# WAM**STER**

AD HOC PHASOR MEASUREMENT NETWORK

WAMSTER system integrates portable, plug-and-play PMU/PQ/CR devices with a reliable server solution for gathering, storing and analyzing synchrophasor data, harmonics and waveforms.
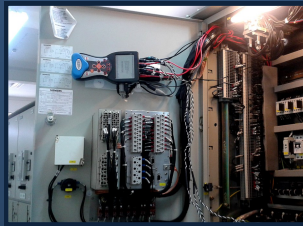

STER PMU is a handheld, portable synchrophasor, power quality meter and continuous data recorder.
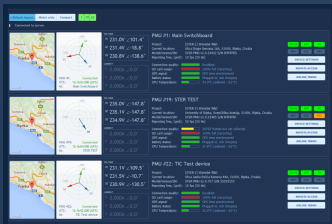

Lightweight measurement accessories are included in a soft carrying bag.
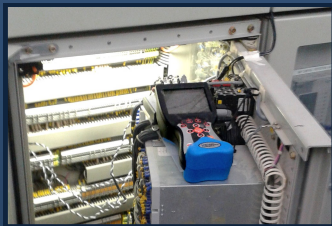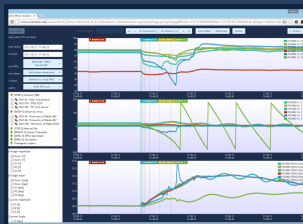

With no ventilation and no rotating parts, STER PMU fits in every cabinet.

Mounted on the door using the magnetically supported baseplate.

Web user interface is used for status monitoring, analysis of trends, oscillograms and harmonics, exporting to other formats and accessing devices remotely for configuration.

User-defined triggering allows automatic capturing of event waveforms, data presentation and e-mail/SMS alarming.

Portable, handheld PMU devices

Lightweight, handheld PMUs with rechargeable battery backup sufficient for 5h of autonomy during blackouts and 32 GB local removable SD flash memory for storing more than 4 months of synchronously reported data (8 channels @ 50/60 Hz). Upgradable to 128 GB.

GPRS/Ethernet IEEE C37.118 link

STER PMU devices use a custom, optimized protocol for GPRS communication and a standard IEEE C37.118.2 protocol for integration with third party PDC systems.

Synchrophasor flow in 30 minutes

All the equipment necessary to start wide area monitoring with a STER PMU is included in a soft carrying bag: It takes only a couple of minutes to setup and connect the device. Synchrophasor data stream is established automatically and synchrophasors are visible over the web instantaneously.

Cloud data storage as a service

Infrastructure and on-site deployment costs are significantly reduced with the cloud data storage service. Custom communication protocol extension ensures that no data is lost regardless of communication link quality.

Web interface for remote data access

Online web interface provides device status, near real-time measurements with magnitude and angle comparisons, historical data export and event-based triggering using any web enabled device, no plugins required.

Customization on request

Additional features, protocols and hardware expansions can be implemented according to customers requests. Since the application is web-based, all updates to the interface are visible immediately. Firmware upgrades can be deployed to devices remotely.

www.wamster.net

STERPMU
PORTABLE PHASOR MEASUREMENT UNIT

Technical specification

AC Voltage inputs

No.of inputs	U_1, U_2, U_3, U_{Earth}
Input range	150/300/1000V
Resolution	10/100mV
Basic accuracy	0.2% of reading
Sampling rate	64 samp./period, synchronized

AC Current inputs

No.of inputs	I_1, I_2, I_3, I_{Earth}
Input range	Voltage coded ...A/1V, ...A/0.1V
Current measuring range	0.5-6000 A (depending on clamps)
Basic accuracy	0.25% of reading
Sampling rate	64 samp./period, synchronized

Device characteristics

Comm. ports	RS232, USB, TCP/IP with GPRS/UMTS or Ethernet adapter
Display	320x200 graphic LCD with backlight
Memory	Exchangeable 32 GB micro SD card upgradeable to 128 GB
V. supply	86 - 240 VAC
Battery backup	6 x 1.2V NiMH, size AA rechargeable (more than 5 h of autonomy, supplying the external GPRS modem also)
Category	1000 V / CAT III; 600 V / CAT IV
Protection	double insulation
W x H x D	115 x 90 x 220 mm
Weight	0.65 kg

Past ad-hoc WAMSTER system installations

HP Dubrava power oscillation

↗ 4 PMUs, 2 months campaign (2012), Croatia.

↗ Problem: power generators trip due to power oscillations, local measurement attempts failed to pinpoint the cause

↗ Goals: provide new insight of system dynamics, possible interaction with nearby machines

UMEME 24/7 project

↗ 6 PMUs, 12 months campaign (2012/2013), connected to LV across Kenya

↗ Conducted by Energynautics GmbH Germany to establish baselines for new socio-economic business model

↗ Recorded national blackout and numerous network separations provided new insight into transmission system dynamics and problems

Renewables Seychelles

↗ 3 PMUs, 4 months campaign, Seychelles (2014)

↗ Conducted by Energynautics GmbH for Seychelles Public Utilities Corporation

↗ Goal: Assessment of Grid Absorption Capacity needed for ramping up renewable energy

DRCS Project

↗ 20 PMUs, 7 months campaign, UAE (2014/2015)

↗ WAM created for TRACTEBEL S.A. for Dynamic Reactive Compensation Strategy project, TRANSCO/ADWEA, UAE

↗ Goals: load modeling with 10 PMUs installed in distribution substations, transmission system behavior monitoring with 10 PMUs installed in grid substations

Event triggering

↗ comprehensive processing rules for automatic **event triggering**: thresholds for instantaneous values, relative values, rate of change, offset from low-pass, etc.

↗ **event analysis and data export**

↗ **e-mail/sms** notifications and alarm reporting

Waveforms

↗ **Continuous recording,** transfer to database on trigger or request

↗ Local storage for 4 days (upgradeable to 28 days), sampling at 64 samples/period x 8 channels

Harmonics

↗ **10-min. assessment according to IEC 61000-4-7**

IEEE C37.118 protocol

↗ STER PMU devices can communicate with IEEE C37.118 compliant PDCs

↗ Wamster server can operate as a IEEE C37.118 sink and relay data to third party C37.118 PDCs

Wamster GPRS protocol

↗ **Custom GPRS optimized** communication protocol

↗ Dynamic reporting speed adjustments, historical frame requests at different frame rates, enhanced diagnostics and full remote device control

Remote device access

↗ Improper site configuration of a PMU can be fixed remotely through the Wamster web service

STER PMU accessories

Current transformer 5A / 1V
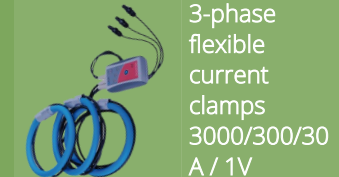
Current clamp 1000/100/5A / 1V

Current clamp 1000A/1V

Mini current clamp 100A / 1V

Mini current clamp 5A / 1V
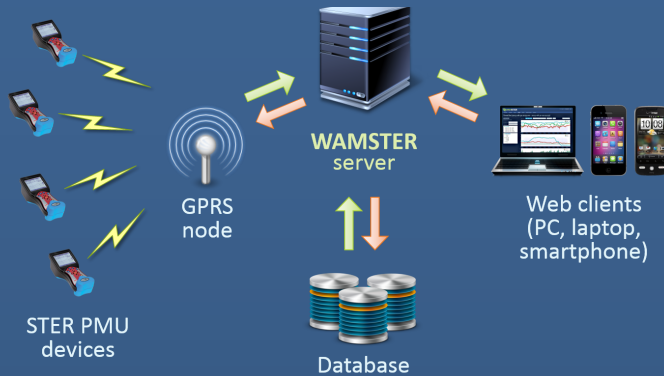
3-phase flexible current clamps 3000/300/30 A / 1V

GPRS / UMTS modem

Serial to Ethernet converter

What is Wamster?

Wamster is a **synchrophasor measurement and storage system** which includes all the equipment for creation and management of ad-hoc PMU wide-area networks.

Compared to a classic WAM system, there are no hidden equipment expenses: all the equipment necessary to start measuring and transmitting data is included with the device.

- STER PMU devices are typically deployed **within 15 minutes** after arrival on site.
- Synchrophasor data flows are **immediately available** to all team members over the web from any web-enabled device.
- Customer does not need a **dedicated PDC device / storage**, which results in lower TCO and less administration.

> *Installing the devices was, as expected, very easy.*
>
> - **Stefan Langanke, Energynautics GmbH Darmstadt,** after the installation of 6 STER PMU devices for the UMEME24/7 project in Kenya, December 2012.

- There are **no hidden installation costs**: all the equipment necessary to start measuring and transmitting data is included with the device.
- Mobile internet traffic is optimized for low-cost, speed-limited GPRS/UMTS plans (5 - 15 USD per site per month).

For articles, whitepapers and access to the Wamster live demo account, please visit www.wamster.net.

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Studio Elektronike Rijeka Ltd. (STER) is a company specialized in developing complete technical solutions, combining software, firmware and hardware development. Our key targets are integrated power quality and measurement solutions.

Our specialty lies in efficient troubleshooting of complex power-related customer problems in various fields of electrical engineering, through modifications of state-of-the-art field measurement techniques according to customer's needs.

STER 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.