



The Standards Based Integration Company

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## SISCO's Grid Analysis Package (GAP)

Accurate and Cost-Effective Phasor and Frequency Measurement

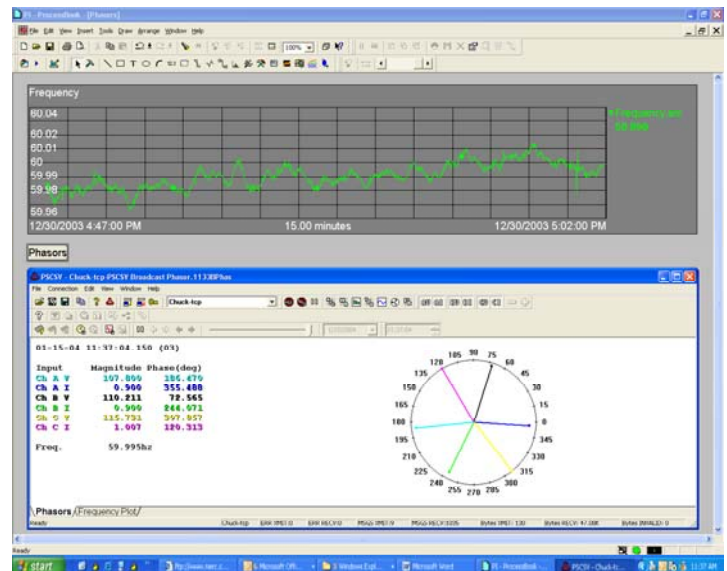
### Description

The SISCO Grid Analysis Package (GAP) is a fully integrated system providing state-of-the-art cost-effective phasor and frequency measurement in addition to more than 60 other power quality measurements. The GAP system includes a Secure VPN Satellite link for remote monitoring. The unit can be commissioned with little or no impact on existing utility telecommunication systems or reconfiguration of existing equipment.

GAP includes local storage and data processing of the raw phasor data, providing rapid recognition of potential grid faults.

### Benefits:

- Embedded software provides powerful local data analysis capability to generate advanced notification of power problems.
- Utilizes a communication infrastructure that is manageable by corporate IT tools.
- Over the network login capability enables diagnostic and maintenance access for remote locations.
- Constructed from best-in-breed software and hardware components.



Example RtPhasor Display

### Benefits (continued):

- Modular self-contained package allows rapid deployment and relocation with minimal disruption to existing equipment.
- Expansion capability allows for other equipment and data to be monitored in addition to the GAP measurements.
- Uses a customizable platform that can be easily tailored to meet specific customer needs.
- Integrates with centralized PI systems for wide area monitoring of power frequency and phasor conditions.

## The Problem:

Deregulation and lack of investment in transmission infrastructure is straining the grid. Maintaining grid reliability is increasingly difficult due to market pressures and antiquated equipment. The 2003 Northeast blackout report clearly indicates limitations on measurement accuracies and time resolutions, in particular the measurement of frequency. This measurement plays a key role in the computation of ACE, and in fact, by itself is an indicator of power imbalance. For example, increasing frequency means that more power is entering an area than is leaving.

Continuous adjustment of generation to match load causes small oscillations in frequency and phase distortions; and as network topology changes, oscillations can either decay or amplify and harmonics can further increase instability. The disturbances, if not checked, can lead to an unstable operating point, that can lead to a voltage collapse.

How can transmission companies assess the stability margins of the grid so that collapses can be avoided?

## The Solution:

SISCO's GAP makes use of OSIssoft™ software and moving window Fast Fourier Transforms (FFTs) computed in real time to provide early warning of grid instability.

### Example:<sup>1</sup>

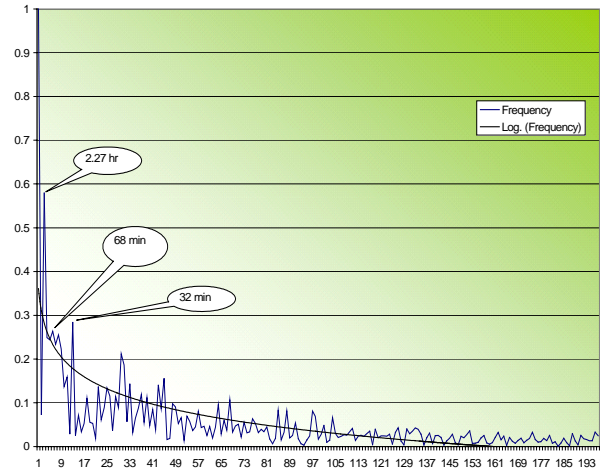
Frequency data on the day of the blackout collected at six second intervals from midnight until four PM was analyzed using moving window FFTs. The results clearly show dynamic increases in power at several low frequency periods (32 minutes to 2.3 hours).

Additionally, there were significant oscillations at periods down to three minutes and the Eastern Interconnect WAMS sensors show oscillations down to 1 Hz.

Several examples of the results are shown to the right.

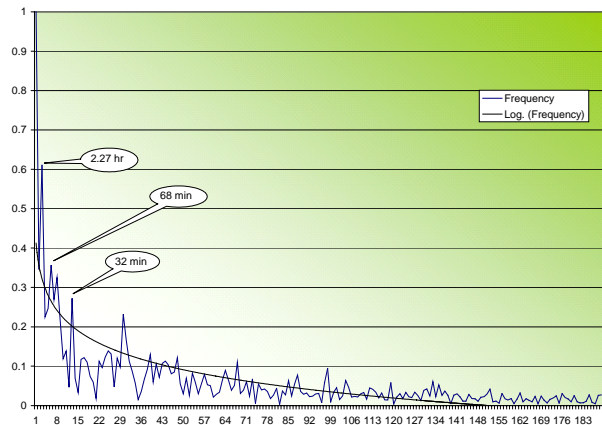
<sup>1</sup> "[Blackout data analysis](http://www.electricity.doe.gov/documents/philly.pdf)", presented to the US-Canada Blackout Analysis team, Philadelphia, PA, December 16, 2003. (<http://www.electricity.doe.gov/documents/philly.pdf>)

0600-1425, 14 August 2003, 4096 FFT (six second samples)



This shows the power spectrum of frequency measurements from six in the morning until 2:25 in the afternoon<sup>2</sup>. There are three significant peaks that have been rapidly growing in amplitude. By four pm, these have grown even further (see below).

0735-1600 August 14, 2003, 4096 FFT



The peak amplitudes in the 2.27 hr, 68 minute and 32 minute periods are substantially higher 10 minutes before the blackout.

All dynamic systems experience this behavior prior to reaching an unstable condition. Actual SCADA data were analyzed using OSIssoft's patented moving window FFT technology.

<sup>2</sup> "[Oscillations in the Grid](http://www.electricity.doe.gov/documents/jan904transcript.pdf)", Toronto, Jan 8, 2004. (<http://www.electricity.doe.gov/documents/jan904transcript.pdf>)

# GAP Specifications

## Hardware:

The standard configuration of the GAP is provided with the following hardware:

- VPN Satellite Gateway with heated satellite dish.
- Substation hardened, SNMP manageable Ethernet Switch.
- Fiber optic Ethernet wiring provides optical isolation between GAP components.
- Full-featured power quality meter.
- Ruggedized PC with embedded OSIsoft PI software and PQ meter interface.
- Uninterruptible Power Supply.
- Auxiliary Ethernet and power connectors for laptop access to the GAP system.

## Environmental:

Operational: -20 to 50 ° Celsius  
Storage: -20 to 70 ° Celsius  
Humidity: 0 to 95% (non-condensing)

## Power:

100-130 VAC (50/60Hz) or VDC

## Input Sensors:

Standard CT and VT inputs

## Frequency Sensitivity:

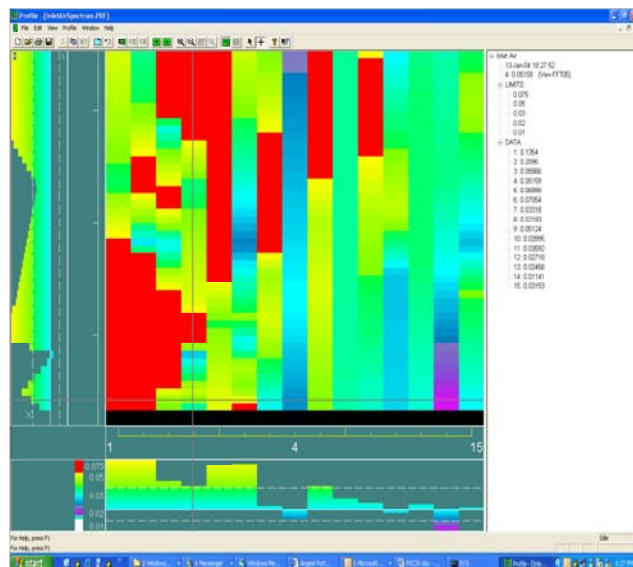
Frequency:  $\pm 1$  mHz  
Phase:  $\pm 0.01^\circ$   
@ 20 Hz per IEEE 1344, & 37.118

## Software:

The standard GAP configuration is provided with:

- OSIsoft PI Historian
- PC Health monitoring software.
- Standard OSIsoft acquisition interface as needed by the GAP supplied meter.
- OSIsoft Client Combo pack.
- RtSpectrae, RtPhasors, and RtAlert displays.

**RtSpectrae** shows current and historical spectra for multiple measurements (see below). Any arbitrary number of spectra can be overlaid and compared in real time. History length is specified by the user.



Sample RtSpectrae Display

**RtPhasor** displays phasor information in real-time as depicted on Page 1.

**RtAlert** is an event notification tool with user configurable values for triggering automatic notifications of power problems and alarms. Notifications are sent to remote sites over the secure satellite VPN connection.

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## Other SISCO OSIssoft related Products

- ❑ **UIB Adapter for PI.** Enables data in the popular PI System from OSIssoft to be viewed and accessed within the context of a data exchange model such as the Common Information Model (CIM) per IEC61970/IEC61968.
- ❑ **COMTRADE Utility for PI.** Historizes data from COMTRADE files into the PI archive for display and analysis of waveform data using ProcessBook and other OSIssoft tools. Supports automatic COMTRADE file retrieval from intelligent electronic devices.
- ❑ **AX-S4 ICCP.** Inter-control Center Communications Protocol (ICCP per IEC60870-6 TASE.2) interface for PI using OPC. Supports bidirectional data transfers using ICCP blocks 1, 2, 4, and 5 as both client and server and automatic configuration of ICCP objects and PI data points.
- ❑ **AX-S4 MMS.** High performance interface for substation automation for PI using the UCA2.0 and IEC61850 protocols via an OPC interface. Supports high-speed peer-to-peer messaging (GOOSE/GSSE), reporting, file transfer, and self-describing devices over Ethernet networks.

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## About SISCO

SISCO, Inc. is a private company founded in 1983. SISCO has established itself as a leader in standards-based real-time integration and communications technologies serving the energy and automation industries. SISCO's products are widely used in many mission critical applications from electrical transmission systems to material handling. We work with both end users and OEMs serving those end users. SISCO's ability to partner with other OEMs and integrators allows us to deliver more capabilities at a lower cost resulting in better solutions for you. Today SISCO has demonstrated leadership and capabilities to provide solutions in the following areas:



- ❑ Model-driven integration technology based upon advanced publish/subscribe and object oriented technology for enterprise integration of heterogeneous applications in the utility environment.
- ❑ Real-time communications and networking based upon open, public, and international standards such as:
  - Inter-control Center Communications Protocol (ICCP) per IEC60870-6 TASE.2 for control center integration and power plant dispatching
  - Utility Communications Architecture (UCA<sup>®</sup>) per IEC61850 for substation automation.

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