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International Frequency Sensor Association (IFSA).
Conserving Energy and Money with Variable Speed Pumps

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Abstract: This short message addresses the problems with current fixed-speed water pump and discusses how load and demand inefficiencies impact energy consumption. However, by using pressure sensors in variable speed pumps, systems can create a financial and energy savings by identifying peak use times and cycling down during low loads and demand. Copyright © 2007 IFSA.

Keywords: Variable Speed Pumps, Pressure Sensors, Energy Consumption

1. Introduction

Currently, pumping systems account for nearly 20 percent of the world’s motor energy use, and a staggering 25 to 50 percent of some industrial plant’s total energy use. In the world of pumps, the energy consumption of centrifugal pumps is directly related to the speed at which those pumps are working. This design does not allow the system to operate efficiently resulting in increased energy consumption and increased user costs.

2. The Problem

Today’s standard pump systems only operate at two speeds – full throttle and stopped – even though demand on the system varies throughout the day. With virtually only one operating speed, pump systems are often over-designed to ensure they can handle “worst case” work loads, leaving them to pump faster, work harder and use more energy than necessary; yet turning pumps on and off is also a drain on energy in that peak energy is used to actually start motor in motion.
Going from off to full speed pumping also causes a rapid change in fluid motion and pressure, creating a pressure shock that strains and, over time, can damage pipes, hoses and fittings. Soft starts and stops, and gradual changes in pump speed, can reduce the negative effects on pipes caused by the water “hammer.”

Couple wasted energy with the cost of excessive wear and strain on lines and pumps, and a move toward variable speed pumps becomes apparent.

3. Figures

**Fig. 1.** Ceramic Capacitive Pressure Transducer for industrial applications including variable speed pumps.

**Fig. 2.** Dimensions of the 61CP Series Ceramic Capacitive Pressure Transducer.
4. The Solution

Variable speed pump systems, using pressure sensors from Sensata Technologies save energy and money, and reduce excessive wear by adjusting the pump speeds to meet system demands. By cycling down pumps during low demand, the energy consumption drops dramatically both during operating periods and by minimizing peak-energy motor start-ups. By monitoring the pump’s discharge pressure in real-time, pressure sensors gauge the exact pumping need and adjust motor speed accordingly.

In a commercial pumping application such as irrigation systems, a water pump might be cycled up or down depending on how much water is being drawn into one or more lines or sprinklers.

Savings can even be found in a home setting, where, for example, a submersible variable-speed well pump may need to maintain pressure to a washing machine and a shower simultaneously, then cycle down to just fill a glass of water.

5. Conclusions

The energy saving potential of variable speed pumps is anywhere from 30 to 50 percent savings on average, and up to 80 percent energy saving for applications such as home circulator pumps. This savings can translate to upwards of $100,000 thousand per year in at some process facilities.

Sensata’s sensor portfolio also includes case isolated sensors (2CH series) which are designed specifically to operate efficiently in the high noise environments present with variable frequency drive pumps.

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Aims and Scope

Sensors & Transducers Journal (ISSN 1726-5479) provides an advanced forum for the science and technology of physical, chemical sensors and biosensors. It publishes state-of-the-art reviews, regular research and application specific papers, short notes, letters to Editor and sensors related books reviews as well as academic, practical and commercial information of interest to its readership. Because it is an open access, peer review international journal, papers rapidly published in Sensors & Transducers Journal will receive a very high publicity. The journal is published monthly as twelve issues per annual by International Frequency Association (IFSA). In additional, some special sponsored and conference issues published annually.

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Contributions are invited on all aspects of research, development and application of the science and technology of sensors, transducers and sensor instrumentations. Topics include, but are not restricted to:

- Physical, chemical and biosensors;
- Digital, frequency, period, duty-cycle, time interval, PWM, pulse number output sensors and transducers;
- Theory, principles, effects, design, standardization and modeling;
- Smart sensors and systems;
- Sensor instrumentation;
- Virtual instruments;
- Sensors interfaces, buses and networks;
- Signal processing;
- Frequency (period, duty-cycle)-to-digital converters, ADC;
- Technologies and materials;
- Nanosensors;
- Microsystems;
- Applications.

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Articles should be written in English. Authors are invited to submit by e-mail editor@sensorsportal.com 6-14 pages article (including abstract, illustrations (color or grayscale), photos and references) in both: MS Word (doc) and Acrobat (pdf) formats. Detailed preparation instructions, paper example and template of manuscript are available from the journal's webpage: http://www.sensorsportal.com/HTML/DIGEST/Submition.htm Authors must follow the instructions strictly when submitting their manuscripts.

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Smart Sensors and MEMS

Edited by

Sergey Y. Yurish and Maria Teresa S.R. Gomes

The book provides an unique collection of contributions on latest achievements in sensors area and technologies that have made by eleven internationally recognized leading experts ...and gives an excellent opportunity to provide a systematic, in-depth treatment of the new and rapidly developing field of smart sensors and MEMS.

The volume is an excellent guide for practicing engineers, researchers and students interested in this crucial aspect of actual smart sensor design.

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