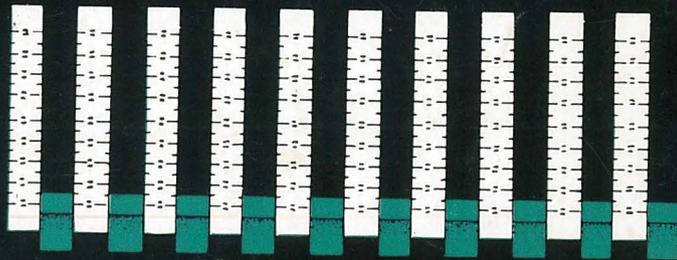




DDM/RSC CONTROL SYSTEM

SPECIFICATION

18th June 1971



RANK STRAND ELECTRIC LIMITED

ROYAL SHAKESPEARE THEATRE

Stratford-upon-Avon

System DDM Computer Controlled Dimmer Memory

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INTRODUCTION

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 these pictures 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.

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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

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may have 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 Contents 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 control is of untold value - with System DDM the control applies - as far as lighting is concerned. Appendix B - Tape repertoire programmer

Part I Operational facilities:

Main Control Desk

Appendix A - Stalls Control

Appendix B - Tape repertoire programmer

FPB/1/9/1970

Part II Equipment

REVISION AS AT JUNE 14/1971

The present specification is a revised and amended version of that dated 1/9/70. These revisions and additions arise from use of, and discussions held around the 240 channel full-sized DDM equipment. The specification is still subject to amendment on points of detail and this particularly applies to the form the Stalls Control and the Standby Control should take. It is not intended from now on that the various wogs shall be incorporated in the DDM as they occur to us but rather that a further revision of this specification shall take place in the next two or three weeks so that the computer programming can be re-written and checked and such items of hardware added or designed and manufactured as necessary.

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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.

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SOFTWARE AND SYSTEM DDM (1)

System DDM can rightly be claimed to be the first of a new generation of controls. It represents a change just as fundamental as that of the introduction of remote control, of dimmer presetting, of group memory, and of instant dimmer memory. It is not at first glance easy to see the fundamental change system DDM represents. It has dimmer memory, the ability to fade in and out different groups, vary the rates or even interrupt a change. The key to the DDM is that it is a computer control - a real one not just a glib publicity use of the expression. Of course the word "computer" carries with it tales of sensational inaccuracies - gasbills to the gasless, extra noughts on bills and bank overdrafts - in fact these newsworthy tales get less and less while what computers do accurately day by day grows more and more enormous. Further computers do for us what we cannot do for ourselves.

This last is the reason for using a computer as the heart of Rank Strand Electric's latest lighting control. The use of a fully computerised system allows us to perform operational routines impossible when as hitherto we have been tied to the characteristics dictated by mechanics or electronics. All lighting controls until now have been largely inspired by what they were built of permitted us to do. A fully computerised system literally allows us to tell the equipment what to do. The telling takes the form of a programme fed into the computer.

This part of the computer is known as the software and Rank Strand DDM is a software machine. Every function can be precisely determined by the needs of the lighting itself. This both permits and demands a re-think of what we expect a modern lighting control to do. We have so to speak got used to lighting controls functioning in certain ways. It could be that there is no logic in some of those things we expect a control to do. They have merely become a habit. Rank Strand System DDM in its present form represents thinking by the

THE PRESENT SPECIFICATION (2)

present author as modified by several discussions with the users of one theatre only. It could be that lighting development in the next years, coupled with the use of such a flexible machine, will indicate modifications to the original programme or even some fundamental changes. Since the whole system is held together as an entity by a software programme this can be rewritten and revised in the light of experience. The provision of extra or different push buttons and controls at the desk is a small matter representing at its most extreme a new panel. The software programme could allow a small physical change to open up some large unexpected and exciting vista with no more trouble than a re-write of the programme.

This should not be taken to indicate that the programme will be re-written or modified frequently at the control. It is something that would only be undertaken after mature thought and experience and while it involves no use of soldering irons or change of components it could in some cases represent considerable time of that expensive specialist the Computer Programmer. Nevertheless there is a considerable advantage to be obtained from the ability to experiment with and furthermore to revise control functions to line up with installations considered appropriate to theatres built and opened maybe years later. Again because of the computer nucleus it is possible to extend or re-arrange desk control functions to embrace such technical developments as servo-operated lanterns and so on.

Finally the use of a fully computerised system allows theatre lighting, itself a very limited market, to take advantage of technological development and experience of the world outside. The larger part of what goes together to function as Rank Strand DDM is not peculiar to that instrument. It is Computer equipment commonly used elsewhere. It is the control desk at the one end and the dimmers at the other that make it into a lighting control. It is the software programme that joins one to the other and enables the operator at the control desk to handle to best advantage those dimmers.

THE PRESENT SPECIFICATION (2)

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, the degree of lap in changing from one to another being determined by separate speed regulators to the increasing and decreasing channels respectively. Basic controls assume progression forwards after each cue is finished with. Progression forwards includes a ready means of skipping, or of adding together, memories before operation as a cue. It is only when it is required to break sequence or blend a number of types of change together for vamping of or composition of lighting changes that a degree of skill is required of the operator. In any display of lighting virtuosity the operator has an ally in the DDM computer which makes an instant comparison between the immediate situation now and its latest instruction or instructions. Cues do not have to be completed, there can be any changes of mind the stage situation demands and the computer itself makes all decisions necessary to ensure that the lighting changes occur without untoward interruption - they flow from one condition to another. System DDM thus 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.

In spite of the virtuosity possible with System DDM it is first and foremost a control with a dimmer memory, the operational routines therefore tend to encourage the user to make a habit of recording so that accurate repeat of something no matter how ephemeral it may appear at the time can take place should it subsequently become necessary.

BASIC PRINCIPLES OF OPERATION (3)

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. Dimmer function, indication and everything else of an individual nature is integrated in this special unit, invented to take over and modify a channel without the need for the operator to match. Mode switches affecting all the rockers at one time further extend the services they can provide.

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 for the memory numbers takes the form of two sets of master push buttons known as the "Green Playback" and the "Red Playback" respectively. The Green provides MOVE, DIM, CROSSFADE, CUT IN and CUT OUT and the Red MOVE, DIM and CROSSFADE only. 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 adjustable speed regulators while corresponding indicators show the progress of the change and a green and/or red display to correspond is presented by the rockers.

Any procedure can be interrupted and/or another substituted at any time both at individual channel level and at master level. The 240 channel rockers form a 25° from vertical panel on a separate wing unit to the left. This consists of eight rows of thirty rockers occupying a working area of twenty-four inches square approximately. The master desk is approximately thirty-six inches wide and eighteen inches deep. To the right are the Playback and Memory controls and to left the Dial Indicator and Mode controls associated with the adjacent channel wing. Between the two is plot and writing space. Auxilary lighting controls, clock signals and communications would be housed in a purpose built unit on the right of the centre desk.

THE CONTROLS (4)

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?

CHANNEL CONTROLS (5)

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.

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.

Associated with the channel rockers are certain MODE controls. These qualify or alter the function of the rockers. Most obvious are the SPEED and LEVER controls. These consist of twin / quadrant 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).

A sign indicator with the word "Instant" is brought in at the top position. A second potentiometer LEVEL by its position determines the position to which the dimmer will travel if the top of the rocker is held. (This may be lower than its present position). The bottom of the rocker always then takes it to zero. The word CHECK appears in a sign indicator at all positions except the top. LEVEL is effective at all speeds.

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 removes this warning. The lamp and push are also used as part of AUTO MOD (q.v.).

CUT-IN There is a group of four mode push buttons. Two reversible luminous/^{pushes}enable 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 third push, a momentary contact, is for FLASH and the fourth a luminous reversible for AUTO-MOD. These are described later.

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 NEXT store and in the top position in the CUT store. These functions will become clearer in the Playback section below.

NUMERICAL SELECTION "CUE SELECT" (6)

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 as 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. Numbers above the maximum capacity will not select i.e. a complete set of three pushes will refuse to light up.

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.

The transfer of a number from CUE SELECT to any window is by use of a NEXT or ADD NEXT control. Exceptions are the CUT-IN and CUT-OUT pushes. These take the number directly. A number can be cleared without using it by the black cancel push alongside.

MEMORY ACTION (7)

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 up this takes the number off the numerical selectors (if alight); pushed down it records the stage picture as that memory number and puts an amber background in the window indicating that recording has taken place.

If however that memory number is already occupied with a recorded picture the number remains 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. Memories which have not been used for recording do not give the warning 'bleep'. All, or selected memories, may be cleared and the 'bleep' removed by means of controls in the PROCESSOR cabinets. All actions associated with recording of or clearing of memory material are subject to master switches operated by removable keys to avoid unauthorised interference

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 they record the contribution of their master system only to the stage. Like the main RECORD they are subject to audible warning. Any attenuation because that playback has not been brought to full will be recorded as attenuated. Whether the NO LIGHT control is on or off is however ignored by RECORD and "playback (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 CUE SELECT this can be taken over for recording instead if NEXT is used to put that number in the playback window. However the background will remain 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.

PLAYBACK CONTROLS (8)

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 NEXT.

The Playback controls provide sustained functions or "actions" so that the operator then only rides the SPEED regulators to get the timing right.

The action push buttons to each playback system are:-

NEXT Memory Number (Substitute)
 NEXT " " (ADDITIONAL)
 CROSSFADE (subject to both Raise and Dim speeds)
 MOVE (" " " " " " " ")
 DIM (subject to Dim speed)
 REVERSE (return to "as you were" for all above)
 INSTANTANEOUS (temporarily cuts out both raise and

dim speeds)
 CROSSFADE will take channels to all levels/on the memory including memory selected. MOVE has the same action except that zeros are treated as neutral. Movement from one set of levels to another is linear and simultaneous, beginning and ending together no matter how disparate the distance to be travelled. DIM uses the memory to identify the channels, it will if not interrupted run them proportionately to zero.

NEXT or ADD NEXT reads the memory into NEXT store where it can be checked (previewed) and modified before use if necessary. Neither NEXT nor ADD NEXT stops any action because next store is not used after the start of an action. Since memories can be called up in the two ways, NEXT and ADD NEXT, two different and useful effects can be obtained from MOVE. After using NEXT the new levels whether higher or lower are substituted whereas if ADD NEXT is used only levels higher than the present ones will take effect.

OPERATION OF CUES (9)

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 CUE SELECT is 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. 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 in the NEXT position.

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, MOVE and DIM as appropriate. It also puts a green background behind the memory number. 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 progress of the change is shown on a dial just above the speed control. For MOVE and CROSSFADE the dial reads from 0 to 10 but for DIM the needle runs from 10 to 0.

Since there are separate speeds for the increasing and decreasing levels the DIAL takes its time from the slower of the two speeds. 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.

When REVERSE is used the speeds of the original action are retained i.e. channels which were increasing their level will while reversed, dim at the same speed as they were increasing at and vice versa.

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.

SPEED REGULATION (10)

Special quadrant levers with scales calibrated 1 to 60 will be supplied. Thus at the top there is a full dimmer travel of 1 sec. and the bottom 60 secs. The "X" factor push when engaged lights up in green and multiplies the duration by a factor of ten. Thus the top is 10 secs. and the slowest about 10 minutes.

A "0" factor push enables either raise or dim to be stopped when specially necessary in such cases the push lights in amber. For normal stopping and pausing use of the reversible "action" pushes is recommended.

A single control will be sited in a secondary area so that the factor can be altered when necessary.

SWITCHING AND CUT (11)

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.

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 while the Display mode switch is held down.

Further memories can be switched-in by selecting and operating CUT-IN. 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. CUT-OUT puts the channels to zero, thus although two memories may be cut-in one after the other to add highest on common channels, these will be tripped when the first of the two memories is CUT-OUT.

As soon as a new cue number is set in action (MOVE, DIM or CROSSFADE) and a green background appears the content of the Cut store is transferred to become 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.

SECOND PLAYBACK (12)

A pair of Mode pushes in Green and Red respectively allow rocker action (not display) to be restricted to only one playback. Both mode switches are normally alight and since they are reversible it is necessary to put the one not required off. Use of NO LIGHT to avoid operating the stage lighting from a playback will also put the Mode push for the other playback off.

The Green and Red Playbacks however can be used quite independently without any need to use the mode switches. Memories can be called up on either or both and any actions and speeds adopted, whether conflicting or not, without trouble because both playbacks are piling their outputs only at the dimmers. As a mimic diagram the rockers also present no difficulty because the Green and Red displays are quite separate at the top and bottom of each rocker. It is the manual functions of the rocker together with the push button/amber warning light in the centre which are shared between the two playbacks and which may need discriminatory action by using the Green or Mode pushes.

These two luminous pushes couple the channel rockers to the green manual action and red respectively and are normally both on. In this condition Green is 'normal' and always has priority. Touching one push puts it out and inerts that colour as far as rocker modification and "Dial" reading is concerned. Touch it again for 'as you were'. These pushes are linked to the NO LIGHT's also. When a NO LIGHT is "on" the mode for the other playback is extinguished and that rocker action inerted. Should however a stage modification be required in this condition - the dark push is held down to make it take over for just that time, the moment it is released it reverts as before. Putting the NO LIGHT off also puts the missing mode switch on once more. The NO LIGHT push is not reversible because the operator might inadvertently throw the content he has been using onto the stage. To trip NO LIGHT it is necessary therefore to press and CANCEL together. This interlock also allows free use of CANCEL when composing memories blind because it removes the risk that the operator might forget to restore NO LIGHT.

When both mode switches are "on" the rockers modify the stage picture however derived. Thus if a channel is taken out of both actions and held in a modification store. At the same time the amber light in the rocker comes on. Progress of an action on either playback resulting in a match of level will

not restore the channel to normal. To do this the level of the channel itself has to be changed to match that of any subsequent action progress. The level taken will be the higher of the two playbacks at the time. Playing back any memory on either Green or Red trips the amber warning. Only if AUTO MOD is used will it be retained (see below).

If rocker action in respect of one playback has been inerted due to one of them being inerted as described earlier then reference is to any memories or levels of the non-inerted playback.

PLAYBACK TRANSFER (13)

(a) A routine is required to speed up or at any rate to alter the speed of some channels within a cue while it is actually in progress. It may be necessary to remove them from the Green Playback and put them on the Red, whatever their state at the time.

The most obvious action from the operator's point of view is to use a memory or memories for the purpose, possibly supplemented by some manual selection or de-selection. The transfer action is therefore similar to "Dim", any channels on the memory being used only for identification but also taking their levels from their state at the time. If what is in use on green consists of memories x, y and z (or their equivalent however arrived at) and memory x contains for example, the cyc channels this could be "Nexted" on the Red but copy "Green to Red" pressed at the same time. This could happen during the progress of a Green cue, for instance a fadeout. Once over to Red the operator could give those channels any action necessary. What would be copied would be identified for match and transfer by what was selected on Red at the time of pressing the Copy/Transfer push. This selection might have been arrived at by use of a memory or by manual selection at the rockers or a mixture of both. An essential would seem to be that they are not already effectively is use^{on Red} i.e. if say channel 13 is already contributing a higher level to the stage store from the Red than the Green it would transfer from Green but not match to the Green level, but if lower

then it would match and transfer. This transfer push since it concerned the calling over of items for the Red playback will be placed to the right of playback dials.

(b) Transfer R to G and cancel R. All Red levels will pile with any channels already on Green. (To clear up a piled playback condition). This transfer push since it calls over items to augment the green playback will be placed to the left of the playback dials.

AUTO MOD (14)

Selected channels can be permanently captured in a modified state and this level will be substituted for any other (except zero) whenever a memory is "Nexted" subsequently which contains that channel (or channels). This modification can be inerted temporarily by putting the AUTO MOD push off (while Nexting). To select a channel onto AUTO MOD a special SET A/M push should held in while pressing the amber rocker push which will then illuminate to show that the particular channel has been captured. Pressing the amber push a second time in conjunction with SET A/M will remove the channel from AUTO MOD and with it the indication. If the channel has already been modified (the amber push will already be on) the SET A/M push will extinguish the amber mimic to enable the selection on auto mod to be seen. N.B. the amber mimic will remain so long as the channel is set on the auto mod store regardless whether the AUTO MOD push is on or off.

FLASH (15)

When the push is held on any channel can be put temporarily to full or to out by holding the top or the bottom of its rocker. Any flashing effect depends on the operator's dexterity.

(* Reading or re-reading a memory can be considered as taking place every time the black ground is changed).

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. Function of Red transfer different from green see item (13) page 15.

RECORD SYSTEM

CUE SELECT White Number range 250

(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. Numbers above 250 will not select.)

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 NO LIGHT.)

(Re)RECORD Amber Light after recording; trip when CANCEL pushes or Next number put in window.

(Records contribution to stage of individual Playback, ignores NO LIGHT.)

Channel System

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

(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, return to original position removes this.)

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

LEVEL Fader lever Positional setting (CHECK sign when not at full)

SPEED " " Range from 30 secs. to instantaneous. Sign repeater under dial for latter.

CUT) Displays on-stage content in rockers.

STAGE) Mode switch Pushed up displays content of Cut store at Rockers and number on red ground.

NEXT) Pushed down does same for Next Store.

GREEN Mode push Reverser action also tripped by Red NO LIGHT. Temp. override by holding down. When "on" connects rocker manual action to Green playback.

RED Mode push As above but connects Red playback and is tripped by Green NO LIGHT.

FLASH Mode push Held for temporary manual flashing by rocker.

AUTO MOD Mode push Captures or releases levels modified when "on". Substitutes its own levels if "on" when Nexting.

SET A/M Mode push Non-luminous captures channels whose amber rocker pushes are pressed while held.

As Collected
30/6/71

APPENDIX A.

Stalls rehearsal control

Thanks to our patented SHIFT system it is possible to use rocker control at the stalls position and yet keep the panel to modest dimensions. In this case there will be a single row of thirty rocker and three groups of eight white illuminated pushes wired three in parallel allow scanning row by row for display and operation, the state of the full set of 240 channel rockers at the main desk.

These thirty rockers are to be engraved or otherwise identified. Unlike the rockers on the main desk they operate and playback only in the GREEN. The rockers are mounted in a single row along the top of the desk. Over the row of rockers is a single row of shift pushes in three blocks to correspond to the three blocks of rockers. These are luminous on-off reversible in white - only one SHIFT push can be engaged at a time and the last touched trips any other.

Putting in on any shift push connects the row of thirty rockers on the Stalls control in parallel with the appropriate row on the main control for display and operation.

As with the main desk, channel rocker action is for modification of state and in consequence channels operated from the stalls under the influence of a SHIFT push remain where they are when that shift push is disengaged unless something else is done to those channels. Channel rockers modified out of a memory will show the same AMBER light at the stalls control as appears on the main desk but only at the time that the relevant shift push is engaged.

It is assumed that when a shift push is engaged all green modification in respect of that row takes place in the stalls but that the playback of memories continues only at the main desk unless transferred by second keyswitch to the stalls.

As Corrected

30/6/71

Associated with the channel rockers on the stalls desk will be the SPEED and LEVEL regulators and also FLASH, the whole being under the control of keyswitch 'A'. When this key is on modification can proceed although the operator is using the main control desk for an actual run through. For complete control from the stalls when no other operator is present keyswitch 'B' is turned on. This provides most of the green playback facilities from the stalls position (see schedule on page 21). A set of numerical call-up pushes is provided and this operates in conjunction with NEXT and ADD NEXT in the normal way. Memory action follows the same course except when keyswitch 'A' only is on. In that case recording is limited to memories above number 200.

Modified channels indicate at the stalls control by the usual amber lamp. Recording at the stalls position is carried out by two centre sprung tab switches. One giving NEXT/RECORD taking in the whole picture on the stage and the other NEXT/MODS ONLY records only those channels in the modification store i.e. those which display amber lights at the rockers. This is not restricted to just those channels actually displayed by the particular SHIFT but covers all those modified at the time.

Indicator Window
 ALL DIM
 Sign Repeaters (3)
 NEXT CROSSFADE
 ADD NEXT
 MOVE
 REVERSE
 INSTANT
 DU
 SPEED
 quadrant levers for Raise and Lower

(When only keyswitch 'A' is "on" then the indicator window carries the same number as that selected by the operator at the main desk with or without green background, also the Sign repeaters light up to show the nature of the cue being carried out from there. Use of keyswitch 'B' makes the Stalls control fully operational.)

As Corrected
30/7/71Schedule of Stalls ControlsSubject to keyswitch A.

CHANNEL ROCKERS, thirty to display green only. Centre pushes to display amber modification and give DIAL reading.

SHIFT PUSHES. Three sets of eight luminous giving row by row display and action.

DIAL to provide channel identification.

SPEED and LEVEL quadrant levers (Corresponding controls on main desk cut out when key A is "on".)

FLASH push as at main desk (but luminous while held and repeating at both positions).

Subject to keyswitch B.

NUMERICAL SELECTORS set of pushes as at main desk

RECORD two centre sprung switches NEXT/RECORD and NEXT/MODS ONLY.

GREEN PLAYBACK

Dial (to show progress of action)

Indicator window CANCEL

ALL DIM

Sign Repeaters (3)

NEXT ADD NEXT

INSTANT CROSSFADE MOVE

DIM REVERSE

SPEED quadrant levers for Raise and Lower

(When only keyswitch A is "on" then the Indicator window carries the same number as that selected by the operator at the main desk with or without green background, also the Sign repeaters light up to show the nature of the cue being carried out from there. Use of keyswitch B makes the Stalls control fully operational.)

APPENDIX B.Tape Facility

Tape capacity approx. 450 cues. Each cassette has two tapes. Tape speed 10 ins per sec. Record/playback time for 100 cues - 40 seconds.

Illuminated thumb wheel switching to set start and stop cue numbers and start and stop tape location numbers. The memory to tape (M → T) or tape to memory (M ← T) pushes to select the mode required. The start push illuminates during transfer of information and extinguishes when the process is complete. When information is transferred to tape, the equipment automatically checks that the information has in fact been recorded; a green RECORDING lamp illuminates to show that this has been done. For editing purposes a SEQential Start push is provided to avoid resetting the tape or memory START numbers once the first sequence of cues have been transferred. (Although magnetic tape recording is very fast indeed. Nevertheless since an automatic complete check process involves running the tape automatically right through once again such alteration to the programme will be made as deemed necessary to speed up recording of limited numbers or of individual cues as for example when shuffling their order.)

The three pilot lamps: "Already recorded", "Insufficient storage", and "Blank Tape" indicate which interlocks are preventing the machine from starting.

Key switches are provided to activate the tape control panel, erase tape and erase memory.

The tape and memory erase facilities are subject to the tape and memory start and stop/^{numerical} thumbwheels and to the START push.

If a recorded tape is to be re-used it should be erased first. The equipment is interlocked to prevent recording on an already recorded tape.

The main DDM control desk is only fully locked out when the tape is actually moving but even then it can be used to hold light on the stage.

Clear Memories - Audible Warning

The main ferrite memory can only be 'cleared' to nothing as distinct from being recorded at all levels including zeros, by using the MEMORY ERASE facility on the tape control panel. It will be possible to record on a clear memory there immediately without the audible warning interlock. Once a memory had been used it would always 'bleep' when a new recording was attempted even if only all zeros has previously been recorded.

1. LIGHTING CONTROL ROOM

1.1 Master Desk

This desk mounts the master controls applicable to playback, recording and channel control. 36ins High, 36 1/2 ins wide x 17 1/2 ins deep.

1.2 Rocker Wing

This mounts 240 rockers for individual channel control. It also contains the necessary interfacing cards for the master desk and the rockers. It is supplied complete with the interconnecting cables to the Master Desk and power unit cabinet. 31 1/2 ins high, 27 ins wide x 18 ins deep.

1.3 Power unit and auxiliary control cabinet

This contains the power supplies for the master desk and rocker wing together with controls for the control system, mimic indication and audible warning levels. 29 ins high, 28 1/2 ins wide x 18 ins deep.

2. ELECTRONIC RACK AREA

2.1 Processor Cabinet

This cabinet (64 1/2 ins high, 22 1/2 ins wide x 27 ins deep) will house the computer, bulk ferrite store for 250 memories, magnetic tape cassette unit and control panel and the necessary interfacing cards and power supplies.

2.2 Channel Cabinet

This cabinet is the same size as 2.1 above and contains the channel output cards which interface the system with the dimmers. It includes the power supplies for these cards and also a monitor panel.

PART II EQUIPMENT

The equipment to be supplied will be permanently installed in three main areas:- (1) Lighting Control Room, (2) Electronics Room, and (3) Dimmer Room. In addition there will be two auxiliary control units the portable Stalls control (4) and the Standby control (5). The exact form and location of these latter two remains to be determined, but this specification includes reasonable provision of equipment for these purposes.

1. LIGHTING CONTROL ROOM

1.1 Master Desk

This desk mounts the master controls applicable to playback, recording and channel control. 36ins high, $36\frac{1}{2}$ ins wide x $17\frac{1}{2}$ ins deep.

1.2 Rocker Wing

This mounts 240 rockers for individual channel control. It also contains the necessary interfacing cards for the master desk and the rockers. It is supplied complete with the interconnecting cables to the Master Desk and power unit cabinet. $51\frac{1}{2}$ ins high, 27 ins wide x 18 ins deep.

1.3 Power unit and ancilliary control cabinet

This contains the power supplies for the master desk and rocker wing together with controls for the control system mimic indication and audible warning levels. 29 ins high, $28\frac{1}{2}$ ins wide x 18 ins deep.

2. ELECTRONIC RACK AREA

2.1 Processor Cabinet

This cabinet ($64\frac{1}{2}$ ins high, $22\frac{1}{2}$ ins wide x 27 ins deep) will house the computer, bulk ferrite store for 250 memories, magnetic tape cassette unit and control panel and the necessary interfacing cards and power supplies.

2.2 Channel Cabinet

This cabinet is the same size as 2.1 above and contains the channel output cards which interface the system with the dimmers. It includes the power supplies for these cards and also a monitor panel.

2.3 Interconnecting Cables

Cables to connect the processor and channel cabinets and also the processor cabinet to the rocker wing will be provided. (See Part 1 Appendix A.)

N.B. It is assumed that the distance between the control room and electronic rack room does not exceed 30 feet although there is no technical reason why it should not be considerably longer.

2.4 Mains Distribution Box

It is proposed that this box accepts, say, a secure 30A single phase supply and provides sub-fusing for the various items of equipment in the control system. It will also house a remotely operated contactor so that the control system could be turned on or off remotely in the control room or at the side of the stage.

3. DIMMER ROOM

3.1 Dimmer Racks

These would comprise twelve Type JTM 20 channel racks with a total of 200 2kW and 40kW thyristor dimmers. The dimmer control cards to be of the revised theatre curve stabilised for drift and temperature.

3.2 Dimmer Curve

The static response curve of the dimmer will be such that when a channel is set using the rocker with SPEED or LEVEL controls, full and even control will be possible over substantially the complete range 0 to 10.

The curve will also be such that with a constant speed fade (up or down) the change will be reasonably even.

3.3 Dimmer Response

The programme will be modified to ensure that a fixed "warming voltage" is applied to all circuits which are due to fade up from zeros at the start of a cue.

This will improve the response of the system so that fades from blackout have a more immediate effect.

7.1 Handbooks

An operator's handbook, users guide and simple fault finding guide will be supplied for each part of the equipment.

7.3 Maintenance

A contract for periodic inspection and maintenance after expiry of the guarantee can be undertaken.

These would be supplied and connected at the control equipment end of the system but the electrical contractor would be expected to run the cables and connect them at the rack end.

4. PORTABLE STALLS CONTROL

(see Part I Appendix A.)

5. STANDBY CONTROL

This will take the form of a miniature pin patch putting any combination of the 240 channels into 10 quadrants. It is intended that emergency group combinations shall be arranged at the time of programming that particular item of the repertoire. The emergency control will form a part of a similar wing unit to the rocker wing and will therefore provide ample space for auxiliary controls, communications systems etc., none of which items are included here. Control from the standby unit is direct to the dimmer and does not pass through any of the processor or interface equipment.

6. INSTALLATION AND COMMISSIONING

All items of the control system, with the exception of the cables mentioned previously will be installed by Rank Strand. The equipment will be thoroughly tested after installation and the customer's operators and engineers will be instructed in the use of the system and in simple fault finding and repair.

7. SPARES

A quantity of spare rockers, channel cards and selected interfacing cards will be supplied. The quantities to be recommended have yet to be determined.

Spares for the system will continue to be available for a period of 15 years. Such spares may be held at component level rather than at sub-assembly level. The right is reserved to supply equivalents or comparables where particular components have ceased to be available.

7.2 Handbooks

An operator's handbook, users guide and simple fault finding guide will be supplied for each part of the equipment.

7.3 Maintenance

A contract for periodic inspection and maintenance after expiry of the guarantee can be undertaken.

RANK STRAND ELECTRIC LIMITED

