A1054

NATIONAL THEATRE

PRODUCTION LIGHTING CONTROL SYSTEM

SPECIFICATION AND SCHEDULES

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SPECIFICATION OF PRODUCTION LIGHTING

CONTROL SYSTEMS FOR THE NATIONAL THEATRE

SECTION 1: INTRODUCTION

1.1. This specification details the requirements for the two production lighting control systems for the Upper and Lower Theatres of the National Theatre building, Upper Ground, London S. E 1.

1.2 The specification has been prepared to enable the manufacturers of intensity memory systems to submit tenders for equipment which will fulfil the requirements given in the specification and which can be accommodated within the physical parameters of the building. As such it is only intended to be definitive on matters such as operational features, panel layouts, physical form, etc and does not define methods of achieving the facilities.

1.3 Both the systems are required to be the same although they will differ in the number of operational circuits. The system specified is different from all presently manufactured intensity memory systems in order to include some additional facilities which will be advantageous to the Client in heavy repertoire working and also to take advantage of the present state of electronic technology.

1.4 The work called for is the detailed design, manufacture, supply, installation, testing and commissioning of all the equipment specified.

1.5 Tenderers are welcome to make suggestions as to the methods of achieving the new features proposed and to indicate alternative approaches. Any queries arising should be raised with the consultants before the date for the submission of tenders.

1.6 The equipment and installation shall be in accordance with the relevant Technical Conditions of Contract issued by the Consultants for the National Theatre.

1.7. It is presently proposed that the equipment installation shall be placed part as a sub-contract through the Main Contractor, Sir Robert McAlpine and Sons Ltd and part as a direct contract from the South Bank Theatre Board. The hardware such as dimmer racks, patching equipment and similar items would be supplied as part of the building contract, but the electronic control equipment and panels, etc, would be installed after the building contract and in the furnishing period. Tenderers may assume that such a division will apply and that that the sub-contract will be in accordance with section 3 of the General Conditions of Contract, while the Direct Contract will be subject to IEE/IMechE Model Form of Contract (Form A - Home Contract with Erection). The commissioning and testing of the complete installation will be included in the Direct Contract.

1.8. The Consultants drawings supplied with the specification have been prepared to indicate the type and layout of equipment required and to act as a guide to the conditions on site. Special attention must be paid to the limited physical space for control and dimmer equipment and to the limitation of noise from equipment. The tenderer shall prepare detailed drawings of equipment which cannot be described by standard literature, and these shall be approved by the Consultants before manufacture commences.

1.9. The tenderer shall supply with his tender a proposed layout for the dimmer and contactor racks in each dimmer room and indication of the trunking routes he would propose between the existing trunking and each of his items of equipment.

1.10. This specification and drawings is the property and copyright of Theatre Projects Consultants Ltd. and previously unpublished ideas and principles included therin shall not be disclosed to a third party or used other than in a contract arising directly from this enquiry by the sub-contractor or others without the prior permission in writing of the Consultants which shall not be unreasonably witheld.

1.11. Where not otherwise stated the contractor or sub-contractor shall supply all items of equipment mentioned including those parts which although not enumerated are, by implication or standard good practice, necessary for the complete and satisfactory commissioning and operation of the installation.

1.12. It is envisaged that a number of additional push buttons and their appropriate back-up electronics may be required in excess of those shown on the drawings to comply with the specification and the tenderers shall ensure that they have included for all facilities mentioned, or have specifically excluded certain described facilities.

1.13. Tenderers may wish to involve an audio sub-contractor to design the modulation equipment (see section 4.8.).

SECTION 2: GLOSSARY OF TERMS USED

The terms 'circuit' or 'circuits' are to imply both singular and plural and shall refer to the control circuits within the lighting system controlling a socket, groups of sockets or all the constituent sockets used in a cue, or group.

A SOCKET shall be an outlet or pair of outlets fed from a dimmer, either directly or via a switching device.

A MEMORY is one of the numbered units of storage of the system capable of recording circuits, intensities and times.

A CUE is a recorded memory consisting of circuits, intensities and times and on recall all the circuits and intensities are reproduced as recorded.

A GROUP is a recalled memory in which modified circuits or intensities remain as previously modified and move in their new relationship. For example CUE 69 is recalled and circuit 201 is raised from 4 to 7. On recall as a GROUP circuit 201 would come at 7, while on recall as a CUE it would come on at 4.

The term 'highest takes precedence' shall indicate that when two or more controllers are contributing to a state of lighting the circuit responds to the higher level selected.

BISTABLE PUSH BUTTON. All the push buttons on the panel are to be momentary contact, ie: they return to their stable position when pressure is removed. Reference to a BISTABLE action indicates that the state invoked by the operation of the push button is maintained electronically until a second press resets it.

SECTION 3: BASIC CONCEPTS

3.1 Recent times have seen the development of a number of 'memory' lighting control systems, all offering varying facilities for instantaneous recording of dimmer levels and their subsequent playback. The lighting control described in this specification attempts to build upon these advances and provide a system with improved facilities aimed at satisfying the requirements of lighting design as far as they can be foreseen.

3.2 Once the problems of dimmer level recording and playback are solved the following areas require improvement.

3.2.1 Lighting compositions will no longer be built through the process of balancing individual channels alone, but also by freely mixing groups of channels.
THE LIGHTING OPERATOR REQUIRES EQUAL ACCESS to CHANNELS and PREMIXED GROUPS OF CHANNELS.

3.2.2 Lighting design has been described as 'painting with light'. However, light in nature is never still. Light moves with time and lighting design might be more accurately described as 'painting with light in time.' As memory systems remove the chore of presetting and lessen the possibility of operator error, the probability of the increase in frequency and complexity in timing of cues grows. Drama ebbs and flows in time as the story is unfolded to its audience; light used in theatre should be increasingly fluid.
THE LIGHTING OPERATOR REQUIRES INCREASED PROVISION FOR SUBTLE TIME CONTROL AND VARIATION. HE SHALL BE IN COMPLETE COMMAND OF THE PROCESS AND ABLE TO BE THE HUMAN LINK BETWEEN THE LIVE ACTION ON STAGE AND THE LIGHTING, AND THUS ABLE TO FOLLOW EACH PERFORMANCE WITH ITS INDIVIDUAL AND PERHAPS UNEXPECTED VARIATIONS.

3.2.3 Another aspect of the relationship between lighting and time is speed of access. Lighting should be capable of manipulation extremely quickly. This leads to the demand for a control system that can be played like a musical instrument, that can allow improvisation both in rehearsal and performance; that can capture the visual effects and nuances of light and play them in accompaniment to the dramatic action.
THE LIGHTING OPERATOR MUST HAVE A HEAD UP, FINGERTIP CONTROL WITHIN FOREARM REACH. THE CONTROL MUST BE AN INSTRUMENT TO BE PLAYED WHILE THE OPERATOR CONCENTRATES UPON THE STAGE.

3.2.4 The relationship between the lighting designer and his operator should be extremely close; and where possible the roles combined. The control should allow, without undue complication, the maximum degree of operator initiative and variation of method of operation.
THE LIGHTING OPERATOR SHOULD BE ALLOWED THE GREATEST POSSIBLE AMOUNT OF INITIATIVE AND CREATIVE FLEXIBILITY IN OPERATION. THE OPERATOR'S ROLE SHOULD BE CREATIVE AND NOT MECHANICAL.

3.2.5 In a repertory theatre the problems of organising lighting to a high standard become complex. Taking into account the present state of the art, and the state of luminaire development, the following approach to organisation must be adopted, assuming two or three productions to be staged per day with full and accurate lighting.

A. A proportion of the lighting installation shall be permanently rigged and focussed to standard positions. (Some part of these to be equipped with remote colour change).

B. A proportion of the installation shall be permanently rigged and equipped with remote focus and positional control. (This will be limited in quantity by economics).

C. The remainder of the installation shall be focussed for each production and dedicated to it.

D. The absolute minimum number of instruments shall be specially rigged for any individual production.

E. All the above will contribute to a SATURATION RIG from which instruments will be chosen or PATCHED for each production with the greatest possible freedom and PATCHED or REMOTELY CONTROLLED as rapidly and with as little labour as possible.
THE OPERATOR SHALL BE ABLE TO SELECT ANY SOCKET (FROM A SATURATION RIG) AND OPERATE IT INDIVIDUALLY OR TOGETHER WITH OTHER SOCKETS AS HE MIGHT REQUIRE.

3.3 Constituent Parts

The basic constituents of the control system are as follows:-

PALETTES
PLAYBACKS
MIMICS
together with:

Remote Control Panel
Automatic Modulation Panel

3.3.1 PALETTES

Lighting compositions shall be built up from individual circuits or groups of pre-mixed circuits on LIGHT PALETTES. Each palette shall include a numerical selector to call up (and operate optionally) sockets or groups and a level control wheel. The operator shall be able to hold up to five 'pieces' of lighting on each palette at any one time for comparative balancing or for any other purpose.
The system shall include two palettes which shall be identical.

3.3.2 PLAYBACKS

Once lighting compositions have been recorded as CUES they will normally be operated on one of the Playback Units. These allow recorded cues or combinations of cues to be

Crossfaded
Moved upwards
Moved downwards
Raised to full
Dimmed out etc.

The playbacks may be operated in two modes:-

AUTOMATIC This provides push button operation instantaneously or to a time that can be prerecorded with the cue or preset by the operator on a control wheel. MANUAL. This allows the operator to use the playback control wheels as manual masters to directly control the movement of any cue or combination of cues.

3.3.3 PALETTES AS OPERATIONAL SUB-MASTERS

3.3.3.1 The palettes described in 3.1 above may also be used as sub-masters to provide greater sensitivity or complexity of timing than that which is provided by the two playbacks units. Each of the subsidiary controllers (4 to each plaette) can be used as a sub-master or cut-store, subservient to or independent of the stage, to operate any recorded cue (or combination) required. The fifth controller associated with the numerical selector may be used as a master fader of the palette.

3.3.3.2 Each palette may be used as an operational sub-master in either the AUTOMATIC or MANUAL MODES. In the former the speed at which the fade in or out will take place is either prerecorded with the cue or preset on the control wheel. With the latter, operation of the control wheel will bring in or take out the cue selected.

3.3.3.3 Each controller may be selected to MODULATE the cue or combination of cues selected to it. This connects the lighting so selected to a subsidiary control panel that will modulate the intensity of the light automatically as required. The stimulae of this modulation may either be a chosen audio source or a prerecorded source prepared for the particular effect required; or a combination of both.

3.3.4 MIMIC DISPLAYS

3.3.4.1 The lighting installations have been so numbered that the socket numbers denote the position of the outlet in the theatre. For example, socket 681 in the Lower Theatre indicates that it is in the 6th zone (the downstage area) the 8th position (ladder stage left) and is the number 1 lamp.

3.3.4.2. The mimic displays are to be in the form of video display units using alphanumeric characters. These are mounted above the operational panels and below the operator's sightline to the stage. The lower part of the screens will at all times show the use to which the controllers are being put.

3.3.4.3. The upper part of the screens can be selected to display:

(a) The State of the Stage (or any cue or store)
This will list all channels in use and give their intensity. It can also show a written description of the cue if so recorded, eg:
CUE 72 Foggy day.

071	- 5	147	- F
077	- 3H	193	- 2

(b) A list of Cues recorded and their verbal description
This is of particular use to the designer or director who prefers not to work numerically. It would allow a considerable amount of lighting to be built up by using groups chosen from their verbal description eg:

071	Warm UL	131	Blue X US
072	Warm UC	132	Blue X CS
073	Warm UR	133	Blue X DS

3.3.5 Rehearsal Panel

For early lighting rehearsals a stalls control shall be provided which shall consist of one PALETTE unit and one MIMIC VDU

3.3.6 Designers Portable Panel

For focussing or for designer's modification in dress rehearsal condition, a pocket size numerical selector shall allow access to or modification of any socket or group from any position in the theatre, if possible by radio signal.

3.4 Remote patching

One of the essential differences between the system described and existing systems is the reduction of the conventional PATCH function to the selection of sockets by number from the control desk.

3.4.1 It is required that up to 250 circuits in the Lower Theatre and up to 300 circuits in the Upper Theatre be capable of use, either for setting or for playback, at any one time. Thus for one cross-fade or lighting change these totals may be used, and any of the installed sockets in the theatre up to this maximum may be called up for inclusion in a cue or lighting change.

3.4.2 Every socket in the theatre is therefore available for use in each cue and its use in that cue will be recorded along with its intensity. Thus special equipment used only for a single effect does not tie up valuable channels as in conventional systems, and changes of patching in repertoire are carried out by the lighting control system. Additionally the full rig of luminaires is available to the lighting designer for each cue.

SECTION 4: GENERAL DESCRIPTION

4.1 OUTLETS AND LOOPING

4.1.1 The production lighting layout in each theatre has been designed specifically to meet the requirements of repertoire working and has been further refined in order to limit the the patching requirements. The layouts (904/240 and 904/241) both consist of two types of dimmer output circuit: direct and parallel. Two sizes of dimmer have been used 5Kw and $2\frac{1}{2}$ Kw.

4.1.2 The direct outlets are wired directly to their respective dimmers, and only one outlet combination can be fed from each dimmer. The parallel circuits are to employ contactors or solid state AC switches on the output of each dimmer such that either one, two, or three outlet combinations can be fed from the dimmer. The idea is that these outlets would generally be alternatives, but that in the event of the individual loads being less than the dimmer capacity, either two or three of the outlets can be switched on and used together.

4.1.3 This method of paralleling outlets has been designated LOOPING and another facility of the system is to loop up control circuits in order to control two or more dimmers and their outlets together. For example a number of cyclorama units may be plugged in a variety of outlets but the system will be instructed to handle all of the relevant dimmers as one circuit. This is control level LOOPING and is intended to reduce the number of adaptors and extension leads used.

4.1.4 Apart from the facilities for power LOOPING on the dimmer side of the installation, the dimmers are expected to be reasonably conventional with the addition of separate fusing for the two sections of a 5Kw feed. The space available in the dimmer rooms is limited as the original design used less dimmers. For dimmer and switching details, see Section 6.

4.2. THE PALETTES

4.2.1. Each palette consists of a number selection panel, a mode selector panel, some ancillary function buttons and five encoder wheels each with a set of function buttons.

4.2.2. Mode selection pushes

4.2.2.1. The mode selection panel has 12 active buttons in a group of 4 x 2 and 4 mounted above the numerical selector. The top row, A, B, C, D, switch the palette to operate on one of the playback stores; A and C being stage stores and B and D being preset stores. Pushes A, B, C, D, are bistable, electrically mutually exclusive and illuminated when selected.

4.2.2.2. The method of contributing to the selected store, or operating in relation to other controls, is set up on the next row IND, HI, LA. These pushes are also bistable, electrically mutually exclusive and illuminated when selected. HI indicates 'highest takes precedence', LA 'latest takes precedence' and IND that the panel is operating independently of the selected store: ie, the circuits controlled will only obey the palette settings.

4.2.2.3. Where the same circuit or circuits are controlled from two positions in INDEPENDENT mode, the LATEST of the independent controls shall have effect, except that where a part of a group or cue is controlled independently of the group, that part will only answer to its own controller.

4.2.2.4. The top row of the number selection pushes is used in conjunction with the numerical selector to call up a socket (SKT) or a group (GROUP) or a cue (CUE). A further button is used to loop outlets (or control circuits). The pushes SKT, GROUP and CUE are bistable and illuminated when selected: they are mutually exclusive If a socket is to be looped to another the sequence of selection would be to select SKT followed by the number required and then to press LOOP followed by the next socket number, and then LOOP and so on. On selection of a previously looped circuit, LOOP will illuminate indicating this: if LOOP is pressed in this condition, the selected socket will be separated from the others in that loop, and the button illumination will go out.

4.2.2.5. The power looping described earlier is made necessary by economics. The layouts of the two theatres contain some permanently looped circuits in which one dimmer feeds up to 3 separate socket combinations. Each socket combination has a discrete number, eg: 201, 303, 405 might be fed from the same dimmer.

4.2.2.6. If circuit 201 is called up when 303 and 405 are not in use, the appropriate contactor closes and the dimmer is controlled as 201. If at the time of selecting 303, 201 is in use the PARA (parallel) indicator lights up and the system buzzes. If the dimmer will not be overloaded by feeding 201 and 303 together the operator can press LOOP and link the two together. This action will be repeated each time one or the other is called up as they will not always be required to operate together. Once recorded in a memory they will continue to appear looped on recall, PARA and LOOP will be illuminated and no bleep will occur. A second press on LOOP while illuminated will disconnect the socket then selected.

4.2.2.7. Cues will be used as well as individual circuits for balancing and mixing as described earlier and this panel will enable them to be called up, either as CUES, in which individual circuits retain their recorded levels, or as GROUPS, in which modified circuits or intensities remain as last modified and in their new relationship.

4.2.3 Number Selection Pushes

4.2.3.1 The number selection panel contains 0, 1, 2, 3, 4, 5, 6, 7, 8, & 9 in the conventional layout and in addition F for FULL (dimmer at maximum output), H for HALF, decimal point, @, + and - and in addition +1 and -1 and CLEAR.

4.2.3.2 The number selection shall work on the principle that the first digit selected takes the unit space, the second digit selected moves the unit figure into the tens position and inserts itself as the unit and the third digit moves the other two to the left and puts itself in the units figure. Thus 342 could become 423 by the selection of a 3. Non-significant zeros do not require setting.

4.2.3.3 This panel contains the additional push buttons in order to enable it to be used for rapid setting of levels as well as selecting sockets, groups or cues. Thus to put socket 13 to FULL:

SKT 13 @ F

and if 15 was to be put to .3 (30% of dimmer output)

SKT 15 @ 3

Note that @ includes an implied decimal point.

4.2.3.4 When it is necessary to alter the setting of a socket this may be done by a similar selection:

SKT 15 @ 3 + 2

would set 15 to level 5. The + and - signs include decimal points when they are used after an @. Thus SKT 15 @ 3 + 2 - 1 would set socket 15 to level 4.

The H button enables level settings of half a point to be included:

SKT 16 @ 6H

and for such half settings to be added or subtracted:

SKT 16 @ 4 - 1 +H

4.2.3.5 If a number of sockets need to be set to the same levels but are not to be looped together, the + button is used. This will put them all to the selected level but on recalling a circuit only that one will be controlled. (No decimal point is implied by the plus sign).

SKT 17 + 18 + 19 @ 8

4.2.3.6 The system will only accept a single digit or a digit followed by a H after an @. Thus, although SKT may be reselected between operations the following shall be acceptable to the system and shall set sockets 107, 103, 110 & 111 to appropriate levels:
SKT 107 @ F 103 @ 6 - 1+2 110 + 111 @ 9
112 @ 3

4.2.3.7 The buttons +1 and -1 shall be used to select the numerically succeeding or preceding socket, group or cue.
Thus SKT 121 @ 6 (+1) @ 7 (+1) @6 would set sockets 121, 122 and 123. Where the number sequence is discontinuous or includes an independant socket, +1 or -1 shall pass on to the next dimmed socket.

4.2.3.8 The decimal point itself is not used for setting levels but only for the creation of fill-in memories in a cue sequence: 27, 27.1, 27.2, 28 etc. This is explained under the cue selector, which is used for selecting the record memory. The point appears on these selectors for recall purposes.

4.2.3.9 Groups and cues may be added on recall in the same way as sockets but whereas sockets may not be subtracted (SKT 121 - 3 is illogical), groups and cues may be subtracted: GROUP 121 - (implied GROUP) 3 will remove these sockets which are above zero setting in Group 3 from Group 121. Similarly SOCKETS may be subtracted or added to a group or cue: GROUP 7 - SKT 14 @ 6.

4.2.3.10 If a wrong selection is made of SKT, GROUP, CUE or a number the selector panel may be wiped clear by pressing CLEAR. It is not necessary to use CLEAR if a wrong level is selected as repressing @ will enable a new level to be set, or + and - may be used. If a level has been set CLEAR is effectively OFF except that it removes the selected circuits from the wheel, rather than just setting them to zero.

4.2.3.11 Sockets ending in zero, such as 230, 340, represent switched-only circuits and are controlled either by contactors or solid state AC switches. When such a socket is selected it can only be set to either ON or OFF. As well as being indicated as switched-only (SWO) on the VDU the F and O buttons on the number selection pushes illuminate to stress the only two settings possible. It is not possible to set switched-only circuits on the wheel, but where they are included in a cue which is faded in

automatically or manually they will switch on at the beginning of a fade-in and switch off at the end of a fade-out. Where an action other than this is required they must be recorded as a follow-on cue.

4.2.4 Setting Controls

4.2.4.1 As soon as the number of a socket, group or cue is selected it immediately comes under control of the first encoder wheel, or can be set to a level as described above. The wheel will control the socket, group or cue displayed and part selection will result in the wrong number being operated. If on calling SKT 761 only SKT 76 is pressed then the wheel will operate on socket 76. The addition of 1 will convert the socket to 761 which can then be controlled. Normal action will be to PARK or reselect SKT, GROUP or CUE before selecting a number.

4.2.4.2 The functions of this wheel are controlled by a set of 9 button in a 3 x 3 matrix. Generally the encoder wheel will set the level of the last item or items selected on the numerical selector, taking it from the level at which it is, or if it is not in use, from zero. However, if a number of circuits are being called up to around the same setting, this level can be set on the wheel and the SET ALL push invoked. This is a momentary action push, electrically converted to a push-push action, illuminated when active. Any circuits selected when it is active will go to the level set and can then be altered from that level on the wheel. The change made for each item will not affect the level set which will apply to other circuits selected until the push is pressed again.

4.2.4.3 The OFF push will set to zero any circuits selected, but the wheel is still in operation and may be used to bring them in again. A second OFF operation will return the circuits to their previous levels unless they have been faded in to any level above zero. OFF is illuminated when applicable.

4.2.4.4 A reselection of SKT, GROUP or CUE or a new number on the numerical selector will clear the wheel by PARKING the circuits onto the store selected on the mode selection panel. This action can be pre-empted by pressing PARK and the selected circuits are moved, at the levels set on the wheel or by the numerical selector, if these are the applicable levels, to the control of the appropriate playback.

4.2.4.5 The circuits on the wheel may be flashed to full by pressing FLASH. This is a momentary action, non-illuminated push. If circuits to be located are on at a high level the OFF push may be pressed: a second push will reinstate them exactly as they were.

4.2.4.6 When a selection of circuits are being set on the wheel or numerical selector it is possible to reset them to their last recorded level by pressing LAST. Thus the adjusting of a luminaire which is found to be no improvement can be cancelled and the socket set back to its previously recorded level. If SET ALL is invoked it would be to this level, and where no level has been recorded, to zero.

4.2.4.7 The push buttons indicated as ⊕ and ⊖ are for use with the TRANSFER buttons on the four sub-masters and are to enable SOCKETS, GROUPS and CUES to be added or subtracted into and from the sub-masters. Their function will be explained under the sub-master description. They are non-illuminated, momentary action buttons.

4.2.4.8 The button labelled NO LIGHTS allows the setting panel to be used to select circuits at zero and to prevent any accidental on-stage adjustment of such circuits by the wheel or numerical selector. NO-LIGHTS however does not apply and will not illuminate when the panel is in a HI mode and control of circuits is taken from the output stores to the setting panel.

In IND or LA a number of selected circuits may be transferred to a sub-master and individually faded in as required on cue. NO-LIGHTS is a momentary action, bistable, illuminated push.

4.2.4.9 The remaining push is an illuminated, bistable push labelled MASTER. This converts the function of the wheel to that of an overall master on the four sub-masters, such that no change in lighting occurs on switching to master or on switching back to normal function. Thus the overall level of a number of sockets and groups may be adjusted. While MASTER is invoked all the other pushes except SET ALL and LAST retain their normal functions and can be used with numerical setting of level. Any circuit on the wheel at the time remains on the setting controller until PARKED or switched OFF just as before. SET ALL returns to use when the MASTER condition is cancelled if it was previously selected. The state of the whole palette can be reset by pressing LAST which corrects changes made by the wheel being used as a master , but not individual sub-master changes.

4.2.4.10 When used in the MASTER mode, indication is given on the VDU and audibly when the relative balance between circuits is destroyed ie: by the first circuit to reach, and hence to stop at full or zero. Such conditions shall be redeemable even after full-up or all out conditions by reversing the motion of the wheel, or pressing LAST which will return all circuits to the state when MASTER was pressed. Deselecting MASTER when the circuits are altered will leave the restoration able to be carried out individually by the sub-master controls and wheels.

4.2.5. Auto-mod facilities

4.2.5.1. Three buttons to the right of the mode selection pushes provide facilities to modify the level of a circuit or to replace a socket with another on playback of a cue or number of cues. Two AUTO-MOD stores exist; one for each palette but either can be used with each playback.

4.2.5.2. If it is necessary to modify the level of a circuit in some instances when a cue, which is otherwise satisfactory, is used, this socket is selected and set to the new level either on the numerical selector or on the wheel. The SET A-M button is then pressed which records this level for this circuit in the appropriate auto-mod store. The whole of the auto-mod store is displayed on the VDU when SET A-M is pressed.

4.2.5.3. To use this new level for the circuit when the cue is recalled the USE A-M button on the playback is selected. The levels in the auto-mod store will be used in place of those in the cue for the relevant circuits while USE A-M is invoked.

4.2.5.4. The clearing of an auto-mod store is effected by using CLEAR A-M which is a non-illuminated push which has to be pressed at the same time as CLEAR on the numerical selector.

4.2.5.5. Auto-mod store information is transferred to tape for permanent storage along with all other memory information.

4.2.5.6 To set a replacement circuit or circuits into the AUTO-MOD store assume the luminaire in socket 219 has been knocked and whenever it is on in a cue it is to be replaced by that in socket 274 set at 7. Select SKT 219 and press A-M REPLACE. This will extinguish 219 and the REPLACE button will illuminate. Other circuits are then tried until a replacement (274) is found. When this is set to the correct level (@ 7), on the setting panel, both A-M REPLACE and A-M SET are pressed together. A-M REPLACE extinguishes indicating that the new circuit has been recorded as a replacement for 219, whenever 219 appears in a playback and USE A-M is selected.

4.2.6 Sub-Master Controls

4.2.6.1 Each sub-master, of which there are four on each palette, is controlled by 9 pushes in a 3 x 3 matrix.

4.2.6.2 These controls are all interdependent. The last action and any related actions shall remain illuminated until superceded: all pushes are momentary action and all except FLASH and LAST are illuminated.

4.2.6.3 In summary their functions are:

TRANSFER: take selected circuits from setting panel.

OFF: set circuits on sub-master to zero and put them on again on second push.

PARK: put circuits on sub-master back on selected playback store at levels set on sub-master, except in HI mode and with a lower setting than on playback.

IN: switch-on circuits in sub-master at levels
(a) set by fade running on playback (LA)
(b) set by movement of wheel on sub-master (IND)
(c) set by highest of playback fade or wheel (HI)

OUT: switch off circuits on sub-master such that they do not contribute to the output but continue to fade as described above.

LAST: set the circuits on the sub-master to to the last recorded levels.

FLASH: flash circuits on sub-master to full.

MOD cause levels of circuits on sub-master to be modulated by external signals.

REC: record levels and content of individual sub-master.

4.2.6.4 A sub-master can take circuits from the numerical selector and setting controls by pressing TRANSFER. All the circuits then under the control of the setting panel will be transferred to the selected sub-master. The setting panel is then empty and in a similar state to that caused by pressing CLEAR. TRANSFER is a momentary action push which illuminates after use until cancelled by PARK or OFF.

4.2.6.5 A second operation of TRANSFER will have no effect while there are circuits on that sub-master unless it is at the same time as ⊕ or ⊖ is pressed on the setting controls. Under these circumstances the circuits on the setting panel will be added or subtracted from the sub-master. TRANSFER only becomes available again when OFF or PARK have been pressed and the circuits under the sub-master's control have been put out or returned to the selected playback store.
OUT in itself is not the removal of circuits but can be made so by pressing OFF after it.

4.2.6.6 The operation of a second TRANSFER button (on either palette) will also take control of the circuits selected. A group containing a socket may be on one sub-master and the socket alone selected to another sub-master for balancing and effects. The sub-masters will work together in the highest takes precedence mode except that circuits from within a group or cue may work in the independent mode if selected.

4.2.6.7 Selected circuits which are not contributing to the store selected for the palette to work on (A, B, C or D) will be available at zero on the setting panel and can be transferred to a sub-master for fading in manually or automatically (see later). However, if a circuit is selected and adjusted with the setting wheel it will be transferred at that level, and circuits contributing to the selected store and not altered would be transferred at that level.

4.2.6.8 The control IN provides facilities for switching on circuits at their recorded levels. Thus if a group is selected and then transferred it can be cut-in to the stage lighting at its recorded levels by pressing IN. IN is a momentary action push which illuminates after use until cancelled by OUT, PARK or OFF. If no level has been recorded IN will not operate and will not illuminate but the circuits may be raised by the wheel.

4.2.6.9 IN and OUT provide a facility by which circuits may be removed from a fade and returned to it at the levels which they would be at if they had been included in the fade process. Thus if a group were transferred to a sub-master at the levels at which they are contributing to the playback store, they may be cut-OUT for a period from a fade affecting that playback and then cut-IN again. Whilst cut-OUT they may, if so required, be reset to their recorded positions by using LAST and then IN.

4.2.7.10 LAST cancels the effect of modifying the levels of circuits using the wheel and resets them to their last recorded levels. LAST may also be used to reset the effects of a fade running on the selected playback as described above.

4.2.6.11 The button OFF enables the circuits under control of the sub-master to be set to zero but they remain available to be brought back to the levels they were switched from by pressing OFF again. OFF followed by a TRANSFER of new circuits clears the original circuits from the sub-master.

4.2.6.12 PARK is the normal method of clearing a sub-master and achieves this by putting the circuits on the sub-master onto the selected playback. This transfer will occur at the levels controlling the output and no lighting change shall occur. Once they are so parked the circuits will immediately become affected by changes occurring in the playback, whereas they might have been unaffected by these under sub-master control.

4.2.6.13 The button labelled FLASH will increase the level of the circuits on the sub-master to full and is operative at all times that there are circuits on the sub-master; ie when TRANSFER is illuminated. It does not work when OFF is pressed but will when these circuits are put on again on second press.

4.2.6.14 A separate panel (described in section 4.8) provides a signal to modulate the level of a circuit or group of circuits. Each sub-master can be switched to a modulation signal and four such sources are proposed so that pairs of sub-masters (one on each palette) are fed from the same source. The modulating signal will define the waveform and overall amplitude of the drive to the dimmers, while the wheel will set the maximum intensity reached. Thus the wheel still controls the overall intensity of the circuits, their variations being set on the modulation panel; note that the function of the wheel is different in the MODULATE mode.

4 2.6.15 Modulation may be switched on to circuits already contributing by pressing MODULATE provided the appropriate signal source is set up, or circuits may be faded in already modulating by using TRANSFER, MODULATE and fading in on the wheel.

4.2.6.16 The RECORD button will record the instantaneous state of the output of the sub-master in the cue number selected on the main cue select panel (see later). If that one is already recorded the system will bleep, but a second press on the button will erase the previous cue and record the new state. The record button will illuminate until such time as a change occurs to the sub-master state from that recorded. Where a continuous modulation or fade is involved the button will illuminate for 2 seconds on release to indicate that the recording has been made. RECORD will not operate in the OFF, FLASH or OUT states or unless TRANSFER is illuminated. Record functions are summarised in section 4.4.

4.3 THE PLAYBACKS

4.3.1 The playback panel consists of two almost identical playback units, one GREEN and one RED and between them a cue select panel.

4.3.2 Cue Select Panel

4.3.2.1 The cue select panel is the panel on which the number of a memory can be selected for recording. The number selected is available to the first RECORD button next pressed.

4.3.2.2 It also has a major function as the main playback selector. Cues for use on either playback or for recall onto sub-masters, with or without times, shall be selected on the cue select panel.

Recall of sockets or groups is not possible on this panel which is for unrecorded memories or cues (recorded memories) only. Note however, that recall of a cue, recorded with times, is possible on each palette using CUE and that it is necessary to select AUTO (see clause 4.4.11, Play Indication).

4.3.2.3 Except for the omission of the right-hand column of buttons the panel is similar to the other number selection panels and a number is selected in the way described for the palette and is displayed on the VDU. If wrong it may be CLEARED and reselected. It may be incremented or decremented by a unit of one using +1 and -1. If decimal cues have been recorded +1 or -1 will move to the next recorded cue in the sequence.

4.3.2.4 Normally memories for recording will be 2 or 3 digits but it shall be possible to so designate some memories that they shall be renumbered and thus able to be used as extras in a sequential recall. It is proposed that in order to insert extra or omitted cues it shall be possible to select, say 12.1 as a cue for recording. This cue would use the last (highest number, n) memory with some new identification, and similarly 12.2 would use (n-1), and another extra, 33.1, would use (n-2). The use of such memories would be shown on the VDU such that the total number remaining unrecorded would be displayed. This information will not be helpful unless CLEAR ALL memories action has been taken before starting.

4.3.2.5 The selected cue is available for use in a number of ways. It may be used on a playback by the next operation of a TAKE, ADD or MINUS button or used in a playback or a palette by operation of a PLAY button. These various functions will be described later.

4.3.2.6 SEQUENTIAL

The use of a cue by a TAKE, ADD, MINUS or PLAY action does not clear the cue selected. In the playback sequential mode which is created by pressing PLAY SEQ, a TAKE, PLAY, ADD or MINUS operation will cause the cue number to step forward to the next cue. PLAY SEQ illuminates while invoked and the sequential series starts from the cue number selected when PLAY SEQ was pressed. Any new selection will not be used until PLAY SEQ is cancelled.

4.3.2.7 Sequential operation on playback shall take account of the decimal figures included as additional cues. For example, if 12.1 and 12.2 have been recorded, sequential operation shall follow 10, 11, 12, 12.1, 12.2, 13, etc.

4.3.2.8 A similar sequential facility exists for recording; REC SEQ This enables a separate series of numbers to be used for recording and these will step on to the next on the satisfactory completion of each recording operation. On reaching a figure of 49 or 99 the system will bleep and the record sequential (REC SEQ) button will flash until repressed tc reset it. A new selection will not be used for record until REC SEQ is cancelled. REC SEQ will not include the decimal figures.

4.3.2.9 The functions of the GEN REC (general record) and REC MODS (record modifications) buttons are described later with other record functions.

4.3.3 Playback Panels in MANUAL Mode

4.3.3.1 The GREEN playback controls stores A & B and the RED playback controls stores C & D.

Both panels and their facilities are similar except for the COLLECT RED push on the GREEN PLAYBACK and the SEL OUT button on the RED PLAYBACK.

4.3.3.2 Each panel can be operated either automatically by setting the speeds of up-fade and down-fade changes required, or by using it as a two preset manual panel. The operating state is selected by the bistable push button AUTO which is illuminated when active. As on the palettes this push is associated with the RECORD and PLAY pushes.

4.3.3.3 In the MANUAL mode (not AUTO) the two encoder wheels act as faders such that a complete motion from top to bottom of the panel will fade circuits which are full to zero and vice-versa.

4.3.3.4 Circuits in the form of cues can be selected to one of the two presets using the outside lines of buttons. The TAKE button replaces any existing cue in the store with the selected cue from CUE SELECT in a switch action. The ADD button takes the selected cue but adds it to whatever is in the store and MINUS will remove circuits from the store if they appear in the cue selected. The CANCEL button clears the store completely.

4.3.3.5 The contents of the A and B or C and D stores can be thus faded in, mixed or cross-faded using the two wheels, the state of each store and of the crossfade being indicated on the VDU immediately above.

4.3.3.6 The memories in use in any store shall be displayed (up to a maximum of 10) on the VDU Note that in manual operation the display of STACE A and PRESET B will have to change through STAGE A and STAGE B (as soon as the up-fader is moved) and then to PRESET A and STAGE B. On selecting AUTO in this stage a complete reversal of stage lighting might occur and thus it shall be inhibited until STAGE A and PRESET B are reinstated.

4.3.3.7 Because of the form of wheel controller the level of the up-fader is set to full and that of the down-fader to zero on switching to MANUAL and the setting of each wheel constantly given on the VDU. This enables the preset wheel to be set to an intermediate level in order that a cut-in may be achieved. In MANUAL the TIME button and STOP have no function.

4.3.3.8 Auto-mod may be used by selecting USE A-M which are momentary action bistable, illuminated pushes. When illuminated any circuit which has been modified or replaced in the auto-mod store will be so changed on the playback on which it is selected.

4.3.3.9 It is possible to use either playback for setting without affecting any lighting on the stage. This is done by selecting NO LIGHTS which allows full operations on the controls but does not provide drives to the dimmers. NO-LIGHTS is illuminated when selected.

4.3.4 Playback Panels in AUTO Mode

4.3.4.1 In the AUTO mode the time taken for in-coming circuits to rise to their new levels is set on the first wheel and the time for outgoing or fading down circuits to reach their new levels is set on the second.

4.3.5.2 A full motion of the wheel segment across the panel will normally give a range of control of about 60 seconds; if a major time change, from seconds to many minutes, is required, the TIME push is pressed while setting the wheel, which will then have a range of more like 5 minutes. This will be finally decided on test.

4.3.4.3 Cues are put into the preset store B using the preset TAKE, ADD, MINUS buttons and if an immediate switch action on stage is required this is done using the stage store A buttons.

4.3.4.4 Having selected the appropriate cue to the preset store it is possible to fade or change over to this using the CROSS-FADE, UP FADE, DOWN FADE, and STAGE DIM and DIM buttons. RAISE, ALL DIM and REV have associated functions. INST (instant) causes any of the other functions to be done instantly and has to be pressed at the same time as the other function button. This can be used to snap finish a slower change.

4.3.4.5.

CROSS-FADE	replaces the cue in the stage store with that in the preset store. Circuits going to a higher level move at speed set by up-fader: circuits going to a lower level move at speed set by down-fader.
UP-FADE	increases level of circuits which are at a higher level in the preset cue
DOWN-FADE	brings down circuits which are at a lower level in the preset cue.

(Note: a MOVE is UP-FADE and DOWN-FADE pressed together which moves all those circuits which are at different levels in the preset cue)

RAISE	raises all circuits in the preset cue to full, irrespective of recorded levels
DIM	fades down all circuits in the preset cue to out.
STAGE DIM	fades down all circuits in the stage store.
ALL DIM	fades down all circuits including the other playback and palettes set to INDEPENDENT.
REVERSE	reverses the action previously selected, and so reinstates the lighting existing before the previous operation.

4.3.4.6. Any of these actions including REVERSE may be stopped by a second push and restarted by a further push. When operating the appropriate push will illuminate and the operation will appear on the VDU. When an action is stopped it will continue to appear on the VDU as a reminder until cancelled by some later move. Any action may be changed to another during any operation by pressing an alternative action button.

4.3.4.7 The STOP buttons may be used also to stop the progress of a fade. These illuminate when invoked and the action is shown as stopped on the VDU.

4.3.4.8 The use of preset MINUS while a fade is running will cause these circuits which have been selected to the PRESET store to be taken out of the fade: they will stop at the levels they have reached and may be restarted in the fade by pressing preset ADD and the appropriate ACTION push.

4.3.4.9 The COLLECT PALETTES and COLLECT RED buttons enable the operator who has carried out a series of complex builds or independent fades on the palettes or the second playback to collect the circuits together onto the GREEN playback. COLLECT PALETTES has the effect of performing an overall PARK action on all the palette controls and copies all the circuits onto the GREEN playback. COLLECT RED copies all circuits on the RED playback onto the GREEN on a highest takes precedence basis and does not cause a change in lighting. Any change already in operation on the GREEN playback will not include the collected circuits, but any action started after collect will include them.

4.3.4.10 The equivalent controls on the RED playback are a COLLECT PAL and a SEL OUT (select out). COLLECT PAL has the same function as on green while SEL OUT enables circuits which have been put in the RED playback present store to be selected out of the GREEN playback. The circuits transfer at their present levels and may be set up either on a palette switched to operate on D or by cue selection.

4.3.4.11 The SELECT OUT action may be used during a fade running on GREEN but the selected circuits will stop at the levels they had reached. A different fade may be started on the RED playback immediately the SELECT OUT action has been made.

4.3.4.12 The POSITION GO push button is the operational control associated with the remote control of luminaires: see later section.

4.4 Record Play and Timing Facilities

4.4.1 RECORDING

The operation of recording requires the cue number to be selected on the cue select panel (B) and then the appropriate RECORD button to be pressed. If the cue selected has already been recorded the system will bleep but will record on a second press of the same button. The button will illuminate to indicate that the recording has been made and will stay illuminated until a change is made such that the circuits are no longer as recorded. In the case of rapidly changing lighting the RECORD button will remain alight for 2 seconds.

4.4 2 RECORD CLASSIFICATIONS

Recordings of cues can include 3 types of information.

1. Circuits and their intensity levels,
2. The controller on which they were at the time of recording.
3. A time setting relevant to the controllers.

The first information is typical of intensity memory systems and the third has been considered previously: only the designation and recall onto the appropriate controller is a new facility.

The function of the record and play buttons are slightly different in MANUAL and AUTO and are described below.

4.4.3 SUB-MASTER RECORD

The individual circuits and intensity levels set on any one of the sub-masters can, in itself, be recorded as a cue by the use of the appropriate RECORD button (H). Even in AUTO these buttons will only record intensities and not any times set.

4.4 4 PALETTE RECORD IN MANUAL

4.4.4.1 The individual intensity levels set on all four sub-masters and the setting wheel will be recorded (such that they can be recalled onto the appropriate sub-master) by pressing PALETTE RECORD (J).

4 4.4.2 It is important that circuits on the setting wheel are included as in the compilation of a scene the last circuits will be on the setting wheel. Note that the recording made will only include circuits which were TRANSFERED to the sub-masters and are under their control not any that have been PARKED or any that have been parked automatically by a reselection.

4.4 5 PALETTE PLAY

A cue selected on the cue select panel may be played back on a palette by use of the PLAY button (K). The operation of PLAY will recall onto each sub-master the circuits which were on it when the recording was made using button J. In the event of recall while circuits are on the sub-masters, an automatic PARK action will take place. If the cue recalled was not recorded on a palette and has merely circuit and intensity information this shall be replayed on a single sub-master, taking an empty one if one exists, or if not, taking the sub-master farthest from the setting panel and carrying out an automatic PARK operation on it. The PLAY operation shall be equivalent to a transfer, that is the circuits shall be put onto the sub-master at zero and are available for fading in or switching using the IN button.

4 4.6 PLAYBACK RECORD IN MANUAL

The record button (L) on each of the playbacks will record the circuits and intensities contributing to the stage output from that playback

4 4.7 PLAYBACK PLAY NOT AVAILABLE IN MANUAL

In the MANUAL state there is no function appropriate to the playback PLAY button as the recall of cues to the fader wheels separately is by using the TAKE buttons (see paragraph 4 3.3.4)

4.4.8 GENERAL RECORD & RECORD MODS

4 4.8.1. This GEN REC button (M) enables the total output state of the lighting to be recorded, irrespective of the master or controller by which each circuit has been balanced. No times are recorded.

4.4.8.2. Mounted with the GEN RECORD button is a RECORD MODS button which will record only the differences between the cues in use, and the actual output. This control operates like the other record buttons. It does not include times.

4.4.9. PALETTE IN AUTO

4.4.9.1. The AUTO button (R) changes both the operation of the palette and the information recorded in the memory. When in use it illuminates and the sub-master wheels adjust the TIME in which the levels previously set on each sub-master are to be reached. The time is displayed on the VDU above as minutes and seconds (eg 10:30).

4.4.9.2. If palette RECORD (J) is pressed while AUTO is selected, the levels of each circuit on the sub-masters, the circuits on each sub-master and the time set on each sub-master are recorded.

4.4.9.3. The setting wheel will retain its intensity control function in the AUTO state. Although it is recorded along with the sub-masters in MANUAL it is not included in the recordings of intensities, sub-masters and times in AUTO.

4.4.9.4. A cue recorded with times like this can be recalled either to a main playback, in which case the times are ignored, or to a palette. If PLAY (K) is pressed while AUTO is selected the recorded times will be redisplayed and the operation of the wheels will enable these times to be adjusted if necessary.

4.4.9.5. PLAY will always load the sub-masters with the circuits at zero as if a TRANSFER has taken place. In the MANUAL mode, IN will cut-in the lighting or the wheel may be used to fade it in. In AUTO, as the times are set on the wheels, the function of IN and OUT is to initiate the fade-in and fade out, respectively, of circuits on the sub-master. If the circuit is fading to a higher level than it is at, the move will be initiated by IN and if to a lower level by OUT. IN and OUT remain illuminated until the fade is complete.

4.4.9.6 The restrictions on recording are the same as those described previously and playing a recording including an empty sub-master will not cause a park action to be applied to circuits which may be on that sub-master.

4.4 9.7 In its AUTO condition the palette operates in the selected mode vis-a-vis the playback stores.

4 4 9.8 On completion of the auto fade moves, or earlier if required, PARK may be used to transfe the circuits to the playback. OFF will retain its switch action functions, as will FLASH but LAST will have no function in the AUTO mode. MOD shall be able to be selected so that circuits may fade in, while modulating, to new final maximum levels.

4.4.10 PLAYBACK IN AUTO

4.4.10.1 This switches the playback into an automatic mode such that the encoder wheels are used for setting times. The left hand wheel in each playback sets the time for circuits to rise to new levels and the right hand wheel sets the time for new lower settings to be reached The operation of such fades are controlled by the central panel of action buttons and has been described in section 4.3.4.

4.4.10.2 The operation of the playback RECORD button in the AUTO mode will record the circuit and intensity contributions of that playback to the lighting and also the TIMES SET on the wheels.

4.4.10.3 To recreate such a recording for use the appropriate cue number is selected and the PLAY button is pressed in the AUTO mode and will put into the PRESET store the state of lighting recorded, and set the TIMES on the wheels. The lighting change is then carried out using the action buttons. If PLAY is pressed no change will occur to a lighting fade in progress until the next action button is pressed, when the times and change in the preset store will take effect.

4.4 10.4 If a lighting state was recorded during a fade, the times will need modification before the cue was used in a performance. A time set in rehearsal for a trial would be recorded, and then modified and rerecorded until correct.

4.4.11 PLAY INDICATION

A recording made in AUTO on any panel will therefore contain timing information which is only relevant to the type of panel from which it was recorded. Thus while INTENSITY STATE cues may be used on TAKE, ADD, MINUS and the palette setting panels, INTENSITY & TIME CUES may only be PLAYED to where they were recorded. Thus the appropriate PLAY buttons shall illuminate in such a situation and switching to AUTO shall be necessary before the cue can be PLAYED on the required panel.

4.5 SUMMARY OF FACILITIES

4.5.1 Recall and Select

4.5.1.1 SELECT SOCKETS

SOCKETS may be selected for forming into groups and for intensity settings and balancing using the number selection panel (A) on either palette.

4.5.1.2 RECALL CUES

CUES may be recalled for further balancing and use on the palette by operation of the number selection panel (A). CUES are recalled for use in the playbacks on the cue select panel (B) CUES are transferred from this panel into a playback store (either A, B, C, or D) by pressing the appropriate TAKE, ADD, MINUS button.

4.5.1.3 RECALL GROUPS

GROUPS are recalled during balancing using the number selection panel (A) on either palette.

4.5.2. Transfer and Collect

4.5.2.1 TRANSFER

Any combination of SOCKETS, GROUPS and CUES selected on the number select panel and thus immediately under the control of the setting wheel (assuming MASTER is not selected) can be moved to a sub master by pressing the appropriate TRANSFER button (C) The use of ⊕ and ⊖ in conjunction with TRANSFER will cause the addition or subtraction of the selected circuits.

4.5.2.2 PARK

The circuits on a sub-master may be moved from that sub-master by using PARK (D). Similarly circuits on the setting wheel may be moved. PARK transfers those circuits to the playback selected for the palette to work on.

4.5.2.3 COLLECT PALETTE

If it is required to move the circuits on all the sub-masters on either palette onto any of the playback stores, the COLLECT PALETTE button (E) is used, which moves all circuits on the highest takes precedence basis to the selected store. This control operates only on palettes selected to operate the playback whose COLLECT button is pressed, but will operate on such a palette even in INDEPENDENT mode.

4.5.2 4 COLLECT RED

Circuits on the RED playback may be moved to under the control of the GREEN playback by use of the COLLECT RED button (F). COLLECT RED copies all circuits on the red playback onto the green on a highest takes precedence basis.

4.5.2.5 SELECT OUT

This control button (F) on the RED PLAYBACK will select out from circuits which have been put into the RED playback, those which are contributing to the lighting on GREEN playback. The circuits transfer at their present levels and may be set up on the RED playback either on a palette or by cue selection.

4.6 THE MIMICS

4.6.1.1 The desk mimics will be in the form of video display units. It is envisaged that up to three will be used in order to display the setting information relevant to each panel immediately above it. This will take some 11 lines at the bottom of each screen the remainder being used for a socket (layout) mimic.

4.6.1.2 The video display units shall be standard 625 line 50Hz television monitors and the display shall use standard 7 x 5 dot matrix ASCII characters. The display formats envisaged are shown in drawing 904/237. 29 lines by 80 characters per line will be required.

4.6.1.3 The tenderer shall include for the supply of the monitors and for any ancillary equipment necessary for the displays. He shall arrange that the V D U. mimics are integrated in the desk in the correct relationship to the panels and operator, and that the monitors are easily removable for maintenance and are correctly ventilated.

4.6.2. Palette Mimics

4.6.2.1 The lower part of the palette mimic is split into 5 sections, one relating to each of the sub-masters and one to the setting panel. As additional information is required with the setting panel this is given a wider portion.

4.6.2.2. The purpose of the V D U mimics is to give numerical information relating to sockets, groups or cues and not to duplicate push button indications except in certain special circumstances.

4.6.2.3 The Mimic above the Setting Panel

The bottom line of the mimic above the setting panel will carry information relating to SET ALL and MASTER functions as shown in the drawings. In addition an asterisk to the right shows that the controller is contributing to the stage lighting output in some way.

4.6.2.4. The top of the right hand side of the section repeats some important information from the control (master) V.D U. These are, from top to bottom, REC SEQ PLAY SEQ and CUE SEL and the appropriate numbers. These are selected on the cue select panel in the centre of the control dssk.

4.6.2.5 The remaining space above the setting panel is used for details of sockets, groups or cues being set on the setting panel. Up to 10 individual items can be displayed in the order in which they are called up, the first being inserted in the lowest line (number 28). When a new selection is made without parking the previous ones, each moves upwards. When the 10 spaces are filled a flashing + sign appears to the right on the bottom line, indicating that more than are displayed are on the setting panel, but the system will continue to accept new selections. A push button (not shown) associated with the V.D.U. shall enable the total selection to be displayed, this cancelling the full socket mimic while pressed. It will be normal practice to PARK circuits or TRANSFER them before the limits are reached.

4.6.2.6 Selecting a PARALLEL Socket

In paragraph 4.2.2.6. the situation if a socket 303 is called up while 201, which is fed from the same dimmer, is on, is described When a parallel socket is selected the system will always display the options available, and any in use at that time will have the level against them. When looped the symbol LPS is used to designate the first of the one or two looped sockets and the following SKT and @ level are blanked.

4.6.2.7 AUTOMOD REPLACE display

Where the automod replace state has been created, a symbol REP BY is used to read REPLACED BY Thus in the separate diagram, 219 has been selected and A-M REP pressed. SKT is blanked and 219 moves to the left and REP BY is inserted. The next selection of sockets will be inserted from the bottom as normal until the correct replacement combination is found. When it is, A-M REP and A-M SET are pressed together and the selected circuits are displayed as shown. As this state is only applicable at the time of setting, selection of the next socket, group or cue will clear the setting panel.

4.6.2.8 When a socket, group or cue is switched OFF or set to zero, the display shows this until the next selection is made, when the items which are at zero are cleared.

4.6.2.9 When switched to SET ALL, the level to which circuits would be set is indicated. Selection to MASTER replaces the SET ALL display and indicates level between the first circuits to reach full, and the first circuit to reach zero. When these conditions apply the display will indicate MASTER @ F or MASTER @ O.

4.6.2.10 The Mimic above the sub-masters

The display above each sub-master is a repeat of the information listed above the setting panel when these sockets, groups or cues are transferred to a sub-master.

4.6.2.11 The bottom line carries the asterisk if that sub-master is contributing to the stage and will normally be blank otherwise, apart from in the AUTO condition when the TIME is indicated. 0 to 60 minutes is required to be able to be set and would probably be set in individual seconds up to 1 minute, to the nearest 5 seconds up to 5 minutes and then to the nearest 10 seconds. The coarse time setting button is not included in these sub-masters. When a fade is running the TIME display becomes TO GO.

4.6 3 Playback Mimic

4.6.3.1 Like the palette mimics, the playback mimics occupy the lower 11 lines of the video display. The display is split into three sections, corresponding to GREEN playback, CUE SELECT and RED playback.

4.6.3.2 Most information is required in the AUTOMATIC mode and this is shown on the left of the drawing 904/237 sheet 2. The right-hand side of the drawing shows the RED playback in MANUAL STATE .

4.6.3.4 Mimic in AUTOMATIC playback

As cues are selected and TAKE, ADD and MINUS are used to make up a total state, this is shown under the appropriate store letter. The minus sign indicates the MINUS action. When more than 10 cues are selected and used the small + sign appears and flashes (as on the setting panel) indicating that the normal maximum has been exceeded. The asterisk indicates that the store is contributing to the stage lighting and the # shows that some modification has been made to a circuit in the selection, such that the lighting state could not be recreated by just selecting those cues in the combination shown.

4.6.3.5 Either side of the central display will be time indicators which show the time to fade up or down, as set on the wheels. The arrows appear in the AUTOMATIC mode. The time setting changes as the fade runs and is also altered during a fade by operation of the wheels if change is required. The action of the fade is indicated above the main fade indicator (boxed) which shows the progress of the fade. The time shown is always the time to complete the action.

4.6.3.6 The central portion provides the operator with information as to the action he has just indicated, or which was last completed. The information will always be accurate, eg: a crossfade followed by reverse would call for both indications as being the last action completed. If this is followed by a upfade this will cancel CROSSFADE and REVERSE, but UPFADE will stay along with DOWNFADE if this is the next action selected. A reselection into the stores will make information about the last action irrelevant and will cancel it

4.6.3.7. The use of AUTOMOD is abbreviated to L A-M and/or A-M R. The state of no-lights is indicated as NO LTS.

4.6.3.8 Mimic in MANUAL playback

The mimic display simplifies slightly in manual mode, but shows the same list of cues selected into each store, the use of auto-mod and no-lights. The state of the manual fader wheels is indicated in the boxes (0 through 0.1 to 9.9 and then F). The modify symbol (≠) and the asterisk indicating contribution to the stage lighting also apply as before.

4.6.4 SOCKET (LUMINAIRE) MIMIC

4.6.4.1 The number of sockets in each theatre are given in the schedules. It will be seen that the total number in each theatre exceeds the space available on the VDU's even allowing for three units. The character spaces available in the top section of each screen are 18 x 80 = 1440.

4.6.4.2 The socket mimic is envisaged as being as shown in 904/237 This is a 4 x 3 =12 character space, of which 6 spaces are used as separators. Thus 18 lines in each VDU represent 6 lines of socket mimic and 80 characters per line allow 20 displays across the screen. Thus a total of 360 individual sockets and their intensities and a code symbol may be displayed at any one time. This is acceptable as the number of sockets to be available to a designer for one production at any one time is to be 250 in the Lower Theatre and 300 in the Upper Theatre.

4.6.4.3 The rules governing the mimic display are that the sockets selected for use will display themselves in sequence making changes as necessary as the sockets are put to use. If a layout giving the sockets to be used is available before lighting rehearsals begin, these sockets can be keyed in first, together with any looping or presetting required. The circuits will display themselves as horizontal lines of 10 wherever possible, 2 such lines being accommodated across the screens. The display will commence on the centre screen and expand to the left and right hand screens.

4.6.4.4. The socket mimic shall be able to show a number of different displays. The display required is selected on the panel above the CUE SELECT panel from one of the following:

Total stage lighting
Store A
Store B
Store C
Store D
Automod Store L (including indication of replacements
Automod Store R (including indication of replacements
Cue selected (including cue TITLE)
Cue list (giving cues recorded and their TITLES)

The individual contents of the setting panels and sub-masters will be located by using the flash pushes if necessary. The remote control mimic push has a slightly different function described later.

4.6.4.5. It shall be possible to type in cue titles which will be displayed in a list of all recorded cues. This is shown in the drawing 904/237 sheet 2 which shows the display under the CUE LIST button. The CUE SELECT display will carry at the top the cue number and the title, if it has been added. The normal cursor and other keyboard facilities will be applicable to the display of TITLES and CUE SELECT.

4.6.4.6. The socket mimic can also be partially replaced (usually on the left hand screen) by the remote control panel display (see paragraph 4.9.4.). This is done by a local mimic push button which will work as a bistable push in parallel with REMOTE MIMIC on the cue select panel. When invoked the near screen will show remote position information until cancelled from one of the two positions. The other mimics will continue to display the selected information.

4.7 Stalls Control

4.7.1.1 This shall consist of one palette complete with record facilities but without the auto-mod buttons. These latter are placed by two buttons (MEMORY and MEM RESET) to help the lighting designer make changes as the show proceeds.

4.7.1.2 All the operations on the stalls control palette shall be the same as those described for the others, including the ability to LOOP circuits, get an indication of PARALLELS and to use the setting wheel as a master.

4.7.1.3 It is envisaged as being usual that the REC SEQ will be selected on the main desk thus allowing a sequence of cues tc be recorded from the stalls; however, it is possible for the stalls' operator to select MEMORY (X) and then to key-in a memory number, either that he wants to change or just to record out to sequence. Decimal numbers for additional cues can also be called up for record and play. The memory selected is only available to the stalls control and doesn't affect REC SEQ or the memory selected on the main panel. Pressing MEM RESET (Y) changes back to the main panel selection.

4.7.1.4 Note that palette PLAY has been retained on the stalls palette; this may be used by recalling a cue recorded on a palette with times and selecting AUTO.

4.7.1.5 The stalls control shall also employ one video display unit. The lower section of this will normally carry the information relating to the palette setting whilst the upper portion will carry the circuit mimic in a slightly different form from that for the main panels. The first circuits will be displayed in number order; if less than 20 in each hundred, then each line will be a discrete hundred. If there are more than 20 in each hundred but all the discrete hundreds contain circuits which are in use, then two or more lines would display the same series of hundreds. As soon as the numbers exceed the lines available the word ROLL appears and it shall be possible to roll the top section of mimic from circuit 1 through to the highest, by use of a mimic wheel (not shown). As circuits change the system shall display the circuits remaining by automatically rolling to display most circuits, and reducing the spread of the display, as explained above.

4.7.1.6 It shall be possible to select to view, in the lower part of the mimic, the operations being carried out on either main palette or the GREEN and RED playbacks. This will be selected on a small control panel associated with the V.D.U. and carrying these selector buttons and the ROLL wheel. Position control information can also be called up.

4.7.1.7 The stalls control unit shall be as light and compact as possible and shall be connected to the remainder of the system by the minimum size of cable. A length of 10 metres of suitable flexible cable shall be allowed, together with the necessary connectors, including mounting these on the panel to be set into the stalls' floor.

4.7.1.8 The monitors used for the stalls controls shall, if possible, be the same as that used in the desks, but shall be fitted with suitable handles for carrying. The monitor feed and selector shall be available on a suitable outlet on the stalls floor panel so it may be used without the stalls control unit.

4.7.1.9 It is envisaged that mains will be required for the monitor but that the stalls control unit would be powered from within the system.

4.8 Modulation panel

4.8.1. The modulation panel has been conceived because light in nature is seldom still; often it moves slowly which can be simulated using the main control system, but it also requires to flash or cycle in man-made situations, while in nature there is the flickering of candles, oil lamps and fires and the shimmering of light off water and the moving patterns of light caused by trees moving in the breeze.

4.8.2 The modulation panel is therefore required to provide:-

(a) cyclic flashing
(b) flickering/shimmering effects from cassette
(c) lighting modulated from external sound effects.

4.8.3 It should be noted that it is required that these signals operate groups, cues or single sockets and are not just alternative dimmer feeds.

4.8.4 Four units are required, one for each of the sub-masters on each palette. Hence sub-master 1 on the left hand palette receives the same modulation out-put as sub-master 1 on the right hand palette and stalls control.

4.8.5. Flashing facility

4.8.5.1 The controls for this are seen as being those of a waveform generator. The cycle time would be set first: this control would provide a 0-60 seconds range. The second control is envisaged as being a setting of the percentage of the cycle time which will be at minimum (minimum light). Individual controls for rise time and fall time (0-30 seconds) are included to enable fast fade-ins to be followed by long decays, etc. The level of the minimum signal is controlled as is the amplitude of the signal to be mixed into the output. The basic concept is shown in drawing 904/242.

4.8.5.2. A monitor point for the waveform shall be provided. The controls are all seen as being rotary types with clear engravings allowing for easy presetting.

4.8.6. Audio Channels

4.8.6.1 The two audio channels are identical in that each has a frequency selector switch (providing 6 discrete audio frequencies), a bandwidth control and a minimum signal level control. Each channel also has an amplitude control.

4.8.6.2 Final details of the frequency selective equipment will be formulated in conjunction with the successful tenderer, but likely frequencies would be 200 Hz, 500 Hz, 1KHz, 2KHz, 4KHz and 8KHz. The minimum bandwidth would be about ± 20% of the selected frequency. At maximum the frequency ranges will overlap.

4.8.7. The amplitude controls shall all include an off position and an indicator light. Some metering of the signal level, so that this can be related to the maximum dimmer drive, should be included.

4.8.8. The three signals, flashing, cassette and audio input are combined on a highest takes precedence basis such that, for example, a signal from the cassette equipment can be further modulated by audio signals.

4.8.9. The cassette equipment shall be incorporated in the modulation equipment panel. It is assumed that where very special signals are required these will be prepared in consultation with the sound department in order not to duplicate synthesiser and tone generation equipment. However, it must be possible to record on to standard audio cassettes the final signal, when this is found to be satisfactory.

4.8.10. Standard 'flickering' and 'shimmering' effects cassettes will be produced by the client and used for normal effects.

4.8.11. It is proposed that the cassette machines shall each be two track, so that synchronised signals may be fed to associated memories when an alternating effect is required. Switching for the tracks to the four modulators shall be included.

4.9 REMOTE CONTROL PANEL

4.9.1 Introduction

4.9.1.1 This panel provides for remote control of position, colour or slide in a luminaire or projector. The supply of luminaires, projectors or other distributed hardware is not included in this specification. This specification covers the panel, its functions, storage required and an output interface suitable for the remote control system.

4.9.1.2 Basically the remote control system is to be a ring or rings into which electro-mechanical units capable of panning/tilting/focussing a luminaire, changing its colour filter or changing the slide in a projector, can be connected. Each discrete mechanism has an address code and can be called up for presetting by the operator. When the position is right, it may be recorded as part of a cue.

4.9.1.3 The panel and push buttons and their functions are described later. The tenderer shall allow a P. C sum for the fabrication of the panel, fitting and connection of the push buttons to the same standard as in the rest of his system and for the provision of POSITION GO and REVERSE signals; play cue, record cue and cue select numbers from his system to be available to another subcontractor.

4.9.1.4 Where a software computer is employed it may be possible for a subroutine to be included for the processing of the remote control signals. Some 500 words of programme (based on a 16 bit word) should be allowed. Where the basic store size of the lighting control system would be made more economic if larger, the addition of 75, 000 words or 85, 000 words could be included as part of the main system.

4.9.2. Facilities required on the panel

4.9.2.1. The panel consists of a numerical selector and above it a set of six pushes and three illuminated indicators. To the left are the three wheels for controlling position, above them ten push buttons for selecting colour and to the right a slide operational panel.

4.9.2.2. Each remote control electro-mechanical device will be given a discrete number (may be all the colour change units begin with 1, all the positional units begin with 4 and the slide change equipment begins with 7) and on keying in this number the appropriate indicator (COLOUR, POSN, PROJ) lights. In addition, if it is a colour change unit the two indicators over the colour change buttons illuminate, if it is a positional unit, those between the wheels illuminate and if it is a projector, the SLIDE button on the numerical selector illuminates. +1 and -1 increment or decrement the selected number as previously.

4.9.2.3. Colour change units

Two types of controller are allowed for, a semaphore and a wheel. The present colour in the luminaire will be shown on the mimic. It shall be possible to select open white (O), two or more colours together on a semaphore unit, or continuous motion on a colour wheel (↜↝).

4.9.2.4. Positional control

Three motions are allowed for: pan, tilt and zoom or focus. A number of mechanical units may provide pan and tilt for luminaires without focus, but some luminaires will have a third function. The wheels, as for intensity control and time setting, must have an agreed tactile response. The wheels shall be differently coloured and arranged so that motion towards the top of the panel is clockwise pan, increased tilt and smaller focus.

4.9.2.5. Slide selection

After selection of the projector, pressing the illuminated SLIDE button enables a new two digit number to be selected for the next slide. It is likely that some restriction will need to

4.9.2.5. cont. be put on the numbers which can be selected , as the slide magazines may well only carry 60 to 80 slides. If the slide selected is available the projector will move to it (subject to the buttons above the selector described later).

4.9.2.6. Slide projectors are often not used singly and it is possible to make up groups to change together using the slide operational panel to the right. A slide projector selected can be transferred or added to one of the groups X, Y, Z by the use of TRNSFR/ADD. If a projector is already on one of the groups it would haveto be removed (DELETE) before being added to another. CLEAR enables the whole group to be erased.

4.9.2.7 . The normal slide operational controls are then provided below, move BACKWARD one slide and move FORWARD one slide. If it is necessary to reset the group X to slide 12, say, X may be selected, SLIDE pressed and 12 keyed in.

4.9.2.8. The remaining small panel of 6 push-buttons control the recording of new settings and the move to new positions. PRESET and FOLLOW are mutually exclusive, bistable pushes. PRESET means that a new selection of colour or position will be shown on the VDU mimic but the unit will not move to it until MOVE is pressed, when any preset moves will be carried out. MOVE does not change the presetting state, it just allows preset moves to be carried out. FOLLOW, on the other hand, creates a state of permanent move in which luminaires will follow the setting of the wheels etc. MOVE will remain illuminated during the motion of all equipment.

4.9.2.9. If a new position has been tried which is found to be unsatisfactory or unwanted it is possible to return to the previous position by pressing LAST. This will apply in either PRESET or FOLLOW modes. Similarly it may be tha a change has been set up in advance of being required for recording. The luminaire may be left in this position, but by pressing OMIT the change will not be included in the next cue recorded, but will be in the following cue.

4.9.2.10 A similar set of three PRESET, MOVE and FOLLOW buttons are provided for the slide operational panel. This enables two or more slides to be stepped past with the panel in preset and then MOVE will take the projector directly to that slide required. Normally the panel would work in the FOLLOW mode.

4.9.2.11. The POSITION GO push button on the GREEN playback enables cue recorded with some new positional information to be involved, either before or after the relevant intensity change. It will cause any remote unit for which there is a new position (i.e. : other than the position at which it now happens to be) in the store, to move to that position or to that colour, etc. In certain circumstances extra, possibly decimal, cues will be recorded which contain purely position information. The POSITION GO push shall stay illuminated until all the moves are fully carried out. A REVERSE action push will also be required for positional changes (not shown).

4.9.2.12. The slide focus buttons will be used in conjunction with individual slide changes (where the unit includes a motorised lens) and the corrected setting will be recorded along with the slide number data. It is not intended to display this numerically but to treat it as a trimming control to work with the slides.

4.9.3. Design points

4.9.3.1. It is important to remember that the remote position control, slide and colour change equipment is electro-mechanical and will not take kindly to conflicting instructions being received. It is essential that the processing electronics takes account of the abilities of the mechanical interface and sends realistic instructions. If, for example, new slides are are being keyed in faster than the machine can display them, this information should not be transmitted to the data highway.

4.9.3.2. All functions will take longer to carry out than it takes to instruct them and this must be indicated in some comprehensive way on the panel or VDU.

4.9.3.3. In the event of units not getting to their in instructed positions due to obstructions or similar external mechanical limitations, this shall not effect the control system which shall continue to command the final position until such time as a new position is called up for that unit.

4.9.4. Remote control mimic

4.9.4.1. The majority of the information required for the remote control functions can be displayed in 3 active lines as shown in 904/237 sheet 1. This relates to the selected remote control unit and shows its present and set position, and also gives a continuing display of the slide numbers applicable to the three slide projector groups X, Y, Z.

4.9.4.2. On selecting a remote unit on the numerical panel, the near central display REMOTE POSITION will appear for a remote position control luminaire, REMOTE COLOUR for a colour change and REMOTE SLIDE for a slide projector.

4.9.4.3. The present (NOW) and the preset (SET) positions of PAN TILT and FOCUS (or zoom) will be displayed. Where a unit has only just been selected NOW and SET will indicate the same. A new position may be preset to a number or found by using the FOLLOW facility. Three spaces are allowed but a two digit display is likely.

4.9.4.4 When a remote colour change or slide unit are selected the word FOCUS becomes COLOUR or SLIDE respectively. Under COLOUR the letters A to H or O can be displayed as appropriate. Under SLIDE the two digit slide number will be shown.

4.9.4.5. To the right of the words SLIDE GROUP are the X, Y, and Z slide group states. These are positioned such that the three digit numbers of the projectors (not shown) in each group can be added in the setting panel space below without blanking any other information. Up to 10 slide projectors can be shown, as for sockets display in the setting panel space, but in excess of this number is indicated by a + sign.

SECTION 5: DESKS AND COMPONENTS

5.1 Introduction

5.1.1 The two systems are envisaged as control panels and display units set into desks in the form shown in 904/236. The location of the desks in the control rooms are indicated in 904/239 together with the space available for control equipment. It should be noted that the Lower Theatre control equipment is to be located in a separate room below the dimmer room (see drawing 904/705). The dimmer rooms are shown in drawings 904/708 and 904/217.

5.1.2 The details of the lighting control rooms, including cable tray or trunking, will be prepared by the Consultants after the final details of the desk and all ancillary equipment are supplied by the lighting control equipment contractor.

5.1.3 The supply of any special cables which are not readily available shall be included by the tenderer who shall anyway include in his tender a schedule and schematic of the complete control cable installation.

5.1.4 The tenderer shall include for the termination and connection all control cables and any mains and video cables associated with his equipment. The main electrical contractor will be responsible for all power connections to dimmer equipment and for the outgoing socket feeds.

5.2 The Desks

5.2.1 The desks shall be formed from blockboard or chipboard, securely constructed with glued and screwed joints, accurately faced with an agreed laminate sheet to provide a hardwearing surface. The edges of the desks towards the operators shall be padded and covered with an appropriate material. Colours to be decided.

5.2.2 The communications panel shall be supplied free issue to the lighting control contractor but he will otherwise be responsible for the complete furnishing on the desk and monitor section between the side walls and from the glazing to the operators edge of the desk. An area shall be included for a layout plan.

5.2.3 Knee space shall be maintained and no controls, cables or electronics shall be allowed to encroach on the physical space required by the operator.

5.2.4 The control room windows are both opened by a mechanism mounted beneath them and for which access is required through beneath the desk: this shall be considered in the design. The tenderer shall include for OPEN, CLOSE and STOP push buttons on the supervisory panel in the desk.

5.2.5 All panels shall locate in a metal frame or frames set into the timber desk and shall finish flush with the laminate facings. Minimum numbers of fixing screws shall be employed (secret fixings preferred). All panels shall be durably finished to a very high standard. An agreed manufacturer's nameplate shall be permitted in one position on the desk. Minimum engraving is required on the panels.

5.2.6 Any processing electronics required shall be included on the back of the panels or located to the side of the desk in the pedestals or a rack. This is to be discussed when final volume required is defined.

5.2.7 The tenderer shall include for any necessary trimming or edging on site to ensure that the desk fits correctly in position. This could take the form of a timber edging fixed to the wall up to which the desk fits. As the desk is likely to be one of the last elements installed it is considered advisable that the desk manufacturer attends site and provides this attendance rather than the main contractor.

5.3 Components

5.3.1 The contractor shall, whenever possible, use tried and tested components and shall remain fully responsible for all problems associated with them. He will be expected to demonstrate his ability to produce reliable electronic circuits and shall describe his expected MTBF and supply details of service and repair facilities (see also paragraph 7.8).

5.3.2 All major components shall be described in the tender: power supplies, stores, computer, cassette system, monitors, encoders, etc., etc.

5.3.3 Certain specific components are required: all the panel push buttons are to be CLARE PENDAR illuminated reedswitch types. The engraving and symbols can be discussed and finalised before orders are placed by the contractor for these components. The encoder wheels are to include an amount of frictional and dynamic feedback which can be adjusted, and the slightly ribbed surface shown has to be tried. At least 3 and preferably 5 wheel colours are required. A prototype wheel shall be demonstrated for the consultants to try.

SECTION 6: DIMMERS

6.1. Introduction

6.1.1. The important parameters of the dimmers are given in order that manufacturers can appreciate whether there are special requirements over and above their normal dimmers: it is not intended that a special dimmer be designed specifically for this installation.

6.1.2. It is expected that thyrister or triac dimmers will be offered and that samples of possible types will be made available for soak testing by the consultants or to their instructions for a period of at least 6 weeks.

6.1.3. In addition to the standard dimmers, contactor or AC solid state switches are required to enable the alternative sockets to be fed as described. Similarly equipment for switching the switched-only circuits shall be included in the installation either as separate racks or included in the switching modules necessary for a percentage of the dimmers.

6.2. Description

6.2.1. Sizes

Both $2\frac{1}{2}$ Kw and 5 Kw capacity dimmers are required and the performance specified shall be achieved by both sizes on loads down to $\frac{1}{2}\%$ of the dimmers' rating.

6.2.2. Packaging

Single or double self-contained plug-in modules are required. These shall be interchangable with each other and shall be in racks of 20 or more. The racks shall be provided with LIVE circuit fusing for all outgoing circuits and shall be of the open front type (the dimmer modules form the front face of the rack). Each module shall carry a permanent serial number clearly marked on it so that individual recurring faults can be easily conformed as being a certain dimmer module. 5Kw and $2\frac{1}{2}$ Kw sizes shall not be interchangable.

The racks and dimmer spaces shall be marked with circuit numbers and phasing and DANGER-LIVE TERMINALS ENCLOSED signs.

6.2.3. Acoustic Noise

The dimmer equipment shall not create noise in excess of NC 20 and shall preferably not require to be blown for cooling. The dimmer rooms will be maintained at an ambient temperature not exceeding 35° C. The Upper Theatre dimmer room has a door into the fly tower and it is therefore important to limit the acoustic noise from the dimmers. No special arrangements are to be required for cooling the racks, which shall be fitted with approved form of over-heating alarm.

6.2.4. Electrical Connections to the racks

Input power: connections shall be to three-phase and neutral busbars fitted in the top of the rack by the dimmer supplier. The busbars shall be of at least 500 A capacity and will be able to be centre-fed. It shall be possible to supply any dimmers in a given rack from a given phase.
Output connections: separate line and neutral connections of a clamping terminal block type shall be provided for each outgoing circuit. The terminals shall be able to accept 10 or 6 mm^2 cable for 5Kw circuits and 6 or 4 or 2.5 mm^2 for $2\frac{1}{2}$ Kw circuits.

All connections, fuses, and terminal shall be clearly and indelibly marked. Suitable earthing points shall be provided in each rack.

6.2.5. Electrical Supplies

These are nominal 240 v, 50 Hz TPN supplies from local distribution switchgear, and subject to ACB's remotely controlled from each lighting control desk.

6.2.6. Dimmer Module Connections

Earthing, power and control volts shall be connected in that order on inserting a dimmer module and arranged such that the dimmers switch off when control volts are removed. No live parts shall be accessible when the dimmers are removed or during the process of removal.

6.2.7. Control signal

It is envisaged that the requirement will be for an analogue DC signal of 0 to +5v. The input impedance of the control circuit shall be such as to limit the current required to less than 2mA. Digital drive to the dimmers is not considered appropriate to this installation.

6.2.8. Control setting - light output law

The dimmer performance shall be such that it is possible for a steadily changing input signal to provide a continuously changing light output from a tungsten source of the full rating of the dimmer. This law, which is not easily defined mathematically, is to ensure that automatically originated fades and crossfades provide a constantly changing light output over the operating range. It will also be found that such a characteristic provides satisfactory presetting as a change of, say, $\frac{1}{2}$ point anywhere on the scale will cause a similar percentage change of light.

It is expected that the absolute values of the curve would be determined by experiment by the consultant and contractor but an ability to produce this characteristic either in the dimmer or by a separate inteface, etc, shall be demonstrated.

6.2.9. Stability

It is important that the absolute value of output volts is stable, with constant input signal over long periods and over the normal operating temperature range.

Periods up to 6 months or extremes of temperature $+10^{\circ}C$ to $+35^{\circ}C$ shall only change output volts by 1% (input signal constant).

6.2.10 Interchangeability

For a constant input signal any correctly aligned dimmer supplied shall provide output volts within $1\frac{1}{2}\%$ for the same load and temperature.

6.2.11. Dissipation

The heat output of the dimmers shall be less than 2% of the full rating when fully loaded. They shall be capable of continuous operation at this dissipation for extended periods of at least 48 hours (see also paragraph 6.2.3.).

6.2.12. Mains voltage variations

The dimmers shall be stabilised sufficiently that the effect of input mains voltage variations is reduced so that over mains variations of + 6 % increase, the output volts for a given control signal remain within 1%.

6.2.13. Dimmer adjustments

These shall be the minimum necessary, but shall be accessible easily and means provided in each dimmer room for local provision of the necessary control signal without using the main control desk. Monitor points to check the presence of the control signal and the correct operation of the control circuit shall be provided on the front panel but checks on the power output would be made on the fuses or terminals in the rack.

6.2.14. Reliability

It is essential that the dimmers are extremely reliable and are not caused to malfunction by mains borne spikes, interference or momentary power failure. Positive firing of the thyristors must be achieved at all times and the equipment must be fully protected against the sudden load of a cold full-rating lamp or short circuit.

6.2.15. Volt drop

The full load voltage drop across the dimmer shall not exceed 5 volts at maximum conduction.

6.2.16. Filtering

The dimmers shall incorporate filters to limit the interference on external audio circuits to generally accepted television studio standards. The tenderer shall specify the rise times for different load conditions.

SECTION 7: ANCILLARIES

7.1.1. A number of ancillary items are required for each system including supervisory panels, tape cassette facilities, fittings for communication facilities and cue lights, and a designer's panel.

7.2. Supervisory panel

7.2.1. A supervisory panel with all the necessary controls on it to switch on the system, switch on the production lighting power (push buttons, key lock and indicators only in this contract) and to authorise the use of the main and stalls control record facilities and the use of the tape cassette system is required. Separate intensity and position record enable keys are envisaged.

7.2.2. This panel will also include controls for adjusting the audible warning the system provides and the intensity of the desk and button illumination.

7.2.3. Overheat and other supervisory alarms will be included. The monitor controls are envisaged as being associated with the monitors themselves but it may be necessary to include changeover facilities in the event of a monitor failing.

7.2.4. The details of these controls will be established in conjunction with the contractor when details of the main system are finalised.

7.3. Tape cassette

7.3.1. A cassette system by which complete or part productions may be committed to a magnetic tape record and then reused is required. The cassette system shall also provide the input for computer and hardware test programmes.

7.3.2. The system shall record both intensity and positional information and shall employ magnetic tape cassettes of sufficient capacity for complete productions. The cassettes shall be rugged and able to be labelled with production name and number. The tape surface should be recessed from the outside of the cassette or covered when removed from the equipment. Some physical device preventing rerecording on certain cassettes would be an advantage.

7.3.3. It shall be possible to transfer cues singly or in groups and to remember cues in the process of transfer. Auto-mod information shall also be transferred as it stands, as auto-mod settings will often be used as a standby for vital luminaires in a production.

7.3.4. Interlocking controls allowing for the erasure of a tape and the clearing of a memory are to be provided. Selectors for the start and finish cues of a sequence shall be included but it is only necessary for these to cope with 3-digit cues. Decimal cues will be recorded as decimals so that when the show returns to the repertoire the cues are the same as before.

7.3.5. The main essential of the tape system is that it is completely reliable and straightforward in operation so that it can be depended on as part of the main system.

7.3.6. System and hardware test programmes shall be proposed by the tenderer and these shall be able to be inserted from prerecorded cassettes into the equipment in order to carry out routine maintenance.

7.3.7. Rather than have a separate paper tape system by which lighting schedules or cues can be fed into the system it would be preferred if an operator could prepare a schedule of circuits or a number of cues from a keyboard as a cassette tape which can then be put into the memory before lighting rehearsals start for that production.

7.3.8. The tape system shall operate at a reasonable speed such that a complete production can be recorded or transferred back into the memory in less than 15 minutes. If possible operation of the tape system shall not preclude lighting operations being carried out using memories outside the range selected on the cassette equipment.

7.4. Keyboard

7.4.1. A keyboard with a typewriter format plus the additional facilities usually associated with a VDU, ie: the cursor positioning push buttons, is required.

7.4.2. On selection of CUE SELECT or CUE LIST the cursor shall become available and shall accept new cue titles or modifications to existing titles. A maximum title length shall be established. The designer may prefer to use it to add notes about each cue or series of cues.

7.4.3. It shall also be possible, as described earlier to switch the keyboard so that it may be used to prepare a plot or series of cues which can then be recorded in a cassette for future use. If the keyboard and a mimic VDU can be used for this it will reduce the amount of equipment required for these ancillary operations.

7.5. Hard copy

7.5.1. A single teletype which can produce hard copy records from either system memory is required. This item would be used to keep permanent records of productions and for analysis. It would not be expected that it would be in permanent use and may well provide a useful computer maintenance component.

7.6. Communications

7.6.1. A communications panel will be incorporated in the desk. It will be manufactured and installed by Pye Business Communications Ltd. but the lighting control system contractor shall allow the required routes for cables, panel fixing points and space, and shall co-operate generally in its inclusion. The size of the panel will be 9" x 20" wide.

7.6.2. The cue lights shown on it (drawing 904/373) may be repositioned in a lighting control panel directly in front of the operator in which case the indicator lights and reply button circuit will be supplied free issue to the lighting control system contractor.

7.6.3. Ring intercom facilities will be provided between control room and the dimmer rooms but the contractor should allow for a temporary telephone system if he feels such will be required for installation and commissioning, as it is likely that the main communications system will be being commissioned at the same time.

7.7. Designers portable panel

7.7.1. This is a portable piece of ancillary equipment conceived to overcome setting problems and to simplify a designer's modifications during rehearsals. It should be quoted as an extra.

7.7.2. The panel is seen as consisting of a set of 19 push buttons laid out as the number selection pushes on the setting panel in a moulded case with a simple display of the selected socket number and the level commanded. The unit will not show the level the socket was at, but only the command.

7.7.3. The panel would only select SOCKETS and would set levels using the @ (as explained before). The O and F pushes would not be illuminated. The dot button will be used to put a circuit back to its last recorded level.

7.7.4. The important facility of this control has to be its portability. While it would be ideal if this unit could use a radio signal, if this is not practicable it should be linked using only a coaxial cable or, at the most, a screened star-quad cable of considerable resilience. This cable could be rigged to drop from a central bridge position, as well as use a socket in the floor, to enable the designer to roam the stalls and downstage areas. The unit would be used around the theatre for setting lamps, especially those in the bridges.

7.7.5. If the unit is radio linked it will obviously be battery powered, but if on a cable it may be fed in two unused cores. A cable diameter of 3/16" maximum is acceptable.

7.7.6. The portable unit will always control circuits in the output store and they will be left as set on it, unless the dot button is pressed before CLEAR. If a circuit is to be put off, it is set to O and then CLEAR used.

7.7.7. If after CLEAR, - and CLEAR are pressed this will put off all the sockets which were on under control of the portable unit.

7.8. Auxiliary Faders

7.8.1. A panel of 20 auxiliary faders is required which can be selected to control a maximum of 10 circuits each on a pin patch system. The pin patch shall refer to the discontinuous series of sockets in the theatre.

7.8.2. The faders are essentially for emergency standby but can also be used for certain groups of sockets required for special effects or when the main system is not on; for example, for additional on-stage rehearsal lighting.

7.8.3. The faders shall be provided with ON-OFF push buttons, including a FLASH facility if possible, and shall drive the dimmers on a highest takes precedence basis.

7.8.4. These faders shall be supplied completely independently, such that if the main system is not on or not even powered, they can be switched on independently and used.

7.8.5. It is envisaged that these faders will be standard quadrant or linear faders with scales showing 0 - 10 with half and quarter markings. They should operate to a 'theatre' law if that described under 6.2.8. is not possible without the main system.

7.9. House Lighting

7.9.1. The control of a number of circuits of house lighting is required within the system. The house lighting circuits will form part of the production lighting installation and will be available as individual dimmers (feeding a number of lamps or outlets) or as a cue (000). If different house lighting groups are required with or without the addition of other production lighting outlets these can be formed up using other cue numbers. Cue 000 will always bring up the house lighting circuits only.

7.9.2. The house lighting dimmers will be identical and interchangeable with all others of the same rating, but should be accommodated if possible in a separate rack. Separate isolation will be provided for these circuits.

7.10. Setting Up and Maintenance

7.10.1. Any test equipment which is necessary for first line maintenance of the complete installation shall be included and its function and use described in the technical handbook. Equipment required for setting up, connecting and putting the installation to use shall remain the contractor's responsibility.

7.10.2. The tenderer shall supply a priced list of test equipment which will be required by a qualified electronic engineer, who has undergone a course on the system, on order to carry out normal maintenance in excess of first line maintenance.

7.10.3. A priced list of recommended spares to be held by the theatre shall be included in the tender based on the following assumptions:

1. First line maintenance (replacement of cards, etc.) will be diagnosed and corrected by theatre staff, possibly in conjunction with contractor's staff over the telephone.

2. Major components will be duplicated so that in the event of failure the system shall be usable, albeit with some restrictions.

(1 and 2 protect against part failure shortly before a performance)

3. The contractor shall provide service call arrangements with qualified staff who will attend within 2 hours of a failure being reported between the hours of 10.00 and 19.00 (and who will continue such work as may be necessary to get the performance on beyond this time). After 19.00 a telephone diagnosis service must be provided, with automatic attendance by service staff the following morning unless the fault is recorded as repaired by the theatre.

4. All spares not included in the list proposed for holding by the theatre, shall be available in the contractor's near-London premises.

7.10.4. The system shall be designed to be easy to diagnose and to maintain. It shall be designed to ensure that, wherever possible, faults on given elements do not affect other parts of the system. Particular attention shall be paid to power supplies and other central equipment which could have far reaching effects.

7.10.5. Dimmer test gear and equipment suitable for setting dimmers up shall be included in the above lists. A fuse test board shall be included in each set of racks, preferably alongside the fuses. This shall be mains powered through a transformer.

SECTION 8: SYSTEM QUANTITIES

8.1 UPPER THEATRE

8.1.1 Dimmers and output circuits

5Kw dimmers with SINGLE output		203
5Kw dimmers with TWO alternative outputs		6
5Kw dimmers with THREE alternative ouputs		51
$5\frac{1}{2}$Kw dimmers with SINGLE output		68
$2\frac{1}{2}$Kw dimmers with TWO alternative outputs		0
$2\frac{1}{2}$Kw dimmers with THREE alternative outputs		108
Switched only circuits		81

8.1.2

$2\frac{1}{2}$Kw house light dimmers with SINGLE output	allow	2
5Kw house light dimmers with SINGLE output	allow	15

8.2 LOWER THEATRE

8.2.1 Dimmers and output circuits

5Kw dimmers with SINGLE output		90
5Kw dimmers with TWO alternative outputs		14
5Kw dimmers with THREE alternative outputs		34
$2\frac{1}{2}$Kw dimmers with SINGLE output		134
$2\frac{1}{2}$Kw dimmers with TWO alternative outputs		0
$2\frac{1}{2}$Kw dimmers with THREE alternative outputs		82
Switched only circuits		62

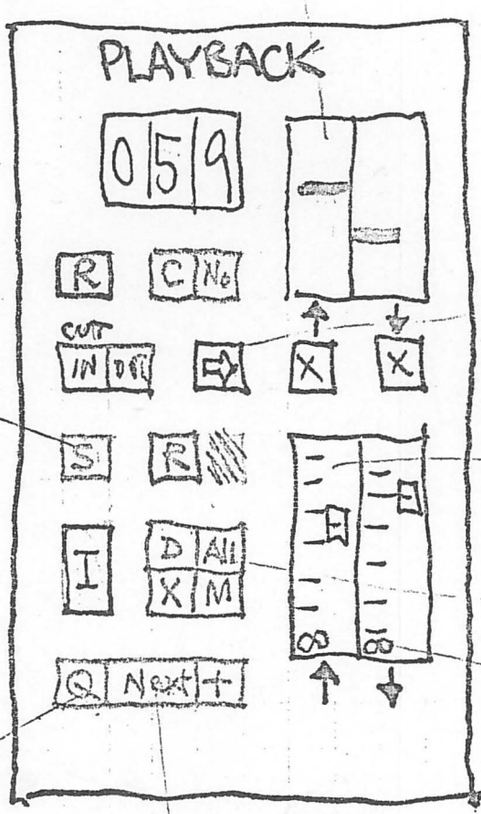
8.2.2

$2\frac{1}{2}$Kw house light dimmers with SINGLE output	allow	5
5Kw house light dimmers with SINGLE output	allow	9

(See also the Schedule of sockets and drawing)

P.D.M / PILFILE
Modifications 10.6.71
RHE/RGB.

Two fade indicators
One for up one for down.



TRANSFER to RED
any Cue selected
on Cue Select.
ON RED PLAYBACK this button transfers all RED to GREEN playback

"Up" on left.

Automatic Sequence.
cancelled off by operation of "Q" or "Next"

All dim.

Infinity.

"Cue" or "next Cue Selected"
"Q" only operative if number selected in "Q Select" & superimposes this number into Playback.
Thereafter until fresh number is selected it will next onward from previous selection in Q Select.

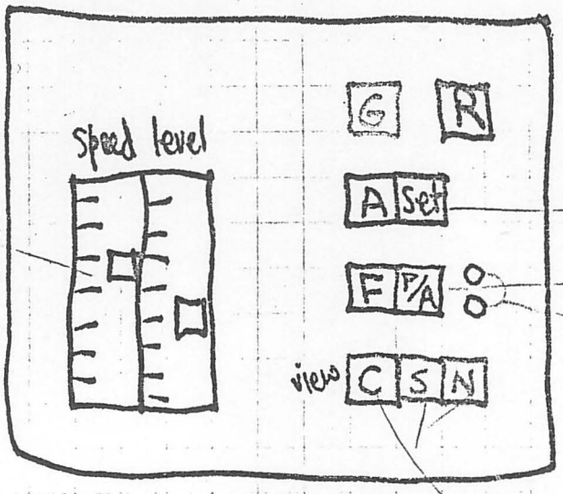
"Next" or "Next Playback Cue"
if no Q in active store "Next" takes up number selected in "Cue Select."
Thereafter ONLY takes NEXT number & ignores "Cue Select."

Ceasing to operate Q & operating "Next" will return Playback to last Q in main sequence.

Q will interrupt & cancell off "S" (Auto seq)

Next will cancell off "S" also

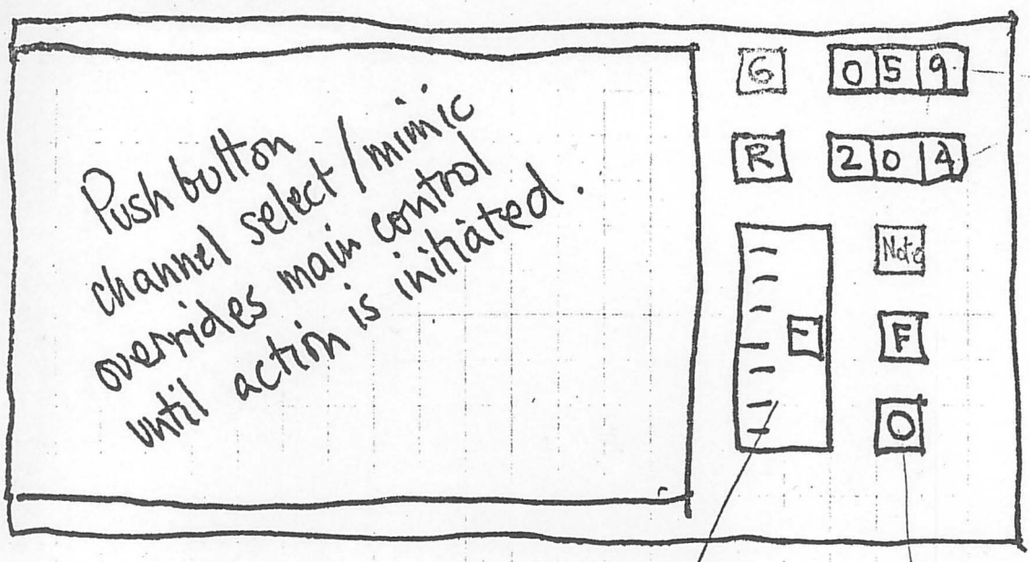
CHANNEL



① Meter on wing

NB Improve immediacy & fade in from black

Sensitivity. — dimmer problems.



servo fader

Stalls wing for dress rehearsal.

for early lighting rehearsal ADD main control desk.

"Override"
Lights up on any "action" at control.
Single push gives or retains overriding stalls control.
Automatically cancells on action complete.

Note. on pressing Note *