

# REFLECTANCE SPECTROPHOTOMETRY



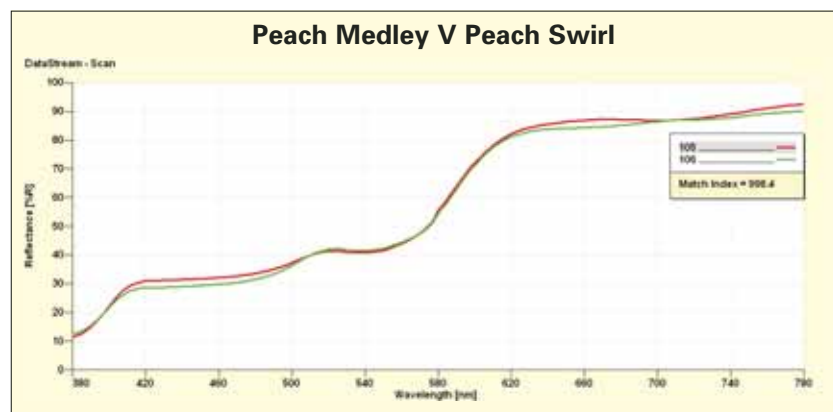
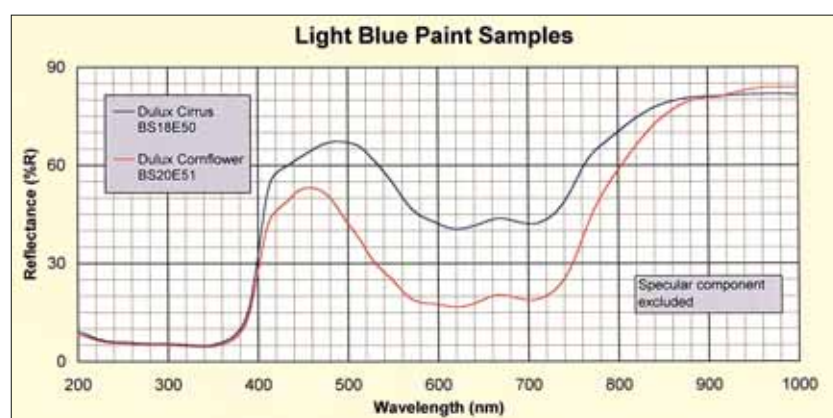
REFLECT  SCAN<sup>TM</sup>

## Diffuse Reflectance Measurements

The integrating sphere allows a wide range of measurements.

- Diffuse and specular samples
- Total hemispherical reflectance
- Specular excluded diffuse reflectance
- Transmittance of turbid or scattering samples
- Diffuse reflectance of powder samples

Measurements of total hemispherical reflectance are made with or without the spectral component eliminated. Spectral reflectance and sample transmission may also be measured.



## Universal Reflectance Measurements

The ReflectaScan™ Spectrophotometer is designed as a universal diffuse and specular reflectance measuring instrument capable of scanning samples over the wavelength range 190-1100nm. An integral printer plots results and an external printer may be used.

## Integrating Sphere

A dedicated, compact high performance Spectralon™ integrating sphere is used for diffuse reflectance and diffuse transmittance measurements. The sphere unit has its own silicon diode detector which uses a separate signal channel within the Spectrophotometer.

## Colour Computations Using Diffuse Reflectance

Onboard software provides automatic analysis and computation of colour samples when scanned.

Overlaid scans of two blue samples from the Dulux paint range are shown; each is specified by its British Standard number shown on the chart.

The automatic analysis of the scans of two very similar pink colours, also from the Dulux range, is shown on the lower graph which displays the overlaid scans. The automatic analysis of each scan is shown and the automatically generated table of colour difference is also shown.

The specular component was excluded from all scans.

## Turbid or Scattering Samples

The sphere unit is equipped with a 10mm pathlength cuvette holder so that transmittance measurements may be made for both turbid or normal samples. Scattering solid films may also be accommodated for measurement.

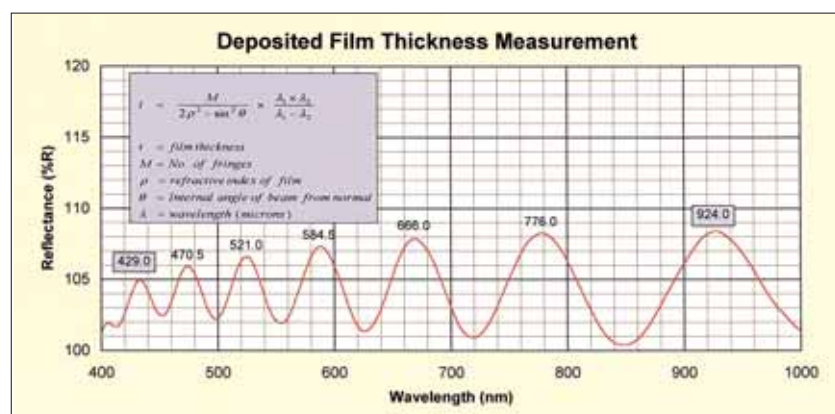
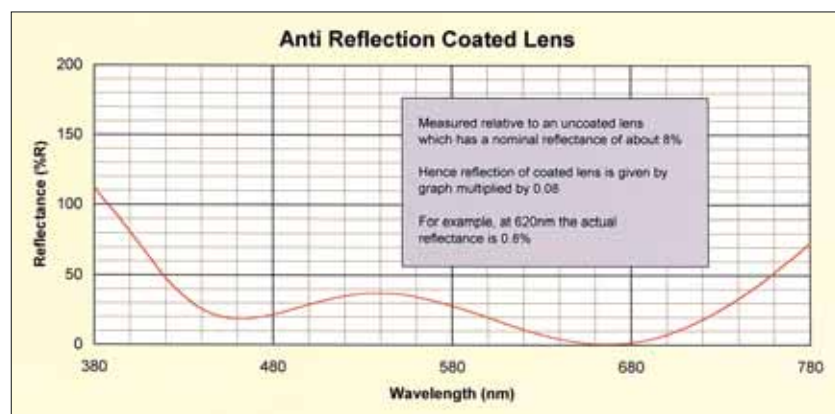
SCAN 105			
Interval:	5 nm		
Illuminant:	C		
Observer:	2 degree		
Tristimulus:	X	Y	Z
	57.335	50.84	38.156
Chromaticity:	x	y	z
	0.392	0.347	0.261
CIE:	L*	a*	b*
	76.582	19.022	22.437
CIE:	L*	u*	v*
	76.582	44.353	28.665
Saturat.	uv:	0.69	
Chroma	uv:	52.81	
HueAngle	uv:	0.574	
Chroma	ab:	29.415	
HueAngle	ab:	0.703	

SCAN 106			
Interval:	5 nm		
Illuminant:	C		
Observer:	2 degree		
Tristimulus:	X	Y	Z
	56.35	50.615	35.574
Chromaticity:	x	y	z
	0.395	0.355	0.25
CIE:	L*	a*	b*
	76.445	17.203	25.369
CIE:	L*	u*	v*
	76.445	43.23	32.821
Saturat.	uv:	0.71	
Chroma	uv:	54.277	
HueAngle	uv:	0.649	
Chroma	ab:	30.652	
HueAngle	ab:	0.596	

COLOUR DIFFERENCE		
CIE	dE*uv:	4.307
CIE	dH*uv:	4.047
CIE	dE*ab:	3.453
CIE	dH*ab:	3.221

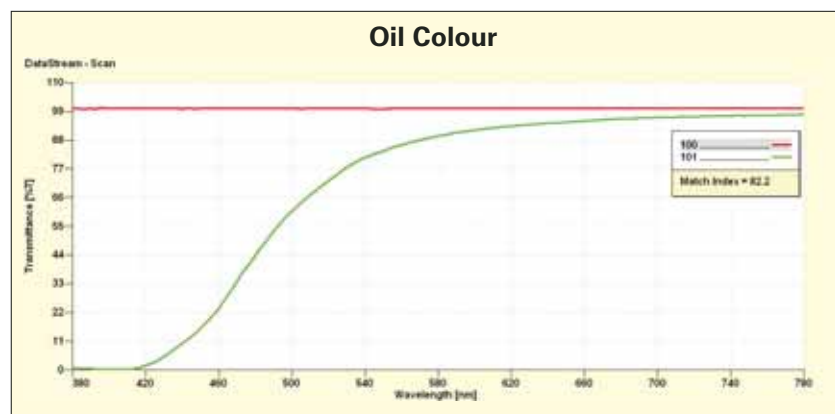
## Coated Lens Reflectance

The optical performance of the anti-reflection coatings on ophthalmic lenses is specifically catered for by the specular reflectance unit. A conical rest is provided to accommodate lenses up to 90mm diameter. Measurements are made with reference to an uncoated lens and the system is excellent for the production control of vacuum coated lenses.



## Petrochemical Applications

Calculations using the transmission characteristics of petrochemical samples is widely used in the industry. The overlaid transmission spectra of two petrochemical samples are shown here as recorded by the CE3055. Scan 100 is of a highly refined, water white, oil used as a reference and scan 101 is of a pale yellow mineral oil. The instrument automatically calculates the Saybolt and ASTM colour reference as printed out below.



## Specular Reflectance

A dedicated specular reflectance unit is used for specular reflectance measurements of surfaces and coated ophthalmic lenses. The unit is ideal for quality assurance in the production of anti-reflection coatings and the measurement of thin film thickness, for instance in the semi-conductor industry. Many of these systems are now in use around the world.

## Ophthalmic Lens Transmission

The transmission characteristics of tinted ophthalmic lenses may readily be measured using the CE 3077 lens mounting system. The lens is accurately centred on a carrier plate which is kinematically mounted on the body of the lens holder.

## Automatic Thin Film Measurement

The measurement of thin deposited films is important in many optical and electronic industries.

The CE3075 Specular Reflectance unit is valuable for measuring the thickness of thin transmitting films such as epitaxial films of silicon oxide on a silicone wafer.

A reflectance scan against wavelength produces a series of reflectance maxima and minima, due to optical interference, from which the ReflectaScan instrument automatically calculates the film thickness for films down to 0.1 microns thick.

The scan shown here gave a film thickness of 1.05 microns.

## Automatic Colour Computations

On board software provides a wide range of colour calculations including tristimulus values, chromaticity, CIE L\* a\* b\*, CIE L\* u\* v\*, whiteness etc.

Standard illuminant tables include CIE, a, b and c and CIE D50, D65 and D75. Observer tables include 2° and 10° angles.

	SCAN 100		SCAN 101
Interval:	5 nm	Interval:	5 nm
Illuminant:	C	Illuminant:	C
Observer:	2 degree	Observer:	2 degree
ASTM Colour:	0.2	ASTM Colour:	0.8
Saybolt:	28.3	Saybolt:	-16

## SPECIFICATION

Optical Monochromator	Littrow using 1200 L/mm holographic grating
Optical Bandwidth	4nm
Wavelength Range and Accuracy	190-1100nm, better than $\pm 1$ nm
Wavelength Reproducibility	$\pm 0.1$ nm
Self Test and Calibration	Automatic at switch on
Wavelength Scale Expansion	Selectable by keyboard entry 1-100nm/cm
Scan Speed	Selectable by keyboard entry 1-4000nm/min
Straylight	Typically $<0.01\%$ at 220nm and 340nm
Display Screen - Backlit LCD	Displays menus, plots etc with six screen widths of viewing available by scrolling
Photometric Ranges	Display of -0.3-3A, 0-200%T, 0-9999C, %R
Photometric Accuracy	$\pm 0.005$ A or 1% whichever is greater
Photometric Noise	Less than $\pm 0.0002$ A (500nm)
Baseline Flatness	Better than $\pm 0.002$ A most of range
Baseline Stability	Better than 0.001A/hour, 500nm
Overlaid Scans	Scans and derivatives with or without offset
Spectral Reprocessing	Scans manipulated; replotted over any range
Integral Printer	Prints scans and data
Scan Storage	Up to 100 stored security code protected
Curve Fitting and Editing	Linear, quadratic or cubic; up to 30 standards
Wavelength Programming	Up to 10 wavelengths
Method Storage	Up to 100 methods stored in safe memory
Derivative Spectra	1st and 2nd derivatives
Time Course Plotting	Plots may be reprocessed and stored
Real Time Clock	Timed and dated reports
Computer/printer interfaces	Bi-directional serial RS232C and parallel port
Size & Weight	480 x 340 x 205mm, 19.5kg
Power Requirements	110-250V, 50/60Hz, 170W

### Integrating Sphere Unit

2" diameter Spectralon™ sphere with integral silicon diode detector, lever operated internal beam reflecting mirror, 0° sample rest for specular excluded measurements, 11° sample rest for total hemispherical reflectance measurements, 10mm cuvette holder for turbid and scattering samples, and film holder. Mounted Spectralon standard.

### Specular and Lens Reflectance Unit

Horizontal sample stage with rest for flat samples, conical rest for lenses, integral beam polarizer and mounted front aluminised mirror reference standard.

### Ophthalmic Lens Holder

Holder for transmission measurements. Kinematically mounted lens centring plate with lens clamping facilities.

## ORDERING ACCESSORIES AND SPARES

### Lamps

Deuterium lamp with hours indicator	2202 01 42
Tungsten halide lamp - in pairs	2303 01 40

### Printers, Cables

RS232 9 pin PC cable and protocol manual	2021 83 00
Dot matrix printer, includes cable	8000 70 01
Colour ink jet printer, includes cable	8000 72 01
Printer connection cable	8000 71 00

## ORDERING

### CE 3055 ReflectaScan™ Reflectance Spectrophotometer

4nm bandpass, 190-1100nm wavelength range, built in integrating sphere signal channel, cell holder, power cable and operators manual.

### CE 3073 Integrating Sphere Unit

Spectralon™ sphere with integral silicon detector, 10mm turbid sample cuvette holder, film holder, 0° and 11° sample rests and internal rotatable mirror system.

### CE 3075 Specular Reflectance Unit

With flat sample rest, conical lens mounting rest, mounted front surface aluminised plain reference mirror and mounting thumb screws.

### CE 3077 Ophthalmic Lens Holder

Holder for transmission measurements with lens centring and mounting plate, and mounting thumb screws.

### 8000 70 01 Dot matrix printer

Includes cable.

### 8000 72 01 Colour Ink Jet printer

Includes cable.

### 8000 73 01 Laser printer

## OPTIONAL SOFTWARE

### DataStream

Fast transfer of data to a PC for use with Excel or other spread sheets.

### Colour Scan Software

For calculation of tristimulus chromaticity, CIE  $L^*a^*b^*$ , CIE  $L^*u^*v^*$  and thin film thickness etc.

### Quant S

Quantitation of corrected bands, difference spectra, spectral stripping, overlaid spectra, spectral storage.

### Program W

Wavelength program for up to 10 wavelengths and timed interval measurements at a fixed wavelength.

### Validation

Absorbance validation using certified standards, wavelength validation using certified standards, optical bandwidth, etc.

Cecil Instruments policy is one of continuous development. We therefore reserve the right to change specification without notice.

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