

# orbit

VOL. 33 | NO. 4 | OCT 2013

A Technical Publication for  
Advancing the Practice of  
Operating Asset Condition  
Monitoring, Diagnostics, and  
Performance Optimization

*industrial internet*



**42<sup>nd</sup> Turbomachinery  
29<sup>th</sup> Pump SYMPOSIA**

GEORGE R. BROWN CONVENTION CENTER  
HOUSTON, TX 9/30 – 10/3/2013

# WORLD-CLASS OUTSTANDING INTERNATIONAL

PROGRAM | EXHIBITION | NETWORKING



42<sup>nd</sup> Turbomachinery  
29<sup>th</sup> Pump SYMPOSIA

GEORGE R. BROWN CONVENTION CENTER

9.30 – 10.3.2013



[turbolab.tamu.edu](http://turbolab.tamu.edu)

 /TurbolabatTAMU  @PumpTurbo

# In this Issue

.....  
**FEATURES**

- 21 Industrial Internet 101
- 25 System 1\* Software – It’s Not Just for Rotating Equipment
- 30 Wireless Condition Monitoring– Extending Battery Life Using Thermal Energy Harvesters

.....  
**NEWS**

- 05 Announcing the TDISecure\* Communication Processor
- 07 High Sensitivity Current Transformer (HSCT) Update
- 09 Interview with Art Eunson
- 12 Landon Boyer Receives American Petroleum Institute Award
- 13 Proficy\*\* Monitoring & Analysis Suite
- 15 The Evolution of System 1 Software
- 18 The Growing 3701 Product Family

.....  
**DEPARTMENTS**

- Back to Basics**
- 34 Accelerometer Mounting
- Case Histories**
- 41 Puget Sound Energy (PSE) Identifies Bearing & Alignment Problems
- SCOUT Camp**
- 47 Collecting Observational Data

## orbit

Volume 33 | Number 4 | Oct 2013

A Technical Publication for Advancing the Practice of Operating Asset Condition Monitoring, Diagnostics, and Performance Optimization

Publisher: **GE Oil & Gas**  
 Editor: **Gary B. Swift**  
 Designer: **Gina Alteri**  
 Printer: **RR Donnelley**  
 European Circulation: **Estelle Séjourné**

**CONTRIBUTORS**

*GE Oil & Gas*  
**Bob Craft**  
**Art Eunson**  
**Darren Evans**  
**Brian Howard**  
**John Kingham**  
**Don Marshall**  
**Brandon Rank**  
**Scott Roby**  
**Joseph K. Taylor**  
**Brant Wilhelm**

*GE Global Research*  
**John Perry**  
**James J. Schmid, Jr.**

*GE Intelligent Platforms*  
**Cynthia Stone**

*PBF Energy – Paulsboro Refinery*  
**Jayesh Patel**

*Puget Sound Energy*  
**Chris D. Brown**

*Texas A&M University*  
**Bethany Womack**

**CREDITS**

*Bently Nevada Communications*  
**Lindsay Sherman**

Questions, suggestions, and letters to the editor may be addressed to:  
 ORBIT Magazine  
 1631 Bently Parkway South  
 Minden, Nevada USA 89423  
 Phone: 775.782.3611  
 Fax: 775.215.2855  
 e-mail: orbit@ge.com

Printed quarterly in the USA.

\*Denotes a trademark of Bently Nevada, Inc., a wholly owned subsidiary of General Electric Company.

\*\*Indicates a trademark of General Electric Company and/or its subsidiaries.

Copyright © 2013 General Electric Company. All rights reserved.

# Editor's Notepad



**Gary Swift**  
Editor  
Orbit Magazine  
gary.swift@ge.com

Greetings, and welcome to *Orbit!* Throughout 2013, we have traced the evolution of the Bently Nevada\* product line, with a brief history of our company roots in the January issue followed by an update of our modern Minden facility in April. As an example of our international presence, we expanded our focus to the India region in July. In this issue, we are taking this expanding view one step further, to the completely global concept of the "Industrial Internet."



The Industrial Internet is a broad term that refers to the growing synergy between machinery condition monitoring data, analytic software, and the communication capabilities required to deliver important information to the right people when they need it for decision-making. Our friends at the GE Software Center summarize these three key pieces as Intelligent Machines, Advanced Analytics, and People at Work. I predict that we will all be hearing a lot more about the Industrial Internet as it evolves during the coming decade!

Our news in this issue includes several product updates, an interview with our General Manager and a well-deserved API award for one of our employees. Features include an interesting example of how System 1\* software is being used to monitor the health of Continuous Emission Monitoring Systems at a refinery, and a report on engineering field trials of thermal energy harvesters as power sources for our wireless monitoring system. Departments include back-to-basics, case history and SCOUT Camp articles. We also include a shout-out to the 42nd annual Texas A&M University-hosted Turbomachinery Symposium, and it's hard to believe a year has already passed since the last one!

Finally, our back cover introduces a new option for delivery of Orbit content, which we developed in response to reader requests. Starting with this issue, you now have the option to go paperless and convert to an e-mailed digital newsletter edition of Orbit magazine, with links to online content. I'm happy to introduce our digital newsletter format, and if you are struggling with piles of old magazines on your desk (like I am), I think you will enjoy this convenient way to reduce some of the clutter!

Cheers!  
Gary

\*Denotes a trademark of Bently Nevada, Inc., a wholly owned subsidiary of General Electric Company.  
Copyright © 2013 General Electric Company. All rights reserved.

# Announcing the TDIsecure\* Communication Processor



**Joseph K. Taylor**  
Bently Nevada Product Manager  
josephk.taylor@ge.com

**T**he TDIsecure Communication Processor is a multi-channel data acquisition device that acquires up to 24 channels of dynamic signals using parallel sampling with bandwidths from DC to 30k Hz, and can acquire an additional 24 channels of process measurement inputs configurable as 4-20 mA or a variety of DC voltage ranges. TDIsecure is used with System 1\* Optimization and Diagnostic Software and

connects to a System 1 data acquisition computer using Ethernet TCP/IP.

It can be used to replace legacy Bently Nevada\* communication processors such as TDXnet\*, but more importantly can be used in new and current installations to acquire analog signals from any vibration monitor system or plant process points and bring the data into System 1 software – providing you with a plant-wide view into machinery asset condition.

## NEWS

Effective plant asset management, and particularly effective fleet management of machinery assets often depends on remote access using condition monitoring software such as System 1. In most vibration monitor systems (VMS), there is a module in the vibration monitor rack that acquires waveform data from monitors in the rack and serves the data over Ethernet to the condition monitoring software.

In most cases a direct Ethernet connection to the VMS is acceptable using good network design and partitioning along with firewall and router rules. This is our recommendation for Bently Nevada systems. However in extreme cases (Reference 1), a direct Ethernet connection to the VMS (the machinery protection system) may not be desirable or even allowed. In such a case, TDISecure can acquire the analog signals from a machinery protection system, and because it is not providing the protective function, it offers a cyber security solution for remote access that is more cost-effective than data diodes.

### Key Features (Reference 2)

- Designed for permanent installations and continuous on-line data acquisition
- 24 Dynamic analog signal inputs with parallel sampling and synchronization to a Keyphasor\* signal
- 24 Direct process measurement inputs that can be configured as independent process inputs or can be associated to a dynamic input
- Up to four Keyphasor inputs and ability to directly power four Keyphasor Proximity\*
- 24 Discrete Inputs for Channel Alarm/OK
- 4 Discrete Inputs for Rack Alarm Status. (one per Keyphasor Collection Group)
- 4 Discrete Outputs for Rack Alarm Status (one per Keyphasor Collection Group) for daisy-chaining to other devices
- Waveform data collection configurable using time intervals or machine speed intervals

- Transient (startup/coastdown) waveform collection on rpm changes
- Simultaneous collection of synchronous and asynchronous waveforms
- Waveform collection triggered on Alarm Events from any of the configured Alarm Event sources (collects pre and post-event data)
- Ability to replicate protection system configuration for common channel types (replication ensures data quality and integrity in cases where cyber security prevents direct connection to a machinery protection system)
- Ethernet 10/100 Base-T communication to System 1 for configuration, data collection, and data display
- Serial Data Interface (SDI) RS-232 or RS-422/485 for Modbus communication
- Same footprint as legacy Bently Nevada communication processors such as TDXnet

### Benefits

Use TDISecure to connect non-Bently Nevada Vibration Monitor Systems to System 1 Optimization and Diagnostic Software.

Connect process variable inputs to TDISecure for viewing, analysis and management in System 1, thereby increasing your level of analytic capacity.

Replace your legacy Bently Nevada TDXnet communication processors and upgrade to our current product for improved waveform collection performance equivalent to our 3500 Machinery Protection System. ■

### References

1. Orbit V32 N1, M. Whaley, G. Aralikatti. "Introduction to Cyber Security."
2. GEA30722, "TDISecure Communication Processor Overview"

\*Denotes a trademark of Bently Nevada, Inc., a wholly owned subsidiary of General Electric Company.

Copyright © 2013 General Electric Company. All rights reserved.

# High Sensitivity Current Transformer (HSCT) Update



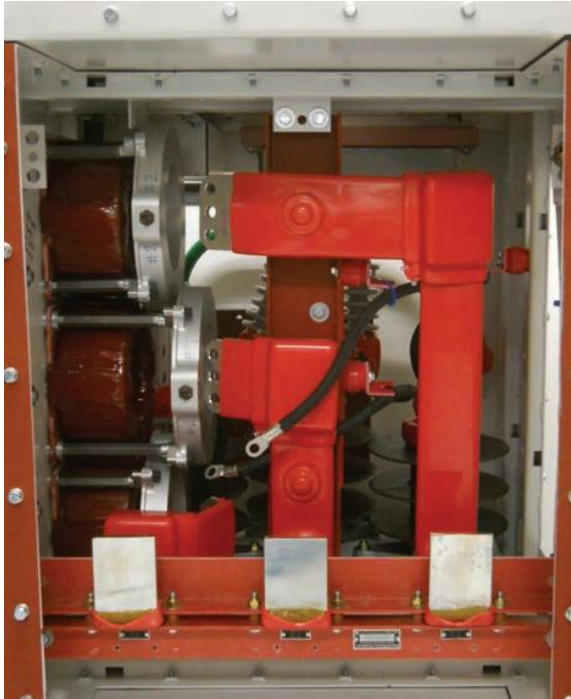
**Brant Wilhelm**  
Bently Nevada  
Product Manager  
brant.wilhelm@ge.com

Last year, we announced our new Motor Stator Insulation Monitor (MSIM) for the 3500 system. As reported in the JAN 2012 Orbit issue (Reference 1) this new permanently-installed system accommodates the continuous online monitoring of winding insulation condition in medium to large three phase ac motors. It depends on the

unique capabilities of the HSCT to measure changes in very low amplitude leakage current that indicate the slow degradation of winding insulation over time. The HSCT sensor, interface module and MSIM module work together to make the monitored motor "smart," so that it can continuously send data to be evaluated by the analytic capabilities of System 1\* software.

THE MSIM SYSTEM IS APPLICABLE FOR LINE-FED 3-PHASE EXTERNALLY-WYE-CONNECTED (6-LEAD) MOTORS UP TO 7.5 KV.





**FIGURE 1:** HSCT sensors during installation in a motor termination enclosure. For each of the three phases, an HSCT sensor (with clear anodized natural aluminum housing) is installed adjacent to the corresponding normally-installed protection CT (the large coils potted in dark -brown resin).

Through additional field testing (Figure 1), we determined that the original HSCT housing – which was mounted using bolts through four evenly-spaced bolt holes – could be improved by the addition of slotted mounting holes. This arrangement facilitates adjusting the orientation of the sensor to more closely match existing mounting points, which reduces the requirement for mounting brackets and adapters.

The new slotted mounting holes allow for approximately 15 degrees of adjustment in the angular orientation of the HSCT housing during installation (Figure 2).

### For More Information

Visit our Motor Stator Insulation Monitor webpage for Datasheet and Fact Sheet on



**FIGURE 2:** Close-up view of slotted mounting holes in HSCT housing

the monitoring system – including the HSCT, which is a key component of the system.

<http://www.ge-mcs.com/en/bently-nevada-monitoring/continuous-online-monitoring/motor-stator-insulation-monitor.html> ■



### References

1. Orbit Vol 32 No 1 JAN 2012, Whitefield, C. David. "New Online Motor Stator Insulation Monitor (MSIM) for 3500 System.

\*Denotes a trademark of Bently Nevada, Inc., a wholly owned subsidiary of General Electric Company.

Copyright © 2013 General Electric Company. All rights reserved.

# Interview with Art Eunson

Art Eunson is our General Manager for the Bently Nevada\* product line. It has been awhile since our last interview, and it was nice to catch up for this issue – Editor



**Art Eunson**  
Bently Nevada  
General Manager



**ORBIT:** Thanks for taking time to talk with our readers, Art. After two years in the business, are there any opening thoughts you'd like to share with us?

**ART:** Sure, Gary. When I started in June of 2011, I quickly learned how passionate this team is about customer service, product quality, and delivering new, innovative solutions to address our customer's problems. While we don't always get it perfect, this team is constantly dedicated to supporting our customer needs, pushing the boundaries with new technologies, and constantly aiming to be leaner, smarter, and better about producing quality products.

**ORBIT:** Where have you spent your time and energy over the past 24 months, and what else have you learned, particularly from our customers?

**ART:** I've taken the time to visit our region teams as well as many customers – learning quickly that the landscape we serve is both complex and diverse. We are mainly focused in the Oil and Gas and Power Generation sectors, but we also serve customers in metals and mining, pulp and paper, and other industries. The good news is that, while there's a wide diversity of problems we are trying to solve, the breadth of our portfolio allows us to address just about all of them.

**ORBIT:** Can you share some of the key messages you've heard from our customers?

**ART:** Quality, of course, is a consistent theme regardless of the product being delivered. Quality in everything from the commercial offering, delivery, the product itself, and service implementation and support are critical regardless of the industry segment or product application. Another consistent theme is the rapidly changing landscape around data and analytics.

Customers are quickly realizing that to optimize production, maintenance, asset availability, and reliability, they will need to leverage the power of advanced analytics. So we spend a lot of time thinking about how we develop new hardware platforms that are "intelligent," with embedded analytics in the sensors and monitors themselves, as well as how we advance our analytic software platforms. We recently conducted a Customer Advisory Board (CAB) with ten companies represented across various industries, and these were consistent themes throughout our discussions.

**ORBIT:** Speaking of business solutions, do you have anything to share on the product updates in this issue?

**ART:** Our two biggest announcements are around the newest members of the Advanced Distributed Architecture Platform Technology (ADAPT) 3701 family and the next generation of System 1\* software. Both of these releases

support GE's Industrial Internet by enabling monitored assets to be "smart" and by providing powerful analytics that convert reams of raw data into useful Actionable Information\* for making asset management decisions. Both of these products will help our customers realize the value of a true condition monitoring program that goes beyond protecting their most critical assets.

It's also worth mentioning we are working closely with our friends in GE Intelligent Platforms to integrate Proficy\*\* SmartSignal anomaly detection software as part of our solution. Early detection with the SmartSignal product provides foresight, and we can then dive deeper with System 1 software to gain more insight around a potential problem. Brought together, these tools are proving to be a powerful solution in many of our customer's condition monitoring and reliability strategies.

---

**ORBIT:** What do you mean by "smart" assets? Is this different from our System 1 software?

**ART:** Yes, absolutely. It's easy to focus on the software part of the Industrial Internet equation, but unless the monitored assets can provide accurate and meaningful data in the first place, the software won't have anything to correlate and evaluate.

---

**ORBIT:** So the Industrial Internet is more than just software...

**ART:** Right. The Bently Nevada product line has actually foreshadowed most of the key concepts of the Industrial Internet - in a somewhat smaller setting - for several years now. Our sensors and transducers, properly installed on monitored machines, send accurate signals to our monitoring instruments. These instruments then apply appropriate signal processing techniques to provide automatic protective machine trips if needed, and create digital data that can be analyzed for condition monitoring.



The final piece of the equation is to have a properly integrated services strategy with each customer to fully extract the value of these products. That might mean remote monitoring support for one customer, full or part time support on the site from our local service teams, or both. Using the data to its maximum capability through a complete product and service offering is the key to success.

---

**ORBIT:** Can you tell us more about how this data is used for condition monitoring?

**ART:** Yes. Some of our customers want to do monitoring onsite, with their local monitoring installation, while other customers provide us with remote access - often as part of an ongoing Supporting Services Agreement (SSA). This kind of setup allows our experts to provide timely advice to our customers without the delays and added cost that would be required to travel to the site in person. In addition to using the logic we've embedded in System 1 RulePaks, we are increasingly using Proficy SmartSignal software to provide early indications of anomalies that need to be looked into more deeply.

---

**ORBIT:** How would you describe the new 3701 distributed platform and System 1 software?

**ART:** I'll address the 3701 family first. Our first member of the family was the 3701/60A Wind Turbine Monitor product (Reference 1). Now we are adding the 3701/55 ESD (Emergency Shutdown) System and 3701/40 Gas Turbine Monitoring Module to the family. While a 3500 or 3500 ENCORE\* rack-based system essentially starts out as a blank slate that is custom configured with appropriate settings for each specific installation, we can supply the 3701 monitors with pre-engineered templates that include signal processing algorithms and protective setpoints created specifically for the type of assets being monitored.



We have done this for various models of wind turbines with the established 3701/60A Wind monitor. These templates save time during installation and commissioning of a monitoring system, and ensure that a more consistent methodology is used – with fewer chances for personnel error during the configuration process. We will continue to develop engineered templates for specific applications of our new 3701 monitors, and will make them available to our customers.

**ORBIT:** That sounds like a great idea. What have our customers said about the 3701 distributed platform?

**ART:** We shared details of these two new monitors, as well as our strategy for developing future members of the family with the participants in our most recent CAB event. They were very enthusiastic about the concept, and they are looking forward to the development of additional monitors and templates that will be specifically focused on other types of assets.

**ORBIT:** This sounds like some good validation of the distributed architecture philosophy. Did you also share details of the new System 1 software with the CAB group?

**ART:** Yes. We did a hands-on demonstration, and our existing System 1 users were very excited with the features of the new software.

**ORBIT:** What did they like best?

**ART:** The first thing they appreciated was the simpler and more intuitive user interaction. The legacy software is very powerful, but it can also be complex and challenging to use. We have done significant work to gather input from a wide variety of users, and to incorporate improvements based on their experience. Just as we can use pre-engineered configuration templates for the new 3701 monitors, the new System 1 software uses a growing set of standardized and very consistent configuration tools.

**ORBIT:** It sounds like the expanding 3701 family and evolving System 1 software share a lot in common.

**ART:** Exactly. We anticipate that they will work very well together – and with other aspects of the Industrial Internet – as development continues over the next decade.

**ORBIT:** Thanks for taking the time to talk with our readers, Art. Do you have any closing thoughts?

**ART:** The biggest thing I want our readers to take away from this interview is that we are absolutely committed to the traditions established in this business over many decades. Those traditions include a continuous reinvestment in our portfolio, a desire to solve tough problems for our customers, and going to market with a reputation of the highest quality, the best people, and an absolute commitment to outstanding customer service. The business has grown substantially over the years, and while we've become more diverse from both a geographical, as well as a portfolio standpoint, we remain committed to these fundamental values. ■

## References

1. Orbit Vol 32 No 1 JAN 2012, J. Hanna, C. Hatch, M. Kalb, A. Weiss. "Detection of Wind Turbine Gear Tooth Defects."

\*Denotes a trademark of Bently Nevada, Inc., a wholly owned subsidiary of General Electric Company.

\*\*Trademark of GE Intelligent Platforms, Inc. SmartSignal is a trademark of SmartSignal Corporation, a wholly owned subsidiary of GE Intelligent Platforms, Inc.

Copyright © 2013 General Electric Company. All Rights Reserved.