A. REPORT ON THE PROPOSED NEW STAGE LIGHTING CONTROL
FOR ROYAL OPERA HOUSE COVENT GARDEN

1. Design Procedure

The proposed stage lighting control system for the Royal Opera House is a special one devised after considerable study of the more difficult existing lighting plots in the repertoire together with lighting elsewhere as practiced by the Sadlers Wells Opera, the Glyndebourne Festival, the Royal Shakespeare and the recent season at the Old Vic, with particular reference to the production of PEER GYNT.

Several meetings have been held with William Bundy and his assistants, Bill McGee and Martin Carr. The specific Royal Opera House productions examined in detail as typical exacting plots of various kinds have been, ANIARA, CAVALERIA RUSTICANA, GOTTADAMMERUNG, MAGIC FLUTE, PAGLIACCI and SIEGFRIED, and the ballets ANTIGONE and LA VALSE.

It is of course a feature that at the time when one is examining the working of lighting plots on a control to be the latest, most up to date and special to the job, the form of control will not exist physically. To overcome this the various lighting levels for each lighting effect were transposed from the existing repertoire plots as a series of figures giving intensity levels against individual dimmers. The working of the moves could then be annotated on these plots and the whole series of manoeuvres for example the 29 cues for ANTIGONE followed through and brought to a successful conclusion. From these mathematical plots, working plots for the master operator and for his assistant (where one was needed) were made and worked through both by us and the Opera House staff on a mock-up lever arrangement in our demonstration theatre.

This plotting system had the result that we all came to know and understand the new control almost as well as if we had each operated it for several productions. A number of Strand Electric staff, not intimately concerned with this design, were set to make their own plots using this system and more importantly both Mr McGee and Mr Carr also wrote trial plots and were able to prove the system for themselves.

An unusual feature of the proposed Royal Opera House lighting control is the amount of work which can be done in advance in the intervals before the actual playing time. The method adopted is a combination of dimmer presetting and automatic memory selection. The result is that only certain productions will require a second operator and no more than two men should ever be needed.

2. Analysis of the Problem

The steps which brought the design of the proposed lighting control for the Royal Opera House to the state where it could be checked as just described are now considered in some detail.

The possibility of a new control for the Opera House has been under general consideration by Strand Electric for some years now and various tentative schemes have been discussed but the matter lacked urgency due to the known lack of money for the purpose. It would be true to say that many methods have come and gone in the past few years.

Consideration became active in the last year when Strand Electric were

virtually told that an adequate system already existed, namely that of Messrs. Siemens Schuckert. As this control has been installed in a number of German opera houses during recent years it would appear to follow that there could be no doubt of its ability to control lighting for opera.

Strand Electric did not wish to manufacture a control to virtually a Siemen's specification for two reasons. The first was a natural distaste for copying someone elses work after a number of years ploughing their own individual furrow. The second reason was that at just the moment when Strand were discardingcompletely the electro-mechanical servo-operated dimmer bank in favour of all-electric systems, it seemed quite illogical to adopt the electro-mechanical servo desk which is the basis of the Siemen's control.

Electronics and mechanics do not mix happily for the simple reason that the latter simply cannot keep up with the as-fast-as-thought potential of the former. Strand Electric began by showing their latest all-electric control 2 preset system C/AE which they considered had great potential. Several of these are in fact being installed. The system was designed for television and although the memory grouping action had its attractions it appeared after mature consideration that the processional* type of opera cue would be difficult to achieve.

All in all it seemed that a 4 dimmer preset, 3 variable group, (selected by switches) desk known to Strand as System CRD would be more appropriate. There would be certain fixed group masters in addition.

At this point the lighting plots enumerated in the opening paragraph of this report were brought in and the various dimmer movements and intensity levels plotted graphically on squared paper. Each ballet or act of an opera became a chart on which the combinational effect of the various dimmer moves against lighting cues could be clearly seen.

The effect of these charts was to show beyond question that lighting for opera or ballet never kept to a group for longer than a single cue. The exceptions to this finding were so rare as to be of no importance. This meant that fixed groups were useless and the three variable groups of Strand system CRD were quite inadequate. It became necessary to reconsider the claims of Strand system C/AE as only the memory action would provide the infinite number of groups required.

The groups referred to are the result of the fact that only few lighting changes affect one, two or three dimmers only, in other words, changes which can be readily encompassed by the hands using modern finger tip controls. What in fact often happens is that a number of dimmers either fade into levels or fade out altogether and therefore what is required is some means of grouping them together for the duration of that cue so that several may be operated from a single master. The graphs proved the existance of the groups but also that groups had to be reconstituted virtually all the time. Indeed, the same group never appeared in that precise form again, even in the same scene let alone the same act or even production! The solution in respect of

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*Lighting changes in which a cue is given for another change to begin before the previous change has been completed.

the group problem was available in the shape of the memory action which has formed part of all Strand Electric larger installations for many years, although it has only recently been available for an all-electric dimmer system. Indeed it was not until the problem had been solved in respect of all-electric dimmers that Strand were prepared to forsake using their electro-mechanical dimmer banks for the larger jobs.

It is curious that switchboard designers other than Strand have not realised the importance of the memory groups but this has probably arisen because only Strand have had for years satisfactory electro-mechanical dimmer banks to which memory could be easily applied in the early state of the art.

The graphical plots showed the processional type of cue to be less of a problem than previously thought; it was in fact quite rare in a true form. However, if dimmers could be grouped on at least two masters at one time and independent hand control could also be available then the particular requirement could be met.

At this point the C/AE4 control was designed to provide the facilities now known to be essential. Fixed master groups were reduced to one only to be used for providing delay to front-of-house circuits while the curtain rises. But adjustable groups were increased from three to forty and provided with memory relay action instead of switching, and dimmer presets became 4 in number (the system C/AE originally put forward had only two). Group masters which can all be used simultaneously became 4 in number. To obtain the fullest variety of use from the dimmer preset I was interleaved in alternate rows with II, and III with IV in the same manner. On the other hand, I and II were available to be used against III and IV in the alternate (left and right) duplicate panel procedure. Memory groups were made independently available to the left and the right yet identical in selection. The resulting control is fully described later in this report.

3. New Metropolitan Opera Lincoln Center Compared

It is interesting to compare the Royal Opera House lighting control project with that recently announced for the new home of the Metropolitan Opera in the Lincoln Center, the contract for which has been awarded to Ward Leonard. At Covent Garden it is proposed to install 240 5kW dimmers, making a total possible load of 1 megawatt. At the Lincoln Center the opera is to have 270 10kW dimmers with a total load of 2.75mW. Bearing in mind the relative sizes of the stages and a certain American fondness for the overlarge installations the figures decided upon for Covent Garden seem neither extravagent nor timid. The present total number of dimmers available is 166.

4. The Silicon Controlled Rectifier Dimmer

The actual form of dimmer specified both for Covent Garden and the Lincoln Center is the same: namely pairs of Silicon Controlled Rectifiers used back to back. Both Strand Electric and Ward Leonard use a high degree of clean up and the output waveforms of the two forms are substantially the same. It is significant that the Metropolitan Opera does not propose to use magnetic amplifier dimmers, a form common in German Opera houses and in the United States television studios for some years. Electrically

the ralatively new Silicon Controlled Recitifier (SCR) is the most compact and versatile dimmer available today. It is thanks to this new form of dimmer that the existing room at Covent Garden which just manages to house the present 120 dimmers of the old Strand Electric 1934 control can be used for 240 under the new project. No invasion or take over of the cramped back stage space has to be contemplated.

A new dimmer carries the questions of how new and how reliable. Apart from the considerable experience amassed in the United States in the recent two years or so of concentrated application (forms of it are marketed by probably a dozen firms) in Britain Strand Electric have had experimental models of theirs in use since the first model was publicly demonstrated in May 1959. Since 1960 a full scale model of 30 5kW dimmers has been working in the Strand Electric demonstration theatre. Similar equipment has been on the BBC premises for test in Studio A and then Studio 3 at the BBC Television Centre, White City, since 1961. In December 1962 a full system of 120 Strand 5kW SCR dimmers went into service for NTS television studios at Brussem Holland and further installations there are to follow. At present a similar number of dimmers is going into service for WDR television studios at Cologne. This latter is in the nature of a repeat order for the other large studio there was equipped with a Strand Electric system CD (the predecessor of the present system) in 1958. In october this year an installation of 152 Strand SCR dimmers will be completed for R.T.F. Paris and about the same time an equipment of Strand 10kW SCR dimmers for the largest studio in the BBC TV Centre will form part of the latest Strand Control System. The first full theatre installation will be the Glyndebourne Opera House (120 x 5kW) early next year. The importance of the television installations of the new dimmers is that such studios represent intensive usage for 12 hours a day and have great concentrations of very sensitive electronic and sound equipment. In consequence a form accepted for use there, particularly by the BBC, must be of exceptionally high standard.

5. Control Desks

While the form of dimmer to be used by Ward Leonard for the new Metropolitan Opera, and proposed by Strand Electric for the Royal Opera House, are substantially alike, it is quite otherwise with the control desk. The control desk system proposed for the Royal Opera will at the time of installation be unique. It will however use new components, such as illuminated dimmer levers which will by that time have been in use for BBC Television Centre No. 1 and the new BBC Glasgow studio, also in Cologne, Paris and Glyndebourne.

The difference in the control desk arises from the greater knowledge in respect of large installations vested in this country, i.e. Strand Electric. In the United States an installation of over 100 dimmers is a rare phenomenon. There a comparatively small number of large wattage dimmers is 'patched' using a plugging system to control a large number of circuits. Recent examples are the McCormick Hall auditorium in Chicago where 997 circuits are patched to 145 dimmers or the O'Keefe Centre, Toronto where over 500 circuits are patched to 100 dimmers. That the system is discredited is shown by the fact that the Metropolitan Opera have decided on 270 dimmers. There is no objection to patching as an economy measure for rarely used, or alternative circuits, and some degree of this is proposed for Covent Garden: it is the complete reliancd on it

that is bad. Patching on a large scale is prodigal of labour and time in setting up which circuits shall be combined for each production. Furthermore, large scale patching denies the essential flexibility required at the most taxing time of all - rehearsal.

All modern lighting installations in Britain and on the Continent have large numbers of dimmers relative to their size. Thus Strand Electric have a hundred or more installations of over one hundred dimmers and seven of over two hundred dimmers.

Experience in control of large numbers of dimmers has shown that the American system of multi-preset proposed for the Metropolitan Opera, even if workable for a small number of dimmers, which is doubtful, is quite out of the question for such a large installation. A 10 preset control desk such as is apparently to be installed in the Metropolitan Opera will not stand examination. 10 dimmer presets for 270 dimmers means 2,700 dimmer levers for this purpose alone. To this have to be added switches for selection and grouping of circuits from which the complexity of the control panel can be imagined. All this perhaps would get by if one could preset before the show and run through the show merely operating the appropriate preset and group masters. However, this is simply not feasible - for example, there is a large number of lighting cues in many recent Covent Garden productions and lighting changes tend to become more in number and greater in complexity with each new production, both here and elsewhere. On the other hand the modern German stage lighting control board as represented by Siemens uses a system which was in the first instance born of the need to preserve the existing lighting procedures established over many decades using, what were then in the 1920s and 1930s, very advanced dimmer regulators operating multi-slider Bordoni transformers. Thus the modern German control board consists of a reproduction in miniature of the style a trained German operator has come to expect. All the interlocking shafting, preset trips, etc. are there, with the main difference that dimmer levers are now at one inch horizontal centres approximately instead of the old centres. Even the old reversed dimmer scale, unique in Germany of all countries in the world is preserved. Everywhere else the practice is that when the dimmer lever is raised to its top position the light is raised to its full intensity, in Germany the process is by tradition derived from the original mechanics, reversed. To provide facilities for dimmer presetting demanded nowadays the levers on the main control desk are driven through an electro-mechanical servo to the intensity levels set on particular series of preset levers at that time connected by master to them. There can be no doubt that the form of German control used today would not have arisen but for the need to reconcile older traditional schools of operation with the new. In practice it is found that features which were useful on the older forms of control tend now to be disregarded on the new because they are less handy for rapid use in the miniaturised form. More and more reliance comes to be placed on the new preset part rather than the vestigial gadgetry. More dimmer presets tends to be the cry.

6. Proposed Control

At the Royal Opera House no handicaps in the shape of tradition apply. The design of the control desk can be governed exactly for the requirements of the moment and the foreseeable future. The existing Strand Covent Garden control of 1934 is unique and while it has been a trusty srvant, designed and installed in the incredibly short time of seven weeks, no one would wish to preserve its method of working. The new control can represent a fresh start right up to date.

The proposed Strand lighting control desk for the Royal Opera House can be summarised as the application of a number of tried Strand Electric principles in a novel form to solve the problems analysed in the early part of the report. These basic principles are :-

a. Avoidance of dimmer multi-presetting with the fantastic number of levers it breeds. There will in consequence be only four sets of dimmer levers.
b. Use of automatic memory grouping action so that only dimmer levers appear on the control desk. This not only reduces the complexity of what has to be assessed visually, but also reduces the size of the desk. This latter is vitally important when trying to house the control in the limited space available front-of-house at Covent Garden.
c. Provision of twin desk working as at Stratford-upon-Avon and the Old Vic to facilitate rehearsal and plotting of initial lighting levels. Lighting is held for plotting on one side while the next change is tried out using the duplicate levers on the other side.
d. Provision of interleaved preset working for accurate matching levels and minor but scattered modifications of intensity levels. This has been achieved without interfering with playability of the levers themselves, i.e. dodging is not required.
e. Ubiquitous and simplified mastering. Except for circuits front-of house which are also subject to a fixed master to delay their action until the curtain has risen there are no fixed group masters. Any dimmer may be used on any master and the master on which it is active is displayed by a coloured light illuminating the appropriate dimmer scale itself. There are no supplementary pilot lamp displays to confuse the operator, everything is integral to each dimmer lever.
f. Selection to the master dimmers either directly to the Masters or indirectly via the memory action is made at the dimmer levers by means of a rocking micro-switch action to the dimmer scales. The results of selections are displayed by internal lighting.

7. Method of Operation

The secret of the Strand System C/CG lies in the instantaneous manner in which groups of dimmers can be selected for action using the appropriate push button, operated as required and immediately stored as independent while the same master is used for some other group, differing wholly or in part. Individual dimmers can be immediately adjusted and the active dimmers are always displayed as on master or independent. To begin a particular act all levers of the 4 dimmer presets are set to the intensity levels of their first appearances: the appropriate number of memory groups required are also set. The latter being a simple procedure of making a selection using the rocking dimmer scales and then when the "memory" is on the appropriate "Recall" button is pressed. The action is instantaneous.

As the opera or ballet proceeds the appropriate series of memory "recall" pushes are used and the masters concerned operated in the manner required rapidly or slowly.

It is a feature of the system that dimmer intensity levels can be set for all circuits including those that make their first appearance very late in the act. Thus everything is at the ready to be brought in at just such time as it is needed. It has been found during the design analysis period that using this method extraordinarily few dimmer levers have to be reset during an act. There is none of the wholesale pushing down to zero before resetting levels that seems to be common practice elsewhere. Movement of dimmer levers required to be at zero can usually be ignored, they are simply not selected by the memory and in consequence do not light.

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B. SSPECIFICATION OF LIGHTING CONTROL SYSTEM
FOR ROYAL OPERA HOUSE COVENT GARDEN

1. Control Equipment to be supplied

1.1 Dimmer Bank

8 System CRD Dimmer Cabinets each of 30 5kW Silicon Controlled Rectifier all-electric variable load channels. As in detail under 2 and 3 below, illustrated in figs 1, 2 and 3.

1.2. Relay Bank

2 System C/AE 40 Memory relay assemblies complete with selection and memory relay action and power pack. Illustrated in figs. 4, 5, 6, 7 and 8.

1.3. Main Control Panel

System C/AE4 as described in paragraphs 6, 7, 8, 9 and 10 below and shown in figs. 9 and 10.

1.4. Stage Control Board

This panel consists of dimmer levers to allow the setting of lanterns during intervals and rehearsals. The levers operate on the dimmers of the main control and are brought in and cut out from a special switch with warning lamp on the main control panel front-of-house.

1.5. Patch Panel

Strand type JK cord and socket panel similar to that in fig.11 but detailed to suit the following circuits and dimmers:-

General: 20 dimmers each with four outlets to feed a total of 80 circuits
Battens: 32 dimmers each with two outlets to feed a total of 56 circuits.
56 switches to cut end circuits.

Dimensions and layout of patch panel will be determined to suit space on existing lighting perch. The sockets representing the dimmers will be mounted on a vertical panel and the jacks with weight retracted cords will be on a table panel below. A switch panel to cut the end section of certain battens is an integral part of the design.

2. Dimmer Bank

Each of the 8 dimmer racks to be standard Strand System CRD silicon controlled rectifier type. Each 30 channel rack will be a self contained unit supplied complete and ready to work with its own power pack and cooling equipment. All that will be required is the connection of the mains feed and the outgoing lighting circuits. The connection by multi-core cable to the remote control desk is included in this contract. Each standard channel will carry 5kW but should it be desired the circuit breaker protection can be altered to restrict this to a lesser load. Larger wattages can be obtained by parallelling a pair of standard ways but the total number of dimmer channels will be correspondingly reduced. Each 30 channel rack is housed in a well styled metal cabinet, 7ft. wide x 2ft. deep x 5ft.6¼in. high weighing 12½ cwt. To facilitate transport and handling on site at the time of installation these racks split into two equal parts. The weight is explained by the high degree of clean-up applied to the waveform. For this purpose iron core chokes are used but the actual load carrying regulation takes place wholly at each pair of silicon controlled rectifiers (connected back to back) and the moment the point in the dimming curve is reached where the waveform is sufficiently complete, the chokes are cut out. The degree of smoothing employed is such that there is no audible lamp filament sing whatever the form of filament lamp used. This high degree of sm othing is equally beneficial in respect of reduction of electrical interference and radiation of mechanical noise. Noise is confined to the dimmer room and the walls of this room should be treated in such a way as to minimise the effects thereof. Each channel has provision completely to safeguard the silicon controlled rectifier against surges experienced when hot

patching, or plugging up cold tungsten lamps, or under short-circuiting conditions. These safeguards also apply when additions are made to a channel already partially loaded. Only if the bank blowing equipment should fail would there be any need to exercise caution in these respects. Such a failure is indicated at the bank and control desk visually and audibly and such indication can be repeated elsewhere if required. Failure of the blowing equipment in the installation under consideration would only apply of course to one bank, and therefore to one eighth of the total installation. The warnings are displayed in respect of individual banks. Orthodox protection is provided by a circuit breaker per channel, and as a final resort, an internal fuse. All protection is part of the dimmer bank itself.

3. Technical Notes of Strand System CRD dimmers

3.1. All the power supplies from the racks to the desk are 24v AC.

3.2. At least two racks supply the desk so that there is no 'master' rack.

3.3. Only one control line is required for each channel and this never exceeds 24v. DC (2mA).

3.4. Each rack is provided with automatic ventilation with green and red pilot indication on desk.

3. 5. All control lines operate dimmers irrespective of the phase to which their load is connected.

3.6. The control cable can be of any length because the amplifier has a high resistance input.

3.7. There is no inter-action between control channels because the input reactance is low.

3.8. 'Full' and 'Zero' adjustments are provided on each channel amplifier so that all channels can be made to have the same dimming curve between '0' and '10' (full).

3.9. A silicon transistor is used in each amplifier on the DC section to eliminate drift.

3.10. To correct for phase displacement, the DC level from the control unit is compared in the amplifier with a synchronised firing waveform produced in the sawtooth unit.

3.11. The gate circuit is fired continuously during the conduction period thus ensuring that there is no loss of an occasional half-cycle as can result from a one-shot gate circuit.

3.12. Each rack contains its own power unit.

3.13. all dimmer channels can easily be changed to any phase as required.

3.14. All channels will carry up to 5kW. Larger loads per channel are easily obtained by coupling.

3.15. A 25 watt lamp is controlled in the same dimming curve as the full load rating of the dimmer.

3.16. When a 25 watt lamp is at any position of illumination, the full load may be cold patched without affecting its intensity.

3.17. The maximum voltage drop across the dimmer when half the rated current is flowing at 'Full' is 3 volts.

3.18. The maximum voltage drop across the dimmer channel when the rated current is flowing at 'Full' is 4 volts.

3.19. A feedback unit always ensures that the dimmer cannot be overloaded.

3.20. All sub-assemblies are made as plug in modules.

3.21. Thermal/magnetic circuit-breakers are provided for load short circuits and isolators.

3.22. High-speed semi-conductor fuses are included for internal faults.

3.23. Unity power-factor when in the 'Full' position.

3.24. The AI (anti-interference) rack is in series with all load wires (i.e. is part of the dimmer channels) and cleans up the output waveform to BS 800 for radio noise, and also removes electrical audio frequencies.

3.25. When a dimmer channel is in the 'Full' position, the AI rack is electrically shorted as interference is only caused when dimming.

3.26. All unwanted noise which could occur in trunking, lamps, etc. is kept in the AI rack which thus makes a 50 p.r.f. noise which is no greater than an equivalent magnetic amplifier.

4. Ventilation

Heat dissipation to be allowed for is as follows :-

Desk	=	100 watts constant 600 watts, max.
All Racks	=	300 watts each when idle 5,000 watts max. (when fully loaded and full on)

Maximum permitted ambient temperature 40°C.
The channel heat loss reduces with dimming and unlike thyratron dimmers and magnetic amplifier dimmers is nil at the 0 position (off).

5. Waveform

Typical examples of waveform taken at the mid-dimmer position, potentially the worst for interference.

I. Input waveform
II. Output from SCRs and input to filter, risetime approximately 2 micro-seconds.
III. Output from filter and supply to 5kW lamp (risetime increased to 1 milli-second).

6. Control Desk System C/AE4

The exact formation and placing, particularly of ancillary controls has yet to be determined in relation to the room available front of house at

Covent Garden, but generally speaking the desk will conform somewhat to the following description :-

There will be two wing units, each with 8 rows of type C/AE luminous dimmer levers. There will be 60 of these levers per row identified boldly by numbering left to right. The tens groups will be clearly indicated and there will be an extra wide vertical division at mid row. to facilitate finding dimmers on the long rows. In the case of the left hand wing the top and alternate rows below will belong to preset No. I and the second and alternate rows below to preset No. II. Identification circuit numbering will be clearly located between the alternate rows so that there is no doubt which pairs of levers share which number. The right hand wing will be exactly similar and laid out in the same way except that the presets concerned will be No.III and No. IV. Pilot lamp indication on each wing will show the state of dim of each master appropriate to that wing so that it will not be necessary to consult the master panel each time. The levers will be mounted to conform with the vertical shape that is operationally and visually satisfactory so that check dimmer levels are not in doubt. In practice this means that the top pair of dimmer rows, i.e. Nos. 1 to 60 preset I and II will be vertical and each pair of rows below this will be angled-in slightly each more acutely.

7. Type C/AE Dimmer Levers

These are luminous and each displays two distinct light signals, red and white. These lamps illuminate internally the dimmer scale and the red condition on the left hand wing indicates "On Master A" and the white condition on the left hand wing indicates "On Master B". In the case of the right hand wing the red indication indicates "On Master C" and the white "On Master D". No light means channel not in use. Further details of the display are given under master controls item 8 below. Each dimmer scale is engraved 0 to 10 representing 0 to 100% with 0 at the bottom position meaning no light. Half divisions are also marked. The actual dimmer lever knob can be supplied in various colours and may be used to provide convenient patterning to help the eye find its way round. (This will be subject to discussion). The scale which is white with black letters, rocks slightly against a spring to operate a micro-switch so that circuits can be selected by touching lightly either of the two scales above each other. An overriding master lock is provided to safeguard against accidental selection.

8. Master Control Panel

This will be determined to suit the site and will contain the following controls:

Master A	(Red scales and black knob)	Left hand wing
Preset 1	Black scale white knob	
Preset 2	Black scale green knob	
Master B	(White scale and black knob)	

Master C	Red scale and black knob	Right hand wing
Preset 3	Black scale and white knob	
Preset 4	Black scale and green knob	
Master D	White scale and Black knob	

All the above masters are the usual vertical motion fingertip type, but A, B, C and D are also operated individually by motor for slow checks of half a minute or over. The black scaled preset masters have an off as well as the O position. Appropriate pilot illumination of the particular preset takes place once the master leaves the off position. Transfer pushes are mounted above and below the A, B, C and D masters as follows:

Transfer to A	: cancel A
Transfer to B	: cancel B
Transfer to C	: cancel C
Transfer to D	: cancel D

Note. Transfer to and from A, B, C or D is interlocked to take place only when the master dimmers are full on. Likewise interlocks prevent the use of the cancels unless the particular masters are at O. A special switch allows the interlocks to be overriden when required for group-switching cues.

9. Memory Controls

The Master control panel will also house two sets of 40 luminous double touch pushes associated with the memory action. One set operates the combination by lighting the appropriate dimmer scales on the left wing i.e. Presets I and II: the other operates the right wing i.e. Presets III and IV. First touch adds the combination to whatever may be already selected, second heavy touch substitutes the new combination. Internal illumination shows the memory last used, when memories are added indication is additive also.

Memories are set by making a selection by hand using the rocking scales then engaging the master setter control and touching the memory push required. A setter lock with key switch is provided.

10. Accessory Controls

Various other controls are fitted to provide for example, control of the speed of the A, B, C and D masters. There is also the Front-of-house master itself and the master controls for the colour filter change and the effects motors, stage board cut-out, etc.

11. Installation of Control System

Our quotation covers the Supply, Installation and Testing of the control desk, dimmer banks and any other equipment specified. Including the connection of the control cables between the control desks, dimmer banks, etc. but excluding the actual running of those cables and excluding the provision of the main supply to and the outgoing circuits from the dimmer banks.

Our price is exclusive of all builders' work and is based upon the assumption that you accept responsibility for the reception of all equipment and that you will make satisfactory arrangements to ensure (a) ready access to the dimmer and control rooms and (b) the availability of labour, lifting tackle ladders, etc.

With regard to the dimmer and control rooms, it is essential that all builders' and other work is completed before delivery of the equipment is effected. In this connection the following points are particularly important :-

1. The floor must be level, dust-free and damp-free. If a floor covering is intended, it should have been laid.
2. The walls and ceilings must be dust-free and damp-free. Whatever finish is intended, should have been applied.
3. Doors must be fitted.
4. The ventilation system must have been completed.
5. All electrical contractors' work must be completed, except for actual connection, and a 'live' supply must be available for temporary lighting and heating, electrical tools and testing.

Guarantee
The equipment is fully guaranteed for twelve calendar months.

12. Operational Notes

The B & D masters are normally kept at zero. The presets operate in the case of I and II on dimmers energised at the time by both A and B or in the case of III and IV by C and D. Raising Preset I master turns both A and B into AI and BI or Preset II would make them AII and BII, for example. Selection of dimmers to the AB I II group and to the CD III IV group is quite independent of the other. These selections can be piled as can all four presets if required. Within A, B or C, D masters however, dimmers can be selected either to A or to B for example but deliberately cannot be selected on both. (This arrangement resembles 2 way switch selection). Within the I, II or III, IV presets whether a dimmer is on either I or II or both is determined purely by the position of its dimmer levers and of course the preset masters.

Each dimmer lever displays red for "On Master A" or white for "On Master B" or no light if not in use, for example. Further only the preset rows whose master has left the off position light-up and in consequence, it is easy to tell which levers can be reset without altering lighting at the moment. The masters have an 'off' as well as an 'O' position so that presets can display for selection before the dimmers controlled therefrom become operational.

Selection is by touching the scales of the dimmers required. This touch affects the scales of both interleaved presets concerned. The active preset will be the one to light if the inactive one is touched. Touching action operates a reverser relay so that touch again and the dimmer is de-selected and the light goes out.

The two sets of 40 memory pushes for the left hand (A-B) panel and the right hand (C-D) panel can be used to capture the combination displayed on its panel provided the master setter is also used. To facilitate transfer of combinations from the A-B panel (presets I and II) to preset III and IV on the C-D panel, the combination on each push is the same for both, but they can be used quite separately; for example, Memory 3 on A-B and Memory 7 on C-D. Whenever a memory push is subsequently pressed the combination lights up the levers selected in the preset in use (or rather, the preset not in the 'Off' position). Memories can be altered at any time or remain locked up without any

deterioration for any length of time.

13. Plotting

Standard forms may be used and once the full plot has been devised then the "during-the-performance-operational-information" can be underlined in red and can be typed in summary for show use.

The plot has the dimmer numbers along the top with vertical divisions at every ten which correspond to the vertical divisions at each ten on the control itself. The levels for each cue are entered against a horizontal line.

It has been found to simplify plot writing if it is assumed that the following operation drill applies unless otherwise qualified.
"Raise A or C" means Raise to full, transfer to B or D and return lever to zero.
"Dim B or D" means Dim to zero, trip and return to full.
The most usual qualification is "and leave" which means in the case of A or C the usual transfer takes place but the lever stays at full ready to receive a selection from B or D to dim out. "No transfer" means that the lever not only stays at full but retains its selection. When A, B, C or D is used as "Dim ...", then the selection dimmed is cancelled at zero unless qualified as "No cancel". Master B and D tend to be used far less than A and C for "Raise" but when so used, no transfer takes place at full. The normal duty of B and D is as "Park" or, in other words, a store or an independent bar.

Some indication must be given where each preset is first brought in. Raise AI means that Preset I must be at full at the same time as A. The preset need not be referred to again until there is a change of preset.

Memories unqualified are assumed to be on A and are described as "on C", etc. when anything different is required.

It is a feature of the system that nothing is operational unless selected, therefore a tick (/) is placed on each dimmer column where selection takes place. Such selection may be individual when there is plenty of time (and/or few dimmers are required) or by the memory action. Use of a memory is shown by a number in a circle in the master column but ticks are still placed against each dimmer selected thereby. This both shows what to set on that memory and what is operational at the time. A dimmer is operational whether selected on the A or C masters or transferred to the B or D masters. This fact is displayed in the appropriate dimmer levers by a white or a red lamp. No light means no selection. In the plot "O"s in a column which is master dimmed will mean dimmers became unselected (when cancelled at the bottom) and they will have to be re-selected when next required unless of course the qualification "No Cancel" has been shown. Transferred dimmers are interlocked so that they can only be selected on Aor C when these dimmers are deliberately tripped or when A and B or C and D are at full. Thus there is no risk of 'lights out' if transferred dimmers are selected by a memory or by hand on to an A or C master at zero.

Each time a preset changeover takes place the complete contents of the preset should be shown in that line of the plot since it represents a fresh start, so to speak. Likewise, at the end of a plot sheet the

contents are added up and carried forward to the head of the next sheet.

Preset settings to begin a show, are shown as a separate item on the plot sheet and do not rely on their particular cue entry. This is because the selection action, memory or otherwise, permits the use of a single preset for several cues. The same preset may return again and again but slightly modified and thus resetting of a preset for a late cue may only involve minor changes written under the dimmers affected.

Changes which do not affect lighting at the moment, for example, resetting an inactive preset, are boxed around in the plot.