DCS Conversion to PLC

Success Story

Individual Ownership and Team Performance

E-Technologies Group

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Challenge

- A global consumer products manufacturer needed to convert its obsolete hybrid Honeywell TDC 3000 DCS/ PLC control system to newer technology using industry-recognized standards.
- The site was the sole supplier for the US market of their leading brand FDA-regulated product, therefore they needed to minimize downtime and other risks.
- Manufacturing consisted of four existing batch systems with a new one planned to increase their production capability.

Solution

E-Technologies Group created a modern robust solution on an open architecture that met FDA validation regulations. We implemented technology that could be easily maintained or supported by multiple sources because the new technology utilized an industry leading platform. Therefore, parts were readily available and internal technical training could be reduced.

What we did:

1. **Sustaining Operations Over Multiple Phases of Implementation-**To minimize the risk to their production at the FDA-regulated site, the conversion had to be done in phases, spanning several years. The migration plan primarily used holidays and other planned downtime events for this phased transition with contingency capability to nearly ***eliminate production risks.*** The conversion project included the addition of a new manufacturing cell, the new cell was designed and implemented first because it did not disrupt manufacturing and added additional capability that would be lost in downtime during subsequent conversions of existing cells. This approach allowed us to shake down the new system and establish a workable solution that could be replicated to the other cells. We had to expand the existing arbitration system that managed the material handling systems that were common with the cells, so that they could support both the existing controls and the new controls during the transition.
2. **Obsolete Documentation Updates**– The client had not kept their functional design documentation up to date as their system and controls evolved. E-Technologies Group undertook a massive effort to ***reverse-engineer*** the original programs. We developed a standardized template and corresponding PLC phase logic methodology and structure that expedited design and implementation throughout the entire project.
3. **Supporting Existing Control Panels During the Phased Transition-**The phased approach to the conversion meant that we had to keep certain existing hardware operational during the transition. E-Tech maintained the existing PLC cabinets of the hybrid system during the transition using Remote I/O connections to the new ControlLogix controllers.
4. **Converting Weighing Technology-**The client had developed advanced predictive adaptive control algorithms for improving the accuracy of weighed material additions that were implemented in the DCS that was going away. These algorithms were now part of a new weigh scale technology. E-Tech developed specialized “add-on instructions” to support the new Mettler-Toledo IND780 Qi Advanced Weighing Terminals.

5. **Effectively Training Operators on the New Technology–** ***Requirement of operator training was reduced by utilizing SFC recipe development.*** E-Tech built off-line simulation capability into each of the fundamental control modules and wrote simulation code that mimicked the process. We could now run the phases and get the feel of the actual process without being tied to physical equipment. This same system was used to train the operators. Running phases and recipes on the virtual process system gave them experience and confidence, greatly improving their productivity from day one and insuring vertical start up.
6. **Significant Improved Validation Documentation-** The initial state of the customer's design documents required a significant effort to properly validate an entirely new control system. It was critical to thoroughly test the new controls to verify that they operated as intended. The thoroughness of our ***SATs*** allowed the customer *to* ***leverage*** those tests into their final validation, saving a substantial amount of time and money.
7. **Convert DCS list-based recipes to Sequential Function Charts (SFCs)**- The original DCS used phase lists to implement their recipes which had limitations on recipe execution manipulations and was not as flexible as SFCs. E-Tech designed all aspects of the controls using ANSI-ISA S88 methodologies and used FactoryTalk Batch with the Material Manager option to create a standard procedural model (consisting of phases, operations, unit procedures, and procedures) and a standard physical model (consisting of control modules, equipment modules, units, process cells, and areas). From this area model, E-Tech converted production, test, and maintenance recipes into SFCs.
8. **Interface with Corporate SAP**-We interfaced this new open platform with corporate SAP for production orders, raw material consumption and quality acceptance of final batches. For SAP to FTBatch, E-Tech created the interface for SAP to push process orders down to the site's batch list to manage their daily production. For FTBatch to SAP, each phase was designed to generate the data necessary for SAP to track raw material consumption, as well as the Critical Process Parameters that SAP used to either hold the batch or release it for further processing.
9. **Information Technology–** E-Tech designed and deployed a scalable, N-Tier, redundant IT architecture to support the manufacturing execution system (MES). The infrastructure solution-mix was based around the VMware vSphere virtualization platform, running on tightly-integrated blade hardware, and a centralized storage area network (SAN). The approach enabled automated real-time performance optimization, while fully eliminating single-point of failure risk within the solution stack. Automated disaster recovery capabilities were also implemented, which exceeded the recovery point objective (RPO), and recovery time objectives (RTO) outlined by the site.

Technical Services Provided:

- Project Management – System Integration
- System Design
- Functional Specifications
- Detailed Design Specifications
- PLC/HMI Software Development
- Specify, purchase, stage, and deploy all SCADA system servers, HMIs, and engineering workstations
- Design and fabrication of replacement control panels
- Batch and recipe design and implementation
- Full System Training
- Software Acceptance Testing (SAT)
- Commissioning
- Instrument Check-Out (ICO)
- Automation Checkout (ACO)
- Automation Operational Qualification (AOQ)
- Control System Validation (CSV) expertise:
- Document Management
- Execute protocols / resolve discrepancies
- Full Simulation System

Technologies Used

- Rockwell Automation ControlLogix
- Rockwell Automation FTBatch with Material Manager and PhaseManager
- Rockwell Automation FTView-SE
- Rockwell Automation FTHistorian-SE with collective
- Rockwell Automation FTVantagePoint
- Rockwell Automation VFDs
- Ethernet/IP
- HART communications (instruments)
- MODBUS
- Cisco Network switches / Redundant Ethernet
- Dell Blade servers
- Redundant VMware virtualization with hot/warm backup
- VMware backup/restore technologies
- Mettler-Toledo IND780 Qi Weighing Terminals
- ACP ThinManager
- ANSI-ISA S88 .01 batch methodology
- Network Attached Storage (NAS) – Offsite backups

Outcome:

The new control system was successfully implemented with minimal planned downtime and no unplanned downtime due to the phased transition plan. With the new system, the customer was able to increase their production capabilities following FDA regulations, improve product quality, improve flexibility, make the solution scalable and reduce unplanned downtime that they had from utilizing an obsolete DCS system. The global consumer product manufacture remained the brand leader on the market and is now rolling this solution out globally.

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