Newflow

Portable
“JitterScope”™
&
Signal Generator

Operating Manual

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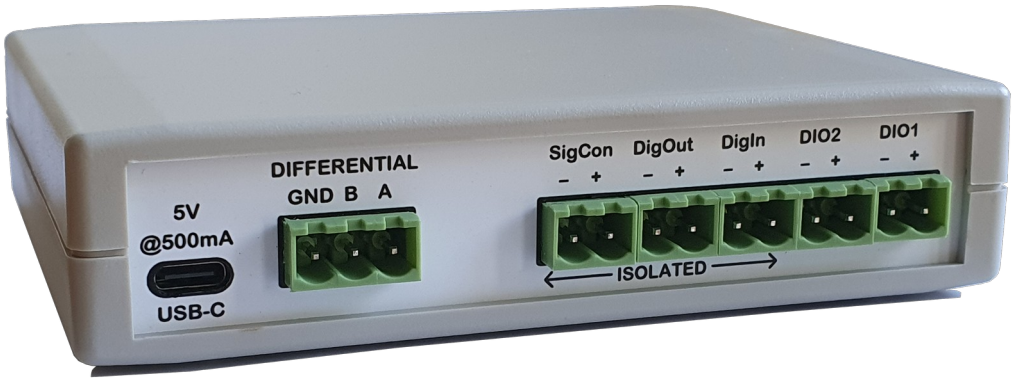
Front View

Rear Connector View



JitterScope™ Display

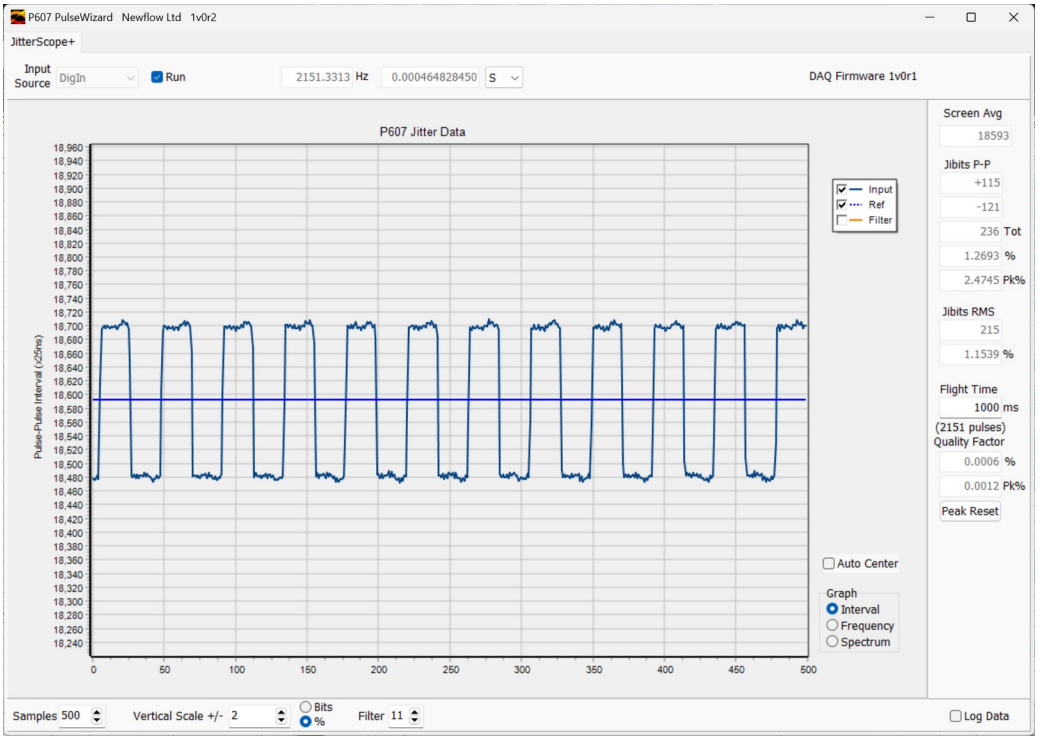


Table of Contents

1 Introduction

The Portable JitterScope system comprises of a small data acquisition unit, the DAQ Module and a Windows Program, which displays and logs the information from the acquisition unit.

The DAQ Module accurately times the rising edge of every single pulse on the selected input channel. This information is transmitted continuously to the PC over the USB connection, which also provides the power for the data acquisition unit.

The JitterScope is a visualization tool to view the inter-pulse timing on repetitive pulses in the range of 1Hz to 20KHz, with exceptionally high resolution and can be used to identify very small variations in frequency caused by noise, digital processing and modulation effects. The input signal can be viewed as a frequency, a pulse interval or a spectrum and the acquired data can be stored for future analysis.

1.1 Installing the Portable JitterScope program

The Portable JitterScope program, P607(x.y.z).exe does NOT require installation.

It is a standalone executable that does not need any supporting files (such as DLLs), it just runs in place like a portable application. It can be run from a USB drive, or the file can be copied to a PC.

1.2 Plugging in the Portable JitterScope DAQ Module

Before launching the JitterScope Windows program, it is recommended that the Portable JitterScope DAQ Module is plugged in first. Windows may play the Device connected sound and immediately afterwards the device disconnected sound. The JitterScope DAQ Module starts as a HID device to allow the Newflow BootLoader program to take control and three seconds later, becomes a USB serial comms device

1.3 (Very) Quick Guide

After plugging in the DAQ Module and launching the JitterScope Windows program

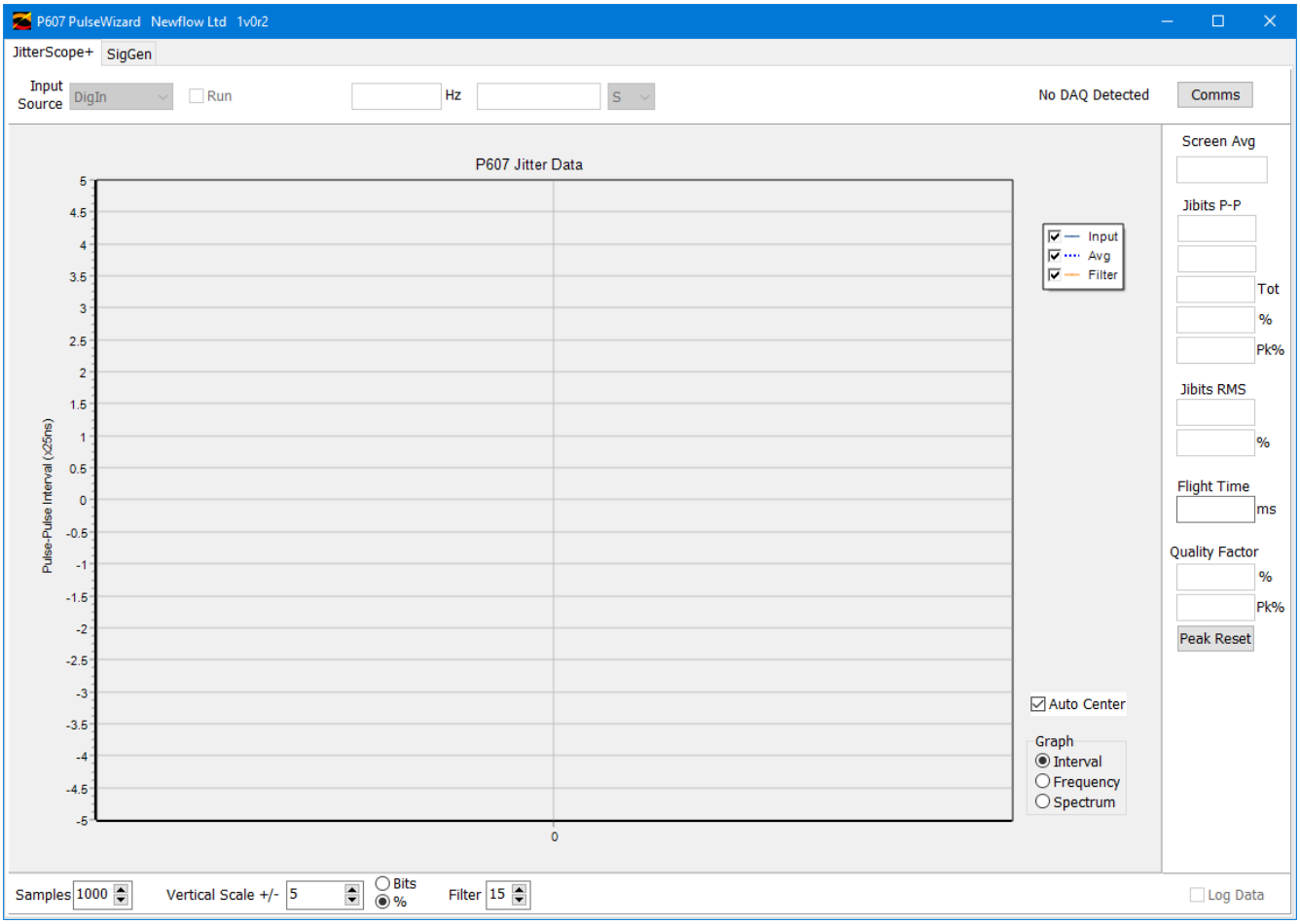
- Click the Comms button and select the appropriate Port. The other fields are not used.
- Go to the Input Source pull-down selection, and chose which input to displayed
- Click the Run tick-box to start the Data Acquisition
- Adjust the resolution controls (Vertical Scale & Bits/%) to view the data
- Check the Input Frequency or Period is as expected

You are now ready to investigate repetitive signals with a unique tool.

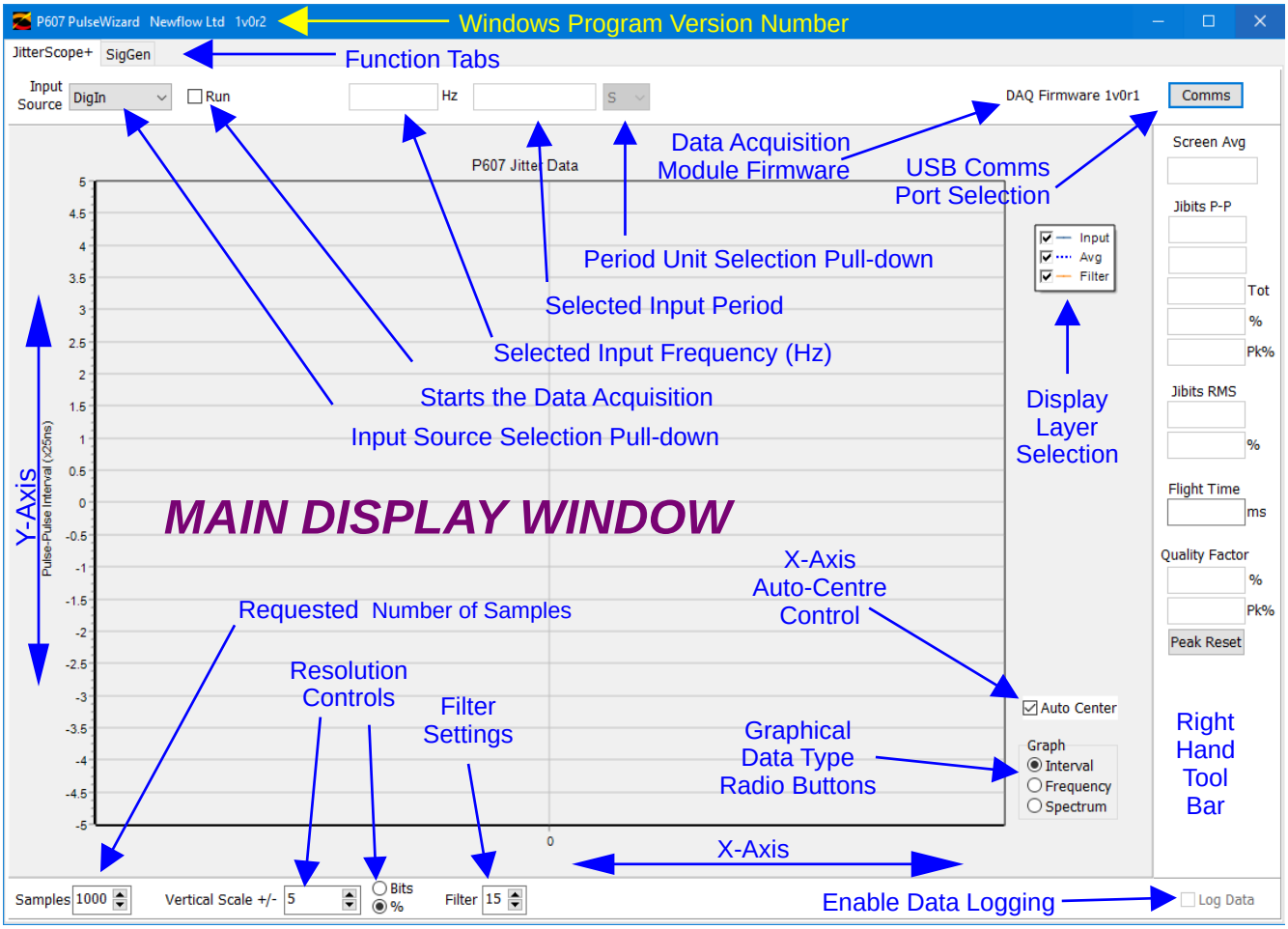
1.4 Launching the JitterScope program

Before launching the program, it is recommended that the Portable JitterScope DAQ Module is plugged in five seconds beforehand, and then the previously selected comms port will be automatically selected.

To launch the JitterScope program, simply double click on the executable or make a link to the executable, pin it to the task bar or start menu and select it. Shown below is the initial screen.



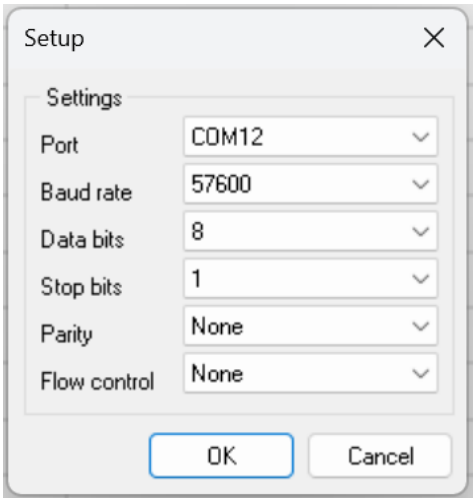
1.5 JitterScope Screen Elements, Main Window



The various screen elements are explained in detail below.

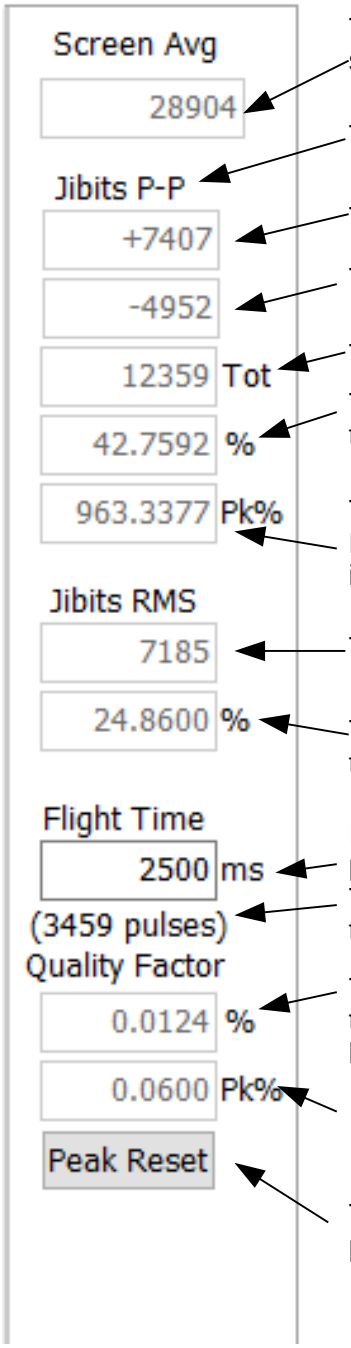
The Right Hand Tool Bar is explained here: Section1.5. JitterScope Screen Elements, Right Hand Toolbar

Windows Program Version Number	The V1.0.0 field following the program name shows the version number of Windows JitterScope program
Function Tabs	The Tabs access additional features available with the DAQ Module
Input Source Selection	The pull down allows the user to choose which input source on the Data Acquisition unit to use. The Choices are SigCon (Signal Conditioner), DigIn (Opto Input) or Differential.
Selected Input Frequency	This field shows the average frequency of all the displayed pulses in Hertz, and is updated around 10 times per second.
Selected Input Period	This field shows the average period between consecutive pulses averaged across all the displayed sample points and is updated around 10 times per second
Period Unit selection	The pull-down allows the selection of seconds (s) milli-seconds (ms) or micro-seconds (us) units for the displayed period

Run	The run tick box commands the DAQ module to stream data to the PC. Once the DAQ module is streaming data to the PC, alternative functions for the DAQ Module are suppressed.
DAQ Module Firmware	Once the correct Comms Port has been selected, this area will show the firmware version running in the DAQ module. If a DAQ is not connected, it will show “No Device Detected”
USB Comms Port Selection	Clicking the Comms box, opens a standard Communications Dialog  The port must be set to match the port number allocated by Windows for the DAQ module. Selecting the Port pull-down will only show the serial ports available to windows. If there are a number of serial ports listed, Microsoft Device manager can be used to identify the DAQ port. All the other parameters are ignored, as the DAC Module is communicating using USB CDC protocol.
Requested Number of samples	This value determines how many data points are displayed within the main window. The number of requested points can be set from 10 up to 3000. Up & Down spin buttons are provided for small changes, but the value can also be typed into the edit box for larger changes.

Resolution Controls	Understanding the resolution control is most important to get the best out of the JitterScope. In Frequency and Interval mode, the resolution controls determines the vertical (Y) axis scaling. In Spectrum mode, the resolution controls determines the horizontal (X) axis scaling In Frequency mode, the two radio buttons allow the scaling of the Y axis to be set either as a percentage of the average frequency or as Hertz (Hz). In Interval mode, the two radio buttons allow the scaling of the Y axis to be set either as a percentage of the average interval or as a number of 25nSec bits. In Spectrum Mode, the X axis scaling is either as a percentage of the average frequency or as Hertz. In percentage mode, the spin buttons allow a percentage between 1% and 100% to be selected although a larger value can be typed in. In Frequency mode, the Hz setting can be any value above 10. In Interval mode, the Bits setting can be any value above 10.
Filter Settings	This selects the number of samples used in the rolling average, displayed in the Display Layer Selection dialog as “Filter”.
Graphical Data Type	The Main Display Window can display the data in three different ways, according the radio button selection made. The three choices are Interval, Frequency and Histogram. If Frequency mode is selected, the vertical (Y) axis will be in terms of Hz. In Interval mode, the vertical (Y) axis shows the interval between one pulse and the next pulse in 25ns units. If Spectrum mode is displayed, the vertical (Y) axis shows a histogram on a logarithmic scale of number of samples that fit into each frequency band.
X-Axis Auto-Centre Control	If the box is ticked, the Interval Average is used as the center point for the Vertical Y-Axis. When un-ticked, the previous centre point is used until the box is again ticked. This is useful for visualizing slowly changing frequencies.
Display Layer Selection	The Display Layer Selection shows a tick box associated with 3 layers that can be shown in the Main Display Window area. These are Input, Avg and Filter. Input displays the data from the selected source. Avg will show a horizontal straight line indicating the average over all of the samples currently displayed. Filter shows a weighted average, with the number of selected points
Enable Data Logging	Clicking the Log Data check box stores the timing data to the PC, in the same directory that the Windows program was launched from. The data is stored as a single column CSV formatted file and give a name with the PC Date & Time. Clicking the check box again, stops the logging and the file is closed.
Right Hand Toolbar	The right hand toolbar complements the Main Display Window by providing some numerical data, see the explanations below.

1.6 JitterScope Screen Elements, Right Hand Toolbar



This box shows the average pulse to pulse interval for all the samples displayed as the number of 25ns bits

The boxes below show the peak Jitter Bits (Jibits) values

This box shows the peak positive Jibits from the sample average

This box shows the peak negative Jibits from the sample average

This box shows the peak to peak total Jibits from the sample

This box shows the peak to peak total Jibits as a percentage of the sample average. So 12359/28904 as a % in this example

This box shows the maximum percentage of Jibits since the Peak Reset button (below) was clicked. A huge number indicates a large change in frequency

This box shows the jitter as an RMS average of Jibits

This box shows the RMS averaged Jibits as a percentage of the sample average.

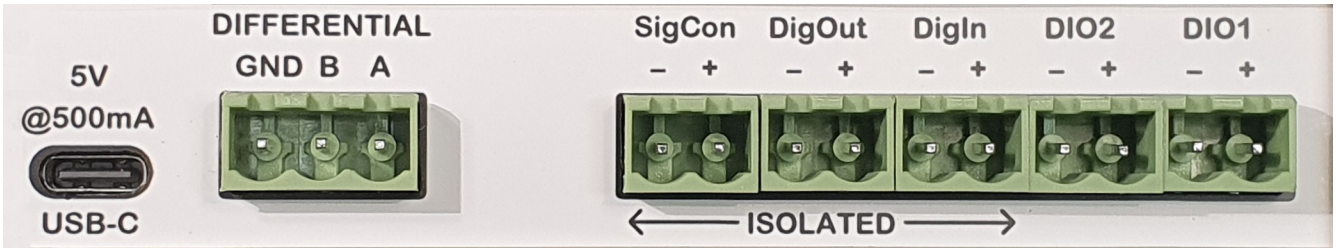
In order to calculate the JitterScope proving Quality Factor, the proving Flight Time must be entered into this box.
The line below then shows the number of pulse between the detector switches

This box shows the prover Quality Factor, which can be used to determine if the pulse stream being fed to the prover has a low enough jitter to prove successfully

This box shows the maximum Quality Factor since the Peak Reset button (below) was clicked.

The Peak Reset button clears both the maximum peak to peak percentage value and the maximum Quality Factor value

2 JitterScope DAQ Module Connections



The rear panel of the DAQ Module has a USB-C port, a three-way 5mm connector block and five two-way connector blocks.

The 3-way is a bi-directional differential I/O. In JitterScope mode this is the differential Input. It expects a 2V to 5V signal level. The I/O is not isolated, and the ground connection should be connected to the ground of the device being analyzed to maintain the signals within the common-mode range to obtain the best results.

In SigGen (Signal Generator) Mode this is a differential output, and is compatible with the Newflow NÅNO Raw Pulse Bus, See Section 7 - Precision Signal Generator

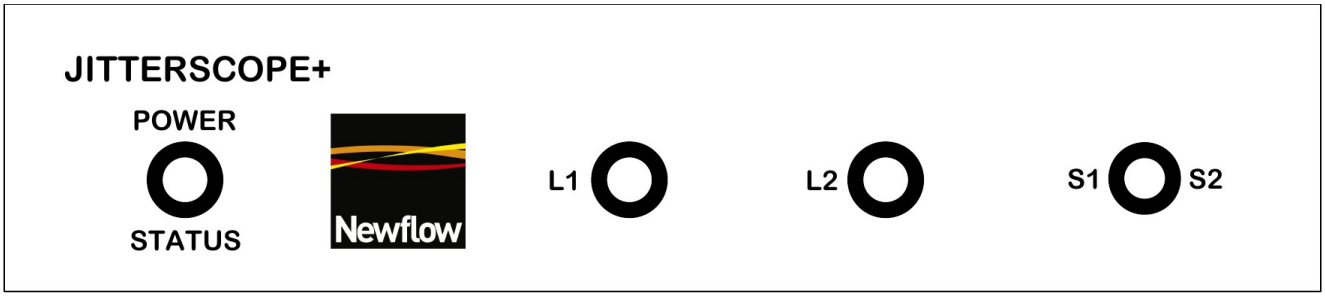
The SigCon input is a high impedance, isolated signal conditioner input. When using the JitterScope function, this input is ideal for connecting to existing systems as it provides very little signal loading (the input impedance is more than 15 KΩ) and will have a negligible effect on the system it is connected to. It can accept any input voltage from 500mV up to 24 Volts.

The Isolated Digital Output, DigOut is not used in JitterScope mode.

The Isolated Digital Input DigIn is the same as a typical flow computer meter input. It is optically isolated and expects a signal of 5V to 24 Volts.

DIO2 and DIO1 are programmable digital inputs or outputs. They are not used in JitterScope mode, but they are used in SigGen (Signal Generator) Mode. See Section 7 - Precision Signal Generator

3 JitterScope DAQ Module Front Panel



The JitterScope DAQ Module front panel has three LEDs and a three position switch

The Power/Status LED is a blue LED and will always be on or flashing when the DAQ Module is powered via the USB-C connector.

LEDs L1 and L2 are two color PWM driven LEDs so can show how the unit is configured.

3.1 LEDs in JitterScope Mode

L1	L2	Meaning
Solid RED	OFF	DigIn Input selected as the source, but no input signal detected.
Flashing GREEN	OFF	DigIn Input selected as the source and an input signal is detected
OFF	Solid RED	Signal Conditioner Input selected as the source, but no input signal detected
OFF	Flashing GREEN	Signal Conditioner Input selected as the source, input signal is detected
Solid RED	Solid RED	Differential Input selected as the source, but no input signal detected
Flashing GREEN alternately	Flashing GREEN alternately	Differential Input selected as the source and an input signal is detected

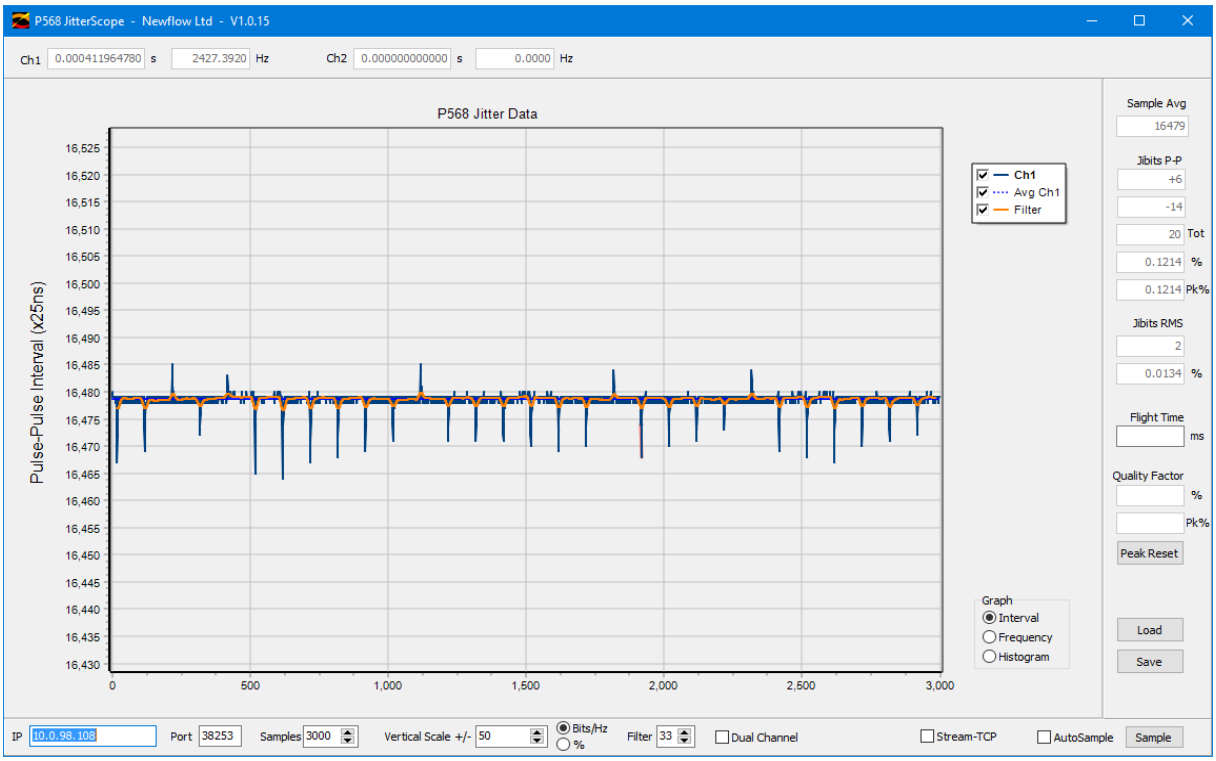
The toggle switch has three positions. It can stay in the Center position or S1 position and can be pushed to the S2 position, but it is sprung and will return to the center position.

The switch is not utilized in JitterScope mode.

4 Running the JitterScope

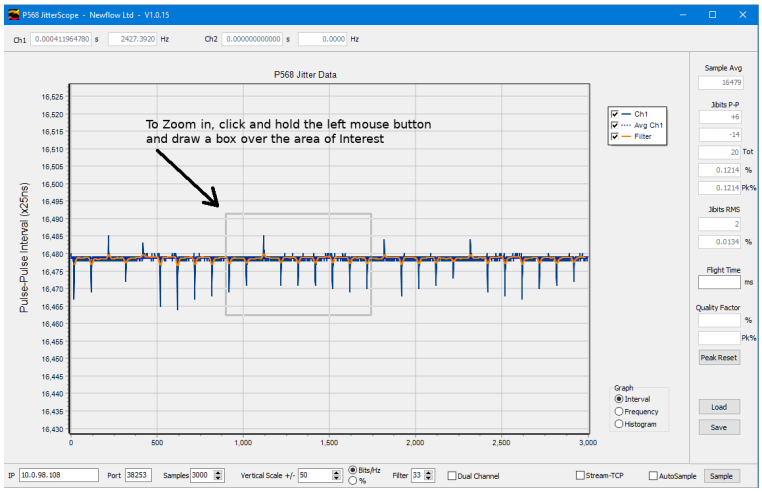
The example screenshot below is from a digitally synthesized frequency generator, showing the typical jitter associated with digital synthesizers.

NOTE: The images are from the P568 JitterScope, but the zoom function works in exactly the same way with the portable JitterScope

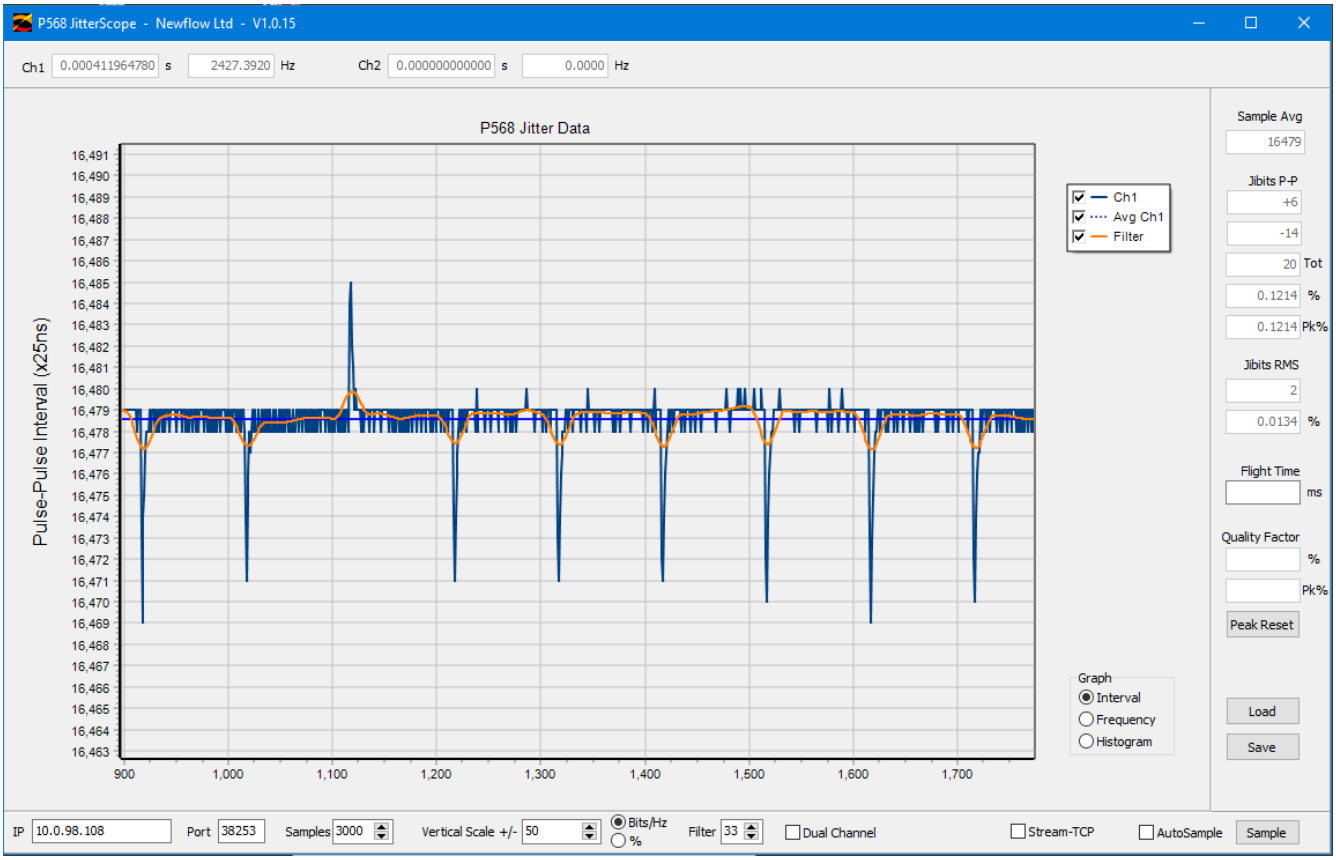


4.1 Zooming in to the Display Window

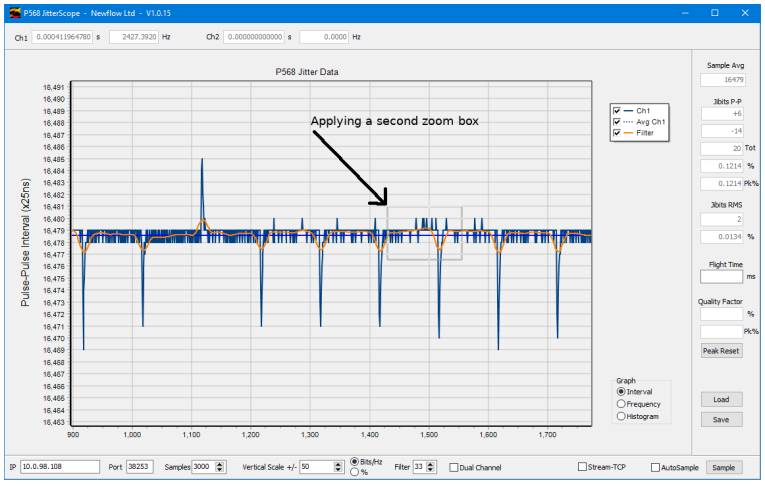
To use the zoom function, un-click the Run tick-box to freeze the display. Zooming is performed by drawing a box over the area of interest by holding down the left mouse button and moving from the left to the right. Then release when the box is the required size. The screenshot below shows how we would zoom into the image on the previous page.



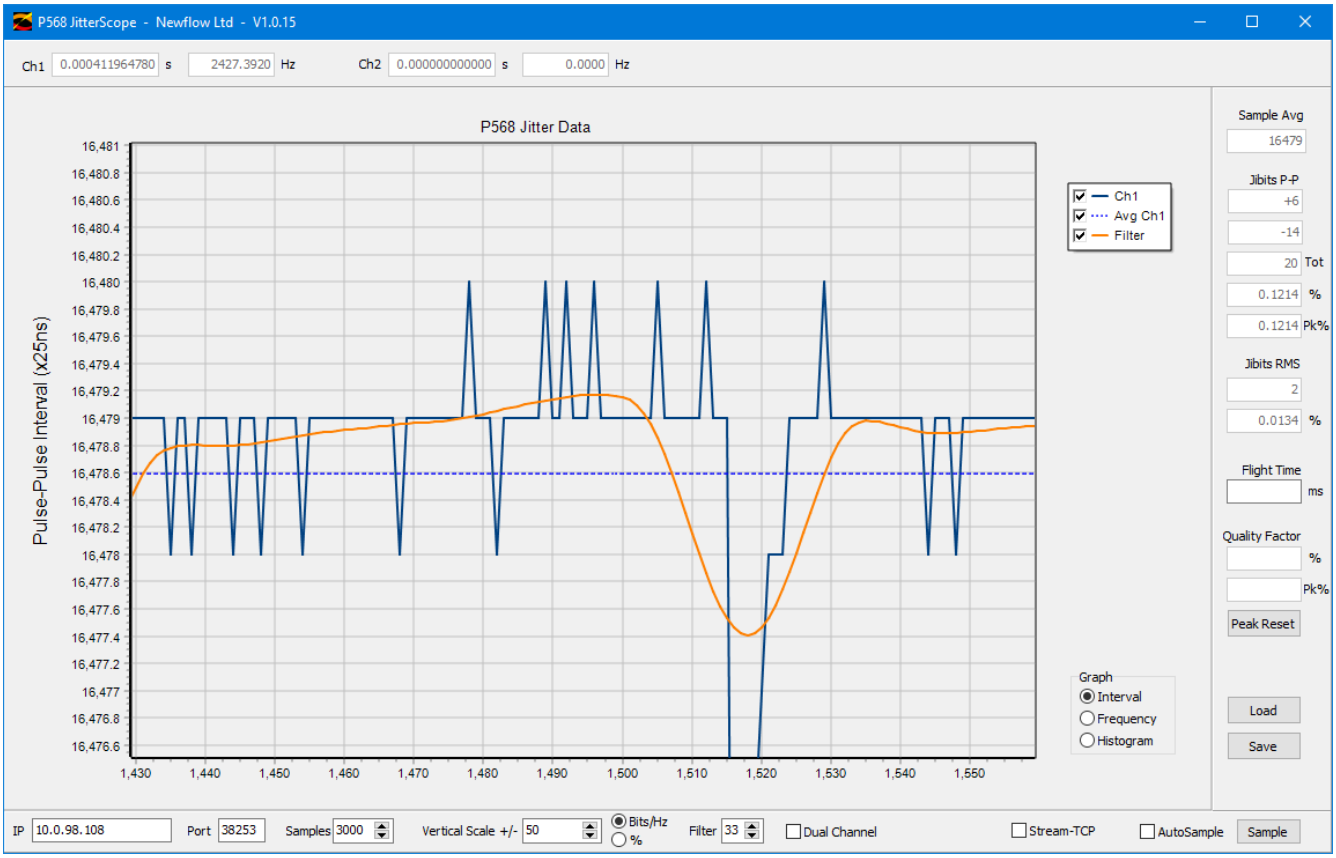
This is the resulting image:-



The zoom is virtually unlimited, so you can zoom in further by repeating the process.



Again the resultant zoomed view:-



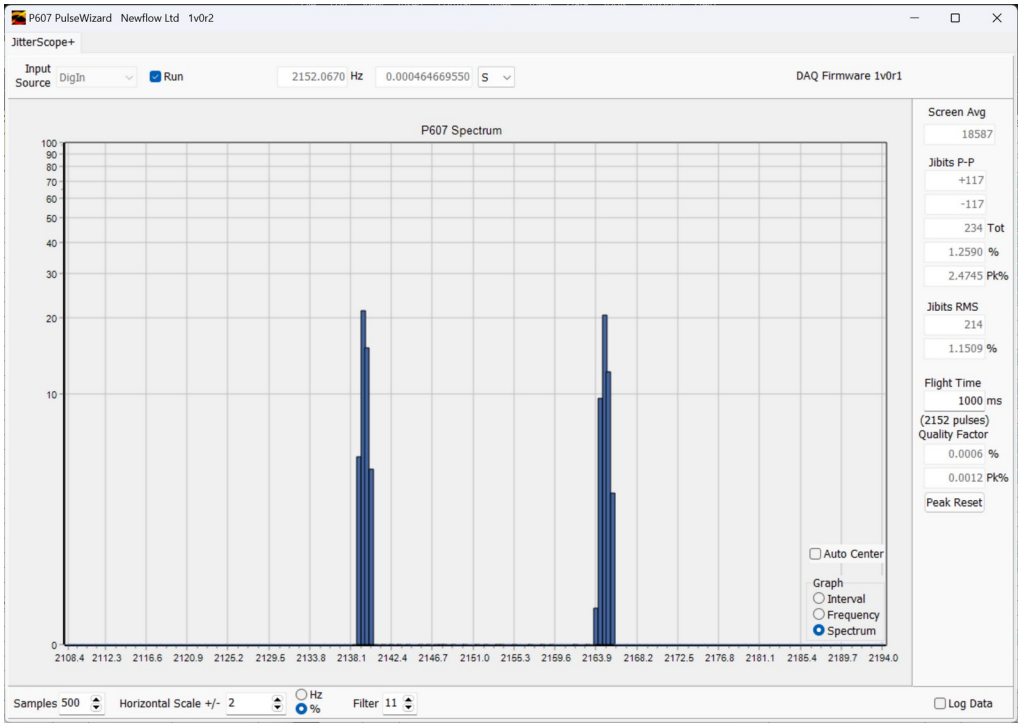
4.2 Zooming out

To zoom out, draw a box of any size but move the mouse in a right to left direction, and the initial view will be restored.

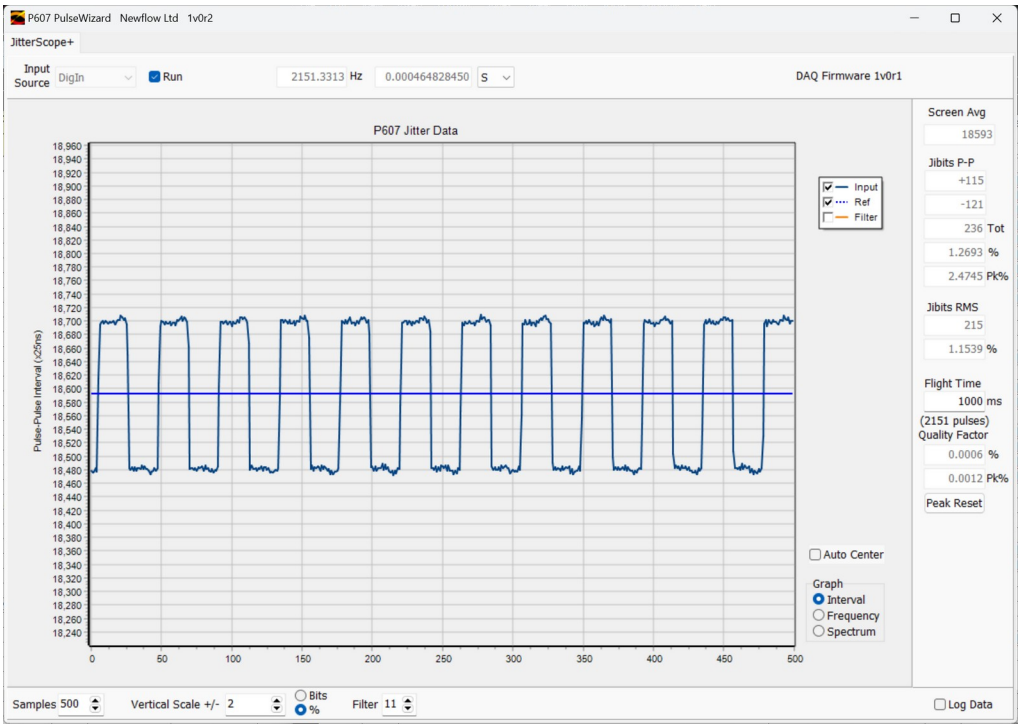
NOTE: When the Run tick box is enabled, the maximum zoom will be automatically restored.

5 Spectrum Displays

If the Data Type is set to Spectrum, a display similar to the screenshot below will be presented. It shows the frequency distribution of the incoming pulses.



The spectrum display shows that there are two discrete frequencies centered around 2138Hz and 2164Hz mixed in the sampled data, and from the interval (or frequency display) this gives a resulting average frequency of 2151.33Hz as shown below.



6 Data Logging

When the Log Data check-box is selected, the data is also saved to the PC storage. The data is saved in the same directory/folder as the JitterScope was launched from.

The file is called DAQ{Date-Time}.CSV

Deselecting the Log Data check-box closes the file

NOTE: The data file can get very large if the JitterScope is left running for long periods with a high input frequency.

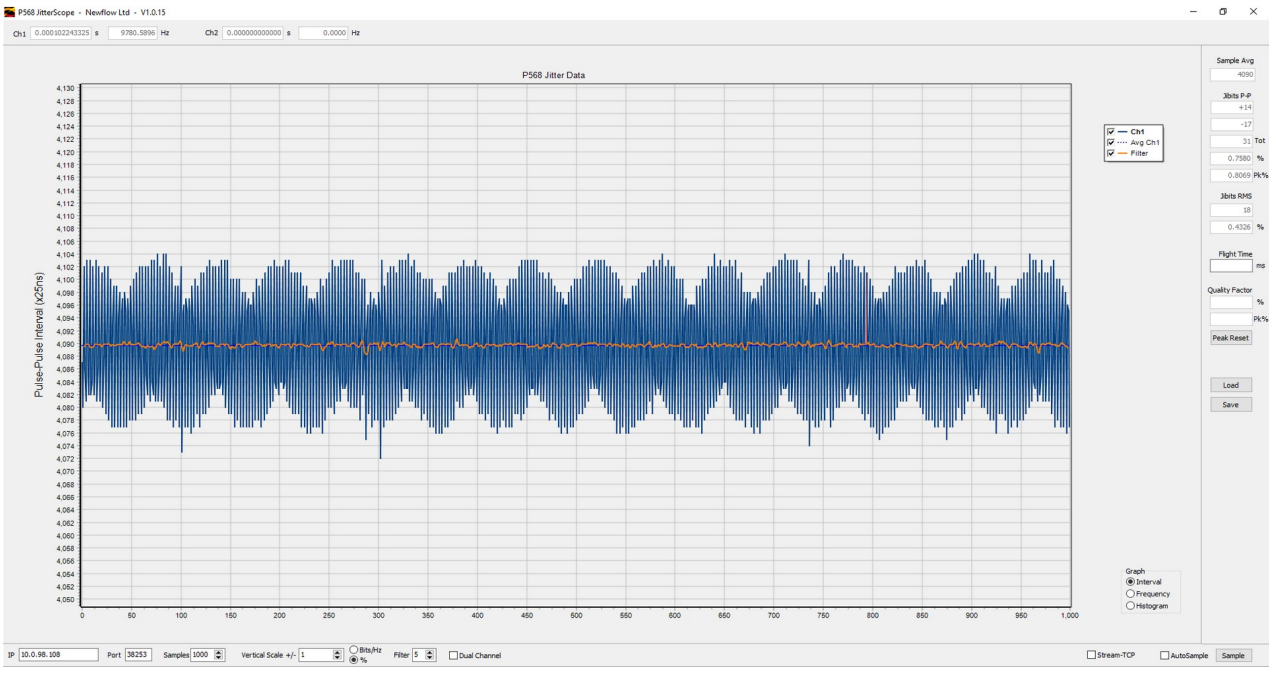
6.1 Importing into a Spreadsheet

The streamed data can be imported in a spreadsheet, such as LibreOffice, OpenOffice or Excel for further analysis and can be then manipulated and/or charted.

As the data is stored a single column, the choice of column deliminator is irrelevant. The first row should be deleted as this is information is not from consecutive pulses.

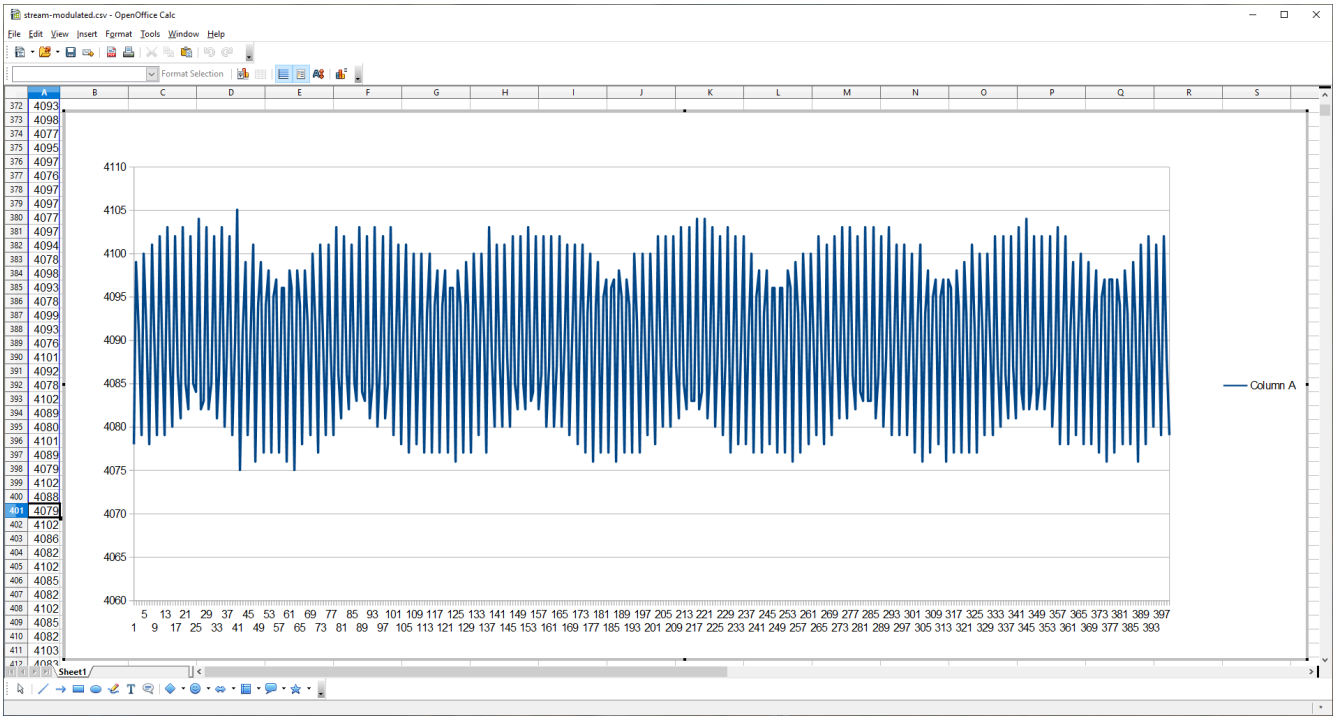
As an example, the JitterScope screenshot on the next page shows the display for a pulse stream which is modulated. Below that is a screenshot of the saved data imported into OpenOffice.

6.1.1 JitterScope View



6.1.2 Spreadsheet Chart

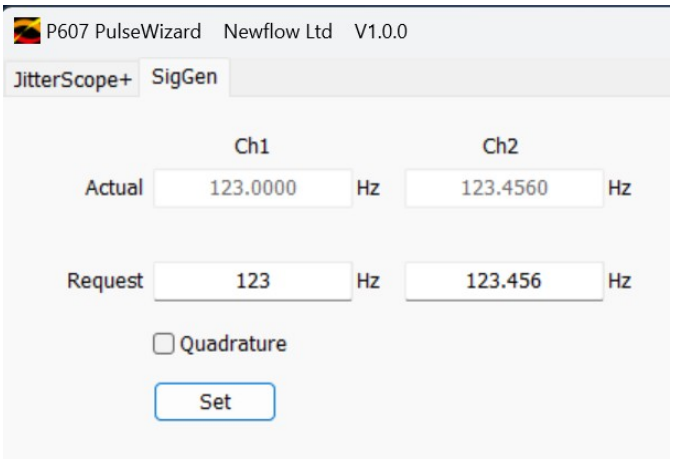
The data that was recorded when the JitterScope display above was made has been imported into OpenOffice and a portion of the data charted.



7 Precision Signal Generator

In SigGen mode, the DAQ Module can produce two highly accurate independent frequencies or a single highly accurate frequency with a quadrature output.

When the Quadrature tick box is not checked, the PC display will look like the screenshot below.



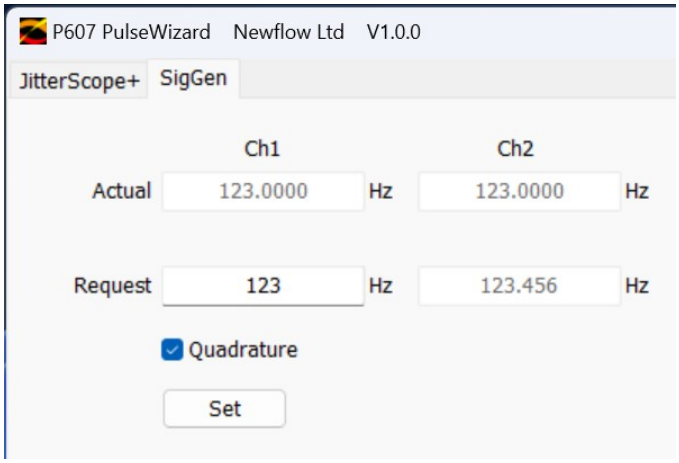
For each channel, type in the desired frequency into the Request field, and click the SET button.

The DAQ Module will calculate the nearest frequency that it can generate, and will populate the Actual field with the frequency being generated. The actual frequency will be within 1ppm of the requested frequency and in many cases, the DAQ module will be able to produce exactly the frequency requested.

The master oscillator is a sub 1ppm TXCO and the average output frequency will be within 1ppm of Actual frequency displayed between 1Hz and 20 KHz.

Channel 1 drives the DIO1 output and the Differential Output.

Channel 2 drives DIO2 output.



If the quadrature box is ticked, the request field for channel 2 (Ch2) is grayed out and only a single frequency can be input.

Channel 1 drives DIO1 output and the Differential Output.

The DIO2 output is the same as DIO1 but with a 90 degree phase shift.

In signal Generator mode, both LEDS L1 & L2 are yellow (mixed Red & Green)

The DIO channels when used as outputs are open-collector outputs with a 12V internal constant current pull-up. If a stronger signal is needed, a 1KΩ pull-up to 24 Volts maximum can be added.

8 Revision History

Rev	Date	Changes	Prepared	Checked	Authorized
R0	27 Aug 24	Original release	MOB	DGS	MPFJ