

uMETER

- Patented multi-window technology for dynamic frequency and ROCOF measurement.
- Simultaneous evaluation of multiple measurement windows (1, 5, 10, 25, 50 cycles).
- High-precision measurement including uncertainty values and TRF¹.
- Reliable measurement results even during transient grid events.
- Up to 5–10× faster response compared to conventional measurement methods.
- Ideal for modern power grids, BESS, PV, inverter and FACTS applications.
- 24/7 waveform and RMS recording for in-depth offline analysis.



General Product Information

The uMETER is a highly dynamic precision measuring instrument for the continuous, real-time measurement of grid frequency and ROCOF (Rate of Change of Frequency). It has been specially developed for electrical energy systems characterised by a high proportion of power electronic components, renewable energy generators and battery storage systems.

Unlike conventional measurement methods, the uMETER analyses several measurement windows in parallel, thereby ensuring both fast response times and high measurement accuracy. In addition, uncertainty values are provided, enabling a well-founded evaluation of the measurement data. This makes the uMETER ideally suited for use in control, protection and grid stabilisation applications such as Fast Frequency Response, virtual inertia and frequency-dependent grid protection functions.

¹ "True ROCOF Fit", defined as the "coefficient of determination" (R^2) of the linear regression of the ROCOF magnitude as a function of time. Its value is between 0 and 1, and the closer the coefficient is to 1, the more realistic the ROCOF is (i.e. the closer the frequency slope is to a constant value).

Use Cases

The following use cases describe typical application scenarios, including the respective business benefits:

- **FFR – Fast Frequency Response**

Very rapid response to frequency deviations to stabilise the grid.

Business benefit: Additional revenue from FFR services and a reduced risk of grid instability..

- **FCR – Frequency Containment Reserve**

Support for primary control energy through precise and robust frequency measurement.

Business benefit: Ensured compliance with grid codes and optimised remuneration from control energy markets.

- **LFSM – Limited Frequency Sensitive Mode**

Reliable operation of generation plants and storage facilities in frequency-dependent operating modes. Business benefit: Increased plant availability by avoiding unnecessary outages.

- **Virtual Inertia**

Provision of inertia-like behavior in grids with a high share of power-electronic generation.

Business Benefit: Increased system stability and enablement of new grid-supporting business models.

- **Anti-Islanding**

Reliable detection of islanded grid conditions using high-resolution frequency and ROCOF analysis.

Business Benefit: Increased safety for personnel and equipment and reduced liability risks.

- **Frequency- & ROCOF-Shedding**

Protection of the grid by selective disconnection of loads or generation during critical frequency events.

Business Benefit: Protection of critical infrastructure and minimization of follow-up costs caused by grid outages.

- **Sub-Synchronous Oscillations (SSO) Analysis and Damping**

Real-time detection of SSO and their beating frequency and amplitude up to 25 Hz. Self-tuning algorithms enable granular and distributed damping.

Business Benefit: Preemptive detection of instability events and adaptive damping.

- **Forensic studies**

Conduct in-depth system analysis using continuous, high-resolution waveform and RMS magnitude recording. Enhanced analysis of harmonics and high-frequency components.

Business benefit: detailed studies for claims assessment and root cause analysis.

- **SCADA enhanced functionalities**

All the measured and calculated values are available to any SCADA for realtime control of frequency, ROCOF, oscillations and RMS magnitudes.

Business benefit: online control by control-room operators.

Technical Specifications

Measurement principle	Patented multi-window analysis
Measurement windows	1 / 5 / 10 / 25 / 50 cycles (simultaneous)
Reporting rate	200 fps (every 5 ms)
Measured quantities	Frequency, ROCOF, uncertainty, TRF
Application areas	Grids, BESS, PV, inverter, FACTS, SCADA
Response time	Up to 5–10× faster than conventional systems
Maximum frequency error	Between 47.5 and 52.5 Hz: ▪ 1 cycle → < 2.3 mHz ▪ 5 cycle → < 1.0 mHz ▪ 10 cycle → < 0.7 mHz ▪ 50 cycle → < 0.3 mHz
Full waveform recording	45 kS/s, 16 bit
Supply voltage	110÷230 V AC
Form factor	19" rack, 2U