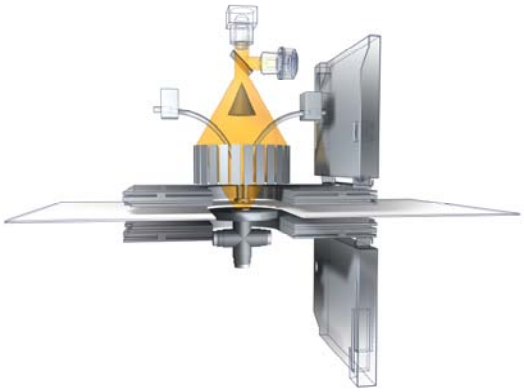
Product Information Note

Honeywell

Experion MX Color Measurement

Experion MX will help improve your business performance in today's challenging economic environment. This fully integrated quality control and process knowledge system provides superior visibility into the papermaking process while it simplifies your operational efforts and is easy and cost effective to maintain and service. Improve paper quality, reduce raw material, energy, services and maintenance costs, and increase production efficiency with a package of solutions that provides the lowest total lifecycle cost available – Experion MX.



Model Q4215-60

Honeywell's Experion MX Color Measurement provides scanning measurement of color, brightness, whiteness, fluorescence, and other appearance qualities. With accurate color measurement and control, your business performance will be enhanced by improving product quality and increasing production efficiency.

The sensor acquires spectra simultaneously from two laboratory-grade spectrophotometers to provide accurate infinite-pad color measurements from the same spot on the sheet[1]. Fast fluorescent color measurement is obtained by merging the beams of a continuous daylight source and a pulsed UV-enrichment source[2]. Sheet position is maintained in the sensor using a non-contacting air vortex sheet stabilizer, for repeatable, non-intrusive measurement.

[1] U.S. Patent No. 5,793,486

[2] U.S. Patent No. 5,642,189

These features, along with fast-response electronics and compensation for environmental sources of error, provide excellent accuracy for closed-loop color control and for accurate reporting of product quality and productivity.

Model Q4215-60 Color Measurement is designed specifically for laboratory-accurate measurement in the on-line environment. The result is a high degree of user confidence, enabling tight process control for reduced color rejects and reduced startup and color grade change culls.

Features and benefits

- Reflectance measurement at 5 nanometer (nm) increments, from 350 to 750 nm, provides very high absolute accuracy, with the capability to report a wide range of diffuse-reflectance appearance measurements.
- Designed for fast, on-line operation delivering ten laboratory accurate measurements per second, providing machine-slice width profile resolution.
- Brilliant quartz-tungsten-halogen (QTH) source provides excellent stability and reliable CIE C illumination and presents no limits to measurement speed.
- Filtered UV-rich xenon source, pulsed at 50 Hz, facilitates fast, accurate measurement of fluorescence index and D65 color, and uses no moving parts.
- Annular (360°) sheet illumination with the industry-standard 45° incident/0° measurement geometry provides measurement insensitivity to fiber orientation and sheet finish[3].

[3] U.S. Patent No. 5,642,192

- Real-time calculation of “infinite-pad” color measurement ensures accurate opacity-insensitive measurements at every slice, enables repeatable color targets from run to run, and avoids potentially erroneous corrections based on previous scans.
- Non-contacting air vortex sheet stabilizer ensures repeatable scanning measurements, prevents pitch or “stickies” buildup on sensor, avoids creation of dust, and eliminates sheet marking or damage.
- Standards are protected in the sealed backing module, and exposed only during automatic standardization in an air-purged enclosure, ensuring long-term accurate measurement.

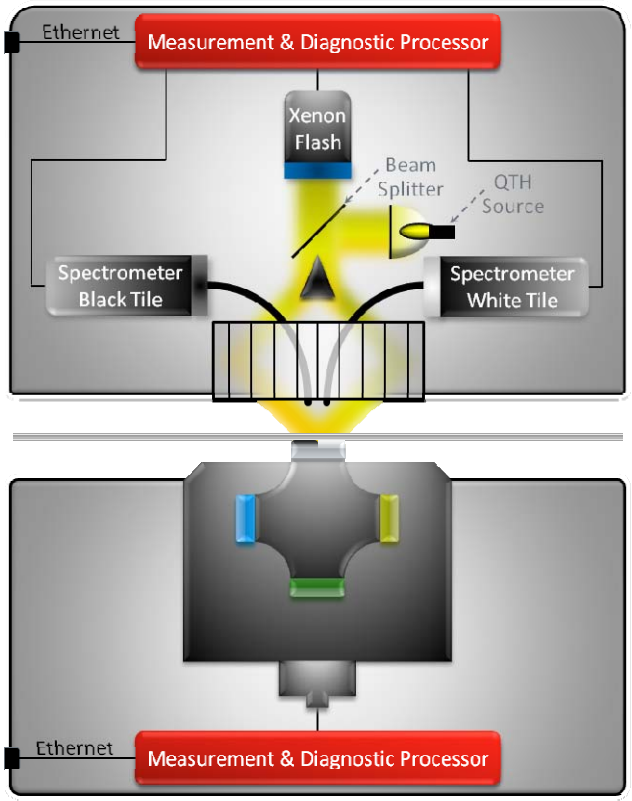
Color Measurement Principle

The sensor measures color using a quartz-tungsten-halogen lamp, mated with a custom dichroic color balance filter, providing continuous illumination with an energy spectrum matching the visible portion of CIE Standard Illuminants C and D65. The second source, a xenon lamp with an ultraviolet transmitting filter, is pulsed.

By measuring the sheet reflectance between and during UV pulses, the impact of FWAs on all appearance variables, such as color, brightness and whiteness, can be determined quickly, without using moving parts.

A beam splitter merges the irradiances of the two sources, creating an illuminating beam that alternates low-UV and UV-enriched daylight illumination every 10 milliseconds. A conical mirror spreads the merged beam within a ring of 24 planar mirrors. Light reflected from the annular mirror ring converges on the sheet at an incident angle of 45° an axis normal to the plane of the sheet. The 360° illumination ensures that the measurement is not sensitive to the sheet surface characteristics.

In the laboratory, a sample is backed by an “infinite pad” of the same paper for the color measurements. On the process, where only a single sheet is measured, the Color Measurement backs the sheet with a half-white and half-black backing. Two fiber optic bundles collect reflected and emitted light from the sheet surface normal to the plane of the sheet (0°). One fiber optic bundle views the black-backed portion of the sheet; and the other views the white-backed portion of the sheet. Using equations based on the Kubelka-Munk model of light absorption and scattering, with proprietary improvements, the black- and white-backed total radiance factors are used to compute an opacity-insensitive “infinite pad” color. Simultaneous acquisition of spectra from both spectrophotometers ensures opacity-insensitive color measurement, even for such small-scale opacity variations as formation effects or coating streaks.



Dual sources with merged-beam optics, and simultaneous acquisition of black- and white-backed total radiance spectra deliver fast, accurate on-line color measurement.

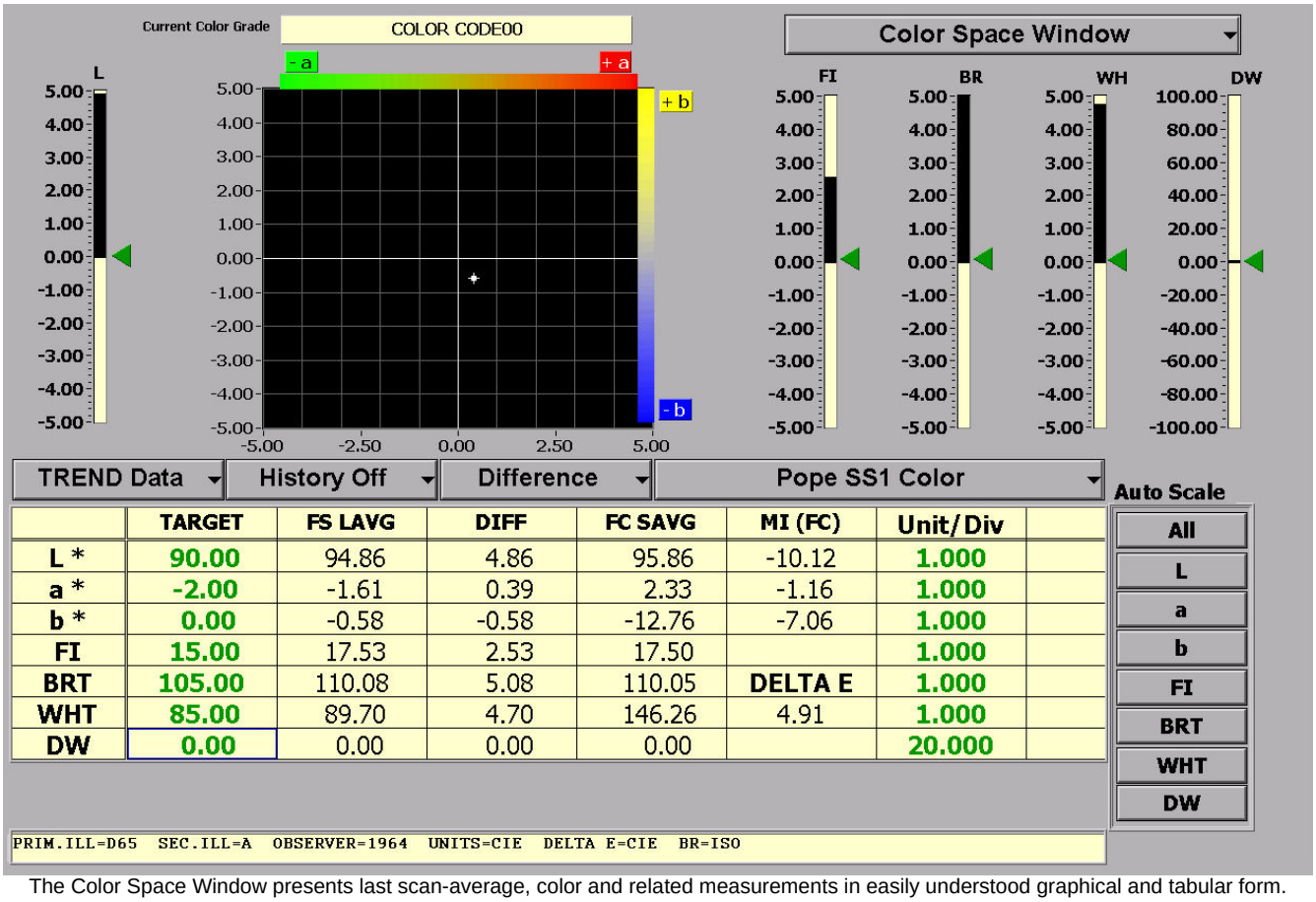
Reliable, Consistent Color Measurement Results

The sensor is protected against environmental contamination by the measurement window and an air purge provides positive pressure in the cavity between the sheet and window to prevent dust buildup.

The calibration standards are protected in a sealed enclosure between standardization cycles. The first phase of standardization measures electrical and light background levels. The backing module bezel is then raised to contact the measurement module, creating a completely protected, air-purged enclosure in the sheet gap. Only then are the white standard, fluorescent standard and yellow check tile automatically presented to the measurement module. The bezel is then lowered, sealing the standards in the backing

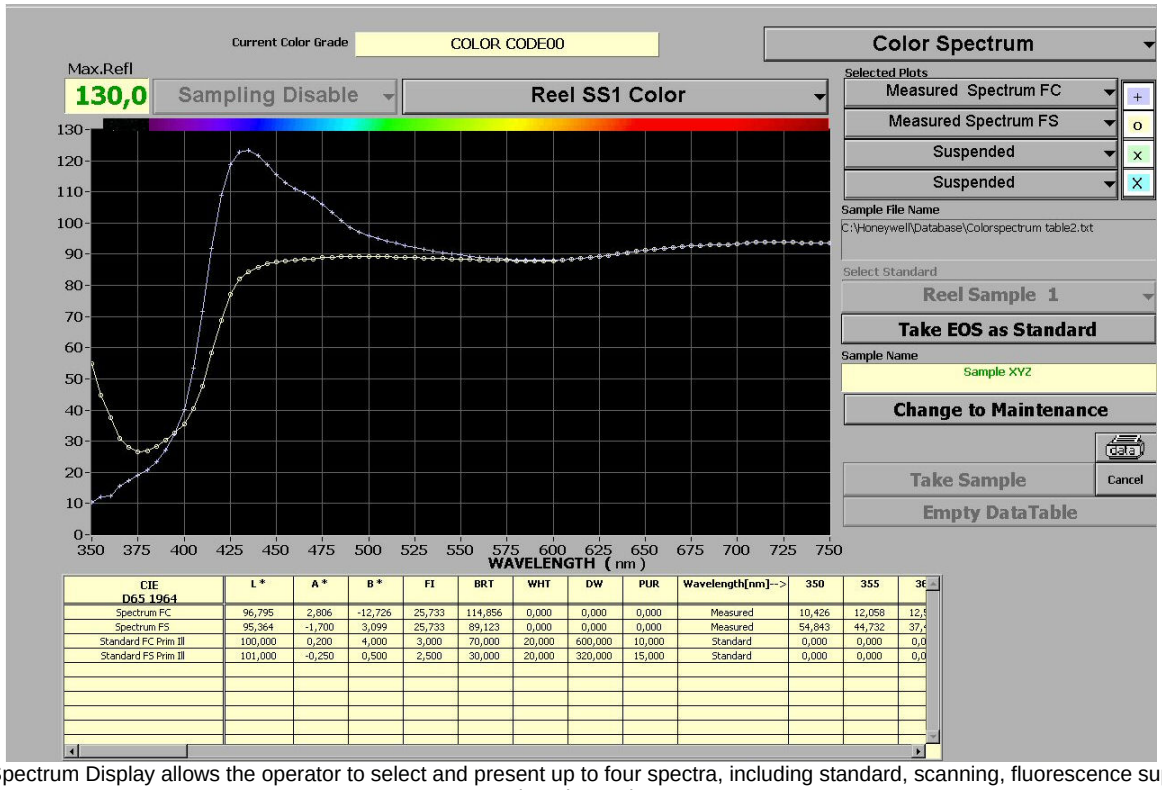
module, and exposing only the on-line black/white backing. A report details standardization results.

The measurement uses a non-contacting air vortex sheet stabilizer. The resulting vortex creates a balance of low- and high-pressure forces that maintain the sheet in close proximity to the black/white backing for accurate measurement without contact, preventing contaminant buildup on the backing or damage to the sheet.



	TARGET	FS LAVG	DIFF	FC SAVG	MI (FC)	Unit/Div
L *	90.00	94.86	4.86	95.86	-10.12	1.000
a *	-2.00	-1.61	0.39	2.33	-1.16	1.000
b *	0.00	-0.58	-0.58	-12.76	-7.06	1.000
FI	15.00	17.53	2.53	17.50		1.000
BRT	105.00	110.08	5.08	110.05	DELTA E	1.000
WHT	85.00	89.70	4.70	146.26	4.91	1.000
DW	0.00	0.00	0.00	0.00		20.000

The Color Space Window presents last scan-average, color and related measurements in easily understood graphical and tabular form.



The Color Spectrum Display allows the operator to select and present up to four spectra, including standard, scanning, fluorescence suppressed or corrected, and sample spectra.

Specifications

Sources:	• Continuous quartz tungsten halogen • 50 Hz pulsed xenon
Measurement geometry:	45°/0°
Wavelength range	350 to 750 nanometers
Wavelength resolution:	5 nanometers
Reflectance range:	0 to 200% reflectance
Reflectance resolution:	0.01% reflectance
Opacity range:	60 to 100%
Illuminants:	CIE: A, C, D65, D50
Observers:	CIE: 2° (1931), 10° (1964)
Measurements:	Using a selected pair of the CIE illuminant and the CIE standard observer: • Each slice: Fluorescence suppressed **or** corrected: CIE L*, a*, b*, or Hunter L, a, b, or DWL, EP, Y Brightness: TAPPI, ISO or D65 Fluorescence Index (ΔBrightness or ΔZ) • Scan average: Fluorescence suppressed **and** corrected: CIE L*, a*, b*, or Hunter L, a, b, or DWL, EP, Y Brightness TAPPI, ISO or D65

	Fluorescence Index (ΔBrightness or ΔZ) Whiteness (CIE) Total color error ΔE_{Lab} or ΔE_{CMC} Total radiance factor for chosen illuminant (FC spectrum) Reflectance factor (FS spectrum)
Repeatability, 2σ:	(30 measurements on non-fluorescent standard tile, one measurement per minute) • Color - CIE L*, a*, b* using (D65/10°): ± 0.05 unit • Brightness: ± 0.10 unit • CIE Whiteness using (D65/10°): ± 0.15 unit
Static Accuracy, 2σ:	(White and non-fluorescent colored opaque samples, compared to a well known laboratory spectrophotometer)* • Color - CIE L* using (D65/10°): ± 0.3 units • Color - CIE a*, b* using (D65/10°): ± 0.3 units or 2% of the reading, whichever is greater • Brightness: ± 0.5 units • CIE Whiteness using (D65/10°): ± 1.0 units
Dynamic Accuracy, 2σ:	(White and non-fluorescent colored paper grades, compared to a well known laboratory spectrophotometer)* • Color - CIE L* using (D65/10°): ± 0.5 units • Color - CIE a*, b* using (D65/10°): ± 0.5 units or 3% of the reading, whichever is greater • Brightness: ± 1.0 units • CIE Whiteness using (D65/10°): ± 1.5 units * Note, moisture content of the measured paper is assumed to be similar during on-line and laboratory measurement. Paper grades containing thermochromic dyes and daylight fluors are excluded.
Reproduceability among Honeywell Sensors, 2σ:	(Using Honeywell verification tile set) • Color - CIE L*, a*, b* using (D65/10°): ± 0.2 unit • Brightness: ± 0.4 unit • CIE Whiteness: ± 1.5 unit using (D65/10°)
Operating Environment:	Maximum Air Temperature, R.H.: See sensor enclosure specification.

More Information

For more information on Experion MX, visit www.honeywell.com/ps or contact your Honeywell account manager or field service leader.

Automation & Control Solutions
Process Solutions
Honeywell

1250 West Sam Houston Parkway South
Houston, TX 77042

Lovelace Road, Southern Industrial Estate
Bracknell, Berkshire, England RG12 8WD

Shanghai City Centre, 100 Junyi Road
Shanghai, China 20051
www.honeywell.com/ps

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Honeywell