Bringing Science to the Art of Papermaking

Leonardo da Vinci's Vision
A true renaissance man, Leonardo da Vinci blended keen scientific observation with his mastery of art, changing the world forever.

In the spirit of the renaissance master, Honeywell's Da Vinci™ brings state-of-the-art technology to the artistry of papermaking. A world of advances in scientific research and computing technology is honed down into practical tools to help you perfect your product.

Da Vinci improves measurement precision with increased scanning and processing speed, higher resolution, and the industry's most comprehensive suite of measurements.

Through design innovation, extensive testing and proven applications, Da Vinci ensures "Reliable Accuracy." A standard of uninterrupted measurement precision and control performance.

Advanced multivariable predictive control technology improves product uniformity and dramatically reduces waste from grade changes and off-quality production.

From the ground up, Da Vinci incorporates industry standard Microsoft Windows™ operating systems and process communication and database access protocols such as OPC and ODBC, opening the door to a world of development tools, process and quality analysis, and business and process control integration.

New Standards of Measurement and Control
With ever-increasing demands for better paper and board uniformity, Da Vinci offers greater insight into process variation than ever before. With higher measurement speed, precision and CD profile resolution, Da Vinci provides better visibility into the process.

With this increased measurement precision and visibility, the performance of cross direction (CD) and machine direction (MD) controls can be optimized for improved product quality and production efficiency.
Precision Measurement Sensors

- Precision Basis Weight Measurement
- Precision Infrared Moisture Measurement
- Precision Microwave Moisture Measurement
- Precision Opacity Measurement
- Precision Gloss Measurement
- Precision SpectraForm Formation Measurement
- Precision Ash / Mineral Measurement
- Precision Color Measurement
- Precision Sheet Temperature Measurement
- Precision Air Gap Temperature Measurement
- Precision X, Y, and Z Measurement
- Precision SSIR Direct Coat Weight Measurement
- Precision SSIR Moisture Measurement
- SpectraFoil MD Wet-end Water Weight Measurement
- GelView Coating Consolidation Measurement

Innovative Measurements

Precision Basis Weight
In addition to conventional Krypton 85 and Strontium 90 basis weight sensors, the Da Vinci line includes the Promethium 147 Precision Basis Weight Sensor. This revolutionary sensor uses a 2 curie Pm""" line source to provide four to five times the beta flux and significantly higher sensitivity than conventional weight sensors – providing:
- 5 mm profile resolution with total insensitivity to shear composition
- 2-3 times better repeatability
- 2-3 times better streak resolution

Revolutionary Resolution and Measurement Speed for Scanning Sensors

Better resolution gives you better control of product quality. Da Vinci Precision Platform scanners deliver the highest resolution in the industry – two to three times higher than any other measurement system. Inside the Precision Measurement Processor, each signal is read 2000 times per second and digitized using 16-bit resolution. This signal processing power coupled with high resolution sensors gives you:

- Sensitive profile measurement in zones as small as 2 mm
- Superior cross-direction (CD) measurement precision and control performance
- Full edge visibility at scan rates of 600 mm/sec (24 in/sec)

Da Vinci brings the industry's most accurate and precise measurements to the papermaker with unmatched process analysis and visibility.

Remote Distributed Sensing

In addition to traditional scanning measurements, Da Vinci further improves machine efficiency and process visibility with new “Remote Distributed Sensing.” By locating a series of single-point sensors down the machine, Da Vinci allows visibility into the “MD profile” of key process variables to form the basis for revolutionary new control strategies to optimize machine efficiency and product quality.

- SpectraFoil MD sensors are positioned along the forming section to track the rate of dewatering and to provide a continuous on-line drainage profile to optimize wet end performance and sheet formation.
- GelView sensors are positioned throughout the dryer section following a coater to track the degree of coating consolidation. Unlike traditional moisture measurements, GelView provides the basis for MD drying rate control of the coating.
**Built-in Precision and Reliability**

The key to reliable accuracy is a stable, high-precision measurement platform. The Da Vinci Precision Platform design, evolved from decades of experience and thousands of scanner installations, ensures that the scanners will operate continuously and reliably in even the harshest papermaking conditions.

The continuous fast-scanning and high resolution signal processing capabilities allow detection of higher-frequency process variation and resolve profile changes three to five times faster than slow-scanning systems.

**Solid Dependability**

The Da Vinci Precision Platform is engineered for structural rigidity and thermal stability based on sophisticated finite element analysis resulting in:

- Dual I-beam structure with rigid reinforced U-beam end-columns reduces vibration sensitivity and ensures continuous sensor alignment
- Heavy-duty, removable, interlocking beam covers with seals enclose all critical scanner components
- Heavy duty drive, track, and carriage systems ensure sensor platform stability to enhance measurement accuracy
- Thermal Equalization System and improved environmental sealing ensure stable, precise profile measurements under dynamic conditions

**Dynamic Alignment Verification**

To provide continuous scanner stability and measurement accuracy, the Da Vinci Precision Platform uses dynamic X,Y, and Z alignment verification and compensation. This advanced measurement visibility tool is one of the reasons why Honeywell is able to ensure reliable accuracy and meet the increasing demands of profile measurement and control.

Extensive testing at temperatures in excess of 100°C (212°F) and 95% relative humidity ensures that the Da Vinci platform will perform reliably in the harshest paper machine environments.

**Reliable Accuracy**

Honeywell delivers uninterrupted performance of the measurement system. Not only does this require reliable, on-line measurement, it also requires reliable signal processing. Each Da Vinci Precision Platform incorporates a dedicated Precision Measurement Processor (PMP) located in a sealed enclosure in the end-column. The measurement speed and precision of existing scanners and sensors can be greatly enhanced and used within the Da Vinci architecture by interfacing a wall-mounted version of the PMP. This dedicated, high-speed signal processor communicates over a dedicated PrecisionNET Ethernet network to provide:

- High-speed, high-resolution, on-line measurements
- Built-in scanner and sensor health monitoring
- Continuous sensor accuracy verification
Results-Focused Control Solutions

Honeywell has applied its control expertise and unique measurement technology with its decades of experience of paper machine control to create Da Vinci Performance MD and CD Controls. The results:

- Improved product quality and customer satisfaction
- Minimized use of fiber and high-priced additives
- Minimized grade-change, sheet break and off-quality losses

Advanced Color and Color-Change Control

Da Vinci's Performance Color features multivariable color control, with control gains calculated using Kubelka-Munk dye and target spectrum characterization, and the industry's first automatic color-change control. Proven to reduce shade change times by 40% and off-color rejects by 50-75%, Performance Color can have an enormous impact on the productivity of shade-critical products.

A Major Advance in Performance CD

Da Vinci combines the industry's most advanced CD controls with the world's leading CD actuator systems. New CD actuators with higher precision and accuracy have been engineered for faster profile control response and unparalleled reliability.

- ProFlow™ for CD basis weight control on consistency profiling headboxes
- AutoSlice™ automated slice lip control for CD weight profile optimization
- Devrotizer® steam shower for hot pressing and CD moisture profile control
- AquaTrol™ hydraulic atomizing and Aqualizer™ air atomizing remoisturizers for mass rewetting and CD moisture profile control
- ProCoat for coat weight control of blade or rod coaters
- CalciOil™ induction heating system for advanced finishing and CD caliper profile control
- Calendarizer™ dry-end steam shower for temperature and moisture gradient calendaring

Performance CD Multivariable

Performance CD Multivariable incorporates the latest model predictive control technology. Generating control actions every scan, this responsive, predictive controller enables control through upsets, start-ups and break recoveries when control is most critical. This unique controller is combined with an on-line IntelliMap™ tool for automatic tuning and precise profile control alignment with non-linear shrinkage determination based on Da Vinci's high-resolution profiles. Advanced CD control that is easier than ever to use.

Multiple Actuator Control Systems

Performance CD Multivariable delivers a true multivariable control that understands the interactions between actuators and measurements, and the constraints and limits of each. The result is superior CD control while optimizing quality parameters. For example:

- Optimizing multiple actuators controlling a single quality parameter, or AFT applications like supercalenders
- Multivariable control is vastly superior to traditional “blended control” in optimizing highly coupled systems, where one actuator affects multiple sheet properties
- Maintaining quality production by automatically adjusting a second controlled variable to keep a critical quality variable within acceptable limits

Da Vinci brings new capabilities to the industry's best profile control strategies
Performance MD Profiling
Honeywell’s unique new remote distributed sensing technology opens up a new vista for controlling product quality and optimizing machine runnability and efficiency. It gives paper makers new insight into the operation of the machine, in essence providing an MD profile of the sheet quality as it is being produced.

Wet-end Optimization with SpectraFoil MD
Positioned under the forming fabric, the patented Da Vinci SpectraFoil MD delivers an instantaneous non-nuclear, non-scanning measurement of water weight in the forming section for Continuous Dynamic Drainage Visibility. With the installation of a series of single SpectraFoil MD elements down the length of the forming section, a dynamic drainage profile can be continuously displayed. This powerful capability enables you to stabilize the wet-end operation, improve sheet formation and optimize first-pass retention.

Coating Optimization with GelView
Patented GelView technology provides a real-time measure and control of coating consolidation for both on-machine and off-machine coating applications. Unique high-temperature sensors distributed along the coating drying process measure surface characteristics to determine the rate of evaporation and percent solids changes along the coater.

The GelView system gives the paper maker the best tool yet to optimize print quality, providing control of the coating drying rate and critical solids points to improve coating quality and reduce variation while minimizing drying energy costs, optimizing production and reducing losses.

Platform for the Future
Windows technologies and standards are opening up new possibilities for the paper industry. Da Vinci has turned these possibilities into reality.

Open Architecture
From on-line scanning measurements to historical information management, Da Vinci makes extensive use of industry standards. Da Vinci is seamlessly integrated into the Experion PKS™ network to provide data and operational integration for the entire process, but its capability to share data throughout the mill does not stop there.

The Da Vinci architecture allows:
- Open database connectivity through open database browser ensures access to all process and quality data
- Open communications standards, including OPC, provides seamless integration between process control systems and information systems throughout the mill
- Open I/O platform allows independent use of existing and future I/O platforms without changing current application software
- Integrated Experion PKS user interface provides a single, configurable view of the process from multiple network-based application servers integrating quality measurement and control, camera-based systems, process, machinery, and drive controls, and historical information management

Leverage Enabling Technology
Because it conforms to Windows standards from the ground up, Da Vinci offers true platform independence. As a result, you can leverage robust, commercially available technology and applications.

Da Vinci’s networked architecture is based on a high-performance Application Server, which is easily scalable and compatible with new hardware and software applications as they evolve.
Results-Focused Control Solutions

Open Applications Development Environment

All Da Vinci applications are based on the widely used and recognized LabVIEW™ graphical application development language. National Instruments’ LabVIEW is the leading development environment for data acquisition, measurement, and analysis applications. Its intuitive graphical programming language allows rapid design and testing with minimal training investment.

- Drag-and-drop programming
- Extensive algorithm library
- Powerful, easy-to-use application development tools
- On-line visibility of graphical configuration for troubleshooting and simulation

For more information about Da Vinci, contact your local Honeywell representative, or access www.iac.honeywell.com/pulp_paper.

Unifying Experion PKS Architecture

Da Vinci’s application server is an integral part of the Experion PKS architecture. Distributed on a high-performance Fault Tolerant Ethernet (FTE) network in a real-time application software environment, the system architecture ensures that distributed applications function as an integrated control system to provide:

- Transparent operation and display navigation across the network
- Common set of services such as alarming and trending
- Simplified configuration, maintenance and upgrades

A Complete System

Within the Da Vinci platform, you’ll find a rich user interface, a full suite of powerful pulp and paper applications, and all the tools you need to customize the Da Vinci applications for your specific requirements. You’ll also find 30 years of Honeywell experience distilled into a complete, world-class solution that includes high-precision measurements, performance controls, and reliability to deliver consistently superior results.

- Continuous fast scanning and advanced measurement strategies for increased process visibility
- Improved product quality and customer satisfaction
- Minimalized use of fiber and high-priced additives
- Improved machine runnability
- Minimalized grade-change and product losses
- Increased downstream converting efficiency
- Overall improved profitability

For more information about Da Vinci, contact your local Honeywell representative, or access www.iac.honeywell.com/pulp_paper.

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