

# Data Loggers –

## *A Useful Tool for Monitoring Power & Energy*

### Part 1 of a 2 part article

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(Figure 1) Easily connect current sensors and voltage leads without power interruption.

ering both the significance and benefits of short-term diagnostic monitoring for plant maintenance and expansion.. We will discuss typical monitoring points and show several examples of data-logging results.

In part two of this article we will discuss things to consider when choosing a portable data logging system and point out things to be cautious about.

#### **What are Energy Monitoring Data Loggers?**

Portable data loggers are compact, light-weight, battery or AC powered, electronic monitoring instruments used for collecting data without the need for operator intervention or presence. They can be installed in load center panels or around the facility without difficulty and removed as easily without the need to shut down the plant or office building first. See figure 1. They are capable of storing tens of thousands of readings to several million readings and can be programmed to collect data on a sub cycle basis or store averages at user programmable aggregation periods. They are available with a display or blind (no display) and can transmit their recorded data locally or remotely.

Data loggers can gather electrical data such as amperage, voltage, power and energy as well as temperature, flow, pressure, event and other data associated with facility maintenance and troubleshooting.

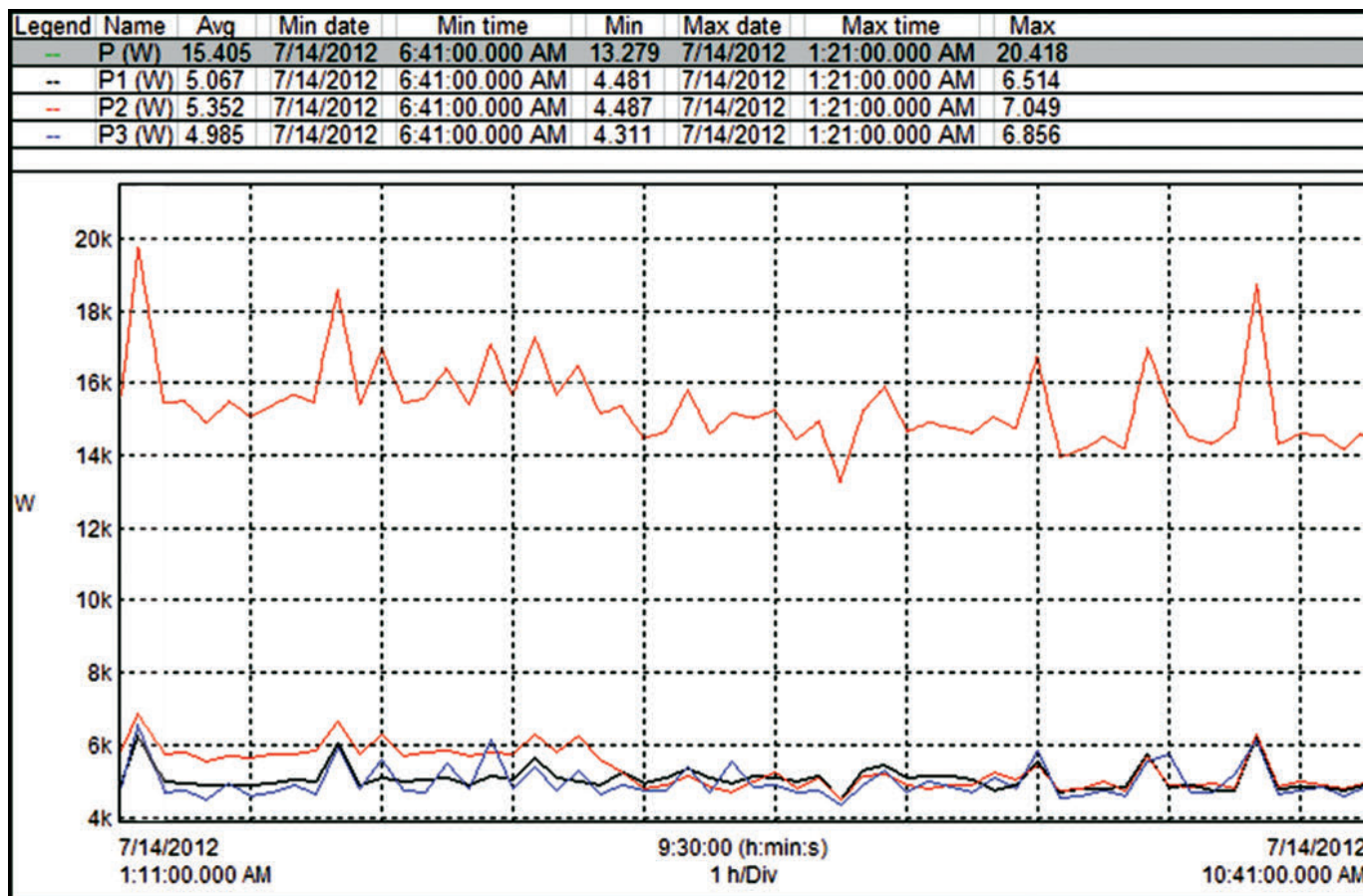
The data loggers with the most versatile application employ separate sensors for each parameter to be recorded. They also provide the ability to automatically recognize those sensors and set the scale and measurement parameters accordingly. They come in single and multi-channel models. Multi-channel data loggers

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**TRACKING FACILITY OPERATIONAL PROBLEMS** that have an effect on energy consumption is quite often time consuming and expensive. However, hidden maintenance complications that often are not noticeable affect both operational and environmental quality and can be the reason for higher than needed energy costs and more frequent equipment repair and replacement. There are many instruments available to the engineer and maintenance staff to tackle finding these problems and costs.

A work horse up to the task is the portable data logger. They are extremely flexible and can save a significant amount of time troubleshooting without the need for an operator to be constantly attending to it. They can detect unseen problems that may be costing many thousands of dollars annually in wasted energy and untimely equipment failures.

Whether for troubleshooting a known problem or proactively seeking opportunities to optimize power distribution systems, portable data loggers and their accessories should be as common in building maintenance technicians' arsenal of tools as a multimeter or thermometer. Energy service industry professionals are making good use of data logging equipment and are discov-



can collect data for several input types simultaneously. For example, a six or eight channel logger may be set up to collect measurements from three or four voltage and three or four current inputs providing the ability to monitor three-phase power systems. Mathematical capabilities provide the ability to calculate power and energy, as well as the cost associated with that energy consumption. Remote access to the data collection process from the office or at remote locations with wireless or Internet access provides the ability to track several consumption points around the facility or multiple facilities without the expense of travel to retrieve the data.

Energy management systems in place today provide logging however, they are often installed with only a limited amount of memory and will only capture a summary data. They tend to be permanently installed devices and will only monitor data from one point in the facility making it difficult to troubleshoot problems around the facility. Portable data loggers overcome these limitations by providing the ability to locate problems and provide information

vital to improving energy consumption.

Data analysis software provides a picture of the monitored data over time and the ability to download to a computer for analysis. Most software is capable of displaying in line graphs often referred to as X/T plots with time on the X axis and amplitude on the Y axis as shown in figure 2. When evaluating harmonic data, it is often easier to view it in a bar graph format rather than a line graph.

The ability to look at several channels of data on the same graph such as three voltage phases or three current phases provides a convenient way to easily troubleshoot power systems. Also, the ability to zoom in and analyze smaller time sections or compare this week's data to last weeks is an invaluable tool.

In the energy game, you can't manage what you can't measure. Energy consumption takes place over time and therefore should be recorded over time. Portable energy monitoring data loggers increase the technician's ability to manage energy by providing the tool to measure and analyze that energy over time.

(Figure 2) Typical X/T plot of energy.

Energy waste is an ongoing issue and is often undetected. Installing an energy logger on equipment that uses large amounts of power or in electrical panels can provide clear and revealing information about energy use when the facility is in a non-operating state. There is a tremendous opportunity to save on energy costs by reviewing this information.

Energy managers usually track monthly utility bills to understand a building's energy use and demand. This helps managers understand when energy use or demand has increased or decreased. Although good energy reviewing practices will sometimes indicate that a problem may exist, it does not always help in understanding where, at what time, and why the increases are occurring or whether they are correct. The use of portable data loggers along with energy reviewing practices provides the missing information necessary to properly evaluate energy problems. Energy loggers can help identify and document when in time and where energy

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waste is occurring, which allows the technician and manager to proactively make improvements and cost savings.

Energy managers can find it difficult to propose changes in equipment and/or procedures to upper management that require investment because of the lack of data to support their recommendations. Data loggers and their analysis software provide energy managers a clear, documented way to graphically present specific data on activities in the facility that increase or decrease energy use. This clear information based on measured data can help energy document the need for operational changes and procurement of more energy efficient machinery. They also provide the ability to record and document the savings by monitoring the energy usage after the changes have been made and by comparing the energy usage before and after.

### **Benefits for Plant Maintenance Staff and Service Contractors**

Performing preventive maintenance

alone is not always enough. No matter how well technicians maintain equipment, if it operates inefficiently, or more often than needed, energy waste will occur. The cost of not paying attention to operational issues along with the maintenance issues can be significant. Many studies performed over the past several years indicate that most energy savings opportunities are operational in nature. Energy savings as much as twenty to twenty five percent of the annual energy cost can be realized through low-cost improvements, with operating improvements accounting for a good portion of the savings. Internal facility staff and maintenance personnel and service contractors can assist the building management more effectively by addressing operational issues as well as equipment maintenance issues. Measuring and recording the performance of energy-using equipment over time is the only way to verify whether the equipment or system performs optimally. Maintaining an instrument tool crib with several data log-

gers will prove invaluable to service technicians and will increase their ability to locate costly building operation problems quickly. Periodically, monitoring critical machinery and high energy consuming building equipment to ensure proper operation should be as important as periodically performing maintenance other tasks such as cleaning coils, lubricating motors or changing filters. Portable data loggers allow facility staff and maintenance contractors the capability to expand their preventative maintenance programs to also include pre-emptive operation tasks.

Next month we will deal with the selection process for determining the right data logger for the task at hand. We will review the process of selecting number of channels needed, the right sensors, sampling and storage mechanisms, display and power requirements, communication techniques and data review and analysis software. Important user programmable parameters and options will also be discussed. □

