
How to use basic color models in L^AT_EX

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Abstract

This article provides a quick reference guide for new or experienced users on how to use the five basic L^AT_EX color models. We describe the color packages, the primary syntax, and examples of how to include colored text (or objects) in a document. In this article, we do not attempt to include a comprehensive coverage of all the options and features in the basic color models; instead, the intent is to help the interested authors start learning (and using) the color syntax in the shortest time possible.

1 Basic color models

The default basic color models supplied with standard L^AT_EX installation provide an extensive range of colors that are easy to use for colored text or reverse color highlighted text.

The five standard color models in L^AT_EX are:

§	<i>model</i>	<i>color names</i>	<i>must load</i>
3	basic	predefined	a or b
4	gray	gray	a or b
5	usenames	predefined	b
6	RGB	arbitrary	a or b
7	CMYK	arbitrary	a or b

a: `\usepackage{color}`

b: `\usepackage[usenames]{color}`

In the **basic** and **usenames** color models, colors and their corresponding names are predefined, so only those predefined color names are available. In the **rgb** and **cmymk** models, a custom color of user-specified name with infinite variation of color hue can be specified (mixed). In the **gray** model, shades of gray are specified.

2 Syntax for colored text

The syntax for using colored text in all color models above is one of two equivalent forms:

1. `{\color{name}text in color}`
2. `\textcolor{name}{text in color}`

where *name* is either a predefined or user-specified color name in one of the color models. The `\color` command may make extra vertical space in some environments such as **tabular**; in such cases, use `\textcolor` command.

To specify a user-defined color in **gray**, **rgb** or **cmymk** color models, the syntax may be a local or global definition:

1. Local definition:
`\textcolor[model]{specification}{text}`

where *model* is **gray**, **rgb** or **cmymk** and specification is described in §§ 4, 6, 7.

2. Global definition: use the `\definecolor` command:

```
\definecolor{color1}{rgb}{n1,n2,n3}
\definecolor{color2}{cmyk}{n1,n2,n3,n4}
then use these custom colors with the syntax
above:
{\color{color1}text in color1}
\textcolor{color2}{text in color2}
```

See examples in the next section.

3 Basic color model

The predefined colors for the basic color model are used without any model specification. The eight predefined color names are **black**, **blue**, **cyan**, **green**, **magenta**, **red**, **white**, **yellow**. Syntax:

```
\textcolor{red}{\textbf{Sample text in red}}
Sample text in red
{\color{cyan}\textbf{Sample text in cyan}}
Sample text in cyan
```

Another example:

```
{\color{magenta} color changes
\textcolor{blue}{can be nested
\textcolor{red}{in all} }
{\color{green}color models.}}
```

color changes can be nested in all color models.

4 Gray scale model

The gray scale model is a variable scale gray and it takes only one number from 0=black to 1=white (as they appear on white paper).

The base color name in this package is fixed as **gray**; however, various shades can be defined using the base name **gray**. For example:

```
\newcommand{\gry}[1]{\textcolor[gray]{0.70}{#1}}
\definecolor{gray1}{gray}{0.50}
```

Syntax:

```
\gry{Sample text in 0.75 gray}
Sample text in 0.75 gray
\textcolor{gray1}{Next text in 0.50 gray}
Next text in 0.50 gray
```

5 ‘usenames’ color model

In the L^AT_EX **usenames** color model, there are 68 predefined color names; see Table 1. This color package must be loaded with the ‘usenames’ option:

```
\usepackage[usenames]{color}
```

Syntax:

```
\textcolor{BrickRed}{text color in BrickRed}
text color in BrickRed
{\color{RoyalPurple} text in RoyalPurple}
text in RoyalPurple
```

```
\colorbox{Fuchsia}{\textcolor{white}{%
  colorbox Fuchsia}}
```

```
colorbox Fuchsia
```

You can create an alias for a predefined color name, for example:

```
\definecolor{ogrn}{named}{OliveGreen}
\textcolor{ogrn}{ogrn is OliveGreen}
ogrn is OliveGreen
```

Table 1: The 68 standard colors known to dvips (not pdf^LTEX).

Apricot	Aquamarine
Bittersweet	Black
Blue	BlueGreen
BlueViolet	BrickRed
Brown	BurntOrange
CadetBlue	CarnationPink
Cerulean	CornflowerBlue
Cyan	Dandelion
DarkOrchid	Emerald
ForestGreen	Fuchsia
Goldenrod	Gray
Green	GreenYellow
JungleGreen	Lavender
LimeGreen	Magenta
Mahogany	Maroon
Melon	MidnightBlue
Mulberry	NavyBlue
OliveGreen	Orange
OrangeRed	Orchid
Peach	Periwinkle
PineGreen	Plum
ProcessBlue	Purple
RawSienna	Red
RedOrange	RedViolet
Rhodamine	RoyalBlue
RoyalPurple	RubineRed
Salmon	SeaGreen
Sepia	SkyBlue
SpringGreen	Tan
TealBlue	Thistle
Turquoise	Violet
VioletRed	
WildStrawberry	Yellow
YellowGreen	YellowOrange

6 RGB color model

In the **rgb** (red-green-blue) color model, the primaries are *additive*; that is, the contribution of each base color is added to obtain the range from black (no light) $\{0,0,0\}$ to white (full light) $\{1,1,1\}$. The **rgb** color model takes three parameters — one value for each of the **red**, **green**, **blue** colors. The three

colors can be “mixed” in any proportion; each parameter must be between 0.0 and 1.0 but they need not add to 1.0. The three base colors themselves can be selected with **red** = $\{1,0,0\}$, **green** = $\{0,1,0\}$, **blue** = $\{0,0,1\}$.

The syntax is

1. Define a color locally, usually for one-time use:


```
\color[rgb]{n1,n2,n3}text
\textcolor[rgb]{n1,n2,n3}{text}
```

Example:

```
\color[rgb]{0.8,0.1,0.8} Sample rgb color
Sample rgb color
```

2. Define a new color name:

```
\definecolor{color1}{rgb}{n1,n2,n3}
\color{color1}text
```

Example:

```
\definecolor{teal}{rgb}{0.0,0.5,0.5}
\textcolor{teal}{Sample teal in rgb model}
Sample teal in rgb model
```

7 CMYK color model

The *subtractive* primaries cyan, magenta, and yellow are the complements of red, green, and blue, respectively; that is, they are subtracted (like filters) from **rgb** for the range of full light (white) $\{0,0,0,0\}$ to no light (black) $\{1,1,1,1\}$. The **cmymk** (cyan-magenta-yellow-black) model is a more complex color model that takes four parameters — one value for each of **cyan**, **magenta**, **yellow**, **black**. The four colors can be “mixed” in any proportion; each parameter must be between 0.0 and 1.0 but they need not add up to 1.0. The four base colors themselves are selected with **cyan** = $\{1,0,0,0\}$, **magenta** = $\{0,1,0,0\}$, **yellow** = $\{0,0,1,0\}$, **black** = $\{0,0,0,1\}$.

The syntax is analogous to that in §6:

1. Define a color locally, usually for one-time use:


```
\color[cmymk]{n1,n2,n3,n3} text
\textcolor[cmymk]{n1,n2,n3,n3}{text}
```

Example:

```
\color[cmymk]{0.2,0.7,0.1,0.2}
Sample cmymk text
```

Sample cmymk text

2. Define a new color name:

```
\definecolor{clr1}{cmymk}{n1,n2,n3,n4}
\color{clr1}text
```

Example:

```
\definecolor{brk}{cmymk}{0.2,0.7,0.3,0.3}
\textcolor{brk}{Sample cmymk color model}
```

Sample cmymk color model

8 Advanced, specialized color models

The basic color models mentioned above generally suffice for most basic (and some complicated) color

applications in text or text objects. If you need (or want) to use a more specialized color feature not easily done in basic color models, you can browse the description of the color packages on the CTAN page <http://ctan.org/topic/colour> which lists over 40 different packages for special applications; some of these applications extend the basic models, some introduce new capabilities.

Perhaps the most versatile and advanced package based on the L^AT_EX basic `color` model is the `xcolor` package, which extends the capabilities of `color` with a variety of shades, tones, tints, and arbitrary mixes of colors, plus additional features. Among the many capabilities of `xcolor` are:

- arbitrary tints of predefined (custom) colors
- complete tools for transformation between eight color models
- complement color specification (`-red=not red`)
- color by wavelength
- define color series
- alternating row colors in tables
- global/local color definitions (to save memory)
- invoke color specification within `pstricks` options, e.g.,
`\psset{linecolor=[rgb]{0.3,0.5,0.7}}`

To load the `xcolor` package, you must include in your document:

```
\usepackage[options]{xcolor}
```

The base (predefined) set of named colors in `xcolor` is:

**black blue brown cyan darkgray gray
green lightgray lime magenta olive
orange pink purple red teal violet
white yellow**

Additional color names can be loaded with package options.

The color definition syntax in `xcolor` is similar to that in `color`, but with extended syntax allowing for expressions. One of the commands to assign a name to a custom color specification is:

```
\definecolor[type]{name}{model-list}{spec-list}
```

Example:

```
\definecolor{red}{rgb/cmyk}{1,0,0/0,1,1,0}
```

defines color name `red` in `rgb` or `cmyk` model depending on which model is currently set.

Two of the packages related to `xcolor`:

`xcolor-material` Defines the 256 colors from the Google Material Color Palette.

`xcolor-solarized` Defines the 16 colors from Ethan Schoonover’s Solarized palette.

Even a brief discussion of `xcolor`’s capabilities is beyond the scope of this article, so we refer the interested reader to the full `xcolor` documentation.

My favorite graphics and plotting package to use in L^AT_EX, `pstricks`, loads the `xcolor` package automatically. Need we say more?

9 Concluding remarks and suggestions

The command `\pagecolor` changes the background color of the entire page until another `\pagecolor` command is seen. Use `\nopagecolor` to change the background color back to normal. There are a number of additional color packages available to color specific environments or create special effects.

Color, when used sparingly and effectively, can make a significant impression on the reader (or consumer) in technical publications (or advertisements). However, it is counterproductive if used improperly or excessively. The only exception is perhaps color used for “art”.

While it is tempting (and fun) to use a multitude of colors in a paper or document, it may be wise to bear in mind the following facts and ideas:

- Ask yourself, is it necessary to use color?
- The appearance of color is different on a monitor vs. paper, on different monitors and printers, and to different or color-impaired viewers.
- Pastel colors just never look nice on a white background.
- What looks nice on the author’s printer may not look as nice on the reader’s printer.
- Most color graphs or charts reproduce badly on a monochrome printer or copier; therefore, they lose their effectiveness.
- Color effects, if included, should be used minimally to enhance clarity only, and to aid in communication of detailed, complex information.
- In most professional publications, all special effects including color should be used sparingly.
- If you are compelled to use colored text to aid the reader, first consider using other “normal” text formats such as `enumerate`, `itemize`, `italics`, `bold face`; even these formats should be used sparingly and consistently.
- Standard L^AT_EX “documentclass” styles provide automatic (and appropriate) font selection for all title, sectioning, and text environments.

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