

Automation and Control Systems

Automation of a manufacturing facility involves the design and construction of a control system, requiring sensors, instruments, computers and the application of data processing. It is now widely recognized that automation of manufacturing processes is important, not only to improve product quality and workplace safety, but also to increase the efficiency of the process itself. A&B Process Systems are renowned throughout North America for the design, fabrication and installation of stainless steel equipment for the processing industries and have the added capability to provide reliable, automated systems with flexible, user-friendly, computerized controls.

Introduction.

The technological advances over the last two decades have led to the availability of a wide variety of sensors, intelligent valves, programmable logic controllers (PLC) and central supervisory control and data acquisition (SCADA) systems. These components are the building blocks of a control system, which, when linked to a manufacturing process system, allows each function of that system to operate with a high degree of accuracy. Automation, the incorporation of the control system into a process system, effectively reduces the labor involved in the operation of complex equipment and provides reliable, consistent performance.

Programmable Logic Controllers.

Today the programmable logic controller is the brain of the control system. It can be thought of as a small, industrialized computer that operates reliably in the environment of a manufacturing facility. The PLC looks at digital and analog sensors and switches (the inputs), reads the control program, makes mathematical calculations and, as a result, controls various hardware (the outputs) such as valves, lights, relays and servo-motors, all in a time frame of milliseconds. The PLC is capable of exchanging information with operator interfaces (HMI) and SCADA systems on the factory floor. Data exchange with the Business Level of the facility (the information services, accounting and scheduling) usually requires interaction with a separate SCADA package. There are many options available when considering the selection of a programmable logic controller. A&B Process Systems have consistently used controllers manufactured by Allen Bradley. For example, the SLC500PLC is a versatile unit that is available in a modular chassis, with options for I/O modules and processors. Allen Bradley has also developed programming software for the various PLC units, e.g., the APS6.0 software for an SLC 500 PLC.

SCADA Systems.

Supervisory Control and Data Acquisition systems enable the design engineer to implement data collection and archiving capabilities in a given control system. In addition, the SCADA system allows more complex forms of control to be introduced, e.g., Statistical Process Control. SCADA has been an integral part of the design of a control system, providing the user with a “real time window” into the process. A SCADA system can also be designed to provide a user at a remote location with the same access to the particular process as an operator literally “standing in front of the equipment.”

The Design of a Control System.

There are several factors that are considered in the design of a control system. An initial analysis of the particular process system may reveal existing restrictions to the effectiveness of the process, as well as alternative approaches that may achieve similar or better results. Furthermore it should identify the necessary levels of performance in terms of product quality, regulatory requirements and safety in the workplace. The control system must be reliable and user-friendly, i.e., easy to operate and maintain. Data management and data processing are also factors that must be considered in the design of the control system.

The control system should balance the need for accuracy, consistency and flexibility --- required to increase the overall efficiency of the manufacturing process --- against the need to control the costs of production. If the control system is specified sensibly the production line will run smoothly. Under-specification or over-specification will inevitably lead to higher operating costs and/or delays in production. To optimize the performance of a process system,

(i) the specifications provided for the control system at each step in the process should be accurate and complete, with attention paid to realistic input tolerances,

(ii) the engineer responsible for the design of the control system should be familiar with the total process and able to communicate with the equipment manufacturer,

(iii) a balance must be established, i.e., ask whether it is necessary to implement sophisticated process control technology or will a simple solution suffice?

The Importance of the Control System.

The importance of the controls incorporated into a process system simply cannot be overstated. To appreciate just how important consider the controls that are required in Clean-in-Place (CIP) systems, which are extensively used in the processing industries. Here it is necessary to include a variety of instruments and devices, e.g., resistors that are dependent upon temperature, pH probes, conductivity meters, flowmeters, timers, level sensors and alarms. A fully automated control system must provide for variable times for rinse and drain cycles and for recirculation of the different solutions. The system must also have the capability to change the temperature, flow-rates, composition and concentration of the cleaning solutions. The main control unit is usually based upon PLC equipment, often as multiple panels to service operator stations and for valve and I/O termination. The process control system is critical to controlling or minimizing hydraulic shock, a common problem in CIP units that can limit the useful life of the unit. The correct sequencing or “pulsing” is required to clean the valves, lip seals, o-rings and valve seats in the process equipment.

The Role of A&B Process Systems.

A&B Process Systems recognized the importance of automation to the processing industries and the need for reliable systems with flexible, user-friendly, computerized controls. The company established an in-house Automation and Controls group at the facilities at Stratford, Wiscon-

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sin, to work with the design and fabrication engineers and with personnel from the customer's plant when necessary. This approach ensured that the controls would be fully integrated with the engineering and fabrication of the particular process system. Thus, A&B Process Systems can offer turnkey automation and control systems, including electrical engineering, custom panel fabrication, PLC programming, schematics and comprehensive start-up support involving on-site engineers and experienced field technicians.

