White Paper

Honeywell

Honeywell Process Solutions

Increasing the Value of Automation for Industrial Infrastructure Projects

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Introduction

In an uncertain economic environment, industrial operations strive to be efficient, cost-effective and reliable. Every facility needs to maximize its performance and availability. For the economic operation of an industrial site, all of the various balance-of-plant (BoP) components must function together through optimally coordinated interfaces and automation systems.

Neglected or poorly performing BoP systems can significantly reduce plant efficiency and reliability as well as trigger regulatory non-compliance. Too often, however, these systems suffer from a lack of adequate monitoring and control capabilities.

The following white paper discusses the use of modern automation technology to support industrial infrastructure projects in the world's developing regions. It describes the latest innovative strategies for automating balance-of-plant units and other supporting assets in new Greenfield facilities.

Background

All around the globe, entire eco-systems of economic activity have emerged. From China and India to Russia and Brazil, exciting growth is taking place. Vast social infrastructure projects are yielding highways, tunnels, power plants, cement plants, mining operations, schools, hospitals and water treatment facilities (See Fig. 1).

Figure. 1 Around the global, vast social infrastructure projects are yielding highways, tunnels, power plants, cement plants, mining operations, schools, hospitals and water treatment facilities.

In the past, the U.S. and other industrialized nations led in knowledge-intensive industries while developing nations focused on developing skills and leveraging relatively low labor costs. That's now changed. The impact of the wholesale entry of billions of people in the regions of China, India, Russia and Latin America into the global economy has created new challenges and amazing opportunities.

For plant owners in expanding markets, the old rules governing automation technology investments no longer apply. Simply buying yesterday's solutions (often, the least expensive equipment) isn't the answer to progress. New approaches to process control have seized the day. Modern automation systems make it possible to measure, calculate, estimate and monitor production efficiency, direct costs, lifetime costs, emissions — and all the interdependencies between them. They enable the plant to optimize and control its operations correspondingly.

The reasons for implementing advanced automation are varied: In highly industrialized countries, it serves to enhance production quality, improve process safety and plant availability, optimize the utilization of resources and lower emissions; in fast-developing countries, on the other hand, mastering mass production is a key motivation. Quality and environmental issues are also major considerations.

The growing importance of automation requires industrial project leaders to make a number of decisions. How can state-of-the-art control solutions improve the use of people and the structuring of work processes? What are the emerging technologies, and how do you lay the best foundation to support plant operations in the future while maintaining the highest return today?

Business Challenges

Competitiveness on a global scale makes it even more imperative for plants to achieve their automation objectives both on time and within budget, while focusing on minimizing operational costs. History has shown how the proper deployment of automation on new construction projects can make the difference between a moderate performer and an industry-leading unit, between average financial results and accelerated profitability.

At power generation plants, for example, the need for reduced energy costs, lower environmental load and minimized use of raw materials has never been greater. Every power producer is looking for ways to boost performance. This demand is spurring new applications for software products, intelligent control systems, low-consumption components and services. Process automation can make a major contribution to improving energy efficiency (See Fig. 2).

Figure 2. At power generation plants, the need for reduced energy costs, lower environmental load and minimized use of raw materials has never been greater.

In emerging market regions, there is frequently very limited capital for automation investments — but a wealth of available manpower. This causes industrial organizations to purchase control and instrumentation systems first on price, even if it means they will require additional labor for implementation and maintenance. Plus, economic considerations force many plants to choose “off-brand” equipment, which sometimes leads to a mind-set that automation is generally unreliable. This, in turn, may result in unnecessary expenditures on redundant system components.

Rather than focus exclusively on price, a growing number of industrial end users are partnering with experienced, knowledgeable automation suppliers dedicated to providing long-term value to their customers. This trend is understandable: economies in developing markets are maturing at a rapid pace, and with a corresponding increase in labor rates, will come to resemble the economies of industrialized regions much more closely during next decade.

Operational Requirements

Aside from the process-critical equipment assets found at a typical industrial site, there are often numerous “supporting” assets that make up the balance of the plant. These components may include thermal systems and equipment directly involved in converting energy in the steam into electrical power, the process service systems and equipment required to achieve proper performance of the conversion system, and the electrical power systems and equipment that supply the electrical energy to the various plant auxiliaries and also transport the electrical power to the grid (See Fig. 3).

Figure 3. Aside from the process-critical equipment assets found at a typical industrial site, there are often numerous “supporting” assets that make up the balance of the plant.

When developing new Greenfield operations, plant managers must find ways to automate all of the surrounding equipment units — not just the main power generation unit. Experience has shown that BoP equipment units will produce more consistent, higher quality results if automated. They also need detailed information about how BoP units are running in order to plan sound maintenance strategies and keep assets in excellent repair.

Balance-of-plant controls can help industrial plant operations to:

- Centralize control room operations
- Schedule required maintenance based on timely reports and logs of critical parameters
- Improve process efficiency via coordinated control of conveyers, pumps and motors

Once BoP units are automated, a central monitoring station can be used to view equipment status, make changes to settings, collect historical information related to maintenance parameters, and run the operation in a more cost-effective manner with zero downtime.

Latest Automation Solutions

In order to help industrial operations realize greater value and a lower cost-of-ownership from their automation technology investments, Honeywell Process Solutions has committed to providing solutions its customers can “start with, live with, and grow with.” This approach is particularly applicable to end users in developing regions, who are increasingly concerned about the long-term costs of maintaining their control systems assets.

Honeywell's strategy enables plant owners to make smaller, incremental automation investments while at the same time moving to a next-generation automation system. Through the company's "continuous technology evolution" policy, it provides the flexibility to deploy updated products, features, and functions with minimal risk to existing system investments.

In 2009, Honeywell introduced its next-generation MasterLogic line of high-speed, compact programmable logic controllers (PLCs) to meet the needs of customers with a wide range of industrial infrastructure projects. MasterLogic offers all of the redundancy architecture options needed for most BoP operations — and at a lower cost than other global brands. Its advanced technology brings higher speed processing and better control (See Fig. 4).

Figure 4. Honeywell's MasterLogic line of high-speed, compact programmable logic controllers (PLCs) meets the needs of customers with a wide range of industrial infrastructure projects.

The MasterLogic solution provides the versatility and low cost commonly associated with PLCs and augments it with a global support network and the ability to integrate with the industry's newest control systems. A versatile line-up of I/O modules and networking options (e.g., Modbus, DeviceNet, Profibus DP, etc.) enables flexibility in how the controller fits into an entire automation scheme. MasterLogic is designed to bring power and robustness to very high-speed logic, interlock and sequencing applications.

Key features of the MasterLogic system include:

- Powerful CPU (high processing speed, IEC61131-3 standard language)
- Redundancy options (CPU, Power Supply, I/O network)
- Enhanced redundancy features including fast switchover time, high-speed synchronization and dual ring topology option
- Compact modular size (I/O dimension: 27m x 98m x 90m) for optimized cabinet installation
- Flexibility of network options (Fast Ethernet, Modbus ASCII/RTU/TCP, DeviceNet, Profibus DP)
- Variety of I/O modules including channel-to-channel isolation
- Interface option to communicate with third-party devices using user-defined protocol
- Robust diagnostics (system/error logs, system monitoring, network monitoring, ping test, frame monitor)
- Integrated programming and engineering environment with SoftMaster
- Tight integration with Experion HS via dedicated protocol

Where industry standards have emerged, MasterLogic is in compliance. Instead of restricting the user to a solitary ladder programming language, the PLC is configured using the IEC 61131-3 set of languages so that it's instantly familiar to the new generation of control engineers. MasterLogic empowers system designers with the flexibility to mix and match different programming languages in a single CPU with modular programs, each intended for a specific process control application.

In addition, Honeywell has released the Experion HS system to help fulfill the requirements of small to medium size unit operations. Experion HS is a powerful, yet affordable software platform incorporating innovative features for human-machine interface (HMI) and supervisory control and data acquisition (SCADA).

In balance-of-plant applications, a MasterLogic PLC can be installed on each equipment unit and networked with an Experion HS supervisory computer. Honeywell's ML server interface software allows the Experion HS supervisory software to have direct access to all memory locations in the MasterLogic PAC for use in operator displays, trends, reports, etc. (See Fig. 5).

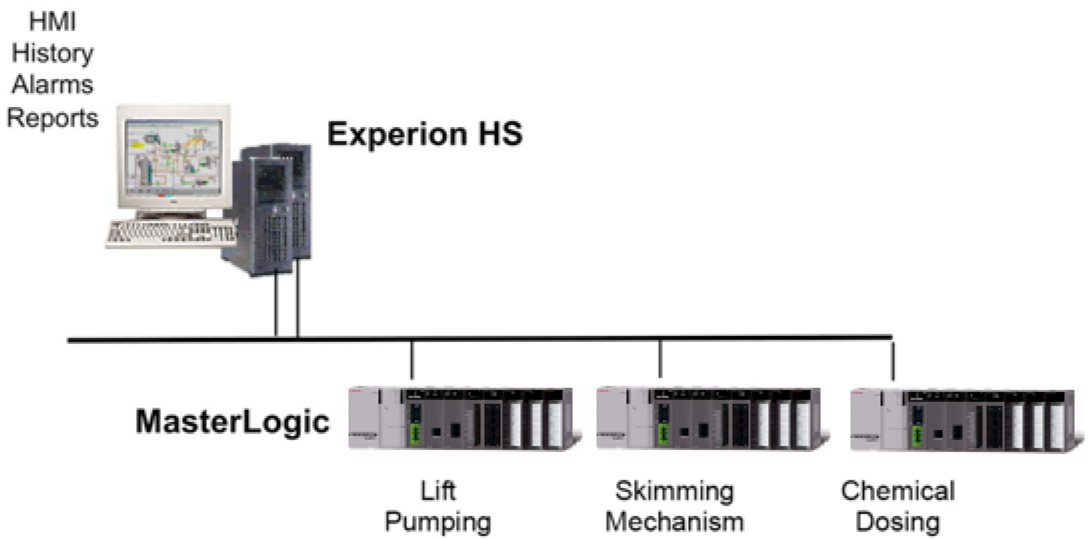

Figure 5. In balance-of-plant applications, a MasterLogic PLC can be installed on each equipment unit and networked with an Experion HS supervisory computer.

The MasterLogic/Experion HS solution contrasts with using the open Modbus protocol to integrate separate, off-brand PLCs and supervisory software, thereby requiring the engineer to perform a layer of mapping in order to access all memory locations. Such an approach is not only labor-intensive, but creates performance issues if the system becomes overloaded with other functions. What's more, the user must re-implement the mapping whenever the PLC and memory map have changed.

Honeywell's Integrated Approach

MasterLogic is much more than just a better PLC; it comes from a company focused on the "system" of automation — not just the parts. Honeywell has always thought about automation problems in their entirety. Its holistic "systemness" strategy, first developed in the 1970s with the introduction of the distributed control system (DCS), supports an integrated architecture with unified sensing, control, operations and information management.

Thanks to systemness, the various elements of a plant automation system can be installed, started and operated together in a prepackaged manner without excessive tuning and adjustment by the implementation project engineer. Hardware and software components continue to operate with high reliability because they were engineered to be compatible. And when it's time to expand or upgrade the system, that task is made easy as well.

The core aspects of Honeywell's systemness include:

- Standard displays, faceplates and detail displays that provide a consistent look and feel to operators even when used with non-Honeywell controllers.

- Embedding of MasterLogic alarms and events into the Experion HS alarm and event sub-system, including Sequence of Event information.
- Critical functionality unifying the real-time, process-connected world of the controller with graphical user interface (GUI) and plant supervisory functions such as monitoring and alarm management.
- Data management functions that derive from history collection and reporting.

The Experion MasterLogic Server was designed with systemness in mind by providing supervisory software with access to actual read & write memory areas of the controller, rather than just internal memory. Plus, the unit's configuration is automatically shown on pre-configured HMI graphics. There is also precise time coordination between the controller and the supervisory software. System alarms are generated and logged without any application engineering effort.

The Experion HS software supports systemness through pre-built standard displays (including process group, point detail, trend, alarm and set point programmer displays), which reduce configuration time. The software's intuitive and flexible HMI meets even the most demanding requirements for process graphics, display navigation and alarm presentation. User-configurable pull-down menus and toolbars promote easier navigation to process data, and enhanced trending for up to 32 pens simultaneously and event markers provide operators with a comprehensive view of the plant. An on-board historian collects history and events, enabling instant access to reliable and accurate process information; and the use of open industry standards and the Microsoft Excel add-in provides greater flexibility in generating reports from process data.

Furthermore, Experion HS's integrated configuration environment enables offline and online configuration changes and minimizes process disruption. Integrated server redundancy is provided without the need for expensive third party, fault-tolerant computing platforms.

Balance-of-Plant Applications

Honeywell's approach to systemness in the realm of process automation can help power generation plants and other industrial sites deal with a wide range of problems encountered in balance-of-plant operations. Typical applications include:

A. Water Conditioning (Demineralization)

It is common to pre-treat water used in boiler operation using various chemicals. This treatment is intended to prevent corrosion, scaling and microbial deposits with constant regard to environmental regulations and customer safety. Automatic chemical feeding and monitoring instrumentation systems are often employed in this application.

B. Fuel Blending

Coal blending optimization helps to improve coal purchasing decisions, reduce blending costs, minimize deviation of blended coal, and ensure the lowest-cost blend for a particular plant. Coal is also blended with other additives having a different heating value and potentially lower ash content.

C. Coal Storage & Handling (bunkers, conveyors, crushing, pulverizing, silos, tripper cars, etc.)

Coal stored in silos awaiting transport to be used as fuel for boilers continuously oxidizes. If the coal is stored too long, oxidation will take place such that the coal begins to burn. Therefore, material handling equipment from the storage silos to the main generation facility must be reliable and trouble-free. It is equally important to have a reliable control scheme in place to monitor and control CO_2 inerting for the coal silo and associated pulverizer equipment. After pulverizing, attention must also be paid to drying the coal as moisture can cause the burning of the fuel to be sub-optimized. The coal drying process is faster when it is automated.

The tripper car is a belt conveyor that runs along a track to deliver material at different locations. Through accurate positioning, the tripper car discharges fuel into various chutes, feeding multiple conveyors or filling different bunkers. Originally, tripper car systems were operated manually. One operator was stationed on the tripper floor to monitor the bunker levels and reposition the tripper to the next fill position. Another operator walked the coal delivery lines, starting and stopping conveyors and opening and closing gates.

Health and safety concerns are the primary motivation behind tripper automation. These projects are intended to: reallocate manpower from the tripper floor in order to perform other critical tasks, improve system functionality and performance, provide new and improved process monitoring, and automate reporting features. The key functions for operators include: system overview, coal flow path selection, barge data entry, coal type data entry, bunker set-up, tripper control, feeder rate setup, motor run time, and alarms.

There are significant advantages to tripper automation: better allocation of manpower, enhanced safety, improved process control and better access to valuable system data. Other activities benefitting from automation include conveyor sequencing; feeder, conveyer and flop gate control; dust collection; and suppression control.

In silos, also called bunkers, volume profiling with laser-based sensors is commonly used. It is important to have an accurate knowledge of the contents of a bunker so that the tonnage of a particular blend corresponds to the demand period when that blend is to be fired.

D. Soot Blowing

At power generating plants, boilers are cleaned while running by regularly blasting pre-heated air, steam or other material across the burners to remove ash deposits that accumulate on heat transfer surfaces. Through tight control of the soot blowing process, the maximum thermal efficiency of the boiler is realized. In turn, flue gas temperatures are kept within a desired range at key locations — supporting the optimal operation of air pollution control equipment. The proper application of soot blower controls can increase plant output power by approximately 8%.

E. Ash Handling

Boilers generate a significant amount of ash as a byproduct of fuel combustion. It is not unusual for 15 tons of ash per hour to be generated. Removing this ash can be quite costly in terms of power consumption, and thus the process must be tightly controlled. Many ash-handling systems work by pulling a vacuum on the piping system. These vacuum-based systems run in a batch mode and benefit from being monitored by site operators, as non-conveying cycle times must be minimized. Logic is used to avoid pulling on empty hoppers.

F. Flue Gas Treatment

Treatment of flue gases is critical to minimizing the environmental impact of coal burning. This process involves the removal of both nitrogen oxide and sulfur dioxide gases, as well as the elimination of solid particles that, if left untreated, would escape into the atmosphere. Various automated equipment units are used for solid particle removal. They include mechanical collection, side stream collection, electrostatic participators, baghouse collectors and wet scrubbers.

Conclusion

In the world's developing economic regions, a growing number of industrial infrastructure projects are taking a long-term view of process automation that considers the overall value from technology investments — not just initial purchase price. In balance-of-plant operations, in particular, reliable controls ensure plant personnel spend less downtime adjusting or repairing their systems. Instead, they can focus on running their plants more efficiently, providing good service to their customers, and increasing their profits for owners and shareholders.

More Information

For more information about MasterLogic, visit our website at www.honeywell.com/ps or contact your Honeywell account manager.

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