Competencies

- Lighting instrument components and design considerations
- Types of spotlights
- Features and characteristics of various spotlights
- Types of floodlights
- Features and characteristics of various floodlights
- Articulated Lighting Fixtures
- Methods and procedures of hanging lighting instruments
- Connectors and wiring techniques
- Circuit breakers and their use

Distribution Control

Distribution refers not only to direction and angle of illumination but also to quality of light. Lighting instrument designers begin with a bare lamp. In an attempt to harness the light energy it is encased in a heavy metal frame. The solid metal box keeps the light from going in all directions and provided a support system for the lamp and other pieces that are added. A reflector is placed behind the lamp to direct the light in one direction. Various lenses are placed in front of the lamp to direct the light source.

A few basic questions must be answered before you begin selection of lighting instruments. Will you need light that is soft or harsh? How much illumination is necessary? After you have determined this, the next step is to determine what lighting instrument(s) you will need. Several factors will affect this determination.

Physical Restrictions

In the Tom T. Hall studio, we are fortunate to have a large physical space with which to light, but this large space also adds constraints. The grid height of over 20' means that we must have high wattage lamps to successfully light a large area especially for television. This is a good example of for using the Falloff formula.

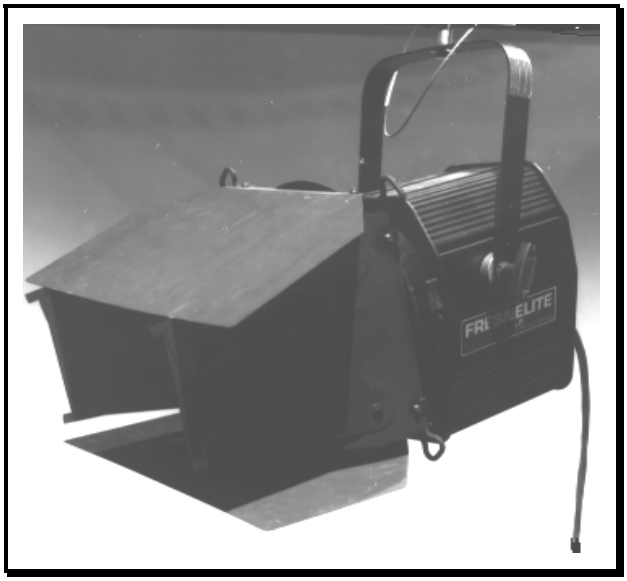
Quality of Light

There are trade-offs when using various types of lighting instruments. Several instruments are designed to provide a sharp, tight beam while others produce a quality that is soft and appears to come from a wide area. You may desire a soft, tight beam of light, but to create the softness, you should use a floodlight but it will not provide a tight beam. Most lighting

situations require control of the light beam. Certain instruments provide this better than others.

Accessories

In the front of most lighting instruments are brackets to hold color media (gel) frames. Wide ranges of color gels are available. Diffusion material called scrim can also be placed in the gel frame to soften and reduce the light intensity.



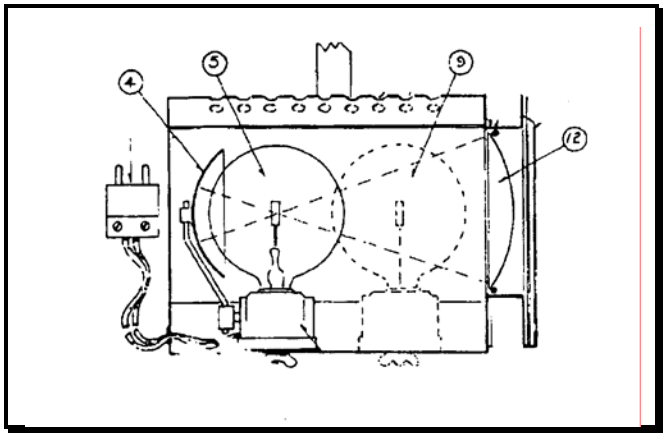
A yoke usually held in place on side studs with wing nuts or knobs hangs lighting instruments. A C-clamp is attached to the yoke and is used to attach the instrument to the pipe grid. It is wise to safety the unit by attaching a chain or wire rope around the yoke and the pipe grid.

Barndoors are metal flaps that can be attached to the front of the lighting instrument. Barndoors are one of the most convenient and commonly used methods of controlling the spill light.

Spotlights

The spotlight is by far the most important lighting instrument you will use. Broadly defined, the spotlight is a metal hood containing a high-powered source of light that is made more effective by use of a lens and a reflector. The resulting beam of light can be shaped by various means.

Plano-Convex Spotlight



The first incandescent spotlight was the plano-convex instrument. In a simple hood, the lamp is mounted on a sliding carriage that is attached to a small spherical reflector that rides behind the lamp and stays in correct position as the lamp is moved.

In front of the unit is a lens that refracts the ray of light into a relatively narrow beam of light. When the lamp is close to the lens in a flood position, the percentage of total light that strikes the lens is quite high, but because this spreads into a wide angle after leaving the lens, there is

no great intensity to the beam. When the lamp is moved back, the beam has a greater intensity because all the light is concentrated in a narrower shaft.

Fresnel Spotlight

Named for Augustin Fresnel (Fir-NEL), who invented the lens used in the instrument, the Fresnel spotlight is the most widely used instrument in television studio production. The Fresnel spotlight is relatively light and flexible. It has a high light output, and its light beam can be made narrow or wide by a focusing device. The spotlight can be adjusted to a "flood" beam position, which gives off a rather wide, spread beam, or it can be "spotted" or "pinned" to a sharp, clearly defined light beam. This change is made by pulling or pushing the bulb-reflector unit inside the light instrument toward of or away from the lens.

On the back of the instrument, you will find a lever that can be moved horizontally. To spot or focus the beam, move the lever to the right. This moves the bulb away from the lens. Moving the lever to the left moves the bulb toward the lens and produces a flood of light. This focusing operation is one of the primary advantages of the Fresnel spotlight. The Fresnel is usually used with barndoors to control the light.

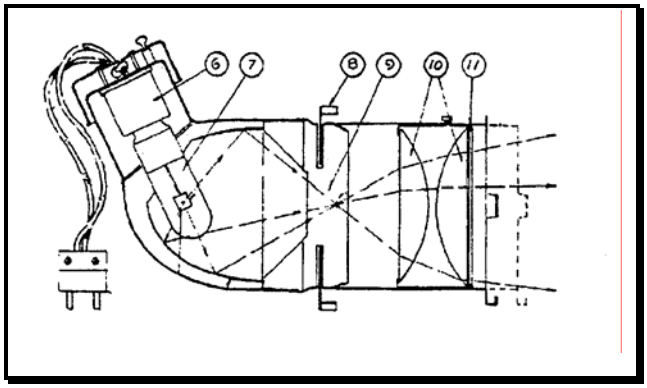
Beam Shaping

The beam of light from a Fresnel is soft if quality, with a smooth, even field. The light will appear to wrap around a figure and shadows will be soft edged and not very harsh. Being a spotlight, the light from a Fresnel exhibits a good sense of direction.

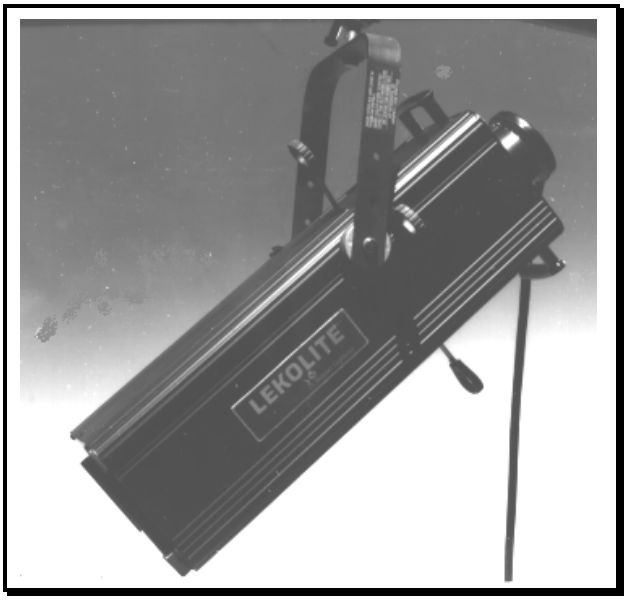
Ellipsoidal Reflector Spotlight (ERS)

The ellipsoidal spotlight has found its greatest use in the theater, while the Fresnel is found most useful in the TV studio. The ellipsoidal reflector aims the light beams to the conjugate focal point. By placing lenses in front of this secondary focal point a spotlight of great efficiency and power can be constructed. In most ERS units, two thin plano-convex lenses are used to refract the light into a relatively narrow beam.

ERS Beam Shaping



Just before the conjugate focal point, where the various rays are still converging, is a metal baffle known as a "gate." This cuts off the rays of light that are not useful in forming a well-controlled beam. It is an image of the opening of this gate, called the aperture, which appears as a round and reasonably smooth pattern when the ERS is focused on a flat surface. Various other features to shape the beam may be placed at the gate. Up to four shutters that can change the beam pattern into almost any simple linear shape can be inserted near the gate. An iris is sometimes inserted, allowing a circular form of the beam to change diameter.



An ellipsoidal will also have a pattern or template holder located just in front of the four shutters. A template or "gobo" or "Cookie", is a metal plate with a pattern cut in it. When a template is used, the ERS can serve as a pattern projector. The pattern will be inverted because of the crossing of the light rays, so the gobo should be inserted upside-down.

Beam Characteristics

The ERS throws an extremely powerful beam of light capable of creating harsh and sharp shadows. Because the lamp, reflector, and lens are static, there is no flood or spot focus. The lenses may be moved slightly, allowing the beam pattern to be thrown out of focus and thus softening the hard, sharp edge of the field.

Most ERS instruments have a fixed-focus beam shape. However, the "Lekos" in the production studio have the option of sizing the beam by adjusting the placement of the lenses.

Par Can

The Par Can is a simply built instrument for mounting a PAR lamp. The PAR lamp is a sealed, self-contained lamp with a built-in reflector, lamp and lens. The PAR can is inexpensive to construct because the PAR lamp itself contains most of the elements of the instrument. The oval-shaped beam of light cannot be effectively altered or shaped, but the quality of the light is uniquely harsh, and the beam edge is fairly soft.

These lamps come in different widths, but the PAR 64 with 1,000 watts is the most commonly used. They are lightweight and provide little in the way of adjustment. The PAR 64 lamp comes in four different models, and provides for a wide to narrow beam width. The diameter of the lamp determines its designation. A PAR 64 lamp is 8" in diameter. They are used mostly in live concerts.

Follow Spot

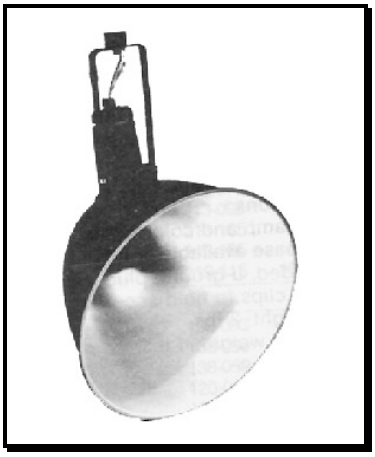
The follow spot is a large, high intensity spotlight that is mainly used in theater and concert performances. An operator is required to move, focus and control the light beam. Follow spots are equipped with controls which enable the operator to "iris in" or "iris out," enlarging or shrinking the size of the beam. The instrument is mounted on an adjustable base to allow the operator the pan and tilt the unit to follow the action on stage. Color gels can also be easily placed in front of the lamp to change the color of the beam. Smaller spotlights are lamped with T-H lamps with a pre-focused reflector. Large follow-spots use a carbon-arc light source for a long throw.

Floodlight

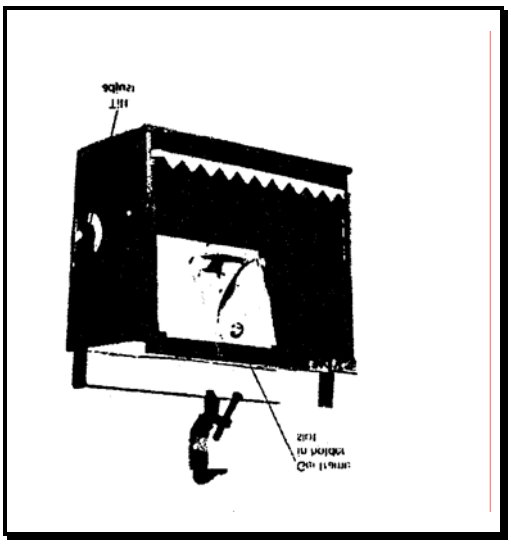
A floodlight is a device for throwing a broad wash of light over a wide area. They emit a beam of soft, highly diffused light that produces few; if any, shadows.

Scoop

The most common floodlight today is the ellipsoidal reflector floodlight (ERF), or "scoop." Named for its shape, the lamp is mounted inside a brush-finished ellipsoidal housing. The scoop emits a very soft and highly diffused beam. It is used in television to light large areas.



Softlights



The soft light is a large aperture (opening) instrument that produces the most diffuse light of any floodlight. Soft lights are ideal for producing virtually shadowless lighting. The biggest disadvantage of the soft light is that it does not permit the lighting director to isolate the beam toward one specific area.

Cyclorama Lights

Most studios are equipped with a cyclorama--a large, continuous piece of cloth surrounding the background edge of the studio. A cyclorama or "cyc" instrument uses a highly efficient reflector to spread a very even beam of illumination across a wide area of the cyclorama.

Articulated Lights

The articulated lighting system used in the Tom T. Hall studio is manufactured by High End Systems, Inc. in Austin. The system includes a controller and two types of articulated lighting instruments. The Intellabeam 700 HX is the more powerful and most costly. The Trackspot, although not having as great illumination, includes most of the features found in the more expensive instrument. There are two Intellabeams and five Trackspots in the studio. There are other articulated lighting fixtures available.

The microprocessor-based instruments respond to an extensive set of programming features. You program these features through the Controller into simple or complex scenes. You can vary the beam sizes, colors, and patterns. You also have variable speed programming for motion, color, pattern, and strobe effects. The system is designed for use in theatrical applications, stage, studio, concert touring and nightclubs.

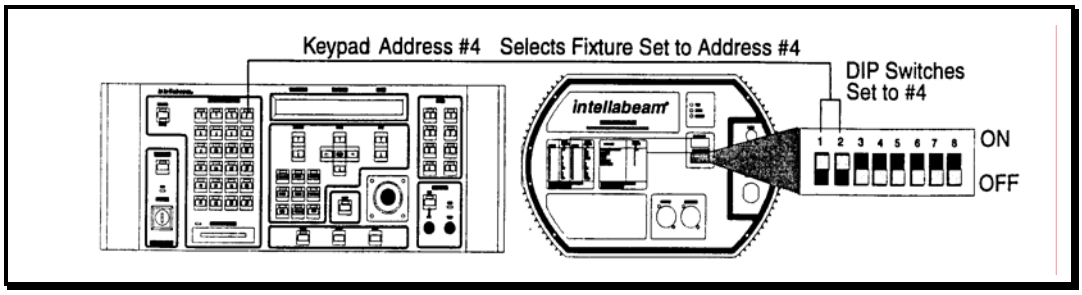
Instrument installation and set-up

Because of the large number of components in the instruments, they weigh much more than standard lighting instruments. Because of this, particular attention should be given to mounting and safety. Two C-clamps are used on the Intellabeams. Double safety chains give added protection.

As with any lighting instrument, the articulated instruments must be focused each time they are moved. Moving the lens tube and tightening the thumbscrew does this.

Each unit is computer-based, so there are control features on each unit. There are two sets of eight-position DIP switches. The switches are 1ocated at the back of each instrument.

The top sets of switches are called the personality DIP switches and are used to set the

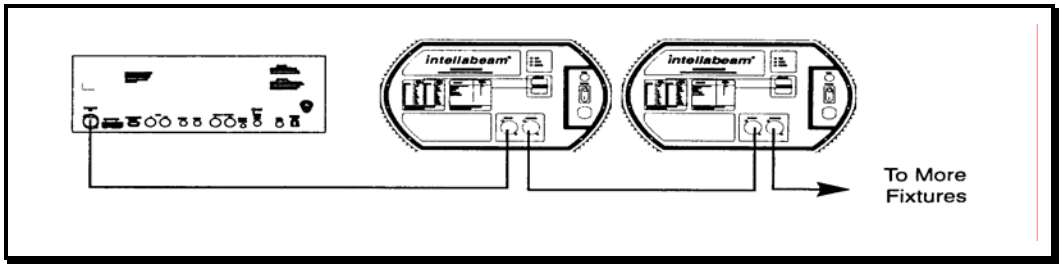


operating mode of the instrument. The normal mode is all switches in the "off" position. This transfers control of the instrument to the controller. Changing the switches provides for self-test, set-up, and focusing modes. The instrument can also be controlled with an industry standard controller, by using proper settings of the switches.

More than one instrument can be assigned to an Address; however, if several instruments are assigned the same Address, all will all operate as one.

To have control over each instrument, each must have a discrete address. This address is set by using Fixture Address DIP switches. A combination of switch settings will provide a unique address to each instrument.

Data signals from the Controller are sent to the instruments over a 600-ohm balanced cable. Professional microphone cable with XLR connectors is recommended. The easiest way to connect the controller to the instruments is to daisy chain from controller to closest instrument, then looping out to the next instrument, etc., until all instruments are connected. They do not have to be cabled in address order. AC power must also be provided to each



instrument.

Mounting and Hanging

The instruments are hung from the grid with a C-clamp. There is a small square-headed bolt for adjusting the horizontal positioning of the instrument in the center of the C-clamp. The clamp itself is attached to the yoke of the instrument.

When you are moving an instrument from one location to another, use the following procedure:

1. Load the instrument, accessories and tools on the "Hefty Herman" lift.
2. Before raising the lift, make sure you have a clear area for the outriggers to open.
3. Use the safety chain to close the opening to the lift.
4. Clear the area below of people and equipment.
5. Be sure to hang the instrument over the lift, so that if you drop it will fall only a few feet...not to the floor.
6. Adjust the yoke so that the instrument will hang in a horizontal position.
7. Loosen the clamp so that the opening will clear the pipe.
8. Grasp the yoke with one hand and raise the instrument using the other hand to properly seat the C-clamp
9. Hand tighten the C-clamp, then use a wrench to secure it to the pipe.
10. Attach the safety wire by circling the pipe grid and yoke.
11. After making sure the power is off, connect the pin plug to power the instrument.
12. Aim and focus the instrument as directed by the lighting person on the floor.
13. Add barndoors, paying particular attention to see that they are correctly attached to the instrument. Gel frames can then be inserted.

To remove the instrument, reverse the procedure. Be sure the instrument has cooled.

The best way to prevent accidents from happening is to keep your equipment in good condition. Sticking shutters, bent bolts, and missing knobs or handles all frustrate the operator and encourage mistreatment.

Keep your lighting instruments clean. Compressed air can be used to remove dust. Lenses can be washed with mild soap and water or with a good glass cleaner. Reflectors should be

wiped with a soft cloth with glass cleaner or water. Clean instruments will dissipate heat better, thereby increasing lamp life, and will also deliver more intensity.

Connectors

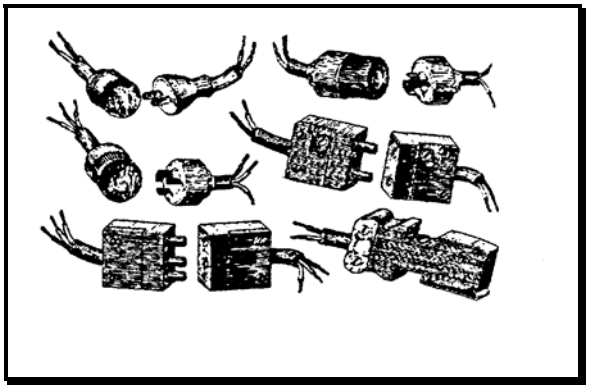
Types of Connector

Placement of lighting instruments is temporary. They are moved after each production and sometimes even between scenes of a play. Thus, it is not wise to make permanent connections of the cables to the various lighting instruments.

Devices that can be easily connected and disconnected are needed. Ordinary household plugs with parallel blades are used in some small operations, but because they are easily disconnected and have limited wattage capacities, they are not advisable.

A departure from the household style is the twist lock. It is similar in appearance to a heavy-duty parallel blade plug but with a design that permits the male and female caps to be locked together with a firm twist. When wiring a three-prong twist lock, always be sure that the grounding (green) wire is connected to the grounding prong (marked "G" or having a green screw head).

Pin connectors; heavy fiber blocks with sturdy brass pins and sockets are probably used as much as any other devices. They have the disadvantage of not always giving a firm electrical connection, and they can be easily pulled apart unless the two cables or connectors are tied together. Pin connectors have a "split" down the center of each brass male pin (hence the name split-pin connector). If a pin is not making a good connection, electrical arcing will occur and the connector will overheat. To avoid this, the individual pins can be "split" or slightly separated with a small knife blade.

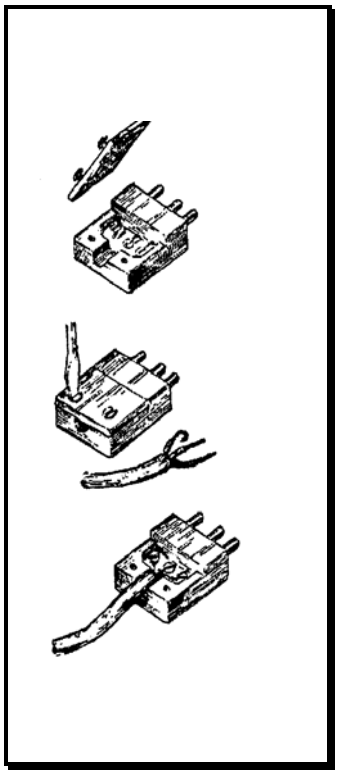


Note that in pin connectors with three pins, the grounding pin is always the middle pin and it offset from center.

Wiring Connections

Proper wiring of stage connectors is important to insure against short-circuiting of loose connections that can result in arcing within the plug. Stage cable and "leads" from lighting instruments will consist of small strands of copper wire. The easiest method of wiring a pin connector is to twist the small strands together (forming a more cohesive single strand) and then wrap the exposed wire around the screw terminal.

Be sure to take the following precautions:



1. Expose only as much bare wire as necessary.
2. Always wrap the wire in the direction the screw will turn when being tightened down (clockwise).
3. Be sure that the connector's strain relief if effective. The strain relief feature in a stage connector will insure that any pulling tension is place on the cable rather than on the connecting terminals.
4. A better and safer technique of wiring a connector involves "tinning" the exposed copper wire. The tinning process simply requires soldering all the small copper strands together to form one stiffer strand.
5. Perhaps it is obvious, but one should realize that a male connector must never be "hot" or "live." For example, leads from a lighting instrument will always terminate in a male connector so that the "live" shielded female connector will plug into it.

Circuit Breakers

A circuit breaker is a form of switch that automatically opens when the current flow (amperage) becomes higher than it should. The circuit breaker can also be used as a switch for the circuit.