KODAK PROFESSIONAL PORTRA 160NC, 160VC, 400NC, 400VC, and 800 Films

Kodak

TECHNICAL DATA / **COLOR NEGATIVE FILM**

February 2009 • E-4040

For years, professional photographers have preferred KODAK PROFESSIONAL PORTRA Films because of their consistently smooth, natural reproduction of the full range of skin tones. Now the PORTRA Films have been reengineered to deliver significantly finer grain at all speeds for improved scanning performance and greater enlargement capability.

KODAK PROFESSIONAL PORTRA 160NC Film: For subtle color and smooth, natural skin tones in controlled lighting situations.

KODAK PROFESSIONAL PORTRA 160VC Film: For more vivid color and slightly higher contrast in controlled lighting situations.

KODAK PROFESSIONAL PORTRA 400NC Film: For subtle color and natural skin tones in low light or with on-camera flash.

KODAK PROFESSIONAL PORTRA 400VC Film: For vibrant color and slightly higher contrast to add snap to images shot in flat or overcast light.

KODAK PROFESSIONAL PORTRA 800 Film: For natural skin tone reproduction, and enhanced color in the most difficult lighting situations.

Try This KODAK PROFESSIONAL Film	For
PORTRA 160NC	• Natural colors • Extremely fine grain • Low contrast • Controlled lighting
PORTRA 160VC	• Vivid colors • Extremely fine grain • Medium contrast • Controlled lighting
PORTRA 400NC	• Natural colors • Very fine grain • Low contrast • Wide range of lighting conditions
PORTRA 400VC	• Vivid colors • Very fine grain • Medium contrast • Wide range of lighting conditions
PORTRA 800	• Well balanced color saturation • Very fine grain • Best-in-class underexposure latitude • Ideal for long lenses and low light

KODAK PROFESSIONAL PORTRA Films offer the following features.

TECHNOLOGY	BENEFIT
• New Micro-Structure Optimized T-GRAIN® Emulsions • Kodak's Proprietary Advanced Development Accelerators • Antenna Dye Sensitization (High speed films)	• Noticeably finer grain • Enhanced scanning performance • Allows for greater enlargement
• Human Eye Spectral Sensitivity • High-Efficiency Masking Coupler	• Beautiful, natural skin tones • Superb color reproduction, even under mixed lighting
• Improved DIR Coupler Technology	• Optimized sharpness • Distinct, fine detail
• Precision Sensitometry with extended latitude • True-to-speed exposure accuracy	• Best-in-class underexposure latitude • Captures a greater range of brightness • More highlight and shadow detail
• Unified Film Emulsion Technology	• Single channel printing across speeds and formats • Album compatibility

SIZES AVAILABLE

Availability may differ from country to country. See your dealer who supplies KODAK PROFESSIONAL Products.

KODAK PROFESSIONAL PORTRA 160NC Film

Size/Format	Code	Base
135	160NC	0.13 mm (0.005 inch) acetate
120	160NC	0.10 mm (0.004 inch) acetate
220	160NC	0.10 mm (0.004 inch) acetate
Long Rolls	160NC	0.13 mm (0.005 inch) acetate, 0.10 mm (0.004 inch) ESTAR Thick
Sheets		0.19 mm (0.007 inch) ESTAR Thick

KODAK PROFESSIONAL PORTRA 160VC Film

Size/Format	Code	Base
135	160VC	0.13 mm (0.005 inch) acetate
120	160VC	0.10 mm (0.004 inch) acetate
220	160VC	0.10 mm (0.004 inch) acetate
Sheets		0.19 mm (0.007 inch) ESTAR Thick
READYLOAD Single-Sheet Packets		

KODAK PROFESSIONAL PORTRA 400NC Film

Size/Format	Code	Base
135	400NC	0.13 mm (0.005 inch) acetate
120	400NC	0.10 mm (0.004 inch) acetate
220	400NC	0.10 mm (0.004 inch) acetate
Long Rolls	400NC	0.13 mm (0.005 inch) acetate, 0.10 mm (0.004 inch) ESTAR Thick
Sheets		0.19 mm (0.007 inch) ESTAR Thick

KODAK PROFESSIONAL PORTRA 400VC Film

Size/Format	Code	Base
135	400VC	0.13 mm (0.005 inch) acetate
120	400VC	0.10 mm (0.004 inch) acetate
220	400VC	0.10 mm (0.004 inch) acetate

KODAK PROFESSIONAL PORTRA 800 Film

Size/Format	Code	Base
135	800	0.13 mm (0.005 inch) acetate
120	800	0.10 mm (0.004 inch) acetate
220	800	0.10 mm (0.004 inch) acetate

STORAGE AND HANDLING

Store unexposed film at 21° C (70° F) or lower in the original sealed package. For extended periods, store film at 13° C (55° F) to preserve consistency.

To avoid moisture condensation on film that has been refrigerated, allow the film to warm up to room temperature before opening the package. Typical warm-up times are given in the table below.

Size	Warm-Up Times (Hours) to Reach Room Temperature of 21° C (70° F) From a Storage Temperature of:		
	-18° C (0° F)	2° C (35° F)	13° C (55° F)
120/220	1	3/4	1/2
135 magazine	1 1/2	1 1/4	1
35 mm long roll	5	3	2
70 mm long roll	10	5	3
10-sheet box	1 1/2	1	1
50-sheet box	3	2	2

Load and unload roll-film cameras in subdued light. Total darkness is required when you load and unload sheet film holders.

Process film as soon as possible after exposure. Protect negatives from strong light, and store them in a cool, dry place. For long-term storage, keep negatives at a temperature between 2° C (35° F) and 13° C (55° F) and at a relative humidity between 30 and 35 percent.

Note: High speed films, such as PORTRA 800 Film, are sensitive to environmental radiation. Expose and process this film promptly. As exposure to radiation is cumulative, you may want to request *visual* inspection of PORTRA 800 film at airport and other security x-ray inspection stations.

DARKROOM RECOMMENDATIONS

Do not use a safelight. Handle unprocessed film in total darkness.

EXPOSURE

Film Speed

Use the speed numbers in the tables below with cameras or meters marked for ISO, ASA, or DIN speeds or exposure indexes (EIs). Do not change the film-speed setting when metering through a filter. Metering through filters may affect light meter accuracy; see your meter or camera manual for specific information. For critical work, make a series of test exposures.

Light Source	KODAK WRATTEN Gelatin Filter*	ISO Speed		
		160NC and 160VC Films	400NC and 400VC Films	800 Film
Daylight or Electronic Flash	None	160	400	800
Photolamp (3400 K)	No. 80B	50	125	250
Tungsten (3200 K)	No. 80A	40	100	200

* For best results without special printing.

Note: The latitude of PORTRA 160NC and 160VC Films allows you to use 100-speed proofing products for test exposures.

Daylight

Use the exposures in the table below for average frontlit subjects from 2 hours after sunrise to 2 hours before sunset.

Lighting Conditions	Shutter Speed (second) and Lens Opening		
	160NC and 160VC Films	400NC and 400VC Films	800 Film
Bright or Hazy Sun on Light Sand or Snow	1/125 *f*/16	1/500 *f*/16	1/1000 *f*/16
Bright or Hazy Sun (Distinct Shadows)	1/125 *f*/11*	1/500 *f*/11*	1/500 *f*/16†
Weak, Hazy Sun (Soft Shadows)	1/125 *f*/8	1/500 *f*/8	1/500 *f*/11
Cloudy Bright (No Shadows)	1/125 *f*/5.6	1/500 *f*/5.6	1/250 *f*/11
Heavy Overcast or Open Shade‡	1/125 *f*/4	1/500 *f*/4	1/125 *f*/11

* Use f/5.6 for backlit close-up subjects.
† Use f/8 for backlit close-up subjects.
‡ Subject shaded from the sun but lighted by a large area of sky.

Adjustments for Long and Short Exposures

No filter correction or exposure compensation is required for PORTRA 160NC, 160VC, 400NC, 400VC, or 800 Films for exposures from 1/10,000 second to 1 second. For critical applications with longer exposure times, make tests under your conditions.

Electronic Flash

Use the appropriate guide number in the table below as starting-point recommendations for your equipment. Select the unit output closest to the number given by your flash manufacturer. Then find the guide number for feet or metres. To determine the lens opening, divide the guide number by the flash-to-subject distance. If negatives are consistently too dense (overexposed), use a higher guide number; if they are too thin (underexposed), use a lower number.

Unit Output (BCPS)*	Guide Number Distances in Feet/Metres		
	160NC and 160VC Films	400NC and 400VC Films	800 Film
350	55/17	85/26	120/36
500	65/20	100/30	140/42
700	75/22	120/36	170/50
1000	90/27	140/42	200/60
1400	110/33	170/50	240/70
2000	130/40	200/60	280/85
2800	150/46	240/70	340/100
4000	180/55	280/85	400/120
5600	210/65	340/100	470/140
8000	250/75	400/120	560/170

* BCPS = beam candlepower seconds

Fluorescent and High-Intensity Discharge Lamps

Use the color-compensating filters and exposure adjustments in the tables below as starting points to expose PORTRA Films under fluorescent or high-intensity discharge lamps. For critical applications, make a series of test exposures under your actual conditions.

To avoid the brightness and color variations that occur during a single alternating-current cycle, use exposure times of 1/60 second or longer with fluorescent lamps; with high-intensity discharge lamps, use exposure times of 1/125 second or longer.

Type of Fluorescent Lamp	KODAK Color Compensating Filter(s)	Exposure Adjustment	KODAK Color Compensating Filter(s)	Exposure Adjustment
	160NC/VC and 400NC/VC Films		800 Film	
Daylight	20R + 5M	+1 stop	40R	+ 2/3 stop
White	40B + 5C	+1 2/3 stop	20C + 30M	+ 1 stop
Warm White	40B + 40C	+2 stops	40B	+ 1 stop
Warm White Deluxe	40B + 50C	+2 stops	30B + 30C	+ 1 1/3 stops
Cool White	30B	+1 stop	30M	+ 2/3 stop
Cool White Deluxe	40C + 10M	+1 stop	10C + 10M	+ 2/3 stop

High-Intensity Discharge Lamp (CCT)	KODAK Color Compensating Filter(s)	Exposure Adjustment	KODAK Color Compensating Filter(s)	Exposure Adjustment
	160NC/VC and 400NC/VC Films		800 Film	
High-Pressure Sodium Vapor	50B + 70C	+2 2/3 stops	70B + 50C	+ 3 stops
Metal Halide	5C + 10M	+2/3 stop	10R + 20M	+ 2/3 stop
Mercury Vapor with Phosphor	30B + 5C	+1 stop	20R + 20M	+ 2/3 stop
Mercury Vapor without Phosphor	80R	+1 2/3 stop	80R	+ 1 2/3 stops

PROCESSING

Process PROFESSIONAL PORTRA Films in KODAK FLEXICOLOR Chemicals for Process C-41 using the replenishment and wash rates in the tables below. Note that the developer replenishment rates are starting-point recommendations only and may vary due to the amount of exposure to the film, scene content, and the presence/absence of sprocket holes.

Replenishment and Wash Rates / PORTRA 160NC and 160VC Films

Film Size	KODAK FLEXICOLOR Developer Replenisher	KODAK FLEXICOLOR Developer Replenisher LORR	KODAK FLEXICOLOR Bleach III, Fixer, and Stabilizer	Wash Water*
135	1012 mL/m^2 94 mL/ft^2	506 mL/m^2 47 mL/ft^2	861 mL/m^2 80 mL/ft^2	31 L/m^2 2.9 L/ft^2
120/220	1012 mL/m^2 94 mL/ft^2	506 mL/m^2 47 mL/ft^2	1023 mL/m^2 95 mL/ft^2	31 L/m^2 2.9 L/ft^2
4 x 5 inch	1245 mL/m^2 116 mL/ft^2	622 mL/m^2 58 mL/ft^2	1152 mL/m^2 107 mL/ft^2	59 L/m^2 5.5 L/ft^2

* Rates are for first wash and a two-stage countercurrent final wash. Double these rates for a single stage final wash.

Replenishment and Wash Rates / PORTRA 400NC, and 400VC Films

Film Size	KODAK FLEXICOLOR Developer Replenisher	KODAK FLEXICOLOR Developer Replenisher LORR	KODAK FLEXICOLOR Bleach III, Fixer, and Stabilizer	Wash Water*
135	1400 mL/m^2 130 mL/ft^2	700 mL/m^2 65 mL/ft^2	861 mL/m^2 80 mL/ft^2	31 L/m^2 2.9 L/ft^2
120/220	1400 mL/m^2 130 mL/ft^2	700 mL/m^2 65 mL/ft^2	1023 mL/m^2 95 mL/ft^2	31 L/m^2 2.9 L/ft^2
4 x 5 inch	1722 mL/m^2 160 mL/ft^2	861 mL/m^2 80 mL/ft^2	1152 mL/m^2 107 mL/ft^2	59 L/m^2 5.5 L/ft^2

* Rates are for first wash and a two-stage countercurrent final wash. Double these rates for a single stage final wash.

Replenishment and Wash Rates / PORTRA 800 Film

Film Size	KODAK FLEXICOLOR Developer Replenisher	KODAK FLEXICOLOR Developer Replenisher LORR	KODAK FLEXICOLOR Bleach III, Fixer, and Stabilizer	Wash Water*
135	1400 mL/m^2 130 mL/ft^2	700 mL/m^2 65 mL/ft^2	861 mL/m^2 80 mL/ft^2	31 L/m^2 2.9 L/ft^2
120/220	1400 mL/m^2 130 mL/ft^2	700 mL/m^2 65 mL/ft^2	1023 mL/m^2 95 mL/ft^2	31 L/m^2 2.9 L/ft^2

* Rates are for first wash and a two-stage countercurrent final wash. Double these rates for a single stage final wash.

JUDGING NEGATIVE EXPOSURES

You can check the exposure level with a suitable electronic densitometer equipped with a filter such as a KODAK WRATTEN Gelatin Filter No. 92 or the red filter for Status M densitometry. Depending on the subject and the light source used for exposure, a normally exposed and processed color negative measured through the red filter should have the approximate densities listed below.

Because of the extreme range in skin color, use these red density values for a normally lit forehead only as a guide. For best results, use a *KODAK Gray Card* (gray side).

Area Measured	Density Reading	
	160NC and 400NC FIlms	160VC and 400VC Films
KODAK Gray Card (gray side) receiving same illumination as subject	0.77 to 0.87	0.81 to 0.93
Lightest step (darkest in the negative) of a *KODAK Paper Gray Scale* receiving same illumination as subject	1.13 to 1.23	1.22 to 1.34
Highest diffuse density on normally lighted forehead —light complexion —dark complexion	 1.08 to 1.18 0.93 to 1.03	 1.16 to 1.28 0.98 to 1.10

Area Measured	800 Film Density Reading		
	EI 800	EI 1600 (Push 1)	EI 3200 (Push 2)
KODAK Gray Card (gray side) receiving same illumination as subject	0.75 to 0.95	0.85 to 1.05	0.95 to 1.15
Lightest step (darkest in the negative) of a *KODAK Paper Gray Scale* receiving same illumination as subject	1.00 to 1.20	1.20 to 1.40	1.40 to 1.60
Highest diffuse density on normally lighted forehead —light complexion —dark complexion	 0.95 to 1.25 0.75 to 1.10	 1.10 to 1.40 0.90 to 1.25	 1.25 to 1.55 1.00 to 1.35

RETOUCHING

You can retouch the sheet and 120 / 220 sizes on both the base side and the emulsion side. Retouch only the emulsion side on the 135 size.

For information on retouching equipment, supplies, and techniques, see KODAK Publication No. E-71, *Retouching Color Negatives*.

PRINTING NEGATIVES

This film is optimized for printing on KODAK PROFESSIONAL SUPRA ENDURA and ULTRA ENDURA Papers, and on KODAK PROFESSIONAL ENDURA Metallic Paper.

Make color slides and transparencies by printing the negatives on KODAK PROFESSIONAL ENDURA Transparency Display Material or KODAK PROFESSIONAL ENDURA Clear Display Material.

Make black-and-white prints on any of the materials mentioned above using the recommendations in KODAK Publication CIS-274, *Printing Black-and-White Images Without KODAK Black-and-White Papers*.

Digital Files

You can scan your image to a file and print digitally to —

KODAK PROFESSIONAL SUPRA ENDURA Paper

KODAK PROFESSIONAL ULTRA ENDURA Paper

KODAK PROFESSIONAL ENDURA Transparency Display Material

KODAK PROFESSIONAL ENDURA Clear Display Material

KODAK PROFESSIONAL ENDURA Metallic Paper

SCANNING NEGATIVES

You can easily scan PROFESSIONAL PORTRA Film negatives with a variety of linear-array-CCD, area-array-CCD, and PMT film scanners. You can scan negatives on desktop scanners as well as high-end drum scanners.

Because no standards exist to define the colored filter sets that film scanners use to capture the red, green, and blue information of the film image, each manufacturer's scanner has its own characteristic output. The output depends on the scanner's sensitivity to the dyes in the film. This sensitivity is determined by the spectral distribution of the colored filter sets and/or the spectral sensitivity of the charge-coupled-device (CCD). In addition to these spectral specifications, scanner output depends on the look-up tables or matrices that the scanner uses to output information for CRT monitors, transmission, etc. These tables or matrices are part of either "plug-in" programs used with specific software packages designed for image manipulation, updateable ROMs included with the equipment, or fixed algorithms for calibrating and balancing, similar to those used in photographic color printing equipment.

The generic "color negative film" channel designation available with scanner software is only a starting point. You can adjust the final color balance and the scene-dependent contrast and brightness of an image by using the scanner's controls during pre-scan, or by using an image-manipulation software program or workstation after acquisition. Some scanners allow you to use "plug-in" programs to customize scanner setups.

For more information, visit the following Web sites.

To access	Go to
Film Terms for KODAK PHOTO CD Imaging Workstations	www.kodak.com/go/pcdFilmTerms
Drivers for KODAK Film Scanners	www.kodak.com/go/scannerDrivers

IMAGE STRUCTURE

Print Grain Index

The Print Grain Index number refers to a method of defining graininess in a print made with diffuse-printing illumination. It replaces rms granularity and has a different scale which cannot be compared to rms granularity.

- The method uses a uniform perceptual scale, with a change of four units equaling a *just noticeable difference* in graininess to 90 percent of observers.
- A Print Grain Index rating of 25 on the scale represents the approximate visual threshold for graininess. A higher number indicates an increase in the amount of graininess observed.
- The standardized inspection (print-to-viewer) distance for all print sizes is 14 inches, the typical viewing distance for a 4 x 6-inch print.
- In practice, larger prints will likely be viewed from distances greater than 14 inches, which reduces apparent graininess.
- Print Grain Index numbers may not represent graininess observed from more specular printing illuminants, such as condenser enlargers.

Negative Size: 24 x 36 mm (Size 135)

Print Size in inches	4x6	8x10	16x20
Magnification	4.4X	8.8X	17.8X
Print Grain Index for—			
160NC Film	32	54	83
160VC Film	34	56	85
400NC Film	40	62	92
400VC Film	42	64	93
800 Film	48	70	99

Negative Size: 6 x 6 cm (Size 120/220)

Print Size in inches	4x6	8x10	16x20
Magnification	2.6X	4.4X	8.8X
Print Grain Index for—			
160NC Film	Less than 25	32	54
160VC Film	Less than 25	34	56
400NC Film	28	40	62
400VC Film	30	42	64
800 Film	36	48	70

Negative Size: 4 x 5 Inches (Sheets)

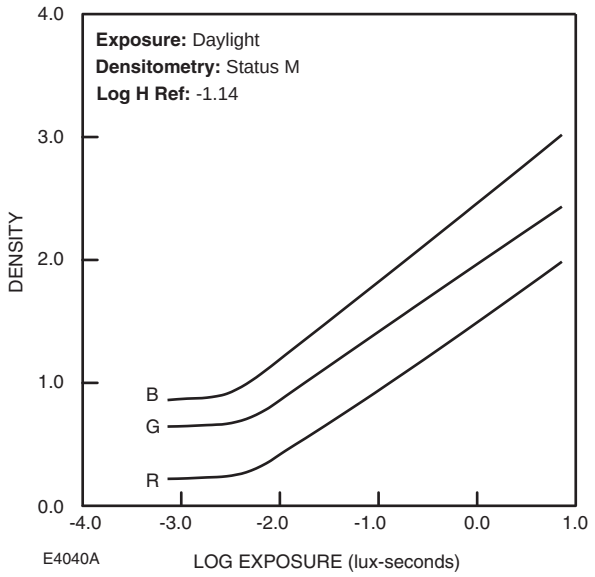
Print Size in inches	4x6	8x10	16x20
Magnification	1.2X	2.1X	4.2X
Print Grain Index for—			
160NC Film	Less than 25	Less than 25	31
160VC Film	Less than 25	Less than 25	33
400NC Film	Less than 25	Less than 25	39

For more information, see KODAK Publication No. E-58, *Print Grain Index—An Assessment of Print Graininess from Color Negative Films.*

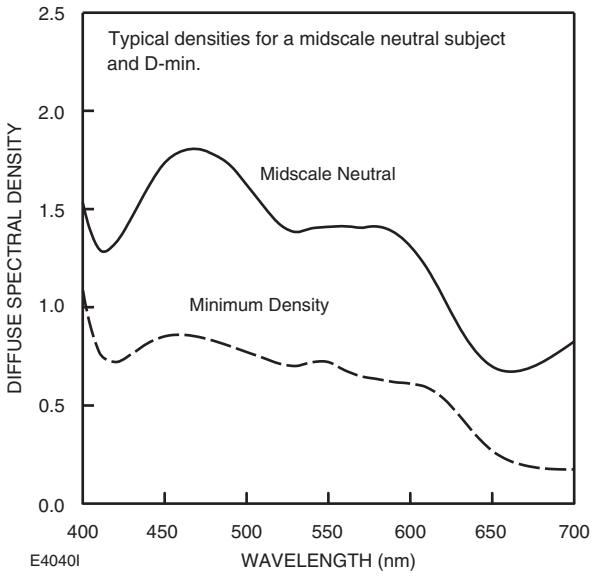
CURVES

KODAK PROFESSIONAL PORTRA 160NC Film

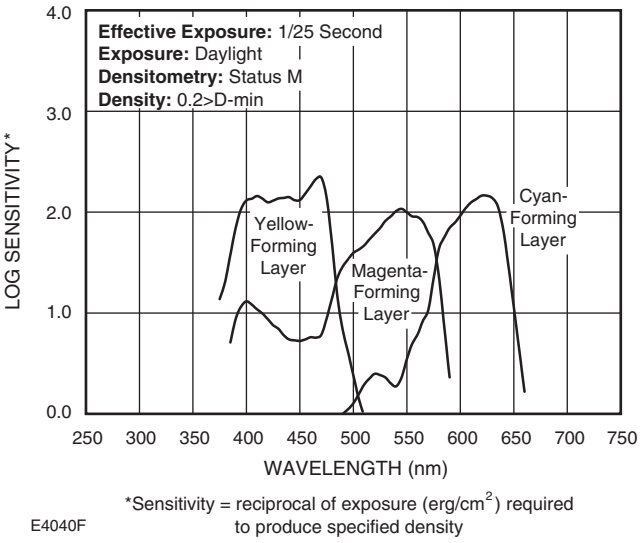
Characteristic Curves



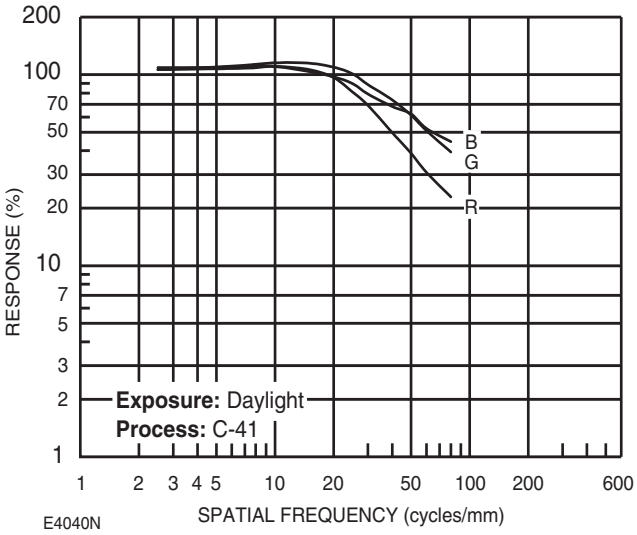
Spectral-Dye-Density Curves



Spectral-Sensitivity Curves



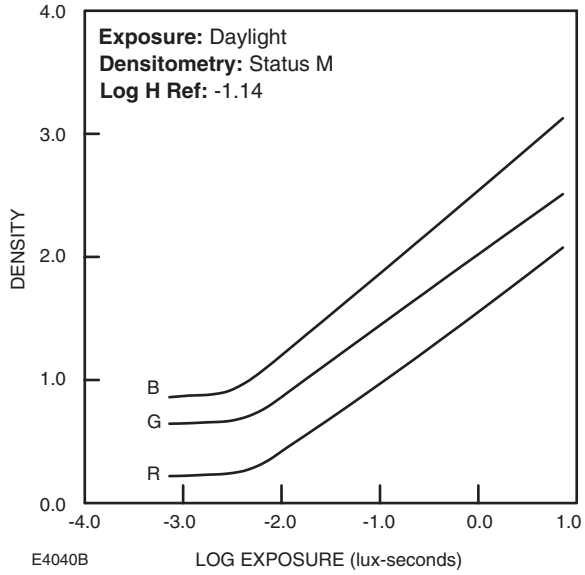
Modulation Transfer Function



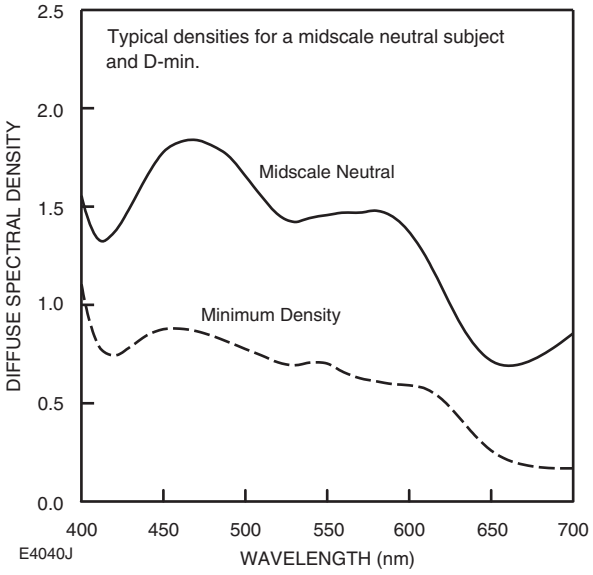
NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications that must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

KODAK PROFESSIONAL PORTRA 160VC Film

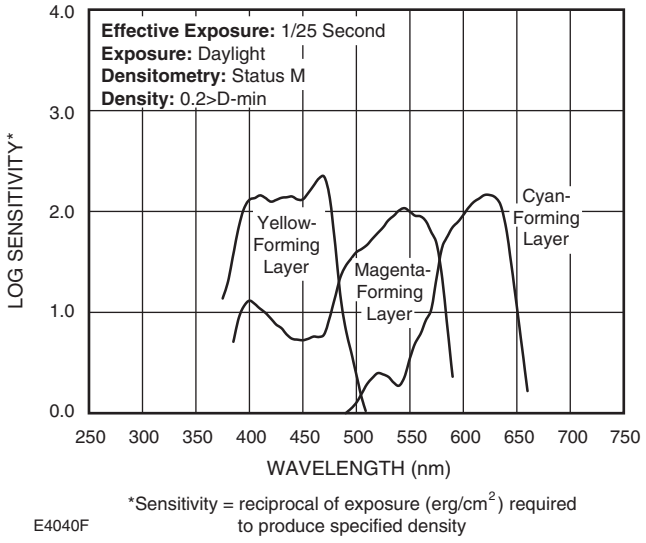
Characteristic Curves



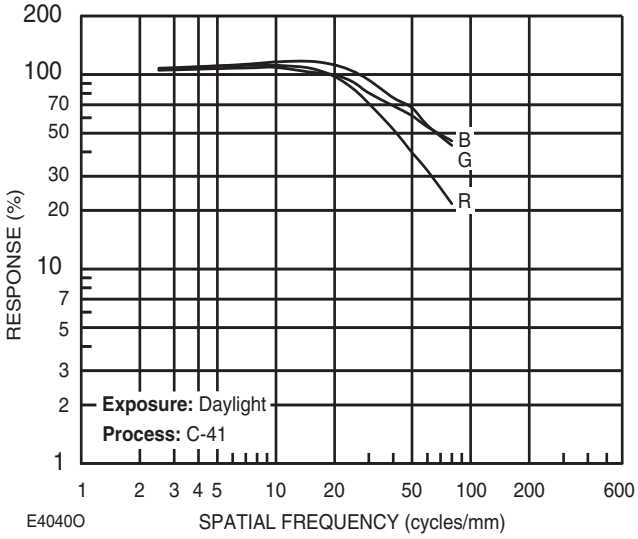
Spectral-Dye-Density Curves



Spectral-Sensitivity Curves

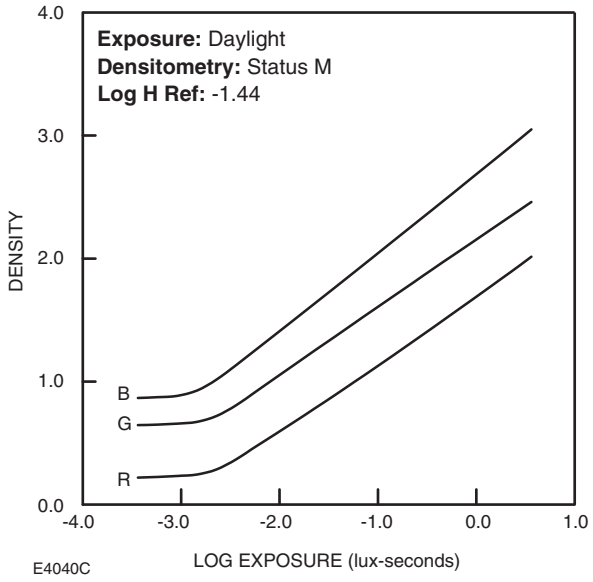


Modulation Transfer Function



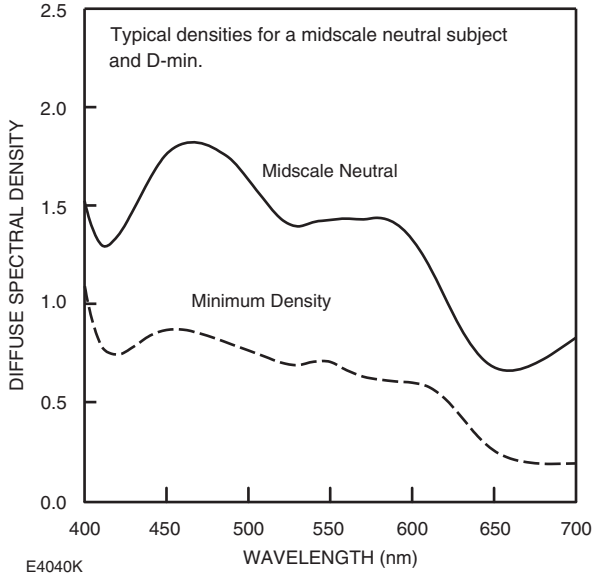
KODAK PROFESSIONAL PORTRA 400NC Film

Characteristic Curves



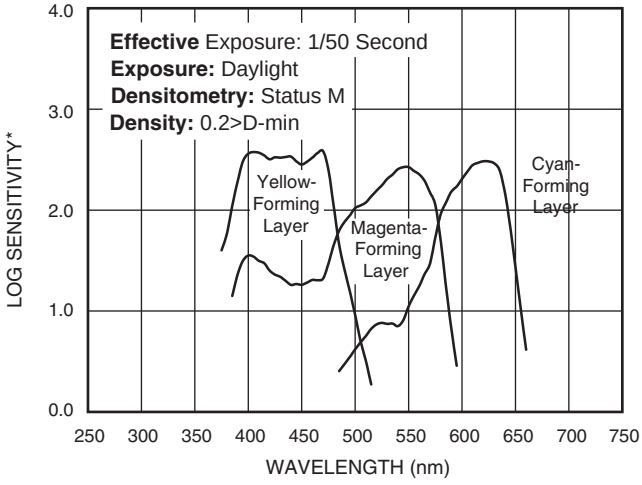
E4040C

Spectral-Dye-Density Curves



E4040K

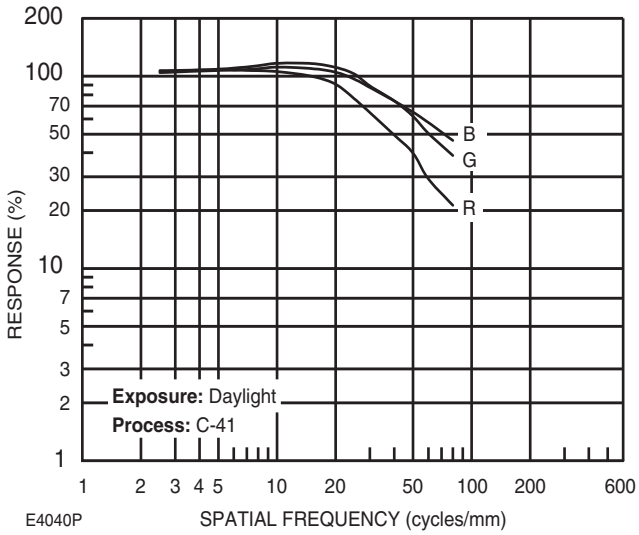
Spectral-Sensitivity Curves



*Sensitivity = reciprocal of exposure (erg/cm^2) required to produce specified density

E4040G

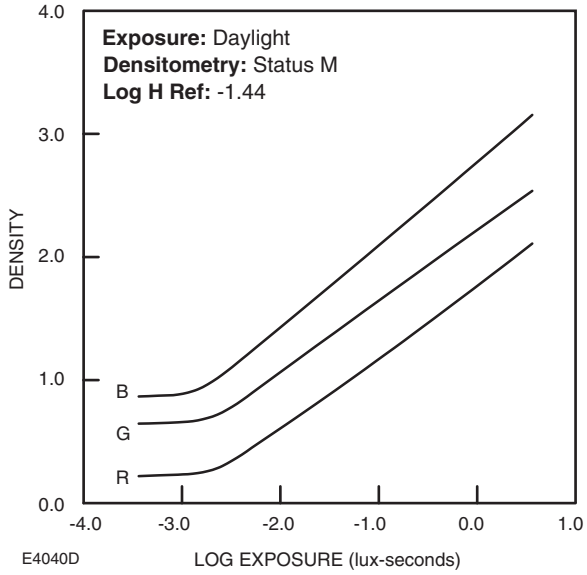
Modulation Transfer Function



E4040P

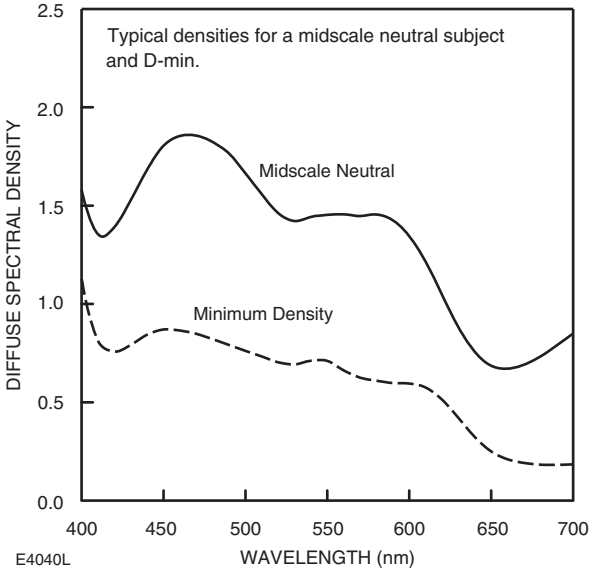
KODAK PROFESSIONAL PORTRA 400VC Film

Characteristic Curves



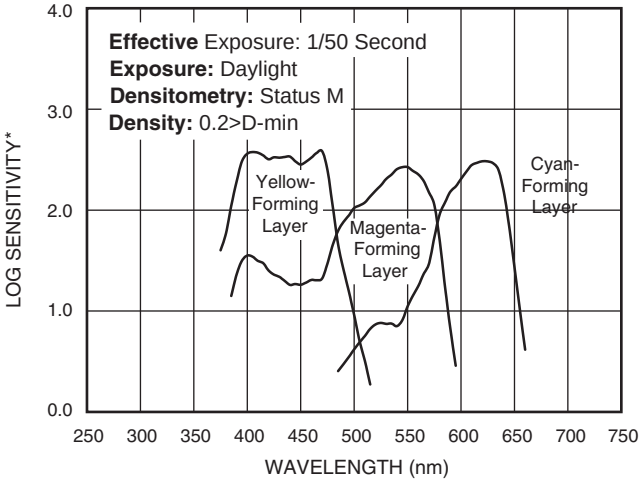
E4040D

Spectral-Dye-Density Curves



E4040L

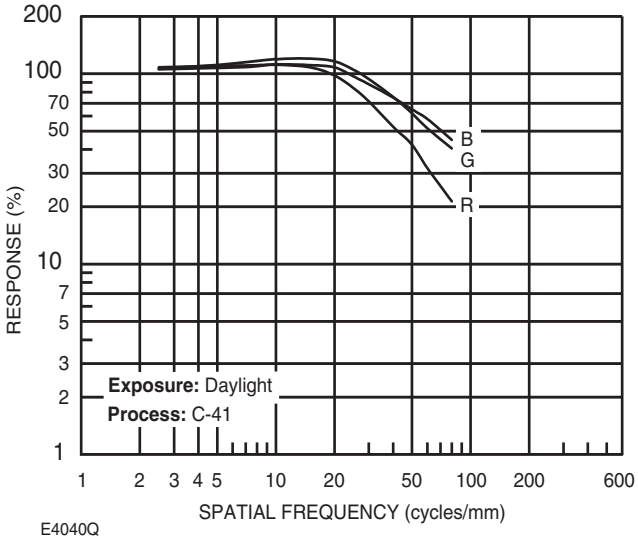
Spectral-Sensitivity Curves



*Sensitivity = reciprocal of exposure (erg/cm^2) required to produce specified density

E4040G

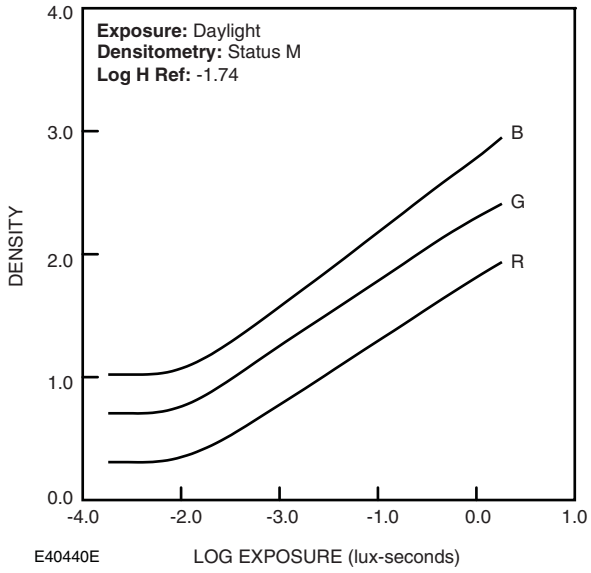
Modulation Transfer Function



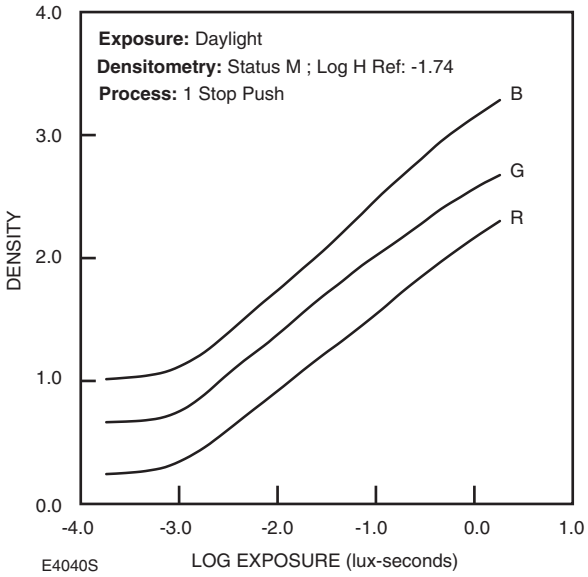
E4040Q

KODAK PROFESSIONAL PORTRA 800 Film

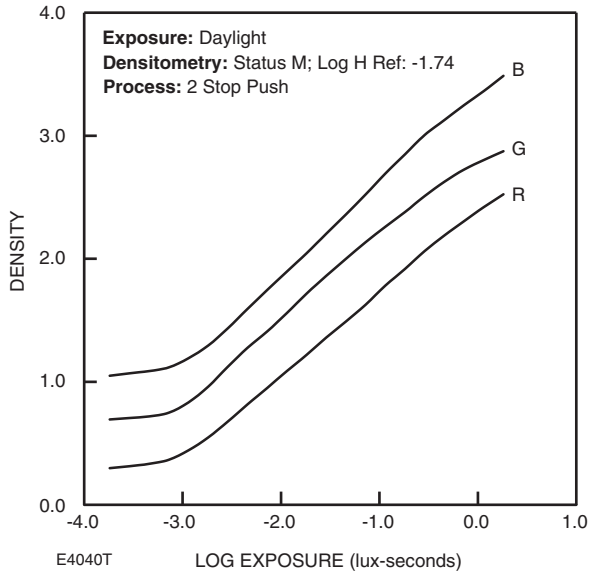
Characteristic Curves, EI 800



Characteristic Curves, EI 1600 (Push 1)

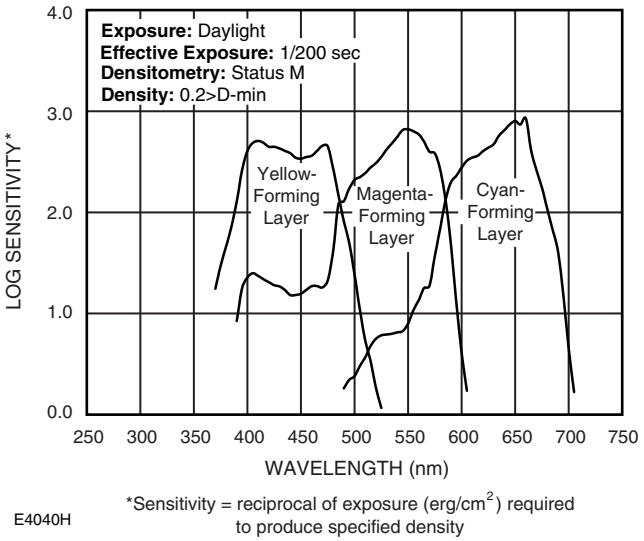


Characteristic Curves, EI 3200 (Push 2)



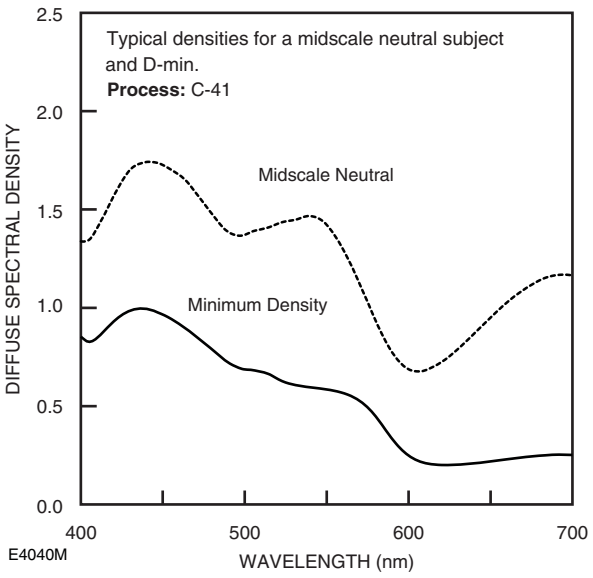
KODAK PROFESSIONAL PORTRA 800 Film (continued)

Spectral-Sensitivity Curves

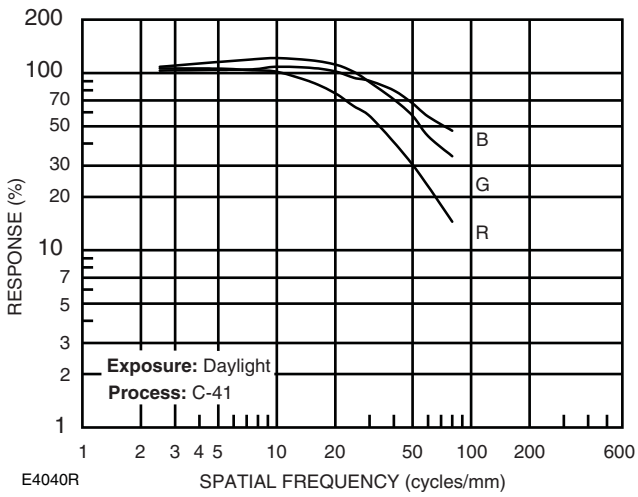


*Sensitivity = reciprocal of exposure (erg/cm^2) required to produce specified density

Spectral-Dye-Density Curves



Modulation Transfer Function



MORE INFORMATION

Kodak has many publications to assist you with information on Kodak products, equipment, and materials.

The following publications are available from Kodak Customer Service, or you can contact Kodak in your country for more information.

E-30	*Storage and Care of KODAK Photographic Materials—Before and After Processing*
E-58	*Print Grain Index*
E-71	*Retouching Color Negatives*
E-4021	*KODAK PROFESSIONAL PORTRA and SUPRA ENDURA Papers*
E-4020	*KODAK PROFESSIONAL ULTRA ENDURA Paper*
E-4038	*KODAK PROFESSIONAL ENDURA Transparency and Clear Display Materials*
E-4028	*KODAK PROFESSIONAL ENDURA Metallic Paper*
E-4035	*KODAK PROFESSIONAL ULTRA COLOR 100UC and 400UC Films*
J-38	*Using KODAK FLEXICOLOR Chemicals in Sink-Line, Bath, and Rotary-Tube Processors*
Z-131	*Using KODAK FLEXICOLOR Chemicals*

For the latest version of technical support publications for KODAK PROFESSIONAL Products, visit Kodak on-line at:
http://www.kodak.com/go/professional

If you have questions about KODAK PROFESSIONAL Products, call Kodak.
In the U.S.A.:
1-800-242-2424, Ext. 19, Monday–Friday
9 a.m.–7 p.m. (Eastern time)
In Canada:
1-800-465-6325, Monday–Friday
8 a.m.–5 p.m. (Eastern time)

Note: The Kodak materials described in this publication for use with KODAK PROFESSIONAL PORTRA Films are available from dealers who supply KODAK PROFESSIONAL Products. You can use other materials, but you may not obtain similar results.

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