IMPROVING POWER QUALITY

POWER QUALITY SOLUTIONS

Security and uptime for your company
MEASURE - ANALYZE - SAFEGUARD

THREE STEPS TO UPTIME

MEASURE
Power quality network analyzers
For data acquisition and monitoring

ANALYZE
GridVis® Power Grid Monitoring Software with clear analysis options and reports

SAFEGUARD
Power quality solutions to protect against unwanted network disturbances

The voltage in our networks today is a long way from the ideal sine wave. This considerably reduces equipment service life. A continuous measurement of the power quality and the analysis of the acquired data enable the detection of deviations before equipment damage is imminent. Janitza offers perfectly matched hardware and software components along with comprehensive services for optimizing power quality.
"YOU CAN'T IMPROVE WHAT YOU CAN'T MEASURE."

William Thomson, Baron Kelvin, named “Lord Kelvin,” * June 26th, 1824, † December 17th, 1907

Analyzing power quality with foresight
You can acquire a detailed picture of your power distribution system thanks to intelligent measurement technology from Janitza. Energy management, power quality monitoring and residual current monitoring are combined in a single system environment. In addition to complying with current standards, you can always keep an eye on the power supply of your system. The acquired measured values provide important information for optimizing the power quality and increasing system safety.

The most important challenges of power quality at a glance
- Inductive phase shifting
- Capacitive phase shifting
- Highly dynamic change to the power factor
- Imbalance
- Static harmonic loads
- Fast harmonic loads
- Resonance detection

Continuous measurement
Detect network disturbances at an early stage and ensure the uptime of your system. Among other things, susceptibility to faults depends on the quality of the power provided by the power utility company. The types of loads downstream of the feed-in point affect the quality of power and thus the service life of your equipment. You should therefore measure from the supply to the sub-distribution. Measure continuously. Only in this way are your values transparent and traceable.

MEASURE
Network analyzers for standard-compliant data acquisition and monitoring
The GridVis® (basic) Power Grid Monitoring Software is included with every Janitza measurement device (free download of the current version from www.janitza.com). Using GridVis®, you can analyze the measured parameters in order to detect possible production failures at an early stage and thus optimize operating times. The scalable, user-friendly software from Janitza is perfectly matched to our measurement devices and ideally suited for setting up standard-compliant power, RCM and power quality monitoring systems.

**Janitza APPs**
There is a large selection of APPs available for Janitza measurement devices which can be used to read, process, and analyze data.

*Display of limit violations, events and transients with the GridVis® 7.3 LET report*
Non-linear electrical loads cause network disturbances which reduce equipment service life. They can also lead to system failures and damage. More specifically, there is a risk of thermal losses on motors, overloading of the neutral conductor, overheating of transformers and failure of IT systems, with associated data loss. Solutions for improving the power quality can be developed by analyzing the acquired measurement data. The objective is to provide active protection and ensure the availability of plants and buildings. Janitza’s power quality solutions are designed to tackle different challenges.

**COST-EFFECTIVE**
- PFC
- Dynamic PFC
- Passive harmonic filter

**COMPACT**
- Static var generator
- SVG

**ALL-ROUNDER**
- Active harmonic filter
- AHF

**SAFEGUARD**
Dynamic PFC to protect against unwanted network disturbances and reactive power.
POWER QUALITY SOLUTIONS

**Measure power quality – analyze measurement data – eliminate malfunctions**

The safety and uptime of the power supply of purpose production plants and data centers are important competitive factors. Negative effects of problems in power quality can be the distortion of the sinusoidal curve or the generation of reactive power. This will affect the service life of equipment. Reactive power, imbalance and harmonics are caused, for example, by the increased use of components, such as frequency converters, switched mode power supplies and much more. The right power quality solution can efficiently and cost-effectively reduce the consequences of power quality problems.

**OVERVIEW OF POSSIBLE POWER QUALITY DISTURBANCES**

**Inductive and capacitive phase shifting**

Today's challenges in compensating reactive power require the highly dynamic control of inductive and capacitive loads. Modern systems enable an optimum power factor (cos phi) when power electronic components are used. In combination with cabling and old compensation systems, these components can ensure that networks become capacitive. The power quality solutions from Janitza allow highly dynamic compensation of capacitive and inductive reactive power.

**Highly dynamic change to the power factor**

Rapidly changing processes, e.g. welding processes in the automotive industry, require fast reaction and adjustment times in order to obtain the best possible power factor (cos phi).

**Imbalance**

It is almost impossible to prevent uneven loads on the phase conductors in modern industrial plants. Machines and plants are being expanded and require plant technology that can quickly and efficiently restore balance. This prevents the additional load on the neutral conductor.

**MEASURE – ANALYZE – SAFEGUARD**

Security and uptime for your system
Inductive phase shifting/reactive power

Reactive power is required to generate electromagnetic fields. Since these fields continuously build up and break down again, the reactive power oscillates between generators and consumers. In contrast to active power, reactive power loads the power supply network and the generator systems (generators and transformers). Since not all power distribution systems can be designed larger in order to provide the necessary current, we recommend reducing the resulting inductive reactive power close to the consumer by using an equal amount of counteracting capacitive reactive power. During compensation, the reactive power in the network is reduced by the reactive power of the power capacitor or the compensation system (PFC). As a result, reactive current is removed from the generator systems and energy transmission installations.

OVERVIEW OF POSSIBLE POWER QUALITY DISTURBANCES

Static harmonic load

Harmonic loads are currents or voltages whose frequency is above the 50/60 Hz fundamental frequency and which are a multiple of this frequency. The current harmonics do not play a part in the active power. They only place a thermal load on the network and are the main cause of invisible power quality problems. In addition to tremendous costs for repairs and replacement investments for defective equipment, excessive network disturbances can cause problems in production processes and even production downtime.

Rapid harmonic change

Rapidly changing processes, e.g. welding processes in the automotive industry, require fast reaction and settling times in order to keep harmonics as low as possible.

Resonances

Resonances occur due to network impedances and system configurations and can also be influenced by switching states. The inductive and capacitive resistance in a resonant circuit are the same. The resonances are excited by harmonics and can damage the system due to high currents or voltages.
SYSTEMATIC MEASUREMENTS

JANITZA NETWORK ANALYZERS

Measure your energy data continuously and reliably with Janitza power analyzers. Janitza measuring technology allows you to record almost all parameters of the power supply – for more safety, profitability and uptime of your system.

In order to check the power quality in accordance with EN 50160 at the point of common coupling (PCC) and in the internal supply network in accordance with EN 61000-2-4, certified measuring methods with high measurement accuracy are used. Janitza offers solutions specifically designed for these applications.

Advantages
- High accuracy of measurement
- Suitable for different types of networks
- Open communication architecture
- Power quality monitoring

One system – threefold benefits
Energy management, power quality and residual current monitoring in a single system environment. That is what the comprehensive Janitza product range stands for. The software and hardware components are optimally tailored to one another. Benefit from our consulting competence and comprehensive services throughout the entire product lifecycle.

MEASURE
Network analyzers for data acquisition and monitoring
UMG 512-PRO
Class A power quality analyzer with integrated residual current measurement, records power quality parameters according to standards EN 50160, IEEE519 or EN 61000-2-4.

UMG 509-PRO
Multi-talent for continuous monitoring of power quality and analyzing electrical disturbances in case of network problems.

UMG 604-PRO / UMG 605-PRO
DIN rail network analyzer with state-of-the-art communication options. Power quality measurement according to IEC 61000-4-30, EN 50160 and EN 61000-2-4 standards.

UMG 96-PA with RCM module
Modular energy measurement device that combines energy management, power quality and residual current monitoring.

UMG 103-CBM
Measurement and control of electrical parameters in power distribution systems, suitable for DIN rail mounting.

MEASURING ON FIVE LEVELS
Measure from the supply to the electrical end user (machine level). Measure continuously. Only in this way are your values transparent and traceable.
PLUG-ON CURRENT TRANSFORMERS

SCREWLESS CONNECTION TECHNOLOGY

When high currents are detected and processed, plug-on current transformers are used. The phase to be measured (busbar or cable) is routed through the window opening and forms the primary circuit of the plug-on current transformer. Plug-on current transformers are primarily used in designing new systems.

Benefit from the world’s first current transformers with screwless connection technology and spring-loaded terminal block. These converters offer innovative, time-saving connection options for solid and flexible phase, where wire end ferrules are not necessary.

Janitza plug-on current transformers at a glance
- UL certified
- Screwless connection technology – spring-loaded terminal block
- Wire end ferrules are not required for flexible conductors
- Shock and vibration resistant, high mechanical holding forces
- Maintenance-free, gas-tight connection
- High current resistance
- Therm. rated continuous current I_{c.th}: 1.2 x IN
- Low-voltage current transformer for max. operating voltages up to 1.2 kV; use in 690 V networks possible
ADDITIONAL CURRENT TRANSFORMER TYPES

THE LINK BETWEEN HIGH VOLTAGE AND DIGITAL TECHNOLOGY

Currents ranging from a few hundred to thousands of amperes cannot be measured directly. Our current transformers convert almost all primary currents into "bite-sized" secondary currents.

Janitza offers a wide range of current transformer types. In addition to plug-on current transformers, total current transformers, residual current transformers or cable conversion transformers are also available. Rogowski coils enable precision measurements, especially for higher harmonics. The long, flexible Rogowski coil provides easy access to hard-to-reach busbar systems, and is a perfect solution for retrofits.

Application areas of Janitza current transformers
- Conversion of high primary currents into secondary currents .../1A or .../5A
- Converter classes 0.5 or 1, depending on the measurement device
- Converters for various busbars and cables are available
- Cable conversion transformer for cables, if the current path cannot be opened
- Residual current transformer (incl. type B+)
- Total current transformers
EARLY DETECTION OF ERROR SOURCES

The transparent display and analysis of the measured values is essential for identifying deficiencies in the power distribution system. There is a large selection of APPs available for Janitza measurement devices, which can be used to read, process and visualize data. The configuration of the measuring instruments is also simplified. The APP management (part of the GridVis® Device Manager) allows you to simultaneously control APPs on several devices.

GridVis® Power Grid Monitoring Software

Using GridVis®, you can analyze in detail the measured parameters in order to detect possible production failures at an early stage and thus optimize the operating times. The scalable, user-friendly software from Janitza is perfectly matched to the measurement devices and is ideally suited for setting up standard-compliant energy, RCM and power quality monitoring systems. The GridVis® basic edition is included with every Janitza measurement device (free download of the current version from our homepage www.janitza.com).
The LET report provides an overview of power quality deviations.

RESIDUAL CURRENTS AND POWER QUALITY AT A GLANCE

**LET report**
- Statistical analysis for internal limit values, transients and events
- Histogram and heat map function
- EN 50160 annual analysis with events and transients

The LET report, which is included in GridVis® 7.3, takes existing PQ reporting to a new level. The heat map and histogram function allows you to statistically monitor and analyze any deviations. The report provides insight on anomalies that occurred in the selected time period. In the Details list, differentiated values (such as duration, time stamp, etc.) of each variance are displayed. The LET report thus goes beyond purely static evaluations and enables rapid error analysis.

**Additional PQ reports:**
- Uptime report
- Utilization report
JANITZA APPs

These Apps allow for a quick high-level view

Benefit from software-based extensions for your measurement device with Janitza measurement device APPs. The functions integrated in the device can be extended and visualized via the APPs. The possible uses of the APPs depend on the type of device and were developed according to the needs of our customers.

**APP EN 50160 Watchdog – continuous monitoring of power quality**
Permanent monitoring of the voltage measured at the network connection point in accordance with EN 50160. All algorithms (including 95% and 100% values) are integrated into the measurement device itself. In order to ensure that power failures are reliably detected as events, the auxiliary voltage of the device must be buffered. The APP does the hard work for you without the need for a separate PC, allowing simplified power quality analysis through a traffic light indicator. Transmissions of large amounts of data to a host system can be eliminated.

**APP IEC 61000-2-4 Watchdog PRO – continuous monitoring of power quality**
Permanent monitoring of the power quality according to IEC 61000-2-4 in customer supply networks. Automatic, complex analysis of the measured data according to the threshold values of the standard. Events are quickly detected and the transmission of large amounts of measurement data is no longer necessary.

**APP measured value monitor – compare current and historical measured values**
Measured values are displayed in the form of graph built in web page of a Janitza UMG measurement device. The APP impresses with its user-friendly drag and drop operation. Up to 6 measured values and 60,000 data points can be displayed in one graph.

ANALYZE
Janitza APPs: Interesting analysis functions for the device homepage
SERVICES

On request, we will be happy to advise you on how to improve the power quality for your company. We record your measurement data, analyze the acquired values and recommend suitable power quality solutions.

PQ analysis
Analysis and evaluation of recorded power quality parameters according to EN 50160 and EN 61000-2-4 with recommended action in case of limit violations or critical parameters. A measurement kit can be provided on request. The suitable power quality solution is selected based on the data.

Installation and configuration
Janitza is here to support you during commissioning of your building. This includes the installation of the GridVis® system software as well as the configuration of the measurement device. As a part of the GridVis® installation process the creation of customer projects with a corresponding measuring point structure will be implemented. The configuration contains the parameterization of the measurement devices to be integrated into the system. In addition, relevant GridVis® reports are set up on a customer-specific basis (e.g. LET report, uptime report).
PROTECTING YOUR SYSTEM

INCREASE THE SERVICE LIFE, SAFETY AND EFFICIENCY OF YOUR SYSTEM

Take an active role and decisively determine your power quality. The Janitza range includes products that specifically eliminate selected disturbances.

<table>
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<tr>
<th>Challenge</th>
<th>AHF</th>
<th>SVG</th>
<th>Passive harmonic filters</th>
<th>Dynamic PFC</th>
<th>PFC</th>
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<tr>
<td>Inductive phase shifting</td>
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<td>Capacitive phase shifting</td>
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<td>Highly dynamic change to the power factor</td>
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<td>Unbalance</td>
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<td>Static harmonic loads</td>
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<td>Fast harmonic loads</td>
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<td>Resonance detection</td>
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AHF Series – Active power quality controller
Active power quality controllers (AHF) are multi-talents that can improve important power quality parameters. The special advantage lies in the detection of resonance points.

SVG – Dynamic power controller
Dynamic power controllers (SVG) perform tasks for correcting power factors and restoring network symmetry.

Passive harmonic filter
Passive harmonic filters often represent an economical alternative in instances where disruptive network disturbances occur. They are choked capacitors tuned to a harmonic frequency with a defined harmonic load capacity.

Dynamic PFC
Dynamic power factor correction systems are used in particular applications with fast and high load changes. Semiconductors connect the capacitors to the network without network disturbances and without stress for the various components, such as fuses or contactors. The smooth switching prevents negative effects on the power quality that would normally result from high start-up currents.

PFC – Power factor correction systems
Among other things, reactive power due to inductive phase shift occurs in motors and transformers - without consideration of line, iron and friction losses. If capacitors of suitable size are connected in parallel to the loads, the reactive current oscillates between the capacitor and the inductive load. The higher-level network is no longer under an additional load.

SAFEGUARD
Solutions to protect the system against undesired network disturbances
ACTIVE PQ CONTROLLER (AHF)

THE STANDARD POWER QUALITY SOLUTION OF THE FUTURE

There are many reasons for using active power quality controllers, because the general conditions for sufficient voltage quality continuously change. The number of non-linear loads, and thus the "harmonic generator", increases in existing networks. In addition, legally permissible limit values are tightened (e.g. EN50160, IEEE519...). The greater the networking of production processes, the more susceptible the entire system is to faults. In general, the following applies: In order to achieve a power quality with compatible distortion levels, the interference of harmonic currents must be limited.

Advantages of active power quality controllers
Active power quality controllers can perform different tasks as shown in the table below. They can be used flexibly. It is possible to easily adapt to changing networks and consumers. Compact designs for wall and rack mounting as well as the user-friendly interface ensure fast commissioning and convenient use during operation.

Power quality optimization with active power quality controllers

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<tr>
<th>REDUCING HARMONICS</th>
<th>AHF</th>
<th>SVG</th>
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<tr>
<td>Automatic detection or targeted elimination of harmonics up to 50th harmonic</td>
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<tr>
<td>Permanent and intelligent resonance detection</td>
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<th>COMPENSATING REACTIVE POWER</th>
<th>AHF</th>
<th>SVG</th>
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<tr>
<td>Inductive and capacitive reactive powers</td>
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<tr>
<td>Continuous and fast control</td>
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<td>The target cos phi is adjustable</td>
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<th>RESTORING NETWORK BALANCE</th>
<th>AHF</th>
<th>SVG</th>
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<tr>
<td>Restoration of the network balance in case of unequal loads</td>
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<td>Reduction of the neutral conductor current</td>
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APPLICATIONS

REDUCING NETWORK DISTURBANCES

Electric motors and pumps with variable frequency drive technology are being used more and more in industrial plants, such as in the packaging industry, in welding processes, but also in biomass power plants. Energy-efficient light sources, laptops and desktop computers have also become standard in building technology. This power electronics, consisting of thyristors and power capacitors, etc., has a negative impact on the power quality. In addition, the behavior in the power distribution network is negatively influenced by network imbalances.

Reducing the harmonic load
- Reduction of downtime costs e.g. for frequency converters
- Automatic detection of resonance points
- Individual compensation and dynamic filtering possible
- Lower losses due to 3-level topology: Twice the number of IGBTs, low losses, reduced number of network disturbances
- Can be expanded with modules
- Easy transport and convenient integration into the system environment (compact design)
- Small investment
- Low maintenance requirements

SAFEGUARD
Active filters – all around protection against undesired network disturbances
Active power quality controllers of the AHF series are suitable for the dynamic compensation of harmonic currents, inductive and capacitive reactive power as well as for balancing asymmetrical loads. The non-reactive and low-loss operation is achieved by employing a 3-level topology and a high clock frequency. In addition, the active power quality controller enables easy integration into existing low-voltage networks through intelligent resonance detection (intelligent FFT). Thanks to their modular system, AHFs are suitable for easy adjustments to changed network and load conditions. The compensation strategy can be changed during operation. Depending on the voltage distortion (THD) and/or the unbalance as well as an automatic restart after power failure, an adjustable standby mode ensures reliable operation of the power quality controller AHF.
DYNAMIC POWER CONTROLLER SVG

REDUCING INDUCTIVE AND CAPACITIVE REACTIVE POWER

The power controllers of the SVG series are suitable for the dynamic compensation of inductive and capacitive reactive power and for balancing asymmetrical loads. The non-reactive and low-loss operation is achieved by employing a 3-level topology and a fast and continuous control. Furthermore, the dynamic power controller enables easy integration into existing low-voltage networks, as there is no risk of resonance. The SVG series power controllers are suitable for simple adjustments to changed network and load conditions, due to their modular system. They are characterized by the compensation of the neutral current in the 4-phase connection and automatic network frequency detection. The compensation strategy can also be easily changed during operation.

Compared to traditional compensation systems, SVGs offer significant advantages:
- Compensation of inductive and capacitive reactive power
- Continuous control
- Short reaction times
- Lightweight: 100 kVar < 50 kg
- Compact dimensions
- No risk of resonance
- No influence on ripple control signals
- Mean time before failures (MTBF) of up to 100,000 hours

Typical SVG applications:
- Reactive current compensation in highly dynamic networks
- Load balancing in industrial commercial buildings
- Replacement of phased-out compensation systems with capacitors
- Dynamic control of reactive power

SAFEGUARD
Dynamic power factor correction to protect against unwanted grid distortions
COMPENSATING INDUCTIVE PHASE SHIFT

In applications with exclusively inductive phase shifts, traditional reactive power compensation may be sufficient. It is particularly cost-effective with long duty cycles and high power consumption. The result is a virtually constant good power factor, which is automatically adjusted by a power factor controller via contactors. A mixture of individual, group and central compensation is possible. A suction effect against harmonic loads can be achieved in combination with a passive harmonic filter.

Advantages of PFC

- Lower kWh consumption due to reduced ohmic losses
- Reduced load on transformers, lines and supply installations
- Increased service life of electrical distribution equipment
- Improved network utilization, additional consumers (kWh) can be connected
- Power stabilization (reduced apparent current reduces the voltage drop at the network impedances)