Engineering Services

The Westinghouse Computer-Assisted Rack Tester (CART)

Background

Westinghouse is helping plants deliver the nuclear promise. For plants with 7300-system process racks driven to reduce durations for channel operational tests, calibrations, and troubleshooting – while simultaneously reducing the likelihood for human-error situations – Westinghouse has developed the Computer-Assisted Rack Tester (CART). The Westinghouse CART system, based on U.S. Patent Number 8,437,974, “Calibration Detection System and Method,” is an automated tool to perform process rack calibration checks and surveillance tests, identify faulty cards, and document test results.

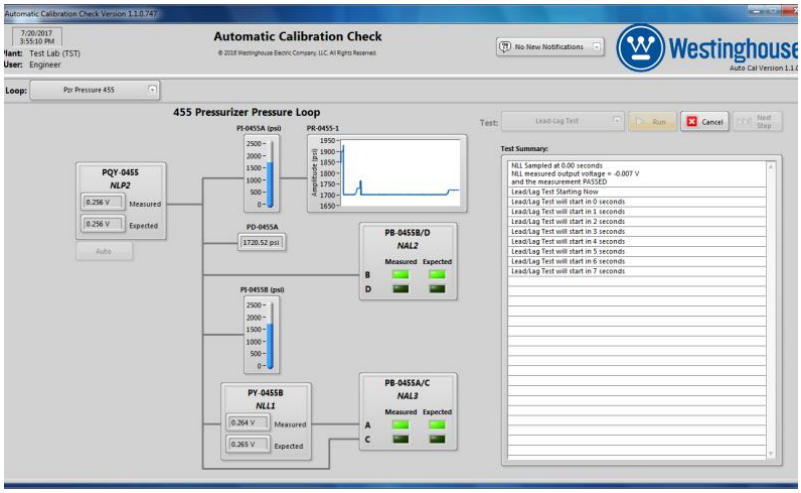
Currently, instrumentation and control (I&C) technicians use an assortment of stand-alone electronic devices – including power supplies, function generators, and digital multi-meters – to generate and measure signals. Each device, including the interface between the test equipment and the I&C system, must be manually adjusted and configured for each step in the procedure.

Manual process rack tests can be prone to human error during set-up and require significant time for a technician to ramp up and down the process rack span, record the data, and then potentially identify faulty cards. The use of the CART automates the testing, reporting, and troubleshooting steps of the calibration check process and also reduces the chance of human error. As demonstrated in a prototype test for a 7300 Pressurizer Pressure function, the CART was able to run the complete test for one channel, identify a faulty card, and automatically generate the as-found and as-left results in the plant datasheet within **10 minutes**.

Description

The CART contains the hardware and software required to stimulate the I&C system and record data to check system calibration. The console accepts command inputs from the system, drives output signals in accordance with surveillance or calibration check test specifications, receives I&C system signals, compares received signals against predetermined acceptance criteria, generates test procedure datasheets, and identifies divergent card responses. All the equipment is contained within a small, portable enclosure.

The CART features a latest-generation, real-time controller; a generic computation platform; state-of the-art, off-the-shelf equipment; and a graphical user interface. The use of field-proven, standard off-the-shelf hardware components minimizes future obsolescence issues. The CART is based on an industry standard software platform – a reliable and responsive real-time monitoring and control system.



The CART Human Machine Interface

The CART is a microprocessor-based instrumentation system that performs the following functions:

- Generate signals to stimulate a 7300-system signal loop
- Measure individual card output from a string of cards
- Compare the measured outputs to the expected output
- Solve mathematical equations to enable real-time comparison with expected results

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- Use deviations from expected results to identify cards in a string that are not performing as expected, focusing any required troubleshooting
- Summarize the results in an electronic data file for use by the technician to confirm the performance of the 7300 system and document in a work package.

Benefits

Fewer Opportunities for Human Error

The CART is designed to perform the entire surveillance or calibration check test in such a way that once connected, the technician would not need to modify the test equipment, wiring, or connections during the test. Using a configuration-controlled software process greatly reduces the chance of human error both in the calculation and testing processes.

Reduced Testing and Troubleshooting Time

With the CART, testing can be run faster without a reduction in quality. Technicians would no longer have to spend time changing wiring and testing equipment settings. The CART software would also reduce the time spent trying to find the source of a failed test. The system is capable of being connected to the entire string of logic, allowing the software to monitor the input and output signals for each component. Deviations between the component measurements and the software model could identify failed components immediately.

Reduced Maintenance Costs

Maintenance costs can be greatly reduced by exercising the plant components less often, reliably identifying failed cards, and gathering data for a more robust preventative maintenance plan. Fewer equipment and wiring changes being performed by the technician helps the plant equipment and I&C hardware to be exercised less frequently, resulting in better maintenance and longer equipment life. Monitoring the test and identifying components that deviate from the ideal case will improve the ability to target failed components for replacement, helping plants to spend less time refurbishing, replacing, and retesting acceptable components. A configuration-controlled software process ensures repeatability, creating more dependable historical results and the ability to trend component health over a period of time. This trending can be used to perform data-driven preventative maintenance to save money on time-based upkeep and/or save time on failures discovered in the field.

The Computer-Assisted Rack Tester

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