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Our thanks to Fluke for allowing us to reprint the following article.

How an electrician with a power quality analyzer solved a mystery, saved a company a lot of money, and helped protect a plant's safety

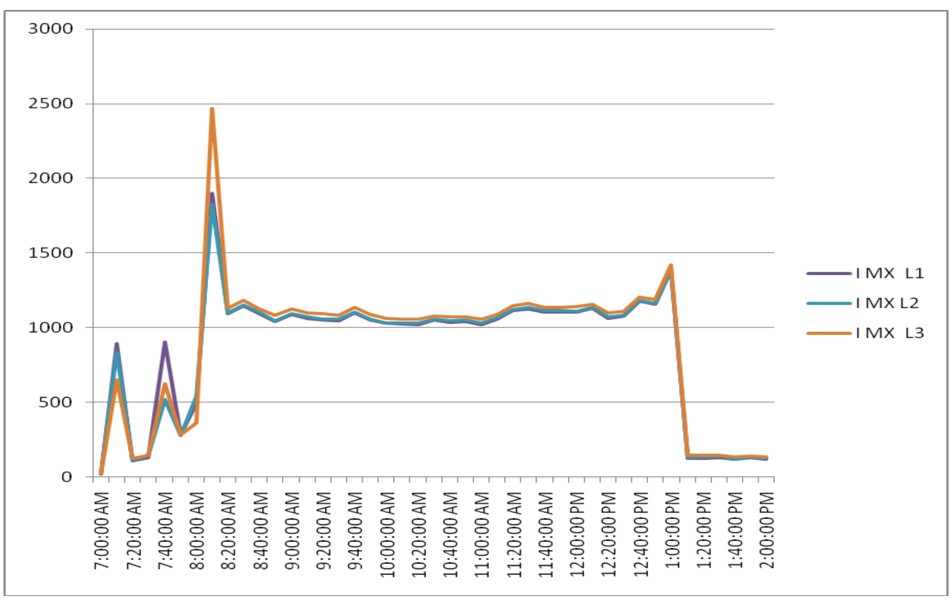
The powerful blowers that transport powdered cement from the transport barge to on-shore storage silos were shutting down too often. So too were the cranes, dust collectors, and other equipment supplied by a 1,600-amp circuit breaker (set to trip at 1,200 amps) that was tripping regularly. Unwilling to continue losing valuable production time, the cement company was considering adding another 4,160-volt feeder from the main switchboard to the transformer at a cost of about $250,000. But before talking that expensive step, the company called in electrical contractor and systems integrator Keithly Electric, seeking a better understanding of what was going wrong.

Suiting Up, Going Hunting

Keithly Electric dispatched electrician Mark Baron, who suited up in his "flash gear"—the flame-retardant overalls, balaclava, 5 kV-rated rubber gloves, switching hood, and other personal protective equipment that help to protect people who work with industrial-strength electricity. Then he connected a Fluke 1745 Power Quality Logger to the secondary of the 4,160-to-480-volt transformer that supplied the barge.

"I have found the Fluke 1745 power quality analyzer to be an excellent tool for troubleshooting power quality issues," Baron said. "These instruments can simultaneously log up to 500 parameters for up to 85 days to uncover intermittent and hard-to-find-power quality issues. I download the data recorded by the instrument to a personal computer. Software included with the instrument runs on the computer to analyze trends, create statistical summaries, and generate detailed graphs and tables to quickly assess the quality of power at the service entrance, substation or load."

Baron monitored the power going to the barge for about a week to see how heavily loaded the transformer was. "In the power logs we could see the blowers turning on and off while other loads such as dust collection fans and lights ran continuously," Baron said. His attention was drawn to the fact that the current flowing in one of the three phases—the C phase—was 20 % to 200 % higher than the other phases. He downloaded the information as a database file and graphed the results for presentation to the customer.



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Loose Connections, High Resistance

Next, Baron turned his attention to the motor control center (MCC), a gray electrical cabinet that houses the cement barge's motor starters. The MCC has a number of small doors arranged in rows and columns along its front. Behind each door is a unit called a "bucket" that connects the electrical devices inside to the tin-plated copper electrical bus bars behind it. The buckets are connected to the bus bars with 3/8-inch (9.525-millimeter) nuts and bolts. Baron noticed that many of the bolts in the motor control center were loose, causing excessive resistance. Significantly, most of the loose connections were in the C phase. Baron described the problem to the plant's electricians, who then tightened the connections.

"If the problem had not been discovered and fixed," Baron said, "the company would have run the risk of an arc flash event"—an electrical breakdown of the resistance of air that can occur when a path opens up between a high voltage line and a lower voltage or ground. An arc flash with 1,000 amperes or more can cause substantial damage, fire, or injury. "This type of event is often not repairable, so it might have required replacing the motor control center at a potential cost of $200,000," Baron said.

The frequent power outages also increased wear on the motors and other electrical components, and occasionally damaged them, so correcting the power problem also provided a significant reduction in maintenance expenses.

Getting the Big Picture

Impressed by this demonstration of the power of data logging, the cement company then asked Baron to take a look at power usage of other feeders in the facility. Even after the corrections in the motor control center, electrical service in the facility was close to hitting the limits. The cement company asked for a determination of how much electricity was used across the facility for various activities, such as unloading cement, blending cement, and so on. Baron connected two additional Fluke 1745 meters to the cement blender service and the OSPH transformer (4160-480 VAC) secondary to try to find additional capacity that could be used elsewhere.

"When these studies are complete, we'll understand where every amp is being used and ensure that our customer is fully utilizing its existing equipment," Baron said. "I am confident that we will find enough spare capacity to enable current operations and expansion without additional investment. Our customer is now a believer and has authorized us to permanently install meters that provide instant access to power quality data locally and across the plant's human-machine interface (HMI) network. This is just one more in a series of successes that Keithly Electric has been able to achieve for our customers by using power quality analysis to pinpoint the cause of a problem."

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