

## Portable PMU devices

- light, handheld PMU units (1.45 lb without accessories)
- GPS module for time synchronization
- GPRS modem (EDGE/UMTS on demand) for wireless transmission of measurements
- rechargeable backup battery for 4h of autonomy
- integrated flash memory for buffering measured data during more than 2h of communication down time
- LCD display with a detailed GUI interface for on-site configuration, diagnostics and metering
- supports 50/60Hz grid frequency and 1W/3W/4W direct and indirect current/voltage connection

## Wamster server

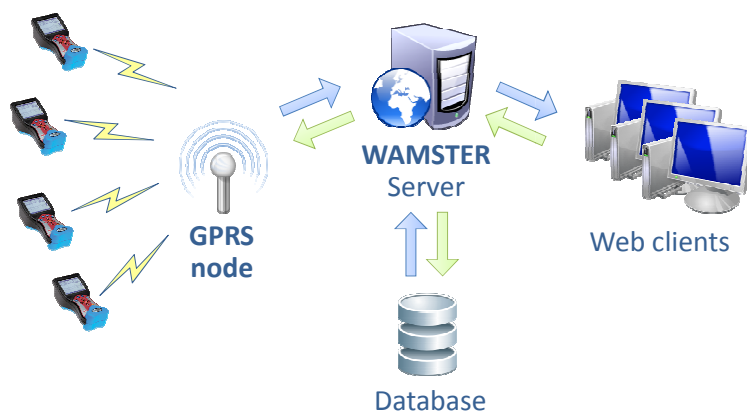
- cloud database with 24/7 availability lowers IT costs
- accessible from all over the world
- web interface for data analysis, comparison, download and reporting
- maximum cross-browser compatibility (no plugins, no flash needed)
- multiple configurable user accounts
- custom triggering and event detection

WAMSTER system integrates portable, plug-and-play PMU devices with a reliable server solution for gathering, storing and displaying phasor data.

## How does Wamster work?

Portable PMU device starts measuring synchrophasors as soon as it is powered on. During the GPRS initialization phase, phasor data is saved to internal flash memory. Next, connection is established to the Wamster server, and data transmission begins. As soon

as the link has been established, server requests any measured frames from the instrument's memory to ensure no data is lost. Measured data is processed and immediately available online, through the web interface.



Whenever there is a drop in connection signal quality, server may temporarily lower the transmission speed, and request any missing phasor frames when appropriate. In case of a blackout, both the device and the modem

remain operational through the installed backup battery. If the modem is unable to connect to the network for any reason, data is still saved to internal flash memory in order to be collected when the link is established again.



## STER PMU development

- built on top of a proven architecture
- base for the PMU device is the handheld IEC 61000-4-30 class A/S power quality analyzer developed by Studio Elektronike Rijeka for Metrel d.d., Slovenia
- two 4-channel 16-bit A/D converters
- three voltage ranges: 150, 300 and 1000V
- configurable current ratios for various current clamps and transformers

## Additional features (on customer demand)

- event-driven data collection on demand: automatically triggered snapshots using user-defined thresholds or external trigger sources
- specific detailed historical analysis tools according to future clients' requests
- custom measurement and communication algorithms for specific problem solving solutions

# Key features

**1 Easy setup: less than 15 minutes from arrival on site to valid PMU data being reported on web**

For the end user, all the equipment necessary to start recording is included in the **soft carrying bag**: It takes **only a couple of minutes** to setup the wiring and signal ranges, as well as configure the SIM card settings and connect to the Internet.



Fig. 1. STER PMU with all accessories. Only a single power supply adapter is needed.

**2 Battery operated: more than 2 hours of autonomy during blackout conditions**

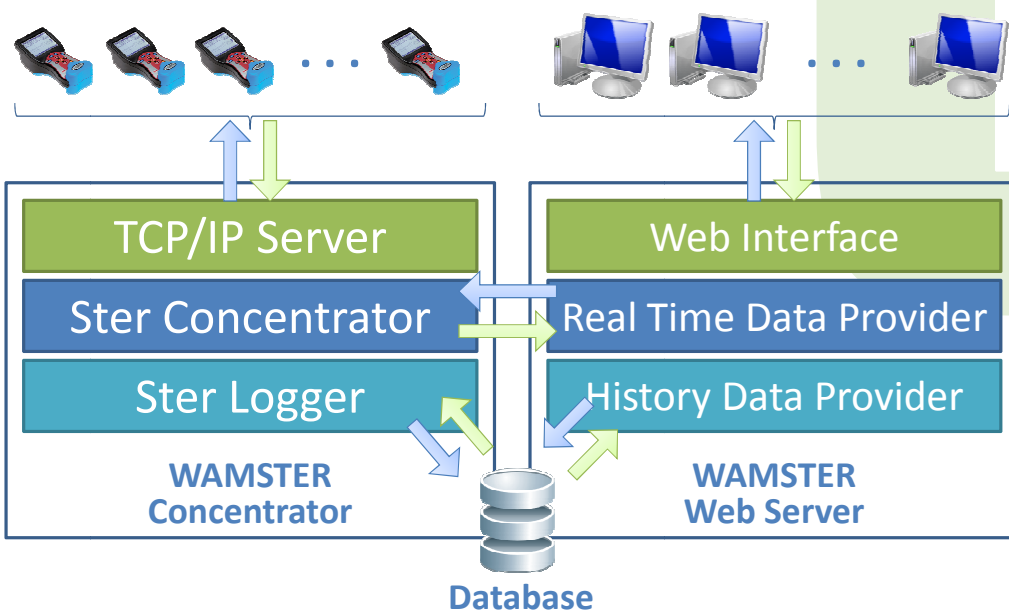
Wamster system is ideal for analyzing blackout conditions.

With its rechargeable battery and flash memory sufficient for storing **2 hours** of 4-phase synchrophasor data (at full reporting speed, 60Hz), all important measurements will be preserved.

**3 Wireless data transmission: no need for additional infrastructure**

After the device starts measuring and connects to the server, work on site is completed. Device continues to transfer all data to the server, using the provided GPRS modem.

EDGE/UMTS versions are also available on request.



view

## 4 Web interface: data is accessible from everywhere

Online web interface (with password authentication) allows quick overview of device statuses, historical views and data comparison, from anywhere. By adhering strictly to current web standards, Wamster is accessible from all modern browsers without the need for external plug-ins (Flash, Silverlight), as well as portable devices (iPhone, Android, Windows Phone).

## 5 Interoperability: data can be exported to various formats for analysis

For offline analysis, Wamster provides simple export functionality: measurements can be filtered by time and device location, and downloaded in various formats.

For integration with other systems, Wamster server can act as an IEEE 37.118 compliant source, therefore creating a bridge between the ad-hoc network and the rest of your equipment.

## 6 Customization: new features are added according to customer's requests

Each Wamster account can be tailored to individual user's preferences, and extended to provide various functionalities. Since the application is web based, all updates are visible immediately, with no deployment needed.

Using wired communication links, STER PMU units can also act as stand-alone synchrophasor data sources, independent from the Wamster server, and integrate directly into existing systems.



Fig. 3. Web browser showing the Wamster demo page.



Fig. 4. Synchronized comparison of two PMU devices, in real time

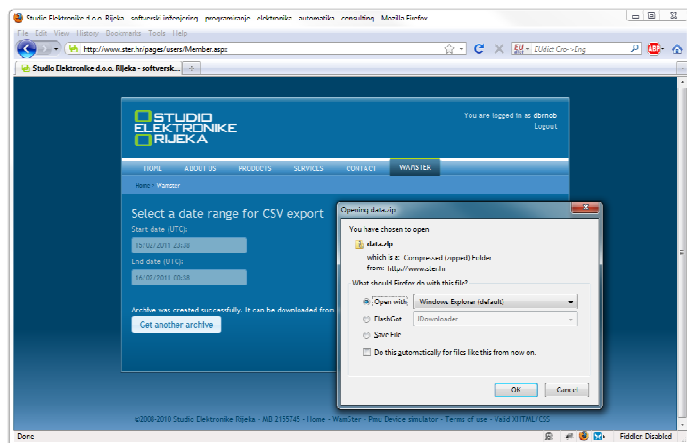


Fig. 5. Data can be exported for offline analysis



# Benefits summary

- cost effective
- no need for additional infrastructure: 24/7 available cloud service
- setting up a PMU device for measurement takes less than 15 minutes from arrival on site
- especially interesting for small R&D teams or academic research teams looking for a complete and affordable solution
- custom features can be implemented as requested and delivered instantly – web interface and firmware updating over GPRS eliminates deployment costs

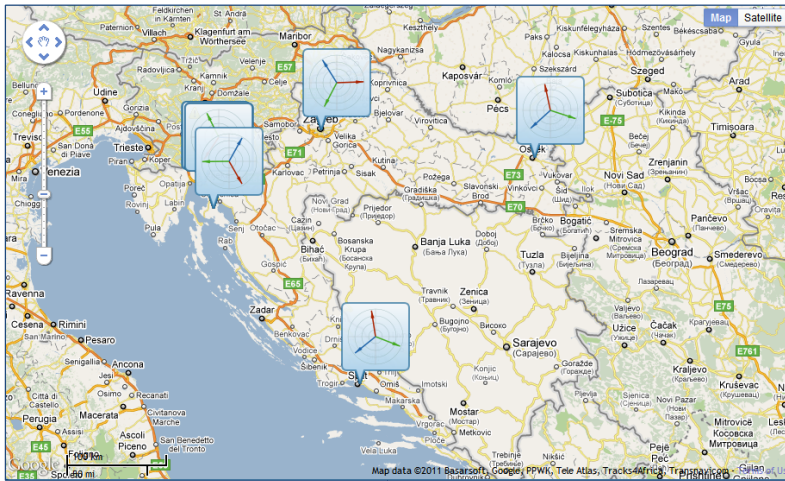


Fig. 6 WAMSTER network of PMU devices for Croatian CARWAM project (image taken from Wamster online demo page at [www.ster.hr/wamster](http://www.ster.hr/wamster))

## Ad-hoc network example: CARWAM AT LOW, MEDIUM AND HIGH VOLTAGE LEVELS

WAMSTER system and STER Portable PMU units are currently being used as the supporting technology for distributed synchrophasor measurements in CARWAM (Croatian Academic Research Wide Area Measurement) research project.

Up to February 2011, devices have been installed on four Croatian universities and

several transformer stations at low and high voltage levels.

During this research period, data from all CARWAM devices, along with several other PMU devices installed by Studio Elektronike Rijeka, will be publicly available for analysis at [www.ster.hr/wamster](http://www.ster.hr/wamster).



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## About us

We are a company specialized in developing complete technical solutions, combining software, firmware and hardware development. Our key targets are integrated power quality and measurement solutions.

We are also specialized in various fields of electrical engineering, with focus on providing quick troubleshooting and solutions to specific and most complex power-related customer problems.

Our development team has years of experience in all phases of microcontroller development, programming dedicated Windows/Web applications for data gathering and analysis, as well as design and commissioning of various industrial automation systems.



Development of WAMSTER is supported by funds from BICRO's **Proof of concept funding program**