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FRONTLINE CASE STUDY

Problem Resolution through Data Integrity Verification

The Setup

Automated Control Concepts, Inc. (ACC) provides process automation, manufacturing execution systems (MES), and utility automation applications. They specialize in all phases of system development: initial system design and specifications, hardware, software, network setup, and support.

For one of their major customers ACC designed and installed a factory automation system using Rockwell Automation PLCs and Wonderware HMI.

The Challenge

Over time, as is the case with most communication systems, a number of changes were made by the user. Several of older PLCs were replaced with newer, faster models. Other PLCs were modified to incorporate greater functionality. Additionally, the HMI software was modified to keep pace with the PLC program changes. These additions and modifications, though well intentioned, were not well coordinated and ultimately compromised the communications network, causing a number of problems. All too often systems ran slowly; in fact, at times the system experienced a complete shutdown. Plant personnel were unable to isolate the root cause of the interruptions and shutdowns.

ACC was called in to investigate the system failures. ACC discovered a 7-second heartbeat-timer timeout was causing the line shutdowns. ACC knew that the reset signal for the heartbeat timer came from a pulse (a 1.25-second square wave) generated in another PLC on the network. An inspection of the logic programs revealed that both PLCs were functioning normally. The PLC responsible for generating the pulse did so when cued, and the PLC containing the heartbeat timer reset whenever it received the pulse. The problem, ACC thought, must be located somewhere in the communications network. The challenge was, then, determining what the specific communication problem was and where it was occurring.

THE FTE Solution

ACC isolated the network downtime problem using **Frontline Test Equipment's FTS4Control.**

ACC's original system design assumed that network communications would sample the output of the PLC, generating the reset pulse often enough that the 7-second heartbeat timer would timeout only when a manufacturing process failed to perform the task that kicked off the pulse. What had happened, however, was that an increased network load brought on a longer Token Rotation, resulting in a decrease in the number of samples taken off the pulse output. This lead to a mismatch between the square wave timing and the network data transfer timing.

ACC captured network data using the filter capabilities of FTS4Control to display only the communication between the two PLCs. **Frame Display**, a function within FTS4Control, allowed ACC to view data at varying levels of granularity, from frame/message level to bit/byte level. With the decoded data displayed in Frame Display, ACC determined that the pulse timer used to reset the heartbeat timer would transmit as many as seven zeros in a row. The pulses were generated normally, but the sampling was infrequent enough to increase the possibility that only low pulse samplings were transmitted during a given seven second period.

Based on this analysis provided through **FTS4Control**, ACC introduced a PLC heartbeat code with an incrementing number, which removed the dependency on asynchronous timing. Subsequent testing with **FTS4Control** confirmed the effectiveness of their solution.

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With these modifications, the plant communication flowed smoothly, resulting in a highly efficient and profitable operation.