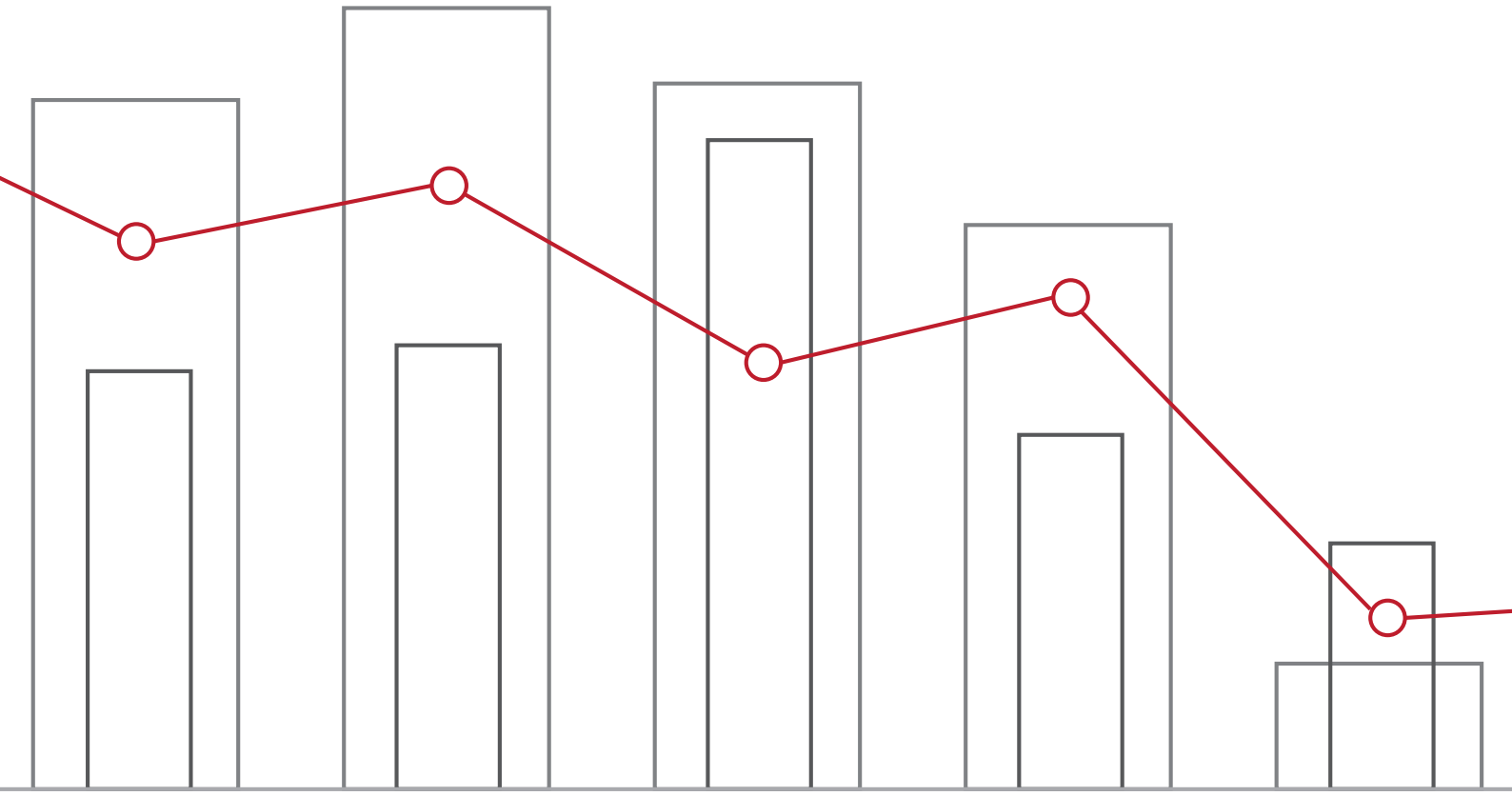
Smart Energy & Power Quality Solutions



ENERGY MONITORING FOR DATA CENTERS

Whitepaper Energy Monitoring

Janitza®

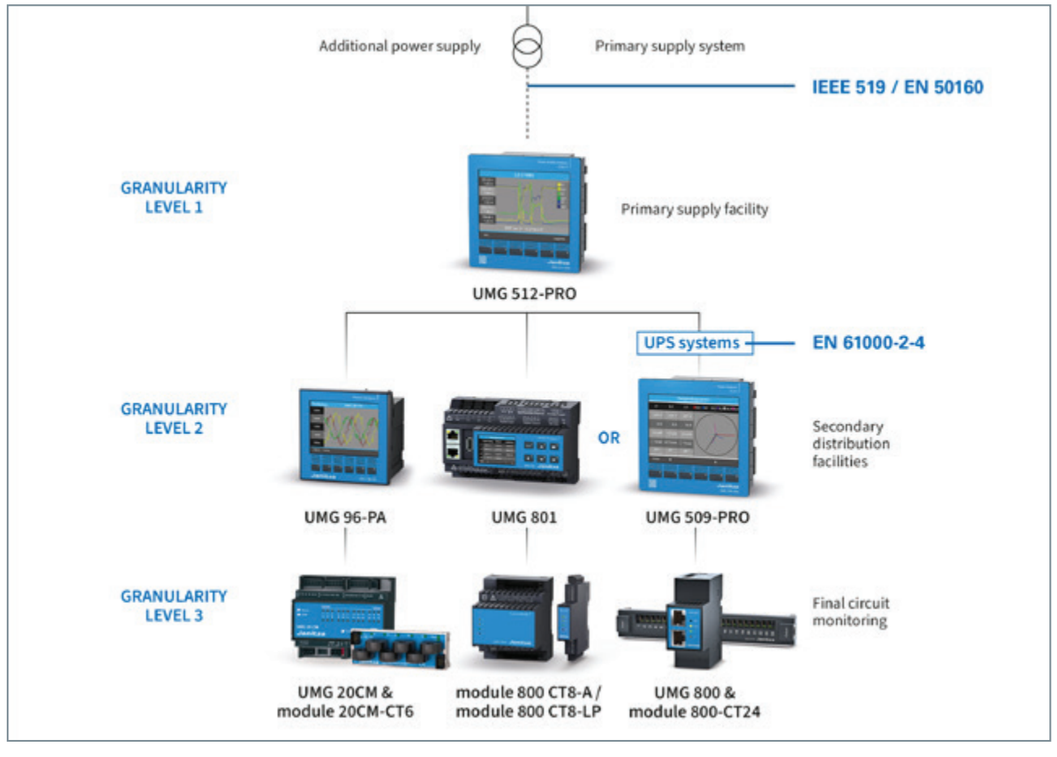
Energy data acquisition for data centers must be able to do more than just display consumption figures. In data centers, high availability is critical — and it depends entirely on a secure power supply and compliance with grid compatibility thresholds. Loads and extreme values must be continuously monitored to ensure long-term high availability. The following article outlines the requirements for suitable energy management software with data-integrated online measurement systems, using Janitza measurement devices and software solutions.

The European standard for data centers, DIN EN 50600-2-2:2019 (VDE 0801-600-2-2:2019), defines the requirements for measurement technology and the compatibility levels for power quality that must be maintained. In the context of enabling energy efficiency, the standard outlines three levels of granularity. These define the measurement points at which power consumption and power quality of the electrical systems and infrastructure within the data center must be recorded.

Granularity Level 1
describes the use of measuring devices at primary and secondary power supplies as well as at the output of uninterruptible power supply (UPS) systems.

Granularity Level 2
refers to the use of measuring devices at intermediate points between the primary distribution systems and the outputs of the final secondary distribution systems.

Granularity Level 3
covers the use of measuring devices at protected sockets supplied by tertiary distribution systems.



Janitza offers the right measurement technology for all levels of granularity

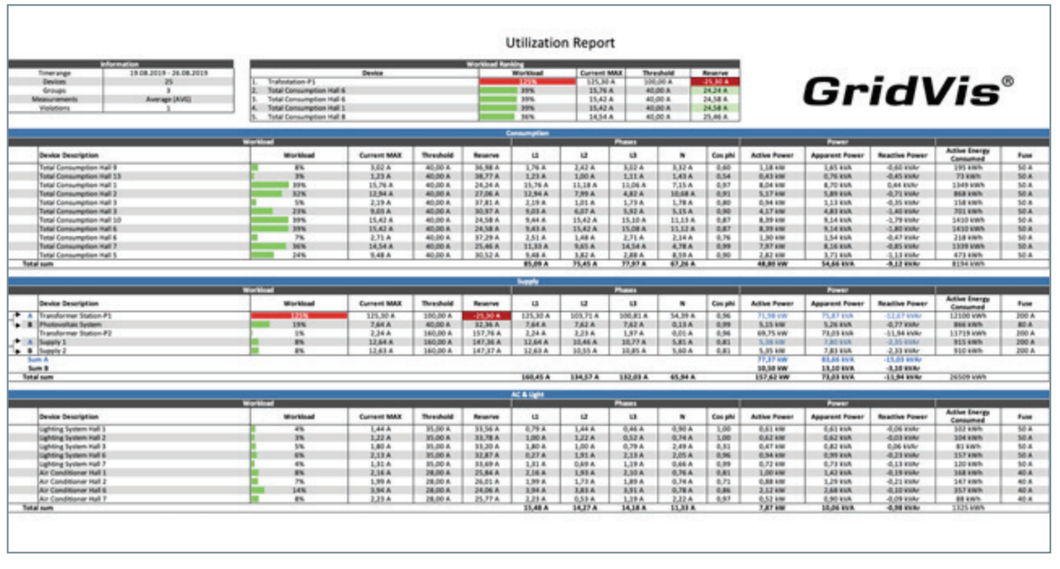
Measurement technology for granularity level 1
There is essentially an incoming goods inspection of the energy from the power utility. As a rule, energy consumption must be measured on all connected phases with measurement class 0.5 for active energy and active power. The current transformers must at least comply with EN 61869-2:2012, class 0.5 and the measuring devices must meet the requirements of EN 62053 class 0.5S or EN 61557-12:2008 class 0.5; but better class 0.2 in combination with class A measuring devices such as the UMG 512-PRO.

Measurement technology for granularity level 2
Voltage, current and power factor provide information about power consumption and voltage quality. In addition, the current on the neutral conductor in three-phase circuits should be calculated or measured. Neutral conductor measurements are particularly necessary for non-linear loads, as the neutral conductor is usually not protected by a fuse. A high number of single-phase loads and third harmonics can, in extreme cases, lead to overheating of the neutral conductor. This can result in complete failure in the form of a neutral point shift (overvoltage) at the connected loads.

Energy consumption must be measured on all phases with measurement class 1 for active energy and active power. The current transformers must comply at least with EN 61869-2:2012, class 1 and the measuring devices must meet the requirements of EN 62053 or EN 61557-12 class 1. Suitable measuring devices include, for example, UMG 509-PRO, UMG 96RM-E or UMG 96PA MID+.

In the range of granularity levels 1–2, the total energy consumption of the data center and IT is measured, and key figures such as PUE (Power Usage Effectiveness) and EUE (Energy Usage Effectiveness) are calculated. The PUE value is the ratio of the total energy consumed in the data center to the energy consumed by the computing equipment. This determines the efficiency of energy use over a certain period of time. Other key values are power losses and system utilization. In data centers with water cooling, the WUE (Water Usage Effectiveness) must also be taken into account. These and many other values can be easily analyzed using the ISO 50001/50006-certified GridVis® power grid monitoring software.

Requirements to the measurement technology for granularity level 3
The standard states: “Where protected socket-outlets supplied by tertiary distribution equipment are installed in groups (...) serving different types of loads (e.g. IT, fuse or environmental control), granularity level 3 must enable separate measurement of each type of load. The distribution equipment must be selected in such a way that the output voltage, output current and power factor can be measured on all phases at the protected socket outlets. The devices used must comply with the following accuracy classes for the measured parameters: current transformers according to EN 61869-2:2012, class 2, and measuring devices according to EN 62053-21, class 2. However, higher classes are recommended.” Suitable measuring devices for this purpose include UMG 20CM or UMG 801 or UMG 800, each in combination with extension modules.



Utilisation report with backup values

Further comments on the granularity levels
Capacity reports are important across all granularity levels, which summarize all the required measurement parameters from the feed-in to the final circuit. Maximum effective values must also be evaluated to represent the actual maximum load. A report generated with GridVis® shows the evaluation of all selected measuring points in tabular form as a percentage and as absolute values over a freely selectable period. Threshold violations, excessive utilization and reserves can be identified at a glance. If energy is billed in kWh, so-called MID meters (Measuring Instruments Directive) must be used. These meters must have at least accuracy class 1 for active energy and class 2 for reactive energy. Suitable options include the UMG 96-PA MID+ or other MID-certified energy meters.

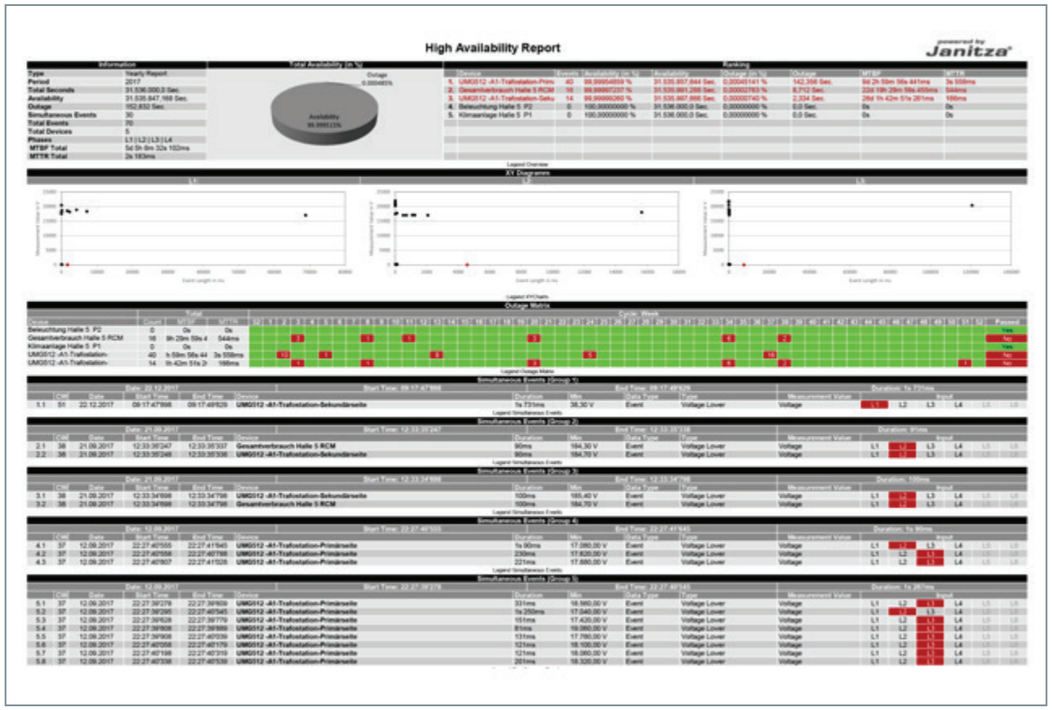
Power quality requirements according to EN 50600-2-2 part 6.2.3.1 and 6.2.5.4
The power quality of the primary and secondary supplies must comply with EN 50160. The voltage quality of the additional supply not provided by the utility company must comply with EN 61000-2-4:2002, class 2. The power quality between the UPS and the protected sockets must comply with EN 61000-2-4:2002 class 1.

How power quality is defined is described in EN 61000-2-4 1-3. The required standards for power quality specify mains compatibility levels which describe the quality of the voltage provided. If the levels are exceeded, failures may occur for which the supplier is not liable. EN 61000-2-4 applies up to 36 kV and is to be used with class 1–2 for the entire data center.

High availability reports
An EN 61000-2-4 report provides information on power quality but is not ideally suited for evaluating electrical availability. For this purpose, dedicated high-availability reports are required, which can be generated with GridVis®. These reports shows whether the power supply was responsible for the failure or whether there was another cause. By aligning events in a time-synchronized manner, causes and effects can be clearly identified. For example, conclusions can be drawn about selectivity or the start time. Statistics and the affected phase conductors are also displayed. This makes it possible to see on which phase the short circuit or earth fault occurred.

Residual current measurements according to EN 50600-2-2 part 6.5.1
In addition to energy transparency and power quality, residual current monitoring (RCM) also plays an important role. A measurement concept for granularity level 1-2 must also be provided for this. Ideally with measuring devices that have six current inputs and can record and monitor both operating currents and residual currents, such as the UMG 96RM-E or the UMG 96-PA MID+. These devices help reduce system costs and simplify threshold setting. For granularity level 3, multi-channel residual current monitoring devices are recommended, which monitor residual currents up to the branch circuit, such as the UMG 20CM or the UMG RCM202-AB.
The topic of RCM is beyond the scope of this article. Further information can be found in the white paper on “Residual current monitoring”, available upon request from Janitza.

CONCLUSION
A powerful energy monitoring system is becoming increasingly important to ensure the safe operation and evaluation of complex power supply systems and to meet the requirements of DIN EN 50600 part 8. Extreme values can only be assessed using high sampling rates and data storage capacities, which traditional building management system cannot provide. The necessary products and requirements for the collection, storage, and analysis of data are defined in EN 62974-1. A certified Energy Management System (EnMS) in accordance with ISO 50001/50006 offers an ideal foundation for meeting these standards.



A high availability report generated with GridVis® software

ABOUT JANITZA

Janitza develops comprehensive energy measurement solutions that ensure transparent energy flows and monitor power quality. The global company, headquartered in Germany, provides individual solutions to meet specific customer requirements across a wide range of industries, including data centers, manufacturing, buildings & infrastructure, utilities, and renewable energy.

PRODUCT RANGE

Janitza's portfolio includes innovative measuring devices and the perfectly integrated Power Grid Monitoring Software GridVis®, complemented by high-quality components. Customers worldwide benefit from solutions in energy data management, power quality monitoring, and residual current monitoring, all within a unified system environment – Made in Germany.

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