

MiCOM Agile P847

Phasor Measurement Unit (PMU)

Electrical power system planners and operators continually have to deal with constraints of stability and thermal limits, voltage collapse and loop flows. With today's stretched systems, often having minimal reserve, cascading events such as the loss of generator units or transmission lines, can easily lead to severe power swings, voltage collapses, possible loss of synchronism and underfrequency load shedding. Real-time knowledge of system conditions and changes is at the heart of the battle to maintain security of supply.

The MiCOM P847 Agile is a product that can help in this battle by providing highly accurate, time-synchronised phasor measurements (synchrophasors) from anywhere in the system.

Use the phasor measurement unit (PMU) as part of a wide area monitoring and control system to assess key metrics in, or between, critical areas in the power system. High-speed transfer of key system parameters, complemented by cutting-edge visualisation tools at the control centre, enhances the system management capability.

Key Features

- Anticipate impending system failures such as angular instability by monitoring bus angles between key generating areas
- Predict impending voltage instability problems by monitoring high VAR flows in the network associated with fast declines in regional voltage magnitudes
- Invoke system wide defense plans to ensure system stability is maintained
- Improve control to prevent the risks of unnecessary islanding, damage to costly transmission equipment, unnecessary load shedding, and blackouts
- Two independently configurable IEEE C37.118 data streams
- Protocols include TCP and UDP Unicast and UDP Multicast (both commanded and spontaneous modes)
- Compliance to IEEE C37.118.1-2011 with 2014 amendment M class specification (Measurement) at data rates of 25 and 50 frames/second for 50 Hz systems and 30 and 60 frames/second for 60 Hz systems; P class (Protection) specification at data rates of 10, 25 and 50 frames/second for 50 Hz systems and 10, 12, 15, 20, 30, 60 frames/second for 60 Hz systems
- Settings for data rates of 10, 25 or 50 frames per second for 50 Hz systems and 10, 12, 15, 20, 30 or 60 frames per second for 60 Hz systems



Key Benefits

- Wide Area Monitoring
 - Accurate, time synchronized measurement of power system data
 - Synchrophasor measurement according to IEEE C37.118-2011
 - Advanced control and recording functions
 - Dual stream synchrophasors
- Redundant Communications
 - Galvanic, fiber optic and redundant IEC 61850 communications
 - Self-healing protocol, dual homing protocol and IEC 62439 PRP/HSR allowing bumpless redundancy
- Advanced Visualization
 - Phasor Terminal provides clear visualization and archiving of real-time IEEE C37.118 data
 - Improve power system security with synchrophasor analysis through **e-terraphasorpoint**

Continuous Improvement

Grid Solutions' philosophy is one of continuous improvement in our products and solutions. Our emphasis on communication in MiCOM has become a focus which secures leadership in the digital substation. To mark this phase of evolution, the P40 Agile livery is applied to the range. P40 Agile is a mark of performance and quality, proudly available from Grid Solutions, and only from Grid Solutions.



Main Features

MiCOM P847 Agile phasor measurement unit is available with a choice of three, or six voltage transformer (VT) inputs and three, six or twelve current transformer (CT) inputs.

CT inputs can be configured as independent phasors or sets of three-phase phasor measurements. When two sets of three phase VT inputs are connected, the P847 reports two sets of frequency and rate of change of frequency (df/dt) measurements.

In terms of C37.118 the P847 can behave as up to two separate PMUs with their data streams sent over the same Ethernet port.

Physical Communications

Galvanic and fibre optic Ethernet communication ports are provided for independent streaming of synchrophasor data.

Px4x devices can be enhanced with an optional redundant Ethernet board. The redundancy is managed by the market's fastest recovery time protocols: self healing protocol, dual homing protocol and IEC 62439 PRP/HSR allowing bumpless redundancy. IEC 62439 PRP/HSR and RSTP (Rapid Spanning Tree) protocol are available offering multi-vendor interoperability. The redundant Ethernet board supports demodulated IRIG-B and the SNTP protocol for time synchronisation. The redundant Ethernet board also has a watchdog relay contact to alarm in case of a failure.

IEEE C37.118.2-2011

Synchrophasor Communications

The MiCOM P847 fully supports synchrophasor data transmission according to IEEE C37.118.2 via UDP/multicast and TCP/IP. Optional setting for UDP multicast enables communication with multiple clients.

Synchrophasors to be transmitted via two IEEE C37.118.2 data streams can be selected from the available set by simply enabling or disabling them in the PMU configuration columns of the menu. Both commanded and spontaneous data transmission is supported.

P847's Options for One or Two Logical PMUs

In/Vn Rating	Logical PMU 1	Logical PMU 2	Case size	Inputs / Outputs
In=1 A : Vn=100~120 Vac	3 VT, 3 CT	-	60TE	16 / 8
In=1 A : Vn=100~120 Vac	3 VT, 3 CT	3 VT, 3 CT	60TE	16 / 8
In=1 A : Vn=100~120 Vac	3 VT, 6 CT	3 VT, 6 CT	60TE	16 / 8
In=5 A : Vn=100~120 Vac	3 VT, 3 CT	-	60TE	16 / 8
In=5 A : Vn=100~120 Vac	3 VT, 3 CT	3 VT, 3 CT	60TE	16 / 8
In=5 A : Vn=100~120 Vac	3 VT, 6 CT	3 VT, 6 CT	60TE	16 / 8
In=1 A : Vn=100~120 Vac	3 VT, 3 CT	-	80TE	24 / 24
In=1 A : Vn=100~120 Vac	3 VT, 3 CT	3 VT, 3 CT	80TE	24 / 24
In=1 A : Vn=100~120 Vac	3 VT, 6 CT	3 VT, 6 CT	80TE	24 / 24
In=5 A : Vn=100~120 Vac	3 VT, 3 CT	-	80TE	24 / 24
In=5 A : Vn=100~120 Vac	3 VT, 3 CT	3 VT, 3 CT	80TE	24 / 24
In=5 A : Vn=100~120 Vac	3 VT, 6 CT	3 VT, 6 CT	80TE	24 / 24

Software Tools

Software tools are available for the configuration, monitoring and analysis of multiple P847 PMUs. All PMU settings can be configured using S1 Agile software locally or remotely.

Dynamic Performance

Under dynamic system conditions the PMU needs to track system parameters very accurately and this is ensured with an advanced frequency tracking algorithm able to perform accurately even under off-nominal frequency and abnormal voltage and current conditions.

Programmable Scheme Logic (PSL)

Powerful graphical logic allows the user to create customised logic schemes using logic gates, latches and timers. Inputs to the PSL can include digital inputs and programmable function keys; outputs can include programmable LEDs, user alarms and IEEE C37.118 digital data.

Password Protection

Password protection may be independently applied to the front user interface, front communications port and rear communications port. Four levels of password protection are available providing access to the controls and settings respectively.

User Interface

The front panel user interface consists of an LCD display, navigation keypad, 10 programmable function keys, fixed function LEDs and 10 programmable function LEDs.

Event Records

Up to 512 time-tagged event records are stored in battery backed memory.

Disturbance Records

The oscillography can record up to 12 analogue channels and 32 digital channels at a resolution of 48 samples per cycle. Disturbance records can be extracted from the relay via the remote communications and saved in the COMTRADE format.

Language Support

The user interface and menu text are available in English, French, German and Spanish as standard. The ability to customise the menu text and alarm descriptions is also supported. Data stream naming is configurable.

Quality Built-in (QBi)

The QBi initiative has deployed a number of improvements to maximise field quality. Harsh environmental coating is applied to all circuit boards to shield them from moisture and atmospheric contamination. Transit packaging has been redesigned to ISTA standard, and the third generation of CPU processing boosts not only performance, but also reliability.

Functional Overview

- Synchronised phasor measurements
- Opto-coupled logic inputs
- Conventional output contacts
- Direct access menu via “Hotkeys”
- Multiple password access levels
- SOE: Event records
- Disturbance recorder
- PSL: Graphical Programmable Scheme Logic
- GPS time synchronisation input
- IEEE C37.118.2-2011 communications
- Two configurable output data streams
- Two independent logical PMUs
- Harsh environment protection as standard

Related Products

Phasor Terminal

Phasor measurement units (PMUs), such as the MiCOM P847, output synchronised phasor data over an Ethernet network at rates of up to 60 frames per second. This results in large amounts of data being produced that can be challenging to handle in real time when commissioning or troubleshooting an individual PMU or even a small wide area monitoring system (WAMS).

Phasor Terminal solves this problem; it is a software tool that provides clear visualisation and archiving of real time IEEE C37.118 data. Multiple PMUs can be quickly and easily configured, connected and graphically compared using an intuitive drag-and-drop interface.

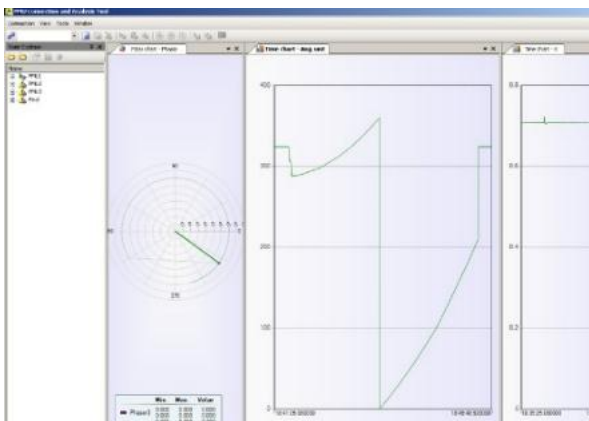


Figure 1 Phasor terminal, synchrophasor visualisation and archiving tool



e-terrphasorpoint

Grid performance can be managed by analysis of synchrophasors in **e-terrphasorpoint** for:

- Improving power system security
- Transfer constraint relief
- Power system dynamics risk assessment
- Dynamic model validation
- Tuning power system stabilisers
- Managing islanded situations and resynchronisation

Substation Phasor Data Concentrator (sPDC)

In support of the MiCOM P847 Agile PMU, a substation phasor data concentrator is available to aggregate and time-align high speed synchronised data from multiple P847s into a single data stream.

The PhasorPoint sPDC offers the following functionality:

- Receives multiple PMU streams
- Phasor stream rate conversion
- Phasor stream time alignment
- Multi-rate stream outputs
- User defined content for stream outputs (managing data provided to third parties)
- Local rolling buffer storage
- Data recovery for upstream archive (PhasorPoint Central PDC based systems only)
- Cyber-security

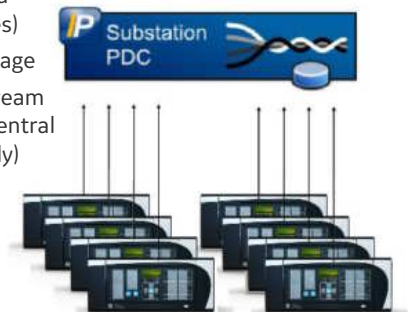


Figure 2 PhasorPoint substation phasor data concentrator

Applications

Synchronised Phasor Measurements

They can be transmitted by the MiCOM P847 Agile to a PhasorPoint phasor data concentrator (PDC) or other upstream application using a high speed communications link. The applications that can be deployed to utilise synchrophasor data include wide area monitoring, visualisation and alarming, post-event analysis, islanding detection and oscillatory stability management.

Islanding, Resynchronisation and Blackstart (IRB)

The MiCOM P847 Agile can be applied to make synchronised measurements of key variables such as voltages, currents and phase angles at strategic busses and corridors in the transmission system.

These measurements can be used by the PhasorPoint islanding, resynchronisation and blackstart (IRB) application to aid the operator before, during and after an islanding event.

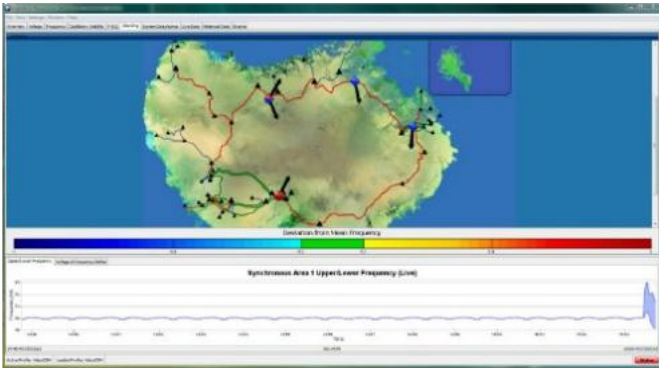


Figure 3 - PhasorPoint islanding, resynchronisation and blackstart (IRB)

Oscillatory Stability Management (OSM)

Synchrophasor data from the MiCOM P847 Agile can be used by the PhasorPoint Oscillatory Stability Management (OSM) application to allow power system operators to visualise and analyse real time power system dynamics. By studying the oscillatory modes of a power system this application can be used to detect and manage power system oscillations which can be a sign of system instability.



Figure 4 PhasorPoint oscillatory stability management (OSM)

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Imagination at work