Investigator

Version 2.3

User Manual

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ELSPEC

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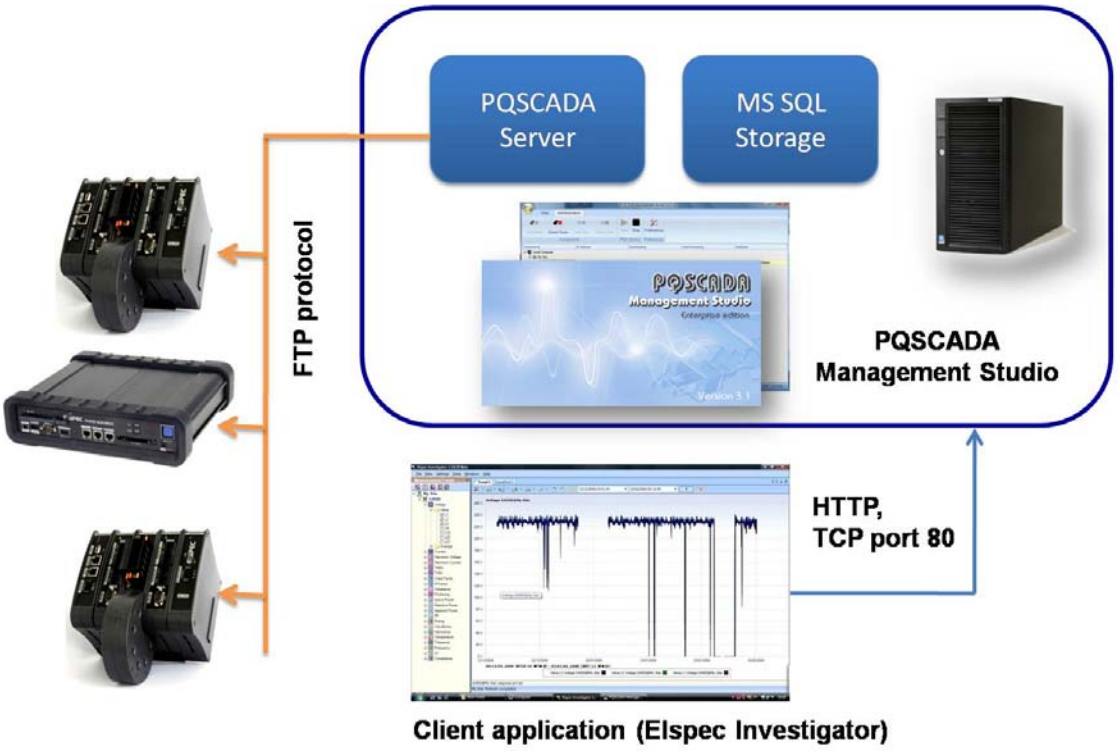
Overview

Innovative Elspec Investigator is a client application that communicates, receives, and displays data from the **PQSCADA Server** system. The communication performed uses a standard **HTTP** protocol (port 80), so it is firewall friendly and can easily be used over local LAN and/or over the Internet.

Investigator



Note: This drawing depicts the master modules initiating the communication

The Investigator application is installed on a personal computer providing unparalleled data monitoring and analysis functionality for all BLACKBOX devices.

By effectively processing enormous amounts of logged network data, the Investigator application provides an immediate, understandable picture of everything that happens within the network. All selected parameters from single or multiple measuring points are presented on one synchronized time line, offering operators a clear and instant graphical view of everything that occurs within the network in a selected timeframe.

Before Getting Started

Hardware Requirements

To install and run the Investigator software:

- Verify that the following requirements are met:

	Minimal	Recommended
CPU	Any Intel x86-compatible	Clock frequency of 1 GHz at minimum, especially if you run reports or large exports
RAM	256MB	512M. If you run reports or large exports: 1GB of RAM is recommended.
Operating System		Generally, any OS Windows that can run Microsoft .NET framework 3.5 Following OS are guaranteed: Windows XP Windows Vista Windows Server 2003 Windows Server 2008 Windows 7

Software Requirements

The use of the Investigator software version 2.3 and above requires the following additional application software to be present on your system.

- **MSI Installer**-Microsoft Windows Installer is an engine for the installation, maintenance, and removal of software on most recent Microsoft Windows systems.
- **.NET Framework 3.5 SP1** A Universal platform developed by Microsoft that provides identical functions for a variety of languages (C#, Visual Basic, Java). It is also designed to facilitate development of web applications. (Enable communication between clients and servers).

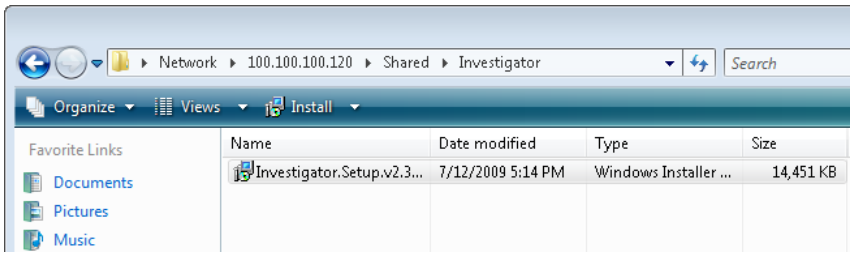
If you currently do not have these programs installed on your PC, then please refer to ***Appendix A: Installing Pre-requisites on page 106.***

Installing the Investigator Software

The following procedure describes a new installation of the INVESTIGATOR software application. For upgrading, the process is the same and, in most cases, there is no need to uninstall the previous version, as it is done automatically. If for any reason, you need to uninstall Investigator manually, please refer to **Appendix B: Uninstalling the INVESTIGATOR Software on page 110.**

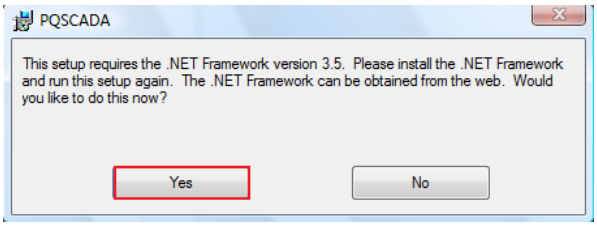
To install the INVESTIGATOR software:

1. Navigate to the **Investigator Setup.exe** file or link at www.elspec.biz/Investigator/Investigator.Setup.v2.3.0.17.msi.

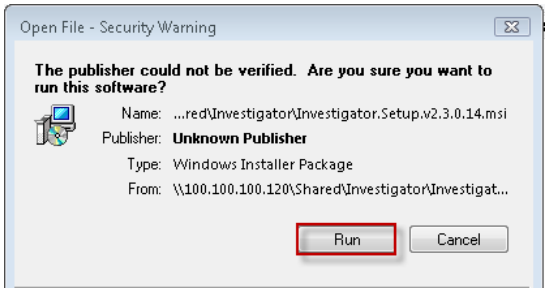


2. .Double click the **Investigator.Setup** file.

If the .NET Framework 3.5sp1 program is not present on your system, the following message appears. (Refer to **Installing .NET Framework 3.5sp1 on page 108)**

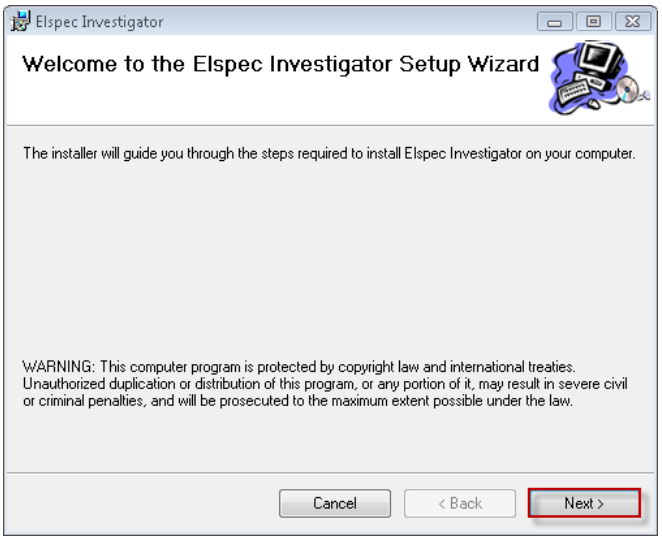


The Security warning screen appears.

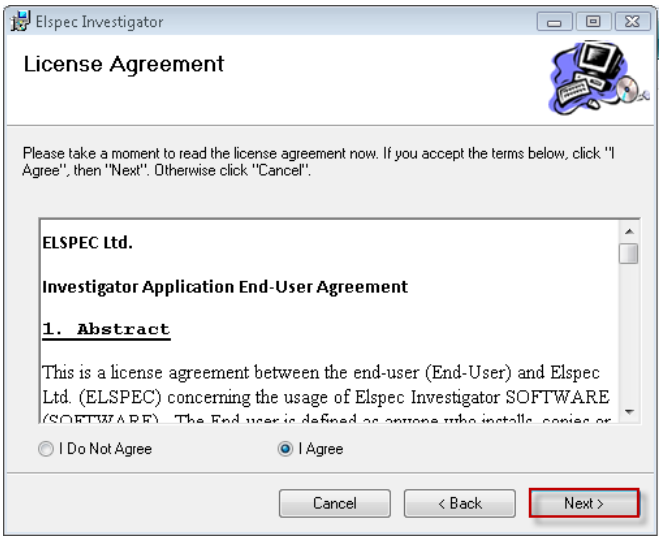


3. Click **Run** to continue.

The Welcome screen appears.

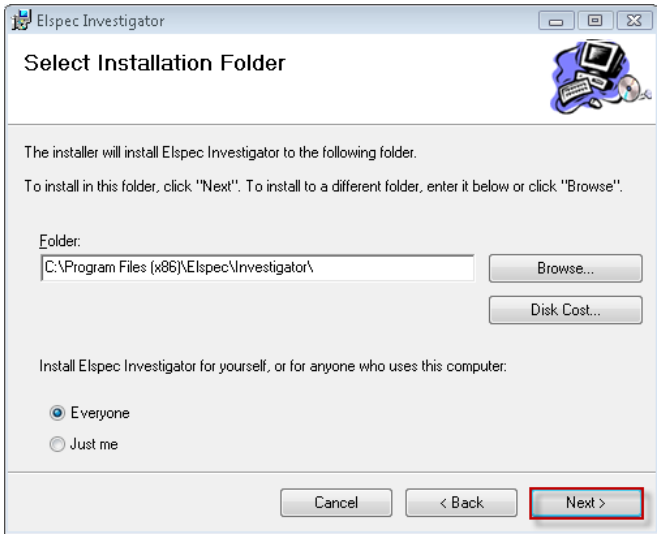


4. Click **Next** to continue.



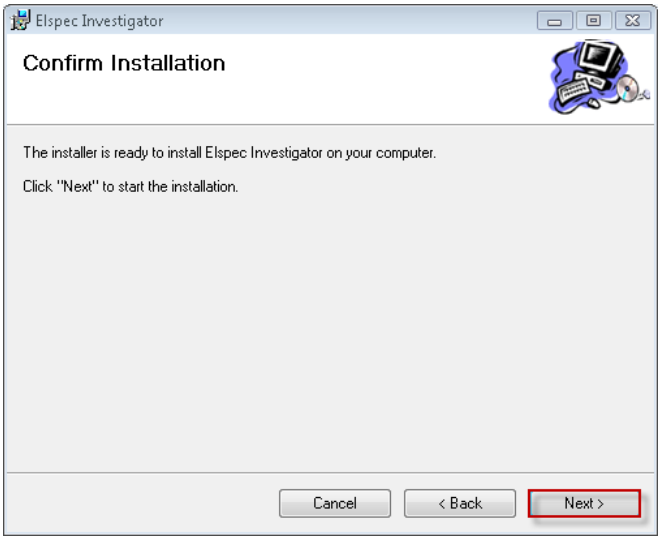
5. Check **I Agree**, then click **Next.**

The **Select Installation** Folder screen appears



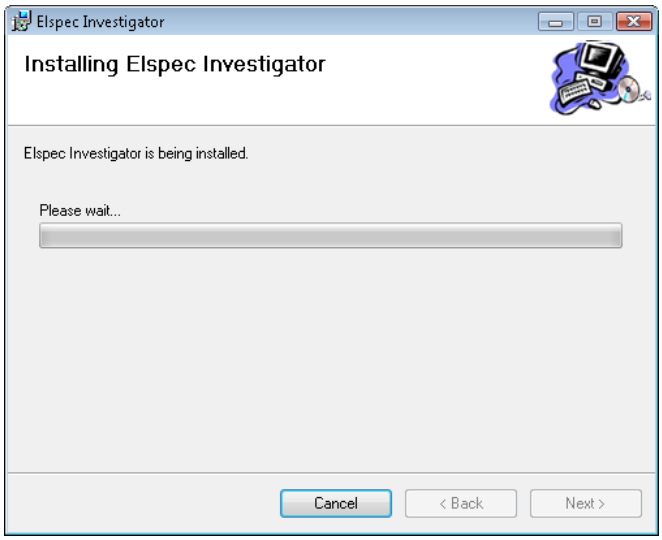
6. Make desired selections, then click **Next**.

The Confirmation Installation screen appears.

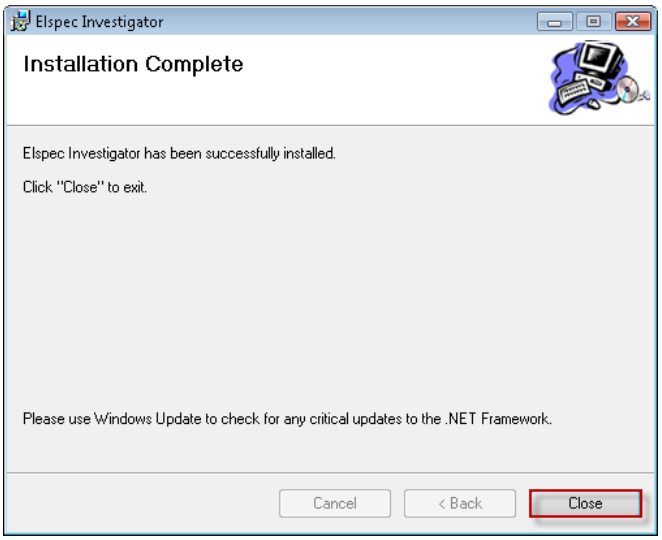


7. Click **Next** to confirm the installation.

The Investigator Installation commences.



The Installation Complete window appears.



8. Click **Close** to complete the installation.

The Investigator Quick Start

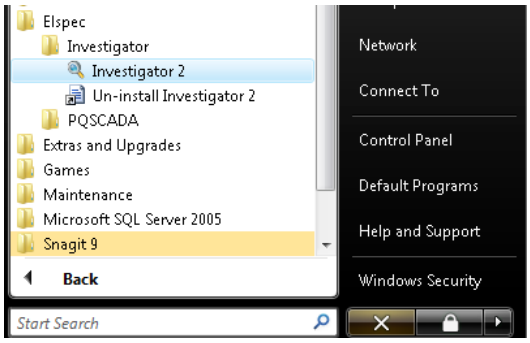
This section is intended for the first time user as a **Quick Start** into the most common critical functions of the Investigator software. For a complete comprehensive explanation of all Investigator components and functions, please refer to **The Investigator Application on page 16**.

Step 1: Starting the Investigator Application

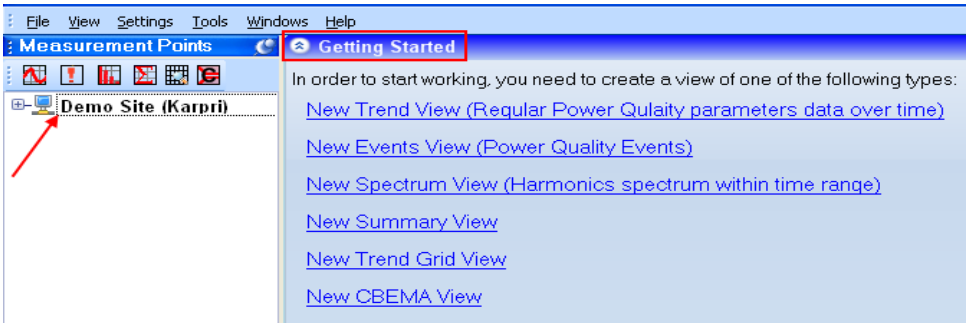
To start the Investigator application:

- Click the 

icon on the desktop or select Start→All Programs→Elspec→Investigator→Investigator 2



The opening screen appears.



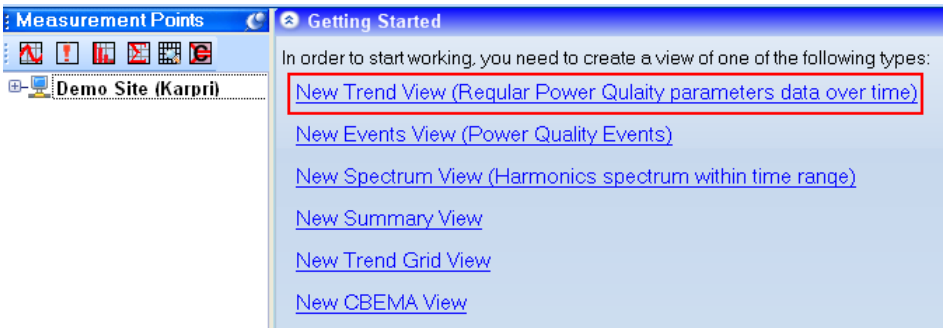
The Getting Started Panel as shown above with the New view options listed is only shown the first time the application is opened. In the Measurement Points panel, we have provided a link to a Demo Site Karpri complete with historical data for demonstration purposes.

Step 2: Select the View

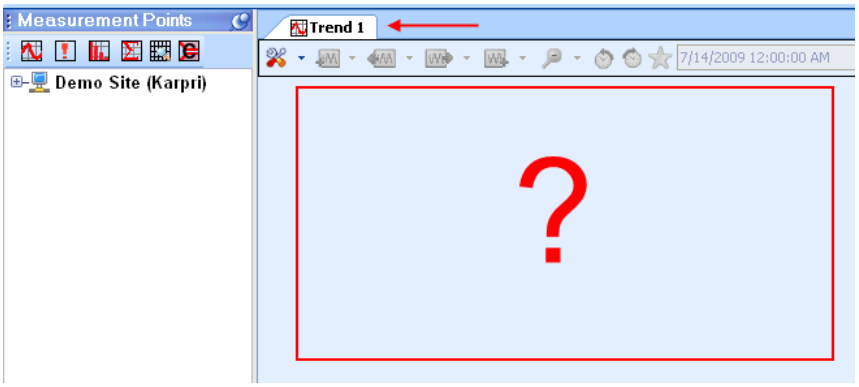
The view types available are shown below. In our example we use the most common type (New Trend View) showing the Power quality parameters over time.

To select the view:

- From the Getting Started panel, click **New Trend View**.



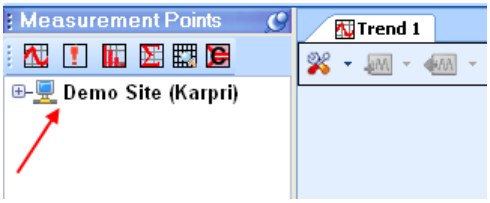
Trend 1 is created for the **Demo Site (Karpri)** although the Main viewing area remains blank:



You must first define the Site, then the Node, then select the specific parameters to be displayed and then, define the time period (time span) over which the parameter's values will be displayed.

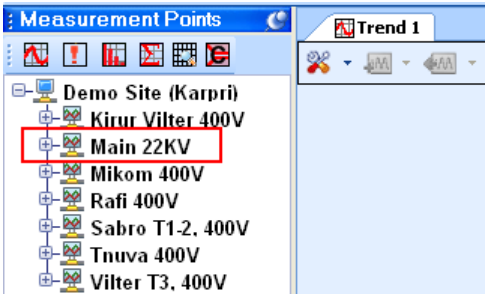
Step 3: Selecting the Site, Node, Parameters, and Time Span

We have provided a link to the **Demo Site (Karpri)** as below for demonstration purposes. If this site does not appear in the **Measurement Points** panel, then please refer to **Appendix C: Communications Troubleshooting on page 111.**

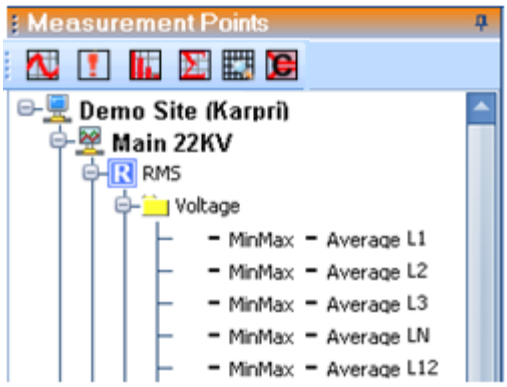


To select the parameters:

1. From the **Measurement Points Panel**, select the site and the ***Node*** by clicking the **(+)** button to the left. In our example we select: **Demo Site (Karpri)→Main22KV**.

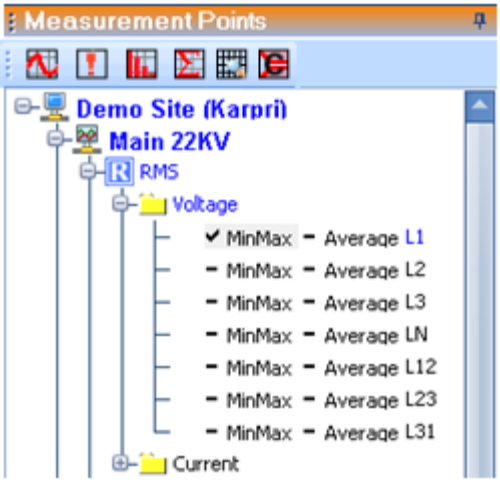


The ***Node*** (**Main 22KV**) appears with the available parameters listed below:



2. Select the desired parameter(s) from the list by clicking to the left of the desired parameter.(**MinMax** of L1 in our example).

A check appears to the left of the desired parameter.



In our example, we are requesting to see the RMS Voltage measurements in MinMax view for Phase 1.

Once the parameter selection is made, the text is highlighted in blue to indicate that it is possible to proceed to the next phase of selecting the time span.

Min/Max vs Average View

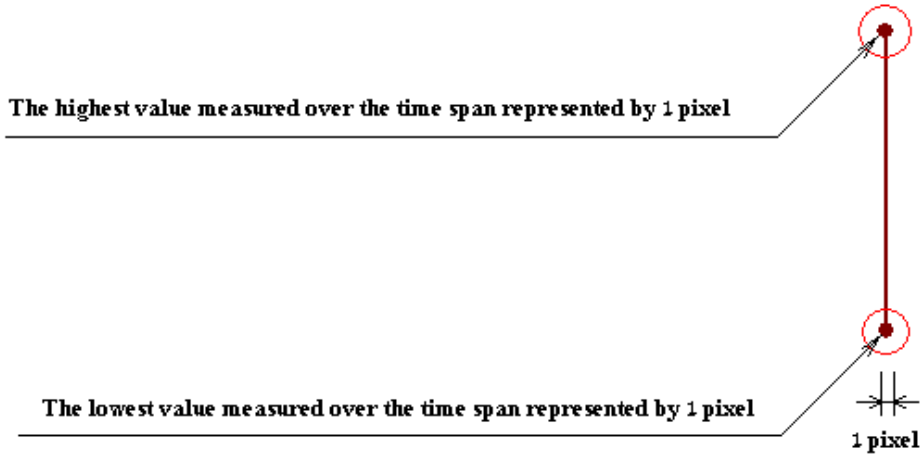
The BLACKBOX system's unique capabilities and proprietary PQZip compression algorithms allow it to continuously record the voltages and currents on all of the channels with a resolution of 1,024 SPC (Samples Per Cycle) for the voltage and 256 SPC (Samples Per Cycle) for the current. This creates a tremendously amounts of data which is available to the user for every single moment, dating years back to ever since the device was initially installed. The user can browse this data being able to drill down and investigate every single cycle at any given moment in time.

When the user commences an Investigation, beginning from a "zoom out" window displaying the data over a time span of a year, the enormous quantity of data exceeds the resolution capabilities of the display being used and also those of the human eye.

For illustration: When displaying the RMS values for a time span of 1 year, there are a little over 1,892 million cycles (60Hz x 60sec x 60min x 24hours x 365days) a year.

On this “zoom out” view, every pixel on the screen represents roughly 1.5 million cycles, which on an average display revolve around certain values but when investigated into smaller time frames include many spikes and aberrations from average.

In order to be able to spot those spikes and aberrations that occurred over very short periods of time relative to the 1 year time span display, the “MinMax view” was introduced. The “MinMax view” allows the representation of every horizontal pixel as a vertical (1 pixel wide) bar while its high end represents the Maximum value measured over the time span the pixel represents, and its low end represents the Minimum Value that was measured over the time span that pixel represents. This way, significant aberrations will be evident to the user’s eye while displaying a “zoom out” view of 1 year. Then, by zooming in, the event can be isolated down to the original time span over which it has occurred.



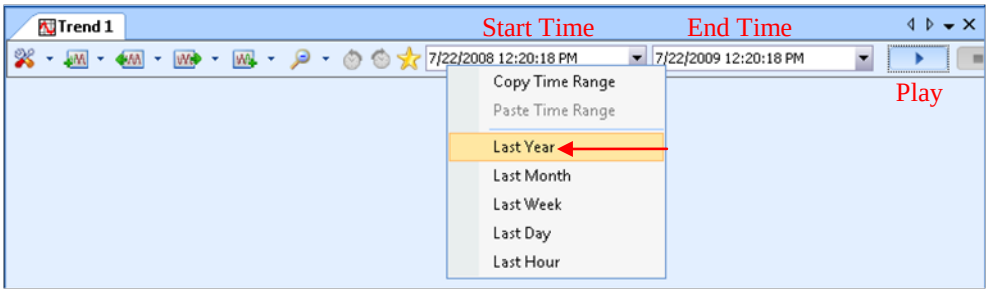
The more you are zooming in, viewing data for a smaller time span, the less difference it is between the MinMax view and the Average view (of a particular parameter over that exact time span).

Step 4: Select the Time Span

To select the time span:

1. From the Main Viewing window, right click the **Start Time** window.

The time range window appears.

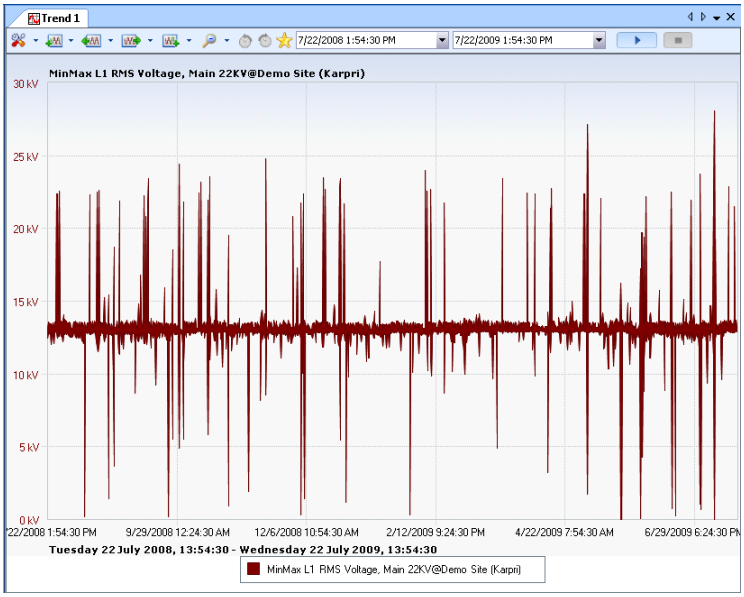


2. Select Last Year.

The **Start** and **End Times** change accordingly.

3. Click the **Start Query**  button in the Main Tool Bar to receive the data.

The graph appears showing the trend values for **min/max phase 1 voltage values for the Main 22KV *Node*** for the previous year.

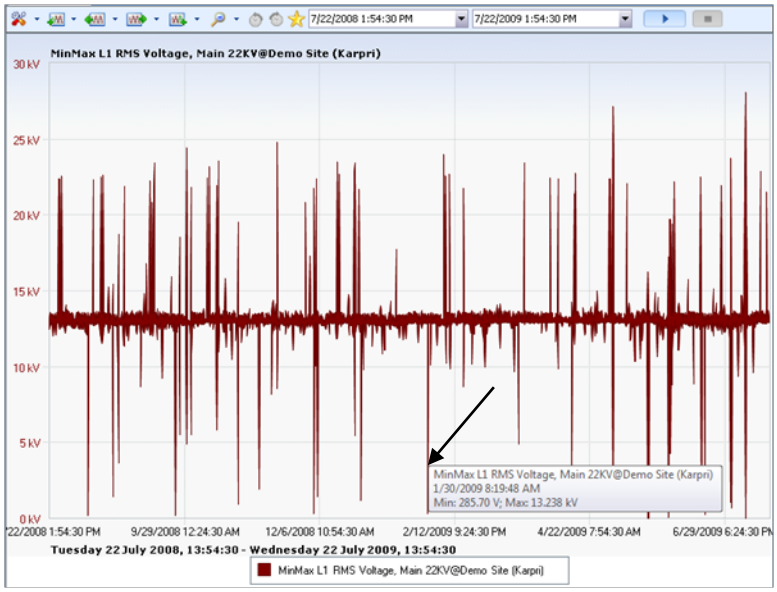


Step 5: Zooming In/Out

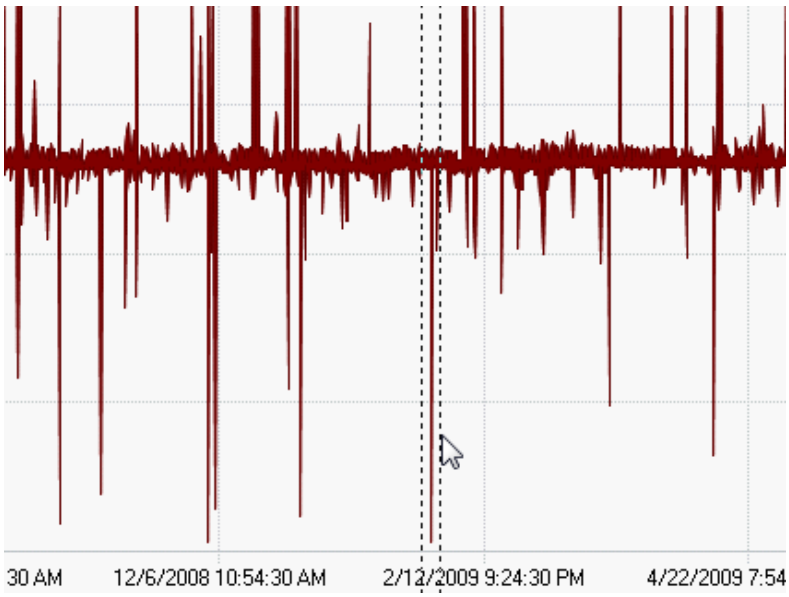
The Investigator application allows you to zoom in and out from a year's worth of data to a millisecond with mouse click simplicity.

To zoom in and out:

1. From the Main Viewing panel, identify the area to be investigated.

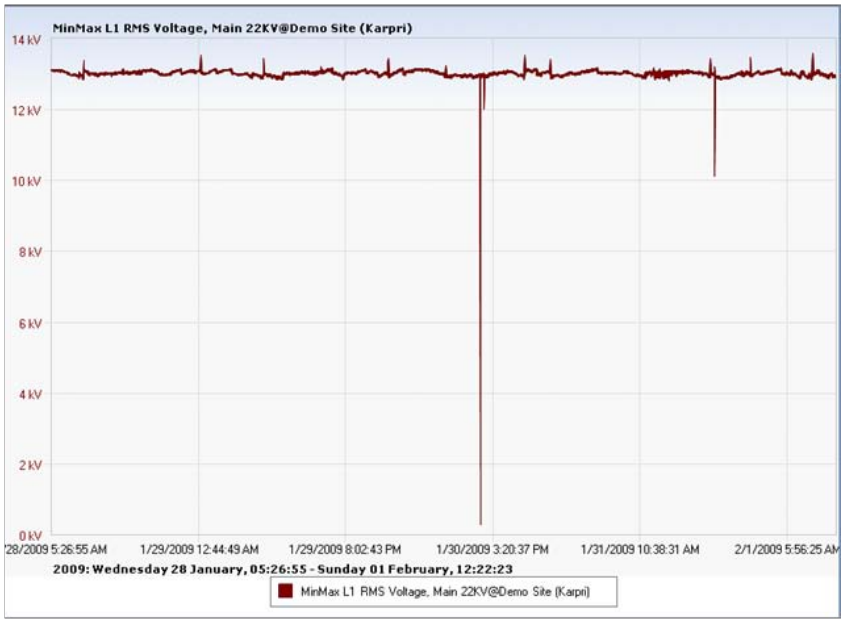


2. Left click at the beginning of the time period, then drag the mouse over to the ending time period.

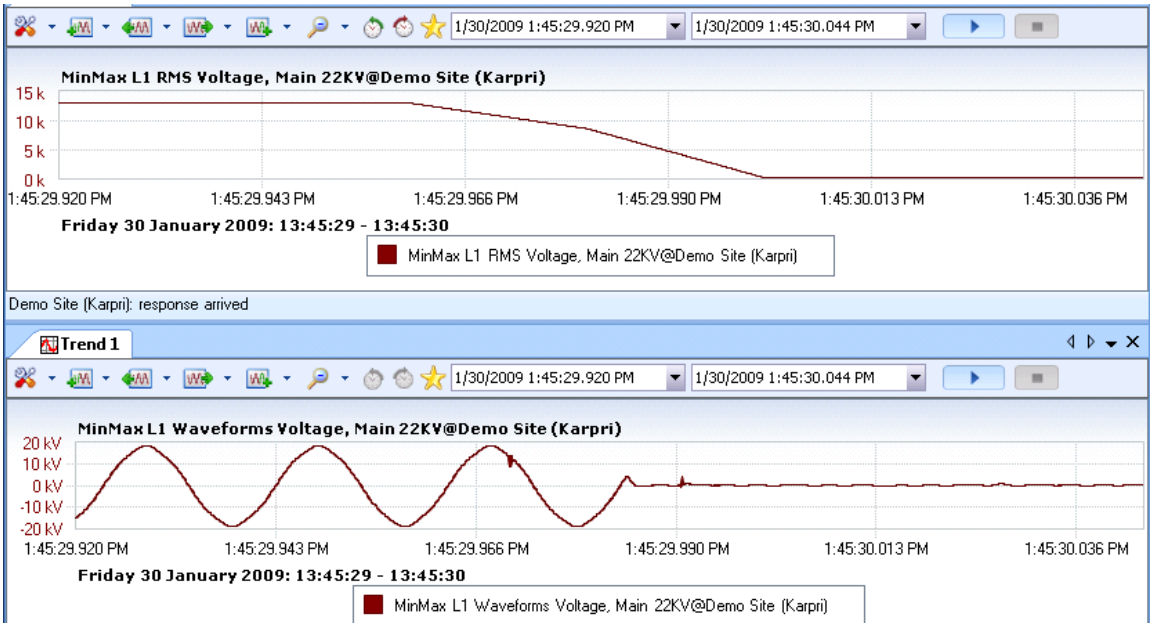


A new Zoomed in view of the area. **Starting from an entire Year to**:

.....To Days



The illustraton below represents a zoom in to **microseconds** of a voltage drop event and the correspoding waveforms during the same time period.

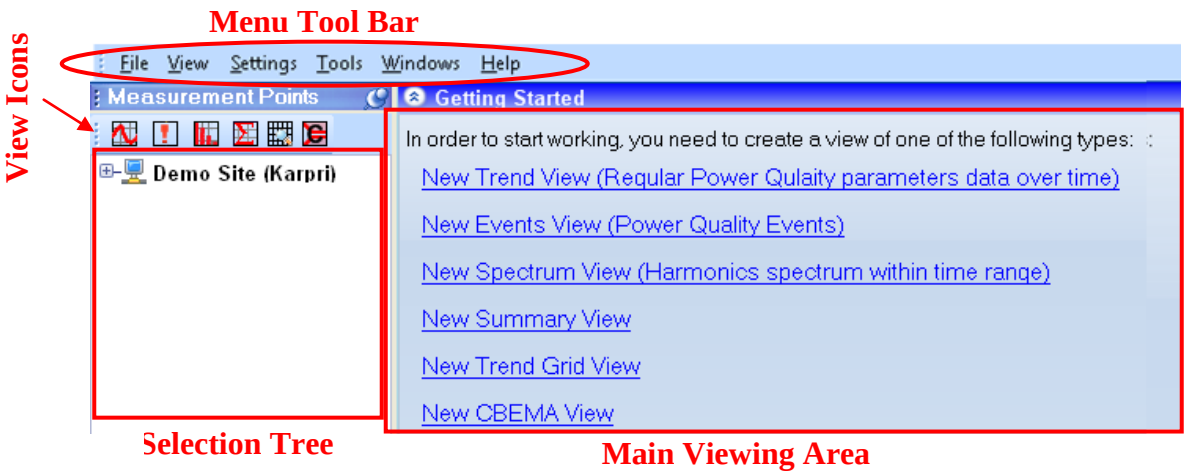

1/30/2009 1:45:29.920 PM
1/30/2009 1:45:30.044 PM
MinMax L1 RMS Voltage, Main 22KV@Demo Site (Karpri)
15 k
10 k
5 k
0 k
1:45:29.920 PM
1:45:29.943 PM
1:45:29.966 PM
1:45:29.990 PM
1:45:30.013 PM
1:45:30.036 PM
Friday 30 January 2009: 13:45:29 - 13:45:30
MinMax L1 RMS Voltage, Main 22KV@Demo Site (Karpri)
Demo Site (Karpri): response arrived
Trend 1
1/30/2009 1:45:29.920 PM
1/30/2009 1:45:30.044 PM
MinMax L1 Waveforms Voltage, Main 22KV@Demo Site (Karpri)
20 kV
10 kV
0 kV
-10 kV
-20 kV
1:45:29.920 PM
1:45:29.943 PM
1:45:29.966 PM
1:45:29.990 PM
1:45:30.013 PM
1:45:30.036 PM
Friday 30 January 2009: 13:45:29 - 13:45:30
MinMax L1 Waveforms Voltage, Main 22KV@Demo Site (Karpri)

The Investigator Application

This section provides an in-depth detailed explanation of all Investigator functions. The Investigator application is presented in an itemized format beginning with a look and explanation of the Main User Screen, then an in-depth description and explanation of all of the functions and components of the software. For a **Quick Reference Guide**, please refer to **The Investigator Quick Start on page 7.**

The Main User Screen

The INVESTIGATOR user interface screen is comprised of three distinct sections; the **Menu Tool Bar, Selection Tree,** and the **Main Viewing Area**.

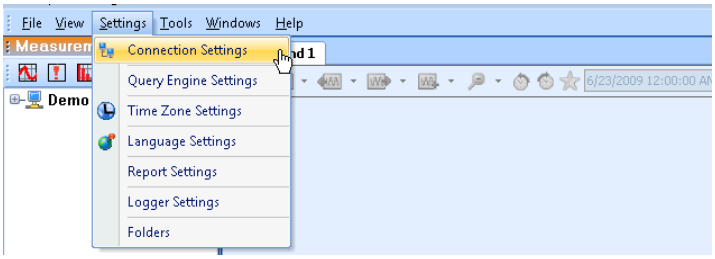


- **Menu Tool Bar:** The tool bar contains the tools that are used to configure the settings of the software.
- **View Icons:** The view icons above the **Selection Tree** each represent a shortcut to a different view type.
- **Selection Tree**: The Selection tree contains all of the Sites and Nodes as well as parameters available for each ***Node***. (see more on Sites and Nodes)
- **Main Viewing Area**: The Main viewing area is the space where all of the graphs can be viewed representing the trend data. This area can be used to provide multiple views

The Getting Started Panel as shown above with the New view options listed is only shown the first time the application is opened.

In the Measurement Points panel, we have provided a link to a Demo Site Karpri for demonstration.

Settings



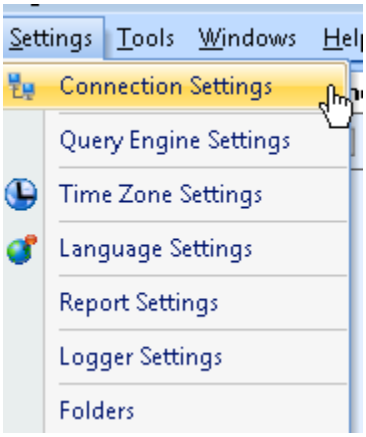
The Investigator software comes from the factory with a set of default settings. In most cases, it is not necessary to change these settings, unless there is a specific need for customization.

- Query Engine
- Time Zone
- Language
- Report
- Logger
- Folders

To select settings:

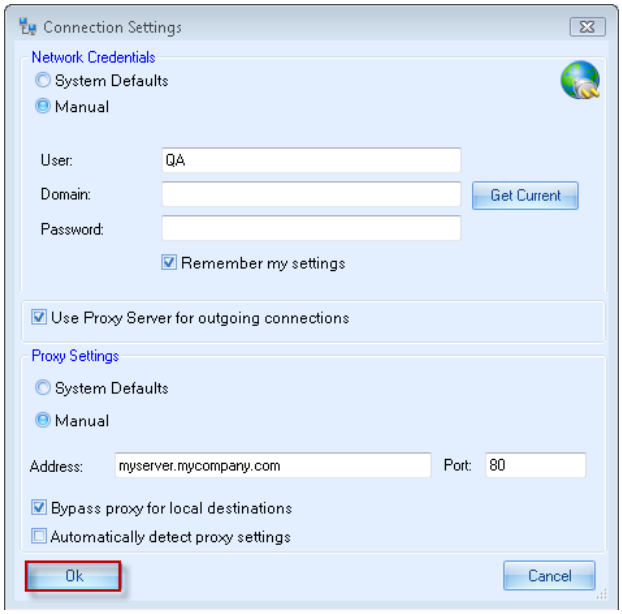
- From the main window, right click **Settings.**

The drop down menu appears.



Connection

You may change connection settings if you need to communicate with the sites which are situated outside your LAN, then you need to have appropriate connection settings for your location.

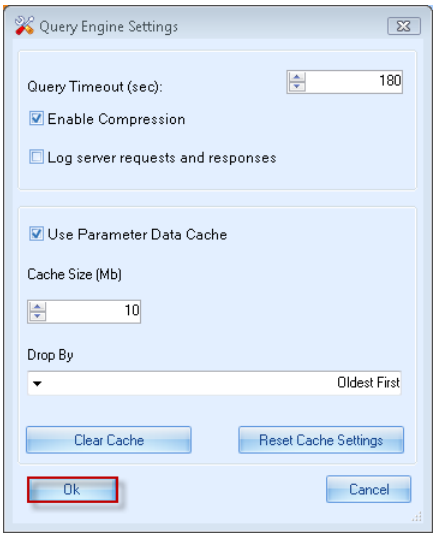


- **Network Credentials**:
  - System Defaults: Default settings taken from Internet Explorer.
  - Manual: User defined settings that override the system defaults.
- **User:** User name provided by system administrator
- **Domain:** Domain name provided by system administrator
- **Password:** User defined password**.**
- **Use Proxy Server for outgoing connections:** This box remains checked if your company has a Proxy Server.
- Proxy Settings
  - **System Defaults:** These defaults are taken from Internet Explorer settings. The software uses **Http port 80** as the default.
  - **Manual:** User defined settings that override the system defaults. In a case when HTTP Port 80 is blocked or occupied by another program, use **Named Pipe**.
- **Address/Port:** This is the specific address of the Proxy Server.
- **Bypass Proxy:** If you communicate with the local site.
- **Automatically Detect Proxy:** The proxy address is being detected automatically using the Internet Explorer script.

Automatic scan may not work if the local firewall prohibits UDP broadcasting, The Elspec Search is running and using the UDP 885 port, or The local site is down or unreachable. Please refer to **Appendix C: Communications Troubleshooting on page 111.** *If you are still unable to use the automatic feature, then you can add a site manually as follows.*

Query Engine

A Query Engine is a component of Investigator that is responsible for all data retrieval from the PQSDADA. Every request sent to the PQSCADA goes through the query engine.



Query Engine Options

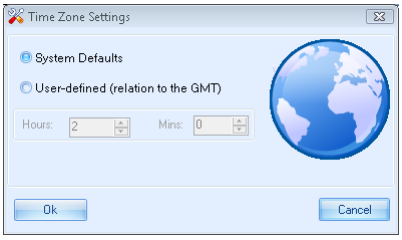
- **Query Timeout:** Every time a query is made, you enter the waiting state. You may remain in this state until you receive a response or you time out. The value of the timeout can be overridden by the user.
- **Enable Compression:** Only disable compression when it is not supported by the PQSCADA Server that you are working with.
- **Log Server Requests/Responses:** For diagnostics only. This logs each request and response to the disk.

Data Caching Options

Data Caching stores the results of received queries in memory. This is intended to spare redundant querying.

- **Use Parameter Data Cache:** By default, this option is enabled. You may disable if every time your query, you need the most updated data, however this is may slow down the query time.
- **Cache Size:** The size of memory used for the cache.
- **Drop By:** When maximum cache size is reached, the queries are being dropped from the cache by either of the following two options.
- Oldest First:
- Largest First
- **Clear/Reset Cache:** There is an option to simply drop all queries and reset the cache.

Time Zone

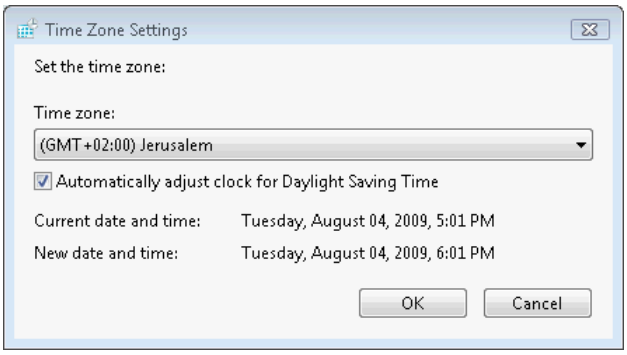


The time zone can be sourced from the system or user defined according to GMT.

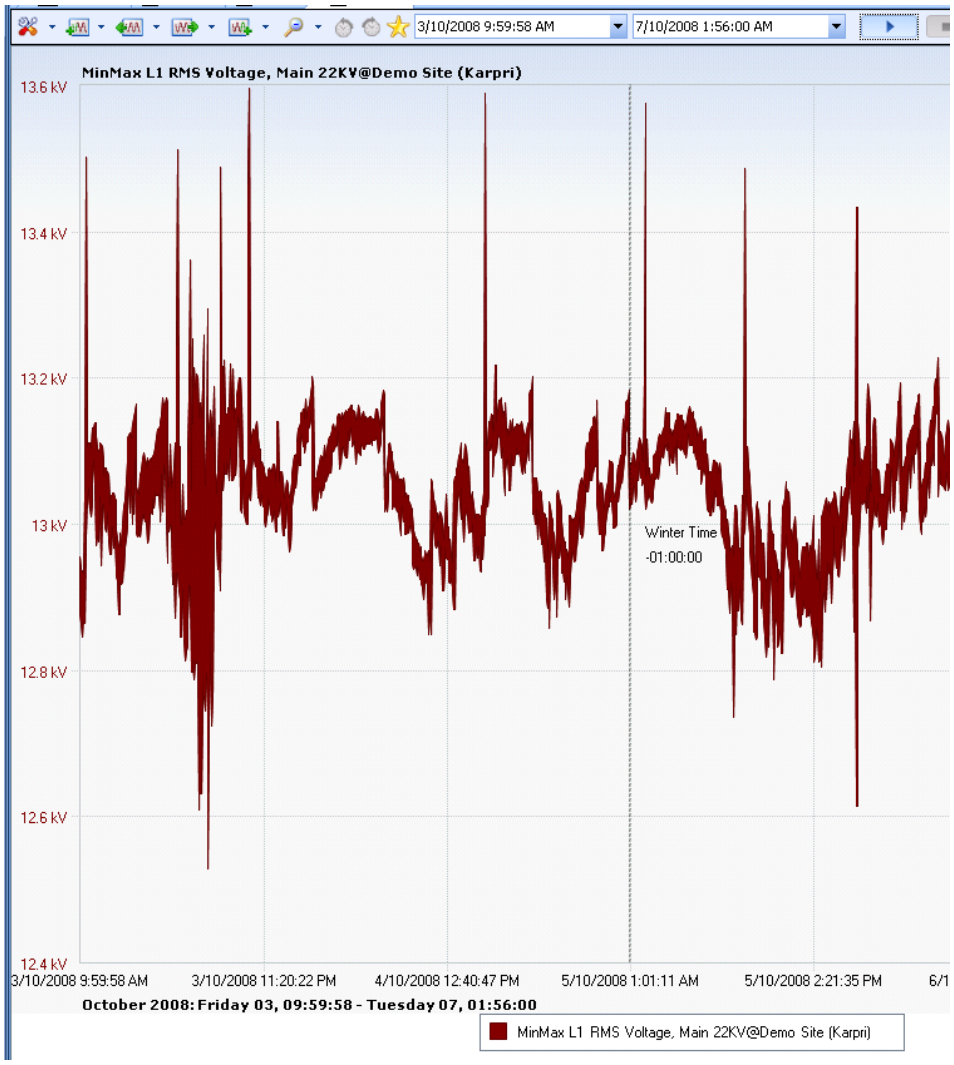
Daylight Savings Time

The times used on all for all of the Views and graphs are dependant on the time zone selected. If you enable **daylight savings time zone,** then the times shown will take into account the daylight savings time.

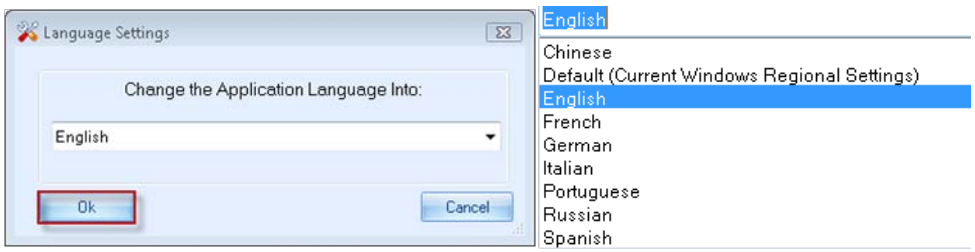
Enable Automatically adjust clock for Daylight Savings Time in your Time Zone Settings.


Time Zone Settings
Set the time zone:
Time zone:
(GMT+02:00) Jerusalem
Automatically adjust clock for Daylight Saving Time
Current date and time: Tuesday, August 04, 2009, 5:01 PM
New date and time: Tuesday, August 04, 2009, 6:01 PM
OK
Cancel

A special feature of this version is the designation on the graph of a change in time during a viewing period. See the example below of a Trend view for a four month time duration that spans the change from Winter to Summer. The exact change time is designated with a vertical dashed line.

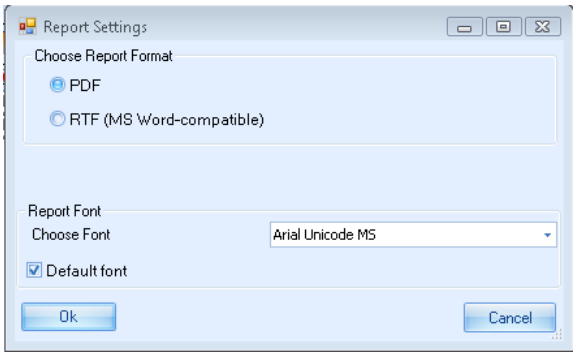


Language



- Select the preferred language (Default is English).

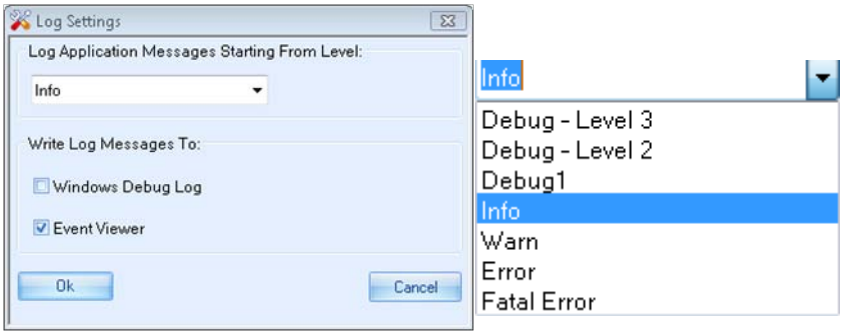
Report



- Choose the report format and font. If you experience problems with text in PDF files, we recommend that you override the default setting.

Logger

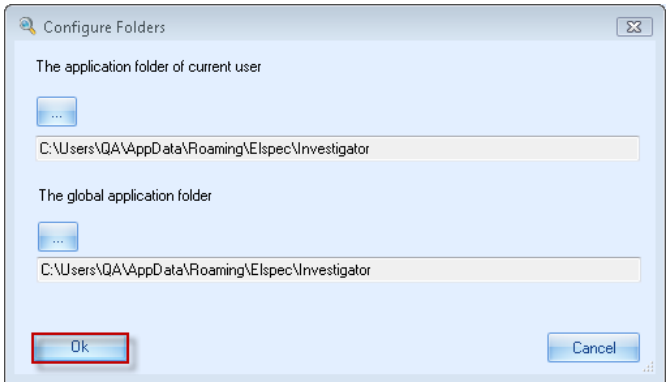
The application contains an internal log in order to record user actions and errors that occur during the execution of the application. If you experience problems, you may be asked by our support team to supply the application log to understand the source of the problem. It is not recommended to override these setting unless instructed by our support engineer.



- **Log Application Messages Starting from Level:** The levels start from the most detailed to the least.
- **Write Log Messages To:** You may choose the destination of the log.

Folders

The user can override the system folders of the application. We do not recommend that you change these settings unless you have specific hard disk limitations on the system hard drive.



Please note there are two folders.

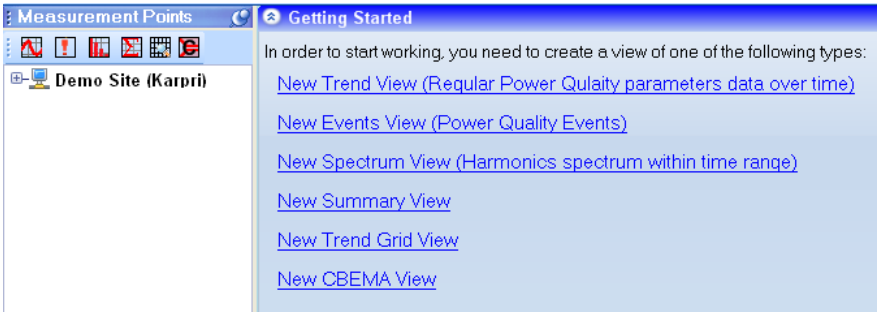
- Current User Application Folder: Specific to the user.
- Global Application Folder: For all users.

Sites

The SITE is a software component (logical representation) of a group of Nodes (devices).

The purpose of a site is to organize the Nodes by a common set of properties. i.e. location. For each monitored device, a ***Node*** must be created.

Initially the Investigator application appears with a window as shown below with only the **Demo Site (Karpri).** This is a site managed by the Elspec computer system and provides continuous measurements from an actual facility with multiple G4K devices.



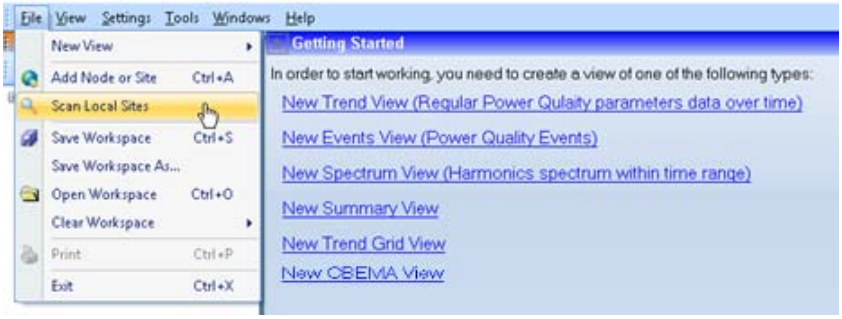
As you can see the **Selection Tree** is empty other that the Demo site. In order to start using the Investigator application to analyze your own data, you must first add an existing PQSCADA site to the application. Sites can be added to Investigator in the following ways:

- Automatic Scan
- Adding a Site Manually

Adding a Site Using Automatic Scan

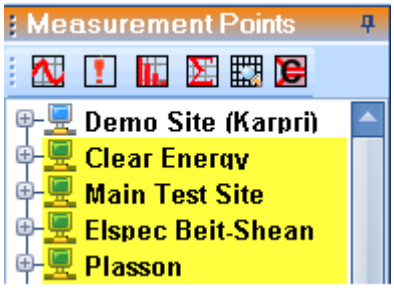
When the PQSCADA server application is running on the same machine, the most convenient way of adding a site is by automatically scanning for local sites functionality.

To add a site using Automatic Scan:



- From the Menu Tool Bar, select **File→Scan Local Sites**.

  The new local sites appear in the window.



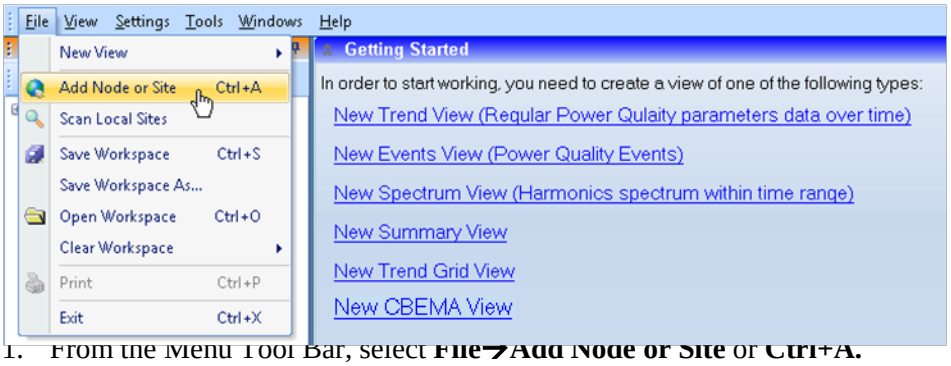
Automatic scan may not work if the local firewall prohibits UDP broadcasting, The Elspec Search is running and using the UDP 885 port, or The local site is down or unreachable. Please refer to Error! Not a valid result for table. **on page 111.**

If you are still unable to use the automatic feature, then you can add a site manually as follows.

Adding a Site Manually

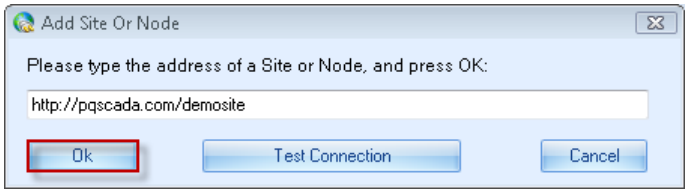
It is possible to add a site manually through an internet connection by entering the URL directly. If you are working with a site(s) where the PQSCADA software is running on the same computer, then you can add a site by copying the link from the site within the PQSCADA.

To add a site manually by entering the URL.



1. From the Menu Tool Bar, select **File→Add Node or Site** or **Ctrl+A.**

The Add Site or Node window appears.



2. Enter a full URL for the Site.
3. Click **OK.**

http://pqscada.com/demosite is a site managed by the Elspec computer system and provides continuous measurements from the Demo Site Karpri.

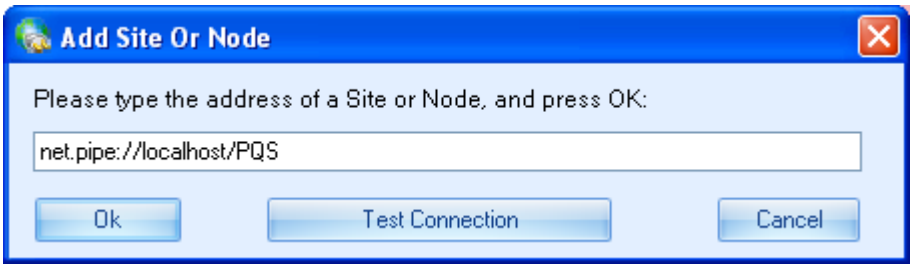
Using NET.PIPE to Overcome Firewall Issues

The purpose of the **NET.PIPE** is to allow a non-TCP/IP internal (inside a PC) connection between the INVESTIGATOR and PQSCADA which are installed on the same PC.

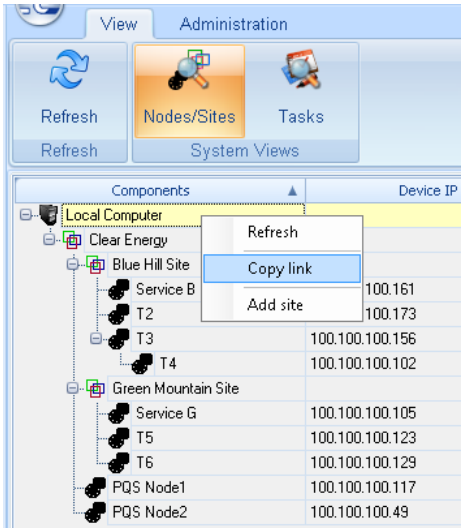
It is required when TCP/IP connection (inside a PC) is blocked (by Firewall) or occupied (by another software – e.g. SKYPE).

To use NET.PIPE to overcome firewall issues:

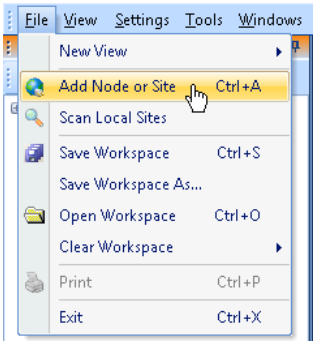
- Enter < **net.pipe://localhost/PQS** > into the Add Site or Node window as below:



To add a site by copying the link:

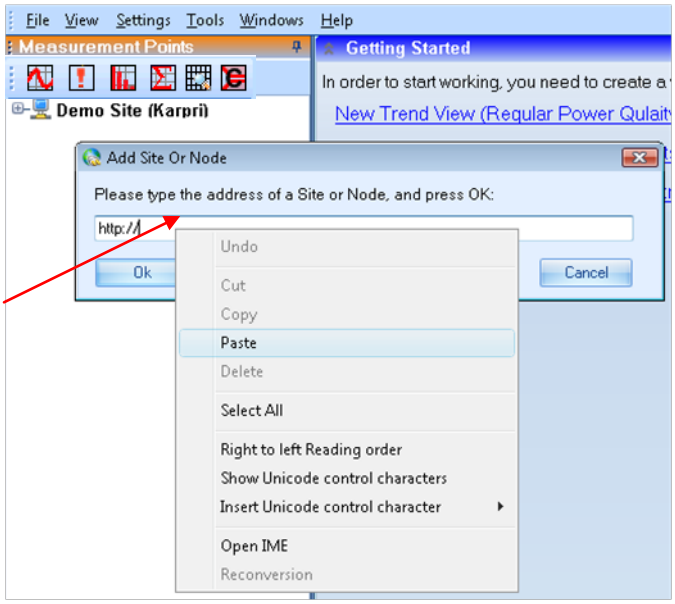


1. From the **PQSCADA Management Studio**, right click the site. (Local Computer which contains the sites Blue Hill and Green Mountain in our example).
2. Select Copy link.



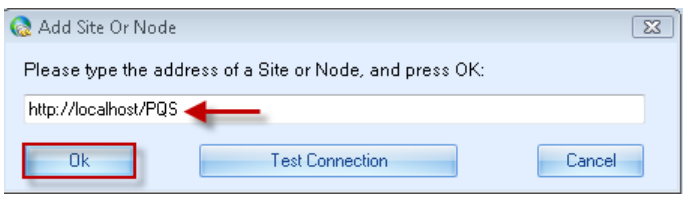
3. Select **Add Node or Site or Ctrl+A** from the Investigator Menu Tool Bar.

The Add Site or Node window appears.



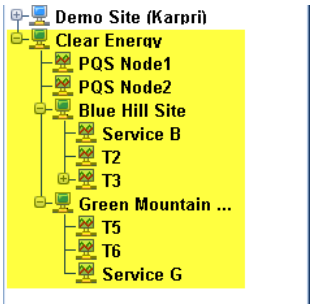
4. Right click directly inside the dialog box, then select **Paste.**

The link from the Local Computer appears in the dialog box.



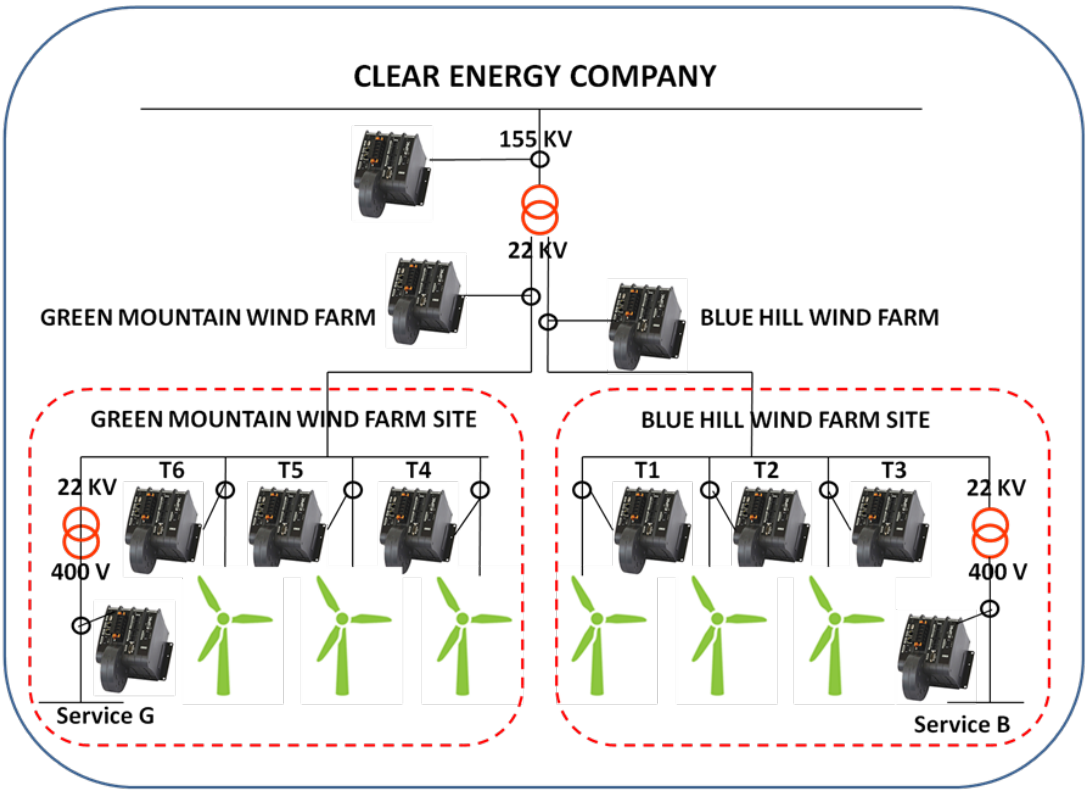
5. Click **OK to** accept.

The new site appears with all sub-sites and Nodes in the Selection Tree.



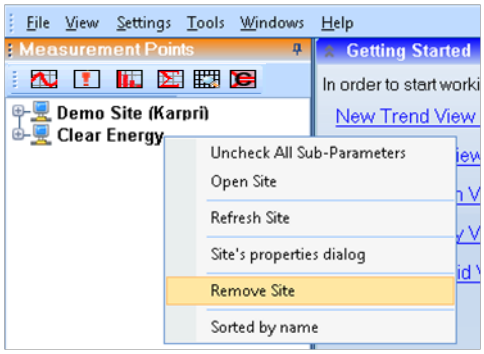
Hierarchical Site Construction

The Investigator software offers a hierarchical site construction view to mirror the PQSCADA. A very large site (Clear Energy Company in our example) is divided into smaller sub-sites (Green Mountain and Blue Hill Wind Farms). In each sub-site, it is possible to create sub-Nodes (T1-T6, Service B, and Service G). Of course the creation of the sites and Nodes is done in PQSCADA This way, the hierarchical structure built in the PQSCADA and INVESTIGATOR, represents the actual electrical grid architecture most accurately.

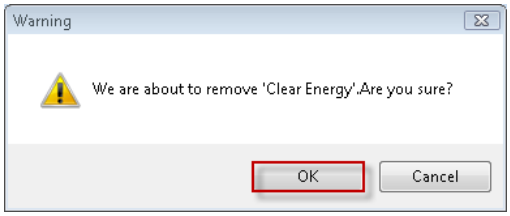


Removing a Site

Since the Investigator application is primarily a viewing tool, then removing a site from the Investigator application does not remove the site from the PQSCADA.



1. From the Selection Tree, right click the Site, then select **Remove Site.**

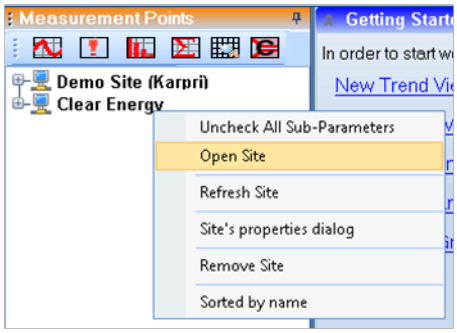


2. Click **OK** to confirm.

Opening a Site

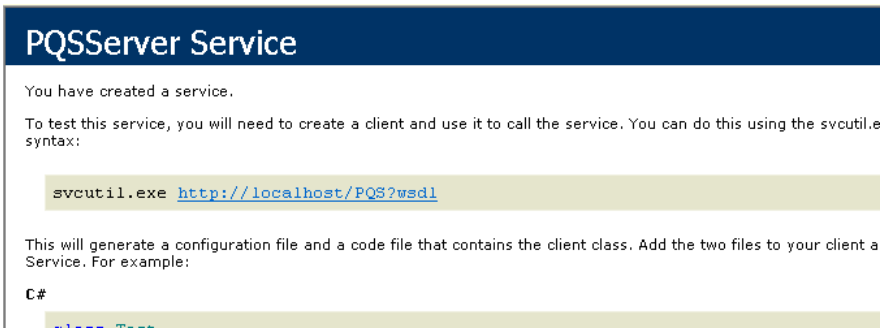
Opening a site is a tool to verify if a site is active. If an error message appears, then please refer to

Appendix C: Communications Troubleshooting on page 111.



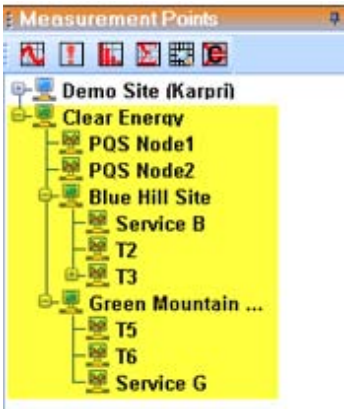
- From the Selection Tree, right click the site, then select **Open Site.**

The following window appears if the connection can be established When the Internet Browser opens with a valid link (underlined blue text), the site is valid.

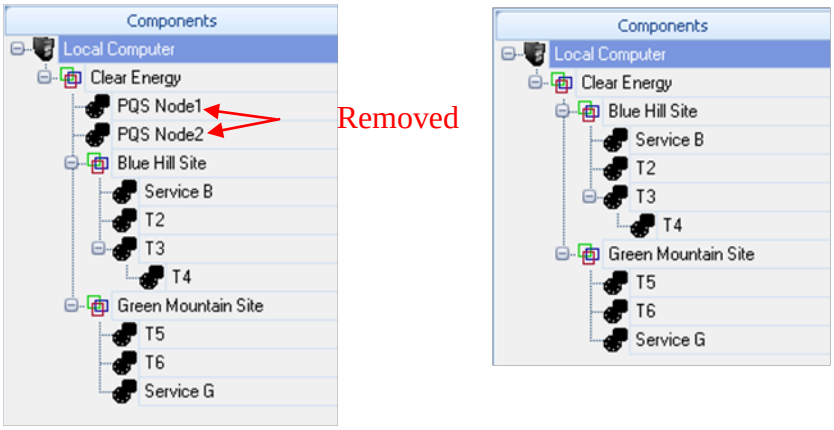


Refreshing a Site

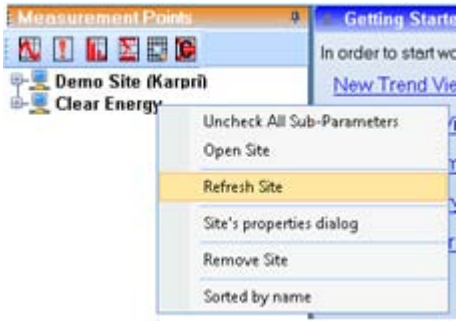
Refreshing a site updates the Investigator with new Site information from the PQSCADA. This is a manual process, therefore whenever a change is made to an existing site in PQSCADA, then it is recommended to update the Investigator by performing this procedure.



There is an existing site **Clear Energy** with two Nodes **PQS Node1** and **PQS Node2**. And two sub sites **Blue Hill** and **Green Mountain. PQS Node1 and PQS Node2** deleted from the PQSCADA as below

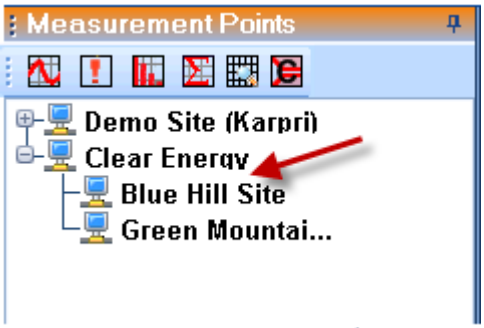


To refresh the Site:



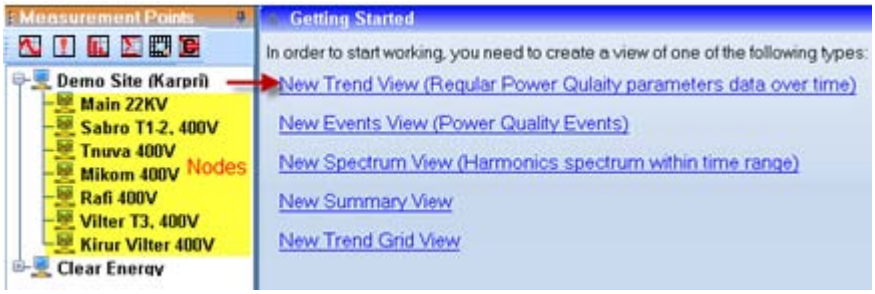
- From the Selection Tree, right click the site, then select **Refresh Site.**

The updated Site appears in Investigator without the two Nodes **PQS Node1** and **PQS Node2.**



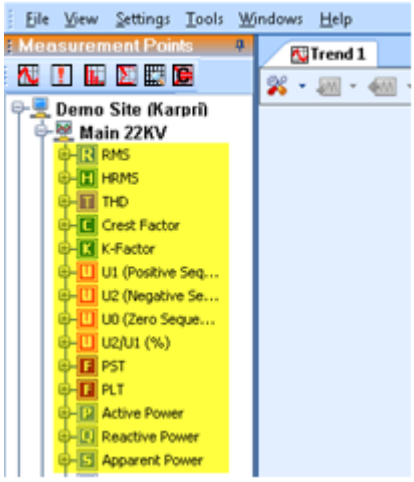
Nodes

A ***Node*** is a logical entity defined by PQSCADA that represents the physical device location. The ***Node*** computes the power quality parameters and discloses them to Investigator. Once a site is added, then the attached ***Node*** comes with the site.



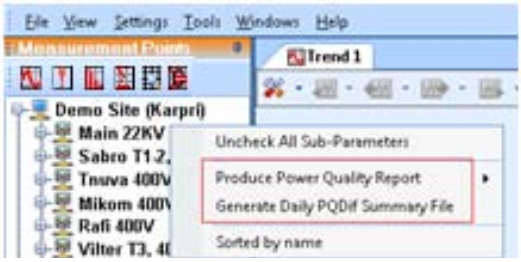
The Demo Site Karpri has seven attached Nodes. In order to select parameters to be investigated for any ***Node***, you must first select a **View (**New Trend View in our example). After a view is selected then the available parameters for that specific view are displayed beneath the ***Node***. (For more on view see

Views **on page 37)**



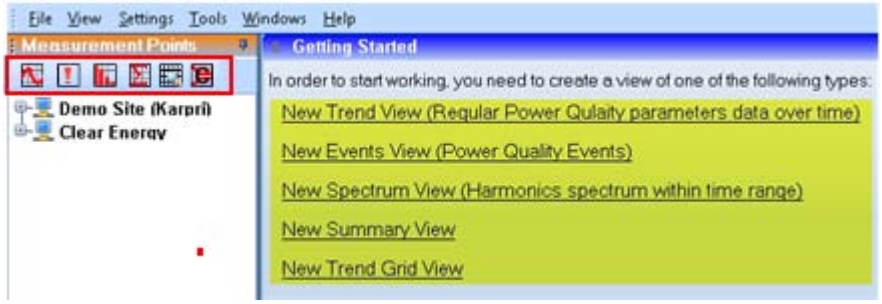
Each *Node* is capable of producing specific reports. (for more on reports see

Reports **on page 100**)


File View Settings Tools Windows Help
Measurement Points
Trend 1
Demo Site (Karpri)
Main 22KV
Sabro T1,2,
Tnuva 400V
Mikom 400V
Rafi 400V
Vilter T3, 4
Uncheck All Sub-Parameters
Produce Power Quality Report
Generate Daily PQDif Summary File
Sorted by name

Views

The Investigator application can present the recorded data in a number of different ways. The data presentation is referred to as a **View.** The first step in data analysis is the view selection. The View selection can be made either in the Main working panel on the right the first time the application is opened, or with the icons in the selection tree on the left (yellow highlighting).



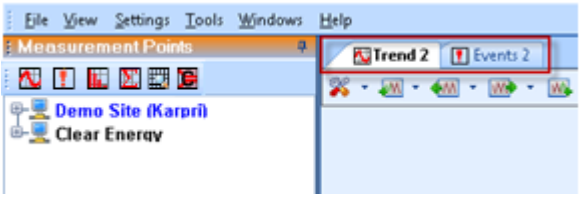
View Types

The available view types, representative icons, and complete descriptions are presented in the table below. Each View type is a historical data representation of electrical and Power Quality parameters.

Icon	View Type	Description
	Trend View	A continuous trend graph of data parameters over time. For more on Trends see **Trend View on page 43.**
	Events View	A table of events captured/detected by the device. For more on events see **Events View on page 79**.
	Spectrum View	Useful for harmonic spectrum representation including voltages, current, and power anomalies. For more on Spectrum see **Spectrum View on page 87**
	Summary View	Displays summary information over a defined period of time, including maximum, minimum, and true mathematical averages of any parameter over a time span defined by the user. For more on Summary, see **Summary View on page 66**.
	Trend Grid View	Similar to the trend view, but with a grid/table style display. For more on Trend, see **Trend Grid** View **on page 71.**
	CBEMA View	The CBEMA (Computer and Business Equipment Manufacturers' Association) is a power quality graph that plots the depth or deviation of voltage dips and overvoltage on the x-axis and the duration on the y-axis. For more on CBEMA, see **CBEMA View on page 93.**

Multi-View

The Elspec Investigator is a multi-view application, which means that you can open and operate a number of views of any type simultaneously. When a view(s) (Trend 2 and Events 2) in our example) are created, they appears as a blank screen and is docked as a tab in the working area as below.

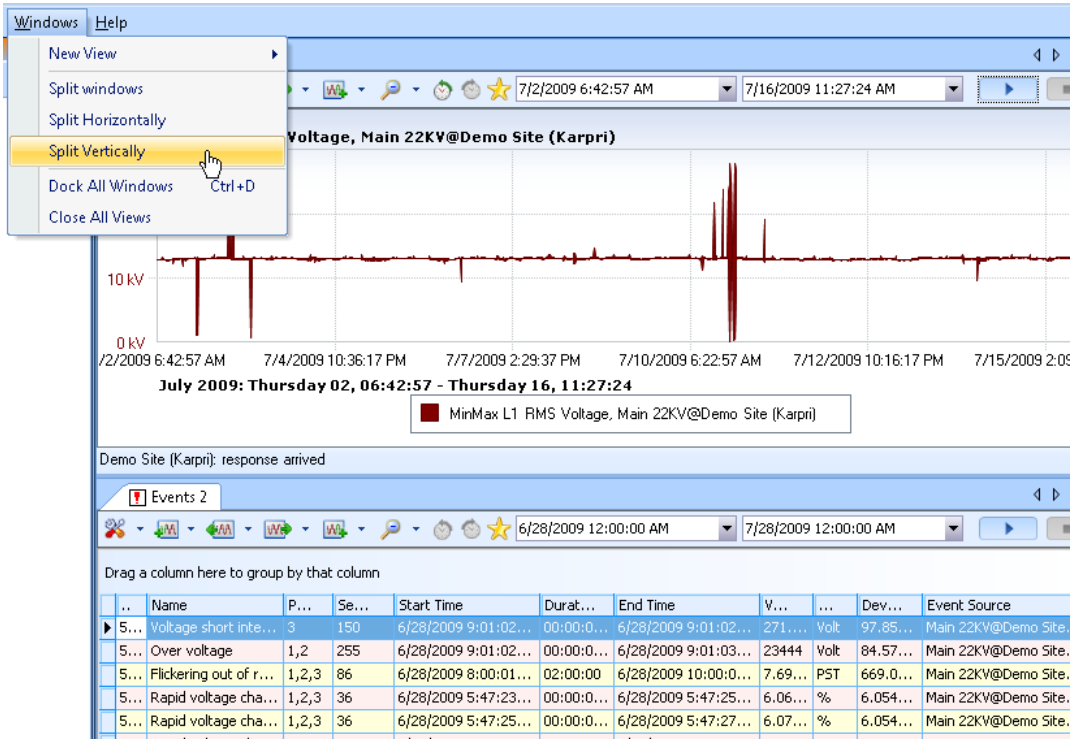


Each view can have its own parameters and time span, so it is possible to display different parameters or different time spans simultaneously using a number of views. In our example, the **MinMax for L1** is the chosen parameter and the time span is consistent for all views.

To display multiple views, you can split the window or drag and drop the view into the working area. (The split option may be more suitable for 2 views)

To split the windows:

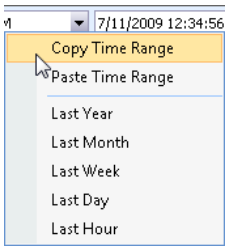
- From the main menu, right click windows, then select **Split Vertically** (for our example the vertical split will be easier for the same time range)



If you want to change the time range (zoom in our out) in one view, then it may be necessary to change the time range in the other view. This can be accomplished simply by copying and pasting the time.

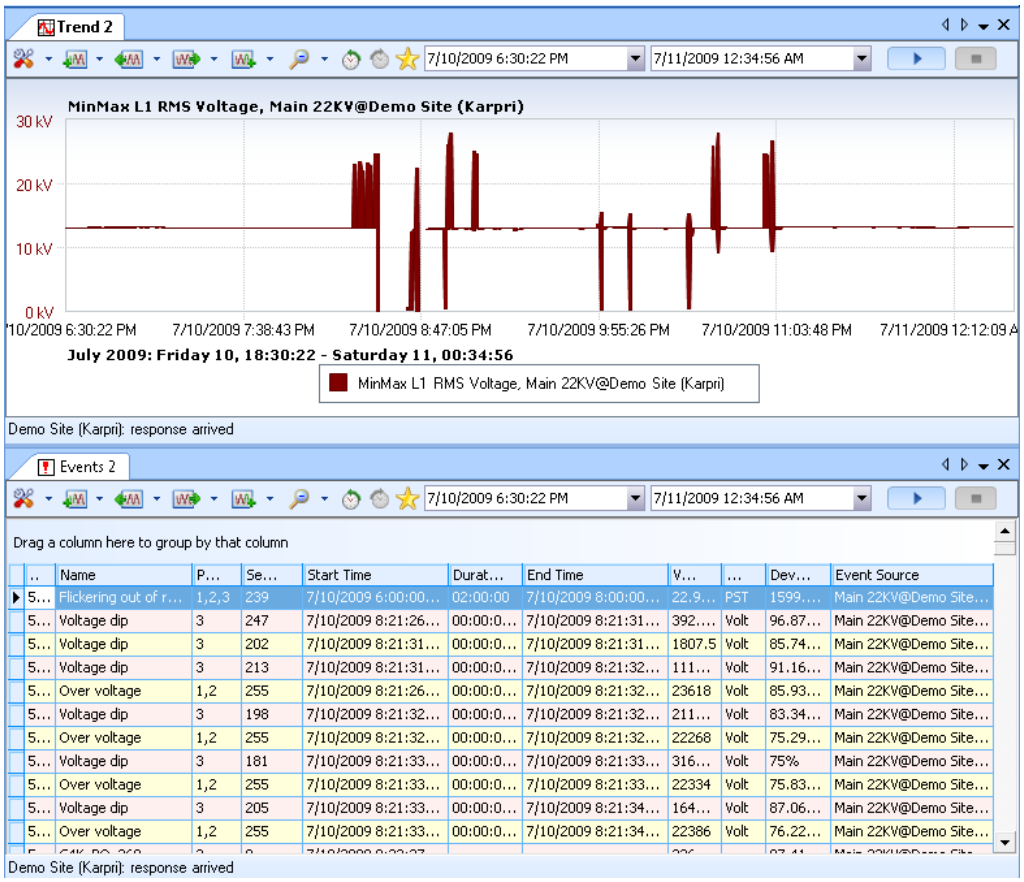
To copy and paste the time range:

1. Right click the time range in the source view, then select **Copy Time Range.**



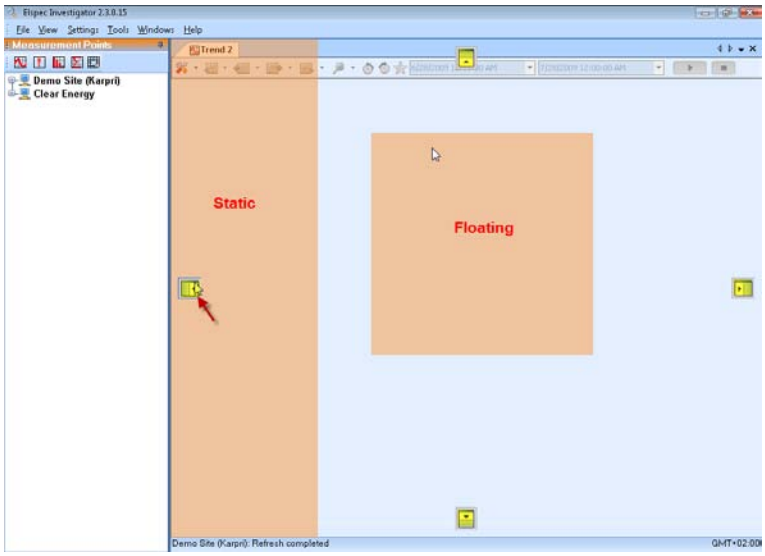
2. Paste the time range in the target view.

Both views can be seen with the new time ranges.

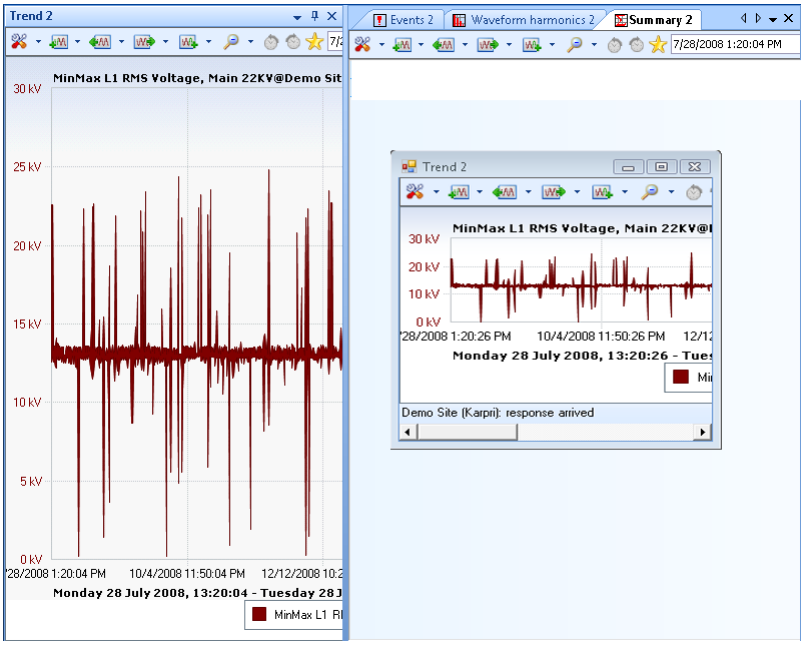


To dock the Views in the working space:

- From the main window, drag and drop the **View(s)** individually into the working area. They can be dropped as floating windows or statically (to the left docking point red arrow) using the docking indicators (highlighted in yellow).

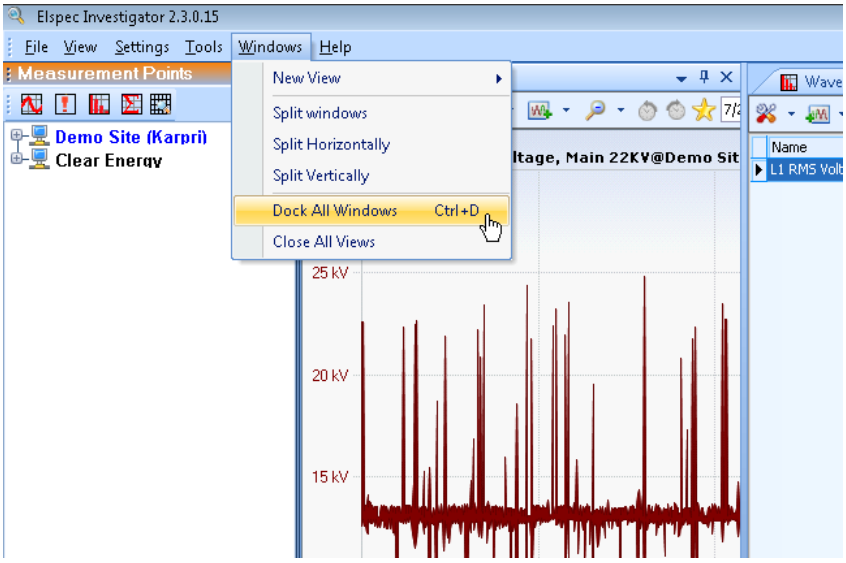


Trend 1 is seen below both fixed to the left docking indicator and floating.

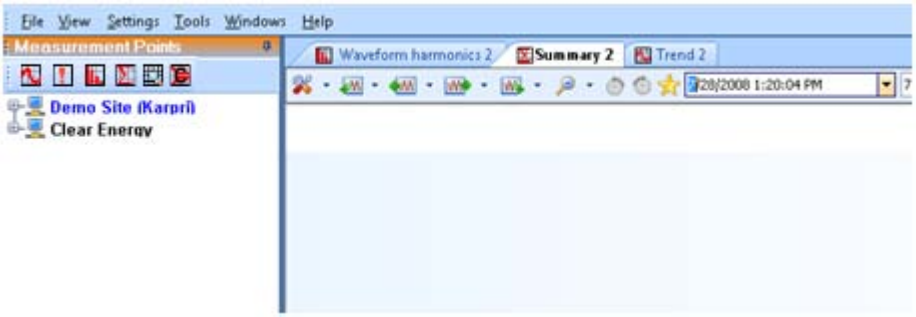


To Default docking:

- From the main tool bar, select **Windows→Dock all Windows or Ctrl + D**.



This restores the windows the default state, when each window is tabbed in the top and therefore fills the entire working area.



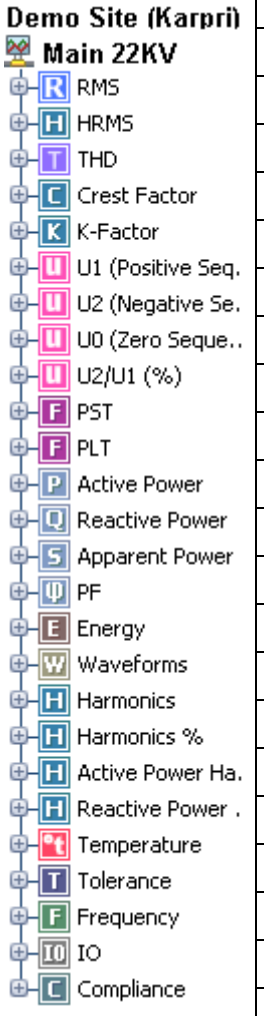
This single click feature is useful when you arrange windows in an undesirable fashion, and want to revert back to a default state.

Trend View

A Trend view is a continuous trend graph of data parameters over time.

Trend Parameters

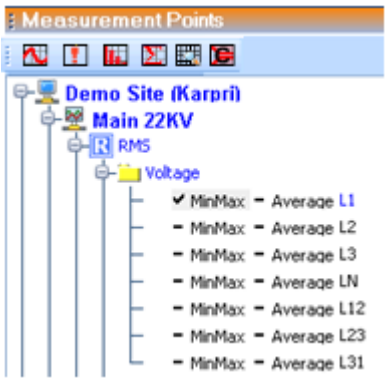
Once the view choice has been made, then you need to select the specific parameters for the ***Node*** to be investigated. The available parameters are dependent on the view type selected. The following table displays the parameters available in the INVESTIGATOR:

Selection Tree	Parameter
	**RMS**
	HRMS
	THD
	Crest Factor
	K-Factor
	U1 (Positive Sequence)
	U2 (Negative Sequence) Sequence)
	U0 (Zero Sequence)
	U2/U1 (%)
	PST
	PLT
	Active Power
	Reactive Power
	Apparent Power
	PF
	Energy
	Waveforms
	Harmonics
	Harmonics %
	Active\Power Ha.
	Reactive Power
	Temperature
	Tolerance
	Frequency
	IO

Selection Tree	Parameter
	Compliance

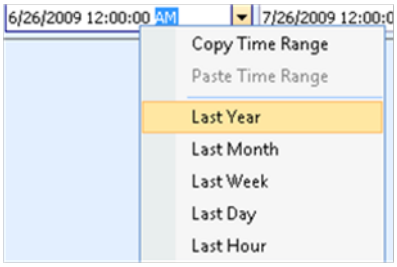
As we can see in the view tool bar below, the time selection as well as all the tool bar buttons remains de-activated until the final parameter selection is made.

Once the final parameter selection (Trend View **MinMax L1** in our example) has been made, the path to the parameter has changed to blue.



Trend Time Selection

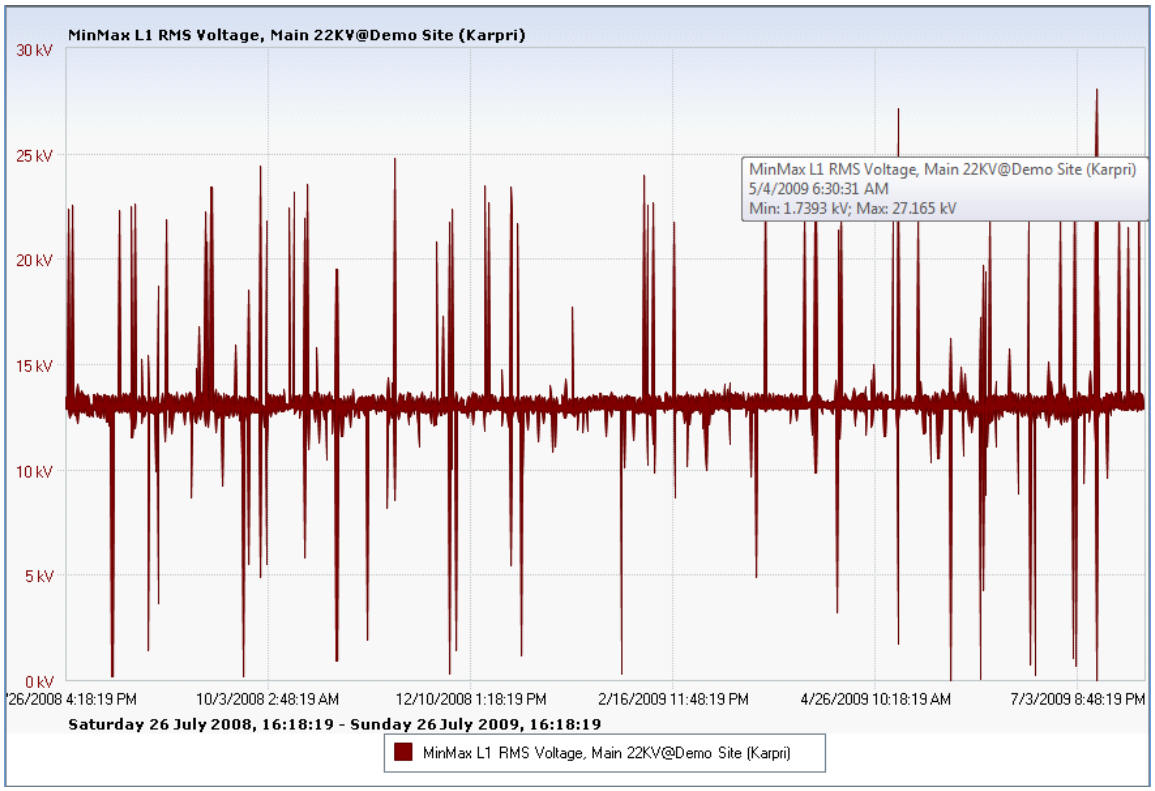
Once at least one parameter is selected in a view, then the time controls in the view tool bar become active; therefore you can make the time selection by either using the drop down calendar on the left or selecting a pre-set time range on the right. (last year in our example)



- To begin querying data, press the  **Start Query** button.

- If needed, to abort, press the  **Stop Query** button.

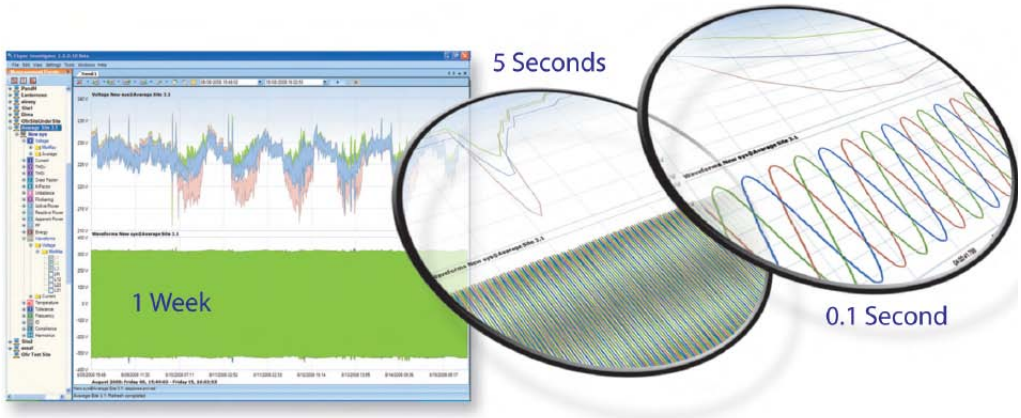
The following is simple trend view showing a historical data presentation, where the selected parameter **RMS Voltage L1 Min/Max** is presented in a continuous time frame for the **Demo Site (Karpri)** over the past year.



The minimum and maximum values are represented in the graph. The dips and the spikes are “Power Quality events”. As you pass the mouse over a specific point in the graph, a message box appears displaying all relevant information regarding the measuring point as below.

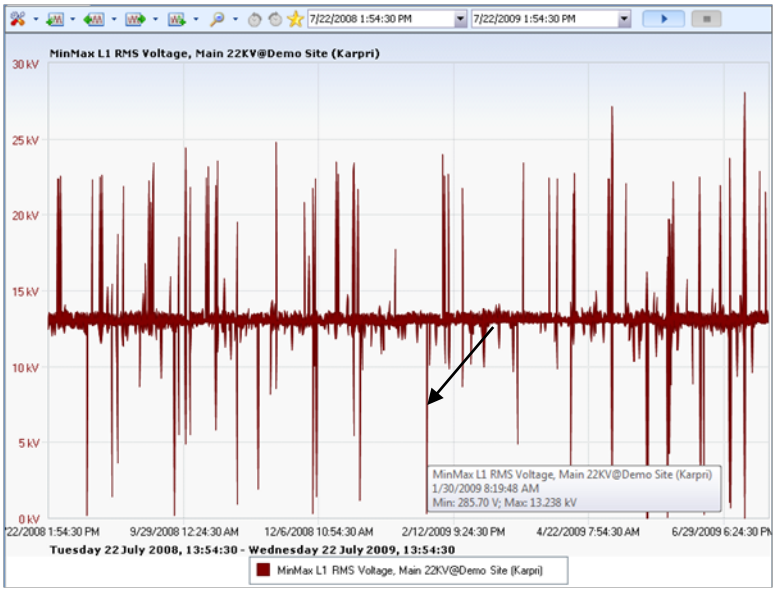
Trend Zooming In/Out

A very important feature of the Investigator application is the ability to drill in to a higher resolution around a specific point in time. With mouse click simplicity, you can drill down from a year to a millisecond. The higher the resolution, the more precise the graph you receive.

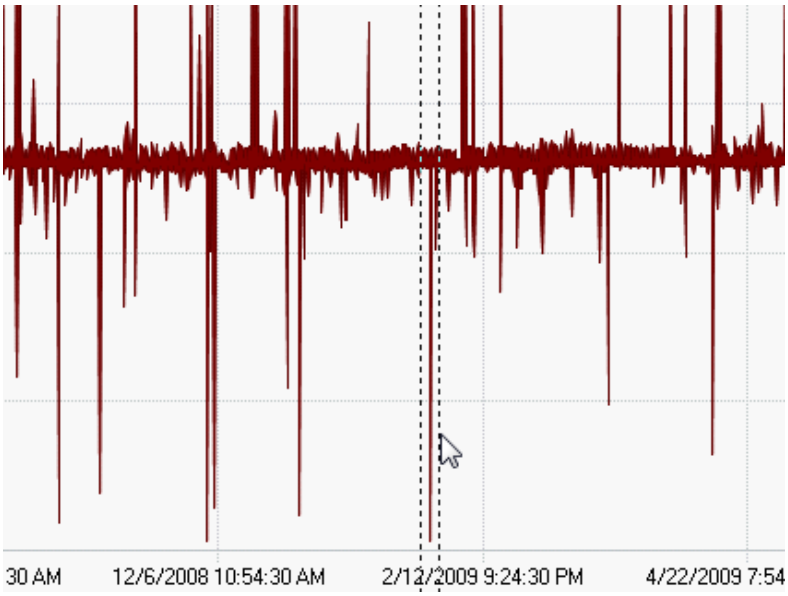


To zoom in and out:

1. From the Main Viewing panel, identify the area to be investigated. In our example, we select a significant voltage dip (285 V) on 30/1/2009 to be further investigated.



2. Left click at the beginning of the time period, then drag the mouse over to the ending time period.

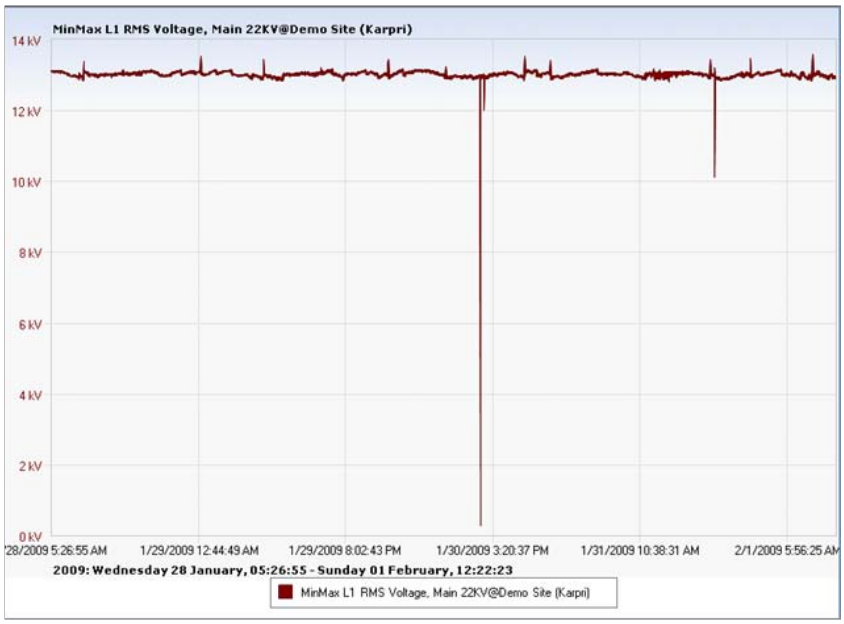


Since we are interested in, not just the event, but what occurred both before and after, we select a time period around the event. The closer the time selection, the more you can zoom in. In our example we are interested in the time period around January 30, 2009, because a large voltage dip occurred on that date.

We select a time period before and after to take a closer look at. In the following graphs, the graphs will show the time of interest taken down from a year into microseconds.

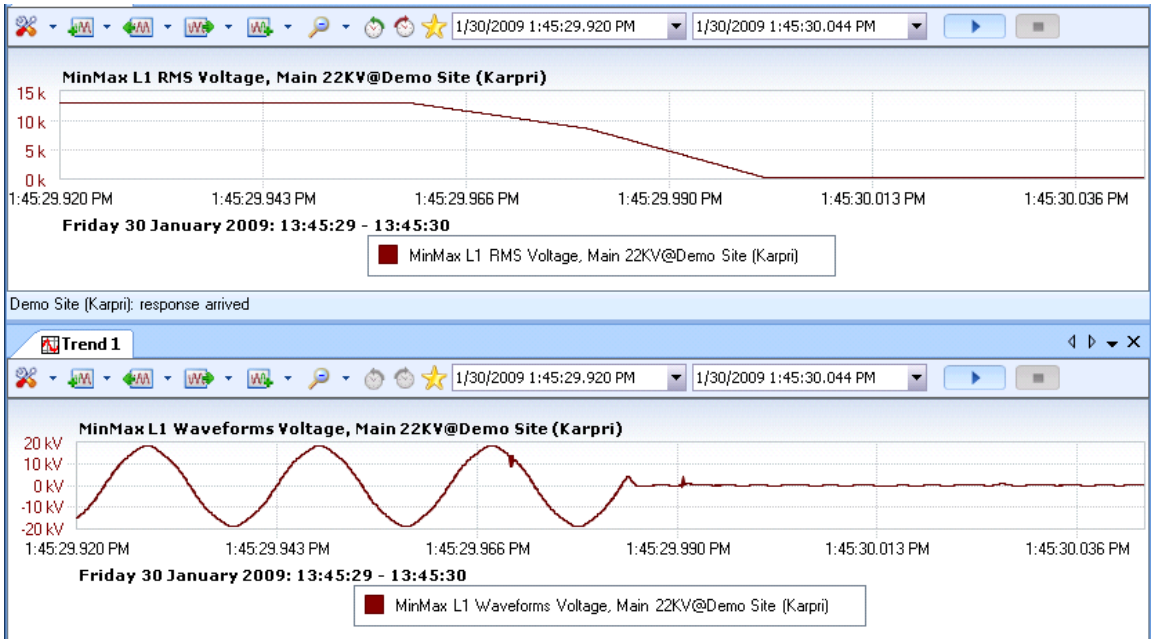
A new Zoomed in view of the area. **Starting from an entire Year**:

To Days.....



To Microseconds……..

The illustraton below represents a zoom in to **microseconds** of a voltage drop event and the correspoding waveforms during the same time period.



Trend Toolbar

Once a view is established, it is possible to change the view with the tool buttons at the top of the Main Viewing area.

								
Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

From the original Trend view as below of L1 Min/Max, the following screens will show how to change the views easily using these tools. Each view can be changed according to a pre-set time period.

Append Back

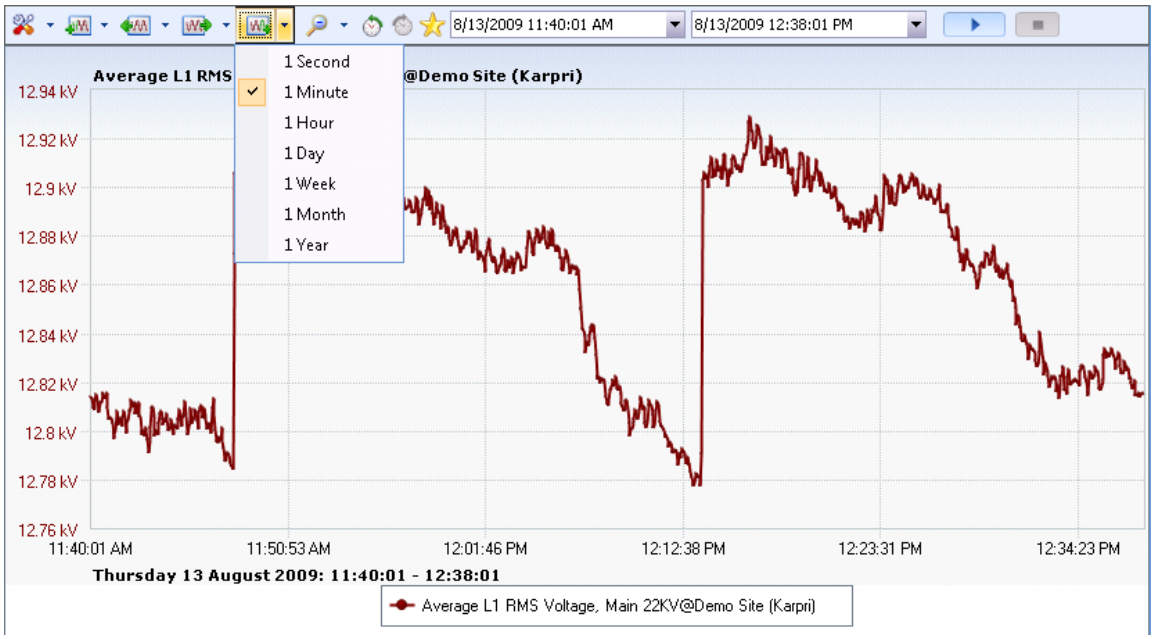
Appending back means that you leave the end time intact and move the start time back by a selected amount (five minutes in our example).

Back

You may select **Back** to shift the current time duration back a specified amount of time (five minutes in our example).

Append Forward

Appending forward means that you leave the start time intact and move the end time forward by a selected amount (ten minutes in our example).



Forward

You may select **Forward** to shift the current time duration forward a specified amount of time (three minutes in our example).

Expand Time

To expand or zoom out from a view, use the **Expand Time button**.

From here, it is possible to select the Zoom out ratio. Therefore an **X3 ratio** yields the three time larger interval as below

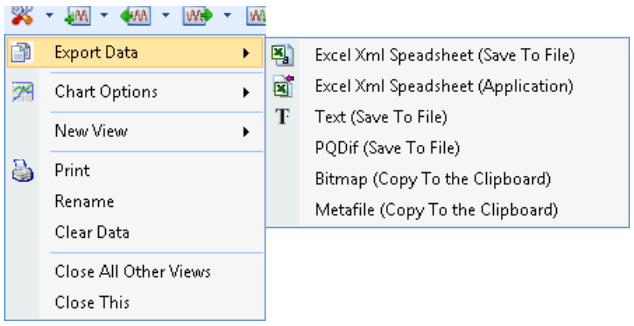
Previous Time/Next Time

In order to move back to the previous time selection, use the **Previous Time** button. To move in the opposite direction, use the **Next Time** frame button.

Trend Data Exporting

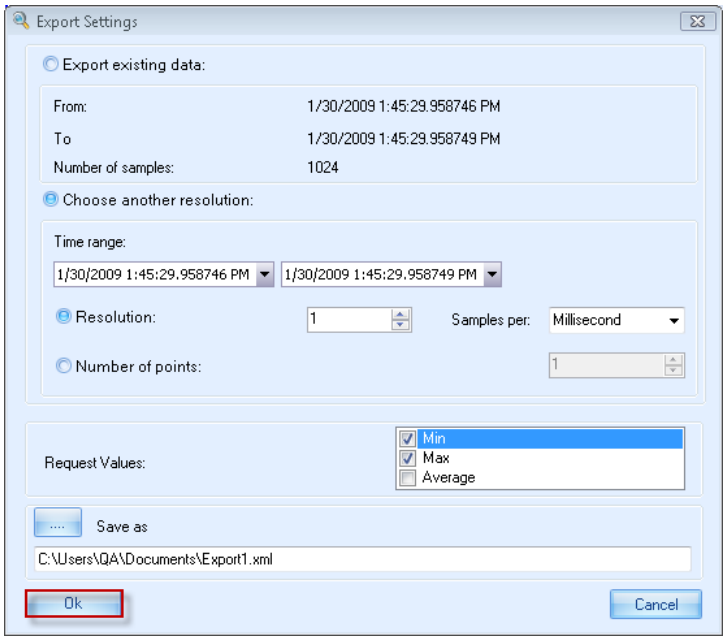
It is possible to export the Trend graphic files in the following formats:

- Excel Xml Spreadsheet (Save to a file or an application)
- Saved as a text file
- PQDif
- Bitmap (Copy to the clipboard)
- Metafile (Copy to the clipboard)



1. From the Main Toolbar, right click the Tools icon.
2. Select **Export Data** from the drop down menu.
3. Select the desired format to export the file.

The Export Settings window appears. (This window does not appear if you are copying to the clipboard).



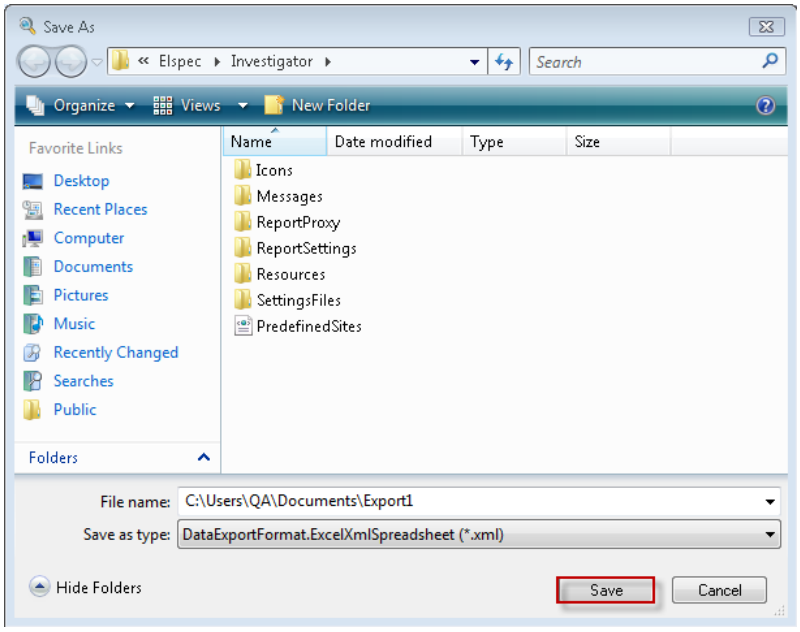
4. Select the Export existing data or Choose another resolution.

If a new resolution is desired, then you may select a new time range. In addition you may choose a new resolution number and sampling rate which will automatically set the number of points, or specify a number of points explicitly.

5. Select the value series of interest from the **Requested Values** box. (The default selections are the parameters originally selected).

6. Click the  **Save As** button or accept the existing path.

The **Save As** window appears (only active if export is to a file).

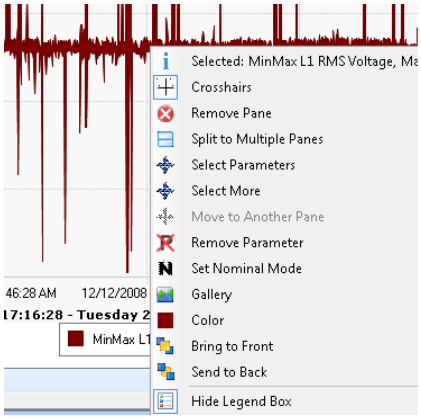


7. Enter the desired path name.
8. Click **Save** to complete.

Trend Advanced Features

There are advanced features available that allow you to view the graphs in different formats to make interpretation and diagnosis easier.

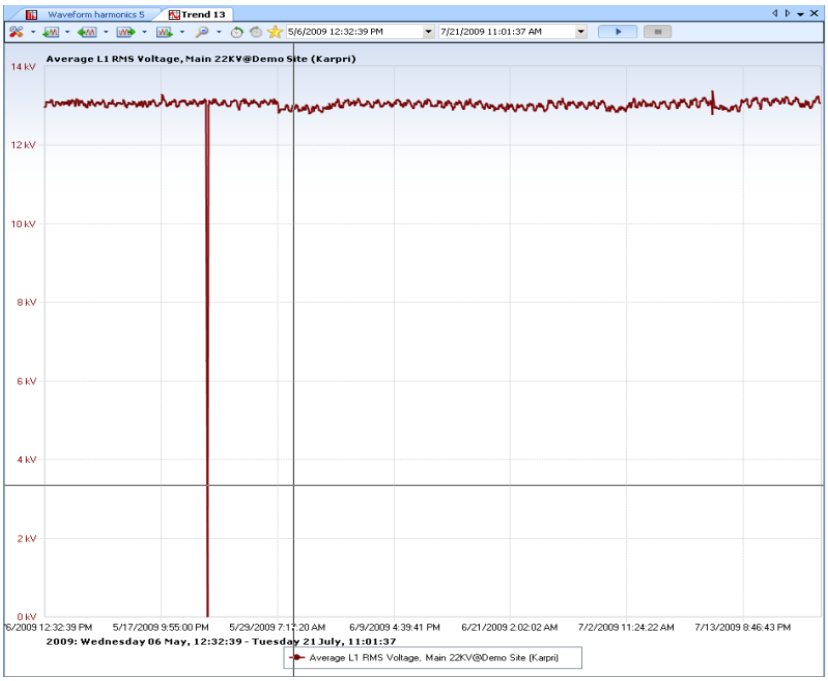
To access the advanced features:



- From any graph, right click at **any point on the graph** to access the advanced features.

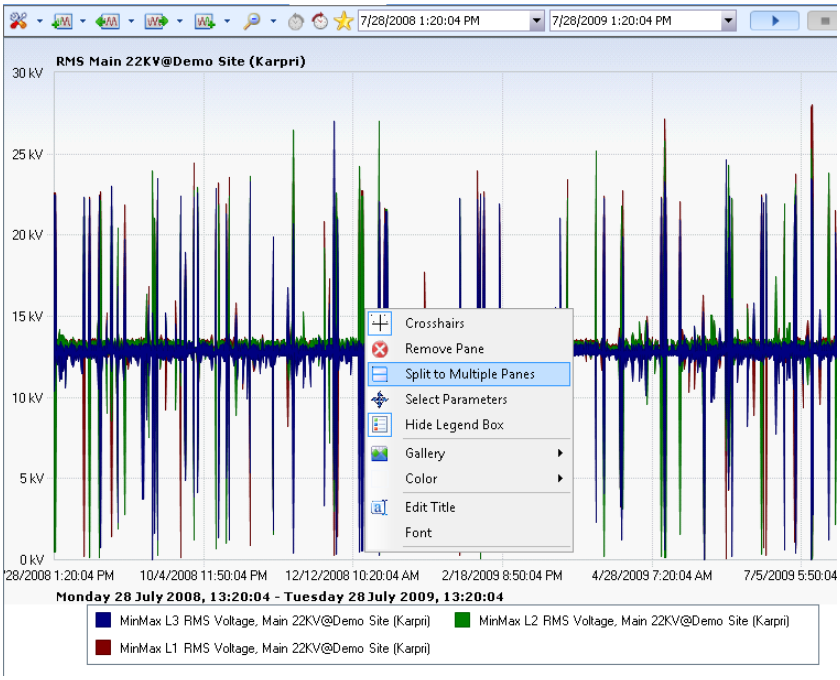
Crosshairs

This option allows you to more clearly identify an area of interest. In our example we are examining the **Min/Max L1 Voltage** and using the RMS nominal **220V** as the baseline. In this illustration we use the horizontal line to identify the severity of the voltage drop event. (below 60V)



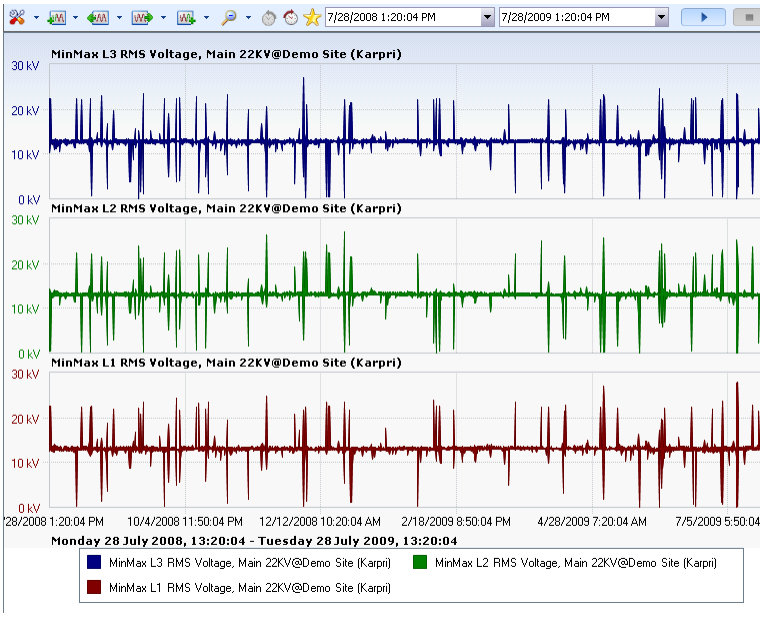
Multiple Panes

A graph can contain multiple parameters. In order to separate each parameter to investigate further it is sometimes easier to separate each into its own pane.



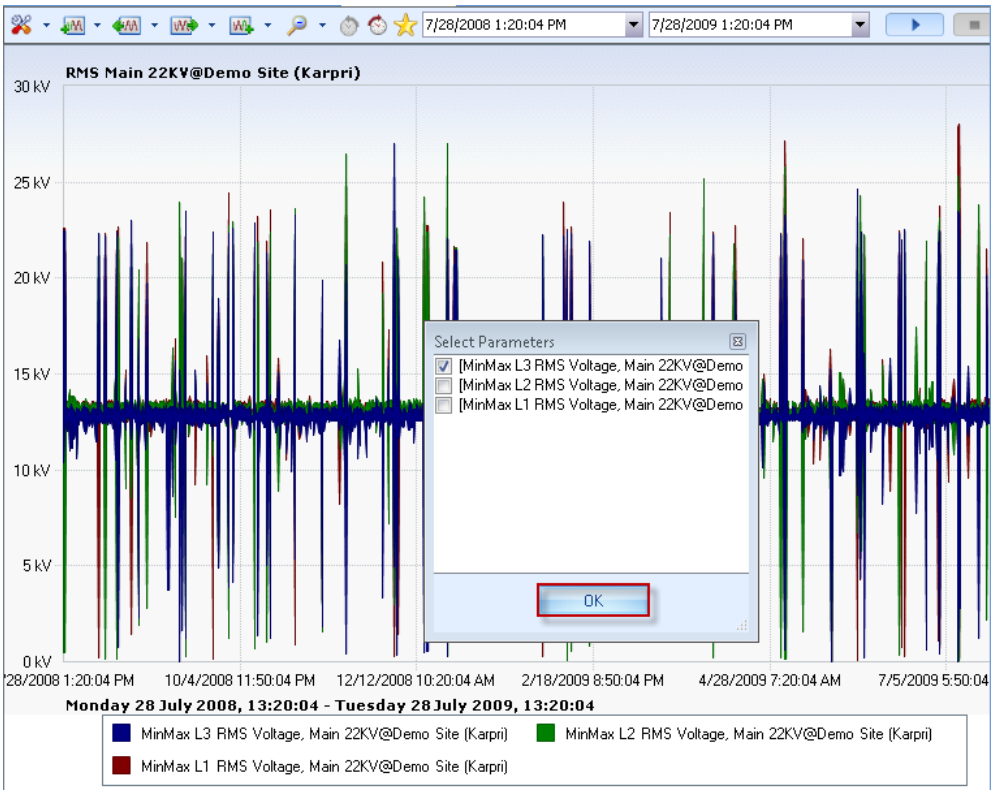
- From any point on the graph, right click, then select **Split to Multiple Panes.**

A new window is created splitting each parameter (L1, L2, and L3 into its own pane.



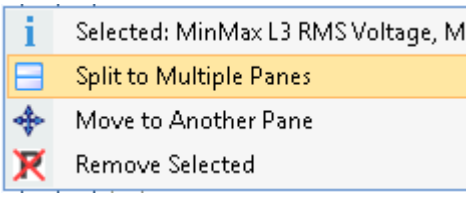
Select Parameters

When certain parameters are to be selected and view together before splitting in to multiple panes.



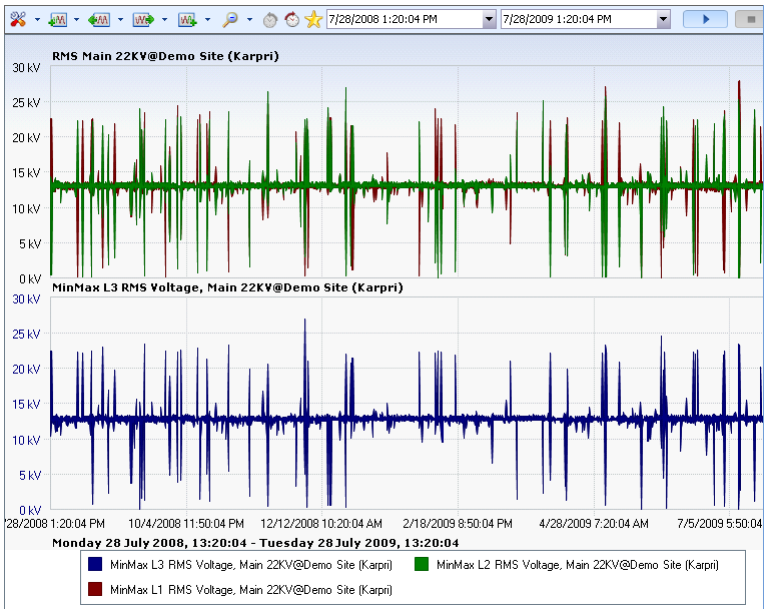
a) Right click on the graph, choose **Select Parameters** from the menu, then select the desired parameter(s). (L3 in our example to be isolated for L1 and L2)

b) Click **OK** to continue



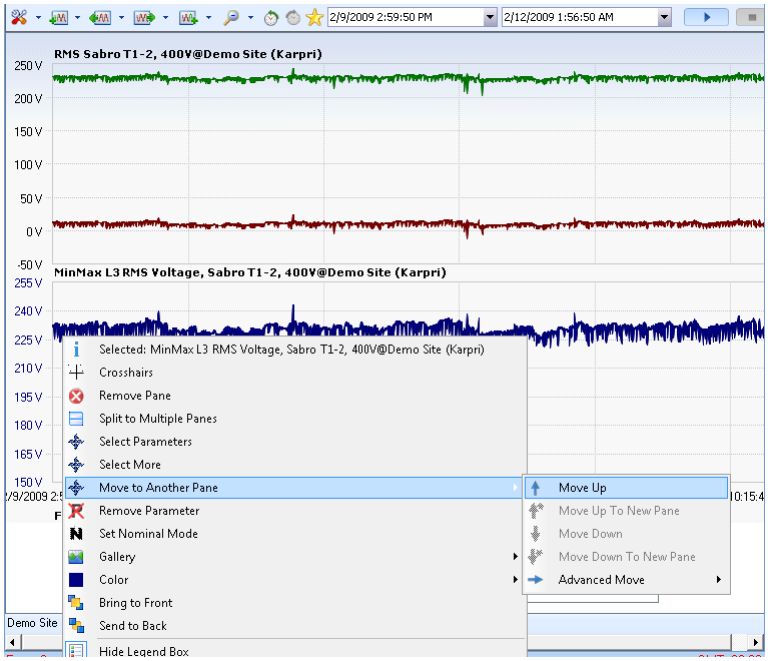
c) Make a selection (**Split to Multiple Panes** in our example).

The graph below shows how L3 is isolated from L1 and L2.



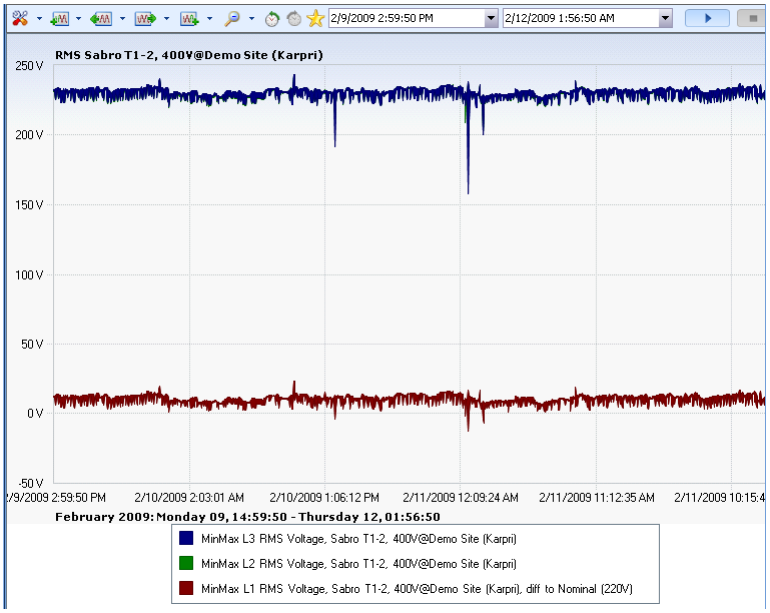
Move to Another Pane

Moving the graph into another pane or combining panes allows you to re-arrange the data to look at multiple series in the same window.



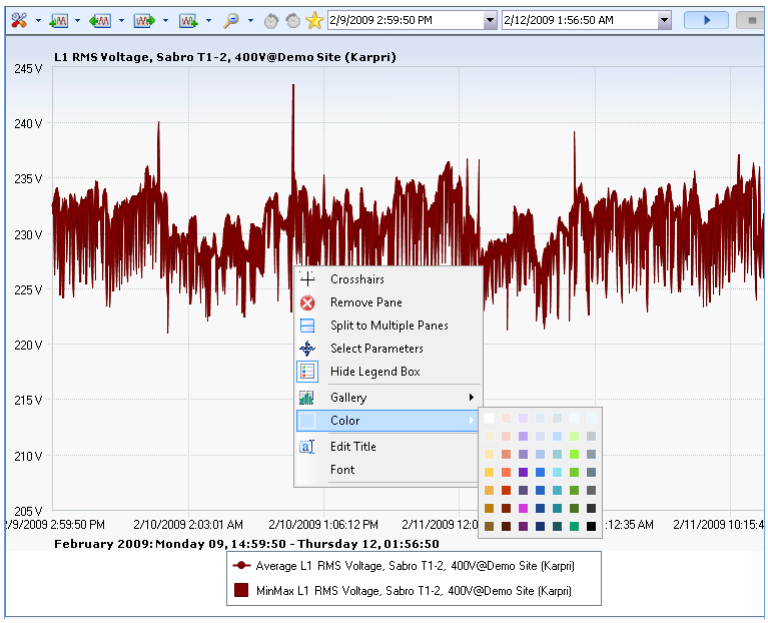
- Right click on the graph, then select **Move to Another Pane→Move Up.**

L3 now shares the pane with L1 and L2. It is difficult to see L2 because the values of L2 and L3 are similar and L3 is lying over L2. In the next section we refer to showing one parameter in front of/back of another.



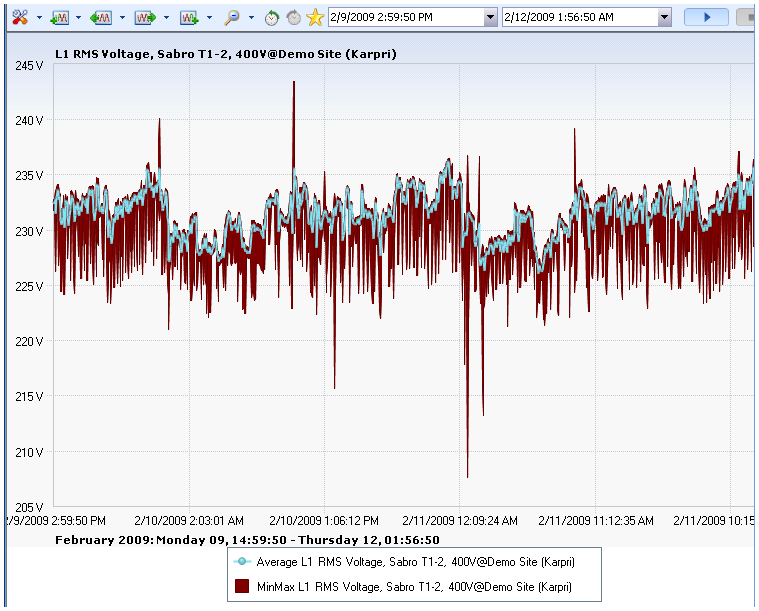
Colors

In order to more clearly distinguish the trends in the graph, you can apply custom user selected colors to each trend individually. In the graph below it is difficult to distinguish the Min/Max values from the Average.



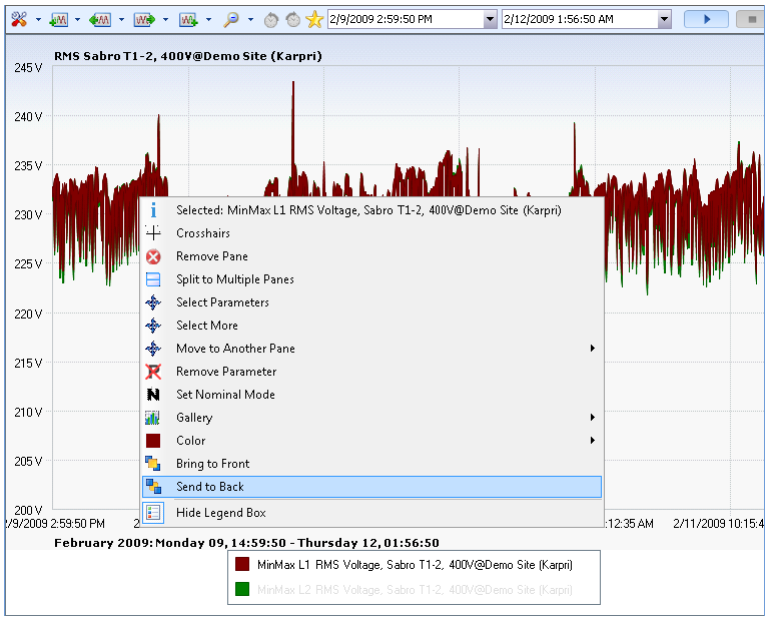
- Right click on the graph, select **Colors→select your color**

  You can now distinguish much more clearly between the parameters.



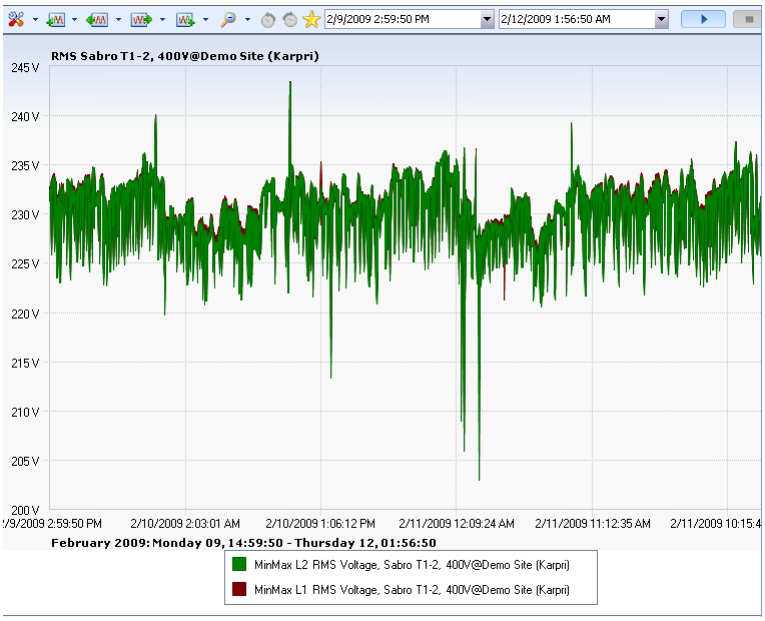
Bring to Front/Back

When selected parameters overlap each other (Min Max of L1 and L2 in our example), we can choose (toggle) between which parameter is in the foreground and which is in the background.



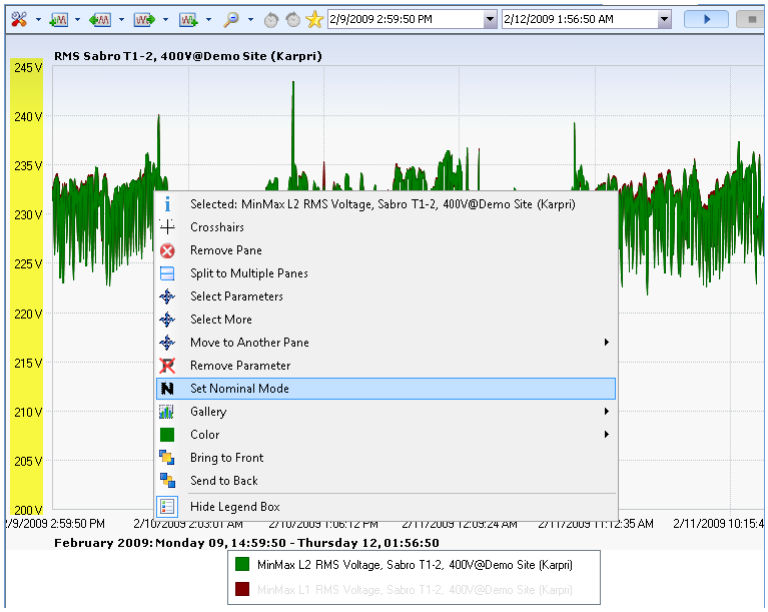
- Right click the graph, then select **Bring to Back or Bring to Front.**

The parameter L1 moves to the background and you can see L2 in the foreground.



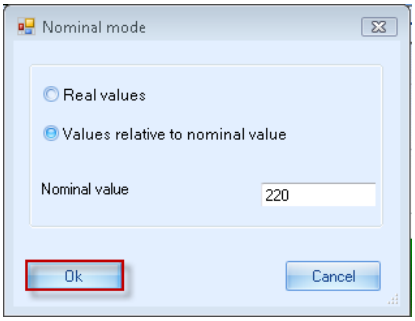
Set Nominal Mode

When examining parameters in relation to a numerical value (RMS Voltage in our example) it may be easier to see variance from RMS by changing the baseline settings to Nominal. (220V in our example).



a) Right click the desired parameter on the graph, then select **Set Nominal Mode.**

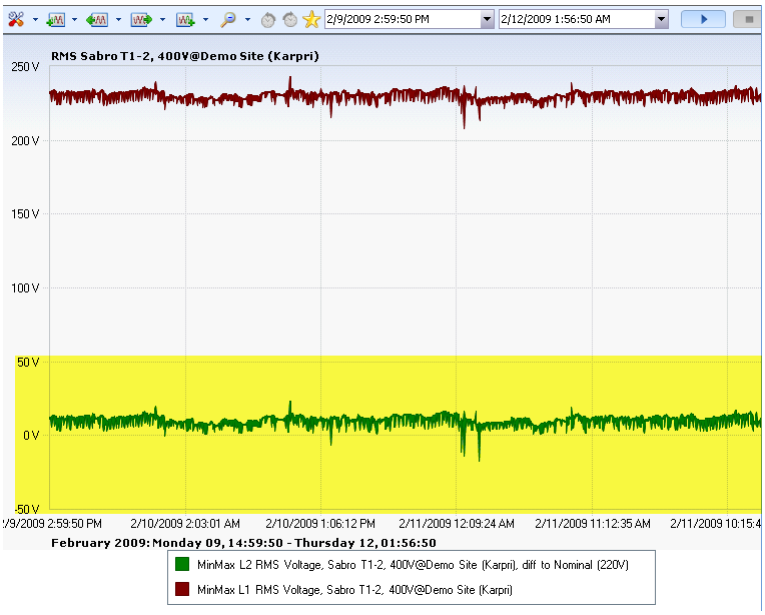
The Set Nominal mode window appears.



b) Change the default Real values selection to **Values relative to nominal value.**

c) Set the nominal value to the desired amount. (220V in our example)

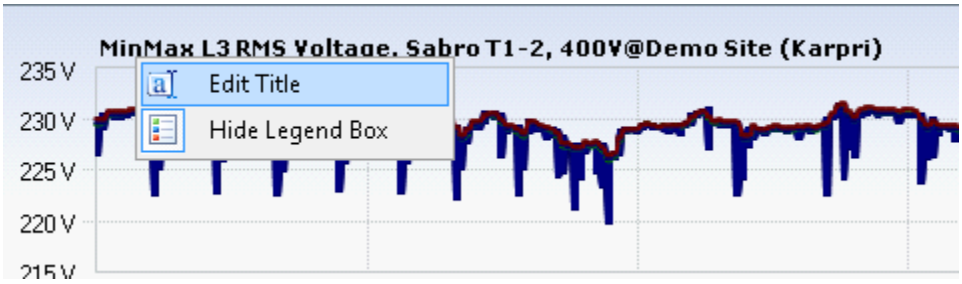
d) The new graph appears with the L2 graph set in relation to the nominal voltage. We can see more clearly the deviation from nominal in this way.



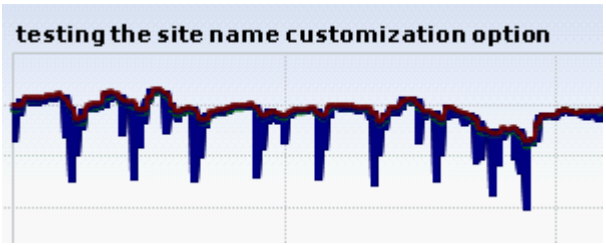
Title Customization

You may customize the title name for each series individually.

a) Right click the title, then select **Edit Title.**



b) Enter a desired new title name.



Summary View

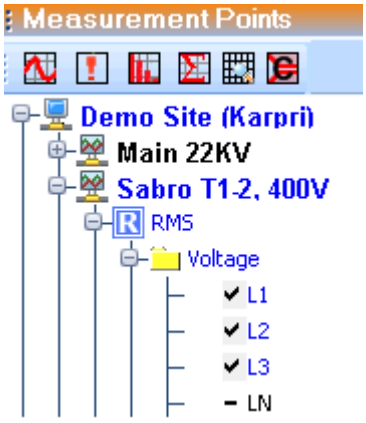
The Summary View displays summary information over a defined period of time, including maximum, minimum, and true mathematical averages of any parameter over a time span defined by the user. The summary view is a table, not a graph that displays a separate line for each selected parameter. Each line contains summation values.

Summary Parameters

Once the view choice has been made, then you need to select the specific parameters for the ***Node*** to be investigated. The available parameters are dependent on the view type selected. The available parameters for **Summary View** are the same as the **Trend View,** with the possible exception of Min/Max and Average values. (see **Trend Parameters on page 43**)**.**

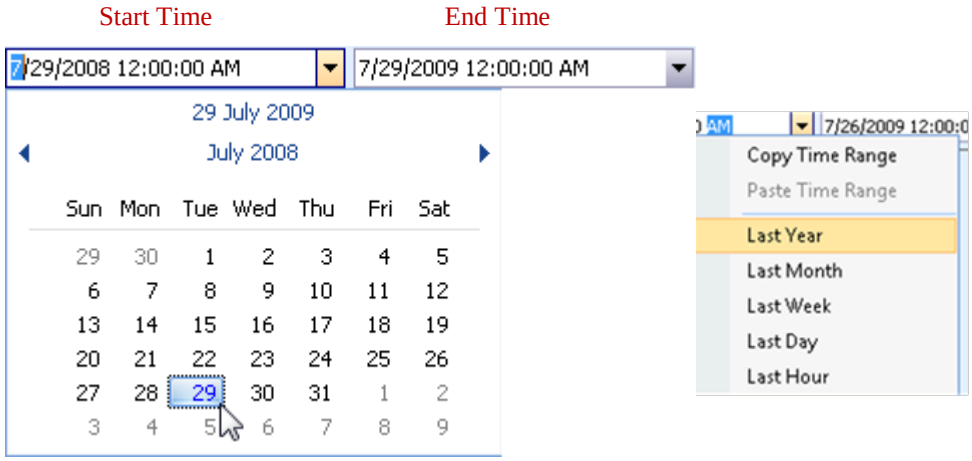
As we can see in the view tool bar below, the time selection as well as all the tool bar buttons remain de-activated until the final parameter selection is made.

Once the final parameter selection (Sabro Site **L1, L2, and L3** in our example) has been made, the path to the parameter has changed to blue. Please note that there is no separate selection for Min/Max and Summary as in the Trend View parameter selection, because **all** of these values are shown in the Summary Table.



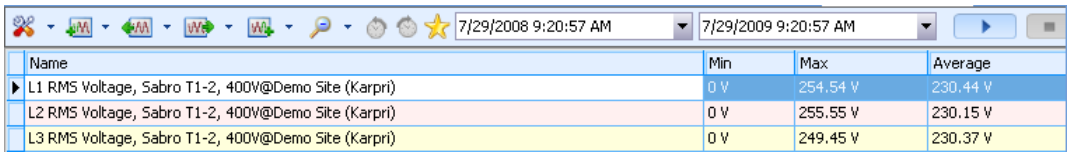
Summary Time Selection

Once at least one parameter is selected in a view, then the time controls in the view tool bar become active; therefore you can make the time selection by either using the drop down calendar on the left or selecting a pre-set time range on the right. (last year in our example)



- To begin querying data, press the **Start Query** button.
- If needed, to abort, press the **Stop Query** button.

The following is a Summary view for all parameter values (L1, L2, and L3) for last year. Each line on the table represents a parameter and the summaries for the entire selected time period for Minimum, Maximum, and Average are shown on the right.

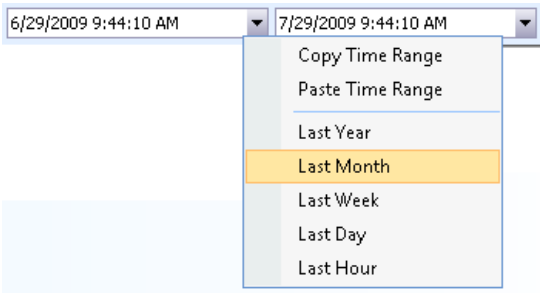


Name	Min	Max	Average
L1 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	254.54 V	230.44 V
L2 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	255.55 V	230.15 V
L3 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	249.45 V	230.37 V

Summary Zoom In/Out

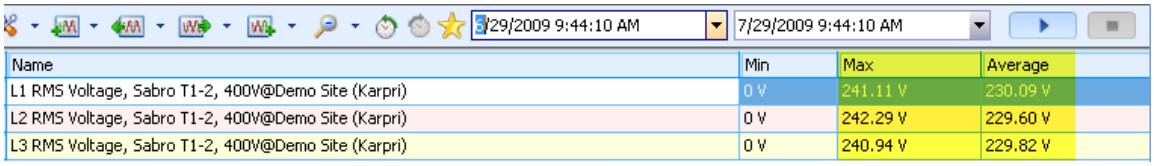
To zoom in or out of a table of values, you need to simply change the values of the dates to shorter or longer time spans.

1. From the original time span of **last year**, change to **last month**.



2. To perform a new query, press the  **Start Query** button.

The values for Max and average have changed as below to represent only the last month.



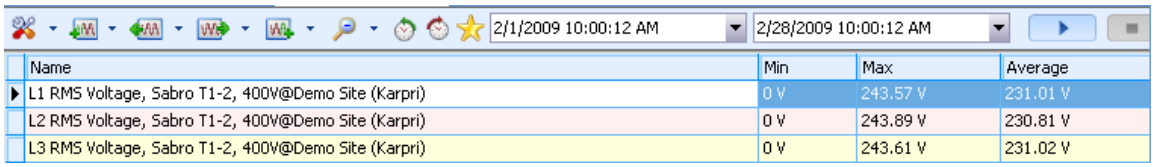
Name	Min	Max	Average
L1 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	241.11 V	230.09 V
L2 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	242.29 V	229.60 V
L3 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	240.94 V	229.82 V

Summary Tool Bar

Once a view is established, it is possible to change the view with the tool buttons at the top of the Main Viewing area.

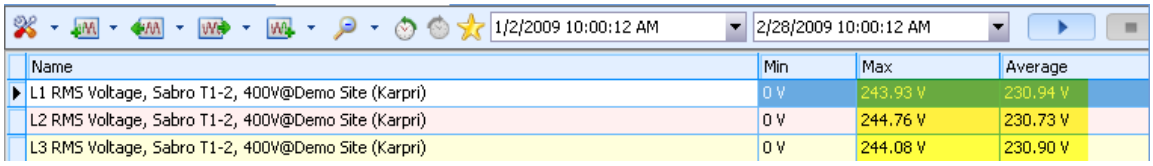
								
Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

In the table below of Min/Max value of L1, L2, and L3 for the month of February 2009.



Name	Min	Max	Average
L1 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	243.57 V	231.01 V
L2 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	243.89 V	230.81 V
L3 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	243.61 V	231.02 V

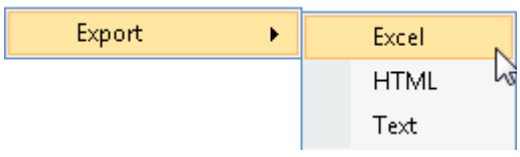
If we append back one month, the new values are shown highlighted in yellow in the following table.



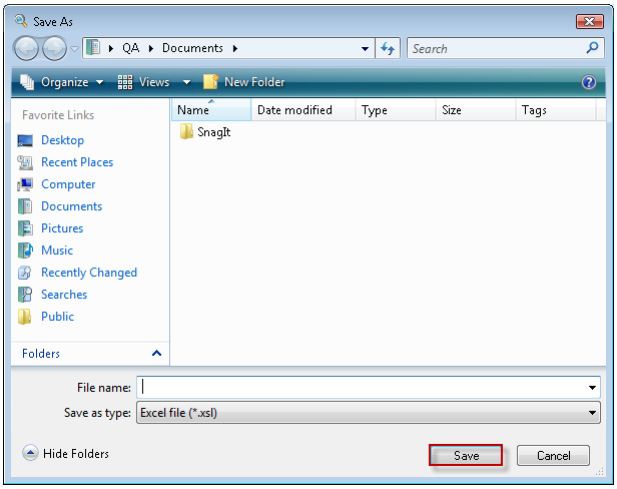
Name	Min	Max	Average
L1 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	243.93 V	230.94 V
L2 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	244.76 V	230.73 V
L3 RMS Voltage, Sabro T1-2, 400V@Demo Site (Karpri)	0 V	244.08 V	230.90 V

Summary Data Exporting

Data Exporting in this view is essentially saving the file on the local computer in any of the following formats:



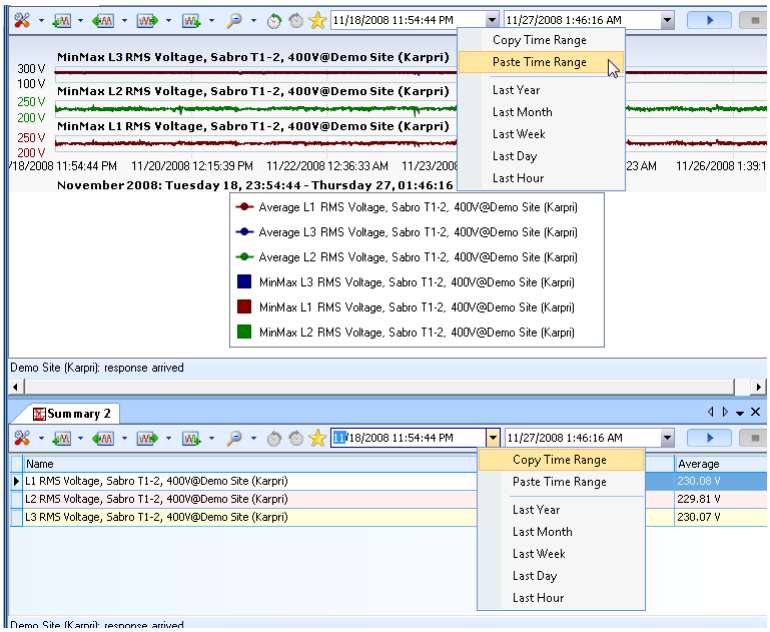
1. Right click anyplace on the table, then select **Export Data** from the drop down menu.
2. Select the desired format to export the file.



3. Enter the filename, then click **Save** to complete.

Summary Advanced Features

One of the most important advanced features of this view is the ability copy the time range values from the table to a Trend view. This can be done by splitting the window and using the **Copy/Paste Time Range** option.



Trend Grid View

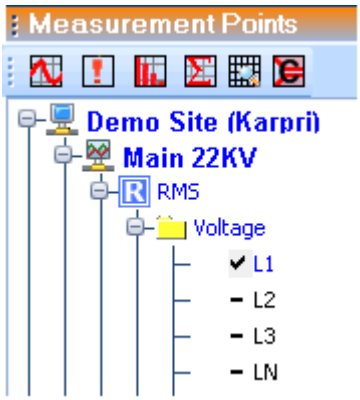
A trend grid view is simply a tabular representation of the trend view. Each measurement point in the table is plotted in graphical format in the **Trend View.**

Trend Grid Parameters

The available parameters for **Trend Grid View** are the same as the **Trend View,** except the entire L1 series (Min/Max and Average) is automatically calculated. (see **Trend Parameters on page 43****).**

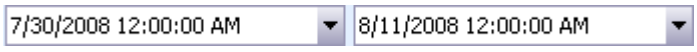
As in all other views, you can see in the view tool bar below, the time selection as well as the tool bar buttons remains de-activated until the final parameter selection is made.

Once the final parameter selection series (Voltage L1 in our example) has been made, the path to the parameter has changed to blue and the time range needs to be selected.



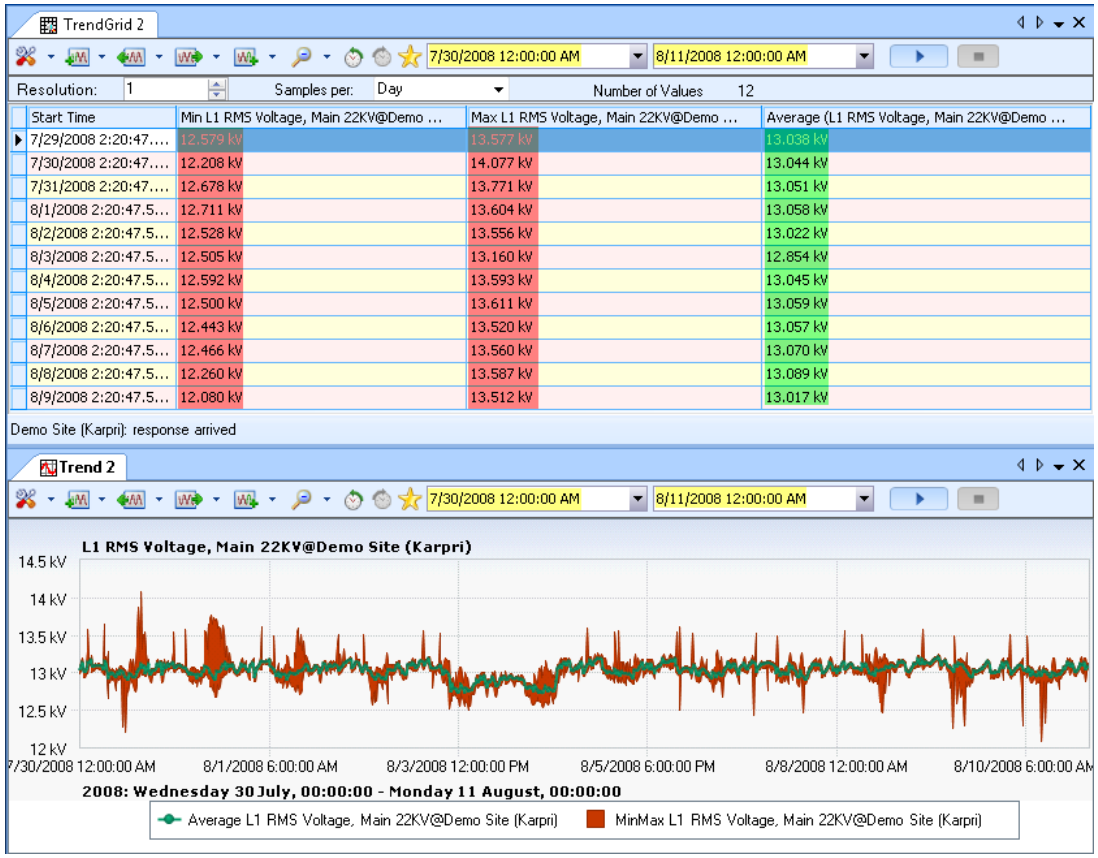
Trend Grid Time Selection

As in the other Views, once at least one parameter is selected in a view, then the time controls in the view tool bar become active; therefore you can make the time selection by either using the drop down calendar or by selecting a pre-set time range. (see **Trend Time Selection on page 44**)



- To begin querying data, press the  **Start Query** button.
- If needed, to abort, press the  **Stop Query** button.

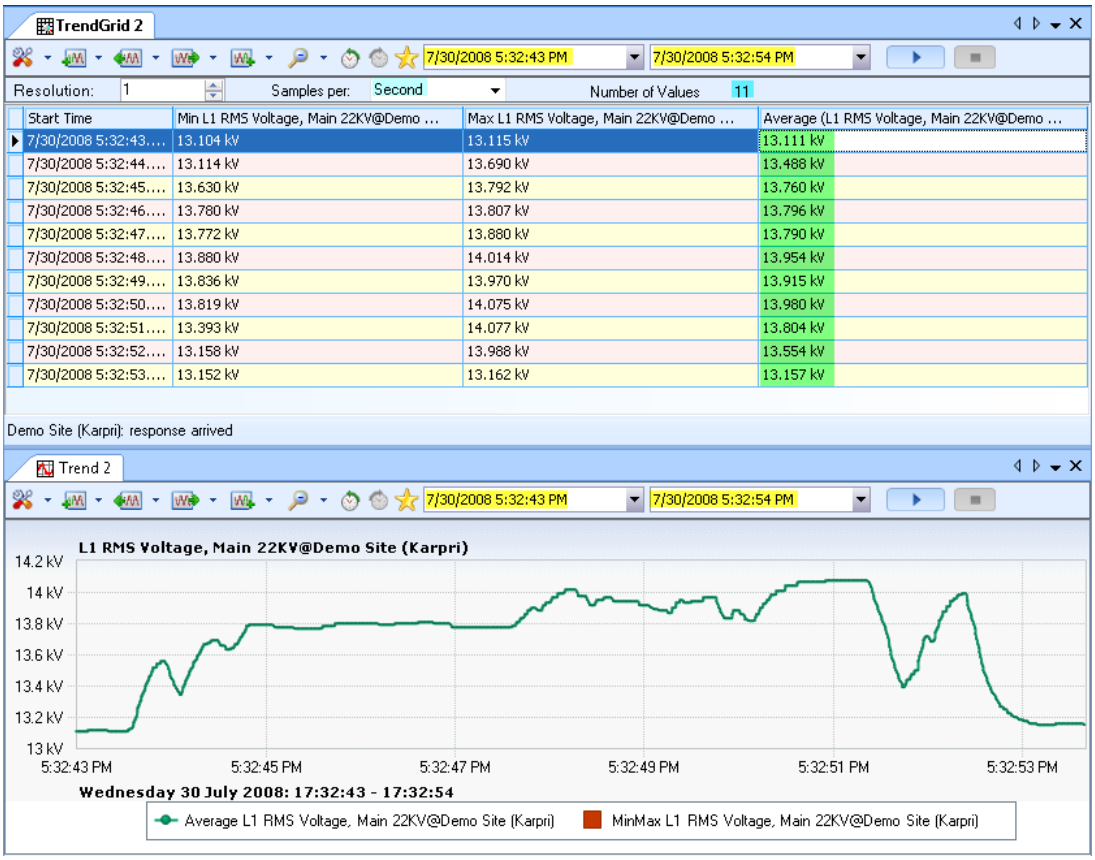
As we see in the example below, the data for each series (MinMax, and Average for L1) from the **Trend 2 View** is found in the **TrendGrid 2 View** below. Therefore, the Trend Grid view takes the same information and displays it in a different format. The dates are the same between the two views to emphasize the similarity.



Trend Grid Zoom In/Out

To zoom in our out of a table of values such as the **Trend Grid View,** you need to change both the date range and in most cases the resolution.

- From the original time span of **7/30/2008 to 8/11/2008,** we can drill in to **seconds** to see an event by copying and pasting from the **Trend View graph** or entering the date manually. Of course the process can be done in reverse as well.



Once the date is changed, it is necessary to increase the resolution to from 1 sample per day to one per second. As we can see the L1 Average data in the table at the top, is representing the exact period of the voltage spike (small) event in the graph at the bottom.

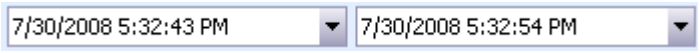
- To perform a new query, press the  **Start Query** button.

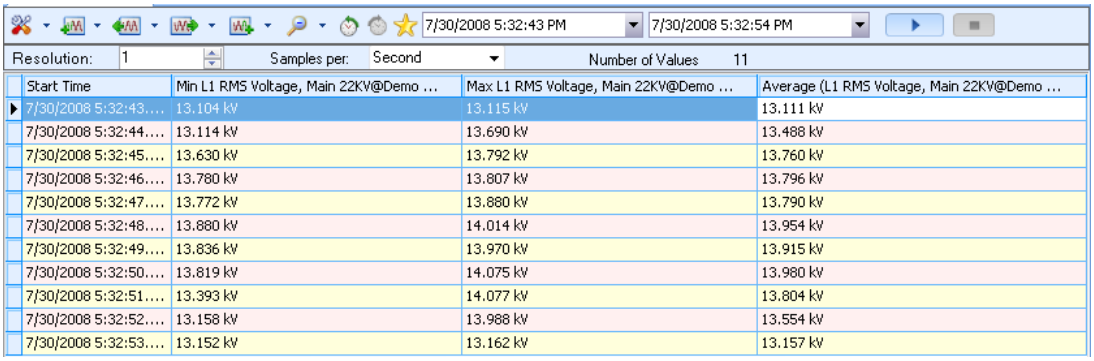
Trend Grid Tool Bar

Once a view is established, it is possible to change the view with the tool buttons at the top of the Main Viewing area.

Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

The original **Trend Grid View** is shown below of L1 Min/Max and Average for the time period as follows:

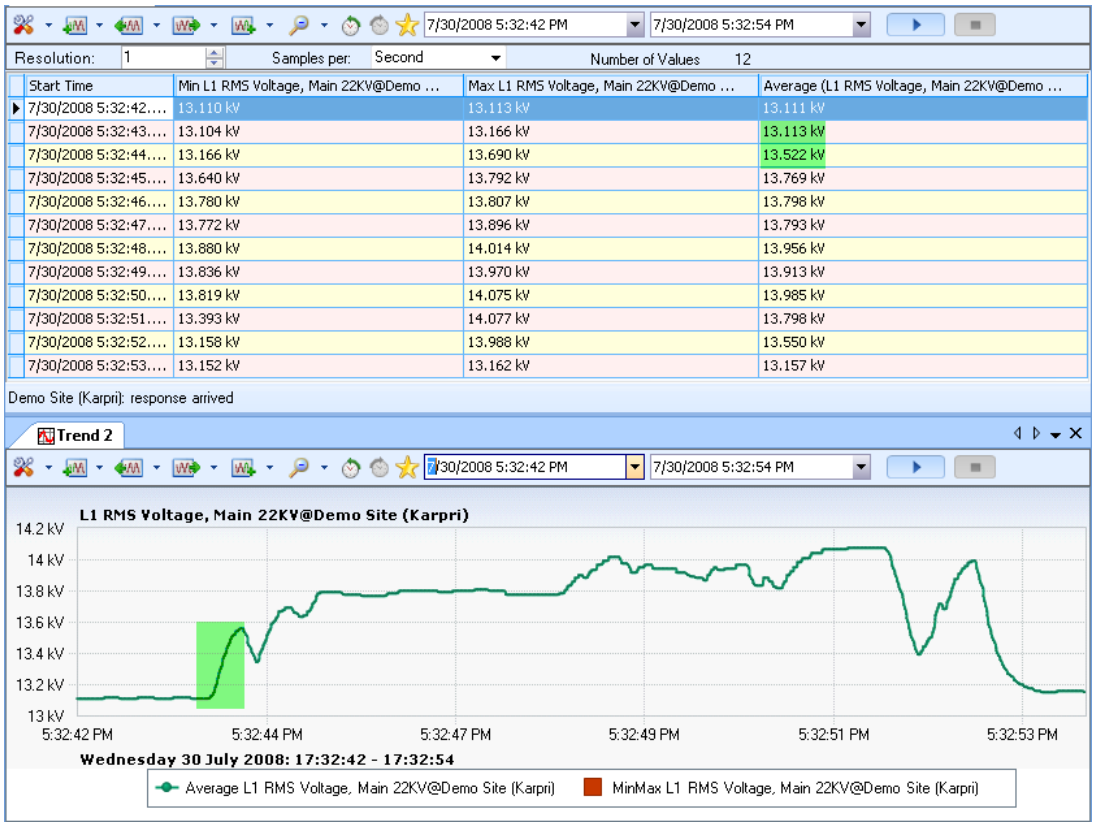




Start Time	Min L1 RMS Voltage, Main 22KV@Demo ...	Max L1 RMS Voltage, Main 22KV@Demo ...	Average (L1 RMS Voltage, Main 22KV@Demo ...
7/30/2008 5:32:43....	13.104 kV	13.115 kV	13.111 kV
7/30/2008 5:32:44....	13.114 kV	13.690 kV	13.488 kV
7/30/2008 5:32:45....	13.630 kV	13.792 kV	13.760 kV
7/30/2008 5:32:46....	13.780 kV	13.807 kV	13.796 kV
7/30/2008 5:32:47....	13.772 kV	13.880 kV	13.790 kV
7/30/2008 5:32:48....	13.880 kV	14.014 kV	13.954 kV
7/30/2008 5:32:49....	13.836 kV	13.970 kV	13.915 kV
7/30/2008 5:32:50....	13.819 kV	14.075 kV	13.980 kV
7/30/2008 5:32:51....	13.393 kV	14.077 kV	13.804 kV
7/30/2008 5:32:52....	13.158 kV	13.988 kV	13.554 kV
7/30/2008 5:32:53....	13.152 kV	13.162 kV	13.157 kV

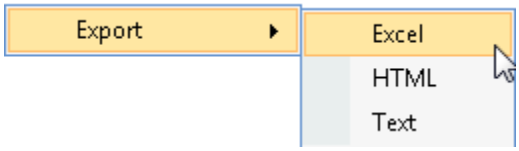
Each view can be changed according to a pre-set time span. We will use seconds since this is the original value of our time span. Since the tool bar functions of this view are identical to the **Trend View** we show the following example.

- If we append back second, the spike (highlighted in green) can be seen very clearly both in the graph and the table.

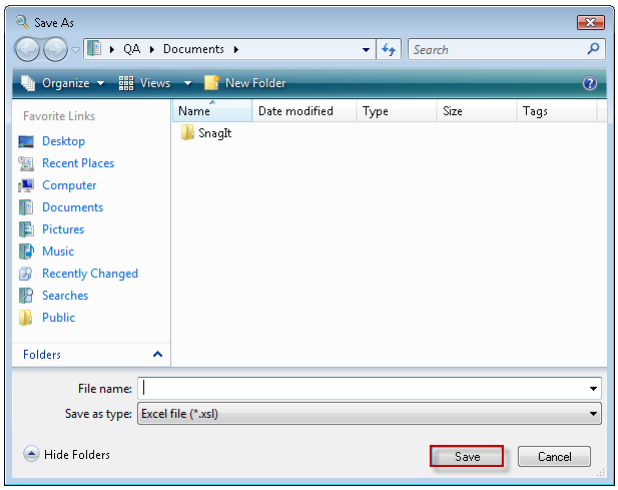


Trend Grid Data Exporting

Data Exporting in this view is essentially saving the file on the local computer in any of the following formats:



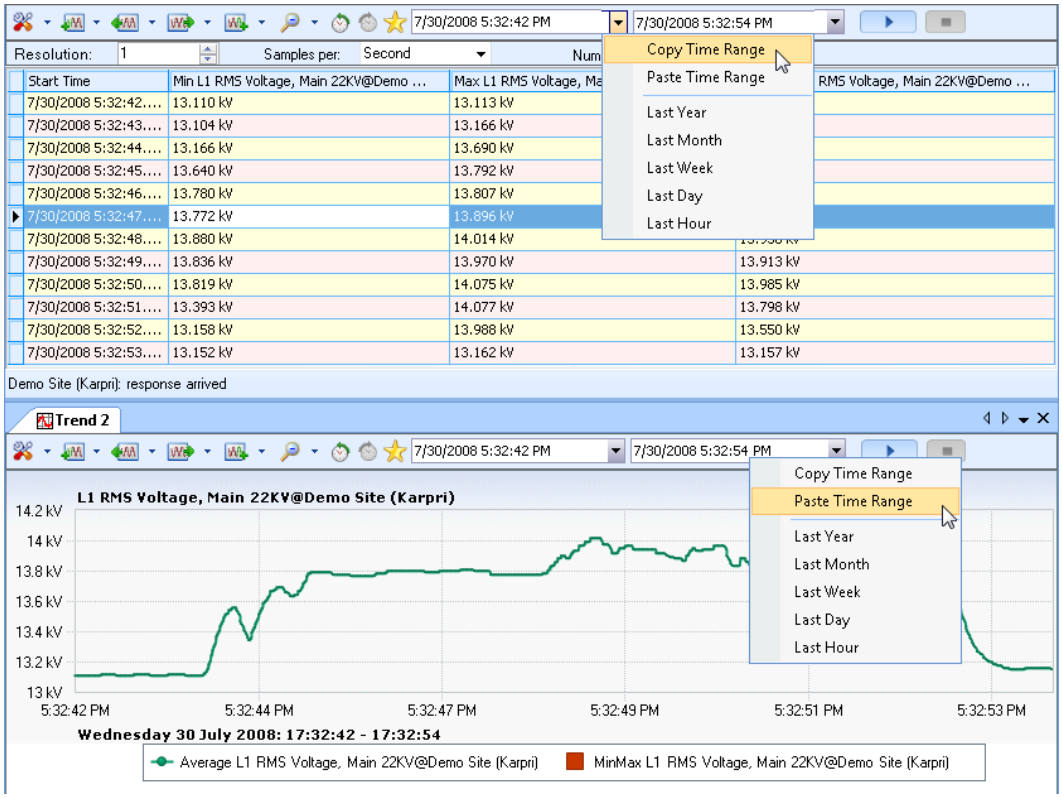
1. Right click anyplace on the table, then select **Export Data** from the drop down menu.
2. Select the desired format to export the file.



3. Enter the filename, then click **Save** to complete.

Trend Grid Advanced Features

One of the most important advanced features of this view is the ability copy the time range values from the table to a Trend view. This can be done by splitting the window and using the **Copy/Paste Time Range** option.


7/30/2008 5:32:42 PM
7/30/2008 5:32:54 PM
Resolution: 1
Samples per: Second
Copy Time Range
Paste Time Range
Last Year
Last Month
Last Week
Last Day
Last Hour
Start Time
Min L1 RMS Voltage, Main 22KV@Demo ...
Max L1 RMS Voltage, Ma
RMS Voltage, Main 22KV@Demo ...
7/30/2008 5:32:42.... 13.110 kV 13.113 kV
7/30/2008 5:32:43.... 13.104 kV 13.166 kV
7/30/2008 5:32:44.... 13.166 kV 13.690 kV
7/30/2008 5:32:45.... 13.640 kV 13.792 kV
7/30/2008 5:32:46.... 13.780 kV 13.807 kV
7/30/2008 5:32:47.... 13.772 kV 13.896 kV
7/30/2008 5:32:48.... 13.880 kV 14.014 kV
7/30/2008 5:32:49.... 13.836 kV 13.970 kV 13.913 kV
7/30/2008 5:32:50.... 13.819 kV 14.075 kV 13.985 kV
7/30/2008 5:32:51.... 13.393 kV 14.077 kV 13.798 kV
7/30/2008 5:32:52.... 13.158 kV 13.988 kV 13.550 kV
7/30/2008 5:32:53.... 13.152 kV 13.162 kV 13.157 kV
Demo Site (Karpri): response arrived
Trend 2
L1 RMS Voltage, Main 22KV@Demo Site (Karpri)
14.2 kV
14 kV
13.8 kV
13.6 kV
13.4 kV
13.2 kV
13 kV
5:32:42 PM
5:32:44 PM
5:32:47 PM
5:32:49 PM
5:32:51 PM
5:32:53 PM
Wednesday 30 July 2008: 17:32:42 - 17:32:54
Average L1 RMS Voltage, Main 22KV@Demo Site (Karpri)
MinMax L1 RMS Voltage, Main 22KV@Demo Site (Karpri)

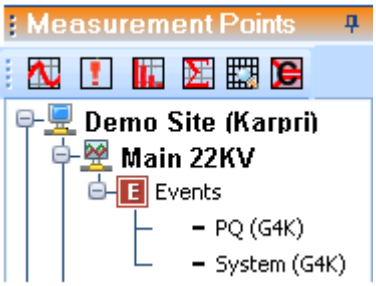
Events View

The Events View displays a table of events captured/detected by the device according to the "Power Quality Compliance." The Power Quality compliance is a set of electrically measured parameters which are typically calculated based on some pre-defined intervals or event triggers and are evaluated over a larger observation window. For most PQ parameters the observation window is one week, however with the both the PQSCADA and Investigator application, all time intervals are able to be defined. (see **Event Time Selection on page 80** for more details).

Event Parameters

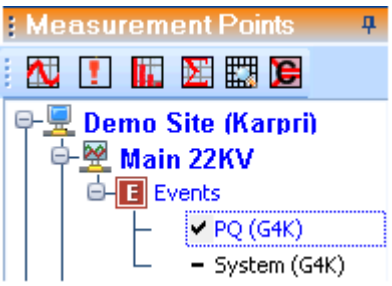
There are two main types of events:

- **Power Quality Events**: a violation of a Power Quality standard or user defined condition.
- System Event: An event recorded by the device as a result of a user action. (i.e.: turning the device on, establishing a connection)



As in all other views, you can see in the view tool bar below, the time selection as well as the tool bar buttons remain de-activated until the final parameter selection is made.

Once the final parameter selection series (PQ(G4K) in our example) has been made, the path to the parameter has changed to blue and the time range needs to be selected.

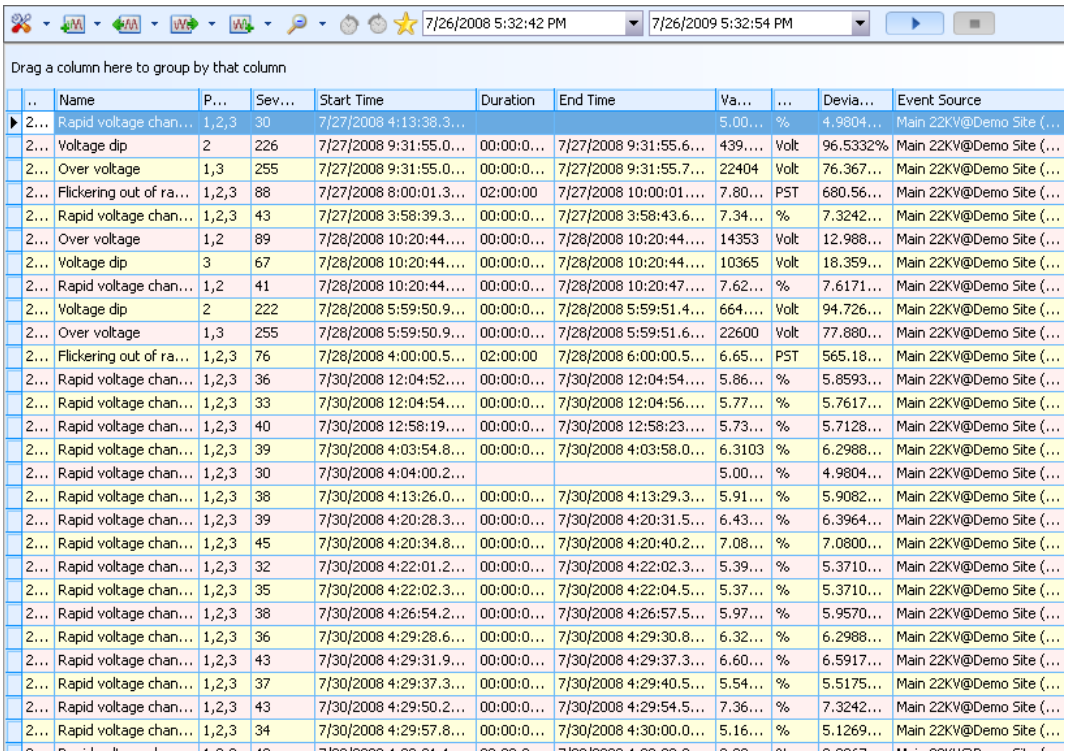


Event Time Selection

As in the other Views, once at least one parameter is selected in a view, then the time controls in the view tool bar become active; therefore you can make the time selection by either using the drop down calendar or by selecting a pre-set time range. (past year in our example) (see **Trend Time Selection on page 44**)

- To begin querying data, press the  **Start Query** button.
- If needed, to abort, press the  **Stop Query** button.

A table of events is shown below for the **Main 22KV device for the past year on the Karpri** site. The name of the view is **Events 2** in our example. Each event was recorded by the device and stored in the PQSCADA. In our example we select only Power Quality Events as below, although it is possible to record system events as well.



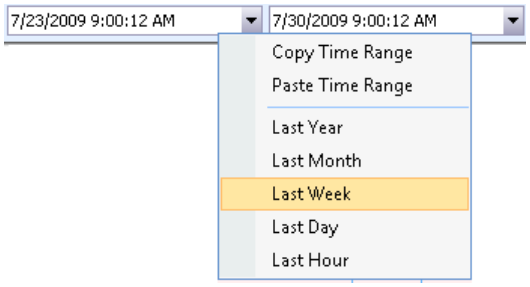
..	Name	P...	Sev...	Start Time	Duration	End Time	Va...	...	Devia...	Event Source
2...	Rapid voltage chan...	1,2,3	30	7/27/2008 4:13:38.3...			5.00...	%	4.9804...	Main 22KV@Demo Site (...
2...	Voltage dip	2	226	7/27/2008 9:31:55.0...	00:00:0...	7/27/2008 9:31:55.6...	439....	Volt	96.5332%	Main 22KV@Demo Site (...
2...	Over voltage	1,3	255	7/27/2008 9:31:55.0...	00:00:0...	7/27/2008 9:31:55.7...	22404	Volt	76.367...	Main 22KV@Demo Site (...
2...	Flickering out of ra...	1,2,3	88	7/27/2008 8:00:01.3...	02:00:00	7/27/2008 10:00:01....	7.80...	PST	680.56...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	43	7/27/2008 3:58:39.3...	00:00:0...	7/27/2008 3:58:43.6...	7.34...	%	7.3242...	Main 22KV@Demo Site (...
2...	Over voltage	1,2	89	7/28/2008 10:20:44....	00:00:0...	7/28/2008 10:20:44....	14353	Volt	12.988...	Main 22KV@Demo Site (...
2...	Voltage dip	3	67	7/28/2008 10:20:44....	00:00:0...	7/28/2008 10:20:44....	10365	Volt	18.359...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2	41	7/28/2008 10:20:44....	00:00:0...	7/28/2008 10:20:47....	7.62...	%	7.6171...	Main 22KV@Demo Site (...
2...	Voltage dip	2	222	7/28/2008 5:59:50.9...	00:00:0...	7/28/2008 5:59:51.4...	664....	Volt	94.726...	Main 22KV@Demo Site (...
2...	Over voltage	1,3	255	7/28/2008 5:59:50.9...	00:00:0...	7/28/2008 5:59:51.6...	22600	Volt	77.880...	Main 22KV@Demo Site (...
2...	Flickering out of ra...	1,2,3	76	7/28/2008 4:00:00.5...	02:00:00	7/28/2008 6:00:00.5...	6.65...	PST	565.18...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	36	7/30/2008 12:04:52....	00:00:0...	7/30/2008 12:04:54....	5.86...	%	5.8593...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	33	7/30/2008 12:04:54....	00:00:0...	7/30/2008 12:04:56....	5.77...	%	5.7617...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	40	7/30/2008 12:58:19....	00:00:0...	7/30/2008 12:58:23....	5.73...	%	5.7128...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	39	7/30/2008 4:03:54.8...	00:00:0...	7/30/2008 4:03:58.0...	6.3103	%	6.2988...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	30	7/30/2008 4:04:00.2...			5.00...	%	4.9804...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	38	7/30/2008 4:13:26.0...	00:00:0...	7/30/2008 4:13:29.3...	5.91...	%	5.9082...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	39	7/30/2008 4:20:28.3...	00:00:0...	7/30/2008 4:20:31.5...	6.43...	%	6.3964...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	45	7/30/2008 4:20:34.8...	00:00:0...	7/30/2008 4:20:40.2...	7.08...	%	7.0800...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	32	7/30/2008 4:22:01.2...	00:00:0...	7/30/2008 4:22:02.3...	5.39...	%	5.3710...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	35	7/30/2008 4:22:02.3...	00:00:0...	7/30/2008 4:22:04.5...	5.37...	%	5.3710...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	38	7/30/2008 4:26:54.2...	00:00:0...	7/30/2008 4:26:57.5...	5.97...	%	5.9570...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	36	7/30/2008 4:29:28.6...	00:00:0...	7/30/2008 4:29:30.8...	6.32...	%	6.2988...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	43	7/30/2008 4:29:31.9...	00:00:0...	7/30/2008 4:29:37.3...	6.60...	%	6.5917...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	37	7/30/2008 4:29:37.3...	00:00:0...	7/30/2008 4:29:40.5...	5.54...	%	5.5175...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	43	7/30/2008 4:29:50.2...	00:00:0...	7/30/2008 4:29:54.5...	7.36...	%	7.3242...	Main 22KV@Demo Site (...
2...	Rapid voltage chan...	1,2,3	34	7/30/2008 4:29:57.8...	00:00:0...	7/30/2008 4:30:00.0...	5.16...	%	5.1269...	Main 22KV@Demo Site (...

Of course the list is much longer but we are limited by the window size. The current view of the table and the lengthy time span make it difficult to identify and further examine specific event(s). If we want to take a closer look, you can **Zoom in** with a shorter time span and use the a **Trend View** to see the event in a graphical environment.

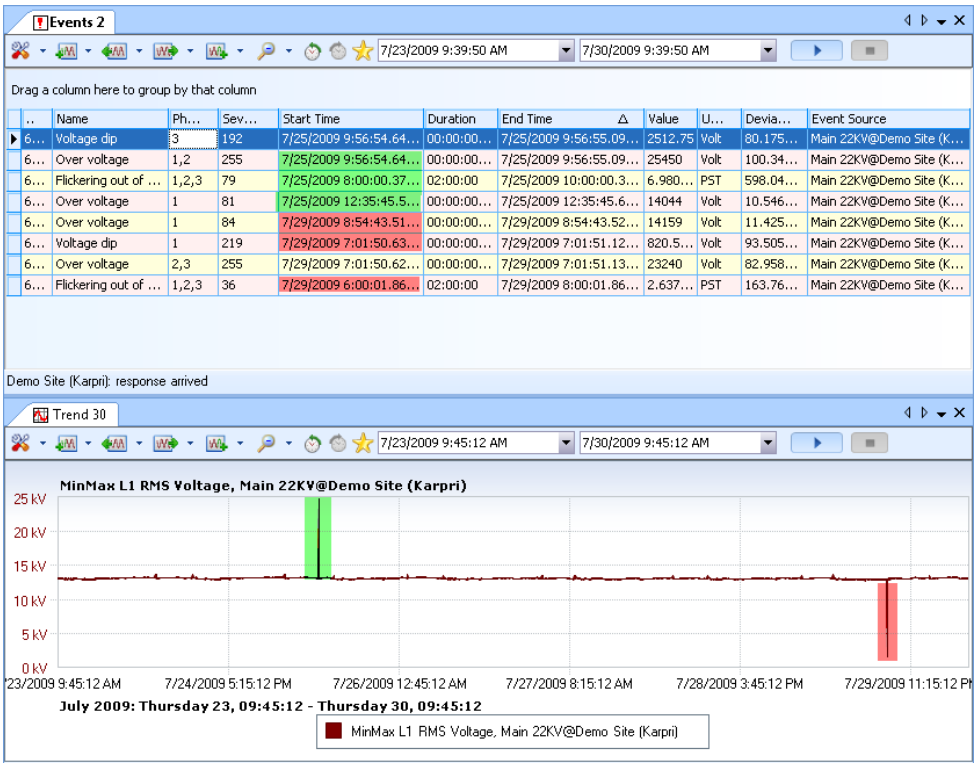
Events Zooming In/Out

For a table of events, zooming in allows us to take a look at smaller number of events over a shorter time span. This is especially useful if we use the **Trend View** in combination with this table to **see** more clearly the severity and extent of the event on the electrical measurements. For example, let's zoom in to **Last Week.**

From the original time span of an entire year**,** we can drill in to **one week** to see an event by using the time bar or copying and pasting from another View.



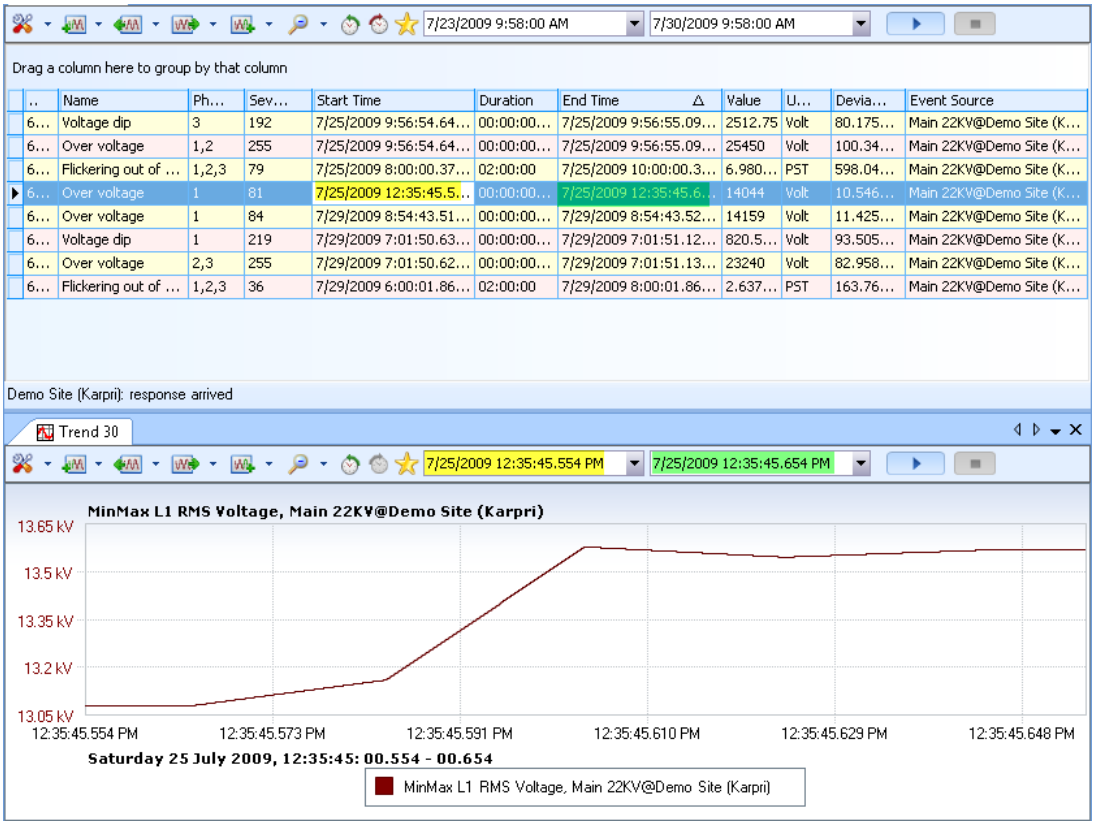
The Split View below shows clearly a set of events occurring on two specific dates (7/25/2009 and 7/29/2009) for **L1 Voltage** and the corresponding spike and dip in the **Trend View** graph at the bottom.



A special zoom in feature of this View is the ability to drill into one event with a simple mouse click and see the corresponding event in the graph.

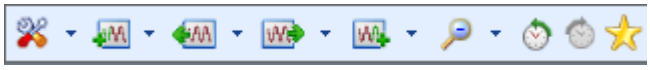
- To use this feature, double click any event

The corresponding time frame is automatically entered in the graph below and the Overvoltage event is seen clearly.



Event Toolbar

Once a view is established, it is possible to change the view with the tool buttons at the top of the Main Viewing area.



Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

The original Zoomed in view of the Event is shown below:

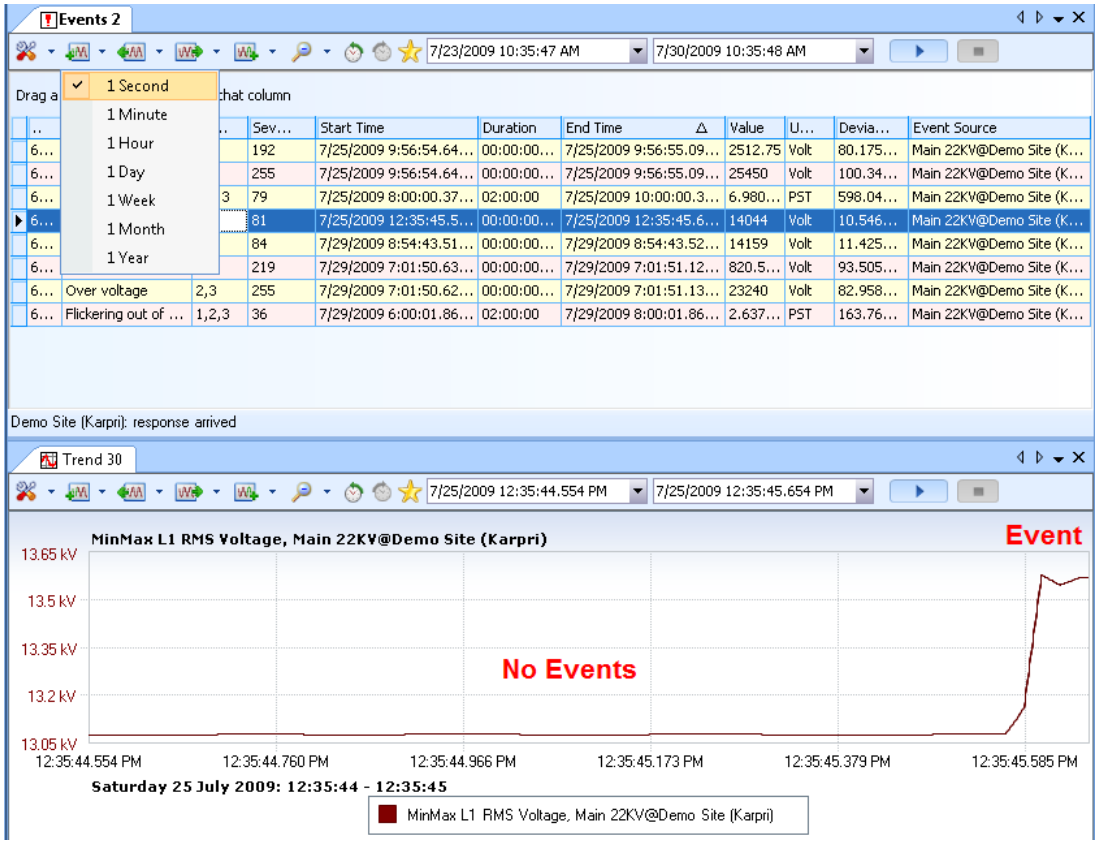
..	Name	Ph...	Sev...	Start Time	Duration	End Time	Value	U...	Devia...	Event Source
6...	Voltage dip	3	192	7/25/2009 9:56:54.64...	00:00:00...	7/25/2009 9:56:55.09...	2512.75	Volt	80.175...	Main 22KV@Demo Site (K...
6...	Over voltage	1,2	255	7/25/2009 9:56:54.64...	00:00:00...	7/25/2009 9:56:55.09...	25450	Volt	100.34...	Main 22KV@Demo Site (K...
6...	Flickering out of ...	1,2,3	79	7/25/2009 8:00:00.37...	02:00:00	7/25/2009 10:00:00.3...	6.980...	PST	598.04...	Main 22KV@Demo Site (K...
6...	Over voltage	1	81	7/25/2009 12:35:45.5...	00:00:00...	7/25/2009 12:35:45.6...	14044	Volt	10.546...	Main 22KV@Demo Site (K...
6...	Over voltage	1	84	7/29/2009 8:54:43.51...	00:00:00...	7/29/2009 8:54:43.52...	14159	Volt	11.425...	Main 22KV@Demo Site (K...
6...	Voltage dip	1	219	7/29/2009 7:01:50.63...	00:00:00...	7/29/2009 7:01:51.12...	820.5...	Volt	93.505...	Main 22KV@Demo Site (K...
6...	Over voltage	2,3	255	7/29/2009 7:01:50.62...	00:00:00...	7/29/2009 7:01:51.13...	23240	Volt	82.958...	Main 22KV@Demo Site (K...
6...	Flickering out of ...	1,2,3	36	7/29/2009 6:00:01.86...	02:00:00	7/29/2009 8:00:01.86...	2.637...	PST	163.76...	Main 22KV@Demo Site (K...

Each view can be changed according to a pre-set time span. We will use seconds since this is the original value of our time span. Since the tool bar functions of this view are identical to the **Trend View, we** show only example below.

To append back:

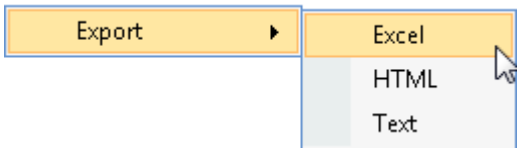
- Click the  icon, then select **1 second** from the drop down window.

If we append back second, there are no apparent events that preceded this particular event as can be seen by both the table above and the graph below.

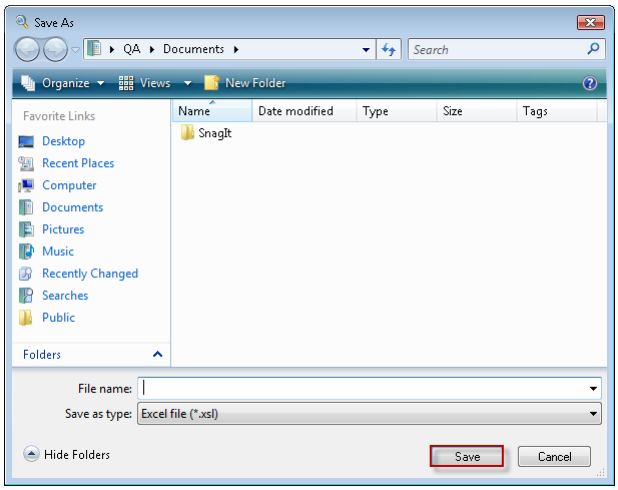


Event Data Exporting

Data Exporting in this view is essentially saving the file on the local computer in any of the following formats:



1. Right click anyplace on the table, then select **Export Data** from the drop down menu.
2. Select the desired format to export the file.



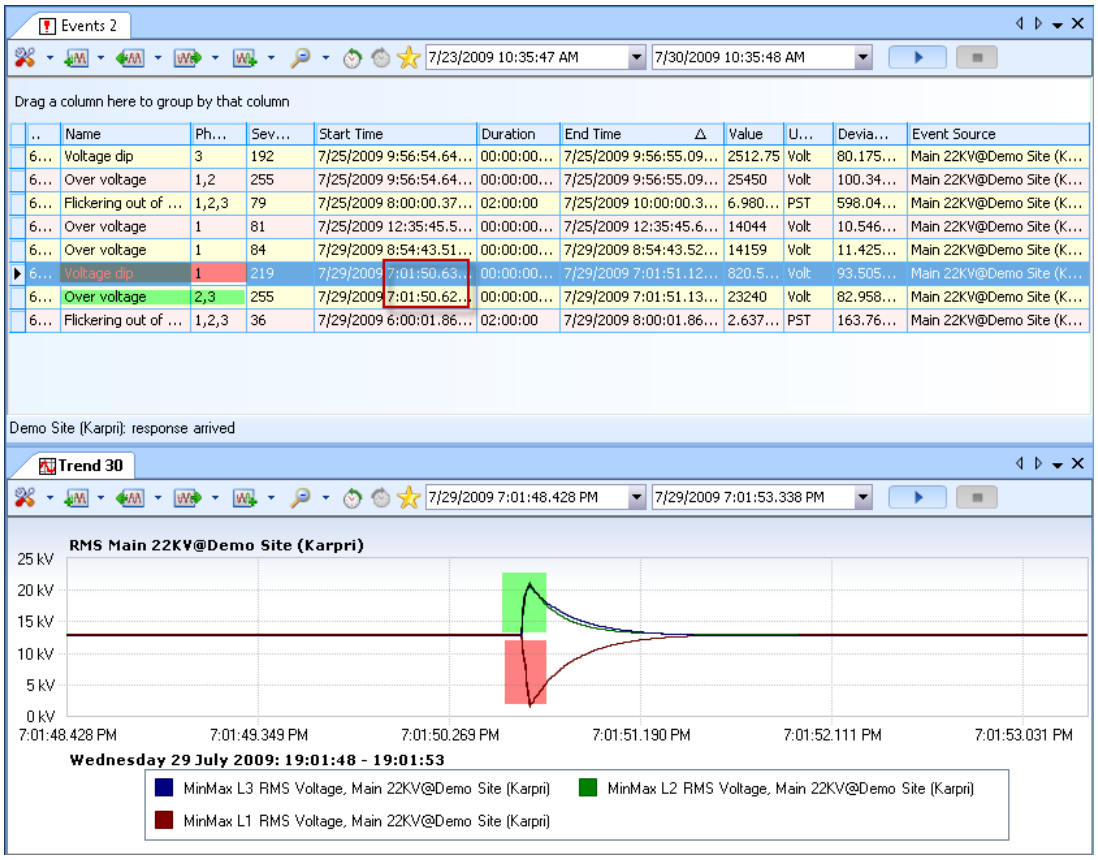
3. Enter the filename, then click **Save** to complete.

Event Advanced Features

A special zoom in feature of this View has been previously demonstrated in the Zoom In/Out section (see **Events Zooming In/Out on page 81**). The ability to drill into one event with a simple mouse click and see the corresponding event in the graph is further emphasized in the following example showing L1, L2, and L3.

- To use this feature, double click any event in the table.

The corresponding time frame is automatically entered in the graph below and the Overvoltage and Voltage dip events are seen clearly (green and red highlights). Note the two succeeding events in the table; Phase 1 experienced a voltage dip 10 milliseconds before Phase 2 and 3 experienced an Overvoltage. In the graph at the bottom, these series of events are very clearly evidenced.



Spectrum View

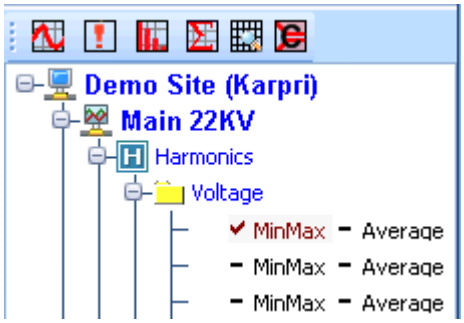
A spectrum view represents the harmonic spectrum over a period of time. The x-axis represents the harmonic number, not time. This view is especially useful for harmonic spectrum representation, including voltage, current, and power harmonics.

Spectrum Parameters

Harmonics	**Harmonics**
Harmonics %	**Harmonics %**
Active Power Ha..	**Active Power Harmonics**
Reactive Power ..	**Reactive Power Harmonics**

As in all other views, you can see in the view tool bar below, the time selection as well as the tool bar buttons remains de-activated until the final parameter selection is made.

Once the final parameter selection series (Harmonic Voltage L1 Min/Max and **Average** in our example) has been made, the path to the parameter has changed to blue and the time range needs to be selected.

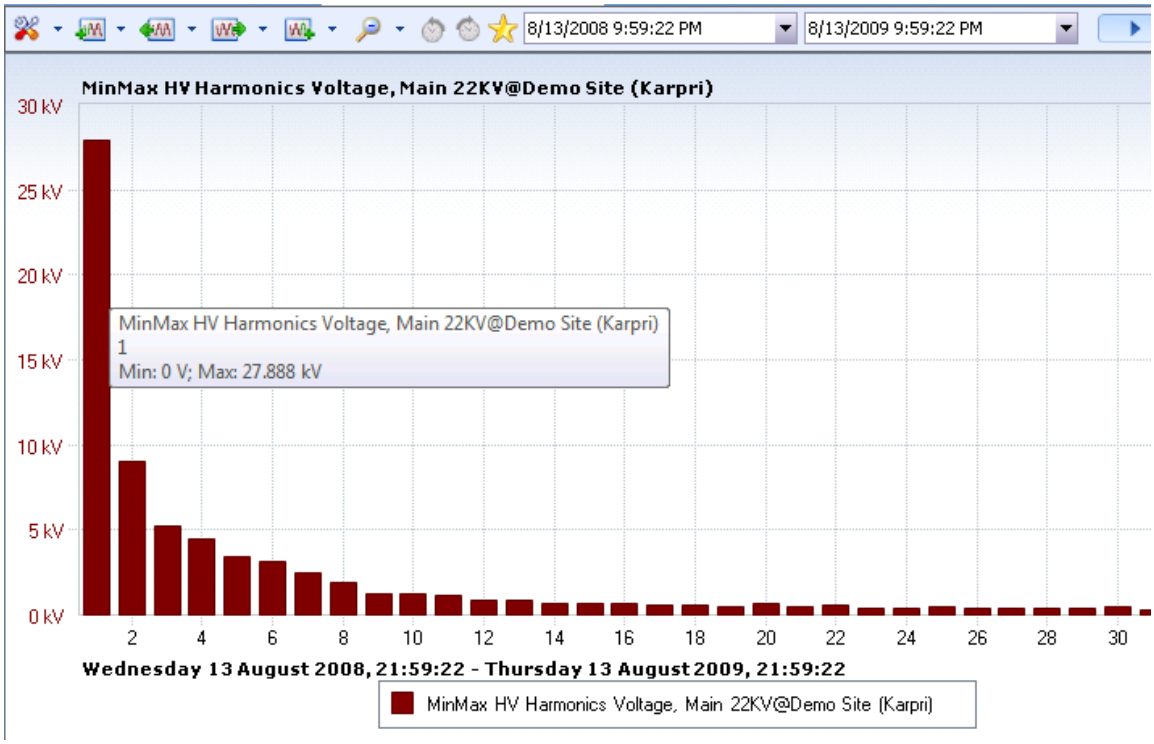


Spectrum Time Selection

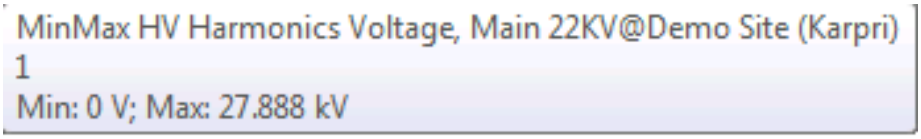
As in other views, once at least one parameter is selected in a view, then the timer controls in the view tool bar become active. Select the time span over which to display the voltage harmonics.

- To begin querying data, press the  **Start Query** button.
- If needed, to abort, press the  **Stop Query** button.

The graph below depicts MinMax Voltage Harmonics up to approximately the 30th Harmonic for the past year. The INVESTIGATOR software displays harmonics up to the 511th harmonic



As you pass the mouse over a specific harmonic on the graph, a message box appears as below displaying all relevant information.

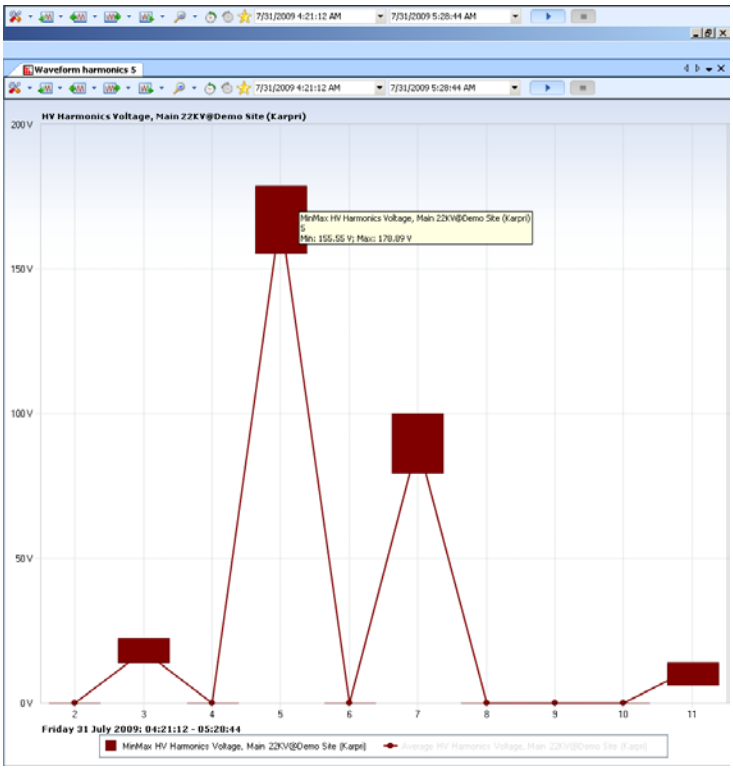


Viewing Minimum, Maximum and Average Values of a Voltage Harmonics

In order to utilize the functionality of the Spectrum View, it may be helpful to view both the Average and the MinMax views of the voltage under investigation. This way it is possible to see all the harmonics up to the 511th with their amplitude but also be able to see the Minimum and the Maximum amplitude for any given harmonic.

Since the first harmonic is the most significant, when viewing all the harmonics together with the first harmonic, it may seem that all harmonics but the first are zero.(Unless there are some real significant harmonics in the voltage being

investigated). In order to view all the other harmonics, you need to zoom in on them and leave the first harmonic outside your area of interest.

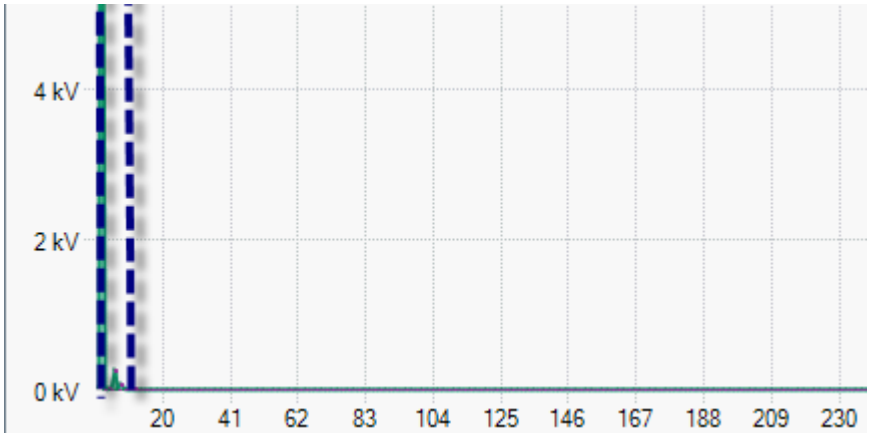


In the Trend View above, phase 1 is displayed both in MinMax and Average view. The rectangular shapes corresponding to harmonics 3,5,7 and 11 represent the Minimum and Maximum amplitudes of every one of these harmonics while the lower side of the rectangle represents the minimal amplitude of that specific harmonic and the higher side represent the maximal amplitude of that specific harmonic. By navigating the mouse and placing the cursor over a rectangle, a window will pop up and display the Minimum and the Maximum amplitude related with that specific rectangle representing an harmonic.

Spectrum Zooming In/Out

As mentioned previously, a very important feature of the Investigator application is the ability to drill in to a higher resolution. **The main difference with harmonics is that Zooming In/Out concerns the range of harmonics displayed, not the time**.

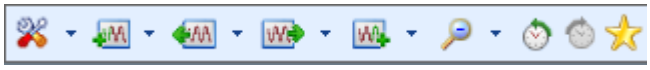
To drill in Spectrum view:



From the Main Viewing panel, identify the area to be investigated. (the first set of harmonics in our example), then Zoom into the Area to be further investigated, by left clicking the mouse and dragging.

Spectrum Toolbar

Once a view is established, it is possible to change the time span of the view with the tool buttons at the top of the Main Viewing area. Use of the tool buttons for this View are similiar to the Trend Toolbar.

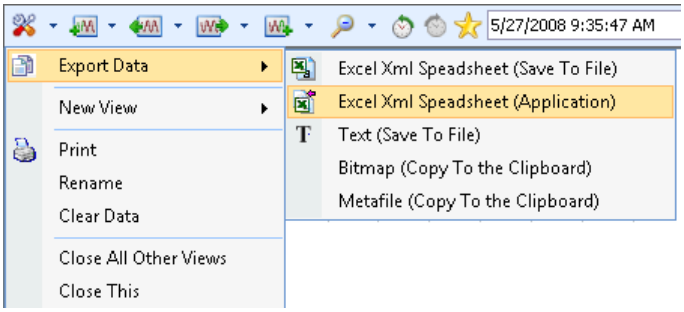


Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

Spectrum Data Exporting

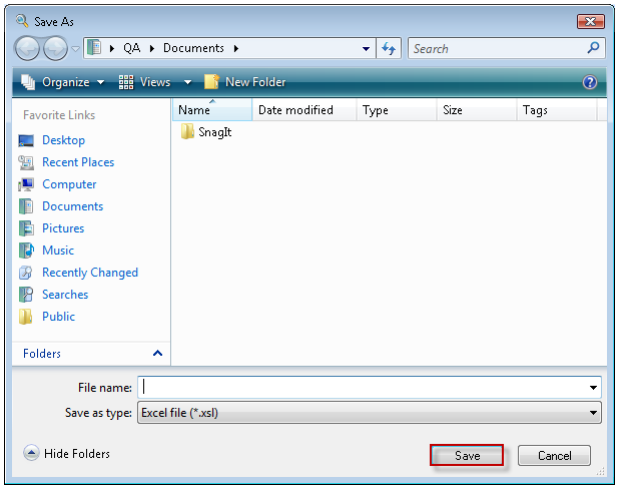
It is possible to export the Spectrum graphic files in the following formats:

- Excel Xml Spreadsheet (Save to File)
- Excel Xml Spreadsheet (Application)
- Text
- Bimap
- Metafile



1. From the Main Toolbar, right click the Tools icon.
2. Select **Export Data** from the drop down menu.
3. Select the desired format to export the file.

The Save as window appears. (This window does not appear if you are copying to the clipboard).



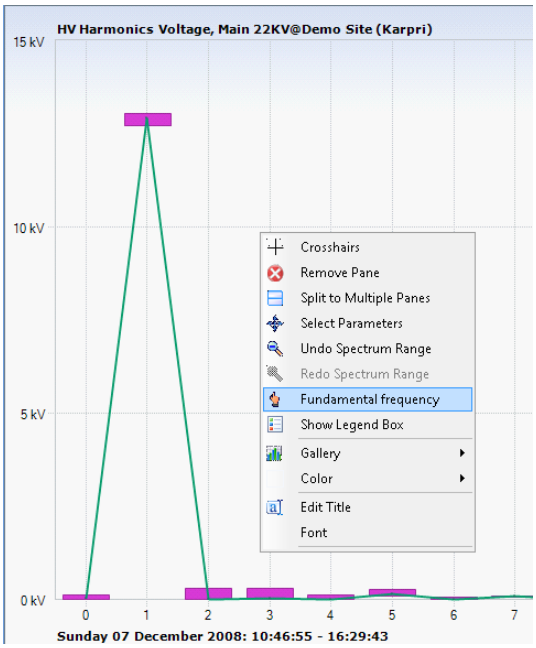
4. Enter the filename, then click **Save** to complete.

Spectrum Advanced Features

There are advanced features available that allow you to view the graphs in different formats to make interpretation and diagnosis easier. The advanced features of this View are similiar to the Trend View (for more see **Trend Advanced Features on page 56).**

An exclusive advanced feature of the **Spectrum View** is the **Fundamental Frequency**. By enabling this feature, you hide the 1st harmonic completely thus allowing you to focus on non-fundamental harmonics.

To access the advanced features:



- From point on the graph, right click, then select **Fundamental frequency.**

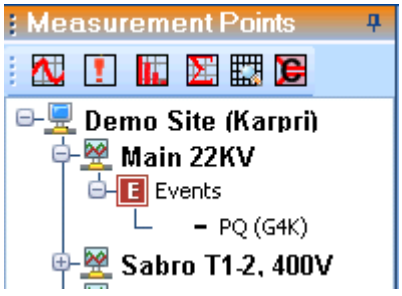
A new graph is created below hiding the value of the 1st harmonic, making it much clearer to view the minimum and maximum, as well as the average values for the targeted non fundamental harmonics.

CBEMA View

The CBEMA (Computer and Business Equipment Manufacturers' Association) is a power quality graph that plots the depth or deviation of voltage dips and overvoltage on the **x-axis** and the duration on the **y-axix.** Each event is plotted according to severity as defined by the CBEMA standard.

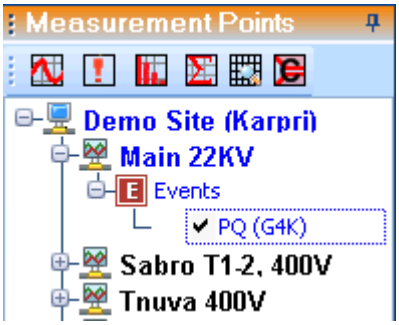
CBEMA Parameters

The only availabe events for CBEMA are overvoltage and voltage dip Power Quality Events.



As in all other views, you can see in the view tool bar below, the time selection as well as the tool bar buttons remains de-activated until the final parameter selection is made.

Once the final parameter selection series (PQ(G4K) in our example) has been made, the path to the parameter has changed to blue and the time range needs to be selected.



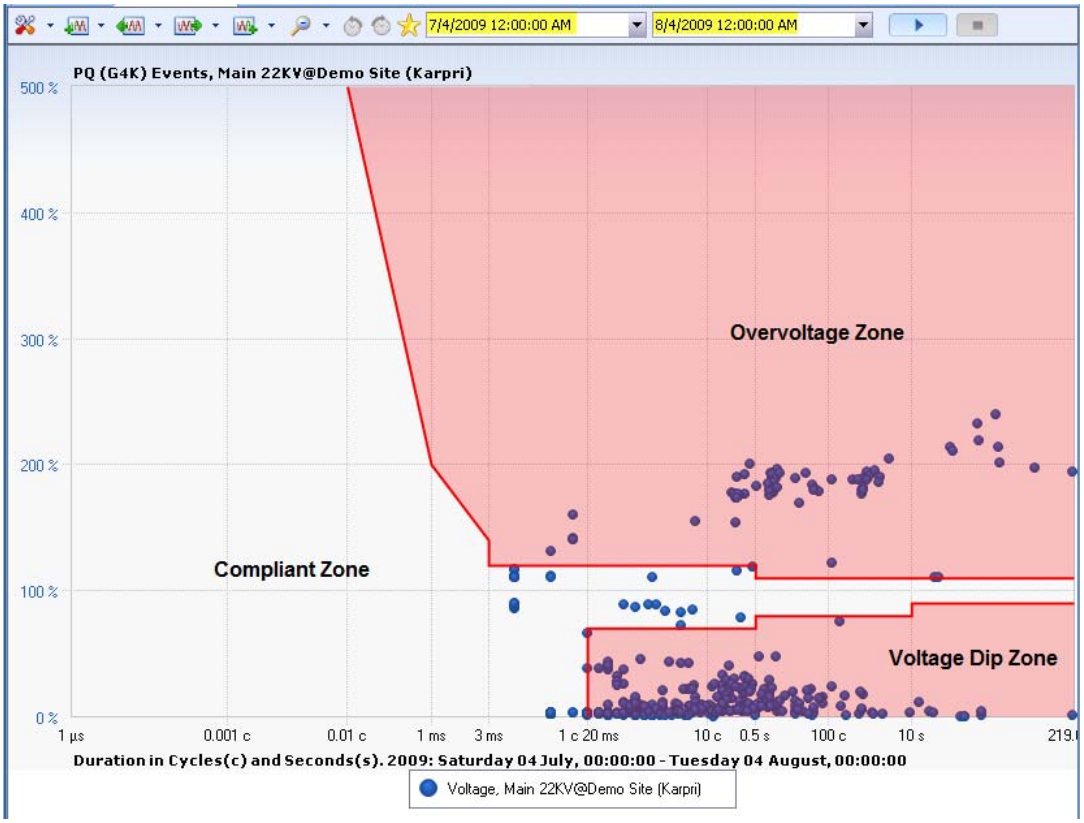
CBEMA Time Selection

Once at least one parameter is selected in a view, then the time controls in the view tool bar become active; therefore you can make the time selection by either using the drop down calendar or by selecting a pre-set time range. (default is the month prior) (see **Trend Time Selection on page 44**)

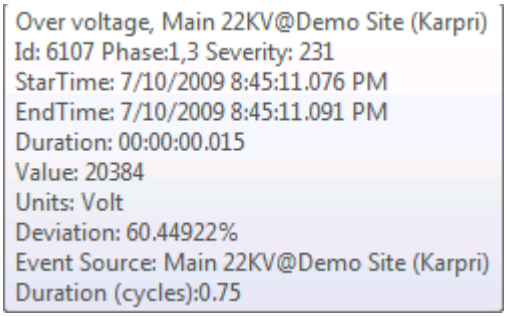
- To begin querying data, press the  **Start Query** button.
- If needed, to abort, press the  Stop Query button.

The following is a CBEMA view showing all events plotted on the chart according to their deviation and duration. The white area represents the “compliant zone” or acceptable events while the red areas are non-compliant or “out of limits” zone. It is clear to see in the chart, not only which events are compliant, but also the severity or level of non compliance. Events that have large deviations and long durations fall deep into the “red zone” while events with smaller deviations and shorter durations fall in or near the white zone. Therefore not all events are considered to be non-compliant.

The Y axis is the severity (% deviation from nominal), while the x-axis is the time duration.



Another feature of this view is the ability to see the indiviual event attributes by passing over the event (dot) on the chart and seeing the window below.

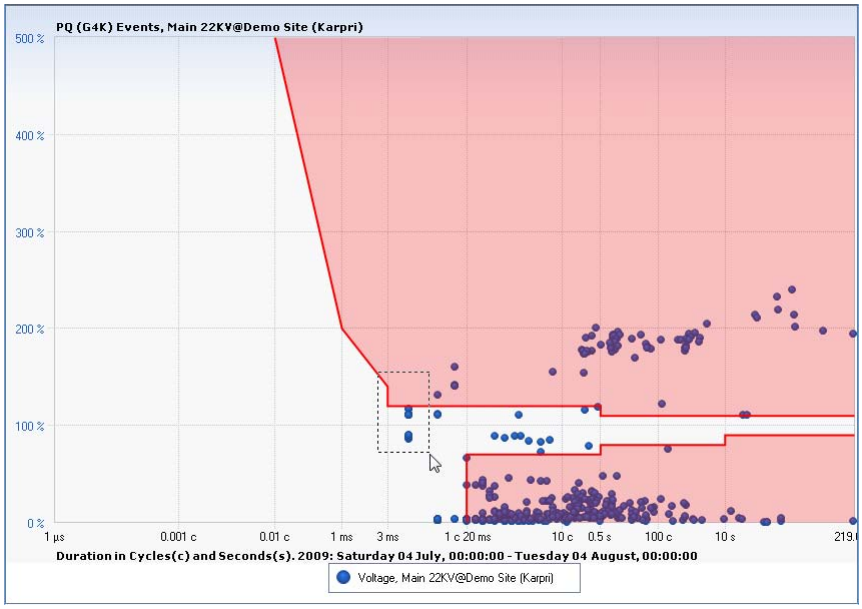


CBEMA Zooming In/Out

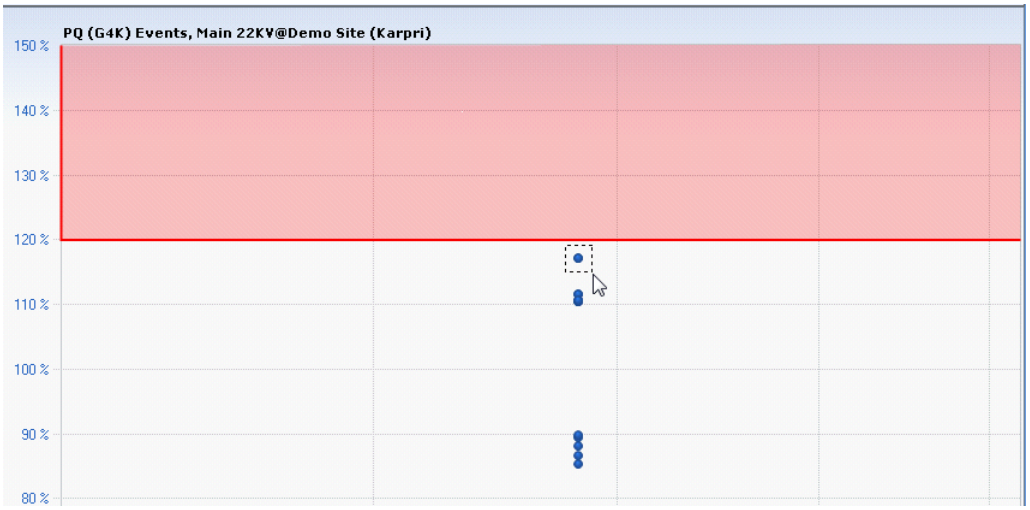
The zooming in and out feature of this view allows you to zoom in a single event or a group of events.

To zoom in and out:

- From the main viewing area, use the mouse to enclose a target zoom area. (dashed box below)



Now, we can take a closer look at the event(s) that border the non-compliance zone to see how close they actually are.



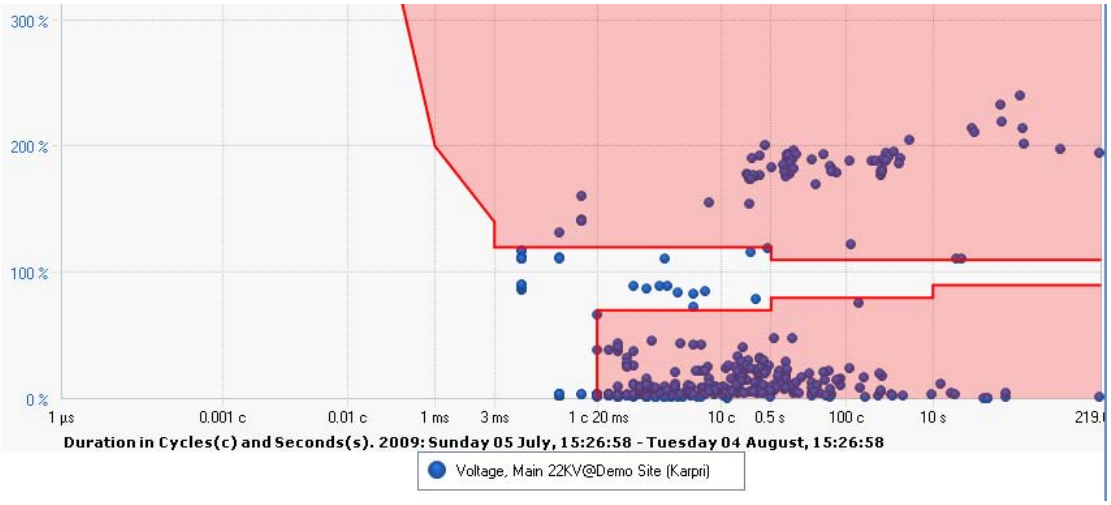
Now zoom in to just the one single event, that actually turns out to be two separate events. It appears from the larger view that these events nearly overlap. When we zoom in, it is apparent that these are two separate events. We pass the mouse over one event and see the attributes in the window.

CBEMA Tool Bar

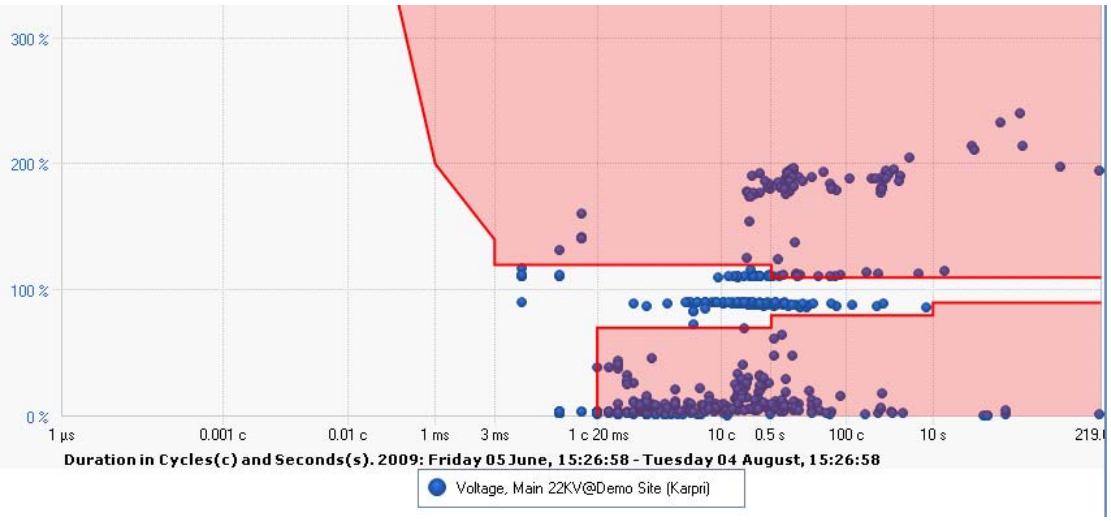
Once a view is established, it is possible to change the view with the tool buttons at the top of the Main Viewing area. Use of the tool buttons for this View are similiar to the other views except their is no time factor. The x-axis represents the duration of each event instead of time.

Toolbar	**Append Back**	**Back**	**Forward**	**Append Forward**	**Expand Time**	**Previous Time**	**Next Time Frame**	**Favorites**

From the original CBEMA view as below of overvoltage and voltage dip events from the Main 22KV node.



Using the Append Back function (one month), it is clear to see that only the number of events has changes, not the compliance zones or the axis values. This is due to the fact that the **x-axis** is not a component of time, but event duration. So using the Appending as well as the Back and Forward tools does not change the appearance of the graph overlay, only the number of events.

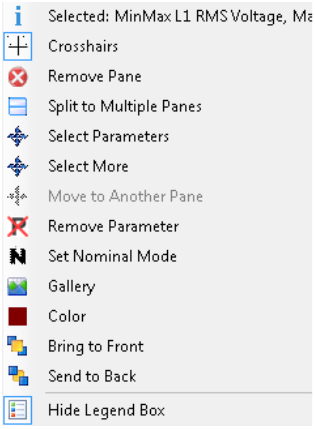


CBEMA Advanced Features

There are advanced features available that allow you to view the graphs in different formats to make interpretation and diagnosis easier. The function of the special features is similar to that of the Trend View (please refer to **Trend Advanced Featureson page 56**).

To access the advanced features:

- From any graph, right click at any point on the graph to access the advanced features.

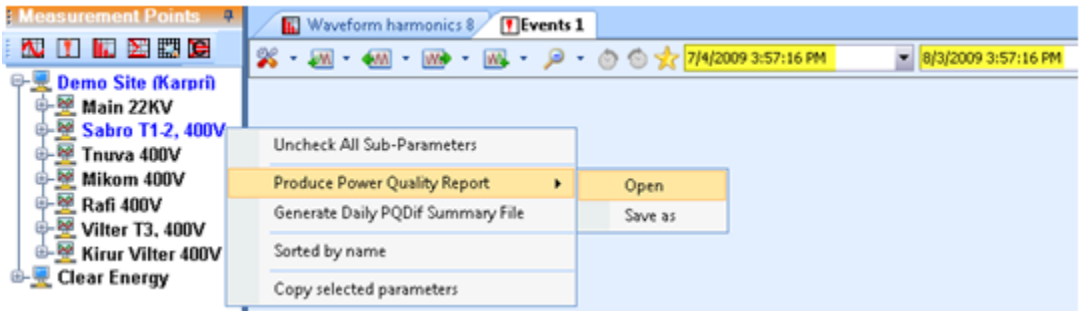


Reports

The Investigator application allows you to produce two different type of summary reports:

- **Power Quality Report**: A pre-formatted Power Quality compliance report according to the European 50160 Standard that includes a summary for all parameters and events.
- **Daily PQDif Summary File:** A 24 hour summary file of all Power Quality parameters and events in PQDIF format.

Producing Power Quality Reports



To produce power quality reports:

- From any node in the selection tree, right click then select **Produce Power Quality Report→Open.**

A preformatted report is produced using the preceding month as the default time range. If an active View window is opened, the report automatically is derived from selected date range in the active view.

Navigating the Power Quality Reports

Executive Summary

2. Executive Summary

Site name: Demo Site (Karpri)
Site description:
Device name: Sabro T1-2, 400V
Device description:
Date range: 7/4/2009 3:57:16 PM - 8/3/2009 3:57:16 PM

Overall Events Statistics

Type	Count	Min Duration	Max Duration	Min Deviation	Max Deviation
Power Frequency Variations	0	-	-	-	-
RMS Voltage Variations	0	-	-	-	-
Rapid Voltage Changes	5	0 sec	3.116 sec	5.03%	11.33%
Voltage Dips	60	5.000 ms	360.000 ms	10.06%	66.80%
Voltage Short Interruptions	3	150.000 ms	8.546 sec	99.90%	100.00%
Voltage Long Interruptions	0	-	-	-	-

A sample of the executive summary as shown above for the **Sabro T1-2 400V** device on the **Demo Site (Karpri)** for the previous month. This report displays the overall event statistics for each group of events. The events are defined by EN50160.

Overall Statistics

3. Overall Statistics

Parameter	Min	Max	Avg
Active Power L1	-498.2902 kW	554.0976 kW	174.9778 kW
Active Power L12	-513.0468 kW	647.6694 kW	175.5930 kW
Active Power L2	-579.0195 kW	817.5968 kW	174.6528 kW
Active Power L23	-721.5327 kW	678.4084 kW	168.9711 kW
Active Power L3	-622.9814 kW	440.3769 kW	163.9954 kW
Active Power L31	-546.1180 kW	445.9360 kW	169.1356 kW
Apparent Power L1	0.0000 VA	857.3721 kVA	209.6022 kVA
Apparent Power L12	0.0000 VA	914.2979 kVA	209.2926 kVA

The Overall Statistics report shows an individual summary for Min/Max and average for each parameter.Each row of the report is a separate parameter. The report is similiar to the **Summary View,** except this report shows all parameters, instead of a selected number.

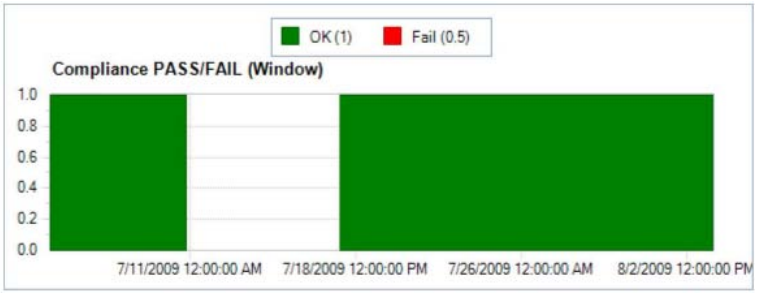
Power Quality Events

A set of graphs (4) is produced for each event individually as below:

- Power Frequency variations
- RMS Voltage changes
- Rapid Voltage changes
- Voltage Dips
- Voltage Short Interruptions
- Voltage Long Interruptions
- Temporary Over voltages
- Flicker Severity
- Voltage Harmonics
- Voltage Unbalance

Compliance Pass/Fail

The graph displays the compliance of the selected parameter over a one week sliding time window.

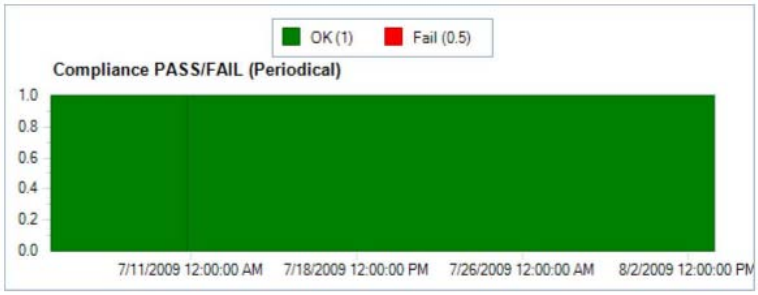
- 

Compliance Value by Percentage

The percentage of time the parameter was within required limits during the one week sliding window time period.

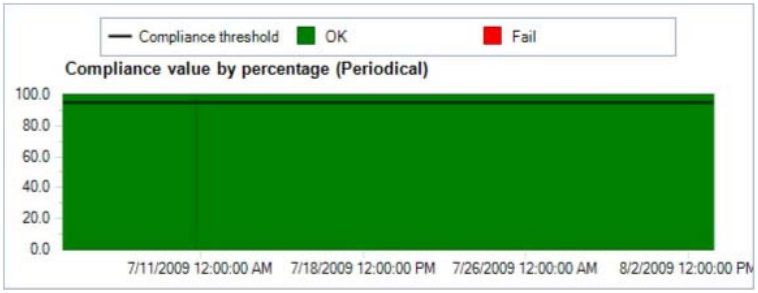
Compliance Pass/Fail (Periodical)

The graph displays the compliance of the selected parameter per time period (2 hours).



Compliance Value by Percentage (Periodical)

The percentage of time the parameter was within required limits per time period (2 hours).



Event Listing

When the parameter falls outside of compliance limits (fails), an event is recorded in the table below for each event classificaton separately. This report (if applicable) follows the graphs.

Events Listing

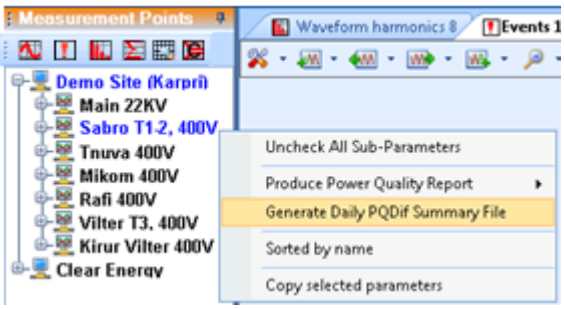
The most severe events are presented below

Start Date	Duration	Severity	Phases	Value	Deviation
2009-07-06 19:52:54.276	3.111 sec	45	1,2,3	9.64 %	9.62 %
2009-07-10 11:01:46.400	3.83 sec	37	1,2,3	5.87 %	5.86 %
2009-07-10 20:30:51.995	2.44 sec	46	1,2,3	11.34 %	11.33 %
2009-07-10 20:42:07.282	3.116 sec	36	1,2,3	5.06 %	5.03 %
2009-07-10 20:43:55.688	0 sec	32	3	6.22 %	6.20 %

If there are no events to report then the message appears. "**No events were found.**"

Generate Daily PQDIF Summary File

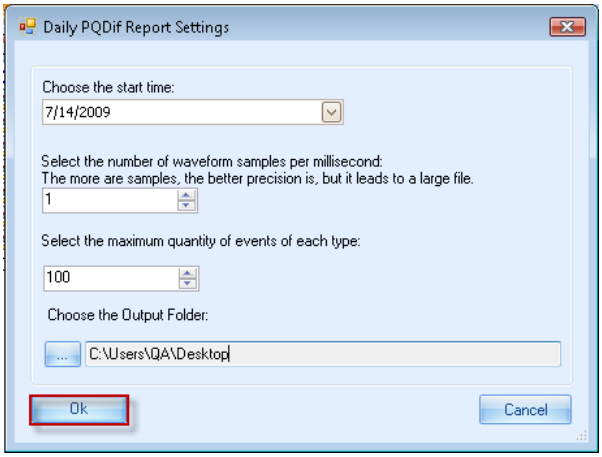
A single daily PQDIF summary file produced that contains a composite of all events and available parameters.



To generate a daily PQDIF Summary file:

1. From any node in the selection tree, right click then select **Generate Daily PQDif Summary File.**

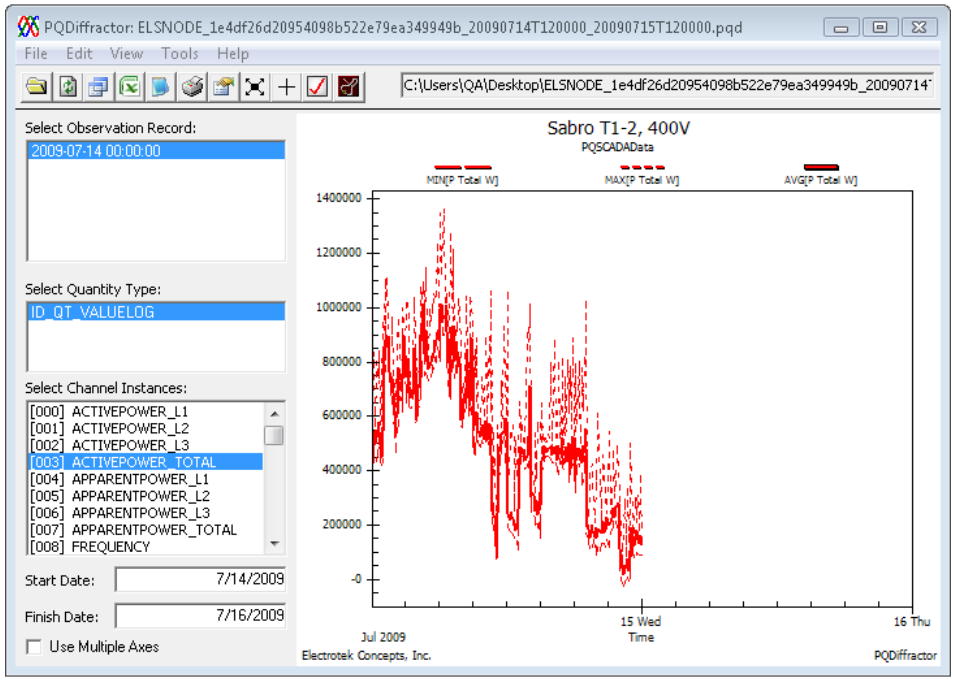
The Daily PQDif Report Settings window appears.



2. Make all appropriate selections. (the time duration is always 24 hours and the # of waveforms is defaulted to 1),
3. Click **OK** to save the report to the specified location (Desktop in our example).

4. Open the PQDif file with any preferred viewer (PQDiffactor in our example).

The file appears in the viewer below with all parameters and events.



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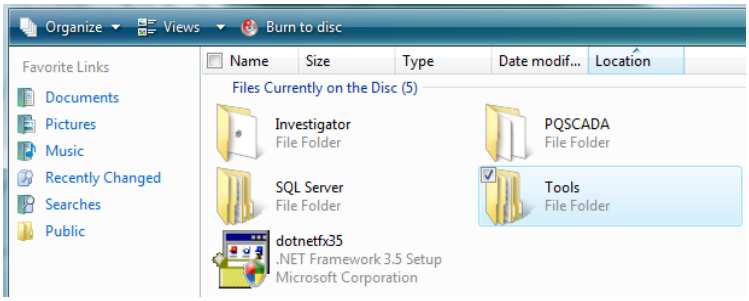
Appendix A: Installing Pre-requisites

If you do not currently have these programs, they can be found on the INVESTIGATOR Installation disk or on the Web.

Installing MSI Installer

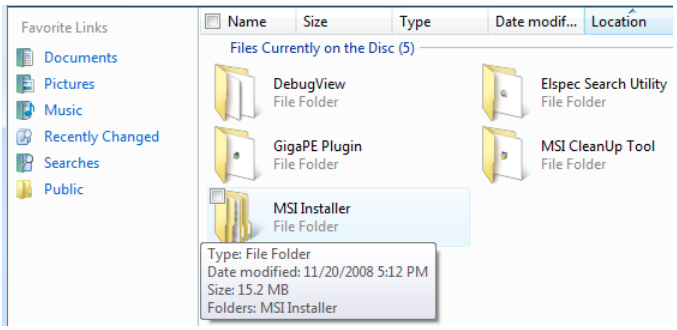
To install MSI Installer from the INVESTIGATOR Installation disk:

1. Navigate to the files on the CD.



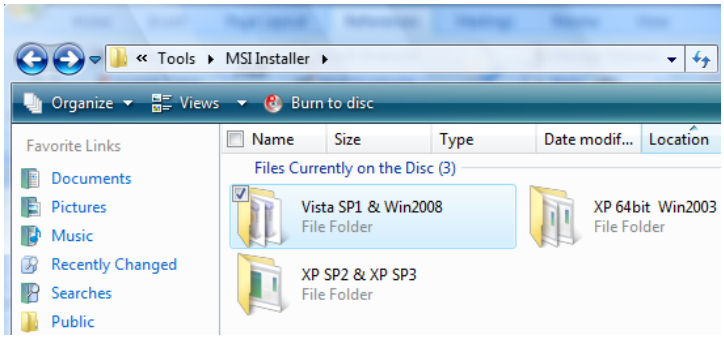
2. Double click the **Tools** folder.

The Tools window appears.



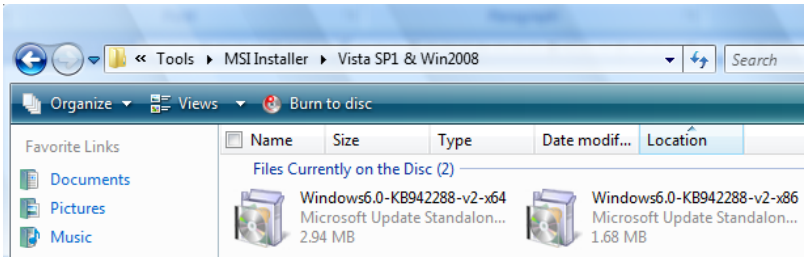
3. Double click the **MSI Installer** Folder.

The MSI Installer window appears.



4. Double click the folder that corresponds with your Operating System.

A window appears with available install files.



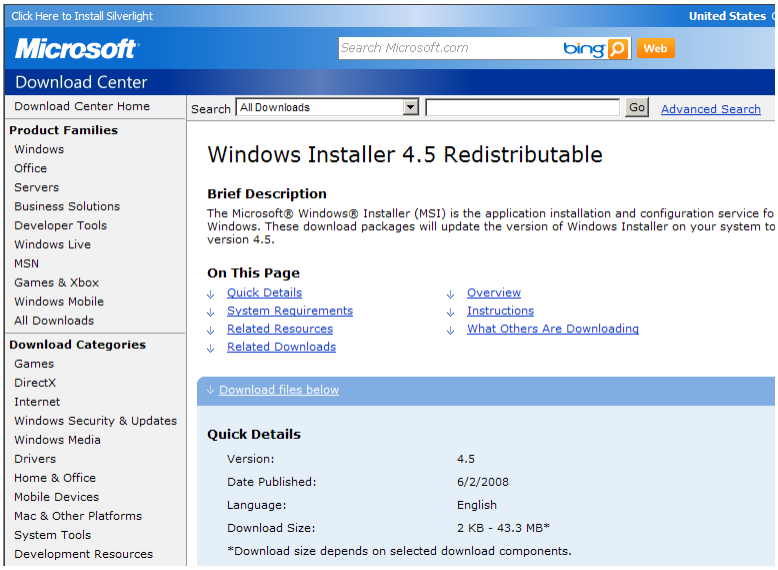
5. Double click the appropriate file to begin the installation process.
6. Follow the installer instructions to complete the installation.

In most cases, it is preferable to access the software from the INVESTIGATOR disk because of the size of the download file.

To install MSI Installer from the Web:

1. Navigate to the Microsoft website at: http://www.microsoft.com/downloads/details.aspx?familyid=5A58B56F-60B6-4412-95B9-54D056D6F9F4&displaylang=en

The MSI download page appears.

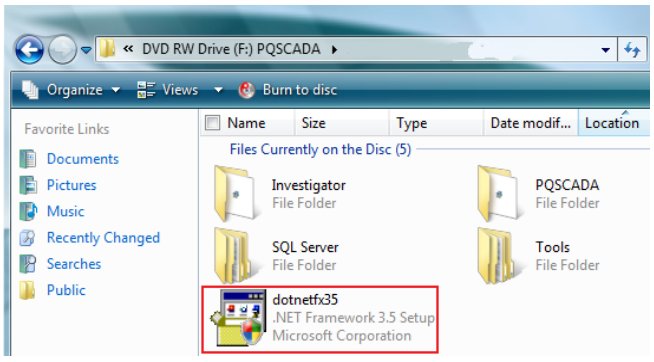


2. Download and complete the installation from the website.

Installing .NET Framework 3.5sp1

To install .NET Framework 3.5sp1 from the INVESTIGATOR Installation disk:

1. Navigate to the **dotnetx3.5.exe** file.

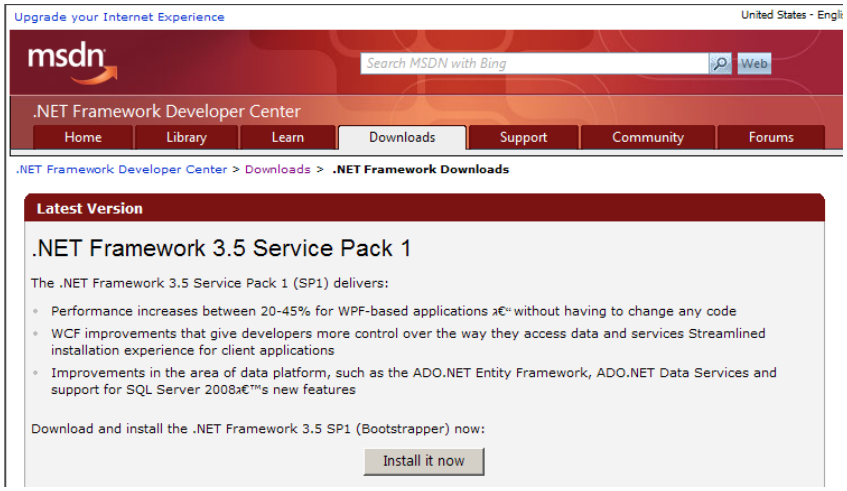


2. Double click dotnetfx35.exe.
3. Follow the installer instructions.

To install .NET Framework 3.5sp1 from the Web:

1. Navigate to the Microsoft website at: http://msdn.microsoft.com/en-us/netframework/aa569263.aspx

The **msdn** download site appears.

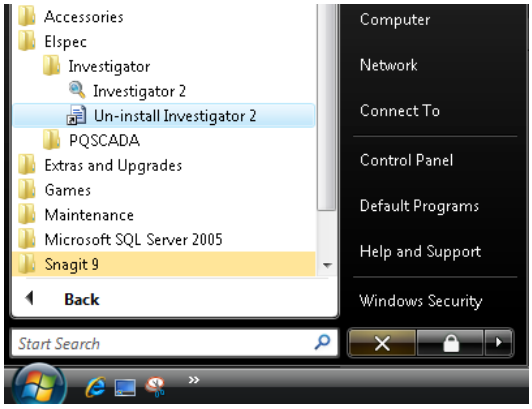


2. Select Install it Now.
3. Follow the installer instructions.

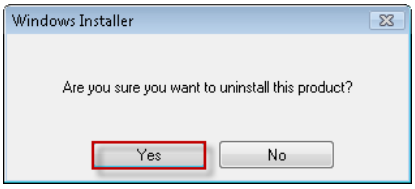
Appendix B: Uninstalling the INVESTIGATOR Software

The procedure for upgrading is identical to installing a new version except you must first uninstall the previous version of the software.

To uninstall the previous version:

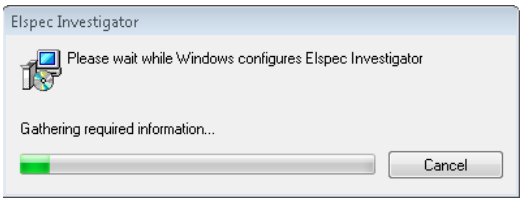


1. Select **Start→All Programs→Elspec→Investigator→Uninstall Investigator**
2. The Windows Installer verification window appears.



3. Click **Yes** to continue.

The Investigator uninstall status window appears showing the progress.



When complete, the Investigator application is removed from the system.

4. Install the New Investigator Version (please refer to **Installing the Investigator Software on page 3).**

Appendix C: Communications Troubleshooting

In certain situations, the device discovery tool fails to discover local sites, you may need to correct any of the following circumstances:

- The local firewall prohibits UDP broadcasting
- The **Elspec Search** tool is running and already using of the UDP 885 port.
- The local site is down and unreachable.

In almost all cases, addressing these circumstances corrects the problem . If for any reason, you cannot establish communication after verifying the previous issues, please contact our customer support at support@elspec-ltd.com.