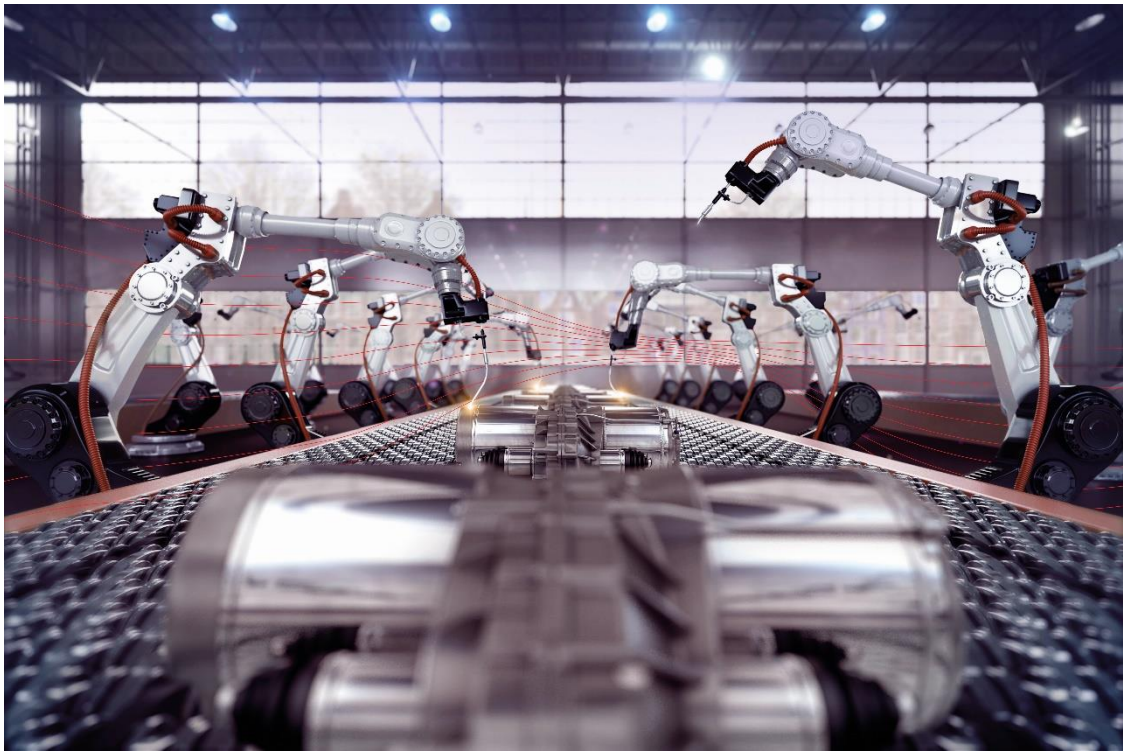
schaffner
MORE POWER TO YOU

# **USER** MANUAL

# Power Quality Simulator (PQS)



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Revision: 3.7 (November 2022)
The most current edition of this document (PDF format) can be obtained from the support page in pqs.schaffner.com

Other technical documentation of our products is also available on our website schaffner.com

Document name:
User Manual SchaffnerPQS v3.7.pdf

Valid for:
PQS version 3.7

**Document version history**

| Date | Reason for changes | Version | Initials |
|---|---|---|---|
| **01/03/2013** | Release version | 1.0 | AK |
| **01/15/2013** | Additional PQ standards have been added to SchaffnerPQS | 1.1 | AK |
| **04/23/2013** | SchaffnerPQS 2.0 released | 2.0 | AK |
| **11/13/2013** | Adjusted default drive model DC-link values | 2.1 | AK |
| **09/05/2016** | SchaffnerPQS 3.0 released | 3.0 | TW |
| **01/11/2022** | SchaffnerPQS 3.7 released with new branding | 3.7 | LM |

# Tables of Contents

# CHAPTER 1

# Preface

## Terms of Use

Schaffner Power Quality Simulator

By registering for and using of the Schaffner Power Quality Simulator (“SchaffnerPQS”) software and the website of the Schaffner Group, you agree to the following conditions:

The website of the Schaffner Group (Site) and the SchaffnerPQS are made available by the Schaffner Group on behalf of itself, and its affiliates (“Schaffner”). Please read these Terms and conditions of use of the SchaffnerPQS (the “SchaffnerPQS Terms of Use”) carefully before using the Site and the SchaffnerPQS.

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## Feedback

If you spot a typo in this guide, or if you have thought of a way to make the software or this guide better, we would love to hear from you!

If you have a suggestion for improving the software or the documentation of it (or any other relevant comments), try to be as specific as possible when formulating it. If you have found an error, please include the chapter/section/subsection name and some of the surrounding text so we can find it easily.

Please submit a report by e-mail to: pqs@schaffner.com.

## PQS Version History

1.0 Release version
1.1 Added several international power quality standards / norms
2.0 SchaffnerPQS 2.0 release including:

- Reworked simulation models allowing for even more accurate simulations
- Reworked component check allowing for more convenient filter adaption
- Improved sanity check engine now including voltage levels, frequency, cabling, transformer size, load size, filters
- usability improvements like progress bar, speed optimization, messages

3.0 SchaffnerPQS 3.0 release including:

- Refreshed new GUI design with improved project handling and overall usability
- Projects can be shared with colleagues/partners by simply copying the URL link
- New report design with more than two standards selectable
- New post-processing features
  - show FFT results as table and bar plot
  - New component check for Active Harmonic Filter
- Wiring functionality has changed: Wiring is done with left click & drag on connection points
- New circuit elements:
  - Generator as source
  - Schaffner 18 pulse Mitigator selectable
  - AC line choke with customizable inductance available
- All existing circuit elements are reworked with new/improved simulation models
  - Active Harmonic Filter (AHF) has filter size and load priority added
  - Power factor correction (PFC) has resonance frequency and Q factor as additional input
  - Silicon Controlled Rectifier (SCR) has power as added input and displays approximated firing angle prior to the simulation
- Prepared for new Passive and Active Harmonic Filter generations

3.7 SchaffnerPQS 3.7 release including:

- Schaffner branding updated
- Product list updated
- Project list pagination to improve performance
- Improvement in the project list sorting
- Frontend and backend update

# CHAPTER 2

# Welcome

## What is The Schaffner Power Quality Simulator

The Schaffner Power Quality Simulator lets you do network simulations in just some seconds. The supply of loads with amplitude and frequency controlled voltage can easily be named as industrial standard. So called power electronics are widely used in the industry and nowadays also in almost all electronic devices within the private sector. These devices or systems mainly consist of rectifiers and inverters which, as non-linear loads, produce currents with high harmonic content. In order to fulfill the regulatory requirements as well as international and national norms concerning voltage and current harmonic distortion it is necessary to put in place corrective actions. There are two types of filters technology available, active and passive filtering. It is essential to know which solution has what opportunities and influence including advantages and disadvantages of each one. This provides optimized proposals with maximum benefits for the users. For the selection of filters systems simulation software has been proved to be a very useful tool. With the Power Quality Simulator the Schaffner Group provides an own software tool for the simulation of networks including Schaffner active and passive filters for the reduction of harmonic distortion. The SchaffnerPQS is adapted on new technologies and is thus a technical tool not only for experts but a multi-useable version for almost all users of all technical levels.

The Schaffner Power Quality Simulator provides:

- Ability to simplified modeling of electrical networks
- Ability to simulate electrical networks with selected electrical components
- Calculate and simulate the effects of the electrical components such as harmonic distortion
- Present results of the simulations in an appropriate way
- Simulate and calculate appropriate solutions for solving given issues (e.g. referring to norms/standards)
- Present solutions including norms
- Create reports including the whole results and norms fulfillments

## About This Guide

This guide is meant to provide comprehensive information on SchaffnerPQS - the Power Quality Simulator. The issues discussed in this guide cover the necessary theoretical conceptions as well as practical aspects of working with SchaffnerPQS. The guide will familiarize you with the way to simulate and administer power networks and to employ the user interface for performing various tasks.

## Who Should Read This Guide

The primary audience for this book is anyone interested in or responsible for administering power network systems. To fully understand the guide, you should have some basic computer system and power quality habits. Attending Schaffner Group training courses might be helpful. Still, no more than basic knowledge of internet browser technology and power networks is required in order to comprehend the major SchaffnerPQS functionality and learn to perform basic simulation operations.

## Get Help

In-tool help is always at your fingertips! The Schaffner Group incorporates the latest in help features, including “Mouse over” functionality that displays a brief description of fields in dialogs and context sensitive help on menu and toolbar buttons. This user manual is included in the support section of the SchaffnerPQS and thus available at a click.

## Get Training

Do you need training? The Schaffner Group can offer a training course comprised of lecture and hands-on workshops designed to introduce you to the fundamental concepts of power quality and the modeling of power networks with the Schaffner Power Quality Simulator.
We also offer customized training courses designed to meet your specific needs. Please contact your local Schaffner representative or the SchaffnerPQS group directly to discuss how we can help you achieve success in your simulation efforts.

## Contact Us

The Schaffner Group – More than just filters. Schaffner is in the unique position of being able to support the user with problem analyses, engineering advice, testing and measurement support, custom products, and a worldwide customer service organization. Our goal is to ensure that you obtain the level of support you actually need. Toward this objective, we invite you to contact your local representative or the SchaffnerPQS Group at any time that we may be of service to you.

| | | | |
|---|---|---|---|
| Support E-mail: | pqs@schaffner.com | Corporate E-mail: | info@schaffner.com |
| URL: | pqs.schaffner.com | URL: | schaffner.com |

# CHAPTER 3

# Registration and Preliminary Operations

## System Requirements

The SchaffnerPQS is a web-based power quality simulator mean to be used within the web-browser of a computer using mouse and keyboard. It is not compatible with smartphone and tablet or touchscreen only device. The application runs on Linux, Windows and MacOS in all recent browsers, including Firefox, Opera, Safari and Chromium based browsers like Chrome, Edge and Brave.

There is no minimum system requirement if the computer can run properly the latest version of the listed browser. However, it must be use on a screen with a good enough resolution.
Minimum resolution: 1280x720
Recommended resolution: 1920x1080 or higher

## Network Requirements

As a web application the SchaffnerPQS software is depending heavily on Internet technologies and makes use of one of the default browsers installed on the system. Thus, an appropriate internet connection is required for using the SchaffnerPQS. The use of a Broadband Internet connection is emphasized. Nevertheless, the SchaffnerPQS will also run on lower speed internet connections but could induce much longer loading times.

## Registration

The use of SchaffnerPQS requires a registration. You can register under pqs.schaffner.com using the create account function and providing a valid email address and strong unique password.

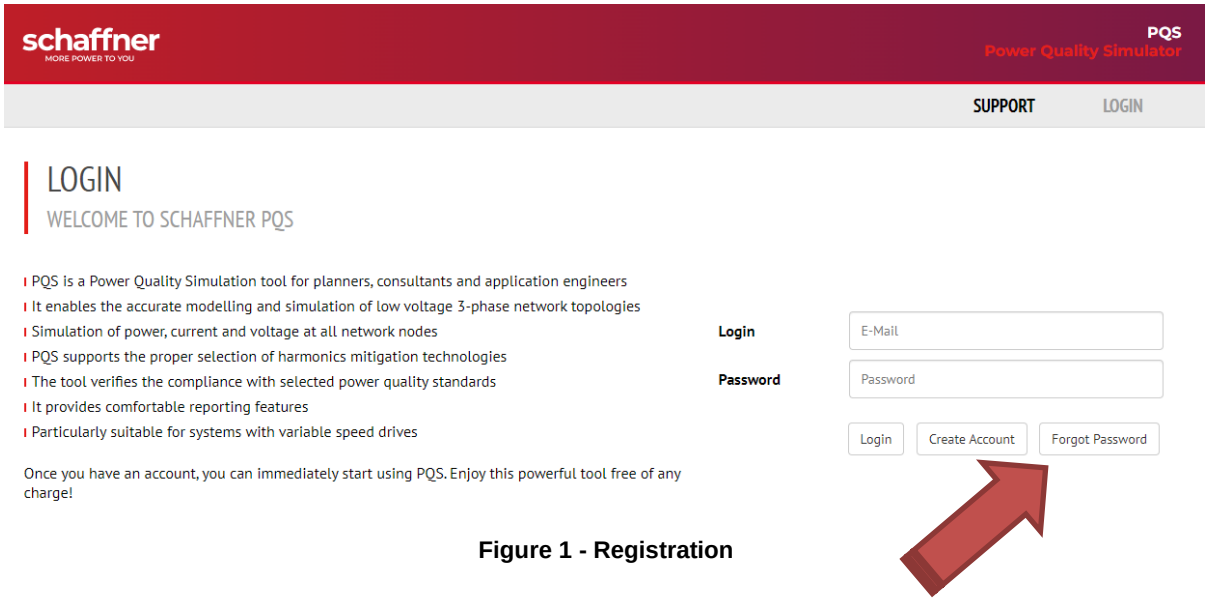



**Figure 1 - Registration**

After you have chosen the create account button you will see the registration form.

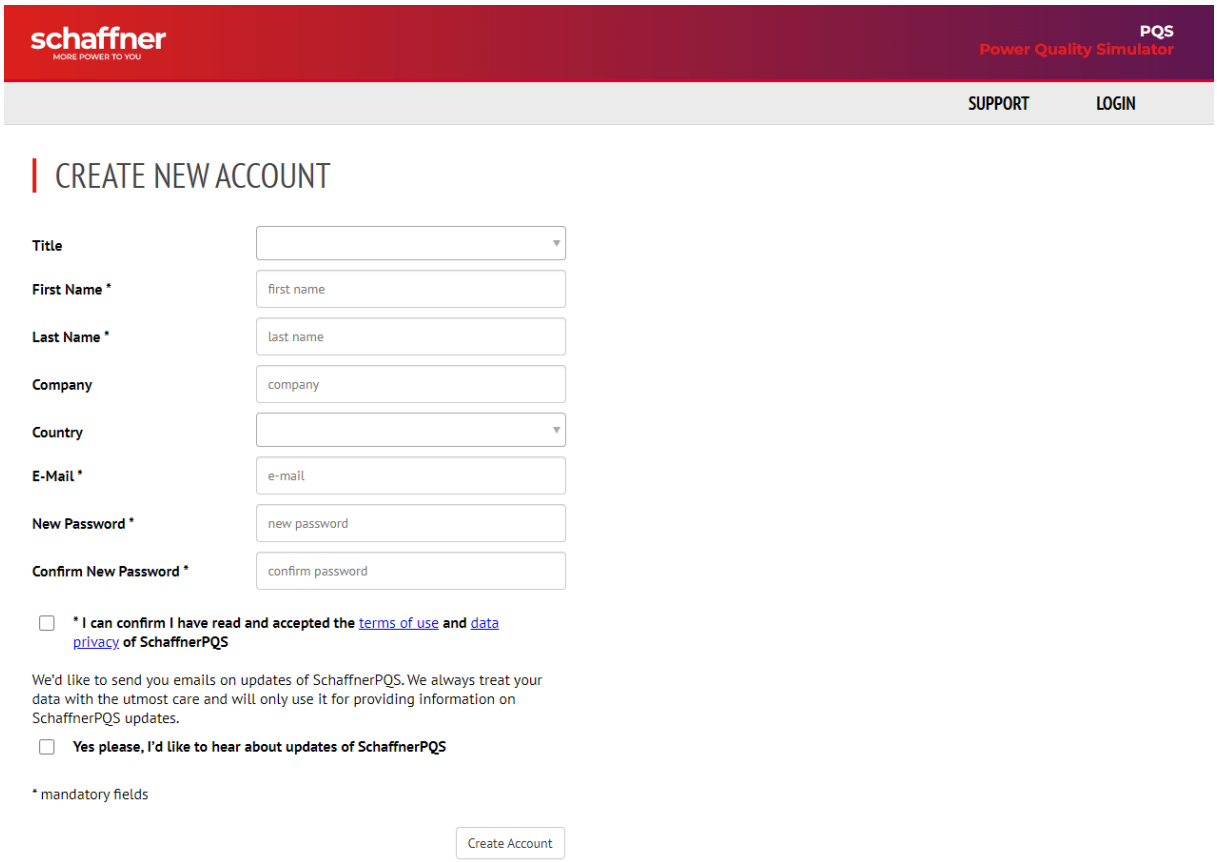



**Figure 2 - Create New Account**

Please fill in all required data, agree to the terms of use and press “Create Account”. You will receive a validation email. If you do not get the verification email please check your spam folder if it was blocked by your spam filter.

# CHAPTER 4

# Getting started

## Accessing an Existing Account

You will have an existing account if you successfully went through the registration procedure. If you do not know your Login ID please send an email request to pqs@schaffner.com with your first and last name as well as your company. If you forgot your password, you can create a new one by using the forget password link on the login screen. Once you have your Login ID and Password, please use pqs.schaffner.com and fill in username and password to log in to the Schaffner Power Quality Simulator (SchaffnerPQS).

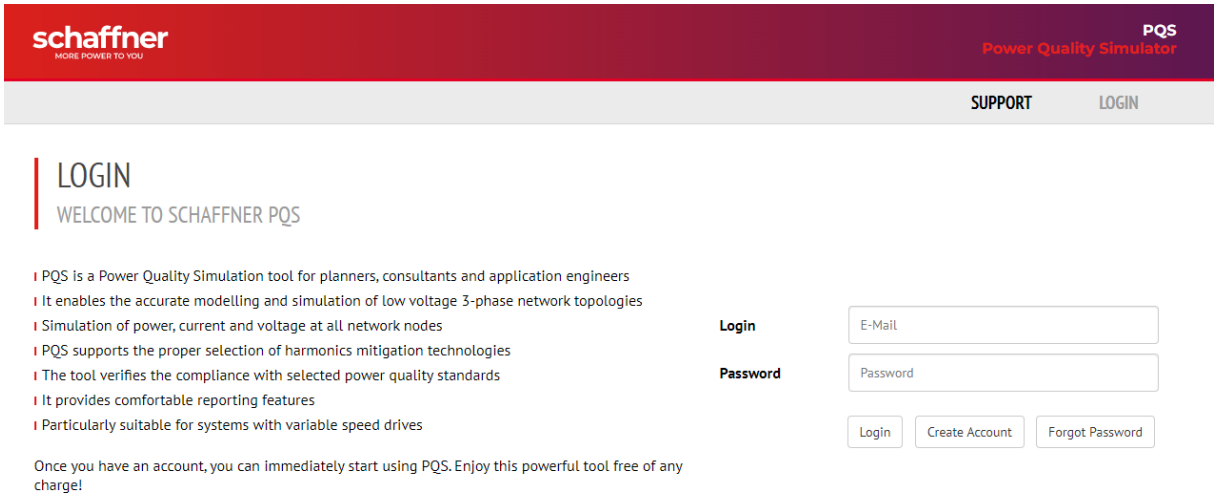



**Figure 3 - Accessing an Existing Account**

## The User Interface

After you successfully logged in to the SchaffnerPQS you will be able to use the full functionality of the user interface.

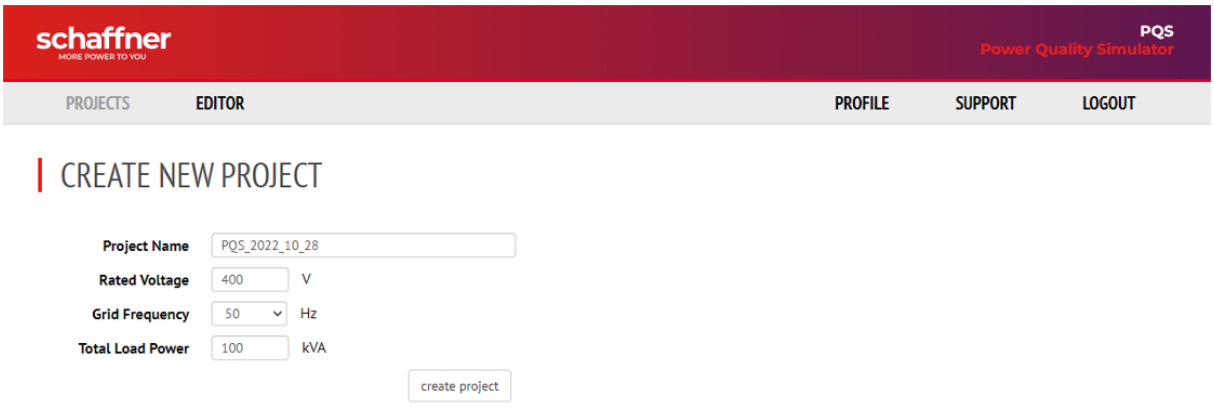



**Figure 4 - The User Interface**

The user interface is developed to be user friendly and easy to understand. After a successful login you are presented with the entry view with the main navigation sections:

- Projects
- Editor (only visible if a project exist)
- Report (only visible if a project exist)
- Profile
- Support
- Logout

You should be able to use them intuitively. Nevertheless all parts will be described in the following chapters.

# CHAPTER 5

# Projects

## Overview

The projects page can be used to keep track on projects that have been saved or to create new projects. To create a new project simply enter the four input fields on the left and click “create project”. Please note that the Project Name is limited to 60 characters, any longer name will be truncated to the first 60 characters once saved. These values will be taken as initial values and can be changed later in the “EDITOR” view.

As soon as you have saved some projects they are visible on the right side of the “PROJECTS” view and can be opened by clicking on its name. To delete a project hover over the project until the “delete” icon is visible and with a click on it the project is deleted (cannot be undone). To copy a project also hoover a project until the “copy” icon is visible.

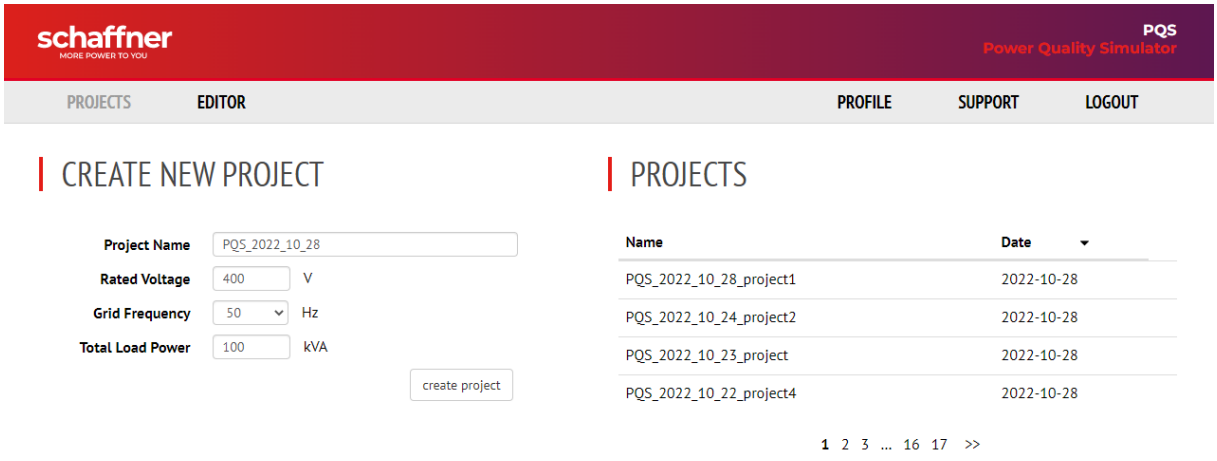



**Figure 5 - Projects View**

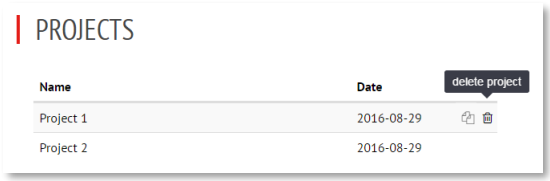



**Figure 7 - Delete Project**

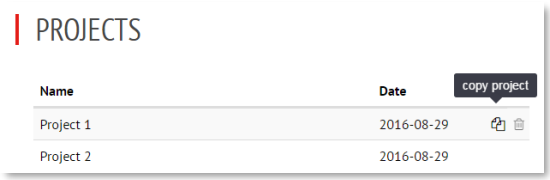



**Figure 6 - Copy Project**

## Sharing Projects

With SchaffnerPQS you can share your projects. The only things you must do is to copy the url and send it to a colleague. If he has an account he can immediately open the same project otherwise he firstly has to create an account. Shared projects can be overwritten from both users! Please make sure to copy the project and share a copy if you don’t want that the other user will modify the original one.

# CHAPTER 6

# Editor View

## Overview

The editor page can be used to create the electrical network that you like to simulate. When accessing the editor page the simulator is ready for inputs. All inputs can be made here. There is a very clear arrangement to easily be able to work with the simulator. The page is consisting of the four main parts, distribution, circuit, buttons and the toolbox.

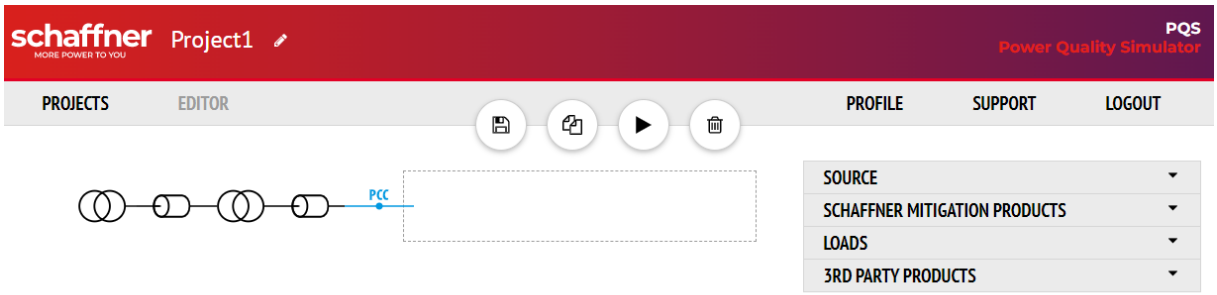



**Figure 8 - Editor View**

## Renaming of Project

To rename a project click in the project header on the edit button (  ) and enter a new name.

## Distribution

The type of distribution can be changed in the “SOURCE” section of the toolbox. There are two possibilities: Transformer and Generator.

### Transformer

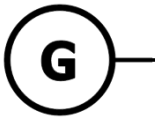
The distribution with transformers consists of two parts, the medium voltage part and the low voltage part. Both parts need to be adjusted to the real technical environment that should be simulated.

### Generator

The generator is a simple model which does not take into account cos(phi) and THDu distortion. To check if the capacitive current is not too high you have to simulate different operating points and compare the results with the generator datasheet.

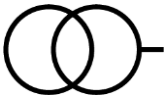

**Figure 9 - Editor View - Distribution**

**Generator**




| User Input | unit |
|---|---|
| **Rated Voltage and Rated power or Short circuit current** | V and kVA or kA |
| **Frequency** | 50 or 60 Hz |
| **Impedance** | % |

**The medium voltage (MV) transformer**

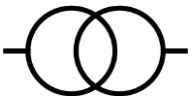


| User Input | unit |
|---|---|
| **Rated Voltage and Rated power or Short circuit current** | V and kVA or kA |
| **Impedance** | % |

**The medium voltage (MV) cable**

| User Input | unit |
|---|---|
| **Cable length** | m |
| **Cross section** | $mm^2$ |
| **Material** | Cu or Al |

**The low voltage (LV) transformer**



| User Input | unit |
|---|---|
| **Rated voltage and Rated power or Short circuit current** | V and kVA or kA |
| **Frequency** | 50 or 60 Hz |
| **Impedance** | % |

**The low voltage (LV) cable**

| User Input | unit |
|---|---|
| **Cable length** | m |
| **Cross section** | $mm^2$ |
| **Material** | Cu or Al |

## Circuit


**Figure 10 - Editor View - Circuit**

The circuit area is the dashed box in the middle. It's the area where the user can build the circuit by using the following functionality:

- **Add** elements there by drag and drop elements from the toolbox
- **Delete** elements and wires by selecting an press "delete" button
- **Wire** the circuit by drag and drop on connection points (visible when the mouse cursor is over the circuit or an element is dragged from the toolbox

The size of the circuit will automatically adapt to the network topology you choose.

## Buttons

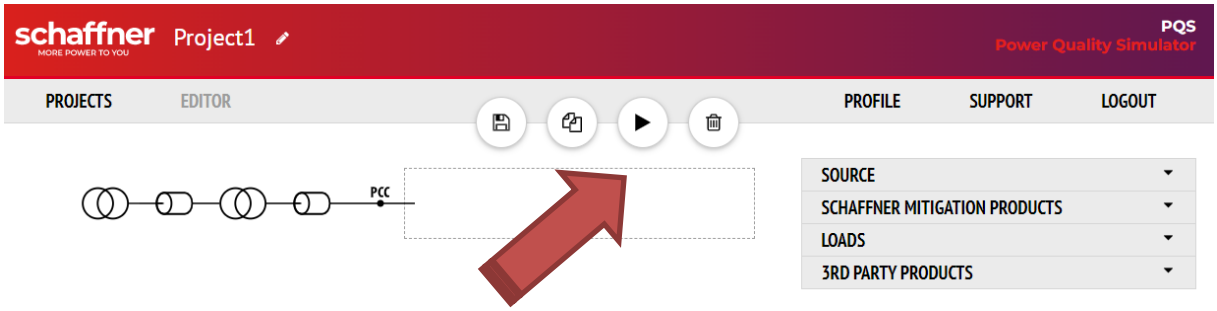



**Figure 11 - Editor View - Buttons**

The four available buttons are:

- Save project

- Save as a copy

- Start simulation

- Delete selected element/wires or if no element or wires are selected it will delete all wires

# Toolbox

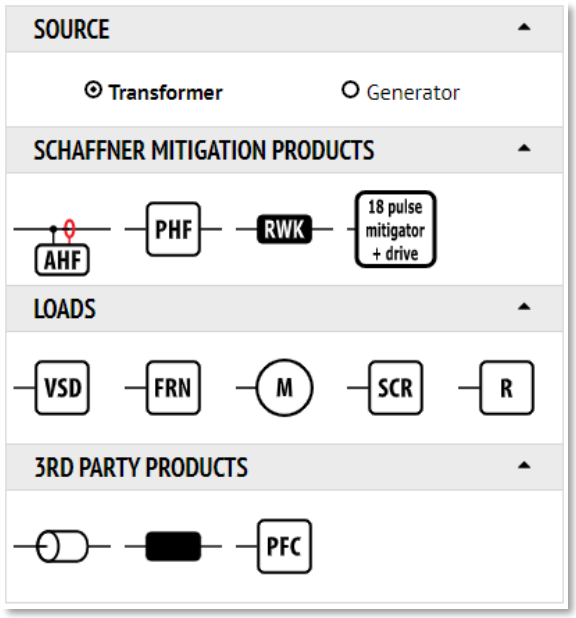



**Figure 12 - Editor View - Toolbox**

The toolbox is a dropdown menu that features all Schaffner mitigation products, loads and 3rd party products that are needed to build a circuit. All elements can be placed in the circuit by using drag and drop functionality. Please be aware that only suitable loads and filters should be placed into the grid.
After you placed an element into the grid you can change its parameters by clicking on the element to open the parameter window.

### Schaffner Mitigation Products

The “Schaffner Mitigation Products” section consists of four elements:

- Active Harmonic Filter
- Passive Harmonic Filter
- AC Line Choke
- 18 pulse Mitigator

These elements are introduced in detail in the next sections.

## Passive Harmonic Filter (PHF)

With this tool you can choose and simulate all available Schaffner Ecosine™ Passive Harmonic Filter:

- FN3440 Ecosine Evo 400V 50Hz Passive Harmonic Filters
- FN3442 Ecosine Evo 400V 60Hz Passive Harmonic Filters
- FN3450 Ecosine Evo 480V 50Hz Passive Harmonic Filters
- FN3452 Ecosine Evo 480V 60Hz Passive Harmonic Filters
- FN3441 Ecosine Evo 400V 50Hz Passive Harmonic Filters for drive with 8% Ldc
- FN3443 Ecosine Evo 400V 60Hz Passive Harmonic Filters for drive with 8% Ldc
- FN3451 Ecosine Evo 480V 50Hz Passive Harmonic Filters for drive with 8% Ldc
- FN3453 Ecosine Evo 480V 60Hz Passive Harmonic Filters for drive with 8% Ldc
- FN3416 Ecosine Economy 50Hz Passive Harmonic Filters
- FN3418 Ecosine Economy 60Hz Passive Harmonic Filters
- FN3470 Ecosine Max 400V 50Hz Full Performance Passive Harmonic Filters
- FN3472 Ecosine Max 400V 60Hz Full Performance Passive Harmonic Filters
- FN3480 Ecosine Max 480V 50Hz Full Performance Passive Harmonic Filters
- FN3482 Ecosine Max 480V 60Hz Full Performance Passive Harmonic Filters
- FN3471 Ecosine Max 400V 50Hz Economy Passive Harmonic Filters
- FN3473 Ecosine Max 400V 60Hz Economy Passive Harmonic Filters
- FN3481 Ecosine Max 480V 50Hz Economy Passive Harmonic Filters
- FN3483 Ecosine Max 480V 60Hz Economy Passive Harmonic Filters

In order to choose the filter, click on the designation name to open the filter selection popup.


**Figure 13 - PHF Parameters**

**Note:**

Schaffner PHF product portfolio covers voltage range 240 to 480VAC, 50Hz and 60Hz grid frequencies, therefore there are many different product series. In order to help SchaffnerPQS users to choose the best suited PHF easily, only the suitable filter options are shown in the filter selection popup, regarding the grid voltage and frequency.

For example, if the frequency of the LV transformer is set to 60Hz, only 60Hz filters are visible in the filter selection popup. If the voltage of the LV transformer is set to 480V, then only the filters that can operate at 480V are shown in the popup list.

Please refer to the product datasheet (available at www.Schaffner.com/downloads/) for more detailed information regarding Schaffner Passive Harmonic Filters.

ECOSINE SELECTION

## FN3440 SERIES
FOR DRIVES WITHOUT DC-LINK CHOKE

| Filter | Load Power @ 400 VAC (kW) | EMI filter in front of drive |
|---|---|---|
| FN3440-1-110 | 1.10 | ☐ |
| FN3440-2-110 | 2.20 | ☐ |
| FN3440-4-112 | 4.00 | ☐ |
| FN3440-6-112 | 5.50 | ☐ |
| FN3440-8-112 | 7.50 | ☐ |
| FN3440-11-113 | 11.0 | ☐ |
| FN3440-15-113 | 15.0 | ☐ |
| FN3440-19-113 | 19.0 | ☐ |
| FN3440-22-115 | 22.0 | ☐ |
| FN3440-30-115 | 30.0 | ☐ |
| FN3440-37-115 | 37.0 | ☐ |
| FN3440-45-115 | 45.0 | ☐ |
| FN3440-55-115 | 55.0 | ☐ |
| FN3440-75-116 | 75.0 | ☐ |
| FN3440-90-116 | 90.0 | ☐ |
| FN3440-110-118 | 110 | ☐ |
| FN3440-132-118 | 132 | not relevant |
| FN3440-160-118 | 160 | not relevant |
| FN3440-200-118 | 200 | not relevant |
| FN3440-250-119 | 250 | not relevant |

## FN3441 SERIES
FOR DRIVES WITH INTEGRATED DC-LINK CHOKE

| Filter | Load Power @ 400 VAC (kW) | EMI filter in front of drive |
|---|---|---|
| FN3441-1-110 | 1.10 | ☐ |
| FN3441-2-110 | 2.20 | ☐ |
| FN3441-4-112 | 4.00 | ☐ |
| FN3441-6-112 | 5.50 | ☐ |
| FN3441-8-112 | 7.50 | ☐ |
| FN3441-11-113 | 11.0 | ☐ |
| FN3441-15-113 | 15.0 | ☐ |
| FN3441-19-113 | 19.0 | ☐ |
| FN3441-22-115 | 22.0 | ☐ |
| FN3441-30-115 | 30.0 | ☐ |
| FN3441-37-115 | 37.0 | ☐ |
| FN3441-45-115 | 45.0 | ☐ |
| FN3441-55-115 | 55.0 | ☐ |
| FN3441-75-116 | 75.0 | ☐ |
| FN3441-90-116 | 90.0 | ☐ |
| FN3441-110-118 | 110 | ☐ |
| FN3441-132-118 | 132 | not relevant |
| FN3441-160-118 | 160 | not relevant |
| FN3441-200-118 | 200 | not relevant |
| FN3441-250-119 | 250 | not relevant |

## FN3416 SERIES
ECONOMY LINE

| Filter | Load Power @ 400 VAC (kW) |
|---|---|
| FN3416-10-44 | 4.40 |
| FN3416-13-44 | 6.00 |
| FN3416-16-44 | 8.80 |
| FN3416-24-33 | 12.0 |
| FN3416-32-33 | 15.0 |
| FN3416-38-33 | 18.5 |
| FN3416-45-33 | 24.0 |
| FN3416-60-34 | 30.0 |
| FN3416-75-34 | 37.0 |
| FN3416-90-35 | 45.0 |
| FN3416-110-35 | 60.0 |
| FN3416-150-40 | 75.0 |
| FN3416-180-40 | 90.0 |
| FN3416-210-40 | 110 |
| FN3416-260-99 | 132 |
| FN3416-320-99 | 160 |

## FN3470 SERIES
FOR DRIVES WITHOUT DC-LINK CHOKE

| Filter | Load Power @ 400 VAC (kW) |
|---|---|
| FN3470-250-99 | 250 |
| FN3470-315-99 | 315 |
| FN3470-355-99 | 355 |
| FN3470-400-99 | 400 |
| FN3470-500-99 | 500 |

## FN3471 SERIES
FOR DRIVES WITH INTEGRATED DC-LINK CHOKE

| Filter | Load Power @ 400 VAC (kW) |
|---|---|
| FN3471-250-99 | 250 |
| FN3471-315-99 | 315 |
| FN3471-355-99 | 355 |
| FN3471-400-99 | 400 |
| FN3471-500-99 | 500 |

**Figure 14 - PHF Selection**

## Active Harmonic Filter (AHF)

With this tool you can choose and simulate all available Schaffner Ecosine Active Harmonic Filter.

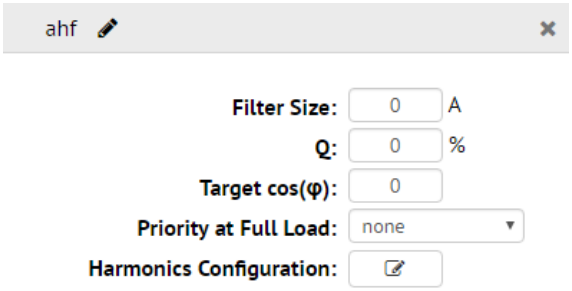



**Figure 15 - AHF Parameters**

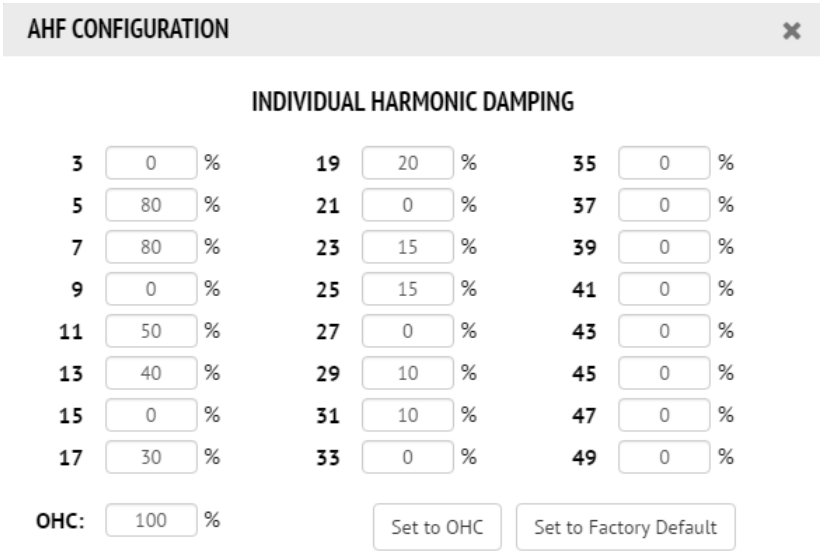



**Figure 16 - AHF Individual Harmonic Settings**

| User Input | Unit |
|---|---|
| **Filter Size (0 means no limitation for filter size)** | **A** |
| **Target Power Factor $\cos\varphi$** | 0.0…1.0 |
| **Reactive Power Compensation Q** | % |
| **Priority at Full Load** | [none, harmonics, reactive power] |
| **Harmonics Configuration** | Popup with individual harmonic settings |

## Choke (Schaffner RWK-Series)

User can choose from the whole Schaffner AC line reactors (RWK-series) from the chokes popup menu. The typical drive power is calculated for the selected line voltage.

RWK SELECTION

### RWK3044

| RWK | Rated current @ 40 °C | Typical drive power rating @ 400 V |
|---|---|---|
| | (A) | (kW) |
| RWK3044-2-88 | 2 | 1.10 |
| RWK3044-3.5-88 | 3.5 | 2.20 |
| RWK3044-6.5-88 | 6.5 | 4.00 |
| RWK3044-9-88 | 9 | 5.50 |
| RWK3044-12-88 | 12 | 7.50 |
| RWK3044-18-89 | 18 | 11.0 |
| RWK3044-24-89 | 24 | 15.0 |
| RWK3044-30-92 | 30 | 18.5 |
| RWK3044-35-92 | 35 | 22.0 |
| RWK3044-48-92 | 48 | 30.0 |
| RWK3044-59-92 | 59 | 37.0 |
| RWK3044-72-99 | 72 | 45.0 |
| RWK3044-88-99 | 88 | 55.0 |
| RWK3044-120-99 | 120 | 75.0 |
| RWK3044-140-99 | 140 | 90.0 |
| RWK3044-180-99 | 180 | 110 |
| RWK3044-210-99 | 210 | 132 |
| RWK3044-260-99 | 260 | 160 |
| RWK3044-320-99 | 320 | 200 |
| RWK3044-400-99 | 400 | 250 |
| RWK3044-510-99 | 510 | 315 |
| RWK3044-570-99 | 570 | 355 |
| RWK3044-640-99 | 640 | 400 |
| RWK3044-800-99 | 800 | 500 |
| RWK3044-1000-99 | 1000 | 630 |

**Figure 17 - RWK Selection**

## 18 Pulse Mitigator (+ Drive)


The 18 pulse mitigator includes a multi-pulse autotransformer and a drive.

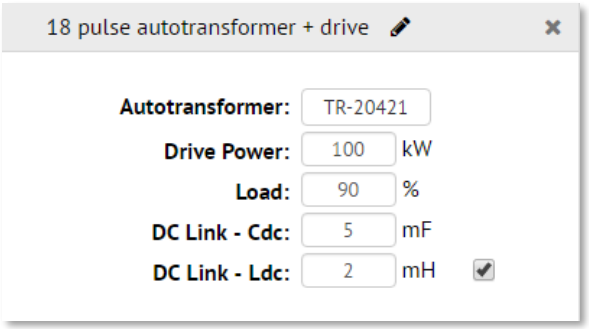



**Figure 18 - 18 Pulse Mitigator Parameters**

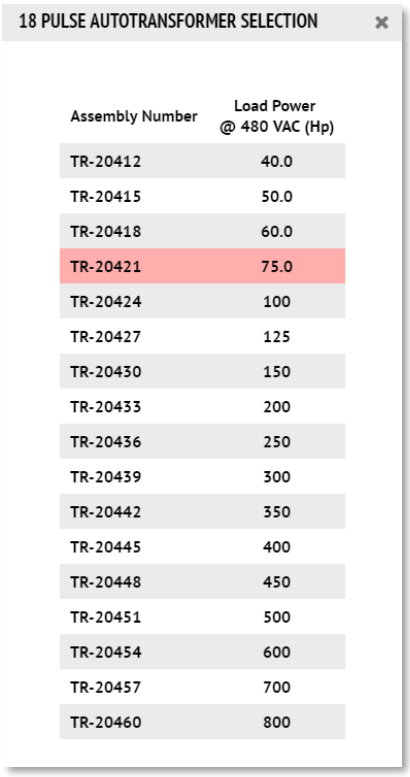



**Figure 19 - 18 Pulse Mitigator Selection**

| User Input | Unit |
|---|---|
| **Autotransformer** | **Popup with available Transformers** |
| **Drive Power** | kW |
| **Load** | 0..100 % |
| **DC Link – Cdc** | mF |
| **DC Link – Ldc** | mH |

# CHAPTER 7

# Result View

## Overview

The result view page is intended to show the simulation results of the electrical network that you created in the design view. After you have started a simulation, this view will automatically open and by default show the simulation results at the PCC (point of common coupling). The PCC with the consumer/utility interface is the closest point on the utility side of the customer's service where another utility customer is or could be supplied. At this point all standards related harmonic limits are assessed. As it might be useful to see the results at any other point of the electrical network, The Schaffner PQS provides this possibility. The result view in general consists of four new parts below the electrical network you created and which was simulated, the FFT screen, the Time screen, the Simulation Results screen and the Standards screen.

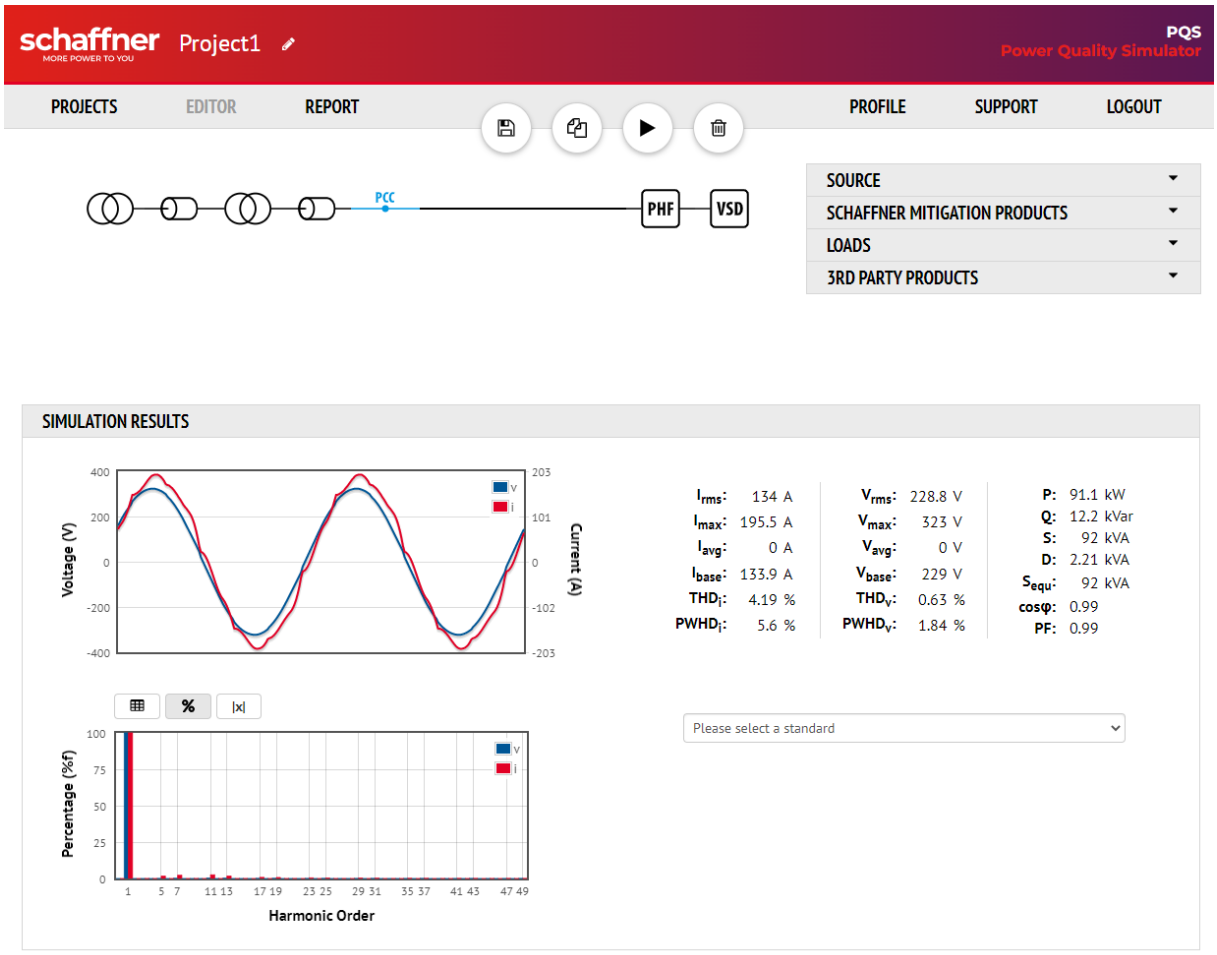



**Figure 20 - Results View**

# Circuit

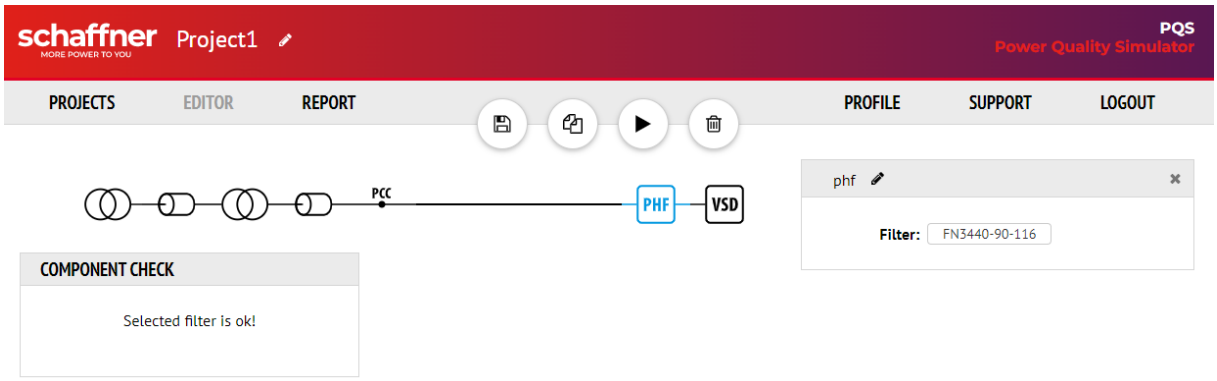



**Figure 21 - Results View - Element Selection**

By default the PCC (Point of Common Coupling) is chosen. The active chosen part of the electrical network is visualized by a blue color. If you choose another part of the network by clicking on it, this blue color will move and the simulation results for this certain point are displayed.

If you choose one of the Schaffner filters as the point of the electrical network that should be presented, you will have an additional feature called component check.

## Secondary Results

Some elements have a second results view. To switch between these select the desired result in the simulation results header

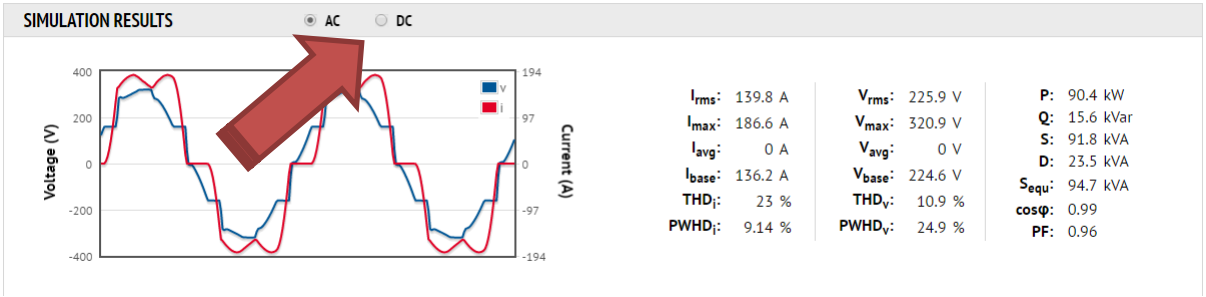



**Figure 22 - Results View - Secondary Results**

# FFT

In electronics the frequency domain is the domain for analysis of signals with respect to frequency. All continuous periodic signals can be represented as a summation of harmonics of integer multiples of the fundamental. The mathematical function behind is called Fourier transformation. A Fast Fourier transform (FFT) is an algorithm to compute the discrete Fourier transform. Within the FFT Screen you can see the results of the FFT for voltage and current at the chosen point of the electrical network. You will find the harmonic level as percent of the fundamental for all odd harmonics up to the 49$^{th}$. If you put your mouse over the charts you will see the harmonic level in Ampere or Volt.

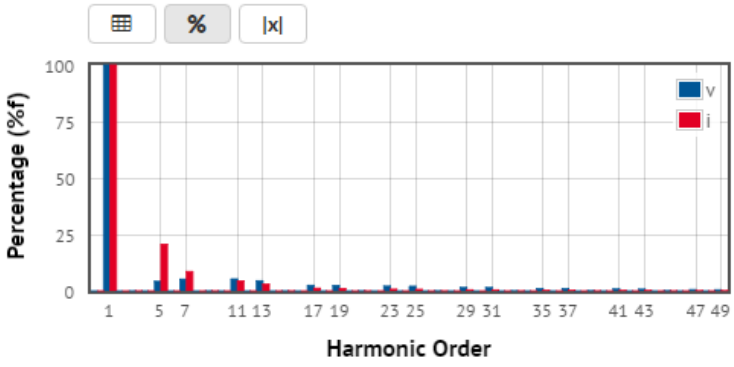



**Figure 23 - FFT Plot**

### Zoom Functionality

The zoom feature lets you zoom on a specific area. You start the zoom by clicking on the area you want to zoom into and keep the mouse button down and fit the area you want to see. Click to zoom out again.

### Plot Selection

With the buttons above the FFT plot you can switch between a table view, percentage y-axis and absolute y-axis. Some results have a limited set of views and will only show the allowed buttons.

## Time

The time-domain graph shows how the voltage and current change over time. You can view voltage and current shape at any chosen point of the network.

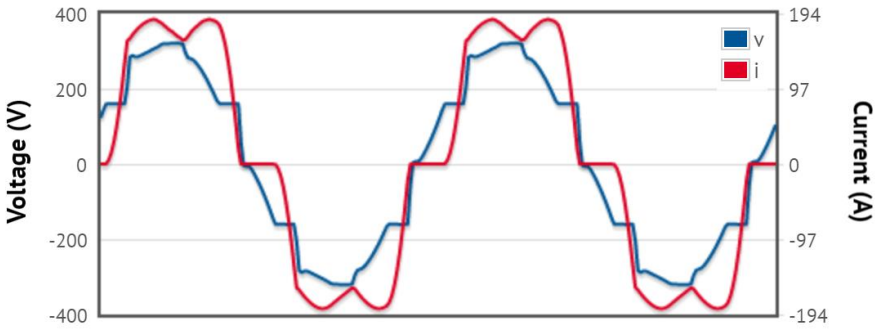



**Figure 24 - Results View - Time Plot**

### Zoom Functionality

The zoom feature lets you zoom on a specific area. You start the zoom by clicking on the area you want to zoom into and keep the mouse button down and fit the area you want to see. Click to zoom out again.

## Simulation Results

In the Simulation Results screen you find voltage, current and power related simulation results.

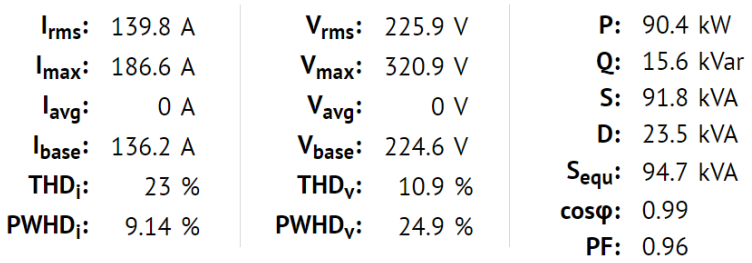



**Figure 25 - Results View - Measurements**

| Displayed value for voltage and current | explanation |
|---|---|
| **RMS** | Root mean square voltage and current |
| **MAX** | Maximum voltage and current |
| **AVG** | Average voltage and current |
| **Base RMS** | Root mean square of the fundamental voltage or current |
| **THD** | Total harmonic distortion of voltage and current |
| **PWHD** | Partial weighted harmonic distortion of voltage or current |

| Displayed value for power | explanation |
|---|---|
| **P** | Real power |
| **Q** | Reactive power |
| **S** | Apparent power |
| **D** | Distorted power |
| **$S_{equ}$** | Complex power with harmonics |
| **$\varphi$** | Phase displacement angle of the current to the voltage |
| **cos $\varphi$** | Cosinus of the phase displacement angle $\varphi$ |
| **PF** | Power factor of the system |

# Standards

In the standard section you can chose one of the most important international power quality standards and see if they are fulfilled. Just chose the applicable standard out of the dropdown list and immediately see if it is fulfilled or not. You will see all limits and the simulated results at a glance.

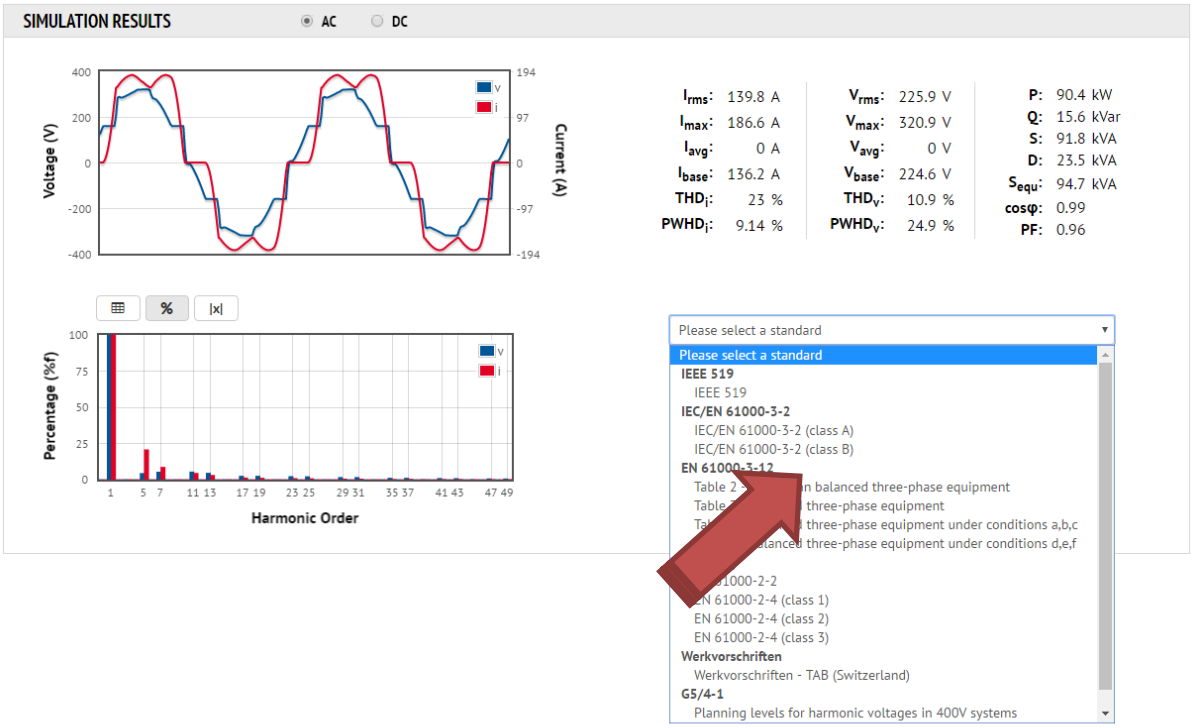



**Figure 26 - Results View – Standards**

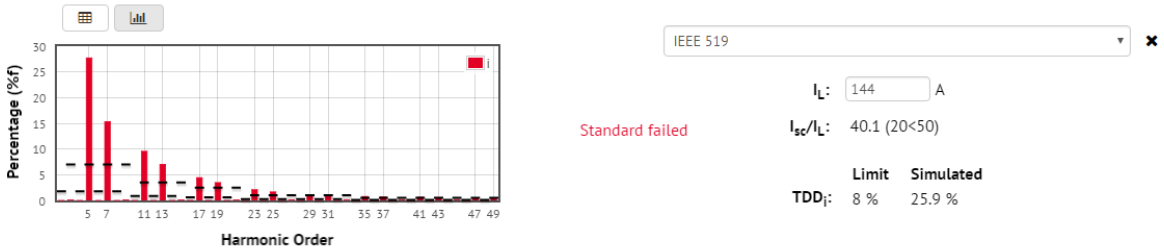



**Figure 27 - Results View - FFT Plot with standard limits**

## IEEE519

If you like to check the fulfillment of IEEE519 please be aware that you might have to adjust the demand load $I_L$ in the norm screen. Within IEEE519 the Short Circuit Ratio ($I_{SC}/I_L$) is of importance. It is the ratio of the short circuit current ($I_{SC}$) available at the point of common coupling (PCC) to the maximum fundamental load current ($I_L$).

The maximum Load Current ($I_L$) is recommended to be the average current of the maximum demand for the preceding 12 months. Unfortunately, this value is inherently ambiguous making it difficult to derive at the design stage when measured load is not available. The SchaffnerPQS is simulating and calculating all needed values with regard to the electrical network you created. It nevertheless might be needed to adjust $I_L$ by hand which is possible in the input field for $I_L$.

# CHAPTER 8
# Report

## Overview

After creating and simulating your electrical network you might like to create a report to save or print the results and technical findings. The report section is the place to do so. You only need to choose what should become part of the report, which current or voltage standard is applicable (if so) and let the SchaffnerPQS do the work.

## Report

The Report screen consists of 4 parts which are the electrical network you created, the project data section, the standard section and the buttons.

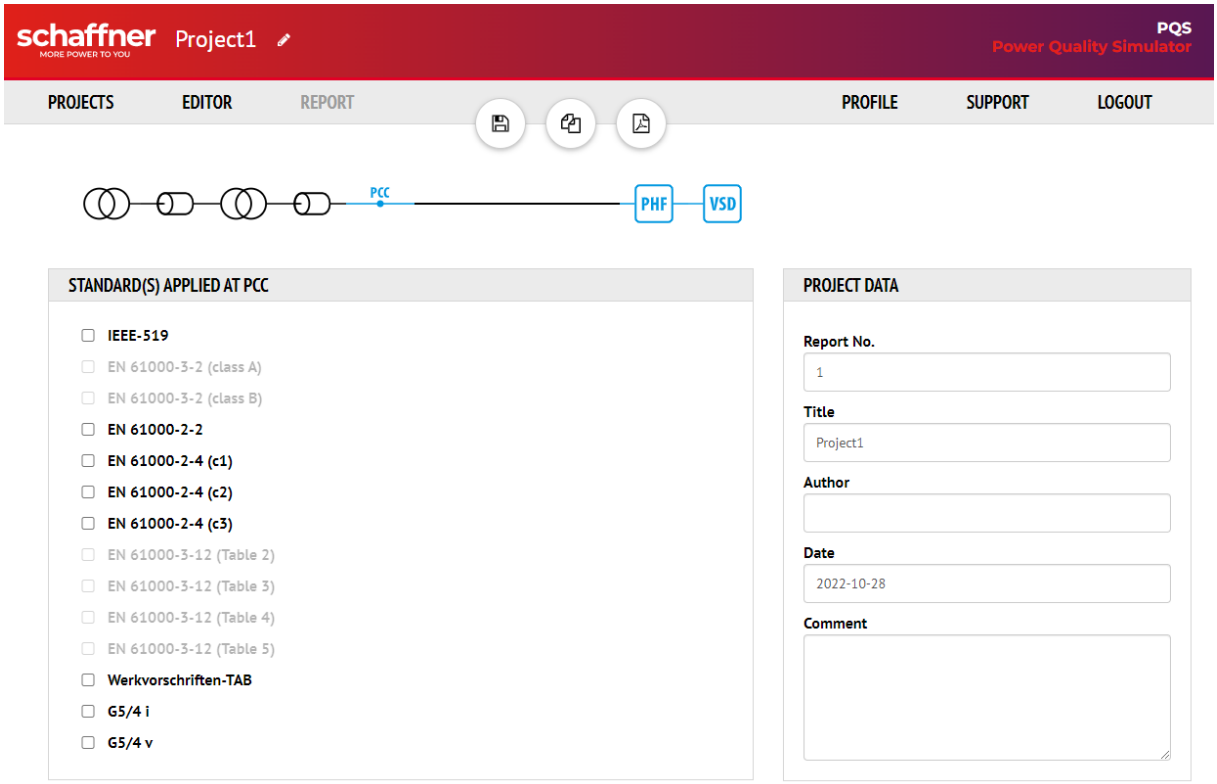



**Figure 28 - Report View - Overview**

### Circuit

On top of the report screen you can see the electrical network you created and simulated. Please choose those parts of it that you would like to have in the report. By default, the PCC and all devices right of it are already chosen. You can check on and off parts of the electrical network by clicking on them. The chosen parts will get a blue color. For parts in black color there will be no detailed description in the report.

### Project Data

The project data section can be used to fill in report number, project title, author's name, the date and comment text area. Feel free to fill in the data you like or leave the fields empty.

### Standards Section

In this section you can select which standard should be present in the report. Grey standards are not applicable for the given circuit and cannot be applied.

### Create Report

To create a report you just have to press  . Once you have pressed the button the SchaffnerPQS will create a PDF report and open it. Afterwards you can print or save the report on your computer.

# CHAPTER 9

# Profile

## Overview

The Profile view provides all information related to profile of the logged in person. It also allows the change of your password if needed and the deletion of the complete account.

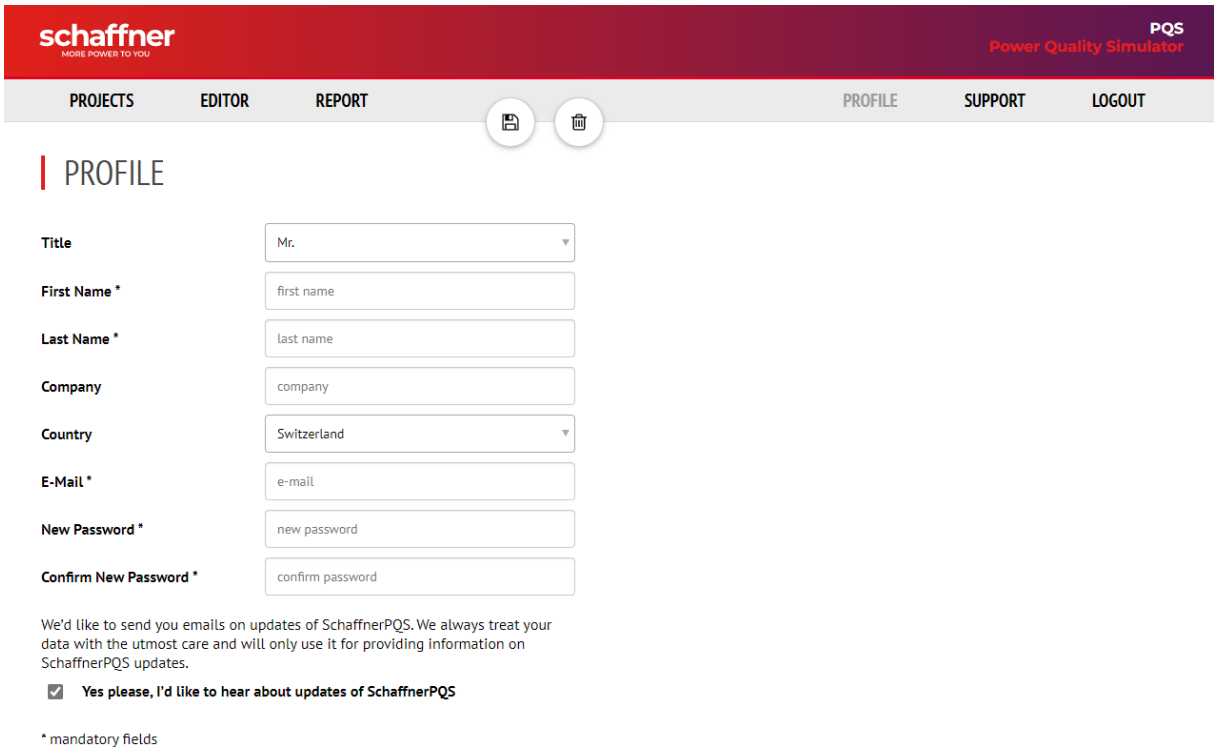



**Figure 29 - Profile View**

## Profile Information

The displayed information is first name, last name, company and email address. The email address is the one that you used to register for the SchaffnerPQS and that you use to log in the system.

## Change Password

In case you like or need to change your password you can do this here.
Please fill out the required fields, which are New Password and Confirm New Password

And click the save button  .Please make sure you choose an appropriate password and of course please remember it! In case you forget your password, please use the forget password function of the SchaffnerPQS (on the login page).

## Delete Account

The delete account function can be used to completely delete the account including all related data. Please be aware that ones you deleted the account, all data are no longer available! For the deletion of an account just click on  and confirm.

# CHAPTER 10

# Support

## Overview

The SchaffnerPQS support page is your starting point for help with the software, featuring contact, manuals, links and if needed technical information.

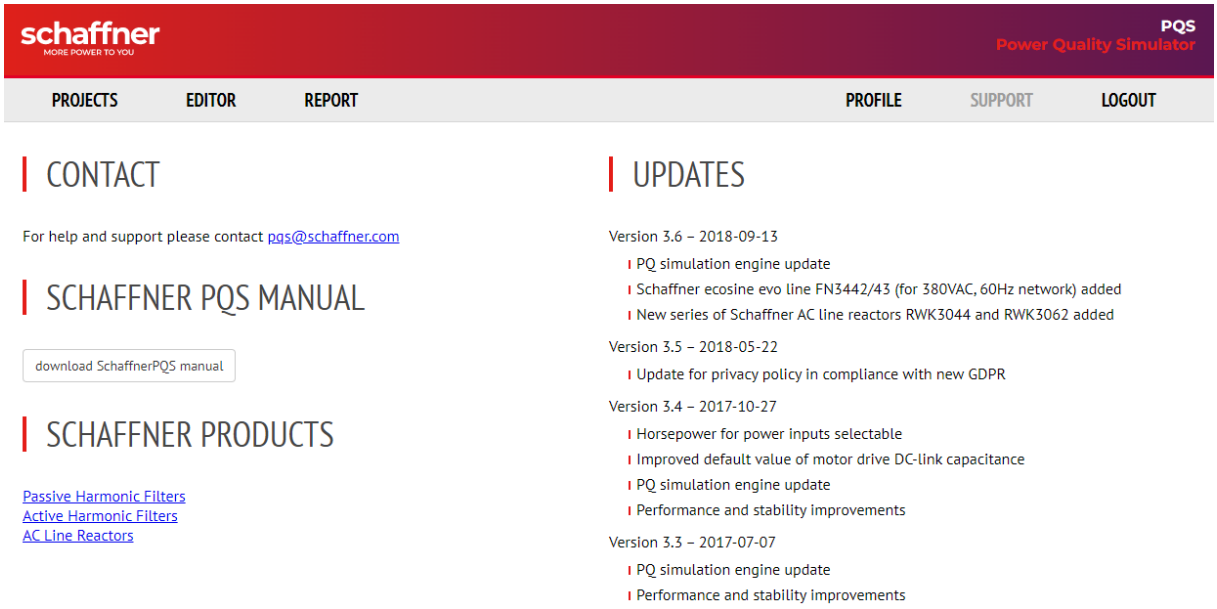



**Figure 30 - Support View**

## SchaffnerPQS Manual

This is where you will find the latest version of this manual. You do not have to be logged in to access the support page!

## Schaffner Product Links

Schaffner will provide links to relevant products that can be simulated in the SchaffnerPQS. Please feel free to follow the links and find detailed information, brochures or technical specification on our homepage.

## Contact

Under Contact you find the email address that can be used to contact the SchaffnerPQS support. Please use this email address to ask for help, support or features as well as for your feedback.

## Updates

We are regularly working on new updates and will list them under this section.

# CHAPTER 11

# Log out

## Overview

The login is required to obtain access to your personal restricted area within SchaffnerPQS. Once a user has logged in, they can then log out when access is no longer needed. To *log out* is to close off one's access to the SchaffnerPQS system after having previously logged in. SchaffnerPQS can remember your login if you just close the browser without clicking the LOGOUT button and the next time you open SchaffnerPQS you will be immediately logged in.

## Log Out Procedure

This is very easy, as the only thing you need to do is to click at the logout button.

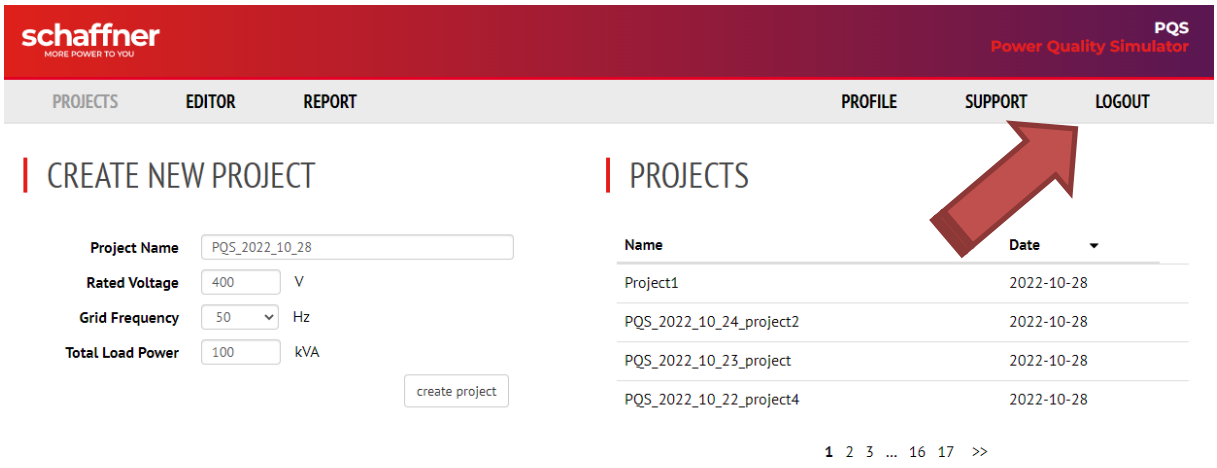



**Figure 31 - Logout**

To find your local partner within Schaffner‘s global network, please visit schaffner.com

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