Instrumentation meets electrical signaling at a high-tech ceramics plant

Application Note

Testing Functions
Case Study

Tools: Fluke 789 ProcessMeter™, Fluke 741 Documenting Process Calibrator, Fluke 97 ScopeMeter®

Operator: Ron Shull, Instrument Technician, CoorsTek

Measurements: Simulating 4-20 mA, calibrating P/I converters, checking encoder outputs, evaluating proximity sensor signals, VFD thyristor bank check, dc power supply evaluation

CoorsTek, whose history extends back to before 1910, manufactures high-tech ceramic components for use in industries from aerospace to chemical processing to electronics to body armor and beyond. Headquartered in Golden, CO, the company has manufacturing facilities in seven states in the U.S. and overseas in Scotland and Korea.

Ron Shull is an instrument technician at the company's Clear Creek Valley Plant in Golden, where his main job is to maintain and keep temperature controllers functioning, and make sure that they're accurate. Ron has been in the business for quite a few years, and he's a master electrician, but his main job at the plant is maintaining the instrumentation.

Among his main tools for this are a Fluke 741 Documenting Process Calibrator and a Fluke 789 ProcessMeter™; he also has an old Fluke 97 ScopeMeter® test tool.

Hot boxes

At the heart of a ceramic manufacturing process is a kiln, and the Golden plant has quite a few of them, including box kilns, in which the bottom lifts up with the product and seals in place, and long tunnel kilns. The box kilns are electrically heated, running on 480 V single or three-phase power, depending on size. They're controlled using thermocouples (T/Cs), temperature controllers, and SCR controllers to vary power to the heating elements.

The tunnel kilns are gas fired, with temperature control via dampers that modulate airflow. Controlling the dampers involves measuring draft pressures in the range of plus or minus 0.25 inches of water. The pressures are monitored by pressure-to-current (P/I) transducers that send 4 mA to 20 mA signals to the temperature controllers.

Shull uses his Fluke 741 Documenting Process Calibrator to check the outputs of thermocouples and to provide a simulated T/C signal to the temperature controllers; he uses his 789 ProcessMeter to provide a 4 mA to 20 mA signal as input to temperature and pressure controllers for damper motors while simultaneously monitoring controller outputs. "I can plug a thermocouple in and see what it's reading;" he explains. "I can also tie into the back of the temperature controller and source the thermocouple signal and make sure my temperature controller is functioning properly and is calibrated."

Shull is delighted with how easy the 789 makes checking out the temperature controls on the electric kilns. "To be able to go in there and simulate the temperature controller with a 4 mA to 20 mA signal to my SCR unit is great," he says, "because then I can also hook up an amp meter and I can set my zero and I can set my gain." He sets the SCR controllers to zero output at 4 mA and full output at 20 mA. "It's so nice to dial in 4, set my zero pot on my SCR controller, dial 20 mA, set my span for somewhere around 40 A on the amp meter." He finds the auto step mode on the 789 especially useful: "It just steps it up 4, 8, 12, 20, and then it will go right back down. It just runs it through its ranges. It works so great," he says. "It's something that I didn't quite know I was getting when I bought the thing, and it has really helped me out a lot."

Shull recently discovered that many of the 100 P/I converters around the plant were out of calibration. To fix the problem, he goes out with his Fluke 789, his pressure module and his pump and connects to P/I converters. "I have my Fluke pressure module going into my documenting process calibrator, and when my documenting process calibrator says I have 1/4 inch of water column, my controller should say it has 1/4 inch of water column as well. If not, I adjust my P/I transducers accordingly."

Multiple uses for the ScopeMeter®

Shull has found his Fluke ScopeMeter useful in a number of applications. On the automation side of the plant he uses it to check the outputs of encoders on robots and other automated machinery. "Everything seems to have an encoder these days," he says, "and until we started using the scope, no one knew how to verify whether an encoder was working or not. It's nice to put that oscilloscope on there and see if you're getting your pulse trains out of the encoder."

In another automation application, he says, the ScopeMeter has been valuable in spotting problems with proximity sensors. "Sometimes you may find that your pulse is breaking-up and you are getting two pulses for one piece of product every once in a while. Adjusting your gain for a slightly longer pulse will eliminate the second pulse, and have your high speed counter back to counting accurately." Something similar can happen with photo-eyes, he adds. It's possible to get "an extra little blip off of a top of something that you're sensing," and at the end of a run "everything else looks like it's fine but the counter is off a few hundred each time." The oscilloscope can spot the occasional second pulse that upsets the count.

Shull also uses the ScopeMeter to check out variable speed dc motor drives. "We can check with that oscilloscope to make sure that all three phases, all three of our thyristor banks are firing," he explains. "You can definitely tell if you're missing an SCR bank."

The same method also works on dc power supplies, he continues. "I have found a couple of power supplies where either the capacitors in them or something else has gone wrong, and you've got a heck of a ripple on top, and there's just no way you're going to find that without an oscilloscope."

Ron Schull at his bench with his ScopeMeter, ProcessMeter, and DMM.

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