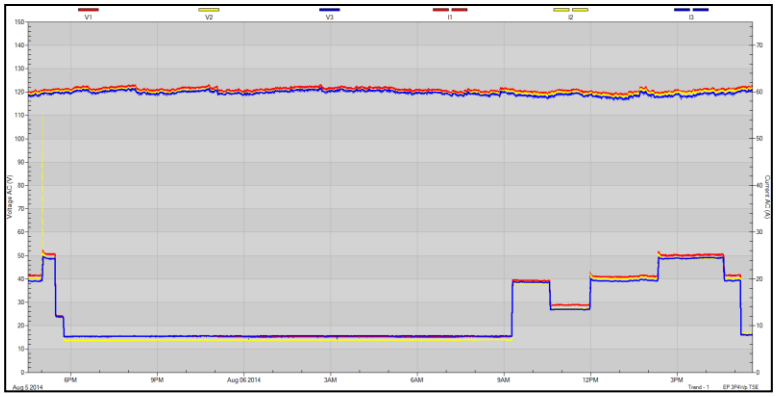
CANDURA instruments

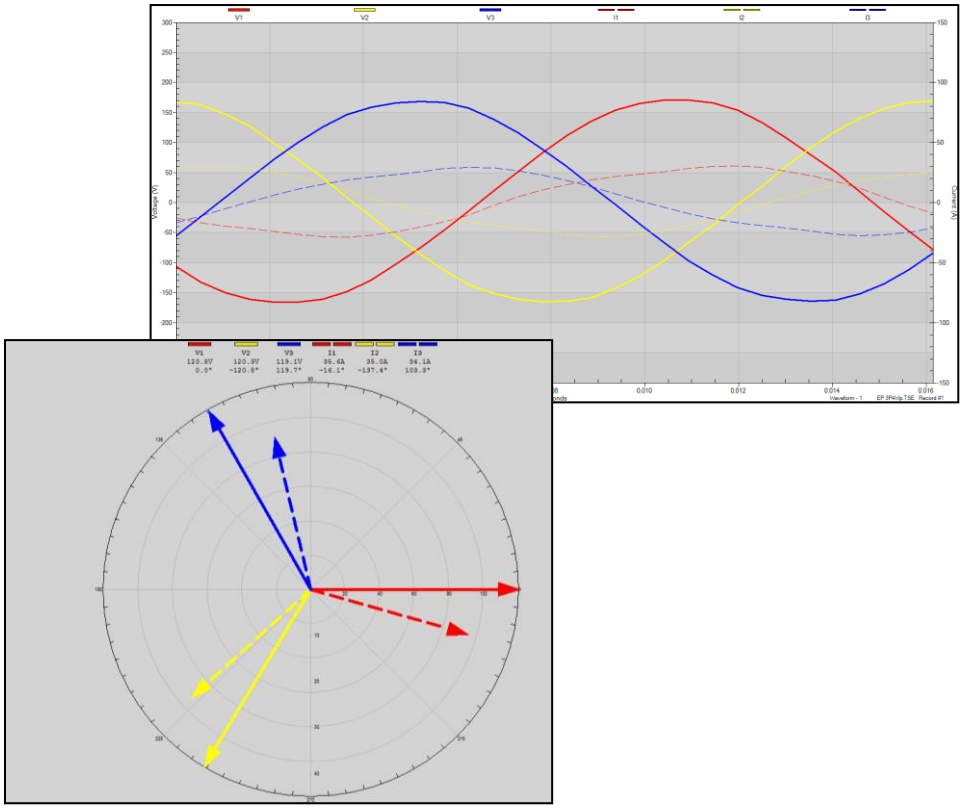
Rugged ▪ Reliable ▪ Weatherproof

User's Guide

PV II™ for the PQPro™

Data Analysis Software





PV II™ for *PQPro*™ User's Guide

Trademarks

Manufactured by:

CANDURA Instruments
775 Pacific Rd, Unit #26
Oakville, Ontario
Canada

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TABLE OF CONTENTS

Page #

1 INTRODUCTION

PV II is the second generation of electrical power data analysis software from CANDURA Instruments. It is an application that builds on the knowledge gained from developing the original PowerView software**.** PV II supports CANDURA's 'Rugged Reliable and Weatherproof' data recorders. Not all features are supported by all the instruments and some features of PV II may only be available for data files from specific instrument models.

This manual is specific for PV II with data files from the ***PQPro™***. PV II has been designed to be easy and intuitive to use.

1.1 File Open

There are two data file types from the ***PQPro™***, both have *.TSQ* file extension:

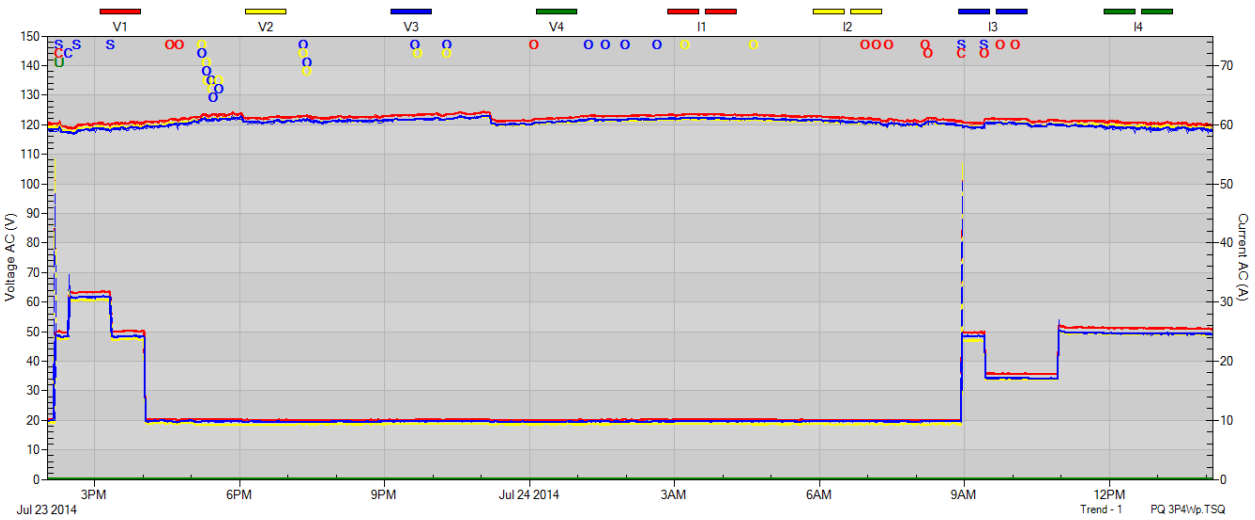
1. Standard power quality (PQ) data files
    - storage rate one second or higher
    - one cycle (Interharmonics off) or twelve cycle (Interharmonics on) waveform snapshot stored every storage interval
    - high resolution event data stored when signals exceed trigger levels

2. Continuous waveform (CW) data files
    - storage rate 200 milliseconds
    - every waveform for every cycle is stored
    - no trigger levels used as everything is recorded

New TSQ files will be opened automatically without additional user prompts for the user and without having to save a decompressed file version.

For the purpose of this section, a demo PQ data file is used. In the supplied USB memory stick, open the file *Data Files > PQ 3P4W.TSQ*

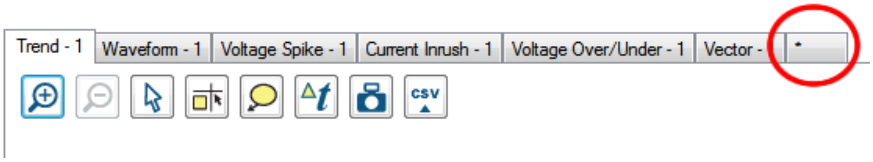
The software will automatically display voltage and current graphs with voltage scaling on the left side and current scaling on the right side.



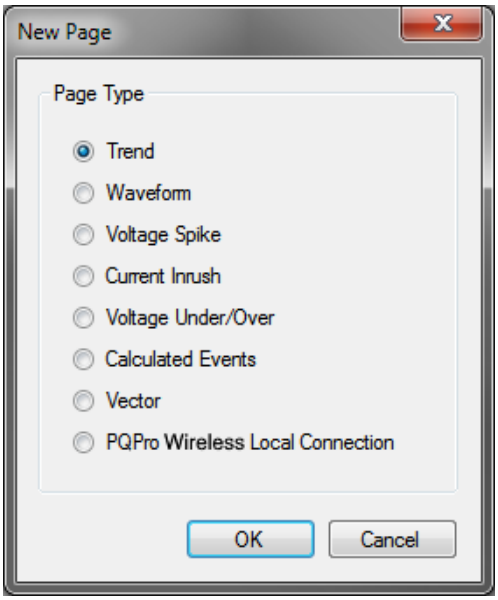
1.2 Display Pages

PV II can open ***PQPro***™ data files with different types of display pages.

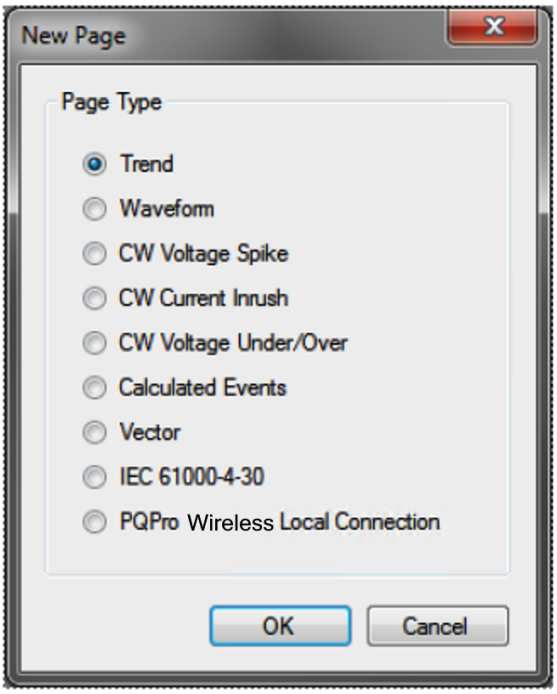
If a page tab is not displayed but is available, it can be opened by clicking on the " * " tab and selecting the desired page, as shown in the figures below.



Standard (PQ) data files



Continuous Waveform (CW) data files



Each page can be configured individually. Configuration includes quantities that are graphed, which traces of the different quantities are displayed, the colours and line style of the traces, scaling of the axis and other features. The user can switch back and forth between these pages by clicking on the page tabs. The configuration of each page is maintained while moving between the different pages. Multiple pages of the same type can be configured. The tab name can be changed by right clicking on the tab.

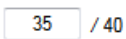
1.3 Speed Buttons

Speed Buttons are shown at the top of each page when they are applicable.

	Zoom		Delta time – add a box between two graph points that displays the time difference
	Un-Zoom		Screen Capture – take a snapshot of the graph which can be pasted to Word or Excel
	Select – a pick tool for Databox, Text Bubble		Export data displayed on the current tab to CSV
	Databox – add boxes anywhere on the graph that display data of Y-axis quantities, record number and time. For more details see Adding annotations to Trend graphs		Export data displayed on the current tab to PQDIF
	Text Bubble – add comment to anywhere on the graph and point to the area of interest. For more details see Adding annotations to Trend graphs		***New*** Graph Measurement Databox – a new feature which provides Min/Avg/Max measurements for what is displayed on the graph. For more details see Adding annotations to Trend graphs

1.4 Graph Play Buttons

These controls enable scrolling through waveform graphs and vector diagrams.

	Scroll continuously backwards or forwards until the end is reached
	Stops the continuous scrolling
	Move one record backwards or forwards
	A specific record can be displayed by entering the record number in the record number box and pressing enter
	Records can also be manually scrolled by placing the cursor over the position indicator, holding the left mouse button down and moving the cursor right or left.

2 PAGE TYPES

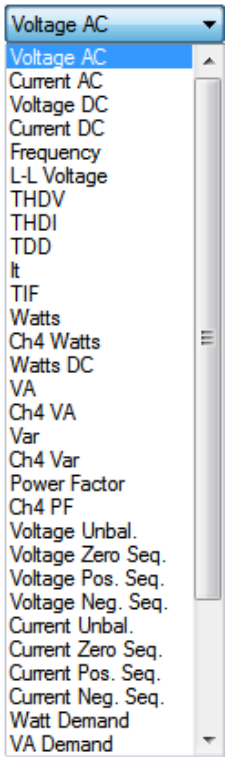
2.1 Trend

The Trend page displays steady state quantities that are recorded at a specific time interval determined by the instrument's storage rate. The ***PQPro***™ has storage intervals that vary from 0.2 seconds to 30 minutes.

Two different quantities can be graphed at the same time, one quantity uses the left axis for scaling and the other quantity uses the right axis for scaling. The bottom axis is the time scale that is common to both quantities.

Both the left and right axis have drop down boxes for selecting the quantity to graph on that axis. Some quantities may not be available for specific files. For example, if the ***PQPro***™ is configured for a single phase (1P2W or 1P3W) power system, then the voltage and current unbalance quantities will not be shown in the drop down list.

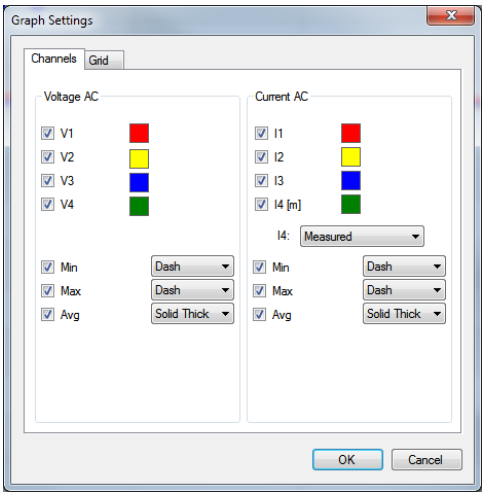
Trend quantities that can be graphed are listed below:



Voltage AC	Ch4 PF
Current AC	Voltage Unbal.
Voltage DC	Voltage Zero Seq.
Current DC	Voltage Pos. Seq.
Frequency	Voltage Neg. Seq.
L-L Voltage	Current Unbal.
THDV	Current Zero Seq.
THDI	Current Pos. Seq.
TDD	Current Neg. Seq.
It	Watt Demand
TIF	VA Demand
Watts	Voltage Demand
Ch4 Watts	Current Demand
Watts DC	Watt Cost
VA	Volt. Harm Trend
Ch4 VA	Curr. Harm.Trend
Var	PST
CH4 Var	PLT
Power Factor	V Synchrophasor (CW data files only)
	I Synchrophasor (CW data files only)

The demo file PQ 3P4W.TSQ is from a three phase four wire (3P4W) power system with data stored every minute. The opening screen is a Trend page that shows the 4 voltages, V1 (red), V2 (yellow), V3 (blue) V4 (green) using the left scaling axis. The 4 currents, I1 (red), I2 (yellow), I3 (blue) and I4 (green) are also displayed and they use the right scaling axis.

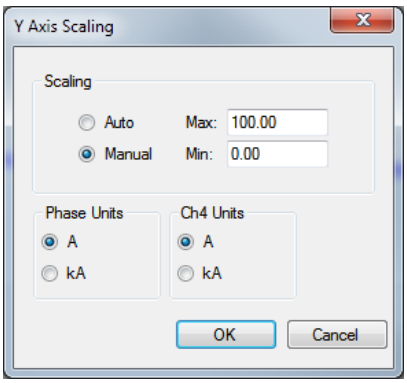
Let's look at a disturbance at 08:57:00 (Record #1137). It appears there was a voltage transient on Channel 3. Let's turn off Ch 1, 2, & 4 in order to see Ch3 voltage and current in more detail. To do this, right click anywhere in the Legend area which is above the graph area.

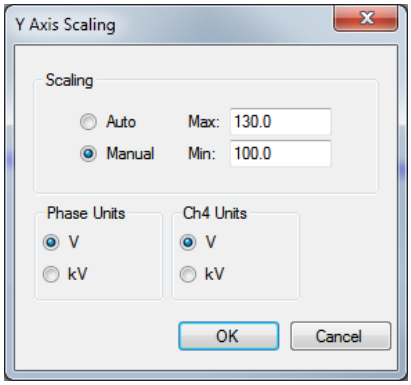


This opens the Graph Settings dialogue box. Unselect V1, V2, V4, I1, I2 and I4 and click on the colour box for I3, change the colour to black and click on "OK".

Alternatively:
Setup > Graphs > Traces/Grid

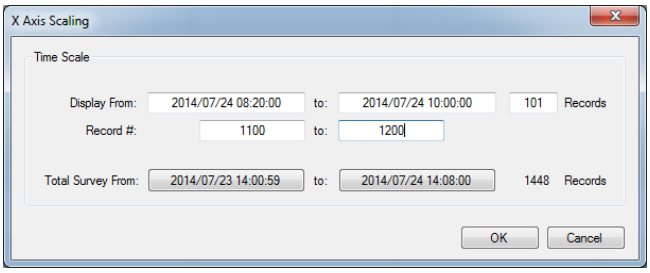
Now the graph will only show V3 and I3. To change the Current scaling, right click on the Current Y-axis. Under 'Scaling', select 'Manual' and enter Max value of 100. To change the Voltage scaling, right click on the Voltage Y-axis. Under 'Scaling', select 'Manual' and enter Min value of 100, Max value of 130.





Alternatively:
Setup > Graphs > Left Y Axis
Setup > Graphs > Right Y Axis

Change the time scaling by right clicking on the Time X-axis. Set 'Record #/;' range from 1100 to 1200.



Alternatively:
Setup > Graphs > X Axis

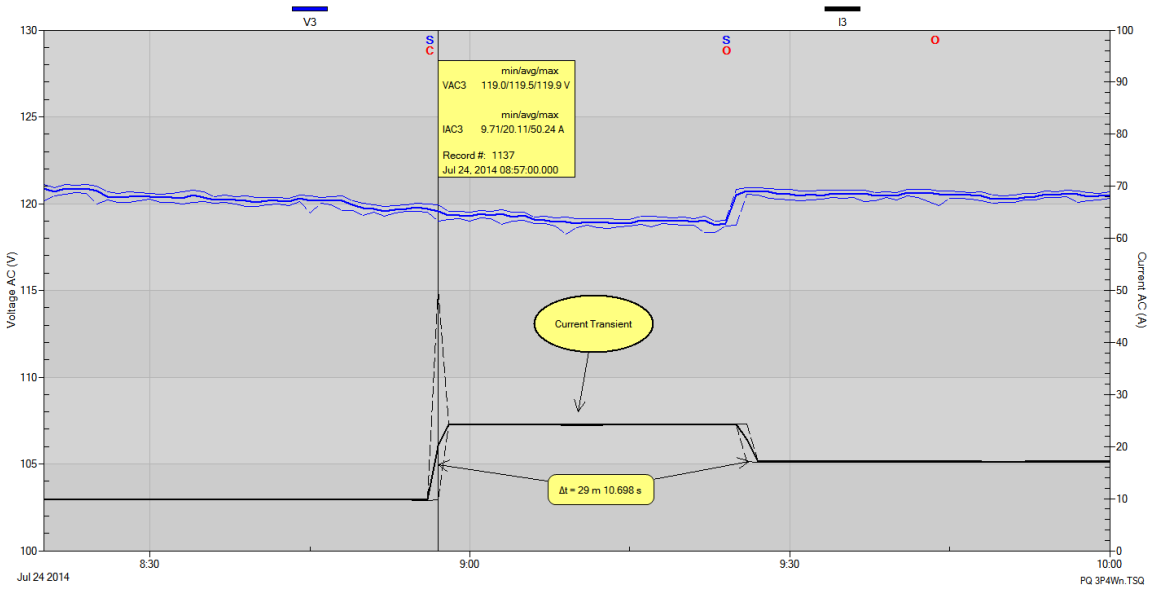
2.1.1 Adding annotations to Trend graphs

From the Speed Button tool bar select the Databox tool 

- Position the cursor at the location of interest on the graph, then lock the Databox on to the graph by either clicking the left mouse button, or pressing 'Enter' on the keyboard.
- To precisely place a Databox at a specific time or record # (for example, record #1137), use left/right arrow keys on the keyboard to move one record at a time when positioning the Databox.
- To reposition the Databox, left click-and-drag the Databox to a new position. The Databox can be repositioned vertically along the reference line or moved from one side of the reference line to the other side.

From the Speed Button tool bar select the Text Bubble tool 

- Position the cursor near the location of interest on the graph, then paste the Text Bubble on to the graph by clicking the left mouse button.
- To reposition the Text Bubble, left click-and-drag the Text Bubble to a new position. When finished, left click somewhere on the graph to complete the move.
- To reposition the Text Bubble arrow, left click over the tip of the arrow head - the cursor will become a finger pointer and the entire arrow will become a thick dash line. Move the finger pointer to a new location then click the left mouse button – the arrow will be redrawn and pointing at the new location.
- To edit the text in the Text Bubble, position the cursor on top of the text until it becomes a text-cursor. Click the left mouse button to begin text editing.
- Similarly, the Delta Time tool  uses the same method to add or remove a text box that displays the time difference between two points on the graph.



- To delete a Databox, Text Bubble, or DeltaTime box, right click on it and select "Yes" when asked to close.

New

A new feature named the Graph Measurement Databox (GMD) which provides Min/Avg/Max measurements for what is displayed on the current graph has been implemented. The measurements can be enabled and made visible by clicking on 

. Once the GMD is enabled the button will become 

- The button is available for the “Trend” and “Waveform” tabs. Once the button is clicked, a Databox will appear in the top left side of the graph with the measurements of the currently displayed graph.

- The bottom of the GMD contains the record range for which the Min/Avg/Max measurements were performed. In the waveform tab, instead of a record range, a sample range is displayed.

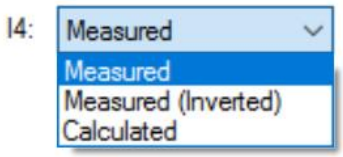
- The GMD updates automatically when the display graph is changed. The GMD will update when the following changes are performed: using the “Zoom In”, “Zoom In X” or “Zoom Out” buttons, resizing the X or Y axis scales, changing the measurement displayed, and making changes to the graph settings.

- In the Trend tab, several measurements have Min/Avg/Max values for each record. If either of the “Min”, “Avg” or “Max” checkboxes are deselected, then the Graph Measurement Button and Databox will be disabled. In the Waveform tabs, if Voltage Harmonics or Current Harmonics is selected as a measurement, the button and databox will be disabled until a new measurement is selected.

- The GMD can be moved within the PVII graph window by left-click holding and dragging and can be closed by right clicking on it. The GMD can be closed by either clicking on 

or by right clicking on the box.

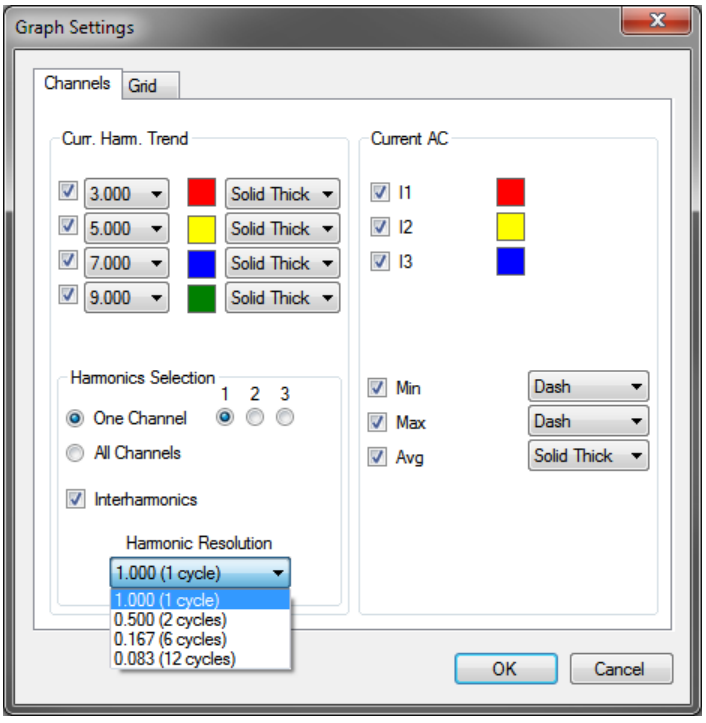
2.1.2 About CH4 Current



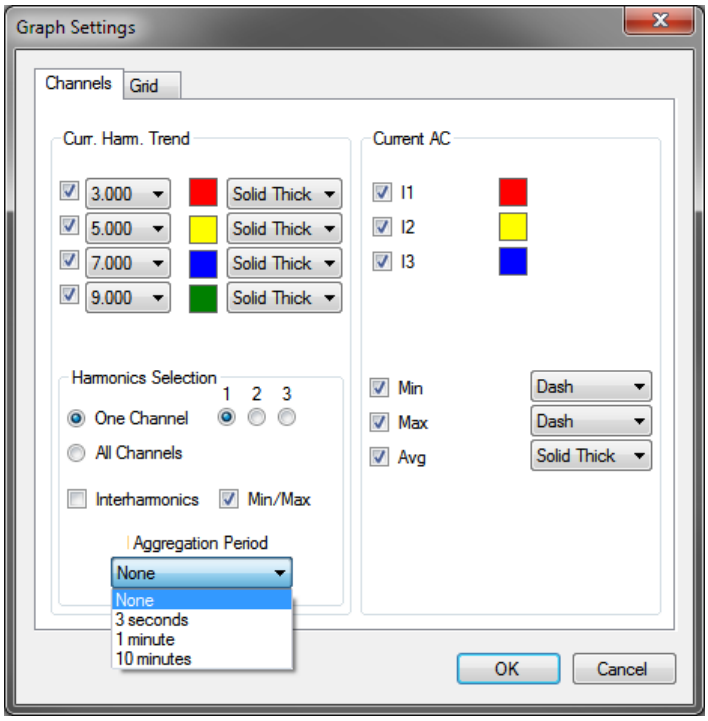
Channel 4 current input can be used to measure neutral current in a three phase system. In a properly functioning 3 phase system the neutral current will be equal to the instantaneous sum of the phase currents. PV II has the ability to calculate the neutral current from the instantaneous (waveform) phase current measurements. Any discrepancies between the measured neutral current and the calculated neutral current is an indication of wiring issues in the power system. Comparison of the measured and calculated neutral current waveforms is aided by the ability to invert the measured neutral current waveform for situations where the neutral current clamp was installed in reverse.

2.1.3 About Harmonic and Interharmonic Trend

Harmonic and Interharmonic trending can be graphed in a Trend page using the “Volt. Harm. Trend” and “Curr. Harm. Trend” selections. The ability to graph an Interharmonic trend depends on the data. For PQ data files with Interhamonics turned off they will not be available. For PQ data files with Interharmonics turned on and for CW data files, Harmonic and Interharmonic trend graphs will be available with adjustable resolution.



If Interharmonics in the Graph Settings dialog box are not selected, then Harmonics can be graphed with different aggregation periods. Some of the aggregation periods may not be available depending on the storage rate used when the file was recorded. For example, the 3 second aggregation period will not be available for a file recorded with 5 second storage rate.



Harmonic and Interharmonic trend options can also be found in the Report (Trend), Export to CSV (Trend) and Export to PQDIF settings.

2.2 Waveform

The waveform page graphs the waveform snapshot that is taken once each storage interval.

For standard PQ data files:

- 1 cycle of data (with Interharmonics Off)
- 10 cycles of data (Interharmonics On, 50 Hz systems)
- 12 cycles of data (Interharmonics On, 60 Hz systems)
- 40 cycles of data (Interharmonics On, 400 Hz systems)

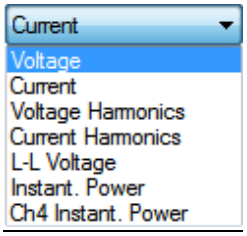
For Continuous Waveform CW data files:

- 12 cycles of data (256 to 1024 samples per cycle)
- 24 cycles of data (128 samples per cycle)
- 40 cycles of data (64 samples per cycle)

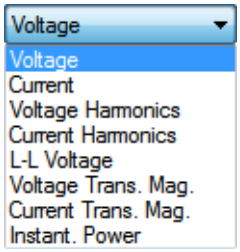
Note that for CW data files the storage interval is 12, 24 or 40 cycles depending on the sample rate. Waveforms are stored continuously with no gaps between them.

Quantities that can be graphed in the Waveform page are displayed below.

Standard (PQ) data files

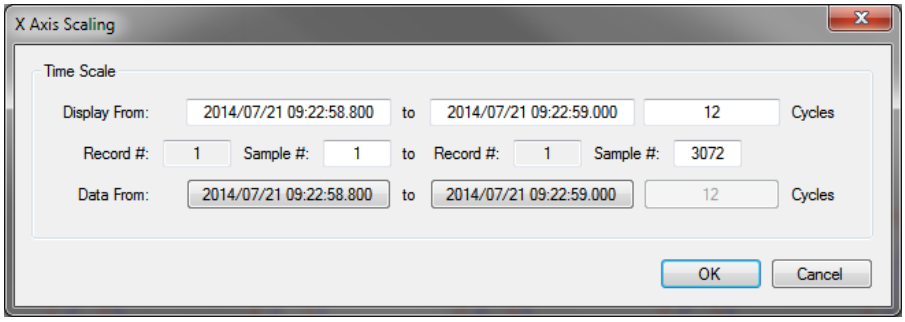


Continuous Waveform (CW) data files



Note that L-L Voltage (Line-to-Line) are calculated from the line to neutral voltage waveform measurements. This selection is only available for 1P3W, 2.5E and 3P4W power system configurations. For 3P3W the L-L voltages are measured directly.

The X-Axis Scaling of waveform graphs, reports, or export functions can be adjusted from the X Axis Scaling menu shown below.



Note that the “Record # / Sample #” method offers the most precise and finest resolution for the positioning of the start and end points of the waveforms.

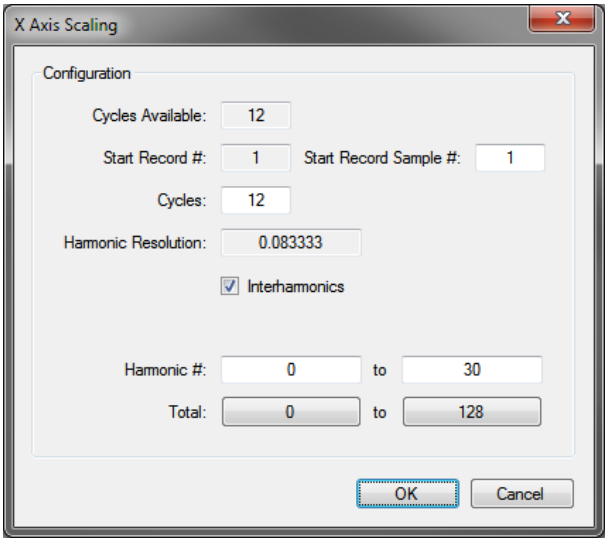
2.2.1 Harmonics and Interharmonics

Harmonics are periodic waveform distortions that have frequencies that are integer multiples of the fundamental frequency. Interharmonics are periodic waveform distortions that have frequencies that are non-integer multiples of the fundamental frequency.

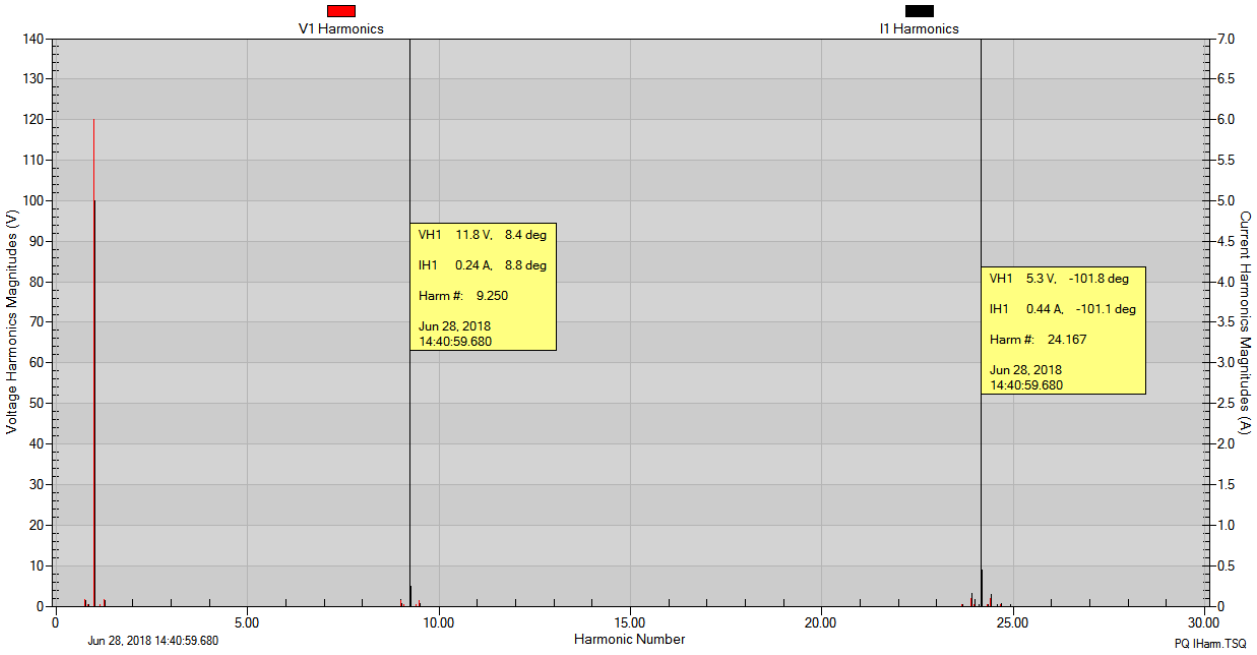
PV II uses a Fourier algorithm to calculate harmonics and interharmonics. Harmonics can be calculated using one waveform cycle or multiple waveform cycles. If multiple waveforms cycles are used then the calculated harmonic magnitudes will be the average over the duration of the cycles. Interharmonics require multiple cycles of waveforms. The number of cycles used determines the interharmonic resolution. Typically in a 60 hertz power system 12 cycles are used for interharmonic calculations. This will result in an interharmonic resolution of 5 hertz (60/12) or, in terms of harmonic number, a resolution of 0.083 (1/12).

The ***PQPro™*** can record single cycle waveform snapshots, 10/12 cycle (50/60 hertz) waveform snapshots or continuous waveforms. With single cycle waveform snapshots PV II can only calculate harmonics, with 10/12 (50/60 hertz) waveform snapshots PV II can calculate harmonics and interharmonics with 5 hertz resolution. With continuous waveform data PV II can calculate harmonics and interharmonics with a resolution of less than 1 hertz using 60 cycles or more.

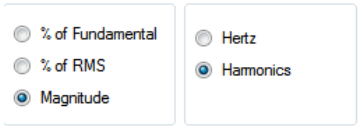
Let's open another file that demonstrates the use of Interharmonics. From the supplied USB memory stick – or the online download of PV II Demo Files, open the file *Data Files > PQ IHarm.TSQ*. This is a data file with 12 cycle waveform snapshots stored every second with Interharmonics at 9.25 (555 Hz) and 24.167 (1450Hz). To view Interharmonics, open the Waveform tab, then select Voltage Harmonics on the left axis and Current Harmonics on the right axis. Select X axis scaling by right clicking anywhere on the X axis. Enable the Interharmonics check box and set the Harmonic range displayed to "0 to 30".



Turn off channels 2 and 3 in Graph Settings and change the colour of channel I1 Harmonics to black (right click on graph legend or select *Setup>Graph>Traces/Grid*).



Harmonics are displayed as a bar chart for harmonics from 1 (the fundamental) to the 128th harmonic. The Y axis can be displayed in Magnitude, % of RMS or % of Fundamental and the X axis can be displayed by Harmonic Number or by frequency.



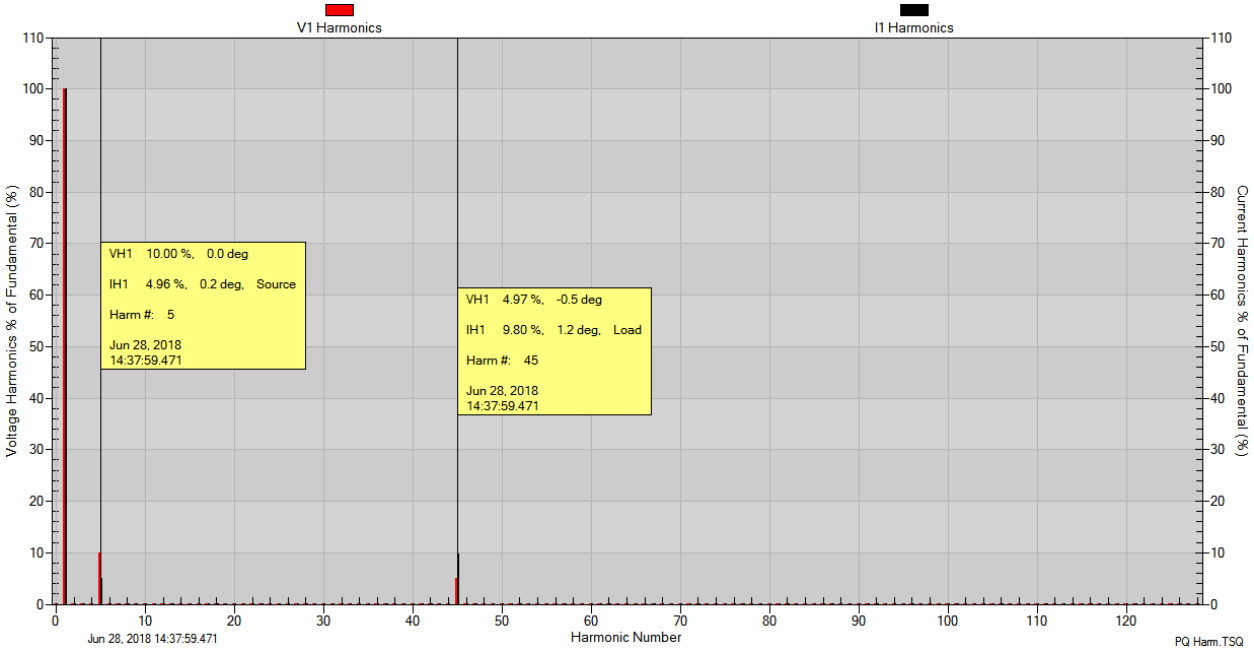
2.2.2 About Harmonic Direction

The software has the ability to estimate if harmonics are load caused or source caused. For example, from the supplied USB memory stick – or the online download of PV II Demo Files, open the file *Data Files > PQ Harm.TSQ*. Open the Waveform tab, then select Voltage Harmonics and on the left axis, and Current Harmonics on the right axis.

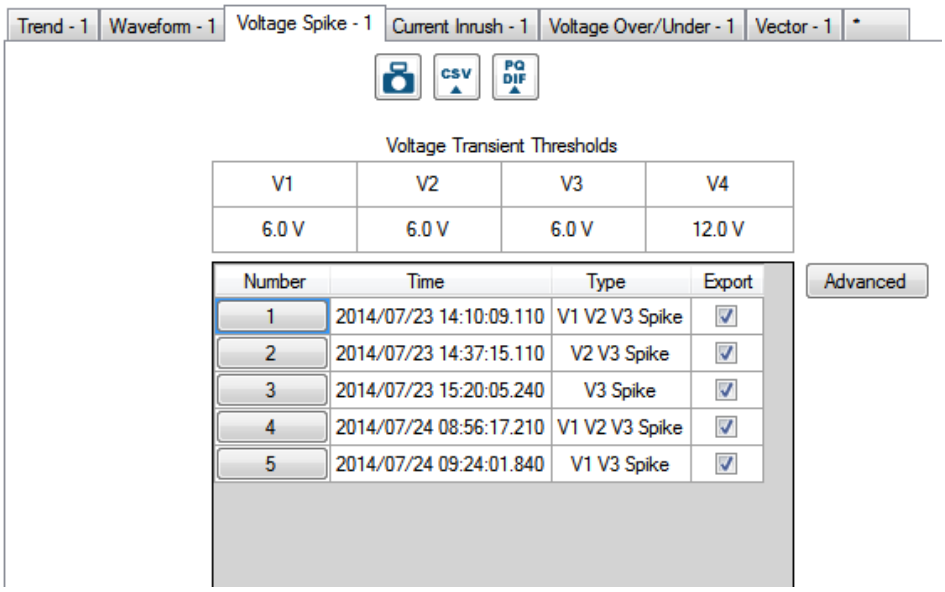
Change the vertical axis to % of Fundamental in order to get the indication of harmonic direction.

Turn off channels 2 and 3 in Graph Settings and change the colour of channel I1 Harmonics to black (right click on graph legend or select *Setup>Graph>Traces/Grid*).

Place the Databox over the harmonic of interest. In addition to magnitude and phase angle, the text "Load" or "Source" is printed in the Databox, as shown in the figure below. If the relative current harmonic magnitude is larger than the relative voltage harmonic magnitude then the software assumes that the harmonics are load caused.



2.3 Voltage Spike



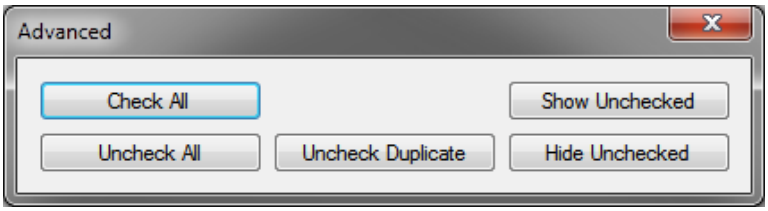
If the ***PQPro***™ captured high speed voltage transients, then there will be a page labelled Voltage Spike. As an example, open the data file PQ 3P4W.TSQ and click on the Voltage Spike tab. You will see a table of the high speed voltage transients that were captured.

Clicking on one of the table column labels (ie. “Number”, “Time”, “Type”) will rearrange the table according to the selected parameter.

To see the waveform for a specific event, click on the Event number. For example, if you click on the Event #4 you will see the voltage and current for channel 1. The number of cycles displayed depends on the PQPro setting. In this case the number of cycles was set to four. The resolution of the Voltage Spike event waveforms is 1024 samples per cycle.

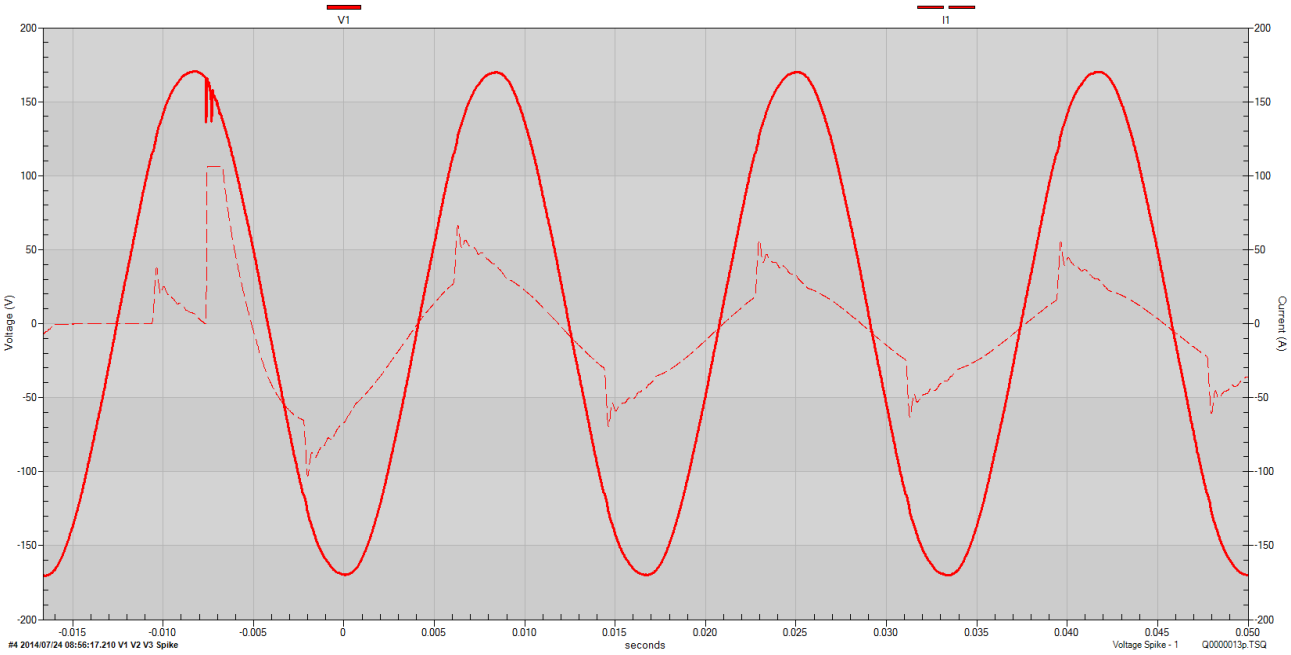
The user can select which event to export by selecting the Export check box in the table, then click on the CSV or PQDIF speed button above the table.

The ‘Advanced’ button allows users to make bulk selections of events in a number of ways: ‘Check All’, ‘Uncheck All’, ‘Show/Hide Unchecked’, and ‘Uncheck Duplicate’.

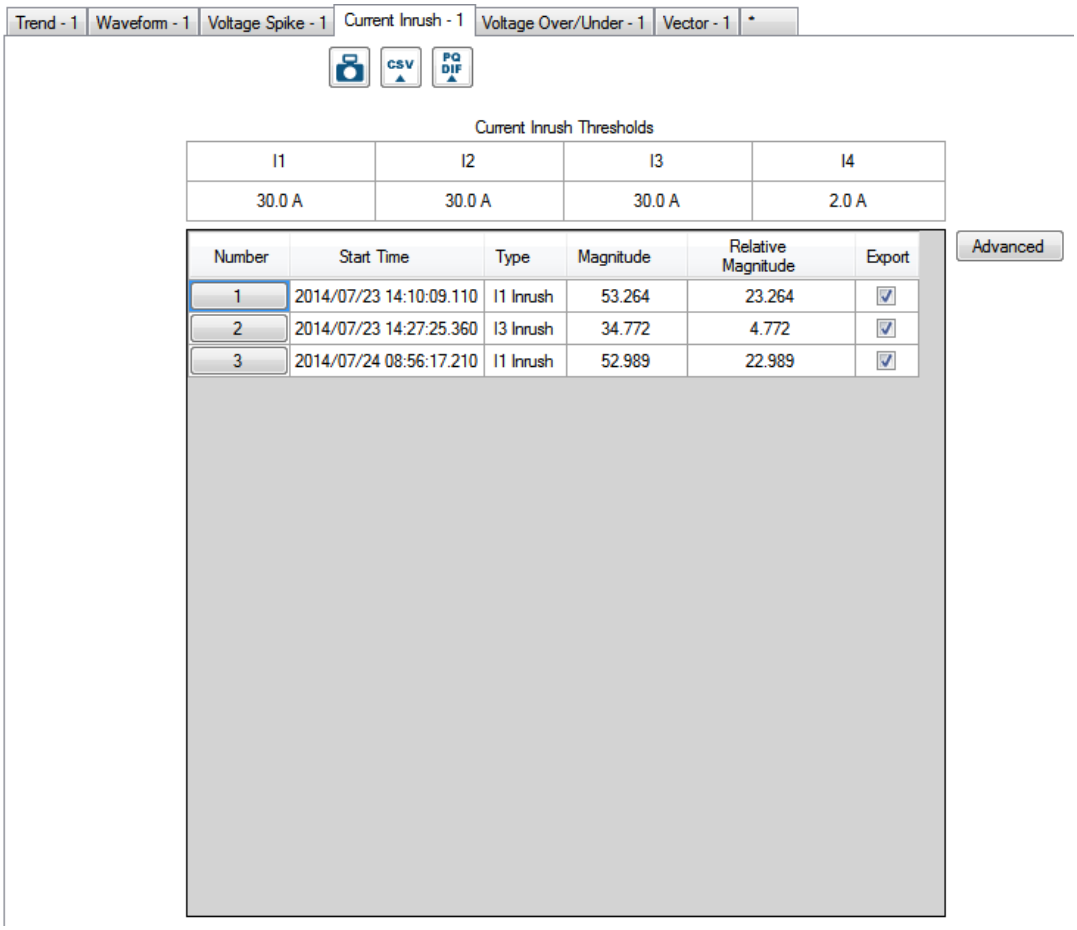


‘Uncheck Duplicate’ is useful when the user wants to filter out duplicate events that occurred within the same event buffer, but have been recorded for different phase voltages and currents.

Another way to access the Voltage Spike event graphs is to click on the event marker that is displayed along the top of a trend graph if enabled in Preferences. For example, if you click on the blue S that is second from right in the Trend graph, you will open a 2nd Voltage Spike page that immediately shows the waveform for Voltage Spike event #4.



2.4 Current Inrush



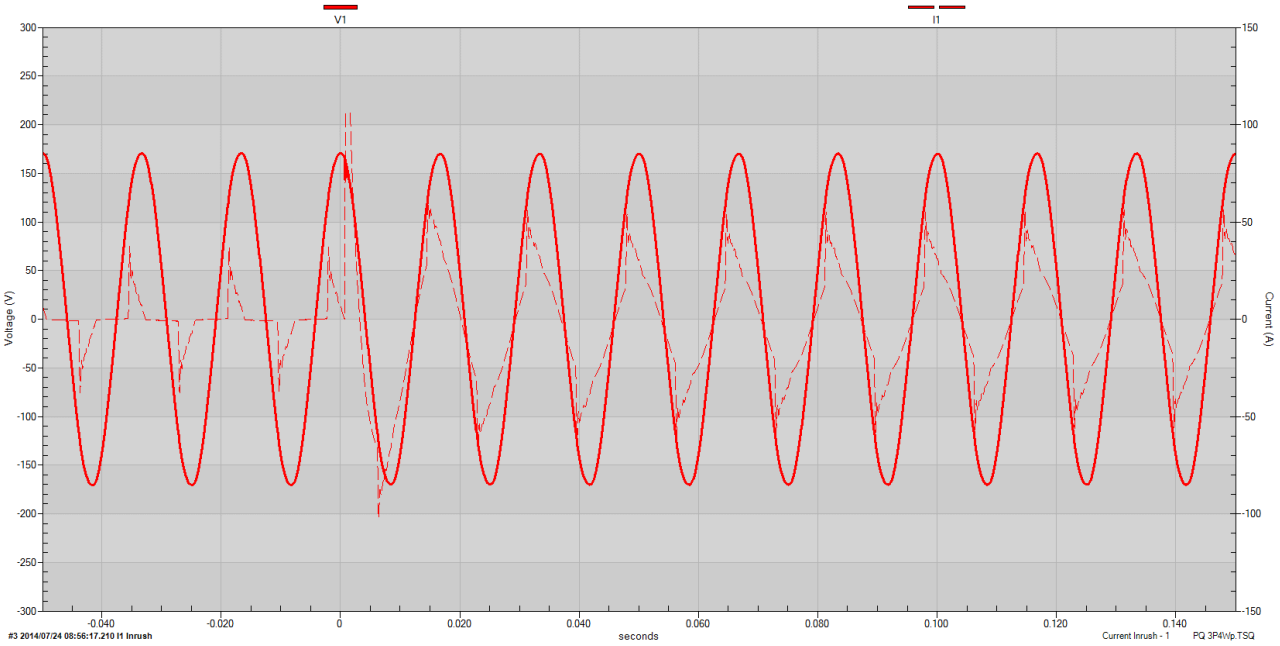
If the ***PQPro***™ captured current inrush transients, then there will be a page labelled Current Inrush. Open the data file PQ 3P4W.TSQ and click on the Current Inrush tab. You will see a table of the current inrush transients that were captured.

Clicking on one of the table column labels (ie. “Number”, “Time”, “Type”) will resort the table according to the selected parameter.

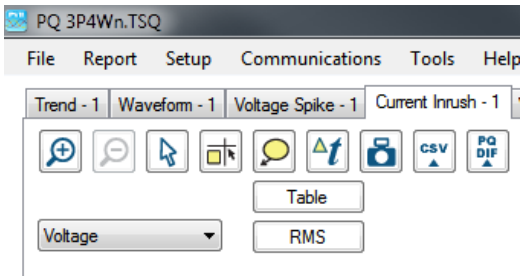
To see the waveform for a specific event, click on the Event number.

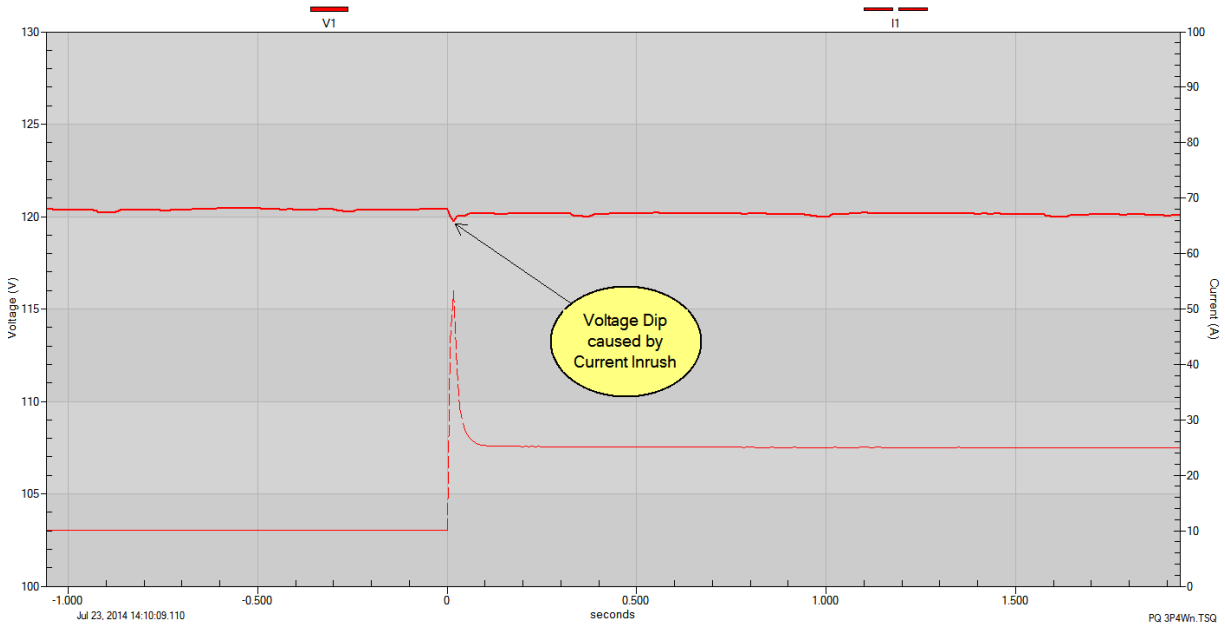
The user can also select which event to export by selecting the Export check box in the table, then click on the CSV or PQDIF speed button above the table.

Another way to access the Current Inrush event graphs is to click on the event marker that is displayed along the top of a trend graph if enabled in Preferences. For example, if you click on the red C on the top right side of the Trend graph you will open a 2nd Current Inrush page that immediately shows the waveform for Current Inrush event #3.

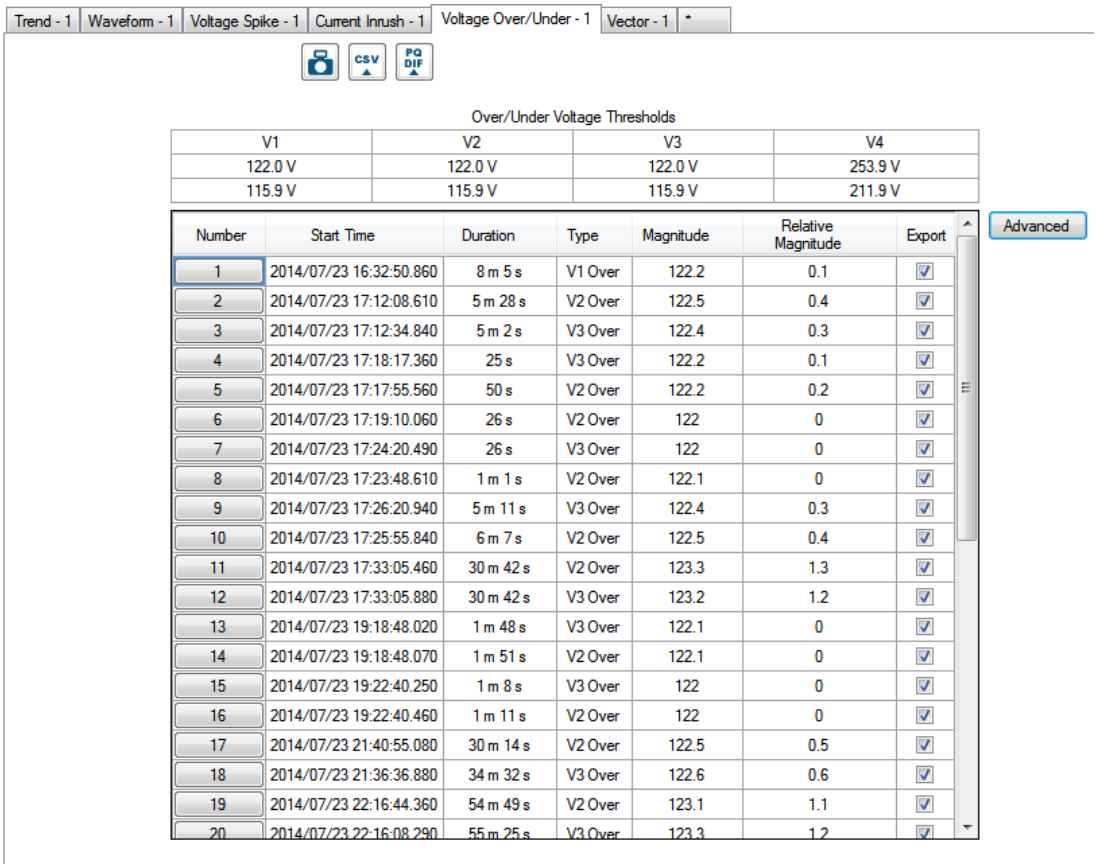


In addition to waveforms, the Current Inrush capture function also captures high resolution RMS data. When viewing waveforms, there are two buttons near the top of the page on the left side, one labelled 'Table' and one labelled 'RMS'. Clicking on the RMS button will bring up the RMS data for the event. The resolution for the Current Inrush RMS data is ½ cycle.





2.5 Voltage Over/Under



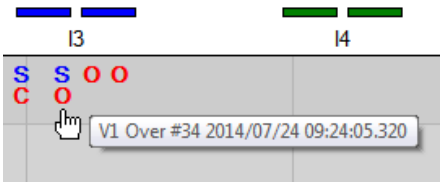
Number	Start Time	Duration	Type	Magnitude	Relative Magnitude	Export
1	2014/07/23 16:32:50.860	8 m 5 s	V1 Over	122.2	0.1	☑
2	2014/07/23 17:12:08.610	5 m 28 s	V2 Over	122.5	0.4	☑
3	2014/07/23 17:12:34.840	5 m 2 s	V3 Over	122.4	0.3	☑
4	2014/07/23 17:18:17.360	25 s	V3 Over	122.2	0.1	☑
5	2014/07/23 17:17:55.560	50 s	V2 Over	122.2	0.2	☑
6	2014/07/23 17:19:10.060	26 s	V2 Over	122	0	☑
7	2014/07/23 17:24:20.490	26 s	V3 Over	122	0	☑
8	2014/07/23 17:23:48.610	1 m 1 s	V2 Over	122.1	0	☑
9	2014/07/23 17:26:20.940	5 m 11 s	V3 Over	122.4	0.3	☑
10	2014/07/23 17:25:55.840	6 m 7 s	V2 Over	122.5	0.4	☑
11	2014/07/23 17:33:05.460	30 m 42 s	V2 Over	123.3	1.3	☑
12	2014/07/23 17:33:05.880	30 m 42 s	V3 Over	123.2	1.2	☑
13	2014/07/23 19:18:48.020	1 m 48 s	V3 Over	122.1	0	☑
14	2014/07/23 19:18:48.070	1 m 51 s	V2 Over	122.1	0	☑
15	2014/07/23 19:22:40.250	1 m 8 s	V3 Over	122	0	☑
16	2014/07/23 19:22:40.460	1 m 11 s	V2 Over	122	0	☑
17	2014/07/23 21:40:55.080	30 m 14 s	V2 Over	122.5	0.5	☑
18	2014/07/23 21:36:36.880	34 m 32 s	V3 Over	122.6	0.6	☑
19	2014/07/23 22:16:44.360	54 m 49 s	V2 Over	123.1	1.1	☑
20	2014/07/23 22:16:08.290	55 m 25 s	V3 Over	123.3	1.2	☑

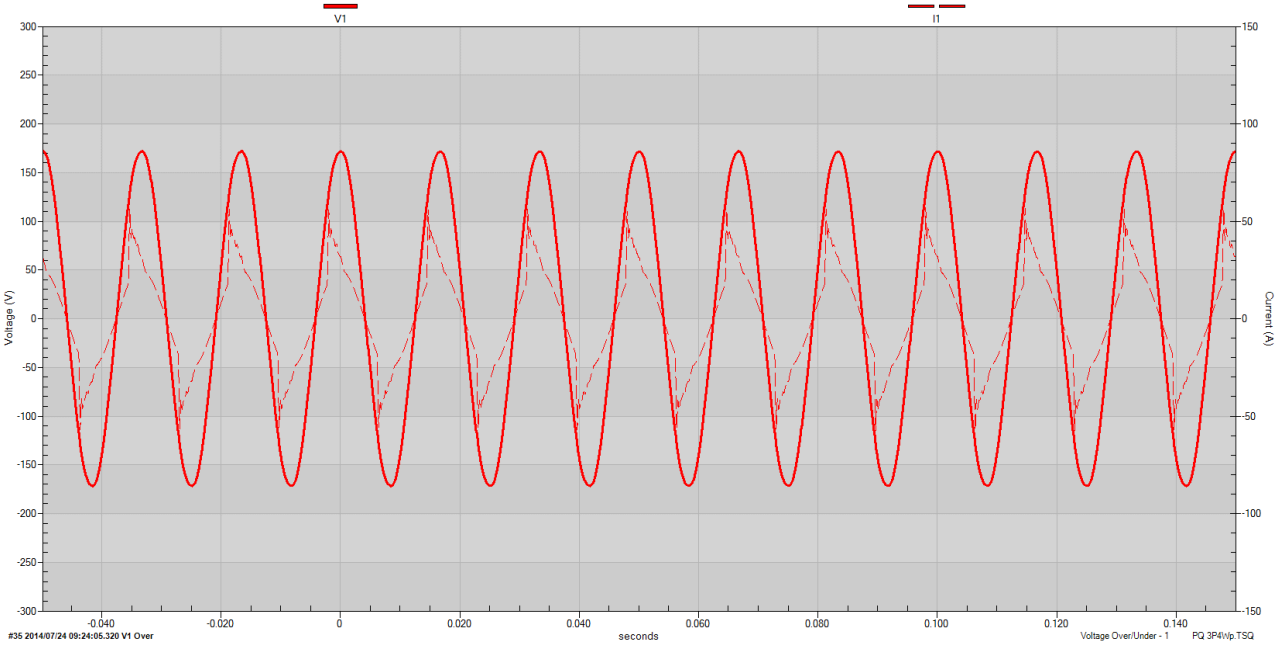
If the ***PQPro™*** captured Voltage Over/Under transients then there will be a page labelled Voltage Over/Under. Open the data file PQ 3P4W.TSQ and click on the Voltage Over/Under tab. You will see a table of the Voltage Over/Under transients that were captured.

Clicking on one of the table column labels (ie. “Number”, “Time”, “Type”) with resort the table according to the selected parameter.

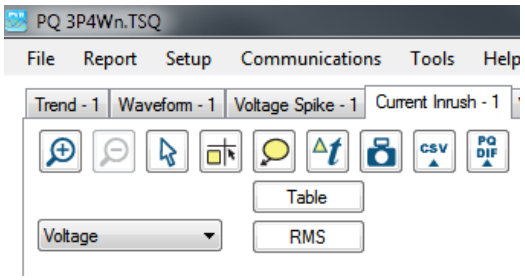
To see the waveform for a specific event, click on the Event number. For example, if you click on the Event #34 you will see the voltage and current for channel 1.

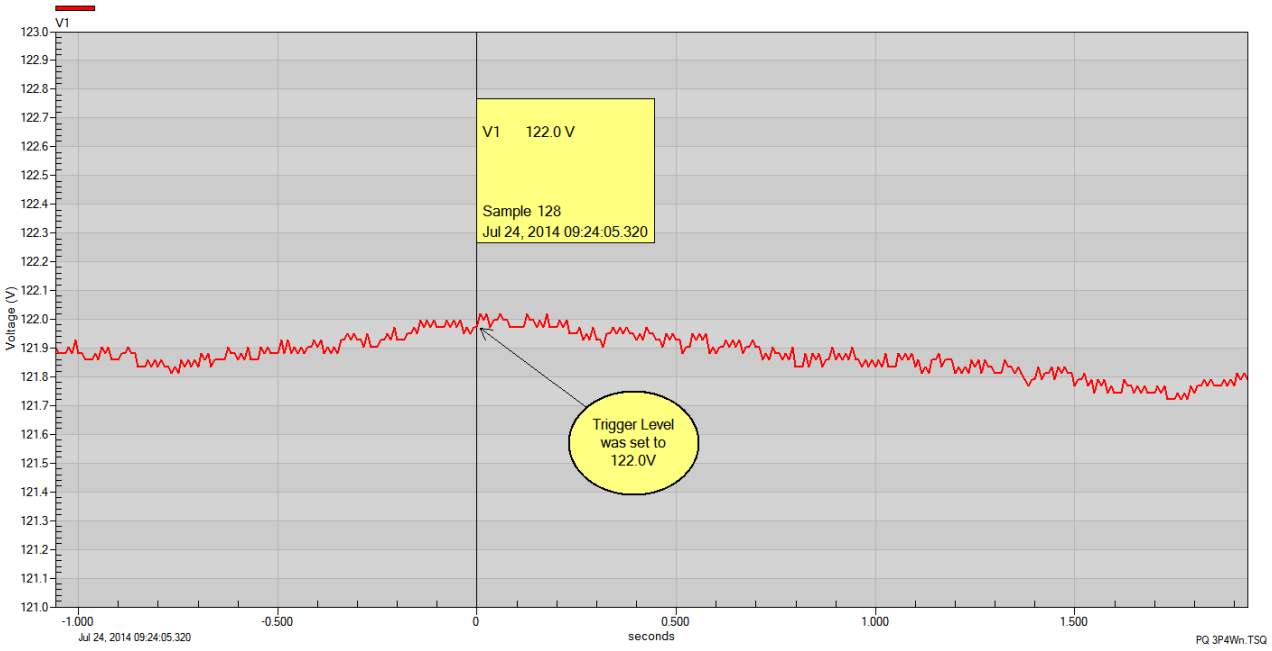
Another way to access the Voltage Over/Under event graphs is to click on the event marker that is displayed along the top of a trend graph, if enabled in Preferences. For example, if you click on the red O third from right in the Trend graph you will open a 2nd Voltage Over/Under event page that immediately shows the waveform for Voltage Over/Under event #34.





In addition to waveforms the Voltage Over/Under capture function also captures high resolution RMS data. When viewing waveforms there are two buttons near the top of the page on the left side, one labelled ‘Table’ and one labelled ‘RMS’. Clicking on the RMS button will bring up the RMS data for the event. The resolution for the Voltage Over/Under RMS data is ½ cycle.

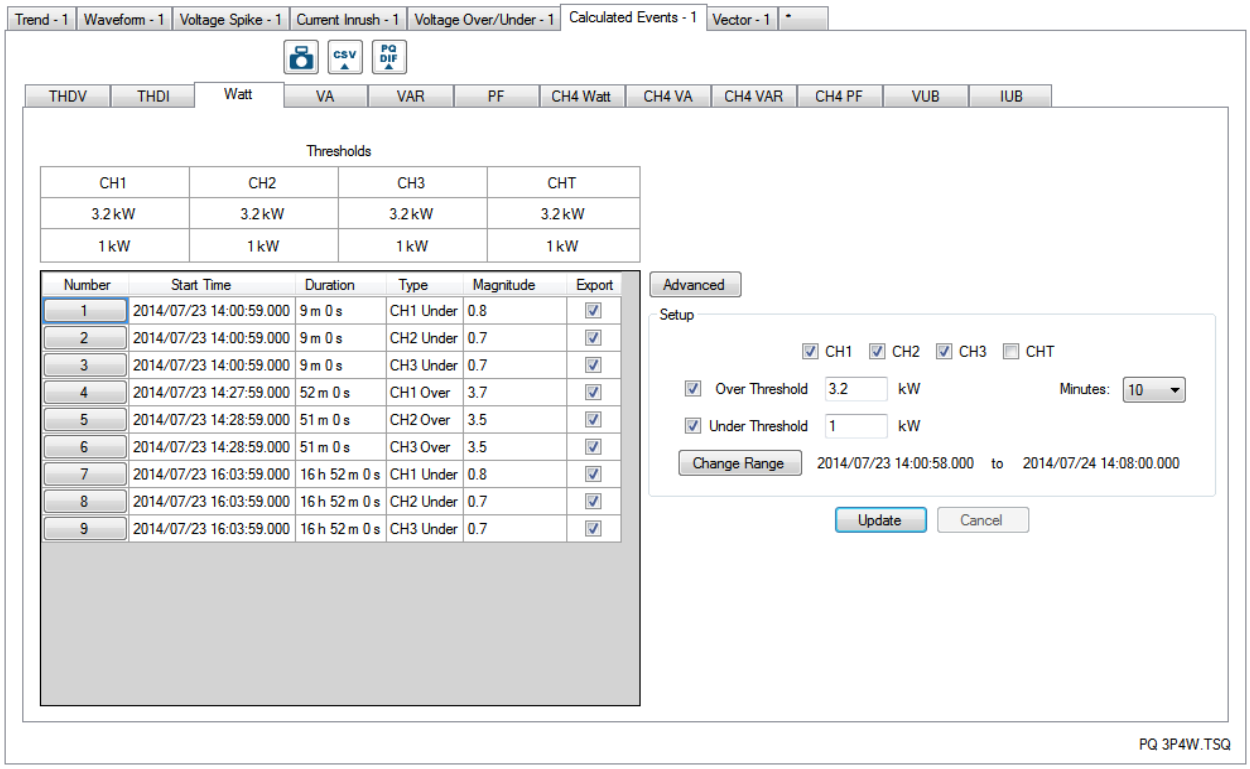




2.6 Calculated Events

PV II software can go through the data file and extract event type data for various trends such as THDV, THDI, Watt, VA, VAR, PF, VUB and IUB.

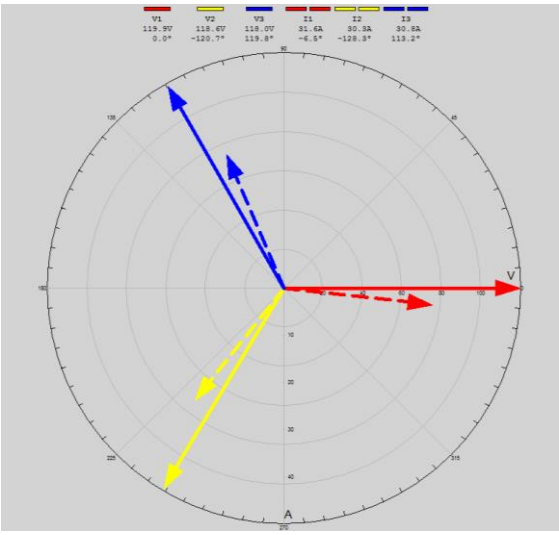
For example, using the data file PQ 3P4W.TSQ, select the Watt tab in the Calculated Events page. Set the Over Threshold to 3.2kW, set the Under Threshold to 1kW and turn off CHT. When the user clicks 'Update' the software will go through the Watts data and it will find 9 events, 6 under and 3 over.



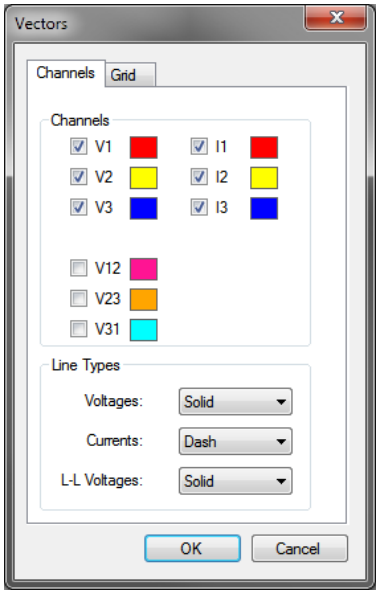
The interface for Calculated Events is similar to the interface for the other events.

2.7 Vector

The vector diagram displays RMS magnitudes and angles of the fundamental components relative to V1 (V1 always has an angle of 0). As with the other graphs, channels can be turned on and off, line styles changed and colours changed. This is accessed by right clicking in the legend area. Scaling is accessed by right clicking anywhere below the legend area.



For connection types that have both Line-to-Neutral voltages and Line-to-Line voltages the vector diagram can show both vectors. Initially, only the Line-to-Neutral voltage vectors are shown, but the user can enable the Line-Line voltage vectors by right clicking in the legend area to open the Vector dialog box.



2.8 CW Voltage Spike

Continuous Waveform (CW) data files do not have any events captured. This is because everything is recorded. The PV II software can then go through the data and flag events based on custom threshold parameters set by the user (as opposed to fixed parameters for non-continuous recordings).

In the supplied USB memory stick – or the online download of PV II Demo Files, open the file *Data Files > 3P4W Continuous.TSQ*. Open a new page by selecting 'CW Voltage Spike'. Set the threshold to 10V and the number of cycles to 5 and then click "Update". This will populate the table with events based on the aforementioned parameters.

Navigating between the event table and event graph is similar to Voltage Spike for PQ data files

2.9 CW Current Inrush

Open a new page by selecting 'CW Current Inrush'. Set the Over Threshold to 70% then click "Update". This will populate the table with events based on the aforementioned parameters.

Navigatiing between the event table and event graph is similar to Current Inrush for PQ data files.

2.10 CW Voltage Over/Under

Open a new page by selecting 'CW Voltage Over/Under'. Set the Over Threshold to 100.6% and Under Threshold to 98.6% then click "Update". This will populate the table with events based on the aforementioned parameters.

Navigating between the event table and event graph is similar to Voltage Over/Under for PQ data files.

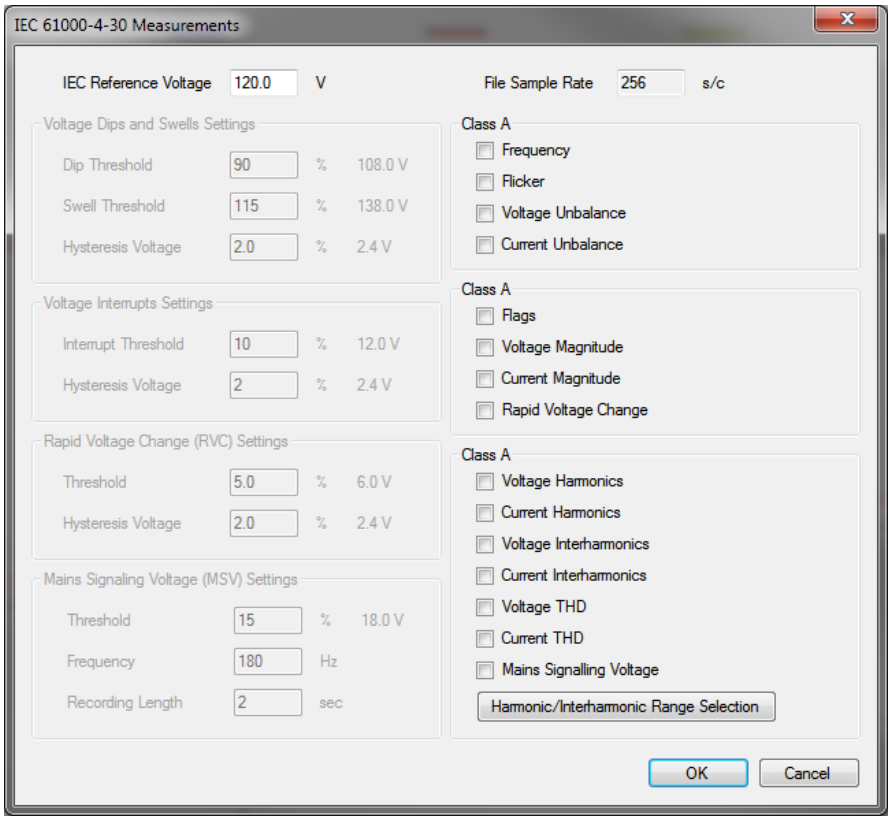
2.11 IEC 61000-4-30

For Continuous Waveform (CW) data files, PV II can calculate the full set of IEC 61000-4-30 Class A power quality results. In order to meet all the Class A requirements the data will need to be time synchronized to UTC time. This is achieved with an optional GPS interface installed in the PQPro. Without the GPS interface the IEC 61000-4-30 results may not meet the Class A time synchronization requirements.

The number of samples/cycle (s/c) also determines whether Class A calculations can be performed:

- Minimum 256 s/c for Class A
- Minimum 128 s/c for Class S

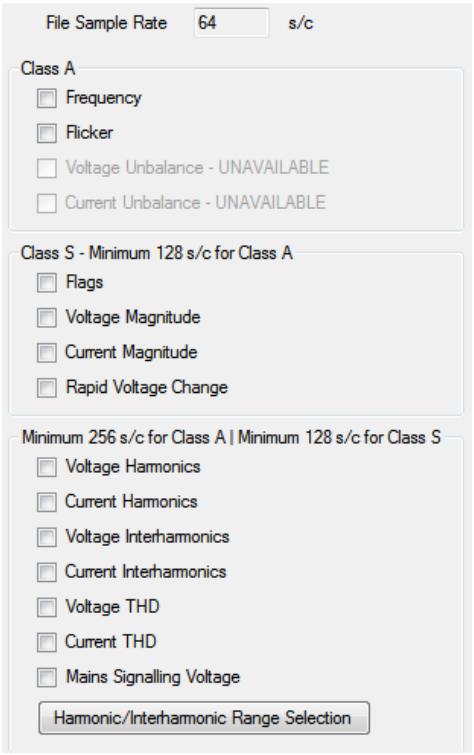
Open the demo file “3P4W Continuous.TSQ”. Before displaying a measurement in the IEC 61000-4-30 tab the user needs to access the following control panel by going to: *Setup > IEC 61000-4-30 Setup*



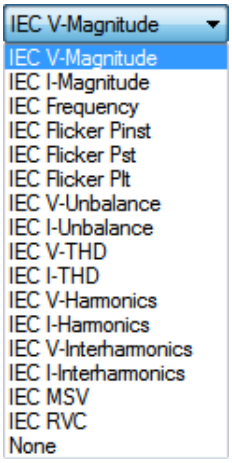
Enter a value for IEC Referenc Voltage (default is 120.0V), then use the check boxes to select which quantities will be calculated for the IEC 61000-4-30 page.

If the file was recorded at 64 samples/cycle, then Class A calucations can only be done on Frequency and Flicker, while Class S calcuations can only be done on Flags, Voltage Magnitude, Current Magnitude, and Rapid Voltage Change.

The remaing quantities will be calculated but will not meet either Class A or Class S standards.

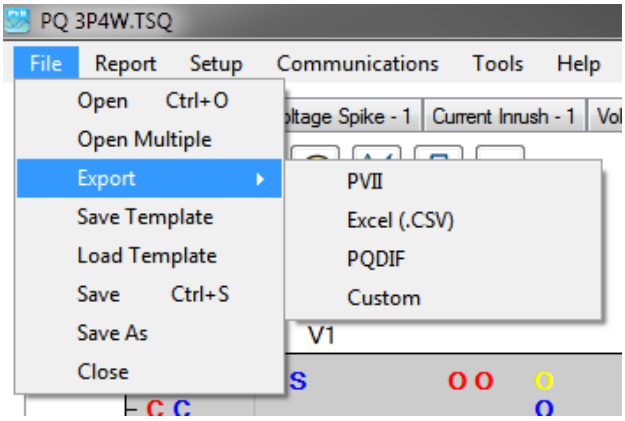


When you have selected the desired quantities in the setup menu, click 'OK'. PV II will pefrom the necessary calculaitons for each selected quantities. When the caculations are completed, the user can can graph the quantities from the Y-axis drop down menu. Similar to Trend Page, two different quantities can be graphed at the same time. The drop-down menu with available quantities is shown below.



The user can go back to the setup menu and compute other quantities of interest. The ones that have already been computed will show up as completed. Some quantities will need to be recomputed if the user changes certain parameters. For example, changing the Nominal Voltage or Dip Threshold Percentage will require the "Flags" quantity to be recomputed.

3 DATA EXPORT



The user can export a portion of a file or the whole file into four different formats:

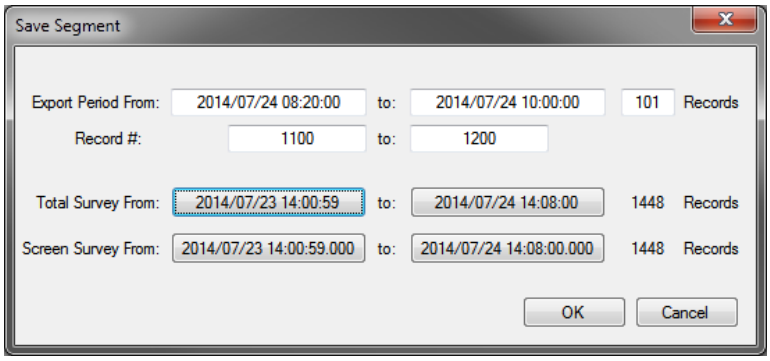
1. .TSE file compatible with PV II
2. .CSV file compatible with Microsoft Excel
3. .PQD (PQDIF format) compatible with PQView from Electrotec
4. Custom ASCII format. (PQ data files only)
5. COMTRADE (CW data files only)
6. IEC-61000-4-30 only (CW data files only, with one or more quantities already selected under IEC-61000-4-30 Setup)

3.1 Export to PV II

PV II can export a portion of a .TSQ file into a separate .TSQ file. This is useful if the user is only interested in data from a specific time period and wishes to reduce the file size.

Select a start and end time for the new file by either inputting the desired times, clicking the total survey buttons, or by selecting a start time and changing the number of records to export directly.

Clicking “OK” will bring up a save file dialog box to select the location and name of the file. Once that is complete the file will be saved, and can be opened in PV II.



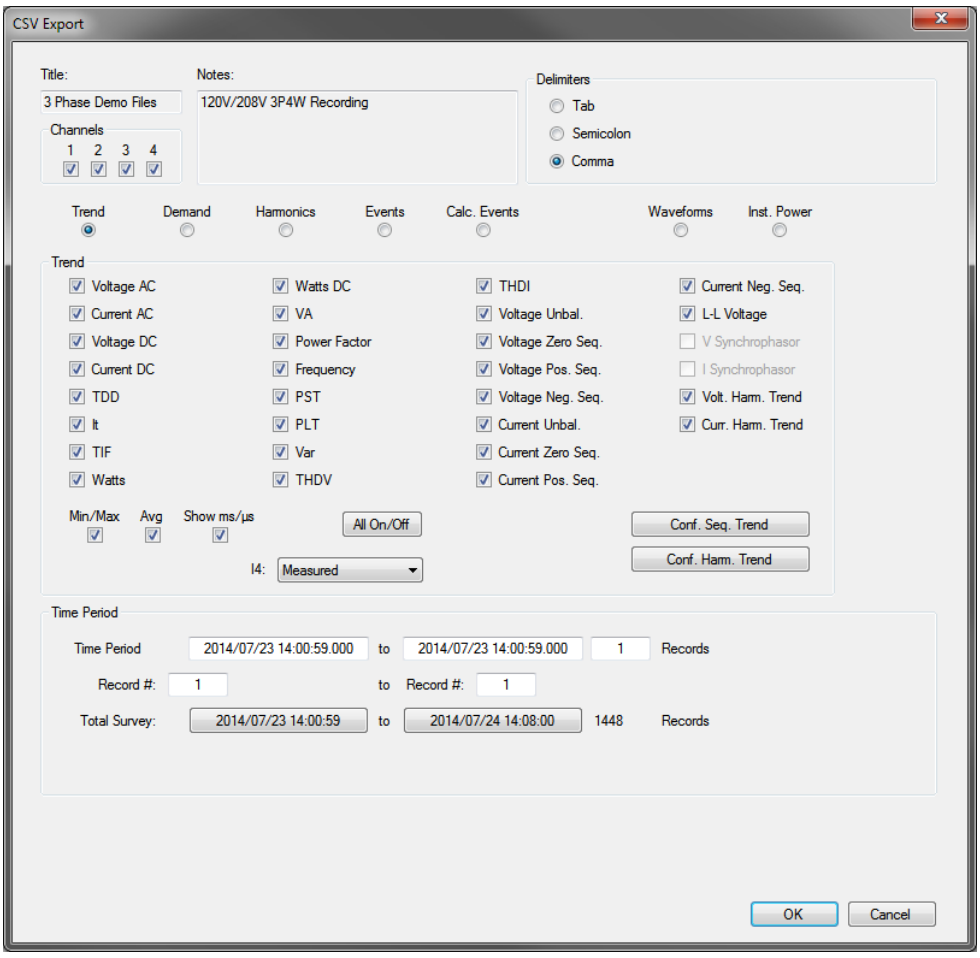
3.2 Export to Excel (.CSV)

When generating a .CSV file the user can choose the delimiter (comma, tab or semicolon), data type, specific quantities and time period. Changing the data type will open a submenu where more specific quantities can be included or omitted. Different types of data that can be exported to .CSV files are:

- Trend
- Demand
- Harmonics
- Events (if available)
- Calculated Events (if page is opened)
- Waveforms
- Instant. Power
- IEC 61000-4-30 (CW data files only)

The resulting CSV file can then be opened in Microsoft Excel.

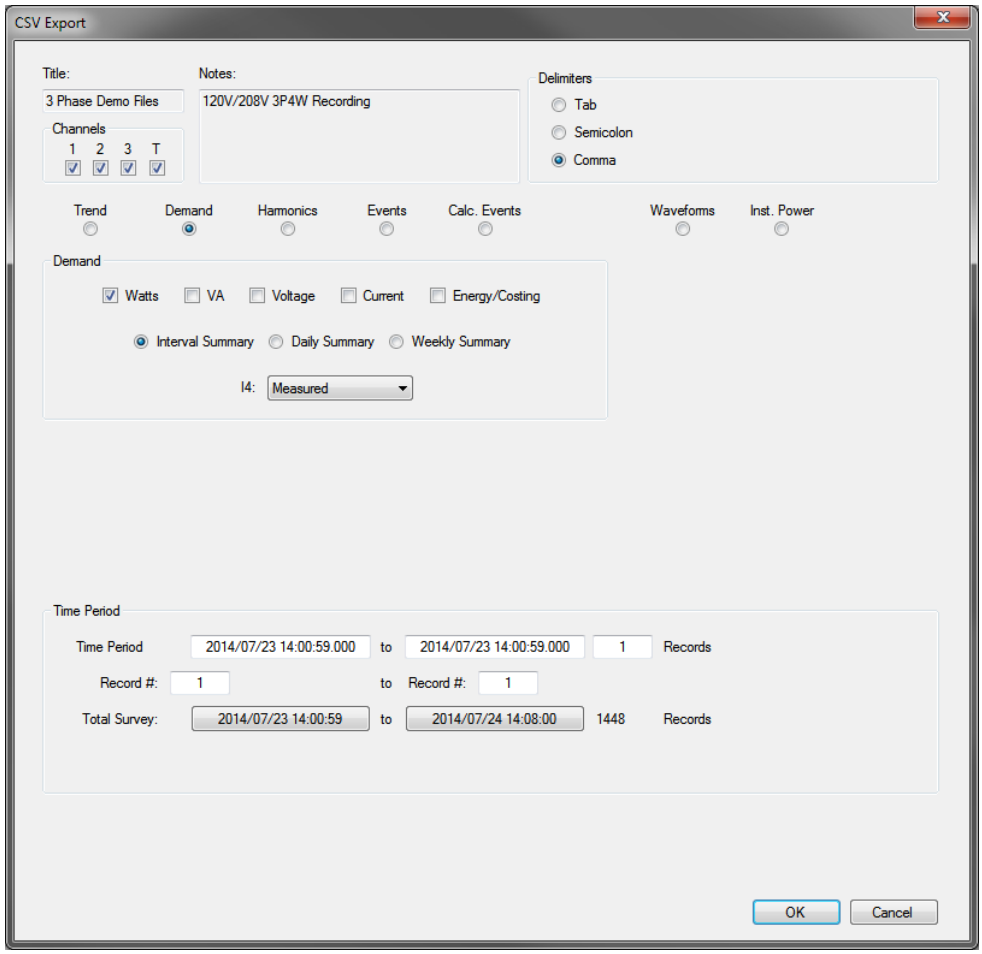
3.2.1 Export CSV – Trend



For voltage and current harmonic trend, click on ‘Conf.HarmTrend’ button to set harmonic number, type, and aggregation.

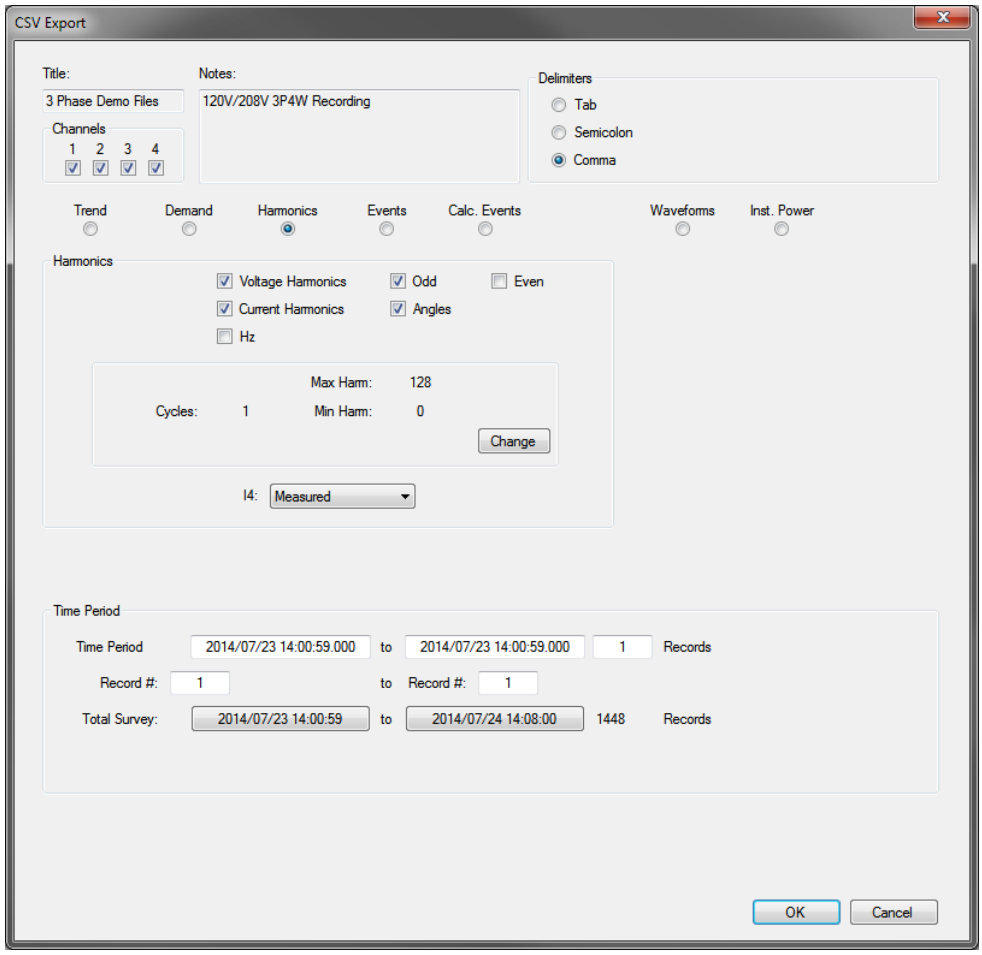
For voltage and current sequence trend, click on ‘Conf.Seq.Trend’ button to set sequence harmonic numbers and type.

3.2.2 Export CSV – Demand



Refer to section Demand and Costing Setup and Preferences – Demand/Costing before exporting Demand csv.

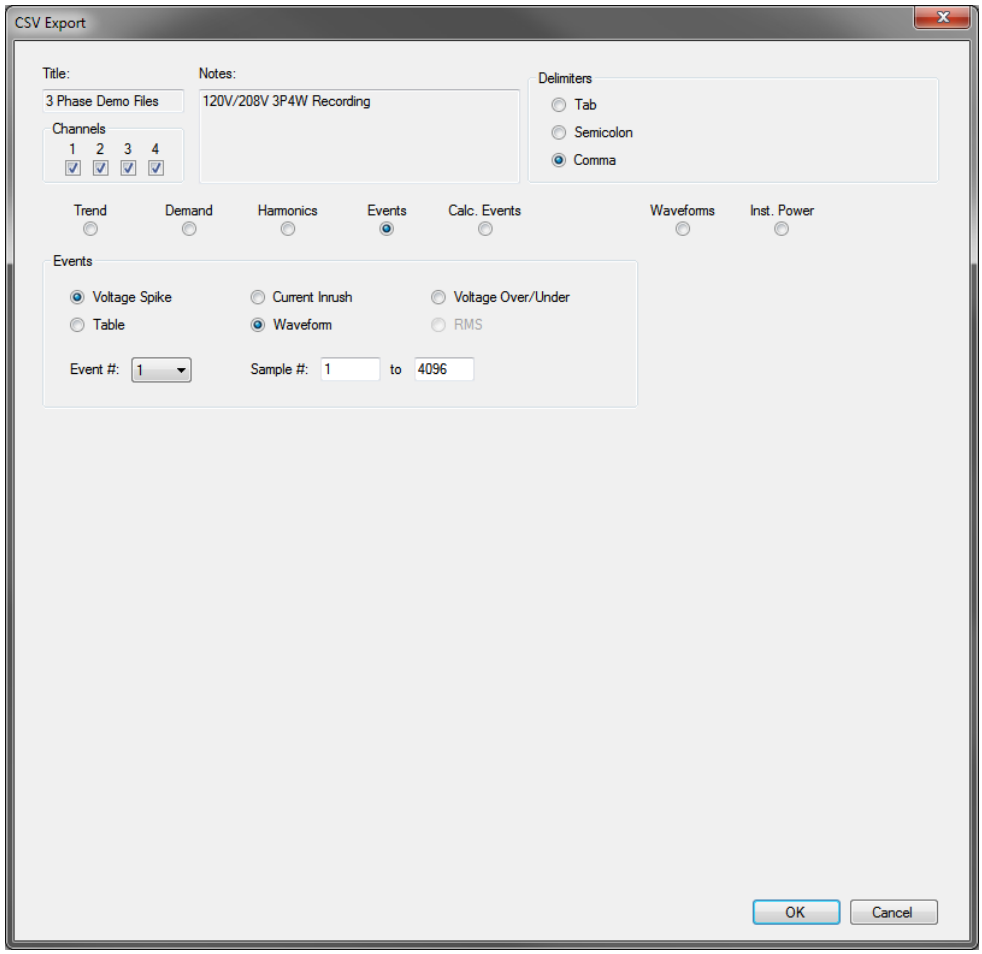
3.2.3 Export CSV – Harmonics



Angles: Angle of V1 fundamental is assumed to be 0º. All other harmonics (voltage and current) including those from other phases are relative to V1 fundamental.

Min/Max Harms: Select min and max harmonics. #0 represents DC while #1 represents the Fundamental harmonic.

3.2.4 Export CSV – Events

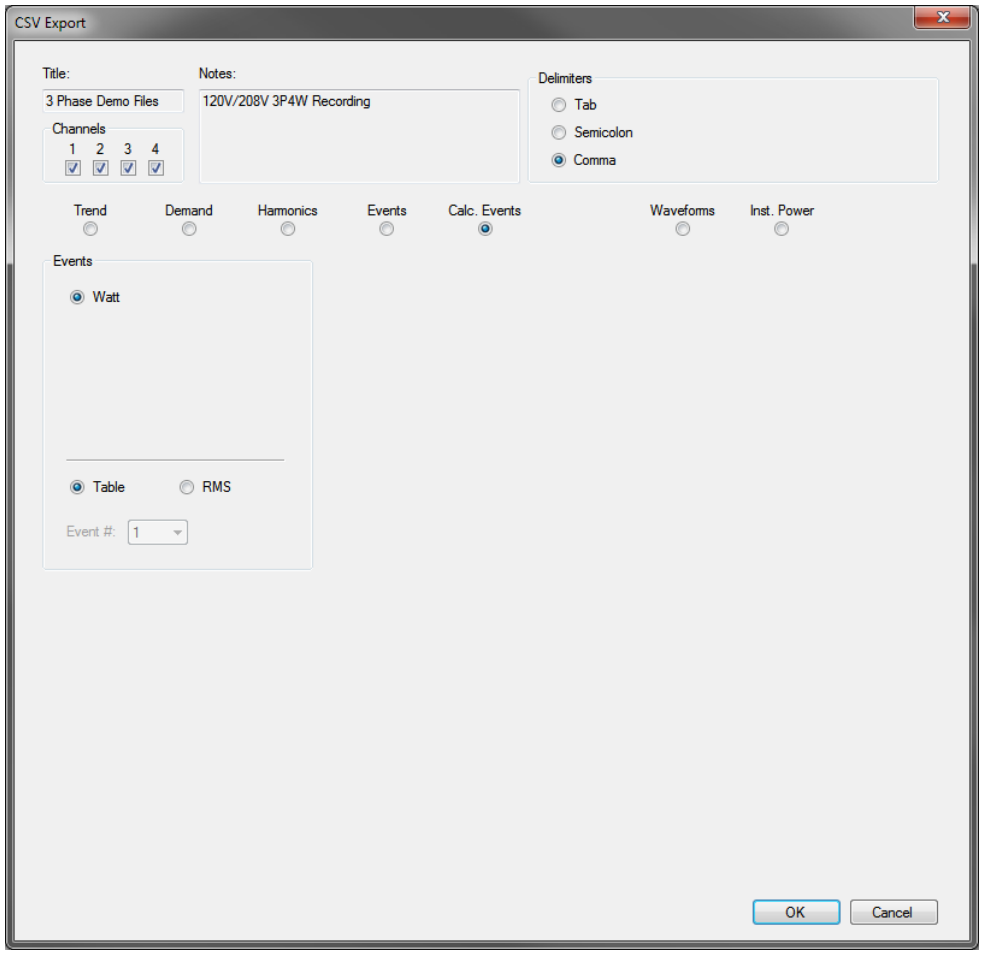


Select one of the three types of Events: Voltage Spike, Current Inrush, or Votlage Over/Under. Then select whether to export events as Table, Waveform or RMS.

If Table is selected, then event numbers that were selected under the corresonding Event Page configurations will be exported.

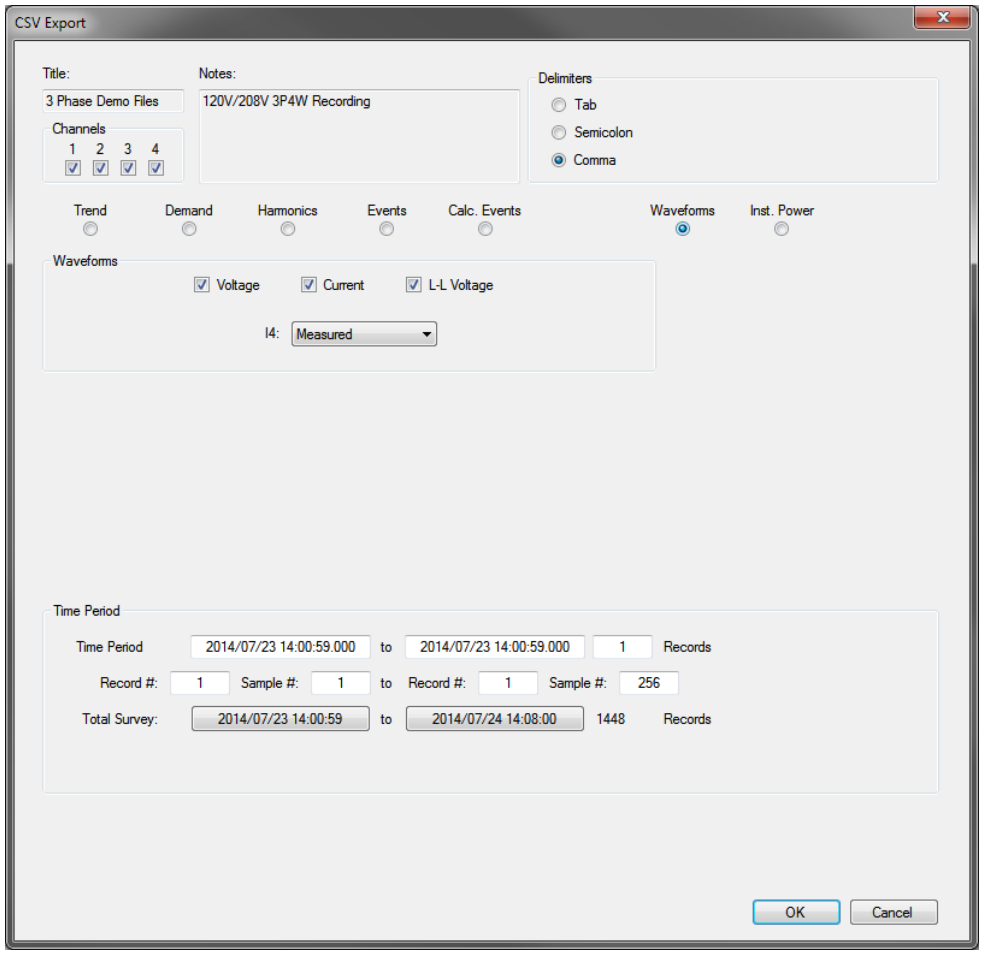
If Waveform or RMS is selected, enter an Event # and a Sample # range.

3.2.5 Export CSV – Calc. Events



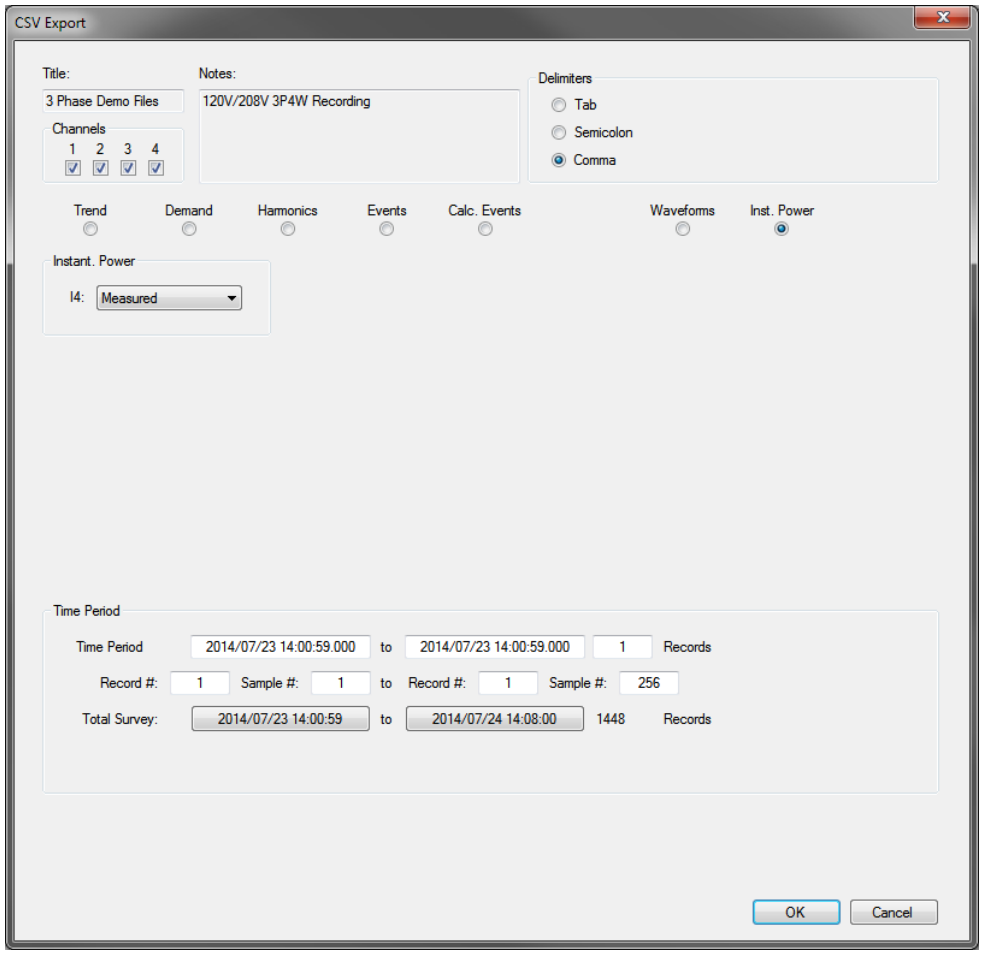
Calculated Events export is only available if a 'Calc. Events' page is opened. In this example, Watt Calculated Events page was opened in reference to section Calculated Events.

3.2.6 Export CSV – Waveforms



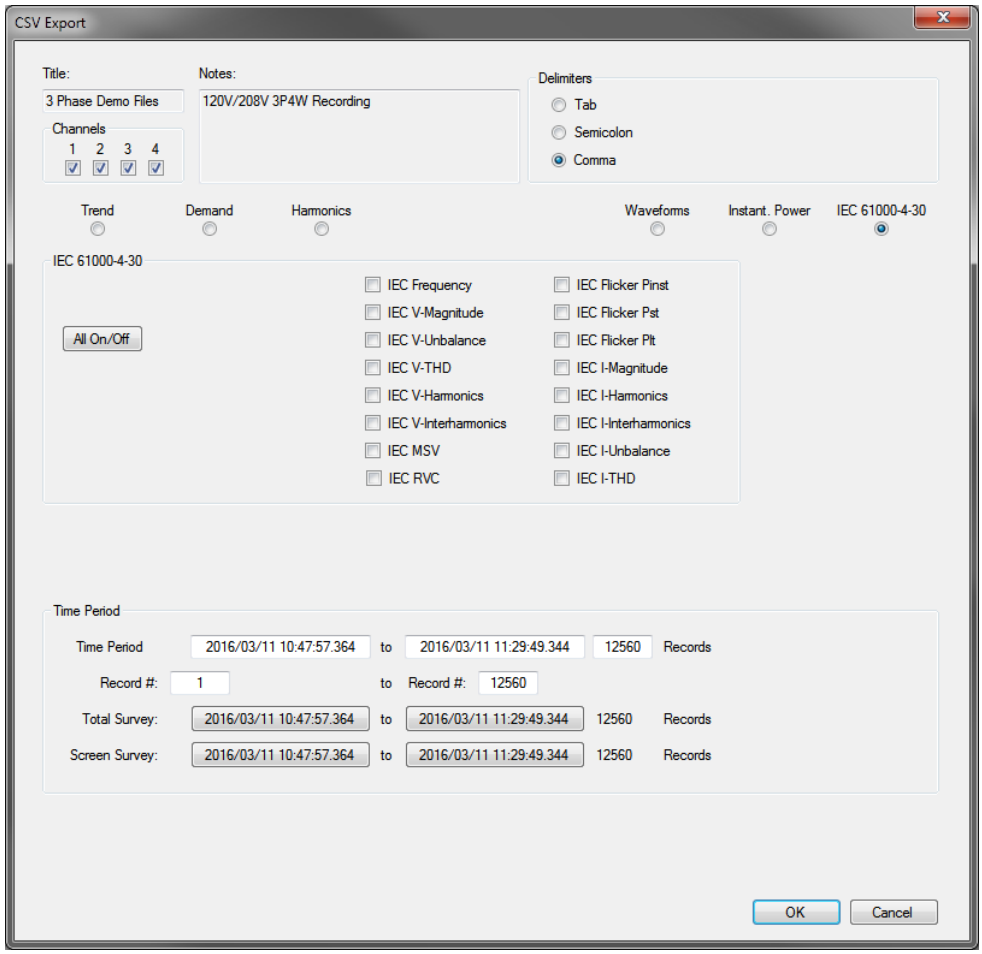
The user should exercise caution when exporting waveform data. At 1024 samples per cycle, it could consume lots of computer's proccessing power and storage space to genertate the csv file, depending on the number of records exported.

3.2.7 Export CSV – Instant. Power



Instantaneous power is calculated from voltage and current waveform data on a sample by sample basis. This is a useful measure of power when monitoring power semiconductor switched loads.

3.2.8 Export CSV – IEC 61000-4-30



This is only available for CW data files. Before exporting IEC 61000-4-30 to CSV, the setup must be done first. Refer to Page Types – IEC-61000-4-30 for more details.

3.3 Export to PQDIF

The PQDIF Export file can only be used with Electrotec's PQView program.

3.4 Export to Custom

The Custom Export option is used with a template file. The result is the same type of file that is generated by the Excel (.csv) option. The Custom Export option uses a template file to determine what is to be exported. Custom Export template files have the extension ***.PVIIcust***. These text files can be created and edited using any text editor such as Windows Notepad.

The file that will be created is an ASCII delimited text file. The delimiter used is specified in the first command. The underscore "_" is used as a command separator and is used where commands can have multiple parts (ie parameter, channel number and type).

The following table shows the commands needed to create and edit a Custom Export template file:

Command	Description	Example
CSV TXT	The very first line of the template file must contain the export to file type and the data delimiter. Two file types are supported: CSV and TXT. Three types of delimiters are supported: comma, semi-colon and tab.	CSV_, CSV_; CSV_TAB TXT_; TXT_; TXT_TAB
SN	Instrument Serial Number	SN
FSD	File Start Date default format is yyyy-MM-dd (note: capitals must be used for month as mm is used for minutes in time format). Alternatively, this formats is also supported: dd/MM/yyyy *Note that if the exported file is opened with Excel the Date and Time formats will be forced to the computer's format which is determined by the Regional Settings.*	FSD_yyyy/MM/dd
FST	File Start Time	
FED	File End Date	
FET	File End Time	
DSD	Exported data start date	
DST	Exported data start time	
DED	Exported data end date	
DET	Exported data end time	
STR	Text to add to each record line	STR_abcde
RN	Record number	RN
RD	Record date	RD
RT	Record time	RT
VAC	AC voltage, additional commands are channel number and type (MIN, AVG or MAX)	VAC_1_AVG
IAC	AC current, additional commands are channel number and type (MIN, AVG or MAX)	IAC_1_AVG
FRQ	Frequency, additional commands are type (MIN, AVG or MAX)	FRQ_AVG
VLL	Line to Line Voltage, additional commands are channel number	VLL_12
THDV	THDV, additional commands are channel number and type (MIN, AVG or MAX)	THDV_1_AVG
THDI	THDI, additional commands are channel number and type (MIN, AVG or MAX)	THDI_1_AVG
TDD	TDD, additional commands are channel number	TDD_1
WATT	Watts, additional commands are channel number or total (T)	WATT_1 WATT_T
VA	VA, additional commands are channel number or total (T)	VA_1
VAR	VAR, additional commands are channel number or total (T)	VAR_1
PF	Power Factor, additional commands are channel number or total (T)	PF_1
VUB	Voltage Unbal, additional commands are type (MIN, AVG or MAX)	VUB_AVG
IUB	Current Unbal, additional commands are type (MIN, AVG or MAX)	IUB_AVG

PF	Power Factor, additional commands are channel number or total (T)	PF_1
VUB	Voltage Unbal, additional commands are type (MIN, AVG or MAX)	VUB_AVG
IUB	Current Unbal, additional commands are type (MIN, AVG or MAX)	IUB_AVG

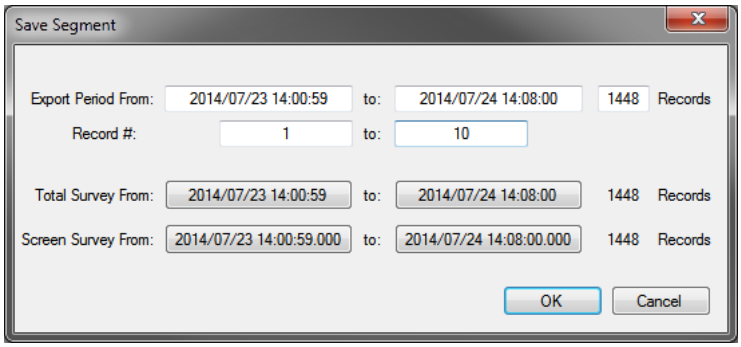
The file is setup where R=Row and C=Column. For Example R1:C1 would place the desired information in cell A1 in Microsoft Excel. Leave one space and put the command.

Example: *R1:C1 "Serial Number:"* will print the text string "*Serial Number"* in cell A1.

Here is an example of Custom Export template file (CustomExportFormat.PVIIcust) which can be found on the supplied USB memory stick – or the online download of PV II Demo Files, in the folder *Software* > *extras*:

```
CSV_,
R1:C1 "Serial Number:"
R1:C2 SN
R2:C1 "File Start"
R2:C3 "File End"
R2:C5 "Export Start"
R2:C7 "Export End"
R3:C1 FSD
R3:C2 FST
R3:C3 FED
R3:C4 FET
R3:C5 DSD
R3:C6 DST
R3:C7 DED
R3:C8 DET
R5:C1 "RECORD"
R5:C2 "DATE"
R5:C3 "TIME"
R5:C4 "VAC1 Avg"
R5:C5 "IAC1 Avg"
R5:C6 "THDV1 Avg"
R5:C7 "THDI1 Avg"
R6:C1 RN
R6:C2 RD_yyyy-MM-dd
R6:C3 RT
R6:C4 VAC_1_AVG
R6:C5 IAC_1_AVG
R6:C6 THDV_1_AVG
R6:C87 THDI_1_AVG
```

To create a Custom Export, first open the data file "PQ 3P4W.TSQ", then click *File* > *Export* >*Custom*.



Select the range of data to be exported (in this example, Record # 1 – 10). Click 'Ok', then select a Custom Export template (.PVIIcust) file to use as format. Click 'Ok', then choose a location to save the csv file.

Here is the CSV file resulting from this example:

Serial Number:	PQPro-00059						
File Start		File End		Export Start		Export End	
2014-07-21	16:54:59	2014-07-22	17:13:00	2014-07-21	16:54:59	2014-07-21	17:03:59
RECORD	DATE	TIME	VAC1 Avg	IAC1 Avg	THDV1 Avg	THDI1 Avg	
1	2014-07-21	16:54:59	120	23.22	0.8	3.5	
2	2014-07-21	16:55:59	119.9	25.84	0.8	2.9	
3	2014-07-21	16:56:59	120	25.81	0.8	2.8	
4	2014-07-21	16:57:59	120.2	25.81	0.8	2.8	
5	2014-07-21	16:58:59	120.2	25.8	0.8	2.8	
6	2014-07-21	16:59:59	120.3	25.8	0.8	2.8	
7	2014-07-21	17:00:59	120.4	25.8	0.8	2.9	
8	2014-07-21	17:01:59	120.4	25.8	0.8	2.9	
9	2014-07-21	17:02:59	120.4	25.78	0.8	2.9	
10	2014-07-21	17:03:59	120.4	25.78	0.8	2.9	

3.5 Export to COMTRADE

This is only available for CW data files. Select a time period, then select whether to export file as ASCII or Binary.

3.6 Export to IEC-61000-4-30 Only

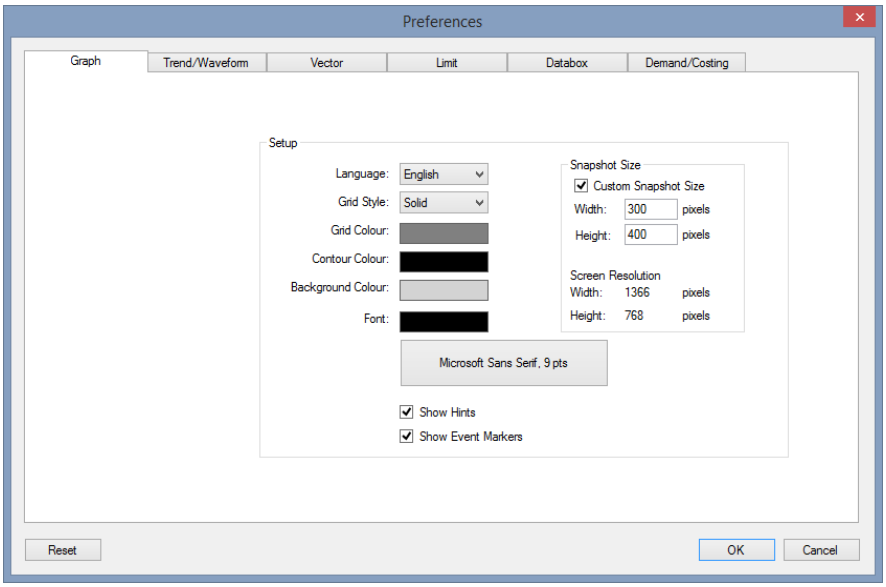
This is only available for CW data files. Before exporting 'IEC 61000-4-30 only', the setup must be done first. Refer to Page Types – IEC-61000-4-30 for more details.

This export will generate a new TSQ file with all waveform data removed and keeping only the IEC-6100-4-30 calculation results, thus reducing the file size significantly.

4 PREFERENCES

The Preferences menu is accessed from *Setup* > *Preferences*. The saved preferences will be applied after PVII is closed and restarted. Preferences will not be applied to data files that have been saved with modifications in order to prevent overwriting any saved formatting changes.

4.1 Graph



- Grid style is the type of line that is used for the interweaving grid lines in the graph areas.

- ***New*** Change Grid Colour, Contour Colour, Background Colour, and Font colour by clicking on the coloured rectangles, then choose a new colour from the palette.

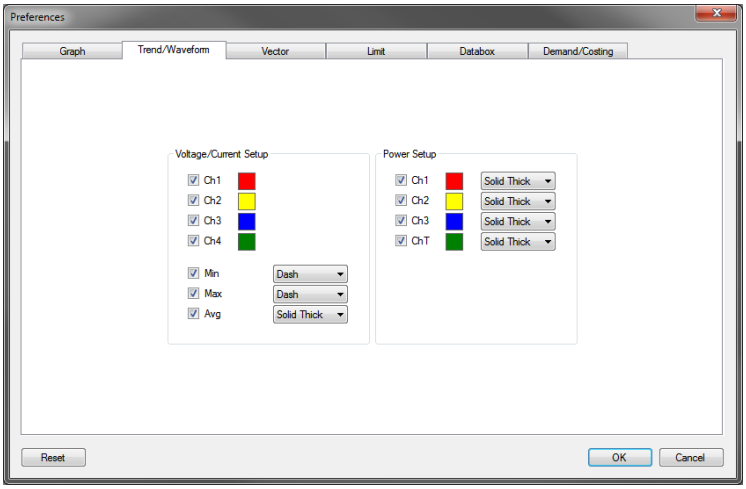
- ***New*** Snapshot size frame shown in the figure above.
  - If the "Custom Snapshot Size" checkbox is selected, the user can set the Width and Height of the Graph snapshot. The screen resolution of the main display screen will be displayed below the custom entries for Width and Height.
  - If multiple screens are utilized, then the window repositioning and the screenshot is taken on the main screen. PVII determines which screen is in use (or which screen contains most of the PVII window), and performs the resizing on that active screen as well as bringing the window back to its original location on the active screen. If multiple screens with different resolution settings are in use, then the screen capture resizing will be limited to the width and height of the active screen.

- Change font by clicking on the font button, then select another font from the font menu.

- Hints are small message boxes that, when enabled, are displayed when the cursor is in an area where the right mouse button is active.

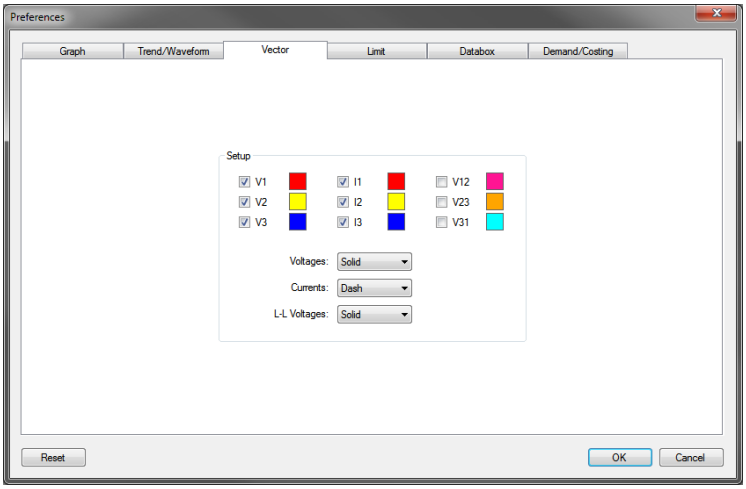
- Event Markers are symbols displayed along the top of Trend pages that indicate the location and type of captured event.

4.2 Trend/Waveform



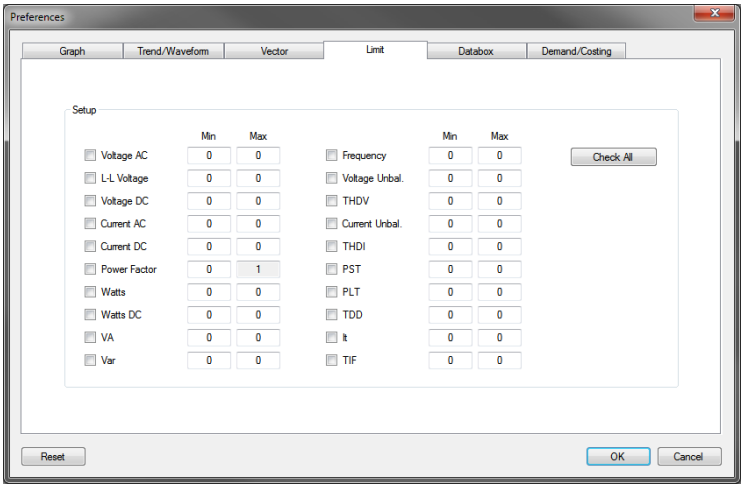
- Change visibility of each channel using the check boxes. Change colour of each channel by clicking on the coloured boxes, then choose a new colour from the palette.
- Change line style by using the drop down menus.

4.3 Vector



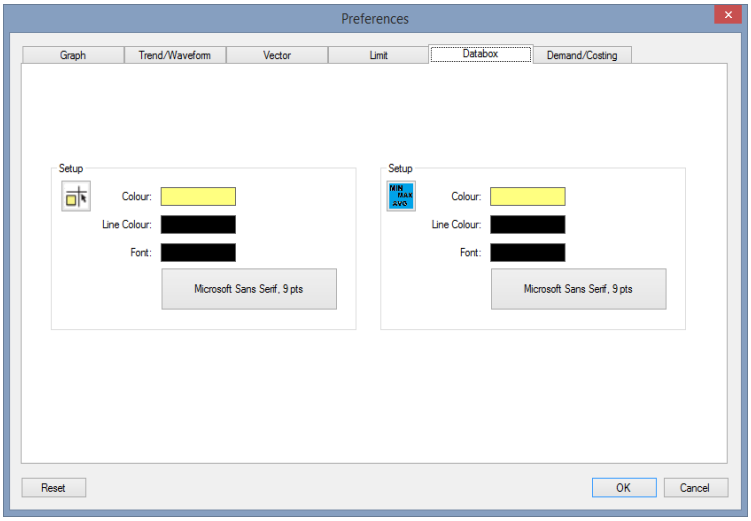
- Change visibility of each channel using the check boxes. Change colour of each channel by clicking on the coloured boxes, then choose a new colour from the palette.
- Change line style by using the drop down menus.

4.4 Limit



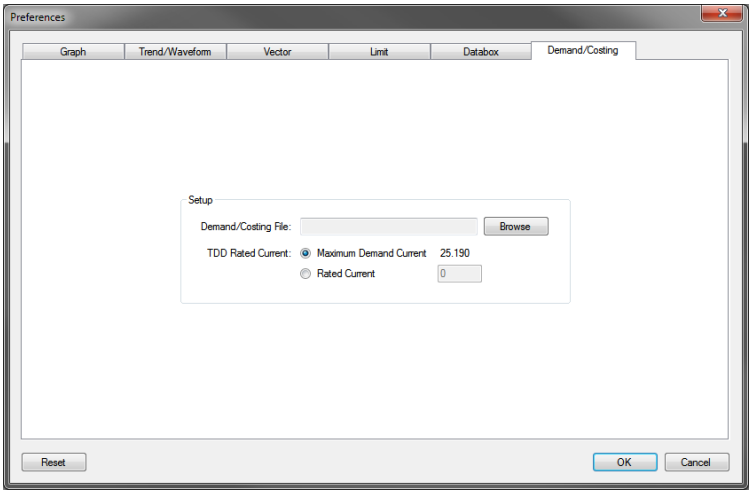
- Limit set in Prefernces will be used as default settings for Custom Report - Limit.
- Use the check boxes to select which prameters will have a limit applied. Type in the ‘Min’ and ‘Max’ values to define the lilmit range.

4.5 Databox



- Change databox background, outline, and font colour by clicking on the coloured rectangles in the left side setup, then choose a new colour form the palette.
- Change databox font by clicking on the font button in the left side setup, then select another font from the font menu.
- ***New*** Same changes highlighted above for the databox can be performed for the Graph Measurement Databox by changing the right-hand setup.

4.6 Demand/Costing



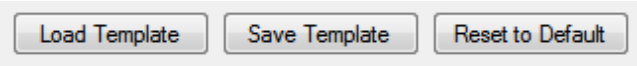
- "Demand/Costing file" is the default demand and costing configuration file that PV II will use. Changing this will cause PV II to read from a different file when starting. It will affect the Demand and Costing Setup found in *Setup > Demand and Costing*.
- TDD rated current is used in the calculation of Total Demand Distortion (TDD).

5 CUSTOM REPORT

Create Custom Report by going to: *Reports* > *Custom Report*

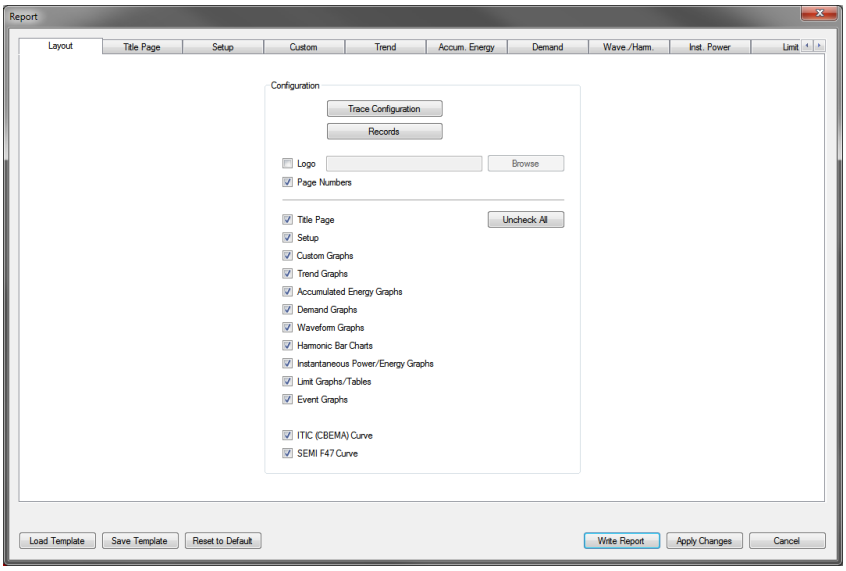
5.1 Load / Save .PQT Template

A report template is useful when standardized report formatting is required. The user can first manually configure various report settings, then save them as a template file for future use.



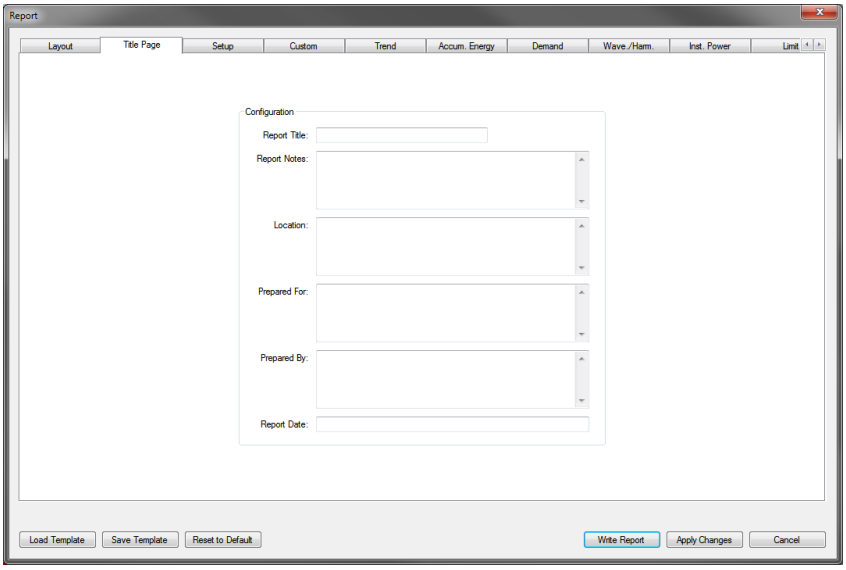
- Select a template file by clicking 'Load Template'.
- Save current report settings as a template by clicking 'Save Template'.
- Remove a loaded template by clicking 'Reset to Default'.

5.2 Layout



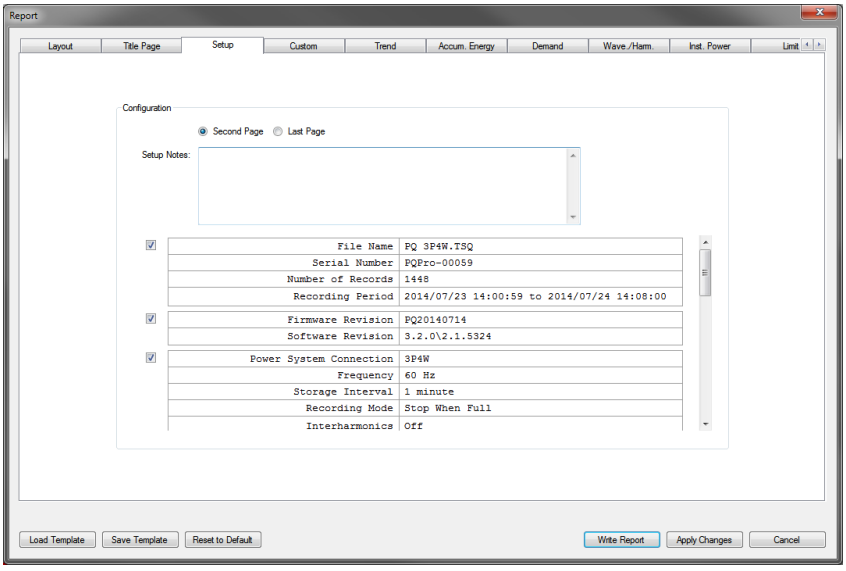
- Select graphs to be included in the report.
- The available selections of graphs correspond to those that are configurable in the adjacent tabs, ie: Custom, Trend, Energy, Waveform, Harmonics, Instantaneous Power, and Limit graphs.
- Add company logo, page numbers title page and setup page to the report.
- The 'Records' button controls the time duration of the report.

5.3 Title Page



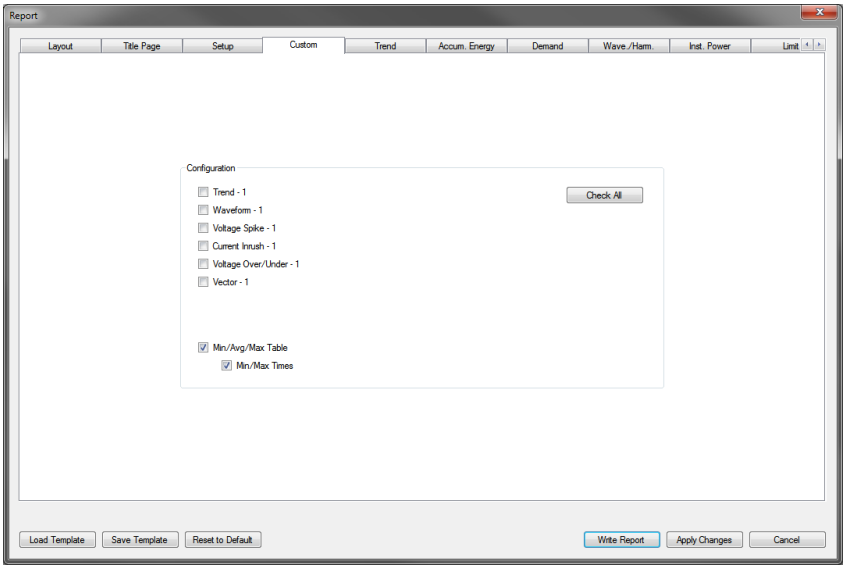
- Add relevant information to the report such as Report Title, Report Notes, Location, 'Prepared For, 'Prepared by', and Report Date.

5.4 Setup



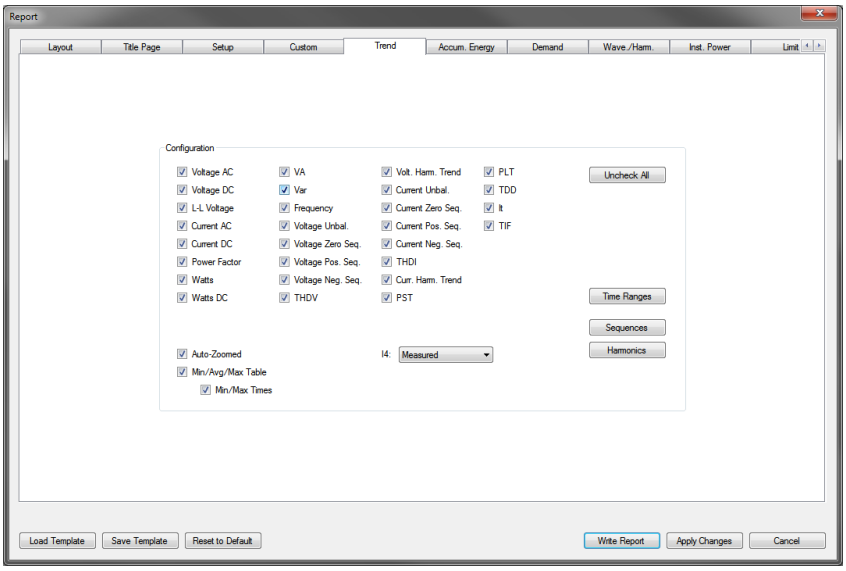
- Select whether to insert this page as the Second Page or Last Page of the report.
- Add setup-related notes, and select the type of information to be included in the Setup Page of the report.

5.5 Custom



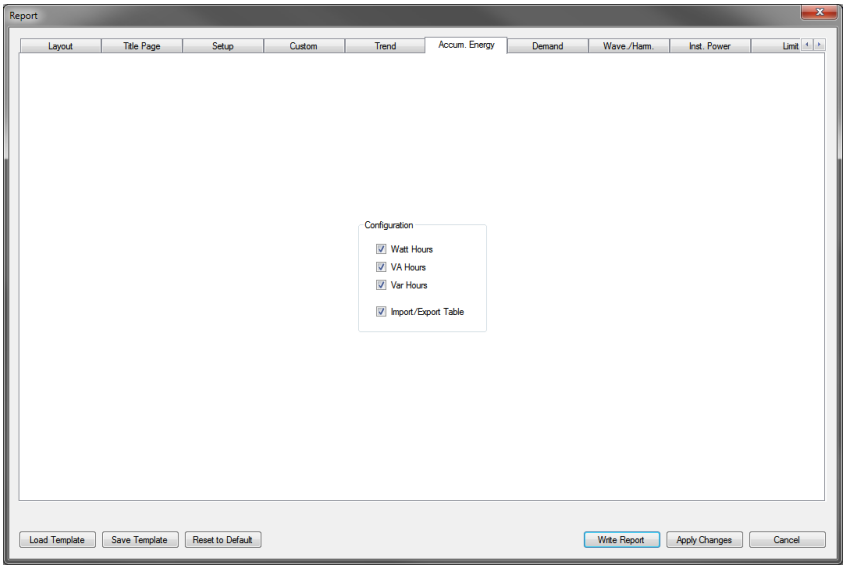
- Add graphs from currently opened pages to the report. This is particularly useful when annotations were added to the graphs and the user wants to include them in the report.

5.6 Trend



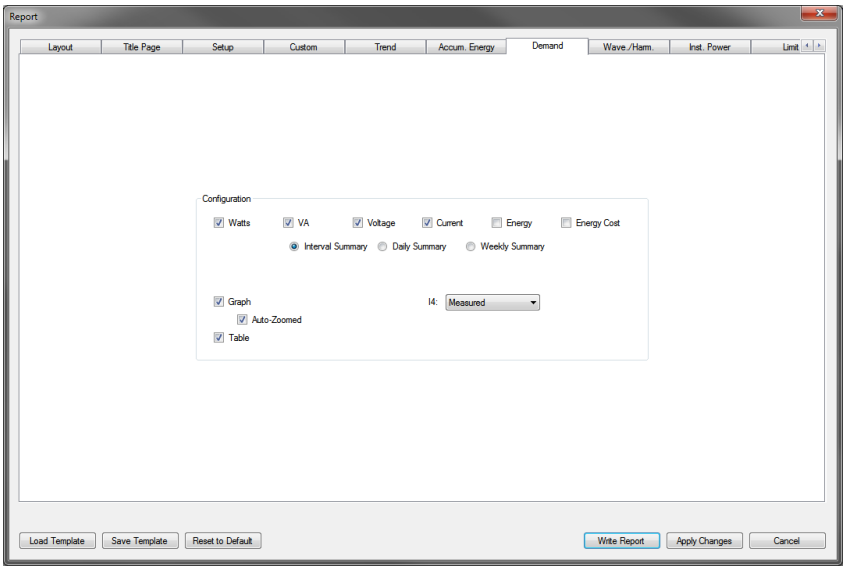
- Select quantities to be included in the report.
- For voltage and current harmonic trend, click on ‘Harmonics’ button to set harmonic number, type, and aggregation.
- For voltage and current sequence harmonic trend, click on ‘Sequences” to set sequence harmonic numbers and type.

5.7 Accum. Energy



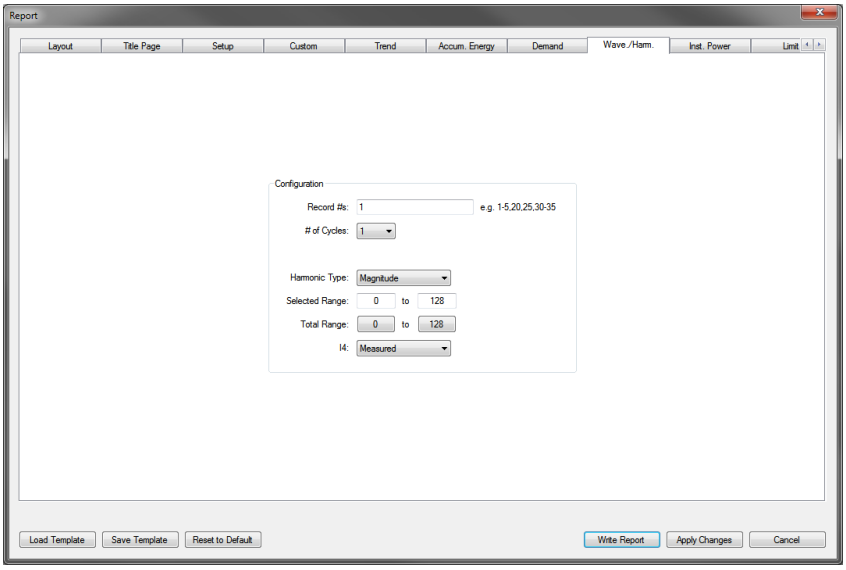
- Select quantities to be included in the report along with Import/Export Table option.

5.8 Demand



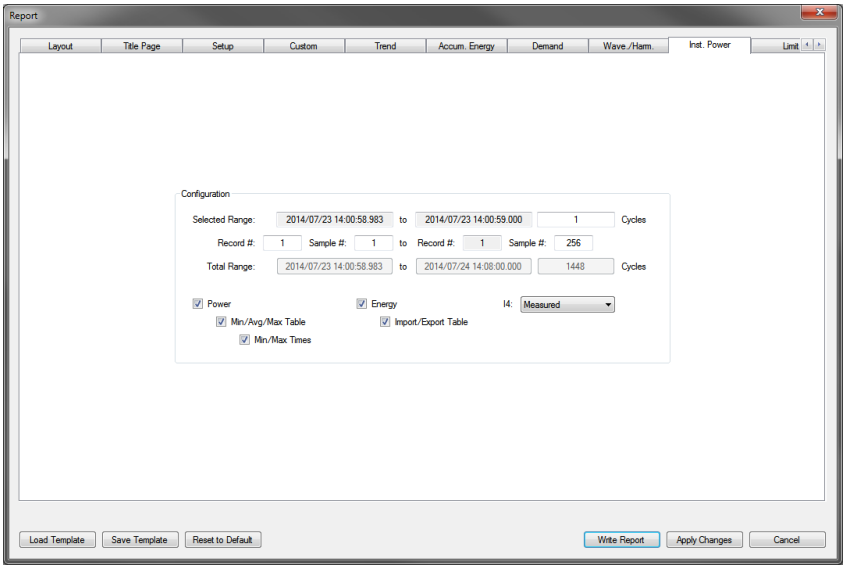
- Select quantities to be included in the report, and the time frame of how Demand is calculated. Note that Interval Summary uses the same Integration Period setting found under Demand and Costing Setup. The default is 15 minutes.

5.9 Waveform/Harmonic



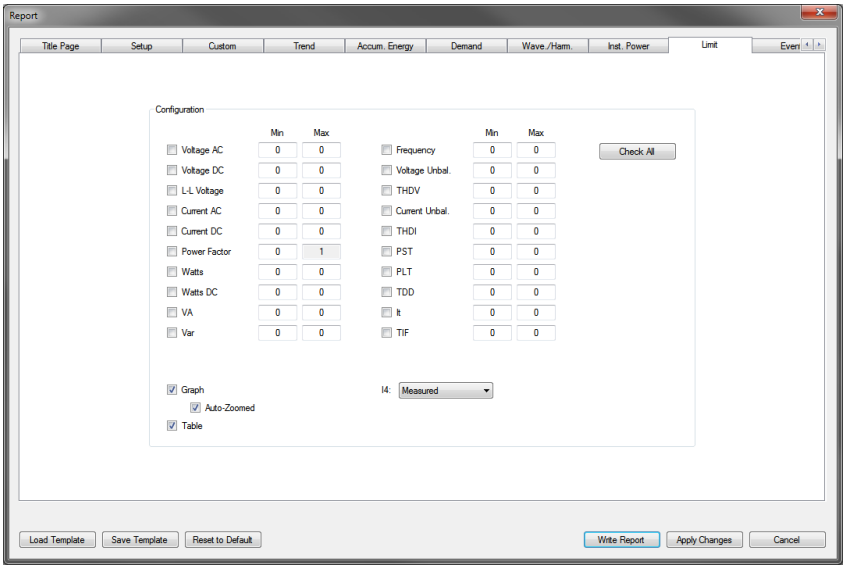
- Enter Record # of interest. Multiple records can be entered. Eg: 1-5,20,25,30-35
- Select other harmonic related parameters.

5.10 Instant. Power



- Select the start time and end time of the report either by time range, or Record/Sample #
- Select other relevant parameters by clicking the check boxes.

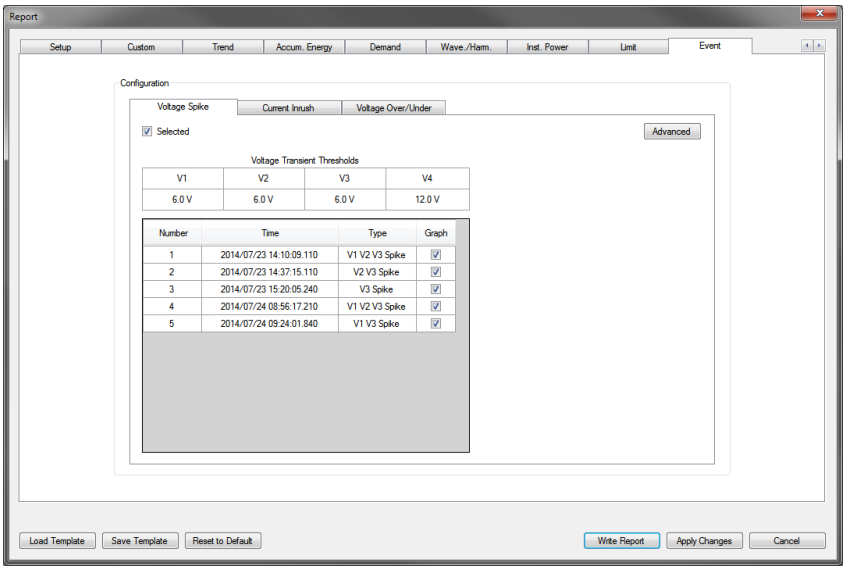
5.11 Limit



- Select which quantity to enable for the Min/Max threshold report. The report will show the % of time when it is:

    - Above the maximum threshold.
    - Below the minimum threshold.
    - Within Limits

5.12 Event

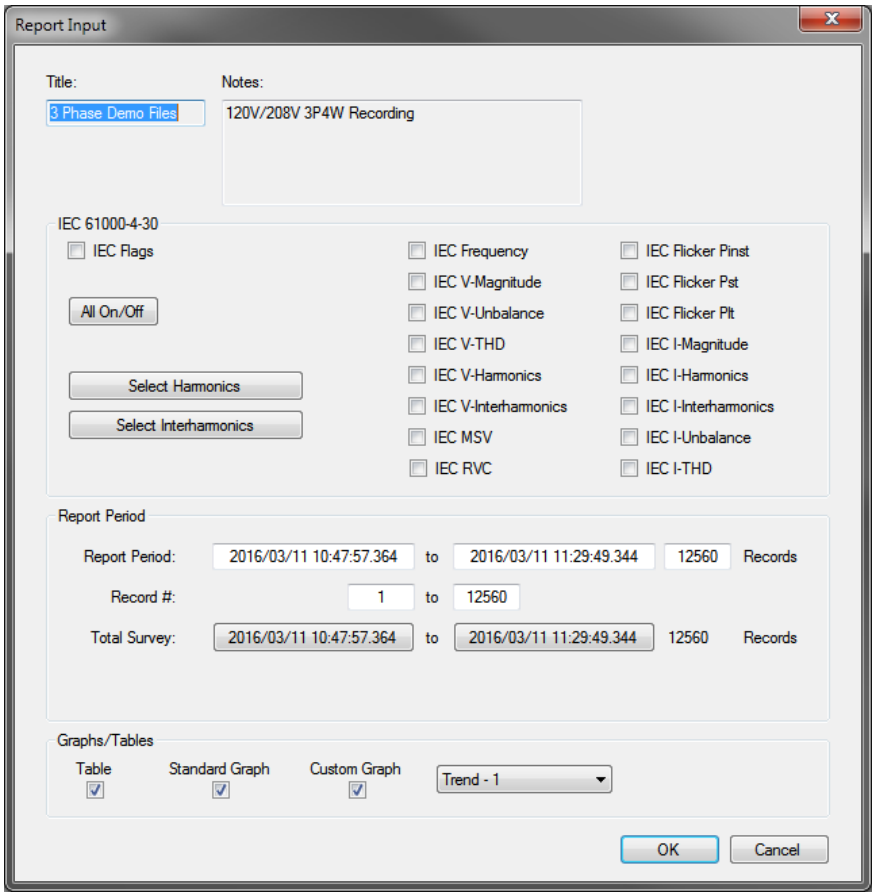


- Select events to be included in the report.

6 IEC-61000-4-30 REPORT

This is only available for CW data files. Before generating IEC 61000-4-30 Report, the setup must be done first. Refer to Page Types – IEC-61000-4-30 for more details.

When setup is done, go to *Report > IEC-61000-4-30*



7 FILE TEMPLATE

A file template is useful when assessing and analyzing a number of recordings that were done under similar conditions. It is created by manually formatting a data file and then selecting *File > Save Template*, which will save a .PVT template file.

Certain conditions must be satisfied in order to use a file template:

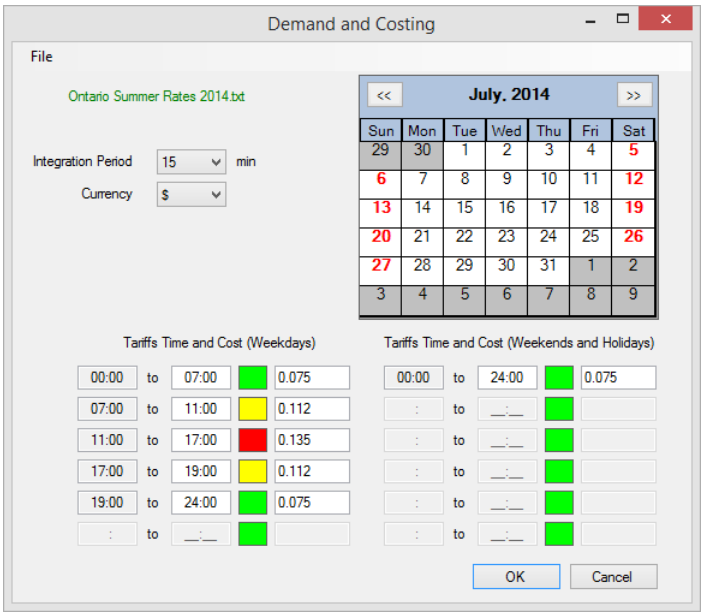
i) Same instrument type, ie. PQPro, EP600i, EPsd, etc.
ii) Same recording mode, ie. interval data or continuous waveform data
iii) If continuous waveform data then same number voltage and current channels
iv) If interval data then the same connection configuration, ie. 1P2W, 1P3W… etc.

File formatting changes saved in template:

i) All tabs and tab labels
ii) Graphed quantities
iii) Scaling changes
iv) Trace colour changes
v) Report template

To apply a file template, first open a data file, then go to File > Load Template, then select the .PVT template file.

8 DEMAND AND COSTING SETUP



The software can take the measured power data and calculate demand and energy costing. The Demand and Costing dialog box is accessed from the top tool bar, select: *Setup > Demand and Costing*

The demand integration period can be set to 1 minute, if the storage interval is 1 minute or less, up to 60 minutes. Tariffs Times and Costs can be setup for both weekdays and weekends/holidays. They can be set manually or read in from a configuration file (.txt).

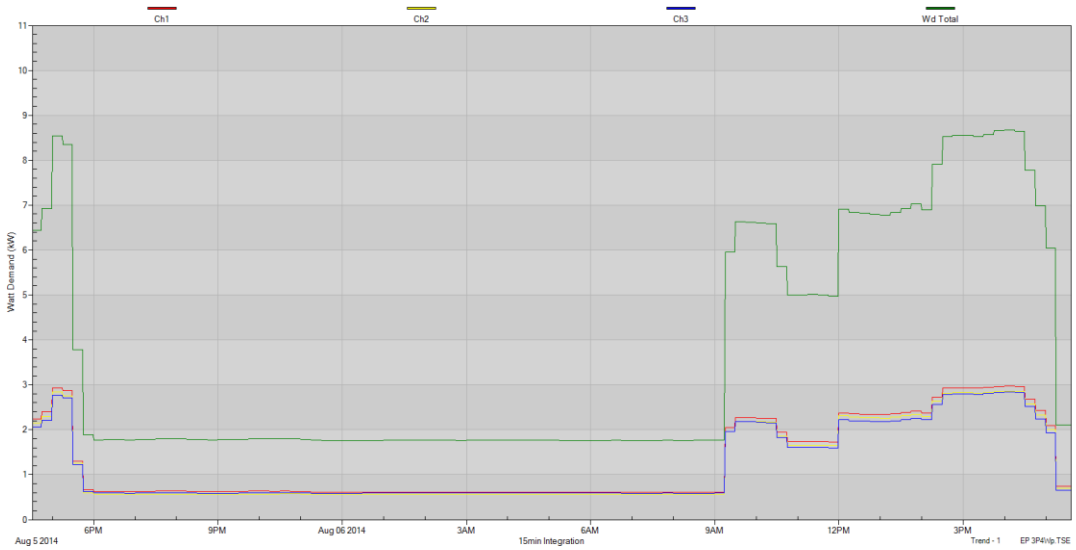
The configuration file can be pre-loaded (as the default setting) by going to *Setup > Preferences > Demand/Costing*. See Preferences – Demand/Costing for details. Alternatively, the configuration file can also be opened at the Demand and Costing dialog box by going to File > Open, then select the .txt file.

To change Tariffs Times and Costs manually, enter an end time for the costing period and enter the cost of a kWh during that time. Each costing periods can be represented by a different colour. This is done by clicking on the colour box and choosing a colour from the palette.

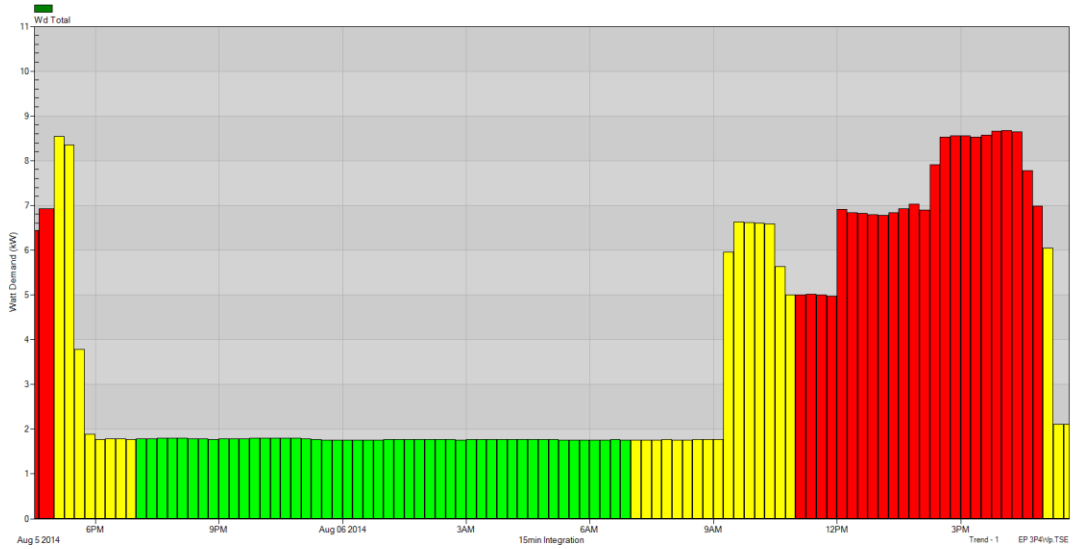
The times on the left are for normal weekdays, and the times on the right are for weekends and holidays. Up to six different costing periods can be setup in a day, and the time must be entered in a 24hr format.

Weekends are automatically configured. To change holidays, click on the appropriate day in the calendar. Days highlighted in red are weekends or holidays. Once clicked, the day will either return to black, or become highlighted in red.

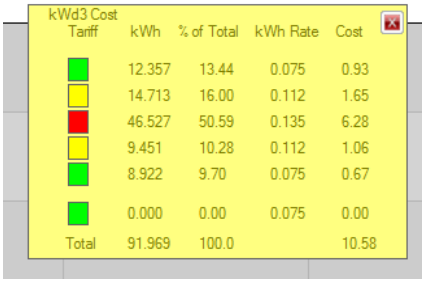
The Watt Demand graph plots channels 1,2 and 3 (for a three phase system) plus Total. When more than one quantity is graphed, the traces are single lines as shown below.



If only one trace is enabled, the graph becomes a bar chart with the bar colour set by the time of use colour, as shown below.



When there is only one trace enabled, a Cost Table button will appear on the top left of the graph. This will bring up a table showing the energy usage and associated cost for each of the tariff times.



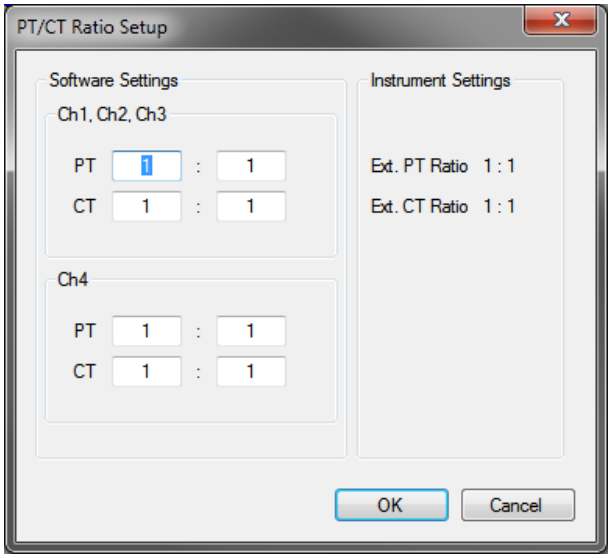
Tariff	kWh	% of Total	kWh Rate	Cost
	12.357	13.44	0.075	0.93
	14.713	16.00	0.112	1.65
	46.527	50.59	0.135	6.28
	9.451	10.28	0.112	1.06
	8.922	9.70	0.075	0.67
	0.000	0.00	0.075	0.00
Total	91.969	100.0		10.58

9 PT/CT RATIOS

The user can change PT and CT ratios in *Setup > PT/CT Ratios*.

Please keep in mind that the CT and PT ratios from software settings are applied in addition to the ratios from instruments (***PQPro™***) settings.

For example, if Ext. PT Ratio in instrument settings was set at 2:1, applying a PT ratio of 2:1 in software settings will result in a total ratio setting of 4:1 for voltage measurements.



10 TOOLS

10.1 Creating Firmware Card

Please refer to the document PQPro Firmware Programming for more details.
To obtain the latest version of .PQC firmware file, please email us info@candura.com

10.2 Creating Option Card

Creating Option Card follows the same procedures as Creating Firmware Card.
To obtain a .PQL option file, please email us info@candura.com