



STRAND

SYSTEM LC

PRESET CONTROL

What is Presetting ?

Preset when used to describe a theatre or television control always means that at least the next set of lighting levels can be set-up precisely without affecting in any way the lighting already in use. Some, or all, of the circuits employed in this lighting may be common to successive changes and the individual levels required in respect of these may be the same or different. A further requirement is that the transition from one lighting set-up to another should take place from master controls giving either an instantaneous cut or a slow fade of any speed. It is also desirable that presets can be added together (piled) when required.

STRAND Preset Lighting Control All-Electric System LC

Here in System LC, Strand Electric offer full dimmer presetting facilities at a remarkably low price. Between simple remote control dimmers such as saturable reactor (e.g. Strand System SR) and a full preset system has always been a large price gulf. This is because the reactor requires a comparatively large control current which prevents the formation of preset networks. Presetting hitherto has required the use of dimmers such as thyratrons, magnetic amplifiers or silicon-controlled rectifiers which are in themselves complex because of their versatile load range. Thus it is not the control panel but the dimmer itself that represents the great increase of cost. Recognising that the ability to preset is of first importance and that complete or near complete load variation at the dimmer is a luxury, where costs must be kept minimal, Strand Electric have devised the simple dimmer system known as LC.

The dimmer is a saturable reactor which is controlled through a compact transistorised amplifier with a modest degree of feedback. The result is a very simple dimmer of two components only giving good control for a load variation of 2 to 1 and an acceptable load variation of 4 to 1. The amplifier is a small plug-in unit requiring no servicing and the load-carrying component is the robust, virtually indestructible, saturable reactor whose electrical output is interference free. The control desk provides full presetting from duplicate sets of the Strand finger-tip controls, famous for their superb feel, large scales and clear layout. The dimmer preset levers are mounted as rows, one above the other, thereby allowing accurate matching of levels where necessary yet retaining the ability to 'play' dimmers within the preset. A full complement of master faders and cut switches is provided and the presets can be piled. To avoid 'wasting' the full set of dimmer levers on changes affecting only part of the studio, or stage, circuits can be formed into three groups by means of tablet switches over each pair of dimmer levers. Two quite independent switching groups can also be formed.

In offering System LC, Strand Electric are confident that it offers full presetting, backed up by a simple trouble-free dimmer at an economic figure which makes possible widespread use of this type of lighting control.

Proof of this claim is to be found in many installations already existing all over the world.

General Description

This system is available for 48, 72 or 96 individually controlled dimmer channels. Each equipment consists of a remote control cabinet and two or more dimmer racks for 24 saturable reactor dimmers, each of which is provided with a transistorised control amplifier. The amplifiers permit the low control currents essential for presetting facilities and they also permit load variations down to 50% of the maximum rating of each size of dimmer without tap-changing. Some reactor dimmers and their associated control amplifiers, or even a complete dimmer rack, can be omitted for initial economy but cabinets always have provision for a full complement of dimmer levers.

Control Cabinets

An upright floor-standing cabinet is supplied as standard. A desk form with the master controls on the right-hand side is available for an additional charge. All controls are inclined from the vertical for ease of operation. The duplicate dimmer levers are mounted one above the other so that lighting levels can be easily matched and yet the operator is not impeded by having to pick out alternate levers when 'playing' a change. All internal wiring is fitted and terminals provided for the control wiring to the dimmer racks.

1. Three-position switch with white, red, blue or green operating tablets engraved with a brief title. The choice of colour allows the channel controls to be patterned to make the layout more memorable. This switch groups the remote contactor in series with the dimmer to the 'Blackout A' master switch when in the top position, to channel off when in the middle, or to the 'Blackout B' master switch when down.

2. Moulded, plug-in individual dimmer lever unit with a continuously variable potentiometer provided with a large *white* scale engraved 0 to 10 with half divisions. The actual dimmer lever is coloured to correspond with the switch (1) described above. For presetting the precise intensity level required.

3. Duplicate dimmer lever unit as described above but with a large *green* scale.

4. Three-position switch with amber operating tablet engraved with the channel reference number which is repeated between the pair of dimmer levers. This amber switch is for grouping the *white* dimmer levers (2) and the *green* dimmer levers (3) to the 'X' *white* and *green* master dimmers when in the top position, to the

'Y' pair of master dimmers when in the middle, or to the 'Z' pair of master dimmers when down.

5. Master dimmers with 330° motion and hand-grip operating knobs to facilitate slow changes. One *white* and one *green* for each of the X, Y and Z dimming groups formed by the amber switches (4). For proportional collective control of the individual dimmer levers.

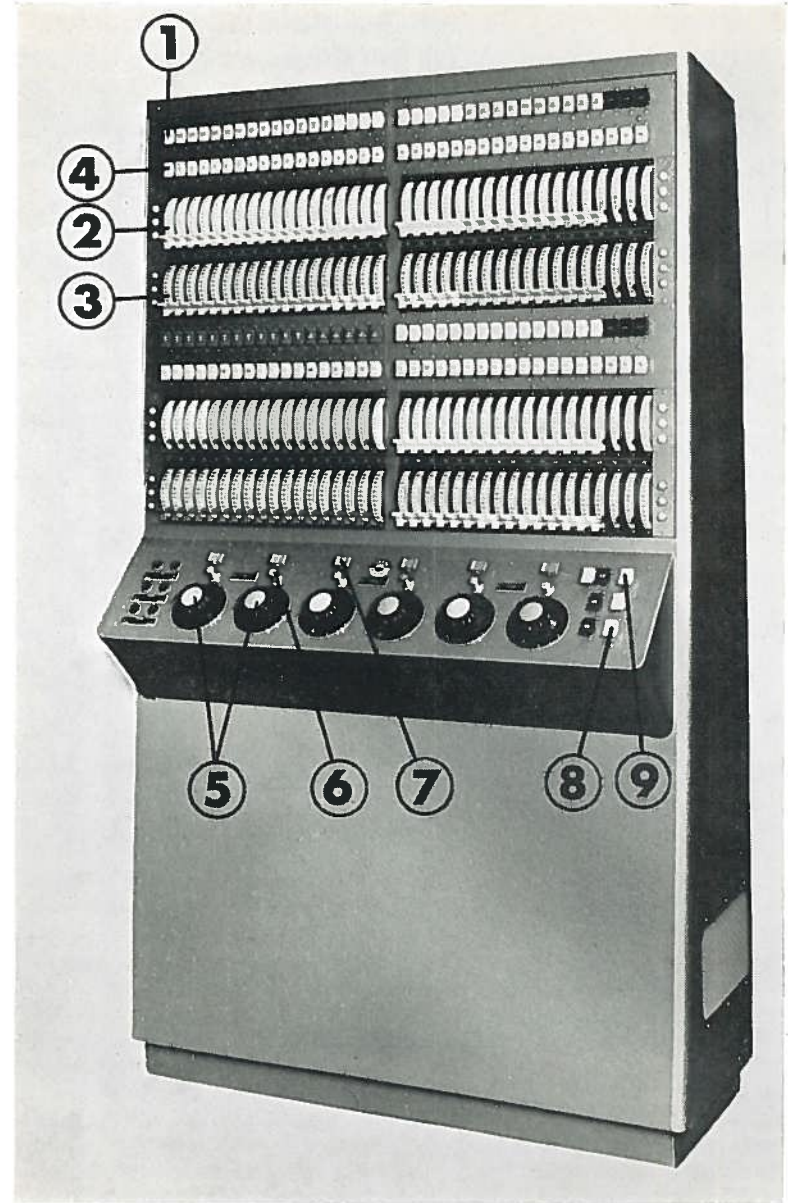
6. Push - pull illuminated Quick - fade switches, one for each master dimmer. The internal indicator lamp provides a visual reminder of the setting of the corresponding master dimmer.

7. Transfer switches with red operating tablets allow two or three dimming groups to be coupled to operate from either the X or Z master dimmers. The normal position of these switches is central when each dimming group is controlled by its own master dimmer.

8. All-fade master switch for a quick-fade of all dimmer channels. This overrides all other dimming master controls.

9. Blackout A and Blackout B master switches for contactor switching of the two groups formed by the upper coloured three-position switch (1) for each channel.

The three coloured lamps at the end of each row of dimmer levers provide a visual reminder of which dimming groups are energised.



Type CLC/72
72 Dimmer Channel Standard Control Cabinet



**Dimmer Rack
for 24 Saturable Reactor Dimmers and their associated
control amplifiers. Covers removed.**

Dimmer Racks

Standard dimmer racks are rated at 2 kW maximum for each of the 24 channels but, if specified when ordering, any of the last four channels of each rack can be fitted with SR/803 3 kW maximum reactor dimmers. All components are contained within the steel framework and a wire-mesh cover is provided in front of the terminal area and a sheet-metal cover over the channel contactors. A sheet-metal top and wire-mesh side covers are fitted as standard on the 110/120-volt range of equipment but on the 220/240-volt range these are an optional extra.

- A. Thermal circuit breaker for protection and isolation of each channel.
- B. Contactor to each channel for load switching.
- C. Plug-in transistorised control and feedback amplifier to each channel for the control of the saturable reactor dimmer.
- D. Cartridge fuse for protection of the feedback circuit from the dimmer output to the control amplifier.
- E. Terminals for the incoming A.C.
- F. Load and neutral terminals for connection of the tungsten lamp loads.
- G. Terminals for the control wiring from the control cabinet and for the control cabinet power supplies.
- H. Transformer and power pack unit including a plug-in stabilizer unit, cartridge control fuses and plug and socket connections for all the control circuit power supplies.
- J. Saturable reactor dimmer, size as specified.

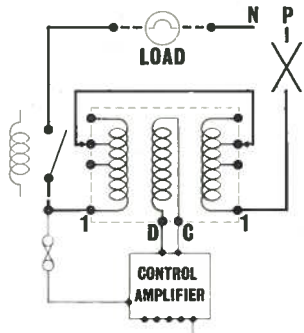
SATURABLE REACTOR DIMMERS AND CONTROL AMPLIFIERS

In this control system the tungsten lamp load is controlled by a saturable reactor dimmer which in turn is controlled by a small transistorised control amplifier. The functions of this amplifier are to reduce the control current so that presetting facilities can be provided and to take a feedback reference from the output of the reactor dimmer. This is used to extend the acceptable load range down to 50% of the maximum rating of the dimmer without the necessity of tap-changing. Each size of reactor dimmer is provided with tapping points to allow the load range to be reduced but for optimum performance the size of dimmer should be chosen so that the tungsten lamp load is within its normal range.

If the load is less than 50% of the maximum rating the lamps will not be extinguished when the dimmer lever is at zero. This may be tolerable in a television studio where the cameras are insensitive to such a low intensity, but for stage lighting it would not be acceptable. By changing the tapping points on the reactor dimmer it would be possible to reduce the load range but the response of the dimmer will lag behind the operation of the controls. It is therefore a short-sighted policy to fit larger dimmers than are necessary. The choice of dimmer size is not difficult for it is the intention of this lighting control that there

should be a dimmer for each spotlight or group of floodlights and, therefore, the location of the lighting unit determines the range, and therefore the dimmer size, likely to be required. Saturable reactor dimmers for this system are available for 0.5, 1, 2, 3 or 5 kW maximum load. Type SR/803 3 kW maximum reactors can, however, only be fitted to the last four channels of each standard rack, and SR/805 5 kW maximum reactors for television requirements require a separate free-standing unit, due to their greater physical size.

The internal wiring of the dimmer rack connects the phase supply and the line to the tungsten lamp load to terminals 1-1 of each dimmer. A bridging cable is connected between two other like-numbered terminals on top of the reactor dimmer. Two thinner D.C. control wires are connected to the central terminals D and C. Each reactor is supplied with the bridging cable connected for optimum performance of the highest load range. If it is necessary to change the load range of any dimmer *switch off the equipment first* and change the bridging cable on top of the reactor dimmer to another pair of like-numbered terminals. *Balance between windings must be maintained by bridging like-numbered terminals.*



Saturable reactor dimmer and control amplifier connections

It is necessary to switch off the equipment and not just to trip the channel circuit breaker, as the potential of the control amplifier varies through 24 volts with the input from the control cabinet, and therefore they must not be shorted to each other or to earth (ground). Each plug-in control amplifier has a maximum gain of 500 and is aligned for the stated supply voltage. The two preset potentiometers on each amplifier are for this alignment and should not be altered except in accordance with the instructions given on the last pages of the Instruction Manual.

Ventilation of Dimmers

The control of lighting through dimmers involves some heat loss in the dimmer room. The ambient temperature should not exceed 35°C but 30°C is to be preferred because at this temperature the circuit and other wiring (not supplied with the equipment) do not have to be de-rated. Ventilation can usually be provided by a simple extract fan, or even by a natural draught. Where calculation is made 60 watts per channel is a convenient figure and diversity can in most circumstances be taken into account.

SYSTEM LC STANDARD MODELS

Equipment is available for 220/240- or 110/120-volt, 50- or 60-cycle single- or multi-phase supplies. It is essential to state the voltage and frequency in all communications.

Control Cabinets and Dimmer Racks

CATALOGUE TYPE	Number and maximum capacity of dimmer channels	CONTROL CABINET			DIMMER RACKS			
		Width ins.	Depth ins.	Height ins.	No. of Racks	Width ins.	Depth ins.	Height ins.
LCCR/48	{ 40 × 2 kW max. 8 × 3 kW max.*	36 (44)	16 (30)	72 (50‡)	2 × 24-way ...	64	19	66‡
LCCR/72	{ 60 × 2 kW max. 12 × 3 kW max.*	42 (56)	16 (30)	72 (50‡)	3 × 24-way ...	64	19	66‡
LCCR/96	{ 80 × 2 kW max. 16 × 3 kW max.*	54 (68)	16 (30)	72 (50‡)	4 × 24-way ...	64	19	66‡

Reactor Dimmers

Type SR/800	0.5 kW maximum load	Weight 17 lb.
Type SR/801	1 kW maximum load	Weight 29 lb.
Type SR/802	2 kW maximum load	Weight 63 lb.
*Type SR/803	3 kW maximum load	Weight 78 lb.
†Type SR/805	5 kW maximum load	Weight 135 lb.

* The last four channels of each dimmer rack can accept SR/803 3 kW max. reactor dimmers if specified at the time of order, otherwise 2 kW max.
† SR/805 5 kW reactor dimmers require the addition of a free-standing unit to substitute for a standard channel.

SYSTEM LC VARIATIONS

Available at the time of manufacture

- Substitution of dimmer rack capable of taking 3 kW reactor dimmers on any or all channels instead of on the last four channels only, rack width increased to 72 ins.
 - Addition of free-standing unit with contactor for a 5 kW reactor dimmer to substitute for a standard channel.
 - Addition of metal top and wire-mesh side covers for 220/240-volt range dimmer racks.
 - Addition of four switched-only accessory circuits consisting of four independent switches fitted to cabinet and a contactor unit fixed to left-hand side of No. 1 Dimmer Rack, increasing the width by 5 ins.
 - Omission of transistor control amplifiers when full complement of reactor dimmers not fitted initially.
 - Omission of one dimmer rack including transformer, power pack and 24 transistor amplifiers to effect initial economy. Cabinets always have provision for a full complement of dimmer levers.
 - Substitution of cabinet in desk form. Dimensions given in brackets in schedule.
 - Addition of switched-only channels for television requirements consisting of three-position switches fitted to cabinet and contactor unit(s) designed for mounting on top of a dimmer rack, increasing the height by 20 ins. Available in multiples of 18 × 2 kW, 24 × 2 kW or 6 × 5 kW units. The dimensions of the control cabinet are increased.
 - Spare transistor control amplifiers, a power transformer, a complete power pack unit or a power unit stabilizer sub-assembly are available, also the General Kit of Spares.
- When ordering spares quote the reference number on the sub-assembly.

INSTALLATION

During the installation of the dimmer racks provision must be made to prevent cable cuttings, metal swarf, etc. from falling inside the equipment and short-circuiting components.

The control cabinet should preferably be sited so that the operator will be able to see the acting area from the same point of view as the audience. In the theatre this demands a position in the auditorium but in a television studio a picture monitor is of greater importance than a direct view of the studio. Localised lighting of the controls should be provided—this should come from over the shoulder of the operator. Lighting controls cannot be successfully illuminated from immediately overhead. Where used in a room with a view through a glass window care should be taken that the glass is angled or the control so positioned that confusing reflections do not impede the operator's view in dark scenes.

Both the standard upright floor-standing cabinet and the desk version are provided with two rear removable panels and therefore the control wiring should enter the cabinet through a short length of flexible conduit to allow movement for access and inspection. The numbered and colour-coded control terminals are arranged in rows corresponding with the number of dimmer racks.

The dimmer racks should be sited as near to the various lamp loads as is practicable in order to avoid expensive cable runs at the lighting voltage. Although it is more usual to group dimmer racks together there is no necessity to do this. If racks are not installed in an area restricted to authorised electrical staff, covers will normally be required. Metallic conduits and trunkings should not be rigidly fixed to dimmer racks of this type as otherwise it would be possible for the slight A.C. hum to be amplified and transmitted to other parts of the building. The terminals for the connection of the tungsten lamp loads, for the control wiring, and for the incoming A.C. supply are all accessible from the front when the wire-mesh cover is removed and, therefore, the dimmer racks can be mounted against a wall. The sequence of the phase connection studs for the incoming supply is from the top left to the bottom right with the neutral connection at the top right. Where a dimmer rack does not require connection of three phases the studs are sometimes commoned on the front of the panel. *All dimmer racks must be earthed (grounded) to a common point.*

The control wiring requires a total of four three-core 70/0076* (15 amp) cables and two three-core 14/0076* cables between the control cabinet and two of the dimmer racks, and two 14/0076

* Increase cable size if over 200 ft. in length to avoid voltage drop.

cables between the cabinet and the rack for each dimmer channel. Each additional switched-only channel requires one 14/0076 cable between cabinet and contactor unit and one 23/0076 (5 amp) cable between the contactor unit and a dimmer rack.

Each dimmer rack is provided with a transformer and power pack unit. The control cabinet power supplies are obtained from two of these power packs. Where there are more than two racks these power supplies (connected by lettered terminals) should be obtained from rack 1 and rack 3. It is then necessary to connect rack 2 to rack 1 with 40/0076* (10 amp) cable and where applicable rack 4 to rack 3.

On each rack there are numbered and colour-coded (blue/orange for dimmer and yellow for switch) control terminals. A similar layout will be found in the control cabinet together with lettered terminals for the power supplies described above.

Interconnect between cabinet and No. 1 rack as follows:—

Using a three-core 70/0076* join A to A with red
join B to B with black
join E to E with green

Using a three-core 70/0076* join C to C with red
join D to D with black
join F to F with green

Using a three-core 14/0076* join G to G with red
join H to H with black
join J to J with green

Interconnect between cabinet and No. 2 rack (or No. 3 rack if more than two racks supplied) as described above.

If more than two racks supplied interconnect with 40/0076* cable:—

join E on rack 1 to E on rack 2
join E on rack 3 to E on rack 4 (where applicable)

Note: Terminals A, B, C, D, F, G, H and J are not used on racks not supplying the control cabinet with power supplies.

Interconnect between cabinet and corresponding dimmer racks:—

Using 12-core 14/0076 join like-numbered and -coloured terminals.

Note: The recommended sequence for 12-core cables is as follows: White, slate, brown, red, red/blue, red/white, pink, orange, yellow, blue, violet, black—then repeat for next cable.

If a switched-only contactor unit is provided its terminal L should be interconnected with terminal L on a dimmer rack with a 23/0076 (5 amp) cable.

OPERATION

Numbers in brackets refer to the photograph on page 5

To set up the control cabinet for normal operation first ensure that all the white and green dimmer levers (2 and 3) are down to zero and all the three-position switches (1 and 4) for each control channel are in the bottom position. On the master panel the Quick-fade switches (6) should be in the normal 'out' position; the red Transfer switches (7), All-fade (8) and Black-out (9) switches all should be in the normal central position, and all the master dimmers put to zero. Check that the equipment is switched on—this is shown by the two orange indicator lamps on the master panel. If at this stage there is a low level of light from any of the dimmer controlled lighting units this indicates that the load is outside the range of the dimmer. (See REACTOR DIMMERS AND TRANSISTOR AMPLIFIERS for range-changing procedure.) It may be difficult to identify the offending channel—if so the channels may be switched off individually by putting the upper three-position switch (1) to the mid 'off' position. Ensure that these switches are returned to the bottom position when the offending dimmer is found.

The first requirement of any new installation, or new production, is to light up the various control channels individually to check the setting, the focus and the colour of each lighting unit.

To Fade-in and Fade-out Channels Individually

Raise the white Master Dimmer Z to full. As all the three-position switches have previously been put to the bottom position all channels will be switched on and both the white and the green dimmer levers will be grouped to the Z pair of white and green master dimmers. Therefore, as the white master dimmer is at full when any white dimmer lever is moved above zero the corresponding lighting load will change to the intensity level set on that lever. Any channels not required for the production should be switched off by putting the upper three-position switch to the mid position.

When all the lighting units have been checked the next requirement will usually be to build-up, step by step, the lighting for each scene or picture. This is done by setting the dimmer levers as described above until the total lighting, and balance, for each scene has been determined. When the levels have been plotted fade the white Master Dimmer Z to zero and rehearse the timing of the fade-in of the channels collectively by raising the same master dimmer to full.

To Cross-fade from One Dimmer Preset to Another

While one set of dimmer levers determines the intensity levels of the lighting in use the duplicate levers are available for pre-

setting the levels required for the next scene. The pilot lights at the end of each row of levers provide a quick visual check of the levers which are energised. On cue the white and green master dimmers would be cross-faded to change control from one set of levers to the other. When one master dimmer is faded to zero and another raised to full always watch the visual effect as a perfect 'electrical' cross-fade may disregard the sluggish response of the larger projection lamp filaments. The arrangement of master dimmers allows subtle variations in the timing of cross-fades, for example, on some occasions it will be desirable for the new lighting to become effective before the previous lighting fades, at other times the reverse will apply.

In rehearsal the lighting will be built-up step by step as previously described but on alternate sets of levers. When the new lighting has been settled it is usually desirable that the previous lighting be restored and the cross-fade rehearsed. In a performance only occasionally will it be necessary to cross-fade from one set of levers to the duplicate set of levers. When there are a series of lighting changes in a short period, valuable time would be lost presetting levers. In fact, the use of a dimmer preset is only necessary when some of the lighting in use requires to be changed to different intermediate intensity levels. If the next lighting change is to be an addition to the previous lighting, a subtraction of some channels, or a fade to blackout, then there are grouping facilities provided by the amber switch which can be used to avoid a lot of resetting.

To Add One Group of Lighting to Another

Form another dimming group for the channels to be added by changing their amber three-position switches (4) to the top position. Raise the white (or green) Master Dimmer X to full and determine the intensity levels of the channels to be added by operating the white (or green) dimmer levers directly. Then fade the Master Dimmer X to zero and rehearse the timing of the addition by raising the same master dimmer to full. A third dimming group can be formed in the same manner by changing the amber three-position switches to the mid position and using either of the Y pair of master dimmers.

To Subtract One Group of Lighting from the Remainder

The channels which are to remain can be held on one dimming group with its master dimmer at full while another group is formed on another master dimmer which is also at full but will be faded to zero on cue.

To Cross-fade from One Group to Another

By cross-fading master dimmers it is possible to fade from one group to another group on the same or on the other preset. This former is invaluable wherever the action changes from one part of the acting area to another lit independently. In a tele-

vision studio adding the new group before subtracting the old permits a preview of the next scene.

To Quick-fade a Group of Lighting

When a group has to be faded to zero quicker than is convenient by rotating a master dimmer knob, use the associated Quick-fade switch instead. Unless the same cue is to be operated in reverse shortly afterwards it is prudent subsequently to fade the master dimmer to zero and restore the Quick-fade switch to its normal position. A Quick-fade switch can be used in reverse to switch on a group providing that the master dimmer has been brought up to full before the switch is returned to normal on cue.

To Quick-fade all Dimmer Channels to Zero

Use the All-fade switch and subsequently ensure that all master dimmers are at zero before restoring the All-fade switch to normal.

To Fade all Dimmer Channels to Zero

First determine which master dimmers are above zero. If there are only one or two, on cue fade them to zero. If there are more use the appropriate Transfer switches to couple two or more dimming groups to either the X or Z master dimmers, and then on cue fade the master dimmer(s) to zero.

To Switch Off a Group of Lighting

A Quick-fade switch can be used in conjunction with one of the six dimming groups or, if an instant cut is necessary, one of the Blackout masters can be used.

The provision of two forms of switching, Quick-fade and Blackout, requires some explanation because with correctly loaded reactor dimmers there seems very little visual difference.

The Blackout switches operate contactors in series with the load circuits and thus give an instant cut. There is no light at the lamp and no potential will be present in the load circuit if the lamp is unplugged. However, it is an inherent feature of all systems using a saturable reactor as a dimmer that the reactor, when unloaded, retains for some seconds a memory of its state at the time of unloading and a fleeting memory of the previous effect may show when the load is restored.

In practice this effect is usually of academic interest only and the vast majority of users of saturable reactor dimmers are quite unaware it exists. It is only in the rare instances in quick-fire revue or variety (vaudeville) where a number lit in blue instantly follows a brightly lit sketch which terminates in a blackout that precautions are likely to be needed. In these cases the All-fade or Quick-fade switches, which interrupt the control circuit not the load, should be used and the channels will be dimmed out to all intents and purposes instantly.

OPERATIONAL HINTS

When three-position switches are changed from the top to the bottom position this should be done with a decisive action in order to avoid any flicker.

Flash boxes, smoke boxes and other similar devices should never be fired from a circuit which includes a dimmer of any kind. Neither should they be fired from a remotely controlled circuit but should be under the control of someone as near to the device as is practical and with a direct view of it.