StruxureWare™ Power Monitoring Expert

Power Quality Advisor Module

Design Guide

7EN42-0164-00

03/2017

Schneider Electric

Legal Information

Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

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Safety Precautions

During installation or use of this software, pay attention to all safety messages that occur in the software and that are included in the documentation. The following safety messages apply to this software in its entirety.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not use the software for critical control or protection applications where human or equipment safety relies on the operation of the control action.
- Do not use the software to control time-critical functions because communication delays can occur between the time a control is initiated and when that action is applied.
- Do not use the software to control remote equipment without securing it with an authorized access level, and without including a status object to provide feedback about the status of the control operation.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

INACCURATE DATA RESULTS

- Do not incorrectly configure the software, as this can lead to incorrect reports and/or data results.
- Do not base your maintenance or service actions solely on messages and information displayed by the software.
- Do not rely solely on software messages and reports to determine if the system is functioning correctly or meeting all applicable standards and requirements.
- Consider the implications of unanticipated transmission delays or failures of communications links.

Failure to follow these instructions can result in death, serious injury, equipment damage, or permanent loss of data.

⚠ WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords to help prevent unauthorized access to device settings and information.
- Disable unused ports/services and default accounts to help minimize pathways for malicious attackers.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cyber security best practices (for example: least privilege, separation of duties) to help prevent unauthorized exposure, loss, or modification of data and logs, or interruption of services.

Failure to follow these instructions can result in death, serious injury, equipment damage, or permanent loss of data.

About This Document

This guide is a supplementary document to the Power Monitoring Expert (PME) Design Guide. It provides guidelines for sales engineers, application engineers, third-party integrators, or other qualified personnel to design and quote a PME system with the Power Quality (PQ) Advisor module from a technical perspective.

Supporting documentation

Refer to the following StruxureWare™ Power Monitoring Expert 8.2 documents:

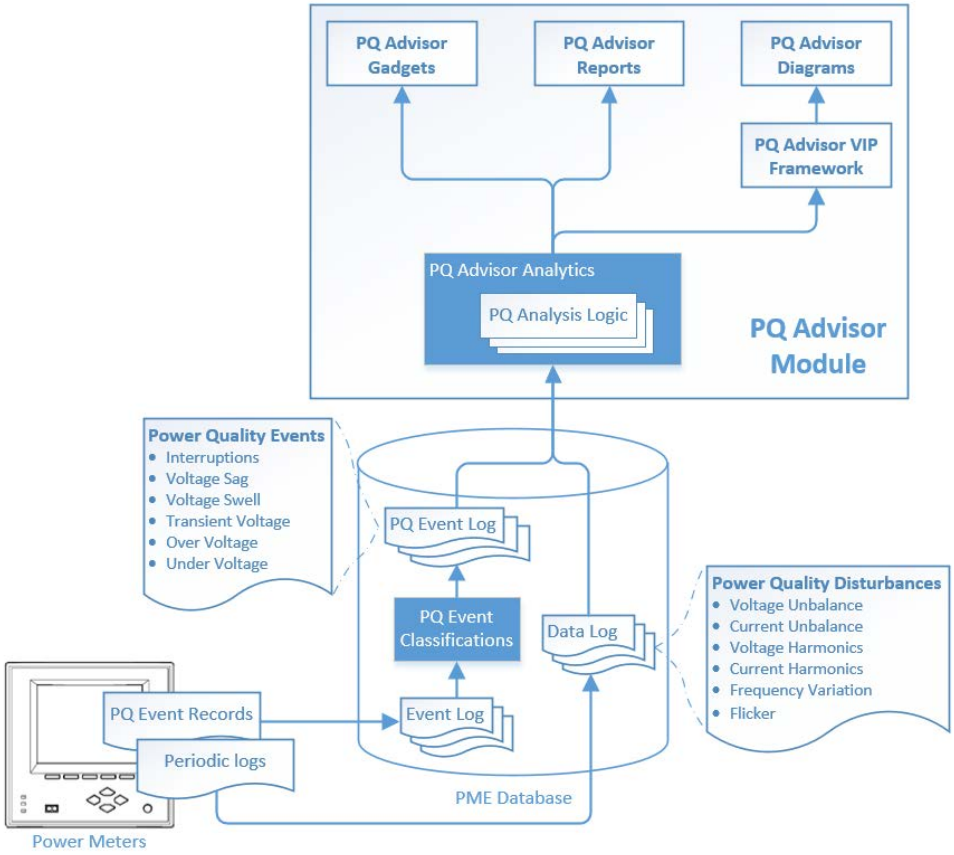
- *Installation Guide* 7EN02-0392-00
- *User Guide* 7EN02-0391-00
- *Design Guide* 7EN42-0141-00
- *Power Monitoring Expert Software Modules Configuration Guide* 7EN42-0148-00

Power Quality Advisor Overview

Power Quality (PQ) Advisor is an optional application module of Power Monitoring Expert software. It gives the end user a simple presentation of complex power quality information. PQ Advisor can help with:

- Base-lining and monitoring power quality in facilities, with an easy to read power quality rating index.
- Understanding the financial impact of power-quality-related downtime or outages.
- Visualizing the cost of power factor penalties.
- Identifying the type, source (internal vs external), and potential impact of power quality events.
- Drilling-down to a color based (red, yellow, green) indication of power quality conditions to better diagnose the system.

The PQ Advisor module consists of Vista diagrams, VIP frameworks, Gadgets, Reports, and back-end analytics.



As shown in the schematic drawing, classified PQ event records are inserted into the PME database, together with the periodic logs for PQ disturbances. The PQ data is used by multiple components of PME, including PQ Advisor.

PQ Advisor does not modify the PQ data stored in the PME database. It processes the data and performs the analysis on demand - when data is rendered in a user interface. In this way, it allows users to look at the PQ data in different ways by re-configuring the settings of the logic.

See Power Quality Advisor Feature Dependencies on page 11 for details of each user interface.

Power Quality Events and Disturbances

Power quality events and disturbances are monitored and captured by the power meters in the system. This section introduces power quality events and disturbances, as well as the methods in which PME classifies them, so that the user can understand the dependency between PQ Advisor features, and each type of power quality event and disturbance, which are described in the following sections.

See Meter Support List on page 32 for PQ Advisor features that are dependent on the PQ events and disturbances, and the devices which support them.

Power Quality Events

Power quality (PQ) events, also known as short-term disturbances, captured by the high-end power meters are characterized by:

- Magnitude
- Duration
- Disturbance direction (only by meters supporting Disturbance Direction Detection)

The PME Power Quality Event Classification method then classifies each event and stores it in the PME database. The following table defines the PQ events.

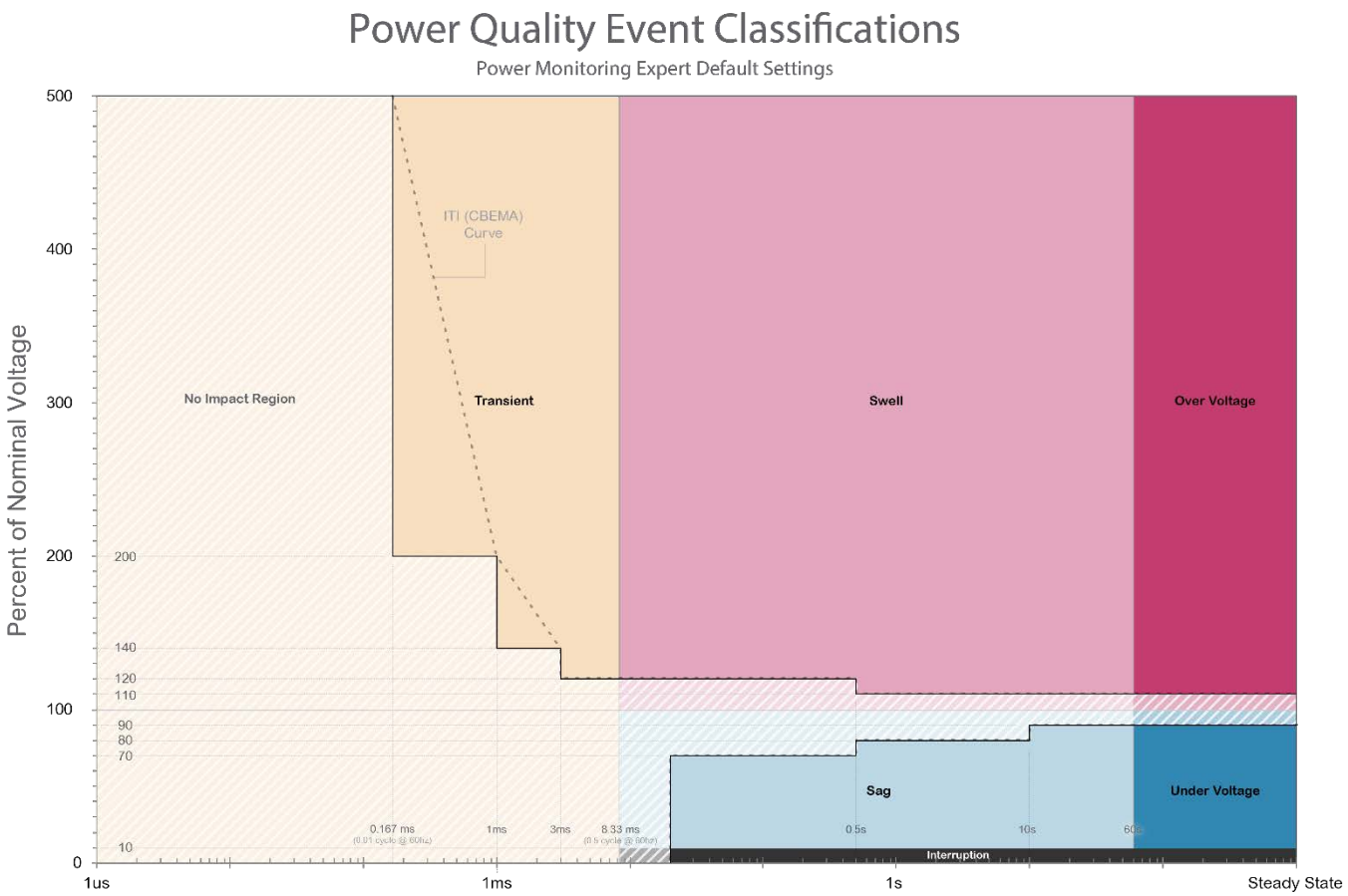
PQ Events	Summary	Magnitude	Source	Duration	Consequence
Interruptions	Loss of the supply voltage	Less than 10% of nominal	Utility or facility	½ cycle to 1 minute or more	Downtime
Voltage Sag	Decrease in voltage magnitude	90% to 10% of nominal voltage (typical)	Utility or large motors starting	½ cycle to 1 minute	Malfunction or downtime
Voltage Swell	Increase in voltage magnitude	110% to 180% of nominal (typical)	Utility or facility	½ cycle to 1 minute	Equipment malfunction or damage
Transient Voltage	Short-duration high overvoltage	Potentially several thousands of volts and amps	Switching activities or lightning strikes	<50 ns to 50 ms	Electronic equipment damage
Over Voltage*	Sustained increase in voltage magnitude	110% to 120% of nominal (typical)	Utility or facility	More than 1 minute	Equipment malfunction or motor heating

Under Voltage*	Sustained decrease in voltage magnitude	80% to 90% of nominal (typical)	Utility or facility	More than 1 minute	Equipment malfunction or damage

* Over and under voltage events are categorized as Power Quality Events instead of Long-term disturbances in order to leverage PME Power Quality Event Classifications.

Power Quality Event Classifications

The following graph indicates the method PME uses to classify PQ event records collected from the meters.



Power Quality Disturbances

Power quality disturbances, also known as long-term disturbances, are measured by meters and logged into PME database as periodical loggings. The following table summarizes the PQ disturbances.

PQ Disturbances	Summary	Magnitude	Source	Duration	Consequence
Voltage Unbalance	Non-symmetrical voltages	0.5% - 2.5% of nominal voltage (typical)	Utility or facility	Steady state	Overheating or malfunction
Current Unbalance	Non-symmetrical current	1.0% - 30% of nominal current (typical)	Utility or facility	Steady state	Malfunction and breaker trip
Voltage Harmonics	Waveform distortion	0 to 20% (typical)	Nonlinear loads	Steady state	Malfunction and overheating
Current Harmonics	Waveform distortion	0 to 20% (typical)	Nonlinear loads	Steady state	Malfunction and breaker trip
Frequency Variation	Deviation of the frequency from the nominal	Up to 5% deviation of nominal (typical)	Standby generators or poor power infrastructure	Intermittent	Malfunction or motor degradation
Flicker	Voltage waveform envelope variations	0.1% to 7% (typical)	Load exhibits significant current variations	Intermittent	Flickering lights, equipment malfunction

Power Quality Advisor Feature Dependencies

This section introduces the Power Quality (PQ) Advisor features and the technical dependency for each feature set. You should take into account these technical dependencies when you design a PME system with the PQ Advisor module.

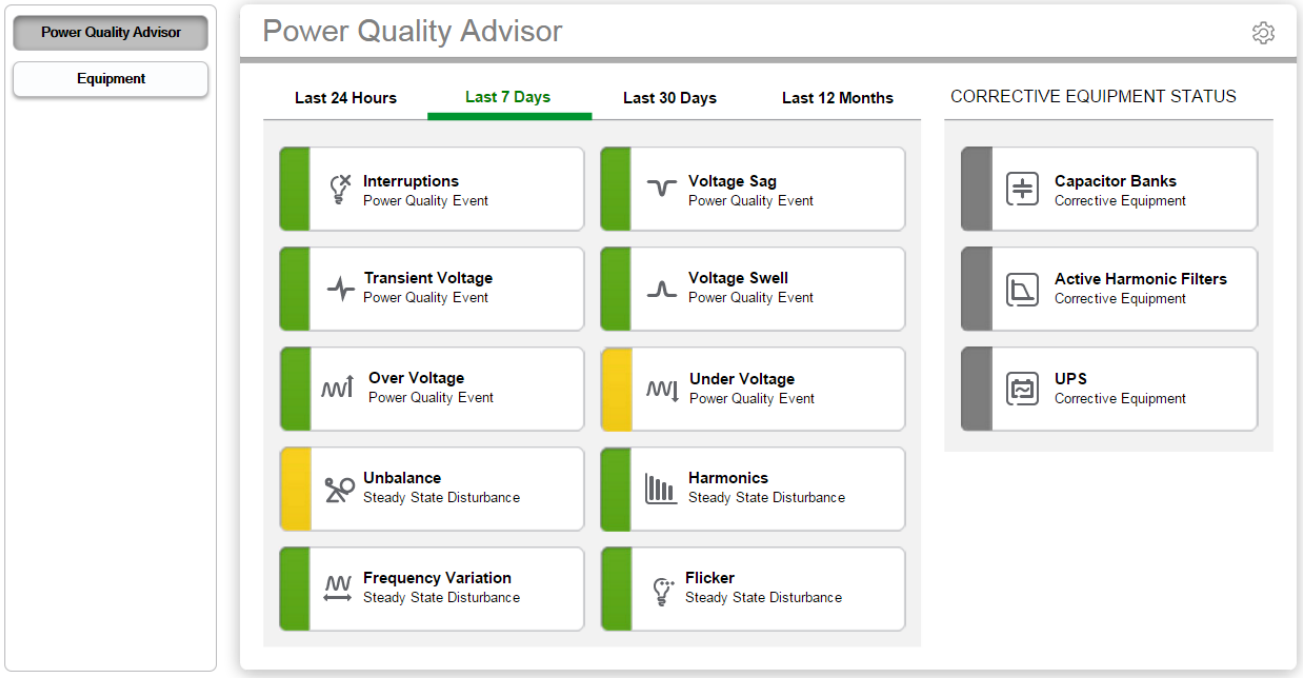
Power Quality Advisor Diagrams

The PQ Advisor Diagrams consists of:

- PQ Indicator Diagrams
- Standardized Equipment Diagrams

Power Quality Indicator Diagrams

The Power Quality Indicator Diagrams display simple green-yellow-red indicators to identify the most common power quality problems.



The PQ Indicator Diagrams include 10 PQ Indicators. Each indicator represents a type of power quality event or disturbance. The indicators are based on recognized power quality standards and statistical analysis. The thresholds are shown on the details page for each indicator. They can be adjusted as per user's needs.

The following diagram indicates which PQ events and disturbances are consumed by the PQ Indicators:

Note: Harmonic information for Current is included in the detail page, but it does not contribute to the PQ Indicator for Harmonics.

See Meter Support List on page 32 for meter requirements for this feature.

Standardized Equipment Diagrams

PQ Advisor Standardized Equipment Diagrams help the user monitor and diagnose the performance of mitigation equipment:

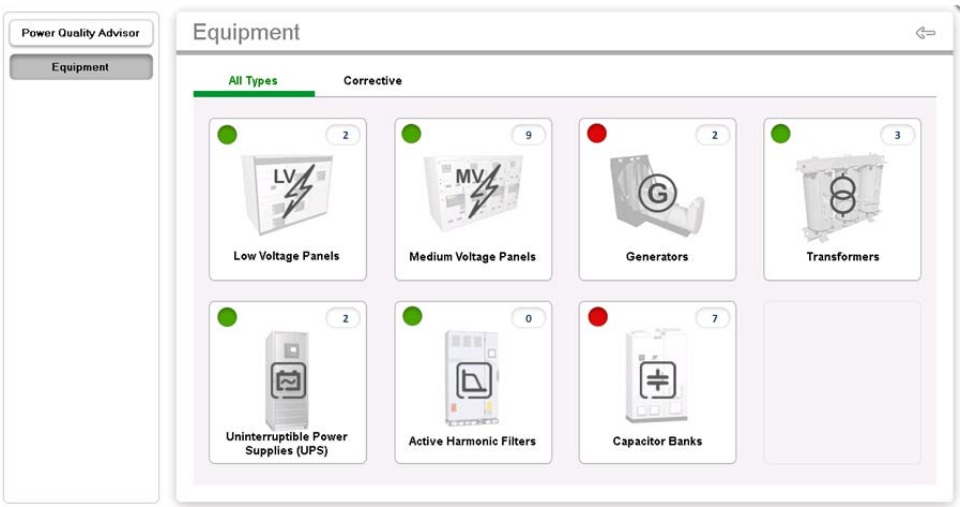
- Uninterruptible Power Supplies (UPS)
  - Galaxy 5000
  - Galaxy 5500
- Active Harmonic Filters
  - Accusine PCS+
  - Accusine PFV+
- Capacitor Banks
  - VarPlus Logic VL6 and VL12

Note: The corrective equipment diagrams are developed to support the products listed above. If the user's corrective equipment is not in the above list, the application engineer can modify the default diagrams to work with the equipment, or create custom diagram pages for it.

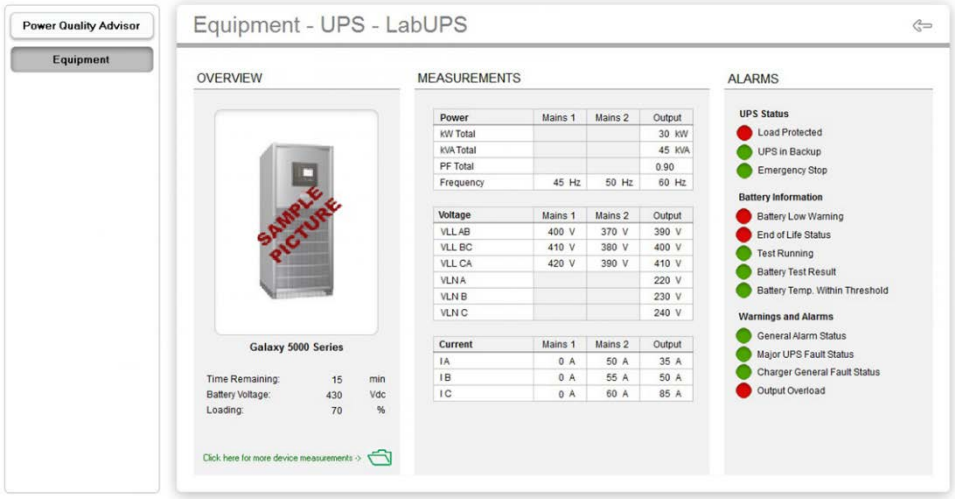
The Standardized Equipment Diagrams have status indicators that use the same colors as the power quality indicators to identify abnormal conditions in the equipment. The user can:

- Drill down to equipment *group* pages to see summarize alarms of each equipment in the category.
- Click further to display a specific equipment page to see the main operating parameters of the device.

Equipment group page:



Equipment page:



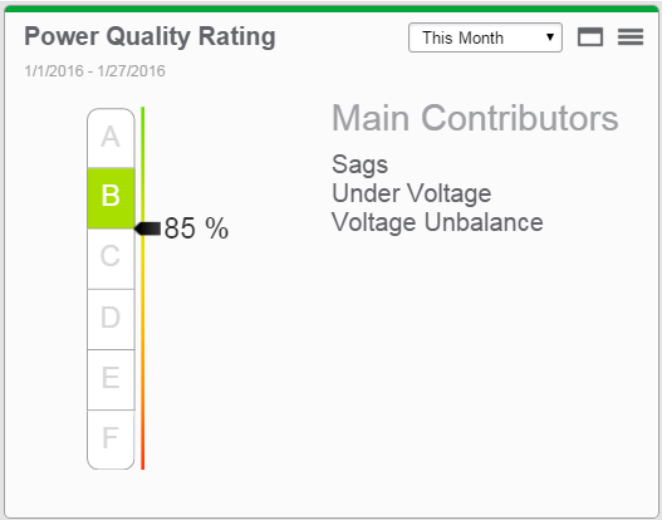
Power Quality Rating Gadgets

The Power Quality Rating gadgets are:

- Power Quality Rating Gadget
- Power Quality Rating Trend Gadget

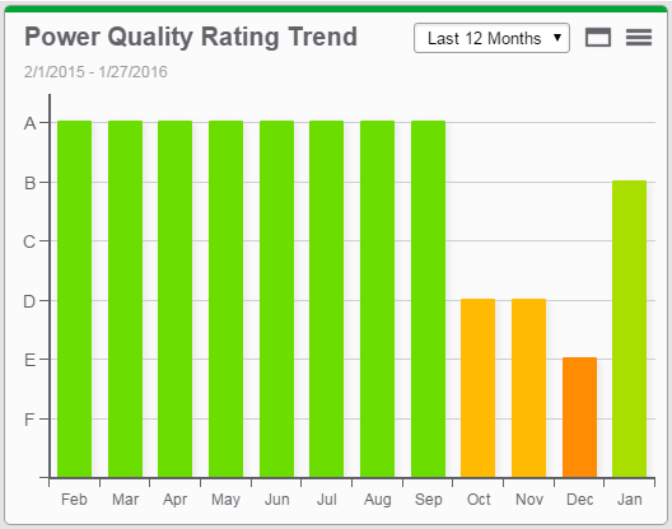
Power Quality Rating Gadget

The Power Quality Rating Gadget shows a simple power quality rating, which is a summary of multiple types of Power Quality disturbances. It also indicates the main contributors to the rating to draw the user's attention to Power Quality issues.



Power Quality Rating Trend Gadget

The Power Quality Rating Trend Gadget shows a trend view of the Power Quality rating to help users create a baseline and track the evolution of their power quality over time.



Feature Dependency

Power Quality Rating is a summary of all individual Power Quality Indicators. It is measured as a percentage:

- 0% = worst power quality
- 100% = optimal power quality

The % value shown in the Power Quality Rating Gadget is mapped to letter the following letter grades:

- Index >= 95.0 → "A"
- Index >= 85.0 → "B"
- Index >= 75.0 → "C"
- Index >= 65.0 → "D"
- Index >= 55.0 → "E"
- Index >= 0.0 → "F"

The formula used to calculate the PQ Rating is:

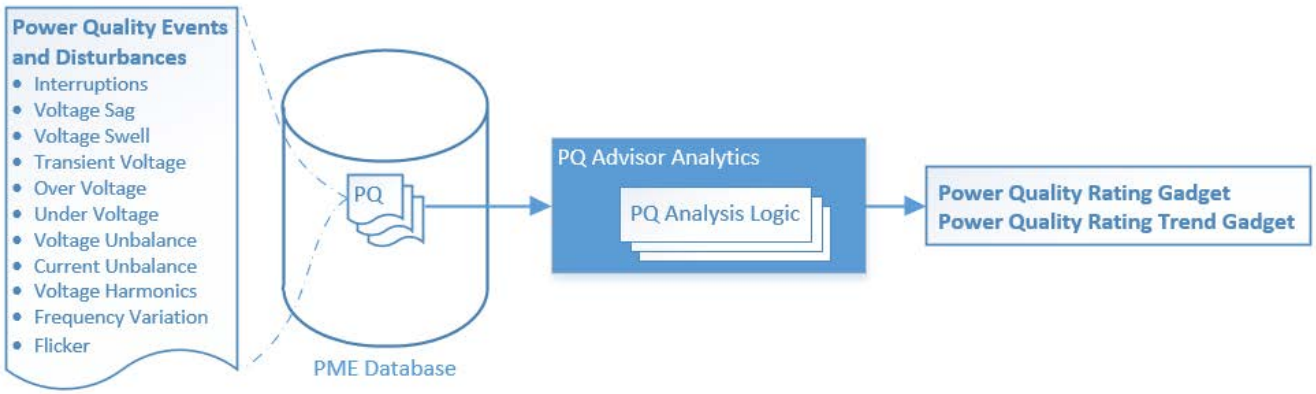
$$PQ.Rating = \frac{\sum PQ.Indicators.Value \times Weight\ Factor}{\sum PQ.Indicators.MaxValue \times Weight\ Factor} \times 100\%$$

Where:

- ***PQ.Indicators.Value*** is a number indicating each Power Quality Indicator status, Green = 2 ; Yellow= 1 ; Red = 0
- ***PQ.Indicators.MaxValues*** = 2 for each individual indicator.
- ***Weight Factor*** is an adjustable value (Default=1) for assigning different weight to each individual indicator as per user's needs.

See Power Quality Advisor Diagrams on page 11 for more information about PQ Indicators.

The following diagram indicates which PQ events and disturbances are consumed by the Power Quality Rating gadgets:



Note: Current Harmonics does not contribute to the calculation of the Power Quality rating.

See Meter Support List on page 32 for meter requirements for this feature.

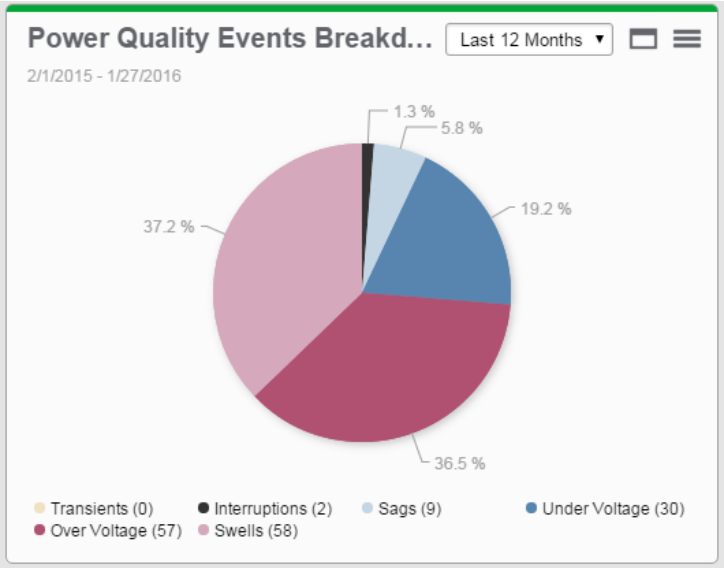
Power Quality Event Details Gadgets

The following Power Quality Event Details gadgets provide a high-level analysis of power quality events in the facility:

- Power Quality Events Breakdown Gadget
- Power Quality Events Impact Gadget
- Power Quality Events Location Gadget

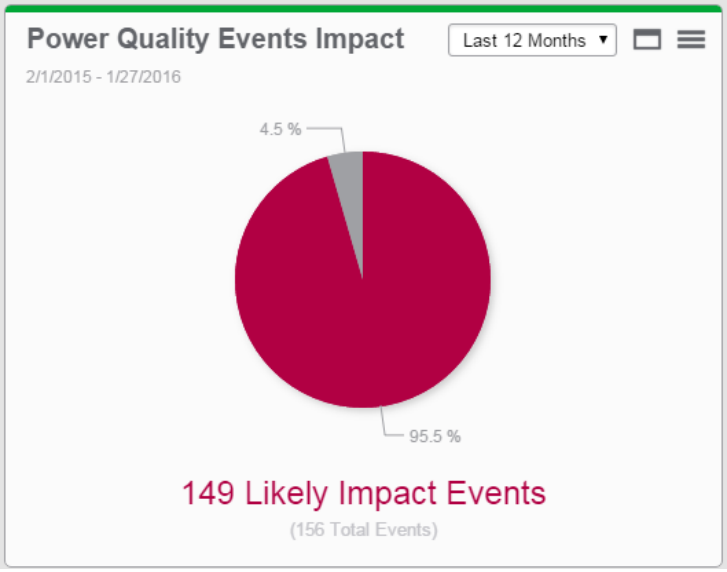
Power Quality Events Breakdown Gadget

The Power Quality Events Breakdown Gadget shows the percentage breakdown by type of event that occurred during the selected time period, in a pie chart. It helps to quickly identify the most common type of event affecting the facility.



Power Quality Events Impact Gadget

The Power Quality Events Impact Gadget shows the percentage breakdown by likelihood of impact that occurred during the selected time period. It summarizes the CBEMA-ITIC curve into a pie chart with two categories: “no impact events” (that is, events inside the curve), and “likely impact events” (that is, events above and below the curve), based on event magnitude and duration.

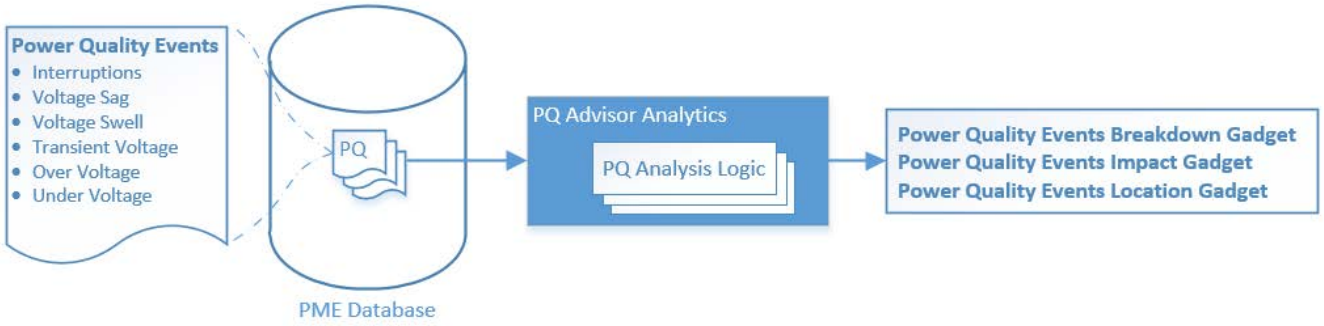


Power Quality Events Location Gadget

The Power Quality Events Location Gadget shows the quantity of events detected over the selected time period and identifies them, in a bar chart, by external, internal, or undetermined locations.

Feature Dependency

The following diagram indicates which PQ events are consumed by Power Quality Event Details gadgets:



Events in the Power Quality Events Location gadget are shown as “undetermined” (that is, no “external” or “internal” indication), if the meter does not support the DDD (Disturbance Direction Detection) feature.

See Meter Support List on page 32 for meter requirements for this feature.

Power Quality Impact Gadgets and Reports

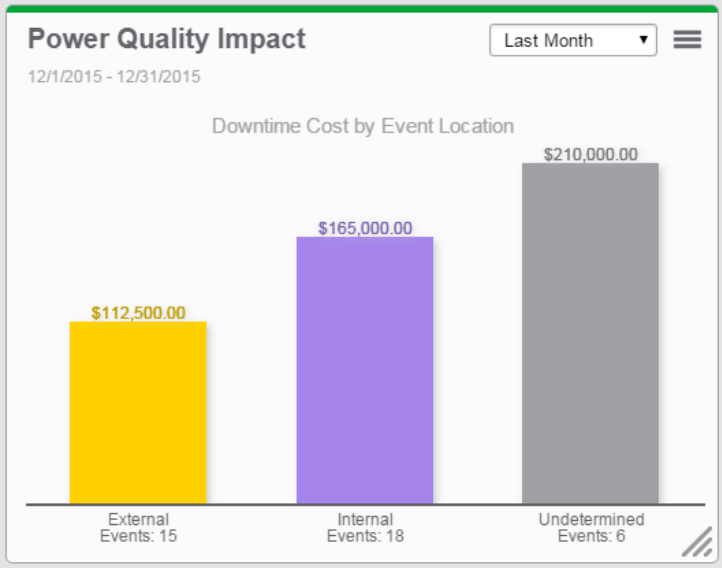
The following Power Quality Impact gadgets and reports associate PQ events with process impact alarms within a given process / production line, and applies a flat-rate cost estimate to the duration of the process impact alarm:

- Power Quality Impact Gadget
- Power Quality Impact Trend Gadget
- Power Quality Impact Report

The Disturbance Direction Detection (DDD) feature, available in select meters, is used to categorize the impact based on the event location.

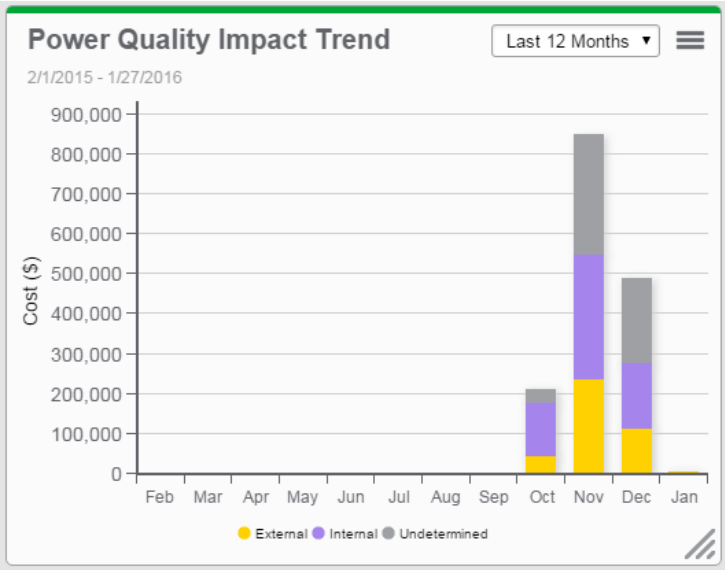
Power Quality Impact Gadget

The Power Quality Impact Gadget shows the cost impact when process impact alarms have been associated with PQ events, and breaks down the cost by the location of PQ events - external, internal, and undetermined.



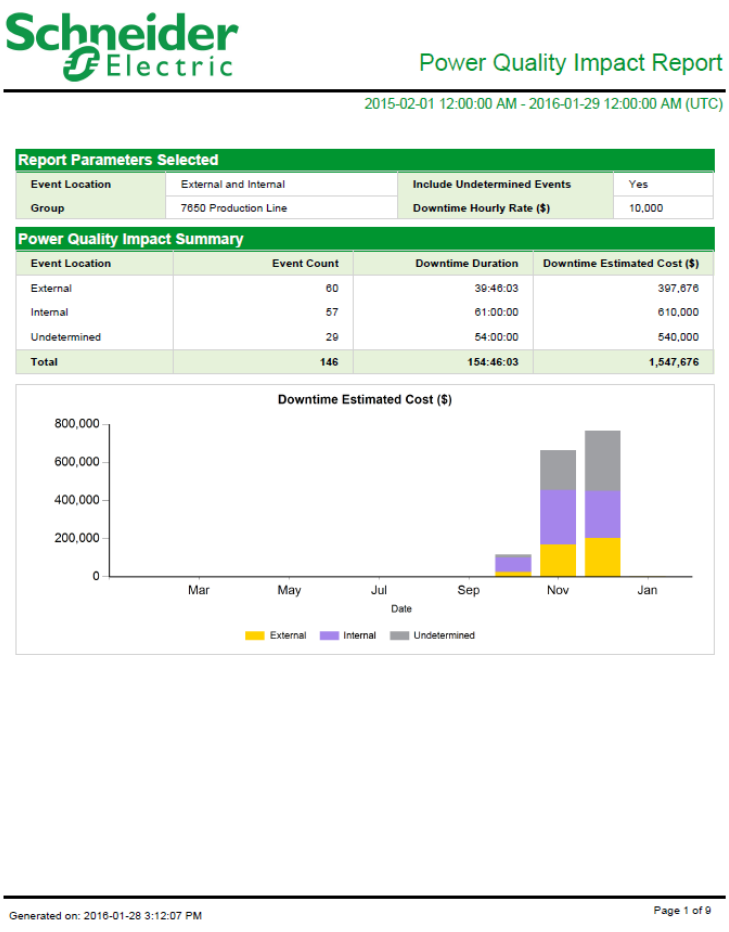
Power Quality Impact Trend Gadget

The Power Quality Impact Trend Gadget shows the cost trend of the external, internal, and undetermined PQ events over time.



Power Quality Impact Report

The Power Quality Impact Report shows details of the potential power quality related process impact costs. The report contains a summary table and graph.



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Power Quality Impact Report

2015-02-01 12:00:00 AM - 2016-01-29 12:00:00 AM (UTC)

Report Parameters Selected

Event Location	External and Internal	Include Undetermined Events	Yes
Group	7650 Production Line	Downtime Hourly Rate ($)	10,000

Power Quality Impact Summary

Event Location	Event Count	Downtime Duration	Downtime Estimated Cost ($)
External	60	39:46:03	397,676
Internal	57	61:00:00	610,000
Undetermined	29	54:00:00	540,000
Total	**146**	**154:46:03**	**1,547,676**

Generated on: 2016-01-28 3:12:07 PM

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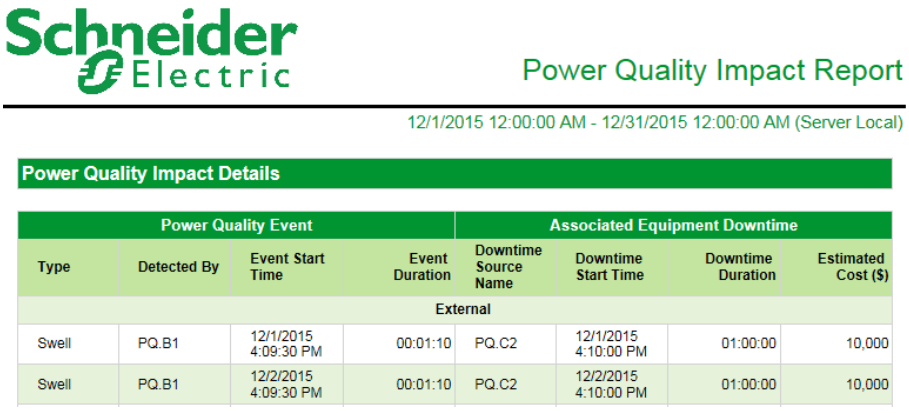
The report also includes detailed information for each power quality event associated with a process impact.



Schneider Electric

Power Quality Impact Report

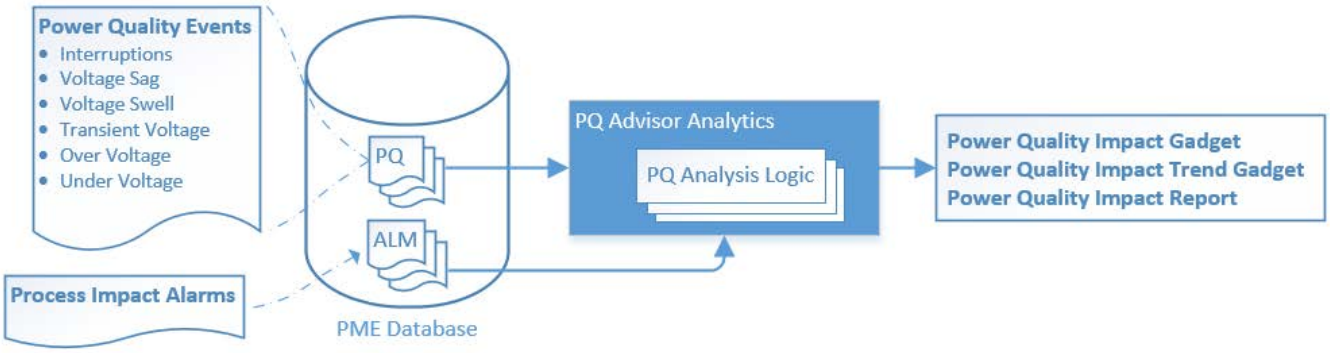
12/1/2015 12:00:00 AM - 12/31/2015 12:00:00 AM (Server Local)

Power Quality Impact Details

Power Quality Event				Associated Equipment Downtime			
Type	Detected By	Event Start Time	Event Duration	Downtime Source Name	Downtime Start Time	Downtime Duration	Estimated Cost ($)
External							
Swell	PQ.B1	12/1/2015 4:09:30 PM	00:01:10	PQ.C2	12/1/2015 4:10:00 PM	01:00:00	10,000
Swell	PQ.B1	12/2/2015 4:09:30 PM	00:01:10	PQ.C2	12/2/2015 4:10:00 PM	01:00:00	10,000

Feature Dependency

The following diagram indicates which PQ events are consumed by Power Quality Impact gadgets. The feature also requires the process impact alarms so that the logic can associate them with the potential PQ events which might be the cause.



Events in the Power Quality Events Location gadget are shown as "undetermined" (that is, no "external" or "internal" indication), if the meter does not support the DDD (Disturbance Direction Detection) feature.

See Meter Support List on page 32 for meter requirements for this feature.

Process Impact Alarms

A process impact alarm is designed to be created on:

- An electrical value (such as current, voltage, power, etc.) from a power device. In this way, PME detects the process impact independently (for example, based on a current drop).
- A process impact signal from another system or equipment. The process impact signals can be:
  - Hard-wired signals from the process. The signal can be from the process PLC, motor VSD, etc. It can be hard wired to a digital input or an analog input of the meter which monitors the corresponding load (requires AI/DI capability on the meter). The signal can also be hard wired to a dedicated PLC, which can then be connected into PME as a Modbus device.
  - OPC tags from the process. PME (working as OPC client) acquires the process impact signals from a process SCADA system (working as OPC server) via OPC.

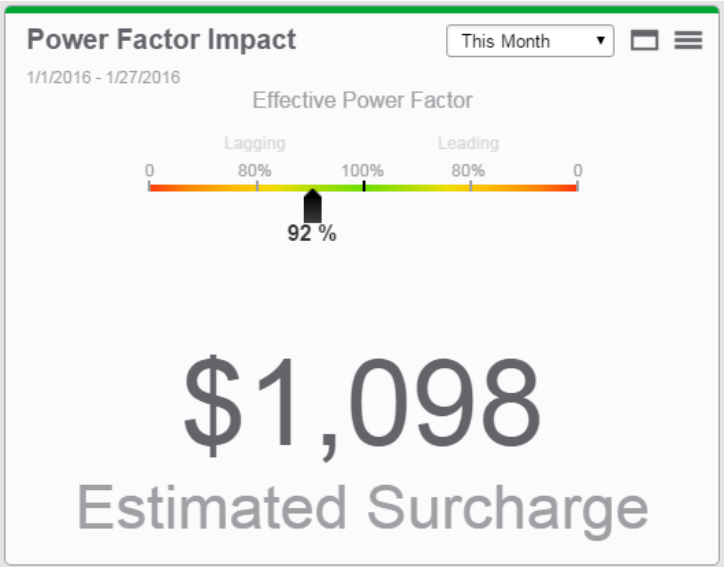
Power Factor Impact Gadgets

The following Power Factor Impact gadgets provide a clear visual indication of the impact of poor power factor on your energy bill:

- Power Factor Impact Gadget
- Power Factor Impact Trend Gadget

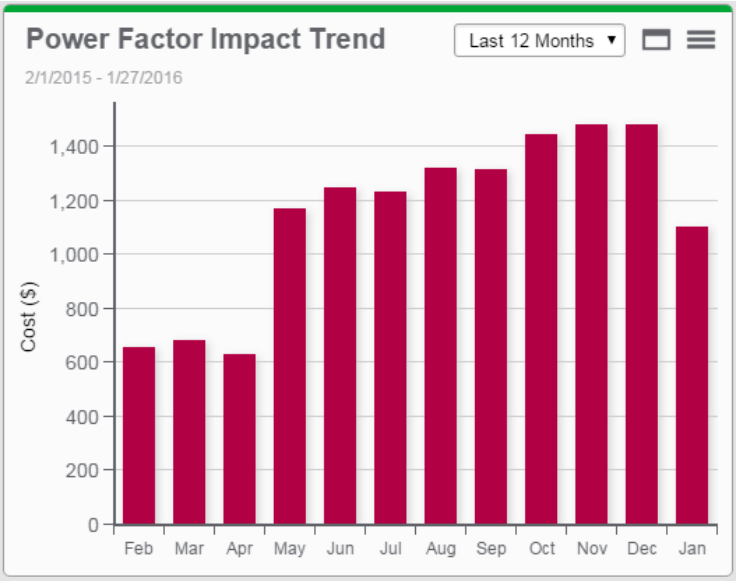
Power Factor Impact Gadget

The Power Factor Impact Gadget uses a simple visualization to clearly indicate the power factor, the nature of the power factor (leading or lagging), and the estimated power factor surcharge on the next utility bill.



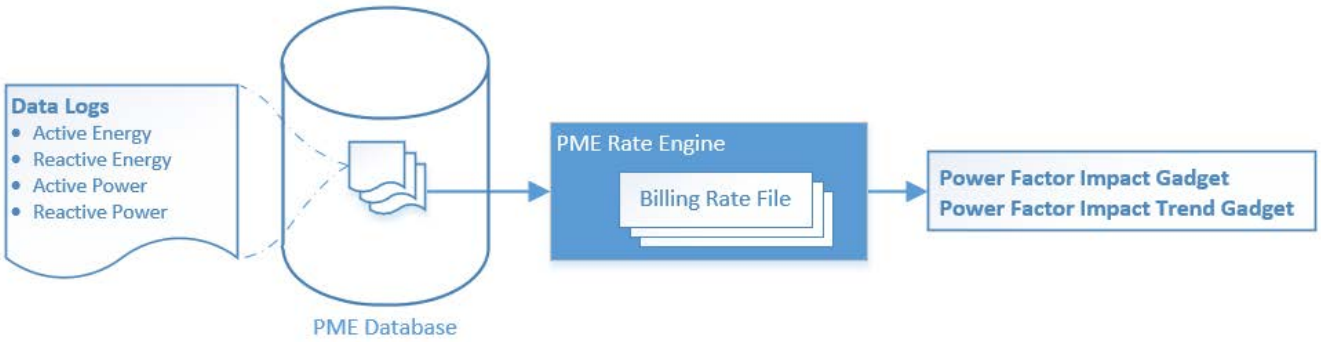
Power Factor Impact Trend Gadget

The Power Factor Impact Trend Gadget displays the cost trend for the power factor impact for the selected time period. It allows the user to track the evolution of the surcharge over time.



Feature Dependency

Power Factor Impact gadgets calculate the surcharge based on the rate defined for the PME Rate Engine. The calculation can be based on energy data, power data, or others, depending on the definition in the rate file. Four power factor penalty calculation rates are provided that may be modified to align with how the utility calculates this surcharge. The following diagram indicates how the data is consumed by the Power Factor Impact gadgets:

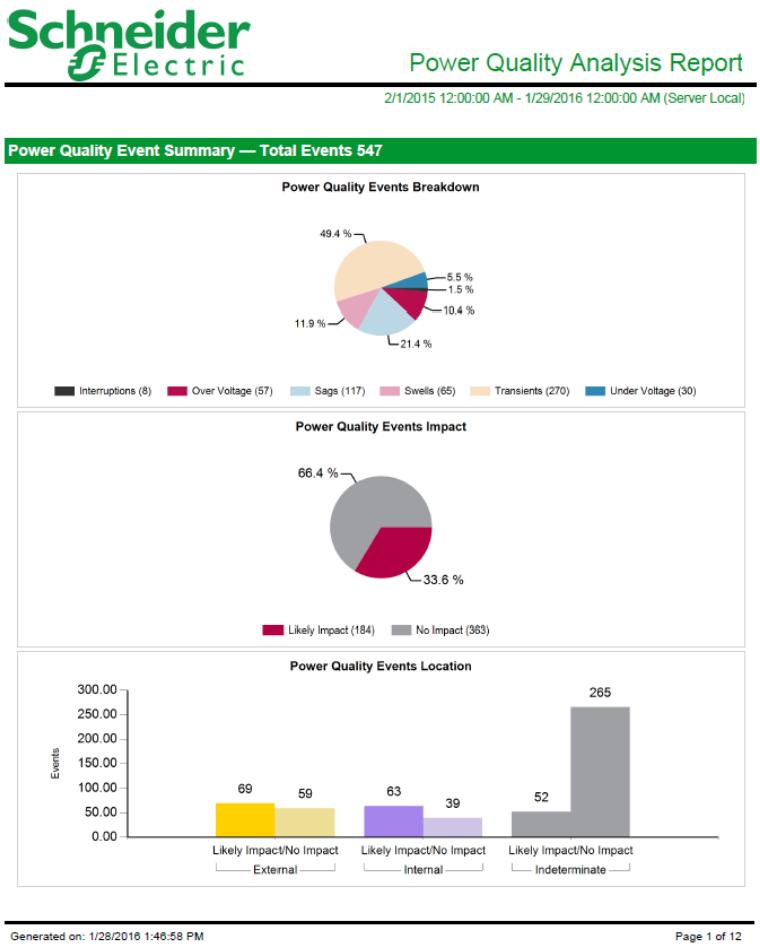


Note: The Power Factor Impact Gadgets only work for billing periods that start on the first day of the month. Billing periods that do not start on the 1st (for example, the 20th) are not supported.

See Meter Support List on page 32 for devices that support this function.

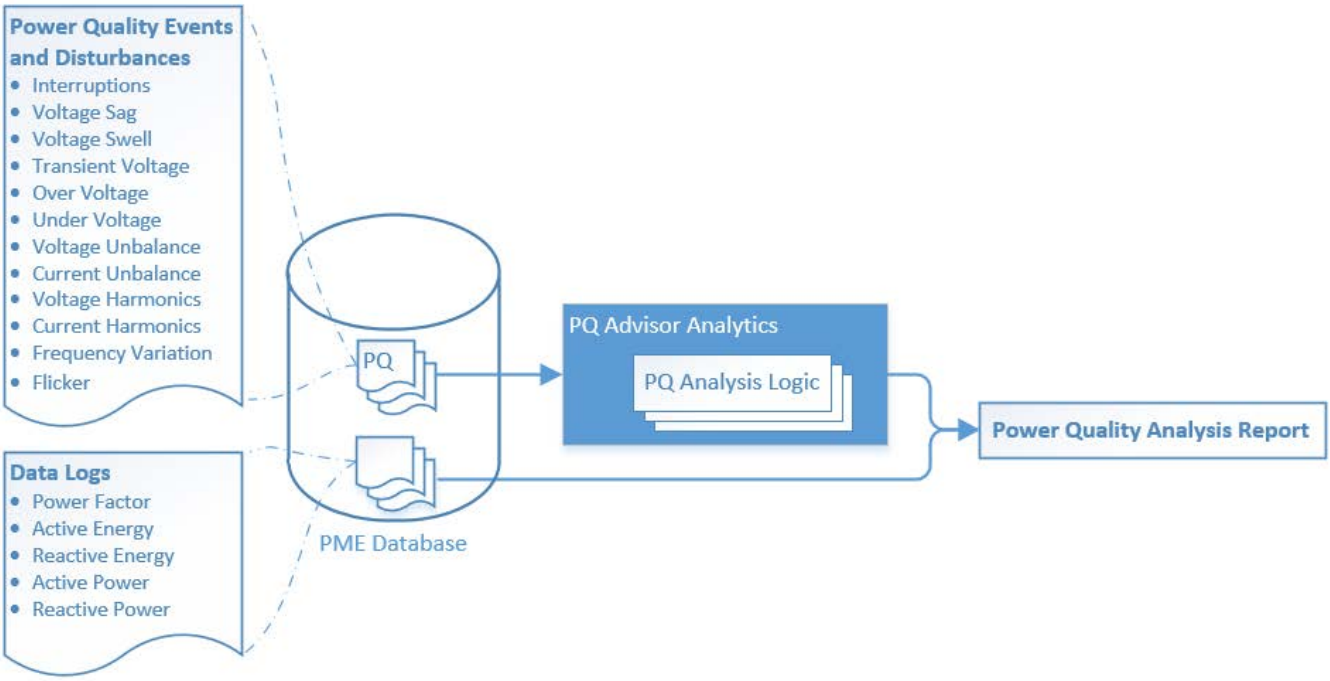
Power Quality Analysis Report

The Power Quality Analysis Report shows additional PQ event information to complement the Power Quality Event Details Gadgets. As well, it shows the details of the PQ disturbances. Finally, it shows the power factor trend with related energy measurements.



Feature Dependency

The following diagram indicates which PQ events and disturbances are consumed by Power Quality Analysis Report. The report also has a power factor section which requires power-factor-related data logs.



See Meter Support List on page 32 for meter requirements for this feature.

Meter Selection

Meter selection is crucial for utilizing the value of Power Quality Advisor. PQ Advisor rolls up PQ data across multiple meters. It is important to have the right types of meters in the right places to monitor for the types of PQ data that is useful in those rollups. (The meter list is configurable per type of PQ event or disturbance.)

Note: If none of the meters in the system are capable of monitoring a certain type of PQ event or disturbance, PQ Advisor still works. For example, if no meter in the system can detect transients, the user will not be able to see transient information in PQ Advisor, but the other PQ events and disturbances are still available.

This section focuses on whether the PQ Advisor required PQ event or disturbance data is supported by a meter (type/series). However, for example, when different types of meters are categorized as “supported” to provide harmonics data to PQ Advisor, the accuracy of the data they provide to the analysis depends on the meter’s capability for harmonic monitoring. Therefore, it is important to refer to the meter specifications for more information on:

- Accuracy and sampling rate
- Power Quality capability (event capturing, individual harmonics monitoring, etc.)
- Data recording capability
- On-board alarming capability
- Inputs / Outputs capability
- Communication
- Etc.

The following sections describe the recommended meter types for different metering locations specified as:

- Incomers
- Feeders and critical loads
- Non-critical loads

Incomers

Incomers include utility incomers and local power sources, such as generators, solar, wind, etc. Incomer power meters typically have the best PQ capability in the power monitoring system.

When using PQ Advisor, the recommended meter types for incomers are:

- ION7650 (preferred)
- PM8000

Note: The PM8000 is not capable of detecting transients and flicker. If the PM8000 is the most advanced meter used in the system, PQ Advisor will not be able to provide analysis on transient and flicker information.

The PQ Advisor module requires the incomer meters to have advanced power quality monitoring capabilities to utilize its features. For example, if the incomer meter does not have DDD (Disturbance Direction Detection) capability, PQ Advisor will not be able to identify if the PQ event is from the utility (external) or the facility (internal).

The following table indicates the PQ events and disturbances supported by the recommended meters.

PQ Events and Disturbances	ION7650	PM8000
Interruption	✓	✓
Voltage Sag/Swell	✓	✓
Transient Voltage	✓	✗
Over/Under Voltage	✓	✓
Unbalance	✓[1]	✓[1]
Harmonics	✓	✓[2]
Frequency Variation	✓	✓
Flicker	✓[3]	✗
Disturbance Direction Detection	✓	✓

Notes:

[1] ION7650 and PM8000 require a custom framework to provide Current Unbalance. However, typically the incomer meters do not need to contribute to the Current Unbalance data to PQ Advisor analysis because the analysis of Current Unbalance is only needed at load level.

[2] Harmonics is not available for PQ Advisor if PM8000 uses the IEEE 519 framework.

[3] Flicker is only available when ION7650 has the PQ framework with EN50160 evaluation enabled.

PQ Advisor calculates the power factor surcharge and shows it in the Power Factor Impact gadgets. ION7650 and PM8000 meters both have revenue accuracy (0.2 Class accuracy), which allows the calculation to be accurate compared to the utility meters.

See Meter Support List on page 32 for detailed information.

Feeders and Critical Loads

This category typically includes LV substations, main distribution circuits/feeders, large and critical process load for industry, critical loads for datacenter, hospitals, and other buildings, etc.

When using PQ Advisor, the recommended meter types for feeders are:

- PM8000
- PM5500 Series
- PM5300 Series

The PQ Advisor module does not require feeder meters to have strong power quality monitoring capability. However, feeder meters are very important for power quality root cause analysis when a problem has been identified by PQ Advisor. For example, when a PQ event is captured as “downstream” on a PM8000 used to monitor a production line, it proves the PQ event was generated inside the production line instead of another part of the facility. Another example: when PQ Advisor shows harmonics problems, the harmonics information from each feeder meter helps to identify the source of the problem.

The following table indicates the PQ events and disturbances supported by the recommended meters.

PQ Events and Disturbances	PM8000	PM5500	PM5300
Interruption	✓	✗	✗
Voltage Sag/Swell	✓	✗	✗
Transient Voltage	✗	✗	✗
Over/Under Voltage	✓	✗	✗
Unbalance	✓[1]	✓	✓
Harmonics	✓[2]	✓	✓
Frequency Variation	✓	✗	✗
Flicker	✗	✗	✗
Disturbance Direction Detection	✓	✗	✗

Notes

[1] PM8000 requires custom framework to provide Current Unbalance. However, typically the incomer meters do not need to contribute the Current Unbalance data to PQ Advisor analysis because the analysis of Current Unbalance is only need at load level.

[2] Harmonics is not available for PQ Advisor if PM8000 uses the IEEE 519 framework.

Note: DI (Digital Input) capability is necessary if process impact signals are designed to be acquired by hard wired signals connected to the meter. See Power Quality Impact Gadgets and Reports on page 20 and Process Impact Alarm on page 23 for more details.

See Meter Support List on page 32 for detailed information.

Non-critical Loads

This category applies to non-critical feeders, power distribution panels, non-critical loads, sub-process unit, etc.

When using the PQ Advisor, the recommended meter types for non-critical loads are:

- PM5300 Series
- PM5100 Series
- PM325X

Similar in concept to feeder meters, the PQ Advisor module does not require non-critical load meters to have strong PQ monitoring capability. However, Current Unbalance at this level is the main contributor to PQ Advisor analysis. In addition, a meter with harmonics monitoring capability can be chosen if there are harmonic concerns.

The following table indicates the PQ events and disturbances supported by the recommended meters.

PQ Events and Disturbances	PM5300	PM5100	PM325X
Interruption	✘	✘	✘
Voltage Sag/Swell	✘	✘	✘
Transient Voltage	✘	✘	✘
Over/Under Voltage	✘	✘	✘
Unbalance	✓	✓	✓
Harmonics	✓	✓	✓
Frequency Variation	✘	✘	✘
Flicker	✘	✘	✘
Disturbance Direction Detection	✘	✘	✘

Note: DI (Digital Input) capability is necessary if process impact signals are designed to be acquired by hard-wired signals connected to the meter. See Power Quality Impact Gadgets and Reports on page 20, and Process Impact Alarm on page 23 for more details.

See Meter Support List on page 32 for detailed information.

Meter Support List

The meter support list provides the detailed information of PQ Advisor feature dependencies on meters. It applies to both greenfield and brownfield designs.

PQ Events and Disturbances	Used by	Supported Meters	Supported Meter Template
Interruptions	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Events Breakdown Gadget PQ Events Impact Gadget PQ Events Location Gadget PQ Analysis Report PQ Impact Gadget PQ Impact Trend Gadget PQ Impact Report	ION 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8650C, 8800A, 8800B, 8800C, PM8000, PM870, CM3350, CM4000 **DDD Support**: ION7400, ION7550 V350 and newer, ION7650 V350 and newer, ION8650A/B V4.20 and newer, PM8000, CM4000	All default meter template
Voltage Sag	Same as Interruptions	Same as Interruptions	All default meter template
Voltage Swell	Same as Interruptions	Same as Interruptions	All default meter template
Transient Voltage	Same as Interruptions	ION 7650, 8600A, 8650A, 8650B, 8800A, CM4000T **DDD Support**: ION7650 V350 and newer, ION8650A/B V4.20 and newer, CM4000T	All default meter template
Over Voltage	Same as Interruptions	ION 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8650C, 8800A, 8800B, 8800C, PM8000	All default meter template
Under Voltage	Same as Interruptions	ION 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8650C, 8800A, 8800B, 8800C, PM8000	All default meter template
Voltage Unbalance	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Analysis Report	**Logged By Default**: ION 7330, 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8800A, 8800B, PM8000, CM3000, CM4000, TesysT, Micrologic 5.0/6.0/7.0 E/P/H (including IFE/IFM) **Not Logged By Default**: PM800[1], PM3250, PM3255, PM5100, PM5300, PM5350, PM5500, EM6400, EM7000, Micrologic 5.2/6.2/5.3/6.3 E	All default meter template
Current Unbalance	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Analysis Report	**Logged By Default**: TesysT, Micrologic 5.0/6.0/7.0 E/P/H (including IFE/IFM) **Not Logged By Default:** PM800[1], CM3000, CM4000, PM3250, PM3255, PM5100, PM5300, PM5350, PM5500, EM6400, EM7000, Micrologic 5.2/6.2/5.3/6.3 A/E	n/a
Voltage Harmonics	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Analysis Report	**Logged By Default**: ION 7330, 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8800A, 8800B, PM8000, CM3000, CM4000 **Not Logged By Default**: ION 6200, 7300, 8600C, 8650C, 8800C, PM200, PM700, PM800[1], PM1200, PM3250, PM3255, PM5100, PM5300, PM5350, PM5500, EM3460, EM6400, EM7000, Micrologic 5.2/6.2/5.3/6.3 E, Micrologic 5.0/6.0/7.0 H (including IFE/IFM)	All default meter template except PM8000 with IEEE 519 template

Current Harmonics	PQ Advisor Diagrams PQ Analysis Report	**Logged By Default**: ION 7330, 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8800A, 8800B, PM8000, CM3000, CM4000 **Not Logged By Default**: ION 6200, 7300, 8600C, 8650C, 8800C, PM200, PM700, PM800[1], PM1200, PM3250, PM3255, PM5100, PM5300, PM5350, PM5500, EM3460, EM6400, EM7000, Micrologic 5.2/6.2/5.3/6.3 E, Micrologic 5.0/6.0/7.0 H (including IFE/IFM)	All default meter template except PM8000 with IEEE 519 template
Frequency Variation	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Analysis Report	**Logged By Default**: ION 7330, 7350, 7400, 7550, 7650, 8600A, 8600B, 8650A, 8650B, 8800A, 8800B, PM8000	All default meter template
Flicker	PQ Advisor Diagrams PQ Rating Gadget PQ Rating Trend Gadget PQ Analysis Report	**Logged By Default**: ION 7400, 7650, 8600A, 8650A, 8800A, 8800B	PQ Framework and EN50160 evaluation enabled

Note:

[1] PM800 series is supported except PM810 without PM810LOG.

Detailed information specifically for Power Factor:

	Used by	Supported Meters
Power Factor	Power Factor Impact Gadget Power Factor Impact Trend Gadget	All meters that have measurements required by the calculation of the defined rate structure. For example: • Active energy • Reactive energy • Active power • Reactive power
	PQ Analysis Report	All meters that measures active energy, reactive energy, and power factor

Engineering Time Estimation

Prerequisites

Competency

Application Engineers who are responsible for deploying the PQ Advisor module must:

- Be familiar with StruxureWare Power Monitoring Expert, StruxureWare Power Monitoring, or PowerLogic ION Enterprise software systems.
- Be familiar with Schneider Electric power meters and circuit breakers.
- Be familiar with Microsoft Windows operating systems.
- Be familiar with Microsoft SQL Server.
- Have basic knowledge of power quality.

It is highly recommended that you take the PME PQ Advisor technical training from your local or regional training center.

System Readiness

The PME system must be fully commissioned before starting the configuration of the PQ Advisor module.

Time Estimation Guidelines

The engineering time estimation guidelines rely on the steps documented in the *Power Monitoring Expert Software Modules Configuration Guide.* The times listed are only for the configuration steps for the PQ Advisor module, and assume that all the prerequisites are met.

Configuration Steps[1]			Time (minutes)[2]	Comments
1	**Device Preparation[3]**		2	Per device
2	**Global configuration**		1	
3	**Configure PQ Indicator Diagram**		2	
4	**Configure Equipment Diagram**			
	4.1	Landing page and grouping page	15	
	4.2	Detail page	5	Per corrective equipment
5	**Configure Power Quality Impact Gadgets and Reports**			
	5.1	Acquire Process Impact Signal[4]	0	Using electrical value (e.g. current drop)
	5.2	Set Up Process Impact Alarms	5	
	5.3	Set Up Power Quality Groups[5]	1	Per group
6	**Configure Power Factor Impact Gadgets**			

	6.1	Set Up the Power Factor Impact Rate File[6]	1	Using one of the sample rate files
	6.2	Set Up the Incomer Meters in the Hierarchy	2	
8	**Set Up Power Quality Advisor Dashboards and Reports**			
	8.1	Set Up Power Quality Advisor Dashboards	6	One PQ overview dashboard and one PQ detail dashboard
	8.2	Set Up Power Quality Advisor Reports	1	Per report as required
9	**Fine-Tuning[7]**			
	9.1	Change Device Inclusion and Exclusion for the Analysis	-	See note 7.
	9.2	Change Power Quality Indicator Thresholds	-	See note 7.
	9.3	Disable Unused Power Quality Indicators	-	See note 7.

[1] Some features function automatically without additional configuration. See the *Power Monitoring Expert Software Modules Configuration Guide* for more information.
[2] The times listed are only for the configuration steps for the PQ Advisor module, and assume that all of the prerequisites are met.
[3] This may include enabling/verifying PQ event detection, enabling/verifying PQ disturbance logging, enabling/verifying time synchronization, etc.
[4] If using signals from the process, you need to consider the additional time required for commissioning according to the method (meter DI, PLC, OPC, etc.).
[5] This does not take into account the time required to understand the relationship between a customer's production and electrical distribution.
[6] Site-specific, according to the rate structure of the customer's utility contract.
[7] Site-specific, and highly dependent on the customer's requirements. It may require a deep understanding of local/regional power quality standards and particular customer needs.

Examples

Based on the time estimation guidelines, the required engineering time for System 1 is approximately 2.5 hours.

System 1	
Number of Monitoring Devices	50
Number of Correction Equipment	3
Number of Processes	5
Number of Report creation	6

Based on the time estimation guidelines, the required engineering time for System 2 is approximately 8.5 hours.

System 2	
Number of Monitoring Devices	200
Number of Correction Equipment	10
Number of Processes	15
Number of Report creation	16

Other Design Considerations

Refer to the *StruxureWare Power Monitoring Expert Design Guide* for PME architecture, communication network design, and other general design topics.

Server Specification

Refer to the “Recommended Power Monitoring Expert Systems” section in the *StruxureWare Power Monitoring Expert Design Guide*.

Notes:

1. Use only an advanced server type for the PQ Advisor module.
2. Do NOT use SQL Server Express with the PQ Advisor module.

Time Synchronization

Time synchronization is crucial for:

- Event clustering (the same event seen by different devices is only counted once).
- Correctly associating the process impact alarms with power quality events.

The standard synchronization between PME server and devices is adequate for enabling PQ Advisor features.

- For Modbus devices, time synchronization through Modbus is activated by default.
- For all ION protocol devices (e.g. ION7650, PM8000, etc.), the application engineer needs to enable this feature.

Note: High accuracy of time synchronization (such as IRIG-B, etc.), can be used to address user requirements, but it is not required for PQ Advisor.

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