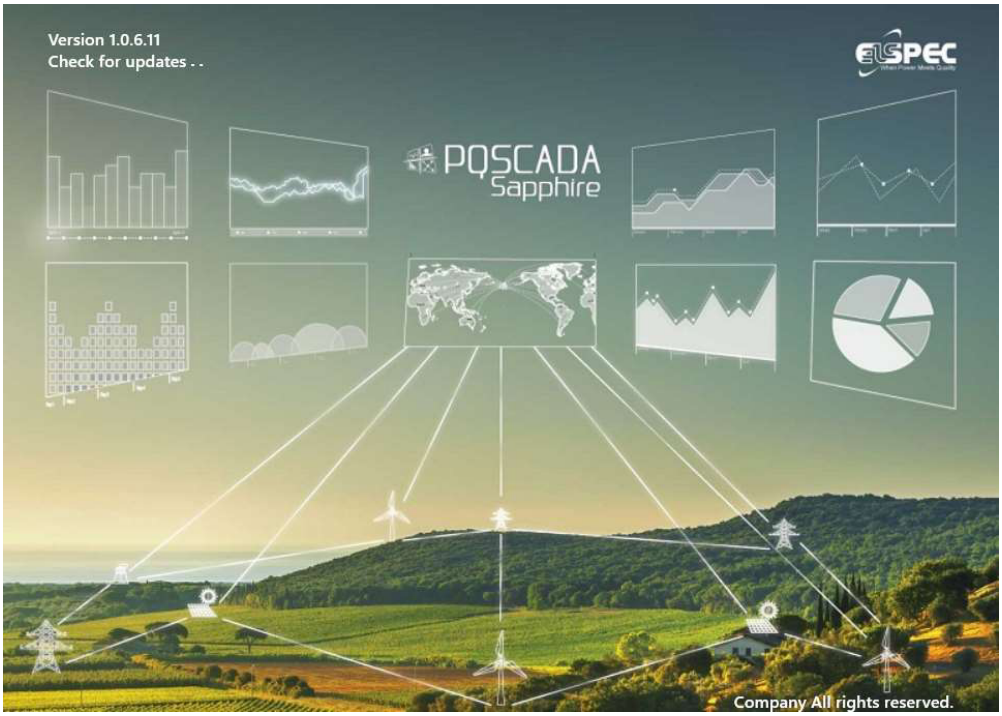
PQSCADA Sapphire



User Manual

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1. Introduction

In today's world, power distribution networks deploy an array of protection equipment, power quality analyzers, revenue meters, and other monitoring equipment to ensure high quality and reliable power flow, as well as energy efficiency.

The ability to analyze synchronized data from a variety of data sources by one system is essential for meeting today's highest level of reliability, quality, and energy efficiency.

PQSCADA Sapphire's multi-vendor support sets new standards in power monitoring management software, which enables the acquisition and analysis of all field-generated data on a central software solution, regardless of the IED manufacturer. PQSCADA Sapphire is an expandable platform in which additional capabilities can be easily added as add-ons, or independently developed by API to meet the customer's custom needs and applications.

PQSCADA can be installed in a single-node system, as well as in a distributed client/server structure.

1.1 Key Features

Multi-Vendor Support

PQSCADA Sapphire acquires, processes, and stores recorded data from any recording device through a variety of communication protocols and file formats. PQSCADA Sapphire will automatically calculate and store ~5,000 power parameters, including individual harmonics from acquired waveform signals.

Simplifies IT Environment

PQSCADA Sapphire simplifies your IT environment by eliminating the need to purchase, install, train users, and maintain multiple systems.

No Missed Events

PQSCADA Sapphire has sophisticated event detection capabilities, enabling the devices to record only raw data. PQSCADA Sapphire will find events according to user-defined thresholds during post-processing.

Secured Access

PQSCADA Sapphire data can be reached from any location using standard secured firewall-friendly protocols.

Get Notifications

PQSCADA Sapphire preconfigured scenarios enable sending emails, SMS's, and Push notifications to users.

Easily Fix Misconfigurations

PQSCADA Sapphire allows correcting device installation and configuration errors by recalculating recorded data, such as reverse polarity, swap phases, connection type, VT/CT ratio, and time inaccuracy which can be easily corrected in past and future measurements.

Reporting & Compliance

PQSCADA Sapphire offers a comprehensive reporting and compliance engine, allowing the design of report templates and compliance policies according to various standards or custom requirements. Reports can be generated manually or on a daily, weekly, monthly, or yearly schedule. Reports can also be triggered by compliance policy violations or by event occurrence.

See the Whole Picture

PQSCADA Sapphire offers a unique set of charts and reports empowering the ability to plan, control, and make data-driven decisions. Get an overview of the electrical network and measuring devices over a geographic map.

Control

PQSCADA Sapphire allows upgrading and/or configuring deployed devices within the network. The tasks automatically update the devices with any Firmware/Configuration files.

Synchronized Monitoring

A unique time synchronization algorithm assures that logged data from multiple units is synchronized and displayed on the same time scale, with a 0.5 µs typical resolution. Each event on the grid is accurately analyzed for precise root cause analysis, behavior propagation, and can be traced to its source.

BlackBox Devices

PQSCADA Sapphire collects compressed recorded raw waveform data using ELSPEC PQZ patented protocol. Raw data is processed, stored, and retrieved upon demand as continuous information. This ensures that all the required information to keep the network fully functioning and safe is acquired.

2. License Selection Guide

Table 2-1 compares the available PQSACADA license options.

Table 2-1. PQSCADA Sapphire License Comparison

File Protocol	Express	Professional	Enterprise
PQZIP	Import/Export	Import/Export	Import/Export
PQZ	Import/Export	Import/Export	Import/Export
COMTRADE	Import/Export	Import/Export	Import/Export
PQDIF	Import/Export	Import/Export	Import/Export
Excel	Export	Export	Export
CSV	Import/Export	Import/Export	Import/Export
Supported protocols			
PQZ	N/A	Yes	Yes
MODBUS	N/A	Per license	Per license
IEC 61850	N/A	Per license	Per license
Investigation			
Measurement points/investigation	2	Unlimited	Unlimited
Trend Chart	Yes	Yes	Yes
Grid Chart	Yes	Yes	Yes
Spectrum Chart	Yes	Yes	Yes
Event Chart	Yes	Yes	Yes
Unipede Chart	Yes	Yes	Yes
Statistics Chart	Yes	Yes	Yes
Scatter Event Chart	Yes	Yes	Yes
Scatter Parameters chart	N/A	Yes	Yes
Phasors	N/A	Yes	Yes
Energy Chart	Yes	Yes	Yes
Cyclic Histogram	N/A	Yes	Yes
Summary Chart	Yes	Yes	Yes
Tasks			
Schedule task	N/A	N/A	Yes
Triggered by event	N/A	N/A	Yes
Manual	Yes	Yes	Yes

File Protocol	Express	Professional	Enterprise
Reports			
Compliance report	Yes	Yes	Yes
Fault location	N/A	Per license	Per license
Components			
Auto fetching	N/A	Yes	Yes
Number of Auto Fetching components Elspec brand	N/A	Per license	Per license
Number of Auto Fetching components other brands	N/A	Per license	Per license
Server			
Concurrent users	1	1	Per license
Security	N/A	N/A	Yes
System Service	N/A	N/A	Yes
Remote access	N/A	N/A	Yes
Servers hierarchy	N/A	N/A	Yes
DataBase			
DataBase size	3 months of continuous recording	1 year of continuous recording	Unlimited
SQL Light	Yes	Yes	Yes
MS SQL server	N/A	N/A	Yes
Postgres	N/A	N/A	Yes
Client module and features			
Overview	N/A	Per license	Per license
Tags	N/A	Per license	Per license
Notifications			
Emails	N/A	N/A	Yes
SMS	N/A	N/A	Yes
Calculated parameters			
RMS	Yes	Yes	Yes
THD	Yes	Yes	Yes
Unbalance	Yes	Yes	Yes
PST	Yes	Yes	Yes
PLT	Yes	Yes	Yes
Active Power	Yes	Yes	Yes
Reactive power	Yes	Yes	Yes
Apparent Power	Yes	Yes	Yes
Power factor	Yes	Yes	Yes
Energy	Yes	Yes	Yes
Waveform	Yes	Yes	Yes
Under deviation	Yes	Yes	Yes
Over deviation	Yes	Yes	Yes
IL 15 Min	Yes	Yes	Yes

File Protocol	Express	Professional	Enterprise
IL 30 Min	Yes	Yes	Yes
TDD 15 Min	Yes	Yes	Yes
TDD 30 Min	Yes	Yes	Yes
TIF	Yes	Yes	Yes
Harmonics	up to 50	Yes	Yes
Harmonics %	up to 50	Yes	Yes
Inter-harmonics	Yes	Yes	Yes
Spectrum	Amplitude	Amplitude + Angle	Amplitude + Angle
RMS Fundamental	N/A	Yes	Yes
THD Even	N/A	Yes	Yes
THD Odd	N/A	Yes	Yes
Fundamental Waveform	N/A	Yes	Yes
Harmonics Waveform	N/A	Yes	Yes
Active Power Harmonics	N/A	Yes	Yes
Reactive Power Harmonics	N/A	Yes	Yes
Apparent Power Harmonics	N/A	Yes	Yes
CBC Frequency	N/A	Yes	Yes
HRMS	N/A	Yes	Yes
Crest Factor	N/A	Yes	Yes
K Factor	N/A	Yes	Yes
Positive Sequence	N/A	Yes	Yes
Negative Sequence	N/A	Yes	Yes
Zero Sequence	N/A	Yes	Yes
Cyclic Histogram	N/A	Yes	Yes
Energy			
Energy	N/A	N/A	Per license

3. Terms and Definitions

Table 3-1. Terms and Definitions

Term	Definition
Component	A Component serves as a logical representation of either a physical device, which acts as a source of data, or an investigation. These representations are derived from various file types, including but not limited to pqzip, comtrade, pqdif, and more.
Feeder	The Feeder is a vital component of an electrical distribution system. It plays a crucial role in carrying electrical power from a designated source to various destinations within the system. The Feeder is specifically designed to deliver power at a precise voltage level, ensuring efficient and reliable distribution. Depending on the requirements of the electrical distribution system, the Feeder is designed to operate at specific voltage levels, such as 480 volts or 11,000 volts. This targeted voltage ensures that the power is delivered effectively and meets the needs of the connected devices or equipment.
Instance	A representation of a physical computer on which PQSCADA Sapphire is running.
Nominal value	Nominal value refers to a specific value assigned to a component, circuit, device, piece of equipment, or system under predetermined or specified conditions. It represents the expected or designated value that is considered standard or typical for the given entity.
Tag	"Tags" are utilized to effectively organize, and group components based on predefined characteristics. Tags serve as labels or markers that are assigned to components within the system, allowing for easy categorization and grouping of related items.
Task	Tasks are additional functionalities that enhance the capabilities of the software. They are designed to run on specific processes and provide valuable features for users. PQSCADA Sapphire supports three main task types: Control and Maintenance, Exports, and Reports.
Quantity	Refers to graphical representations of measured data displayed in a chart format. A Quantity is a collection of series that exhibit slightly different characteristics, such as minimum/maximum values, averages, or other relevant statistics.

4. Getting Started

4.1 Installing the Software

Note: Before installing the software, ensure the following:

- There is at least 13 GB of free space on the computer for installation.
- You are the admin of the computer the software is being installed.

1. Download the PQSCADA Sapphire set-up file from the Elspec website.
2. Double-click the **Elspec Sapphire Setup v1.x.x.x** file to run the setup wizard.

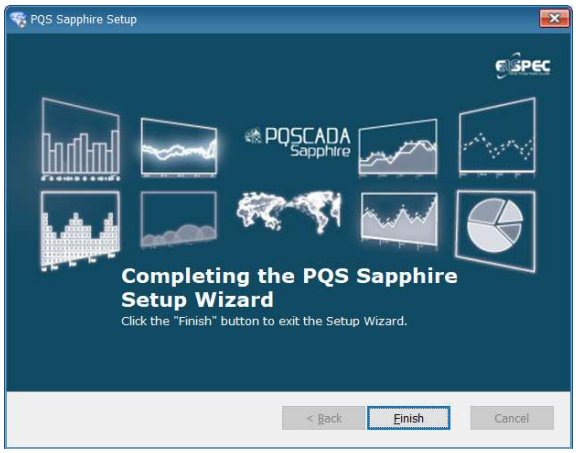
   The Welcome page appears (indicating the version being installed).

3. Click **Next** to start the installation.
4. Select the installation folder path.
5. Click **Next** to install.

   The **End-User License Agreement** is displayed.

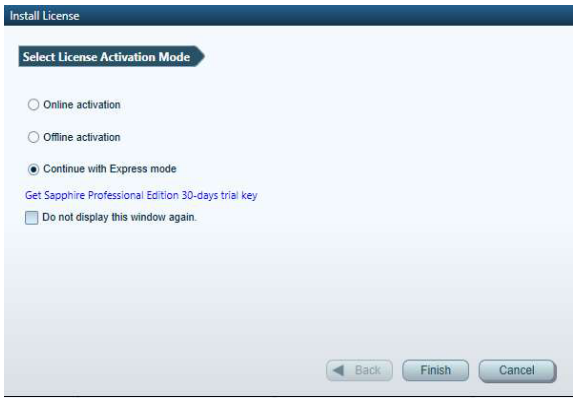
6. Read the license agreement; select **I accept the terms in the License Agreement** option and click **Next**.
7. Click **Install** to start the installation process.

   Wait for the program to be installed.



8. Click **Finish** to launch the PQS Sapphire application.

After the first installation of a client, or in every PQSCADA activation, the following message appears.



Note: To activate your PQScada Sapphire License, select one of the first two Activation Modes and continue as described in section 4.4.

9. Press **Finish** to continue in the **Express** mode (no license) to work in the limitations presented in Table 2-1.

4.2 Launch Screen Layout

Launching the PQSCADA Sapphire application opens in the Investigation module main screen.

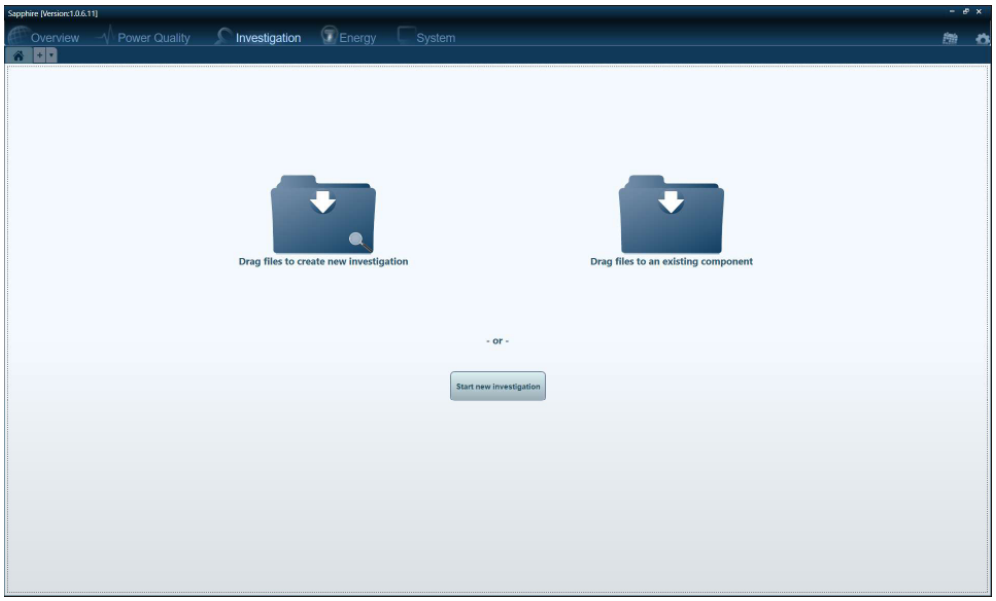


Figure 4-1. Investigation module main screen

The available PSCADA Sapphire modules are displayed on the Modules bar:

- **Overview** (see section 0)
- **Power Quality** (see section 7)
- **Investigation** (see section 6)
- **Energy** (see section 0)
- **System** (see section 5)

On the upper right corner are the following two icons:

- **Setup**  icon (see section 0)
- **Schedule**  icon (see section 0)

4.3 Upgrading the Software

There are two ways to upgrade the software.

The first one is when the Setup  icon turns orange. This occurs when the computer is connected to an active internet and the application detects that a new file is available.

1. Press the Setup  icon. A drop-down menu opens.
2. Select to Download the file.
3. Continue by following the software installation instructions (see section 4.1).

The second way is through Elspec's website:

1. Go to the Elspec website.
2. Copy the Installation file to your computer and follow the software installation instructions (see section 4.1).

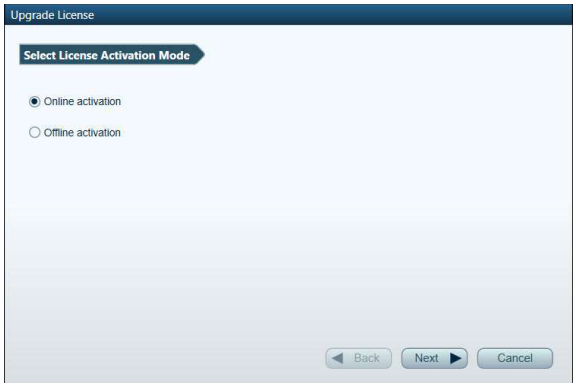
4.4 Activating the License

4.4.1 Online Activation

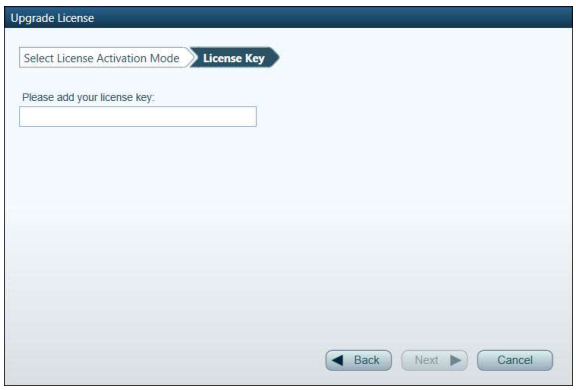
To run Online activation, make sure your computer is connected to the internet.

Note: Activation for the Enterprise edition must run on the server machine.

1. Click the **Setup**  icon (upper right corner of the application) and select **Install/Upgrade** license from the menu to launch the Upgrade License wizard.



2. Mark the **Online activation** radio button.
3. Click **Next** to go to the License Key page.



4. Enter your license ID. It is recommended copying and pasting the License ID from the License Certificate received from Elspec. This will avoid issues of distinguishing between letters and numbers.
5. Click **Next** to run the activation.
6. On a successful license activation:
    a. Click **Close** for a Professional license setup.
    b. Click **Next** for an Enterprise license and the PQS service installation (see section 4.4.1.1).

4.4.1.1. Service Installation for Enterprise Edition

With the Enterprise edition license ID installation, the PQSCADA Sapphire service installation wizard opens automatically.

After installing the software, an Instance with SQLite DB is created.

If required, the user can configure the PQSCADA Sapphire to use a different type of database.

To create an instance with a different DB:

1. Select the **System** module.
2. Right-click the server instance and select **delete server**.
3. Right-click the server instance and select **create server**.

Configure the following options on the Database page:

DB Type – Select the database type in which PQSCADA Sapphire will store the data. PQSCADA Sapphire supports the following DB types:

- SQLite.
- MS SQL Server (MSSQL).
- PostgreSQL DB.

Select the DB type & configure the following options:

- **DB URL** – enter the DB URL or click Browse to search for the SQL service.
- **DB username** – enter your DB username.
- **Password** – enter your DB password.

Note: The mentioned configuration is compatible with both MSSQL and PostgreSQL database systems.

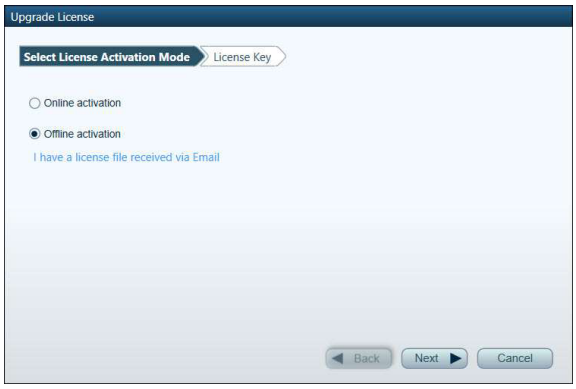
4. Click **Test** to verify the connection with the DB.
5. Click **create** to close the wizard.

4.4.2 Offline Activation

This option is used by clients without an internet connection (e.g., secured production environment).

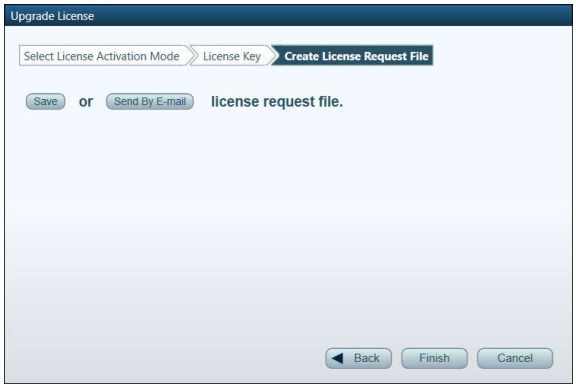
1. Click the **Setup** icon and select **Install/Upgrade** license from the menu to launch the Upgrade License wizard.

Note: The Enterprise edition activation must be performed on the server machine.



2. Mark the **Offline activation** radio button.
3. Click **Next** to go to the License Key page.

4. Enter your license ID. It is recommended copying and pasting the License ID from the License Certificate received from Elspec. This will avoid issues of distinguishing between letters and numbers.
5. Click **Next** to open the Create License Request File page.



6. Select the following:
   - **Save** –store the license request file on your server.
   - **Send by Email** – opens your default email client for sending the license request file by email.
7. Click **Finish** to close the wizard.
8. Copy the "request" license request file to the computer with an internet connection.
9. Browse to Elspec licensing website.

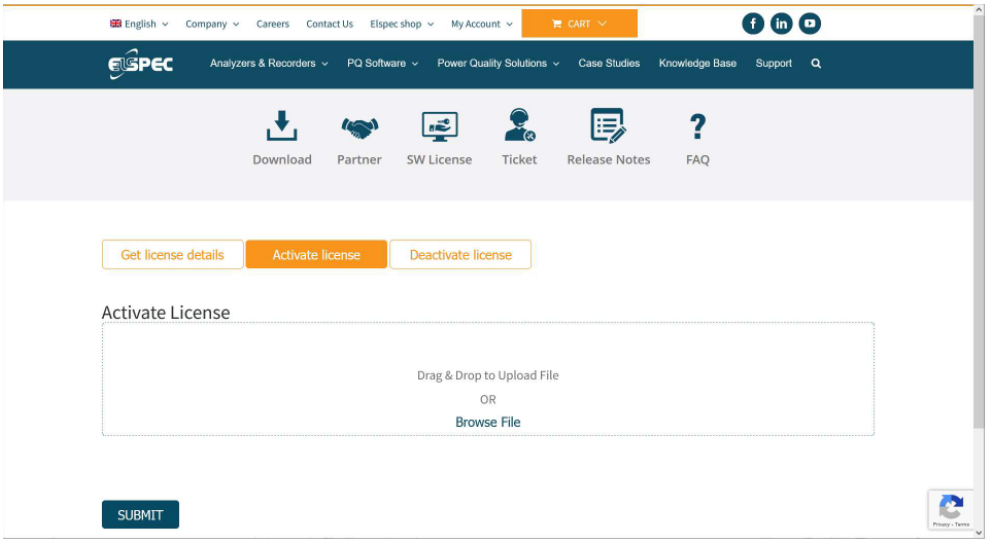


Figure 4-2. Elspec licensing website

10. On the Elspec licensing website, select **Activate license**.
11. Drop the "request" license file into the designated window.
12. Download the "response" license file to your local computer.

4.4.2.1. Activating the License File

1. Open the license "response" file onto the PQSCADA Sapphire computer.
2. Click the **Setup** icon and select the **Install/Upgrade** license to launch the Upgrade License wizard.

3. On the License Activation Mode, do the following:
    - Select the **Offline activation** radio button.
    - Click **I have a license file received via email**.
    - Browse to the license file location and select it.
4. Click **Next**.

4.4.2.2. Service Installation for Enterprise Edition

With the Enterprise edition license ID installation, the PQSCADA Sapphire service installation wizard opens automatically.

After installing the service, an Instance with SQLite DB is created.

If required, the user can configure the PQSCADA Sapphire to use a different type of database, as described in section 0 above.

5. System Module

The System module in PQSCADA Sapphire is utilized for the configuration and monitoring of objects within the system. PQSCADA Sapphire supports two types of objects:

- **Instance:** An Instance represents a physical computer on which PQSCADA Sapphire is running. There are two types of instances supported by PQSCADA Sapphire:
    - **Local Machine:** In the Express and Professional editions, PQSCADA Sapphire runs as a user process on the local machine.
    - **Server:** In the Enterprise edition, PQSCADA Sapphire runs as a Windows service on either a local or remote location.
- **Component:** A Component is a logical representation of a physical device within PQSCADA Sapphire. Components are hosted under an Instance. PQSCADA Sapphire supports two main types of components:
    - **Investigation Component:** These components are created by manually fetching files for analysis within the system.
    - **Auto Fetching Component:** This type of component supports various communication protocols to automatically fetch data. Auto Fetching components are available in the Professional and Enterprise editions only. The number of auto-fetching components included in a specific license is defined (e.g., the Enterprise License includes 20 auto-fetching components by default, but the user can request to increase this number).

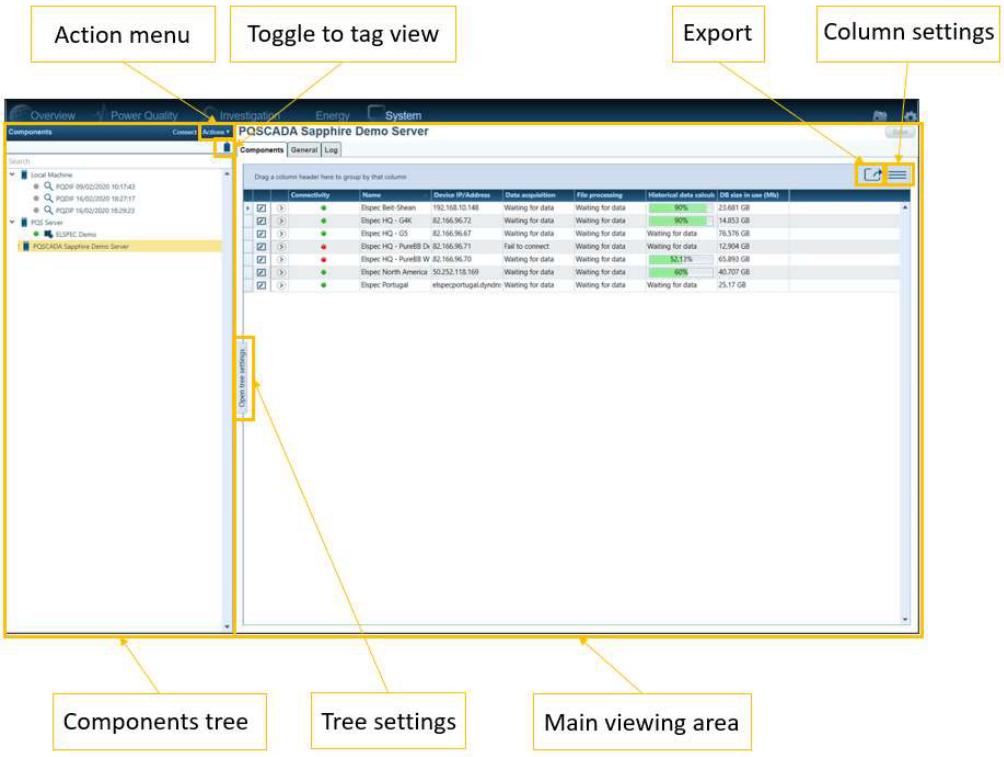


Figure 5-1. System Module

The **System module** screen in PQSCADA Sapphire is divided into two primary sections, separated by a splitter control line. The purpose and behavior of each section are as follows:

- **Left Section:** The left section of the System module screen showcases the connected **Instances** and their hosted **Components**. It provides a visual representation of the hierarchical structure of

Instances and the Components associated with each Instance. This section allows users to navigate and select specific Instances and Components for further configuration or monitoring.

- **Right Section:** The right section of the System module screen displays the properties of the selected object. When an Instance or Component is selected from the left section, its corresponding properties are presented in the right section. These properties may include information such as configuration settings, connectivity details, status indicators, or other relevant data specific to the selected object.

5.1 Connect to a Server (Enterprise edition only)

Once you have successfully created your service, a server will be automatically generated for you, the server will be configured to support the **HTTPS** protocol with **SQLite** DB integration, ensuring secure communication between your service and users.

5.1.1 Connecting to a Remote Server

If you wish to connect to a server that is located far away from your current location, please follow these steps:

Click the **Connect** button on the upper right corner of the **Components** tree to open the **Add Server** configuration window.

(The following is an example when connecting to the demonstration site, with “Demo” as the Username and Password).

In the **Add Server** configuration window, you will find several fields to fill in. Follow the steps below to complete this information:

- **Server Address** – select the service URL. Click the **Scan for server** icon to search for active services in your network.
- **Authentication** – Choose the authentication manager for the server connection.
- **Username** – Enter your username associated with the remote server.
- **Password** – Provide the password associated with your username for authentication purposes.
- To enable automatic login to the remote server whenever you launch PQSCADA Sapphire, mark the **Stay logged in** checkbox.
- After entering the necessary information, click the **Add** button to initiate the connection process.

5.2 Disconnect Server (Enterprise edition only)

1. Right-click the server in the **Components** tree.
2. Select **Disconnect server**.

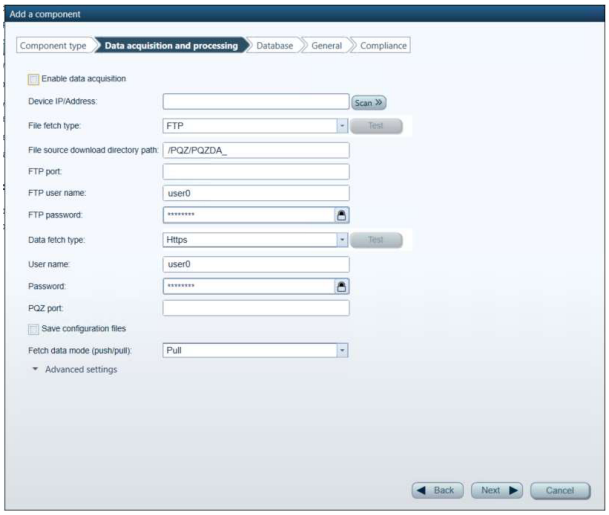
5.3 Add a Component (Professional and Enterprise editions only)

Note: PQSCADA Sapphire supports various component types. Call our support team to integrate PQSCADA Sapphire with other component types of different vendors.

1. Click **Actions** on the top right corner of the **Components** section and select **Add component** from the menu.
2. **Select a component type** from the dropdown list and click **Next**.

Note: For this description, we have added the BlackBox DFR G5 component. This will ensure that most steps in the wizard are fully explored.

5.3.1 Data Acquisition and Processing



1. Select and enter the following **Regular settings** information:
   - **Enable data acquisition** - marked by default for downloading data upon component creation. When the box is unchecked, the component will not hold data, but you will be able to drag and drop files with data to component.
   - **Device IP/Address** – enter the device IP address/URL or click **Scan >>** to search for devices connected to your network.
   - **File fetch type** – Select the protocol to fetch files from the device.
   - **File source download directory path –** Select the location or file path on the device where files are stored (e.g., for a DFRG5 device, it is /PQZ/PQZDA_).
   - **FTP port –** Select the port connection to connect and fetch files from the device.
   - **FTP Username** – enter the FTP username. By default, the username is set to the default username of the selected device (e.g., for a DFRG5 device, use user0).

     Note: Each device has a default FTP username and password that can be changed by the user on the device. If not changed, leave the default.

- **FTP password** – Enter the FTP password. By default, the password is set to the default password of the selected device (e.g., for a DFRG5 device, use aA123123).
- **Data fetch type** - Select the protocol to read real time data from the device.
- **Username** – enter a username for reading RT data. By default, the username is set to the default username of the selected device (e.g., for a DFRG5 device, use user0).
- **Password** – enter a Password for reading RT data. By default, the username is set to the default username of the selected device (e.g., for a DFRG5 device, use aA123123).
- **PQZ port –** Select the port connection to connect and read data from the device.
- **Save configuration file –** see section 5.9.8.4.

2. Select and enter the following **Advance settings** information (Optional):
   - Mark the **Start time** checkbox and enter the date & time to begin the data acquisition.
   - Mark the **End time** checkbox and enter the date & time to exclude from the data acquisition.
3. Click the **Test** button to verify the connection with the device.
4. Select the **Download mode** from the dropdown list (**All data**/**Only events**) – Only for G4K
5. Click **Next** to move to the tag page, where applicable, or click **Finish**, to add the new component.

5.3.2 Database (Enterprise edition only)

1. Select and enter the following information:
   - **DB Type** – select the database type in which PQSCADA Sapphire will store your data. PQSCADA Sapphire supports two DB types:
     - SQLite
     - MS SQL Server (MSSQL)
     - POSTGRESQL

   If **MSSQL** was selected, configure the following options:
   - **DB URL** – enter the DB URL, or click the Browse button, to search for SQL service in your network.
   - **DB username** – enter your DB username.
   - **Password**: enter your DB password

   If **POSTGRESQL** was selected, configure the following options:
   - **DB URL** – enter the DB URL or click the Browse button.
   - **DB username** – enter your DB username.
   - **Password**: enter your DB password
2. Mark the **Save as default** checkbox to keep these settings as default. You can use set defaults next time to fill in the default settings.
3. Click **Test** to verify the connection with the DB.
4. Click **Next** to move to the next step.

5.3.3 General

Give the component a name and click **Next**.

5.3.4 Tags

1. Configure the available tags if tags were configured in the **Instance** configuration.
2. Click **Next** to move to the next step.

5.3.5 Compliance

1. Mark the required compliances from the list (more than one compliance can be selected).
2. Click **Finish**. A request is sent to the server to add the new component.
3. Click **Close**.

5.3.6 PMU Mapping

A Phasor Measurement Unit (PMU) is a sophisticated monitoring device used in electrical power systems. It precisely measures voltage and current phasors, providing real-time information about the magnitude and phase angle of these electrical quantities.

PQSCADA gives the user the ability to use an existing mapping or create a new mapping file.

5.4 Attach a Component

An existing previously detached component can be attached to an instance. This may be particularly useful when exchanging processed data with colleagues, or when upgrading to a new computer.

To attach a component:

1. Right-click the instance and select **Attach a component**.
2. Select the **DB type** – **SQLite** or **MSSQL** or **POSTGRESQL** (Enterprise edition only).
    - If **MSSQL** was selected, enter the required connection details, and click **Next** to display a list of available components. Mark the **Create component** checkbox next to each component you would like to attach and click **Finish**.
    - If **POSTGRES** was selected, enter the required connection details, and click **Next** to display a list of available components. Mark the **Create component** checkbox next to each component you want to attach and click **Finish**.
    - If **SQLite** was selected, select **Reattach existing components** and click **Next** to display a list of available components. Mark the **Create component** checkbox for each component you want to attach and click **Finish**. Alternatively, you can directly import a database file (SQLite extension), and Sapphire will automatically build the required folder structure.

5.5 Detach Component

Detaching a component will remove it from the instance. However, database files and folder structure will remain intact. You can later reattach the component.

1. Right-click the component that you wish to detach and click **Detach**.
2. Confirm by clicking **Yes**.

5.6 Delete Data from a Component

1. Right-click the component you want to delete data from and select **Delete data from the database in the time range**.
2. In the Delete data from the database in the time range, select the following:
    - **Start time**
    - **End time**
    - Mark the **delete system events (Log)** checkbox to also delete the events.
3. Click **Delete**.

5.7 Delete Component

Deleting a component will remove all database files and folder structure that is associated with the component. **This action is irreversible**.

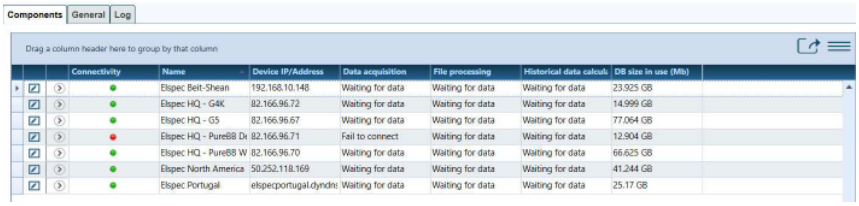
1. Right-click the component that you wish to delete and click **Delete**.
2. Confirm by clicking **Yes**.

5.8 Server Configuration

Click the Instance object in the Components tree to change the Instance configuration. The available configuration tabs are displayed based on the Instance type and user authentication.

5.8.1 Components

The Components tab displays data of all hosted components with statuses of the selected instances.



Click the **Export** icon to export the displayed table to an Excel file.

Click the **Column settings** icon to select what columns to display. The available columns are according to the selected instance.

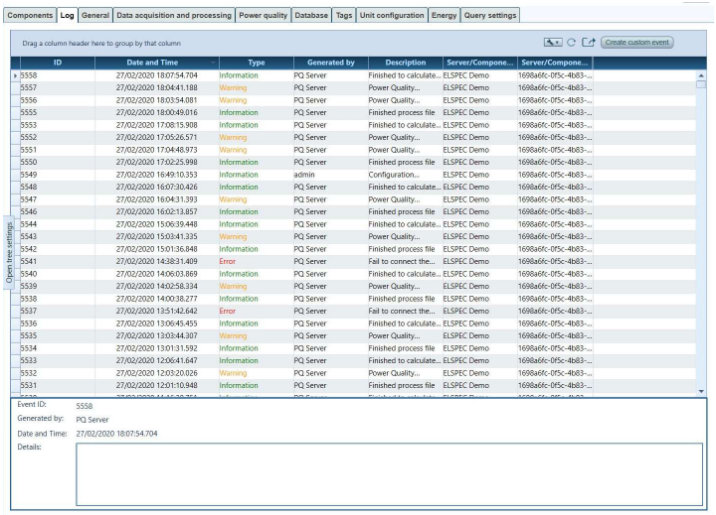
- **Connectivity** – represented as a color indicator:
  - **Green** – connection to the device is enabled and working.
  - **Red** – connection to the device is enabled but doesn't work.
  - **Gray** – connection to the device is disabled.
- **Name** – the name of the component.
- **Device IP/Address** – the IP address of the device.
- **Data acquisition** – displays the acquisition status of the component:
- **Waiting for data** – downloading is finished; wait for the next connection attempt.
- **Scanning folder** – component scans for new files in the device.
- **Downloading** – percentage indication of the current file downloading progress.
- **Disabled** – downloading is disabled.
- **Fail to connect** – communication error.
- **Files processing** – displays the status of the component file processing.
- **Historical data calculation** – displays the status of the historical data calculation process.
- **DB size in use** – shows the DB size of the component.
- **Optional columns -** Product serial, HW version, Firmware version, Site name, Company name, Username, Product name, DB type**,** Component type, ID, serial port.
- **Data availability** – the percentage of the available data (from the total), as set under client settings.

Click the expand icon to the left of the component to display more information about the component.

Click the **Edit** icon to the left of the component to show the basic configuration of the component and to select if to enable data acquisition, file process, and historical data calculation.

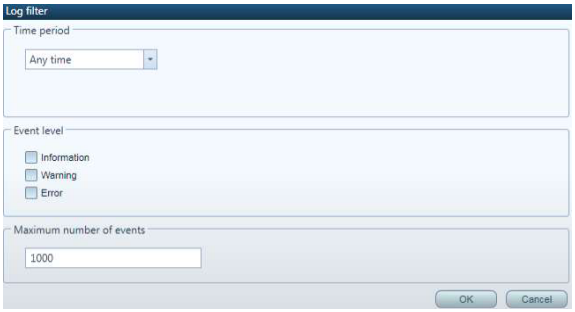
5.8.2 Log

The Log tab displays specific information related to log entries. This information can be used to troubleshoot problems, track the status of the system, and audit user activity.



5.8.2.1 Log tool bar

- **Refresh log** - To refresh the log entries, click the Refresh log icon on the top right corner of the main screen.
- **Export to CSV** - To export the log entries, click the Export to CSV icon on the top right of the main screen.
- **Log filter** - To narrow down the view, click the Log filter icon on the top right corner of the main view. The Log filter window is displayed.



5.8.2.1.1. Log filter

In the Log filter menu, do the following:

1. Select the **Time period**.
2. Select the **Event level**:
   - **Information** – includes general information on actions taken in PQSCADA Sapphire.
   - **Warning** – includes malfunctions that the PQSCADA Sapphire will resolve by itself.
   - **Error** – Includes malfunctions that the PQSCADA Sapphire was unable to resolve (e.g., failed Tasks due to an incorrect E-Mail address).
3. Enter the **Maximum number of events** to be displayed.
4. Click **OK**

5.8.2.1.2. Create custom event

To create a custom event, click the **Create custom** event button. This will open a configuration window where you can enter the event name, time, and details. Once you have entered the information, click **Save** to create the custom event.

5.8.3 General

The General tab includes the following information for the selected Instance:

- **Name –** instance name
- **Server version –** the version of the server
- **Server URL –** the unique resource location of the instance
- **Server ID**
- **Session timeout in hours –** Session will terminate after max number of hours.
- No limit – 0

To change the Instance name:

1. Type the Instance name in the **Name** text box.
2. Click the **Save** button to apply changes.

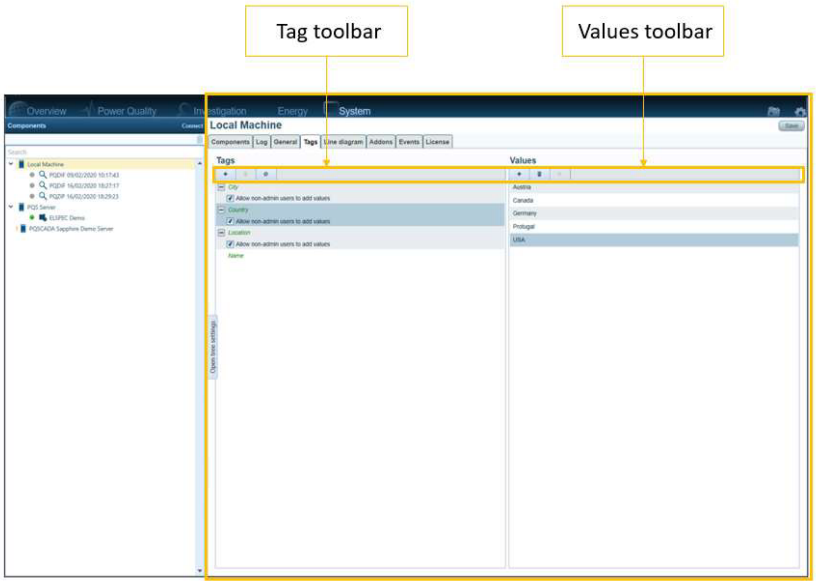
5.8.4 Tags

Tags are used to organize and group components in PQSCADA Sapphire. Components can be assigned to multiple tags, and tags can be assigned to multiple components. This allows you to create a hierarchy of tags, which can be helpful for organizing your data and making it easier to find.

The Tags tab in PQSCADA Sapphire is divided into two sections:

The **left** section displays a list of enabled tags.

The **right** section displays the values of each of those tags when selected.



5.8.4.1 Tag tool bar

Add existing tags

To enable a tag, follow these steps:

1. Click **Add**  icon in the **Tags** toolbar to open the **Tag selection** window.
2. Mark the Tag checkboxes to enable.
3. Click **Add** to save and close the **Tag selection** window.
4. Click **Save** to apply the changes.

Cancel tags selection

To disable a tag, follow these steps:

1. Click the Tag you wish to disable.
2. Click the **Cancel**  icon in the Tags toolbar.
3. Click **Save** to apply the changes.

Delete a tag

To delete a tag, follow these steps:

1. Click the Tag you wish to disable.

2. Click the **Delete**  icon in the Tags toolbar.
3. Click **Save** to apply the changes.

5.8.4.2 Configure a Tag

The tag includes a Name, Description, and a list of values. The **tag values** can be either a closed list, editable by the system admin only, or an open list editable by any user.

Set the tag list as open/closed

The **tag values** can be either a closed list, editable by the system admin only, or an open list editable by any user.

1. Click the  icon next to the Tag name to expend the tag row.
2. Mark the **Enable adding values** checkbox.
3. Click **Save** to apply changes.

Add values to a tag

Each tag has its own values that can be added, canceled, or deleted.

1. Click the **Add**  icon in the **Values** toolbar. The Tag value addition window will pop-up.
2. Enter the new value in the text box.
3. Click **OK**.
4. Click **Save** to apply the changes.

5.8.4.3 Create Tag

PQSCADA allows the users to create new tags.

1. Click the **Add**  icon in the **Tags** toolbar to open the **Tag selection** window.
2. Click **Create tag** to display the **new tag configuration** data.
3. In the New tag configuration window, enter the following data:
   - **Name** – the name for the new tag.
   - **Description** – a description of the added tag.
4. Mark the checkbox to **Enable adding values**.
5. Type tag values in the text box and click **Add value**. They appear in the **Values field** and can be deleted by clicking the **Cancel**  icon.
6. Click **Add** to add the new tags to the tags list.
7. Click **Save** to apply changes.

5.8.4.4 Apply Tags to the Component Tree

1. Click on the **Open tree setting** button located on the splitter control.
2. Select the Instance to apply the Tags on.
3. Mark the **Show tags** checkbox to enable Tags.
4. Mark the Tags checkboxes you want to display in the **Components** tree. A list of the selected tags will be displayed in the bottom part of the **Server and component tree setting** pane. By default, the tag hierarchy is set according to the selection order.

5. To **filter tag** values, click on the expand icon ▾ next to the tag checkbox and uncheck the values to be filtered.
6. Drag and drop tags (up or down) in the Selected tag hierarchy section to change the tags hierarchy.

5.8.5 Line Diagram

Graphical representation that uses lines to depict the relationships or connections between various elements or data points.

Add line diagram

1. Click the **Add**  icon on the upper left corner of the Instance section.

   The Add line diagram window appears.
2. Click **Browse** to find the line diagram (AutoCAD DXF, DWG JPEG and PNG files).
3. Click **Upload**. The drawing is added.
4. Repeat to add more diagrams.

Delete a Line diagram

1. Click the Line diagram you wish to disable.
2. Click the **Delete**  icon in the Line diagram toolbar.
3. Click **Save** to apply the changes.

5.8.6 Secondary Servers (Enterprise edition only)

PQSCADA Sapphire allows the administrator to organize networked servers into a hierarchy. PQSCADA Sapphire servers are united into a master server – the secondary server hierarchy. Each PQSCADA Sapphire server can have more than one secondary server within a hierarchy. When the server gets to be secondary, it automatically inherits the configurations of the master.

5.8.6.1 Add Secondary Servers

1. Select the Secondary servers tab.
2. Click the **Add**  icon to open the **Add Server** configuration window.
3. In the Add Server configuration window, do the following:
   - **Server Address** – select the server URL. Click Scan to search for active servers on your network.
   - **Authentication** – select the authentication provider.
   - **Username** – enter the Admin username.
   - **Password** – enter the Admin password.
4. Click **Add**.

Remove a Secondary Server

1. Select the server you wish to remove from the **Secondary server's** table.
2. Click the **Delete**  icon to remove the secondary server.

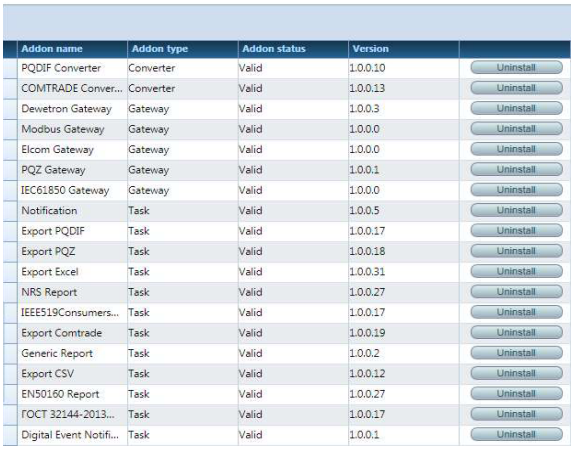
5.8.7 Add-ons

PQSCADA Sapphire is modular software enabling the user to extend the PQSCADA Sapphire capabilities to meet any application and/or requirement.

The PQSCADA Sapphire supports the following add-on extension types:

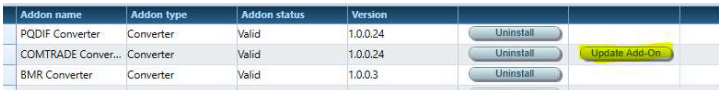
- **Gateway -** (Professional and Enterprise edition only): designed to extend PQSCADA Sapphire communication options. Modbus (standard and fast) and IEC 61850 gateways are already implemented and are part of the professional and enterprise edition package.
- **Converter** - designed to extend PQSCADA Sapphire importing options. COMTRADE and PQDIF converters (usually formats of non elspec's devices) are already implemented and are part of the PQSCADA Sapphire package for all editions.
- **Tasks** - designed to extend PQSCADA Sapphire's reporting, exporting, and controlling capabilities. Various tasks were already implemented, and part of the PQSCADA Sapphire package depends on the license edition.

The **Addons** tab displays a list of the installed add-ons in the Instance



Addon name	Addon type	Addon status	Version	
PQDIF Converter	Converter	Valid	1.0.0.10	Uninstall
COMTRADE Conver...	Converter	Valid	1.0.0.13	Uninstall
Dewetron Gateway	Gateway	Valid	1.0.0.3	Uninstall
Modbus Gateway	Gateway	Valid	1.0.0.0	Uninstall
Elcom Gateway	Gateway	Valid	1.0.0.0	Uninstall
PQZ Gateway	Gateway	Valid	1.0.0.1	Uninstall
IEC61850 Gateway	Gateway	Valid	1.0.0.0	Uninstall
Notification	Task	Valid	1.0.0.5	Uninstall
Export PQDIF	Task	Valid	1.0.0.17	Uninstall
Export PQZ	Task	Valid	1.0.0.18	Uninstall
Export Excel	Task	Valid	1.0.0.31	Uninstall
NRS Report	Task	Valid	1.0.0.27	Uninstall
IEEE519Consumers...	Task	Valid	1.0.0.17	Uninstall
Export Comtrade	Task	Valid	1.0.0.19	Uninstall
Generic Report	Task	Valid	1.0.0.2	Uninstall
Export CSV	Task	Valid	1.0.0.12	Uninstall
EN50160 Report	Task	Valid	1.0.0.27	Uninstall
ГОСТ 32144-2013...	Task	Valid	1.0.0.17	Uninstall
Digital Event Notifi...	Task	Valid	1.0.0.1	Uninstall

When a new addon version is available, PQSCADA automatically notifies the user.



Addon name	Addon type	Addon status	Version		
PQDIF Converter	Converter	Valid	1.0.0.24	Uninstall	
COMTRADE Conver...	Converter	Valid	1.0.0.24	Uninstall	Update Add-On
BMR Converter	Converter	Valid	1.0.0.3	Uninstall	

5.8.7.1 Install a New Add-On

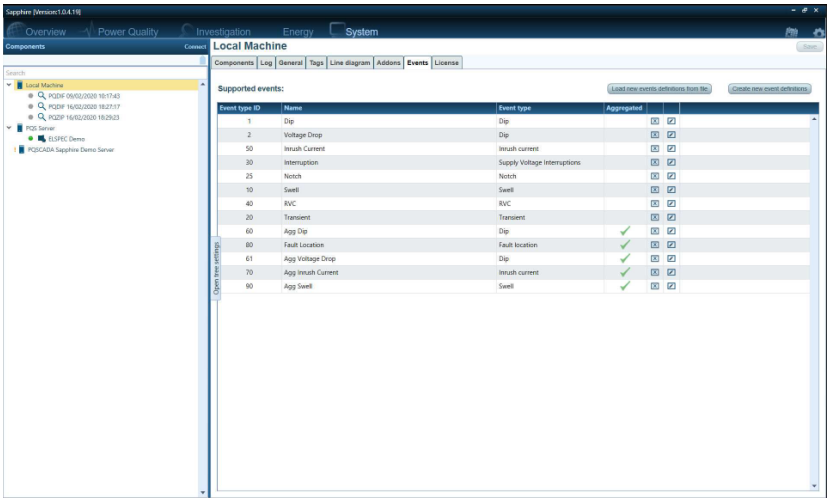
1. Click the **Install Addon** button in the upper right corner.
2. Click the **browse**  icon to open Windows Explorer.
3. Select the Addon installation files and wait for validation.
4. Click the **Install addon** to start the installation.
5. Click **Close** to close the Install add-on window.

To uninstall an Addon

1. Click the **Uninstall** button from the addons table.
2. Click **Yes** in the **Uninstall addon** pop-up window.
3. Click **Close** to close the Uninstall addon pop-up window.

5.8.8 Events

The Events tab displays a list of all the Supported events for the Instance.



- **Load new events definitions from file** – Load new events definitions from an XML file by clicking.
- **Create new event definitions** - new events can be created by clicking Create new event definitions to launch the **Create new event** wizard.
- When creating a new event, the event type can be defined as an **Aggregated** event that combines configurations (to combine up to 4 event types).

For the PQSCADA to present the aggregated events, the aggregated event must be calculated by the PQ server (for example, if you used dip & swell events to be aggregated, the dip and swell events must be calculated from the PQ server and NOT fetched from the device).

Note: To assign an event to a component, go to Events configuration under the Power Quality tab on the component configuration.

5.8.8.1 Create a New Dip Event

1. On the Event type page, select **Dip**.
2. Click **Next** to go to the Event configuration page.
3. On the Event configuration window, configure the following options:
   - **Event name** – type the event name.
   - **Reference (Nominal)** - refers to a standard or baseline value used as a point of comparison.
   - **User tag** – used to distinguish between events of the same type.
   - **Threshold [% of Ref]** – defines the trigger level limit that starts the event (percentages of the reference nominal).
   - **Hysteresis [% of Ref]** – defines the end event limit in the nominal percentage. End event limit = Thresholds + Hysteresis.
   - **Cancel [% of Ref]** – defines the limit in which an event will be canceled.
   - **Min. duration [ms]** – defines the time length (in milliseconds) a parameter may pass out of bounds without failing.
   - **Max. duration [ms]** – defines the maximum time allowed (in milliseconds) for an event to be active before it is canceled.
4. Click **Finish** to save changes.

Note: According to the configured feeder topology, a Dip event is automatically assigned to all voltage channels in the component.

5.8.8.2 Create a New Swell Event

1. On the Event type page, select **Swell**.
2. Click **Next** to go to the Event configuration page.
3. On the Event configuration window, configure the following options:
   - **Event name** – type the event name.
   - **Reference (Nominal)** - refers to a standard or baseline value used as a point of comparison.
   - **User tag** – used to distinguish between events of the same type.
   - **Threshold [% of Ref]** – defines the trigger level limit that starts the event (percentages of the reference nominal).
   - **Hysteresis [% of Ref]** – defines the end event limit in the nominal percentage. End event limit = Thresholds + Hysteresis.
   - **Cancel [% of Ref]** – defines the limit in which an event will be canceled.
   - **Min. duration [ms]** – defines the time length (in milliseconds) a parameter may pass out of bounds without failing.
   - **Max. duration [ms]** – defines the maximum time allowed (in milliseconds) for an event to be active before it is canceled.
4. Click **Finish** to save changes.

Note: According to the configured feeder topology, a Swell event is automatically assigned to all voltage channels in the component.

5.8.8.3 Create a New Supply Voltage Interruption Event

1. On the Event type page, select **Interruption**.
2. Click **Next** to go to the Event configuration page.
3. On the Event configuration window, configure the following options:
   - **Event name** – type the event name.
   - **Reference (Nominal)** - refers to a standard or baseline value used as a point of comparison.
   - **User tag** – used to distinguish between events of the same type.
   - **Threshold [% of Ref]** – defines the trigger level limit that starts the event (percentages of the reference nominal).
   - **Hysteresis [% of Ref]** – defines the end event limit in the nominal percentage. End event limit = Thresholds + Hysteresis.
   - **Cancel [% of Ref]** – defines the limit in which an event will be canceled
   - **Min. duration [ms]** – defines the time length (in milliseconds) a parameter may pass out of bounds without failing.
   - **Max. duration [ms]** – defines the maximum time allowed (in milliseconds) for an event to be active before it is canceled.
4. Click **Finish** to save changes.

Note: According to the configured feeder topology, an Interruption event is automatically assigned to all voltage channels in the component.

5.8.8.4 Create New RVC Event

1. On the Event type page, select **RVC**.
2. Click **Next** to go to the Event configuration page.
3. On the Event configuration window, configure the following options:
    - **Event name** – type the event name.
    - **Reference (Nominal)** - refers to a standard or baseline value used as a point of comparison.
    - **User tag** – used to distinguish between events of the same type.
    - **Threshold [% of Ref]** – An RMS voltage is in a steady-state condition if all 1/2 cycle 100/120 RMS values (50/60 Hz respectively) remain within the RVC threshold from the average of those 100/120 RMS values. The RVC threshold is set by the user as a percentage of Nominal.
    - **End Threshold [% of Ref]** – define the end event limit.
    - **Cancel Dip [% of Ref]** – defines the lower limit to cancel an event.
    - **Cancel Swell [% of Ref]** – defines the upper limit to cancel an event.
    - **Delta steady-state [%]** – define the maximum allowed difference between two steady-state conditions. Leave 0 to disable this condition.

If there isn't any change for 100 cycles the event ends.

4. Click **Finish** to save changes.

Note: RVC event is automatically assigned to all voltage channels in the components according to the configured feeder topology.

5.8.8.5 Create a New Transient event

1. On the Event type page, select **Transient**.
2. Click **Next** to go to the Event configuration page.
3. On the Event configuration window, configure the following options:
    - **Transient type** – select Transient or Notch.
    - **Event name** – type the event name here.
    - **Reference (Nominal)** - refers to a standard or baseline value used as a point of comparison.
    - **User tag** – user tag is used to distinguish between events of the same type.
    - **Envelope [% of Ref]** – Transient event triggered when the measured waveform crosses a virtual envelope. Envelope size is defined in percentage from the nominal waveform peak.
    - **Max duration [ms]** – defines the maximum time allowed (in milliseconds) for an event to be active before it is canceled.
4. Click **Finish** to save changes.

Note: The Transient event is automatically assigned to all voltage channels in the components according to the configured feeder topology.

5.8.8.6 Create a new Custom Event

1. On the Event type page, select **Custom event**.
2. Click **Next** to go to the General page.
3. On the **General page**, configure the following options:
   - **Event name**
   - **User tag**
   - **Min duration [ms]** – defines the time length (in milliseconds) a parameter may pass out of bounds without failing.
   - **Max duration [ms]** - defines the maximum time allowed (in milliseconds) for an event to be active before it is canceled.
4. Click **Next** to go to the Activate page.
5. On the **Activate page**, do the following:
   - Parameter selection - Click the **Parameter A** button. The **Select parameter** window opens. Select a **Parameter**.
   - **Operator** - Select an operator from the dropdown list, a **number**, **% or +** from the dropdown menu.
   - Reference - Select **Nominal**, **Previous sample (H. cycle),** or **Average.**
   - **Min duration** – defines the time length (in milliseconds) a parameter may pass out of bounds without failing.
   - **Number of samples for average reference -** represents the count of the sample set considered when determining the average reference.
6. Click **Next** to open the Deactivate page.
7. On the **Deactivate page**, repeat the steps as on the Activate page.
8. Click **Next** to open the Cancel page.
9. On the **Cancel** page, either mark the **Enable cancelation** checkbox and enter values as in the above or leave it unchecked to disable cancelation.
10. Click **Finish** to save changes.

5.8.8.7 Create an Aggregated Event

1. On the Event type page, select **Aggregated event**.
2. Click **Next** to go to the Aggregated event configuration page.
3. On the Event configuration window, configure the following options:
   - **Event name** – type a name for the event.
   - Select the Logic operator between events (And/Not/Or).
   - Select the event type from the dropdown list.
4. Mark if to **Match groups**.

The selected power topology rules the usage of phase-to-neutral or phase-to-phase parameters. Therefore, if not checked, an event will be triggered, for example, when there is a dip on V1N and swell in V12 (differential channel). When **Match groups** are marked, it will trigger an event only when the configured events are from the same topology group (V12, V23, V31, or V1N, V2N, V3N).

5. Click **Finish** to save changes.

5.8.8.8 Create an Oscillation Event

Refers to a phenomenon characterized by repeated back-and-forth movements or fluctuations around a central point.

5.8.9 License

- **License type** – can be Express, Professional or Enterprise
- **Maintenance status** – display maintenance expiration date
- **Number of concurrent users** - number of people who can actively connect to the server at the same time.
- **Number of Elspec component** – number of allowed Elspec component
- **Number of Non Elspec component** – number of allowed Non Elspec component.
- **Update license** – pressing on this link will open the upgrade license wizard.
- **Deactivate license** – pressing on this link will open the deactivate license wizard.

5.8.10 Server Communication (Enterprise edition only)

Displays the Protocol type and port. For the https protocol, it also displays the Certificate.

- **HTTP** – for unsecured communication. By default, the PQSCADA Sapphire service binds to port 80. If port 80 is already in use, the service automatically falls back to port 8080 and then to port 8081. The port can be manually configured in the HTTP port field.
- **HTTPS** – for secure communication. By default, the PQSCADA Sapphire service binds to port 443. If port 443 is already in use, the port can be manually configured in the HTTPS port field. A valid certificate must be installed on the server machine and selected in the Certificate field.
- **Certificate -** digital document that verifies the authenticity and integrity of something or someone. It is issued by a trusted authority, known as a Certificate Authority (CA), and contains information such as the name of the entity or individual being certified, a unique identification number, and a digital signature.

Approved certificates table

Table containing approved non-trusted certificates.

- **Add certificate –** user will have the ability to add certificates.
- **Delete certificate –** user will have the ability to delete certificates.
- **Clean certificate -** clear all certificates from the table.
- **Clean SSH fingerprints -** remove SSH fingerprints.

SSH fingerprints are cryptographic keys used for secure communication with SFTP servers, whether they are Pure or G5 servers.

5.8.11 E-mail Configuration (Enterprise edition only)

1. Enter the following configurations according to your SMTP server:
   - **SMTP gateway** – enter the SMTP server hostname or IP address.
   - **SMTP port** – enter the SMTP server port.

   If the SMTP server requires authentication:
   - **Username** – the email username.
   - **Password** – the email password.
   - **From** – email source (example: John@yourdomain.com).
   - **Enable SSL** – mark if your SMTP server requires encryption.
   - **Allow attachments** – mark to allow PQSCADA to attach files to emails.
2. Enter an **email address** and click **Test email configuration**.
3. Click **Save** to apply changes.

5.8.12 SMS Configuration (Enterprise edition only)

1. Enter the following configuration according to your modem:
   - **Modem port** – the serial com port to which your modem is connected.
   - **Baud rate** – the Baud rate supported by your modem.
   - **Data bits** – the number of bits per one character of data supported by your modem.
   - **Parity** – the number of check bits supported by your modem.
   - **Stop bits** – specify the number of bits used to indicate the end of data transmission.
   - **Flow control** – the flow control supported by your modem.
   - **Send attempts** – number of times PQSCADA Sapphire will send the SMS before failure.
2. Enter a **phone number** and click **Test SMS configurations**.
3. Click **Save** to apply changes.

5.8.13 Logged-On Users (Enterprise edition only)

Displays a list of currently logged-on users.

- **Delete current sessions** - terminates the current session that a user has established with the server.

5.8.14 User Credentials (Enterprise edition only)

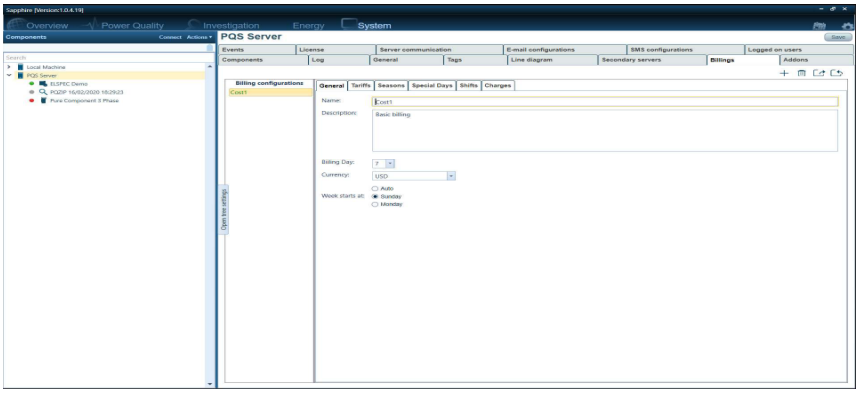
- **Reset password** - Allows PQSCADA users to change their passwords (in case the option to reset password is added to his user profile).

The user credentials screen will include three fields:

- New password
- Confirm new password
- Old password

5.8.15. Billings

The Billing tab enables adding and configuring different electricity consumption billing methods and charges for use by the PQSCADA Energy module.



To add a new billing

1. Click the **Add new Billing** + icon.
2. Give a **Name** to the added billing in the TOU Configuration Name pop-up.
3. Added billings are displayed in the **Billing configurations** pane.

5.8.15.1. General

1. If required, modify the billing **Name**.
2. Add a **Description**.
3. Select the **Billing Day** of the month from the dropdown list (1–28).
4. Select the **Currency** from the dropdown list.
5. Select the **Week start at** to select the day the week starts.
    a. **Auto** – week start at will be according to client settings.

5.8.15.2. Tariffs

Different tariffs can be configured for a single billing configuration. The tariffs can include past/future Tariff changes.

1. Give the tariff a **Name**.
2. Select the **Units** ($ or %).
3. Select the **Color** for the tariff.
4. Select the **Start date**. The end time is indefinite.
5. Type the value (price) for the **Tariff**.
6. Click the **Add** + icon within the created tariff to add more tariffs under the same Tariff name (different Start date and/or Tariff).
7. Click the **Add** + icon of the Tariff tab to add and configure more tariffs with different names.
8. To delete a tariff, click the **Delete** icon (in the tariff or the Tariffs tab).

5.8.15.3. Seasons

1. Give a Name for the season.
2. Configure the Start Day by selecting the day and month or by defining the starting day.
3. Configure the End Day by selecting the day and month or by defining the last day.
4. Click the **Add**  icon to add and configure more seasons.

To delete a created season, select it and click the **Delete**  icon.

5.8.15.4. Special Days

1. Give a Name for the special days.
2. Configure the Start Day and the End Day for the special days. The days can be configured by date (day and month) or by selecting an appearance (First/Second/Third/Fourth/Last) of a day in a month.
3. Click the **Add**  icon to add more special days.

To delete a created special day, select it and click the **Delete**  icon.

5.8.15.5. Shifts

1. Click the **Add**  icon to add shifts (note that their total duration cannot exceed 24 hours).
2. Configure the Shifts (**Name**, **Start** time, **Duration**, and **Color**).

   Edit the shift duration before editing its Start time.
4. Click the **Add**  icon to add more shifts.

To delete a created shift, select the shift and click the **Delete**  icon.

5.8.15.6. Charges

1. Click the expand icon to show the fields to edit.
2. Give a Name to the charges.
3. Select the **Charge Type** from the dropdown list. The parameters and fields change according to the selected Charge Type.

5.8.15.6.1. Consumption

Charges are based on energy consumption.

1. Select the **Units** from the dropdown list.
2. Select the **Calculation method** from the dropdown list:
   - **TOU** – Time of Use. This is a rate plan in which rates vary according to the time of day, season, and day type (weekday or weekend/holiday). Higher rates are charged during the peak demand hours, and lower rates during off-peak (low) demand hours. This rate structure provides price signals to energy users to shift energy use from peak hours to off-peak hours. The example below shows the pricing for an illustrative time-of-use rate plan. Red indicates high price periods (On-Peak), yellow indicates moderate price periods (Mid-Peak), and green indicates low price periods (Off Peak).

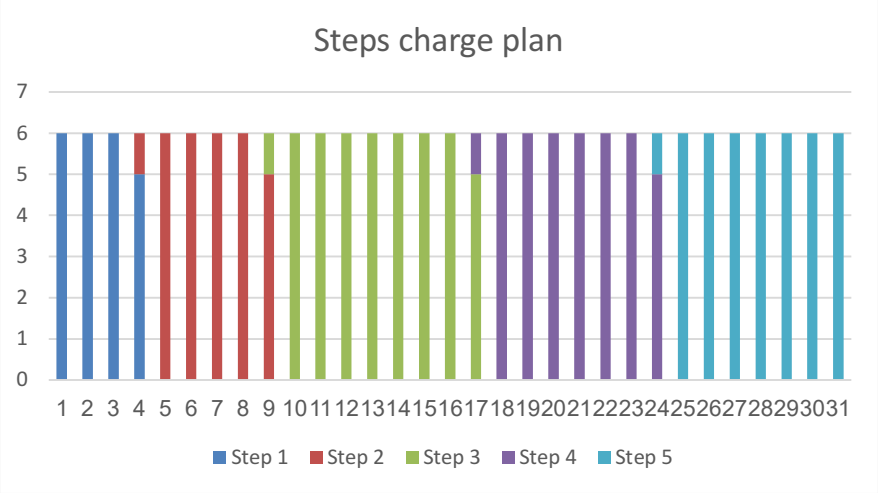
Time of day	Weekdays	Weekends	Special days\ Holydays
00:00 – 06:00	Off-Peak	Off-Peak	Off-Peak
06:00 – 17:00	Mid-peak	Off-Peak	Off-Peak
17:00 – 21:00	On-Peak	Off-Peak	Off-Peak
21:00 – 00:00	Mid-peak	Off-Peak	Off-Peak

3. Add **Seasons** (see section 0):
   a. Select the **Season** from the dropdown list (see section 0).
   b. Select the **Week Structure** from the dropdown list.
   c. Double-clicking a Week Structure opens a floating window to **Add a New Day Structure** (**Start** time and **Tariff** from the dropdown list), with the option to save as a template.
4. Add **Special day**s from the dropdown list (see section 0).
   a. Double-clicking a Week Structure opens a floating window to **Add a New Day Structure** (**Start** time and **Tariff** from the dropdown list), with the option to save as a template.
   b. **Steps** – This is a rate plan in which rates vary according to predetermined consumption steps. When using only the Steps rate plan, there is no need to define Seasons, Special days, and Shifts.
      - Edit the first step (**From**, **To**) and select the **Tariff** (created in the Tariffs tab, see section 0) for the step.
      - Click the **Add** icon to add more steps.

To delete a created step, select it and click the **Delete** icon.

- The created Steps can be saved as a template by clicking the **Save as template** icon.

- The example below shows the pricing for an illustrative Steps rate plan.
- Each step represents the measured kWh in the precondition rate limits. The 1st step represents the charge price for each kWh between 0–23, 2nd for each kWh between 23–53, 3rd for each kWh between 53–101, 4th for each kWh between 101–143, and the 5th for each kWh from 143 to 186.



5.8.15.6.2. Demand

Charges are applied to the electric bills of commercial and industrial customers based on the highest amount of power demand during any (typically 15-minute) interval during the billing period.

1. Select the **Units** from the dropdown list.
2. Select the **Demand Calculation**- Current.
3. Edit the first step (**From**, **To**) and select the **Tariff** (created in the Tariffs tab, see section 0) for the step.
4. Click the **Add**  icon to add more steps.

To delete a created step, select it and click the **Delete**  icon.

The created Steps can be saved as a template by clicking the **Save as template**  icon.

5.8.15.6.3. Fix

A type of charge. The Fix charge type can be used as a monthly "subscription fee" or can be used to create a refund or any other type of fixed value charge.

1. Select a **Tariff** from the dropdown list (see section 0).
2. Select the **Demand calculation** duration (**Day**, **Month**) for the fixed cost.

5.8.15.6.4. Tax

A type of charge that is usually added to one of the above rate plans. With this charge, you can add the required taxes to the billing (e.g., VAT).

Select a **Tariff** from the dropdown list (see section 0).

5.8.15.6.5. Penalties

A type of charge that is usually added to one of the above rate plans as a penalty if the set charge values are exceeded.

1. Select the Penalty parameter from the dropdown list.

   Consumption

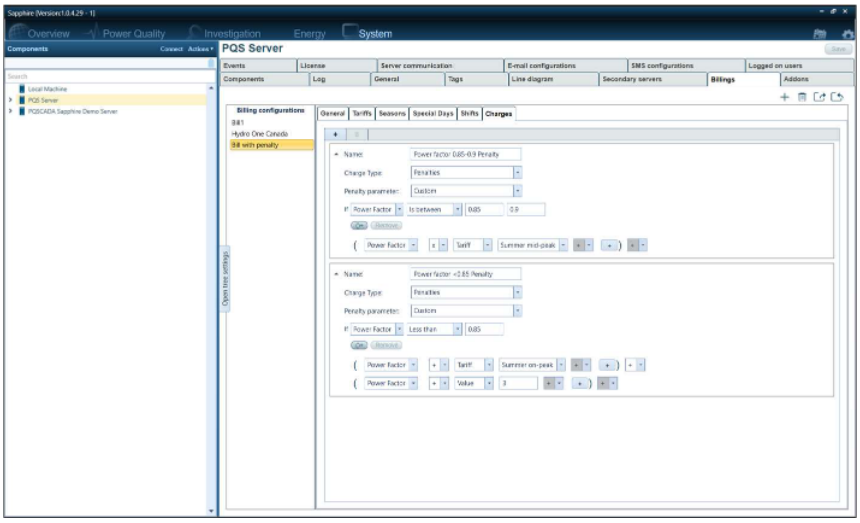
   - Select the **Units** from the dropdown list.
   - Select a **Tariff** from the dropdown list (see section 0)
   - Define the consumption **From** and **to** values.

   Demand

   - Select the **Units** from the dropdown list.
   - Select a **Tariff** from the dropdown list (see section 0)
   - Define the consumption **From** and **to** values.

   Custom

   - Define the logic and formula for a custom penalty.



   - Formulas can be extended by clicking the **bracket** ()+ icon.
   - To remove the formula extension, either right-click the extension line and click **Remove** or click the line and click the **Remove** Remove button.

5.8.15.6.6. Add Charges

Click the **Add** + icon to add and configure additional Charges.

5.8.15.7. Export and Import Billings

Created billings can be exported and imported.

- To export a billing, click the **Export Billing**  icon. The browser opens to select the name and location for saving the exported billing.
- To import a billing, click the **Import Billing**  icon. The browser opens to select the billing to import.

5.8.14.1 Remove Billings

1. Select the Billing configuration to delete.
2. Click the **Remove Billing**  icon.

5.9. Component Configuration

A Component is a logical representation of a physical device – a set of configuration parameters that are defined in two XML files:

- **Common** – set of configurations that apply to all component types (e.g., component name).
- **Specific** – set of configurations that apply to a specific component type (e.g., a device IP address, which is a specific configuration parameter for components that support LAN communication).

The configuration parameters are connected to a component configuration tab in the PQSCADA Sapphire (e.g., General, Data acquisition and processing, etc.). Therefore, different component types include different configuration parameters and different configuration tabs.

To view/modify the components configuration, click on the component object in the **Components** tree. The available configuration tabs are based on the component type and on user authentication.

5.9.1. Component

Refer to Section 5.8.1 for additional instructions.

5.9.2. Log

Refer to Section 5.8.2 for additional instructions.

5.9.3. General

The Component General tab includes editable fields and informative fields. The available fields vary according to the component.

- **Component type** – informative only.
- **Name** – the component name. By default, the investigation component name is set as the date & time of the component creation.
- **ID** – each component has a unique ID provided by PQSCADA Sapphire (Informative only).
- **Use custom time zone** – mark the checkbox to select a time zone from the dropdown list. The default time is that of the operating system.
- **Geographic coordinates** – enter the geographic coordinates for the correct display on the map.
- **Product name** – the name of the product (informative only).
- **Product serial** – product serial no. of the physical device (Informative only).
- **Site name** – the name of the site (informative only).
- **HW version** – HW version of the physical device (Informative only).
- **Firmware version -** SW version of the physical device (Informative only).
- **Product version** – product version of the physical device (Informative only).
- **Site description** – a description of the site (Informative only).
- **Operator name** – the name of the operator (Informative only).
- **Company name** – the name of the company (Informative only).
- **Calibration date** – specific date when the device was calibrated (Informative only).
- **Reboot the device** – Some devices can be rebooted manually.

- Additional informative fields may be presented, depending on component type.

5.9.4. Data Acquisition and Processing

Data can be acquired by downloading files, streaming data, or all the above. For example, acquiring data from G4K devices is possible by downloading PQZIP files using FTP and streaming real-time data by MODBUS.

The following description is for the BlackBox Fix G4 component type, ensuring most of the options in the Data acquisition and processing tab are fully explored; however, the available parameters and fields depend on the component type.

5.9.4.1. Data acquisition

- **Enable data acquisition** – mark the Enable data acquisition checkbox to enable file downloading.
- **Device IP/Address** – Enter the IP address of the device from which you want to acquire data. You can also click on the "Scan" button to search for other devices on your network.
- **File fetch type** – Select the protocol that will be used for file fetching. This determines how the data files (such as Comtrade, PQZ, PQDIF, etc.) will be downloaded. Additionally, there is a "Data fetch" option, which allows downloading summaries (calculated data) directly from the unit without the need for PQSCADA to perform calculations. This method is faster and saves the data to the database as summaries.
- **File source download directory path** – This option specifies the path to the folder where the data files are located. By default, the path is set to the default path of the selected device. For example, for the G4K device, the default path is "/CF_UPMB/PQZIPDATA_".
    -

5.9.4.2. File fetch configurations

- **FTP port** – the FTP port for downloading files from the instrument.
- **FTP username** – the FTP site username for downloading files from the instrument.
- **FTP password** – the FTP site password for downloading files from the instrument.
- **Test** – click the **Test** button to verify the File fetch connection to the device.

Limit download period:

Refers to a specified time duration which a file can be downloaded. Use these settings to limit the downloaded data to a specific time range:

- Mark the **Start time** box and enter the date & time to exclude data from the previous date. If it is not defined, the component will pull all the data from the device, from the oldest to the newest, and will continue pulling every newly generated file.
- Mark the **End time** box and enter the date & time to exclude data from a later date.

Download schedule:

Mark the **Enable schedule** to select days and **Start time**/**End time** for configuring when file download should occur.

5.9.4.3. Data fetch configurations

- **Data fetch type** – can be selected between http/https**.**
- **Username** – the site username for reading data from the instrument.
- **Password** – the site password for reading data from the instrument.
- **PQZ port** – the port for reading data from the instrument.
- **Test** – click the **Test** button to verify the data fetch connection to the device.

- **Gateway** – the gateway method is defined in the component XML configuration file and is presented as information. The gateway communication for G4K devices is Modbus or Json. Therefore, Port, Slave ID, and Modbus mapping need to be configured. For G5DFR and PureBB components, the gateway is PQZ, and the username and password need to be configured.

Modbus configurations:

Refer to the settings and parameters used to establish communication between devices using the Modbus protocol.

- **Modbus mapping** – XML files that are used for mapping data. These mapping XML files contain configurations that define the conversion of data.
- **Modbus port** – specific communication port used for transmitting Modbus protocol-based messages.
- **Slave ID** – refers to a unique identifier assigned to a slave device on a Modbus network.
- **Registers bits number in FC4** – used for reading input registers.
- **Registers bits number in FC3** – used for reading input registers.
- **High byte/Low byte** – The high byte refers to the most significant byte in a multi-byte value, while the low byte refers to the least significant byte.
- **High word/Low word** - The high word refers to the most significant word in a multi-word value, while the low word refers to the least significant word.

5.9.4.4. Advanced settings

- **Fetch files every (min)** – set the file fetching period.
- **Fetch historical data every (min) -** set the historical data fetching period.
- **Fetch events every (min) -** set the events fetching period.
- **Override existing database records with the newest data** – new data fetched to a component overrides existing data. Uncheck to discard new data with overlapping timestamps with existing data in the database.
- **Allow files download while scanning with multiple FTP connections** – if multiple FTP connections are available, check to allow scanning and download simultaneously.
- **Fetch unit configuration every (min) –** allows you to specify the interval at which the component will check for new configurations and update itself.
- **Data availability type -** select how to calculate the data availability on binary or historical.

Website configurations (only for G4K):

- **Website username** – the username to access the device's web UI.
- **Website password** – the password to access the device's web UI.
- **Website port** – the port to access the device's web UI.

Save files to backup folder:

Refers to storing files to a designated folder specifically created for backup purposes.

- **Backup files directory path** - specific location where backup files are stored.
    - **Validate the backup folder** – verifies the integrity of folder path.
- **Backup directory max size in MB** - refers to the maximum allowed storage capacity or size limit for a backup directory. When reaches max size, truncate mode is ON.

Download mode (Only for G4K):

- **All data** - to download all compressed PQZIP files when available.
- **Only events** that will be “pushed” when occurring. In this mode, the data availability will be faster and not when the file is scheduled to be closed and scanned by the PQSCADA component.

PMU configurations:

Refer to the settings and parameters that are defined for a Phasor Measurement Unit (PMU). PMUs are devices used in power systems to measure and monitor electrical quantities such as voltage, current, and phase angles with high accuracy and precision. PMU configurations involve specifying various parameters to tailor the behavior and functionality of the PMU according to specific requirements.

- **Send device command** – refers to the action of transmitting a specific command to the PMU device from a control or management system. This command is used to trigger a particular action or operation on the PMU.
- **PMU ID code** – refers to the identification code assigned to a PMU. It is a unique identifier that distinguishes a particular PMU from others in a network or system.
- **Config protocol** – defines the configuration protocol used for setting up or modifying the settings and parameters of a device or system.
- **Config port** – communication port dedicated to configuring or modifying the settings and parameters.
- **Data protocol** – defines the protocols and specifications for exchanging data.
- **Data port** – port that is used for transmitting or receiving data.
- **Frame rate** - refers to the frequency at which frames are displayed or captured.

Note: component and device configurations MUST be identical.

5.9.4.5. Firmware upgrade and configuration update

Settings for users with many similar units. The PQSCADA allows creating an upgrade/configuration task to upgrade/configure all units by a single task. The following parameters enable the user to set the details of the firmware/configuration files.

- Firmware upgrade IP
- Firmware upgrade port
- Firmware upgrade path
- Firmware upgrade username
- Firmware upgrade password
- Configuration update IP
- Configuration update port
- Configuration update path
- Configuration update username
- Configuration update password

5.9.4.6. Data Processing

- **Enable file process** – mark the checkbox to enable the processing and storage of binary data.
- **Enable historical data calculation** – mark the checkbox to enable the calculation of summary data.
- **Firmware upgrade connection type** – select the connection type for upgrading the component firmware.
- **Save configuration files** – See section 5.9.8.4.

5.9.5. Power Quality

The Power quality tab includes four sections that are displayed as a horizontal stackable list with expand/collapse functionality. The sections define the **Compliance**, **Events**, **Parameters**, and **Energy** to be calculated and stored as part of the acquisition process (see section 5.9.4 above). Note that calculating can extend the processing time.

Selecting a section expands the view showing the content within.

5.9.5.1. Compliance

The compliance section has two columns: **Recalculate** and **Compliance**. The Compliance column includes a list of supported compliance standards (see Appendix A for reference).

1. Mark the compliance you want to apply to the component (more than one can be marked).
2. Mark **Recalculate** if you want the Instance to recalculate the data for the selected compliance (it may take a while).
3. Click **Save** on the top right of the screen to apply changes.

When marking **Recalculate**, the **Save configuration** window will pop-up. Under the save configuration window, do the following:

- Select the **Start time** for the recalculation.
- Select the **End time** for the recalculation, and click **Save**.
- To prioritize the recalculation over the acquisition process, mark the **Stop Current calculation** checkbox.
- **Ignore fetch from device** - When checking the new feature's checkbox and parameter's recalculation checkbox, all parameters base that are selected as 'Calculated by device' will be calculated by PQ server without the need to manually change them.

Parameters (e.g., voltage RMS) and events (e.g., dip) required for the compliance process will automatically be selected in the Parameters and Events sections and highlighted in yellow.

5.9.5.2. Events

The Event section displays a list of events preconfigured in the Instance Events tab (see section 5.8.8). Events are acquired by PQSCADA Sapphire in one of the following modes:

- **Fetch from device** – PQSCADA Sapphire acquires the events logs directly from the device.
- **Calculate by PQS server** – PQSCADA detects and logs the events from the stored historical data. The events logs are additionally acquired directly from the device.

Events highlighted in yellow are required by the selected compliance standard.

1. Select the logging **Mode** for each of the listed events.
2. Check **Recalculate** if you want the Instance to recalculate the event detection. This applies to events in **Calculate by PQS server** mode.

If recalculation is not selected, the component will calculate the event only on the newly received data.

3. Click **Save** to apply changes.
    - If the **Recalculate** checkbox is marked, the save configuration window will pop-up. Under the save configuration window, do the following:
        - Select the **Start time** for the recalculation.
        - Select the **End time** for the recalculation.

- To prioritize the recalculation over the acquisition process, mark the **Stop Current calculation** checkbox.
- **Ignore fetch from device** - When checking the new feature's checkbox and parameter's recalculation checkbox, all parameters base that are selected as 'Calculated by device' will be calculated by PQ server without the need to manually change them.

5.9.5.3. Parameters

The Parameters section displays a table with a list of parameters Group and their supported resolutions.

RMS, for example, refers to all RMS data from all channels, voltage, and/or current. Parameter Group can support multiple resolutions, such as 1/2 cycle, 10/12 cycles, 150/180 cycles, etc.

This section only applies to the Summary data (see Appendix C.1).

Parameters highlighted in yellow are required by the selected compliance standard and cannot be disabled.

Note: In most cases, the default calculated parameters are used. When a specific parameter that its calculation is not enabled by default is needed, the user can enable its calculation. Enabling all parameters will overload the system, and the processing might take an extremely long time.

1. Select the operation mode for the required cell in the table according to the component type. The options may vary:
   - **Calculate historical data by Instance** – the instance will calculate and store summary data based on the stored binary data.
   - **Calculated by device** – Summary data is fetched from the file.
   - **Fetch historical from device** – Summary data will be fetched directly from the device using the component gateway.
   - **Fetch instance from device** –PQSCADA Sapphire will fetch real-time high-resolution data from the device using the component gateway. Summary data will be calculated by PQSCADA Sapphire. For example, PQSCADA Sapphire will fetch RMS V1 at a 1-second resolution as Instance data and will calculate and store summaries every 1 minute.
   - **Receive report from device** – acquire data using the report option of the IEC61850 protocol.
   - **Do not calculate** – PQSCADA Sapphire will not calculate nor fetch any summary data.
   - **Do not calculate and delete** – PQSCADA Sapphire will not calculate summaries for future data and will delete summaries stored in the database.
2. Check **Recalculate** if you want the instance to recalculate a parameter.
3. Click **Save** to apply changes.
4. If **recalculate** was marked, the save configuration window will pop-up. Under the save configuration window, do the following:
   - Select the **Start time** for the recalculation.
   - Select the **End time** for the recalculation.

   To prioritize the recalculation over the acquisition process, mark the **start recalculation and discard the data in the processing phase** checkbox.

5.9.5.4. Energy

Some system modules use the load current demand (for example, to define the allowed harmonics limits within the IEEE519 power quality report).

The load current is calculated as the current flow during the peak demand during the month. The value that is used will be the maximum value from the last 12 readings (so it is basically calculated over 12 months).

The Energy section enables setting the Maximum demand load current calculation type. Select the method from the dropdown list:

- **Auto** – when selecting Auto, mark according to what the calculation should be performed: By Total or by phase.

  The system will use this calculation method when the last 12-months data is available; else, it will adjust itself to provide the value from the available data (less than 12 months).

- **Manual** – when selecting Manual, enter a value in the Demand load current value field.

Using the manual option allows the user to manually set a constant value so the system will not calculate it.

5.9.6. Database

The Database tab includes the following configurations:

- **DB type** – display the DB type of the instance.
- **DB URL** – display the DB URL of the instance.
- **DB limit size (Mb)** – refers to the maximum allowable capacity of a database.
- **DB limit data duration (days)** – refers to the maximum period for which data can be stored in a database.

Note: When the Database limit size or duration is exceeded in PQSCADA Sapphire, a data management mechanism called "Truncate" is activated. This mechanism automatically removes old data from the database to make space for new incoming data. The process involves the deletion of older data records, allowing the database to maintain a manageable size and prevent it from reaching its capacity limit.

5.9.7. Tags

The tags tab lists the enabled tags of the instance (see section 5.8.4).

Select the tag(s) from the dropdown list(s).

5.9.8. Unit Configuration

The Unit configuration tab organizes the Channel Configuration mapping for a component with waveform data. It consists of three sections: **Physical channels**, **Auxiliary channels**, and **Virtual channels**. These sections are displayed as a stacked list that can be expanded or hidden. Clicking on a section reveals its content. Additionally, **Time sync configurations** are available for G5DFR and pure devices.

Time sync configurations:

- **Device time (UTC) –** Display device current time in UTC0.
- **Clock source –** Display the device current time sync.
- **SNTP 1\2 –** Insert the IP of the NTP server.
- **Signal strength –** Display the current time quality of the time sync.
- **Sync with OS (only for SELF) –** by pressing on this button instrument time will be synchronized according to operating system (OS) of the computer.

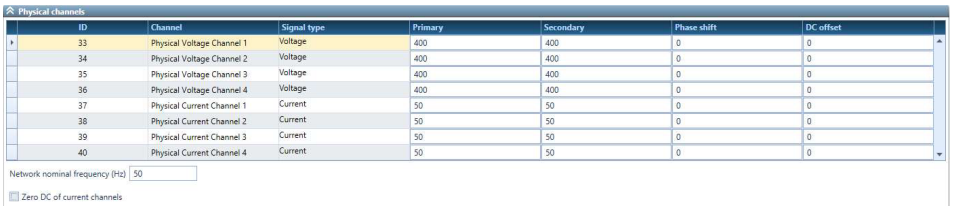
Unit configuration tab has two states:

- **Synchronize with component (Default state) -** PQSCADA Sapphire imports the channel mapping configuration from the physical device. The data in the sections is informative only.
- **Unsynchronized with component -** PQSCADA Sapphire ignores the channel mapping of the physical device. This state is used to fix or modify misconfigurations and incorrect connections as a post-process.

5.9.8.1. Physical Channels

A measurement device typically has multiple physical channels, each designated for a specific type of signal or measurement.

On the bottom is the Nominal frequency (Hz) and Zero DC of current channels configurations.

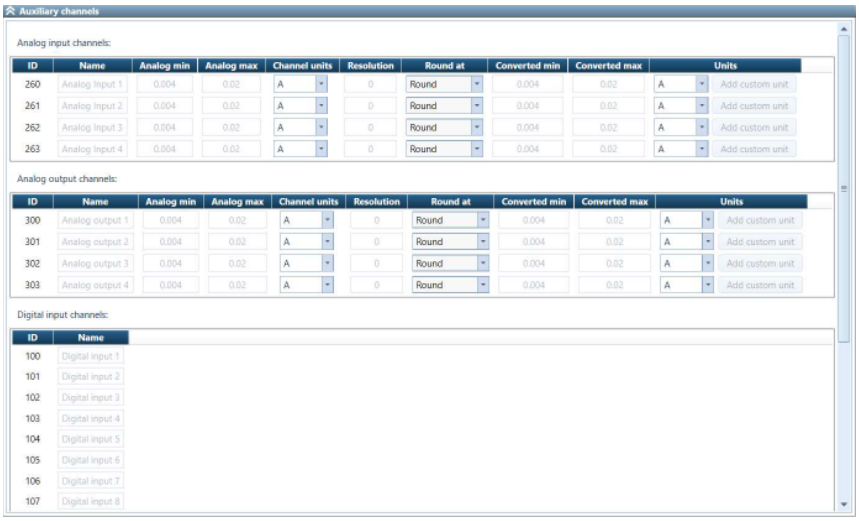


Note: Physical channels store the waveform data as recorded by the physical device.

- **Channel** – displays the name of the physical channel.
- **Signal type** – the signal type of the physical channel (e.g., voltage, current).
- **Primary** – the primary value (mainly for transformers).
- **Secondary** – the secondary measured value (mainly for transformers).
- **Phase shift** – enter a value if a shift in the waveform is required.
- **DC offset** – enter a value isf a DC offset in the waveform is required.
- **Network nominal frequency** - refers to the standard or expected frequency at which an electrical power network operates.
- **Zero DC of current channels (G3500\G4500)** - Zero the DC component in I1, I2, I3 and IN when importing PQzip files.

5.9.8.2. Auxiliary Channels

The Auxiliary channels section in PQSCADA Sapphire provides a list of device auxiliary channels and their properties. It supports five types of auxiliary channels: Analog input, Analog output, Digital input, Digital output, and Relay.



Analog input and output channels:

- **ID** – displays the channel ID number.
- **Name** – the new channel name.
- **Analog min.** – the minimum value of the analog input (e.g., 4 mA).
- **Analog max.** – the maximum value of the analog input (e.g., 20 mA).
- **Channel units** – select the units to display the measurement. This combo box contains a list of optional units (e.g., Hz, °C, etc.).
- **Resolution** – used for user parameters. For example, if the converted min & max defines 0–60 Celsius (temperature) and the user sets a resolution of 60, the Y-axis will have steps of 1C and if the set resolution is set to 120, the steps on the Y-axis will be 0.5.
- **Round at** – for rounding the measured value (Round/Round up).
- **Converted min.** – select the value to display when the reading is equal to the analog min value.
- **Converted max.** – select the value to display when the reading is equal to the analog max value.
- **Units** – click on Add custom unit and enter the new unit type.

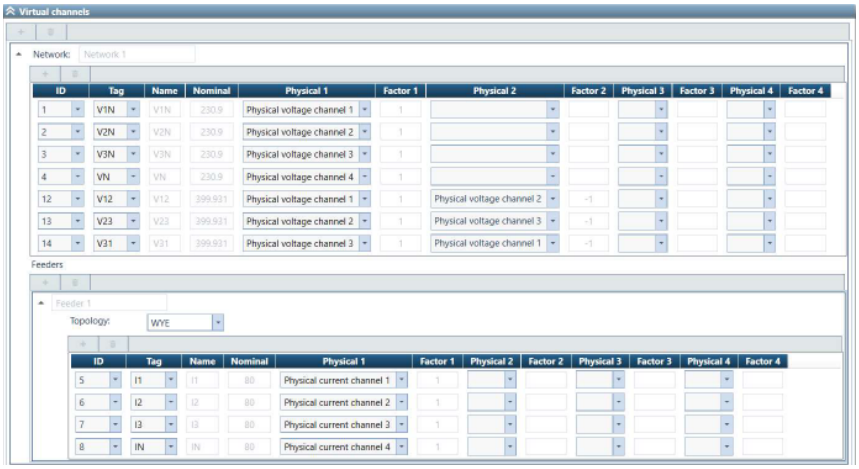
Digital input, output, and Relay channels

- **ID** – displays the channel ID number.
- **Name** – the new channel name.

5.9.8.3. Virtual Channels

This section is used to map physical channels to power topologies.

For an explanation about loads and connection types, see Appendix B. Appendix B



The power topology elements are:

Network

The network properties encompass voltage, virtual channels, and feeders. A network is formed by combining multiple feeders that share a common voltage denominator. This means that the voltage remains consistent across all lines within the network.

- **Add network** – Up to 5 networks are allowed.
- **Delete network** – All associated Voltage and Current channels should be deleted to remove a network.

Voltage channels

- **ID** – Unique identifier of a channel, editable.
- **Tag** – used for classifying the virtual channel to a specific phase.
- **Name** – Channel descriptive name.
- **Nominal** - Refers to the standard or expected value at which an electrical power network operates.

Feeder

The feeder properties include current, virtual channels, and power topology. Each feeder represents a specific electrical line or circuit within the network. The feeder properties provide information about the current flowing through the feeder, virtual channels associated with it, and the power topology configuration.

- **Topology** – hierarchical power mapping.
- **Add feeder** – Up to 5 feeders are allowed.
- **Delete feeder** – All associated Current channels should be deleted to remove a feeder.

Current channels

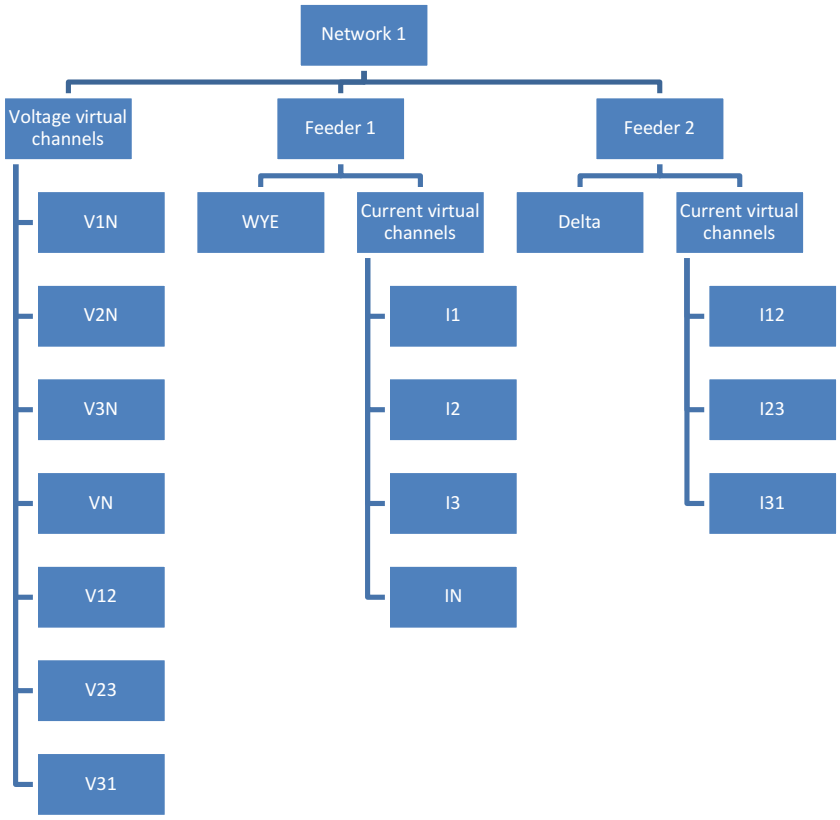
- **ID** – Unique identifier of a channel, editable.
- **Tag** – used for classifying the virtual channel to a specific phase.
- **Name** – Channel descriptive name.
- **Nominal** - Refers to the standard or expected value at which an electrical power network operates.

When configuring virtual channels in PQSCADA, potential differences play a crucial role. For example, to configure V1N (voltage between phase 1 and neutral), we assign the physical channel number of V1 to one physical channel and set the factor to 1. Similarly, we assign the physical channel number of N to another physical channel and set the factor to -1. This creates the potential difference between V1-VN.

Likewise, for configuring virtual channel I12 (current difference between two phases), we assign the physical channel number of I1 to one physical channel with a factor of 1 and assign the physical channel number of I2 to another physical channel with a factor of -1. This creates the current difference I1-I2.

In the files obtained from the meters, PQSCADA stores measurements from both physical channels and the virtual channels configured in the unit. If there is a configuration error, you can rectify it and perform a recalculation. PQSCADA will use the actual data from the physical channels and adjust the values based on the updated configuration.

Following is an example of a single network with 2 feeders:



To add/modify voltage virtual channels for the network:

1. Under **Virtual channels**, Click the **Add channel** + icon. A Network with one voltage channel and one feeder will be created by default.
2. Configure the following: **Tag**, **Name**, **Nominal**, **Physical, Factor**
3. Virtual Channel= $\sum_{N=1}^{4}(\boldsymbol{Physical})_N \boldsymbol{X} (\boldsymbol{Factor})_N$
4. Set the **Topology** under the Feeder (WYE, Delta).
5. Add/modify current virtual channels for the feeder.

6. Click **Save** to apply changes.
7. Under the save configuration, do the following:
    - Mark the **new time** checkbox.
    - Enter the time to apply the new configuration form.
    - Click **Save** to apply changes and start Recalculation (see Appendix C.2).

5.9.8.3.1. Special Tags

ILEAK:

Kirchhoff low of currents states that for any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node. If for example, we have three current lines going into a junction we can say that I1+I2+I3=0.

- What electricians do to find if there is a leakage in the system, is take all the current lines and measure if the sum of all the lines is 0. If not, there is a leakage. To configure it in the virtual channels you configure I1+I2+I3 (all the factors are 1) and you expect to see 0 current.

VLEAK:

Kirchhoff low for voltage states the sum of voltages in a junction V1=V2=V3. Usually, we put a meter between the neutral and the ground and if we measure a voltage, it means we have a leakage.

- There are also indexes (ID) which allow us to see the data according to channel (then the channels don't have anything that relates to differential channels like power unbalance etc. – it is standalone).

5.9.8.4. Configuration file

Enterprise customers required us to manage devices configuration files within PQSCADA Sapphire. This feature is mainly important for cases in which the customer replaces a unit for repair.

- This feature will support only Elspec devices e.g., G4k, G5(DFR ver. 1.2.1.X and above), G4500, G4kN.
- PQSCADA Sapphire will download and store the latest configuration files (up-to 10 latest files) automatically when this function is enabled.
- PQSCADA will have the option to upload a specific configuration file to the device when needed.
- When uploading configuration files to a device, the user will have the option to select which configuration chapters are required. Calibration parameters will not be uploaded.
- G5 and G4KN: a new configuration file will be added every 12 hours if any change is made.
- G4k and G4500: a new configuration file will be added with any configuration change.

5.9.8.4.1. Save configuration file

1. Navigate to the system module
2. Choose the requested component for which you want to manage configuration files.
3. Navigate to the 'Unit configuration' tab
4. Expand 'Configuration file' blue bar
5. Check\uncheck 'Save configuration files' checkbox

5.9.8.4.2. Upload configuration file

1. Under action column, Click on the 'Upload' button
2. Check the specific configurations you wish to upload to the device
3. Click on the 'Set Configurations' button to initiate the upload process

5.9.8.4.3. Delete configuration file

1. Under the action column, select the 'Delete' button corresponding to the file you want to remove
2. Confirm the deletion by clicking the 'OK' button when prompted

Following these steps, you can effectively manage configuration files for Elspec devices using PQSCADA Sapphire, including enabling/disabling automatic saving, uploading specific configurations, and deleting unnecessary files when needed.

5.9.9. Confirm the deletion by clicking the 'OK' button when prompted
Energy

The Energy tab defines how billing is calculated. Edit the fields as required.

- **Energy billing interval** – this is a sliding window. The window width for calculating the Energy (for example, 15 minutes).
- **Energy billing sub interval** – the sub-interval is the refresh rate (for example, 1 minute).

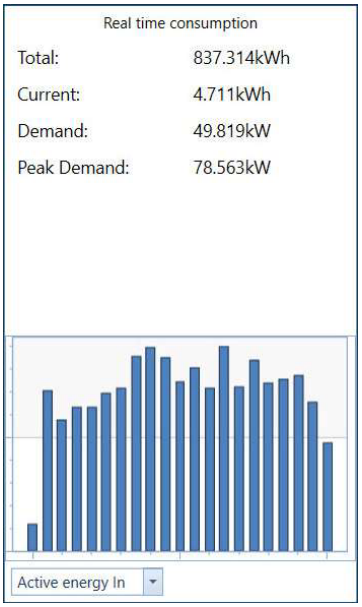
Using the above two sample values, assuming the first window is calculated over 10:00–10:15, the second window will be calculated over 10:01-10:16, and so on.

- **Billing per feeder** – select the Billing template for each Feeder from the dropdown list, as defined in the System module Billing tab (see section 5.8.15).
  For some components, it is according to its topology (WYE/Delta).

Energy limits – enter values for the following limits:

- Active energy in low limit
- Active energy in high limit
- Active energy out low limit
- Active energy out high limit
- Reactive energy in low limit
- Reactive energy in high limit
- Reactive energy out low limit
- Reactive energy out high limit
- Apparent energy low limit
- Apparent energy high limit

The limits are displayed graphically on the charts of the Energy module (right widget from Figure 0-1).



5.9.10. Query Settings

The Query Settings tab enables changing the scale factors and clock settings, this configuration provides flexibility and control over the data, enabling accurate and reliable analysis in cases where time discrepancies or adjustments are necessary for comprehensive **investigation and power quality** modules.

Time synchronization

- The configuration described is particularly useful when the data time is incorrect or requires adjustment by shifting it forward or backward. It should be noted that this configuration applies only to the specific component and not the data source, which is the device itself. Changing the time shift will have an impact on the investigation and power quality modules, allowing for accurate analysis and assessment of the data.
- By adjusting the time shift, you can align the data with the correct time references or compensate for any discrepancies in timing. This is crucial for maintaining the integrity and accuracy of the data during analysis and investigation processes.
    1. Mark the Time shift checkbox to enable time-shifting.
    2. Select the time shift direction: Forward or Back.
    3. Enter the amount of time to shift in the time picker.
    4. Click Save to apply changes.

Regular channels:

- **Primary PT** – enter the new primary PT value.
- **Secondary PT** – enter the new secondary PT value.
- **Primary CT** – enter the new primary CT value.
- **Secondary CT** – enter the new secondary CT value.
- **V to I ratio** – enter the new V to I ratio of the clamps.

Neutral channels:

- **Change neutral setting** - if a Neutral channel requires different scaling factors check it.
- **Primary PT for neutral channel** – inserts the new Primary PT for the neutral channel.
- **Secondary PT for neutral channel** – inserts the new secondary PT for the neutral channel.
- **Primary CT for neutral channel** – inserts the new Primary CT for the neutral channel.
- **Secondary CT for neutral channel** – inserts the new secondary CT for the neutral channel.
- **V to I ratio** – enter the new V to I ratio of the DC clamps.

Notes:

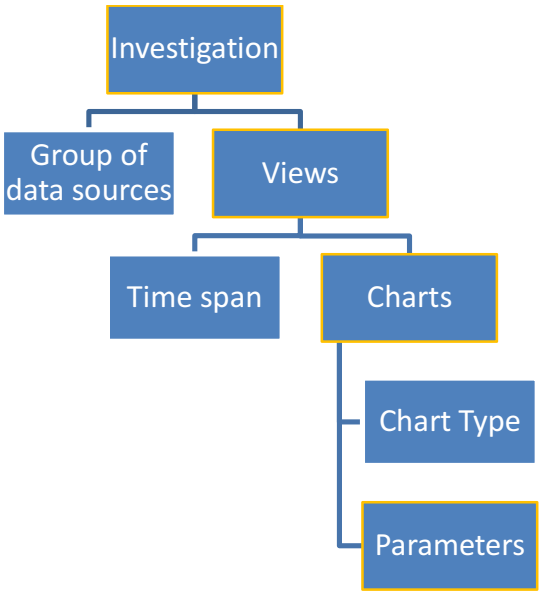
- Query settings apply to the **Summary** data only (see Appendix C.1). Therefore, some parameters may not be recoverable in all situations.
- To apply scaling factors, swap phases, and reverse polarity on the waveform data. For full recovery, follow the steps in the **Unit configuration** tab (see section 5.9.8).

6. Investigation Module

The Investigation module is used to perform power quality analysis based on one or more measuring points (components). It provides a variety of powerful tools to assist in the data analysis process.

To fully understand how to operate this module, it is important to know how items are tied together and how to manipulate them.

The investigation module consists of four objects: **Investigation**, **Views**, **Charts,** and **Parameters**, in the following hierarchy:



Investigation:

The Investigation is the highest level of the module's hierarchy. It includes data sources (components) and one or more views.

Views:

Each View contains a single time interval and one or more charts.

Charts:

Each chart within the PQSCADA contains at least one parameter. The software supports thousands of parameters across 12 different chart types (see section 6.5.2).

Parameters:

A parameter is a numerical or measurable factor that can be plotted or represented in the selected chart. It represents a specific data point or characteristic that can be visualized or analyzed within the chart.

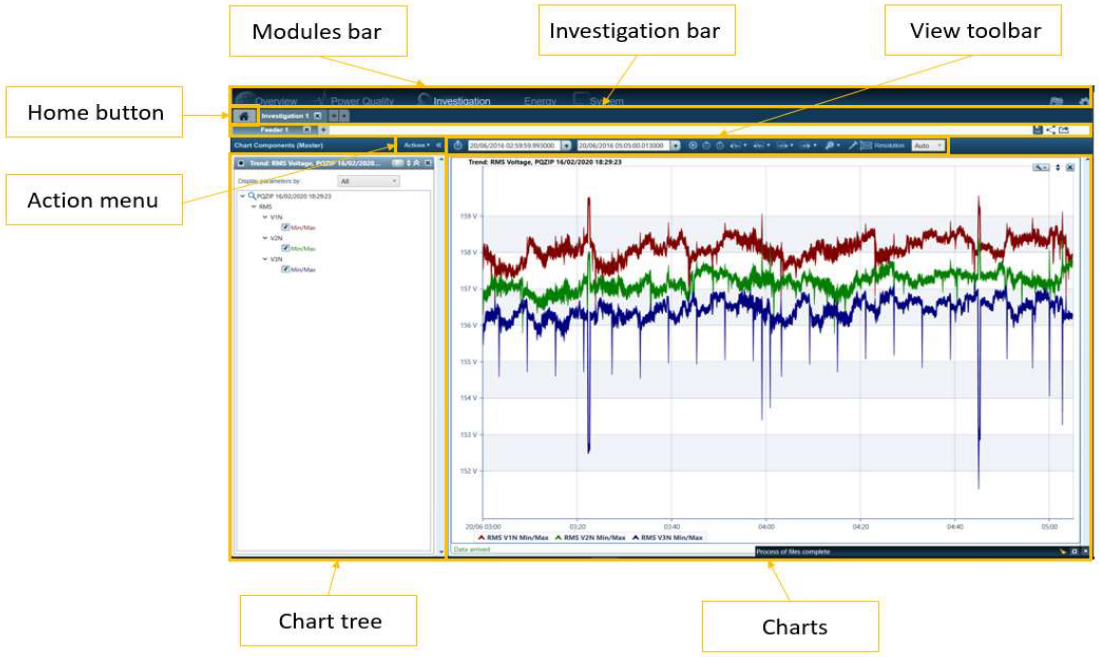


Figure 6-1. Investigation screen

The **Investigation module** screen is divided into two main sections that are divided by a splitter control line (a vertical line between the two sections):

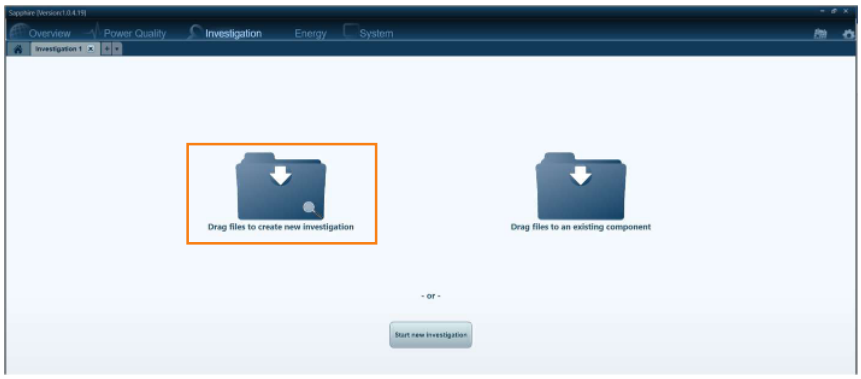
- Charts tree.
- The charts tree section can be hidden by clicking the Hide parameters tree icon on the upper right corner of the Charts tree section.
- Charts section – in the selected view.

Investigations and Views are displayed as tabs in the Investigation bar.

The position of the splitter control can be changed by clicking and dragging the splitter control to the left or right with a pointing device.

6.1. Drag and Drop Files to PQSCADA Sapphire

1. Click the **home**  icon in the Investigation module (upper left corner).
2. Drag and drop supported files (e.g., Elspec PQZ, pqzip, Comtrade, pqdif) into the **Drag file to create a new investigation** folder.



Notes:

- New investigations are created using predefined templates.
- To open multiple files, hold down the SHIFT or CTRL keys and click on additional files. However, all the files must be of the same kind.
- A COMTRADE file consists of two files (.CFG and .DAT) that must have the same leading file name. Both files should be dragged and selected together.
- When files from PureBB or COMTRADE are dragged and dropped, a Network and Device Configuration window will automatically appear. This window provides a user-friendly interface for configuring the network and devices associated with the imported files. Users can conveniently specify the desired network settings and device parameters.

Component name:

When a file is dragged and dropped, the component name will follow the format: **File Type, Date, and Hour**. The date and time in the component name will correspond to the exact date and time of the drag and drop action.

Example: PQZip 22/06/2023

6.1.1. Status window

When multiple files are dragged and dropped, a status window will be opened to provide an overview of the process. This status window displays the current state of the new component and all the files that are being imported.

Buttons:

- **Minimize\maximize button** – for minimizing and maximizing the status window.
- **Clear all processed files** – remove all processed files from list.
- **Close** – for closing status window.

Statuses:

- **Component**

- **Completed –** component files process finished.
- **Processing –** there are files that are in processing state.
- **Calculating historical data**
- **Deleted –** component has been removed.

- **Files**
  - **Completed –** file process finished.
  - **Wait for processing –** file in que.
  - **Failed –** something is wrong with the file.

6.1.2. File Record Types

In the world of electricity files recording there are two types of parameters that are interesting:

- **Waveform** – the electricity wave in the time of an event.
- **Calculated data** – the RMS (for example) at a certain time.

Note: The larger the resolution that is used, the more disk space is required.

Until pqzip was invented (controlling the large amount of data), companies used two methods. The first method ignored the calculated data and was only interested in knowing the waveform during an event, so the meters had a buffer of the last 3 seconds until the end of the event.

6.1.2.1. Comtrade

Comtrade allows for recording the waveform and static state of digital channels surrounding an event. However, meters using Comtrade typically stop recording the event after 3 seconds, even if the event is still ongoing.

PQSCADA is designed for pqzip and can generate waveforms from recorded harmonics. Comtrade provides the actual waveform data but requires knowledge of the number of samples, cycle start/end times, and frequency. Without these parameters, it becomes challenging to extract the data since FFT works best with cyclic signals, whereas Comtrade files contain event waveforms, which are less cyclic in nature. Hence, in PQSCADA, Comtrade files are saved as waveforms.

PQSCADA includes a mechanism that can automatically identify the configuration based on naming conventions (e.g., UL1 indicates a WYE topology with Channel 1). When opening a Comtrade file in PQSCADA, two situations may arise:

If the format is recognized (e.g., UL1, VL1), the file opens correctly.

If unfamiliar names like P_H are encountered, PQSCADA prompts the user to define the feeders manually.

This allows for proper interpretation and visualization of the data within the PQSCADA software.

6.1.2.2. PQZIP

To record a waveform over time with 1024 samples in one cycle, we would typically need to record the value 1024 times (32 bits) × 50 times (for 50Hz) × 60 (seconds) × 60 (minutes). This applies to each phase, resulting in a significantly large file size when considering all voltage and current phases (usually 4 of each).

To address this issue, we can reduce the number of harmonics while retaining important data by introducing a tolerance. If the difference between amplitude/angle values within a specific harmonic fall below the tolerance, the current value is retained and written for the number of consecutive times the value remains below the tolerance.

The following table shows 3 harmonics for 3 cycles without compression.

	Amplitude	**Phase**
H1	230	0
H1	230	0
H1	230	0
H2	231	60
H2	236	60
H2	236.5	60
H3	0	0
H3	0	0
H3	0	0

The first harmonic has a constant value, the second harmony has two value changes, one of them is below the tolerance, and the third harmonic has zero value. In this case, without compression to each harmonic you need to save six values (one for amplitude and one for phase) so we have 18 values to record.

In the next table we can see the results after compression considering the tolerance.

	Amplitude	Phase	Number of cycles
H1	230	0	3
H2	231	60	1
H2	236	60	2

In this example, every change that was less than the tolerance was not written.

In the first harmony there was no change in value in all three cycles and therefore we added the parameter "number of cycles" which tells us that the value did not change for three cycles.

In the second harmony the second value change was above the tolerance and therefore it was written but the third changed value was smaller than the tolerance, so it was not recorded, and we recorded '236' and '60' for two cycles.

The third harmony values were less than the tolerance, so they were not recorded at all.

Now we have 9 records for all the harmonies instead of 18 before the compression (50% less and you need to remember that a waveform contains around 512 harmonies).

There are two kinds of tolerances: fixed quality and fixed ratio.

Fixed quality (which exist in G4) – fixed percentage from nominal (for example: 0.1% of nominal).

There are two issues with this method:

1. If the tolerance was not defined correctly, we may lose data for good because it is not recorded.
2. If a low tolerance is defined in a very loud network, a lot of data is recorded and holes in data start to appear.

Fixed ratio (exist in G5, pure and new G4) – we determine the amount space we want to use each month (e.g., 16GB every month). The max available is 32GB per month.

Every file contains a few records, and the unit can change the tolerance after every recorded file. So, if the last file was very big the tolerance for the next file grows so that less data is available, and vice versa, if the last recorded file was very small the unit can lower the tolerance for the next file so more accurate data is recorded. These changes happen to remain in the monthly set ratio (usually at the end of the month we get more data than we planned).

Another thing that has changed from G4 units to G5 pure and the new G4 is that in these units' a/d convertor is used. The waveform gets to the converter (after a few reductions because all electronics work on very a low voltage 1–5 V) as a waveform with values between 0–1.

The converter usually has a resolution of 2^24 bits (more than 16 million numbers), so every waveform sample gets a digital value according to the a/d resolution. The a/d converter does not know what the original waveform value was.

Only the PQSCADA knows the conversion rate between the real value of the waveform and the value of waveform exiting the a/d converter (malt factor). The PQZIP contains only the data coming from the a/d output, so when PQSCADA opens the file, it needs to add the conversion rate to know the original waveform value (there are also other malt factors to add such as the calibration malt factor).

The advantage of using that system is that if the client configured the channels wrong or any configuration changes, it is not a problem because we have the real raw data which is in the a/d output and all the calculations PQSCADA does on that raw data, so if there was a mistake in the configuration we can fix it in PQSCADA and the new calculation will take place on the original raw data.

The disadvantage of the system is that it takes a lot of time, especially for the parameter called flicker (PST). To overcome this issue, this parameter (and others) is calculated in the meter itself (it is already calculated in the meter in order to show them in real time chart web and lcd) and the calculation is inserted to the pqzip file as summarized (like RMS every minute, RMS every 10

minutes, RMS every hour, etc.) and from there to PQSCADA's DB so there is no need to calculate this parameter again showing the data in PQSCADA faster

The reason for the file sizes being bigger than what we asked (when we choose for example to save 20GB per month but 25GB are saved) is because of that summary calculated in the meter and inserted into the pqzip.

Another reason is that we insert the file energy data. Because we need to be super accurate when calculating energy (the electric bill we pay is based on energy parameters), the calculation must take place on the whole data and not on the compressed data which is less accurate.

Another reason is that we also insert the data of the auxiliary channels into the file. The general thinking is that they do not change a lot so why compress them. Therefore, if the data was 1 for 15 cycles it is compressed to one row value 1 for 15 cycles but whenever a change occurs (change from 1 to 0 or from 0 to 1) it is written in the file and it gets bigger.

6.1.2.3. PQDIF

PQDIF stands for "Power Quality Data Interchange Format." It is a standardized file format used for exchanging power quality data between different software applications and systems. PQDIF files contain comprehensive information about power quality measurements, including voltage and current waveforms, harmonics, flicker, transients, and other relevant power quality parameters.

PQDIF files are designed to be vendor-neutral, allowing interoperability between different power quality monitoring devices and software platforms. They provide a structured format for storing and exchanging power quality data, ensuring consistency and compatibility across different systems.

PQDIF files typically include metadata that describes the measurement setup, including device information, measurement locations, time stamps, and event details. The actual power quality data, such as waveforms and recorded values, are stored in a structured manner within the file

6.2. Start New Investigation Wizard

Launch the start new investigation wizard by one of the following methods from the **Investigation** module home screen:

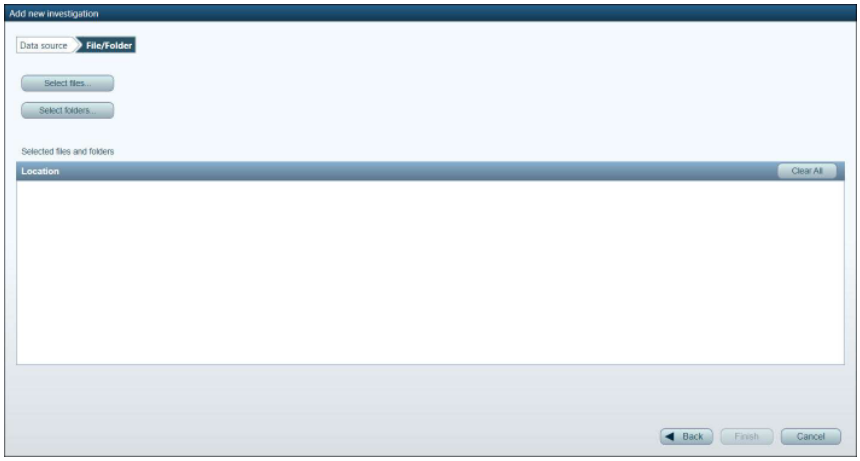
- Click the **Start new investigation** button.
- Click the **Add new investigation**  icon.

The investigation **Data source** can be from multiple locations.

6.2.1. Importing Files\Folders from a Local Computer

1. Type a name for the investigation.
2. Select **File/Folder**.
3. Click **Next** to go to the File/Folder page.
4. Select one of the following options:
   - **Select files** – opens file explorer to select specific file/s.
   - **Select folder** – opens file explorer to select a specific folder/s.

A list of the selected files/folders is displayed on the bottom part of the page.



5. Click **Finish** to start processing the files.

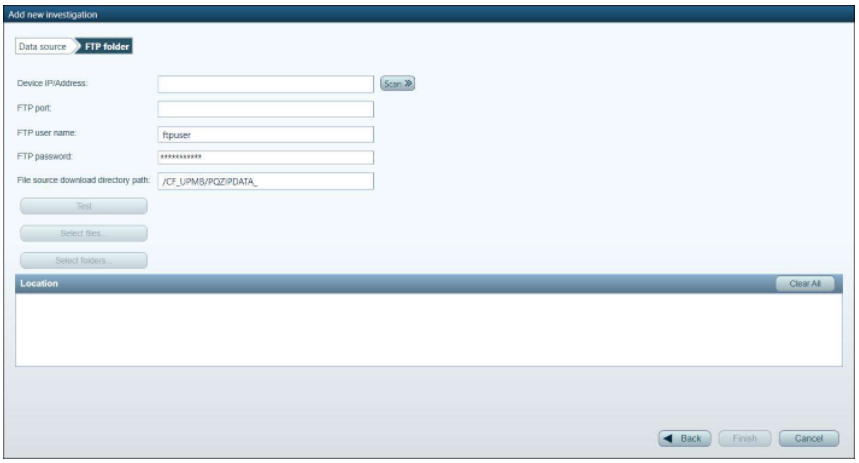
Notes:

- New investigations are opened based on predefined templates.
- Multiple files can be opened by holding down the SHIFT or CTRL keys and clicking on additional files, but they all must be the same kind.
- A COMTRADE file is a pair of two files (.CFG and .DAT). The leading file name must be identical for both files, and they must be dragged/selected at the same time.

6.2.2. Importing Files from an FTP Server

The FTP option was optimized to import PQZIP/PQZ files from Elspec BlackBox devices.

1. Type a name for the investigation.
2. Select **FTP Folder**.
3. Click **Next** to go to the FTP Folder page.



4. On the **FTP Folder** page, configure the following options:
   - **Device IP address** – enter the FTP server address or click Scan >> to search for available devices on the network.
   - **FTP port** – the FTP port for downloading files from the instrument.
   - **FTP username** – the FTP site username for downloading files from the instrument.
   - **FTP password** – the FTP site password for downloading files from the instrument.
   - **Test** – click the Test button to verify the File fetch connection to the device.
   - **Files source download directory path** – enter the path to the folder where the files are located. By default, the path is the default path of the selected device (e.g., for the G4K device it is /CF_UPMB/PQZIPDATA, for G5\PURE it is /PQZ/PQZDA_).
   - **Select files** – will open Windows Explorer to select specific file/s.
   - **Select folder** – will open Windows Explorer to select a specific folder/s.

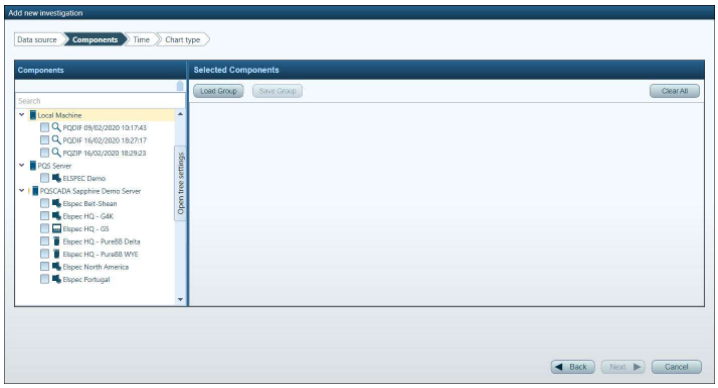
After selecting, a list of the selected files/folders will be presented at the bottom part of the page.

5. Click **Finish** to start processing the files.

6.2.3. Creating Investigation from a Component

If data was already uploaded and processed, a new investigation can be performed based on existing components.

1. Type a name for the investigation.
2. Select the **Component** option.
3. Click **Next** to go to the Component page.



4. Select the components to include in the investigation by one of the following methods:
   - Mark the component boxes in the Component section.
   - Click the Tag icon to sort components by tags (for more details on tags, see section 5.8.4).
   - Click the **Load Group** button in the **Selected Components** section to load components with Windows Explorer.

A list of the selected components appears in the Selected Components section. To save the selected list, click **Save Group**.

5. Click **Next** to go to the Time page.

6.2.3.1. Time

1. Configure the following options:
   - **Time intervals** – The time interval is a list of predefined time intervals. Selecting **All** will set the time interval for all the data available in the database. When selecting **Selected interval**, the time interval can be manually configured in the **from date** and **to date** fields.

Selecting **Real time** allows streaming and displaying real-time data from a Component into PQSCADA Sapphire. Four chart types are supported: Trend, Spectrum, Phasor, and Waveform.

   - **Resolution** – defines the displayed resolution of the selected parameter. Selecting Auto optimizes the resolution to the screen size, screen resolution, chart type, and selected parameter. The resolution depends on the time interval. When setting a small-time interval, the smallest resolution parameters show, and when increasing the time interval bigger resolutions are displayed.

2. Click **Next** to go to the Chart Type page.

6.2.3.2. Chart Type

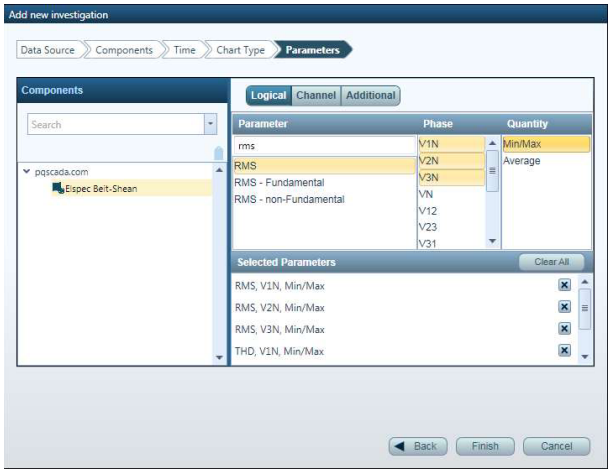
1. Select one of the chart type options or a Template.

Notes:

- The **Event** chart leads to **Event types**. Check the event type to display.
- The **Template** chart leads to **Templates**. Select the template to display.

2. Click **Next** to go to the Parameters page.

6.2.3.3. Parameters



1. Select how parameters are tagged:

   - **Logical** – parameters are tagged according to their logic when choosing a topology in virtual channels.

Note: In cases where a component is connected to multiple feeders, a feeder selection feature is available. This allows users to choose a specific feeder associated with the component for further analysis or configuration.

   - **Channels** – parameters are stored without any power topology and can be selected by a channel name as set by the user in virtual channels.

   - **Additional** – non-power parameters are selected (e.g., Temperature).

2. Select **Components** in the Component section. Multiple components can be selected by holding down the SHIFT or CTRL keys and clicking on another component. Click the **Tag** icon to sort components by tag.

3. Select the **Parameter** in the parameter column. The list of parameters is dynamic and depends on the selected component and time interval.

Note: Only parameters calculated in the selected time range will be presented.

4. Click the **Phase** value to select. A second click cancels the selection. Multiple phases can be selected.

Quantity values are displayed. Quantities are graphical representations in a chart of the measured data. Each quantity consists of a collection of series with slightly different characteristics (e.g., Min/Max, Average, Sample).

- **Min/Max** –the minimum and maximum values during a period.
- **Average** – the average value during a period.
- **Sample** – the native resolution of a parameter without any aggregation.

5. Click **Finish** to open the investigation.

Harmonics parameters

In the context of Harmonic Parameters, it is possible to define Harmonic Ranges. The selected parameters are listed under the selected parameters box, providing a comprehensive overview.

The following options are available for selecting harmonics within a given range:

- **All**: This option selects all harmonics within the specified range.
- **Odd**: This option selects only the odd harmonics within the specified range.
- **Even**: This option selects only the even harmonics within the specified range.
- **Multiple of 3**: This option selects only the harmonics that are multiples of 3 within the specified range.

6.3. Investigation Bar

The Investigation bar serves as a user-friendly interface that displays all open investigations and views in the form of convenient tabs. Additionally, it includes various tool icons that enable users to perform essential actions such as saving, sharing, and exporting the investigations. These tools empower users to efficiently manage their investigations, ensuring seamless collaboration and easy access to valuable data and insights.

6.3.1. Save an Investigation

1. Click the **Save** Icon at the top right corner of the Investigation screen.
2. Select the folder to save the investigation.

6.3.2. Share an Investigation

1. Click the **Share** icon at the top right corner of the Investigation screen.

Your default email application will open with the investigation files attached.

2. Send the attached investigation files to selected recipients.

Note: The Investigation files contain the Investigation, views, charts, and parameter properties, as well as the parameter's data.

6.3.3. Export an Investigation

1. Click the **Export** icon at the top right corner of the Investigation screen.

A drop-down menu with the export formats will open.

Note: PQSCADA Sapphire uses a predefined editable XML export template for the word export.

2. Select the folder to save the investigation.

6.3.4. Open a Saved Investigation

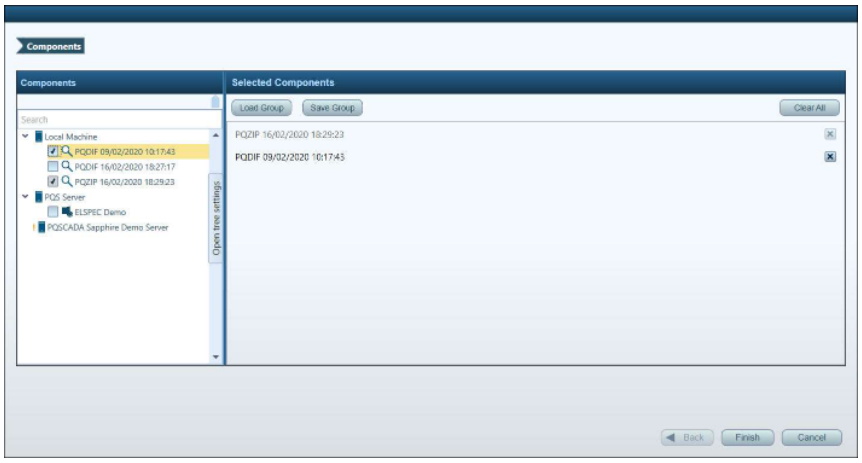
A saved investigation can be opened in one of the following methods:

1. Click the **Home** icon, then drag and drop the .inv files into the **Drag file to create a new investigation** folder.
2. Double-click the **.inv** file to automatically open the Investigation module in the PQSCADA Sapphire application.
3. Click the **Import investigation** icon next to the Investigation tab in the Investigation bar and select **Import investigation**.

Notes: The data stored in an investigation file has the same resolution and time range as the one configured in the charts. Therefore, if a saved investigation is opened on a computer that does not have open communication with the data source (component), new data queries such as zoom in/out will not work, and an exclamation mark ! will appear next to the component name in the components tree.

6.3.5. Add Component to an Investigation

1. Right-click the Investigation tab and select **Add component** from the menu. The Components page is displayed.



2. On the **Components** section, select component/s by marking the component checkbox. Click the **Tag** icon to sort components by tag.

A list of the selected components is displayed in the **Selected Components** section.

- Click **Load Group** to load components from a folder.
- Click **Save Group** to save the selected list.

3. Click **Finish** to close the Components window.

Note: Once a component has been selected, it cannot be removed or deselected from the current selection.

6.3.6. Rename an Investigation

1. Right-click the **Investigation** tab in the investigation bar and select **Rename**.
2. In the Rename window, enter the new investigation name.
3. Click **OK** to apply the changes.

6.3.7. Move an Investigation Tab

Right-click the Investigation tab in the Investigation bar and select **Move left** or **move right**.

6.3.8. Close an Investigation Tab

Either click the tab close icon or click the mouse center button.

6.4. Views

Views are the second level of an investigation. Views are multiple charts with one common length of time.

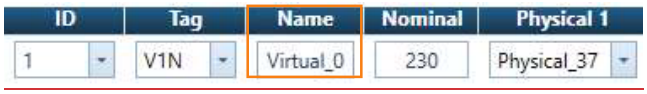
6.4.1. Add a New View

To add a view to an investigation, click the **Add new view** icon next to the view tab in the investigation bar.

The **Add investigation view** wizard is launched.

1. On the **Time** page, configure the following options:
    - **Time intervals** – The time interval is a list of predefined time intervals. Selecting All will set the time interval for all the data available in the database. When selecting Selected interval, the time interval can be manually configured in the from date and to date fields.
    - **Resolution** – Defines the displayed resolution of the selected parameter. Selecting Auto fits the best resolution to the screen size, the screen resolution, the chart type, and the selected parameter. Resolution depends on the time interval. When setting a small-time interval, the smallest resolution parameters are shown, increasing the time interval displays a larger resolution.
2. Click **Next** to go to the Chart type page.
3. On the Chart type page, select one of the chart type options or Template.
4. Click **Next** to go to the Parameters page.
5. On the Parameters page, select the component(s) to view from the **Components** section. Multiple components can be selected by holding down the SHIFT or CTRL keys and clicking other components. Click the **Tag** icon to sort the components by tag.
6. Select the parameter in the **Parameter** column on the right side of the Parameter page. The list of available parameters is dynamic and depends on the selected component, the time interval, and the type of parameters:
    - **Logical** – parameters are tagged according to their logic when choosing a topology in virtual channels.

- **Channels** – parameters are stored without any power topology and can be selected by a channel name as set by the user in virtual channels.



- **Additional** – for non-power parameters such as Temperature, Pressure.

7. Select the **Phase** (or **Channel** for Channel parameters). A second click cancels the selection. Multiple Phases/Channels can be selected.
8. Depending on the selected Parameter, selects the **Quantity**. Quantities are graphical representations of measured data in a chart. Each quantity consists of a collection of series with slightly different characteristics (e.g., Min/Max, Average, and Sample). A second click cancels the selection. Multiple quantities can be selected.
    - **Min/Max** – displays the minimum and maximum values during a period.
    - **Average** – displays the average value during a period.
    - **Sample** – displays the native resolution of a parameter without any aggregation.

After selecting, the list of the **Selected parameters** is displayed at the bottom of the page.

9. Click **Finish** to open the view.

6.4.2. Rename a View

1. Right-click the View tab in the investigation bar and select **Rename**.
2. On the Rename window, enter the new investigation name.
3. Click **OK** to apply the changes.

6.4.3. Move a View Tab

Right-click the View tab in the investigation bar and select **Move left** or **move right**.

6.4.4. Clone View

Allows you to clone the current view to do manipulations in the investigation.

6.4.5. Close a View Tab

Either click the tab close icon or click the mouse center button.

6.4.6. Actions Menu

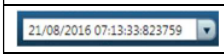
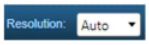
The Actions menu provides a list of features and actions that can be applied to the view. To access the Actions menu, click on the Actions button, and from the menu, select the desired options based on your requirements. Some possible selections from the Actions menu could include:

- **Add new Chart** – Launches the Add new chart wizard (see section 0).
- **Hide charts legend boxes** – Hides the chart legend box for all charts in the view.

- **Change charts background color** – for changing the chart background color.
- **Normalized display mode** – Normalizes the data of all the charts in the view. Voltage and current will be normalized to the nominal values in%. Power will be normalized to the product of Voltage × Current nominals. To undo the Normalized display mode, click on Regular display mode.
- **Save as template** – save the current view as a template for use in future investigations or for defining a file or an event template.
- **Export** – exports this view to the selected file format (Word/Excel/to Clipboard).
- **Clone view** – opens a new view with the same view characteristics. This can also be done by right clicking the view tab and selecting the Clone view.
- **Add slave pane** – Enables investigating two time-ranges simultaneously in a single window. The left pane is the master of the slave pane on the right.
- **Create new task** – opens the Add new task wizard based on the selected time frame and components of the view (see details in section **Error! Reference source not found.**).
    - Certain configurations of the investigation, including component selection and start/end time, will be copied to the task.
- **Vertical + Horizontal crosshair** – adds the horizontal crosshair. To remove the horizontal crosshair, select Vertical crosshair.

6.4.7. View Toolbar

Once a view is established, the view settings can be modified from the View toolbar.

	**Fixed time interval** – select a predefined time interval. Selecting All will set the time interval for all the data available in the database.
	**Start time** – sets the start time of the view.
	**End time** – sets the end start time of the view.
	**Start new query** – click the start new query button after changing the selected time interval.
	**Previous time/Next time** – move back to the Previous time frame. To move in the opposite direction, click the Next time frame icon.
	**Append back** – leaves the end time intact and moves the start time back by a selected amount.
	**Back** – shifts back the current time duration to a specified amount of time.
	**Forward** – moves forward the current time duration for a specified amount of time.
	**Append forward** – leaves the start time intact and moves the end time forward by a selected amount of time.
	**Expand time** – expands the time interval equally in both directions at a specified magnitude. To return, click Previous time.
	**Zoom/Drill modes** – PQSCADA Sapphire supports two zoom modes: drill and digital. The drill mode requires changes in the time frame of a new query from the server, and the displayed data is optimized to the time interval and screen resolution. • To zoom in, select the Zoom navigation mode; then, click the end of the scrollbar and drag it to the required zoom. • To drill in, select the Drill navigation mode; then, right-click or left-click or center-click the pointing device and drag it to the required time interval. The drill action involves a new query from the database. For details on how to drill, see section 6.5.5.
	**Fit charts in view** – Organizes the chart size in two modes: • Fit charts to screen – resized to the screen height. • Best fit with scrolling –optimized chart height to the screen height to enable scrolling.
	**Resolution** – defines the number of points to be displayed on the chart. In Auto mode, PQSCADA Sapphire optimizes the number of points to the screen resolution.

To understand resolution in PQSCADA, we need to grasp two key concepts: **"based on"** and **resolution**.

The term **"based on"** refers to the time interval over which a parameter was calculated. Each parameter is sampled from a waveform, typically consisting of about 1024 samples per cycle. The base represents the number of cycles (or time) used for calculation.

For example, if a parameter like RMS is based on 1 cycle, it means that the value of the calculated RMS is derived from a time interval of 1 cycle (approximately 1024 samples).

Note: The number of samples varies among meters is irrelevant for the base calculation.

Resolution, on the other hand, represents the average, minimum, and maximum values of the parameter within the base time range. To illustrate this, consider RMS based on 10 seconds with a resolution of 1 minute, within a 1-minute time frame. In this case, there are six 10-second points within 1 minute. Choosing the average value provides a single point that represents the average of those six points. Selecting min/max values displays the lowest and highest points among the six. Increasing the time frame to 10 minutes would yield 10 points, and so on. If the resolution matches or exceeds the base, a straight line with the same average, minimum, and maximum values is shown.

When initiating an investigation in PQSCADA, you can specify the base in which all parameters should be displayed. However, if some bases have not been calculated and saved to the database, they cannot be shown or selected by the user.

In instances where the time frame is short (e.g., half an hour), the resolution drop-down list does not include large resolutions, as they would generate too many data points to present effectively (e.g., a base cycle with a 10-minute resolution results in 1,800,000 points, which is impractical). PQSCADA calculates the number of pixels available and determines the smallest and largest resolutions that can be chosen based on the time division.

Auto-resolution is employed when sampling occurs at irregular intervals. PQSCADA utilizes knowledge of the base and pixel count to calculate the best resolution that matches the specific request.

To accommodate high-resolution bases with resolutions spanning months or years, PQSCADA employs a database within the unit. This database stores parameters with bases of 1 minute, 1 hour, and 1 day. The resolution is obtained from these unit summaries.

For further information on binaries and summaries, please refer to Appendix B.

6.5. Charts

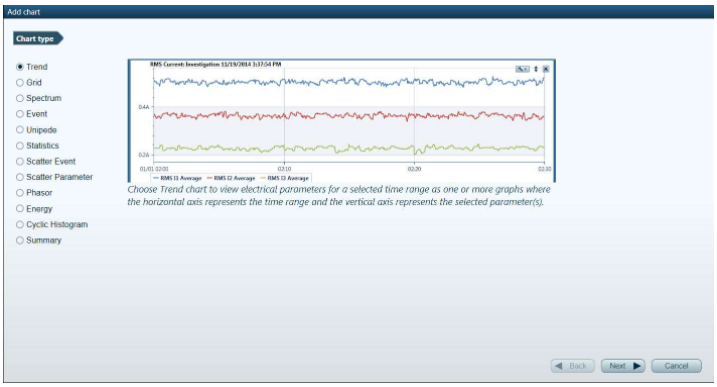
In the PQSCADA Sapphire Investigation module, charts represent the third level of an investigation. They provide detailed visual representations of data and play a crucial role in analyzing and interpreting information.

Note: To determine the specific charts available for each license, please refer to Table 2-1 in Chapter 2.

6.5.1. Add a New Chart

To **add a new chart** in PQSCADA, follow these steps:

1. Click on the **Actions** menu.
2. From the menu options, select "**Add new chart**."
3. This action will launch the Add Chart Wizard.



4. Select one of the chart types (see chart types in the following section 6.5.2).
5. Click **Next** to go to the **Parameters** page or the **Event type** or **Scatter Event Chart Type** when selecting the Event or Scatter Event chart types.
6. On the **Parameters** page, select the component(s) to view from the **Components** section. Multiple components can be selected by holding down the SHIFT or CTRL keys and clicking other components. Click the **Tag** icon to sort the components by tag.
7. Select the parameter in the **Parameter** column on the right side of the Parameter page. The list of available parameters is dynamic and depends on the selected component, the time interval, and the type of parameters:
   - **Logical** – parameters that are according to logic and can be calculated.
   - **Channels** – parameters without any power topology.
   - **Additional** – for non-power parameters (e.g., temperature, pressure).
8. Select the **Phase** (or **Channel** for Channel parameters). A second click cancels the selection. Multiple Phases/Channels can be selected.
9. Depending on the selected Parameter, selects the **Quantity**.
   - **Min/Max** – the minimum and maximum values during a period.
   - **Average** – the average value during a period.
   - **Sample** – the native resolution of a parameter without any aggregation.

After selecting, the list of the **Selected parameters** is displayed at the bottom of the page.

10. Click **Finish** to open the view.

6.5.2. Chart Types

On the upper right corner of the charts, you will find three icons that provide various actions and functionalities for the displayed chart. These icons are:

Chart settings: Clicking opens the chart settings menu.

Move chart up/down: Clicking the arrows moves the chart up or down.

Close: Clicking closes the chart.

The Chart Settings Menu:

The Chart Settings menu in PQSCADA includes options that are applicable to all chart types. Many of these options are self-explanatory and can be easily understood. However, there are some options that may require further explanation and could be unique to specific chart types. These options provide additional customization and control over the chart's appearance and behavior.

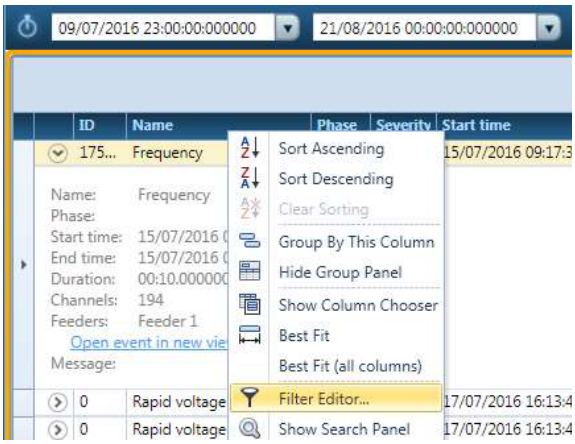
Changing Chart Order:

When there are multiple charts in the charts tree, their order can be easily rearranged using a drag and drop functionality. Simply click and hold a chart, then drag it to the desired position within the charts tree. This feature allows users to organize and prioritize the charts based on their preferences or analytical needs.

Table-Type Chart Options:

For charts that display data in a table format, there are two specific options available:

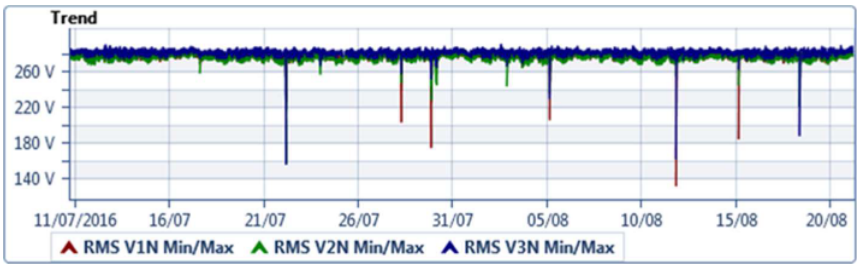
- **Grouping Columns -** By dragging each header cell to the upper bar, you can group the table based on the values in that column. Multiple cells can be dragged to create a hierarchy, allowing for more advanced grouping and organization of the table data. This feature enhances data analysis and facilitates a deeper understanding of the information presented in the table.
- **Table Tools Pop-Up Window -** Right-clicking on the header row of a table-type chart opens the table tools pop-up window. This window provides additional options and functionalities specific to table-type charts. It may include features such as column customization, sorting, filtering, and other table-related tools. These options enable users to manipulate and explore the table data according to their analysis requirements.



- The table tools pop-up window has various options to select, such as **Show Column Chooser** to select which columns to display.

6.5.2.2. Trend Chart

The Trend chart in PQSCADA is designed for visualizing the trend of parameters over a selected time range. It provides a graphical representation of how the parameters change over time, allowing users to analyze patterns, fluctuations, and trends in the data.



Trend chart tools

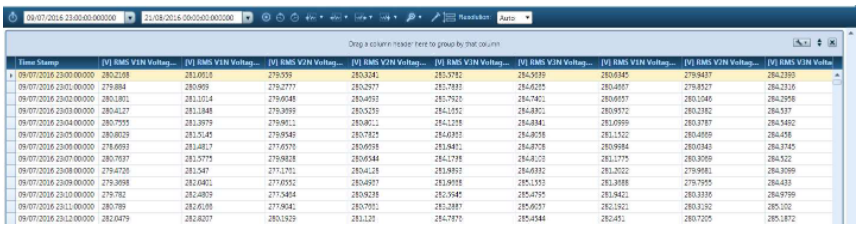
The Trend chart tool menu in PQSCADA offers several options to customize and interact with the chart. These options include:

- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Hide/Show Crosshair -** You can choose to hide or show the crosshair, which is a vertical and horizontal line that intersects at the cursor position on the chart. The crosshair helps in precise data inspection and analysis.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Hide/Show Grid Lines -** This option allows you to hide or show the grid lines on the chart, providing visual reference lines that aid in data interpretation.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Normalized Display Mode -** This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.
- **Axis Y Settings -** You can customize the minimum, maximum, and step values on the Y-axis of the chart, allowing for better control over the displayed range and intervals.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Bring Parameter to Front -** If two graphs overlap on the chart, you can bring a specific graph to the front for better visibility and analysis.
- **Show/Hide Min/Max Values -** This option helps determine the minimum and maximum values of the displayed charts within the current time interval, providing quick insights into the data range.
- **Disable/Enable Curve Chart -** You can choose to display the data in the charts according to the measurement resolution or enable curve chart mode, which smooths the individual measurements to create a continuous chart.

- **Vertical + Horizontal Crosshair -** This feature enables the display of both vertical and horizontal crosshairs, aiding in precise data inspection and analysis by providing reference lines at the cursor position.

6.5.2.3. Grid Chart

The Grid chart in PQSCADA allows users to view selected parameters within a specified time range in a tabular format.



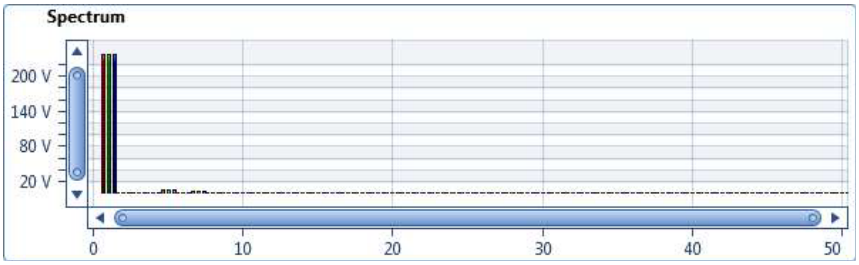
Grid chart tools

The Grid chart tool menu in PQSCADA offers several options to customize and interact with the chart. These options include:

- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Export to Excel** - The Export to Excel feature allows users to export chart data or grid table data directly to an Excel file for further analysis, reporting, or sharing purposes.
- **Normalized Display Mode -** This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.
- **Resolution -** The grid chart resolution can be set independently from the view resolution. The available resolution options depend on the selected time interval. In auto mode, the grid will include 100,000 points at a resolution equal to [time interval]/100,000. This allows users to adjust the level of detail and data density in the grid chart. In view mode, the grid resolution aligns with the resolution set for the view.
- **Show/Hide status column -** Users can choose to add a status column in the grid chart, which indicates the data status for each entry. This column helps identify missing data or events, providing additional context for analysis.
- **Show\hide percentile value** – This option is available if configured in the client settings. It is active when the number of time stamps is 100 or less and is achieved by increasing the resolution or decreasing the time interval. The percentile value represents a parameter value that exceeds a certain percentage (X%) relative to the remaining values. The percentile calculation is based on the average value of the parameter. To ensure accurate percentile calculations, it is recommended to use a resolution that is at least three times larger than the base resolution. For example, if the base resolution of the parameter is 10 minutes, a resolution of 30 minutes or higher should be used.

6.5.2.4. Spectrum Chart

The Spectrum chart in PQSCADA is specifically designed for analyzing frequency domain phenomena and visualizing selected parameters over a specific time range in a bar chart format. Unlike the Trend chart, the Spectrum chart does not use the time domain as the X-axis. Instead, the horizontal axis represents the harmonics, while the vertical axis represents the amplitude of each harmonic. A drill-in option is not available (the digital zoom option is enabled by default).



Spectrum chart tools

The Spectrum chart in PQSCADA offers a variety of tools and options to enhance your analysis and exploration of frequency domain phenomena. The Spectrum chart tool menu includes the following options:

- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Hide/Show Crosshair -** You can choose to hide or show the crosshair, which is a vertical and horizontal line that intersects at the cursor position on the chart. The crosshair helps in precise data inspection and analysis.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Hide/Show Grid Lines -** This option allows you to hide or show the grid lines on the chart, providing visual reference lines that aid in data interpretation.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Bring Parameter to Front -** If two graphs overlap on the chart, you can bring a specific graph to the front for better visibility and analysis.
- **Show/Hide Min/Max Values -** This option helps determine the minimum and maximum values of the displayed charts within the current time interval, providing quick insights into the data range.
- **Disable/Enable fundamental** – This option allows you to disable or enable the fundamental bar in the Spectrum chart. Disabling the fundamental bar rescales the Y-axis, providing a better view of the nonfundamental harmonics.
- **Include/exclude flagged data** – This option enables you to include or exclude flagged data, which represents data influenced by power quality events (PQ events). This allows you to

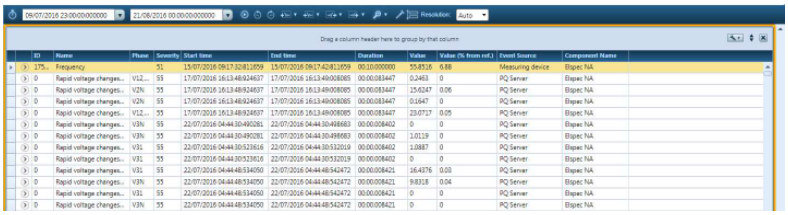
analyze the harmonics with or without the influence of PQ events, providing a clearer view of the underlying harmonic content.

6.5.2.5. Event Chart

When creating an Event chart in PQSCADA, you have the flexibility to select from various Event types to analyze and visualize different types of events. The available Event types include:

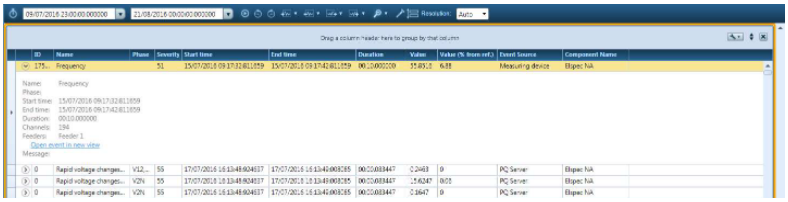
- **System Events -** These events pertain to the system-level operations and conditions. They provide insights into system-wide events such as system start-up, shutdown, alarms, or other system-related activities.
- **Power Quality Events -** This category includes events related to power quality disturbances and anomalies. It helps in identifying and analyzing power quality issues such as voltage sags, swells, interruptions, harmonics, flicker, and other power quality-related events.
- **I/O (Digital, Analog, Relay) Events -** These events are specific to input/output (I/O) operations in the system. They can represent events related to digital inputs, analog inputs, or relay operations. Examples include the activation of a digital input, changes in analog input values, or the status of relays.
- **Custom Events -** This option allows you to define and configure custom events based on specific criteria or conditions that are relevant to your analysis. You can define events based on combinations of parameters, thresholds, logical expressions, or other custom rules

Once you have selected the Event type(s) for the Event chart, the events are displayed in a table format for the selected time range. The table provides comprehensive information about each event, including the occurrence time, duration, severity, and any additional relevant data associated with the event.



In the Event chart of PQSCADA, you can expand individual events to view more detailed information and access additional functionalities. Here's what you can expect when you click the event expand icon:

- **Detailed Bar -** Clicking the expand icon ⓘ opens a detailed bar for the selected event. This bar provides additional information about the event, such as event type, occurrence time, duration, severity, and any other relevant details associated with the event.
- **Mask/Unmask Events -** Within the detailed bar, you'll find checkboxes that allow you to mask or unmask events. Masking an event means excluding it from further analysis or visualization, while unmasking allows the event to be considered in subsequent evaluations.
- **Link to Open Event in a Different View -** The detailed bar also includes a link that allows you to open the event in a different view based on a predefined template. This feature enables you to quickly switch to a dedicated view specifically designed for analyzing and investigating the selected event. The predefined template may include specific charts, parameters, or settings tailored to provide a comprehensive analysis of the event.



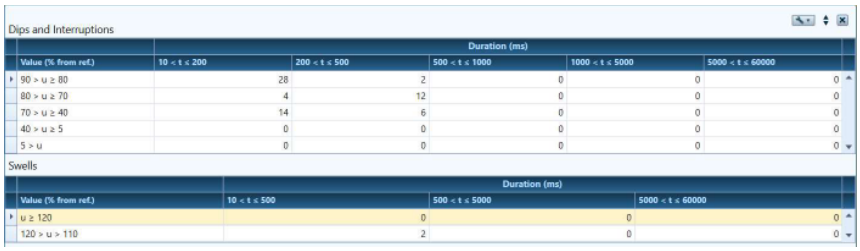
Event chart tools

The Event chart in PQSCADA provides various tools and options for managing and analyzing events. Here are the available options in the Event chart tool menu:

- **Export chart to Excel -** This option allows you to export the event chart data to an Excel file for further analysis or documentation purposes.
- **Save columns order as default -** You can customize the order of columns and choose which columns to display in the event chart using the column chooser. By clicking this button, your column settings will be saved as a default template for all future event chart tables.
- **Separate/aggregate PQ events -** By default, power quality events are aggregated in the Event chart. If multiple events of the same type occur simultaneously in different phases (within the same power topology), PQSCADA Sapphire will aggregate them into a single event. The aggregated event's start time is determined by the time the first phase entered the event condition, and the end time is determined by the time the last phase exited the event condition. The depth of the aggregated event represents the highest or lowest phase value within the aggregation.
- **Display oldest events first -** This option allows you to choose the sorting order of events in the chart. Selecting this option will display the oldest events first.
- **Set maximum events to display -** You can define the maximum number of events to display in the chart. The default value is set to 2000, but you can adjust it within the range of 1 to 100,000.
- **Show/Hide masked events -** In compliance scenarios where flagged or non-flagged data is defined, this option allows you to control the visibility of masked events. Masked events refer to events that should be ignored based on specific criteria or flagged data. Choosing to show masked events will display all events, including those that should be ignored, while hiding masked events will show only events where no flagged data is present.
- **Filter events by component data availability -** If you have knowledge that a specific component experienced a man-made event (e.g., power outage), you can choose to ignore events based on the data availability of that component. You can select the percentage of data availability that should be considered in the filtering process.

6.5.2.6. Unipede Chart

The Unipede chart is designed to display power quality events in a table format, adhering to the EN5016 standard. The table would contain relevant information about the occurrence and duration of these events, which can be valuable for power quality analysis.



Dips and Interruptions

	Duration (ms)				
Value (% from ref.)	10 < t ≤ 200	200 < t ≤ 500	500 < t ≤ 1000	1000 < t ≤ 5000	5000 < t ≤ 60000
90 > u ≥ 80	28	2	0	0	0
80 > u ≥ 70	4	12	0	0	0
70 > u ≥ 40	14	6	0	0	0
40 > u ≥ 5	0	0	0	0	0
5 > u	0	0	0	0	0

Swells

	Duration (ms)		
Value (% from ref.)	10 < t ≤ 500	500 < t ≤ 5000	5000 < t ≤ 60000
u ≥ 120	0	0	0
120 > u > 110	2	0	0

Unipede chart tools

The Unipede chart in PQSCADA offers a variety of tools and options to enhance your analysis and exploration of frequency domain phenomena. The Unipede chart tool menu includes the following options:

- **Separate/aggregate PQ events -** By default, power quality events are aggregated in the chart. If multiple events of the same type occur simultaneously in different phases (within the same power topology), PQSCADA Sapphire will aggregate them into a single event. The aggregated event's start time is determined by the time the first phase entered the event condition, and the end time is determined by the time the last phase exited the event condition. The depth of the aggregated event represents the highest or lowest phase value within the aggregation.
- **Show/Hide masked events -** In compliance scenarios where flagged or non-flagged data is defined, this option allows you to control the visibility of masked events. Masked events refer to events that should be ignored based on specific criteria or flagged data. Choosing to show masked events will display all events, including those that should be ignored, while hiding masked events will show only events where no flagged data is present.
- **Export chart to Excel -** This option allows you to export the Unipede chart data to an Excel file for further analysis or documentation purposes.

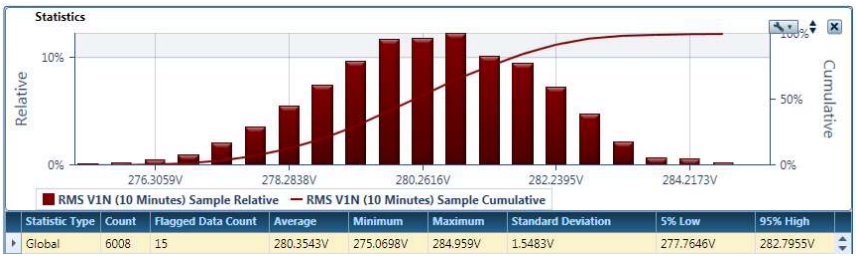
6.5.2.7. Statistics Chart

The Statistics chart in PQSCADA is designed to display calculations based on parameter values divided into bins representing specific value ranges. It provides both **Relative** charts, where the parameter values are divided into bins, and **Cumulative** statistics calculations, which are represented by a continuous line accumulating the values of the bins.

The **Relative** charts show the distribution of parameter values across different bins or value ranges. Each bin represents a specific range, and the chart displays the count or percentage of parameter values falling within each bin.

On the other hand, the **Cumulative** statistics calculations chart represents a continuous line that accumulates the values of the bins. This line provides information about the cumulative distribution of the parameter values, allowing you to analyze the overall trend and distribution patterns.

In addition to the graphical representation, the Statistics chart also includes a **statistic data table**, which presents detailed information about the parameter values, bins, and corresponding statistics. This table can provide valuable insights into the distribution and statistical characteristics of the parameter data.



Statistic Type	Count	Flagged Data Count	Average	Minimum	Maximum	Standard Deviation	5% Low	95% High
Global	6008	15	280.3543V	275.0698V	284.959V	1.5483V	277.7646V	282.7955V

- **Parameter Name -** This refers to the selected parameter for which the statistics are being calculated. It represents the specific parameter you have chosen to analyze.

Statistic data table

- **Statistic Type -** The Statistics chart can operate in two modes:
    - **Global -** In this mode, the statistical calculations are based on the entire range of the parameter, providing insights into the overall distribution and characteristics of the parameter values.
    - **Range -** In this mode, the statistical calculations are focused on the selected range displayed in the chart. If you zoom in on a specific range, the percentage values will refer to that zoomed-in interval or the entire range, depending on the configuration.
- **Count -** This represents the total number of data points included in the statistical calculation. It indicates the number of data samples or measurements considered for the analysis.
- **Flagged Data Count -** This indicates the number of data points that were ignored or excluded from the statistical calculation due to certain flags or predefined criteria. Flagged data points are typically excluded to ensure the accuracy and integrity of the statistical analysis.
- **Average -** This represents the average value of the selected parameter during the specified time interval and within the defined parameter range. It provides an indication of the central tendency or typical value of the parameter.
- **Minimum -** This shows the minimum measured value of the selected parameter within the specified time interval and parameter range. It represents the lowest recorded value observed during the analyzed period.
- **Maximum -** This indicates the maximum measured value of the selected parameter within the specified time interval and parameter range. It represents the highest recorded value observed during the analyzed period.

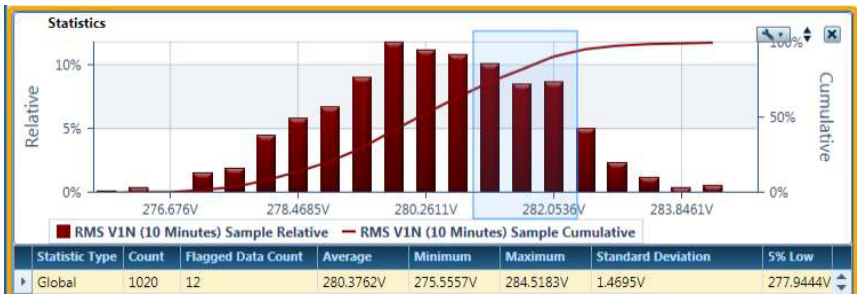
- **Standard Deviation -** The standard deviation is a measure of the dispersion or variability of the parameter values. It quantifies the average amount by which the parameter values deviate from the mean (average) value. A higher standard deviation indicates a greater spread of values, while a lower value suggests a more concentrated distribution.
- **5% Low -** This refers to the lower percentile value, specifically the value below which 5% of the parameter values fall. It provides information about the lower boundary of the parameter distribution.
- **95% High -** This represents the upper percentile value, specifically the value below which 95% of the parameter values fall. It provides insights into the upper boundary or threshold of the parameter distribution.

In the Statistics chart, the parameter range you have selected is automatically divided into a specified number of subranges. By default, **the chart splits the range into equal subranges ranging from 5 to 50**, and this configuration can be adjusted through the Chart Setting menu.

Each subrange is represented as a bar in the chart, and the height or length of the bar corresponds to the relative statistic value for that specific subrange. The relative statistic value represents the calculated statistic (e.g., average, minimum, maximum) for each subrange in relation to the entire parameter range.

To **drill** into a specific subrange and focus on a narrower range of values, you can use the left-click and drag functionality. Simply click and hold the mouse button while dragging it across the desired subrange. This action allows you to zoom in and examine the statistics and distribution within the selected range in more detail.

By **zooming** into a specific subrange, the chart adjusts the displayed statistics and percentage values to reflect the zoomed-in interval. This provides a closer view of the selected subrange and allows for a more detailed analysis of the parameter values within that range.



Statistic Type	Count	Flagged Data Count	Average	Minimum	Maximum	Standard Deviation	5% Low
Global	1020	12	280.3762V	275.5557V	284.5183V	1.4695V	277.9444V

Statistic chart tools

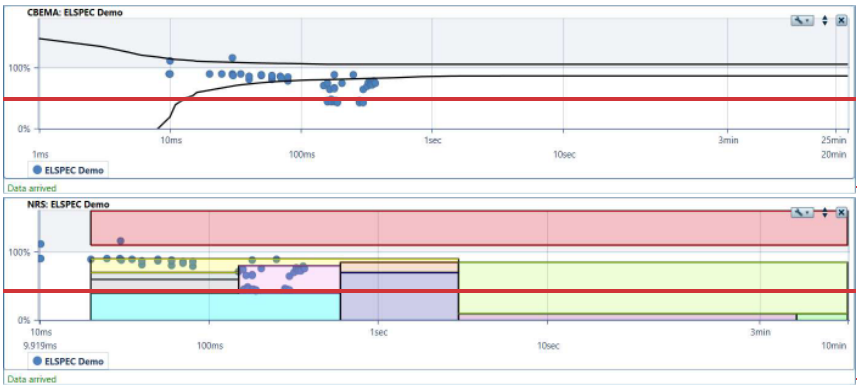
The Statistic chart in PQSCADA offers a variety of tools and options to enhance your analysis and exploration of frequency domain phenomena. The Statistic chart tool menu includes the following options:

- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Hide/Show Crosshair -** You can choose to hide or show the crosshair, which is a vertical and horizontal line that intersects at the cursor position on the chart. The crosshair helps in precise data inspection and analysis.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Hide/Show Grid Lines -** This option allows you to hide or show the grid lines on the chart, providing visual reference lines that aid in data interpretation.

- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Normalized Display Mode -** This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Hide/Show statistics data** - The Hide/Show Statistics Data option in the Statistics chart allows you to toggle the visibility of the statistics table. When this option is enabled, the statistics table is displayed along with the chart, providing detailed information about the calculated statistics for each subrange.
- **Range mode** – toggle between Range mode and Global mode
- **Back to default range** – allows you to return the chart to its original range after zooming in.
- **Set number of ranges** – controls the number of bars or subranges displayed in the chart.
- **Bring Parameter to Front -** If two graphs overlap on the chart, you can bring a specific graph to the front for better visibility and analysis.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Change percentage values** – allows you to modify the low and high percentage values for the chart.
- **Set Min/Max range values** – enables you to specify the minimum and maximum range values for the parameters.
- **Include/exclude flagged data** – This option enables you to include or exclude flagged data, which represents data influenced by power quality events (PQ events). This allows you to analyze the statistics with or without the influence of PQ events, providing a clearer view of the underlying harmonic content.

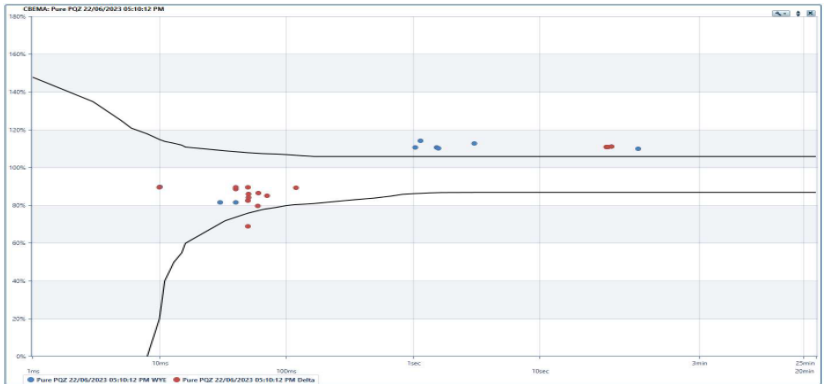
6.5.2.8. Scatter Event Chart

The Scatter Event chart in PQSCADA allows you to view events based on various standards, including CBEMA, NRS, ITIC, IEEE1668 (Type 1, 2, 3), SEMI F47-0706, AS 61000.3.100, and custom definitions. This chart provides a graphical representation of events in relation to their severity and duration, helping you analyze power quality issues based on different standards.

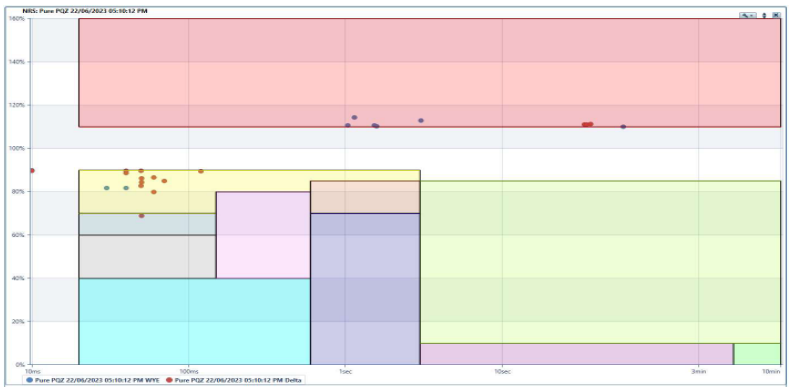


Scatter Chart types:

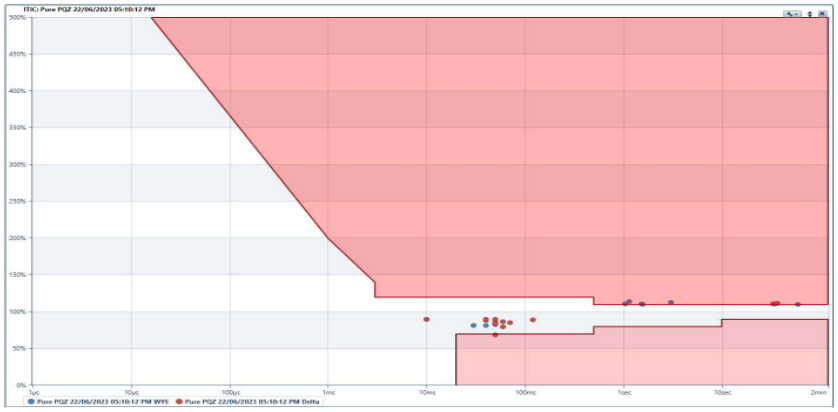
- **CBEMA** – The chart displays power quality events such as DIPs, SWELLs, and INTERRUPTIONs. It also includes area layers indicating prohibited and no damage regions. The X-axis represents event duration, while the Y-axis represents event deviation, helping users understand the impact of voltage variations on their equipment.



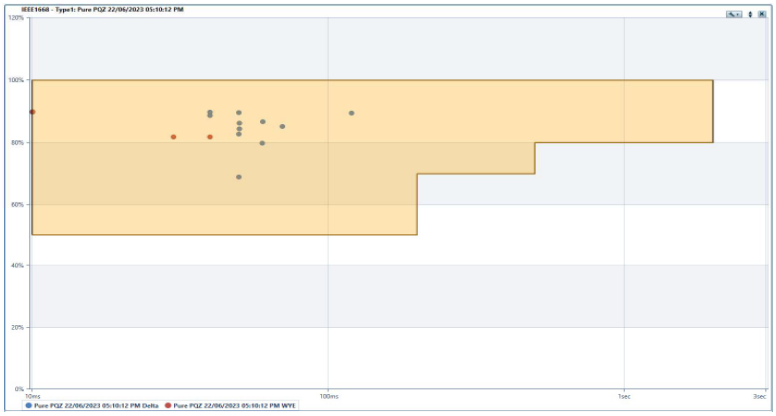
- **NRS** – The chart displays power quality events such as DIPs, SWELLs, and INTERRUPTIONs. It also includes area layers that divide the chart into several regions. The X-axis represents event duration, while the Y-axis represents event deviation, providing insights into the impact of voltage variations on electrical equipment.



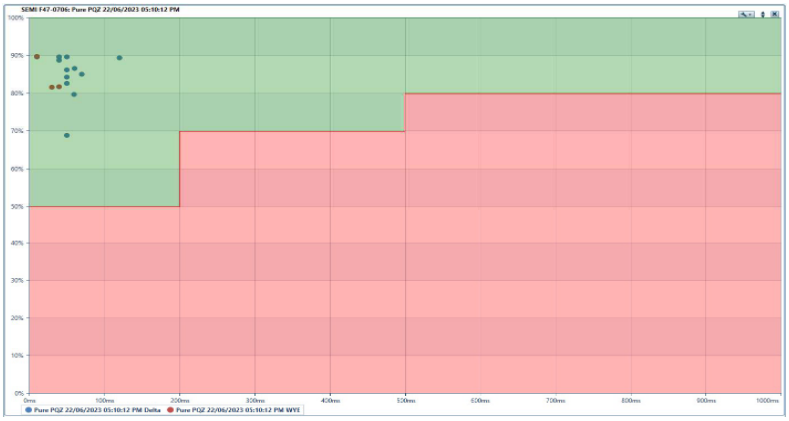
- **ITIC -** The chart displays power quality events such as DIPs, SWELLs, and INTERRUPTIONs. It also includes area layers that divide the chart into several regions. The X-axis represents event duration, while the Y-axis represents event deviation, providing insights into the impact of voltage variations on electrical equipment.

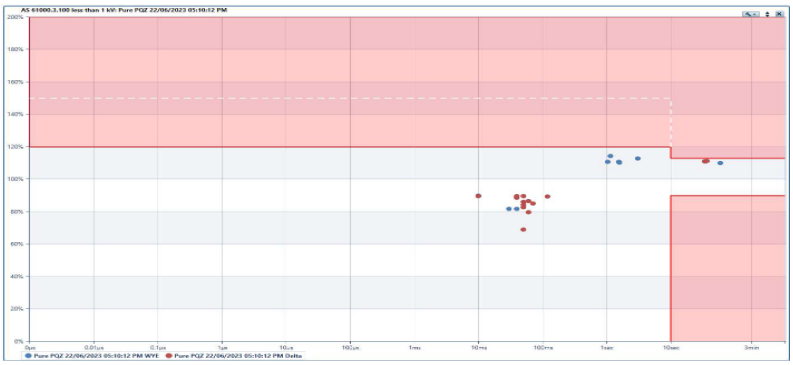


- **IEEE1668 (Type 1, 2, 3) –** This chart focuses specifically on Dip events and provides separate charts for different types of dips:
    - **Type 1:** Displays dip events that occurred in 1 phase.
    - **Type 2:** Displays dip events that occurred in 2 phases**.**
    - **Type 3:** Displays dip events that occurred in 3 phases.



- **SEMI F47** - focuses on Dip events. The X-axis represents the duration of the event ranging from 0ms to 1000ms. The Y-axis represents the percentage deviation from the nominal value. The green area indicates the unaffected region, while the red area represents the region where mis operation may occur.



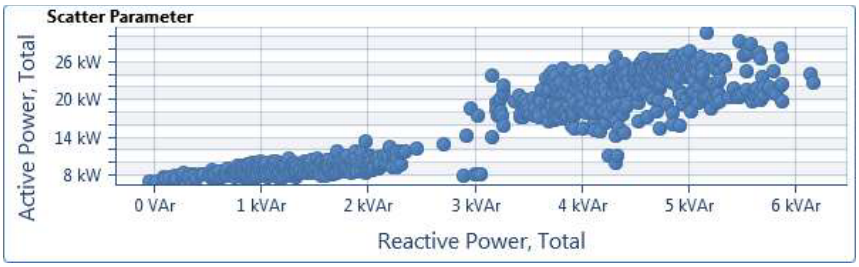
- **AS 61000.3.100** - chart displays Dip, Swell, and Interruption events. The chart distinguishes between Phase-to-Earth and Rural areas with dotted lines. The voltage level in kV is determined based on the component's nominal voltage channel. For line-to-line voltage channels, the nominal is the selected type of threshold, and for L-N voltage channels, the threshold is the channel nominal multiplied by the square root of 3.
- 
    - **Custom** - allows users to select specific power quality (PQ) events and choose an area layer (CBEMA/NRS/ITIC) to be displayed on the chart.

Scatter Event chart tools

- The Scatter Event chart tool menu includes the following options:
- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Hide/Show Crosshair -** You can choose to hide or show the crosshair, which is a vertical and horizontal line that intersects at the cursor position on the chart. The crosshair helps in precise data inspection and analysis.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Hide/Show Grid Lines -** This option allows you to hide or show the grid lines on the chart, providing visual reference lines that aid in data interpretation.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Separate/aggregate PQ events -** By default, power quality events are aggregated in the chart. If multiple events of the same type occur simultaneously in different phases (within the same power topology), PQSCADA Sapphire will aggregate them into a single event. The aggregated event's start time is determined by the time the first phase entered the event condition, and the end time is determined by the time the last phase exited the event condition. The depth of the aggregated event represents the highest or lowest phase value within the aggregation.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Show/Hide masked events -** In compliance scenarios where flagged or non-flagged data is defined, this option allows you to control the visibility of masked events. Masked events refer to events that should be ignored based on specific criteria or flagged data. Choosing to show masked events will display all events, including those that should be ignored, while hiding masked events will show only events where no flagged data is present.

6.5.2.9. Scatter Parameters Chart (Professional and Enterprise only)

The Scatter Parameters chart allows reviewing scattered dots of a specific parameter in relation to another parameter. One parameter is represented by the horizontal axis, and the other parameter is represented by the vertical axis. This chart helps visualize the relationship or correlation between the two parameters.



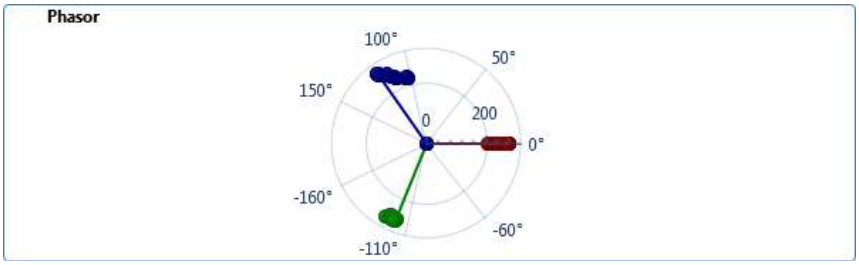
Scatter Parameter chart tools

The Scatter Parameter chart tool menu includes the following options:

- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Hide/Show Crosshair -** You can choose to hide or show the crosshair, which is a vertical and horizontal line that intersects at the cursor position on the chart. The crosshair helps in precise data inspection and analysis.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Hide/Show Grid Lines -** This option allows you to hide or show the grid lines on the chart, providing visual reference lines that aid in data interpretation.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Normalized Display Mode -** This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.
- **Axis Settings -** You can customize the minimum, maximum, and step values on the X-axis and Y-axis of the chart, allowing for better control over the displayed range and intervals.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Add/Remove regression line** - This option allows you to add or remove a regression line on the Scatter Parameters chart. A regression line is a line that represents the best-fit trend of the data points, minimizing the distance between the line and the scatter points.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Filter on** - This option allows you to apply a filter based on a third parameter's normal operating condition. By enabling this feature, you can hide data points that fall outside the specified range of the third parameter.

6.5.2.10. Phasor (Professional and Enterprise only)

The Phasor chart allows you to view the amplitude and angle of a phasor for a selected time range. The chart represents the changes in both the amplitude and phase of the phasor over time. It provides a graphical representation of the phasor's behavior and allows for the analysis of its magnitude and phase angle variations.



Phasor chart tools

The Phasor chart tool menu includes the following options:

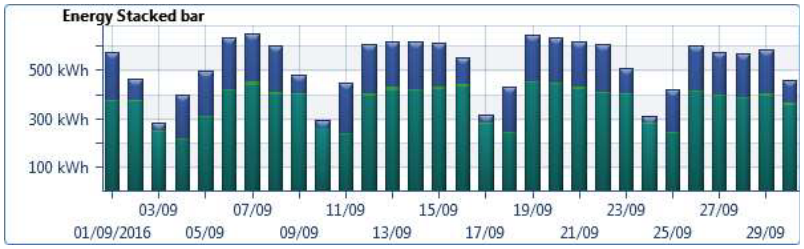
- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Normalized Display Mode -** This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.
- **Change Color -** This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Set zero origin** – By default, it is set to 3 o'clock, but you can click "Set zero origin" to choose a different origin point.
- **Show limit series** – define a limit radius that will be displayed in the phasor chart, helping to visualize any specified limits or boundaries.

6.5.2.11. Energy Chart

In the Energy data chart, you can view energy data from multiple components for a selected time range. There are four layout types available:

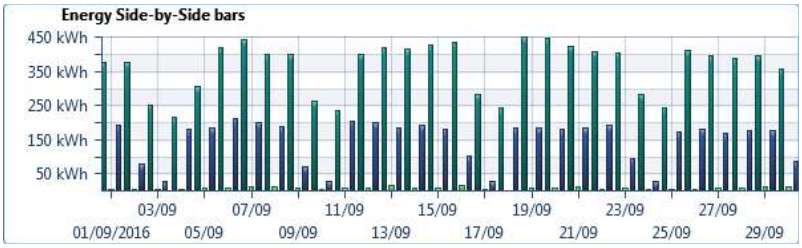
Stacked bars

Energy data from multiple components is displayed on top of each other in stacked bars.



Side-By-Side Bars

Energy data from multiple components is displayed next to each other in separate bars.

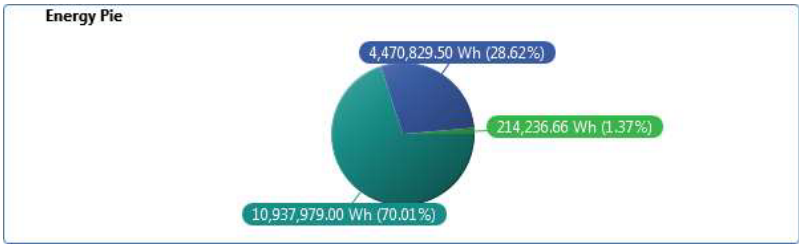


Trend

Energy data is displayed over time as a trend. When multiple components are selected, the chart can show the summary trend of all components.

Pie Chart

Energy distribution between different components is represented in a pie chart format.



Energy chart tools

The Energy chart tool menu includes the following options:

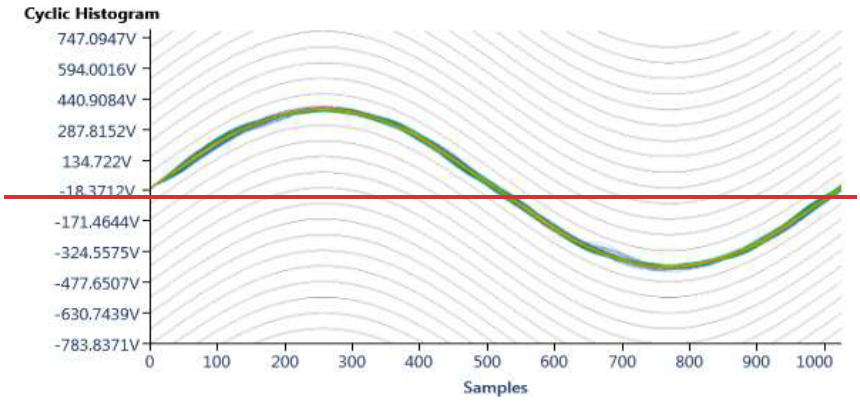
- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.

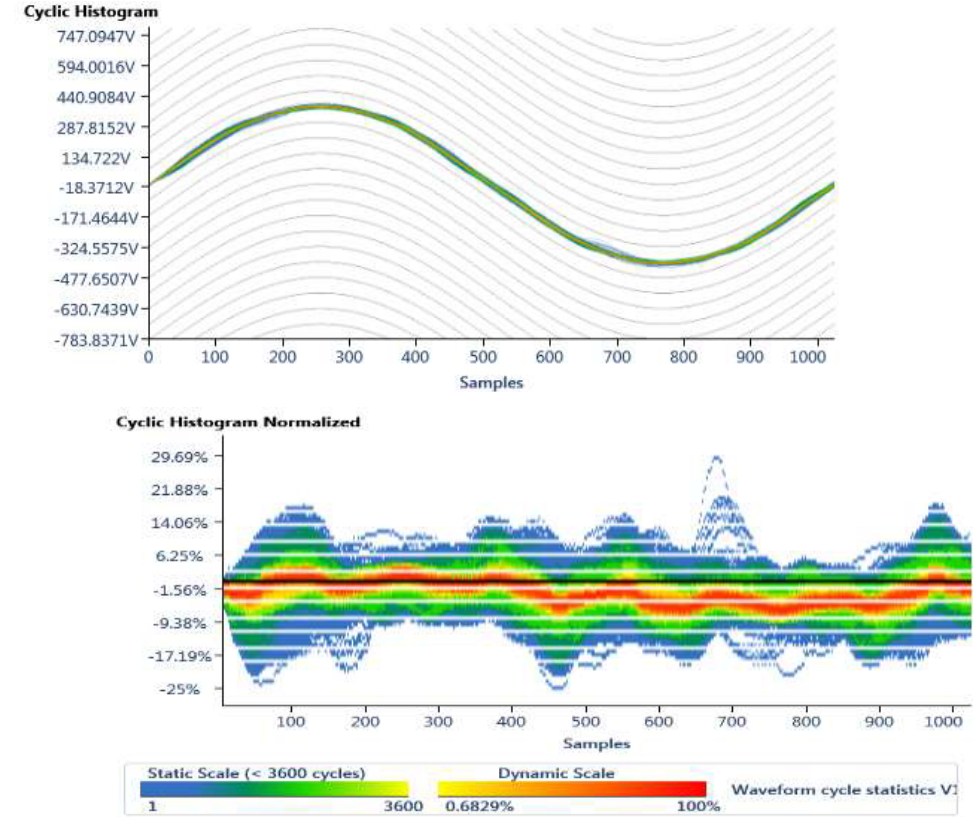
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Split to Charts -** When multiple parameters are displayed on the same chart, this option splits the chart into separate charts based on the displayed parameters. You can revert to the non-split chart by dragging and dropping the parameters from the Chart Components tree.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Chart layout** – Click on "Select new chart layout" to choose from different layout options such as Side-by-Side, Trend, or Pie. The default layout is set in the investigation settings.
- **Change Color** - This option enables you to change the color of any graph on the chart, providing visual differentiation between parameters and aiding in data analysis.
- **Show total series (Trend only)** – By clicking this option, the chart will display the total energy series, which represents the combined energy consumption of all selected components. This is applicable only in the Trend layout.

6.5.2.12. Cyclic Histogram (Professional and Enterprise only)

The Cyclic Histogram allows you to visualize overlaid waveform cycles for a selected time range. This feature is made possible by the continuous recording mechanism of Elspec BlackBox analyzers. The histogram displays the deviation from the expected ideal waveform by overlaying the waveforms. To view this chart, you need to select the "waveform cycle statistics" parameter.

Note: by default, this parameter may not be calculated or fetched from the device, so you will need to recalculate it.





Cyclic histogram chart tools

The Cyclic Histogram chart tool menu includes the following options:

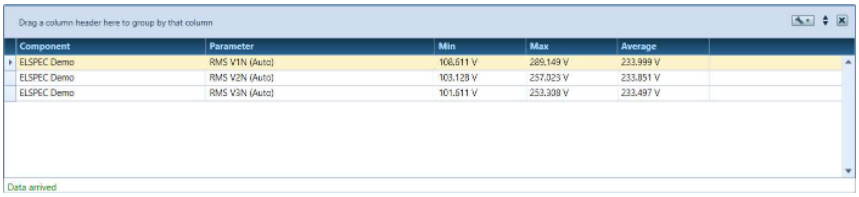
- **Hide/Show Legend Box -** This option allows you to hide or show the legend box that displays the parameter names and their corresponding colors on the chart.

- **Reset zoom to 100%** - allows you to restore the original zoom level of the chart.
- **Export -** You can export the chart information using different methods such as copying the chart to the clipboard, exporting the chart as an image file, or exporting the chart to Excel for further analysis or reporting.
- **Change background color -** Gives you the ability to customize the background color of the Spectrum chart to suit your preferences or improve visual clarity.
- **Edit chart title** – Allows you to modify the name of the chart.
- **Edit axis Y scale** – allows you to select the number of steps of the Y axis.
- **Grid -** allows you to control the grid lines displayed on the chart. It provides the following functionalities:
    - **Show/Hide Grid Lines** - You can choose to show or hide the grid lines on the chart. When enabled, grid lines are displayed to assist in visually aligning and interpreting data points.
    - **Change Grid Line Color** - You have the option to change the color of the grid lines. This allows you to customize the appearance of the grid to suit your preferences or to enhance visibility.
    - **Change Grid Line Spacing** - You can adjust the spacing between grid lines. This allows you to control the density or frequency of grid lines displayed on the chart. Increasing the spacing results in fewer grid lines, while decreasing the spacing increases the number of grid lines.
- **Normalized Display Mode** - This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.

Note: The data used for the Cyclic Histogram chart is waveform samples. When requesting a large time range, such as more than a few seconds or minutes, a significant amount of data is involved. As a result, the response time for generating the chart may take 10-15 seconds or even longer, depending on the requested period. It's important to be aware of this potential delay when working with larger time ranges to ensure a smooth user experience.

6.5.2.13. Summary Chart

The Summary chart allows you to view the key statistics of selected parameters for a specific time range. It provides the following information:

- **Minimum Value -** Displays the lowest recorded value of each parameter within the selected time range.
- **Maximum Value -** Shows the highest recorded value of each parameter within the selected time range.
- **Average Value -** Represents the average (mean) value calculated from all data points of each parameter within the selected time range.
- 

Summary chart tools

The Summary chart tool menu includes the following options:

- **Export to Excel -** The Export to Excel feature allows users to export chart data or grid table data directly to an Excel file for further analysis, reporting, or sharing purposes.
- **Normalized Display Mode** - This mode normalizes the data in the chart, particularly for voltage, current, and power parameters. The values are adjusted based on their nominal values, providing a standardized view for comparison and analysis.

6.5.3. Real time charts

Real-time charts in PQSCADA provide live monitoring and visualization of power quality data as it is being collected. With real-time charts, users can observe and analyze power quality parameters and trends as they occur.

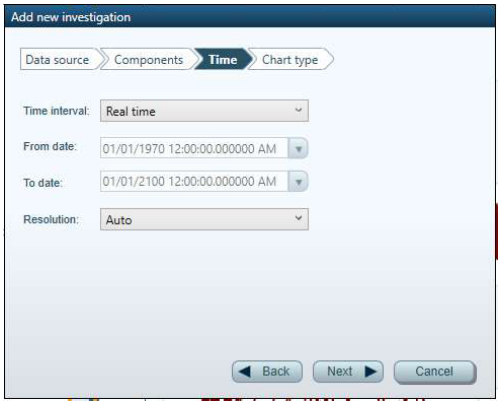
PQSCADA's real-time charts offer a dynamic and interactive display of power quality data, presenting it in a visually appealing and easily understandable format. Users can customize the charts to show specific parameters of interest, such as voltage, current, frequency, harmonics, and more.

6.5.3.1. Add a new real time chart

Real time charts can be added via creation of **new investigation** and **new view**. Make sure that the selected component is a **live** unit.

To **add a new real time chart** in PQSCADA, follow these steps:

1. Click on the **'Add New investigation'** button to initiate the process of creating a new investigation.
2. The **'Add new Investigation'** Wizard will appear.
3. On the data source page, click the '**Next'** button to move forward.
4. Select a live component and click the '**Next'** button.
5. Set the **Time interval** to **'Real time'** to ensure that chart displays live data, click the '**Next'** button.



6. Choose the type of real time chart you want to add, such as Trend, Phasor, Spectrum, or waveform, click the '**Next'** button.
7. Select the parameters you want to include in the chart. You can choose from a variety of power quality parameters. Once you've made your selections, click the **'Finish'** button.

6.5.3.2. Real time tool bar

Start\pause button - used to control the streaming of real-time data in a chart.

Fit charts in view – Organizes the chart size in two modes:

- Fit charts to screen – resized to the screen height.
- Best fit with scrolling –optimized chart height to the screen height to enable scrolling.
    - **Resolution** - defines the number of points to be displayed on the chart. In Auto mode, PQSCADA Sapphire optimizes the number of points to the screen resolution.

Note:

- Old data is deleted when changing resolution.

- **Add\Remove** parameters option is available while real time is in **Pause** mode.

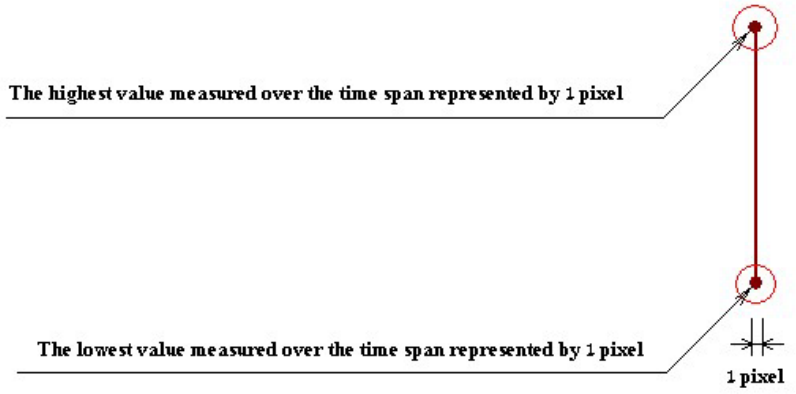
6.5.4. Min/Max View

The Min/Max View is a feature in PQSCADA Sapphire that optimizes the representation of data considering the request and response time. When dealing with a large amount of waveform data over an extended time interval, such as a year, the resolution of the display and human eye becomes a limitation.

For example, when displaying RMS values over a year, there are millions of data points representing each cycle (60Hz x 60sec x 60min x 24hours x 365days). With limited screen resolution, each pixel on the screen represents many cycles, making it difficult to identify spikes and aberrations.

To address this, the Min/Max View was introduced. In this view, each horizontal pixel on the screen is represented as a vertical bar, 1 pixel wide. The top end of the bar represents the maximum measured value, and the bottom end represents the minimum measured value. This representation allows significant aberrations to be clearly visible, even within the limited screen space.

By drilling into a specific event or time range, the view can be zoomed in to focus on the original length of time over which the event occurred. This allows for a detailed analysis of the event and its characteristics.



6.5.5. Drilling In

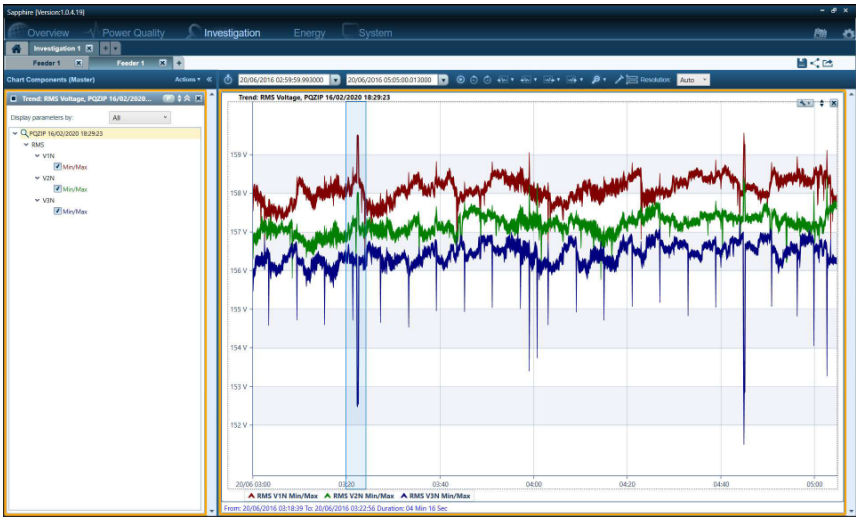
When investigating collected data in PQSCADA Sapphire, drill-in options provide a way to focus on specific locations or regions within the chart, helping to identify the cause of failure or anomalies. There are three drill-in options available:

- **Active Region** - This option allows drilling into the active region of interest, which is typically determined by user interaction or specific criteria set by the system.
- **Single Region** - With this option, users can drill into a single specific region on the chart. By selecting a particular area or time range, the data within that region is expanded for closer inspection.
- **Multiple Regions** - allows users to select and drill into multiple regions of interest on the chart. This is useful when there are multiple areas or time ranges that require closer examination.

6.5.5.1. Active Region

To use the Active Region drill-in option in PQSCADA Sapphire, follow these steps:

1. Click on the **Drill navigation mode** icon located on the view toolbar. This enables the drill-in functionality.
2. **Left click and drag the mouse** along the desired region on the chart that you want to drill into. As you drag the mouse, a blue shadow will highlight the selected region, and the corresponding time interval will be displayed below the chart.
3. **Release the mouse button** to drill into the selected region. The chart will be zoomed in to display the drilled-in region in more detail.
4. To navigate back to the **previous time frame**  , click on the Previous time frame icon, typically represented by a left-pointing arrow. This will revert the chart view to its previous state before drilling in.
5. If you wish to further enlarge or explore another region of interest, repeat the above steps to continue drilling in and analyzing specific regions along the chart.



6.5.5.2. Single Region

To use the single Region drill-in option in PQSCADA Sapphire, follow these steps:

1. Click on the **Drill navigation mode** icon located on the view toolbar. This activates the drill-in functionality.
2. **Right-click and drag the mouse** along the desired region on the chart that you want to drill into. As you drag the mouse, a red shadow will highlight the selected region, and the corresponding time interval will be displayed below the chart.
3. **Release the mouse button** to drill into the selected region. The chart will be zoomed in to display the drilled-in region in more detail, and a new chart tab will be created specifically for that region.
4. If you wish to further enlarge or explore another region of interest, repeat the above steps by right-clicking and dragging the mouse to select and drill into additional regions.
5. You can also continue using the Single Region feature by left-clicking and dragging the mouse within the already drilled-in region to zoom in further and analyze specific areas within that region.

6.5.5.3. Multiple Regions

To use the single Region drill-in option in PQSCADA Sapphire, follow these steps:

1. Click on the **Drill navigation mode** icon located on the view toolbar. This activates the drill-in functionality.
2. **Center-click and drag the mouse** along the desired region on the chart that you want to drill into. As you drag the mouse, a green shadow will highlight the selected region, and the corresponding time interval will be displayed below the chart.
3. **Release the mouse center button** to select the region. The selected region will be highlighted, and the time interval will be recorded.
4. Repeat steps 1-3 to select additional regions of interest. Each selected region will be highlighted with a green shadow.
5. Once you have selected all the desired regions, **double-click** any of the selected regions with the left mouse button.
6. The drilled-in region will be displayed, and a new chart tab will be created specifically for that region.
7. Repeat steps 5-6 for each of the selected regions to create separate drill-in chart tabs for each region.
8. To further enlarge the region of interest, you can continue using the Active Region or Single Region drill-in options within the already drilled-in region, following the respective steps provided earlier.

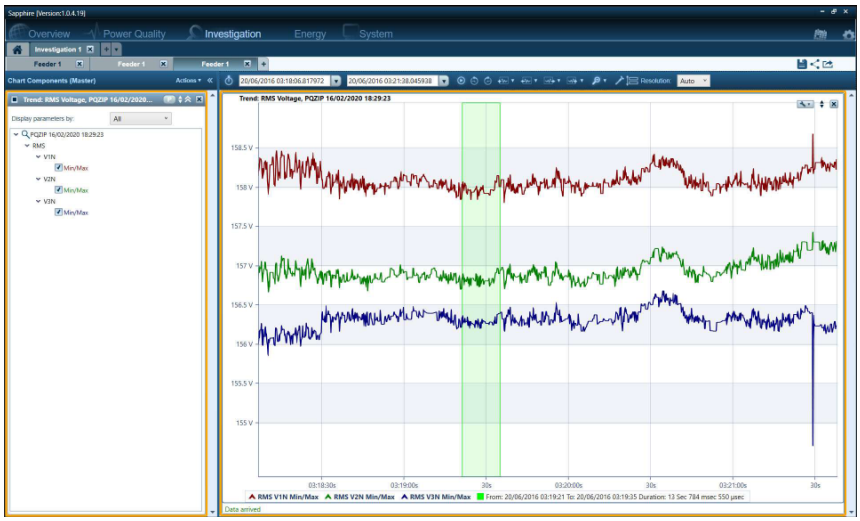
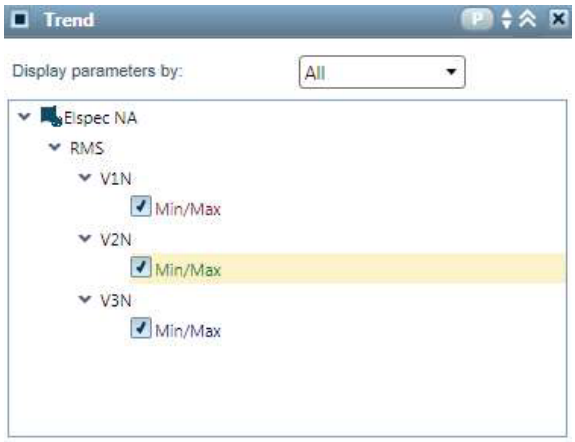


Figure 6-2. Selected regions

6.6. Charts Tree

The chart tree in PQSCADA Sapphire provides a list of parameters displayed on the chart. Here are the icons and their functionalities located on the chart tree bar:



Use the following icons located on the chart tree bar:

Hide chart – Click to hide or unhide the chart from the view.

Add Parameter – Click to add\remove parameters to\from the chart.

Add/remove event type - Click to add or remove event types (specific to event charts).

Move chart – Click and drag to reposition the chart within the view.

Minimize chart tree – Click to minimize the chart tree, collapsing it for a more compact view.

Delete chart – Click to delete the chart from the view.

Minimize parameter – Click to minimize a parameter within the chart tree, collapsing its details.

Hide parameter – Click to hide or unhide a parameter from the chart.

All

Display parameters by – parameters in PQSCADA Sapphire can be displayed as channels (e.g., channels 1, 2, 3, etc.), logical (e.g., V1, V2, V3, etc.), or additional (e.g., temperature, pressure). Use the Display parameter by to sort parameters according to type.

6.6.1. Move Parameters Between Charts

To move a parameter between charts in PQSCADA Sapphire, follow these steps:

1. Locate the parameter you want to move within the chart tree.
2. Select the parameter by clicking on it.
3. Click and hold the selected parameter.
4. Drag the parameter to the scrollbar area, which is outside the chart tree section.
5. While dragging, you will see a visual indicator showing the parameter being moved.

6. Release the mouse button to drop the parameter into the new chart.

By dragging and dropping the parameter between the chart trees, you can easily move parameters from one chart to another, organizing and customizing the charts according to your preference and analysis needs.

6.7. Templates

Templates in PQSCADA Sapphire are preconfigured investigations that include topologies, charts, and parameters. They serve as a convenient starting point for creating new investigations with specific focuses or analysis needs. You can create your own custom templates or use pre-existing templates provided by PQSCADA Sapphire.

For instance, an event investigation template could be designed to analyze power quality events such as voltage sags or dips. This template would include high-resolution parameters, such as Voltage RMS, that are relevant to capturing and analyzing the specific event. By using this template, you can quickly set up an investigation with the necessary charts and parameters already configured.

6.7.1. Investigation Template

To streamline the process of creating a new investigation or view in PQSCADA Sapphire, you have the option to use a preexisting investigation template. These templates come with preconfigured topologies, charts, and parameters, allowing you to quickly set up an investigation with a specific focus or analysis objective.

To open a new Investigation/View from a Template, select **Template** from the **Chart type** page of the **Add new Investigation/View** wizard.

6.7.1.1. Create a New Investigation Template

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
    - Under 'Template type', select **'Investigation'**.
    - Provide a name for the new template.
    - Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
4. If you want the template to include events, enable the "Create a separate view for each of the following events" checkbox and select the events you want to include.
5. Finally, click on the **"Save"** button to save the template.

6.7.1.2. Modify an Investigation Template

A single template can include different parameters for different power topologies. For example, the same template will include differential voltages when you open a component configured as Delta and phase to neutral voltages when you open a component configured as WYE.

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
4. Under 'Template type', select **'Investigation'**.
5. Select the template you want to modify.
6. Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
7. If you want the template to include events, enable the "Create a separate view for each of the following events" checkbox and select the events you want to include.

8. Finally, click on the **"Save"** button to save the template.

6.7.2. Include Event in a Template

In PQSCADA Sapphire, templates offer the option to open separate views for selected events. This feature allows for a more detailed analysis of specific events that occur within the selected time interval of the view.

When using a template and selecting a time interval for the view, if there are events detected within that interval, such as dips, PQSCADA Sapphire will automatically open additional views for each of those events. For example, if there were three dips detected during the selected time interval, PQSCADA Sapphire would open three additional views, one for each dip.

6.7.3. Event Template

Event templates are used to open a view with predefined charts and parameters for a specific event type. For example, a template for a dip will include voltage waveform and RMS charts, while a Harmonic event will include a spectrum chart.

6.7.3.1. Create a New Event Template

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
   - Under 'Template type', select **Events**.
   - Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
   - Select the event type.
   - Check the enable user tags to select the user tags range.
4. Finally, click on the **"Save"** button to save the template.

6.7.3.2. Modify Events Template

A single template can include different parameters for different power topologies. For example, the same template may include differential voltages when you open a component configured as Delta and phase to neutral voltages when you open a component configured as WYE.

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
   - Under 'Template type', select **Events**.
   - Select the template you want to modify.
   - Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
   - Select the event type.
   - Check the enable user tags to select the user tags range.
4. Finally, click on the **"Save"** button to save the template.

6.7.4. Files Template

In PQSCADA Sapphire, the File Template feature allows you to open a new investigation based on PQZIP and PQZ files. These files contain recorded power quality data and can be used as a starting point for your analysis.

When you upload a PQZIP or PQZ file to the PQSCADA Sapphire application, you can define a File Template that specifies the initial investigation settings for that file. This includes the charts, parameters, and other configurations that you want to have preconfigured when opening the file.

6.7.4.1. Create New File Template

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
    - Under 'Template type', select **File**.
    - Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
    - Select the file type.
4. Finally, click on the **"Save"** button to save the template.

6.7.4.2. Modify File Template

A single template can include different parameters for different power topologies. For example, the same template will include differential voltages when you open a component configured as Delta and phase to neutral voltages when you open a component configured as WYE.

1. Create a View with all the charts and parameters you wish to include in the template. The view cannot include more than 1 component.
2. Click on the **Actions** menu and select **Save as template**.
3. In the **Save template** window, perform the following actions:
    - Under 'Template type', select **File**.
    - Select the template you want to modify.
    - Choose the appropriate topology from the "Topology" dropdown menu, specifying where this template will be active.
    - Select the file type.
4. Finally, click on the **"Save"** button to save the template.

7. Power Quality Module

The Power Quality module in the system provides valuable information about the power quality conditions in your network or at individual measurement points. It allows you to configure the power quality compliance standards according to your specific requirements, such as EN50160, FOL, IEEE519, and others.

By applying these compliance conditions, the module helps you identify any violations and determine the root cause and type of the violation quickly and efficiently. It supports multiple compliance conditions for a single measurement point, enabling easy comparison.

In addition to real-time monitoring and analysis, the Power Quality module also offers the capability to generate comprehensive reports based on the power quality data. These reports provide detailed insights into the power quality conditions, making it easier to analyze and address any issues.

For more detailed information on power quality compliance and standards, you can refer to Appendix A of the system documentation. It will provide you with additional guidance and specifications related to power quality compliance.

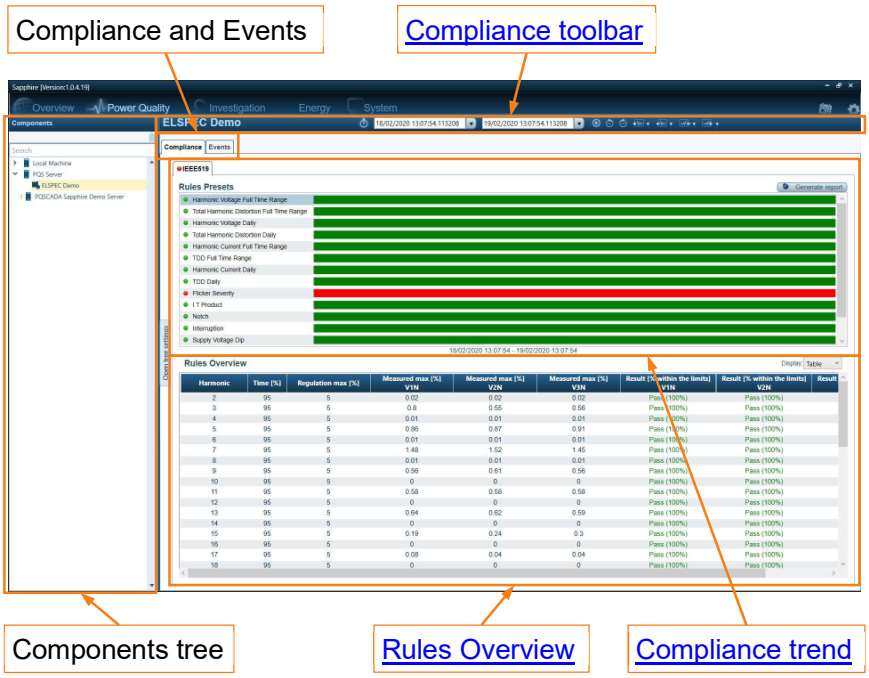


Figure 7-1. Power Quality screen

The Power Quality module screen is divided into two main sections:

The **left section** is dedicated to displaying the connected Instances and their hosted Components. This section provides an overview of the different instances and components within your power system.

The **right section** of the screen is reserved for displaying the Compliance results of the selected object. This section provides detailed information about the compliance status and any violations detected based on the configured power quality compliance conditions.

To adjust the size of the sections and allocate more space to either the Instances and Components section or the Compliance results section, you can use the splitter control line. The splitter control line is a vertical line located between the two sections. By clicking and dragging the splitter control with

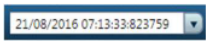
your pointing device, you can move it to the left or right, thereby changing the width of each section according to your preference.

7.1. Compliance Toolbar

The compliance toolbar in the Power Quality module provides various options for adjusting the compliance view and navigating through the time intervals. Here's an explanation of each option:

Fixed times interval – This option allows you to select a predefined time interval as a shortcut. For example, selecting "All" will set the time interval to include all the available data in the database.

Start time – You can manually set the start time of the compliance view using this option. It allows you to specify a specific point in time from which the view will start.



End time – Similar to the start time, the end time option allows you to set the end time of the compliance view. It defines the point in time at which the view will end.

Start new query – Clicking this button applies the changes made to the set time interval. It triggers a new query to update the compliance view based on the modified time range.

Previous time/Next time – These buttons enable you to navigate back and forth through the previously selected time intervals. You can move to the previous time selection or to the next time selection using these buttons.

Append back – This option keeps the end time intact and moves the start time back by a selected amount. It allows you to extend the time interval by adding more data preceding the current view.

Back – Selecting the Back option shifts the current time duration back by a specified amount. It allows you to go back in time within the current view.

Forward – The Forward option shifts the current time duration forward by a specified amount. It helps in moving forward in time within the current view.

Append forward – This option keeps the start time intact and moves the end time forward by a selected amount. It extends the time interval by adding more data following the current view.

7.2. Starting a New Compliance Investigation

1. Select the component from the **Components** tree. To sort the components by tags, click the **Tag** icon.

   For details on Open tree settings, see section 5.8.4.

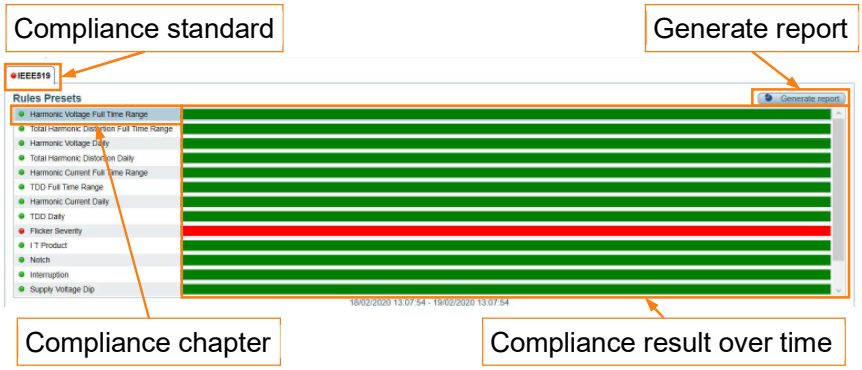
2. Select the time interval from the compliance toolbar with one of the following options:

   - Click the **Fixed time intervals** icon to select a fixed time interval.
   - Type the Start and End times in the time picker box.

3. Click the **Start query** icon.

7.3. Compliance Trend

In the Compliance Trend part of the screen in PQSCADA Sapphire, you can analyze the compliance results over time based on selected standards. Here's a closer look at the different elements:

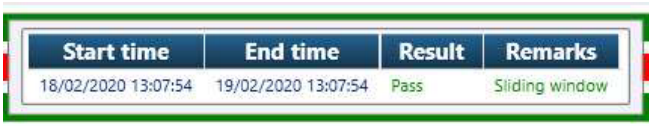


- **Compliance Standard -** Select the specific standard you want to investigate. You can choose from various compliance standards, such as EN50160 or others. Multiple compliance conditions can apply to a single measurement point, allowing for comparison and analysis.
- **Compliance Chapter -** Compliance is organized into chapters, each having its own set of rules, evaluation window, observation window, sliding window, and result over time. The rules within a chapter determine the compliance criteria and parameters to be evaluated.
- **Compliance Results Over Time -** Compliance assessment is performed over a specified period. For example, EN50160 has an evaluation period of 1 week. The sliding window determines the frequency of the results. If the sliding window is set to 1 day, you will see a result for each day, representing the compliance status for the past 7 days.
- **Sub-Time-Intervals -** The compliance result over time section is divided into sub-time-intervals that represent the compliance results for each sliding window period. When selecting a time interval, PQSCADA Sapphire divides it into sub-time-intervals of 7 days based on the sliding window duration. Each sub-time-interval represents a portion of the selected time interval.
- For example, when selecting a time interval of 10 days (May 1st to May 10th) for a compliance standard with an evaluation window of 7 days and a sliding window of 1 day, PQSCADA Sapphire will display 3 sub-time-intervals: the first represents the result from the 1st to the 8th day, the second for the 2nd to the 9th day, and the third for the 3rd to the 10th day. The maximum number of sub-time-intervals is 96.
- **Colors for Compliance Results -** The compliance results are displayed using four different colors:
    - **Green -** Indicates a pass, meaning the power quality parameters meet the compliance criteria.
    - **Orange -** Represents a pass, but the parameters did not meet the target specified by the standard.
    - **Red -** Indicates a failure, indicating that the power quality parameters did not meet the compliance criteria.
    - **Gray -** Indicates insufficient data to evaluate compliance for a particular sub-time-interval.
- **Generate Report -** Clicking the "Generate report" button allows you to generate a report based on the configured compliance standards. This report can provide a comprehensive overview of the compliance status and analysis.

7.4. Drill In

When working with the Compliance Trend section in PQSCADA Sapphire, you can use the "Drill in" feature to obtain more detailed information about specific sub-time-intervals and sliding windows. Here's how you can do it:

1. **Hover over a sub-time-interval:** Move your cursor over a particular sub-time-interval on the Compliance Trend chart. This action will trigger a pop-up window called the "List of sliding windows."

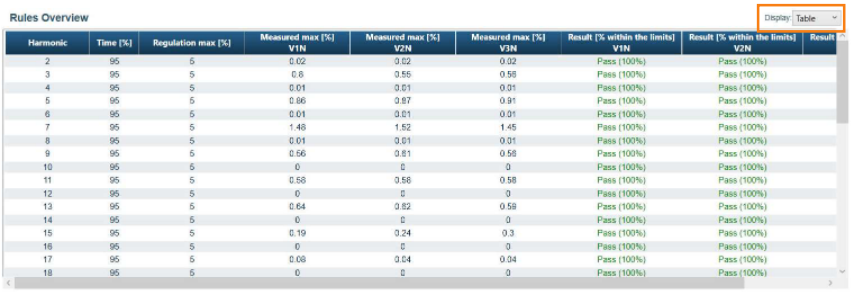


Start time	End time	Result	Remarks
18/02/2020 13:07:54	19/02/2020 13:07:54	Pass	Sliding window

2. **Click on a row:** In the "List of sliding windows" pop-up window, click on the row that corresponds to the sliding window you wish to drill into. You have two options based on the type of click:
    a. **One-click -** By performing a single click on a row, you can change the observation window of the Rules overview section. This allows you to focus on specific compliance rules and their evaluation within the selected sliding window.
    b. **Double click -** If you double click on a row, the compliance window time interval will be adjusted to match the selected sliding window. This action provides a more detailed view of the compliance results specifically within that time range.

7.5. Rules Overview

In the Rules Overview section of PQSCADA Sapphire's Compliance Trend, you can access a detailed overview of a specific chapter and observation window related to the compliance trend. This section provides information about the rules associated with the selected chapter and the corresponding results within a specific time interval.



Rules Overview

Display: Table

Harmonic	Time [%]	Regulation max [%]	Measured max [%] V1N	Measured max [%] V2N	Measured max [%] V3N	Result [% within the limits] V1N	Result [% within the limits] V2N	Result
2	95	5	0.02	0.02	0.02	Pass (100%)	Pass (100%)	
3	95	5	0.6	0.56	0.58	Pass (100%)	Pass (100%)	
4	95	5	0.01	0.01	0.01	Pass (100%)	Pass (100%)	
5	95	5	0.86	0.87	0.91	Pass (100%)	Pass (100%)	
6	95	5	0.01	0.01	0.01	Pass (100%)	Pass (100%)	
7	95	5	1.48	1.52	1.45	Pass (100%)	Pass (100%)	
8	95	5	0.01	0.01	0.01	Pass (100%)	Pass (100%)	
9	95	5	0.56	0.61	0.58	Pass (100%)	Pass (100%)	
10	95	5	0	0	0	Pass (100%)	Pass (100%)	
11	95	5	0.58	0.56	0.58	Pass (100%)	Pass (100%)	
12	95	5	0	0	0	Pass (100%)	Pass (100%)	
13	95	5	0.64	0.62	0.59	Pass (100%)	Pass (100%)	
14	95	5	0	0	0	Pass (100%)	Pass (100%)	
15	95	5	0.19	0.24	0.3	Pass (100%)	Pass (100%)	
16	95	5	0	0	0	Pass (100%)	Pass (100%)	
17	95	5	0.08	0.04	0.04	Pass (100%)	Pass (100%)	
18	95	5	0	0	0	Pass (100%)	Pass (100%)	

To enhance the visualization of the data, you have two display modes available: table and chart.

- **Table -** Selecting the table mode will present the detailed data in a tabular format.
- **Chart -** Opting for the chart mode will display the detailed data in a graphical representation.

By switching between the table and chart modes in the Rules Overview section, you can choose the presentation style that best suits your analysis and interpretation needs.

7.6. Events

In PQSCADA Sapphire, the Events section provides a continuous display of events that are typically observed in a power quality monitoring system. These events can be managed and edited through the Events tab in the System module (refer to section 5.9.8 for more information).

The Events column header can be interactively dragged up to group events based on the selected column. This feature allows you to organize and analyze events based on specific criteria or parameters, providing a more structured view of the data.

Clicking on an event in the Events section automatically creates an investigation related to that event. This enables you to delve deeper into the event, analyze it further, and gather more detailed insights. For more comprehensive information on investigations and their functionalities, you can refer to Chapter 5 of the documentation.

8. Energy Module

The Energy Module in PQSCADA Sapphire is a robust tool designed to analyze energy-related data for the customers. Here are some key specifications and features of the Energy module:

- **Enterprise License -** The Energy module is available as an Enterprise licensed feature, providing advanced energy analysis capabilities to the users.
- **Integration with Billing Tab -** The Energy module is closely coupled with the Billing tab in the client's System module (refer to section 5.9.16). This integration ensures that much of the displayed data is based on the billing configuration, allowing for accurate and relevant energy analysis.
- **Customizable Dashboards -** Users have the flexibility to create custom dashboards in the Energy module, tailoring the displayed information and visualizations to their specific needs and preferences.
- **Export to Word -** The Energy module allows users to export their custom dashboards to Word format. By clicking the Export Energy icon located on the top right corner of the screen, a Word file is generated based on an XML template. This template can be modified as per the customer's requirements, and the exported file serves as a comprehensive report of the energy analysis.

The Energy Module is a powerful tool that can be used to analyze energy by the customer's PQSCADA Sapphire.

Custom dashboards can be exported to Word by clicking the **Export Energy** icon on the top right corner of the screen. The Word file is created from an XML template that can be modified per customer requirements at (C:\Users\<username>\AppData\Roaming\PQS\Templates\Export).

8.1. Home Page

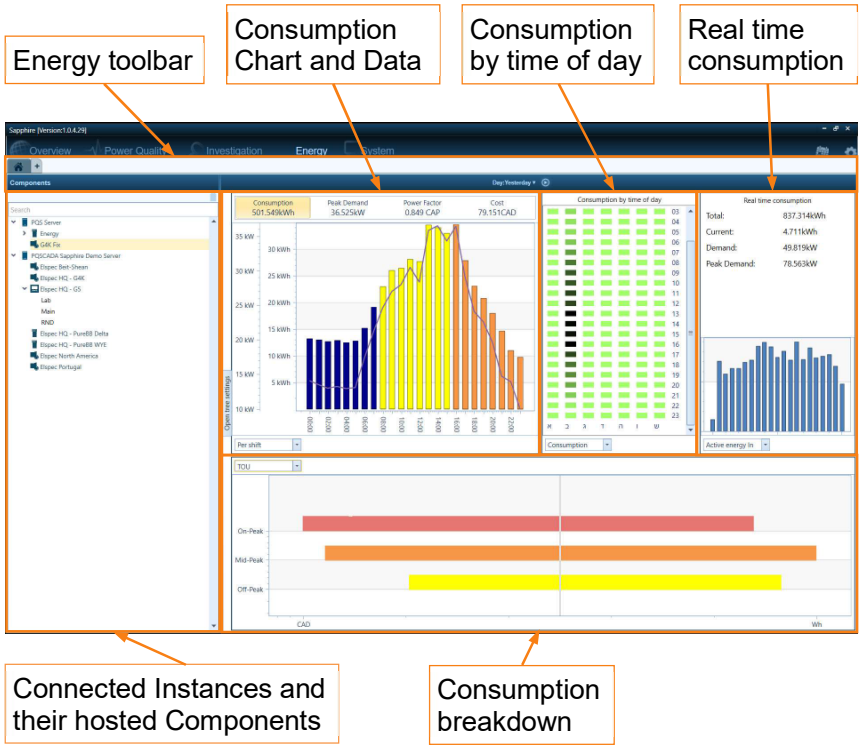


Figure 0-1. Energy Module

In the **Energy module** of PQSCADA Sapphire, the screen is divided into two main sections separated by a vertical splitter control line. Here's a breakdown of each section:

- **Left Section -** This section displays the connected Instances and their hosted Components. It provides a hierarchical view of the energy-related objects and their organization within the system. You can navigate through the Instances and Components to select the specific objects you want to analyze.
- **Right Section -** The right section of the Energy module screen is dedicated to displaying the Energy Consumption of the selected objects. It provides detailed information and visualizations related to energy consumption, such as charts, graphs, and tables. This section allows you to analyze and interpret energy consumption data for the selected objects.

To adjust the size of the sections, you can click and drag the splitter control line to the left or right with a pointing device. This allows you to allocate more screen space to either the Instances and Components section or the Energy Consumption section, depending on your preference and the information you want to focus on.

8.2. Energy Toolbar

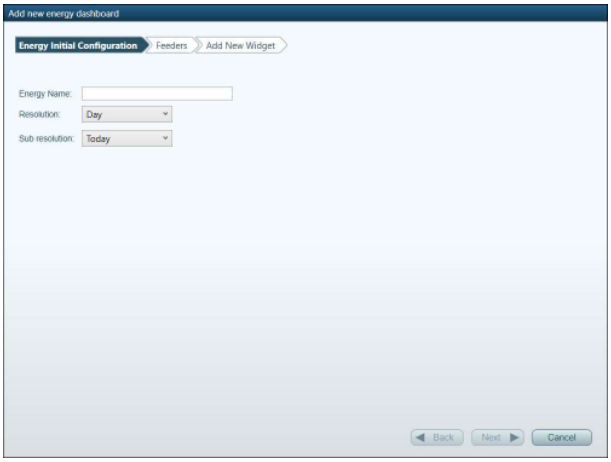
The Energy toolbar in the Energy module of PQSCADA Sapphire provides several important functionalities for managing energy dashboards and querying data. Here's an overview of the features available in the Energy toolbar:

- **Create New Energy Dashboard -** This button allows you to create a new energy dashboard. Energy dashboards are customizable views that display energy-related data, charts, and visualizations based on your specific requirements and preferences.
- **Resolution -** The resolution option enables you to select the level of detail or granularity for the displayed energy data. You can choose from various resolution options such as hourly, daily, weekly, monthly, or custom intervals, depending on the available data and your analysis needs.
- **Start Query -** Clicking the Start Query button initiates the data retrieval process based on the selected resolution and other filter settings. It retrieves the energy consumption data and updates the Energy Consumption section of the screen, accordingly, reflecting the latest available information.
- **Add Widget -** The right side of the home page screen in the Energy module displays energy consumption Widgets, which provide summarized information and insights regarding energy consumption.

8.3. Add New Dashboard

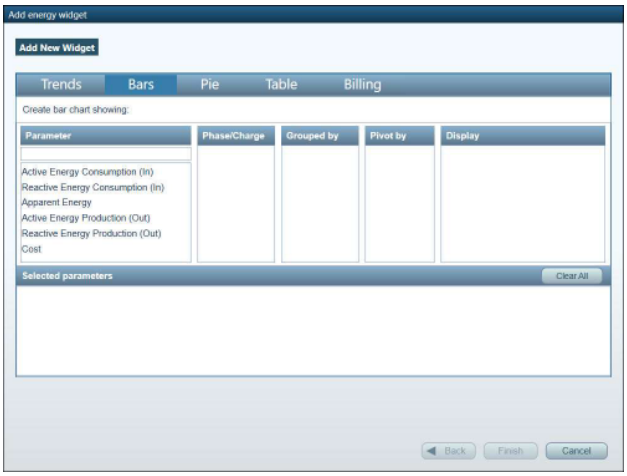
To create a new energy dashboard in the Energy module, follow these steps:

1. Click on the "**Add new dashboard**" icon.



2. Fill in the required information and make the necessary selections:
   - **Energy Name -** Enter a name for the energy dashboard to identify it.
   - **Resolution -** Choose the desired resolution for the displayed energy data. Options typically include Day, Week, Month, Year, and Custom.
   - **Sub resolution -** Set a sub-resolution for the energy data, which depends on the selected resolution.
3. Click **"Next"** to proceed to the **Feeders** page.
4. Select the desired feeders for the dashboard.

   If there are multiple feeders available, the selected feeders will be displayed in the Selected Feeder pane or section.
5. Click "Next" to proceed to the Add New Widget page.



6. Select the **type of widget** you want to add from the top bar. Common options include Trends, Bars, Pie, Table, and Billing.

   The available parameters and how to display them will depend on the selected widget type.

7. Choose the specific **parameter** you want to display in the widget. If applicable, make additional selections or configurations for the chosen parameter.

   The selected parameters and their display settings will be added to the Selected Parameters pane.

8. Once you have made all the necessary selections, click "**Finish**" to create the new energy dashboard.

In the Energy module, each widget within a dashboard has two icons at the top right corner, which allow you to perform specific actions on the selected widget:

 **Chart settings -** This icon opens the chart settings menu, where you can customize various aspects of the widget's chart. Chart settings include:

- **Add/Remove Parameter -** This icon allows you to add or remove parameters from the widget. Clicking on it opens a menu or dialog where you can select additional parameters to be included in the widget's chart or remove existing parameters.
- **Export the Chart to Excel -** This option allows you to export the widget's chart data to an Excel file.
- **Copy the Chart to Clipboard -** This option enables you to copy the widget's chart image to the clipboard.

 **Close -** Clicking on this icon will remove the widget from the dashboard, and it will no longer be displayed.

8.4. Resolution

The energy toolbar in the Energy module of PQSCADA Sapphire provides options for setting the display resolution and allows for easy comparison of energy data based on different time intervals. Here's an explanation of the available options for setting the display resolution and performing comparisons:

- **Day** - Today, Yesterday, Compare to (Previous day, Same day last week, Same day last year, Same day of week last year).
- **Week** - Last 7 days, This week, Last week, Compare to (Previous period, Four weeks ago).
- **Month** - Last 30 days, This month, Last month, Compare to (Previous period, Four weeks ago, Previous year, 52 weeks ago).
- **Year** - Last 12 months, This year, Last year, Compare to (Previous period).
- **Custom** - Time range, Compare to (Previous period, Last year).

8.5. Start Query

To initiate a query and retrieve energy data based on your selected parameters, you can click on the "Start query" icon  in the energy toolbar. This action will trigger the system to fetch the relevant energy consumption information according to the specified resolution and any other criteria you have set.

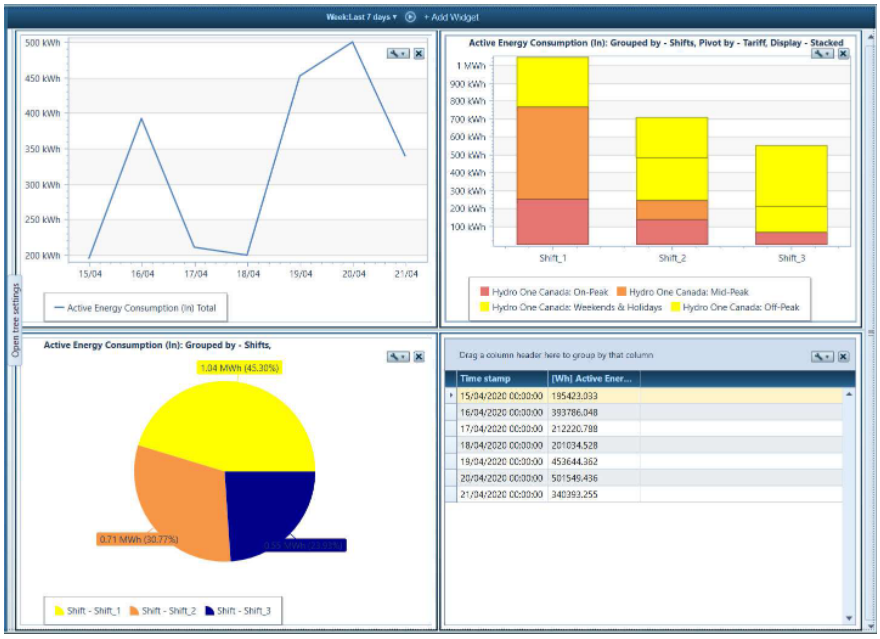
Note: whenever you change the resolution, the system will automatically initiate a new query to retrieve the energy data based on the updated resolution.

8.6. Widgets

The right side of the home page screen in the Energy module displays energy consumption Widgets, which provide summarized information and insights regarding energy consumption.

8.6.1. Add new Widget

+ Add Widget **Add widget -** Widgets can be added to a selected dashboard by clicking +Add Widget on the Energy module toolbar. Multiple widgets can be added and displayed.



8.6.2. Consumption Chart and Data

The **left widget** in the Energy module displays a numeric and graphical presentation of the consumed energy parameters, including Consumption, Peak Demand, Power Factor, and Cost. The widget provides both a numerical value and a graphical representation of these parameters.

The chart within the widget can be customized to display data according to any one of the selected energy parameters: Consumption, Peak Demand, Power Factor, or Cost. Depending on the selected energy parameter, the chart can be further refined by choosing from the dropdown list of values:

- **Per measurement point -** The chart will show the selected parameter based on individual measurement points.
- **Per tariff -** The chart will display the selected parameter based on different tariff rates.
- **Per shift -** The chart will present the selected parameter based on different shifts or time periods.
- **Per charge -** The chart will showcase the selected parameter based on different charging periods or billing cycles.

The **numeric values** displayed in the widget represent the overall consumption for the selected parameter. These values provide a summarized view of the total energy consumed.

The **chart bars** in the widget represent the selected parameter, while the trending curve represents either the Demand (when selecting Consumption or Cost) or the Consumption (when selecting Peak Demand). This visual representation helps identify consumption patterns and trends over time.

By **hovering the pointing device** (mouse) over the chart bars or trend line, users can view the corresponding values per point, providing more detailed information on energy consumption at specific intervals.

8.6.3. Consumption by Time of Day

The **center widget** in the Energy module displays the consumption data based on time and day. It presents a grid-like structure with seven columns representing the days of the week (Sunday to Saturday) and 24 rows representing each hour of the day.

The values within the grid represent the consumption for a specific day and hour. By hovering the pointing device (mouse) over any value in the grid, users can view the numeric value corresponding to the specific day and hour. If the selected period includes multiple time windows, the displayed value will be a summary of all the windows.

The color of the grid cells corresponds to the magnitude of the consumption value. Higher values are represented by darker colors, allowing users to quickly identify periods of higher energy consumption.

The dropdown list within the widget provides the option to switch between different parameters for the presentation of consumption by the time of day. The available options in the dropdown list are:

- **Consumption -** Selecting this option will display the energy consumption values for each day and hour. It provides insights into the patterns of energy usage throughout the day and across different days of the week.
- **Cost -** Choosing this option will show the cost associated with energy consumption for each day and hour. This allows users to analyze the cost implications of energy usage patterns at different times and days.

8.6.4. Real Time Consumption

The **right-side widget** in the Energy module presents real-time consumption data with numeric values for various parameters: Total, Current, Demand, and Peak Demand. These values provide insights into the current energy consumption status.

The widget also includes a chart that visualizes the real-time consumption data. The chart can be customized based on the selected value from the dropdown list. The available options in the dropdown list are:

- **Active energy In -** This option displays the real-time values of active energy being consumed.
- **Active energy Out -** Selecting this option shows the real-time value of active energy being exported or generated.
- **Reactive energy In -** This option presents the real-time values of reactive energy being consumed.
- **Reactive energy Out -** Choosing this option displays the real-time values of reactive energy being exported or generated.
- **Apparent energy -** This option visualizes the real-time values of apparent energy, which represents the total magnitude of power being consumed.

The real-time chart bars are displayed at 15-minute intervals, allowing users to monitor energy consumption patterns and fluctuations in near real-time.

8.6.5. Consumption and Cost

The bottom widget in the Energy module provides information on energy consumption and cost based on the selected value from the dropdown list. There are two options available in the dropdown list:

- **TOU (Time of Use) -** Selecting this option displays the energy consumption and cost chart based on time-of-use rates. The vertical axis of the chart represents the rates per time of use, while the horizontal axis represents the consumption vs. cost. Hovering the mouse over the chart allows users to view the specific values associated with each point on the chart.
- **Shifts -** Choosing this option presents the energy consumption and cost chart based on shifts. The vertical axis of the chart represents the shifts, which are predefined time periods

within a day, such as morning, afternoon, and evening. The horizontal axis represents the consumption vs. cost. Like the TOU chart, users can hover over the chart to view the corresponding values.

9. Overview Module

The Overview module in PQSCADA Sapphire provides multiple visualization options to display measuring points and their real-time data:

- **Geographical Map -** The Geographical Map view presents all measuring points on a live map. Each point is represented by an icon, allowing you to visualize their locations. The map provides real-time data and general statuses for the measuring points, giving you an overview of their current conditions.
- **Line Diagram -** The Line Diagram view displays a graphical representation of the system using lines and symbols to represent measuring points and their connections. It allows you to visualize the topology and interconnections between different components or instances in your system.
- **Table View -** Table View presents a tabular representation of all instances and components in a structured format. It provides a comprehensive overview of the measuring points, their properties, and real-time data. You can customize the displayed columns and sort or filter the data based on your requirements.

These different views in the Overview module offer flexibility in visualizing and analyzing the data from measuring points. You can choose the most suitable view based on your needs and preferences, whether it's a geographical map for spatial representation, a line diagram for network topology, or a table view for detailed information and data analysis.

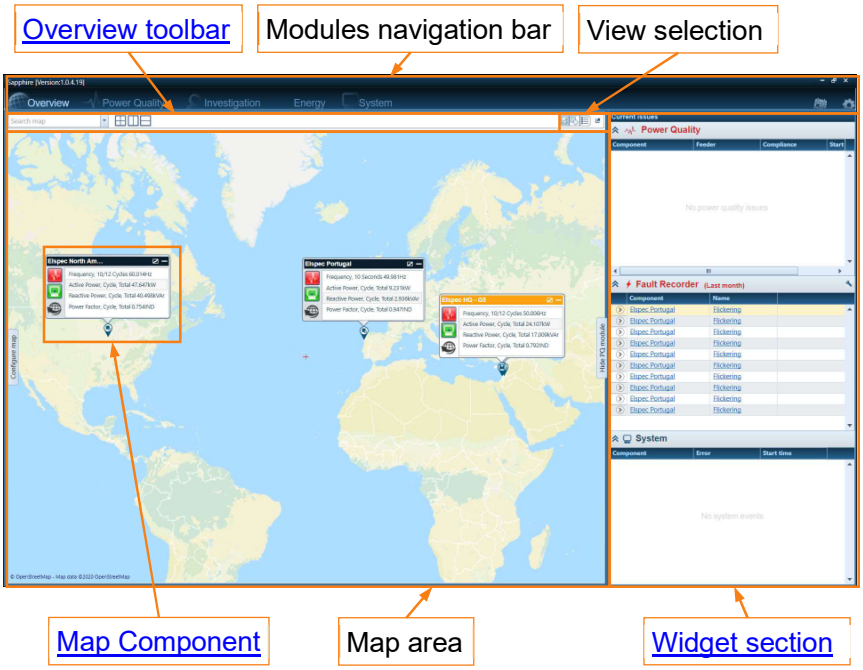


Figure 0-1. Overview screen

In the Overview module of PQSCADA Sapphire, the screen is divided into two main sections:

- **Left Section -** The left section displays the connected Instances and their hosted components in different visualization modes, such as a live geographical map, a table view, or a line diagram. You can switch between these modes based on your preference or the type of information you want to visualize.
- **Right Section -** The right section of the Overview module displays Widgets (see section 0). These Widgets provide additional functionalities and information related to the selected Instances or components. The specific Widgets available may vary based on the configuration and customization of your PQSCADA Sapphire system. The Widgets can offer

real-time data, analytics, alarms, or other relevant information for monitoring and managing the system effectively.

9.1. Overview Toolbar

In the Overview module toolbar of PQSCADA Sapphire, you will find the following symbols for performing various actions:

Search – allows you to search for a specific component or measuring point on the map.

Split view – enables you to split the screen view into different sections. You can choose to split the view vertically, horizontally, or into four equal areas.

Toggle Map/List view/Line diagram – allows you to switch between different views for displaying the Instances and components. You can toggle between the map view, a list view in table format, or view electrical line diagrams of specific instances.

Pop-up – opens a separate floating window with the selected view.

Close map – applicable when you are in a split view mode. It allows you to close a specific view or map when you no longer need it.

9.2. Map Components

In the map components display of PQSCADA Sapphire's Overview module, you will find the following elements (see following Figure 0-2):

- **Physical Location** - The map components are visually represented on the map based on their actual physical locations. Each component is displayed at its corresponding geographical position.
- **Window icons** - The window icons provide additional functionality for the selected measurement. There are 3 types of window icons:
- **Chart Icon -** allows you to view a chart or graph of a selected measurement. For example, you can click on the chart icon to see the frequency or power data in graphical form.
- **Add/Remove Parameters -** enables you to add or remove specific parameters from the displayed measurements.
- **Hide Measurements Window -** allows you to hide the measurements window associated with a component.

 **Power Quality Status -** appears as a green icon and reflects whether the electrical conditions of the component follow the preconfigured grid code. A green status indicates that the power quality conditions meet the required standards.

 **System Status -** appears as a green icon and represents the operational status of the measuring device associated with the component. A green status indicates that the device is in normal operating condition.

 **Device Website Link -** If applicable, a link is provided to open the device's website. This link allows you to access additional information or details related to the selected component or measuring device.

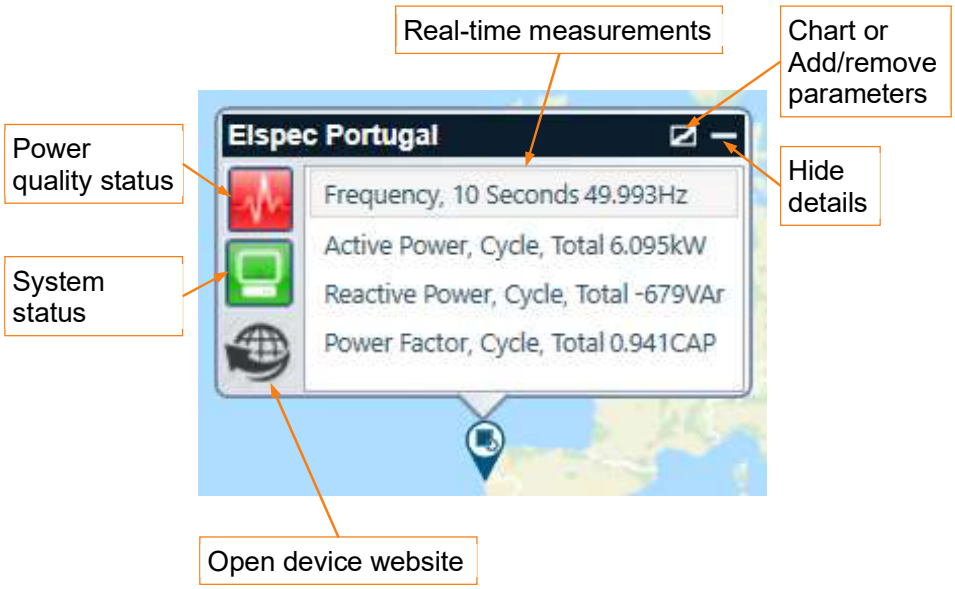


Figure 0-2. Map Component

9.2.1. Adding/Removing a Component to the Map

To add or remove components from the map in PQSCADA Sapphire's Overview module, you can follow the steps below:

To add a component to the map

1. Click on **"Configure map"** located on the left edge of the map section. This will open the **Components pane**.
2. In the Components pane, locate the desired component that you want to add to the map.
3. **Right-click** on the component and **drag** it to the desired location on the map, indicating its physical position.
4. Once you have placed the component at the desired location, click on **"Save changes"** on the map view to apply the configuration.
5. If you decide to disregard the changes made and not save them, you can switch to a different view and click on **"Don't save"** on the Save Configuration pop-up.

To remove a component from the map

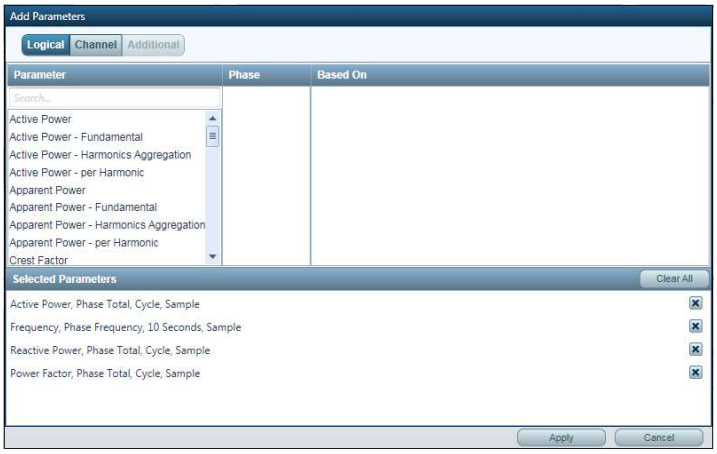
1. **Right-click** on the component that you want to remove from the map.
2. From the context menu that appears, select **"Remove component from the map".**
3. This will remove the selected component from the map display.

Note: the ability to add or remove components from the map requires writing permissions. Ensure that you have the necessary permissions to perform these actions.

9.2.2. Adding/Removing Parameter to a Component

To add a real-time parameter to a component

1. Click on the **Parameters** icon located on the top right corner of the map component. Alternatively, you can right-click on a component in the components tree and select **"Add/remove parameters"**. This will open the Add parameters configuration window.



2. In the Add parameters configuration window, you will see a Parameter list containing available parameters that can be displayed for the selected component.
3. Select the desired parameter from the Parameter list by checking the corresponding checkbox next to it.

4. Once you have selected the parameter(s) you want to add, click on **"Apply"** to apply the changes. The selected parameter(s) will now be displayed in real-time for the component on the map.

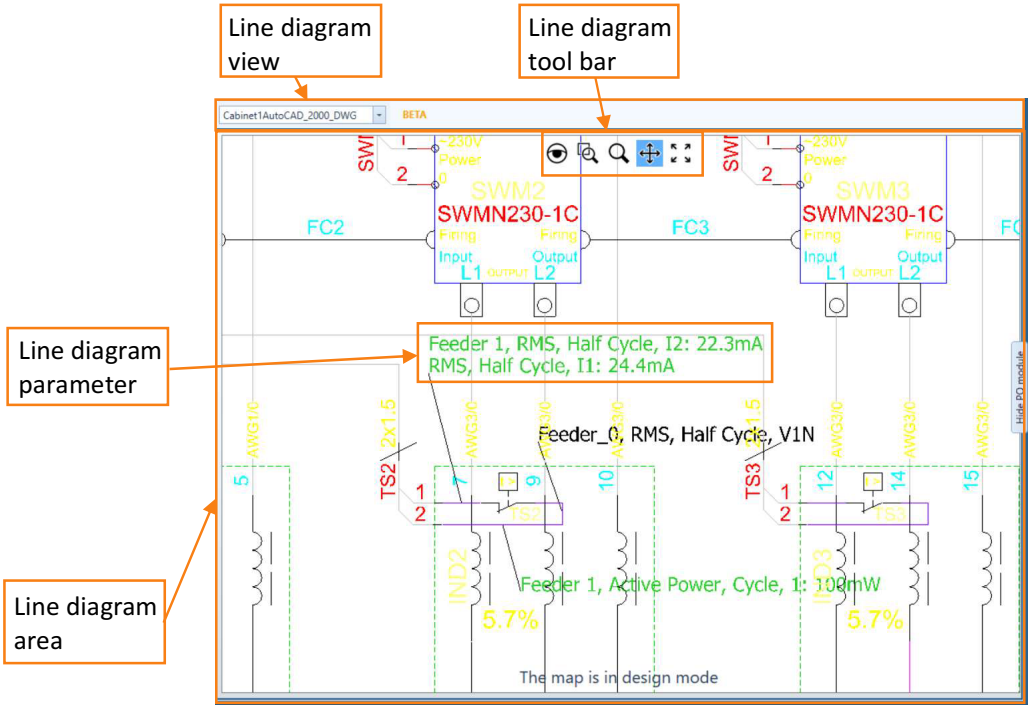
To remove a real-time parameter from a component

1. Click on the **Parameters** icon on the top right corner of the map component, or right-click on a component in the components tree to open the Add/remove parameters configuration window.
2. In the Add/remove parameters configuration window, you will see a list of currently displayed parameters for the selected component.
3. To remove a specific parameter, click on the **Delete** icon next to that parameter.
4. If you want to remove all parameters at once, you can click on **"Clear All"**.
5. After removing the desired parameter(s), click on **"Apply"** to apply the changes. The selected parameter(s) will no longer be displayed for the component on the map.

Note: The availability of parameters for display may vary depending on the component type and configuration.

9.3. Line Diagram

Line diagrams of an instance can be added in various formats (DWG, DXF, JPEG, PNG). For adding Line diagrams, see section 5.8.5.



9.3.1. Line Diagram parameters

To add a parameter on the line diagram:

1. Switch to the Line diagram view in the left section of the Overview module.
2. **Right-click** on the object in the line diagram where you want to display the parameter.
3. From the context menu that appears, select **"Add/Remove Parameters"** This will open the Add/Remove Parameters configuration window.

4. In the configuration window, you will see a list of available PQ server components. Select the component you want to display its parameters list.
5. Then, you will see a list of available parameters. Select the parameter you want to display on the line diagram by checking the corresponding checkbox.
6. Click **"Save changes"** to confirm the selection and add the parameter to the line diagram.
7. The parameter will now be displayed on the line diagram for the selected object or component.

   Parameter format - Feeder name, parameter name, based on, Phase, RT value.

   Example: Feeder 1, RMS, Half cycle, I1: 2.5A

Note: the above scenario is correct for line diagram from formats as DWG, DXF

Parameter configurations:

After adding a parameter, you can perform additional actions by **right-clicking** on the parameter itself. The available options include:

- **Parameter's location -** You can click and drag the parameter to a different position on the line diagram.
- **Showing/hiding connecting line -** You can choose to display or hide the line that connects the parameter to the object or component.
- **Select font size -** You can adjust the font size of the displayed parameter for better visibility.
  - **Font size –** select the desired font size, The default font size can be set via client overview settings.
  - **Apply to all parameters blocks in the specific diagram –** allow you to apply the font size change to all parameter blocks within the specific line diagram.
  - **Set as default for all diagrams -** make it the default font size for all diagrams.
- **Select name** - You can customize the parameter name.
  - **Display name** – select the desired parameter name.
  - **Set default** – if checked, the default parameter name will be displayed.
- **Changing the parameter's font color** - You can adjust the font color of the displayed parameter for better visibility, The default font color can be set via client overview settings.
  - **Connected –** color of the parameter when the component status is connected**.**
  - **Error –** color of the parameter when the component status is disconnected**.**
  - **Event -** color of the parameter when the parameter is under defined threshold**.**
  - **Apply to all parameters blocks in a specific line diagram -** allow you to apply the colors to all parameter blocks within the specific line diagram.
  - **Set as default for all line diagrams -** make it the default colors for all diagrams.
- **Set event threshold -** allows you to define a specific threshold value for a parameter and configure the system to trigger an event when the parameter value exceeds or falls below that threshold.

9.3.2. Line Diagram tool bar

Line diagram includes a toolbar that provides users with various tools and options to control and manipulate the diagram. Here are some common tools that you can find:

Zoom fit - Clicking this button or icon automatically adjusts the zoom level to fit the entire line diagram within the view, ensuring it is fully visible.

Pan - This tool enables you to move or pan the diagram within the view, allowing you to explore different parts of the diagram.

Zoom - These buttons or icons allow you to zoom in or out of the line diagram.

Zoom window – allows you to draw a rectangular area on the line diagram, and upon release, the view automatically zooms in to display only the selected area in more detail.

Magnifying glass - provides a magnified view of a specific portion of the line diagram when you hover the cursor over that area.

9.3.3. Widgets

The Power Quality widget, Fault Recorder widget, and System widget in the Current Issues section of PQSCADA Sapphire provide valuable information about the status of the electrical network. Here's an explanation of each widget:

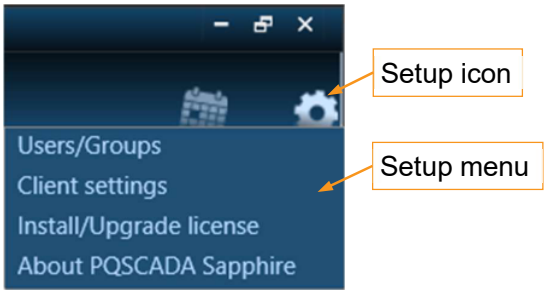
- **Power Quality** - Displays a list of measurement points that are in violation of the preconfigured grid code. It alerts you to any power quality issues detected in the system. The widget provides information about the specific measurement points that are experiencing violations. It includes details such as component name, feeder, violated compliance, and its start time. The widget also offers convenient links to the map or the Power Quality module for quick access to additional information and analysis.
- **Fault Recorder** - Displays a list of short, predefined events that have occurred during the specified period (last hour, day, week, or month). These events typically represent electrical faults or disturbances in the system. The widget provides information about events, such as the type of fault or disturbance and the time it occurred. It also includes links to the map or investigation for quick access to more detailed information. Clicking on a specific event in the list will open the associated investigation according to the event template, allowing for further analysis and troubleshooting. Investigation for a specific event in the list will be opened according to the event template.

To customize the preferences of the Fault Recorder widget, you can click on the **Preferences tool** icon (represented by a gear or settings icon) within the widget. This will allow you to adjust settings such as the period for displaying events and any specific criteria for event filtering.

- **System –** Displays a list of system messages and warnings related to the operating conditions of the electrical network. These messages may include notifications about system performance, equipment status, or any other relevant information. The widget provides a quick overview of the current system status and alerts you to any potential issues that require further investigation. It may also provide links to the system module for in-depth analysis and troubleshooting.

10. Setup

The Setup icon in the upper right corner of the PQSCADA Sapphire application provides access to the setup menu, where various configuration options and settings can be accessed. Clicking on the Setup icon opens the setup menu, allowing users to customize and manage different aspects of the application according to their preferences and requirements.



Note: When there is an update available for the PQSCADA Sapphire application, the Setup icon will be displayed with an orange color to indicate that an update is ready to be installed. (see section 0 for details).

10.1. Users/Groups

The Setup **Users/Groups** screen in the PQSCADA Sapphire application provides a user interface divided into two main sections. The left section displays the Server object and Users/Groups objects, allowing users to manage and configure user and group settings. The right section displays the properties of each selected object, providing options to modify and customize their properties.

In the Enterprise edition of PQSCADA Sapphire, the application operates in security mode. This means that users connecting to the PQS Enterprise server need to provide valid credentials, including a Username and Password, to access the system. The security scheme implemented in PQSCADA includes user and group definitions to manage access and permissions.

10.1.1. Authentication Providers

PQSCADA Sapphire supports three types of authentication providers for users and groups:

PQSCADA Sapphire authentication

With this authentication provider, users and groups are created and managed internally within the PQSCADA Sapphire application itself. User accounts and group memberships are maintained within the application's database. This authentication method is primarily used for managing users and groups specific to PQSCADA Sapphire and is not directly tied to any external authentication systems.

In a hierarchical structure of primary and secondary servers, authentication between the instances is based on PQSCADA Sapphire authentication. This means that user authentication and authorization are handled within the PQSCADA Sapphire application across the server instances.

Local machine authentication

allows users and groups to be created and managed at the operating system level. These user accounts and groups are recognized by PQSCADA Sapphire and can be assigned permissions and roles within the application.

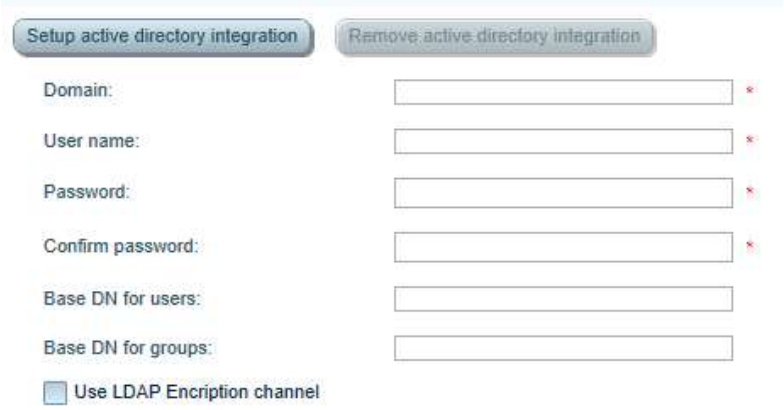
With local machine authentication, users and groups are typically managed by the underlying operating system. Users authenticate using their operating system credentials, and their permissions and access rights within PQSCADA Sapphire are controlled based on the assigned roles and permissions.

Active directory configurations

To create users and groups based on an organization's existing user directory, the Setup Active Directory Integration button is available. This functionality enables integration with the organization's active directory, which is typically managed by the IT manager and contains user information for the organization.

Upon clicking the "Setup Active Directory Integration" button, you will be prompted to provide the necessary credentials to establish the connection to the active directory. The required information includes:

- **Domain**: The domain name of the active directory, in this case, "elspec.local".
- **Username**: Your username for authentication.
- **Password**: Your password for authentication.
- **Base DN Users**: The base distinguished name for the users in the active directory, specifying the organizational unit (OU) structure. In this example, the base DN for users is "OU=SBSUsers, OU=Users, OU=MyBusiness, DC=Elspec, DC=local".
- **Base DN Groups**: The base distinguished name for the groups in the active directory, following the OU structure. In this example, the base DN for groups is "OU=Security Groups, OU=MyBusiness, DC=Elspec, DC=local".



After configuring the active directory integration, the PQSCADA client will display modules based on the user permissions defined in the active directory. The PQSCADA server will then validate user requests against these permissions to ensure proper access and functionality within the system.

To configure Active Directory authentication in PQSCADA Sapphire, you need to set up the domain name and provide a valid username and password for binding to Active Directory. This configuration is performed on the server object within the application.

- users and groups are created and managed externally by an administrator on the Domain level, recognized by PQSCADA Sapphire, and can be assigned with permissions and roles.
- To utilize Active Directory authentication, the domain name needs to be configured with a valid username and password, which will be used for binding to Active Directory. This configuration is done on the server object.

10.1.2. Creating Users

To add a user in PQSCADA Sapphire, follow these steps:

1. Click on the **"Actions"** menu and select **"Add user"** from the options.
2. Choose the appropriate Authentication Providers from the available options (PQSCADA Sapphire authentication, Local machine authentication, or Active Directory authentication) and click **"Next"**.
3. If you selected **PQSCADA Sapphire authentication**, choose the user type (**Admin/Non-Admin/Device Notification**) and click **"Next"**.
4. Enter a **Username** and **Password** for the user. Confirm the password, provide an email address, and select a Priority from the dropdown list. Click **"Next".**
5. Optionally, you can add the user to one or more groups by selecting the group(s) from the **"Available groups"** list and clicking the arrow to add them to the **"Member of"** field. This step is not mandatory.
6. Click **"Finish"** to complete the user creation process.

For **Device Notification** users, they are specifically used to allow push files from G5 devices into the existing components. These users enable G5 devices to send files to PQSCADA Sapphire. When creating a Device Notification user, select the appropriate User type and configure the necessary details.

If you choose **Local machine authentication** or **Active Directory authentication** as the authentication provider, you need to select a user from the drop-down menu, provide a valid email address, select the User type (Admin/Non-Admin), and optionally add the user to groups. Click "Finish" to complete the process. In these cases, the username and password are configured either on the operating system level or the domain level, depending on the selected authentication provider.

It's important to note that the password for users must meet certain requirements:

- The password length must be at least eight (8) characters.
- The password must contain at least 3 of the following 4 categories:
- Lowercase Roman letters (a, b, c, ..., x, y, z).
- Uppercase Roman letters (A, B, C, ..., X, Y, Z).
- At least one special character (!@#$%^&*()_-+).
- Digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9).
- The password must not contain the user's name.
- The password must not contain a sequence of digits, letters, or characters on the keyboard.

Note: Admin user should be separated from regular users with a distinct sign 

10.1.3. Creating Groups

To add a group in PQSCADA Sapphire, follow these steps:

1. Click on the **"Actions"** menu and select **"Add group"** from the options.
2. Choose the appropriate Authentication Providers from the available options (PQSCADA Sapphire authentication, Local machine authentication, or Active Directory authentication) and click **"Next".**
3. If you selected PQSCADA Sapphire authentication, select the group type (**Admin/Non-Admin**) and click **"Next".**
4. Enter the Group name and click **"Next".**

5. Optionally, you can add users to the group by selecting the user(s) from the **"Available users"** list and clicking the arrow to add them to the **"Members"** field. This step is not mandatory.
6. Click **"Finish"** to complete the group creation process.

If you choose **Local machine authentication** or **Active Directory authentication** as the authentication provider, you need to select a group from the drop-down menu, choose the group type (Admin/Non-Admin), and click "Close". In these cases, the name of the group and the member users are configured either on the operating system level or the domain level, depending on the selected authentication provider.

Note: Admin Group should be separated from regular groups with a distinct sign 

10.1.4. General tab

In the "General" tab of the Users/Groups configuration in PQSCADA Sapphire, the admin user can configure various settings related to users and groups. Here are the configurations that can be set in this tab:

- **User Email -** The admin user can specify the email address associated with a user.
- **Username -** The admin user can set or modify the name of a user.
- **User Group Relationship -** In this section, the admin user can manage the relationship between users and user groups. This includes adding users to specific user groups or removing them from groups as needed. User groups provide a way to organize users with similar roles or permissions.
- **Priority -** The priority of groups/users in PQSCADA Sapphire becomes relevant when there are limitations on **concurrent users** specified in the **enterprise** license. Here's how the priority works in such scenarios:
- **Example:** Suppose the enterprise license allows a maximum of five concurrent users to connect to the server at any given time. When a user with a higher priority than any of the currently connected users attempts to connect to the server, their priority level is considered. If all five concurrent user slots are already occupied, the **user with the lowest priority will be disconnected** from the server to make room for the new user.
- However, if the new user has the lowest priority among the connected users, they will not be able to connect to the server since their priority does not meet the criteria for allowing a connection.
- **Reset Password -** admin users can **reset the passwords** of PQSCADA users. This can be useful in situations where a user forgets their password or needs to change it for security reasons. By resetting the password, the admin user can ensure that the user can regain access to the system.

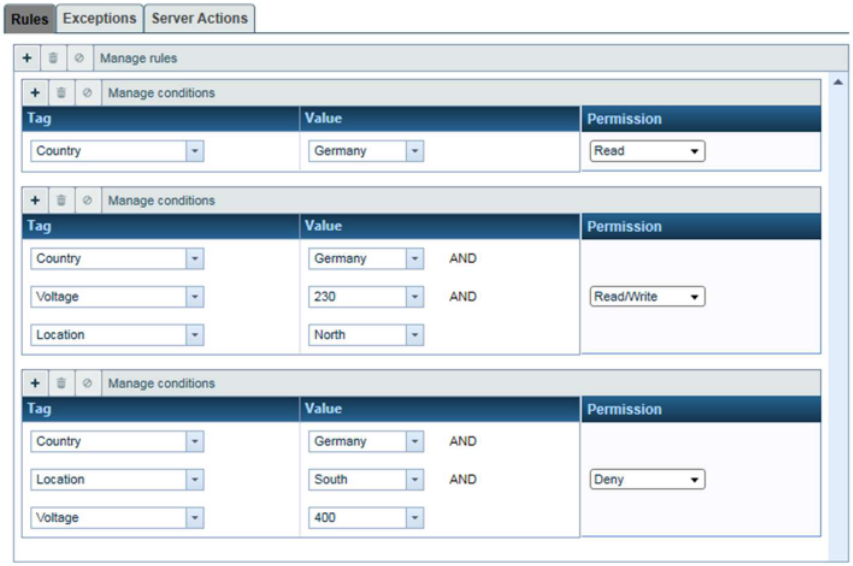
10.1.5. Assigning Permissions to Groups and Users

Permissions are primarily applicable to **non-admin users and groups**. Admin users and groups have unrestricted access and are not limited by permissions.

PQSCADA Sapphire's security module offers a comprehensive set of features for creating a highly granular access policy. This policy is configured on the Permissions tab after adding a new user or group, specifically for non-admin users and groups.

When setting permissions, you can define specific access rights and restrictions for non-admin users and groups. This allows you to control and restrict their access to certain modules, functionalities, data, or actions within the PQSCADA Sapphire application.

It is important to carefully assign the admin status to users and groups and ensure that only trusted and authorized individuals or entities are granted admin privileges to maintain the overall security and integrity of the system.



10.1.5.1. Rules

The access policy and permissions are applied only when **tags exist** for the components. This means that the rules and conditions set for groups or users are effective and enforced based on the presence of defined tags on the server.

Rules

For each group or user object, you can create one or multiple rules to define their access permissions. The logical operator between multiple rules is **'OR'**, meaning that if any of the rules match, the corresponding permissions will be applied.

Conditions

Within each rule, you can create one or multiple conditions. The logical operator between multiple conditions is **'AND'**, indicating that all conditions must be met for the permissions to be applied.

Conditions are tag-oriented, which means they are based on specific tag-value combinations. You can assign 'Read', 'Read/Write', or 'Deny' permissions for each combination.

- **'Read' permission** - allows the user or group to view data in the component's tabs.
- **'Read/Write' permission** - allows them to edit editable fields in the component's tabs, such as component names.
- **'Deny' permission** - means the user or group cannot see or access the specific component in the components tree at all.

The permissions are based on the association of tags with components. If a component has the specified tag-value combinations, the corresponding permissions will be applied.

For example, let's consider a user named "David." David has 'Read' permissions on all components associated with the "Country" tag with the value "Germany." Additionally, for components associated with the "voltage" tag with the value "230" and the "location" tag with the value "North," David has 'Read/Write' permissions. However, for components associated with the "voltage" tag with the value "400" and the "location" tag with the value "South," David has 'Deny' permission, which means he cannot access any data stored in those components.

Please note that the permissions are only applicable when tags are defined for the components. If there are no defined tags on the server, there is no option to set rules or conditions based on tag-value combinations.

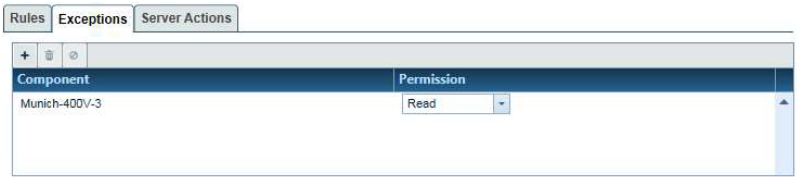
10.1.5.2. Exceptions

Exceptions provide a component-oriented approach to permissions. They allow for direct assignment of 'Read', 'Read/Write', or 'Deny' permissions to specific components on the system. Exceptions take precedence over rules, allowing for further fine-tuning of permissions.

Let's consider the example of the user "David" from the previous example. Suppose David has been assigned 'Read' permissions for all components associated with the "Country" tag Germany, as well as 'Read/Write' permissions for components associated with the "voltage" tag 230 and the "location" tag North. However, by default, David would have been denied access to components associated with the "voltage" tag 400 and the "location" tag South based on the rules and conditions set.

In this case, if there is a specific component named "Munich-400V-3" that is associated with the "voltage" tag 400 and the "location" tag South, but David needs access to this component, an exception can be created. The exception would grant David 'Read' permission specifically for the "Munich-400V-3" component.

By creating this exception, David will be able to gain access to the "Munich-400V-3" component despite the rule that would have initially denied him access. Exceptions allow for overriding the default permissions set by rules and provide a way to grant specific access to individual components as needed.



10.1.5.3. Server Actions

Non-administrative users can be **delegated** certain permissions and actions that are typically associated with administrative privileges. Here are some examples of the actions that can be delegated to non-administrative users:

- **Query period limit -** This permission allows administrators to set a specific period limit for non-administrative users when performing queries. By setting a query period limit,

administrators can restrict the amount of historical data that non-administrative users can retrieve or analyze.

- **Create components -** non-administrative users can be granted permission to create new components within the system. This allows them to add new devices, measurement points, or other entities to the system as per their role and responsibilities.
- **Add/Remove tasks -** By enabling or disabling this permission, administrators can control whether non-administrative users are allowed to add or remove tasks within the system. Tasks can include various automated processes, data analysis routines, or other scheduled actions.
- **Reset password -** When the "Reset password" permission is granted to a non-administrative user, they can change the passwords of other users within the system. This can be useful in scenarios where user passwords need to be reset or managed by designated users without granting them full administrative access.

10.2. Client Settings

In the setup Client Settings screen, the layout is divided into two sections, separated by a vertical splitter control line. Here's an overview of each section:

- **Left Section** - Client Settings Groups: The left section displays the Client Settings groups. These groups are used to organize and categorize different client settings configurations. Each group represents a specific set of settings that can be applied to the client application.
- **Right Section** - Properties of Client Settings Groups: The right section displays the properties of the selected Client Settings group. When you select a group from the left section, its corresponding properties will be displayed in the right section. These properties include various settings and configurations related to the selected group.

You can adjust the width of each section by clicking and dragging the splitter control line to the left or right using a pointing device. This allows you to customize the view and allocate more space to either section based on your preferences or the amount of information you need to see.

Note: After making modifications to the client settings, it is necessary to restart the application for the changes to take effect. This ensures that the updated settings are applied and reflected in the functioning of the PQSCADA Sapphire application.

10.2.1. Localization Settings

In the setup Client Settings screen, there are several configuration options available for customizing the display and precision settings. Here's an explanation of each setting:

Day and Time Display Format

- **Auto culture -** This option uses the Windows configurations for the date and time format (default).
- **Custom culture -** Selecting this option allows you to choose a specific culture from the drop-down menu, which sets the date and time format according to the selected country.
- **Manual -** With this option, you can manually customize the date and time format according to your preferences.

UTC Offset

- **Time zone -** This option uses your local computer's time zone as the client's time zone (default).
- **Custom time zone -** You can select a specific time zone from the drop-down menu to set the client's time zone according to a particular country.
- **Manual -** With this option, you can manually set the UTC offset for the client's time zone.

Calendar

Select the first day of the week. Choosing "Auto" will use the Windows configuration for the first day of the week.

Language

Select the language of the client. Choosing "Auto" will use the Windows configuration for the language. If the selected language is not supported by PQSCADA Sapphire, the default language will be English.

Precision Settings

- **Decimal places for number -** Choose the number of figures to display after the decimal point for absolute numbers.

- **Decimal places for percentage -** Choose the number of figures to display after the decimal point for percentage numbers.

Note: After making modifications to the client settings, it is necessary to restart the application for the changes to take effect. This ensures that the updated settings are applied and reflected in the functioning of the PQSCADA Sapphire application.

10.2.2. Proxy Settings

In the setup Client Settings screen, there are options available for configuring proxy settings if your organization uses a proxy server. Proxy servers act as intermediaries between users' computers and the Internet, providing control over internet access, bandwidth optimization, and enhanced security. Here's an explanation of the proxy configuration options:

No Proxy

Selecting this option means that PQSCADA Sapphire will connect directly to the internet without going through a proxy server. No additional configuration is required.

Use system proxy settings

With this option, PQSCADA Sapphire will use the same proxy settings as configured in Windows' Internet Options. These settings can be found in the Connections tab and LAN Settings. No manual configuration is required in PQSCADA Sapphire.

Manual proxy configuration

Choose this option if you need to specify a different proxy server for PQSCADA Sapphire compared to the operating system. In this case, you will need to provide the Proxy server hostname and port. Additional configuration is required for this option.

The **"No Proxy for"** field allows you to specify hostnames and IP addresses that should not be accessed through the proxy server.

If the **"Bypass proxy server for local addresses"** checkbox is marked, connections to other hosts on your local network will not be proxied.

Network Credentials

Depending on the proxy server configuration and authentication requirements, you have two authentication methods available:

- **Windows Authentication** - If your organization uses Windows logon credentials for proxy authentication, PQSCADA Sapphire can use your Windows logon credentials for authentication. This method is commonly used in domain environments.
- **Manual** - This option allows you to manually enter a valid username and password for proxy authentication. You can also choose to save the credentials by marking the "Save credentials" checkbox.

10.2.3. Investigation Settings

In the setup Client Settings screen, there are various settings available for performing investigations in PQSCADA Sapphire. Here's an explanation of these settings:

Default charts display mode

- **Normalized** - Voltage and current values will be normalized to their nominal values, and power will be calculated as the product of voltage and current nominals.
- **Regular** - Displays absolute data without normalization.

Default charts curve mode

- **Enable** - Creates a continuous curve from the chart point values.
- **Disable** - Displays the points as discrete values on the chart.

Default number of ranges

Controls the number of displayed bars in a statistics chart.

Default trend charts horizontal crosshair mode

Selects the type of crosshair to display on trend charts.

Default power factor display mode

- **Load** - If the readings are conducted on a load.
- **Source** - If the readings are conducted on a generator.

Default charts angle mode

Selects how angles will be displayed in a pie chart.

Default calculation base mode

- **Auto** - PQSCADA Sapphire automatically selects the base resolution based on the selected parameter and investigation duration. In long investigation periods a small resolution will give more than 1 million testing points. For min/max values, the highest available resolution in the database is used.
- **Manual** - User selects the base resolution on the parameter selection page of the add new chart wizard.

Default energy chart layout

Selects the chart type to display for energy charts.

Default flagged data mode

Determines whether flagged events are included or excluded in statistics and spectrum charts.

Chart export settings

Specifies the size in pixels of the exported image of a chart.

View export settings

Specifies the size in pixels of the viewed image of a chart.

Default charts background color

Selects the color of the chart background.

Event approach

Determines whether events should be displayed as polyphase or by channel in grid charts.

Unit settings

Marks the checkbox to scale units in Excel exports.

IEEE1366 chart

When checked, the IEEE1366 chart is added to the chart list when creating an investigation. This chart is related to interruption-type events.

Grid percentile settings

Enables setting percentile value and base interval for grid charts.

Phase color definitions

Allows selecting the displayed color for each phase, frequency channel, auxiliary channels, and total parameters.

In the Advanced tab, you can define colors per parameter, phase, and quantity, allowing further customization of the visualization.

Note: After making modifications to the client settings, it is necessary to restart the application for the changes to take effect. This ensures that the updated settings are applied and reflected in the functioning of the PQSCADA Sapphire application.

10.2.4. PQ Settings

In the PQ Settings, there are two parameters that can be marked to control the generation of PDF reports in the Power Quality module:

Synchronized power quality requests to compliance evaluation window

When marked, the power quality requests will be synchronized with the compliance evaluation window. This parameter affects the behavior of the Power Quality module.

Run single report for each window

When marked, a single report file will be generated for each window in the Power Quality module. The number of exported reports is determined by this parameter.

Based on how these parameters are marked, the generation of PDF reports will follow the following scenarios:

Scenario 1

Run single report for each window is marked.

Power Quality module has only one period (no sliding window).

Result: A single report file will be generated for the entire period.

Scenario 2

Synchronized power quality requests to compliance evaluation window is marked.

Run single report for each window is not marked.

Power Quality module has multiple periods (sliding window).

Result: A single PDF report file will be generated, which will include separate reports for each period.

Scenario 3

Synchronized power quality requests to compliance evaluation window is marked.

Run single report for each window is marked.

Power Quality module has multiple periods (sliding window).

Result: Separate PDF report files will be generated, one for each period. Each report will correspond to a specific period, such as every 7 days with a 24-hour sliding window.

10.2.5. System Module Settings

In the PQ Settings, there are additional options and settings available:

Data availability period

This value is related to the available data in the System module under the component tab. It serves as a reference for the 100% data availability calculation. The data availability is refreshed every 60 minutes by default.

The updating period can be modified in the PQSClient.wrs configuration file using the </AvailabilityTimePeriod> parameter (the value is in minutes).

Tree settings

When the checkbox is marked, the local server will not be presented in the tree settings by default.

Data acquisition

Under the data acquisition and processing tab, you can change the IP address of the units simultaneously.

When the checkbox is unmarked, you have the flexibility to choose multiple components in the System module.

When the checkbox is marked, you are restricted from changing the IP address of the components.

10.2.6. Overview Settings

In the PQSCADA Sapphire application, there are additional customization options available for line diagrams in the Overview module:

Disable Popup of the component on notification

By default, when components on the map are in a minimized mode and a notification arrives, they pop out again to ensure their visibility to the user.

However, there might be cases where you prefer the components to remain minimized and not pop up when notifications are received.

By checking the "Disable Popup" option, you can prevent components from popping out of their minimized mode when notifications occur.

Electrical diagram defaults

Once you upload an electrical drawing (line diagram), you can add parameters to the drawing and customize their appearance.

You can set the color and font size of the parameters to enhance visibility and highlight specific information on the diagram.

This customization feature allows you to optimize the presentation of data and make it more visually informative.

10.2.7. Security Settings

In the PQSCADA Sapphire application, there is a feature that allows you to view and manage approved certificates from your local PQSCADA server to other PQSCADA servers. Here are some key points about this feature:

Approved Certificates

The list displays the certificates that have been approved for use between your local PQSCADA server and other PQSCADA servers.

These certificates enable secure and authenticated communication between the servers.

Cleaning the List

If you choose to clean the list of approved certificates, it does not directly affect the other servers you are currently connected to.

However, when you reconnect to those servers, you will need to obtain a new certificate for the renewed connection.

Default Authentication Mode

The default authentication mode determines the authentication method that will be used by default when connecting to a new PQSCADA server.

This mode simplifies the connection process by automatically selecting the preferred authentication method for new server connections.

10.3. About Application

Click the **Setup** icon and select **About Application** to see the installed application's version and update.

10.4. Install/Upgrade License

Click the **Setup** icon and select **Install/Upgrade license** to upgrade the license of the installed application. For more details, see section 4.4 above.

10.5. Download New Update

An update to the PQSCADA Sapphire application is available when the Setup icon is orange.

1. Click on the Setup icon and select the **"Download new update"** line.
    - A brief description of the available update's release notes will be displayed, along with a shortcut to access the full release notes.
2. Click the **"Download & install"** button to initiate the update download.
    - The download process will begin, and a window titled "Update installation" will appear.
3. Verify that the Client installation path displayed in the **"Update installation"** window is correct.
    - Ensure that the installation path points to the correct location where the PQSCADA Sapphire application is installed.
4. Click the "Update" button to proceed with the update installation.
    - The client will be closed, and the update process will begin.
5. Wait for the update to complete.
    - The application will be updated with the latest version.
6. Click the **"Close"** button on the "Update installation" window once the update is finished.
7. Restart the PQSCADA Sapphire application.
    - Close the application and then reopen it to start using the updated version.

11. Scheduler

The Scheduler module in PQSCADA Sapphire provides users with extensive functionality for managing and monitoring tasks in real-time. This module allows users to oversee tasks that are currently running, scheduled to run, or have already been executed. Users can add, modify, delete, stop, and resume tasks, giving them complete control over task management.

Tasks in PQSCADA Sapphire are add-ons that run as individual processes. There are three task types supported by PQSCADA Sapphire:

- **Control and Maintenance:** This task type focuses on managing and controlling various aspects of the system, such as configuring system settings, performing maintenance operations, and ensuring optimal functionality.
- **Export:** The Export task type enables users to generate and export data in different formats, allowing for seamless data exchange and integration with other systems or applications.
- **Report:** With the Report task type, users can generate detailed reports containing valuable insights and analysis of power quality data. These reports help users make informed decisions, identify trends, and evaluate the performance of the power system.

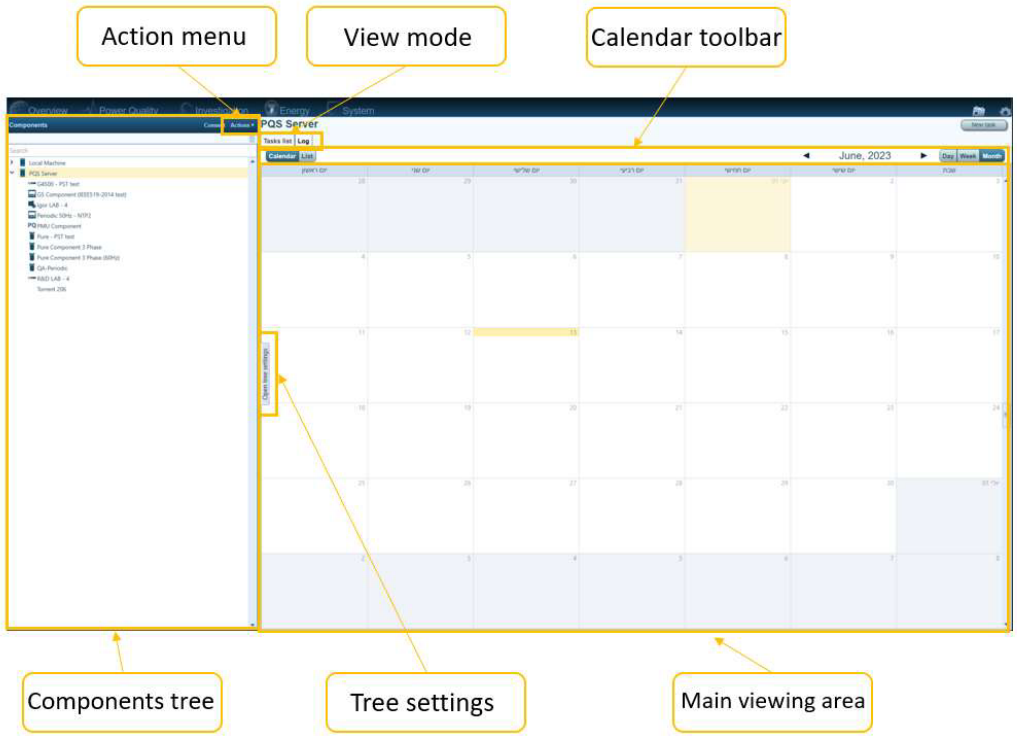


Figure 11-1. Scheduler

The **Scheduler module** screen is divided into two main sections that are divided by a splitter control line (a vertical line between the two sections).

Left Section - Connected Instances and Hosted Components

- The left section of the screen provides an organized display of the connected instances and their hosted components. This section offers an overview of the system's architecture, allowing users to easily navigate through the interconnected elements. Users can explore the hierarchical structure of instances and components, gaining insights into the system's configuration.

Right Section - Configured Tasks

- The right section of the screen presents the configured tasks related to the selected object. When an instance or component is chosen from the left section, the right section updates to show the tasks associated with that specific object. This section provides a centralized view of the tasks, enabling users to efficiently manage and modify their properties. Users can customize scheduling parameters and configure execution settings from this section.
- Splitter Control
- The splitter control line, positioned between the left and right sections, allows users to adjust the width of each section based on their preferences. This feature provides flexibility in customizing the screen layout for better usability.

11.1. Add or Disconnect a Server

On the Components section top-right, the following can be performed:

1. Click **Connect** to Add a Server.
2. Click **Actions** and select **Disconnect server** to disconnect a connected server.

11.2. View mode

You can use the View mode in the Scheduler module to toggle between the Tasks list and Log views. Here's how you can switch between these views:

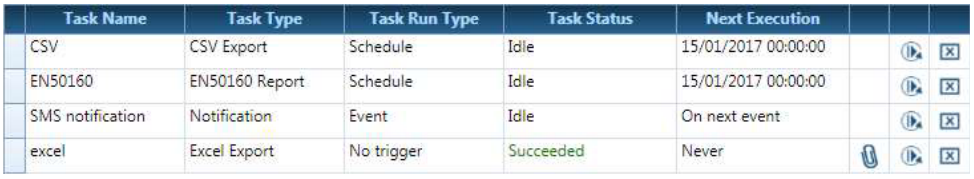
1. Open the Scheduler module in PQSCADA Sapphire.
2. Look for the View mode option, which is typically located in the toolbar or menu of the module.
3. Click on the View mode option to toggle between the Tasks list and Log views.

When you select the Tasks list view, you will see a list of tasks that are currently running, scheduled to run, or have been executed. This view allows you to manage and monitor the status of your tasks.

On the other hand, when you switch to the Log view, you will be able to see a log of past task executions. This view provides a historical record of task execution details, including start and end times, status, and any relevant log messages.

11.3. Tasks List

The section you mentioned in the Scheduler module provides valuable insights into the execution and progress of tasks. Here's a breakdown of the information displayed in that section:



Task Name	Task Type	Task Run Type	Task Status	Next Execution
CSV	CSV Export	Schedule	Idle	15/01/2017 00:00:00
EN50160	EN50160 Report	Schedule	Idle	15/01/2017 00:00:00
SMS notification	Notification	Event	Idle	On next event
excel	Excel Export	No trigger	Succeeded	Never

- **Task Name** - This field displays the name of the task that is being monitored.
- **Task Type** - This field indicates the type of task, such as Control and Maintenance, Export, or Report.
- **Task Run Type** - This field shows the trigger for the task, which can be one of the following:
- **Schedule** - The task is set to run at specific recurring intervals based on a predefined schedule.
- **Event** - The task is triggered by a specific event occurring in the system.
- **No Trigger** - The task is designed to run only once without any specific trigger.

- **Task Status** - This field indicates the status of the last operation performed by the task. The possible statuses include:
- **Idle** - The task has not been triggered yet and is waiting for its scheduled time or event.
- **Succeeded** - The task operation was executed successfully without any errors.
- **Failed** - The task operation or output encountered an error or failure.
- **Next Execution** - This field displays the date and time for the next scheduled execution of the task.
- **Attachment** - If an attachment is associated with the task, clicking on the attachment icon will open the attached file.
- **Rerun** - For single-running tasks that have already been executed, clicking the rerun icon allows you to manually rerun the task.
- **Delete** - Clicking the delete icon allows you to delete the selected task from the instance.

11.4. Log

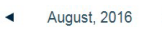
In the Log mode of the Scheduler module, you can view logs of executed and scheduled tasks in two different ways: Calendar view and List view. Here's an explanation of each view:

- **Calendar View** - In this view, the logs are displayed in a calendar format, allowing you to easily visualize the execution and scheduling of tasks over time. Each day is represented on the calendar, and you can navigate between months to view past and future logs. The calendar highlights the days with executed tasks, and you can click on a specific day to see the tasks executed on that day.
- **List View** - In this view, the logs are displayed in a list format, providing a detailed overview of the executed and scheduled tasks. Each log entry includes information such as the task name, task type, task run type, task status, and the date and time of execution. You can scroll through the list to view past logs and easily search for specific logs using filters or search functionality.

11.4.1. Calendar Toolbar

In the Scheduler module's Calendar view, you can customize the calendar settings using the options available in the Calendar toolbar. Here's an explanation of each setting:

Toggle View Mode - This button allows you to switch between the Calendar view and the List view. Clicking on it will toggle the display between the two views, allowing you to choose the one that suits your preference.



Calendar Date - This feature enables you to navigate through the calendar by moving left or right to change the displayed date. You can use the navigation arrows or click on the date field and select a specific date from the calendar pop-up.

Calendar Period - This option allows you to toggle between different calendar periods, such as Day, Week, and Month. By selecting a specific period, you can adjust the level of granularity in the calendar view to focus on a specific time range.

11.5. Adding a task

To add a new task in the Scheduler module, you can follow these steps:

1. Launch the Add Task wizard:
   - Click on **"New Task"** at the top right corner of the main viewing area.
   - Click on the **"Actions"** menu and select "Add Task" from the menu.

- Right-click on the instance and select **"Add Task"**.

2. Select the Task Group: In the Add New Task wizard, you will be prompted to select the task group. There are three task groups available:

- **Control and Maintenance** - This group focuses on managing and controlling various aspects of the system.
- **Exports** - This group enables you to generate and export data in different formats.
- **Reports** - This group allows you to generate detailed reports containing valuable insights and analysis of power quality data.

The Add New Task wizard consists of two stages:

- **Stage 1 - Scheduler Settings:** In this stage, you will configure the scheduler settings for the task. This includes setting the schedule for when the task should run, such as a specific date and time or a recurring schedule.
- **Stage 2 - Add-on Settings:** In this stage, you will import the configuration required by the task add-on. This may include specifying the parameters to be exported, selecting the type of report to be generated, or defining other settings specific to the task.

11.5.1. Export Task Common Wizard

11.5.1.1. Task Group and Type

In the Export Task Common Wizard, the first section is Task Group and Type. To set up an export task, you can follow these steps:

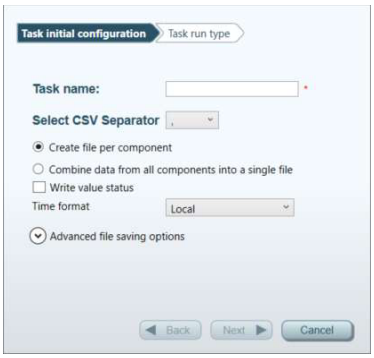
1. Mark the **"Export"** task group. This indicates that you want to create an export task.

2. Click **"Next"** to proceed to the Task Type page. Here, you will see the available task type options based on the installed add-ons in your PQSCADA Sapphire system.
3. Mark the required Task type. Select the specific task type that suits your export requirements from the available options.
4. Click **"Next"** to upload the Add-on configuration and go to the Task initial configuration page. This step uploads the necessary add-on configuration for the selected task type. It may take a few minutes for the upload process to complete. Once the add-on is uploaded, you will be directed to the Task initial configuration page.

Note:

- The time taken for the initial upload of the Task add-on may vary depending on the size and complexity of the add-on.
- After the Task add-on is uploaded, you won't be able to return to the Task Type page to change the selected task type. Therefore, ensure that you have selected the correct task type before proceeding.

11.5.1.2. Task Initial Configuration



In the Task Initial Configuration section of the Export Task Common Wizard, you will configure various options for the initial setup of the task. Here are the steps involved:

1. On the Initial Configuration page, configure the following options:
   - **Task Name** - Enter a name for the task.
   - **Select CSV Separator** - Choose the CSV separator character from the dropdown list.
   - **Create file per component or Combine data from all components into a single file:**
     - **Create file per component** - This option will generate separate output files for each selected component. The number of output files will correspond to the number of selected components.
     - **Combine data from all components into a single file** - This option will merge the data from all selected components into a single output file.

   If you want to change the default **destination folder**, click the expand arrow for Advanced file saving options:
   - Mark the **"Set output folder manually"** checkbox to set the following options:
   - **Server output folder** - Choose this option to save the task output on the instance machine. Make sure that the PQSCADA Sapphire instance has permissions to store files in the specified path.
   - **FTP output folder** - Choose this option to save the task output on a remote FTP server. You will need to enter the FTP details.
2. Click **"Next"** to proceed to the **Task run type page**.

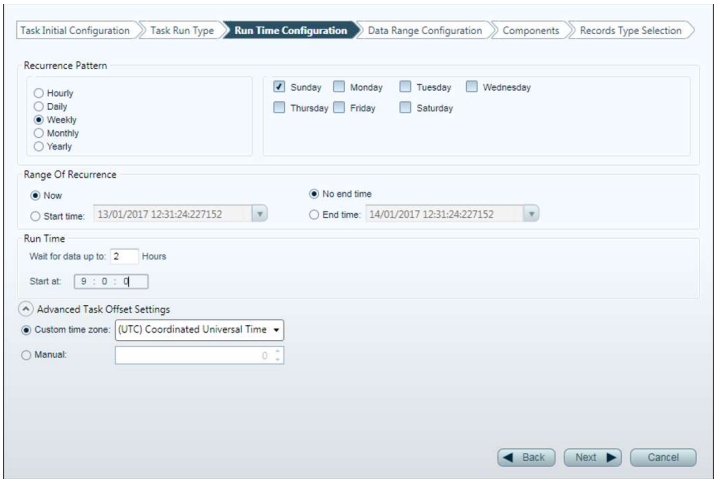
3. On the **Task run type** page, select one of the following options:
   - **Single Task Run** - The task will run only once.

- **Schedule Task Run (enterprise edition only)** - This option allows you to create a task that will be executed automatically after a designated time interval.
- **Event Base Task Run (enterprise edition only)** - This option allows you to define events that, when triggered, will start the execution of the task.

4. Click **"Next"** to proceed to the **Running time configuration** page.

   By following these steps, you can configure the initial settings for the **CSV Task** in the Export Task Common Wizard.

10.5.1.3. Running Time Configuration

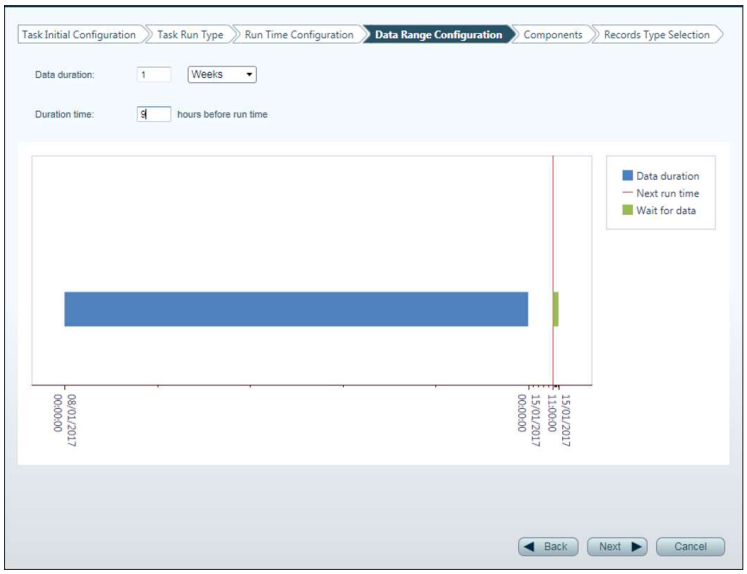


In the Running time configuration page, you will configure the options specific to the selected Task run type. Here are the steps for configuring the options when selecting **"Schedule Task Run"** (enterprise edition only):

1. Configure the following options:
   - **Recurrence Pattern** - Select how often the task will be executed. You can choose from options like hourly, daily, weekly, monthly, or yearly.
   - **Range of Recurrence** - Specify the start and end dates for the recurring task. By default, the recurrence is set to start now and has no end time.
   - **Run Time**:
     - **Wait for data up to** - Use this option to delay the task execution if part of the data is missing. You can specify the time duration for which the task will wait for the data to become available.
     - **Start at** - Set the specific time at which the task should be executed.
2. **Advance Task Offset Settings** - Use this option to set a time offset different from the instance machine. This allows you to adjust the execution time of the task based on a specific time zone or offset.

   For example, if you configure the task to be executed every Sunday at 9:00 AM UTC and specify a wait time of 2 hours, the task will wait for up to 2 hours for the required data to become available. After the wait period, the task will be executed regardless of the data availability.
3. Click **"Next"** to proceed to the **Data range configuration** page.

11.5.1.4. Data Range Configuration



In the Data range configuration page, you will configure the options related to the data duration and end time for the export task. Here are the steps to configure these options:

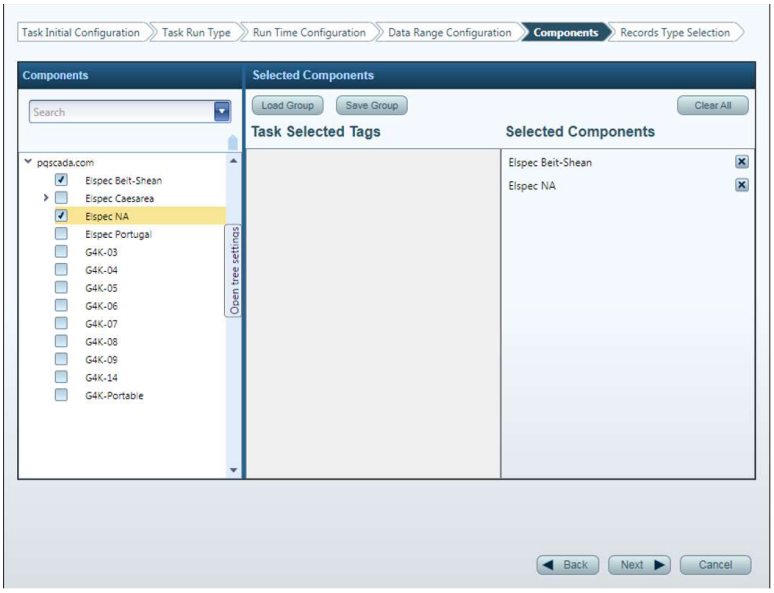
1. Configure the following options:
    - **Data Duration** - Set the duration of the data to be exported. You can choose a specific duration, such as 1 day, 1 week, 1 month, etc.
    - **Duration Time (Hours before run time)** - Set the end time relative to the Run Time configured in the Run-Time Configuration page. This determines the time range from which the data will be exported.

    For example, if you set the Data Duration to 1 week and the Duration Time to 9 hours, and the task is scheduled to run every Sunday at 9:00 AM UTC, the export task will execute every Sunday from 9:00 AM to 11:00 AM UTC. The exported file will contain the data from the previous week, starting from midnight to midnight.
2. Click **"Next"** to proceed to the **Components** page.

11.5.1.5. Components

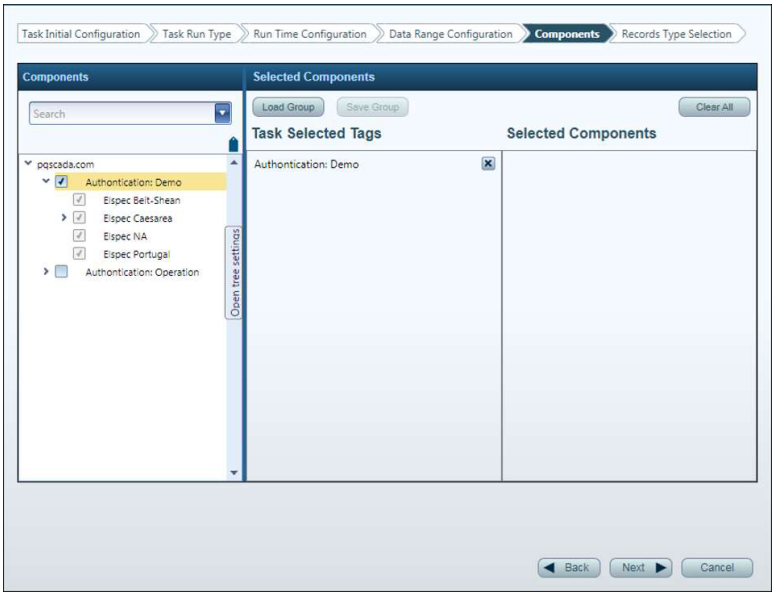
To select the components for executing the task, you have two options: Component selection and Tags selection. Here's how you can perform these selections in the Components page:

1. **Component Selection**
    - Mark the checkboxes of individual components in the **Components** section on the left side of the page. You can select multiple components by marking their checkboxes.
    - Click the **Tag** icon to sort the components by tags. This will group the components based on their tags.
    - To reset the tag selection, click on the **"Open tree settings"** icon.
    - Alternatively, you can click the **"Load Group"** button in the Selected Components section. This allows you to load a saved group of selected components. To save the current selection as a group, click **"Save Group."**



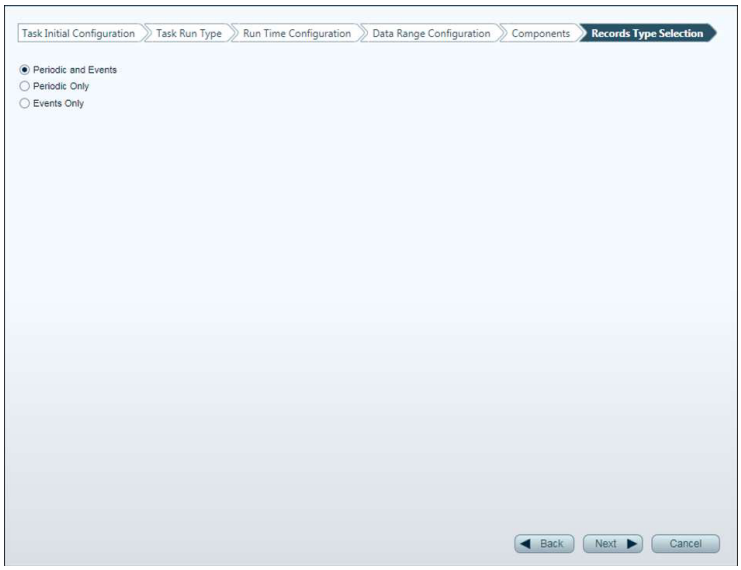
2. **Tags Selection**

- Click the **Tag** icon to sort the components by tags. This will display a list of available tags.
- Mark the checkboxes of the desired tags in the **Components** section. This will select all components that are configured with the selected tags.
- The selected tags will appear in the **"Task Selected Tags"** column.



Once you have made the component or tag selection, click **"Next"** to proceed to the **Records type selection** page.

11.5.1.6. Records type selection



In the Records type selection page, you need to choose one of the following options:

- **Periodic and Events**

  This option is used to export both low-resolution parameters for the entire task data duration and high-resolution parameters and waveforms for events that occurred during the task data duration.

- **Periodic Only**

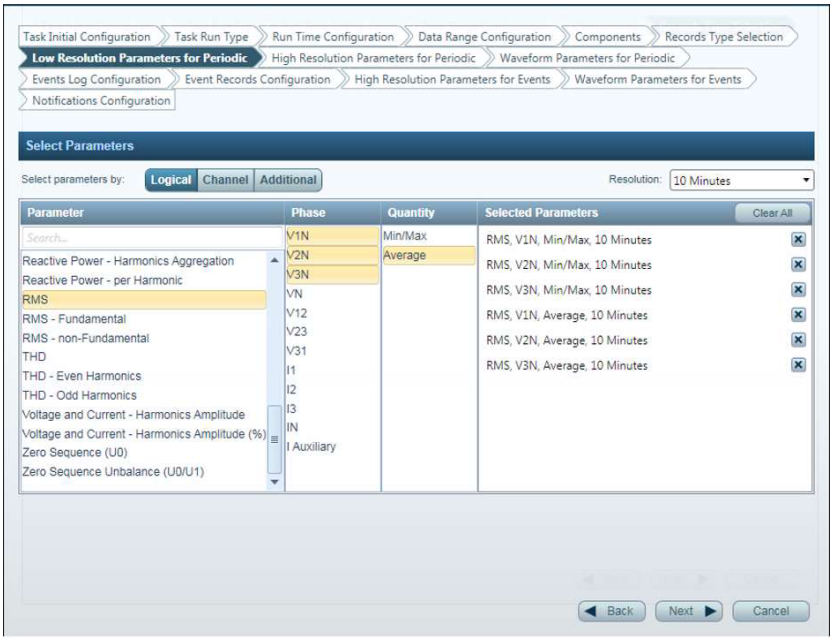
  This option is used to export parameters continuously for the entire task data duration, without including event-related data.

- **Events Only**

  This option is used to export high-resolution parameters and waveforms for events that occurred during the task data duration. Each event is considered a data record with a duration equal to the event duration plus pre/post margins.

Choose the appropriate option based on your requirements. Once you have made the selection, click **"Next"** to proceed to the next page, which is the **"Low-resolution Parameters for periodic"** page.

11.5.1.7. Low-Resolution Parameters for Periodic



In the Low-resolution Parameters for periodic page, you need to configure the following options:

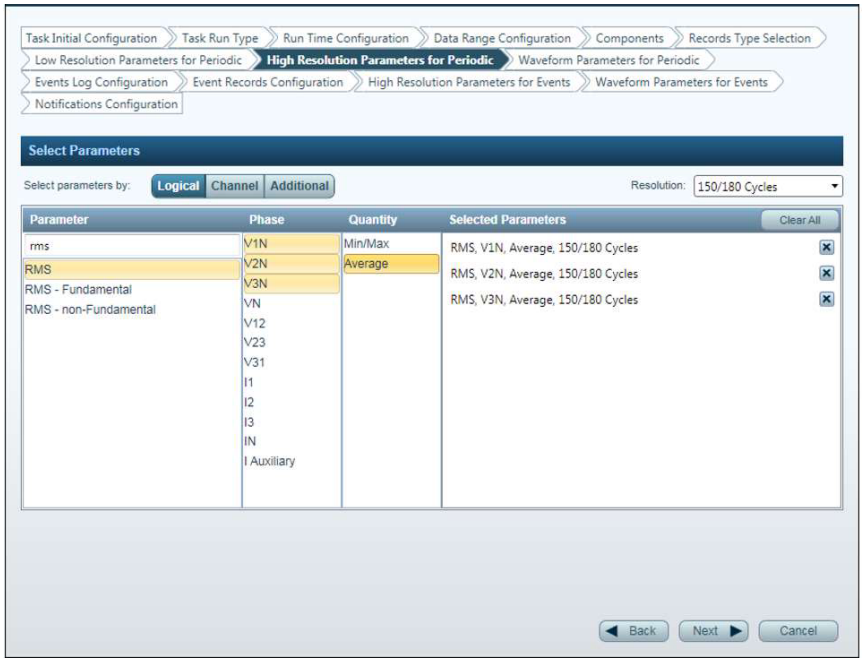
1. Select how parameters are **tagged**
    - Choose one of the following options:
        - **Logical** - Parameters are logically tagged based on their power-related characteristics.
        - **Channels** - Parameters are stored without any power topology and can be sorted by channel number.
        - **Additional** - Non-power parameters, such as temperature, are included.
2. Select the **Resolution**
    - Choose the desired resolution from the dropdown menu in the upper right corner. This determines the interval at which the low-resolution parameters will be recorded.
3. Select the **Parameter**
    - From the parameter column, choose the specific parameter you want to include in the export. The available parameters depend on the selected component, time interval, and task type.
4. Select the **Phase**
    - From the phase column, select the desired phase for the parameter. Clicking on a phase again cancels the selection. You can select multiple phases if needed.
5. Select the **Quantity**
    - Choose the desired quantity of the parameter. This determines the quantity that will be displayed in the output file.

The selected parameters will be displayed in the right column.

Note:

- **for a CSV export task, low-resolution parameters will be exported as a single file. For an Excel export task, the low-resolution parameters will be exported to a dedicated sheet.**
- **Once you have configured the options, click "Next" to proceed to the High-resolution parameters for periodic page.**

11.5.1.8. High-Resolution Parameters for Periodic



In the High-resolution Parameters for periodic page, you need to configure the following options:

1. Select how parameters are **tagged**
   - Choose one of the following options:
     - **Logical** - Parameters are logically tagged based on their power-related characteristics.
     - **Channels** - Parameters are stored without any power topology and can be sorted by channel number.
     - **Additional** - Non-power parameters, such as temperature, are included.
2. Select the **Resolution**
   - Choose the desired resolution from the dropdown menu in the upper right corner. This determines the interval at which the High-resolution parameters will be recorded.
3. Select the **Parameter**
   - From the parameter column, choose the specific parameter you want to include in the export. The available parameters depend on the selected component, time interval, and task type.
4. Select the **Phase**
   - From the phase column, select the desired phase for the parameter. Clicking on a phase again cancels the selection. You can select multiple phases if needed.
5. Select the **Quantity**

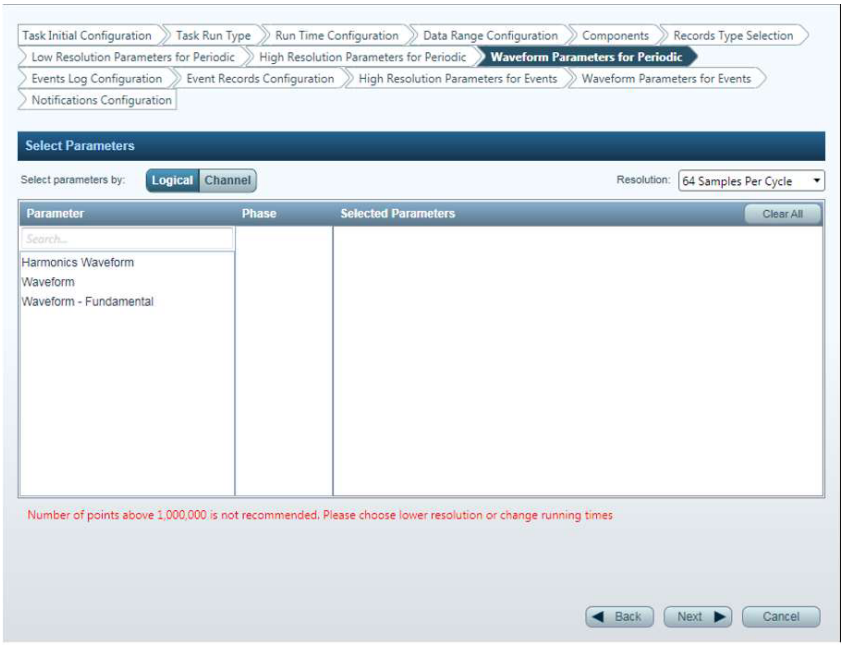
- Choose the desired quantity of the parameter. This determines the quantity that will be displayed in the output file.

The selected parameters will be displayed in the right column.

Note:

- For a CSV export task, High-resolution parameters will be exported as a single file. For an Excel export task, the High-resolution parameters will be exported to a dedicated sheet.
- Once you have configured the options, click **"Next"** to proceed to the **Waveform parameters for periodic** page.

11.5.1.9. Waveform Parameters for Periodic



In the Waveform Parameters for periodic page, you need to configure the following options:

1. Select how parameters are **tagged**
    - Choose one of the following options:
        - **Logical** - Parameters are logically tagged based on their power-related characteristics.
        - **Channels** - Parameters are stored without any power topology and can be sorted by channel number.
2. Select the **Resolution**
    - Choose the desired resolution from the dropdown menu in the upper right corner. This determines the interval at which the Waveform-resolution parameters will be recorded. The max. number of exported points per parameter is **limited to 1,000,000**.
3. Select the **Parameter**
    - From the parameter column, choose the specific parameter you want to include in the export. The available parameters depend on the selected component, time interval, and task type.
4. Select the **Phase**

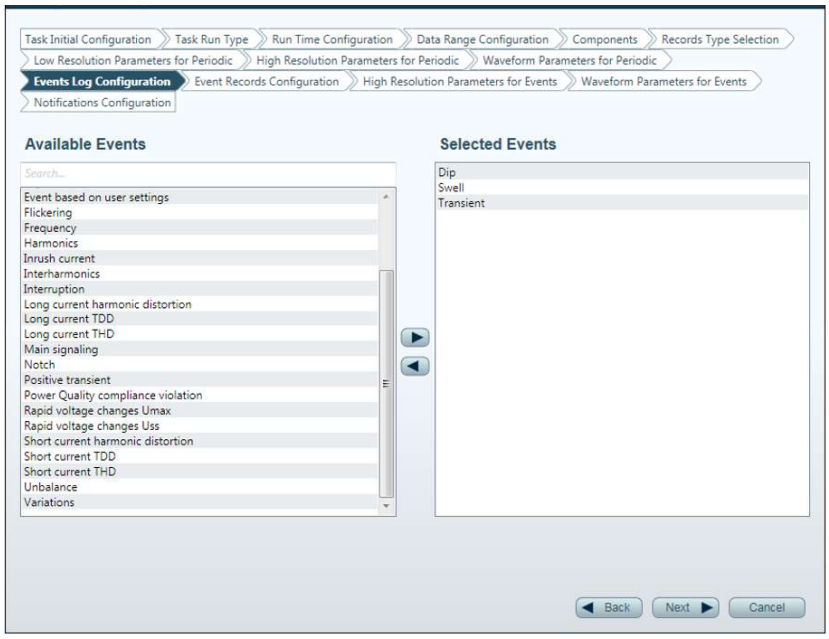
- From the phase column, select the desired phase for the parameter. Clicking on a phase again cancels the selection. You can select multiple phases if needed.

The selected parameters will be displayed in the right column.

Note:

- **For a CSV export task, Waveform-resolution parameters will be exported as a single file. For an Excel export task, the Waveform-resolution parameters will be exported to a dedicated sheet.**
- Once you have configured the options, click **"Next"** to proceed to the **Event log configuration** page.

11.5.1.10. Events Log Configuration



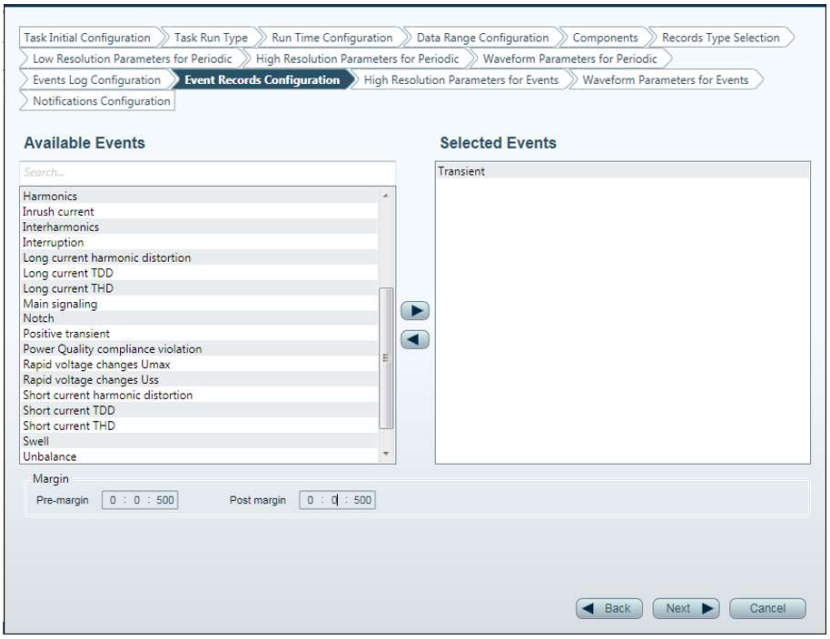
In the Events log configuration page, you can configure the settings related to events records for the export task.

1. Select the events to include in the event log table by **double-clicking the event** type from the Available events list. This will move the selected events to the Selected events list.

Note:

- **for a CSV export task, Waveform-resolution parameters will be exported as a single file. For an Excel export task, the Waveform-resolution parameters will be exported to a dedicated sheet.**
- Once you have configured the options, click **"Next"** to proceed to the **Events records configuration** page.

11.5.1.11 Event Records Configuration



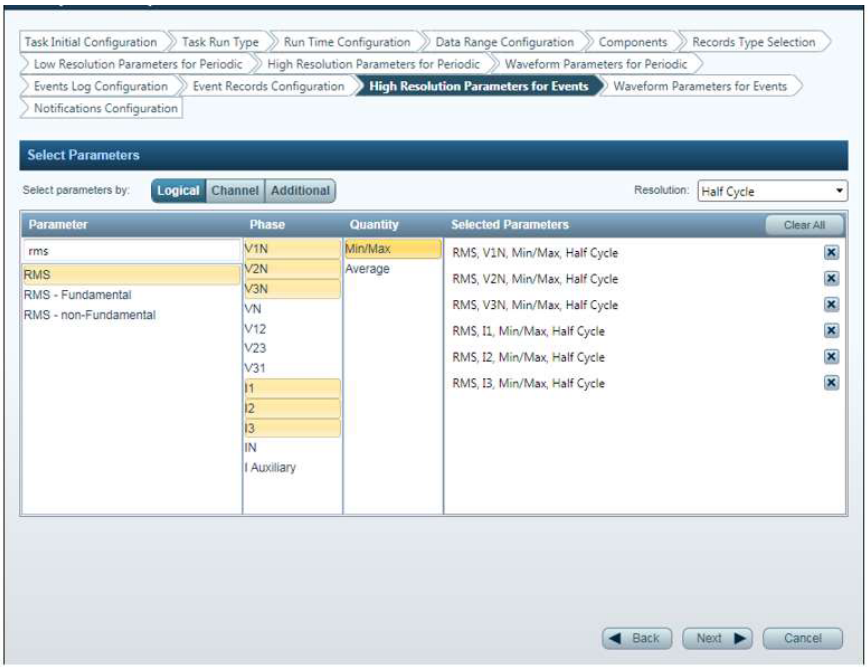
In the Event Records Configuration page of the Add task wizard, you can specify the events that will trigger event records and set the Pre/Post margins for the event records.

Here are the steps to configure this section:

1. Select the events that you want to include as triggers for event records by **double-clicking on the event type** from the **Available events** list. This will move the selected events to the Selected events list.
2. On the bottom part of the page, you can set the **Pre/Post margins**. These margins determine the duration of the event records by specifying the time before and after the event.
3. Once you have selected the events and set the Pre/Post margins, click **Next** to proceed to the next step, which is the configuration of **high-resolution parameters for events**.

Note: Please note that the options and available events may vary depending on the specific task type and settings.

11.5.1.12. High-Resolution Parameters for Events



In the High-resolution parameters for events page of the Add task wizard, you can configure the parameters that will be included in the event records and specify their resolution, tag type, phase, and other settings.

Here are the steps to configure this section:

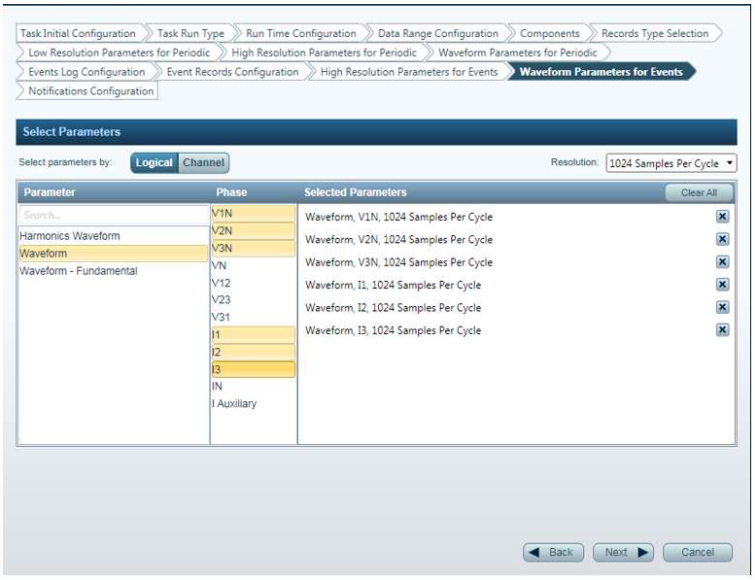
1. Select how parameters are **tagged**
    - Choose one of the following options:
        - **Logical** - Parameters are logically tagged based on their power-related characteristics.
        - **Channels** - Parameters are stored without any power topology and can be sorted by channel number.
        - **Additional** - Non-power parameters, such as temperature, are included.
2. Select the **Resolution**
    - Choose the desired resolution from the dropdown menu in the upper right corner. This determines the interval at which the low-resolution parameters will be recorded.
3. Select the **Parameter**
    - From the parameter column, choose the specific parameter you want to include in the export. The available parameters depend on the selected component, time interval, and task type.
4. Select the **Phase**
    - From the phase column, select the desired phase for the parameter. Clicking on a phase again cancels the selection. You can select multiple phases if needed.
5. Select the **Quantity**
    - Choose the desired quantity of the parameter. This determines the quantity that will be displayed in the output file.

6. The selected parameters will be listed in the Right column, indicating that they will be included in the event records.

Note:

- **for a CSV export task, low-resolution parameters will be exported as a single file. For an Excel export task, the low-resolution parameters will be exported to a dedicated sheet.**
- **There is a maximum limit of 1,000,000 exported points per parameter. If the event duration is too long, PQSCADA will export only the first 1,000,000 points.**
- Once you have configured the high-resolution parameters for events, click **Next** to proceed to the next step, which is the configuration of **waveform parameters for events**.

11.5.1.13. Waveform Parameters for Events



In the Waveform Parameters for Events page, you can configure the parameters for exporting waveform data associated with events. Here are the steps to follow:

1. Select how parameters are tagged:
   - **Logical** - Parameters will be logically tagged.
   - **Channels** - Parameters will be stored without any power topology and can be sorted by channel number.
2. Select the **Resolution** from the dropdown menu in the upper right corner.
3. Select the **Parameter** in the parameter column. The list of available parameters is dynamic and depends on the selected component, time interval, and task type.
4. Select the **Phase** from the phase column. A second click cancels the selection. Multiple phases can be selected.

A list of the selected parameters will be presented in the Right column.

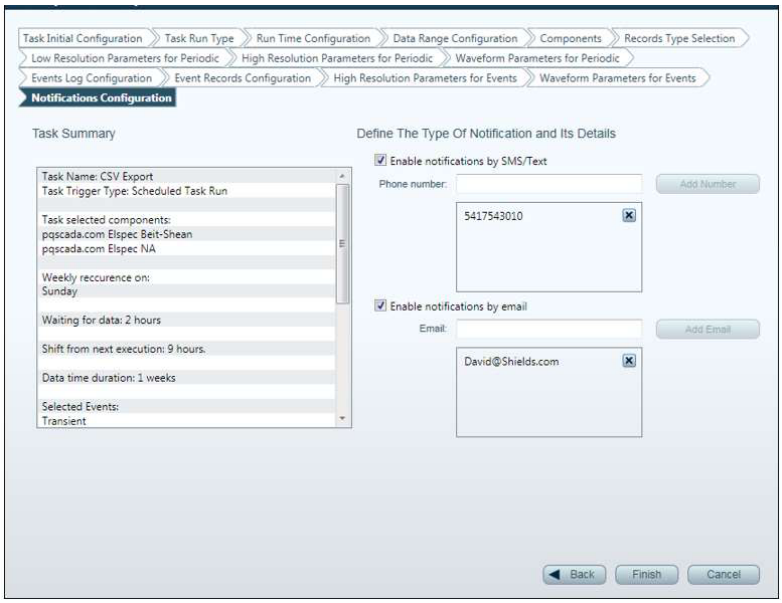
Notes:

- In the **CSV export** task, each event record generates two files: high-resolution and waveform.
- In the **Excel export** task, all event records generate a single file. The file includes two sheets for each event record: high resolution and waveform.

- The maximum number of exported points per parameter is limited to 1,000,000. If the event duration is too long, PQSCADA will only export the first 1,000,000 points.

Once you have configured the Waveform parameters for events, click **Next** to proceed to the next step, which is the configuration of **Notification configuration.**

11.5.1.14. Notification Configuration



In the Notification Configuration page, you can define the type of notification and its details. Here's how you can do it:

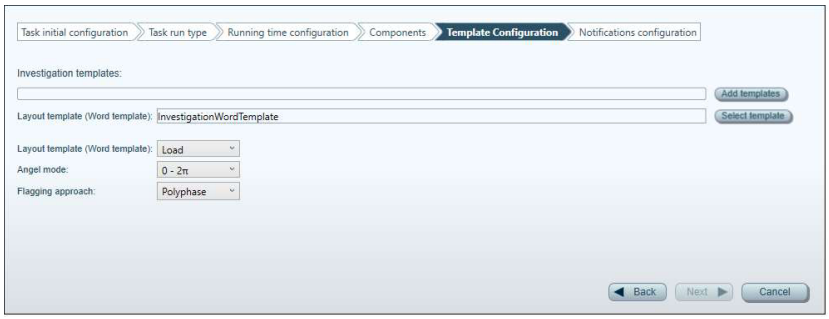
1. Enable notification by **SMS/Text**:
   - Mark the Enable notification by SMS/Text checkbox.
   - Add cell phone numbers to send text message notifications on task execution.
2. Enable notification by **email**:
   - Mark the Enable notification by email checkbox.
   - This allows you to send email notifications and attachments (if enabled) on task execution.

Note: Do not enable email/SMS notification if the email/SMS configuration has not been set up and tested.

3. Click Finish to apply the changes.

11.5.2. Specific export types

11.5.2.1. Based on template



Referring to a task that is created or derived from a pre-existing template in PQSCADA Sapphire, there are two types of templates that can be used:

1. **Investigation template**
    - This template is used for tasks that generate output in the form of charts, tables, and parameters based on a selected template from the investigation folder.
    - The investigation template allows you to define the specific layout and content of the generated reports based on your requirements.
2. **Layout template (Word template)**
    - This type of template refers to a Word document template that provides a predefined structure and styling elements, such as fonts, headings, margins, and page layouts.
    - By using a layout template, you can ensure consistent formatting and branding across your generated reports.

If the task is configured to run on multiple components, each component will generate its own individual report based on the selected template. This means that for each component, a separate report will be created, providing specific information and data related to that component.

11.5.2.2. Comtrade export

Task combines selected parameters across different resolutions in a wizard interface. It then generates a **pair of Comtrade** files for each chosen component.

11.5.2.3. CSV export

Task combines selected parameters across different resolutions in a wizard interface. It then generates a **CSV file** for each chosen component.

11.5.2.4. Excel export

Task combines selected parameters across different resolutions in a wizard interface. It then generates an **Excel file** for each chosen component.

11.5.2.5. Siemens CSV export

Task will run by pulling data from two components:

- **Main meter -** The component from which Input Frequency and Active Power parameters will be pulled.
- **SCADA -** This component must be FastModbus type, from this component we will pull the parameters Baseline, SOE import, SOE export, availability.

11.5.2.6. PQDIF export

Task combines selected parameters across different resolutions in a wizard interface. It then generates a **PQDIF file** for each chosen component.

11.5.2.7. PQZ export

Task combines selected parameters across different resolutions in a wizard interface. It then generates a **PQZ file** for each chosen component.

Users can export a PQZ file, which includes **binary data, historical data, and historical harmonic data**. The usage of harmonic data is dependent on the availability of historical data.

Furthermore, users have the option to export the data from the PQZ file as a single file or separate files per day.

11.5.3. Report Task Common Wizard

11.5.3.1. Task Group and Type

In the Report Task Common wizard, the first section is Task group and Type. To set up a report task, you can follow these steps:

1. Mark the "**Report**" task group. This indicates that you want to create a report task.

2. Click **"Next"** to proceed to the task type page. Here you will see the available task type options based on installed add-ons in your PQSCADA Sapphire system.
3. Mark the required **Task Type**. Select the specific task type that suits your report requirements from the available options.
4. Click **"Next"** to upload the Add-on configuration and go to the Task initial configuration page. This step uploads the necessary add-on configuration for the selected task type. It may take a few minutes for the upload process to complete. Once the add-on is uploaded, you will be directed to the Task initial configuration page.

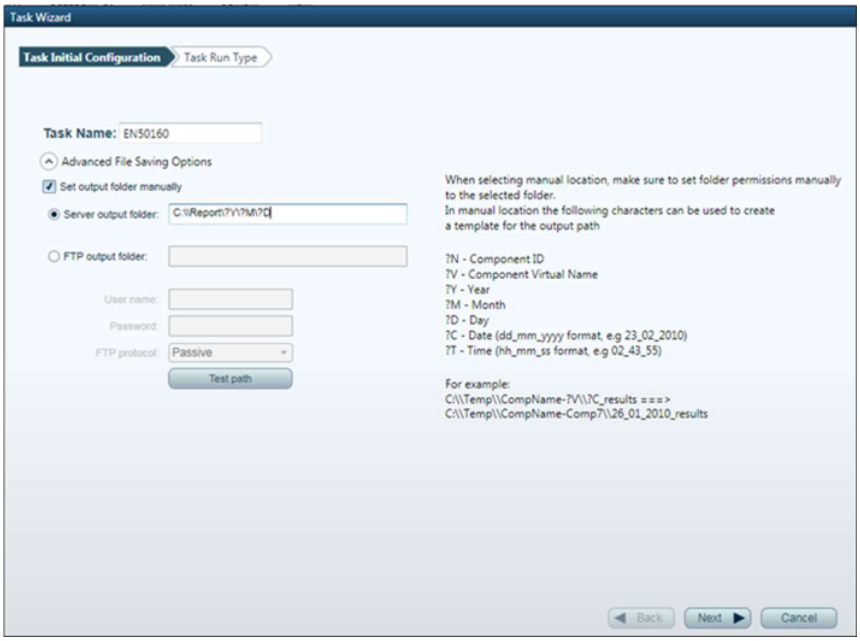
-

Note:

- The time taken for the initial upload of the Task add-on may vary depending on the size and complexity of the add-on.
- After the Task add-on is uploaded, you won't be able to return to the Task Type page to change the selected task type. Therefore, ensure that you have selected the correct task type before proceeding.

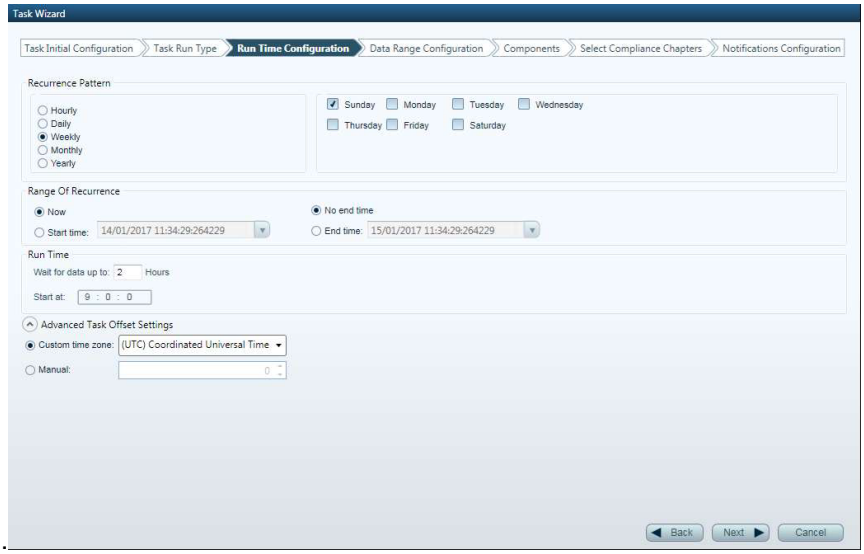
For this example, it is assumed that task **EN50160** was selected. This will ensure that all steps in the wizard are fully explored.

11.5.3.2. Task Initial Configuration



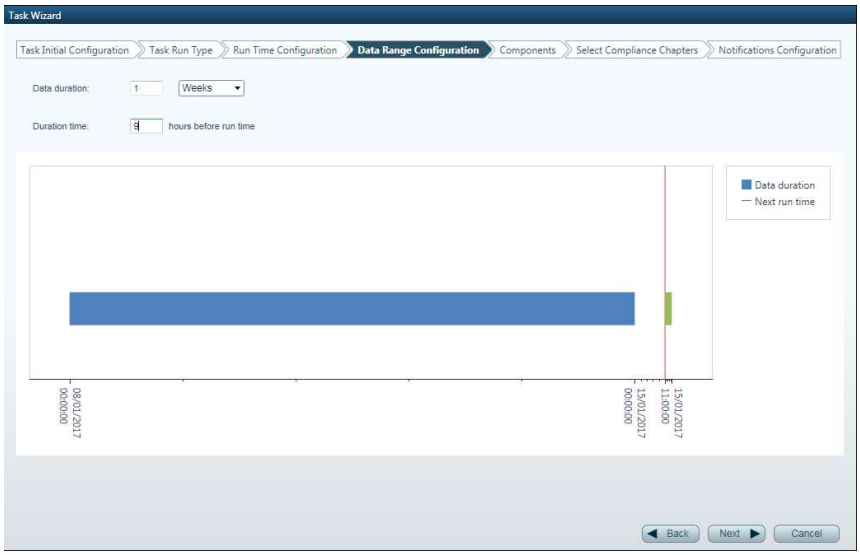
See section 11.5.1.2.

11.5.3.3. Run Time Configuration



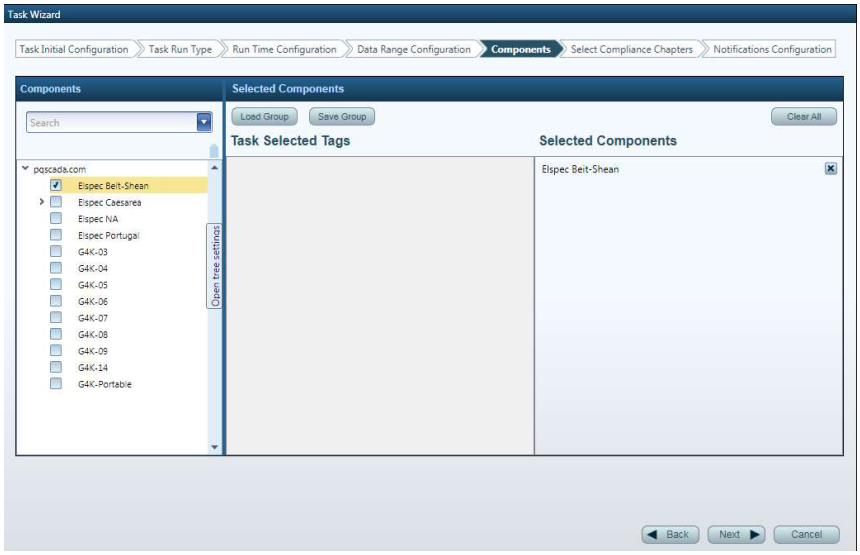
See section 11.5.1.3.

11.5.3.4. Data Range Configuration



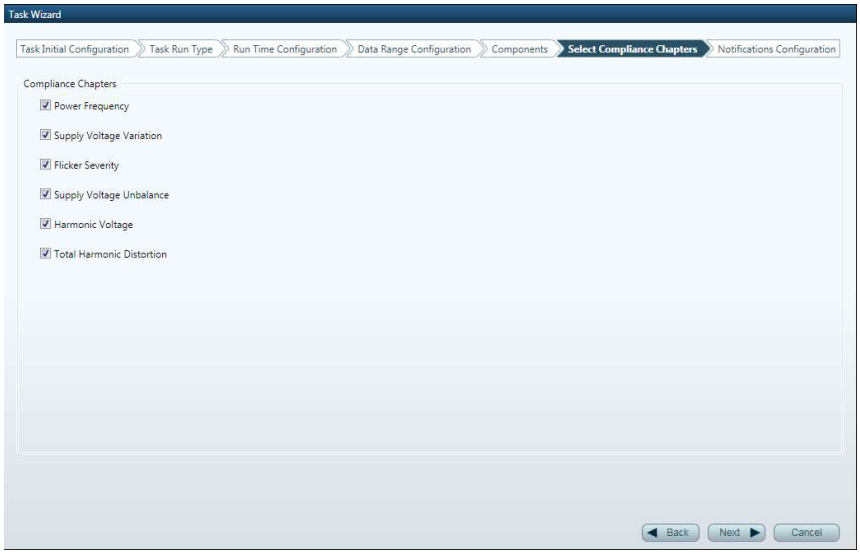
See section 11.5.1.4

11.5.3.5. Components



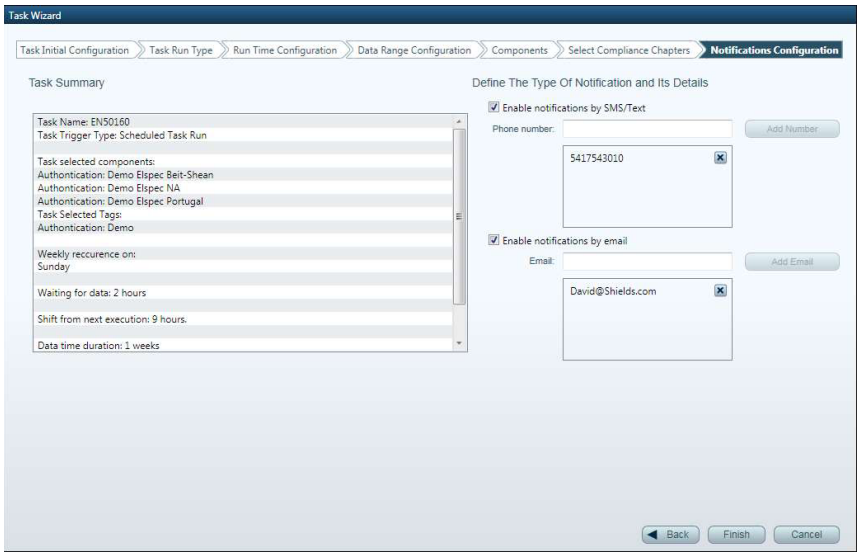
See section 11.5.1.5

11.5.3.6. Select Compliance Chapters



1. On the Compliance Chapters Selection page, you will have the option to choose the specific Compliance Chapters that you want to include in the report.
2. Select Compliance Chapters:
3. Mark the checkboxes next to the Compliance Chapters that you want to be included in the report.
    - You can select one or multiple Compliance Chapters, depending on your requirements.
4. Click **"Next"** to Proceed to the **Notification Configuration** page

11.5.3.7. Notification Configuration



See section 11.5.1.14

11.5.4. Specific Report Types

11.5.4.1. Sub-Harmonic Analysis Report

The sub-harmonic analysis task is offered as an Add-on (See section 5.8.7) that enables generating a Sub-Harmonics report.

Analyzing sub-harmonics can be useful for a variety of applications and diagnosis, because sub-harmonics may cause transformer saturation, torque amplification, errors in phasor estimation and other phenomena.

The Sub-Harmonic analysis report filters harmonics equal to and above the 10th and can be exported to CSV. A single html file will be generated for every 5 minutes in the report, and an index file will be created in case of multiple files. The index will include links and timestamps for each 5-minute file.

11.5.4.2. Control and Maintenance Task (Enterprise edition only)

This Control and Maintenance task is used to configure notifications. Customers can use it to upgrade all their units by one task instead of performing a single firmware upgrade to each unit, or for configuring physical devices.

11.5.4.2.1. Task Group and Type

1. Select the **Control and Maintenance** option.

2. Click **Next** to go to the **Task Type** page.

3. Select one of the four displayed task types. The available types depend on the installed add-ons.

In the first three task types, the task configuration begins with selecting the components and ends with the notification configuration (selecting the email/text notification).

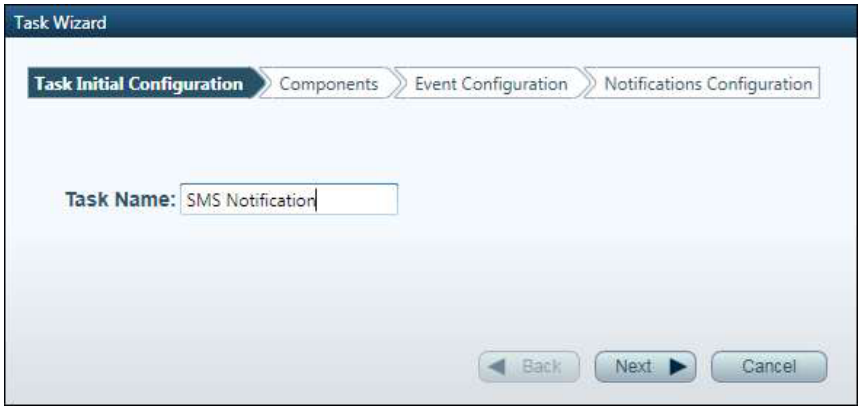
For the Unit Maintenance task type, see details in section 0.

4. Click **Next** to upload the Add-on configuration, beginning with the **Task Initial configuration** page. The page will be according to the selected Task type.

Notes:

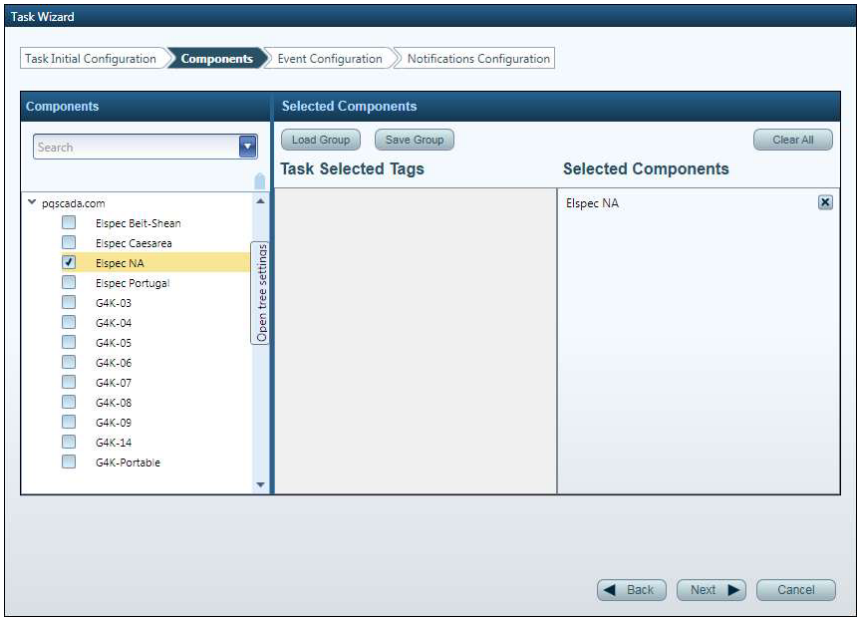
- Uploading the task add-on for the first time can take a few minutes.
- Once the task add-on is uploaded, returning to the Task type page is no longer available.
- To this description, it is assumed that the EN50160 task is selected. This will ensure that all the wizard steps are fully explored.

11.5.4.2.2. Task Initial Configuration



See section 11.5.1.2.

11.5.4.2.3. Components



See section 11.5.1.5

11.5.4.2.4. Task Type Configuration

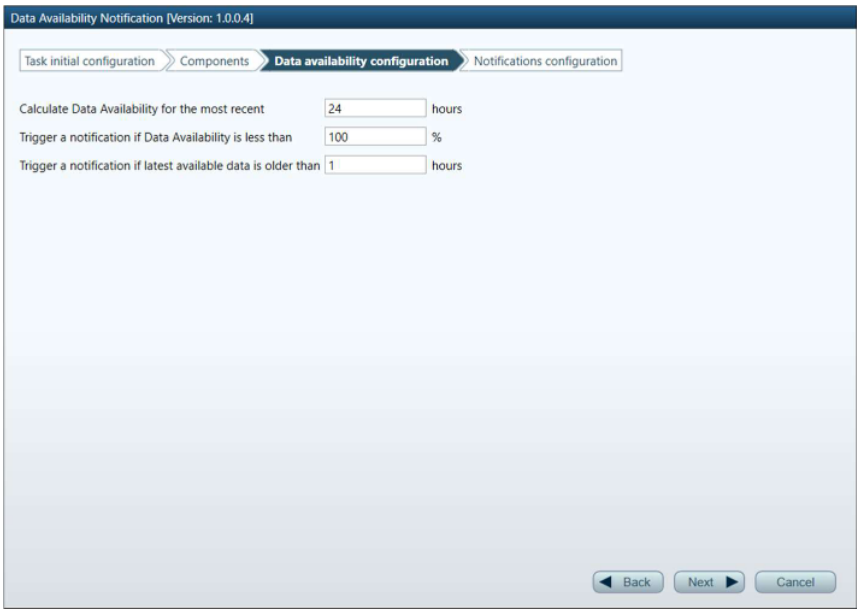
The task configuration page and details depend on the selected Control and Maintenance task type.

Configure the task details and click **Next**.

11.5.4.2.4.1. Data Availability Notification

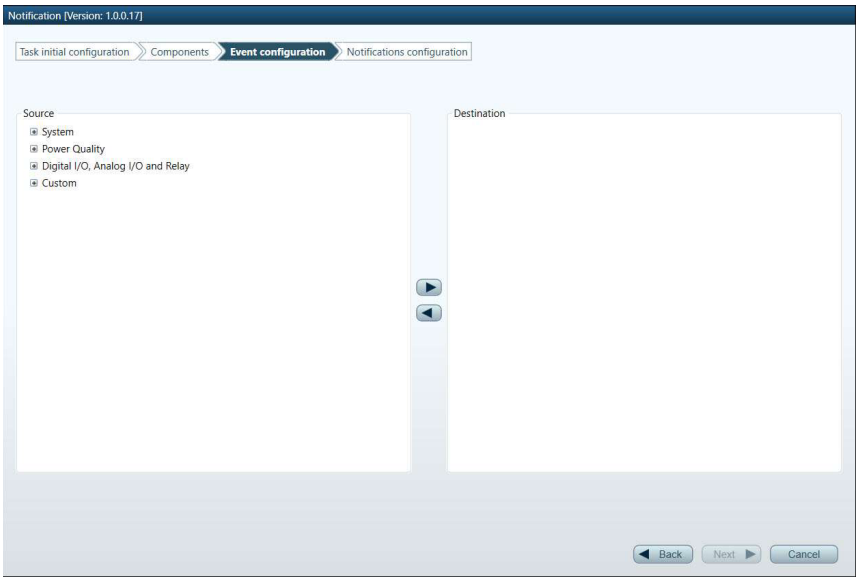
The **Data Availability Configuration** page within PQSCADA Sapphire allows users to define parameters related to data availability. This configuration is crucial for ensuring that data is continuously accessible. Here are the key components of this configuration:

- **Calculate Data availability** – This setting refers to the time interval over which data availability is measured. It defines the duration within which data should be continuously available without interruption.
- **Trigger a notification if Data availability is less than (%)** - Users can specify a percentage of data availability. If the actual data availability falls below this percentage, a notification will be automatically generated and sent to alert users of the issue.
- **Trigger a notification if latest available data is older than –** This setting allows users to define a time threshold. If the latest available data exceeds this specified time threshold, a notification will be triggered.



11.5.4.2.4.2. Notifications

The **Event configuration** page enables configuring the source that should trigger the event (including non-power quality events such as the system).

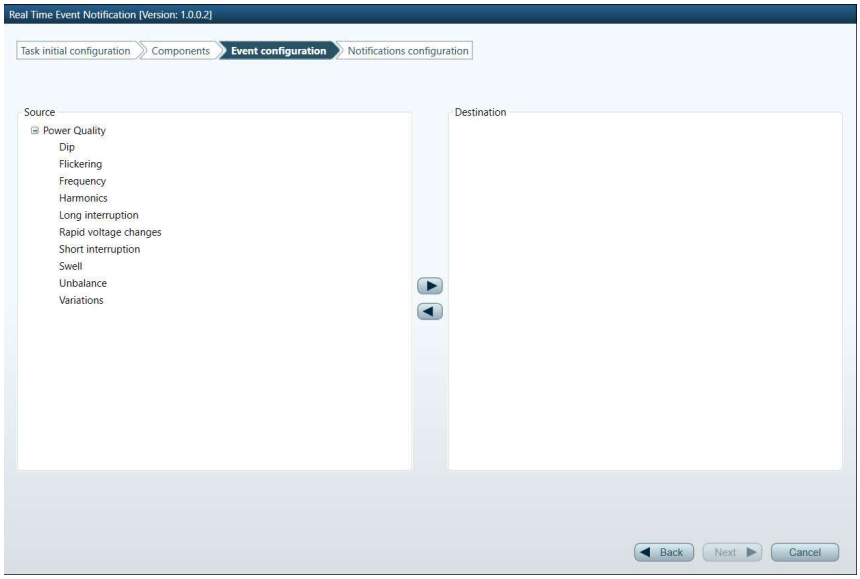


11.5.4.2.4.3. Real Time Event Notification

The **Event configuration** page enables configuring the power quality event that will trigger the event, The task should read the counter every 5 seconds and in case the counter increases from the previous reading a notification should be triggered.

The list of event counters is part of the Emerson Modbus block.

- Only for G4K devices (Based on Modbus/Json)
- Only power quality events



11.5.4.2.4.4. Unit Maintenance

Selecting the **Unit Maintenance** task type enables configuring components and firmware (fw) upgrade tasks.

1. Select task running time from one of the following:
    a. **Now**
    b. **Running time** – select the date and time from the dropdown calendar.
    c. Click **Next** to go to the **Unit type** page (G4, G5, Pure).
2. Select the unit type from the dropdown list.
    a. Click **Next** to go to the **Components** page.
3. Select the Components (See section 11.5.1.5)
    a. Click **Next** to go to the **Select action** page
4. Mark one or both of the following actions:
    a. **Configuration file** and browse to the location (path) of the fw/cnfg file.
    b. **Upgrade file** and browse to the location (path) of the fw/cnfg file.
    c. Click **Next** to go to the **Notifications Configuration** page.
5. Notification Configuration (See section 11.5.1.14)

11.5.4.2.4.5. Daylight saving updater

Selecting the Daylight Saving Updater task will allow users to check the transition times configured in G4 devices hourly, daily, or weekly. The task will compare these transition times to the transition times

configured in the operating system. If there are any differences, the task will update the daylight configuration in the G4 devices accordingly. In this task you only need to select the Run type and component.

11.5.4.3. Modifying a Task

1. Switch to the **"Tasks List"** view within the Scheduler's main interface.
2. Locate the task you want to modify and double-click on it.
3. Follow the instructions provided by the task modification wizard to make the necessary changes.

11.5.4.4. Deleting a Task

1. Navigate to the **"Tasks List"** view in the main Scheduler interface.
2. You can delete a task using one of the following methods:
    a. Right-click on the task you wish to delete and select **"Delete."**
    b. Find the task's corresponding row and click on the **"X"** icon in the delete column to remove it.

11.5.4.5. Opening an Attachment

Option 1(Task list view):

1. Within the Scheduler's main interface, switch to the **"Task list"** view.
2. Locate the requested task you want to inspect or access.
3. Press on the **"Attachment"** button 
4. Select the requested files that you would like to download and press the **"Download"** button 

Option 2 (Log view):

1. Within the Scheduler's main interface, switch to the **"Log"** view.
2. Locate the task log associated with the task you want to inspect or access.
3. Double-click on the task log entry to open it. This will allow you to view any attachments or additional information related to the task.

12. Special Features

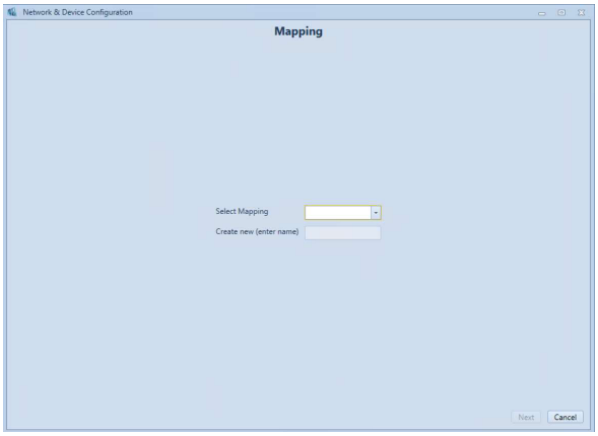
PQSCADA provides users with a range of special addons to enhance data analysis and management.

12.1. CSV Import

One such addon is CSV Import, which enables users to import data from CSV files. This addon includes a mapping file wizard that allows users to define how CSV data should be interpreted. The mapping file can be saved for future use, streamlining the import process. CSV Import allows users to bring in data from CSV files through various methods, including drag-and-drop, file/folder selection, or by adding a new component with CSV data.

12.1.1. Mapping selection

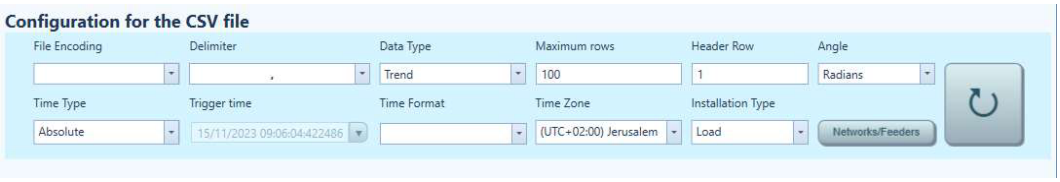
First user should drag and drop a CSV file, then the CSV Wizard is initiated.
In the mapping selection page, users have the option to create a new map or use an existing one from the server.
To create a new CSV mapping, users should provide a name and click **'Next'** to proceed.



12.1.1.1 Create new map

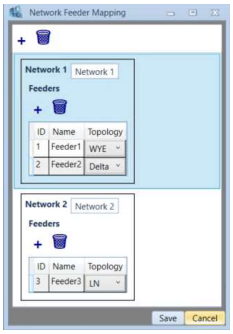
In this wizard page, the user can configure the mapping and parameter settings for the CSV file.

12.1.1.1.1 Configuration for the CSV file



- **File encoding –** Select the desired file encoding, such as UTF-8 or ANSI.
- **Delimiter –** Specify the character used to separate or split text in the CSV file.
- **Data type –** Choose how PQSCADA will parse the data, based on whether it's trend data (to be mapped to PQZ parameters) or log data (to be mapped to specific log table columns).
- **Maximum rows –** Define the number of data rows to parse from the CSV file.
- **Header row –** Specify which row in the CSV file contains the header information.
- **Angle –** Decide whether to use angle values in degrees or radians.

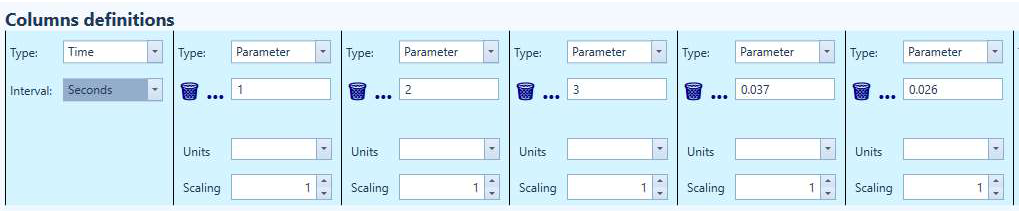
- **Time type -** Users can choose between two options:
  - **Relative time -** This setting incorporates CSV configured time alongside the selected time zone.
  - **Absolute time -** Enables the configuration of Trigger time, time format, and time zone for precise settings.
- **Installation Type -** In Sapphire, there is support for two standards regarding power factor parameters: IEC and IEEE. This setting determines the approach used for the conversion of power factor parameters within the system.
- **Network\Feeder button –** By default, the designated component is set with one network and one feeder. Users have the capability to modify existing network/feeder configurations or add new ones as needed.



- **Reload the map Based on configurations** – Refresh the new map page when configuration changes are made.

12.1.1.1.2 Column definition

Within the CSV Import wizard, users can further configure how the columns in the CSV file are interpreted.

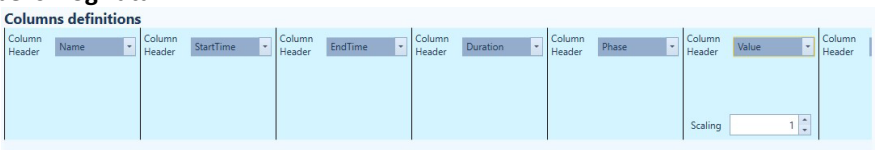


Data type is 'Trend'

- **Parameter –** This is typically used for measurement data.
  - **Name**
    - **Non-standard name -** PQSCADA Sapphire will generate a parameter name automatically.
    - **Standard parameter -** Click on the three dots to open the parameter selection wizard and a list of parameters will be presented. Feeders list will be displayed according to user modification.
  - **Units –** users can select a unit to Non-standard parameters, for standard parameters, the original units associated with these parameters are automatically recognized and displayed.
  - **Scaling –** Users have the option to scale parameter values. This means multiplying the original value by a specified scaling factor.

- **Time –** Usually, the first column in a CSV file represents time.
    - **Interval –** This setting determines the duration between each data row and is accessible exclusively when the time type is set to 'Relative'.
- **Flag –** Certain devices include a "status" column primarily for the flagging concept. In such cases, customers may need to map the corresponding values to the supported statuses in PQSCADA for compatibility and proper integration.
- **Clear –** This button allows users to clear any parameter name or selection previously made for a column.

Data type is 'LogData'



- **Column header** – allows the user to determine the column data type.
  Note: Column header must be correct.

12.1.1.1.3 Data preview

In the CSV file, data rows are organized for each column, and all data should be mapped and displayed per column in a list.
This ensures that each column of data is correctly associated with its corresponding parameter or attribute in PQSCADA Sapphire, allowing for precise data analysis and visualization .

To finalize the creation of the mapping file:

- Once you've configured the mapping file settings, click on the **'Save'** button.
- The wizard window will close, and the mapping file will be saved for future use.
- Additionally, a new investigation will be generated in PQSCADA Sapphire, incorporating the specified configurations you've set.

To cancel the configuration process:

- If you choose not to proceed with creating the mapping file, click on the **'Cancel'** or **'X'** buttons.
- This action will result in the closure of the wizard window without saving any new file mapping configurations you might have set.

12.1.1.2 Existing mapping file

Users can choose to utilize an existing mapping file or modify an existing file:

Modify an existing mapping file

- Select the desired mapping file from the list of existing files.
- Click on the 'Edit' button.
- Make the required updates or modifications to the existing configurations.
- Upon completion of changes, click the 'Save' button to preserve the updated mapping file.

Execute an existing mapping file

- Select the desired mapping file you intend to run from the available list of existing mapping files.
- Click on the 'Run' button linked to the chosen mapping file to initiate its execution.

12.1.2. CSV Component

Another option is to create a component from CSV type, but to use this component preparation should be done.

Copy existing CSV mapping file

- Navigate to the directory: \\AppData\Roaming\PQS\AddOns\Converters\CSV\MAPS
- Copy 'MAPS' folder containing the required mapping files.
- Paste these copied mapping files into: C:\ProgramData\PQS\AddOns\Converters\CSV\MAPS
- Restart the PQS server service

To create new CSV component

1. Go to Actions >> 'add new component'
2. Select CSV_component and click on the **'Next'** button
3. Enter details such as: device IP\Address, port, username, password and directory path of the requested device, click on the **'Next'**
4. Under the CSV mapping page, choose between:
    a. **Single map file** – Choose this option if you want the component to work with only one existing mapping file.
    b. **Multiple map files** – Select this option if you want the component to work with multiple existing mapping files. For each CSV mapping file, insert a search word. Every time a CSV file contains this search word, the component will know which mapping file to use.
    c. **Add new row** – You can add a new row to specify additional mapping files to associate with the CSV component.
    d. click on the **'Next'** button
5. Choose the desire DB type and click on the **'Next'** button
6. Insert valid component name and click on the **'Next'**
7. Complete the process by clicking 'Finish'.

Now, you can create an investigation using data from this newly created CSV component within PQS.

12.2. Event source detection

PQSCADA involves detection of events from dip and interruption types, with the software distinguishing between 'Upstream,' 'Downstream,' and 'Unknown' sources:

- **Upstream:** Denotes an external network as the source of the event.
- **Downstream:** Indicates an internal network as the source of the event.
- **Unknown:** Signifies that the source of the event couldn't be identified.

This information regarding the event source is presented as a column in the Event chart available under the investigation and Power Quality modules within PQSCADA.

Starting from Sapphire version .1.0.7.28, PQSCADA automatically recognizes the source of events for data processed after the installation of this version.

However, for historical events, if the user wishes to enable PQSCADA to detect their sources, they can do so using the event source detection feature found in the Schedule\Task module. This allows the system to identify the source of historical events.

Event chart

Event source column will always be display with the source detection.

Event source detection task (Historical data)

The Event Source Detection task in PQSCADA allows users to perform historical data analysis to detect event sources. Here's a step-by-step guide on how to execute this task:

1. Navigate to the Schedule\Task module within the PQSCADA interface.
2. Click on the option to create a new task.
3. Choose the "Control and Maintenance" option and proceed by clicking the 'Next' button.
4. Select 'Event Source Detection' from the available options and proceed to the next step.
5. Insert a valid name for the task and click 'Next' twice to advance.
6. Select the time interval for the task to run and process the historical data. Then, click 'Next'.
7. Choose the relevant component for which you want to detect event sources, then click 'Next'.
8. Move the specific event types (limited to Dip and Interruption events) from the source to the destination area, then press the 'Next' button.
9. Once configured, click 'Finish' to conclude the task setup.

Upon completion of the above steps, you can create an event chart based on the specified data time interval from step 6 to visualize and analyze the event sources detected by PQSCADA for the selected component.

13. Appendices

Appendix A. Compliance

In PQSCADA, compliance settings play a crucial role in assessing the quality of the electrical network between the supplier and the consumer. Compliance settings are specific regulatory standards or guidelines that vary by country or region. These standards are used to evaluate and ensure the quality of the power supply. Here are some key points about compliance settings in PQSCADA:

Available Compliances:

1. **Belarus ГОСТ 32144-2013**
2. **DranetzFOL**
3. **EN 50160**
4. **FOL**
5. **Generic**
6. **ГОСТ 32144-2013**
7. **IEEE519 2014**
8. **IEEE-519 2022**
9. **NRS**
10. **PQElia**

Recalculation on Past Data:

Compliance settings can be applied retroactively to past data, enabling you to assess historical power quality against current compliance standards.

Purpose of Compliance:

Compliance settings are used to determine if the electrical network's quality meets the regulatory standards of a specific region. This is important for ensuring the reliability and stability of the power supply.

Parameters and Time Frame:

Each compliance is based on specific parameters, and these parameters are evaluated within a defined observation window, typically a week. Statistics are generated based on data collected during this time frame.

Variety of Rules:

Compliance settings consist of rules or chapters within the compliance report. Each rule defines certain criteria that must be met. For example, a rule might specify the maximum allowable number of voltage dips within the observation window. If this limit is exceeded, the compliance fails. Another rule might establish boundaries within which a parameter's value should remain. Deviating from these boundaries for more than a specified percentage of the time would also result in compliance failure.

Customization and Selection:

In PQSCADA, you can select the compliance that needs to be calculated for each component. Once a compliance is selected, the relevant parameters and events required for that compliance are highlighted in yellow, indicating that they cannot be changed. This ensures that the assessment is conducted according to the selected compliance's criteria.

Multiple Compliances:

PQSCADA allows users to select one or more compliances, enabling a comparison of compliances based on the same data. This feature is valuable for evaluating power quality against multiple sets of standards or regulations simultaneously.

For example:

IEEE-519 2014 limits

Harmonic	Time Percent Limit[%]	Regulation max [%]
2	99	7.5
3	99	30
4	99	7.5
5	99	30
6	99	7.5
7	99	30
8	99	7.5
9	99	30
10	99	7.5
11	99	14
12	99	3.5
13	99	14
14	99	3.5
15	99	14
16	99	3.5
17	99	12

IEEE-519 2022 limits

Harmonic	Time Percent Limit[%]	Regulation max [%]
2	99	15
3	99	30
4	99	15
5	99	30
6	99	15
7	99	30
8	99	30
9	99	30
10	99	30
11	99	14
12	99	14
13	99	14
14	99	14
15	99	14
16	99	14
17	99	12

Appendix B. Loads and Connections

This appendix provides an overview of different load types and connection configurations commonly used in electrical systems. Understanding these concepts is essential for managing and monitoring power quality effectively.

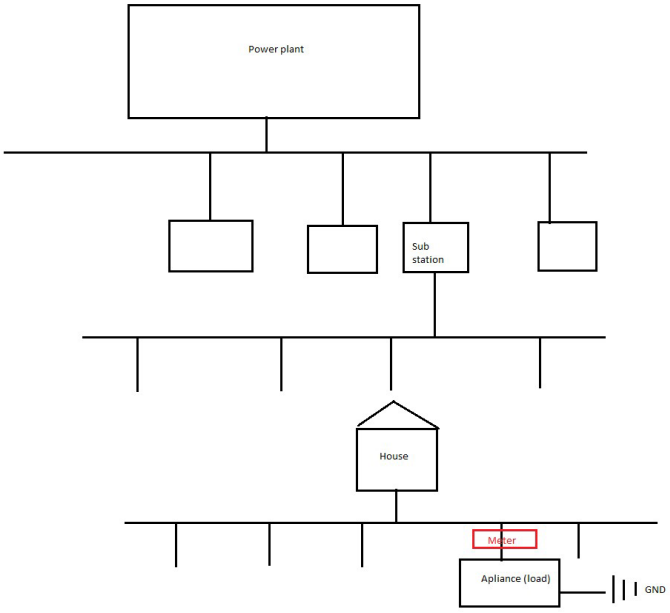
Load Connection Basics:

Current Flow: When a load is connected to an electrical system, it creates a path for electric current to flow from the power source to the load itself. In essence, it completes the circuit, allowing the flow of electricity.

Meter Connection Options: When connecting a meter to an electrical system, there are typically two options:

- **Measuring Output from Source:** This option involves measuring the electrical parameters as they exit the power source.
- **Measuring Load Consumption:** The more commonly used option is to measure the electrical parameters as they leave the load, i.e., after passing through the load.

Measuring Point: The location where the meter is connected to measure load consumption is known as the "measuring point." In Elspec, this measuring point is referred to as a "Feeder."



Load Connection Topologies:

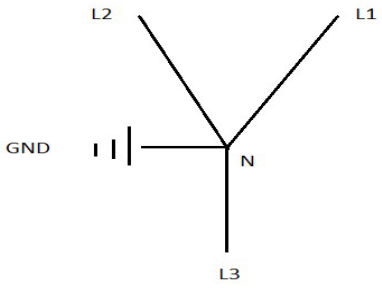
Understanding the topology at the measuring point (Feeder) is crucial because it determines which electrical channels are relevant. Several topologies are important to know:

WYE (Star Connection):

This is the most common type of electrical connection.

Voltage is measured as the difference between potentials. For example, V1 (L1) refers to the voltage difference between V1 and the Neutral (N).

In household electrical sockets in Israel, there is one phase (V1) along with Neutral (N) and Ground (GND). However, at the entrance to the house in the electrical cabinet, all three phases are present.

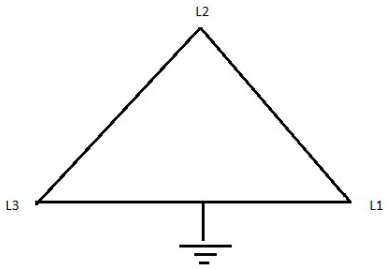


Delta (Triangle Connection):

Delta connections aim to reduce the number of wires needed by not using a Neutral (N) wire.

In Delta configurations, the potential difference is not between the voltage and the ground, but between phase-to-phase voltages, such as V1 to V2, V2 to V3, and V3 to V1.

This configuration can result in higher voltages (e.g., 345V) and lower currents, which reduces heat generation. It is often used for high-energy-consuming devices.



LN (Line to Neutral):

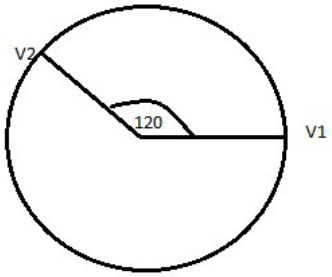
In LN topology, there is only one household phase along with Neutral (N) and Ground (GND).

This method is used when a load operates in a single phase, and current flows from the Voltage (V) to Neutral (N). An example is an electrical light train.

LL (Line to Line):

LL is a special case of the Delta connection where Line-to-Line voltage (e.g., V1 to V2) is utilized.

This configuration is used in cases where current flows from one phase to another, such as in a bullet train.



Safety Notes:

- Birds perching on electrical wires typically only touch one wire (phase). If they don't touch the ground, there's no voltage difference, and electricity doesn't flow through them.
- Rubber boots act as insulators, preventing electricity from passing through a person wearing them.

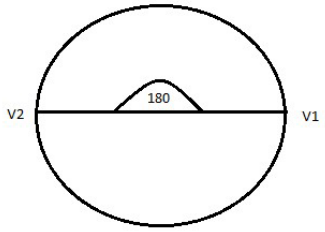
2 Phase TR (Two-Phase Transformer):

This topology is used when long electrical wires are required in remote areas, such as the Australian desert.

It uses only two phases (V1 and V2) for long-distance transmission.

When connecting at the destination, one of the phases may be connected to ground.

This configuration provides both line-to-line (V1 and V2) and line-to-ground measurements.



Appendix C. Historical Data

PQSCADA Sapphire manages historical data using two primary types: Binary Data and Summary Data. Understanding these data types and their characteristics is crucial for effective power quality analysis.

C.1. Binary and Summary Data

1. **Binary Data:** Binary data consists of waveform data stored in chunks of 1 minute each. This data can include raw information on harmonics or compressed waveform data (depending on the source). Binary data is stored in a dedicated database table (binary 1 table).
    - Binary data is typically used for requests that cover **less than 3 hours** of data.
    - For requests spanning more than 3 hours, Summary data is used.
2. **Summary Data:** Summary data consists of calculated parameters, including minimum, maximum, and average values over different time intervals. Summary data is crucial for quickly accessing data at lower resolutions (e.g., 1 hour, 1 day, etc.).
    - Summary data may include thousands of parameters, which can be calculated from binary data, fetched instance data, or acquired directly from a device.
    - Summary data can arrive in two ways: it can be calculated by PQSCADA based on the incoming data, or it can be obtained directly from a unit.

Calculating Historical Data:

- Calculating historical data, especially from raw binary data, can be resource-intensive and time-consuming.
- Summaries calculated in the unit itself might differ slightly from those calculated in PQSCADA due to variations in raw data. Recalculating parameters in PQSCADA can ensure precise results but may require significant processing time.

Managing Summary Data Size:

- Summary files are not compressed, making them large. This can lead to issues with file accuracy.
- One way to manage this is by adding a database (DB) in newer units (like G5 and the new G4). PQSCADA can then directly retrieve summary data from the unit using the PQZ communication protocol. This keeps files small but may limit the ability to retrieve older data from the unit's DB.

Fetch Data for Real-Time Charts:

- Fetch data is mainly used for real-time charts and involves obtaining instant data from the device. Not all parameters displayed in real-time are saved into the database.
- In Elspec's units (Pure, G5, and new G4), parameters are typically based on an average of 200ms, with min/max values based on cycle frequencies (HCYC). When data is pulled from the unit to PQSCADA, this is the base.

C.2. Recalculation Process

Recalculation is a vital process for maintaining data accuracy and adjusting when necessary. It is used in the following scenarios:

1. Adding, removing, or modifying power quality parameters in the summary data.
2. Adding, modifying, or removing events from a component.
3. Adding, modifying, or removing compliance standards for a component.
4. Changing unit configurations due to misconfiguration or incorrect installations.

The recalculation process involves recalculating selected parameters, events, or compliance standards from the raw waveform data. When unit configurations change, the recalculation applies to all historical data, ensuring consistency and accuracy in the analysis of power quality data.