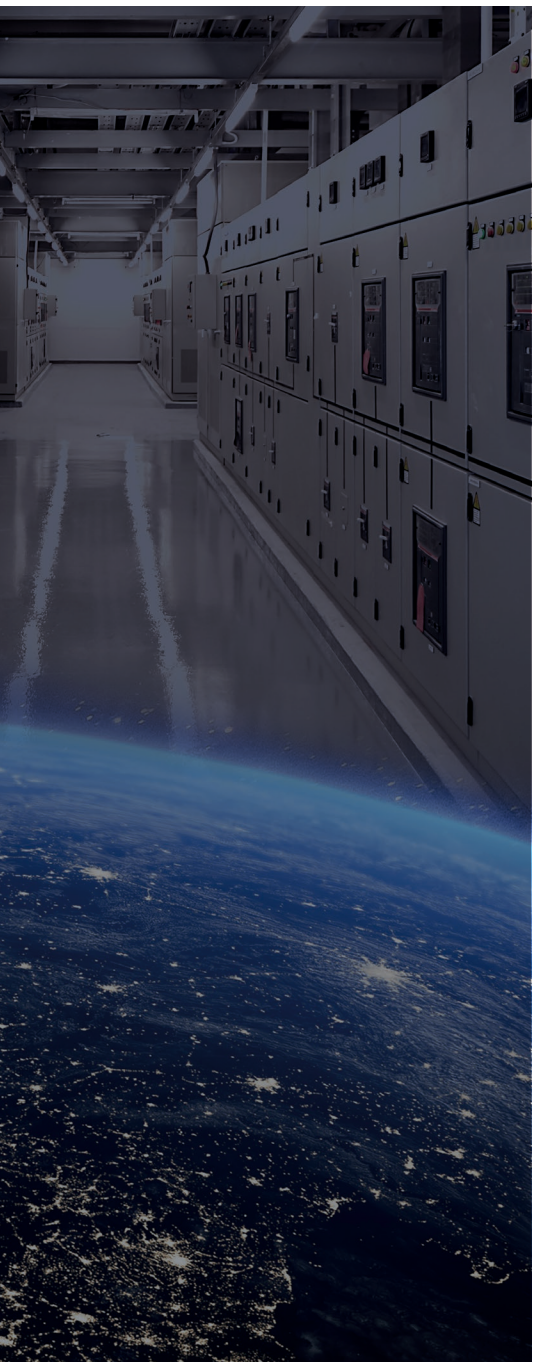
CAMILLE BAUER

CENTRAL ENERGY FLOW MONITORING

WIRELESS ACQUISITION AND ANALYSIS OF ENERGY FLOWS IN DISTRIBUTION SYSTEMS BY RADIO



PME: THE RADIO SOLUTION

DIGITIZATION OF ELECTRICITY MADE EASY

Wireless acquisition of energy flows (up to 100 energy flows and currents)

The PME (Power-Monitor-Energy) option extends the functionality of a base unit from the SINEAX® AM, SINEAX® DM5000, CENTRAX® CU or LINAX® PQ series into an actual energy center by collecting additional information about the distribution of the energy or the consumption of individual loads. This scalable solution makes the temporal power flows transparent and thus creates the basis for comprehensive energy management. It is typically used where the energy is distributed, for example in transformer stations or the supply of industrial plants or building complexes. Radio modules based on Rogowski coils are used as sensors, powered by batteries or via USB-C.

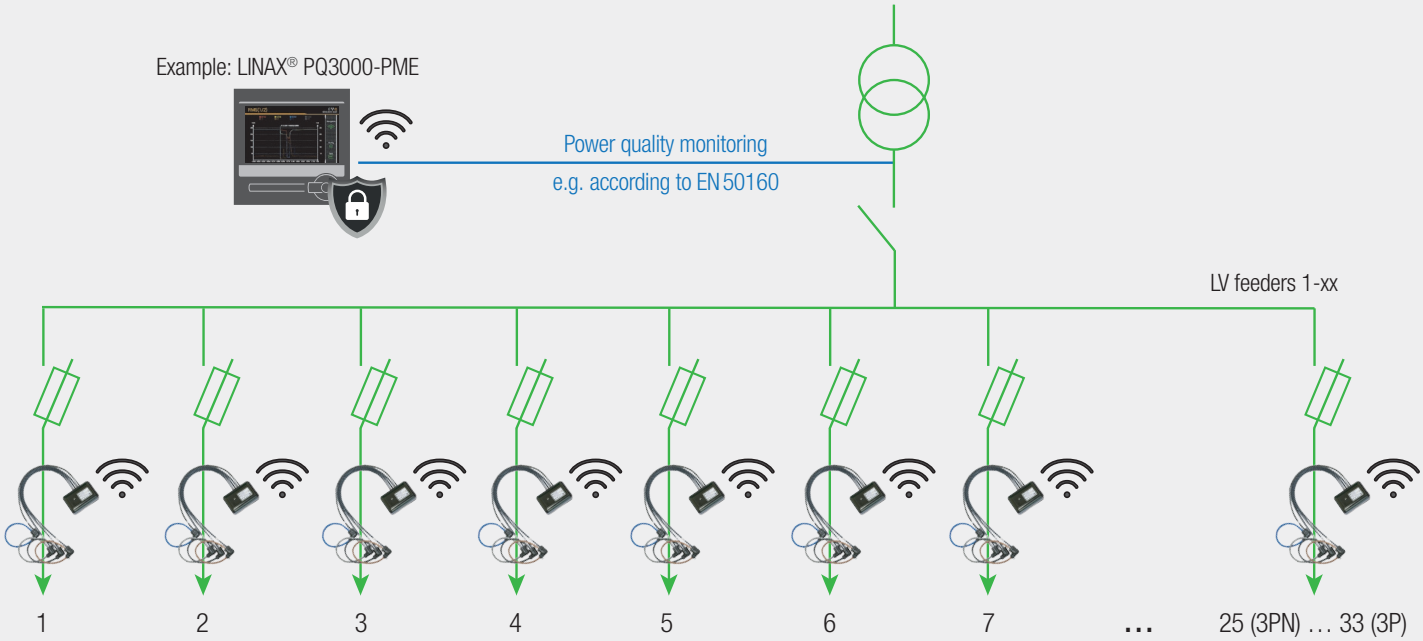
Up to 100 currents, divided between the PME sensors for 3 or 4 conductors each, can be reliably recorded (AES-128 encryption) without any additional wiring effort. Once a second, not only the current current values are determined from this, but also, thanks to synchronization with the voltage measurement of the base unit, comprehensive performance data and average loads, load profile data and energy meter values are derived, which are also stored as time series in the device.

The data determined with the help of the wireless sensors can be accessed centrally via the communication interface(s) of the base unit. In addition, an automated data export of the averaged data via CSV files to an SFTP server is also supported.

Anti-collision detection allows up to 5 PME systems, with up to **500 current channels**, can be used at the same location.

EXEMPLARY APPLICATION

In the case shown below, the power quality is monitored on the secondary side of the transformer in a transformer station. The sub-distribution of the energy is measured using PME sensors. This way, it can be determined when how much current flows through the cables in which feeder, what the current active and reactive power flow is and in which direction the energy is actually flowing in the individual feeders. By averaging and aggregating these data, the time loads of the individual phases and the energy balance per outlet also become transparent. In this way, energy consumption can be optimized and peak loads avoided.



Base unit LINAX® PQ3000 with Power Monitoring Energy (PME) option and PME sensors for monitoring up to 100 currents via radio

Additionally available measurement data per measurement system (3- or 4-wire)

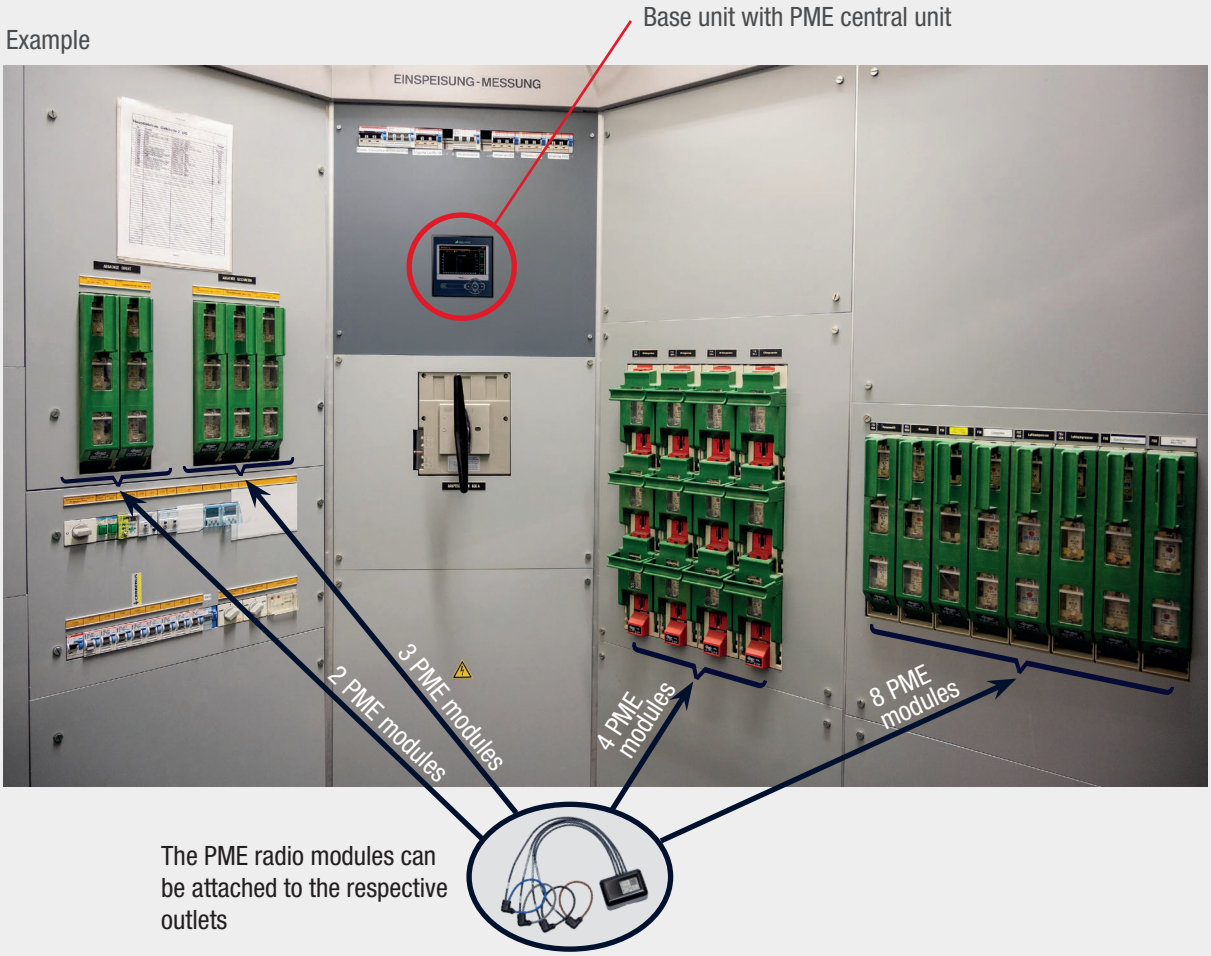
MEASURED VALUE GROUP	APPLICATION
INSTANTANEOUS VALUES • I (per phase) • P, Q, Q(H1), S (per phase and total) • PF und cosφ (per phase and total) • Temperature (in sensor junction box) • Battery charge level	» Monitoring the conductors current load » Reactive power compensation » Checking a given power factor » Ambient temperature in the sensor area » Sensor management
HARMONICS • THD I and Total Demand Distortion TDD I (per phase) • Waveform (100/120 samples per cycle)	» Evaluation of the thermal load of equipment » Possible conclusions about the connected consumers
ENERGY BALANCE • Energy meters active / reactive energy, import / export • Mean values P, Q, Q(H1), S, PF and cosφ (per phase and total) • Mean values I, THD I and TDD I (per phase)	» Preparation of (internal) energy bills » Determination of energy consumption over time (load profile) for energy management or energy efficiency reviews » Monitoring of average conductor load (heating)

INSTALLATION AND OPERATING CONDITIONS

The base unit and the wireless sensors are typically installed in a control or distribution cabinet, normally on the cables of the incoming or outgoing lines. The distance between the base unit and the wireless sensor is designed for a distance of 10 m when delivered. This way, the radio level can be kept low and the sensors time in operation can be kept high (typically up to 10 years) before the batteries needs to be changed.

During commissioning, the sensors are linked to the base unit, supported by the option of sensor registration via QR code. Adaptation to the local conditions is possible by adjusting the transmission power and by setting the frequency of the sensor query. The aim is to achieve reliable communication with the longest possible battery life.

Example



Communication

- Radio frequency 2.4 GHz, distance of 10 m when delivered
- Fast commissioning by sensor registration via QR code
- Supply using batteries **(lifetime up to 10 years)** or USB-C
- Access via the measuring device (PME center)

Sensor installation

- Open sensor housing and insert batteries or power supply via USB-C
- Register the sensors via website of the base unit by scanning the QR code on the sensors nameplate or by entering the install code
- Assign sensor to a measurement system
- Assign a name and a system type to the measurement system

Sensor registration via QR code

THE PME SYSTEM IS AVAILABLE WITH THE FOLLOWING DEVICES

The PME option is an extension to the devices of the series SINEAX® AM, SINEAX® DM5000, CENTRAX® CU und LINAX® PQ, whereby the PME system always provides the same additional functionality independent of the base unit. The choice of the base unit allows the user to adapt the measurement solution to his individual needs. For example, a base unit from the PQ series can be selected for a compliance assessment of the power quality. A CU device makes sense if pre-processing of the data or on-site control is required or if additional measuring devices are to be connected via Modbus. Even an AMx000, as the simplest version of the base unit, can comprehensively monitor the status of a feeder, record voltage events according to the PQ standard and detect fault currents.

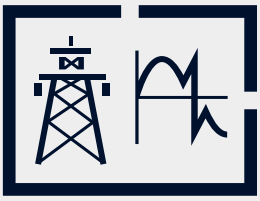
Measuring and Displaying

SINEAX® AM1000

SINEAX® AM/2000/AM3000

SINEAX® DM5000

Power Quality

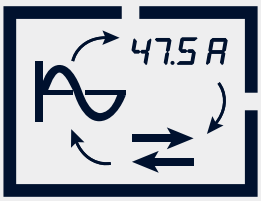


LINAX® PQ1000

LINAX® PQ5000

LINAX® PQ3000

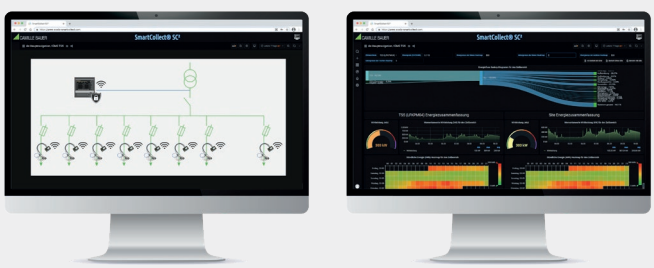
Monitoring and Controlling



CENTRAX® CU3000

CENTRAX® CU5000

And the right monitoring system to go with it



The ideal combination with SMARTCOLLECT® SC²

DATA EXPORT

With all base units, measured value information can not only be queried directly, but also saved in the form of files in the device and/or sent to an SFTP server using a data export scheduler. The same possibility also exists for the mean values data of the PME option.

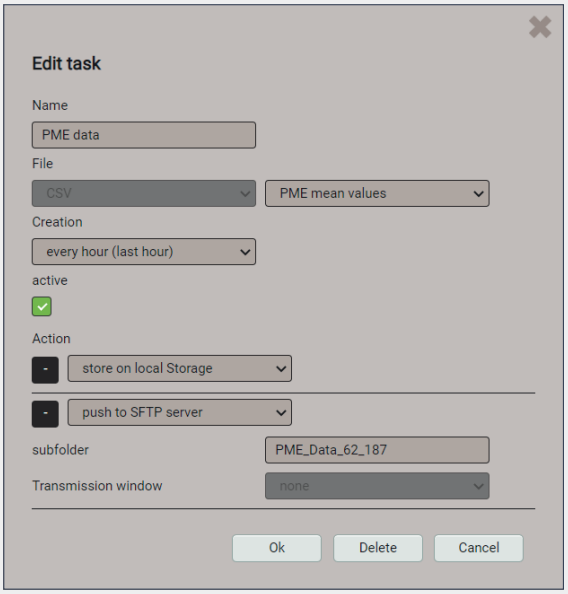
- CSV files: Providing mean value progressions, load profiles or meter readings
- PQDIF files: For PQ data (LINAX®PQ base units only)

Tasks may be prepared for the generation of files which will then run automatically and are linked to the actions of save locally and / or send to SFTP server. Data locally saved in the device may be transferred to a computer via the device website or the REST interface.

The Secure File Transfer Protocol (SFTP) facilitates the encoded transfer of files. It may also be used for the transmission of measured value information via secured network structures, e.g. via Smart Meter Gateways.

File formats

- ***CSV**: Comma Separated Value*
- ***PQDIF**: Power Quality Data Interchange Format according to IEEE 1159.3*

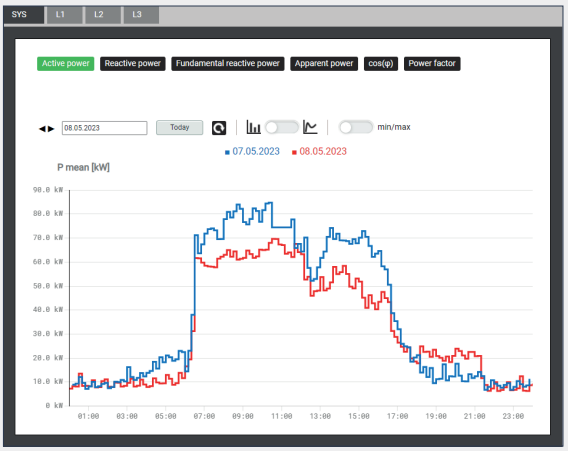


Task for saving / pushing of all data of the PME measurement systems once an hour

LOAD FLOWS

Acquisition of load profiles and power factors, short-term load peaks and meter values for each monitored phase and each of the up to 9 measuring points.

- Transparent temporal energy demand
- Analysis of transformer and line load
- Overload phases become visible



Tages-Lastgang mit Vortageswerten für einen PME-Sensor via Webseite des Basisgerätes

CYBER PROTECTION

Secure protocol for PME communication between current sensors and PME central in the base unit (Advanced Encryption Standard AES-128, standard for WLAN communication)

Do you already know about our comprehensive Cyber Security (OT) at the meter level?

Feel free to consult with us or discover for yourself at:
https://pq-as-a-service.com/en/cyber-security-solution/

TECHNICAL DATA OPTION PME

CURRENT SENSOR TYP CTR75-1000A

Number of channels	3 or 4
Max. number of sensors	25...33 (≤100 currents per PME central)
Frequency reange:	10 Hz up to 100 kHz
Maximum rated current I_N	1000 A [1)]
Max. measurable current	1.2 x I_N
Starting current	2.0 A (fundamental component)

[1)] The measurement range will be automatically set based on the rated value selected for the associated measurement system.

Sampling rate	6 kHz
Polling interval	configurable, default 1s
Transmission power	configurable, default 0 dBm
Range	10 m at transmission power 0 dBm

POWER SUPPLY

Sources	4 x battery 1.5 V AA / FR6 /L91 (not included in the delivery) or USB-C (5 V DC)
Battery life time	appr. 10 years at transmission power 0 dBm using „Energizer Ultimate Lithium AA“

TYPES OF CONNECTION

4-wire unbalanced or
3-wire unbalanced or
split phase (2-phase system)

BASIC UNCERTAINTY

Current	±0.5 %
Active / reactive energy	Class 3.0 (typical)

RADIO COMMUNICATION

Frequency	2.4 GHz
Security	Advanced Encryption Standard AES-128
Number of PME systems	Up to 5 at the same location

ENVIRONMENTAL CONDITIONS, GENERAL INFORMATION

Operating temperature	–10 up to 15 up to 30 up to +55 °C
Storage temperature	–25 up to +70 °C
Temperature influence	0.5 x basic uncertainty (typical) per 10 K
Long-term drift	0.5 x basic uncertainty per year
Relative air humidity	<95 % without condensation
Operating altitude	≤2000 m above NN

Only to be used in buildings!

MECHANICAL PROPERTIES

Conductor diameter	≤75 mm
Sensor cable	Ø 6 mm

SAFETY

Current inputs are galvanically isolated from each other.

Protection class	II (protective insulation, voltage inputs via protective impedance)
Pollution degree	2
Protection	IP42 (junction box) IP67 (Rogowski coils)
Measurement category	1000 V CAT III, 600 V CAT IV

GMC INSTRUMENTS

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