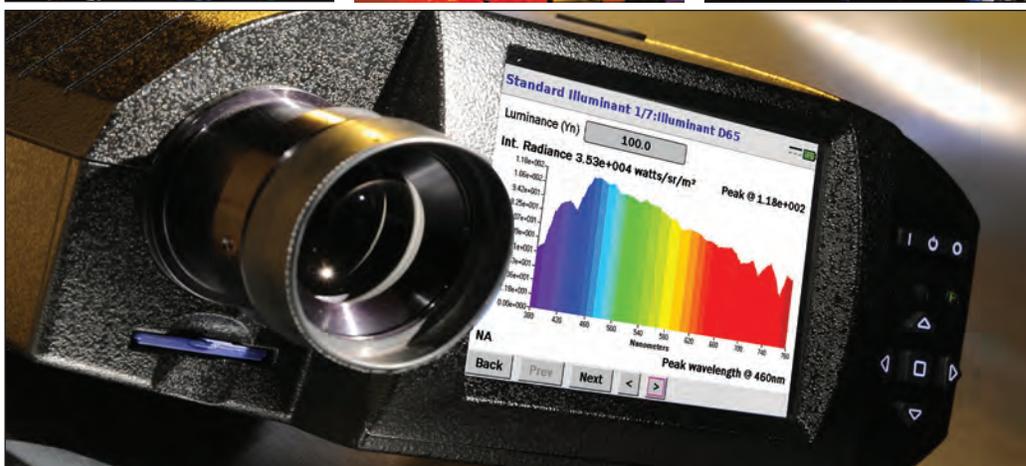
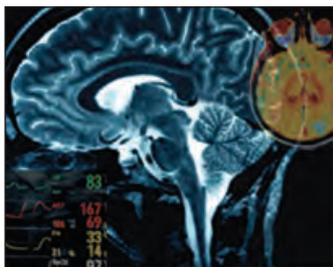




# PR-655 PR-670 PR-680 and PR-680L SpectraScan® Spectroradiometers



# THE NEW ERA OF LIGHT AND COLOR MEASUREMENT



Gone are the days when the calibration of displays or projector systems could rely on the 'magic eyeball'. The correct adjustment and verification of color, RGB White Point, contrast, gamma, screen gain, and uniformity among others, requires accurate and repeatable measurements. When the proper tools are utilized the required test can be conducted in a timely manner and insures that the images being displayed, regardless of the technology, are the best possible.

The PR<sup>®</sup>-6XX SpectraScan<sup>®</sup> family of Spectroradiometers, the PR-655, PR-670, PR-680 and PR-680L SpectraDuo from Photo Research provided the necessary tools to guarantee that your product and your image are the best they can be.

- PR-655 SpectraScan<sup>®</sup>
- PR-670 SpectraScan<sup>®</sup>
- PR-680 SpectraDuo<sup>®</sup>
- PR-680L SpectraDuo<sup>®</sup>

## PRITCHARD<sup>®</sup> OPTICS

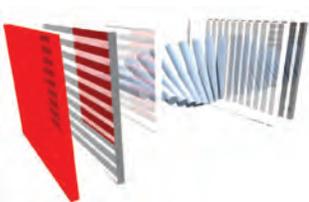


When measuring small character stroke widths or miniscule samples in a large field, an accurate and precise optical system is essential to insure proper alignment. The world renowned Pritchard Optics is such a system, widely accepted as the most accurate and versatile in use today. In the Pritchard system the user sees a bright and magnified image in the center of which is a black dot (aperture). Since only the light passing through the aperture is measured, the aperture accurately and unambiguously defines the measuring field within the field of view.

The PR-6xx is as easy to use as point-and-shoot. The Pritchard optics system makes target alignment as easy as aim and focus. When you are ready to make a measurement, simply press the measure button. The PR-670, 680 and 680L are all supplied with 4 automated measuring apertures (1°, 1/2°, 1/4° and 1/8°). The multi apertures are ideal for measuring both large and small targets without the need for any additional lenses or accessories, and with minimal repositioning of the instrument.

If the spot coverage with the standard lens is too large, the PR-6xx instruments can be optionally equipped with a series of magnification lenses to achieve spot coverage as small as 0.0036 mm (0.0014 in.).

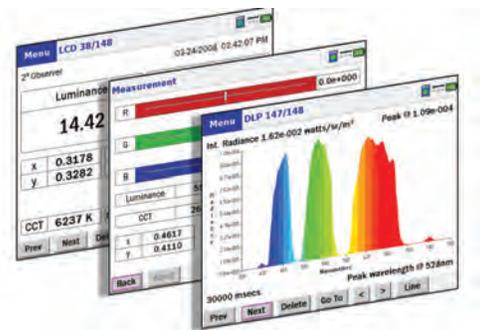
## LOW POLARIZATION



The PR-6xx's Pritchard optical system minimizes polarization errors to less than 1%, assuring accurate results when measuring polarized sources, such as LCD's.

# COLOR TOUCH SCREEN DISPLAY

The PR-6xx design provides stand alone operation - no PC required. Menus are accessed via the on-board, 3.5" high resolution, full color touch screen LCD display and 5-way navigation keypad. Following a measurement, the PR-6xx displays **data and color spectral graphs on the system display.**



# AUTOSYNC®



The patented Auto Sync® feature takes the worry out of accurately measuring high intensity, fast refreshing sources such as LCD's, PDP's, DLP Projectors, etc. by adjusting the detector exposure time to the source refresh rate. When enabled Auto Sync® insures that entire pulses are captured, improving the accuracy and repeatability of the measurements. The Sync rate of the source is displayed once a measurement is completed.

# PORTABILITY



The PR-6xx family of instruments take portability to the next level. All instruments come standard with a Li-Ion battery which, on a full charge, can last for over 12 hours of continuous use. Secure Digital (SD) storage allows for over 80,000 measurements on a 512 MB card. Measurements stored on the SD card can be viewed on the instrument or using the optional SpectraWin® 2 Windows software. Don't want to be wired down? The PR-6xx instruments can be equipped with a Class 1, 100 meter range Bluetooth option. The Bluetooth option provides for wireless remote control of the instrument from a Theater Booth, Office, Lab, etc..



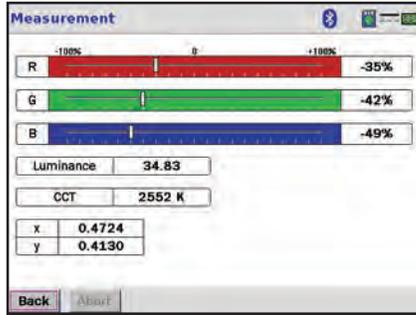
Support for SD cards sizes up to 1GB



PR-6xx Status Bar, displays real-time system information.

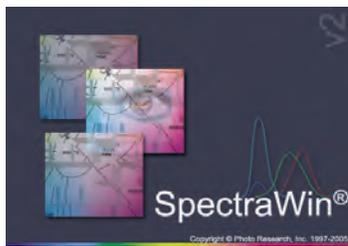
- SD Card Storage
- Bluetooth Wireless Adapter
- Over 12 Hours of Continuous use
- Less than 4.5 lbs.
- Real Time System Status

# RGB WHITE POINT CALIBRATION



In addition to spectrally based measurements of luminance, chromaticity coordinates and correlated color temperature, the PR-6xx provides the user with a spectrally based interactive method of performing white point calibrations of CRT's, LCD's, PDP's and digital projectors, among others. Since the PR-6xx RGB is a spectrally based system, white point calibration can be achieved simply by entering target values into the setup screens including luminance and chromaticity coordinates (CIE 1931 xy values). The user can also select from pre-stored phosphor sets (NTSC, SMPTE, HDTV, etc.) or create user phosphor values to be used during the calibration sequence.

## SOFTWARE



- Color Rendering Index (CRI)
- CIE Chromaticity
- $L^*a^*b^*$  /  $L^*u^*v^*$
- $\Delta E^*$  Lab,  $\Delta E^*$  uv
- Transmittance
- Optical Density
- Reflectance
- RGB Display Calibration

SpectraWin<sup>®</sup> 2 is a full featured, menu driven, Windows XP, Vista, Windows 7 for 32 or 64 bit PC's based control program. SpectraWin 2 is designed to provide a powerful and easy-to-use interface to control and manipulate data from your PR-6XX SpectraScan. In addition to the standard features of measurement and display of spectral power distribution, luminance and CIE colorimetry, SpectraWin 2 has additional features for viewing, analyzing and calculating measured data.

SpectraWin 2 Pro includes a powerful Macro Scripting tool to help you automate your measurement tasks. The optional RGB DisplayCal package turns your SpectraScan into a Windows based display calibration tool enabling you to interactively set the white point of the display from a learned stimulus (golden display) or by entering target values.

## THE SPECTRA DUO



The PR-680 and 680L SpectraDuo<sup>®</sup> are the first and only instruments to contain a fast-scanning 256 detector element spectroradiometer and an ultra-sensitive, low noise Photo Multiplier Tube based filter photometer in one. Available operating Modes are: 1) As a fast scanning spectroradiometer 2) As a highly sensitive photometer or 3) Auto Select Mode which automatically chooses the detector based on the available signal.

The unique design of the SpectraDuo<sup>®</sup> series makes tasks such as spectrally based colorimetry and high speed, low level luminance - required for display metrology - possible with a single instrument. Since the Pritchard viewing and measuring optics are shared by both the spectroradiometer and photometer, instrument realignment is not necessary when switching between Spectral and Photometer modes.

The SpectraDuo can optionally be equipped with analog output capability, using the PMT as a high speed sensor for characterizing display response (3  $\mu$ sec response) or waveform analysis of flash sources.

## WIDE DYNAMIC RANGE

Dynamic Range	Instrument	Contrast Ratio
	PR-655	150 Thousand to 1
	PR-670	4 Million to 1
	PR-680	78 Million to 1
	PR-680L	1.1 Billion to 1

Information display performance is continuing to improve at an almost exponential rate. Of these improvements, one of the most important is luminance contrast. To achieve improved contrast ratios, display manufacturers are striving to make black blacker. In parallel with improvements in performance comes an increased level of difficulty in measuring the ever decreasing luminance levels. The PR-6xx family of instruments not only meets but exceeds the demand of measuring these low levels. The table at the left details contrast ratio capabilities for the different PR-6xx models.

## CONNECTIVITY

It's easy for the PR-6xx series to talk to the outside world - all instruments are equipped with USB 1.1, and can optionally be supplied with a class 1 Bluetooth wireless interface. All instruments come standard with a simple ASCII based, Remote Mode command language to setup and control the instrument using a PC or MAC, making it a simple task to generate custom programming to perform specific tasks or for inclusion in an ATE environment. If needed, a traditional RS-232 interface can be added to complement the standard USB interface. On the PR-655, the RS-232 option allows for drop in replacement of a PR-650. Need to trigger the PR-6xx from an external source? The external trigger port allows remote measurement activation from either a push button or peripheral device



• Bluetooth



• RS-232 Port



• USB

## USER PROFILES & SPEED MODES

Have multiple users using the PR-6xx series? With User Profiles you can save both Setup and Preference settings of the PR-6xx under a unique identifier, for recalling later. To recall your instrument setup at a later time simply select the unique profile from the User Profiles menu and minimize the amount of time required to modify current setup parameters. The total time needed to complete a measurement is certainly an important factor. The PR-6xx series features five **Speed Modes** that can reduce measurement times by changing the way the Adaptive Algorithm determines when a measurement is completed. Available modes are Normal, Fast, 2X Fast and 4X Fast. In 4X Fast Mode, measurements are completed approximately 20 times faster than in Normal Mode.

## USER SPECTRAL CALIBRATION

Need to correlate the PR-6xx instrument to another Spectroradiometer? The User Spectral Calibration feature makes this a simple task. Simply upload a spectral measurement from a second spectroradiometer to the PR-6xx using an SD card, hit Measure and the PR-6xx will automatically create and use custom spectral correction factors based on the uploaded data.

# ONE INSTRUMENT - A PLETHORA OF APPLICATIONS

For applications other than luminance the PR-6xx series of instruments can be supplied with optional optical accessories such as a cosine receptor for illuminance/irradiance measurements, LR-127 LED Analyzer for testing LED's to CIE 127 conformity, fiber probe for remote non-line of- sight testing, and a series of magnification lenses for small spot size analysis.

## LUMINANCE ACCESSORIES

Lenses	MS-5X, 2.5X - MicroSpectar Lens series, 5X and 2.5X magnification, fixed focus lens for luminance/radiance measurements.
	MS-7.5 - MacroSpectar Wide-Field Lens, wide angle lens suitable for applications that require large spot coverage with short working distance.
	MS-55 - MacroSpectar 1X lens focusable from 1.75" to infinity.
MISC.	SL-1X, 0.5X - High resolution supplementary lens, reduces the near focus range to 91.4 mm. See table below for spot coverage. Used with the standard MS-75 lens.
	Fiber Probe (FP)- Flexible fiber probe option for making non line of sight measurements. Available in lengths of 2, 4 and 10 feet, other lengths available - contact factory for more information.
	Luminance Adapter (LA)- For applications that require contact measurement of luminance and radiance in ambient light condition.

## LUMINOUS INTENSITY ACCESSORIES

**CIE 127 LED Analyzer (LR-127)** - Patented optical accessory designed to test discrete LED's for compliance to CIE 127. Tests both conditions A (far) and B (near) of the CIE recommendation. Calibrated for luminous intensity (millicandelas). Both conditions can be tested with the flip of a lever from 'A' to 'B'. No need to change tubes or even remove the LED between tests. Accepts T1 (3 mm) and T1.75 (5 mm) packages. Consult factory for alternate LED packages.

**LED Receptor** - Designed to measure discrete LED's, accessory accepts 0.125" (3.18 mm) diameter and 0.25" (6.36 mm) diameter LED's. Calibrated for radiant intensity ( $w \cdot sr^{-1}$ ) and luminous intensity (millicandelas) with an 8° acceptance angle. Consult factory for alternate LED diameters.

## FILTERS

**Neutral Density (ND)** - Source attenuation filters, for use on MS-75, SL-1X, SL-0.5X lenses. Available ND filters are 0.3, 0.7, 1, 2, 3, 4, attenuation of 2, 5, 10, 100, 1,000 and 10,000 respectively.

**Filter Holder (FH)** - Designed to hold two, 2" x 2" (51 mm x 51 mm) filters. Ideal for filter transmission measurements including Dolby 3D filter measurements. Threads onto the MS 75, SL-0.5X or SL 1X lenses during use.

## LUMINOUS FLUX ACCESSORIES

**Integrating Sphere (IS)** - 3" (76.2 mm) integrating sphere is designed to measure small point sources (e.g. miniature lamps, LED's, etc.) over 4pi steradians. Includes sample mounting fixture that accepts 0.125" (3.18mm) and 0.250" (6.36mm) sources and replaces the MS-75 during use. The mounting fixture is adjustable so that the tip of the sample is positioned precisely at the entrance port of the sphere. Calibrated for Radiant Flux (watts) and Luminous Flux (lumens). Consult factory for other special sizes.

## ILLUMINANCE ACCESSORIES

**Cosine Receptor (CR)** - Designed to measure cosine corrected illuminance/Irradiance falling on a plane from all sources within the hemisphere above the plane.

**Integrating Cosine Corrector (ICC)** - 3" (76.2 mm) integrating sphere featuring a 1 inch (25.4 mm) entrance port designed for applications where the integrated measurements of point sources is required. The sphere is fully baffled to insure complete integration of the incoming radiant energy. Calibrated for Irradiance (watts/meter<sup>2</sup>) and Illuminance (footcandles and lux).

## REFLECTANCE STANDARD

**RS-3** - 2" diameter (51 mm diameter) PTFE reflectance standard used for making ambient light measurements, measurements of point sources (e.g. lamps) or measurements of the illuminating source for reflectance (GAIN) or  $L^*a^*b^*$  calculations. The RS-3 is uncalibrated, meaning that all spectral reflectance correction factors are set to 1.00. With SAE ¼ - 20 thread. Black anodized, aluminum case.

**SRS-3** - All the capabilities of the RS-3 and calibrated for absolute spectral reflectance. Includes reflectance factors and certificate of calibration.

Measurement Spot Size	Accessory	Working Distance	Apertures			
			1°	1/2°	1/4°	1/8°
Measurement Spot Size	MS-75	355 mm to 305 m	5.25 mm to 5.32 m	2.63 mm to 2.66 m	1.315 mm to 1.33 m	0.658 mm to 665 mm
	MS-55	44.5 mm to 305 m	1.31 mm to 7.26 m	0.656 mm to 3.63 m	0.327 mm to 1.81 m	0.164 mm to 0.907 m
	SL-0.5X	94.1 mm to 137 mm	1.5 mm to 2.54 mm	0.75 mm to 1.27 mm	0.375 mm to 0.635 mm	0.188 mm to 0.318 mm
	SL-1X	46 mm to 66 mm	0.890 mm to 1.32 mm	0.445 mm to 0.660 mm	0.226 mm to 0.330 mm	0.113 mm to 0.165 mm
	MS-2.5X	46 mm	0.51 mm	0.225 mm	0.128 mm	0.064 mm
	MS-5X	28 mm	0.289 mm	0.145 mm	0.072 mm	0.036 mm
	MS-7.5	100 mm to 30.5 m	24.8 mm to 5.32 m	12.4 mm to 2.66 m	6.20 mm to 1.33 cm	3.10 mm to 665 mm
	LA-680	Contact	13.2 mm	13.2 mm	13.2 mm	13.2 mm
	FP-680	Contact	3.17 mm	N/A	N/A	N/A

## SYSTEM OPTIONS

**5NM Bandwidth** - Ideal for applications that require accurate color measurements of narrow band or "spiky" spectra.

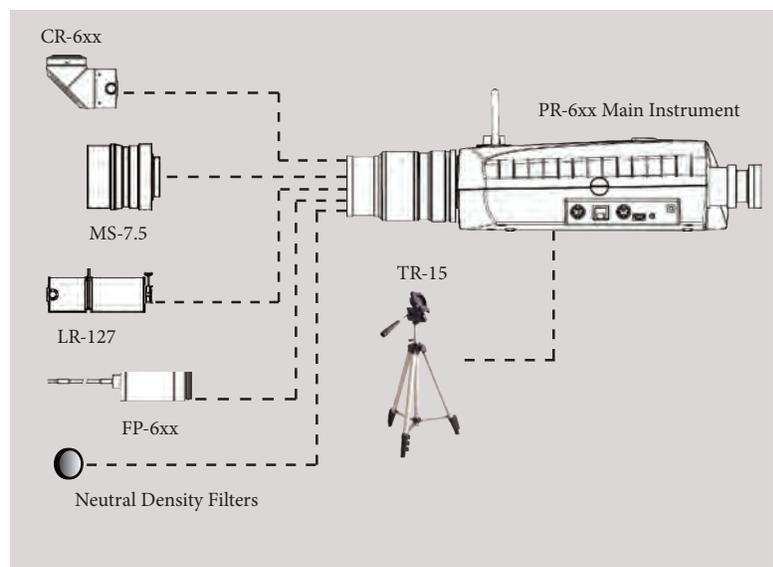
**Bluetooth (BT)** - Provides a wireless (Class1, 100m range) interface between a Bluetooth enabled host computer and the instrument.

**RS-232** - Adds a port to connect to RS-232 devices. Includes a 3 meter cable terminated on one end with a 9 pin sub-D female connector. PR-655's equipped with this option can be drop in replacements for PR-650's.

**Analog Output (PR-680/680L Only)** - Provides the capability of using the PR-680/680L as a high speed optical input (PMT signal) to a device such as an oscilloscope. The bandwidth is approximately 3 usecs. Useful for tasks such as ON/OFF or gray level response time for LCD's. Includes interconnecting cable terminated with BNC connector.

**PMT-ND1 (PR-680/680L Only)** - Provides an internal, fully automated Neutral Density (ND) 1.0 filter to the PMT detector system of the PR-680/680L. The attenuation of this filter is 10X (0.1 transmission) thereby enabling the PR-680/680L to measure luminance levels ten times higher with the ND filter than without it.

## SYSTEM PREFERENCES



# PRODUCT SPECIFICATIONS/COMPARISON

Feature	Unit	PR-655	PR-670	PR-680	PR-680L
Spectral Range	nm	380 - 780			
Detector		128 Detector Photo Diode Array	256 Detector Photo Diode Array	256 Detector Photo Diode Array + Photomultiplier Tube (PMT)	256 Detector Photo Diode Array + Ultra Sensitive Photomultiplier Tube (PMT)
Exposure Time	ms	3 - 6,000	6 - 30,000		
Spectral Bandwidth	nm	8(std.)/5(opt.)			
Spectral Accuracy	nm	± 1			
Wavelength Resolution	nm	< 3.5	< 2		
Luminance Range* (Illuminant A)	fl	0.2 to 30,000	0.01 to 2,500,000	0.001 to 5,000,000	0.00007 to 5,000,000
	cd/m <sup>2</sup>	0.7 to 103,000	0.03 to 8,566,000	0.003 to 17,130,000	0.0002 to 17,130,000
Luminance Accuracy <sup>1</sup> (Illuminant A @ 2856K)	%	± 2			
Luminance Repeatability <sup>1</sup> (Illuminant A @ 2856K)	%	≤ 1			
Color Accuracy <sup>1</sup>		± 0.0015 in CIE x,y			
Digital Resolution	bits	16			
AutoSync <sup>†</sup> Range	Hz	20 - 400 (Custom Sync 20 - 1200)			
Aperture		1° or 0.5° (opt)	1°, 1/2°, 1/4°, 1/8° automated		
Field of View		7° with MS-75			
Minimum Measuring Area	inch	0.01 with MS-5X Lens	0.001 with MS-5X Lens & 0.125° aperture		
	mm	0.254	0.02		
Minimum Working Distance (w/ Std. Lens)	inch	14			
	mm	356			
Battery		Rechargeable Li-Ion			
Interface		USB, RS-232 (opt.), Bluetooth (opt.), IEEE488 (opt.)			
Data Storage		Secure Digital(SD) Card			
Mode of Operation		Stand alone or PC			
System Software		SpectraWin™ for Windows (opt.)			
Size (approx.)	inch	14" x 7.94" x 3.21"			
	mm	355.60 x 201.68 x 81.53			
Weight (approx.)	lbs.	3.75		4.5	
	kg.	1.7		2.04	

- ### MEASURING CAPABILITIES
- Luminance
  - Spectral Radiance
  - Illuminance
  - Spectral Irradiance
  - Spectral Radiant Flux
  - Radiant Intensity
  - CCT (in Kelvins)
  - L\*a\*b\*
  - L\*u\*v\*
  - RGB Display Calibration
  - Dominant Wavelength
  - Display Contrast
  - Response Time (PR-680/680L Only)

	Accessory	Detector	Apertures (fl)			
			1°	1/2°	1/4°	1/8°
PR-680L/680 Sensitivity Chart <sup>2</sup>	MS-75	Photo Diode Array	0.02	0.08	0.32	1.28
		Photomultiplier Tube <sup>1</sup>	0.00007	0.00028	0.0011	0.0044
	SL-0.5X	Photo Diode Array	0.02	0.08	0.32	1.28
		Photomultiplier Tube <sup>1</sup>	0.00007	0.00028	0.0011	0.0044
	SL-1X	Photo Diode Array	0.02	0.08	0.32	1.28
		Photomultiplier Tube <sup>1</sup>	0.00007	0.00028	0.0011	0.0044
	MS-2.5X	Photo Diode Array	0.05	0.2	0.8	3.20
		Photomultiplier Tube <sup>1</sup>	0.00018	0.0007	0.0028	0.011
	MS-5X	Photo Diode Array	0.08	0.32	1.28	5.12
		Photomultiplier Tube <sup>1</sup>	0.00028	0.0011	0.0045	0.018
	MS-7.5	Photo Diode Array	0.02	0.08	0.32	1.28
		Photomultiplier Tube <sup>1</sup>	0.00007	0.00028	0.0011	0.0044
	LA-600	Photo Diode Array	0.02	0.08	0.32	1.28
		Photomultiplier Tube <sup>1</sup>	0.00007	0.00028	0.0011	0.0044
	FP-600	Photo Diode Array	0.05	N/A		
		Photomultiplier Tube <sup>1</sup>	0.00018	N/A		
CR-600	Photo Diode Array	0.04 fc	N/A			
	Photomultiplier Tube <sup>1</sup>	0.00014 fc	N/A			

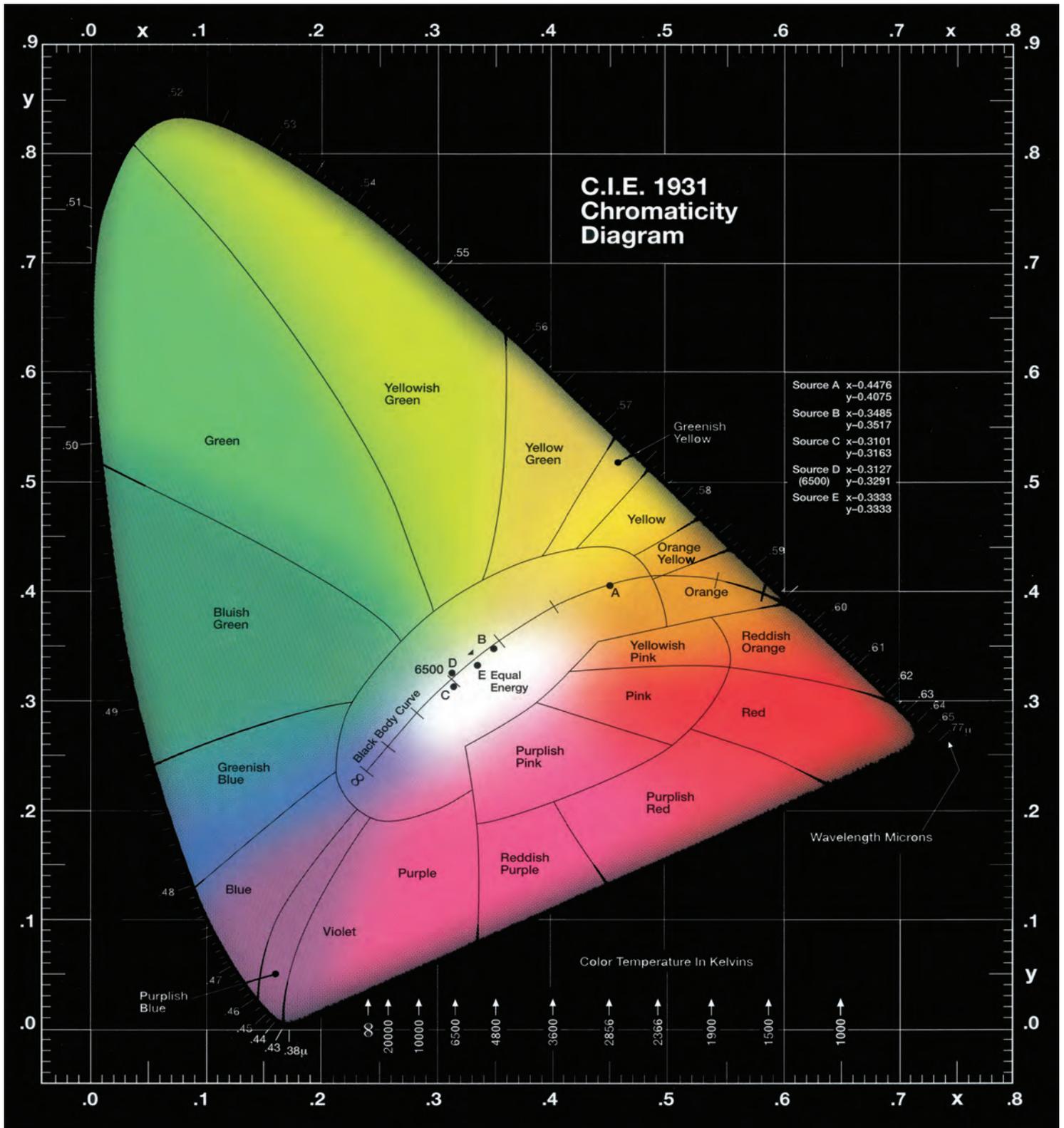
	Accessory	Apertures (fl)			
		1°	1/2°	1/4°	1/8°
PR-655/PR-670 Sensitivity Chart <sup>†</sup>	MS-75	0.01 to 39,000	0.04 to 156,250	0.16 to 650,000	0.64 to 2,500,000
		0.2 to 30,000	0.8 to 120,000	N/A	N/A
	SL-0.5X	0.01 to 39,000	0.04 to 156,250	0.16 to 650,000	0.64 to 2,500,000
		0.2 to 30,000	0.8 to 120,000	N/A	N/A
	SL-1X	0.01 to 39,000	0.04 to 156,250	0.16 to 650,000	0.64 to 2,500,000
		0.2 to 30,000	0.8 to 120,000	N/A	N/A
	MS-2.5X	0.025 to 97,500	0.10 to 390,000	0.40 to 1,560,000	1.60 to 6,240,000
		0.5 to 72,000	2.0 to 288,000	N/A	N/A
	MS-5X	0.04 to 156,000	0.16 to 624,000	0.64 to 2,496,000	2.56 to 9,984,000
		0.8 to 120,000	3.2 to 480,000	N/A	N/A
	MS-7.5	0.01 to 39,000	0.04 to 156,250	0.16 to 650,000	0.64 to 2,500,000
		0.2 to 30,000	0.8 to 120,000	N/A	N/A
	LA-600	0.01 to 39,000	0.04 to 156,250	0.16 to 650,000	0.64 to 2,500,000
		0.2 to 30,000	0.8 to 120,000	N/A	
	FP-600	0.025 to 97,500	N/A		
		0.5 to 72,000	1.6 to 300,000	N/A	
CR-600	0.02 to 78,000 fc	N/A			
	0.4 to 60,000 fc	1.6 to 240,000 fc	N/A		

Notes: <sup>1</sup> Stated sensitivities are for a precision of 10:1 against an Illuminant A (2856 K) source using largest available aperture.

<sup>1</sup> Luminance level of 3 fl for the PR-655, 0.15 fl for the PR-670, 0.3 fl (spectroradiometer) and 0.002 (PMT) for the PR-680L with a 1° aperture against an Illuminant A NIST traceable standard.

<sup>2</sup> For the PR-680, multiply PR-680L PMT luminance by a factor of 14.29.

<sup>†</sup> PR-670 sensitivity values are highlighted in yellow.



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