



**VINCENT**

LIGHTING SYSTEMS

*Entertainment & Architectural Lighting & Rigging*

▶ FOCUSED

# LIGHTING 102

BASIC PRINCIPLES AND TECHNIQUES OF ENTERTAINMENT LIGHTING

---

[WWW.VLS.COM](http://WWW.VLS.COM)

*This guide is intended to give you an understanding of the general lighting process. It is a learning tool only, and is in no way, meant to be substituted for training in lighting and electronics.*



*Music Man, Grove City College*

The field of entertainment lighting was once limited to theater, film and television, but has grown to include retail, display, photography, education, worship services, corporate events and trade shows. This article will provide some of the basic principles and techniques of entertainment lighting. We refer to entertainment or stage lighting in general terms, to pertain to the varied applications mentioned above. Of course, there is more than one way to approach entertainment lighting. However, what follows is basic lighting theory and practice that is recognized by our industry.

---

## FUNCTIONS OF STAGE LIGHTING

The following criteria should be used to determine if stage lighting is necessary and effective.

### VISIBILITY

Visibility is a very important function of stage lighting. The audience should be able to see exactly what you want them to see, or not see those things that should remain hidden. Therefore, we might rename this function as “selective visibility.”

An example of selective visibility can be found in the play, *Wait Until Dark* by Frederick Knott. A blind woman is terrorized by a murderer hiding in her apartment. To even her odds against him, she smashes all of the light bulbs thus plunging him - and the audience - into darkness. The action is revealed verbally and occasionally visually with flashlights, matches, and a very surprising source of light at the climax of the play.

### REVELATION OF FORM

Similar to selective visibility, revealing the form of the actor, dancer, or speaker will make them stand out from their background. Using techniques described later in this article, you will be able to make the subject appear natural and be the focus of attention for the viewers.

For example, when lighting a ballet it is important for the stage lighting to reveal the form of the dancers. The audience wishes to see the dancers move through the space and stand apart from the background. Lighting ballet has been described as “lighting fish in an aquarium.” Light is the same as water in this metaphor. The lighting designer creates an “environment” for the dancer to move through.

### PLACING THE ACTION

The stage lighting can be effectively used to represent the location of your presentation. Does the action take place inside or outside? At day or night? At dusk in a garden or at dawn in Manhattan? The lighting can be instrumental in establishing time and place.

### MOOD

Are you staging a “light” comedy or a “dark” drama? These metaphors are used on purpose to make the point that stage lighting can help provide the mood for your event. Comedies are often bright and cheery. Dramas may be darker with shadows.

### COMPOSITION

Perhaps today more than ever before, stage lighting can be used to compose a picture. Some events contain little or no scenery and use lighting to create the overall picture of the scene. Musical concerts can be an example of this function.

## REINFORCING THE STORY

Two examples follow of how lighting can reinforce the story being told:

Late at night after partying with friends, an infatuated Romeo sneaks into Juliet's garden, hoping to catch a glimpse of her. Juliet enters from above, on her garden balcony. Romeo says, "But soft, what light through yonder window breaks? It is the east and Juliet is the sun!"

Scene 9 of Tennessee Williams' play *A Streetcar Named Desire*: An angry Mitch confronts Blanche about her lies and questionable past. Mitch says, "I don't think I've ever seen you in the light... You never want to go out till after six and then it's always some place that's not lighted much... I've never had a real good look at you Blanche. Let's turn the light on here." Blanche says fearfully, "Light? Which light? What for?" Mitch: "This one with the paper [lantern] on it." He tears the paper lantern off the bare light bulb hanging from the ceiling. He then switches on the light bulb. Blanche utters a frightened gasp...

Certainly these classic works of literature would still be excellent if performed in a hangar under fluorescent lights. But, in a controlled stage production, the lighting can help reinforce the story.

We can likely come up with other functions or dissect those listed above. If you use these functions in the proper proportion for your needs, you will have a successful lighting design.

---

## THE QUALITIES OF LIGHT

We have described six functions of stage lighting. Next, we need to define some of the qualities used to describe light.

### INTENSITY

Light has intensity and can be described as bright or dim. The intensity can be adjusted using equipment which will be described later.

### COLOR

Light also has color. How many colors are evident in a sunset? Many to be sure. What color is light from candles with no electric lighting? What color is sunlight at dawn? Answers to these questions and your decisions about color are often very personal and subjective. If you are designing *Romeo and Juliet*, what color is the sunlight coming through their bedroom window on the morning after their secret wedding? Or, what color does the "envious moon" in Juliet's garden cast? A discussion on tools for coloring light, and suggestions for the beginner will follow.

### DISTRIBUTION

Distribution describes the direction of the light (or lack of direction if it is soft and diffused). The distribution of stage lighting is represented differently on stage whether it is direct sunlight, a living room or a castle's dungeon.

## MOVEMENT

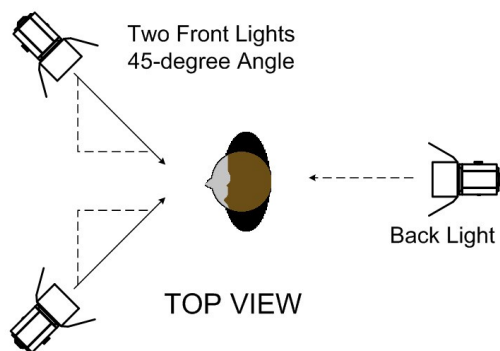
Does light have movement? Sure, and we're not talking about lights that pan and tilt. Imagine how the stage lighting "moves" at the end of Act I of the opera *Madame Butterfly* by Puccini. Cio-Cio-San (Madama Butterfly) confesses to Pinkerton (her bridegroom) that yesterday, alone and in secret, she climbed the hill up to the Mission as she adopted the religion of her bridegroom. With the wedding ceremony completed, the guests toast the couple. The atmosphere is very happy and bright. Suddenly Cio-Cio-San's uncle, the Bonze (a Japanese priest) bursts upon the scene with her extended family, cursing the girl for having renounced her ancestors' religion. Pinkerton furiously orders the Bonze and family to leave. Alone at last with his bride, Pinkerton reassures Cio-Cio-San and dries her tears. As they stand in the moonlit garden gazing at the stars, they discover their love for each other. The familiar and beautiful love duet *Viene la sera* ("Evening is falling") ends Act One.

The lighting can be described as moving, or progressing, from afternoon, when it is happy and bright; to dusk with an orange sunset during the Bonze's scene; to a romantic moonlit garden.

---

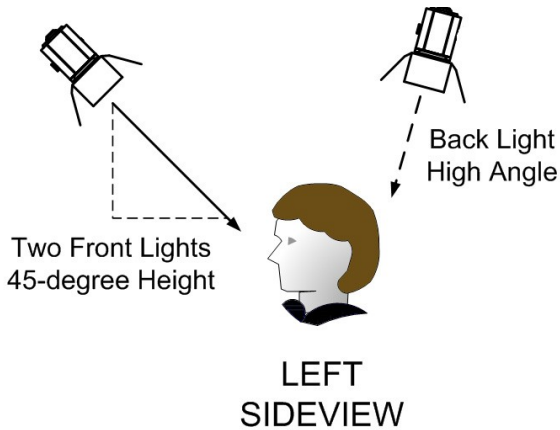
## STAGE LIGHTING PLACEMENT

As the lighting designer, you can define goals by choosing which qualities and functions of lighting you wish to accomplish in your design. How do you accomplish your goals? We will first describe a method for lighting fixture placement.



The most common method for lighting a stage is called the McCandless System. Stanley McCandless wrote about this method in his 1932 book, *A Method of Lighting the Stage*. His method was not meant to be the definitive method, but it is a useful system based on his experience.

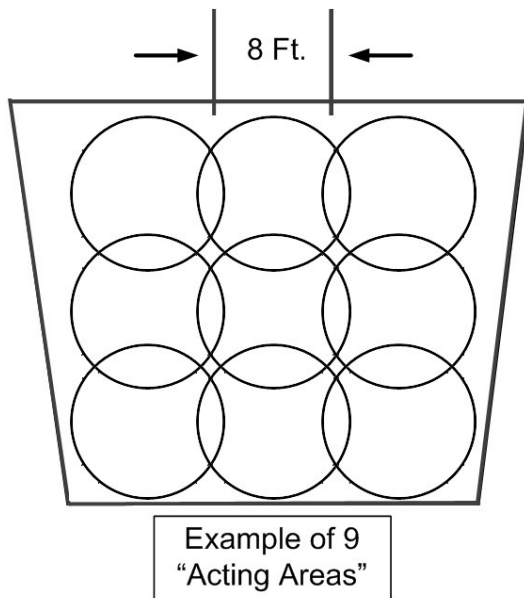
The method can be described as a 3-point system. Two lighting fixtures are placed in the front of the subject and one fixture behind. The front lights are located at a 45-degree angle to the left and right of the subject and at a height equal to an angle of 45-degrees above the subject. These locations make the subject appear natural and have 3-dimensional form. The shadows caused by the angles of the light provide definition of form without causing deep, dark shadows under the eyebrows, nose, or chin. The location and angle also provide visibility as the subject turns his/her head from side to side.



Color and intensity added to the front lights will provide visibility and definition. McCandless recommended using a warm color in one front light, and a cool color in the other. The colors blend for a natural appearance and contrast with each other to provide definition.

The third light is to be placed behind and high overhead the subject, without being directly over the subject or shining in the audience's eyes. The "backlight" causes the subject to stand out from the background and further defines his/her form by

lighting the back of the head and top of the shoulders. The color of the backlight depends on your intentions. Usually you are "coloring the shadows" cast by the front lights. However, you may want to create a halo effect by using intense, warm backlight.



"Do I need more than three fixtures?" Yes, unless your subject is a speaker at a podium, never moves, or doesn't have a background to be lighted. Based on the typical lighting fixtures and auditorium heights, you should consider the area covered by a single three-point group of fixtures to be eight feet in diameter. Therefore, you will need several fixtures placed at eight-foot intervals to cover your entire stage or platform. If this area is 25 feet by 25 feet, you may have nine "acting areas" of eight-foot diameters. This represents an ideal scenario of equipment and space. The realities are not often ideal.

This lighting design will provide basic illumination for your stage or platform. If you require more colors or more angles, you may have to double or triple the

number of fixtures focused on one acting area. Examples would be needing in one event both day and night; different locations; or perhaps entirely different productions during the same event. Your blue back lighting may be great for Juliet's garden, but bad for a hot summer day in the streets of Verona (Juliet's home town).

Additional lighting will be required to light a background, drapery or scenery; and to provide "specials," which highlight a specific area or action not covered by the general "area" lighting.

---

## CONTROLLING THE COLOR OF STAGE LIGHTING

We learned in school that the primary colors of pigment are red, blue and yellow. Mix these together in the right combination to create any color. Mix them all together to get black.



Light also has primary colors, however, they are different. Mix red, blue or green light to create any color. Mix all three together and you'll get white light (not black). The physical properties of light and color are beyond the scope of this article. Excellent books on the science and art of lighting can be found in the recommended reading section at the end of this guide.

Stage lighting is usually colored by placing a thin sheet of plastic in front of the lens. These sheets are called "color filters," or "gel" because they were originally made of dyed animal gelatin. Modern gel has a polymer base of acetate, vinyl, polyester or polycarbonate. Stage lighting fixtures produce very high temperatures and the light filtered by the gel is converted to heat. Therefore, do not use anything except color filters designed for use in entertainment lighting.

Gels come in hundreds of colors/hues and the use of color is very subjective. However, if you are a novice and need some advice, we recommend the following colors to get you started:

Position	Color	Manufacturer Name/Gel Number		
Warm front light:	Bastard Amber	Roscolux 02	Lee 162	Apollo 7050
Cool front light:	Special Lavender	Roscolux 54	Lee 702	Apollo 3350
Back light:	Daylight Blue	Roscolux 65	Lee 196	Apollo 4500
Background lighting:	Light Red	Roscolux 26	Lee 026	Apollo 8300
	Primary Blue	Roscolux 80	Lee 079	Apollo 4250
	Primary Green	Roscolux 91	Lee 139	Apollo 5300

Additionally, there are color filters made for video and photography designed to balance the colors of different light sources, or "correct" the color of an artificial light to make it appear as daylight by the camera. These filters are called color correction filters. "Diffusion" or "silks" are filters used to soften the hard-edge of the beam of light to varying degrees.



---

## CONTROLLING THE INTENSITY OF STAGE LIGHTING



*Dimmer Rack*

The most common way to control the intensity of stage lighting is by an electrical dimmer. Stage dimmers have more electrical capacity than household dimmers. They are usually arranged in equipment racks, and the racks are placed in a mechanical room, isolated from the performance area due to the heat and noise generated by the cooling fans. Smaller, portable dimmers can be placed right next to the light fixture.

In a modern dimming system there is one dimmer for each electrical outlet. Outlets are distributed throughout the performance space in every possible location you may want to place a light fixture. However, it is better to place the fixtures as needed for your event rather than place a fixture in each outlet. Flexibility is the key to a successful installation.



*ETC Eos Ti Control Console*

Whether the dimmers are in a mechanical room or next to the fixture, they are controlled remotely. The dimmers are connected with a low-voltage, digital control wire to a tabletop control console. The operator of the control console will program or otherwise operate the console to control individual dimmers or groups of dimmers. The entertainment industry standard for the control signal is called “DMX.” The dimmers can also be controlled by various styles of architectural wall stations when you don’t wish to use your main console.

---

## LIGHTING FIXTURES

### ELLIPSOIDAL REFLECTOR SPOTLIGHT (ERS)

*Trade names: Leko, Source Four, SL*



*ETC Source Four*

The ERS is a fixture with an elliptical-shaped reflector to gather and direct light from a single-point source. The light is directed through a tube with one or more lenses. It provides a sharp circular beam of light. ERS are equipped with four internal shutters that allow the user to control the beam of light by shuttering off walls, scenery, etc. ERS are most commonly used for projecting medium to long distances. Wattage is typically 575 watts, but can range from 375 watts to 1000 watts.

Because they have a lens, the ERS is also used to project patterns and images, called “gobos.” Gobos may be stainless steel or glass. Hundreds of standard images and patterns are available, as well as custom patterns made to order.



*Steel pattern or  
“gobo”*

## FRESNEL SPOTLIGHT



*Strand Acclaim  
Fresnel*

Pronounced [frə-'nel], this fixture is named for the man who invented the shape of the lens, which was originally used in lighthouses. The fresnel has a small parabolic reflector to direct light out of the front of the fixture and through the fresnel lens. Like the ERS, the fresnel produces a circular beam of light, but it is soft and not as easily controlled. Only the size of the pool of light can be adjusted on the fresnel. A fresnel is described in “spot” focus if the pool is zoomed to a small diameter. The fresnel is in “flood” focus if the pool of light is zoomed out to a larger diameter.

Fresnels are typically used for short to medium throw distances. Typical wattages range from 500 watts to 2000 watts, however, 5,000 to 10,000 watts is not unusual for film/video production in large studio spaces.

By adding a “barndoor” accessory to the front of the fixture, you can block light off of scenery and walls.

## PAR FLOODLIGHT



*Altman PAR Can*

PARs or PAR Cans were developed as the staple of the rock and roll lighting industry. They are light, rugged, easy to use, and produce a great deal of light. The PAR fixture is essentially a hollow tube with a lamp socket. The lamp consists of a parabolic aluminum reflector (thus PAR) with a lens attached to the reflector. The lamp resembles the traditional auto headlamp. PAR lamps are chosen based on their wattage and beam spread of the lens, from narrow to wide.

PAR fixtures produce an oval beam pattern. The only adjustments to the beam are made by rotating the entire lamp inside the fixture, thus rotating the oval pattern.

You can also adjust the beam by changing the beam spread of the lamp with a different lamp.

PARs are typically used for back lighting or lighting from the sides. They are also used for front lighting where shaping the beam is not crucial. Barndoors can be used to shutter extra light “spill” off walls and scenery.

## STAR-PAR OR SOURCE FOUR PAR FLOODLIGHT



*Source Four PAR*

These fixtures are the next generation of PARs. They use the more efficient ERS lamps and have interchangeable lenses to vary the beam spread. Typical wattages are 575 or 750 watts. Use these fixtures as you would traditional PARs.

## STRIPLIGHTS, BORDERLIGHTS, CYC LIGHTS, AND GROUND ROWS



*Altman Spectra  
Cyc 400*

These names describe several types of fixtures with multiple lamps, or “cells.” They are used to light a wide, flat area such as a backdrop, curtain, or as general lighting over a stage. Typically, the striplight contains 3 or 4 circuits, each circuit with a different gel color. By mixing the colors and intensities you can color the background or stage to your desired color. This is how a sky background changes from light blue to orange, then purple, then dark blue for night.

The size and wattage of these fixtures varies depending on their application.

Typical striplights are 500 or 1000 watts for each cell. Typical borderlights use PAR38 lamps rated from 120 watts to 300 watts for each cell. Vincent Lighting Systems can recommend the best fixture for your needs.



*Lycian Midget*

### FOLLOWSPOT

The followspot is designed to spotlight performers in a bright pool of light which “follows” the performer around the stage. A person standing next to the followspot manually operates it. The fixtures range from compact units for short distances and intimate settings, to large fixtures used in arenas and stadiums. Every auditorium should have at least one followspot for spotlighting a solo performer.

## AUTOMATED OR INTELLIGENT FIXTURES



*Clay Paky  
Sharp*

These terms refer to fixtures containing electronics and motors onboard to vary the position, color, and intensity of the beam of light. Some have onboard dimmers. Most of them contain several “gobos” on a wheel and an “iris” for making the beam large or small. Automated fixtures also have a method of coloring the beam in pre-set colors or any color you desire.

The fixtures come in two basic styles: “moving-yoke,” where motors control the pan and tilt of the entire fixture; and “moving-mirror,” where a rotating mirror is mounted on the front of the fixture. As the mirror moves, so does the beam of light.

The functions of the fixtures are controlled by a “DMX” data signal from the main control console. They are used for “special effects” or placed in hard-to-reach locations where it is difficult to change color filters and aiming positions for every show. However, these fixtures do require routine maintenance and their lamps will eventually burn out, so they cannot be placed in a completely inaccessible location.

Once only utilized in large scale concerts, automated fixtures are now more affordable and easy to program, leading to their increased use in schools and community theaters.

---

## CONCLUSION

It is our hope that this article has provided you with basic information to use entertainment lighting to meet your needs. Knowing the qualities and functions of lighting will help you choose how much equipment you need and where to place it. The information on color, control and fixtures should enable the movement of your design to heighten the viewers' experience. Vincent Lighting Systems sells and rents lighting equipment, stocks theatrical supplies, and can provide experienced people to help with your design. If you are planning a renovation or new construction project, our outside sales staff can visit onsite to assist you with your planning.

---

## RECOMMENDED READING

### ***Scene Design and Stage Lighting***

W. Oren Parker, R. Craig Wolf, and Dick Block

### ***Stage Lighting***

Richard Pilbrow

### ***Lighting the Stage: Art & Practice***

Willard F. Bellman

### ***A Method of Lighting the Stage***

Stanley McCandless

### ***The Dramatic Imagination***

Robert Edmund Jones

---

## NEED HELP?

Vincent Lighting Systems employs degreed and certified team members. We pride ourselves in creating customers for life, so we want to help you understand your lighting system, so you can love lighting as much as we do.

Whether you need advice on which fixtures or control board to purchase, to create a special effect, or a site survey to diagnose, troubleshoot or upgrade your system, we can provide you with advice on purchasing, renting or supply you with a quote. Our services include Production, Rental House, Repair & Training, Rigging & Safety Inspections, Stocking Distributor of Supplies and Expendables and Systems Integration & Programming. Contact us at [info@vls.com](mailto:info@vls.com).

---

## ABOUT VINCENT LIGHTING SYSTEMS

### **RELIABLE**

Vincent Lighting Systems provides reliable entertainment and architectural lighting and rigging products that are inspected, maintained and tested for compliance with industry standards prior to delivery. Our reputation for reliability is backed with a commitment to providing on-time delivery, a personal equipment operation guarantee and after-hours project, rental and production support.

### **PROFESSIONAL**

Every customer of Vincent Lighting Systems can count on a dedicated team of certified and degreed lighting professionals with an accumulated 500+ years of industry expertise, all fully focused on delivering an outstanding customer experience.

### **CREDIBLE**

Since 1978, the award-winning professionals at Vincent Lighting Systems have met the needs of entertainment and architectural lighting customers with the broadest range of equipment and products from more than 100 industry manufacturers. We have managed more than 10,000 projects and productions, including specialty architecture, bridges, theatres, schools, houses of worship, weddings and corporate events.

*©2018 Vincent Lighting Systems, 6161 Cochran Rd Ste D, Solon OH 44139, 216-475-7600 [www.vls.com](http://www.vls.com). All rights reserved.*