



ORIGINAL DDM
SYSTEM
PRE RSC

LIGHTING FOR ENTERTAINMENT

STAGE LIGHTING AND SYSTEM DDM

The common method of lighting today is the creation of a number of stage pictures each meticulously balanced and plotted. The changes between each represent a cue whose nature and timing has to be rehearsed. These pictures and cues are then improved in execution and content at subsequent rehearsals and finally go into the repertoire or the run for repeat performances.

This traditional approach ideally suits a dimmer memory system especially in the instant magnetic form available now but theatre is not a place for playing records whether sound or visual - mere repeats - it is a creative process. In this the lighting may have to be as "live" as all the rest. Indeed with some of today's production ideas of extemporisation and "participation" by the audience the man at the lighting control may have to play a part, in public, just as subject to the inspiration of the moment as the actor. He may indeed have to live on his wits to ensure that the show is lit at all let alone appropriately.

System DDM reconciles the two extremes - the exact and rehearsed on the one hand with the "free for all" on the other. Somewhere between the two lies the composition process and this is the time when, however disciplined the conduct of the rehearsal, flexibility and rapidity of response in the control is of untold value - with System DDM "the stage waits" no longer applies - as far as lighting is concerned.

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CONTENTS

- | | |
|--|--------------------------|
| 1. Use of Software | 8. Playback Controls |
| 2. Economic Sizes | 9. Operation of a Cue |
| 3. Basic Principles of Operation | 10. Speed Regulation |
| 4. The Controls | 11. Switching and Cut |
| 5. Channel Controls | 12. Use of two playbacks |
| 6. Numerical Selection
"Cue Select" | 13. Ergonomic Layout |
| 7. Memory Action | 14. Schedule of Controls |

1. USE OF SOFTWARE

While the "action" of system DDM is based on "software" namely an instructional programme fed into the computer instead of rigid circuitry joined together with a soldering iron or some equivalent, there is a great risk that this will lead to anarchy. Every blessed switchboard will be different and everyone who believes he has an idea for the good of mankind or merely a personal fancy can have it indulged in and add to the confusion. A confusion which would lead to a considerable training period before any new operator feels at home in the particular theatre installation. There has to be standardisation and the best agency for this at the moment would seem to be Rank Strand itself.

What the "software" approach confers, which rates way above the mixed blessing of being able to change one's mind, is the ability to specify ergonomic action completely divorced from the discipline imposed by the characteristics of the electrical and the electronic circuits which of practical necessity may have to be used. Until now a control system has always been a compromise between what one wanted to do and what the circuits economically would allow one to do. To design a lighting control it was necessary to be an engineer with knowledge of the techniques of the means to do it. With the use of full computer techniques, as in the case in System DDM, specification begins and ends in ergonomic terms. What does an operator need to be able to do it? What is it reasonable to expect him to be able to appraise and use as either the man lighting the show or his intermediary?

This last is very important. Although we cannot permit the control to require a Barenboim or an Ashkenazy to play upon it we have to recognise that any theatre requires the man at the control to bring something more to the actual working of the rehearsal and the show than mere hack operation. Use of the machine must stimulate and extend his interest so that he and the lighting he controls are a live part of a live show. If this is so in any theatre it is even more so in the kind of theatre which envisages spending the amount of money a first class dimmer memory system involves.

Thus it is that the control we are discussing and describing in these pages presents a paradox. It can record exactly each lighting picture and reproduce them as a series of crossfades one after the other in which literally only one control has to be used each time; yet any process can be

interrupted and any other course of action substituted with complete disregard of the state of the switchboard at the time. The machine itself makes all decisions necessary to ensure that the lighting changes occur without untoward interruption - they flow from one condition to another. System DDM combines at one and the same time dead accuracy with live vamping. Precision and improvisation are equally possible and can be combined at any time and in any proportion.

The controls enumerated and described herein express these intentions in practical form and this is being manufactured. It is suggested that, in view of the time scale, changes to them shall be confined to just those essential to make the result acceptable to the Royal Shakespeare theatre both operationally and physically. Once the control is working the result can be appraised, and thanks to the software approach, modifications made if necessary. Further changes could follow after a period of active working in the theatre.

2. ECONOMIC SIZES

The following description assumes that System DDM is based on a 120 channel 100 memory module but the actual figures need further consideration. Thus a 240 channel control consists of two identical systems working in tandem. While a very high degree of reliability is aimed at nevertheless this does carry the insurance that a major fault could afflict at most half the number of channels. It is suggested that to make the most of this insurance channels should be split odd numbers on one and evens on the other rather than as 1 to 120 and 121 to 240. Dimmer memories can be increased as multiples of 100 but because this includes 0 as a number this means that the top number is 99 or 199. The use of 0 itself as a memory number is not recommended as there is a certain advantage in using it for what ordinary mortals regard as nothing (i.e. no light at all) but the computer regards as a recording of zeros (i.e. lights at zero intensity).

3. BASIC PRINCIPLES OF OPERATION

System DDM is designed to be operated either as a completely flexible composing instrument or as a machine for exact reproduction of information already recorded. Roughly speaking the first corresponds to the rehearsal period and the second to public performance. In fact system DDM can combine these two methods of operation in any proportion required by circumstances. Thus it could be that a public one night stand without any rehearsal time would be vamped from end to end while a rehearsal on the other hand might consist of already recorded information either solo or in combination.

System DDM is provided with an individual control to every dimmer channel so that lighting can be adjusted to make up the picture or series of pictures to be recorded. These channel controls take the form of Rockers and dimmer function, indication and everything else of an individual nature is integrated in this special unit invented just for this purpose. Mode switches affecting all the rockers at one time further extend the services they can provide. A particular advantage of the rocker over the conventional dimmer lever is that while one can readily increase or decrease light by touching the top or the bottom it has no inherent positional quality. Thus it can take over and modify a channel without the need for the operator to match the control lever at all to the position of that channel at the time of take-over.

A stage picture once set can be recorded in the magnetic store; this can be thought of as filing under a reference number. The process is virtually instantaneous both in recording and subsequent playback so the term "memory" is used. A form of Numerical selector is used to start a sequence or to break it but it is not necessary to use these in normal progression from one number to the next. Separate indicator windows display both the number last recorded and that in playback.

The means of playback takes the form of a set of master push buttons providing RAISE, DIM, CROSSFADE, CUT IN or CUT OUT in respect of these memory numbers. Thus the lighting represented by a particular memory can be added to, be subtracted from or can replace the lighting, if any, existing on the stage. The rate at which this happens is governed by an adjustable speed regulator while corresponding indicators

-4-

show the progress of the change.

Any procedure can be interrupted and/or another substituted at any time both at individual channel level and at master level. The various controls to be provided and their operation is now described in detail.

4. THE CONTROLS

There are three distinct types of control function in the dimmer memory system DDM (a) The Channel Controls to create the stage lighting pictures using the dimmers in the first place and subsequently to modify them at any time. (b) The Numerical Selection controls to enable each picture to be recorded (filed) under a reference (cue) number and subsequently selected for playback. (c) The Master Controls which determine what is to be done with the picture selected for playback. Shall it be added to that already on the stage or substituted and at what rate of speed?

All controls can be mounted on one desk but if preferred the channel controls can form a quite separate wing unit on one side or split either side in a formation resembling the stop jambs of an orthodox organ console.

5. CHANNEL CONTROLS

These are completely differentiated from all others. They take the form of a centre stable Rocker tablet which in effect integrates three push buttons and three pilot lamps as one unit mounting at $\frac{3}{4}$ inch horizontal centres and 3 inch vertical. The top of the rocker is available for the engraving of any supplementary information if desired, for example:- FOH, Flys, Dips or something of the sort: the bottom carries the channel number.

Touching the top of the rocker raises the channel dimmer and the bottom lowers it. In both cases removal of the finger stops the process instantly. The action is monitored by a green pilot lamp inside the top. This comes on at half light for all intermediate dimmer levels and at full when the channel is full on - no further gain being possible. The completion of the reverse process to out is indicated by extinction of the lamp. Precise information is given on the CHANNEL DIAL. Whenever a

channel rocker is touched the dial monitors that particular dimmer position. If several are held under the fingers to travel simultaneously, perhaps in conflicting directions, then the one actually touched first takes precedence on the dial. The position of particular channel dimmers can be ascertained without movement by using the push button in the centre of the rocker.

The fact that excellent provision is made for monitoring and reading the position of dimmers on a large scale dead-beat meter must not be allowed to suggest that in practice this will be much used. In a full dimmer memory system, such as DDM, where the operator has neither to write down nor read a plot this exact information is but of very occasional interest. The computer looks after all that, what the operator and/or lighting designer will find himself concentrating on is the effect on the stage in purely visual terms.

Associated with the channel rockers are certain MODE controls. These qualify or alter the function of the rockers. Most obvious is the SPEED control. This consists of twin linear potentiometers. That on the left regulates the time dimmers will take when operated manually from the rockers to "travel" from zero to full or vice versa. The range of speed is from instantaneous (top) to 30 secs (bottom). At instantaneous speed (i.e. switching) it becomes desirable to be able to limit dimmer travel and in consequence the second potentiometer is automatically brought in. This enables the level to which the channel or channels are switched to be precisely determined. Movement of this control, known as TOP SET, while a rocker or rockers are held will cause the channel(s) to function exactly as if they were worked from a normal switchboard dimmer lever.

As under these circumstances the top of the rocker switches in the dimmer instantaneously, touching the bottom will switch it out. A luminous sign indicator appears immediately under the channel dial in which the word SPEED or TOP SET reminds the operator at a glance whether touching rockers will give a gradual or an instantaneous change without the need for him to carefully examine the position of the twin potentiometers.

There is an amber warning lamp in the centre push of each rocker which lights whenever a rocker is used to modify a memory in playback. Return of the channel to the level prior to modification or re-recording removes this warning. The lamp and push are also used as part of AUTO MOD (q.v.).

A second mode switch in rotary form enables the rockers to control dimmers in association with the RED PLAYBACK system (q.v.) instead of with the GREEN system as is normal. The red lamps are in the bottom section of the rockers and the green in the top enabling both to be displayed simultaneously without confusion when necessary. The extreme anti-clockwise position of this mode switch provides GREEN control, the second notch RED control and the third FLASH and AUTO-MOD combined. This last is a special function which is described under AUTO-MOD later on.

The use of the rockers for other purposes in addition to channel dimmer control is as far as operation is concerned only a matter of adding further stations on the rotary mode switch. It could have notches for lantern pan, tilt and focus also colour filter change. This subject is treated more fully under "Other Control Possibilities" below.

A third mode control known as the DISPLAY MODE, more frequently used, takes the form of a three position sprung-centre switch. In its normal "centre" position the rockers display and operate the lighting ON STAGE. Held in the bottom position the display and operation is of the lighting in the "NEW" store and in the top position in the CUT store. These functions will become clearer in the Playback section below.

6. NUMERICAL SELECTION "CUE SELECT"

A set of luminous push buttons is provided to enable the requisite range of numbers to be selected for filing in, or obtaining for playback from, the memory. These are arranged in columns for units, tens and where applicable hundreds. In addition there is a black non-luminous CANCEL push.

To provide the computer with a message all columns must be occupied. Thus "one" displays as "001". Use of the digits column automatically sets zeros in the other columns. Any push when used substitutes its number for any other which may be already selected in its own column.

Associated with numerical selections are three luminous indicator windows, for RECORD, GREEN PLAYBACK and RED PLAYBACK respectively. The numbers can be shown in these against black, green, red or amber backgrounds as described later. Each time a number is used it is automatically cancelled, the lights being

extinguished at the pushes. Selection of numbers in this way is only necessary to start a sequence or when breaking it to go back or to jump well ahead. Except when using the special CUT pushes the Next number is usually obtained by inching-on with the NEXT control which forms part of each playback. Should an operator inadvertently select a wrong number on the numerical pushes it can either be changed by immediately selecting the correct one or cleared without using it by pressing the CANCEL push. (Alternative: if preferred the numerical selector can take the form of an eleven push Bell telephone type selector in which case there is an extra indicator window so that the number is checked before actual use, there being no visual indication at the pushes themselves in that type).

7. MEMORY ACTION

The memory controls consist of an indicator window displaying numbers against either a black or amber ground. Under this is a sprung centre switch. Pushed down this takes the number off the numerical selectors (if alight), records the stage picture against it and puts it in the window against an amber ground indicating that it has been so used.

If however that memory number is already occupied with a recorded picture the number appears against a black ground and an audible warning is sounded to give the operator a chance to have second thoughts. Pushing the switch down a second time removes the inhibition, recording takes place and the amber background appears. Pushing the switch up inches the number in the window up one at a time but always with a black ground (a process known as Next-ing). When pulled down at any time it records subject only to the inhibitory action as before. Use of the switch to record without selecting any new number and in consequence the amber background is already present will both remove this to leave that number against a black ground and sound the warning.

The RECORD switch puts into the instant memory system the complete lighting picture as present on the stage at the time. If there is no light then it will be remembered as no light i.e. the memory set to zeros. A memory with zeros throughout is of course considered "free" and sounds no warning.

The GREEN and the RED PLAYBACK systems have a record push under their windows, which is referred to as RE-RECORD because this is its commoner use. When pressed it records the contribution of that master system only to the stage. Any attenuation because the NEW master has not been brought to full will be recorded as attenuated. Whether the BLACKOUT control is on or off is however ignored both by RECORD and RE-RECORD thus making it possible to set up memories without disturbing the stage.

The number in the playback window will be used when re-recording whether it has a coloured background or not. If however a number is displayed on the numerical selectors, this will be taken over for recording instead and that number put in the playback window. However the background will be black showing that the particular number has not necessarily been recalled as lighting in fact. Indication that recording has taken place when using these individual playback re-record facilities is given by an amber light appearing in the push itself. As soon as the number in the window is changed from that actually used to record or re-record the amber light is extinguished.

The levels of the channels will be recorded as a 6-bit word giving an accuracy of $1\frac{1}{2}\%$. The playback controls will act linearly and are continuously progressive. A keyswitch lock will be provided to prevent unauthorised recording. A memory clearing switch can be provided if desired but this could be rather dangerous. An alternative not requiring any special equipment is for the operator to record zeros one memory at a time using NEXT - a rather usefully deliberate action. The need to clear memories to nothing is debatable; it could be irritating when manually recording to have to keep disregarding the warning bleep - one might come to disregard it once too often. When automatic tape cassette re-programming is used no such problem exists.

8. PLAYBACK CONTROLS

Either the Green or the Red playback system can be used in exactly the same way, the only difference being in the colour of the display at the channel rockers and elsewhere.

Each playback system has a numerical display window and a set of controls. Associated with each is a store referred to as the NEW. There is in fact another store in which the state of lighting at the time of initiating a new cue is automatically parked as a holding action. The operator ignores this store completely. The computer alone decides when to use it (i.e. when to hold channels in there or remove them) in order to fulfil the particular operational instruction given it.

The Playback controls provide sustained functions or "actions" so that the operator then only rides the SPEED regulators to get the timing right. An action decision is made and then the tempo is varied to provide the vamped element of a cue - to tie in with the human goings on to be seen on the stage.

The action push buttons to each playback system are:-

NEXT Memory Number (ADDITIONAL)

NEXT " " (Substitute)

CROSSFADE (subject to both Raise and Dim speeds)

RAISE (subject to Raise speed)

DIM (subject to Dim speed)

REVERSE (return to "as you were" for all above)

INSTANTANEOUS (temporarily cuts out both raise and dim speeds)

CROSSFADE has a positive relation to a memory. It will, unless interrupted at an intermediate position, take channel dimmers proportionately to their recorded levels, hold those for which no change is recorded and remove all others.

RAISE will bring in channels to their recorded levels but in the case of channels which are already in use it will be the higher level which will take precedence. Where channels are already at higher levels there will be no change. Movement to higher levels is proportional not sequential, i.e. in the case of a cue in which channel 'X' is to increase from 0 to 50% and channel 'Y' from 70% to 80% both actions begin at the same time but of course 'X' will change at a faster rate than 'Y' but not arrive at its destination at an earlier time. Should a pile cue of the type commonly carried out on orthodox preset controls be required, the Red and Green Playback systems are used together. In the case of the above use example, channel 'X' would then change before channel 'Y'.

Use of the CROSSFADE, RAISE or DIM push buttons automatically reads the memory using the number in the window or at the Numerical Selector and the computer decides what to do with the information in order to carry out that instruction.

DIM has to use the memory in a different way it discards the positional information and uses it only to identify the channels. In all cases the existing stage lighting state at the time of starting a new cue is automatically stored (parked) until such time as an operational instruction to the computer requires use of it.

9. OPERATION OF CUES The process of operating lighting cues as distinct from composing them, begins by selecting a number. This has to be put in the playback window by using the NEXT push buttons. Either the Numerical Selectors are used and the NEXT push takes that number or the push is used on its own to inch up numbers one at a time until the number required appears. In either case the number will have a black ground and the selection of it will not interrupt the progress of the previous cue on that master.

Two NEXT pushes are provided, the left hand one is used when a memory number is to be substituted i.e. is to be taken solo and operated exactly as described. The right hand is used when the memory number is to be added to others. In this case the contents of a number of memories can be added together (highest levels in any common channels taking precedence) before a cue is initiated. Where this is done the ADD NEXT push lights up internally and remains illuminated until the NEXT push is pressed to obtain a memory solo; the window will show the last number added. ADD NEXT trips the CROSSFADE, RAISE, DIM and REVERSE controls also their sign indicator, whereas NEXT does not. To obtain a preview of the contents of memories, whether solo or added, and then modify them the 3-way Display mode switch is used.

The memory number or numbers once selected the required action push is pressed; this lights internally and in addition lights the indicator sign to show CROSSFADE RAISE and DIM as appropriate. It also puts a green background behind the memory number. (N.B. the green background will already be there if ADD NEXT had been used to add memories). Completion

of the action extinguishes the light in the push but leaves the Indicator sign and also the green background to the memory number. A new number removes the latter and use of another action push changes the sign. The rate of change is shown on a dial just above the speed control. For RAISE and CROSSFADE the dial reads from 0 to 10 but for DIM the needle runs from 10 to 0. REVERSE in each of the above three actions initiates a return to the condition before the particular push was pressed. It follows therefore that pressing the REVERSE push before an action push has been used can do nothing whatever. Because this is so the push will neither light up when touched nor will it put a green background in the window. Once the green background has been put there by any one of the three action pushes, whether the action itself is complete or not (or still in progress or not) the REVERSE push will extinguish the action push and light up itself until the reverse is completed.

The effect of REVERSE in the case of CROSSFADE, RAISE and DIM is to return the stage lighting to exactly the state before the particular push was pressed.

So long as a green background appears in the memory number window the REVERSE push will be able to take effect. This will often be in respect of a just completed action and in consequence no action push is alight but the sign indicator with the name of the last action will be, as a reminder to the operator as to what it was. Completion of the reversal extinguishes the light in the REVERSE push but only initiation of a different action will alter the sign indicator. A reverse action like any other can be interrupted or stopped.

All actions except Cuts are influenced by the SPEED control (q.v.) but as an operational precaution the speed when in full top position is one sec. not instantaneous. Thus obviating the risk of the operator running inadvertently from a dimming cue into a switching one. Use of the INSTANT push will provide an instantaneous switching when required, see Switching and Cut. As to what channels switch in to an increased and what to a decreased level or to out will be entirely governed by the lighting effect recorded on the memory used.

10. SPEED REGULATION

Since we are dealing with electronic timing devices anything is possible in range, the difficulties are purely ergonomic. The problem is to provide something convenient for the operator particularly so that he can carry out the all-important riding of the speed in order to align the completion of a cue with the action on the stage. The more complicated the arrangements the less likely he will be to bring that off. Outside opera very slow changes are more bother than they are worth. It is very difficult to gather from rehearsal or indeed one performance with another whether a change of 20 minutes is really going to play 18 or 22. Further to get even the theoretical time right the lever has to be set with fiendish accuracy each half division representing, as it does, one minute!

Concentration should be on obtaining the ideal scale of speed for normal dimming changes and to these an adjustable slowness factor can be added by push button. As a basis for discussion it is suggested that the eleven full divisions of a standard Rank Strand quadrant lever should each represent roughly half as much again as its predecessor. Thus at the top we get 1 sec and the bottom 60 secs. The SLOW push when engaged would multiply the duration by a factor of ten. Thus the top is 10 secs and the bottom 10 minutes.

A single control could be sited in a secondary area so that the factor can be altered when necessary. Since the control is dealing with speed of, not travel position of, the master a series of decisive notches on the regulator may have advantages over a continuously variable regulator. There would be then 21 contacts i.e. nineteen intermediate steps between 1 sec and 60 secs. It is proposed to reserve the fastest speed (instantaneous) for the various CUT pushes, BLACKOUT and TOP SET so that all risk of riding from a speed condition to a switching one is obviated. One sec has sufficient lag cushion effect still to be able to call it dimming.

There will be a twin linear lever to each playback. Where there are two playbacks the second pair will be mounted adjacent to the other so that all four can be regulated together by one hand if necessary. The right hand of each pair concerns channels which are increasing in intensity, the left hand those decreasing. Thus CROSSFADE concerns both speeds at once but

RAISE only the right hand lever and DIM the left hand. The master panel layout leaves a certain amount of extra space in the speed area so that there is freedom of choice in the type of fader to be adopted. It should be remembered however that this is speed regulation and not positional regulation and in consequence fader performance is far less critical. In positional regulation every little jerk and uncertainty is directly conveyed to the lighting whereas in this case it is not.

11. SWITCHING AND CUT

The three pushes CROSSFADE, RAISE and DIM can be made to operate as switching functions by pressing the INSTANT push alongside at the same time. This overrides the speed which then immediately reverts to normal when released.

In addition there is an auxiliary cut store which can be used to pile switching cues on the Green playback without interrupting long duration changes. In theatre installations whether of the single or double playback type there is only one cut store. For television there are always two playbacks and two cut stores.

For the Cut store there are two pushes CUT-IN and CUT-OUT and they obtain their memory number direct from the CUE SELECTOR. The CUT-IN lights up itself, switches on the channels to the level of the memory and puts the number against a red ground in the Green window. The green function already going on is not interrupted and both that number and the display of its content (for individual rocker modification if necessary) will appear if the Display mode switch is held down.

Further memories can be switched-in by selecting and operating CUT-IN. (The effect being similar to continued use of RAISE). Memories can be switched-out either by selecting a specific number for the purpose and pressing the CUT-OUT in which case just the content of that particular memory will be tripped or by simply pressing the CUT-OUT without selection whereupon the entire content of the Cut store will be tripped. In the first case the light in the CUT-IN push will not be extinguished until the store is completely clear. However the window will revert to its normal action Green number whenever CUT-OUT is used. Thus to Cut-In and Cut-Out a single memory it is only necessary to select a number for the first purpose and subsequently trip it by pressing CUT-OUT. However a whole

series of switching cues can be put in one by one and taken out specifically by selecting their numbers while the actors leap unpredictably from "prop" fitting to "prop" fitting trying to catch out the operator at the control. In this kind of situation the memories would be given numbers in the units column only and only one selector push would then need to be pressed in each case since the computer would put in the zeros for the tens and hundreds. (In television, provision for automatic effects such as flashing signs, if required, would be added to the controls of the Cut-stores.)

As an example of this special operation a Crossfade to give a sunset to take 5 mins is in progress with cue 10 in the window against a green ground. The Cut number (11) is selected, the CUT-IN is pressed, the lighting switches in on the stage and the number 11 appears against a red ground in the window. The crossfade continues undisturbed without any further action on the part of the operator. Its progress is still shown by the light in the CROSSFADE push and the dial movement.

The number of the crossfade memory (10) has been lost from the window but this can be recovered temporarily as a reminder by using the Display mode switch to examine the New store. If the CROSSFADE push is touched while still alight when a number, in this case 11, is appearing against a red ground in the green window the push being reversible will go out and the crossfade stop. Touch it again and it will continue as before i.e. memory 10 since CROSSFADE, RAISE and DIM will ignore any number with a red ground in the playback window. The number belonging to the Cut will remain with its red ground until a new number is selected and Cut-In. The Cut with cue 11 can be switched out by using the CUT-OUT push, further Cut cue numbers selected and Cut-In or Out without disturbing the progress of cue 10.

The above arrangement assumes that a Cut differs from Raise or Dim in the fact that is likely to be piled with a sustained slow cue. Neither the Cut nor the continued action in progress interfere with each other but a change to a totally different cue on that playback, represented by a new green background number, can and indeed must. It would be a bad thing for a Cut of any kind to be left stranded high and dry unaffected by any general stage crossfades and fadeouts which might follow.

Therefore as soon as a new cue number is set in action (Raise, Dim or Crossfade) and a green background appears the content of the Cut store is parked and becomes an integral part of the stage lighting picture which will be affected or not by the cue change or changes as memorised that follow. To prevent this trip action deliberately the CUT-IN push must be held down manually while using other action pushes.

Red Cut-in levels are piled with the levels of the normal Green change in progress highest taking effect. Thus channels which are common to both a lighting fittings cue and a dawn will continue to grow as they would in nature until the daylight overtakes the artificial light. Reversal of the Cut-In cue by touching the CUT-OUT push may by that time only have the prop. lighting fitting itself to kill.

On two playback systems the Green and Red playbacks can be used simultaneously. The dawn taking place on the one and the Cuts on the other. This will still ensure the appropriate swamping action in respect of those channels which are common to both the switching cues and the dawn cues. It is of course possible to imagine a series of dimmer changes going on using both the Green playback and the Red playback with all four regulators set to different speeds. On top of this switching cues could be superimposed using the Cut store but such virtuosity is a far cry from the essential simplicity of the dimmer memory system.

12. SECOND PLAYBACK

This is brought in by turning the rotary mode switch to Red. The channel rockers then operate the dimmers through a red store and the result is displayed as a red lamp at the bottom of the rocker. No light, half light, and full light as with the green. While in the Red mode the pushes in the centre of the rockers will read the position on the Dial in respect of that store.

It is of course possible at any time, whether the rotary mode switch is used or not to initiate a Red playback action by simply using its controls instead of those of the normal Green playback. The two playbacks are quite separate and only meet so to speak at the channel dimmers at one end and at the channel

rockers at the other: both of which they share. In television, Green controlled and Red controlled channels are less likely to be in common play - part of the same effect - than in the theatre. In television Green and Red playback areas of the studio will mainly represent separate areas viewed by separate cameras -

stages or theatres almost - and common lights will be rare. Because they are likely to be used quite independently - each playback will be complete in a television version of system DDM.

In theatre the concern is with one stage, all of which is viewed by the audience at the same time and the amount of independence allowed to one playback from another has to be carefully considered and restricted otherwise it can set traps and demand an unnecessary amount of operator virtuosity at times of critical action. He should not find himself playing two switchboards at once!

There are two obvious uses of the Red playback:- firstly the recording of memories in advance under cover of the Red Blackout while lighting is held on the stage from the Green Playback; secondly the independent playing of two action areas in the theatre, rather like television practice but of course in this case the audience sees both at once. This could be done on one playback only, by adroit calling up of memory numbers especially as any process can be interrupted by, or combined with, any other when the appropriate action controls and/or memory add are used.

However it may be convenient to use the two playbacks quite separately for a time anyway - after all they are there. To get from this into normal single playback condition it will only be necessary to press "O" in the units column of CUE SELECT and CROSSFADE on the Red Playback. This will remove all Red contribution but whether this is done before, after or during a Green change would depend on the nature of the lighting cue.

When one blackout push is "on" (i.e. showing white warning light with no-light from that source on the stage) the channel rockers if so indicated by the mode switch modify or read that one playback only. Thus combinations of lighting can be preset using TOP-SET, for example, and put on memories without affecting the stage lighting. Under other circumstances, including when both blackouts are "on" the channel rockers will affect both

playbacks so that lighting on the stage is bound to be modified thereby.

This means that the operator requiring to modify a particular channel on stage does not have to concern himself whether a rocker is showing a green, or red, or green and red display. Pressure at the top will increase light and at the bottom decrease it. The system has automatically to take into account that the green contribution and red contribution may not match at the time. For example the green might be at 70% and the Red at 15%. When two playbacks are in use at the same time the result is piled so it is a case of "highest" namely 70% and operation from this latter level will be immediate and the two levels will automatically be lined up on this value and thereafter both act effectively as one.

13. ERGONOMIC LAYOUT (See photographs)

Accompanying this description of the DDM controls is a photograph showing suggested master panel layout and another of a channel wing layout. The latter shows a proposal for 120 channels and assumes that it will be mounted on the left of the master panel or near vertical as a wing unit; in which case double the number of channels could easily be accommodated. In very large installations or where it is preferred, there could be two wing units (one either side of the master panel) and the dial panel part would be repeated on each but opposite handed.

The master panel shown in the photograph aims to keep the number of controls down and arrange them so that they convey their function and relationship with the minimum labelling. There are four distinct functional areas. The first is the Memory at the top left, followed to its right by the Green Playback and then the Red Playback both of which occupy the entire vertical height of the panel. Bottom left is the numerical selector area common to the other three.

Along the top are the all-important numerical display windows reminding the operator that he is in fact dealing with a memory system no matter how much vamping and ad-libbing the show may require at the time. To the left at the top is the memory recording number with the Next/Record centre sprung switch below. Below that are the luminous numerical selector pushes for starting or breaking memory number sequence anywhere on the control.

This area would be occupied by the alternative eleven push call-up system if preferred, in which case there will be an extra indicator window to allow the operator to confirm that he has selected the right number before he actually makes use of it. This would be smaller than the others to avoid confusion. The system shown in the photograph is self confirming since the push buttons used to select the numbers light up when pressed. The number displayed in this manner can be cancelled if not required by pressing the black "0" push alongside.

Immediately under the numerical display windows to the playbacks are three useful pushes which nevertheless are capable of making a nuisance of themselves if accidentally touched. They are therefore kept up there well out of the way. RECORD (Amber luminous) is on the left. In the centre is BLACKOUT (Reversible and luminous to warn when it is in use). On the right is CANCEL ("0" on black non-luminous and non-reversible to wipe playback clear but not the memory store.)

Below this comes the sign indicator to repeat the action initiated on the group of action push buttons directly below.

The top two of these are concerned with obtaining the Next memory number either solo by means of the black push or additional by the coloured push. Once more than one memory is called up at the same time this latter lights internally. Unless there is a number shown on the "cue select" push buttons the number called will be the next after that already in the window. Any amount of "nexting" can be carried out before using a number. This number appears in the window above.

To use the content filed under a memory number a decision must be made to RAISE the channels comprising it, to Raise them and Dim the remainder (i.e. CROSSFADE), or only to DIM them. The two pushes concerned with a missing action are placed side by side and the DIM push below. The push to REVERSE any action is alongside that. All action pushes are "on-off" or "off-on" each time they are touched and in consequence the same push can be used to start an action as to stop it, the internal lamp showing whether it is active at the time. Continuity of indication is provided by a repeater sign.

These actions can be turned into switching ones by holding down the black INSTANT push immediately adjacent. Alternatively the dimming speed can be regulated by the linear levers. These are grouped together so that all four (a pair to each playback) can be operated together by one hand. The pair of levers enables a different speed to be chosen for the increasing and decreasing channels, for example, of the crossfade. These levers are positioned clear so that none of the fingers of the hand resting on them can activate one of the action pushes involuntarily. Both the levers and the action pushes are intended for use by the operator without the need to look down at them. Over the speed levers are the "X" pushes to multiply the duration of a lighting change while above them is a dial to show the progress of a change on each playback. The "X" pushes light up in the colour of the playback i.e. green or red.

The playback dial, the sign indicator and the memory number display window constitute vital information which needs to be taken in at a glance. To ensure this they are positioned on the top half of the panel well clear of obstruction by the operator's hands and arms in most of the actions he regularly undertakes.

The simplest and commonest of these will concern the NEXT and CROSSFADE to obtain progressively the next memory and then substitute its lighting effect for that already in use. To facilitate this the two pushes are placed together, one immediately over the other and may well be the only two used in an entire production (subject only to the occasional alteration of the speed regulator), although it has in fact a plot of many cues.

The Green playback (both playbacks in a TV model) has two extra push buttons CUT-IN and CUT-OUT. These are placed to one side towards the CUE SELECT pushes though still below and obviously influenced by the Green Playback window. This is because they do not obtain their memory numbers from the NEXT and ADD NEXT pushes ^{but} from the CUE SELECT numerical pushes only. Cut or Switching cues can always be performed by using RAISE, CROSSFADE or DIM along with the INSTANT (Speed) push and will in general be better done that way. The connection between INSTANT and switching is also indicated by placing its push in vertical line with the CUT pushes. The specific Cut pushes are intended as an auxiliary when it is

convenient to operate a number of switching cues at any time within a sustained cue. The splitting up into, and recording for separate call-up of, a number of memories representing several combinational variations can be avoided. That it is an accessory within a playback is emphasised by the sharing of the green display window and not providing a sign indicator. Thus many switching cues may be performed during a slow change. That these are happening is shown both by the CUT push and the unusual red background in the Green window but as soon as a new number appears in the window with a green ground then the operator receives an indication that the playback has reverted to normal.

AUTO MOD

This is rather a luxury for theatres but in the case of TV however it is essential. Certain rogue channels (i.e. lamp out of position or wrong lamp plugged up) have to be marked so that whenever a memory includes any of them they go to the level of the Auto mod instead of the one recorded - in the theatre this is likely to be zero but in TV could be any level. Procedure will be:- set rotary mode switch in extreme clockwise position. Set channel to required new level using TOP SET whereupon amber lamp in push lights up to show the usual unrecorded - mod condition. Once the rotary mode switch is moved off this position the condition is locked and both the modification and the indication of it will appear every time a memory brings in that particular channel. It can only be unlocked by removing the mod or re-recording when the Mode switch is put again in the Auto mod position.

SUMMARY OF BDM CONTROLS

(see separate sheet)

SUMMARY OF DDM CONTROLS AUGUST 28th 1970

Square luminous Pushes reversible on-off and off-on to start and stop except where otherwise stated.

GREEN PLAYBACK Numerical indicator to show Black or Green background with Red for Cut cue numbers. Items grouped as below:

ADD NEXT White Number next-ed and added on green ground.

NEXT Black " " " substituted on black " .

(Repeat use of NEXT inches-on to skip numbers; ADD NEXT adds memory and lights up when two or more are added. Highest content will be effective.)

CROSSFADE Green Memory levels substituted: green ground

RAISE " " " add highest: " "

DIM " " channels to out: " "

REVERSE " As-you-were " "

(All subject to speed control. Lights in pushes reversible to stop also tripped at completion or by another push. Movement shown on dial. REVERSE will not latch unless green ground is present. Sign repeater to each green push only tripped by use of another.)

SPEED RAISE twin lever Range from 1 sec. to 1 min. normal.

" DIM

INSTANT black Instantaneous speed while held

(X factor switch-in by green reversible push over each lever. Factor adjustable, say 5X to 20X, for all four as a whole i.e. Red playback as well.)

CUT-IN Red Memory levels instantly add highest: red ground

CUT-OUT " " " " tripped: green "

(CUT-IN is non-reversible. Red ground, number and all content tripped by CUT-OUT unless restricted by calling specific number. CUT-IN push luminous but not CUT-OUT. CUT-IN and content also tripped by any green push unless manually held. Cue select for Cuts from numerical pushes only.)

BLACKOUT Green Reversible mainly used to set memories

CANCEL ("O") Black Non-reversible; clears all except memory and number.

RED PLAYBACK Exact repeat of the above but for Green substitute Red. The controls of the one system do not interfere with the other except that memory content is shared. There is no special Cut store or controls on the Red Playback (Unless it is a television installation.)

RECORD SYSTEM

CUE SELECT White Number range as required

(Numerical selection right to left automatically adds zeros. The memory number takes precedence anywhere but is tripped on adoption. Used only to start a series or break sequence except in Cut.)

Record Indicator Black or Amber background to number

NEXT Push up for next, down to Record. Audible warning if number engaged (removes amber background if already there). Second attempt overrides and gives amber ground.

RECORD Sprung switch

(Records the lighting picture on stage but unaffected by Blackout.)

Re-RECORD Amber pushes Light after recording; trip when number put in window. Will not record when black ground present.

(Records contribution to stage of either Playback, ignores BLACKOUT).

Channel System

"Raise" Rocker Green lamp in top, Red in bottom, Amber push

"Lower"

"Stop"

(Channel modification affects lighting on stage but can be restricted by mode switches below. Half light indication for levels other than full or off. Modification lights amber while relevant. Re-recording or return to original position removes this.)

"Dial" Monitors channel dimmers. Also indicates from rocker centre push.

TOPSET
SPEED twin lever Range from 30 secs. to instantaneous which latter brings in TOP SET. Sign repeater under dial.

CUT
STAGE
NEW Mode switch Displays on-stage content in rockers. Pushed up displays content of Cut store at Rockers and number on red ground. Pushed down does same for New Store but green number.

GREEN/RED/
AUTO MOD Mode switch Anti-clockwise (normal) gives Green Playback then red. Clockwise gives Flash/Auto-Mod.

