STRAND ELECTRIC

STRAND TELEVISION
LIGHTING CONTROL

System ... "C"

Studio ... Riverside I.

Ref: ... RIV.1/R.&.D/2/8/1955

LONDON

MANCHESTER DUBLIN MELBOURNE

SPECIFICATION

of

STRAND LIGHTING CONTROL. SYSTEM "C"

B.B.C. RIVERSIDE STUDIO I.

348 CIRCUITS. 166 CHANNELS

REVISED AUGUST, 1955. RIV.1/R.& D/FPB/2/8/1955.

SPECIFICATION STRAND LIGHTING CONTROL.

B.B.C. RIVERSIDE STUDIO I. REVISED AUGUST, 1955.

1. SUMMARY: This studio to consist of ~~352~~ 348 circuits (384 socket outlets) controlled by 166 channels each with a dimmer. Patching of circuits to dimmers to be by selector switches. All dimmer and switching (including patching) to be electro-mechanically operated from remote pilot desk and panels in camera control room.

2. CONTROL DESK: This is to consist of a centre table approx. 42 inches wide x 24 inches x 31 inches high, with a wing panel 3ft. wide x 4ft high x 12 inches deep (max.) each side. The assembly is arranged to be used by a seated operator, but the supply of the chair is not included. No integral lighting of control levers or plot desk is provided and the B.B.C. should supply an overhead fitting (suitably masked) for the purpose. The three desk components are separate and floor cable entries will be required for each. Entry to the wings and table is intended to use the hollow legs, but wiring access to the centre table will have to be more exactly determined on site when the B.B.C. requirements in auxiliary (non-lighting) controls are fully known. All components are intended to be rigidly fixed, bolted to the floor, and clearance to allow rear access for maintenance, will be necessary. Position is shown on B.B.C. Drawing B.I.D:SK:4760M.

3. LEFT WING PANEL: See Strand Drg. R&D 28246. Two rows each of 14 pairs of dimmer levers and four of sixteen. The left lever of each pair will have a black knob and the right lever a red knob. Over each pair of levers will be a Compton luminous push with electric reciprocating action to switch the channel contactor on and off. Luminous heads to be engraved with channel numbers (e.g. 1X, 7Y etc.) and the label at end of each 14 way row to show the detail in the inverted commas schedule below.

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End of row also to accommodate pair of luminous heads showing which preset, black or red, is in use. These heads are also operative.

Top Row, Channels	IX to 14X	"Red" phase.
2nd " "	IY to 16Y	"1/2 k.w." dimmer.
3rd " "	IZ to 16Z	"Single" contactors.
4th " "	IX to 14X	"White" phase.
5th " "	IY to 16Y	"1/2 k.w." dimmer
Bottom Row "	IZ to 16Z	"Twin" contactors.

4. RIGHT WING PANEL: Three rows to carry 16 pairs of levers per row one row of fourteen pairs- one row of twelve pairs and the bottom row is free for B.B.C. ancillary gear.

Top Row, Channels	IX to 14X	"Blue" phase.
2nd " "	IY to 16Y	"0.5/I k.w." dimmers.
3rd " "	IZ to 16Z	"Single" contactors.
4th " Gantry	1 to 8	"2.k.w.T." dimmer "Blue" phase
Controls for 4 x 5 k.w. dimmers		
5th Row, Floor	1 to 16	"2 k.w.T" dimmers.

Botto row. B.B.C. gear where applicable.

5. CENTRE TABLE: This will be flat with Buff Linette Formica top and metal frame and legs. Mounted on the table top will be two self-contained panel boxes with sloping fronts, one for the Strand Master Lighting Controls; the other for those of the auxiliary controls required by the B.B.C. which may be considered part of the lighting operator's activity.

6. STRAND PANEL CONTROLS: (see Drawing R & D 2834).

(a) "Dead Blackout" (separate Black Tablet Switches to left and right wings).

(b). ". "Switching Hold" (one tablet type green).

(c). ". "Lit Move" (one sprung off amber tablet).

(d) Red dimmer preset (Luminous push red letters on white).

(e) Black " " (" " black letters on white).

(f). ". "Switching Presetter" (sprung off push).

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(g) "Switching Presets" (20 sprung off pushes). "Cancel" All Off (one push).

(h).+."Preset Add" (sprung off push).

(i) "Individual Go" 2-way sprung centre white tablet.

(j) Mptor Speed. Two balanced pedals of eight stations with pilot lamps. Coupler normally joining left bank to right for speed. Left and right pairs cover left and right dimmer banks. Speeds to be:- 2 secs,3,4,5,7,10,15,25 and 45 seconds dimmer travel. Slower speeds automatic with switch and potentiometer. (15 mins.slowest speed). Inching controls and speed pilots only on panel.

(k) Indicator Dials: Two uncalibrated for left and right wing preset changeover respectively. One calibrated for Individual Position.

(l) "Outstation On". Red tablet switch (See 8 below).

.+. These controls are duplicated by foot pedals.

7. PANEL FOR B.B.C. CONTROLS: (see Dwg.No.2835). The following apparatus required by the B.B.C. will be mounted where applicable as part of the lighting control, or as a wall mounting panel.

(a) 1 Flush mounted 4" square pattern voltmeter, Grade I to BSS 89,1954. Scaled 0-150 volts Metro-Vick or equivalent.

(b) 1 Flush type 3-way voltmeter selector switch.

(c) 3 Ammeters as (a) above scaled 0-500 amps, suitable for working from 500/5amp.current transformers (not supplied under this contract) with a red line at 350 amps.

(d) 1 Flush type voltage control selector switch labelled "Auto Control Phases A-B, Auto Control Phase C. Push button control".(as Brentford Transformer Drg.No.D.5686 20/6/55).

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(e) 1 set of flush type push buttons labelled, "Raise Volts, Lower Volts".

(f) 1 Pre-set voltage control potentiometer to give ± 3% voltage control, 35 ohm 1 amp. Screwdriver operated with looking nut, no scale.

(g) 3- Flush mounted type, English Electric Type NS.HRC. 2 amp.fuses for incoming 208/120 volt supply.

(h) Monitor control.

(i) Talk back.

(j) TELEPHONE.

The wiring for A to G above to be brought out to OBA stud terminals to which others will connect. Glands for 10 core, 4 core and 4 core 7/029 wire armoured cables to be provided.

Items H.I.J. to be brought to terminals as appropriate no entries being provided but sheet metal space for holes and glands as others may supply and determine. Panel mounting space of approx. 40 sq.ins. to be allowed for and apparatus will be supplied by B.B.C. for embodiment.

8. OUTSTATION CONTROL. 12 terminals controlled by "outstation on" switch to permit presets to be operated from push buttons in studio or in producers control room. These latter are to allow close synchronisation with camera change-over if and when desired. External wiring and outstation push button boxes not included. Relay circuit to convert switching action "on set" to momentary contact.

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9. PATCHING PANEL. This will be identical physically with the left wing panel. It will contain rows of eight position vertical selector switches, similar in form to the dimmer regulating levers in 3 and 4 above. There will, however, be one such unit to each control channel instead of two. Above each will be a sprung off switch with an engraved tablet knob (as label) in the appropriate phase colour. This switch is held down to obviate flashing of lights on positions intermediate to the one required. (There is no electrical reason against this flashing, it is to obviate visual nuisance. In consequence, no mechanical interlock will be provided; reliance to be on operator drill supplemented by advice label). Layout to be as follows:- (Drawing No. R. & D.3813).

Top Row.

Left 14 levers for X Red phase.

Right 14 " " X Blue phase.

2nd Row.

Left 16 levers for Y Red phase.

Right 16 " " Y Blue phase.

3rd Row.

Left 16 levers for Z Red phase.

Right 16 " " Z Blue phase.

4th Row.

Left 14 levers for X White Phase.

Right 24 3-way switches for XI to X24 White Twin Circuits.

5th Row.

Left 16 levers for Y White phase.

Right 28 3-way switches for YI to Y.28 White Twin Circuits.

6th Row.

Left 16 levers for Z White phase.

Right 28 3-way switches for ZI to Z28 White Twin Circuits.

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10. PATCHING LEVERS: To be at one inch centres. The 3-way switches for the twin circuits will be mounted in two rows to every single row of the selector switches. Each of these switches in the middle position connects both sub circuits (" 2 scoops"); in the top position the left circuit only and in the bottom the right only. Patching levers on 16 channel groups will be wired as below. The eighth position (bottom) will be labelled 0 and will be "off", i.e. channel free:-

No.1 lever (left) circuits 1 - 7
No.2 " " 8,2 - 7
No.3 " " 8,9,3-7
No.4 " " 8-11,4-7
No.5 " " 8-11,5-7
No.6 " " 8-12,6-7
No.7 " " 8-13,7.
No.8 " " 8-14
No.9 " " 15-21
No.10 " " 22,16-21
No.11 " " 22,23,17-21
No.12 " " 22,24,18-21
No.13 " " 22-25,19-21
No.14 " " 22-26,2P,21
No.15 " " 22-27,21.
No.16 " " 22-28

Patching levers on 14 channel groups will be wired as follows:-

No.1 lever circuits 1-7
No.2 " " 8,2-7
No.3 " " 8,9,4-7
No.4 " " 8-10,4-7.
No.5 " " 8-11,5-7
No.6 " " 8-12,6,7
No.7 " " 8-12,6,7
No.8 " " 13-19
No.9 " " 20,14-19
No.10 " " 20,21,15-19

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No.11 lever	circuits	20-22, 16-19
No.12 "	"	20-23, 17-19
No.13 "	"	20-24, 18, 19
No.14 "	"	20-24, 18, 19

In both the above layouts, where a horizontal series of positions on the selector switches control the same circuit, only the end numbers will be engraved. On the intermediates dashes will be engraved, making it easy to see if two dimmers have been patched to one circuit. (There is no electrical objection to such patching it is a matter of inconvenience only). The above system not only gives a very compact panel, which can be placed adjacent to the main lighting control, but also very clear indication of the patching potential and when set up, the state of patch. The patch is easily cleared before each setting up, since it is only necessary to push all levers down to the bottom zero position.

11. MAIN CONTROL CABLE: This will be 175ft long and consist of all 15 volt and 50 volt D.C.wires and their mains required between the lighting control and the patching control and the Strand equipment in the dimmer room. This control cable will be supplied in a single or twin cable in flexible metallic hose or hoses by Strand Electric, who will also connect the ends. All other wires will have to be run and connected to the appropriate terminals by the wiring contractor. The running, fixing and further protection, where necessary of cables in this section is not included.

12. DIMMER ROOM: Layout to be as Strand Drg.A.716. There will be two standard 5 tier Strand P.R. electro mechanically operated banks. The left bank will correspond to the left wing of the control desk lighting (phases red and white) and the right bank to the right wing (phase blue). Each bank to be extended by a section for the patching relays and wiring.

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13. LEFT BANK: DIMMER SCHEDULE.

IX-14X Red phase 14 x 1000/2000w Resistances.
IY-16Y " " 16 x " " "
IZ-16Z " " 16 x " " "
IX-14X White " 14 x " " "
IY-16Y " " 16 x " " "
IZ-16Z " " 16 x " " "
92

14. LEFT BANK: PATCHING SCHEDULE.

Channels IX -14X to circuits XI- X24) Red (98 relays
" IY -16Y " " YI- Y28) Red (112 relays
" IZ -16Z " " ZI- Z28) Red (112 relays
Channels IX - 14X to circuitsXI- X24) White (98 relays
" IY - 16Y " " YI- Y28) White (112 relays
" IZ - 16Z " " ZI- Z28) White (112 relays

Circuits XI to X24 White each to Left and or Right 48 relays
" YI to Y28 " " " " " " " " 56 "
" ZI to Z28 " " " " " " " " 56 "
804

15. RIGHT BANK: DIMMER SCHEDULE.

IX - 14X Blue phase 14 x 500/1000w Resistances.
IY-16Y " " 16 x " " "
IZ-16Z " " 16 x " " "
Gantry 1-8 " " 8 x 2000w Transformers.
5 k.w.circuits 1-4. Blue Phase 4 x 5000w Resistances.
74 (= 46 singles, 24 transformers & 4 two plates).
Floor 1-8 Blue phase 8 x 2000w. Transformers.
" 9-16 " " 8 x " "

16. RIGHT BANK: PATCHING SCHEDULE.

Channels IX -14X to circuits XI-X24) (98 relays
" IY -16Y " YI-Y28) (112 "
" IZ -16Z " ZI-Z28) (112 "
322

All relays to be of the 20amp.G/S type. There is no patching to auto transformer and 5 k.w.channels.

17. SWITCHING SUSTAINER HOLD.

All patching selector switches and blackouts on non patched channels will each be fed from a N.E.I. wire contact sustainer relay (166 in all). This will in turn feed the sprung closed switch above each selector. The object of the sustainer

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relay is to allow reverser output contacts to be uncoupled from the lighting relay and used to reset the presets during transmission if necessary. The patching relays are in fact used as circuit blackouts.

18. ACTION & MOTOR RECTIFIERS.

Two 3-phase transformer and metal rectifier units will be supplied one to stand by the other.

Outputs to be:-

15-17 volt D.C.200 amp.

50 volt.D.C. 65 amp.

Input to rectifier transformer to be fed through 3-pole contactor with 120 volt 50 cycle coil energised from desk and dimmer room. Sustainer contact of contactor to be tripped by overload relay in 15 volt D.C.mains. H.R.C. fuses as below, in addition.

Output: 15-17 volt 1. 100 amp. Positive Left bank.
One " " Right "
" " " Main relay desk
50 volt. One 15amp. Positive Left bank and Left Wing } PR System
One " " Right " and Right " }
" " " Left " Motor
" " " Right " Motor

19. MAIN ACTION RELAY.

Main components to be:-

168 reversers with separate main to off coils and to jiggers.

Two 20 preset setter relays each of 84 stops.

N/C m/C blocks to remove main from off coils. and jiggers.

N/C and N/O M/C blocks for setter action.

Couplers for "Lit Move"

" " "Dimmer Preset" Black and Red (50 volt).

" " "Lighting Hold".

" " "Individual Go"

The above relays will be mounted in mahogany boxes with removable lids back and front as standard Compton practice on their pipe organs in the concert halls at Broadcasting House and Maida Vale. Relays will be carried on hard wood frames but Strand bakelite testboards will be fitted.

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D.C.C. waxed wiring will be used on all 15-17 volt circuits on wood framed section D.C.C. and enamelled wire to the small section devoted to the 50volt polarised relay control lines.

20. DIMMER BANKS: (Strand drawings A.721 & A.722)

There will be two of the Strand P.R.type with electro mechanical action, but extended by sections for remote patching relays. For schedules see 13, 14, 15, & 16 above.

(a) Dimmer banks will be arranged with five tiers of dimmers. All shafts are chain coupled together and driven by a geared motor unit in the centre, of ample power to start when loaded with all dimmers at all speeds. Clearance is allowed so that the motor may be unbolted and removed from the bank for inspection. The shafts are provided with self-aligning ball-bearings. The Telemotor motors are variable [illegible] speed 50 volt D.C.units, Norman Electric type 200 Geared unit nominal output 9 r.p.m. giving a range from 2 seconds dimmer travel to 45 seconds. Mounted in the centre of each dimmer bank above the motor is the "setter unit" which is permanently coupled to the corresponding indicator dial in the remote desk, and which indicates the amount of travel imparted to the dimmers when changing over from one dimmer preset to another.

(b) Dimmers are of the Type "A" Element Sunset, with the resistance wire (nickel copper alloy) wound on formers. There are 100 contacts (approx.) devoted to the resistance steps, the studs at the full on and blackout ends of travel being additional. Dimmers are theatre rated so that they may be left in intermediate

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positions for any reasonable length of time. On 120 volts the limit to a single dimmer plate is 2000 watt. Dimmers will be wound for a tolerance of plus or minus 1/3, which means, in fact, 500/1000 or 1000/2000 as shown in schedules 13 and 15.

(c) Mounted on each dimmer is a 1000 ohm 50 volt D.C. potentiometer which moves with the dimmer arm and always remains live. This potentiometer is part of a Wheatstone bridge circuit and enables the position of any dimmer to be preset whether the main dimmer is alive or not. The potentiometer is shunted by a fixed resistance 2000 ohm between centre arm and the down end for theatre work and centre and full-on for television. This ensures that the dimmer can be moved even if a potentiometer opens circuit.

(d) A polarised relay (Telephone Manufacturing Company type 6BI or equivalent) is carried on a bracket at the low voltage end of the dimmer. Relay has plug base and is used to determine dimmer position in conjunction with the potentiometers on dimmer and desk. The relay is completely enclosed and dimmer potentiometers have dust covers. Clutches will be shunted by rectifier type suppressors to protect polarised relay contacts.

(e) Dimmers are driven by pairs of magnetic clutches Strand Electric Patent, to move "up" or "down" from the uni-directional

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shaft. The design of the clutch is such that a dimmer can always be moved by hand without the necessity of going to the control, provided the desk presets are off. A button cancelling these is on each bank testboard. The clutch is die cast, mounts at 5 inch horizontal centres and is split to add or remove without taking down the shaft. The units also incorporate springs to clear the magnet pole pieces from the wheels when not engaged, thereby ensuring freedom from noise. Clutch arms are fitted with grease nipples and coils are fed via P.V.C. twin flexibles.

(f) Mounted on the back of each dimmer (i.e. the end remote to the clutch and driving shaft) is a contactor or relay of a suitable size to control the load, magnetic blowouts being fitted for currents of over 20 amps. These contactors are normally open electrically closed and are wired in series with the dimmer. The blackout contactors will be fed by auxiliary relays, used as a sustainer to cover certain operations. On circuits where remote operated patching using relays is needed, the dimmer contactor or relay will be omitted.

The dimmers and contactor switches are wired in the phase side as required by the L.C.C. and I.E.E. Regulations, the number of fuses being also determined by these Regulations.

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(g) Fuses for lighting circuits are of English Electric HRC. cartridge type S.S.25, S.M.60. 5% replacements in cartridges of various sizes will be included. All fuses are mounted together on a dead front Sindanyo panel at one end of each bank. The rear of this panel forms an enclosed busbar chamber. The fuse is between the live busbar and the dimmer. No further fuse will be provided, each patched circuit being covered by its dimmer fuse only. All fuses will have circuit identification.

(h) Wiring: All high voltage wiring from the dimmers is in Enbestos or Rockbestos heat resisting cable carried in horizontal metal trunkings and terminating in numbered pummel connectors mounted in busbar chamber to take 7/044 for all circuits except the 5kw which will have 60 amp.lugs . Neutral connecting bus bars are alsomounted in this chamber. Neutral links are not fitted to the lighting circuits. The contractors wiring and connection takes place in the busbar chamber and at other centralised terminal points; in no case is it necessary for his wiring to extend along the banks to pick up at individual contactors, relays, etc.

(i) Mains: Cable glands for mains as shown on B.B.C. drawing PID.3322.9.IH will be fitted to dimmer banks. Provision

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is for bottom entry of mains but lighting circuits to be taken out at the top. Mains to left bank three single 3 x 0.4 C.I.L.C. Mains to right bank 2 x 0.4 C.I.L.C. Rectifier and transformer unit for Action (see 18 above) to be 4 core 0.06 R.I.L.C. Strand Electric to provide cable glands and lugs but not supply of mains or connection thereof.

(j) Transformer dimmers will be installed where variable load factor is considered important (see Schedule in 15 above). The auto-transformer dimmer will dim to the same curve any load within its total rated capacity. Thus, 250 or 2000 watts may be connected to a 2.kW. transformer and the dimming curve will be the same. The transformer dimmer fitted to the Strand P.R. bank is a special Strand-Phoenix unit constructed on a standard die cast dimmer frame and arranged for 2 kW. The clutch drives are compensated so that whatever type of resistance or transformer dimmer is used the result to the operator at the control desk is the same. Mounted on the back of each transformer dimmer will be a 20 amp. G/S. relay to disconnect the phase side. This relay operates to switch the lighting circuit on and off but it is also fed via a micro limit switch at the dim end of travel. The transformer winding is thus automatically switched out of circuit whenever the dimmer is down.

(k) Low-voltage action wiring to clutches, limit switches, contactor coils and indicator rheostats is rigidly mounted on each dimmer frame and brought to a connector block at the clutch end. Wiring on dimmers is by glass braided tinned copper glass sleeved where necessary for extra protection. From the dimmer blocks a purpose made-up P.V.C. insulated

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cable runs to the dimmer bank test-board where all wires are labelled and where the various circuits can be provided with main for testing without going to desk or relay. Dimmers can be easily removed and replaced since their wiring is tied out so that it cannot be reconnected wrongly. Dimmers are provided with engraved labels giving circuit identification number, name and wattage. The low voltage side has identification numbers sign-written on the main frame. Phasing is indicated by the colouring of the dimmer feet.

Recording meters: Each dimmer bank will have a Sangamo Weston S16 (or equivalent) recording meters connected between one phase and neutral to indicate bank hours in use.

(1)Weights and sizes: (Dimmer Room) (approx.)

Left Dimmer Bank.	17'4"x7'4"high x3'10"deep.	4 tons.
Right " "	17'4"x7'4"high x3'10"deep	4 tons.
Main Relay.	3'6"x7'0"high x12" deep	7 cwt.
Rectifier Unit.	4'0"x5'0"high x2'0" deep	5 cwt.

21. DIMMER ROOM CONSTRUCTION: Natural ventilation if some cross draught can be encouraged may be sufficient. Alternatively, a fan of the Vent-Axia type will be effective. On large installations can extract fan brought in by a thermostat, is desirable in which case air filter inlets may be advisable. Care should be taken that the room is reasonably soundproof, the principal source of noise being the larger wattage contactors and the motor speed contactors. No special treatment or soundproofing has been required in any installation yet.

A good washable paint to the walls and an anti-dust finish to the floor is advisable in order to reduce the amount of cleaning required. The door to the room must be kept locked to prevent unauthorised access.

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22. ACCEPTANCE TESTS: Lighting dimmer banks will be erected and wired at our Works to the control desk. It will therefore be possible to operate same before re-erection on site. It will not be possible to load the dimmer banks in respect of lighting due to the non-standard voltage and heavy current required. Dimmers will be tested individually by us before mounting on banks. When mounted they will be re-tested singly in the presence of BBC engineers if desired.

The "patching" wiring will all be made up and preformed at our works but will only be partly connected there in respect of the main cable in order to save unnecessary repetitive work.

23. TRAINING OF OPERATOR AND MAINTENANCE. The customer's own operator may attend at our Works during the last week of construction in order to gain an inside knowledge of the apparatus, its testing, maintenance and operation. Our own operator attends during the first two weeks the equipment is actually working in the studio, to operate the lighting and train operators.

Contracts for regular maintenance and cleaning of the apparatus can be entered upon.

A complete set of wiring diagrams, together with a description of the way the various circuits work, how to work them and suggestions for maintenance and test are supplied on completion of the installation. (20 such copies have been included for).

24. VARIATIONS FROM B.B.C. TECHNICAL CONDITIONS OF CONTRACT III.

(1) Dimmer Banks will be constructed as standard Strand practice and are only arranged to be dead front (all live metal screened) in respect of the end busbar chambers, fuse and patching relay. Banks will be so constructed that the open part of the framework carrying the dimmers can form a separate part of the dimmer room screened by mesh and gate with Castell key interlocks.

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This protection does not form part of this contract. Outside the protected area all live metal above 50 volts will be screened by metal covers and guards requiring at least three screws to uncover. Warning labels will be fixed to all such covers. Fuses (see 20 (g) above) will not be mounted behind covers as ready access is essential to working of the studio and the whole dimmer room should constitute an enclosure preventing unauthorised or untrained access.

(2) Due to the large number of mechanical contactor switches and relays required by the specification, the apparatus will be somewhat noisy and the room walls should be constructed with this in mind. For similar reasons we cannot guarantee this apparatus to be free of electric interference in respect of your broadcasting equipment but are prepared to co-operate with B.B.C. Engineers in tests at any London Theatre where similar apparatus is installed.

(5) The two indicating meters on the desk for preset changeover will be the standard used on this type of equipment, i.e. Measuring Instruments Pullin, 2½ inch dial Series 25 square flush voltmeter.

(7) Finish: Control desk main frame will be finished as required in high grade finish B.B.C. grey.(ED.24) Dimmer lever inserts will be standard pale cream engraved as described in our desk schedules above. Other exposed metal with fixing screws finished black, bronze or plated as applicable.

Main relay: See Specification 19 above for finish.

Dimmer Banks: Standard Strand Electric finish including all iron framework painted red oxide under-coat and one coat semi gloss I.C.I. Radio Grey.

An extra coat to be brush applied after erection on site.

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Sheet iron panel covers to be one coat red oxide and one coat hammer grey stoved. Trunkings and bus-bar chambers of lead coated steel finished red oxide undercoat and stoved hammer grey top coat. Hammer grey to match Radio grey as near as possible. Fuse panels to be semi-gloss black Pierrite grade C.O. Fixing studs and nuts covered by black moulded caps. All steel dimmer and clutch bolts, split pins, washers, etc. cadmium plated. Magnet pole pieces rust proofed. Dimmer clutches and collars in natural die cast aluminium finish. Dimmer frames and arms in natural Mazak 3.

(8) Spares: The following items will be supplied as spares.

Main dimmer bank Telemotor - 1.

Main Rectifier transformer unit - 1.

Sunset Resistance dimmer 1000/2000 w. - 1.
500/1000 w. - 1.

Strand Phoenix Transformer dimmer - 1.

Clutch Magnet coils - 6.

" Suppressors - 6.

Potentiometer strips 1000 ohm - 36.

" wire brushes - 36.

" carbon brushes - 36.

Sunset dimmer carbon brushes - 12.

" " contacts complete - 1 gross.

Transformer dimmer brushes - 36.

Fuse cartridges 5% of all sizes minimum 2

20 amp G/S relay - 6.

24-way wire contact relay - 6.

C/O. & Sust. wire contact relay - 6

P.R. relay - 2.

Burgess Micro switches - 3.

Luminous pushes - 2.

Lamps for Luminous pushes - ~~24~~ 12

Patch selector switches - 2.

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(10) Technical Information: Maintenance Instructions circuit descriptions and diagrams form part of the Control handbook and are supplied on completion of the installation. (20 copies).

(11) (a) Dimmer Bank labels will be of traffolite coloured to correspond with the control key colour. Phasing of dimmers is indicated by colour painting their mounting feet.

(b) Cables entries will be arranged as convenient to suit the external wiring and building layout.

(12) Material quality: Attention is drawn to the fact that the short delivery time allowed and the state of the market does not permit us to submit components for B.B.C. approval. The equipment supplied by us will be of first class manufacture and in our opinion more than adequate for the class of work, we shall comply with the standard B.B.C. conditions and specifications as far as possible under the circumstances.

R & D./FPB/2/8/1955.