

Smarter platform, smarter process

Network Platform: a new quality control system for the paper industry

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For some 20 years, ABB's Smart Platform has been the workhorse of its quality control system (QCS) for papermakers and has helped maintain ABB's place as the number-one QCS provider in the paper industry worldwide. ABB has renewed this technology platform by introducing the Network Platform. This new product represents a significant advance on many fronts and provides a base upon which further exciting features can be built.

Product innovations

The paper upon which this article is printed might seem the simplest thing in the world – a familiar product that has been around for over 2,000 years. But the modern production of these simple sheets involves an almost unimaginable array of technology, a key element of which originates in ABB.

In fact, as ABB is the number-one supplier of quality control systems to the paper industry, it is highly likely that this very paper has passed through ABB sensors.

ABB Smart Platform

The chief weapon in the papermaker's arsenal is his scanning platform, exemplified by the ABB Smart Platform. This consists of a steel O-frame (through which the paper being made passes), which holds an assembly of sensors that are scanned across the paper as it is manufactured. These sensors measure the moisture, thickness, density, ash, color, fiber orientation, etc of the paper.

As the paper web¹⁾ can be over 10 m wide, moving at 90 km/h, and the sensors glide just a few millimeters above the surface, the sensor assembly must be guided precisely. In fact, the top and bottom sensor assemblies, which are separated by a 7 mm gap through which the paper passes, must be aligned to an accuracy of at least 0.4 mm across the full width of the paper. This is accomplished with rails that are precisely mounted on the frame. An indication of the required sensor-measurement precision is given by the fact that the caliper sensor, for instance, measures the paper thickness to within one millionth of a meter across a 10 m wide paper web!

Another example of the scanning platform's extreme sensitivity and precision lies in the basis weight sensor. This sensor is so hyper-sensitive that even a tiny change in the air temperature, and thus the mass of that volume, would completely dominate the measurement of the paper's mass. So

the air in the sensor gap is very carefully temperature controlled.

The environmental conditions in the paper mill also present a challenge: Just a few millimeters from the sensor heads, paper is heated to over 100 °C. Excessive vibration, 100 percent humidity and a liberal sprinkling of dust are usually also guaranteed.

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Up to 10 different sensors can be deployed on one frame, and the sensor data collected is collated and fed into sophisticated control algorithms, which generate instructions for the paper machine. These instructions (eg, add moisture in certain areas, add and remove pulp, add dye) are carried out by the actuators, also supplied by ABB and by a plethora of third-party suppliers. The paper machine operator is able to view almost any data he chooses and make manual interventions.

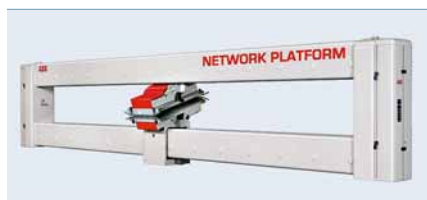
A modern paper machine cannot be operated without such technology.

1 Network Platform scanning with high-temperature cover



2 ABB Network Platform scanner family

a NP1200



b NP700



c Reflection NP



Footnote

¹⁾ Paper is made in a continuous process and collected in a roll at the end of the machine. As each roll becomes "full," an air bazooka cuts the paper and a skilled operator whisks the tail of the paper to a new roll. The paper "web" refers to the paper as it goes through the machine, from the flimsy, wet substance at the headbox to the roll at the end.

At any paper mill in the world, there is a good chance that ABB's Smart Platform is scanning the paper as it rolls – literally – off the machine. Several thousand of these systems have been installed in the field.

ABB continually strives to enhance its products and bring the latest technologies to its customers, thereby enabling cost reduction, greater reliability and increased performance.

Factbox 1 Network Platform advantages

- Improved visibility and diagnostics
- Modern platform to enable continued product development for the next 10 to 15 years
- Improved ease of use for the customer and service engineers (tools, software updates, reduced training)
- Facilitates addition of new sensors and sensor complements
- Easier factory configuration and project delivery
- Faster scanning at 600 mm/s (1,000 mm/s is planned)
- Improved integration with System 800xA Asset Optimization and remote diagnostics
- Increased capability to accommodate new technologies
- Better use of RAM and CPU real-time capabilities, at 25 percent and less than 5 percent, respectively
- Rapid integration of new sensor developments

Through this ever-present desire to “push the envelope,” ABB developed its new QCS product, Network Platform, helping keep the company at the forefront of quality control systems for papermakers ².

Previously, very elegant electronics boards with elaborate, hard-wired logic were required to handle the huge volume of data produced by high-speed sensors. Today, the job can be done with simpler high-speed chips, which are employed in the Network Platform. This is just one of the many features of ABB's new scanning platform.

ABB Network Platform

Network Platform primarily employs standard electronics; the small amount of custom electronics will disappear when the sensors are upgraded. The platform features state-of-the-art technology and is fully compliant with modern standards – all of which ensure that it will be easily supported, now and in the future ^{Factbox 1}. The processor core has been upgraded to an Intel Pentium 1.1 GHz single-board PC, which runs on Windows XP Embedded. There is no hard drive, as the application is stored on Compact-Flash. Portability of architecture is ensured via IBM Rational Rose Technical Developer, so a move to a new PC board or to a new Windows operating system, for example, is not an issue.

Rational Rose is a model-based development tool that utilizes the Unified Modeling Language (UML) as its cen-

tral design paradigm ^{Factbox 2}. This tool allows developers to create complex state machines by using simple modeling constructs. These constructs can then be extended by the developers with customized code that applies to any given problem domain. In the case of Network Platform, this domain is the measurement of paper properties.

In addition to Rational Rose, other IBM products were utilized by the Network Platform development team to ensure a seamless tool integration, from software inception to application

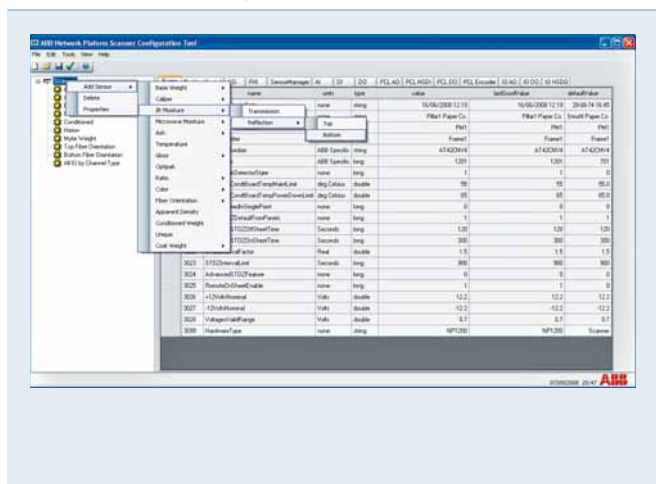
Factbox 2 Benefits of using UML

- Distributed development
 - Using configuration management tools, each software component can be managed independently of the complete solution.
 - Black boxes with defined inputs and outputs can be used early in the development life cycle for undeveloped components.
- Portability of solution
 - The same code base can be used to deliver a solution on multiple operating-system platforms.
- Self-documenting code
 - The tight coupling of code with the design model ensures that design documents always reflect the current code state.

3 Network Platform diagnostics tool



4 Network Platform configuration utility



Product innovations

deployment. These include Rational RequisitePro for requirements capture, Rational Test RealTime for black-box testing, and Rational TestManager for the control and recording of system tests. The use of these integrated tools ensured that the difficulties normally associated with pan-continental development teams (in this case from Europe, Asia and North America), such as disparate times zone, cultural differences and physical distance between team members, could be managed with the minimum amount of effort.

The new software brings a host of new features **Factbox 3**. It now takes a mere two to four hours to build, install and test object code when the source is modified. A single DVD contains all the manuals and documentation. And the de facto standard application language C++ has been chosen for maximum portability and supportability.

In addition, substantially improved diagnostic tools and displays have

dramatically increased the customers' access to the paper process data **4**. This, coupled with the overall simplicity and flexibility of the system, reduces training requirements and eases the configuration in the factory and during project delivery **4**. For example, sensor-complement assignment, in which the system is set up for its particular permutation of sensors (almost every system is different), was previously a complex task but is now very simple, as is integration with System 800xA Asset Optimization and remote diagnostics features.

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ABB's Network Platform also provides a lower cost of ownership for the customer through:

- Improved ease of use for the installer and maintainer of the system
- Support for remote connectivity
- Enhanced support for sensor additions in the field
- Better support for software upgrades in the field
- Improved support for external safety I/O

The development project itself was an excellent example of successful international cooperation with teams based

in Columbus, Ohio (United States), Bangalore (India) and Dundalk (Ireland), pooling many man years of effort to complete the project. Huge emphasis was placed on the test management, and the zero-defect rate in the first product shipments has proven the value of the stringent test strategy.

Future perfect

This new modern platform will enable continued QCS product development for the next 10 to 15 years and will accommodate many new technology advances, such as flexible scan patterns, wireless technology, ultra-fast scanning and the integration of very high-speed sensors. With only 25 percent of the RAM capability and about 2 to 5 percent of the CPU real-time capability currently being used, there is enough reserve horsepower to drive many new ideas!

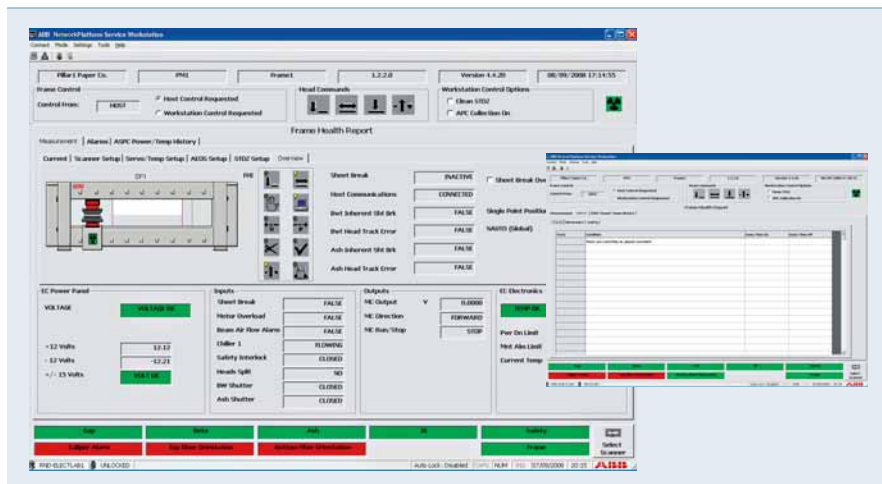
Already, advanced testing is taking place on two new core sensors that both have a performance specification far in advance of any comparable sensor from the competition. Only the Network Platform could provide the processing muscle to deal with the very high-speed raw data and the very advanced diagnostics offered by these new sensors.

The first production systems have already been shipped and are performing very well indeed. Deliveries are ramping up and dozens of ABB Network Platforms will be running in paper mills all over the world within the year.

Factbox 3 Design features

- Software architecture ensures operating-system-platform independence
- Use of commercial off-the-shelf electronics aided in reducing design life cycle
- Simplified cooling of end-column electronics by use of air cooling

Service Workstation



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