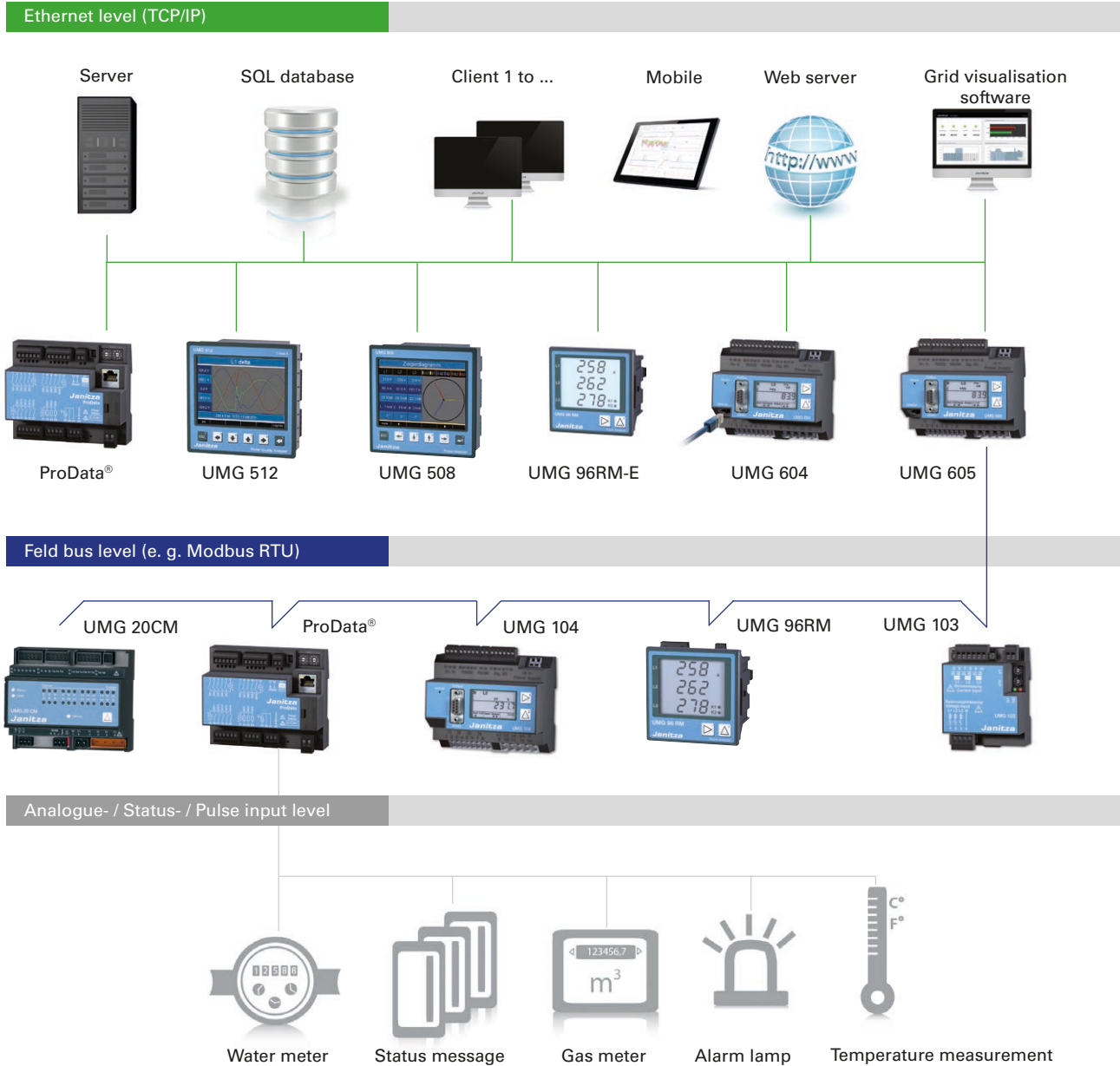




## Application report: AN1017/V01

Whitepaper Flicker – What exactly is flicker?

# Janitza electronics®



UMG 508 / UMG 604 = Janitza power analyser

UMG 512 / UMG 605 = Janitza power quality analyser

UMG 96RM / UMG 96RM-E / UMG 103 / UMG 104 = Janitza multifunctional measurement devices for energy measurement technology

UMG 20CM = Janitza Residual current monitoring (RCM) and energy data acquisition



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## What exactly is flicker?

*The term „flicker“ means a subjective perception of a change to light intensities, for example lamps flickering. This is normally caused by periodical, fluctuating voltage changes, i.e. small voltage dips and swells that occur frequently as opposed to an actual voltage dip that is normally a one-time event (for more information, see Janitza electronics GmbH white paper on voltage dips).*

The voltage dips that cause the flickers can be captured using measurement technology via an algorithm that is written in accordance with DIN EN 61000-4-15. Flicker is caused by high load variations that occur quickly e.g. welding machines, arc furnaces, photovoltaic systems, wind turbines, magnetic resonance tomography, rock crusher etc.

There are difficulties due to the fact that personal perception of the flicker depends on many subjective conditions such as vision, irritability of the retina in the human eye, the general lighting conditions that are present and much more.

The perception threshold is very different for each person and can therefore only be determined statistically. Therefore, a flicker level of 1 is that where the perception threshold applies to 50 % of the people tested. The

perception threshold changes as the frequency of the voltage change that is to be observed changes. It is at its lowest at 8.8Hz. From this, it becomes clear that the flicker is a measurement value that must be measured throughout a specific frequency spectrum.

### **But why measure flickers?**

Very high flicker levels cause an increase in maintenance effort and faults on electronic equipment, up to and including destruction (mains power supplies).

Moreover, the flicker causes employees to become tired more quickly, to become irritable and to lose concentration, particularly at workstations in office buildings. The continual adjustment of the optic nerve to the changing lighting conditions causes tiredness quickly

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and finally transfers to the person's overall sensitivity. Therefore, the power quality standard EN 50160 sets out threshold values which must be adhered to, in order to help prevent the negative effects of the flicker.

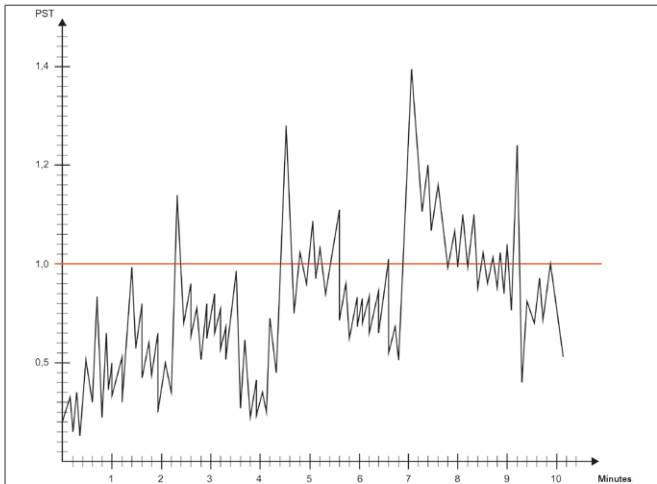


Image 1: Development over time of short-term flicker (PST)

### Flicker measurement

Since the flicker manifests itself in very quick and small voltage variations, it can only be captured using very high quality measurement instrumentation. This is described in DIN EN 61000-4-15. The instantaneous value of the flicker is of less interest here, as longer-term effects are to be considered. Therefore, the short term flicker PST and long term flicker PLT values have been defined. These are mean values taken over 10 or 120 minutes.



Image 2: Practical example for flicker: Gravel quarry

The UMG 512, UMG 511 and UMG 605 measurement devices from the Janitza electronics GmbH product range measure all three values and therefore comply with the DIN EN 61000-2-4 standard.

However, due to the empirical nature of the flicker (see above), this is not a simple, linear measured value such as the voltage. A flicker meter must therefore capture the empirically-determined test level of square wave signals and sinusoidal voltage variations for certain frequencies correctly in accordance with the specified accuracy, in order to be able to be separated into the appropriate flicker meter classes. The UMG 512 and UMG 511 are in class F1 and the UMG 605 is in class F3 for flicker meters.

However, in order to receive meaningful values, the values obtained in PST and PLT must be „graded“. Since these are mean values that were obtained at different frequencies, a higher level for one single frequency would otherwise carry very little weight; i.e. the values must be weighted. As a result, higher values are considered more in the final value than a very small level.

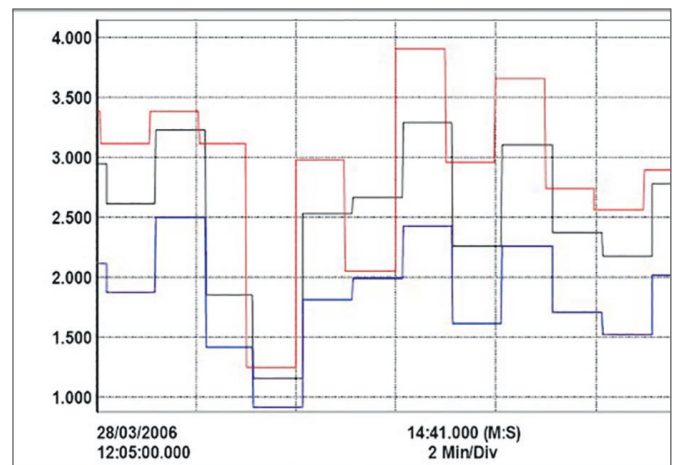


Image 3: Development of flicker

The power quality standard EN 50160 standardizes a permitted flicker level of 1 in the mains power supply and therefore provides a guideline for its measurement. If the standard is violated continuously, measures must be taken to stabilize the voltage (higher transformer powers, dynamic compensation systems, UPS, etc.). For manufacturers of non-linear electrical loads, the flicker emission is standardised to  $PST=1$  and  $PLT=0.65$  (EN 61000-3-2). The most simple method for evaluating the value is the = 1 p.u. curve. P.u. stands for the „unit of

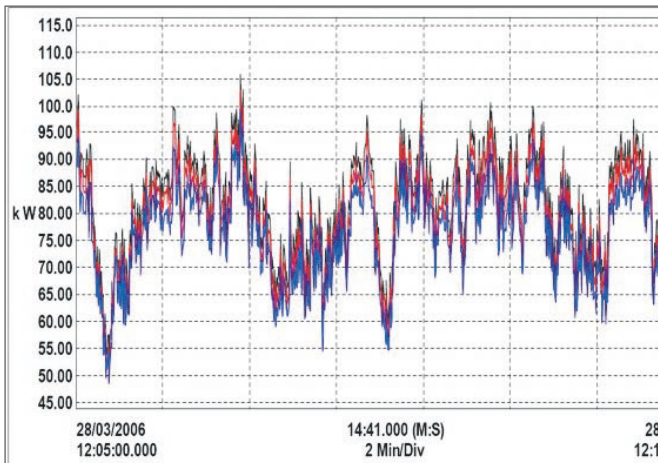


Image 4: Effective power development dependent on the volume and consistency of material

perception” and is the maximum tolerance level for the interference sensitivity of the human eye with regards to its perception of light fluctuations. It is also not permissible to exceed the value = 1 p.u. in combination with all interferers.

## Company profile

### Janitza electronics GmbH®

Janitza electronics GmbH is a German company and has been active for 50 years in the manufacturing of systems for efficient power application, energy measurement and cost savings. As a globally renowned manufacturer of network monitoring and energy management systems, digital integrated measurement devices, power factor controllers and compensation systems, the company stands for the highest quality standards and innovations. Products are manufactured according to leading-edge expertise with state-of-the-art production technology. At Janitza, quality management is an ongoing managerial task (e.g. ISO 9001). Comprehensive know-how, competent consultancy and concept generation, right through to the commissioning of tailored solutions, ensure fulfilment of customer wishes and requirements.

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It is to share the broad application know-how of Janitza electronics GmbH® and its experts, which was established with partners from the PQM, PM and PQS over a long-term period around the world.

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