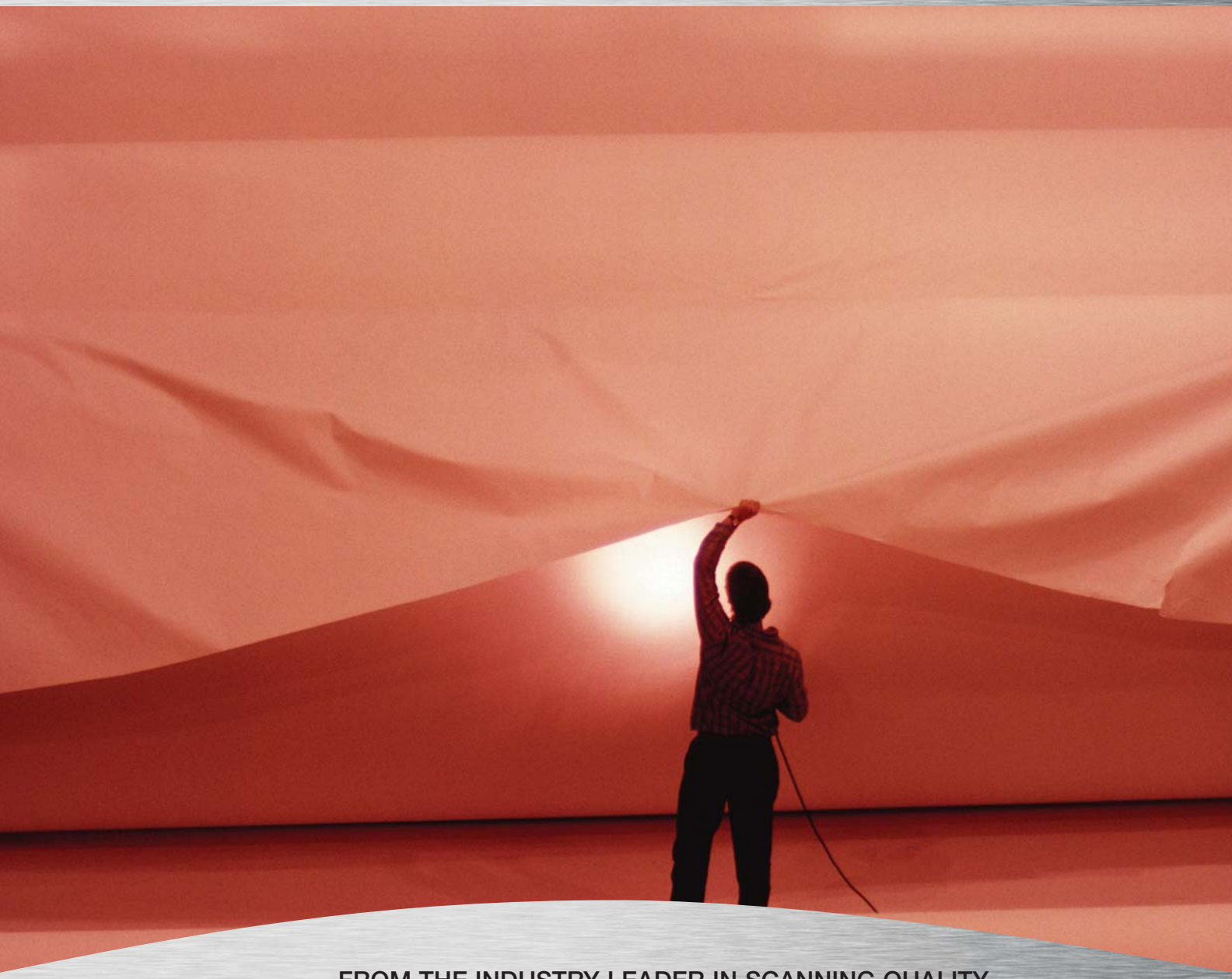
Pulp and Paper Solutions

Honeywell



FROM THE INDUSTRY LEADER IN SCANNING QUALITY
AND REMOTE DISTRIBUTED SENSOR TECHNOLOGY

Precision Measurement for the Paper Machine

Da Vinci: Bringing Science to the Art of Papermaking

Honeywell helps you achieve your business objectives: perfecting your product, improving productivity, and enhancing profitability and competitiveness.

Combining more than three decades of design experience and innovation with extensive testing and proven applications, Honeywell s Da Vinci Paper Quality Control System ensures Reliable Accuracy, a standard of uninterrupted measurement precision and control performance that is unmatched in today s marketplace. Da Vinci offers the fastest scanning and processing speeds, the highest resolution cross direction profiles, and the industry s most comprehensive suite of measurements.

Remote Distributed Sensing

Expanding this suite of measurements is Honeywell s unique, patented Remote Distributed Sensing (RDS) portfolio, which provides online measurement along the length of the paper machine. Because the architecture provides multiple, small, robust sensor heads, they can be placed at the source of process variation, offering the papermaker even greater visibility into the process and product quality. Keeping sensitive signal processing components off machine, in a more suitable and accessible environment, increases reliability and reduces maintenance.

RDS sensors not only generate trend information, but they also generate machine direction profiles, giving rate of change information. Combining this enhanced visibility with Da Vinci s Performance Controls guarantees a competitive edge in today s global markets with their demand for increased quality and efficiency.

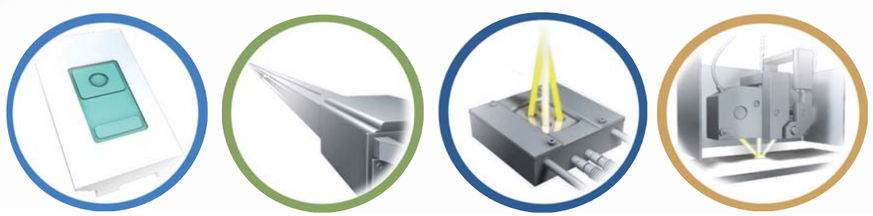
Da Vinci Measurement is the Basis for Improved Quality Control

Profitable papermaking means continuous production with minimal deviations from quality specifications. While steady-state control performance is essential, the elimination of waste during transitions such as grade changes and break recoveries is where the greatest economic gains can be achieved. As production rates rise, often stretching the design capacity of the paper machine, Da Vinci will allow you to maintain and improve production efficiency and product quality.

Da Vinci Precision Scanning Platform

Precision Platform Scanners provide rock-solid and reliable scanning support for Honeywell s Precision Measurements in hostile production environments and across the widest processes. The Precision Scanning Platform provides continuous fast scanning, increased process visibility and decreased response times for quicker, more accurate control.

- **Fast scanning, at 600 mm/sec (24 in/sec), delivers up to three times faster profile measurement response than conventional systems**
- **2 mm–5 mm (0.1 in–0.2 in) measurement zones provide the clearest picture of the process, ensuring that the narrowest streaks are revealed at any point across the full width of the sheet**



- **The system processes sensor data at 2,000 times per second with 16-bit analog-to-digital resolution, ensuring accurate digital representation of your web**
- **> 200 Hz frequency response for all critical sensors (including the moisture sensor) improves measurement response and enables faster scanning**
- **Unmatched sensor repeatability and accuracy is critical for both Advanced Process Analysis Tools and CD profile measurement response**
- **Edge-to-edge measurement, critical to full sheet control, is possible due to the unique sensor design, preventing saturation of sensors at the sheet edges**

Honeywell

Advanced Process Visibility and Control

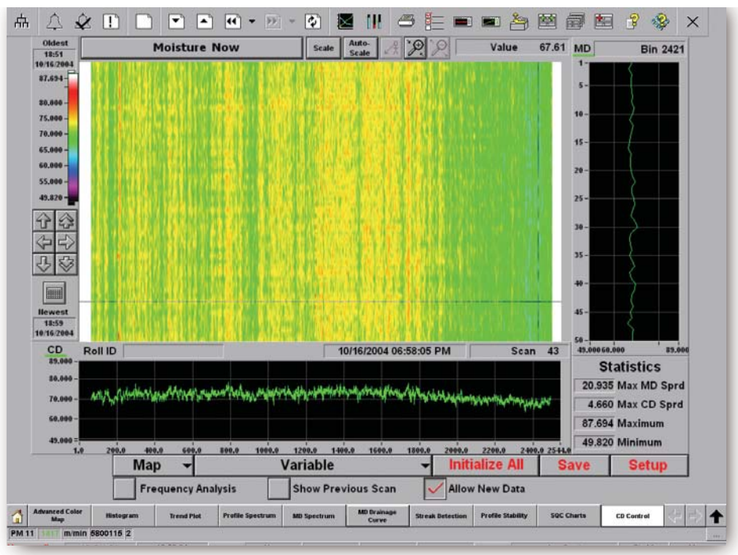
Honeywell's Advanced Controls provide the tools necessary to extract the full value from the superior sensor measurements.

Da Vinci sensors provide increased scanning and processing speed, higher resolution, and the industry s most comprehensive suite of measurements. The Honeywell sensor family includes Precision scanning sensors and Remote Distributed Sensors, all designed for reliability with advanced engineering and sophisticated signal processing. They provide fast response, high-resolution measurement, and edge-to-edge visibility, while enabling sensor placement flexibility in tight process spaces.

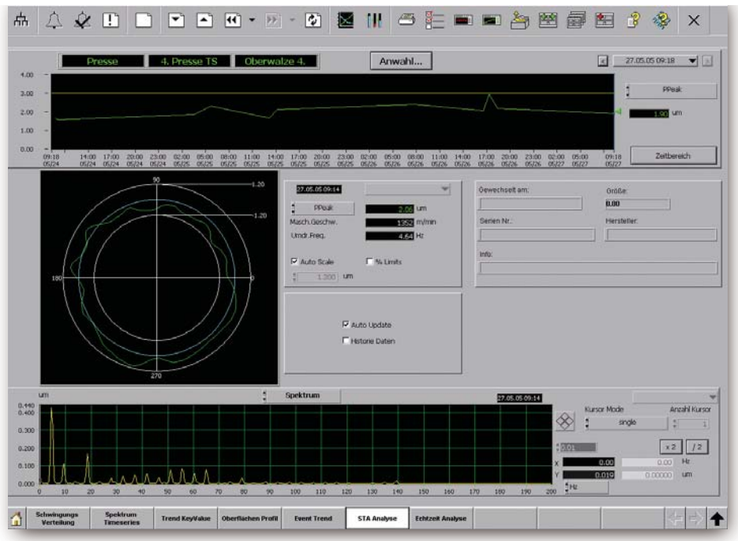
Integrated High Frequency Analysis

Combining an advanced suite of sensors with the industry s most precise signal processing brings process and product quality into greater focus than ever before. High-resolution Color Maps and MD and CD Power Spectrum Analysis displays offer unparalleled visibility into the process, allowing the papermaker and process engineer to continually benchmark the machine and troubleshoot the process. These advanced analysis tools combined with the embedded Machine Sentinel application facilitate the targeting of the root cause of quality and process variability.

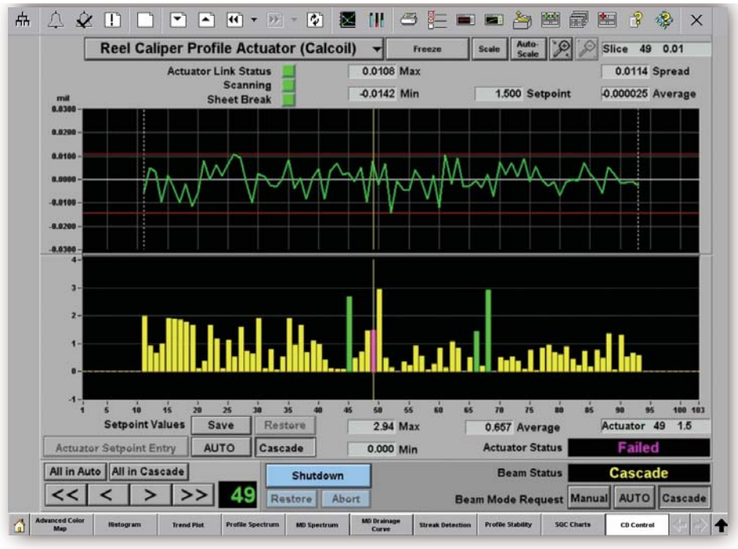
Da Vinci MD Power Spectrum Display



Da Vinci Color Map Display



Machine Sentinel Summary Display



Da Vinci Performance CD Control Overview

Reducing MD Quality Variations with Integrated Process Monitoring

Da Vinci s integrated process monitoring application, Machine Sentinel, takes advantage of the system s sampling rate and the industry s fastest sensor response to identify stock pressure pulsations, nip vibrations, and other higher frequency process disturbances that have a direct impact on product quality. With this powerful tool, papermakers not only reduce high frequency quality variations in the sheet that impact runnability and efficiency on the machine, but with the insight into the health of rolls and felts, the unscheduled downtime can also be reduced. A 10 percent MD variation is just as bad as a 10 percent CD variation.

Improving Profile Control Results

The basis for Da Vinci s traditional and advanced multi-variable CD control is its fast, high-resolution profile measurement, typically 40-60 percent faster than conventional systems. Not only does this ensure improved steady-state quality performance, it provides the best control during process upsets, break recoveries, grade changes and machine startups, where downtime is money lost.

Honeywell

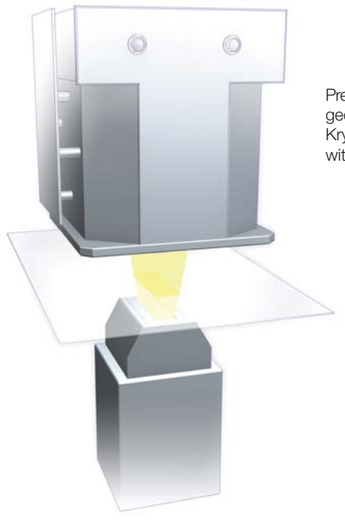
Visibility into Paper Structure: Basis Weight, Coat Weight, Ash

Knowing what is in your paper, and how it is distributed throughout the sheet, is crucial in determining the paper quality, and your raw material costs.

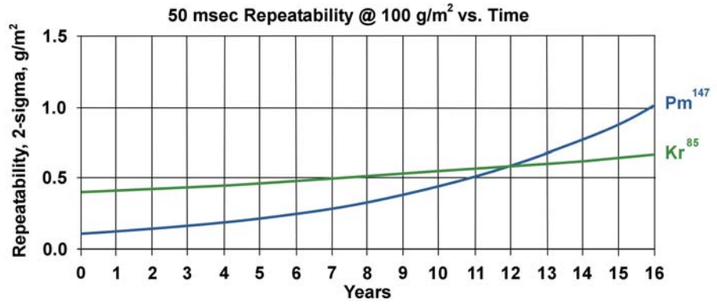
Precision Basis Weight Measurement

For medium and heavy grades the benefits of Krypton (Kr85) are used. For Tissue, Newsprint, LWC and other lightweight sheets, no other supplier can match the sensitivity and accuracy of our Promethium (Pm147) sensor, which provides unparalleled repeatability and resolution to optimize profile measurement response and CD weight control results. This 2 Curie line-source was designed to outperform conventional Krypton-based sensors 12 years after installation with a single source. With its High Flux Geometry designs, Honeywell s Basis Weight measurements minimize the influences of everything but your paper for long-term accuracy and reliability.

- 2 Ci Pm147 line-source with five times the flux allows small changes to be measured accurately
- MD oriented, line-source geometry gives a narrow measurement width to provide superior streak resolution and edge-of-sheet measurement, yet maintains the surface area needed to increase flux, and improve sensor repeatability
- Minimized air column design significantly reduces the air temperature effects
- Patented, Full-Range Standardization using two internal flags assures long-term stability



Precision Basis Weight Sensor, with a line-source geometry and five times the flux, outperforms Krypton-based sensors for up to 12 years with the original source



- Filler component insensitivity and enhanced UniCal™ sensor algorithm enable one calibration to cover all grades and coating recipes
- Patented dynamic Z-axis correction eliminates errors due to scanning changes in the gap between the source and the receiver

Precision Coat Weight Measurement

Optimizing coating coverage is critical to meeting gloss and printability specifications, and to reducing startup and off-quality waste. The Honeywell Pm147 basis weight sensor provides unparalleled differential weight based MD and CD coat weight accuracy on lighter weight printing grades. The patented Direct IR Coat Weight sensor ensures the fastest, most repeatable CD coat weight profile measurement to optimize CD control response following coater breaks and blade changes.

- **Patented Direct IR Coat Weight sensors measure CaCO3, clay and Latex from just one side of the web, fitting into the tight constraints of existing and new machines**
- **Simultaneous measurement of all wavelengths provides the fastest CD profile measurement response, and precise streak detection**
- **Application-matched solutions let you choose from direct IR, differential dry weight or differential ash, to optimize control**
- **Best-in-class differential dry weight measurement (Pm147) assures superior coat weight profile accuracy on lightweight grades**

Precision IR Coat Weight sensor directly measures coating constituents, delivering fast and accurate measurements suitable for CD coat weight profile control from single-scan data

Precision Ash Measurement

Ash and filler levels in the sheet have a critical impact on the surface characteristics, printability, and furnish cost of most printing and writing papers. Both the absolute filler level and the CD profiles generated on the former are critical to maintaining uniform print quality. To take advantage of the fast scanning Da Vinci platform, X-ray tube technology is required to get the high flux needed to generate sufficient signal-to-noise to produce meaningful profiles in real time. Honeywell ash sensors are factory-calibrated to give accurate ash measurements in spite of varying filler constituent loading typical of many recycled furnishes.

- **Tuned X-ray tube source gives high signal-to-noise for fast and stable measurements**
- **Sensor is insensitive to varying mixtures of filler constituents (clay, TiO2, CaCO3) to maintain accurate total filler levels in spite of variations in recycle furnish and additive blending**

Honeywell

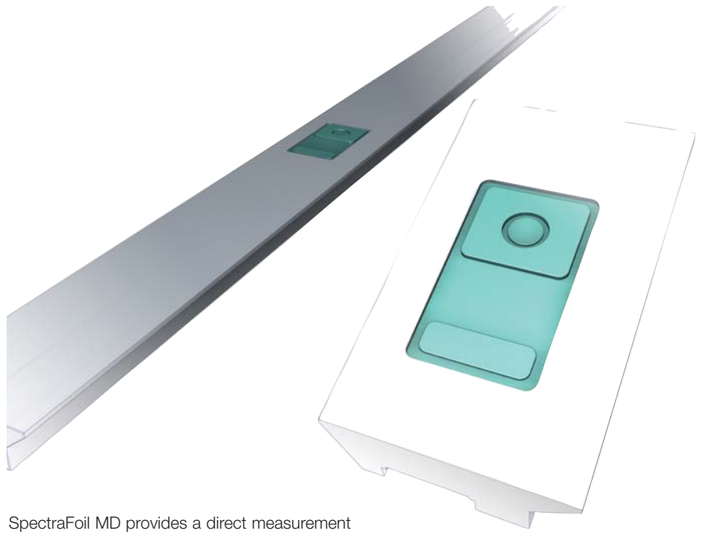
Visibility into Water Removal: SpectraFoil, ExPress Moisture

Your paper machine is all about removing water, which is why moisture measurement and control has such focus within Honeywell.

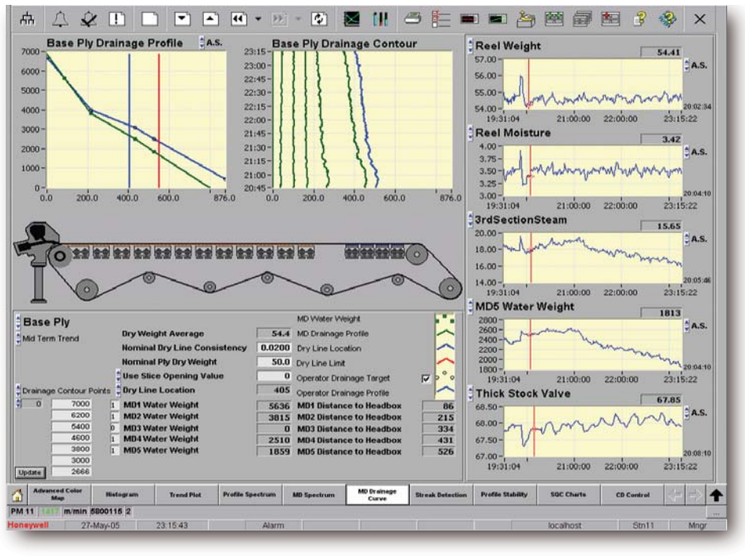
RDS Dewatering: SpectraFoil MD

SpectraFoil MD is a measurement system for the wet end of a paper machine, which provides continuous visibility of machine direction drainage. An array of sensors positioned under the wire, embedded in the forming foils, and aligned in the machine direction measure water weight to provide the paper machine operator with a real-time display of drainage from the forming board to the dry line. The unparalleled sensitivity of these measurements allow the papermaker to see the impact of the smallest changes in refining and furnish mix, retention and wet end chemistry, and vacuum and headbox consistency.

- **Patented technology provides continuous visibility of machine direction drainage, or rate of dewatering, to optimize formation, wet end chemistry, and water removal efficiency**
- **MD drainage profiles can be measured on each ply, to provide unique visibility for multi-former applications**
- **Non-nuclear, resistive field technology sensors are embedded into either poly or ceramic forming foils on Fourdrinier or gap formers**



SpectraFoil MD provides a direct measurement of drainage in the forming section providing feedback for wet-end optimization



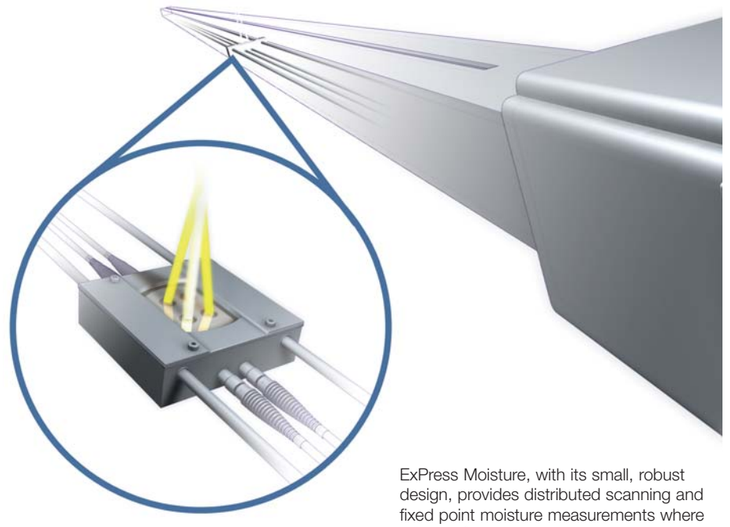
RDS displays include machine direction profiles, along with contour maps of those MD profiles that reflect accurate, current conditions and recent changes

RDS Pressing and Drying: ExPress Moisture MD and CD

ExPress Moisture provides online measurement of moisture directly in the press and drying sections of the machine. A fast, compact, high-resolution scanning measurement is combined with multiple fixed-point sensors down the length of the machine, to provide complete visibility and control of the water removal efficiency on the machine.

Honeywell ExPress Moisture enables the measurement of moisture between nips in the press section, exiting the press before the broke pit and throughout the dryers, to continuously monitor water removal efficiency and improve machine operation. Sensors are small, robust and very fast. ExPress CD generates cross machine profiles on the widest machines in just seconds, while providing better than 3 mm (0.1 in) streak resolution. This patented measurement and CD control application ensures more uniform draws and dried-in tension profiles to improve runnability and reduce waste on the machine, in downstream operations, and on the printing press.

- **High-power IR energy, coupled into fiber-optic cables, delivers accurate moisture measurements in difficult physical locations, without on-machine power or electronics, to improve reliability**



ExPress Moisture, with its small, robust design, provides distributed scanning and fixed point moisture measurements where never before possible

- **4 m/sec (150 in/sec) scanning speeds generate high-resolution, 3 mm (0.1 in), CD moisture profiles in seconds to optimize CD control**
- **Fast single point MD sensors monitor water removal efficiency and target the source of higher frequency MD variations in the wet end**
- **Robust design minimizes maintenance**

Honeywell

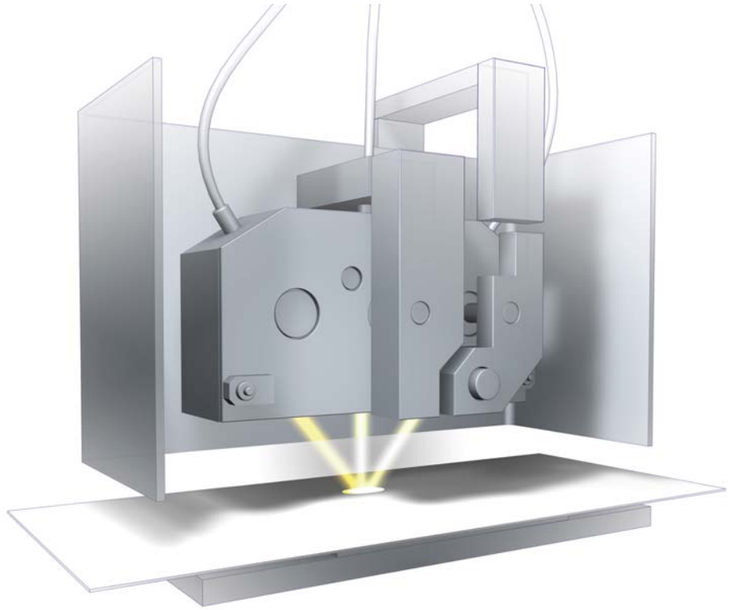
Visibility into Water Removal: GelView, Precision Moisture

Your paper machine is all about removing water, which is why moisture measurement and control has such focus within Honeywell.

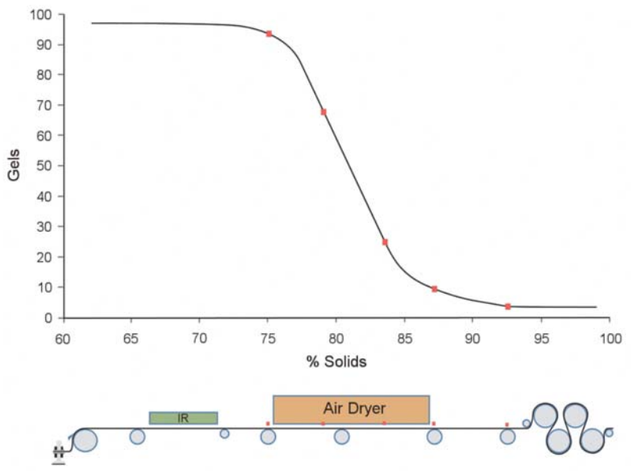
RDS Coating Drying: GelView

Improper drying of coated sheets is one of the leading causes of poor print quality on coated papers. GelView gives papermakers online tools to measure and control the coating drying process. These patented fiber-optic based sensors ensure reduced operating costs, increased production, and top-quality product with greater uniformity, in spite of blade wear and other process changes. It provides the first commercially available solution for the measurement and control of coating drying with proven results.

- **Patented technology measures and controls the location of the gel-point and its rate of drying to optimize print quality, reduce energy usage, and eliminate production bottlenecks**
- **Compact, robust fiber-optic sensors are installed inside the coating dryers to provide reliable measurement and control of the coating process**



GelView sensors directly measure the change in solids of the coating during drying, giving the first ever control of coating consolidation

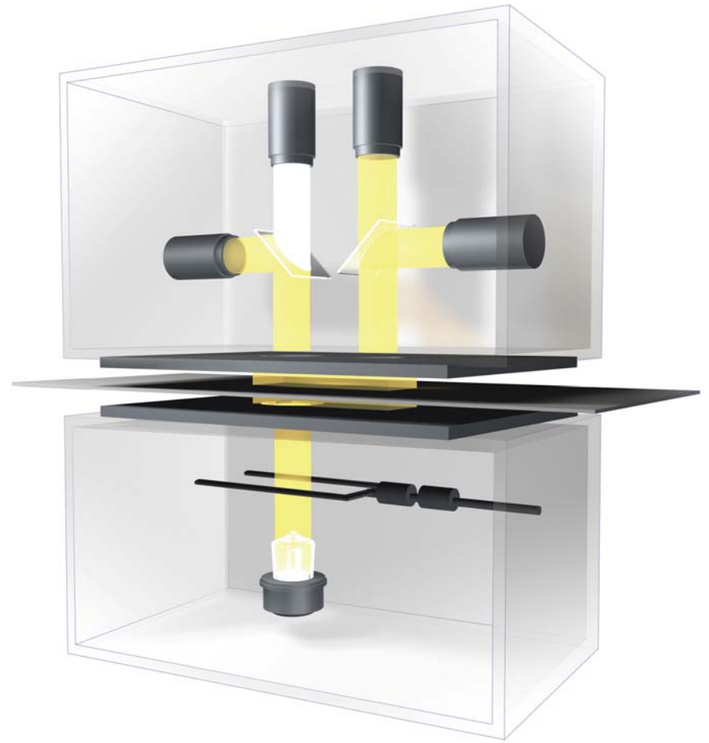


GelView coating drying curve

Precision Moisture Measurement

Precise moisture measurement, and in particular CD profile measurement, is critical to machine productivity and final sheet quality. Honeywell s patented same-spot optics, the simultaneous detection of multiple IR wavelengths, removes the roadblock to fast scanning with high-resolution moisture measurement. With higher scan speeds, the faster CD profile measurement response optimizes CD moisture and dry weight profile control. The key to accurately measuring frequencies (up to 200 Hz) is the simultaneous use of multiple detectors with precise temperature control. This is needed for the fast scanning and has the added benefit of being a useful condition monitoring input, providing a measurement of the true impact that process equipment oscillations have on the final product quality.

- **Unique “same-spot” optics eliminate the need for signal averaging enabling faster scanning and faster CD profile measurement response for optimized CD control**
- **Patented INFRAND optics maximize moisture sensitivity and minimize sensitivity to basis weight changes**
- **Patented light scattering measurement maintains moisture accuracy by eliminating sensitivity to filler levels, refining and furnish changes**
- **Full range of moisture sensors to match your application:**
  - **Lightweight: Single-sided and Transmission IR**
  - **Heavyweight: High Power IR and Microwave**



Precision Moisture Sensor with INFRAND same-spot optics provides high-speed moisture measurement for improved CD profile measurement and control

Honeywell

Visual Perception: Color, Gloss, Formation

The end consumer judges your product by look and feel–color, gloss, opacity and formation. Honeywell understands your need for consistency.

Precision Color Measurement

Having the lab report that targets have not been met for the previous reel is too late. The accuracy of the color lab is required online to really improve quality and impact the bottom line. Honeywells Precision Color and Brightness sensor ensures infinite pad color measurement accuracy online.

Dual spectrometers provide continuous measurement against a black and white backing to ensure accurate color measurement, despite weight and opacity variations.

Honeywell Color Control utilizes a sophisticated decoupling strategy to control up to six dyes per color grade for a consistent production match to the standard. The self-tuning feature of the control utilizes a modern reflectance transformation algorithm, for dye and target shade spectra. This ensures precise control to the target spectra, eliminates metameric matches, and minimizes color rejects and color grade change time.

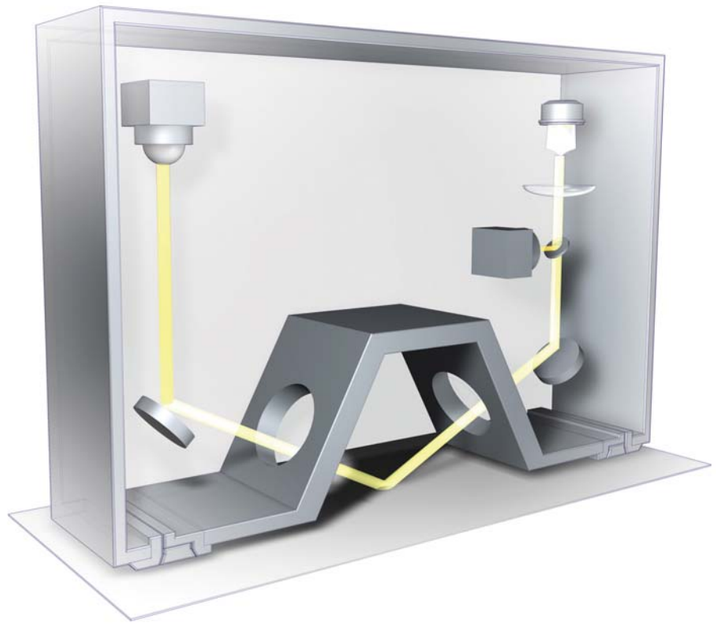
- **Patented technology delivers continuous scanning measurement of color, brightness, whiteness, fluorescence, and other appearance qualities**
- **Full-spectra is measured simultaneously from two laboratory-grade spectrometers to provide accurate, infinite pad reflectance measurement, for excellent lab correlation**
- **Continuous daylight source, merged with a Xenon source, pulsed at 50 Hz for UV enrichment, provides continuous fluorescence measurement to optimize color control**

Precision Color Sensor integrates daylight and UV light sources with dual lab-grade spectrometers to measure appearance qualities online

Precision Gloss Measurement

Bringing laboratory quality gloss measurement to the online paper finishing environment is important to fully capitalize on Honeywell s multivariable-based Advanced Finishing Technology. This strategy ensures that your customers take notice of the printed page. The Honeywell gloss sensor provides accurate, repeatable gloss measurements, conforming to industry standards and maintaining accuracy with little maintenance.

- **Automatic dirt compensation provides accurate measurements with less maintenance**
- **Correlation with the TAPPI standard assures industry acceptance**
- **Non-contact web stabilization prevents sheet marking or damage**
- **Stable long-life LED source means consistent measurements over time**
- **Unique optics minimize sheet pass-line sensitivity to ensure accurate CD profile measurement for CD gloss control**



The Gloss Sensor has robust accuracy, achieved with its LED light source and automatic dirt compensation

Precision Formation Measurement

The human eye is very sophisticated and can easily distinguish between good and poor formation. As might be expected, a sophisticated measurement is required to assure that paper is produced with uniform formation. Honeywell s Formation sensor is unique in its ability to measure average floc size, intensity and size distribution.

Providing more than a simple formation index, this sensor enables the operator to adjust drainage, chemical addition, consistency, and refining to optimize formation and print quality.

- **Floc size, intensity and size distribution are displayed to give an accurate representation of sheet formation**
- **Greater formation detail allows forming variables to be adjusted to optimize print quality**

Honeywell

Visibility into Paper Performance: Caliper, Porosity

From runnability on your machine, through converting and into the hands of the consumer, mechanical properties are essential to the success of your product.

Precision Laser Caliper

Precision Laser Caliper optimizes CD control performance without touching the sheet. The non-contacting design enhances measurement on many grades where contacting sensors are impractical or problematic. The Laser Caliper sensor matches the sensitivity and accuracy of contacting sensors, while eliminating the inaccuracies and maintenance associated with stickies , coating build-up, and wear of the sensing elements. It also reduces the waste associated with contact-induced holes and sheet marking.

- **Measures web thickness without contact**
- **The precision of dual-laser triangulation delivers best-in-class reel building for newsprint, highly filled sheets and sensitive surface grades**
- **Patented air clamp design controls sheet stability to ensure CD profile measurement accuracy**
- **Patented online standardization and calibration techniques ensure reliable accuracy**
- **Demonstrated CD caliper profile accuracy and repeatability of less than a micron**

Precision Contacting Caliper

Reel building and runnability issues in converting, printing and sheet handling drive the need for flat caliper profiles. The UniFoil Caliper Sensor ensures firm contact with minimum pressure to optimize CD caliper control performance and minimize wear and sheet marking. A unique combination of wear-resistant material and aerodynamic shaping is the key to the UniFoil s contacting sensing head. Combining flexible bellows with a fully-gimbaled arm arrangement, UniFoil maintains uniform contact across the full sheet width regardless of flutter and edge effects.

- **UniFoil's proprietary air foil contacting surface creates a partial vacuum that is proportional to machine speed to maintain intimate contact with less pressure**
- **Sapphire contacting elements reduce contaminant build-up and wear, while ensuring the precision required for optimum CD profile control**
- **Flexible bellows and fully gimbaled mounting provide uniform but gentle contact and precise sheet edge measurement**

Precision Porosity Measurement

Porosity is a reliable indicator of the internal structure of your paper. Almost all grades require information about porosity, especially sack, filter, cigarette, and copy papers where air permeability determines product performance. Applied coating penetration and printability also largely depends on achieving exactly the correct porosity. Honeywell's Poros scanning porosity sensor has the unique measurement speed necessary to provide reliable CD profiles. The design is based on the measurement of air flow through the paper, which correlates directly with paper sheet porosity. This linear, non-grade-dependent measurement approach emulates laboratory methods, thus minimizing calibration requirements.

- **Both MD and CD porosity measurements are made online in real time, providing feedback for process changes to improve paper quality**
- **Can be calibrated with any porosity standard**
- **Robust construction ensures trouble free, continuous operation, even in hostile environments**

Precision Laser Caliper (left) delivers reel building accuracies without contacting the sheet

Precision UniFoil Caliper Sensor (above) has the lightest touch in the industry for safe, accurate caliper measurement

Precision Porosity Sensor provides online scanning measurements of MD and CD air permeability, for better continuous monitoring of sheet structure

Honeywell

Enhance Business Performance

The Honeywell Da Vinci QCS solution is based on a solid foundation of superior sensors, actuators, process visibility and control software, and data analysis tools.

Honeywell QCS

Business Performance

Advanced Control
Performance CD scan by scan control execution
50 percent faster control response to breaks and start-ups

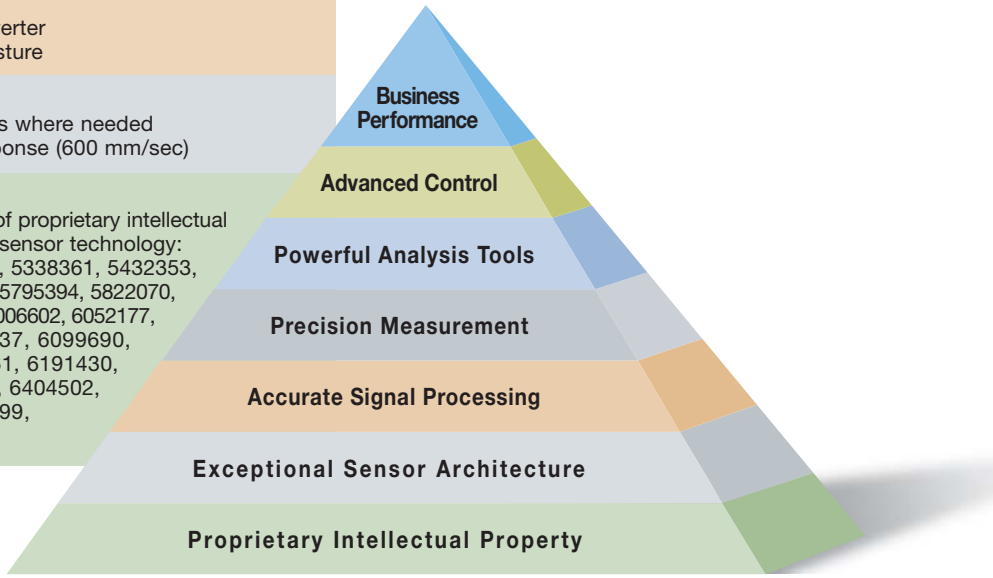
Powerful Analysis Tools
Integrated Machine Sentinel process/quality monitoring
Integrated quality reporting and data warehousing

Precision Measurement
Moisture measurements with same-spot optics
5x better repeatability with 2 Ci line source Pm basis weight sensor

Accurate Signal Processing
2kH sampling with 16-bit analog-to-digital converter
>200 Hz response for all sensors including moisture

Exceptional Sensor Architecture
Remote Distributed Sensing puts measurements where needed
Precision 4000 Scanner gives faster profile response (600 mm/sec)

Proprietary Intellectual Property
Honeywell Solutions are built upon a foundation of proprietary intellectual property including the following U.S. patents for sensor technology: 5235192, 5243407, 5276327, 5297062, 5315124, 5338361, 5432353, 5455422, 5576541, 5642192, 5654799, 5793486, 5795394, 5822070, 5891306, 5928475, 5933243, 5953111, 5954923, 6006602, 6052177, 6059931, 6067162, 6074483, 6080278, 6087837, 6099690, 6126785, 6149770, 6168687, 6179918, 6183561, 6191430, 6204672, 6233053, 6281679, 281689, 6341522, 6404502, 6416651, 6466839, 6483325, 6507403, 6805899, 5101661, 5138878



For More Information

Learn more about how Honeywell s Pulp and Paper solutions can improve your performance. Visit our website at www.honeywell.com/ps or contact your Honeywell account manager.

Automation & Control Solutions
Process Solutions
Honeywell
2500 West Union Hills Dr.
Phoenix, AZ 85027
Tel: 877.466.3993 or 602.313.6665
www.honeywell.com

Paper for this brochure was quaiity controlled by Honeywell Systems

BR-05-006-ENG
September 2005

Honeywell