Industrial^{IT}
System 800xA

Extending the reach of automation to achieve continuous productivity improvements

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'The right information, for the right people, at the right time' – that was what end-users across the manufacturing spectrum consistently identified as the key to making good business decisions during a recent management forum in the USA. The data is available, but how do we make it relevant in terms of time, context and format? How can we make the most of all the information provided by today's 'smart' field devices? And how can we best use it to keep driving productivity forward?

The answer lies in extending the reach of the automation system beyond the world of process control, in moving the whole concept of automation to a new level. This is what ABB's Industrial^{IT} Extended Automation System 800xA was developed to do.
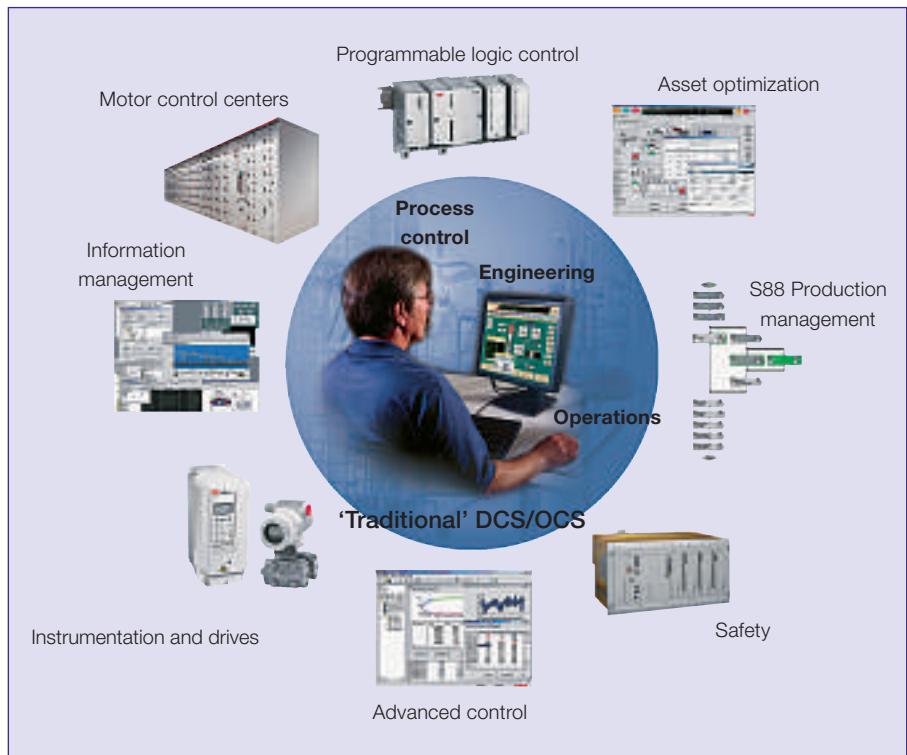
Automation is largely about productivity improvements, and distributed control systems have been deployed extensively in process and manufacturing companies around the world to that end. While the systems were installed to reduce process variability, increase plant availability and automate tasks, the improvements were gained by focusing primarily on process control. In the 1990s ABB introduced open control systems. These had been developed to 'open up' the control system environment, making information from the plant floor available to other applications and facilitating interfacing with applications assigned principally to keeping the process running smoothly. They were the first such systems to feature major incorporations of 'off-the-shelf' technology, and so were able to replace proprietary versions of operator stations, engineering stations and the like. However, the focus was still primarily on controlling the process **1**.

All that has now changed. To deliver additional productivity gains today it is necessary to extend the reach of the automation system beyond the world of process control.

1	Traditional installations are characterized by multiple databases and operations interfaces to provide access to intelligent devices and applications.

Utilizing data more intelligently

As mentioned, consistent and predictable process control was achieved in the past with traditional DCS/OCS functionality – operations, engineering and process control logic. The operations functions were focused on the needs of the production operator. Interfaces to applications and devices external to the control system with their own data storage typically were collected and duplicated in the control system database to provide accessibility for reporting and operational needs. This approach was found to be difficult to engineer and maintain. The practice of having information stored in multiple locations made it difficult to ensure data integrity as the individual software applications were advanced at asynchronous paces and the customized interfaces between them required frequent maintenance. The increasing deployment of peripheral applications related to productivity

improvement, such as quality systems, advanced control, production management, information management and maintenance management, resulted in different user interfaces for different

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types of information sources. More recently, the availability of 'smart' field devices has vastly increased the amount of data available to improve productivity in a plant, utility or mill. However, each device has its own data collection and communication environment, adding to the complexity of the integration task.

So the data is there, but can an enterprise be sure that it is made available to the right individual, at the appropriate time and in a format that is relevant? The data must be analyzed, and action taken to ensure maximum production asset availability, optimal quality and predictable and appropriate performance – ever-increasing productivity. At a recent management forum hosted by ARC Advisory Group [1], one of the most consistent demands voiced by end-users was the need to get the right information to the right person to facilitate sound business decisions and appropriate action. Worth noting is the fact that this demand came from all branches of manufacturing, with applications as disparate as refining, food and beverages, and pulp and paper.

Introducing the ABB Extended Automation System

ABB, by introducing the Industrial[IT] Extended Automation System 800xA, has moved the concept of automation to a

new level. From an information access and integration perspective, the system incorporates functionality far beyond process control.

Specifically, the system incorporates process control, production management, safety, discrete logic and sequence control, advanced control, information management, smart instrumentation, smart drives and MCCs, asset management, and document management capabilities in a singular virtual database environment **2**. This unique integrated system environment allows the incorporation of 'best in class' applications from ABB, or third parties through the use of ABB's patented Aspect Object technology, and the Industrial IT certification process. The Aspect Object technology inherent in the 800xA system provides the unifying platform base that allows data to be maintained in its source application, while providing association to a production asset. Thus, it is possible to

access data directly from its source in the context of the production asset without needing to know where the data comes from, and without concern about data integrity and concordance. This elegant solution addresses the engineering and maintenance issues of the past solutions mentioned above.

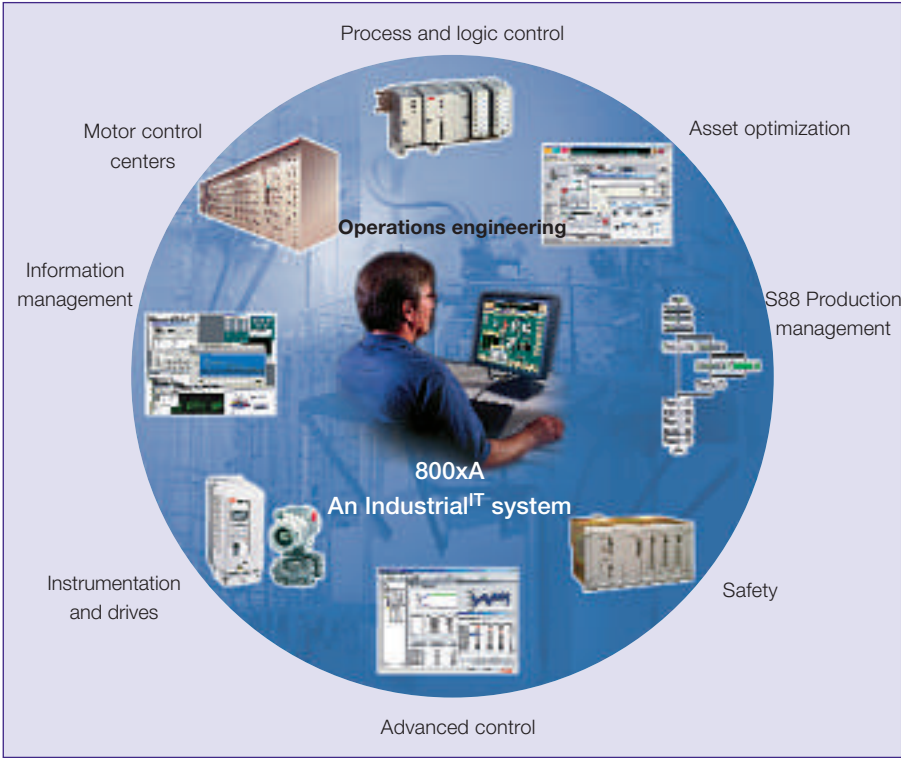## Putting operations within reach of different stakeholders

From an operations perspective, the System 800xA Operations applications extend the reach of ABB's successful Industrial IT Process Portal product to provide a single, consistent intuitive human-system interface to access and interact with information from all the applications encompassed within the Extended Automation environment. It allows users of all disciplines that impact production to organize information and navigate throughout the system in the context of their job function. The package is designed to provide a work environment which helps users to iden-

tify events occurring in the process that are relevant to their job function in real-time, while they are happening. This is achieved by customizing the information that is displayed – and, just as importantly, the information that is not displayed – as well as the way it is presented for a given process area, according to the job function of the person using the system. The root cause of events can be quickly and intuitively analyzed, and the best course of action determined, by virtue of the system's integration and its ability to link to the process object all aspects of information provided by the various system applications. Finally, the Extended Automation system environment facilitates streamlined, electronic work processes and the interdisciplinary communication required to take proper action.
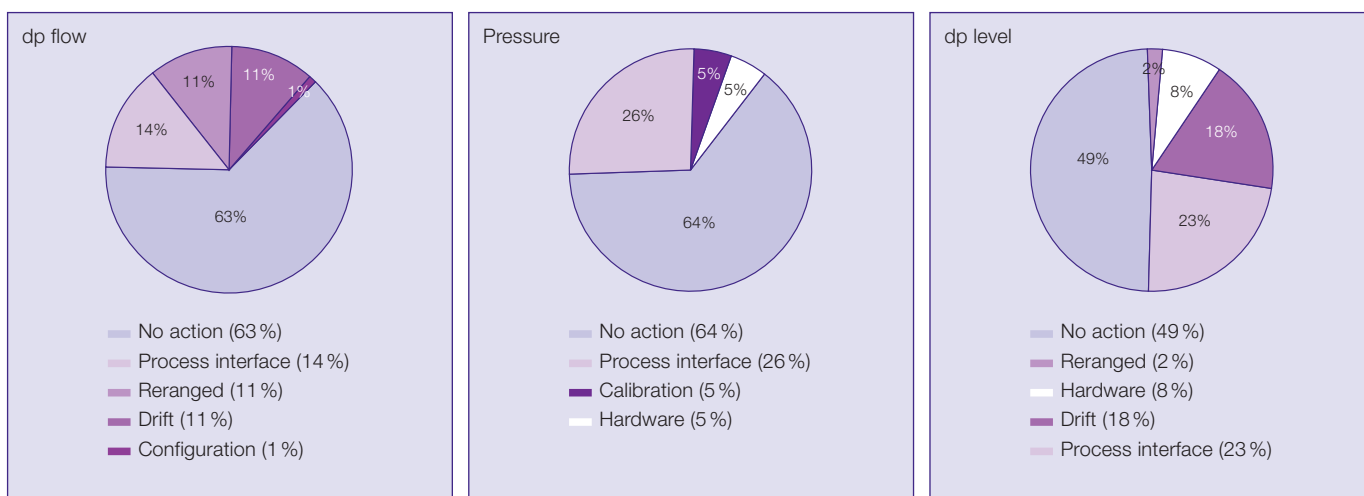
The reaction of most end-users to this previously unheard of capability is invariably the same: "This sounds great. We have had this goal for years, but so far all solutions have been highly customized and require significant initial and ongoing investment to keep the various solution components connected and up to date. How much effort has to be put into engineering and maintaining all of these connections in the System 800xA solution?"

This question is best answered by a look at what is perhaps the most compelling and differentiating capability of the ABB Extended Automation environment. System 800xA Engineering provides a singular engineering environment for designing, configuring and maintaining the intellectual content associated with all of the applications encompassed by the Extended Automation system, and for maintaining the connections associated with and providing real-time access to all aspects of key data needed to engineer, control, maintain and optimize all of the assets in a production process. The 800xA engineering applications provide an environment for utilizing pre-configured standards that encompass all of the features and functions associated with the applications contained in the Extended Automation system to de-

2	The 800xA Extended Automation System integrates the process control with all extended automation applications and smart devices in a single operations, engineering and information management environment.

Process and logic control

Motor control centers

Asset optimization

Operations engineering

Information management

S88 Production management

**800xA
An Industrial^{IT} system**

Instrumentation and drives

Safety

Advanced control

3	Breakdown of effort invested in pressure transmitter maintenance Source: Shell

dp flow

- No action (63 %)
- Process interface (14 %)
- Reranged (11 %)
- Drift (11 %)
- Configuration (1 %)

11 % · 11 % · 1 % · 14 % · 63 %

Pressure

- No action (64 %)
- Process interface (26 %)
- Calibration (5 %)
- Hardware (5 %)

5 % · 5 % · 26 % · 64 %

dp level

- No action (49 %)
- Reranged (2 %)
- Hardware (8 %)
- Drift (18 %)
- Process interface (23 %)

2 % · 8 % · 18 % · 23 % · 49 %

velop a library of standards for any user's process. This library of standards is then deployed through instantiation to create the Extended Automation application. Changes made to the standards subsequent to deployment, can be instantiated automatically to all application objects in the system, providing for a highly efficient, reliable engineering environment that yields predictable results.

How the Extended Automation system can improve productivity
A good example of how System 800xA can positively affect productivity can be found in the area of plant asset availability and performance. Two methods of instrument maintenance are prevalent today in utilities, process plants and mills: preventive and corrective maintenance. Preventive maintenance is a scheduled activity, based on experience or recommendations designed to reduce or eliminate the possibility of a failure that could cause a production stoppage. Correc-

tive maintenance is carried out 'after the fact', ie when a device has failed in operation and requires immediate repair.

Failures are rare today, since most of the field instruments operating within their design range have an MTBF[1] of five years and more. Re-ranging and drift require manual intervention, but this need is also greatly reduced when fieldbus and digital transmitters are used. Pressure transmitters, for example, are essentially trouble-free devices. Nevertheless, there is always the possibility of unstable process conditions and unexpected process events significantly affecting device performance (eg, measurement accuracy or sensor availability). Extended operation in stress conditions will, over time, affect the measurement accuracy. If these events go undetected, the device could continue to send wrong readings to the control system until the next scheduled maintenance, which might be months away.

> The Aspect Object technology inherent in 800xA allows each application to maintain data in its source application and provide association to a production asset.

To prevent this happening, all pressure transmitters are manually checked on a regular basis. However, this exercise is wasteful as well as costly; in more than 60 % of the scheduled interventions the result is 'negative – no failure found!' That this has an adverse effect on productivity hardly needs mentioning.

Pressure devices and their maintenance
■ exemplifies the above points as they apply to the maintenance of pressure transmitters at Shell [2].

By tying smart field devices together with documentation, asset optimization and maintenance management functions, the ABB Extended Automation system ensures that events leading to performance degradation and failures are detected, and that the time between detection and notification, decision and action are reduced to a minimum. This is accomplished as follows:

- Events leading to potential degradation of performance are detected and registered in the pressure transmitter.
- The system tracks the severity of these events and notifies the relevant personnel when a limit has been reached.
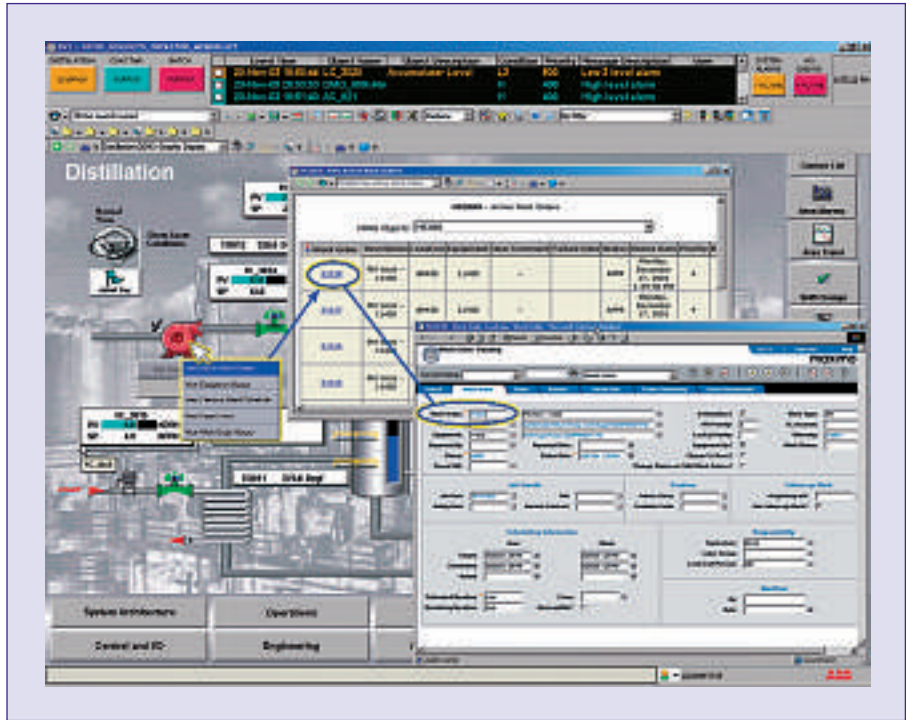
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[1] MTBF: Mean Time Between Failure

- Information relating to the event and the recommended response are presented to the personnel responsible for taking action.
- A electronic work process is facilitated that will ensure efficient remedial action.

Today's smart field devices store a wealth of data that can be used to assess their health and performance. ABB's 2600T pressure transmitter, for example, detects process conditions outside the operating range of the device, like overpressure. It tracks the severity, duration and regularity of the events to determine when measurement performance is at risk. The emergence of fieldbus, Fieldbus Device Tools (FDT) and Device Type Manager (DTM) standards has meanwhile made this data available to control systems and other asset management applications. The problem here, however, is that someone has to retrieve the data from the device to determine if there is a need to act. Most companies don't have the staff needed to regularly survey all of their devices and make such an assessment.

The 800xA system provides all of the capabilities needed for continuous condition monitoring as well as for streamlining the maintenance process. Let's now look at how it works and at the benefits it provides in practice.

4	A user may instruct the 800xA system to automatically transform action information into a work request with a CMMS and then monitor its status – all through contextual access using the 800xA Process Portal user interface.

Predicting performance degradation

The System 800xA Asset Optimization application includes asset monitors that track internal conditions of field devices such as the 2600T pressure transmitter. These asset monitors aggregate the condition data with information from other sources associated with the loop to determine the overall asset condition. In addition to determining the health of the asset, the monitor can detect indications of performance degradation and notify the appropriate individual that further investigation is required. In the case of the 2600T, maintenance personnel can be notified in several different ways; possible formats include pagers, e-mails and messages, to name a few. There is no need to alert a process operator at this stage since we are not looking at a process alarm, but a notification that maintenance is required.

> The 800xA system ties smart field devices together with documentation, asset optimization and maintenance management functions.

At the System 800xA Operations workplace, a maintenance supervisor logging into the maintenance portal would find a list of all asset monitor notifications that are active. He might also note an indication on a graphic display that the loop associated with the subject 'pressure transmitter' has an asset condition that has 'degraded'. By selecting the symbol representing the device and right clicking the mouse he can access the asset monitor event report.

The report informs the user of the nature of the event and recommends action to be taken. If more information is needed to analyze the event, the user may right click to view a DTM display and access information from the field device, manufacturer's documentation, or any other piece of information

within the 800xA Extended Automation environment associated with the device. Once convinced that the action recommended by the asset monitor is appropriate, he may add additional comments and have the 800xA system automatically transform the information into a work request within a CMMS[2] 4. This provides for an efficient, documented, and auditable work process, able to detect, analyze and respond to an event that might otherwise have gone unnoticed, and which may eventually have led to a degradation of production performance, poor quality or a production stoppage due to asset failure.

> ABB will provide the 800xA system to Norsk Hydro to support simultaneous access to different fieldbus protocols and assist it in choosing the best solutions for various applications.

Continuous monitoring of asset conditions allows preventive maintenance strategies to be replaced by predictive maintenance in response to warnings of degraded asset performance before the asset can fail, and focuses maintenance activity on those devices requiring it. This significantly reduces the number of unnecessary device checks in the field.

Reaching down to the bottom of the sea

The Ormen Lange gas field is located 120 kilometers northwest of Kristiansund, in the Norwegian Sea. Some 40 kilometers long and 8 to 10 kilometers wide, the field lies about 3000 meters below the water's surface. Norsk Hydro is operating the field while it is being developed, but once production starts it will be handed over to Norske Shell.

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[2] Computer Maintenance Management System

At the time Ormen Lange starts operating, nothing will be visible above the water's surface, all production units being located on the seabed at depths of 800 to 1000 meters. The automation and monitoring systems will be land-based and tied to the subsea field equipment by a 120-km umbilical line. The geographical and functional organization of the substations makes a fieldbus-based solution imperative.

Diverse fieldbus protocols are necessary as Norsk Hydro wishes to have the capability to select the 'best in class' automation solutions for each application. The bulk of process control related instrumentation will utilize Fieldbus Foundation, while valves and positioners will be integrated using HART. Smart motor control centers will communicate via TCP/IP INSUM, and the safety interlocking systems will use ASI bus. The automation system must therefore be capable of integrating several 'islands of automation', with different fieldbuses.

ABB will provide its Industrial[IT] 800xA Extended Automation system to support simultaneous access to the different protocols and assist Norsk Hydro in choosing the best solutions for the various applications. The project comprises about 6500 process control related I/Os, of which approximately 800 are Foundation Fieldbus devices, the balance being HART-compatible process devices. In addition, there are 2500 safety signals, for which ABB will supply its SIL2-approved safety system. ABB's INSUM MSN will supervise the MCCs. Finally, the 800xA also has the

capability to integrate the project's metering systems, anti-surge controllers, condition monitoring systems and subsea systems.

The Extended Automation solution, by providing remote diagnostics capability for field equipment such as valves and rotary machinery, will enable expert support centers to be alerted when faults are detected at an early stage. This breakthrough application opens the door to a new era in oil and gas exploration and production, especially within the context of the 'smart' fields envisaged for the future.

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