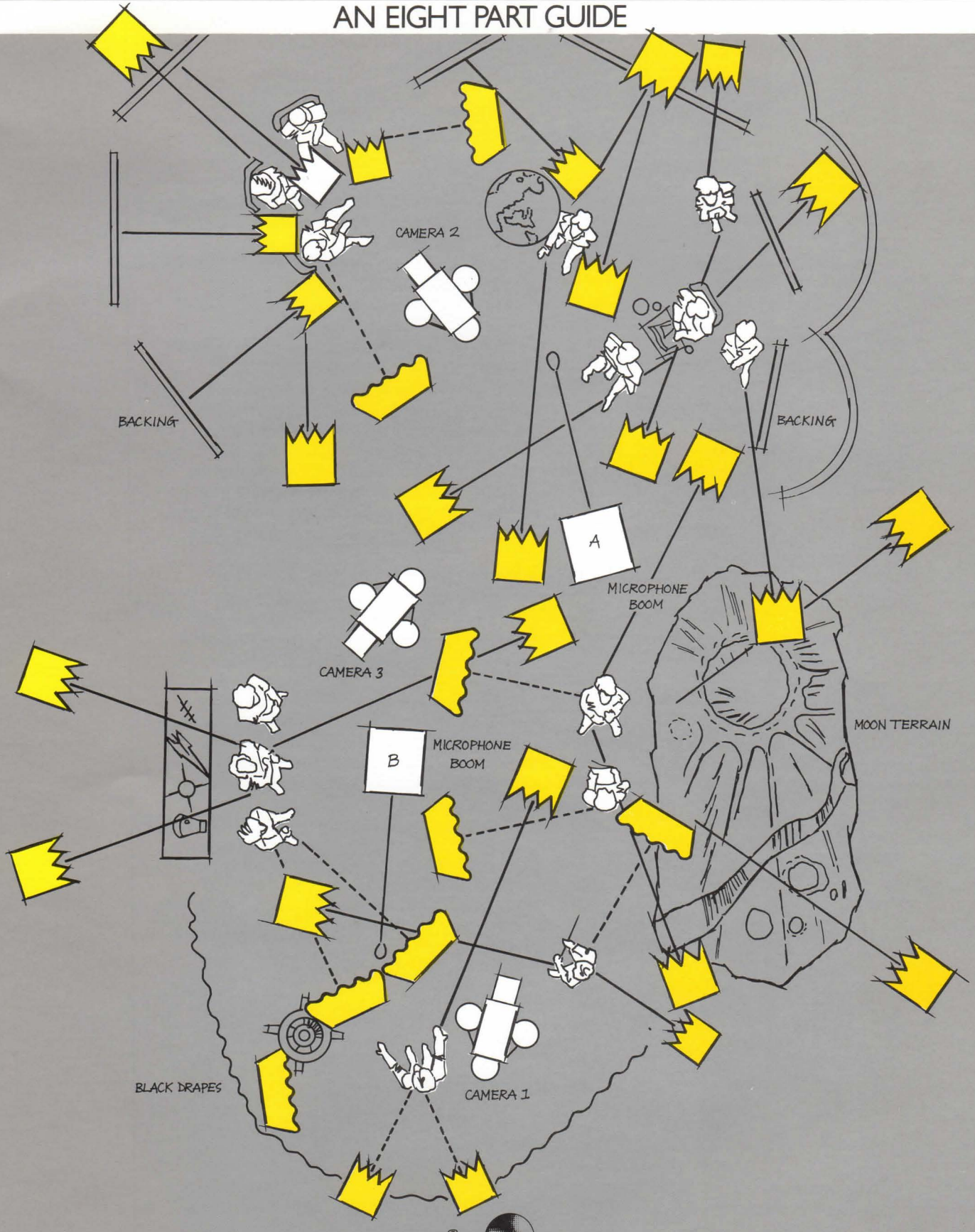
LIGHTING FOR TELEVISION

AN EIGHT PART GUIDE



Strand Lighting

The purpose of this booklet is to set out in a straightforward way the basic principles behind the planning of television lighting systems. It is not intended as a guide to the finer points of lighting which other publications already cover.

Originally developed from film lighting, television lighting has now become an art form in its own right. New ideas and purpose-designed equipment have made possible new standards and effects that meet the unique challenge and potential of the medium. Nevertheless, the underlying principles of good lighting remain much the same as ever, and success depends on adherence to simple rules which are just as applicable to television as to film-making, photography or painting.

In colour television productions, effective lighting of scenery and costume is especially important if costume and set designers are to achieve their aims. The concentration of the eye onto a small picture automatically leads to much closer examination of detail in a scene than would be the case if life-size.

Consider, for example, a walk in the country on a sunny day. The colour of the scene is taken for granted, much of the detail around perhaps hardly noticed. Yet a countryside scene viewed on a television screen in a darkened room at night is vivid with colour and alive with obvious detail because the image is concentrated into a very small area.

The fact of colour in television does not mean that additional colours must inevitably be employed in lighting, although there are situations where this is effective and necessary. Everything around us has its own colour. A man in a grey suit with a coloured tie against a neutral background will achieve prominence when properly lit. The most successful productions can be those which faithfully transmit to the viewer pictures of subjects in their natural colours.

This booklet was first published ten years ago, and has been fully updated to reflect the present state of the art in television lighting. Since the first edition, lighting consoles have become more sophisticated even for the small studio installation. Discharge lighting has made an enormous impact on location lighting techniques, for both film and electronic media. Outside broadcasts have become more complex and a section has been added dealing with this subject.

Because of the almost universal adoption of colour television worldwide, all reference to monochrome has been omitted. But a section on cameras has been introduced to help the non-technical reader appreciate the need for the numerous items of main and ancillary equipment that constitute 'lighting for television'.

PART 1

TERMS & DEFINITIONS

ASPECT RATIO

The ratio of the width to the height of a TV screen or viewed image.

BACK LIGHT

A luminaire used to light the subject from the rear to help separation from backings and to increase the three dimensional effect.

BARNDOOR

Moveable shutters fixed to a luminaire (usually a spotlight) to control and shape the light beam.

BARREL

A metal tube, usually 48mm diameter, for suspending luminaires (scaffold tube).

BASE LIGHT

The basic level of flood lighting intensity required to satisfy the medium used.

CATENARY

A flexible power feeder suspended at several points to enable movement of a lighting suspension unit e.g., pantograph.
Note: usually seen on overhead mobile cranes.

CHANNEL

The circuit from the fader on the console to its associated dimmer.

COLOUR TEMPERATURE

A method of specifying the colour of a source which emits light in a continuous spectrum. Expressed in Kelvin units, the range used in lighting is from 2600K (white light with a high red content) to 6000K (white light with a high blue content).
N.B. Cannot be used with discharge sources although sometimes used as a guide to approximation of colour.

CONE

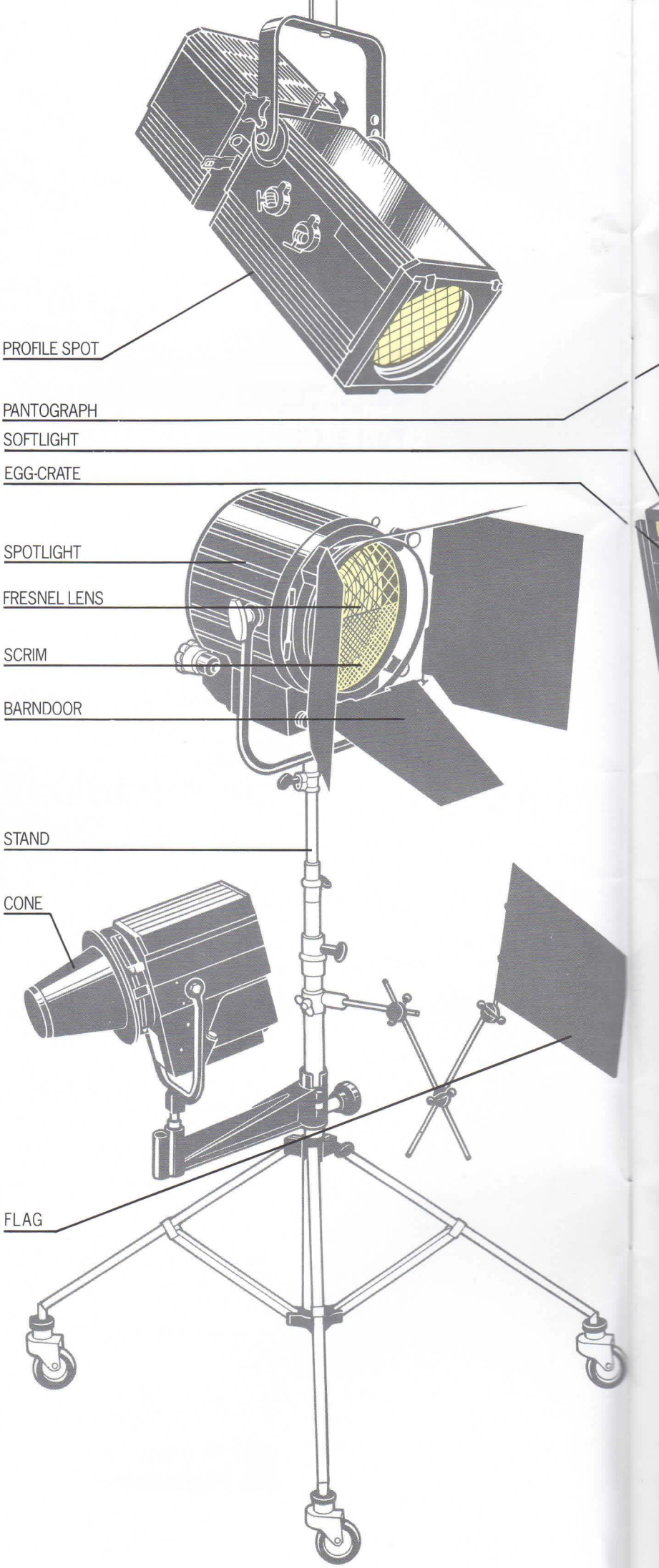
A tube placed in front of a spotlight to give a smaller beam of light.

CROSS BARREL

Used between barrels to allow accurate positioning of luminaires.

C.S.I.

A discharge lamp which tends towards a tungsten source for colour balance. (4000K approximately).



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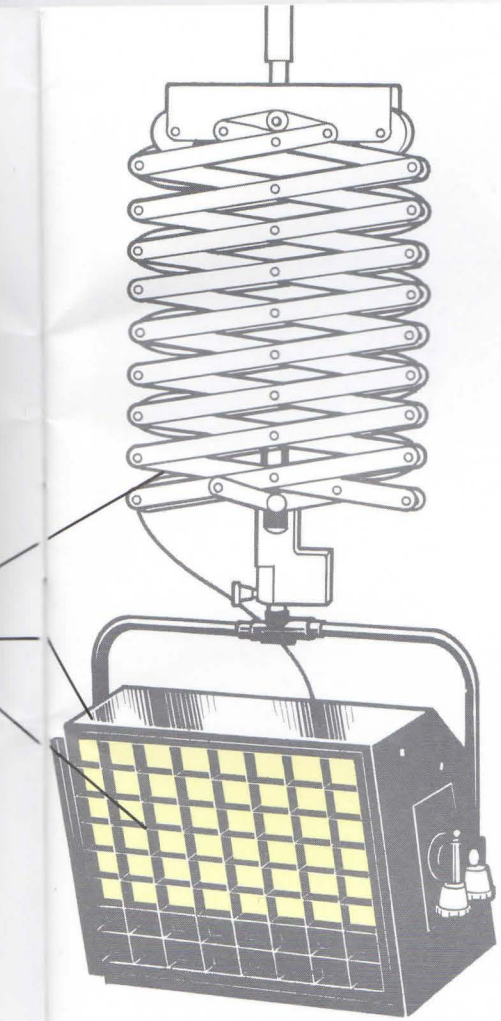


CYCLORAMA

A backing mounted in a studio to provide a continuous surface and an illusion of infinity.

DIFFUSER

Sheets of frosted plastic or spun glass fibre used to soften the shadows produced by the light beam.

DIMMER

An electronic device used to reduce current flow to a lamp and therefore allowing its light intensity to be adjusted.

DROP ARM

Used to hang a luminaire lower than the normal suspension system permits.

EGGCRATES

A device consisting of small cross baffle plates to restrict the spread of the light beam on a softlight.

EXTENSION BAR

Used to extend barrels for accurate positioning of luminaires.

FADER

A control potentiometer for indirectly setting the current output of a dimmer and thus varying the light intensity.

FILLER

Used to control shade areas; usually a soft light but can be controlled hard light.

FLAG

A sheet of metal or card mounted a short distance in front of the luminaire to give a sharp cut off to the light beam.

FLOODLIGHT

A luminaire that only has a reflector to control the beam and has a wide angle distribution. (Soft light and cyclorama light).

FOLLOW SPOT

A narrow angle focusing hard edge spotlight used to follow moving artists.

FRESNEL LENS

A convex lens built up in steps to reduce its thickness, thus reducing its size and weight.

GOBO

A mask placed in the gate of a profile spot to shape the beam. It is a simple form of outline projection.

HARD LIGHT

A luminaire that produces strong shadows, normally a spotlight.

H.M.I. (C.I.D.)

A discharge lamp which is daylight colour balanced (5600K).

KEY LIGHT

A principal modelling light, usually the fresnel spot.

LUX – (Lumens/m^2)

The unit of measurement of the incident light arriving at a surface. (Old system used foot candles; 1f.c. = 10.76 lux.)

MASTER/GROUP MASTER

Usually refers to a lighting control system fader which overrides a group of individual faders.

PANTOGRAPH

A spring-balanced cross-armed device for varying the height of luminaires.

PICK-UP-TUBE

The name sometimes used for camera tube (generally denotes photo-sensitive device).

PRESET (BLIND MODE)

A facility on lighting control systems that enables a lighting plot to be set up without affecting the lights already operative.

PROFILE SPOT

A luminaire used to project shapes or patterns.

SATURATED RIG

A lighting installation where luminaires are used in large numbers to avoid the need for physical movement thus reducing rigging time and manpower.

SCRIM

A fine mesh used in front of a spotlight to attenuate the whole or part of the light beam.

SOFTLIGHT

A luminaire designed to produce virtually shadowless light; used to control contrast.

SPOTLIGHT

A luminaire with a focusing system to concentrate the light beam and give greater control.

STAND

A tripod device which allows varying fixed heights of luminaires above floor level.

TELESCOPE

A device made from retractable tubes that is used to suspend luminaires at varying heights in the studio.

TUNGSTEN HALOGEN

Describes a family of lamps with either hard glass or quartz envelopes, **tungsten** filaments and **halogen** (usually iodine or bromine) fillings.

VOLTAGE DROP

That loss of volts which occurs through energy wastage when a current passes through a cable or electronic device.

PART 2

GENERAL LIGHTING

2:1 THEORY

To help the reader it will be useful to examine some of the properties of light and how light behaves.

Lighting in its most basic form consists of sunlight and light from the sky. Most of our lives we see fairly well balanced lighting created by the sun and sky. An instance of unbalanced lighting are the pictures from the 'Apollo' moon shots where only the sun provides light and the pictures are of high contrast due to the absence of sky or 'fill' light.

Light always travels in straight lines, but it can be deviated by reflection, in mirrors, etc. and more importantly, it can be refracted when passing between air and glass. All lenses rely on refraction to focus rays of light, either in a camera or, more relevant to this booklet, in a luminaire.

Light is modified by reflection and, in general, the TV camera is responding to that reflected light. This modification by reflection is important because it gives the shape and texture as we view the scene. We are also very much concerned with the colour of the light sources. Sunlight and incandescent lamps behave in a similar way because they are black body radiators. What is a black body radiator? Imagine a piece of black metal being heated: first it glows deep red when it is radiating mainly in the red end of the spectrum, through white heat to an intense blue at the far end of the spectrum.

The balance of the colour temperature depends mainly on the relative amounts of red and blue, the colour temperature being expressed in Kelvin units, which are based on Celsius units, starting at Absolute Zero or –273 Celsius. Thus the medium red of an electric fire is around 2000K; in other words about 1737C.

Sunlight, which tends to red, is 4800K; a blue cloudless sky is about 10000K upwards. We normally see a mixture of both sun and sky; standard European daylight is around 5600K. The best way of understanding the range of light is to think of incandescent lights of 3200K as a pale pinkish white and daylight as a pale bluish white. We, of course, never see it that way because our brain takes care of the colour difference. The television camera can be lined up to accept incident light over a wide range, but if lined up for 3200K will reproduce daylight of 5600K as a slightly blue picture.

Some sources in use today, namely the discharge sources, such as fluorescent and mercury or sodium street lights, are not black body radiators and emit light in several narrow bands. Although strictly speaking these devices cannot have a colour temperature, they can have an equivalent which is called the correlated colour temperature. Much research has been done to improve the colour rendering properties of discharge sources and the HMI and CID lamps are good examples of modern lamp technology.

It is evident that we require light when working in the studio but on what parameters is the lighting based? There are several factors which dictate how lighting is applied.

i) There is a minimum quantity of light required that will enable the camera to work successfully. This is computed from the level of illumination required on the pick-up-tubes to give a good picture with allowances being made for the camera's optical system.

ii) The scene and action (day, night, sun, dull etc.)

iii) The angles and distances of the lights to the subject.

We must remember that the sun gives us almost constant illumination irrespective of where we are. Our distance to the sun (150,000,000km) is much greater than relative distances between objects or people. With our local light sources we have to take into account the inverse square law, which states that the light falls off at a rate determined by the reciprocal of the square of the distances, i.e., double the distance and we get one quarter of the light.

A picture can be obtained by illuminating all parts of the scene in a uniform manner, but the results are flat and uninteresting, e.g. a dull overcast day!

One reason for the disappointing result is that television is a two-dimensional system, unlike human vision which gives us three dimensional images. The human eye allows us to see shape, form and depth. For television, we have to create depth and this can only be achieved by lighting in conjunction with the subject matter. It is important to realise that it is not the light that creates the picture, but the shadows created by the light. An object uniformly lit would have no substance or shape. In the studio we can create the illusion of day or night, interior or exterior. One other aspect of lighting is to create atmosphere; having satisfied the technical requirement, we can use our lighting to stimulate emotion. Where a bright feeling is required, low contrast lighting together with fairly bright colours may sometimes be used. Where a sombre atmosphere is required high contrast lighting is employed, creating dark shadows and possibly only picking out the main points of interest. (Orson Welles' film – "Citizen Kane", is the supreme example of highly dramatic lighting).

From experience we can draw conclusions that the sun is a relatively small source (in area) of light and creates hard shadows; on the other hand the sky is a large area of illumination and creates very soft shadows, if any at all. Sunlight at dusk becomes diffused by dust in the atmosphere and this softens the effect a little. At dawn the atmosphere is free of dust and this results in hard light of high contrast. The mood created by light is affected by the colour of that light. Direct sunlight at mid-day is yellow and in the evening it becomes red (due to the scattering of blue light by dust in the air). The sky tends to let red light pass outwards and reflect blue light back to the earth. A subject lit by sunlight will appear warm, whereas if lit from the north sky, it will tend to take on a cold appearance.

As we will now find out in television our sun will be the spotlight and our sky will be a softlight.

2:2 PRACTICE

BASIC LIGHTING

The following descriptions apply to the lighting of people; however, it will be readily appreciated that all objects can be treated in a similar way and thus any picture is built up.

The Key (A)

Why do we call it the 'key' light? Because it is the principal light and tends to be the key to the whole picture; it establishes the mood and character of the picture, and generally is capable of producing acceptable results when used on its own – it does not however contribute a great deal to the depth of the picture. The key tends to be used at a vertical angle of 30° but can be within the range of 20° to 45°. The range of horizontal incidence that gives satisfactory results is within 45° either side of normal. When the horizontal and vertical angles of incidence are both approximately 30° then usually good results are obtained. Typical light levels are 1000–2000 lux.

Backlight (B&C)

The backlight is used to enhance separation and depth; the angle of backlight to the subject should preferably not exceed 45° in the vertical plane and can be varied more than the key. It is more difficult to get a good backlight angle in the television studio due to the fact that the subjects have to be positioned quite a long way into the studio and this is generally impractical.

The ratio of intensity of backlight to key light is generally 1:1 but strong backlight can sometimes be effective in creating mood and drama. Twin backlights are usually advantageous for subjects with long hair.

Fill light (D, E & F)

Fill light is often regarded as a base light upon which the modelling is built. Certainly the cameras have to have a definite level of light to work well, but it is found that modern cameras tolerate high contrast scenes extremely well, and base light does not have the importance that it did in the past. It is much better to light the scene and artists for effect as individual items built to a total, rather than flood the area with soft light and then add modelling keys.

Fill light also tends to be thought of as a soft source and, in general, is the most useful. This is not necessarily true for all situations. It is often found that a side hard light gives a very satisfactory result and spill light from keys is often carefully controlled to do just this.

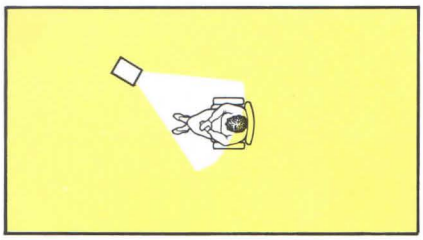
A point to be borne in mind is that soft light is not shadowless light and the position of the soft light is most important. It is used generally to reduce the contrast created by the key light. The soft light has a level of approximately 500 lux.

A soft light used from the front can be used to control contrast but not often used in television. A soft light at 45° to the subject, would give a double key effect. A soft light from the side, used with our 30°/30° keylight gives the best result as you will see from our final illustration. When all the lights have been built up (Plot G bottom right) the final result can be very pleasing.

PART 2

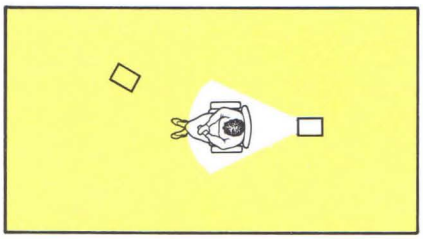
LIGHTING PLOT A:

The Key



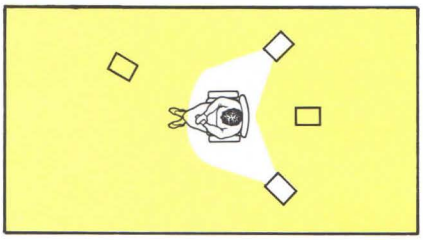
LIGHTING PLOT B:

Single backlight



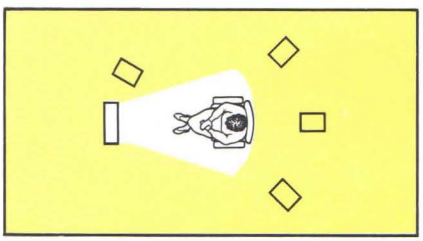
LIGHTING PLOT C:

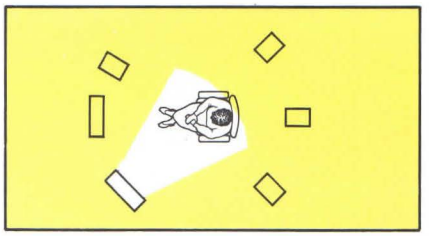
Twin backlight



LIGHTING PLOT D:

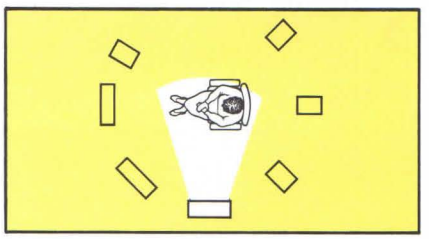
Fill light (soft light from front)





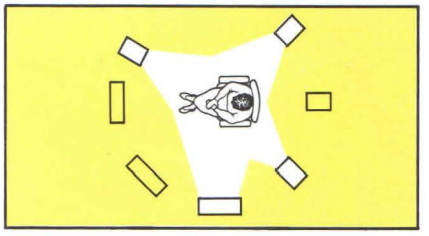
LIGHTING PLOT E:

Fill light (Soft light at 45° to subject)



LIGHTING PLOT F:

Fill light (soft light from side)



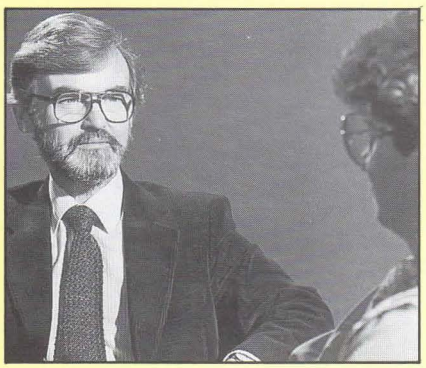
LIGHTING PLOT G:

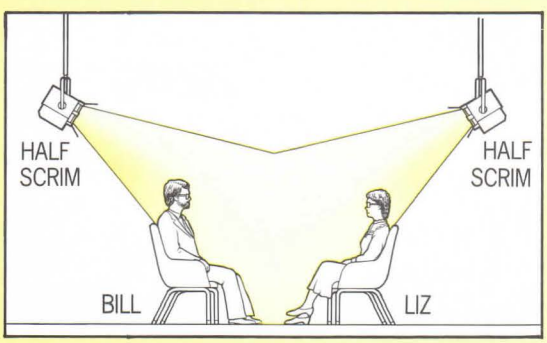
All lights built up

PART 2

Having lit one person, it is now possible, with a little modification, to light two people in a fairly typical TV situation – the two-way interview.

Cameras 2 and 3 give cross shots of the subjects and camera 1 gives the wide shot. As can be seen in Plot H, 'A' is Liz's key and acts as Bill's backlight. 'B' is Bill's key and Liz's backlight. The two softlights are used for filler and the background is generally illuminated.





STUDIO OPERATIONS

In colour studio operations the incident lighting levels tend to be between 1000 to 2000 lux. Generally a figure of 1500 lux incident is considered adequate for most purposes and dependent upon the lighting level, it is normal for cameras to work at about f2 to f4. The general height for luminaires is 3 to 4 metres from the studio floor level and plotted at 3.5 to 4.5 metres horizontal (around 4 to 5 metres actual distance).

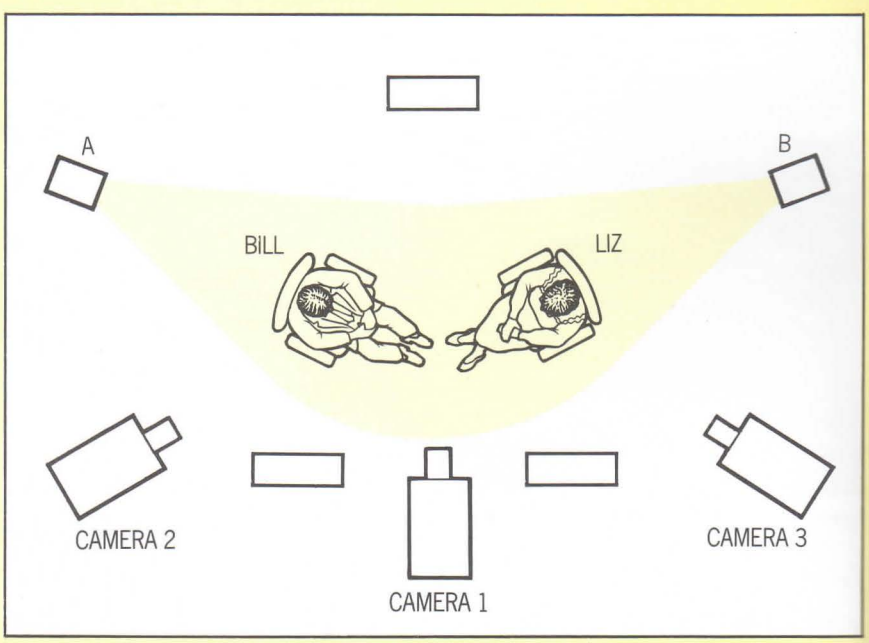
When single point suspension, i.e., monopoles or pantographs on track, are used, then each luminaire is independent for setting of its position. For flexibility when using barrels with two luminaires suspended they are rigged with their own pantographs so that differential heights can be easily achieved.

The luminaires are generally used in the flood mode which gives the coverage required. However, by varying the focus (spot/flood) the light output is changed and this can be a method of controlling the light beam without the dimmer and has the added advantage of not changing the colour temperature.

Dimmers used in television studios normally have a square law light output which means the square of the fader setting from 1–10 gives the percentage light output, i.e., level '6'=36%. The tungsten lamps used in television studios have a colour temperature of approximately 3200K at full voltage. It is normal when using the television lighting dimmer system to align the channel controllers to position '7' which means the dimmer supplies current to operate the lamp at 49% output, with a colour temperature of approximately 2950K. The reasons for this are that in normal operating conditions a tolerance of plus or minus one stop about the mean gives satisfactory control of light level, i.e., level '5' = 25%, level 10 = 100%. It has also been found that the +/– 200K colour temperature variation is acceptable in the majority of cases. It must be pointed out, however, that this variation when applied to the human face may be less; much depends on the texture and colour of the skin. This means, in practical lighting terms that the lighting can be varied, from its maximum to as low as 2750K (approximately 25% light output), without noticeable colour picture change; thus enabling a wide range of control to allow balancing between the light sources giving optimum results to the transmitted picture.

In the example shown, it is clearly impossible to balance for Liz's backlight without reducing Bill's key. To reduce the light falling on Liz it is usual to use a scrim, which is fitted in front of the lower half of the lens. This has the effect of attenuating the lower portion of the light beam. The effect within a luminaire's light beam with respect to fall-off can be likened to the depth of field of a lens. As we go further away from the source so the relative intensity levels over set distances become less variable. When close to the luminaire the changes of intensity are rapid and dramatic. A luminaire produces 2000 lux at 4m distance; to go from 4m to 3m changes the light level from 2000 lux to 3550 lux, a difference of **1550 lux for 1m distance change.** When we go to 5m we get a light level of 1280 lux which is a difference of **720 lux for a 1m distance change.**

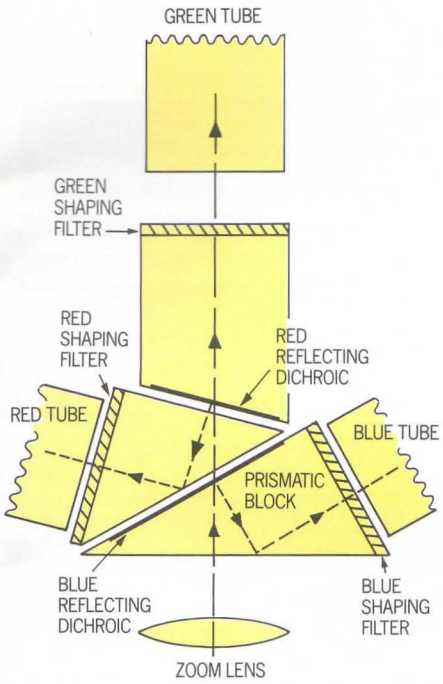
It can therefore be seen that it is much better to use slightly more powerful wattage luminaires over a reasonable distance to achieve a certain light level than to use lower powered luminaires closer to the subject. Although this latter technique can produce high light levels the rate of change of light is exaggerated by the movements of the subjects.



BILL'S KEY IS LIZ'S BACKLIGHT: LIZ'S KEY IS BILL'S BACKLIGHT

LIGHTING PLOT H

END OF PART 2



2:3 THE TELEVISION CAMERA

The camera has to analyse the reflected light from a scene which is a mixture of RED, GREEN and BLUE, the primary colours, in some combination:

MAGENTA (Purple)	RED+BLUE
YELLOW	RED+GREEN
CYAN (Turquoise)	BLUE+GREEN

The above combinations are the more straightforward ones and obviously others are more complex. However, all coloured surfaces can be broken down into the three component parts. Colour distortion can take place when the scene is illuminated with a source of light either deficient in some colour or with an excess e.g., fluorescents have a high green spectral component.

At present no commercially available professional quality camera tube is capable of producing the three separate signals required for colour television. It is thus a fundamental requirement that three separate tubes be employed. The use of three colour tubes and the consequent splitting of light that must occur makes the colour camera optically more complex.

Basic requirements of the colour separation system:

i) Light falling on the three tubes must have a common entrance pupil, i.e., each tube face must 'see' exactly the same scene in order to avoid parallax problems.

ii) Division of light must be effected with minimum loss, thus avoiding either excessive lighting levels in the studio or 'noisy' pictures produced by low light levels on the camera tubes photo-sensitive surfaces.

The camera pick up tube has a sensitivity which requires a certain amount of light just as the film in our still camera requires an amount to satisfy its ASA (ISO) rating. Below this level, noise (under-exposure in film) will become apparent. Above this level, over-exposure will occur. In both cases we control the amount of light entering and hence the exposure, with an iris.

These requirements led to the development of special optical systems for colour cameras. The most obvious one being the use of zoom lenses to ensure a single path from the viewed scene to the camera electronics.

In television the aperture of the iris in the studio has been generally determined by the depth of field commensurate with production requirements. Camera iris settings in the range of f2 to f4 with today's cameras, require an incident scene light level of 1000 to 2000 lux so that the camera's basic sensitivity is satisfied and good quality, relatively noise free pictures are produced.

2:4 OUTSIDE BROADCAST LIGHTING

Lighting for outside broadcasts falls into two categories:

i) large scale floodlighting of sports events, church interiors, etc., generally achieved by discharge luminaires;

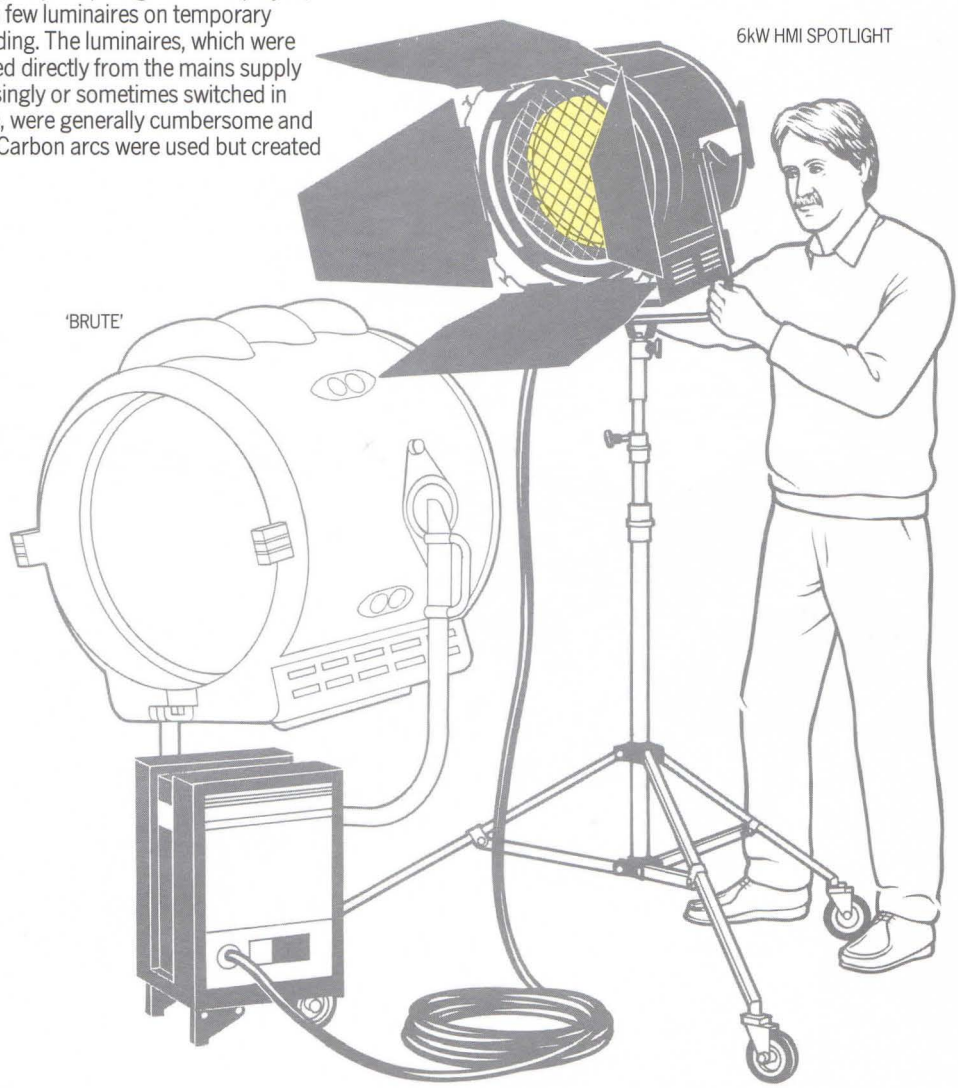
ii) light entertainment and music programmes where the lighting is required to be the same as the studio.

In the early days of outside broadcast lighting, very simple rigs were employed, using a few luminaires on temporary scaffolding. The luminaires, which were powered directly from the mains supply either singly or sometimes switched in groups, were generally cumbersome and heavy. Carbon arcs were used but created rigging problems and so manufacturers were encouraged to look for alternatives. The breakthrough came with CSI and HMI discharge lamps which enabled smaller luminaires to be used with high light outputs. Although useful in many situations, such as (i), the fact that these sources cannot be dimmed successfully sometimes limits their use.

Outside broadcasts have become extremely complex and lighting directors now expect light sources of all types, capable of being dimmed, together with sophisticated lighting consoles to cater for outside broadcasts as in (ii).

In recent years, due to the complexity of lighting rigs and to improve safety a British Standard (BS 5550) on location lighting was introduced which covers both the film and television industries.

Today our lights are as small as possible, supplied from sophisticated dimmers and distribution systems, complete with all known safety features. The consoles are generally portable derivatives of studio types, capable of dealing with all lighting situations up to and including large scale productions such as the Eurovision Song Contest, etc.



3:1 GENERAL

As stated in 2:1 the spotlight is our 'sun' and the softlight the 'sky'.

WHAT IS A SPOTLIGHT?

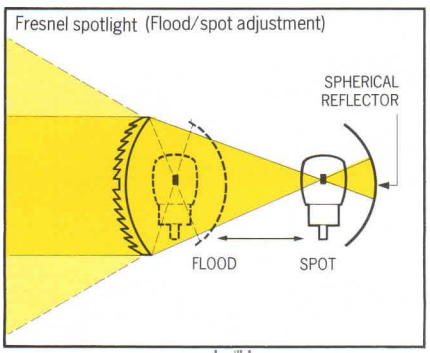
It is a light source where the light beam is shaped; controlled by a curved reflector and/or a lens and may be divided into three groups:

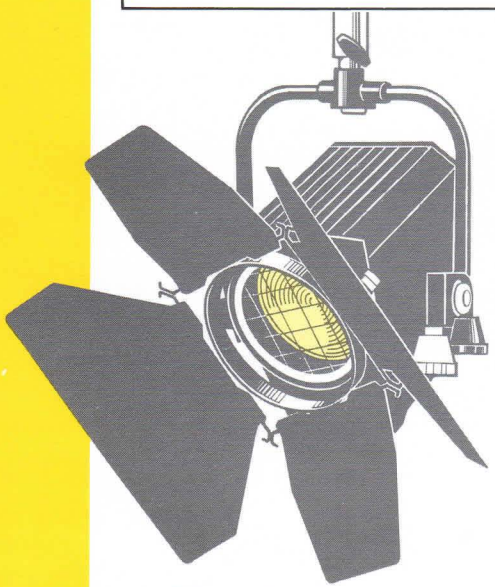
Fresnel spotlight

This produces a fairly hard edged beam whose width is controlled by the spot/flood mechanism which operates by moving the lamp/reflector combination with respect to the lens. The Fresnel lens is a convex lens which has been segmented and flattened to reduce weight and help with heat dispersion; it generally has a dimpled rear surface to break up lamp filament images.

Open spotlight

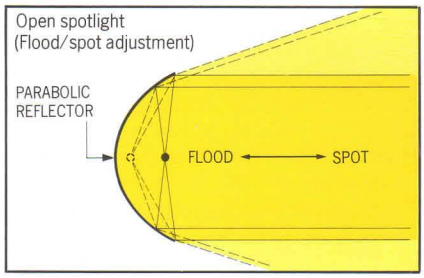
In the open spotlight spot/flood is achieved by moving either the lamp or the reflector in relation to the other. The edge of the light beam is not so well controlled or defined but the luminaire has a higher light output relative to the Fresnel lens type.

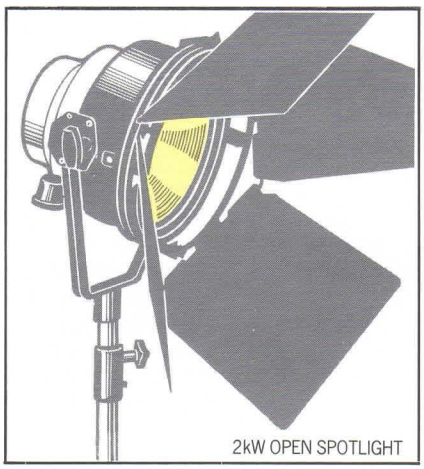




1kW FRESNEL SPOTLIGHT

In both types of spotlight barndoors will be used to block the path of the light and thus confine the light beam to those areas we require to light for effect. Barndoors give a soft shadow, the character of which varies between spot and flood particularly with open spotlights.

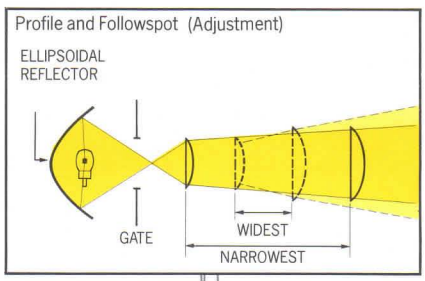


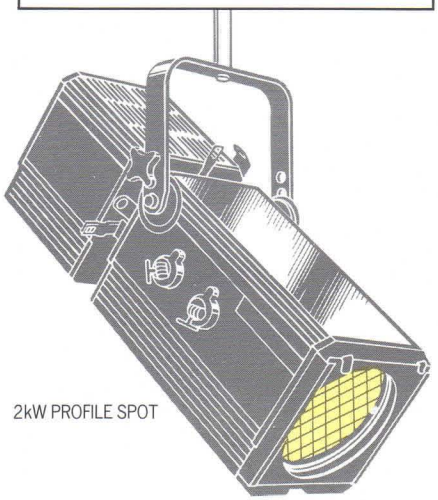


2kW OPEN SPOTLIGHT

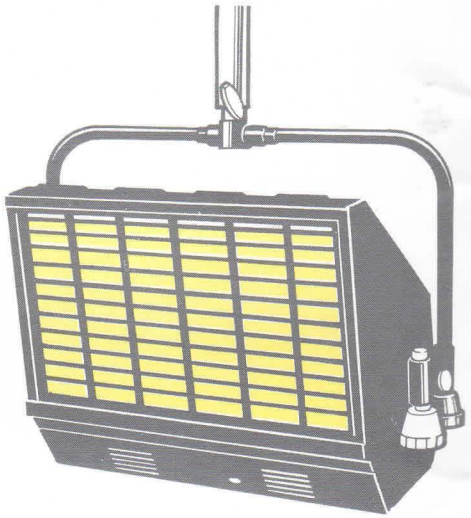
Profile and Followspots

These have optics capable of producing hard edged beams and generally work by adjusting their lenses.





2kW PROFILE SPOT



5kW SOFTLIGHT

SOFTLIGHTS

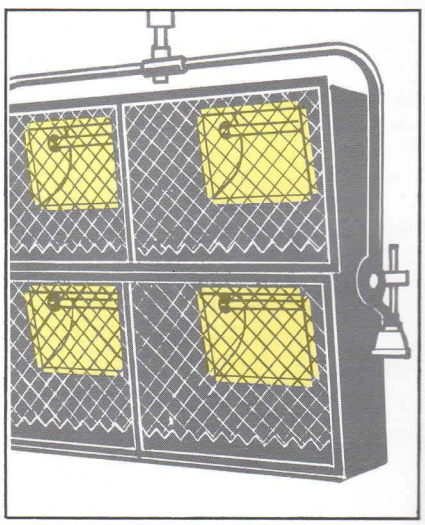
Although in theory softlights should be as large as possible, there are obvious practical constraints; there are two forms of softlights:

Softlight for filler

This is made as large in area as practicable and relies upon a simple indirect reflective system to scatter light in a fairly random manner.

Floodlights for Cyclorama lighting

Although in general cyc lights are considered a floodlight, very good results are obtained when the optical system is refined. This enables luminaires such as the 'IRIS' unit to be used close to the cyc cloth yet illuminate very evenly. It is also important that their overlap characteristics are well controlled, particularly so with a groundrow unit.



4-COMPARTMENT CYCLORAMA TOP LIGHT

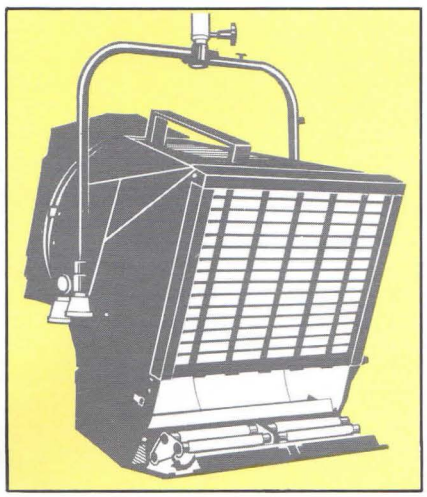
PART 3

3:2 SPECIALISED LUMINAIRES

DUAL PURPOSE

Recent years have seen the development of the dual purpose luminaire; this device is a combination of a hard and soft source in one unit and is available in dual wattage versions as well. By its very nature the dual purpose luminaire offers far greater flexibility than conventional luminaires and saves time during rigging and studio operations. However, for the best results these luminaires should be used with a saturated grid. (This is where at least one luminaire is rigged per suspension point over the whole studio).

It has been suggested that the need to keep the physical size and weight of these luminaires to a minimum to enable easy handling and rigging, means that the soft light is a compromise; this is not always the case as some manufacturers design these units using lightweight metals, pressed to give great strength and giving a similar light output to a conventional softlight. Because of its dual function the luminaire is more complex than the conventional hard and soft sources in general use, and together with the increase in weight may pose limitations in handling and design of the studio suspension system. In use with properly designed saturated grids the advantages can outweigh the disadvantages.



2.5/5kW DUAL-PURPOSE LUMINAIRE WITH LAMP TRAY OPEN

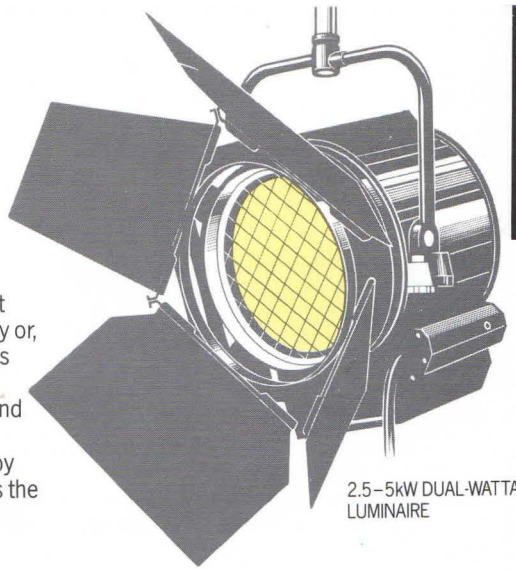
DUAL WATTAGE

Dual filament lamps are produced so that either filament can be used independently or, by addition, different power combinations are achieved, i.e. 1.25kW and 2.5kW filaments when combined give 3.75kW and spread of light is 3:1.

There can be advantages in rigging by using dual wattage luminaires as it allows the same luminaire to be used as a standard throughout the studio rig. Also where marginal lighting levels are reached the lighting director can easily make the necessary changes. One drawback of dual wattage luminaires is that their physical size is dictated by the ventilation requirements of the highest wattage used.

The chart shows the usable range of light output for the various wattage combinations in use at the present time. It is assumed that the dimmer has been set to '7' so that plus or minus one stop is available.

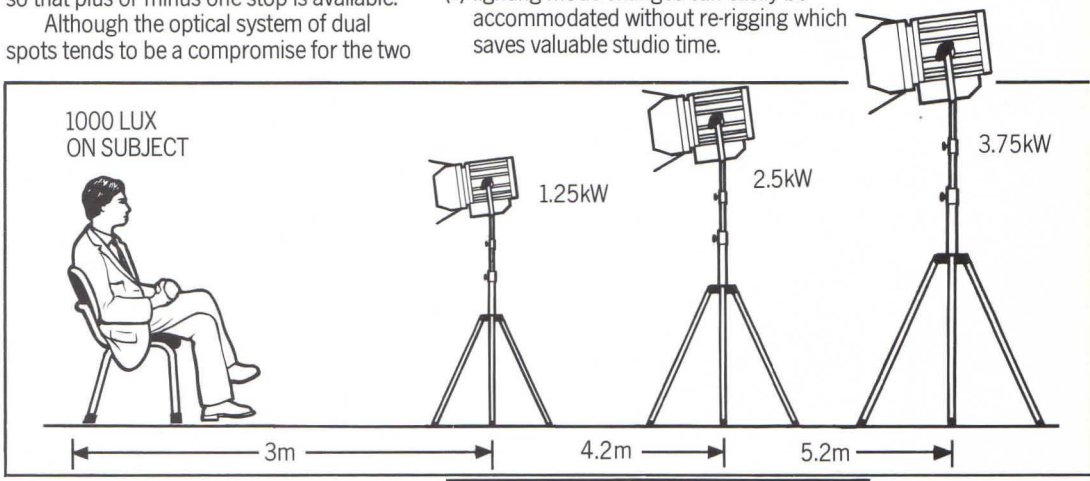
Although the optical system of dual spots tends to be a compromise for the two filaments, in practice this has not proved to be noticeable. Softlights can sometimes have differing characteristics dependent upon switch modes but most modern luminaires have overcome this problem.

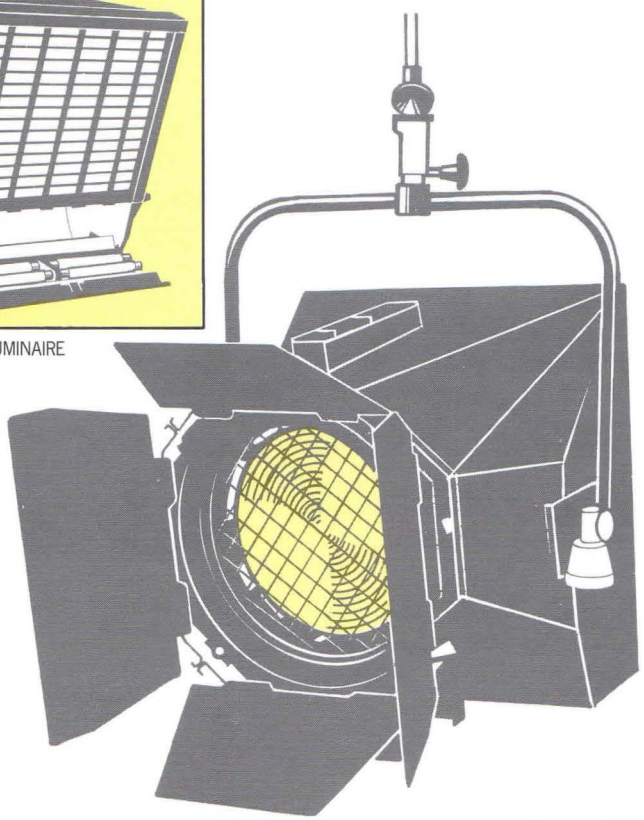


2.5–5kW DUAL-WATTAGE LUMINAIRE

Two points in favour of the dual wattage are

(i) with one luminaire in use maintenance spares are kept to a minimum.
(ii) lighting mode changes can easily be accommodated without re-rigging which saves valuable studio time.





3:3 CONSTRUCTION AND HANDLING

With modern lighting the number of luminaires in use imposes a considerable load upon the supporting structure. It is therefore essential to keep the weight to a minimum, and this is also desirable when handling luminaires. It can be shown that maintenance and damage increases with the weight of the luminaire, imposing a strain on the operating staff. Ideally, luminaires should be within the handling capability of one or two men. A 5kW spot weighing 17kg can be handled by one man, but when this weight is exceeded, two men are required.

Luminaires have been substantially reduced in weight in recent years without affecting durability or performance. With the increased requirement for lighter luminaires have come associated problems, other than the robustness of the luminaire, as their compact size demands an efficient ventilation system to ensure adequate convection cooling of the lamp.

To aid rigging and handling of luminaires, pole operation is usually employed in the studios. Functions such as pan, tilt, spot/flood and barndoor adjustments can be made from the studio floor with a specially made operating pole to avoid using step ladders to manually make these adjustments.

PART 3

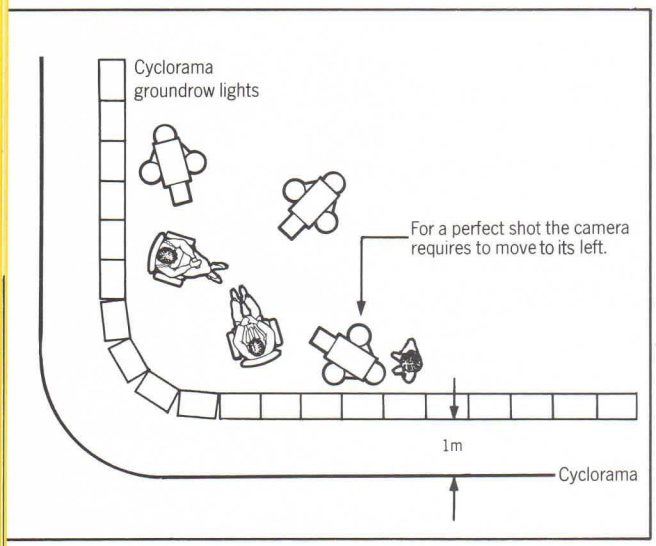
3:4 CYCLORAMA LIGHTS

Why are cycloramas so important? They offer, after the initial cost, an inexpensive and reliable method of providing a multiplicity of backings which would be costly and more inhibiting with conventional 'flats'.

Four compartment groundrow units are usually placed 1m from the cyc spaced at 1.22m centres and four compartment top units are placed 3m from the cyc spaced at 2.5m centres. Generally the floor units will use 625W lamps and top units 1250W lamps.

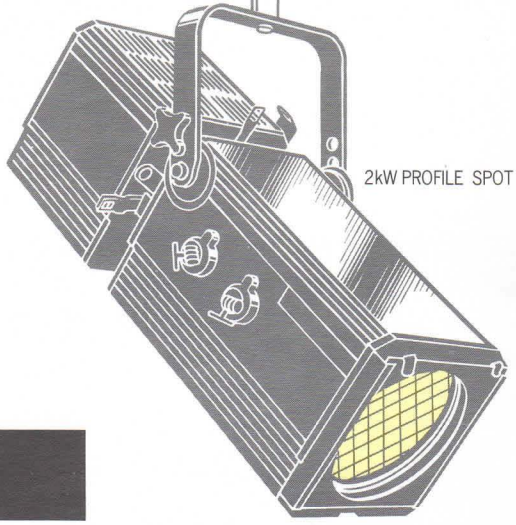
To light from the cyc bottom in four colours approximately 2000W per metre is required. A small studio, e.g., 100m^2, with cyc on three sides, i.e., 25m of cyc, would require 50kW; if only two colours are used, then the figure of approximately 25kW is still quite substantial. Top cyc lighting at the quoted distance will also require 2000W per metre for four colours.

In the case of studios up to 200m^2 bottom cyc lighting poses a problem with regard to floor space. To have a studio with cycs on three sides with units placed 1m away from the cloth in a 100m^2 studio means 35% of floor area is lost. This loss can give problems with camera shots (see illustration below)



and it should be borne in mind when planning small studios. Having made this point, it must always be remembered that the lighting director needs the artists at least 1m away from the cyc, so that backlights can be used effectively. For these reasons top cyc lighting is preferred in studios up to 200m^2.

Multicolour cyc lighting on a grand scale is more often used with large open space sets such as light entertainment and music productions. In this type of production the cyc top lighting often predominates. With other types of production, such as drama, the requirement for cyc lighting is very much reduced and the need is usually to light backings to windows and the studio exteriors. Owing to the increased complexity of lighting of artists and sets in drama type productions groundrow cyc lighting is used, thus saving valuable grid space.



2kW PROFILE SPOT

3:5 PROFILE AND FOLLOW SPOTS

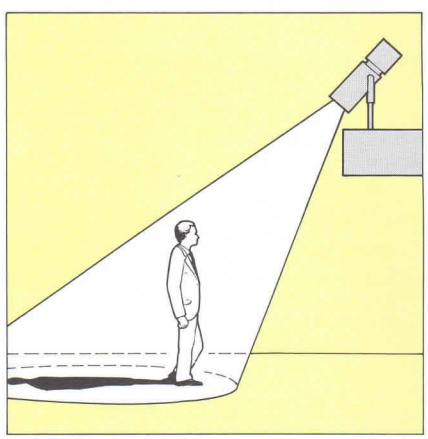
The Fresnel spot, although a focusing source, produces a beam with a soft edge. Whether by accident or design, this feature is essential to good overall lighting, allowing one source to merge with another, without apparent changes. There is also a requirement for luminaires with a hard edged beam for effects purposes.

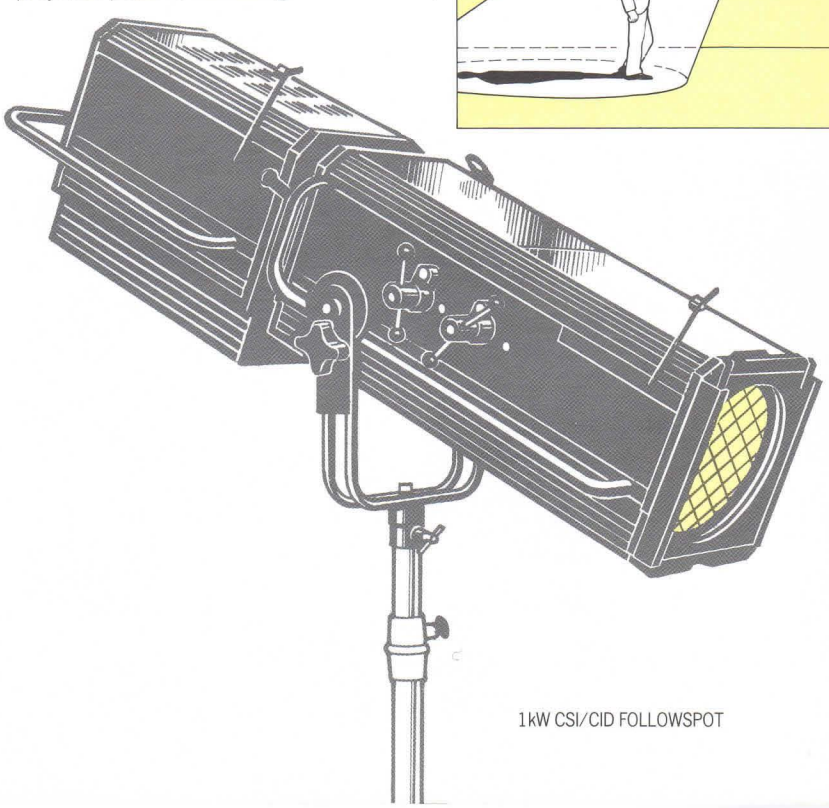
In the studio, there are occasions when certain effects have to be simulated e.g., sunlit window pattern projected on a wall; either a full sized window is used with a Fresnel spot, or the profile spot can be employed. The profile spot can be likened to the normal photographic projector with a similar optical system for the projected hard edged images. In the case of the window quoted in the example, a simple cut out shape of the window is made, usually from metal foil, placed in the gate (which is too hot for plastic materials) and projected by the correct angle optics to the surface where the effect is required. Thus a very good effect can be obtained without the need to occupy valuable studio space. One point to be borne in mind is that the projector has to have good wide angle optics at close range rather than narrow angle optics at a longer distance. If not, any movement however slight, will be magnified. This highlights one of the drawbacks of profile spots. They must be stationary to be effective – it is most disturbing to see projected patterns wandering.

The window cutout mentioned is a dramatic use of the profile spot. It should, however be obvious to the reader, that any shape can be used and projected to give visual interest to the television picture. Although focused shapes have been discussed, very good effects can be achieved by partial defocusing of the image.

The follow spot can be regarded as the 'elder brother' of the profile spot, but in this case a pattern is not projected. The follow spot has very narrow angle optics which allow it to be used over long distances as the following key light on the main artist.

Both the profile and follow spots are usually supplied with integral framing shutters to give straight edges to the beam and an iris to vary the circular size of the beam. They will also accept colour frames on the front of the optics to allow the use of colouring material or in some cases colour correction filters.





1kW CSI/CID FOLLOWSPOT

END OF PART 3

3:6 DISCHARGE LUMINAIRES

Discharge luminaires have been around for many years and in fact were used in the film industry forty years ago. A big step forward took place when Thorn introduced the CSI lamp with a correlated colour temperature around 4000K. It was used mainly for outside broadcast lighting, but its colour was a drawback when used in mixed light situations because it had to be filtered to match daylight. The HMI lamp, when introduced, overcame these problems with a correlated colour temperature of 5600K and very good colour rendering properties.

Discharge sources offer light output four times greater per watt than their tungsten equivalent. Used mainly for location lighting for outside broadcasts and film, in the form of lightweight portable luminaires of high light output, they consume less power, reducing the size of generator required.

Due to the arc which produces the light in these lamps, care has to be taken with the associated control gear so that flicker effects do not occur due to the synchronisation of lamp and camera to the mains waveform, i.e. 50Hz beat pattern.

Three methods are generally used to avoid problems:

(i) Ensure that the light source and the camera are running in synchronization.
(ii) Supply the lamp from an electronic square wave generator so that the light output is more constant.
(iii) Supply the lamp from a high frequency supply so that the beat frequencies are avoided.

Tungsten halogen lamps have very convenient shapes for their purposes. The projector lamp offers a small source of light to the optical system of a spotlight and the linear lamp is a very good source for a softlight.

The discharge lamp, although a very good compact source for the spotlight, requires careful luminaire design to produce the soft shadow effect associated with conventional tungsten softlights.

3:7 LAMPS

Two main types of lamps are used – tungsten halogen and discharge, both of which can be sub-divided into various categories, depending on use. The tungsten lamp produces light when its filament is heated. It radiates much more heat than light, however it does have a continuous spectrum with little ultra-violet radiation, but lots of infra-red. The discharge lamp, although giving a higher light output is a discontinuous source and great expertise is required in the filling of these lamps so that their light output gives good colour rendition. Energy is released in high proportions in the ultra-violet portion of the spectrum. The luminaire manufacturers take special precautions in design to prevent operators and artists being exposed to this hazard.

TUNGSTEN HALOGEN

All tungsten filament lamps of this type are filled with a halogen, usually bromine, which maintains the light output and colour within fine limits, throughout the lamp's life. Lamps are constructed with hard glass or a more robust quartz envelope. Quartz envelopes, being thicker, allow a higher internal working pressure within the lamp which gives it twice the life of its hard glass equivalent. To balance the economics, quartz lamps are also more expensive.

Most TV studio tungsten lamps are operated at about half light output which increases the lamp life by a factor of about ten. Running the lamp at lower volts does not appear to adversely affect the halogen cycle and hence the performance.

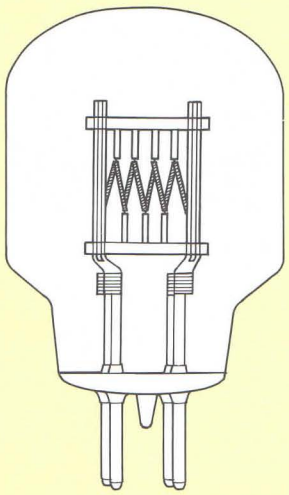
Types of lamps in popular use are shown below.

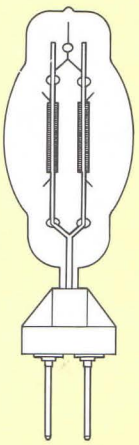
DISCHARGE

Discharge lamps have a quartz envelope and no filament and rely on an arc struck between two electrodes to excite the filling gas. The voltage has to be sufficiently high so that current flow will commence between the electrodes. This current has to be controlled, usually by a choke or ballast.

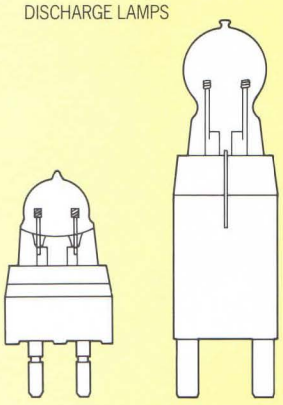
Generally these lamps must be allowed to cool down before they can be re-struck. Most modern discharge lamps in use for film and television are the 'hot re-strike' type. They can be re-struck at any time by the application of a high voltage to the electrodes i.e. about 40kV.

TWIN-FILAMENT LAMPS (TUNGSTEN HALOGEN)



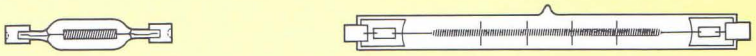


DISCHARGE LAMPS

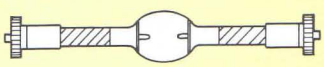


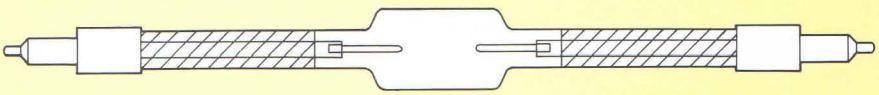
CSI CID

LINEAR LAMPS (TUNGSTEN HALOGEN)



HMI DISCHARGE LAMPS





4:1 POWER

GENERAL

For all studios an allowance of 650W per square metre must be made to give the electrical power intake requirements for the **basic** studio lighting.

As studios increase in size, usually above 200m² area, additional power allowance must be made for cyc and effects lighting. For example, a studio of 250²m requires a 210kW power intake comprising 162kW normal lighting (650W/m²) together with an allowance of 50kW to light a 50m cyc in two colours. This total power requirement gives a new estimating figure of 850W/m² which should be used in all large studios. Typical figures are given with the studio illustrations.

It cannot be over emphasised that with TV studio operations much thought should be given to the use of the entire lighting installation. This has extremely important implications on the ventilation system which is usually based upon a two-thirds utilisation figure.

To operate a tungsten lamp at a lower colour temperature, the voltage is reduced. In the case of a 240V lamp going from 3200K to 3000K this means a reduction of approximately 40 volts – the current also reduces but not by such a margin. It can be seen that operating the lamp in this way will reduce the total power used. In the case of lamps being operated with the dimmer output at '7' this reduction means a saving of approximately one quarter of total power.

As a guide it is normal to allow one 5kW dimmer per 1.5m² of floor area. Although this figure seems high in relation to the estimating figures given previously it has been calculated assuming a total coverage of the studio allowing for barrels, cyc circuits, floor circuits, etc. If a compromise is made and extension cables are employed from fewer power outlets then this figure can be reduced but operationally is not as flexible.

POWER OUTLETS

The cables from the dimmers to the power outlets must be designed to minimise volt drop – this also ensures fuses and circuit breakers will operate within their specified characteristics.

In the studio the power outlet sockets have to be distributed in an organised manner to suit the type of suspension system employed. The majority of outlets will be at high level, either on barrels or in the working grid and will also be distributed around the gantry and at floor level.

If a permanent cyc system is installed then a special feeder cable system will be used; the outlets probably always being connected to the same channels on the lighting console. With modern lighting control systems dedicated cyclorama lighting circuits are usually installed.

There will be a mixture of power outlets according to the requirement of the studio. Large and medium studios will have a mixture of 10kW and 5kW outlets. Small studios, i.e., below 150m² will usually have 5kW. The 10kW outlets, which are limited in number, will be distributed in the main in the grid, or at gantry level, the outlets being positioned near the points of maximum demand. Extension cables are then employed to feed the 10kW luminaire.

Barrel system

Barrels will usually be fitted with sufficient sockets for the type of studio operation, and also dependent upon the length of barrels installed, i.e., a 2m barrel can accommodate two 5kW spots; therefore at least two sockets should be provided. It is useful to provide one parallelled twin socket so that two lower wattage luminaires can be easily fed from one dimmer channel. This is particularly useful with 1kW profile spotlights and set dressing luminaires, such as the 1kW Fresnel spot.

Pantograph system

If a pantograph point suspension system is used then one power socket should be provided at the bottom of each pantograph. The main power cable is terminated to this socket or to the top of the pantograph with an independent feeder cable down the pantograph.

Telescope system

Here the distribution is usually contained above the working grid with long feeder cables used from each luminaire. Again the installation of parallelled outlet sockets in the working grid is useful for twin luminaires working on one dimmer channel output.

4:2 DIMMERS

All modern lighting control systems utilise solid state dimming devices. When these switch on to conduct they do so by allowing a burst of current to pass. This current is switched very rapidly in millionths of a second and in so doing creates interference in the form of electro magnetic induction, just as the refrigerator makes the radio 'click'. In broadcasting centres these problems obviously must be minimised and manufacturers usually incorporate a choke to slow the rise time of the harmful waveforms and thus prevent problems.

Other ways of reducing interference are:

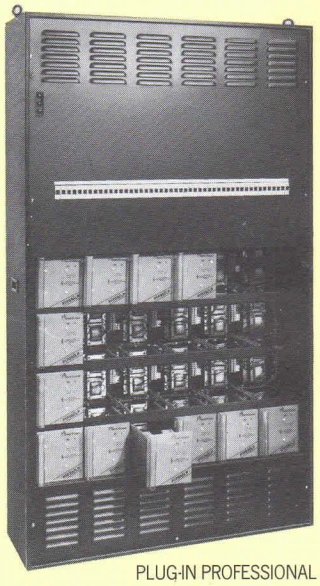
i) Keeping the power feeder cables and the audio cables separated.

ii) Use of special audio distribution cables.

If all the above steps are taken then the interference is negligible and no trouble is experienced.

Usually a few volts are dropped across the dimmer when it is conducting. If the power distribution cables in the studio are not generous in current rating then additional volt drop can occur. The total of these two drops is of the order of 10V so it can be seen that a boosted input voltage to the dimmers can be advantageous.

In the earlier days of colour TV it was felt that mains variation would cause problems with regard to light output and hence the colour temperature of light sources. To get over the problem Automatic Voltage



PLUG-IN PROFESSIONAL DIMMER

Regulators (AVRs) were used on the lighting supply. These were cumbersome and slow in action and could cause more problems than they cured. Modern dimmers are generally supplied with a closed loop characteristic for mains supply variations and are very fast acting so that as far as the operators are aware little or no variations occur with regard to light output at the normal operating points of the dimmers.

Dimmers are supplied as 'plug-in' or 'wired-in'. Plug in dimmers, as their name suggests are complete dimmers of varying power sizes that plug in to the main power dimmer rack. In the event of failure or replacement it is very easy to change the dimmer. Wired-in dimmers are designed so that the most critical parts are capable of being replaced easily but the main power components i.e., thyristor and choke, are wired in, thus the control cards are provided as plug-in units.

Dimmers for major television studios are usually produced in 5kW and 10kW versions; lower wattage versions are available but proportionately do not offer much saving in cost. Savings can be made when using dimmer racks with high packing densities. Generally, dimmer racks are designed to house from twelve to forty dimmers; hence they require high current inputs. This creates the need for associated switchgear together with substantial feeder cables which are usually armoured. The fuses and circuit breakers which feed the dimmer racks have to be carefully designed to offer a high degree of electrical protection and safety.

TEMPUS DIMMER PACKS

END OF PART 4

4:3 LIGHTING CONSOLES

GENERAL

In the past, lighting control utilised large, hand operated resistance dimmers capable of being mechanically coupled together so that 'on cue' the electrician could change a few channels at a time. This system was reasonable when time was allowed for changes to the lighting and the amount of changes were small. In television, earlier lighting control systems used auto transformer dimmers in banks driven by an electro-mechanical system with low voltage control from a master console with the ability to memorise the ON/Off state of each channel.

One of the biggest steps forward was the introduction of solid state dimmers which allow voltage control of the dimmer direct from a console rather than control through the electro-mechanical system. This results in savings regarding heat dissipation and space.

A lighting console must provide for various basic functions and these are:

i) The ability to switch a channel ON/OFF at any level.
ii) To be able to set a channel anywhere from 'ZERO' to 'FULL' light output.
iii) To mix channels which are grouped together.
iv) The ability to override channels by 'Master or Group Faders' and by 'Master Switches'.
v) The facility for collecting selected channel information either singly or in groups and storing in 'Memories'.

MANUAL SYSTEMS

In a manual system each channel is directly fed from a fader, thus a simple 60 way system uses 60 faders. If the system is two 'Preset' this means that two faders are provided per channel with the ability, using two Preset Master Faders, to fade between either one of their preselected states; the highest of the selected states taking precedence when the two Masters are fully on. For example, Channel X is set at '7' on the Red Preset and '5' on the Green Preset. With the Red Master up and the Green down channel X is set to '7'; when the Red Master is down and the Green Master is up then the channel is set at '5'. When the Red Master is at FULL raising the Green Master to FULL will not change the state of channel as the Red channel is the highest – the output will be '7'. This gives simple twin state (or preset) mixing. The state of each channel can be easily set on the lighting console and an overriding Master facility is available.

In the less sophisticated television studio this type of console is quite sufficient as the variations in the lighting are minimal and can be handled quite readily.

Manual systems require a lot of space to accommodate the faders and have the drawback that various channel states cannot be set without resetting the fader lever.

MEMORY SYSTEMS

The most significant advance in recent years has been the development of control systems which enable the level of any channel to be memorised. The modern lighting console uses one or two channel controllers, each of these having the ability to control any channel. Having selected a channel on the controller, the level is set and stored away. The channel controller is now free to set the state of the next selected channel. The console also has the ability to manipulate and store many groups of channel information. A modern console probably has at least 100 memories, thus all channels can be stored in each of these memories at the selected level required.

The ability of the console to memorise the lighting of each scene within the studio means that the lighting director can select the lights required for the scene, balance for optimum effect and then store the information until required again. If the same lights from the preceding scene are used he can now set completely independent levels from those already memorised without the need to consider the old information. The control system does it for him.

TEMPUS M24

GEMINI

As must be realised by now, these consoles are, in a sense, miniature computers. It is essential that they provide rapid access and respond positively to operational commands at the same time being 'user friendly'. Although physical controls have been reduced, the total control is very flexible and many operations can easily be performed. At a touch of a button or two, mixes, fades, crossfades, add-in fades, take out fades and switch cues are readily accomplished. The only possible limitation now is in the skill of the operator utilising the system to its full potential.

Consoles are now available from about twenty-four up to hundreds of channels. They come complete with sophisticated back-up and special effects systems so that all the lighting effects for pop music shows can be pre-set and replayed at the touch of a button.

As the physical size of these consoles has been reduced so they have been adapted for use on outside broadcasts.

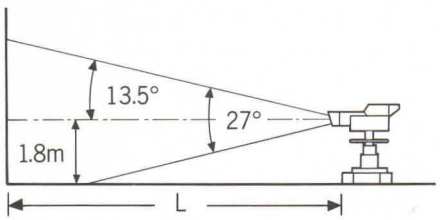
The costs of sophisticated modern consoles are very reasonable and in real terms actual costs have reduced over the years.

GALAXY 2 STUDIO

5:1 DESIGN CONSIDERATIONS

It is extremely important to get the operating heights within the studio correct and therefore the following suggested system gives very good results. It is never satisfactory to try to fit equipment into a 'box' as an afterthought.

CYCLORAMA HEIGHTS



Camera viewing aspect ratio = 4:3

Assume 36° lens used this gives vertical angle of shot = 27°

Assume lens height of 1.8m

Cyclorama height = (L x tan 13.5°) + 1.8m

Cyclorama heights (m) for studios with maximum dimension (m) of:

Studio	Cyc. ht.	Studio	Cyc. ht.
6	3.2	20	6.6
8	3.7	22	7.1
10	4.2	24	7.6
12	4.7	26	8.0
14	5.2	28	8.5
16	5.6	30	9.0
18	6.1	32	9.5

STUDIO HEIGHTS

Studios are usually constructed with floor dimensions in the ratios varying from 5:4 to 3:2. Generally the proportions approximate to Length 5.5: Width 4: Height 3.

For example:

Studio dimensions = 30m x 24m

Cyclorama height for 30m = 9m

Height allowance for luminaires and pantographs for suspension system = 2m

Therefore grid height = 11m

Allowance above grid for maintenance = 2.5m

Allowance for air conditioning and services above grid maintenance area = 2.5m

Total studio height = 11 + 2.5 + 2.5 = 16m

The example quoted is for a conventional studio with a barrel grid. The figures still hold for monopole grids but if no access is required above the grid then the total height could be reduced.

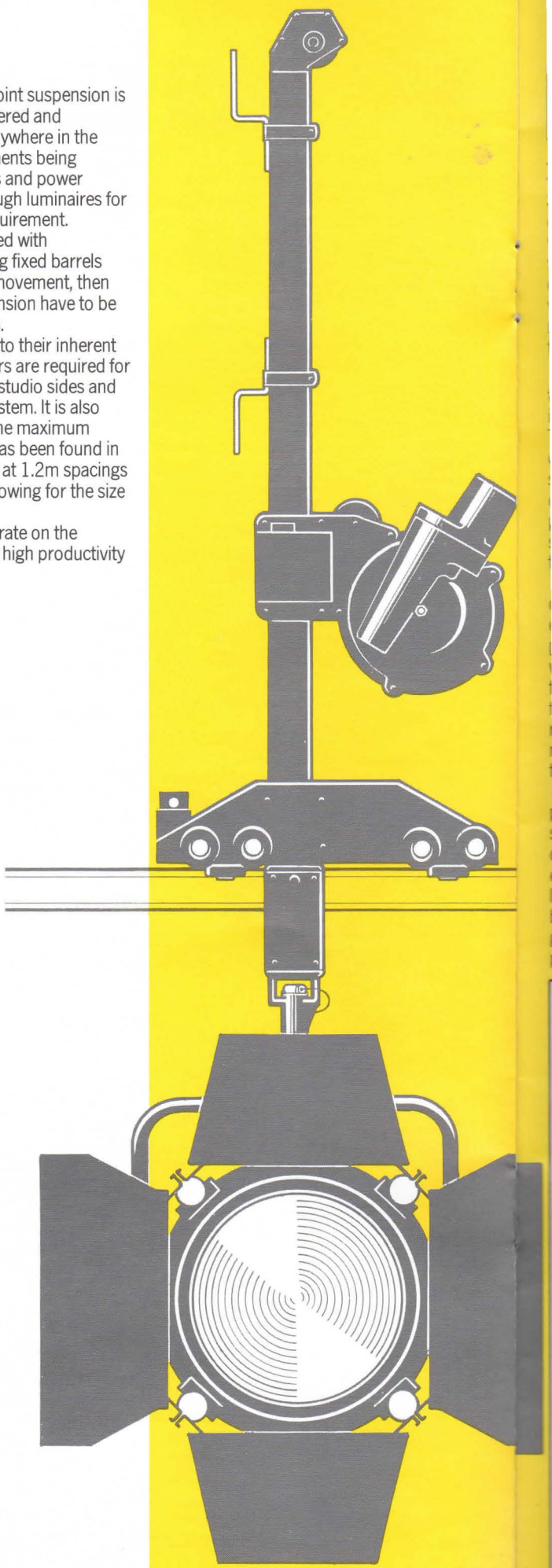
SUSPENSION

Where monopole single point suspension is used, great flexibility is offered and luminaires can be hung anywhere in the studio. The main requirements being sufficient suspension units and power outlets, together with enough luminaires for the largest production requirement.

If the studio is equipped with pantographs running along fixed barrels which allow no sideways movement, then additional bars and suspension have to be provided as in barrel grids.

With barrel grids, due to their inherent fixed nature, additional bars are required for peripheral lighting for the studio sides and also for the cyc lighting system. It is also important to provide for the maximum number of barrels and it has been found in practice that 2.4m barrels at 1.2m spacings offer the best coverage allowing for the size of dual source luminaires.

Barrel grids often operate on the saturated principle to give high productivity in utilisation.



5:2 TYPES OF SUSPENSION

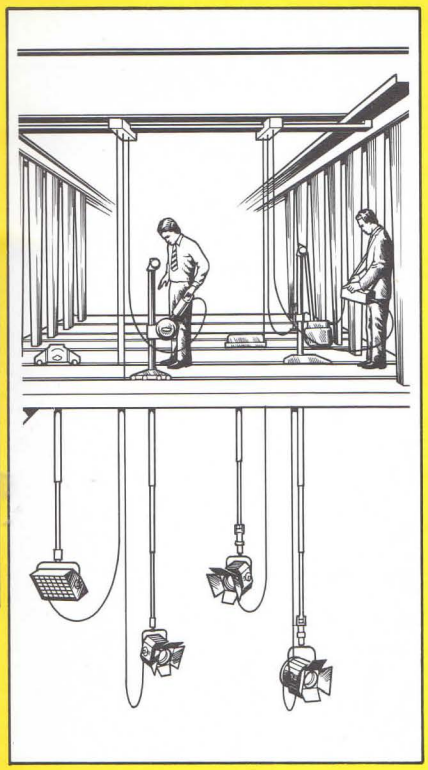
MONOPOLES

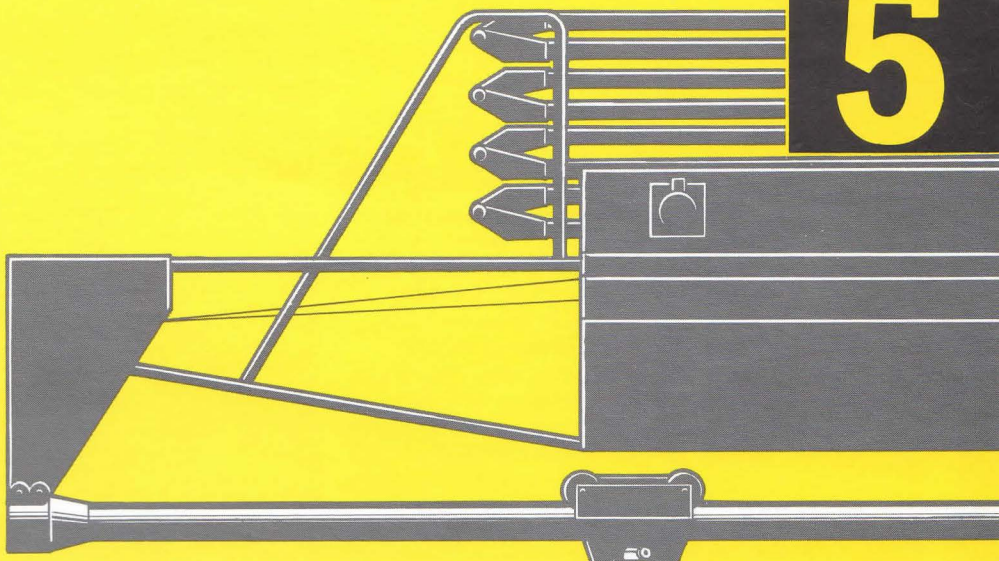
Single point suspension usually involves an overhead lighting grid which provides a working platform for the studio electricians, with the luminaires suspended from the grid on a telescopic device which permits variation in height and freedom of movement for positioning the luminaire at the required place in the set.

The overhead grid is an integral part of the studio construction and is incorporated in the design of the studio from the outset. The grid is divided into sections by continuous slots that run the length of the studio at intervals of around 1m. In some designs a number of additional slots are provided running across the width of the studio to facilitate transfer of telescopes from one main slot to another.

The telescopes are made to fit the width of the slots and are provided with wheels to enable the unit to be moved along the grid platform to any position in the studio. A winch is provided on the top section of the telescope above the grid platform, to enable the luminaire to be raised or lowered to the required height. The winch is operated by means of an electric or air powered hand tool or by a hand operated crank.

The rigging crew work on the grid platform and move the luminaires above the sets to the positions indicated by the lighting director. The grid also carries the main electrical distribution system. Loading of the luminaires and maintenance is undertaken by moving the telescope to the edge of the grid where access is obtained via a peripheral gallery.





THE MOTORISED HOIST

The motorised hoist is the main rival in larger studios to the overhead single point suspension grid. It consists of a length of barrel (48mm scaffold) supported by wire ropes connected to a motor winch mounted in the studio roof. Power outlets for connecting the luminaires can be mounted into a frame above the barrel and power cables housed in a collapsible tray which folds and unfolds as the barrel height is altered. The barrels are usually 2.4m long and the luminaires attached to them by means of clamps or on small wheeled trolleys which give the additional possibility of lateral positioning of the luminaire.

The hoists are placed at regular intervals along the length and across the width of the studio to enable luminaires to be fixed at almost any required position. It is usual to rig two luminaires on each barrel.

As all the luminaires normally remain on the barrel, de-rigging the studio at the end of a production can simply consist of raising all barrels to maximum height through a single master control.

This system gains maximum advantage when the number of different types of luminaire are reduced and the installation density of luminaires is increased compared to the requirements of the single point suspension system (i.e., the saturated grid). The dual source luminaire is particularly suited to this type of suspension.

Medium sized studios can be fitted with handwinched hoists, which are similar in conception to the motorised hoist but the suspension cables are diverted through roof mounted pulleys to winches mounted on the studio wall either operated from floor level or from a gantry.

Raising or lowering of the hoist is achieved through the use of a hand operated handle or a power tool similar to that used with the single point suspension telescope.

ROLLER PANTOGRAPH

This suspension system consists of long pantographs suspended from runs of fixed barrel across the studio with no lateral transfer possible. No access is provided above the grid and all operations have to be carried out at floor level. Generally economical to install, it offers a high degree of flexibility. Recent systems use motorised pantographs for enhanced operation.

END OF PART

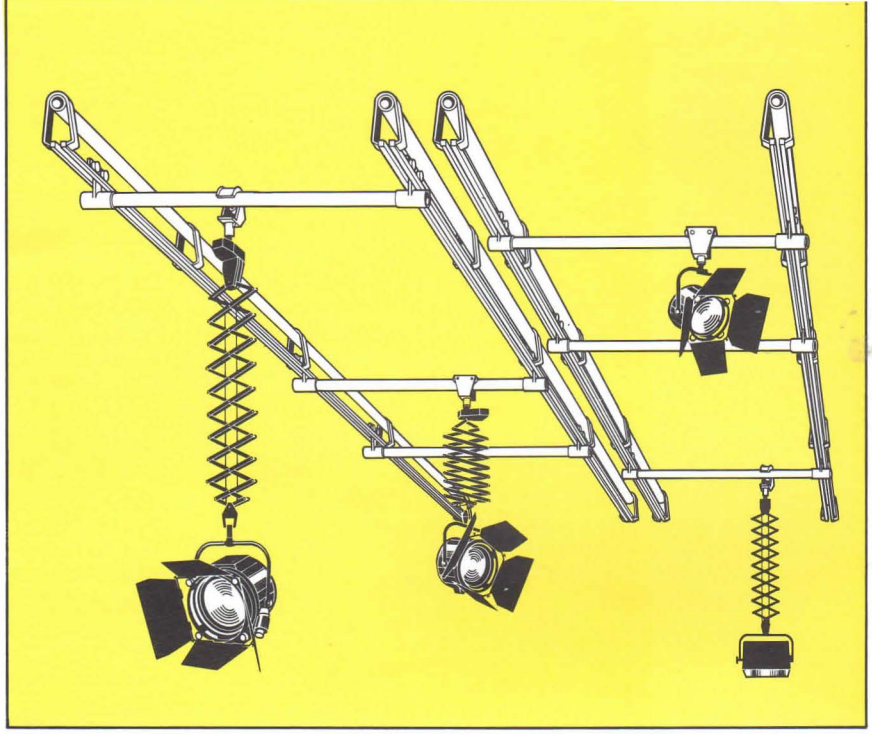
5

TRACK AND BARREL SYSTEM

Smaller studios, particularly those of limited height, are ideally suited to the track and barrel system. This comprises pairs of tracks (similar to that used for industrial sliding doors) mounted directly under the studio ceiling. The number of pairs of tracks is determined by the studio width. The barrel is fitted with a roller carriage at each end which runs in the tracking, enabling the barrel to be moved along the length of the studio.

The luminaires are rigged on the barrel by means of a roller trolley which allows them to move the length of the barrel or on a pantograph which gives the additional facility of individual height adjustment.

Power distribution is generally achieved by mounting sockets on trunking between the adjacent pairs of tracks. The luminaires can remain connected to these sockets with the trailing power cables supported by a supplementary catenary system.

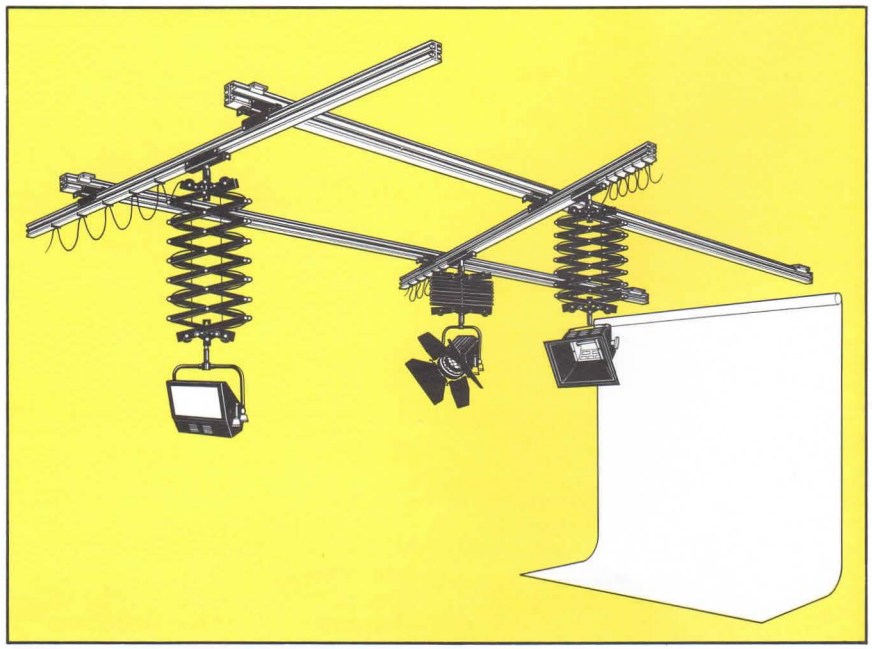


TRACK AND BARREL SYSTEM

LIGHTRIG SYSTEM

This suspension system is a variation on the track and barrel grid, but it is much more flexible as the traversing tracks can be adjusted diagonally across the primary track, providing a greater combination of luminaire positions, with the added advantage that fewer traversing tracks are required. Moreover, the traversing track can travel through its supporting carriages to provide an extended overhang outside the normal primary supports, as well as extra positions for luminaires in inaccessible places.

LightRig is a flexible system, ideal for small studios where the height is comparatively restricted.



LIGHTRIG

FIXED BARREL SYSTEM

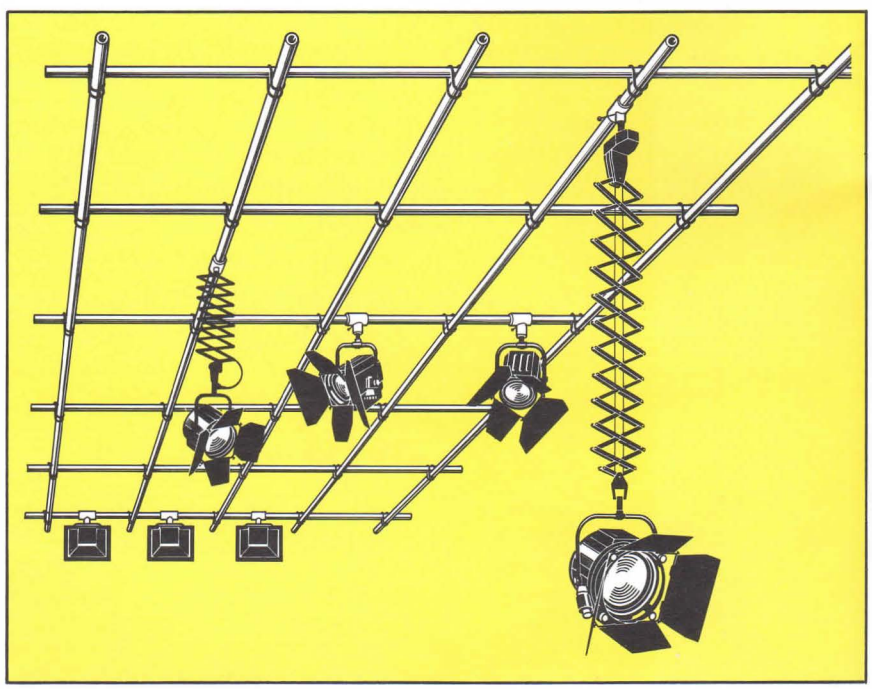
This is the simplest form of installation and one that is adequate for presentation studios or small to medium sized studios where a fixed lighting installation can be used, as for example when the same sets are used for each production or with very little change in the scene.

At its simplest, the fixed barrel system comprises scaffold barrels mounted across the full width of the studio just below the studio ceiling. The luminaires are attached to the barrels with clamps and little or no attempt is made to provide facilities for height variation or lateral movement.

ANCILLARY LIGHTING

Although generally the studio will be rigged with the necessary luminaires, there are occasions when other luminaires will be used. Certain effects can only be achieved by luminaires at studio floor level, e.g., fireflicker, water rippling. As well as effects, it is often desirable to use soft and hard sources at floor level. In particular, softlights can be at their most effective when square to a subject.

When planning the studio this must be taken into account and it is therefore necessary to supply floor stands to support the equipment. Other than these lights at floor level, there is the need to rig luminaires on the top of scenery flats which will require special clamps.



FIXED BARREL SYSTEM

PART 6

STUDIO LAYOUTS

The studio layouts employed are designed to show many of the situations that arise in normal television production. They also show a multiplicity of luminaires in use and it is hoped show some of the ways in which they may be used.

In the case of the 50m², 100m², and 150m² studios, very simple plots are given, using the 2kW and 1kW Fresnel spotlights, together with lower wattage soft lights. The first two studios show a simple talks programme, the 150m² studio is typical of a magazine type programme with interviews, a pop group and a consumer type item on new cars.

The layout used in the 250m² studio shows a programme about space research with a presenter, an interviewer, various models of rockets and sets which give an impression of the moon. This plot is designed to show the use of the dual wattage Fresnel spot in its two modes.

In conclusion it may be said that any of the situations depicted throughout the plans may be found in any studio irrespective of size. Of course they would be scaled down, or possibly portions of the layout shown. It is hoped that by studying the plans the reader will get an insight into the complexities of modern studio lighting and a realisation of the quantities and types of luninaires used.

It should be borne in mind that straightforward lighting situations (i.e. talks programmes) require slightly less light per unit area because of the fixed nature of the performers positions.

With light entertainment the tendency is to use a few performing positions with a large number of lights used for backings and general effect.

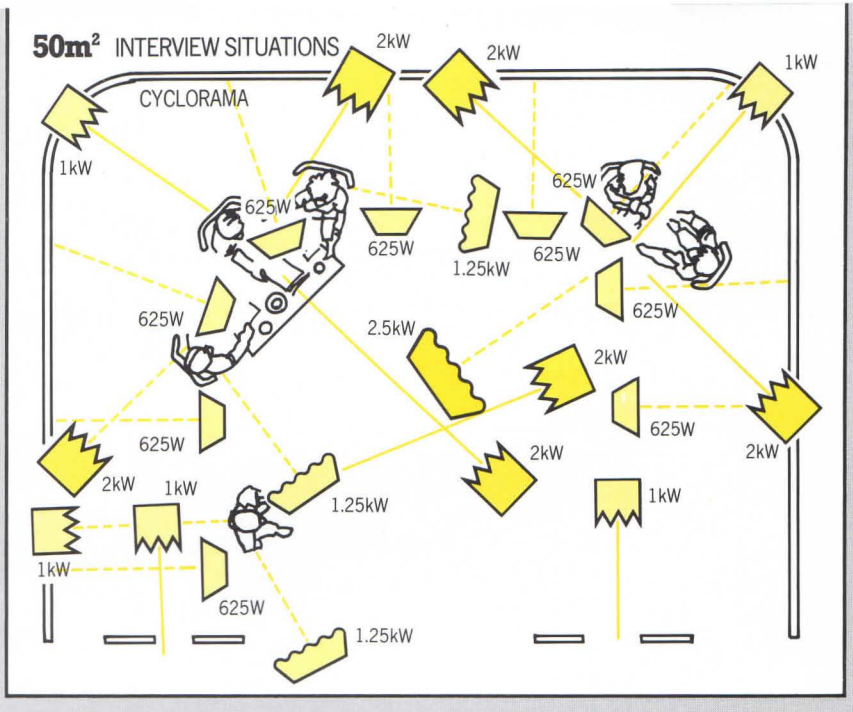
In the case of drama, there are usually many artists positions to be catered for and thus the majority of the lighting is used to light the action. With ballet one gets a mixture of many positions and also varied large scale backings.

The heads which show main performers positions are an amalgam of all positions that will be used during the programme, not necessarily in sequence, or combined, at any one time.

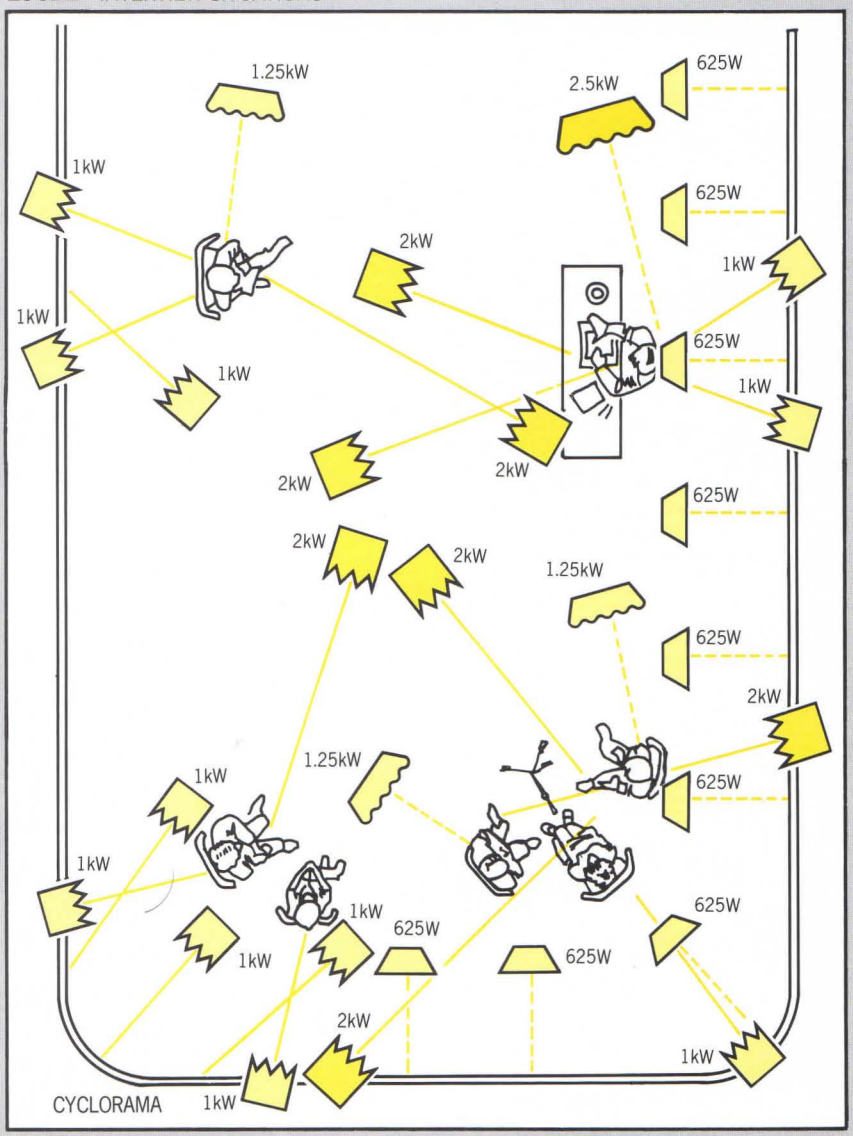
The plots show idealised luminaire positions; in practice, of course, some compromise will be necessary because of the positions of the suspension system.

The figures quoted are for the minimum requirement, they may be varied to suit specialised needs. Depending upon the installation, drop arms and other ancillary equipment may be needed but this must be the subject of detailed planning with the lighting consultant involved on the project.

50m² INTERVIEW SITUATIONS



100m² INTERVIEW SITUATIONS



SUGGESTED EQUIPMENT

50m² Minimum power required: 32.5kW

8 x 2kW Fresnel spots
10 x 1kW Fresnel spots
8 x 1.25kW Softlights
4 x 1kW Profile spots
1 x Floor stand
Cyc: 12 x 625W single compartment top units.
Lighting control system as appropriate

100m² Minimum power required: 65kW

16 x 2kW Fresnel spots
10 x 1kW Fresnel spots
6 x 1.25/2.5kW Softlights
4 x 1.25 Softlights
4 x 1kW Profile spots
6 x Floor stands
Cyc: 16 x 625W single compartment top units
Lighting control system as appropriate

PART

6

SUGGESTED EQUIPMENT

150m² Minimum power required: 97.5kW

24 x 2kW Fresnel spots and
10 x 1kW Fresnel spots

or: (34 x 1.25/2.5kW Dual wattage Fresnel spots)

10 x 1.25/2.5kW Softlights
6 x 1kW Profile spots
8 x Floor stands

Cyc: 24 x 625W single compartment top units

Lighting control system as appropriate

250m² Minimum power required: 210kW

20 x 5kW Fresnel spots and
10 x 2kW Fresnel spots

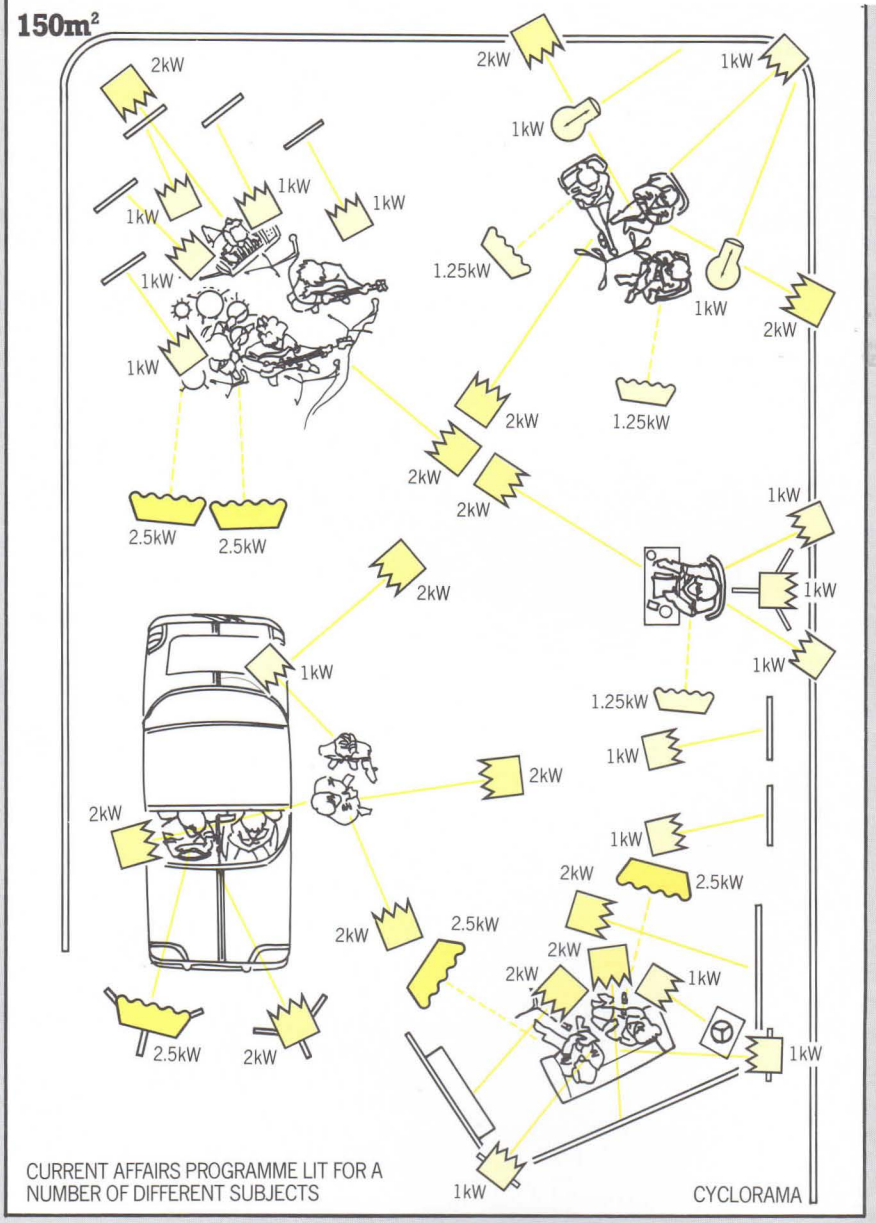
or: (30 x 2.5/5kW Dual wattage Fresnel spots)

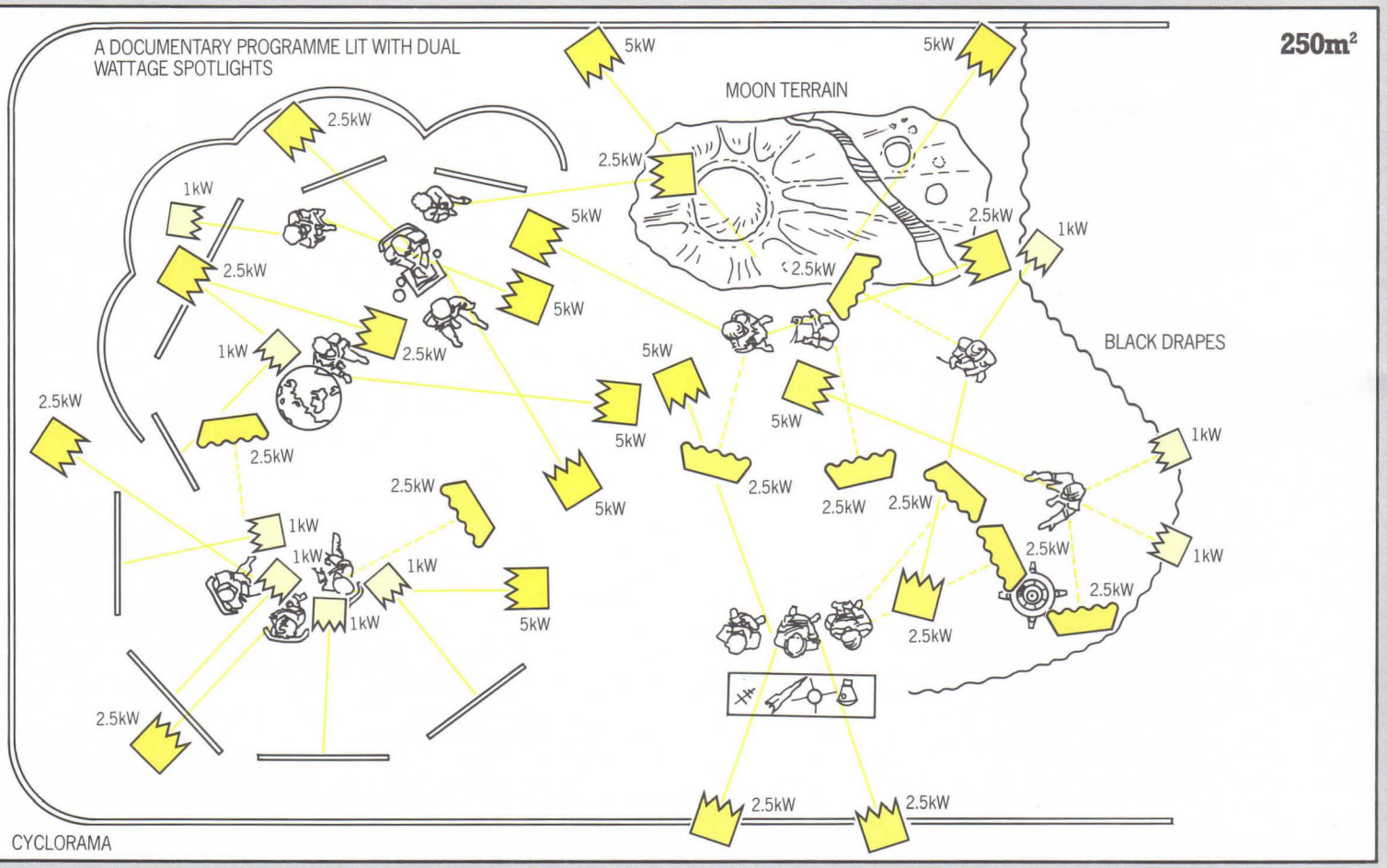
10 x 1kW Fresnel spots
6 x 1.25/2.5kW Soft lights
6 x 2.5/5kW Soft lights
6 x 1kW Profile spots
10 x Floor stands

Cyc: 16 x 1.25kW 2-compartment top units
or: 30 x 625W 4-compartment groundrow

Note: This gives coverage for a 40m cyc.

Lighting control system as appropriate





The plot for the 400m² studio shows a mixture of straightforward Fresnel spots at 10kW, 5kW and 2kW. The programme is that of an orchestra with guest singers, some of whom use the roadway, surrounded by trees depicted in the upper right. In the upper left of the studio plan we have a set composed of small 'flats' with a group of singers performing.

SUGGESTED EQUIPMENT

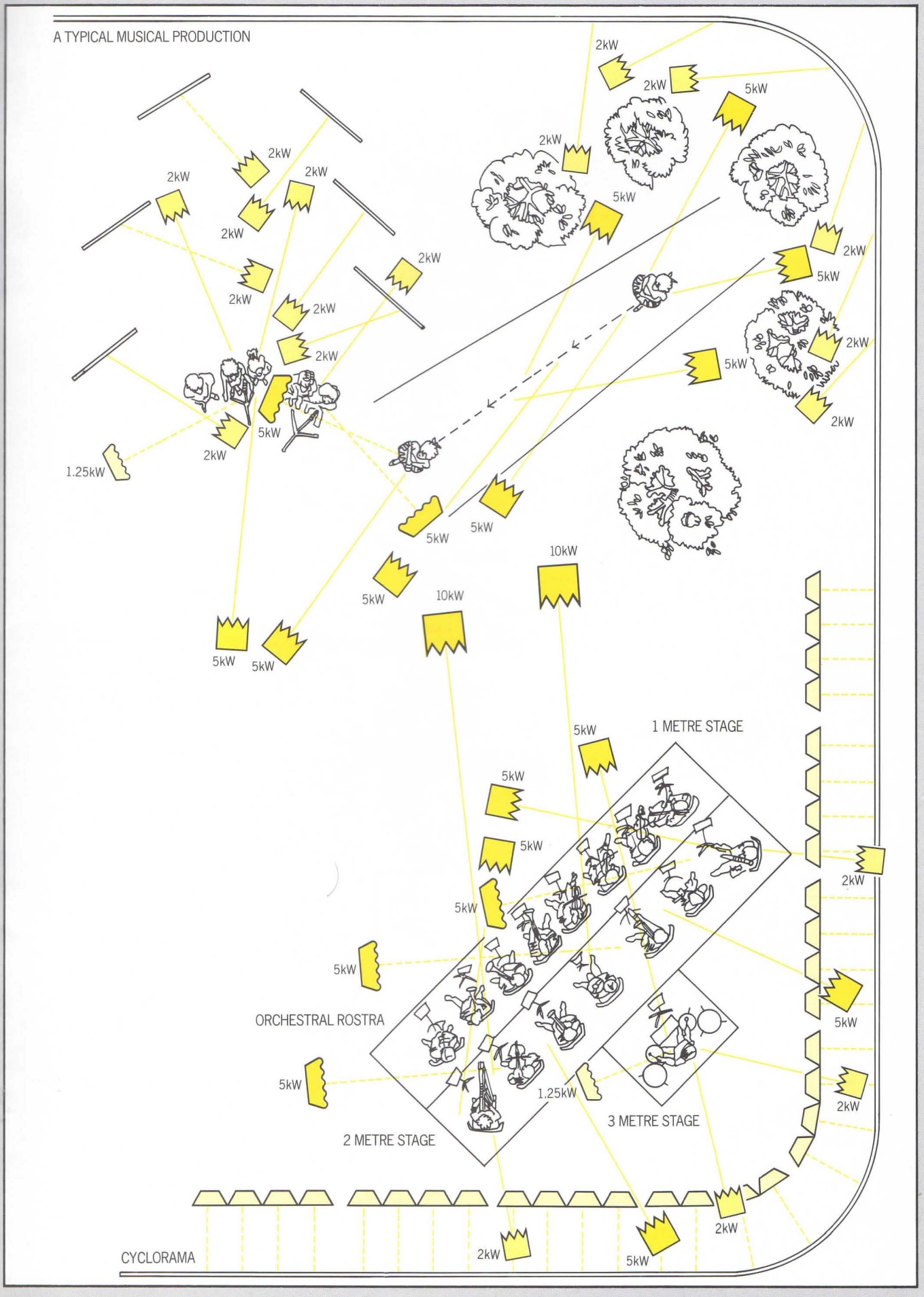
400m² Minimum power required: 340kW

3 x 10kW Fresnel spots
25 x 5kW Fresnel spots and
20 x 2kW Fresnel spots
or: (45 x 2.5/5kW Dual wattage Fresnel spots)
12 x 1kW Fresnel spots

12 x 2.5/5kW Softlights
8 x 1kW Profile spots
12 x Floor stands
Cyc: 16 x 1.25kW 4-compartment top units
or: (40 x 625W 4-compartment groundrows)

Lighting control system as appropriate

400m²



PART

6

We now come, in the case of 750m² studio to the most complex plot. This is typical of a play and shows the supermarket set being lit to simulate fluorescent lighting, the car dealer's yard to show a sunny day and the hotel bar set is typical of a night scene, where it will be noticed the use of 1kW spotlights on the practical lighting fittings. The country house is lit for daylight and the dining room shows another scene in the same house at night. It will be noticed that some of the luminaires used have two directional lines employed. This is to show their multi-purpose use during the programme.

SUGGESTED EQUIPMENT

750m² Minimum power required: 640kW

6 x 10kW Fresnel spots
50 x 5kW Fresnel spots and
30 x 2kW Fresnel spots

or: (80 x 2.5/5kW Dual wattage Fresnel spots)

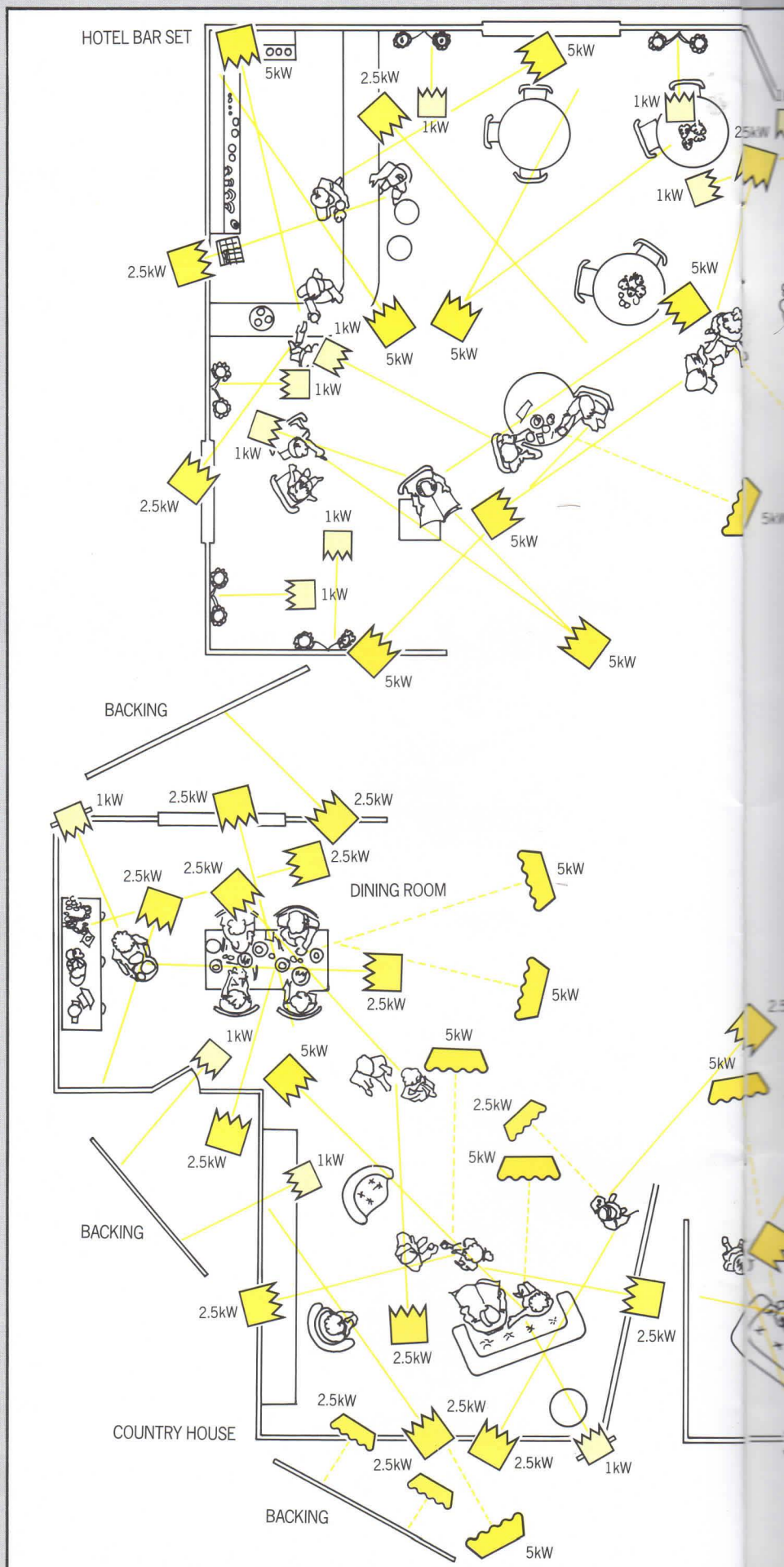
20 x 1kW Fresnel spots
20 2.5/5kW Softlights
12 x 1kW Profile spots
16 x Floor stands

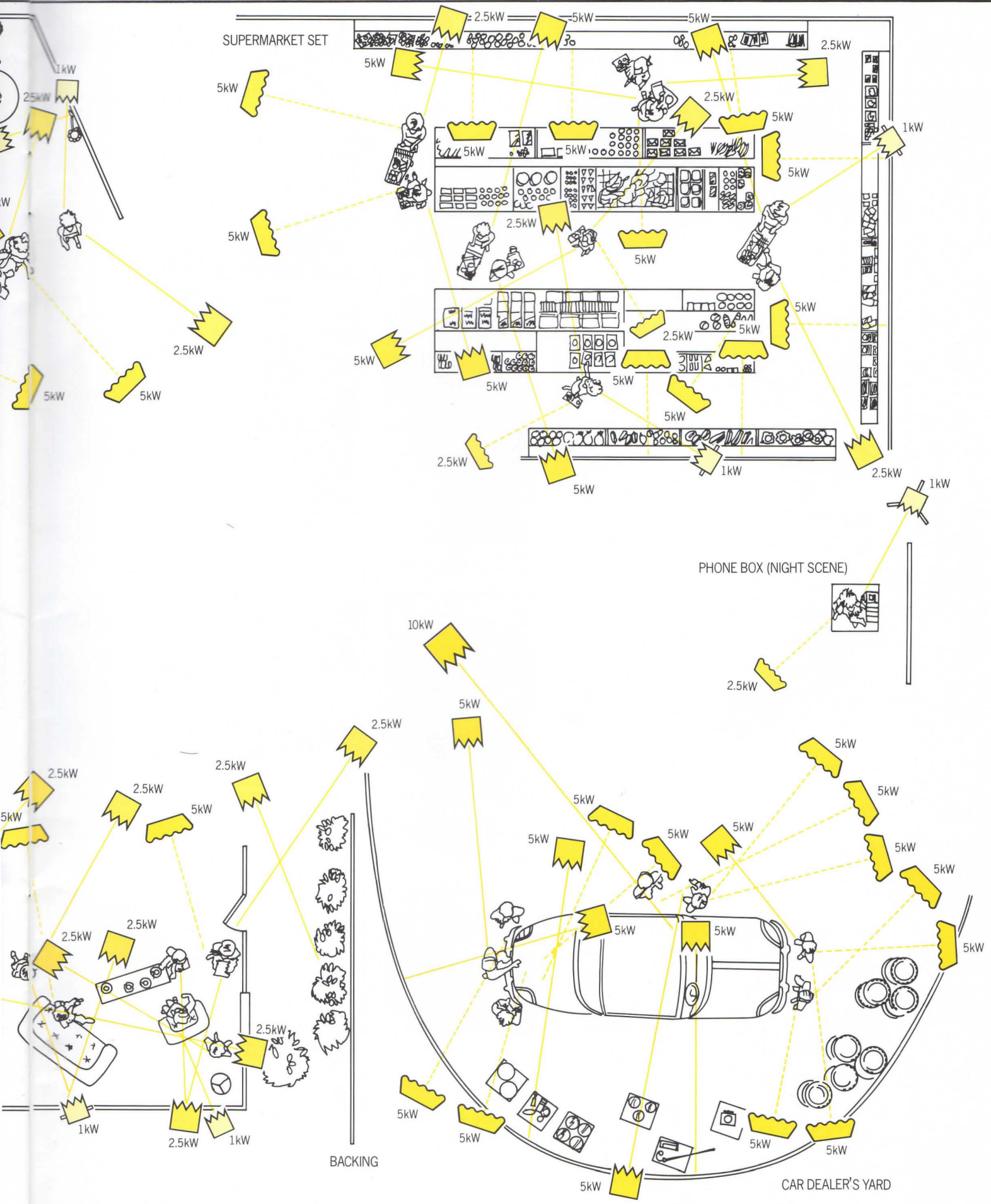
Cyc: 30 x 1.25kW 4-compartment top units

or: (70 x 625W 4-compartment groundrows)

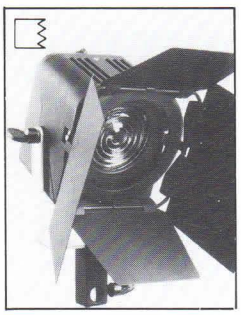
Lighting control system as appropriate

750m² DRAMA SITUATION WITH SEVEN SETS



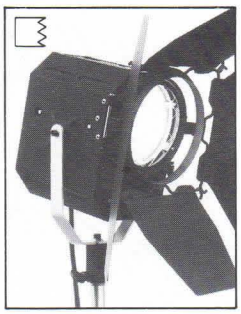

SUPERMARKET SET
PHONE BOX (NIGHT SCENE)
BACKING
CAR DEALER'S YARD
1kW
2.5kW
5kW
10kW

TUNGSTEN HALOGEN LUMINAIRES

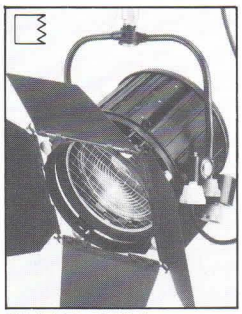


MIZAR 300/500W spotlight
The smallest Fresnel spotlight in the Quartzcolor range, and particularly suited to lighting detail and special effects.

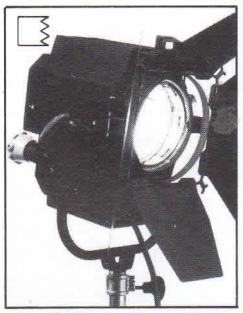
POLARIS 1kW spotlight
A compact Fresnel spotlight available in manual or pole operated versions.



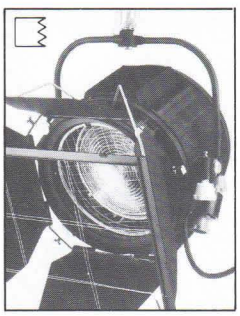
BAMBINO 1kW spotlight
A Fresnel spotlight designed for location working in situations where space is restricted.



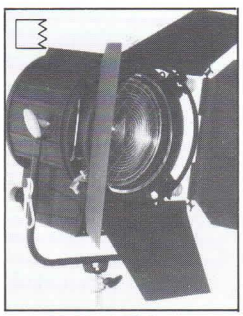
CASTOR 2kW & 1.25/2.5kW spotlight
This Fresnel spotlight is suitable for studio and outside location, utilising single or twin-filament lamps. Manual or pole operated versions available.



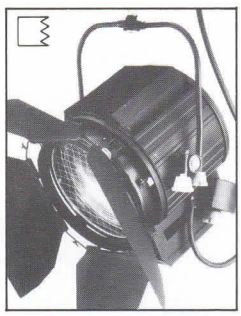
BAMBINO 2kW spotlight
Designed specifically for location use, this Fresnel spotlight is available in manual or pole-operated versions.



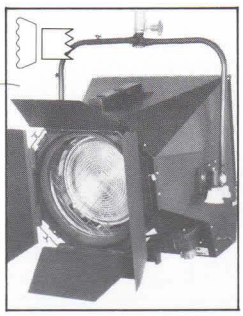
POLLUX 5kW & 2.5/5kW spotlight
A single or dual-wattage Fresnel spotlight, suitable for studio or location working. Manual or pole-operated versions available.



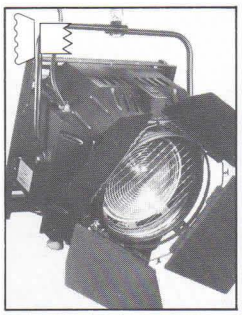
BAMBINO 5kW & 2.5/5kW spotlight
Specifically designed for outside locations, this Fresnel spotlight utilises single or twin-filament lamps. Manual or pole operated versions available.



VEGA 10kW spotlight
Compact lightweight Fresnel spotlight available in manual or pole-operated versions.

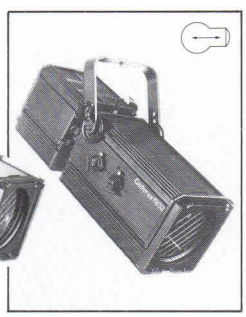


GIANO 2.5/5kW dual source spot/softlight
A dual-purpose Fresnel spotlight/softlight operating from separate single-filament lamps at the soft end, twin filament lamp at the Fresnel end.

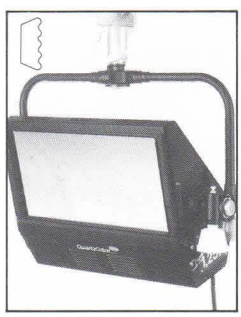


KAHOUTECK 2.5/5kW dual source spot/softlight
This dual-purpose Fresnel spotlight utilises a single twin-filament lamp.

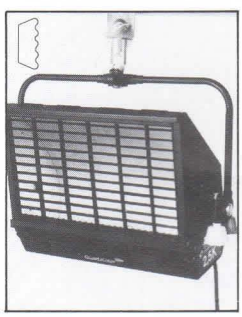
SOLO 2K followspot
Variable-spread followspot from Strand, incorporating a built-in iris diaphragm and beam shaping shutters. A 1kW CSI/CID version is also available.



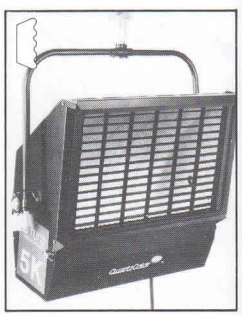
CADENZA 19/32 2kW profile spot
A medium to wide angle variable spread Strand luminaire with integral iris diaphragm and beam-shaping shutters.



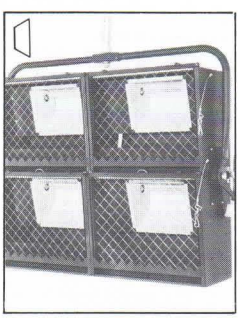
ARTURO 1.25kW softlight
Designed for small studios or as a location fill light. Manual or pole-operated versions available.



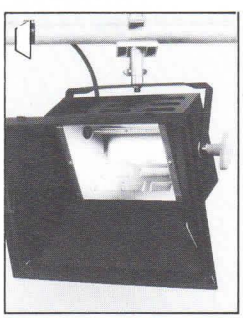
ARTURO 2.5/5kW softlight
A variable power softlight producing indirect illumination. Manual or pole operated versions available.



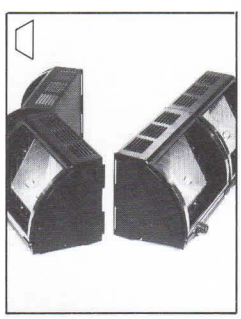
ARTURO 1.25/2.5kW softlight
A dual power indirect softlight available in manual or pole-operated versions.



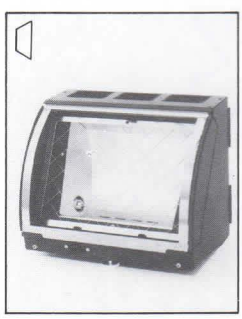
IRIS 4 cyclorama top light
Four compartment cyclorama top light designed for 4-colour light mixing. Also available in 3 compartment (horizontal) and 2 compartment (horizontal or vertical) versions.



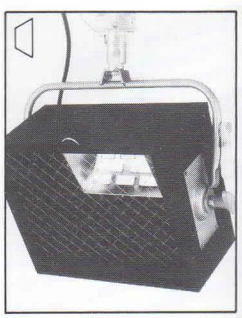
MINI IRIS cyclorama top light
Designed for T.V. presentation suites, E.N.G. locations, audio visual and still studios. Extremely compact but using the same reflector system developed for all the Iris range.



PALLAS 4 cyclorama groundrow
A four compartment unit for 4-colour light mixing. Available in rigid or hinged versions.



PALLAS 1 cyclorama groundrow
Single compartment version of Pallas 4.

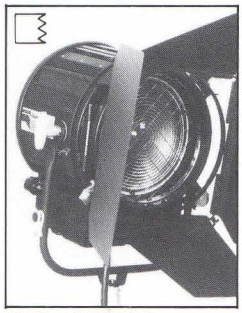


IRIS 1 cyclorama top light
Single compartment version ideal for small studios. Manual or pole operated versions available.

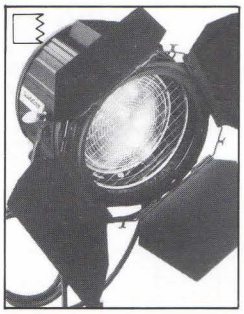
END OF PART 7

DISCHARGE LUMINAIRES (DAYLIGHT)

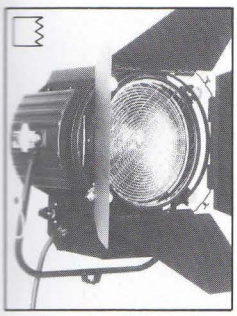
SIRIO 575W HMI spotlight
A compact Fresnel spotlight, with twice the light output of a 2kW filtered tungsten source. Ideal for small locations and "bounce" light.



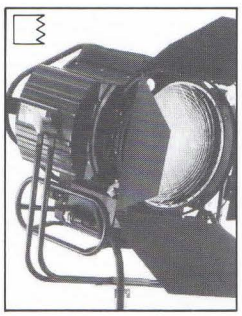
SIRIO 1.2kW HMI spotlight
High intensity, variable beam Fresnel spotlight. Light output approximately that of a 5kW filtered tungsten source.



SIRIO 2.5kW HMI spotlight
A Fresnel spotlight suitable for lighting large areas and balancing strong sunlight. Light output equal to 10kW of filtered tungsten light.

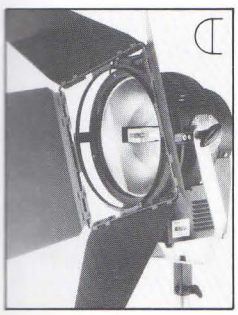


SIRIO 4kW HMI spotlight
Fresnel spotlight designed to produce maximum punch lighting for location use. Light output approximately that of a 14kW filtered tungsten source.

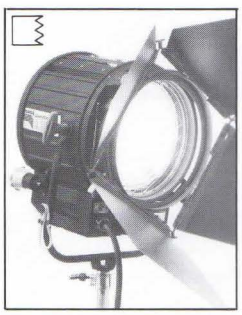


SIRIO 6kW HMI spotlight
A Fresnel spotlight with an output equal to 25kW of filtered tungsten light. Comparable with the 'Brute'.

SIRIO 12kW HMI spotlight
Designed for location working, this Fresnel spotlight is the largest discharge lamp designed for television and filming



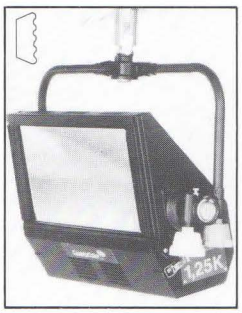
SHAULA 575W HMI floodlight
A compact open-face luminaire ideal for lighting large areas.



ALTAIR 1kW CID/1.2kW HMI spotlight
A compact Fresnel spotlight with two lampholders to accept either a CID or HMI lamp.

ALTAIR 2.5kW CID/HMI spotlight
A twin lampholder Fresnel spotlight designed to operate with a CID or HMI lamp.

ARTURO 575W HMI softlight
A location fill light providing virtually shadowless diffused lighting complementing the Sirio focusing Fresnels, matching daylight colour temperature.

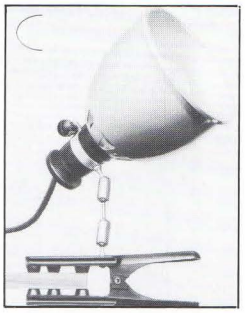


ARTURO 1.25kW HMI softlight
Designed for location working with diffused lighting and matching daylight colour temperature of the Sirio focusing Fresnels.

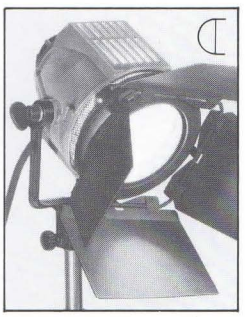
ARTURO 2.5kW HMI softlight
A fill light with virtually shadowless diffused lighting with daylight colour temperature, matching the Sirio focusing Fresnels.

PORTABLE LIGHTING

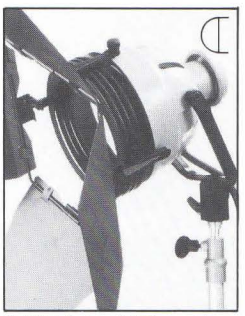
MEGALUX 250W handlamp
Comfortably operated with one hand, this open-face floodlight is powered by 30v battery.



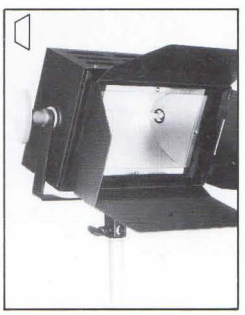
PINZA 500W clamplight
A compact fill light, this open-face floodlight is ideal for use where space is limited. Clamps to any convenient mounting.



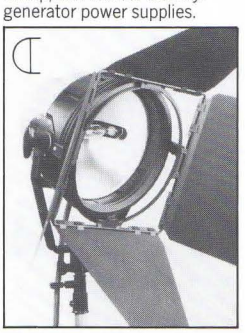
PULSAR 650W floodlight
Variable beam, open-face floodlight with fibreglass lamphead. Ideal as a fill light or for lighting set detail.



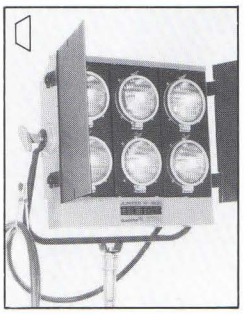
REDHEAD 800W spot/floodlight
A variable beam, open-face luminaire . Three versions available: one for stand mounting, one fitted with a clamp, and one for battery/generator power supplies.



BROAD 1.2kW floodlight
A lightweight floodlight providing a wide angled even fill light. Ideal for concealment on set.



BLONDE 2kW floodlight
A compact high-intensity variable-beam open-face floodlight, ideal for E.N.G. and outside locations.

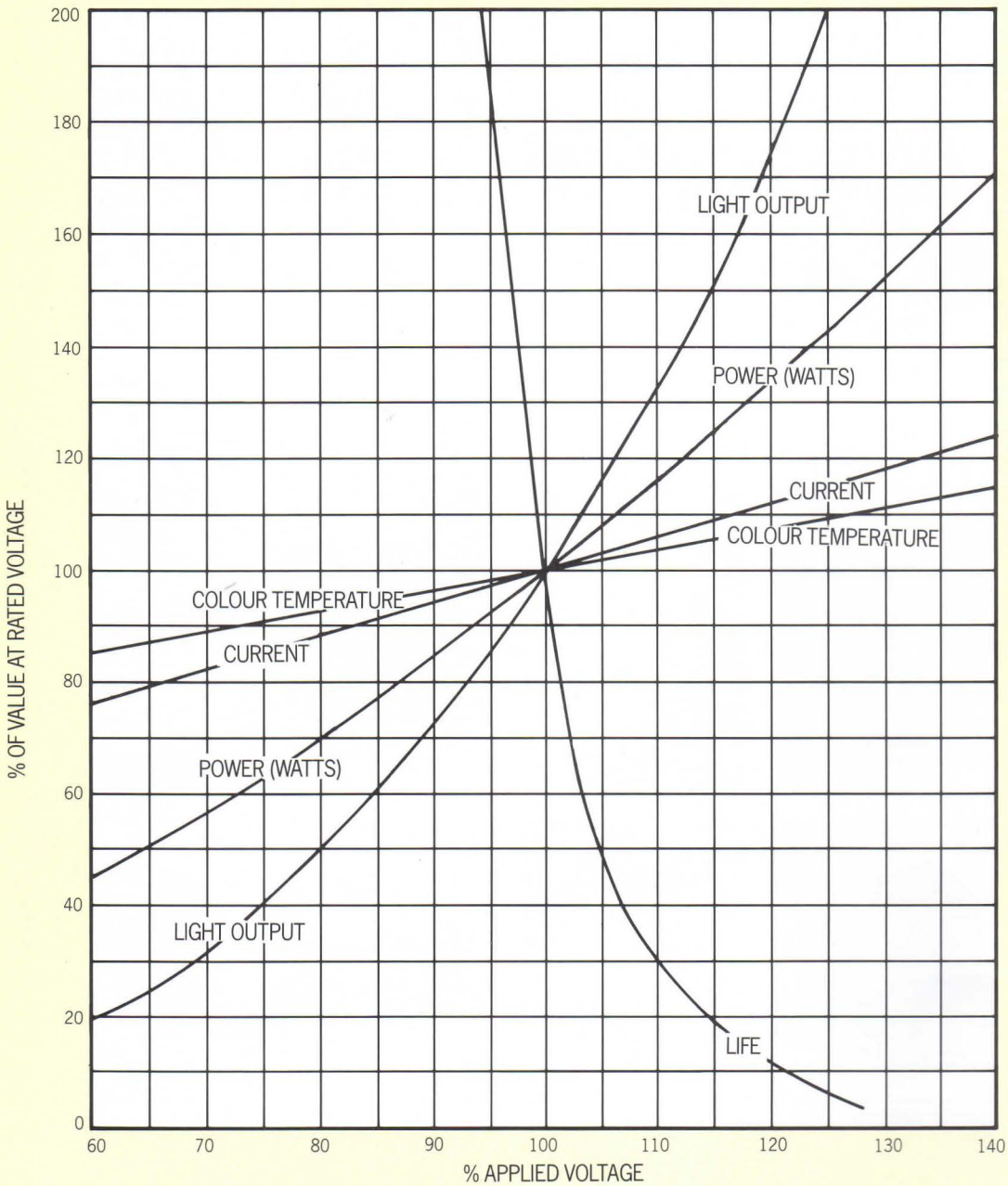


JUPITER 6 (3.9kW) floodlight
High-intensity light source, ideally suited to outside location working.

LIGHTING KITS
A wide configuration of kits is available, using suitable standard equipment from the Quartzcolor range.

QuartzColor ianiro SPA
products are manufactured in Italy

CHARACTERISTICS OF TUNGSTEN HALOGEN LAMPS



The above graph shows the effect of changing the applied voltage to a lamp. The % change will apply to the lamp manufacturer's stated characteristics.

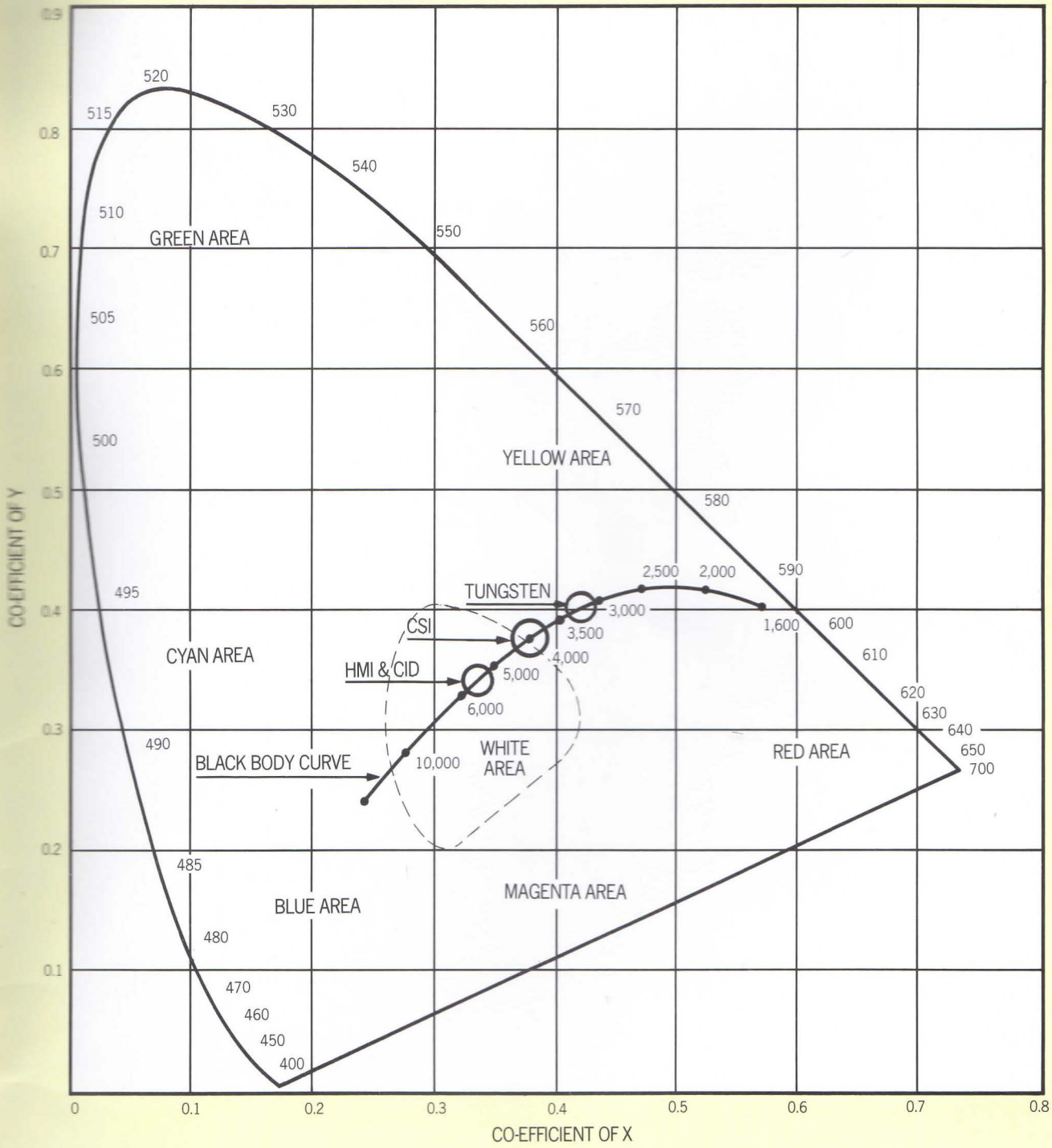
SQUARE LAW DIMMING

The square of the fader setting gives the percentage light output e.g. Fader at '6' equals light output of 36%.

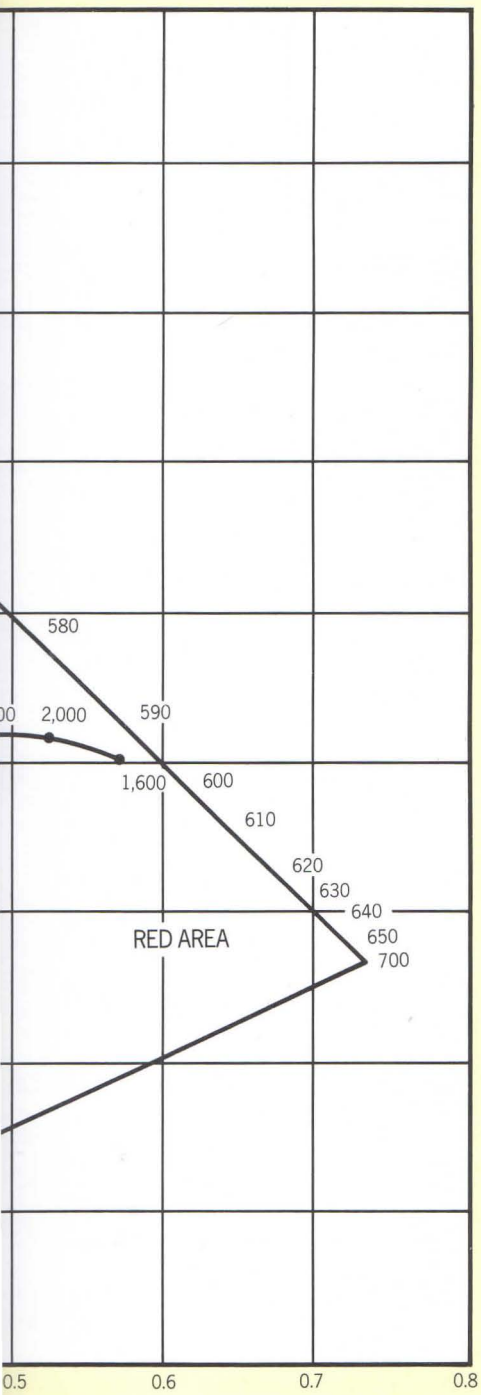
Fader	Light Output %	Colour Temp (K)	Mains Voltage %	240	120	Current %	Power %
10	100	3200	100	240	120	100	100
9	81	3120	93	224	112	96	89
8	64	3040	88	211	106	93	82
7	49	2960	81	194	97	88	72
6	36	2860	74	178	89	85	63
5	25	2750	66	158	79	78	52
4	16	2600	59	142	71	73	43
3	9	2400	51	122	61	67	34
2	4	2200	39	94	47	59	23
1	1	—	23	55	27	46	11
0	0	0	0	0	0	0	0

The table shows the values for the operating parameters of tungsten halogen lamps when used with a square law dimming system. It should be noted that the ideal colour temperature figure is seldom reached in practice and most lamps will run about 100-200K less throughout their range.

CIE 1931 (X,Y)-CHROMATICITY DIAGRAM



Colour temperature curve relates to black body radiators.
The HMI, CID and CSI lamps lay close to the curve within the prescribed limits.



KEY TO STUDIO LAYOUTS

1kW Profile spotlight

1kW Fresnel spotlight on scenery flat

1kW Fresnel spotlight on stand

1kW Fresnel spotlight

2kW Fresnel spotlight

2.5kW Fresnel spotlight

5kW Fresnel spotlight

10kW Fresnel spotlight

2.5/5kW Dual-purpose spot/softlight

1.25kW softlight

2.5kW softlight

5kW softlight

Cyclorama light

LUMINAIRE SYMBOLS

Floodlight

Fresnel spotlight

Special floodlight

Effects projector

Reflector spotlight

Softlight

Sealed beam lamp

Bifocal spotlight

Lens spotlight

Variable spread profile spotlight

Profile spotlight

Followspot.

Strand Lighting

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USA – 18111 South Santa Fe Ave, PO Box 9004, Rancho Dominguez, Calif. 90224.
Tel: (213) 637-7500. Telex: 664741

CANADA – 6490 Viscount Road, Mississauga, Ontario, L4V 1H3.
Tel: (416) 677-7130. Telex: 06968646

WEST GERMANY – 3340 Wolfenbüttel 16 – Salzdahlum.
Tel: 053 31/7951-53. Telex: 95641

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