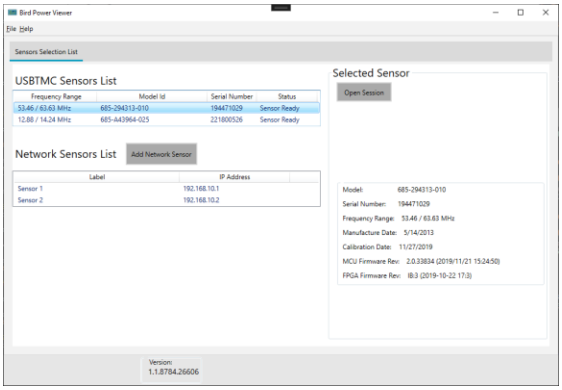
3. Using the Bird Power Viewer

To use the Bird Power Viewer to make measurements, follow these steps:

3.1. Run the BPV by double clicking the desktop icon or by typing BirdPowerViewer.exe in the Windows Search box.

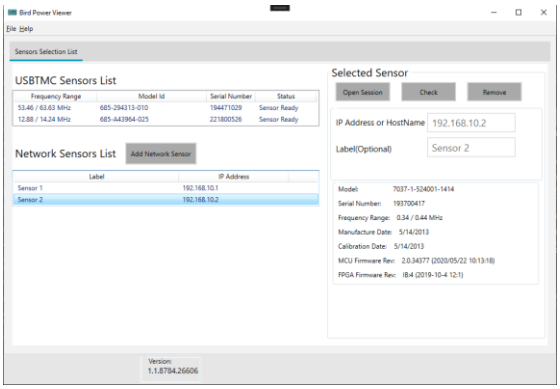
3.2. To Make Measurements using a USBTMC sensor:

- Connect one or more USBTMC Sensors to the same Windows machine running the BPV.
- The sensors will be automatically detected and displayed in the *Sensor Selection View* automatically.
- Wait for the sensor status to show *Sensor Ready.*
- To See information about the sensor, *select* it in the list.
- To start a session using the sensor, *click* the ***Open Session*** button in the sensor information panel on the right or *double click* the sensor in the sensors list on the left.



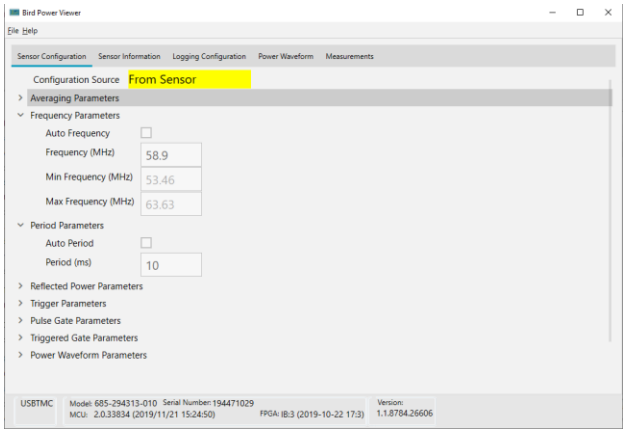
3.3. To Make Measurements using a Network sensor:

- Connect one or more Network sensors to a network that is accessible to the Windows machine running the BPV.
- Click the ***Add Network Sensors*** button:
  - Enter a valid *IP Address* for the sensor.
  - Enter a descriptive *label* for the sensor (this is optional).
  - Click the ***Check*** button to verify that the sensor can be reached using the configured network parameters.
  - Click the ***Save*** button to add the sensor to the Network Sensors list.
    - The BPV will retain this list when you exit and restart the application.
- To See information about the sensor, *Select* it in the list and click the ***Check*** button.
- To start a session using the sensor, click the ***Open Session*** button in the sensor information panel on the right or *double click* the sensor in the sensors list on the left.



3.4. Click the ***Sensor Configuration*** tab to configure the sensor for a specific measurement scenario.

- See the Manual for more detailed guidelines for configuring a pulse sensor for various measurement scenarios.



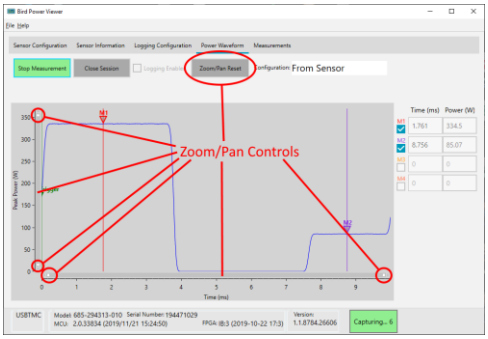
3.5. *Click* the ***Logging Configuration*** Tab to configure logging as desired.

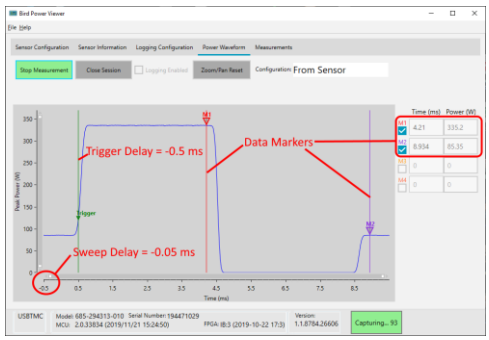
3.6. *Click* the ***Measurements*** tab.

- *Click* the ***Select Measurements*** button and choose the scalar measurements you want to see on the display from the drop down list.
- *Drag* the ***measurement tiles*** to reorder them as you wish.
- *Enable* or *Disable* Logging as you wish.
- *Click* the ***Start Measurement*** button to begin the measurement stream.

3.7. *Click* the ***Power Waveform*** tab to see the power waveform plots.

- *Enable* one or more data markers to read precise values on the waveform plot.
- *Drag* the ***zoom/pan*** controls to explore details of the plot.





4. Sensor Configuration

4.1. The table at the end of this Quick Start guide for a list of all the configuration parameters with descriptions and limits.

4.2. Principals/Guidelines

These are some general guidelines for working with the Configuration Settings of Pulse Sensors to get useful measurement results.

- If you are making measurements on a signal that varies in frequency over time (for example from a frequency agile generator), turn Auto Frequency off and set the frequency to the center frequency of your signal's range. Note that if the actual frequency differs from the one you set, the accuracy of the power measurement is reduced.
    - Bird Pulse Sensors cannot reliably measure frequency when the frequency is shifting, so using a fixed frequency in the center of the expected range will yield the best results from the sensor.
- For Power Waveform Measurements:
    - If you configure a specific sweep time, set the sweep time <= 2 x the period. If Sweep time > Period, the sensor may deliver waveform frames with varying sweep time. Since the waveform plot auto selects the time scale based on the content of the waveform, the plot will not be stable in this case.
- For pulsed signals with more than 2 states (multi state pulses):
    - Do not use auto period and sweep time. These features were designed for 2 state pulses and will yield unpredictable results for pulses with more than 2 states. Instead use the manual period and manual sweep time parameter to set the period and sweep time to the expected values.
    - Do not use the standard pulse measurements in the sensor (period, repetition rate, width, and duty cycle). These are designed for simple 2 state pulses and will yield unpredictable results for pulses with more than 2 states.
        - You can turn these off using the Measurement Selection button on the Measurements view.
    - When configuring the triggered gates for measuring power in specific states of a pulse, follow these guidelines for the begin and end delay parameters for the states for best results:
        - The end time of each state should be greater than the begin time.
        - The total span of all the states (begin time of the first state to the end time of the last state) should be less than or equal to the period.

- Finally note that all gate times are calculated from the gate reference point on the power waveform.
    - The gate reference point is offset from the trigger point by the trigger delay.
    - The trigger point will always be at T=0 on the waveform plot.
    - Note that T=0 may not be at the left edge of the plot. This point will move right or left based on the sweep delay time.
    - Negative sweep delays will move T=0 to the right. Positive sweep delay times will move T=0 to the left.

5. **Questionable Measurement Status:**
   Bird pulse sensors are designed to make precision measurements on pulsed RF signals within the designed bandwidth and power limits of the model sensor you are using. If the signal passing through the sensors is outside these limits, the sensor may not be able to make a specific measurement or the measurement accuracy may be degraded. Under these conditions, the BPV will display one of two questionable measurement icons next to the measurement to indicate this condition.
    - The  icon indicates that the sensor is unable to make the specific measurement. If you see this icon with a measurement value, it indicates that the value is stale (made in past).
    - The  icon indicates that the measurement accuracy is degraded. This may occur if sensor is unable to measure the frequency (perhaps due to a noisy or very small signal) or if the measured frequency is outside the calibrated range of the sensor.

Sensor Configuration Parameters

Note that the limits shown here will work for a wide range of pulse sensor models, but some models will accept values beyond the limits listed here. See the manual for a list of models with specific limits.

Parameter Name	Writable	Min	Max	
Averaging Parameters				
Enabled	Yes	0	1	Enables an exponential moving average of the following parameters over all acquired pulses over multiple measurements: • Pulse Power • Pulse Width • Pulse Period • Pulse Duty Cycle • Pulse Repetition Rate • Gate *n* Power
Count	Yes	1	2^31-1	Sets the value of "k" in the exponential moving average: $\overline{X}_i = \frac{x_i}{k} + \frac{(k-1)\overline{X}_{i-1}}{k}$
Frequency Parameters				The Bird Pulse sensors are calibrated over a specified frequency band. The Frequency Parameter configures how the sensor determines what frequency to use when applying the calibration to measurements.
Auto Frequency	Yes	0	1	Enables/Disables auto frequency detection in the sensor. If auto frequency is on, the sensor attempts to measure the frequency of the signal and uses this measured frequency to look up calibration coefficients.
Frequency (MHz)	Yes	min	max	Applies if Auto Frequency is off. If auto frequency is off, the sensor uses this frequency to look up calibration coefficients. Must be between min and max frequency for the specific sensor model. The min and max are displayed in the configuration view for reference.
Max Frequency (MHz)	No	N/A	N/A	Read from the sensor. The accuracy of the sensor is not guaranteed above this frequency.

Min Frequency (MHz)	No	N/A	N/A	Read from the sensor. The accuracy of the sensor is not guaranteed below this frequency.
Period Parameters				The Bird Pulse sensors attempt to measure several fundamental pulse parameters in each measurement frame. All of these depend first on determining the period of the pulsed signal. The sensor can be configured to do this automatically, or the user may tell the sensor what period to use.
Auto Period	Yes	0	1	Enables/Disables auto pulse period measurement in the sensor. If auto period is on, the sensor attempts to determine the period using an iterative algorithm on a captured sample buffer. All other pulse measurements (repetition rate, width, & duty cycle) depend on this measurement of the period.
Period (ms)	Yes	0.2	10	Applies if Auto Period is off. If auto period is off, the sensor uses this period value and proceeds with the rest of the pulse measurements accordingly. If the period is known, using this option will yield faster measurements in the sensor. Note that the limits are sensor models specific, the limits shown here cover nearly all the production models. A few models will work with limits beyond this range. Specific model information will be added in the next version of this document.
Reflected Power Parameters				
Enabled	Yes	0	1	Enables reflected power measurements in the sensor. If this is off, the sensor will not make any measurements of the reflected power. This may yield faster measurements for use cases where speed is most important.
Trigger Parameters	Yes			Power Waveform framing in the pulse sensors depends on a trigger event. The sensor can be configured to accept an

				external trigger (a TTL pulse) or to generate an internal trigger based on edge detection in the captured sample buffer. Subsequent waveform processing and triggered gate measurements proceed from this trigger event.
Source (INT/EXT)	Yes	INT	EXT	Sets the trigger source to external or internal.
Slope (POS/NEG)	Yes	NEG	POS	Sets the polarity of the trigger event for both external and internal triggers. NEG means the sensor will look for a falling edge, POS means the sensor will look for a rising edge.
Auto Level	Yes	0	1	Enables/Disables auto trigger level detection for the internal trigger algorithm. If auto trigger level is on, the sensor will set the trigger level midway between the min and max samples in the buffer.
Level (W)	Yes	0	Max P	Desired trigger level in Watts. Applies if Auto Trigger Level is off. If auto trigger level is off, the sensor looks for the signal to cross this level (either rising or falling depending on the slope setting). The max trigger level should be set below the max power for the sensor (see the sensor specs for this value).
Delay (ms)	Yes	-Max Pd	+Max Pd	Trigger delay. Shifts the trigger point to the left or right of the relevant edge. The trigger delay is sensor model specific. The limits shown (+/- the period) will work for most sensors. Specific model information will be added in the next version of this document.
Power Waveform Parameters				The pulse sensor is able to capture Power Waveform data in the time domain. The Sweep Parameters control the details of the Power Waveform acquisition.
Sweep Delay (ms)	Yes	-Max Pd	+Max Pd	Sweep delay shifts the start of the Power Waveform relative to the trigger

				event. The limits shown (+/- the period) will work for most sensors.
Auto Sweep Time	Yes	off	on	Enables/Disables Auto Sweep Time for the Power Waveform measurement. When this is enabled, the sensor will automatically determine the time frame captured for this measurement. Auto sweep time works best for simple two state pulsed signals, and does not work reliably for pulsed signals with more than 2 states or for CW signals.
Sweep Time (ms)	Yes	0.1	2 x Pd	When Auto Sweep Time is off, the Sweep time parameter establishes a maximum time frame for the Power Waveform acquisition. The time returned will be less than or equal to this number. The min sweep time is sensor specific. The listed min time of 0.1 ms will work for all sensor models. Specific model information will be added in the next version of this document.
Auto Sweep Periods	Yes	0	100	When Auto Sweep Time is on, this parameter tells the sensor how many periods to try to include in the Power Waveform.
Max Samples	Yes	16	4096	Max Samples sets a limitfor the number of samples to include in the Power Waveform. The actual number of samples will typically be less than this number since the achievable sample rates are restricted by the fundamental ADC sample rate in the sensor and the resampling math used to construct the Waveform dataset.
Pulse Gate Parameters				Pulse Gate Parameters control the behavior of the automatic gated pulse measurements in the Pulse Sensors. These measurements are designed for use with simple 2 state pulses, and should not be used for pulsed signals with more than 2 states.

Begin Level Low (%)	Yes	0	50	The low threshold level for the leading edge of the pulse (% of the total power span). The power must cross this level from low to high to qualify as a leading edge candidate.
Begin Level High (%)	Yes	50	100	The high threshold level for the leading edge of the pulse (% of the total power span). The power must cross this level from low to high to complete the detection of the leading edge.
Begin Delay (ms)	Yes	0	0.9	The left edge of the pulse gate measured from the leading edge (a positive number).
End Level Low (%)	Yes	0	50	The low threshold level for the trailing edge of the pulse (% of the total power span). The power must cross this level from high to low to complete the detection of the trailing edge.
End Level High (%)	Yes	50	100	The Hi threshold level for the trailing edge of the pulse (% of the total power span). The power must cross this level from high to low to qualify as a trailing edge candidate.
End Delay (ms)	Yes	-0.9	0	The right edge of the measurement gate measured from the trailing edge (a negative number)
Triggered Gate Parameters				Triggered Gate Parameters control the behavior of up to four triggered gate states in a multi state pulse. The Pulse Sensor will calculate the mean, min, and max power for each enabled state. Note that Begin/End times for triggered gates are set relative to the sync point of the sweep. The combined width of all the states should be less than the period specified for the sweep.
Per State (up to 4 states)				
Enabled	Yes	off	on	Enables or disables measurements for this state.
Begin (ms)	Yes	*	*	Sets the left edge of the state relative to the sync point. Limits depend on the number and width of all the enabled states and on the programmed period.

				See the notes on configuring states for the criteria to follow.
End (ms)	Yes	*	*	Sets the right edge of the state relative to the sync point. Limits depend on the number and width of all the enabled states and on the programmed period. See the notes on configuring states for the criteria to follow.