PR-880 Automatic Filter Colorimeter / Photometer ®

PHOTO RESEARCH INC.

The Reference in Color and Light Measurement

Introduction

The PR-880 is designed for flawless precision and exceptional ease-of-use. Every function including multiple-mirror aperture positioning, dual filter wheels, detector zero and viewing system shutter are automated with precise motorized controls.

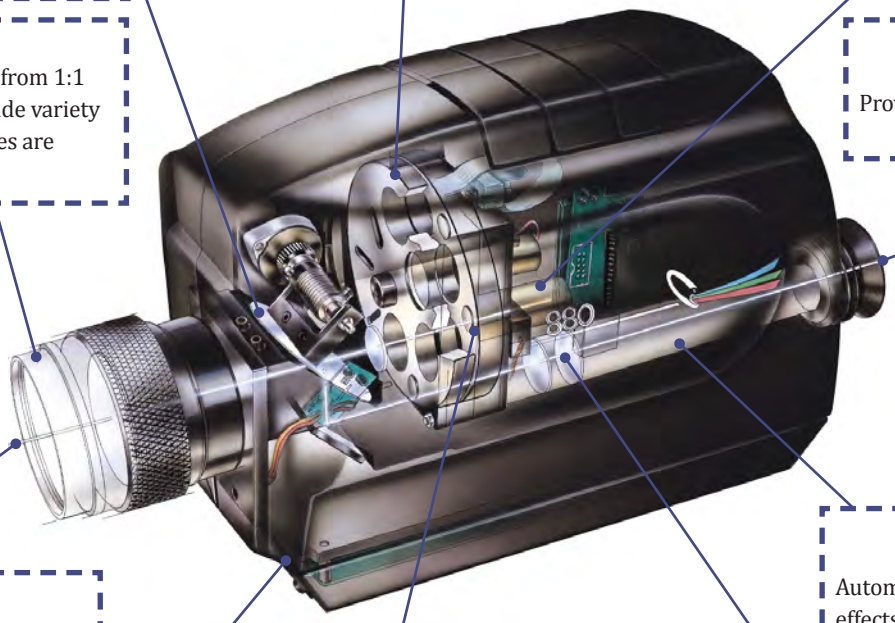
Onboard microprocessor control- a powerful 16-bit, on board microprocessor controls all mechanical components, measurements and calculations. Results displayed on the 4 x 20 character backlit Liquid Crystal Display (LCD) enable at-a-glance analysis.

Automatic internal calibration- the PR-880 features automatic calibration using an optically-regulated internal calibration source. The stability of this internal source assures you the utmost accuracy and repeatability.

Built-in memory, Save & Restore- the PR-880 stores all operating software, calibration factors, and up to 100 measurements on an internal 512K Integrated Circuit Memory (ICM) card. Standard Save/Restore software and the RS-232 interface support contingent data, software, and calibration factor recovery.

An ultra-sensitive photo-multiplier tube (PMT) featured in the PR-880 is enhanced by four ranges of electronic gain (1X, 10X, 100X and 1000X) and four internal neutral-density attenuation filters (10X, 100X, 1000X and 10000X) yielding eight decades of dynamic range for each aperture.

PR-880 AUTOMATIC FILTER PHOTOMETER



PRITCHARD APERTURE MIRROR
Metallic mirror with five measuring apertures plus a sixth optional aperture. All aperutes allow unambiguous alignment/viewing field.

OBJECTIVE LENS
Standard MS-55 lens focuses from 1:1 magnification to infinity. A wide variety of lenses and other accessories are available.

OPTICAL PATH
Direct, unimpeded optical path results in zero polarization error.

512K ICM CARD
Contains complete operation program, calibration factors and space for storage of up to 100 measurements.

ATTENAUTOR FILTER WHEEL
Automated filter wheel with four ND filters providing up to 10,000 X attennaution in 10X steps.

CIE FILTER WHEEL
Automated filter wheel with custom matched photopic and CIE tristimulus filters.

DETECTOR
Ultra-sensitive photomultiplier tube (PMT) allows the PR-880 to measure light levels as low as 10^{-5} fl.

EYEPIECE
Provides 8.5° field of view (FOV).

VIEWING SHUTTER
Automatically shields the PMT from the effects of ambient light entering through the eyepiece during a measurement.

INTERNAL CALIBRATION SOURCE
Optically regulated source automatically calibrates the PR-880 to ensure stable, repeatable measurements.

Measurement Capabilities

Luminance
Illuminance (Optional)
Colorimetry
Correlated Color Temperature
L*u*v*
ΔE*
Source Refresh 40-250 Hz

Full automation

The PR-880 is the only fully automated filter photometer available today. We've automated the measuring apertures (5 standard sizes), the filter turrets, the measuring (zero) shutter and viewing (eyepiece) shutter. All of these features are controlled by an on-board computer and are accessed via 8 push buttons on the integral control panel. After setting up the measurement from menus on the 4 X 20 back lit LCD display-making a measurement is as easy as pushing a button. The corrected measurement value (e.g. luminance) is automatically displayed following the measurement. There is no need to apply correction factors for optical accessories, the PR-880 does it all for you. This helps remove any possible "cockpit" errors that could yield false results.

Pritchard Optics- The PR-880, like all of the Photo Research's photometers and spectroradiometers, utilizes Pritchard measuring and viewing optics. Pritchard optics assures accurate, non-ambiguous target alignment every time regardless of the sample size.

Sensativity / Versatility

Like it's predecessor, the PR-1980A, the PR-880 is the most sensitive filter photometer in it's class. Combined with standard multiple apertures and a wide range of optical accessories, virtually any measurement requirement can be met. The sensitivity range of the PR-880 is extended by using four decades of Neutral Density (ND) filters - ND-1, ND-2, ND-3, ND-4 located in a second, fully automated filter turret.

Color it Better

Photo Research is among the small minority of filter colorimeter manufacturers that provides 4- filter colorimetry. The majority of filter colorimeters utilize three filters - CIE X (Red), Y (Green or Photopic) and Z (Blue). The CIE X function has two peaks, a minor peak at 442 nm (blue region) and a major peak at 599 nm. 3- filter colorimeters ignore the part of the CIE X function that peaks at 442 nm. This can yield significant errors especially for blue rich sources.

When ordered with the matched CIE Tristimulus filter option (X_b, X_r, and Z filters in addition to the standard Photopic (Y) filter), the PR-880 can be commanded to speed up color measurements by making these measurements using two or three filters instead of all four filters - yielding time reductions of up to 60% (for two filter measurements). For accuracy, correction factors are used that are established based on a full, 4-filter measurement.

Applications

- Automotive Lighting
- Photometric Reflectance studies
- OLED Testing
- Photometric Transmittance Studies
- Flat Panel Displays (FPD)
- LED Measurement
- LED Backlighting
- Military & Commercial Aerospace Displays
- Color Temperature Determination
- Electroluminescent (EL) Panel Evaluation
- Human Factors Testing
- Head-up Display Measurement
- Go/No Go Testing
- MIL-SPEC Testing

PHW-200 Display Temporal Measurement Opition (Response/Flicker Ananlysis)

The PHW-200 has been specifically designed to use a PR-880 to measure Display characteristics such as ON/OFF, OFF/ON transitions and display flicker. The PHW-200 is capable of generating reports to analyze data recommended by the ICDM standard. All software is serialized to an instrument. One licensed copy needs to be purchased per instrument.

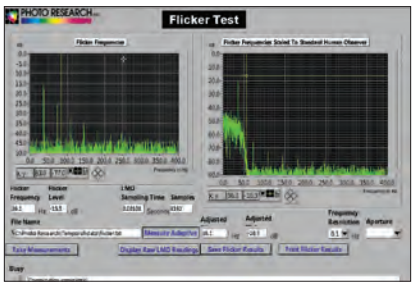
PhotoWin

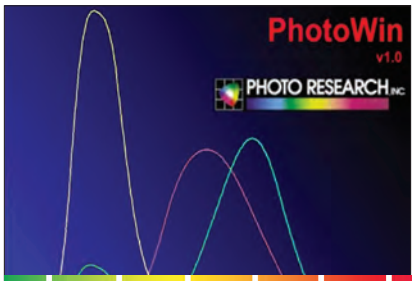
Windows based control and data analysis software for the PR-880. Select hardware settings including aperture, filters, accessories, measurements to average, contrast, reflectance and transmittance and colorimetry. Display measurement results and plot color measurements graphically within CIE diagrams. Measurement results can be exported directly into Microsoft Excel with a single mouse click.

Remote Mode Control

This powerful feature allows you to control the PR-880 measurement and data functions from virtually any computer using simple ASCII (text) commands over the built-in RS-232 interface. Combined with the full-automation capabilities of the PR-880, Remote Mode makes an easy task of creating an Automated Test Environment (ATE) for hands off testing-an ever increasing need to help reduce the time to verify that a product meets stringent specifications/requirements.

Software Options





Sample Remote Mode Mesuremet Sequence

- Places PR-880 in Remote Mode
- Sample command to execute photometer measurement. In this example, simultaneously selecting aperture and ND Filter Position
- Display message following measurement (0 is the file# for data)
- Request data (file0) in long format
- Measurement data in long format (Comma delimited short formats available)

```
PHOTO
MP A=3 F=0 <CR>
M measurement done (P# 0)
NL0
Photo Research Inc.
Photometer: P#000 U 09/30/96 11:45:51
Y= 8.798e + 00fl Lum
FREQUENCY =Hz
PRI ACC: MS-55 LUM SEC ACC: NONE
FF=OPEN Aperture = 1/4 deg. View Shutter=Closed Gain= 1X
```

Accessories

LR-127 LED Analyzer

The patented LR-127 LED Analyzer is a unique tool for making luminous intensity (in candelas) measurements of discrete LED's for compliance to CIE 127 Condition A (2°) and Condition B (6.5°). During operation, the LED is inserted into a special holder that insures that it is securely mounted. Two holders are supplied and accept either T-1 (3mm) or T- 1.75 (5 mm) packages. Contact us for special configurations. Like all optical accessories for Photo Research instruments, the LR-127 is supplied with NIST traceable calibration from the factory and certified for accuracy for six months. There is never a need to calibrate the accessory every time it is used with the instrument.

FP-55 Fiber Optic Probe

This 2-foot (89 cm) long fiber bundle is used for measuring the luminance of back lit sources that are inaccessible to direct-line-of sight. The 0.125 in. (3.18 mm) tip is placed in contact with the device under test. Replaces the MS-55 during use. Calibrated for luminance. Fiber lengths of 4 ft. (1.22M) and 10 ft. (3.05M) are available.

RS-3 Reflectance Standard

2" (51 mm) diameter PTFE reflectance standard used for making ambient light measurements of point sources (e.g. lamps) or measurements of the illuminating source for reflectance or L*a*b* calculations. The RS-3 is uncalibrated, meaning that the photometric reflectance correction factor is set to 1.00. It is encased in a black anodized, aluminum case with a SAE 1/4 - 20 threaded hole. The PRS-3, mechanically identical to the RS-3 is calibrated for absolute photometric reflectance.

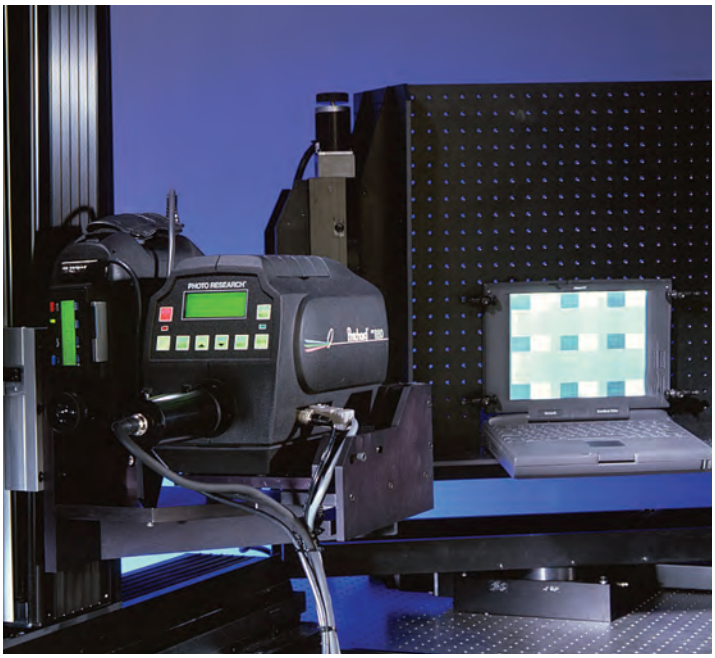
MS-55 MacroSpectar Lens

This Macro lens, standard equipment on the PR-880 is focusable from 3.25 in. (82.6 mm) to infinity and provides 1X magnification at 3.25 in. working distance.

MS-10X - MicroSpectar Lens

10X magnification lens with a working distance of 0.6 in. (15.2 mm). Replaces the MS-55 during use. Calibrated for luminance.

ATE Environment



RS232 connectivity and Remote Mode software makes it an easy task to incorporate the PR-880 into an Automated Test Environment (ATE). Whether measurement tasks are required in conjunction with a conveyor belt on a production line, linear stages used for an R&D test fixture (pictured at left), robotic parts handler, control of display output or other application specific hardware, the PR-880 ASCII (text) based command language simplifies the addition of measuring tasks to hardware control software.

Features and Benefits

Alignment Certainty
Pritchard optics provide superior, non- ambiguous target alignment. Since the measuring aperture and alignment are one in the same, accurate positioning is guaranteed.

Range & Versatility
The PR-880's range and versatility make it an exceptional value. Variable apertures and the MS-55 objective lens accommodate virtually any target size. For target sizes down to 0.001 mm, a variety of microscopic objectives lenses are available.

Assured Accuracy
Photo Research instruments meet the highest standards of quality and accuracy. Case in point: The PR-880's photopic filter is designed to precisely match the eye's daylight adapted response from 380 nm to 760 nm. Thus, the PR-880 provides the right answer regardless of the source spectral distribution.
(See measuring field coverage chart)

Best in it's Class
For the most versatile light measurement solution offering unparalleled accuracy, precision, and ease -of-use in one, compact, ergonomic package, the Pritchard PR-880 filter photometer is clearly the best in class.

Sensativity Chart

Accessory	Working Distance	Units	3°	1°	1/2°	1/4°	1/8°
MS-55	1.75 in. (44 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-4})	1 x 10^{-3} (3x10^{-4})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-1X	3.80 in. (97 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-165	6.5 in. (165 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-3})	x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-2.5X	1.76 (45 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-5X	1.11 in (28 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-77	4.25 in. (108 mm)	fl cd/m²	1 x 10^{-4} (3x10^{-4})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-7X	0.7 in. (17.8 mm)	fl cd/m²	1.2 x 10^{-4} (9x10^{-4})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-3} (3x10^{-3})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
MS-10X	0.6 in. (15.2 nm)	fl cd/m²	2 x 10^{-4} (9x10^{-4})	1 x 10^{-3} (3x10^{-4})	1 x 10^{3} (3x10^{-4})	1 x 10^{-2} (3x10^{-2})	1 x 10^{-2} (3x10^{-2})
FP-880 Fiber Probe	Contact	fl cd/m²	2 x 10^{-4} (9x10^{-4})	3 x 10^{-2} (9x10^{-2})	3 x 10^{-2} (9x10^{-2})	3 x 10^{-1} (9x10^{-1})	3 x 10^{-1} (9x10^{-1})
CR-880 Cosine Receptor	N/A	fc lux	4 x 10^{-4} (1.2x10^{-3})	4 x 10^{-3} (1.2x10^{-2})	4 x 10^{-3} (1.2x10^{-2})	4 x 10^{-2} (1.2x10^{-2})	4 x 10^{-2} (1.2x10^{-2})
IB-880 Incidance Baffle	7.75 in. to ∞ (44 mm to ∞)	fc lux	N/A	1 x 10^{-7} 1x10^{-6}	N/A	N/A	N/A

ILLUMINANCE ACCESSORIES

Cosine Receptor (CR) - For cosine corrected incidence (illuminance) measurements. Calibrated in footcandles and lux. Replaces the MS-55 during use.

Incidence Baffle IB-55 - This accessory, which is used with the MS-55 lens, is designed to measure small point sources (e.g. miniature lamps) for illuminance. Calibrated in footcandles and lux.

FILTERS

Scotopic Filters - For making measurements below 0.1 footLamberts (0.34 cd *m-²). Includes a custom trimmed scotopic response filter. Trimmed using the MS-55 lens unless otherwise specified. Includes NIST traceable calibration and calibration curve.

Tristimulus Filters - Select this option for absolute filter colorimetry. Includes specially trimmed CIE RED (Xr and Xb) and BLUE (CIE Z) filters in addition to the GREEN (CIE Y or PHOTOPIC) filter, NIST-traceable calibration and calibration curves. Performance Specifications: Colorimetric Accuracy ± 0.005 for CIE 1931 x,y when measuring incandescent sources.

LUMINOUS FLUX ACCESSORIES

IS-880 Integrating Sphere (IS) This 3" (76.2 mm) integrating sphere is designed to measure small point sources (e.g. miniature lamps, LED's, etc.) over 4 π steradians. It includes a 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 Luminous Flux (lumens). Consult factory for other special configurations. Replaces the MS-55 during use.

Measuring Field Coverage Chart

Measuring Field Coverage Chart			Apertures				
Accessory	Working Distance	Units	3°	1°	1/2°	1/4°	1/8°
MS-55	1.75 in. to ∞	inches (mm)	0.114 (2.89)	0.038 (0.97)	0.019 (0.48)	0.009 (0.24)	0.005 (0.12)
MS-55	10 ft. (3.05 meters)	inches (mm)	6.3 (160)	210 (53.3)	105 (26.7)	52.5 (13.3)	26.3 (6.6)
MS-1X	3.80 in (97 mm)	inches (mm)	0.114 (2.89)	0.038 (0.97)	0.019 (0.48)	0.009 (0.24)	0.005 (0.12)
MS-165	6.5 in. (165 mm)	inches (mm)	0.114 (2.89)	0.038 (0.97)	0.019 (0.48)	0.004 (0.10)	0.005 (0.48)
MS-2.5X	1.76 in (45 mm)	inches (mm)	0.030 (0.76)	0.015 (0.38)	0.008 (0.19)	0.002 (0.05)	0.002 (0.05)
MS-5X	1.11 in (28 mm)	inches (mm)	0.016 (0.38)	0.008 (0.19)	0.004 (0.10)	0.003 (0.08)	0.001 (0.02)
MS-77	4.25 in. (108 mm)	inches (mm)	0.026 (0.64)	0.013 (0.32)	0.006 (0.16)	0.0014 (0.08)	0.002 (0.04)
MS-7X	0.7 in. (17.8 mm)	inches (mm)	0.016 (0.41)	0.0054 (0.138)	0.0027 (0.069)	0.0014 (*0.034)	0.00068 (0.017)
MS-10X	0.6 in. (15.2 mm)	inches (mm)	0.0114 (0.289)	0.0038 (0.097)	0.0019 (0.048)	0.0009 (0.024)	0.0005 (0.012)

Lenses

MS-5X, 2.5X - MicroSpectar Lens series, 5X and 2.5X magnification, fixed focus lens for luminance measurements. Replaces the MS-55 during use.

MS-165 - 1X magnification, fixed focus lens with a working distance of 6.5 in. (165 mm) Replaces the MS-55 lens during use. Calibrated for luminance.

MS-7X MicroSpectar 7X Lens- 7X magnification lens with a working distance of 0.7 in. (17.8 mm). Replaces the MS-55 during use. Calibrated for luminance.

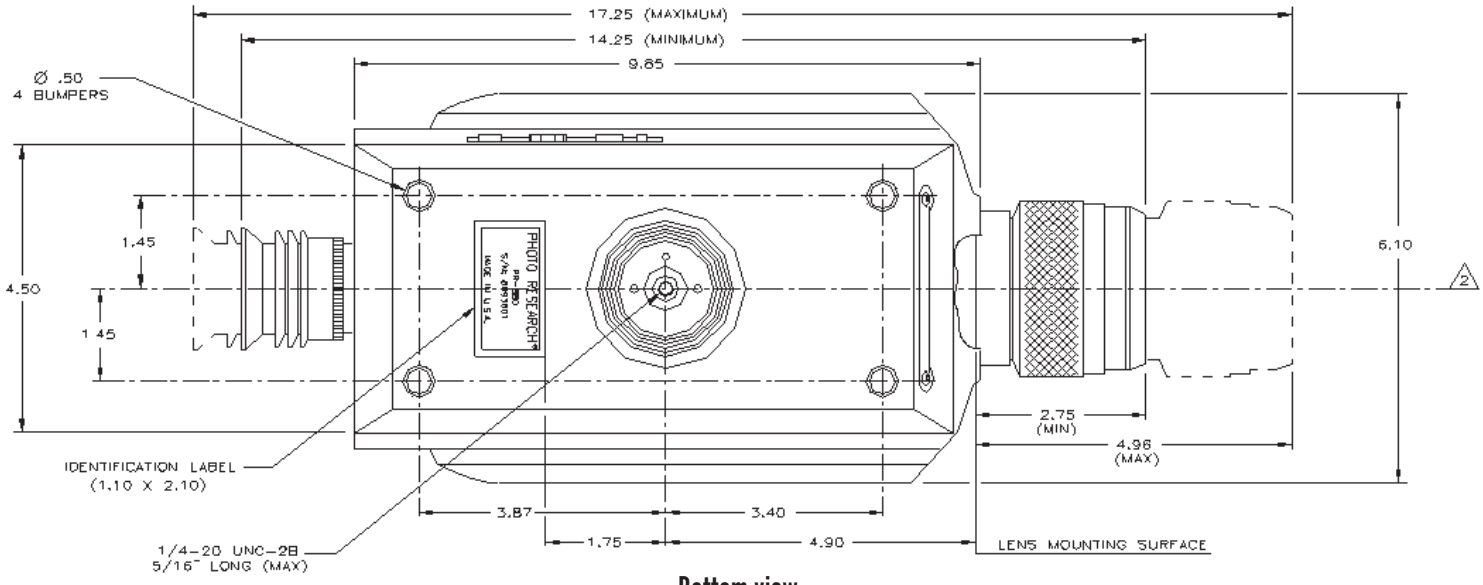
MS-1X- MacroSpectar 1X Lens 1X magnification, fixed focus lens with a working distance of 3.8 in. (97 mm) Replaces the MS-55 lens during use. Calibrated for luminance.

MS-77 MicroSpectar Lens-Fixed focus 3X magnification lens with a working distance of 4.25" (10.8cm). Has a built-in 2" x 2" (50.8mm x 50.8mm) filter holder that accepts two filters. Ideal for filter transmission studies. Calibrated for luminance (fL/cd*m-2). Replaces the MS-55 during use.

Specifications are subject to change without notice.

SPECIFICATIONS

CPU	16 bit
AD Resolution	14 bits (1 part in 16.384)
Local Control	8 push buttons
Display	4 x 20 character super-twist LCD (4 levels of black lighting including OFF)
Standard Apertures	Automated 3°, 1°, 1/2°,1/4°, 1/8° (angular subtense calculate with MS-55 lens focused at infinity)
Optional Apertures	Automated 2°, 1/4°, 1/8°, 0.4'x 40', 2' (angular subtense calculated with MS-55 lens focused at infinity)
Filter Turrets	Two six position turrets (automated)
Standard Filters	Photopic, Red, Blue, Open, ND-1, ND-2, ND-3, ND-4
Interface	RS-232 (IEEE-488 optional)
Analog Output	0 - 10 volt DC @ 50 Ω impedance
Field of View	8.5° with MS-55 lens focused at infinity
Photometric Accuracy	±2% of reading at 2856 Kelvin (Illuminant A) when measuring NIST standard
Colorimetric Accuracy	±.0015 CIE 1931 xy measuring Illumimant A with optional P/N 6880-0006-01
Power	input: 100 - 230 Volts AC / 50-60 Hz
Operating Temperature	41° F (5°C) to 95° F (35°C)
Storage Temperature	0°F (-32° C) to 130° F (54° C)
Humidity	0 - 90% non condensing
Weight	9.4 lbs. (4.3 kg) with MS-55 lens
Measuring Capabilities	Luminance, Illuminance, luminous intensity, tristimulus colorimetry , L*u*v*, correlated color temperature, chromaticity.



Bottom view

1. Sensitivity calculated Measuring Illuminant A (2856K)

2. All Specifications subject to change without notice. All trademarks are property of Photo Research Inc.

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