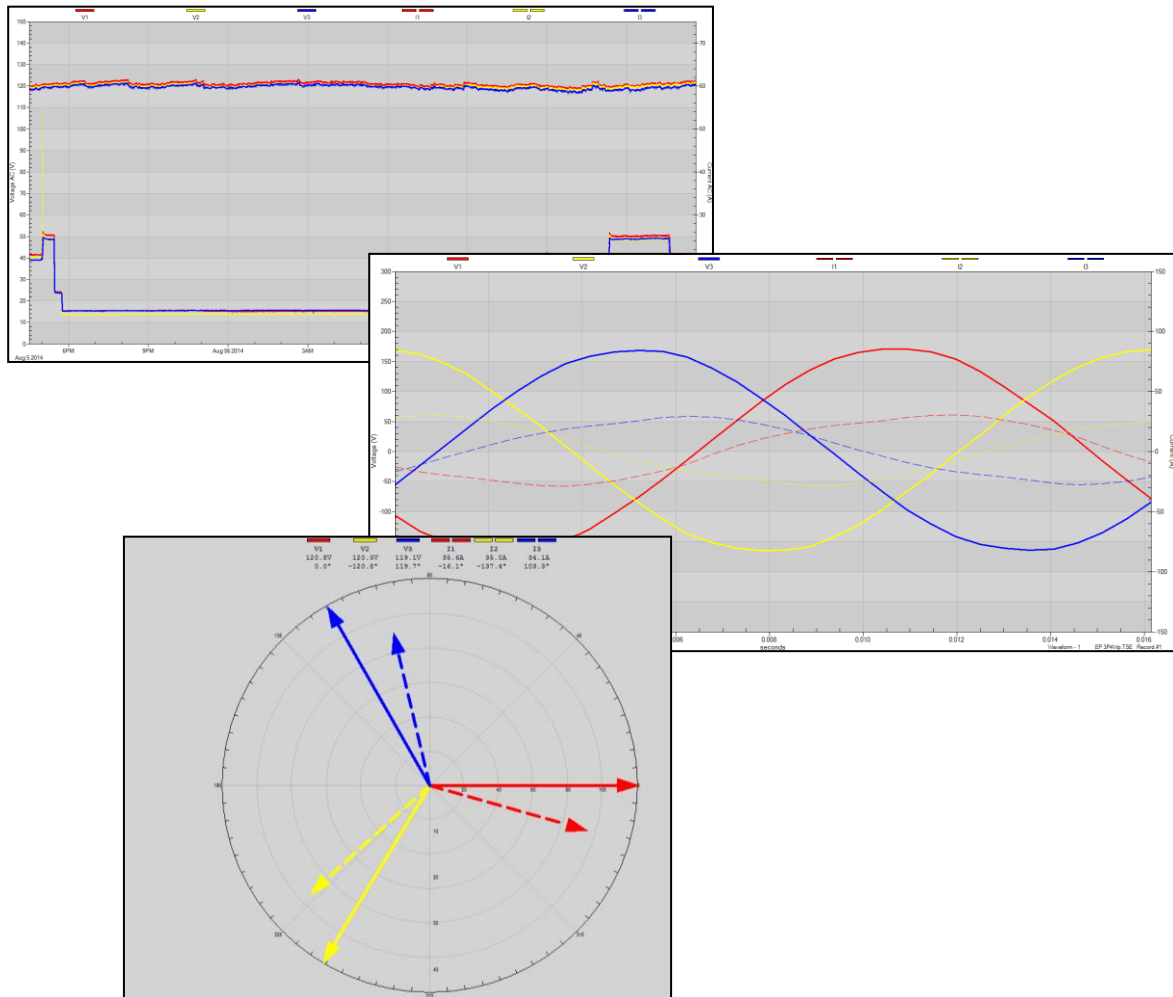


User's Guide

PV II™ for the EA-100™

Data Analysis Software



PV II™ User's Guide

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Table of Contents

Introduction	1
File Open	2
Page Types.....	3
Trend.....	4
Waveform.....	7
Vector Page	9
Graph Play Buttons	10
Data Export.....	11
Preferences	17
Generating a Report	18
Demand and Cost Setup	19
Notes	22

Introduction

PV II™ is the second generation of electrical power data analysis software from Radian Research. It is a totally new application that builds on the knowledge gained from developing the original PowerView software. **PV II™** supports all of Radian'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 **EA-100™**. **PV II™** has been designed to be easy and intuitive to use.

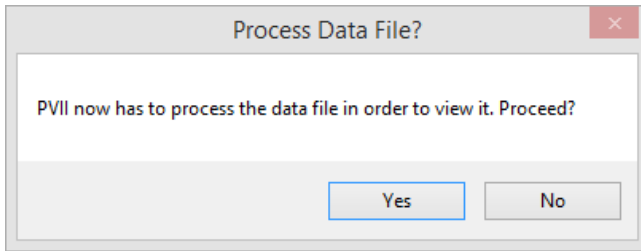
File Open

All **EA-100™** data files will have the extension .TSE. Only one .TSE file will be stored on the data card. The maximum number of records that can be recorded is 600,000 with a maximum file size of 300MB. For smaller number of records the file size will be smaller. When the software reads the data file on the memory card it processes the data and then writes it to a new file keeping the .TSE extension.

For the purpose of this section the file EP 3P4W.TSE is used. In the supplied USB memory stick, you can find this file under the folder “Data Files \ Data Card”.

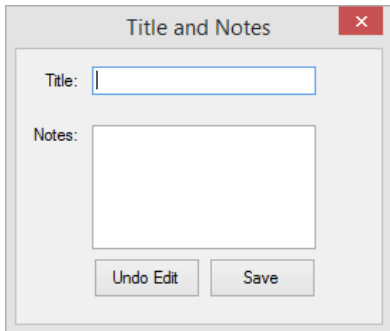
As an example, open the unprocessed data file (EP 3P4W.TSE). On the top tool bar select “File” and “Open”. Then select the drive letter of the USB memory stick, and open “Data Files \ Data Card \ EP 3P4W.TSE”.

Data card files must be processed before the software can open them. This only needs to be done once as the processed file is saved and next time the software can open the processed file directly.



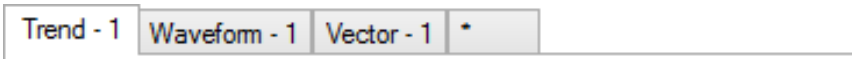
After the file has been processed you will be prompted to save the processed file. **PVII™** will automatically keep the same name with the addition of a “p” to indicate it is processed. You may change the name and folder if desired.

After clicking “Save” you will be prompted to enter a title and notes to describe the file such as instrument settings, location, etc. This may be left blank and can be edited later.



When this information has been entered or intentionally left blank, click “Save”. The RMS voltage and current trend graphs are displayed by default when the data file is first opened.

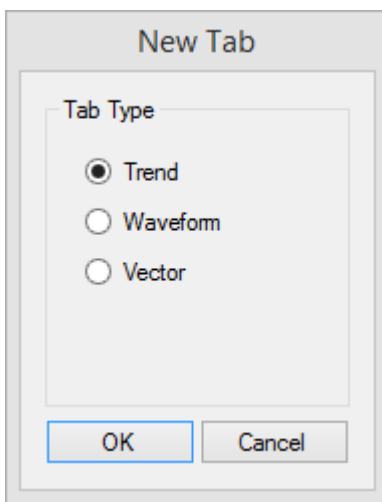
Page Types



Standard **EA-100™** data files have three different types of display pages available:

- Trend
- Waveforms
- Vector

If a page tab is not displayed but is available it can be opened by clicking on the “+” tab and selecting the desired page:



Each page can be configured individually. Configuration includes quantities that are graphed, which traces of the different quantities are displayed, the colors 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.

Page Types - Trend

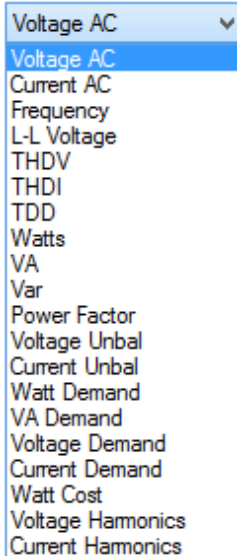
Trend

The Trend page graphs steady state quantities that are recorded at a specific time interval that is determined by the instrument's storage rate. The **EA-100™** has storage intervals that vary from 1 second 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 **EA-100™** is configured for a single phase (1P2W or 1P3W) measurement then voltage and current unbalance will not be in the drop down list.

Trend quantities that can be graphed are:



Under the page tabs is a row of tool buttons that can be used to zoom, unzoom, select, place a data box, place a text bubble, query a point on the graph, or take a snapshot of the graph which can be pasted into a Word or Excel document.

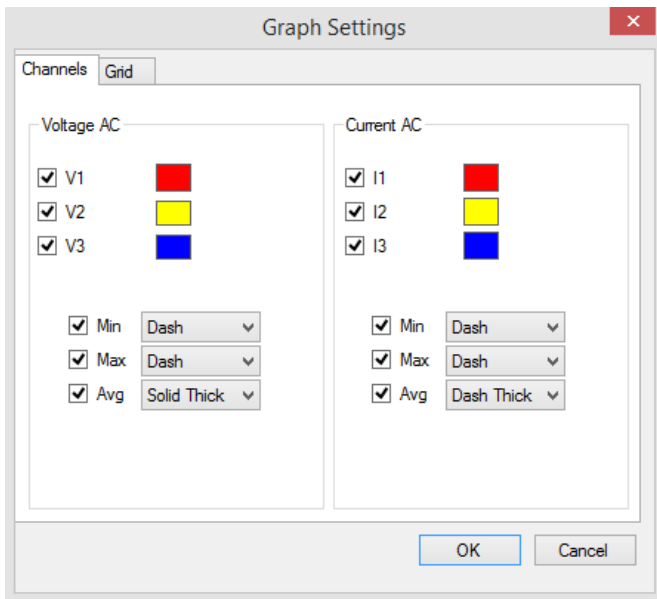


The demo file EP 3P4W.TSE is from a three phase four wire (3P4W) measurement with data stored every minute. The opening Trend screen shows the 3 voltages, V1 (red), V2 (yellow), and V3 (blue) using the left scaling axis. The 3 currents, I1 (red), I2 (yellow), and I3 (blue) are also displayed and they use the right scaling axis.

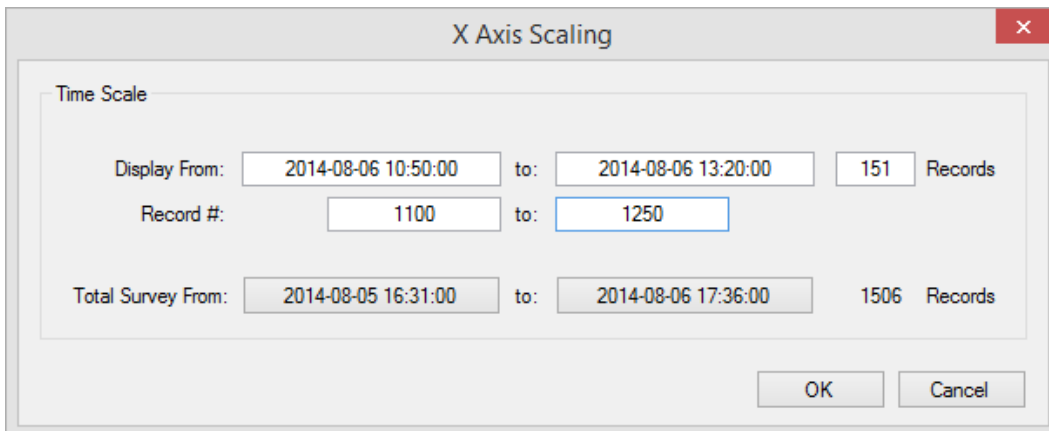
Page Types - Trend (continued)

Moving the cursor around the outside of the graph area enables access to some of the page setup features. If enabled, a hint box will appear when a feature is available. Right clicking the mouse button will bring up the dialog box for a specific feature. The hint box can be enabled or disabled from the "Setup - Preferences" dialog box.

In the EP 3P4W.TSE file RMS Trend data has a load change at 11:59:00 (Record #1169). To view channel 3 voltage and current data in more detail channels 1 & 2 can be turned off. To do this right click with the cursor in the legend area (just above the graph). Unselect V1, V2, I1, and I2 and click on the colour box for I3, change the colour to black and click on "OK".



Now the graph will only show V3 and I3. To change the current scaling right click in the area to the right of the graph, select "Manual" and adjust the Max value to 50 click "OK". To change the voltage scaling right click to the left of the graph and select Manual scaling of 110 to 125. Change the time scaling by right clicking below the graph and set the records to 1100 to 1250.



Page Types - Trend (continued)

From the Speed Button tool bar select the Data Box tool:



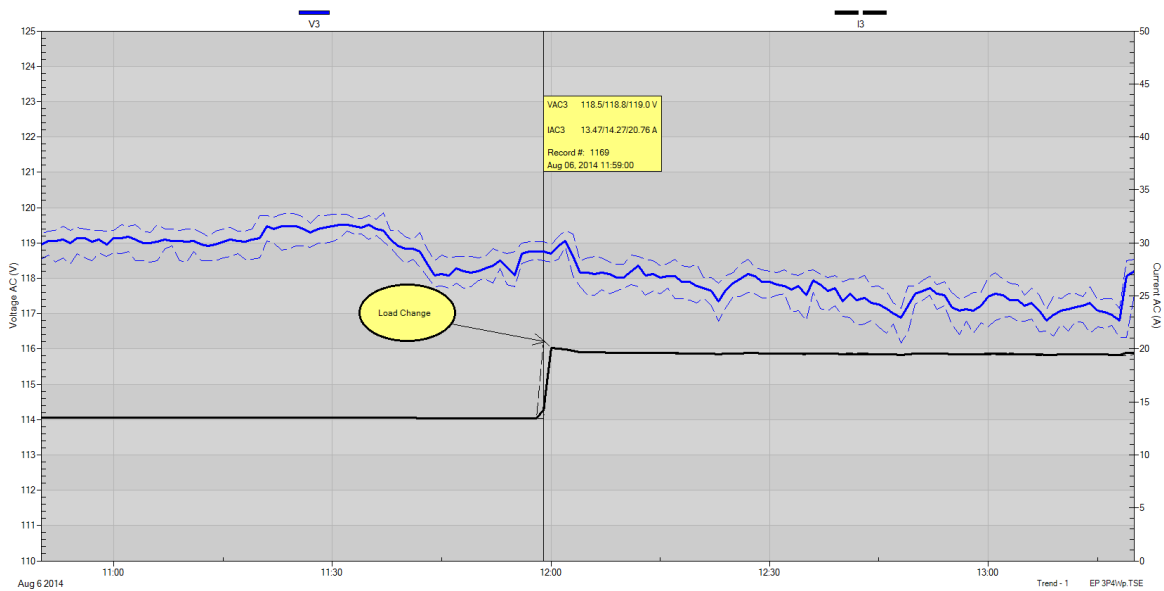
Position the cursor at the location of interest on the graph, in this case at record # 1169, using the mouse or the left eight arrow keys. Click the left mouse button or press the Enter key, this will paste the Data Box onto the graph at the desired location.

Move the cursor over the Data Box and hold the left mouse button down. The Data Box can now be repositioned vertically along the reference line or moved from one side of the reference line to the other.

From the Speed Button tool bar select the Text Bubble tool:



Position the cursor near the location of interest on the graph and click the left mouse button. This will paste the Text Bubble on to the graph. To reposition the Text Bubble place the cursor inside the Text Bubble, hold down the left mouse button, move the cursor to the desired position and release the left mouse button. To move the Text Bubble arrow place the cursor over the end of the arrow and click the left mouse button - the arrow will become thicker. Move the cursor to the desired location for the head of the arrow and left click – the arrow will be redrawn to go from the Text Bubble to the desired location. To edit the text in the Text Bubble position the cursor inside the Text Bubble and click the left mouse button. To delete a Text Bubble or Data Box, right click on it and select “Yes”.

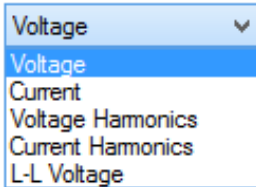


Page Types - Waveform

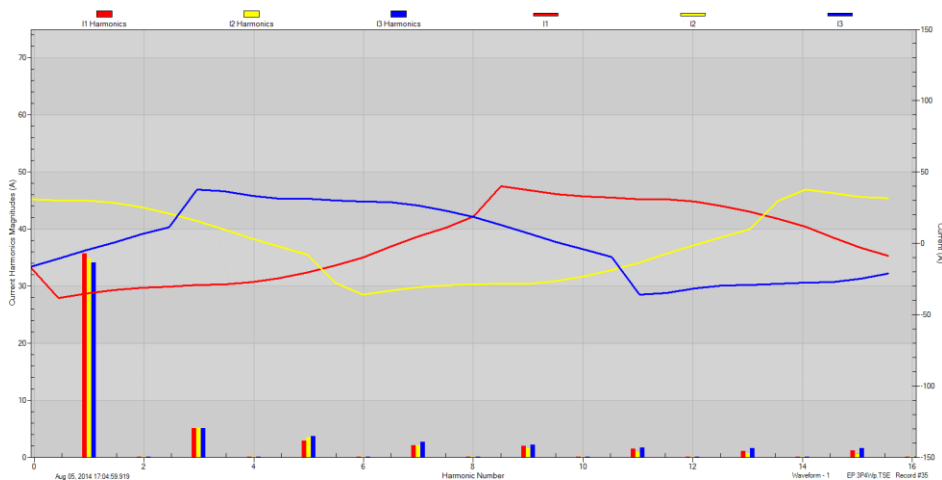
Waveform

The waveform page graphs a one cycle waveform snapshot that is taken once each storage interval.

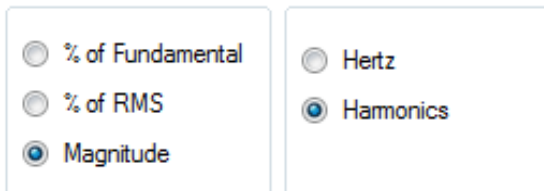
Quantities that can be graphed in the Waveform page are:



To view waveforms and harmonics select the Waveform tab and change the record number to 35. Using the left side drop down box change the graph to Current Harmonics. To see the current waveforms better right click on the legend above the graph and change the right hand side graph line style to Solid Thick.

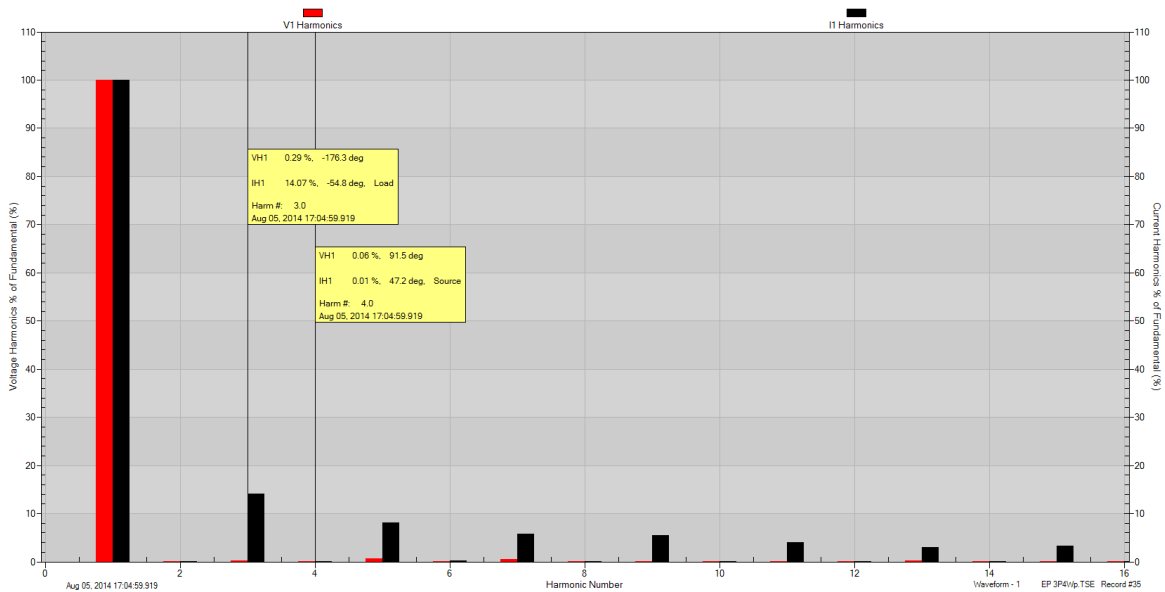


Harmonics can be displayed as a bar chart for harmonics from 1 (or the fundamental) to the 16th harmonic. The Y axis can be display in Magnitude, % of RMS or % of Fundamental and the X axis can be display by Harmonic Number (up to 16) or by frequency.



Page Types - Waveform (continued)

The software has the ability to estimate if harmonics are load caused or source caused. For example open a new waveform page and change to record #35. On the left axis plot Voltage Harmonics and on the right axis plot Current Harmonics. Turn off channels 2 and 3 and change the current harmonic bar color to black. Change the vertical axis to % of Fundamental in order to get the indication of harmonic direction. Place the data box over the harmonic of interest and in addition to magnitude and phase angle the text “Load” or “Source” is printed in the data box. If the relative current harmonic magnitude is larger than the relative voltage harmonic magnitude then the software assumes that the harmonics are load caused.

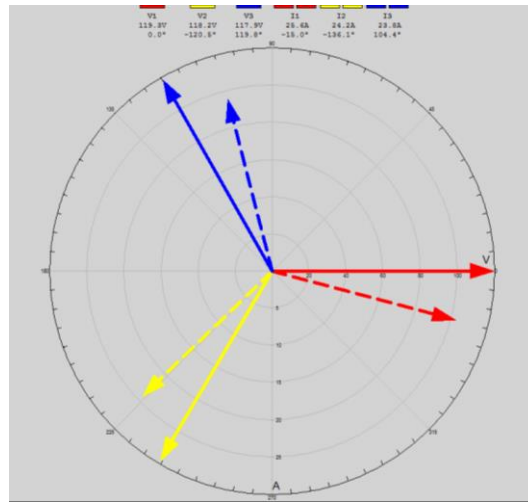


Pages Types

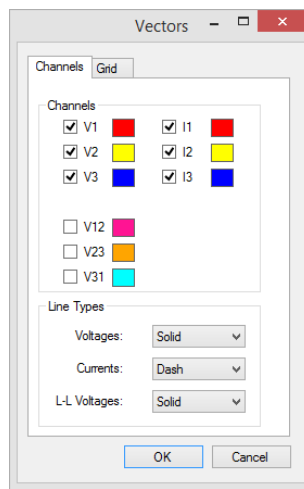
Vector Page

To display vectors click the Vector tab.

The vector diagram displays the RMS magnitudes and the 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 and colors changed. This is accessed by right clicking in the legend area. Scaling is accessed by right clicking anywhere below the legend area. The diagram below is for record #30 with Current axis set to Manual - Max: 30A and Voltage axis set to Manual – Max 120V.






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



Graph Play Buttons



These controls enable scrolling through zoomed Trend graphs, waveform graphs and vector diagrams. The  buttons scroll continuously backwards or forwards until the end is reached. The  button stops the continuous scrolling. The  buttons move one record backwards or forwards. A specific record can be displayed by entering the record number in the record number box: / 18 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.

Data Export

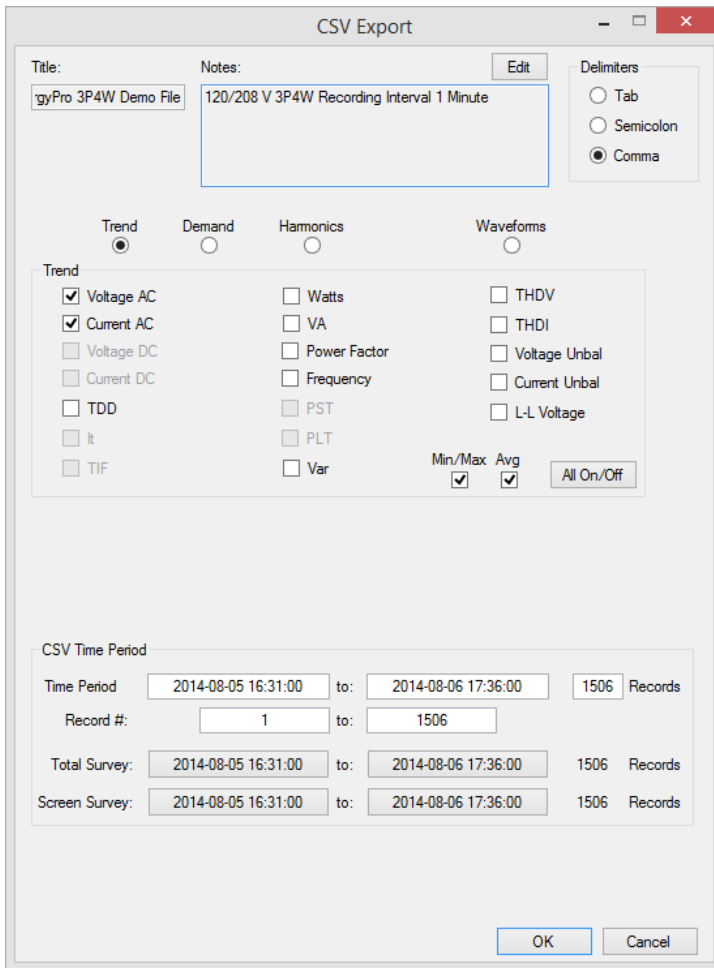
The user can export a portion of a file or the whole file into four different formats; a .TSE file compatible with **PV II™**, a .CSV file compatible with Microsoft Excel, a .PQD (PQDIF format) compatible with PQView from Electrotec or a custom ASCII format. These options can be found in the File→Export menu.

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

Different types of data that can be exported to .CSV files are:

- Trend
- Demand
- Harmonics
- Waveforms

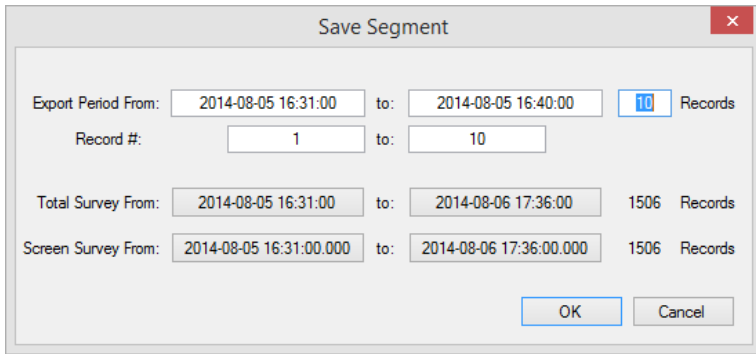
The resulting CSV file can then be opened in Microsoft Excel.



Data Export (continued)

The user can select a specific time period to export which is set by the Time Period values.

PV II™ allows you to export a portion of a .TSE file into a separate .TSE file that can be opened by **PV II™**. 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™**. The purpose of the **PV II™** export function is to generate a smaller file that contains data from a specific time period.



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

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 files can be edited using Windows Notepad.

Creating a Custom Export:

This is a text file that can be edited with Notepad. This file contains formatting commands for the PVII Custom Export Function. The file that is created using a template file will be an ASCII delimited text file. The delimiter used is specified in the first command and can be a comma (CSV) or a semi-colon (TXT). 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 file must contain the export to file type. Presently two file types are supported: CSV and TXT	CSV_ TXT_;
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). Other supported formats are: dd/MM/yyyy Note that is 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	

Data Export (continued)

Command	Description	Example
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	TXT_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 and total (T)	WATT_1
VA	VA, additional commands are channel number and total (T)	
VAR	VAR, additional commands are channel number and total (T)	VAR_1
PF	Power Factor, additional commands are channel number and 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
WATTD	Watt Demand, additional commands are channel number and total (T)	WATTD_1
VAD	VA Demand, additional commands are channel number and total (T)	VAD_1
WATTC	Watt Cost, , additional commands are channel number and total (T)	WATTC_1

Data Export (continued)

The file is setup where R=Row and C=Column. For Example R1:C1 would place the desired information in A1 in Microsoft Excel. Leave one space and put the command. Example R1:C1 "Serial Number:" will print this text string in cell row one, column one.

Here is an example of a basic Custom Export:

```
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

Data Export (continued)

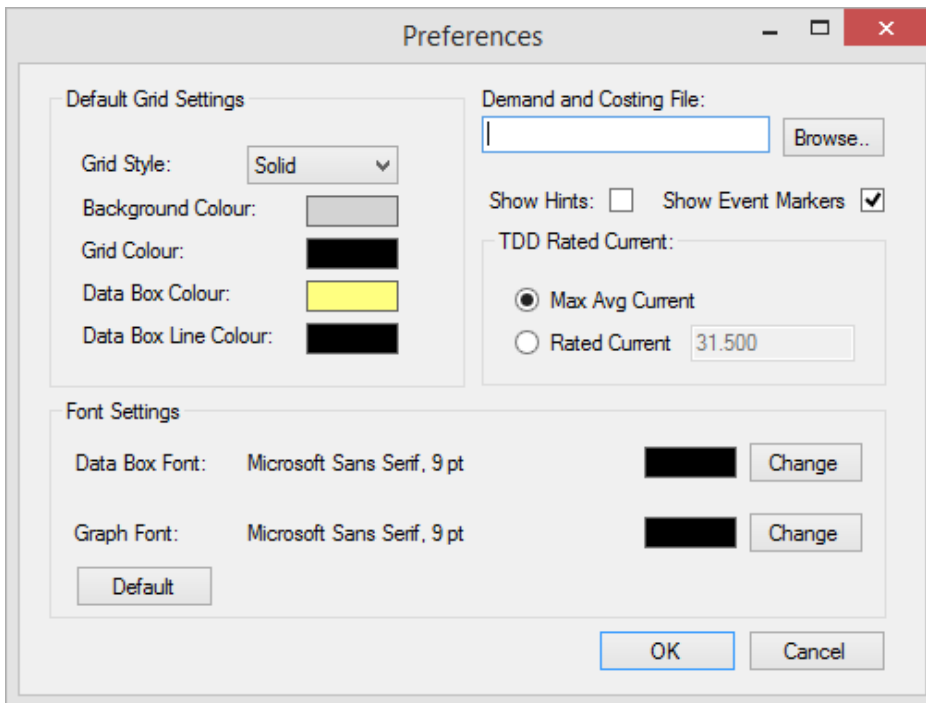
To create a Custom Export you need to open a file in PVII. Click File, Export, Custom. Now pick the range of data to be exported. This example will be using records 1 – 10. Choose the desired Custom Export template (.PVIIcust) file. Choose the location to save the new file. Export Complete. Now open the new file using Excel.

Here is the CSV file resulting from this example:

Serial Number:	EP60000535						
File Start		File End		Export Start		Export End	
2014-08-05	16:31:00	2014-08-06	17:36:00	2014-08-05	16:31:00	2014-08-05	16:40:00
RECORD	DATE	TIME	VAC1 Avg	IAC1 Avg	THDV1 Avg	THDI1 Avg	
1	2014-08-05	16:31:00	120.3	20.9	0.8	8.1	
2	2014-08-05	16:32:00	119.9	20.82	0.7	7.8	
3	2014-08-05	16:33:00	120	20.79	0.7	7.7	
4	2014-08-05	16:34:00	120	20.76	0.8	7.7	
5	2014-08-05	16:35:00	119.9	20.74	0.7	7.7	
6	2014-08-05	16:36:00	119.7	20.68	0.7	7.6	
7	2014-08-05	16:37:00	119.7	20.73	0.7	7.8	
8	2014-08-05	16:38:00	119.7	20.68	0.6	7.6	
9	2014-08-05	16:39:00	119.9	20.71	0.7	7.7	
10	2014-08-05	16:40:00	120	20.7	0.7	7.6	

Preferences

PVII™'s preferences menu is accessed from the Setup drop down list. It allows you to customize various aspects of the software. Once the preferences have been changed, they will become the default settings that **PVII™** will use when a file is opened.



Grid style is the type of line that is used for the interweaving grid lines in the graph areas. Colors for various aspects of the graphical display can be changed by clicking on the colored rectangles, then choosing a new colour from the colour menu.

“Demand and Costing file” is the default demand and costing configuration file that **PVII™** will use. Changing this will cause **PVII™** to read from a different file when starting. It will affect changes in the Setup→Demand and Costing 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 not used for .TSE files.

TDD rated current is used in the calculation of Total Demand Distortion (TDD).

Font Settings can be used to change the font style and colour for the Data Box/Text Bubble and the Graph Labels.

Generating a Report

PV II™ can generate a report for a specific time period that reports the minimum, maximum and average values of selected quantities

The type of report, the selected quantities and the time period can be adjusted before the report is generated. Changing the type of report will open a submenu where more specific quantities can be included or omitted from the report. To select a time period for the report, the time values or record# range can be altered manually, or by pressing the “Total Survey” or “Screen Survey” start or end point buttons. The “Total Survey” is the time period spanning the entire file. The “Screen Survey” is the time period spanning the graph on the last page displayed.

The screenshot shows the 'Report Input' dialog box. The 'Title' field contains 'gyPro 3P4W Demo File'. The 'Notes' field contains '120/208 V 3P4W Recording Interval 1 Minute'. The 'Channels' section has three checked checkboxes labeled 1, 2, and 3. The 'Trend' radio button is selected. The 'Trend' section has a grid of checkboxes for various parameters: Voltage AC, Current AC, Voltage DC, Current DC, TDD, It, TIF, Watts, VA, Power Factor, Frequency, PST, PLT, Var, THDV, THDI, Voltage Unbal, Current Unbal, and L-L Voltage. The 'Min/Max' and 'Avg' checkboxes are checked. The 'Report Period' section shows a time range from 2014-08-05 16:31:00 to 2014-08-06 17:36:00, with 1506 records. The 'Graphs/Tables' section has the 'Table' checkbox checked and a dropdown menu set to 'Trend - 1'. The 'OK' and 'Cancel' buttons are at the bottom.

The Trend report can include all the quantities that can be viewed in the Trend page or only the selected ones. These minimum, average and maximum values can be displayed in a table. The “Standard Graph” includes a graph of the selected quantity. The “Custom Graph” puts the graph of the last page displayed at the beginning of the report.

Demand and Cost 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" and "Demand and Costing". The demand integration period can be set to 1 minute (if the storage interval is a minute or less) or up to 30 minutes. Time of Use times and cost can be setup for both weekdays and weekends and holidays. They can be set manually or read in from a configuration file. The active configuration file can be set from the Setup and Costing dialog box or from the Preferences dialog box. To access the Preferences dialog box select from the top menu bar "File" and "Preferences".

To change Time of Use times and pricing manually, simply enter an end time for the costing period, and enter the cost of a kWh during that time. Also, select a colour that will represent that time period on the graph. The times on the left are for normal weekdays, and the times on the right are for weekends and holidays. There can be up to six different costing periods in a day, and the day must go from 00:00-24:00.

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.

Demand and Costing

File

Ontario Summer Rates 2014.bt

Integration Period: 15 min

Currency: \$

July, 2014

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9

Tariffs Time and Cost (Weekdays)

00:00	to	07:00	■	0.075
07:00	to	11:00	■	0.112
11:00	to	17:00	■	0.135
17:00	to	19:00	■	0.112
19:00	to	24:00	■	0.075
:	to	---	■	

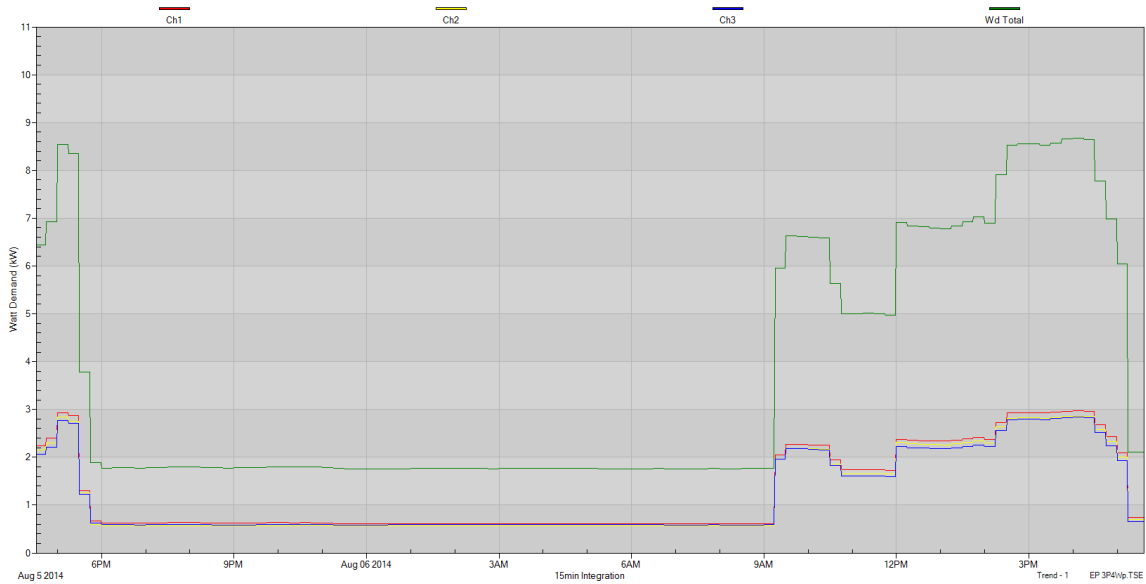
Tariffs Time and Cost (Weekends and Holidays)

00:00	to	24:00	■	0.075
:	to	---	■	
:	to	---	■	
:	to	---	■	
:	to	---	■	
:	to	---	■	

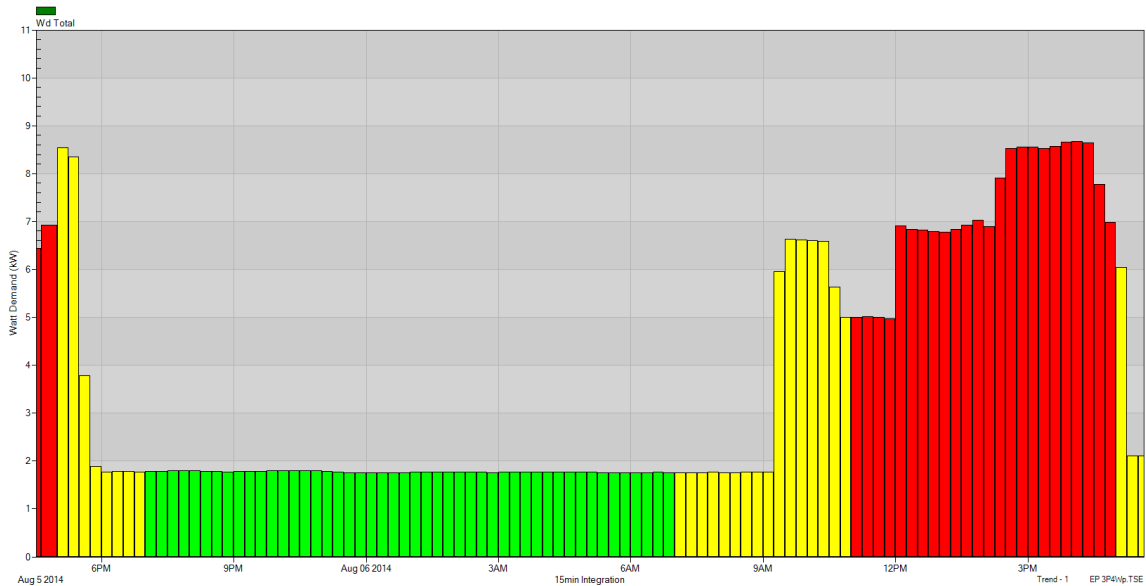
OK Cancel

Demand and Cost Setup (continued)

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.

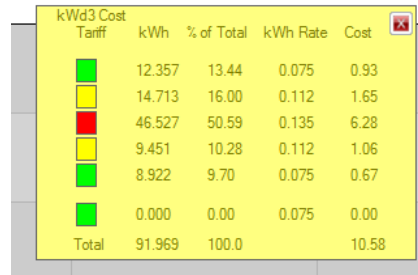


If only one trace is enabled the graph becomes a bar chart with the bar colour set by the time of use colour as shown below.



Demand and Cost Setup (continued)

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
Green	12.357	13.44	0.075	0.93
Yellow	14.713	16.00	0.112	1.65
Red	46.527	50.59	0.135	6.28
Yellow	9.451	10.28	0.112	1.06
Green	8.922	9.70	0.075	0.67
Green	0.000	0.00	0.075	0.00
Total	91.969	100.0		10.58

Notes