STRAND TELE
LIGHTING CO

System ... C.

Studio ... RIVERSIDE I.

Ref: ... FPB/INS/RIV.I/22/6/56.

B. B. C. RIVERSIDE STUDIO I

STRAND SYSTEM C - LIGHTING CONTROL

INSTRUCTIONS AND MAINTENANCE

REF: FPB/INS/RIV.I/22/6/56

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PART I - STRAND SYSTEM C

1. GENERAL INTRODUCTION

This Studio has 166 Control Channels each with its own dimmer. These are controlled by a Strand System C desk remotely operating a Strand System P.R. electro-mechanical dimmer bank.

There are 138-1000/2000w Resistance dimmers, 4-5Kw resistances and 24-2000w transformer dimmers for complete variable load control.

As the number of control channels is very high in relation to the number of circuits and as each channel has its own dimmer, there is no patching in this studio. The remote control itself has a switching panel which enables each channel to operate any one of seven circuits. These circuits overlap somewhat from channel to channel in such a way that several alternative paths are available.

As the Strand System C and P.R. Bank uses electromagnetically operated mechanical equipment its facilities as a control are more extensive than a system employing magnetic amplifier or electronic (direct or indirect) dimmers. This springs from the fact that a mechanical dimmer equipment remains at the state to which it was last called when deprived of its control, whereas the other systems require constant control current to hold their state.

This means that control levers can be uncoupled and reset while the lighting remains static and further that the new instruction to effect a change need only be issued to the channels concerned. There is no necessity as with the other systems to set up for a state of no movement.

2. CHANNEL CONTROLS

Each channel has a luminous push known as the "channel switch", and two Dimmer levers - one black and one red.

The channel switch has a reverser relay and when touched, the first time, its internal light will come on and the studio circuit is made live. Touched again, both indicator and circuit are dead.

When alight, the luminous push also feeds the channel dimmer clutches; therefore normally a dimmer cannot be moved unless its lamp is alight (but also see I.22 below)

The two dimmer levers to each channel are for

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presetting dimmer position. Which of the two is operative is governed by the Black and Red preset Masters.

3. MASTER CONTROLS

These are situated on the centre desk as tablet switches, push buttons and luminous pushes. The latter have on-off reversers. Foot pushes known as "toe pistons" and other pedals are also used. Dial and pilot lamp indicators are fitted as appropriate.

4. SWITCHING MASTERS

These are:- DBO Left and Right black tablet switches, Lamp Hold, Green tablet with duplicate toe piston, the 20 memory push buttons, and the cancel push. The memory pushes are "set" or "added" by two toe pistons. A further red tablet switch is neutral in the centre and gives Outstation in the top position, and Test station in the bottom.

5. DBO: LEFT AND RIGHT

Kills all lighting on the left and right wings respectively, but does not trip any controls to do this.

6. LAMP HOLD (GREEN)

Locks the lighting combination "on" in the studio so that the channel switches have no effect until this switch is put off. A green pilot lamp indicates that the lamp hold is on. A steady glow from this means that the channel switches may be used without effect in the studio.

7. PRESETTER AND MEMORY PRESETS

Depression of the former allows a touch on any of the latter to memorise for recall later any combination of luminous pushes in use at the moment. The Presetter must be closed first and released last.

8. CANCEL

This is a push which is permanently preset to take all luminous pushes and their reversers off. It is convenient when shutting down the job or when setting the memory presets. As each group has been set up and memorised, the slate may, so to speak, be wiped clean by using the cancel before manually selecting the next combination.

Alternatively, before beginning to set up a new

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show, the cancel may be pressed and afterwards the setter toe piston held while all 20 memory buttons are touched one after the other. Then when we come to preset, each memory button used without the setter will automatically clean up its predecessor's left overs.

9. PRESET ADD

When depressed causes the combination on any memory preset to be added to, instead of replacing, the combination in use.

10. OUTSTATION (RED)

When this switch is put up, two memory presets (19 & 20, one for "on" and the other for "off") may be operated via the B.B.C. studio control circuit.

II. TEST STATION (RED)

When the switch (in 10 above) is centred, the gantry control panel becomes live, but when it is put down the panel is "off" (see II.3 and III.11). When in fact the test station is in use, the red pilot will light.

12. DIMMING MASTERS

These are:- Luminous pushes for Black and Red preset with indicator dials, two speed pedals with lamp indicators, speeds uncoupled amber tablet, extra slow speed switch and potentiometer. A 2-way and off white tablet gives "individual indicator" in the top position and "individual go" in the bottom. In addition, three toe pistons provide Raise, Dim and Gen. Move, respectively.

13. BLACK AND RED PRESET

Two luminous pushes to energise the black or red control channel dimmer levers. These pushes also start the shaft driving motors. The change from one preset to another is visually indicated by dials for the left and right wings. The pushes will not operate when the red lamp immediately under them is on (see I.17 below). These pushes are duplicated on the left and right wing panels as pilot lights, but will not operate from there. If Lamp Hold is in use and either of these presets is on, it will cause the green pilot of the "lamp hold" (I.6 above) to flash, as a warning that dimmer movement might affect a lamp whose contactor is locked on.

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14. SPEED PEDALS

These are balanced to stay at any position. Toe pressure increases speed. Heel pressure decreases. Speeds are:- 2, 3, 4, 5, 7, 10, 25 and 40 secs. dimmer travel and the position of the pedal is indicated additively by pilot lamps on the centre panel. The slowest speed is known as "1" and the fastest as "8".

15. SPEEDS UNCOUPLED (AMBER)

The speed pedals above are normally coupled to work off the right pedal. When this switch is put down, the left and right pedals work independently the left and right wing dimmer banks.

16. SLOW ON (SWITCH & POTENTIOMETER)

This automatic impulse circuit is designed to be used with the pedals right back on their slowest speed. The amber lamp indicates motor stopped and the green, motor running. The rate of impulse is increased by clockwise rotation of the potentiometer knob, and the circuit is brought in by putting the switch down.

17. INDIVIDUAL GO (WHITE)

When put down, the Black and Red presets are tripped and locked out. A Red lamp is put on under these pushes to warn the operator that their non working is not a fault. The switch also locks the channel switch reversers to remain as they are at the time.

By holding any channel switch in, whether internally lit or not, that channel dimmer will control from the "individual go" dimmer lever, subject of course to the speed that may be selected.

18. INDICATOR (WHITE)

When the switch in I.17 above is put up, it has exactly similar action to that already described, except that holding any channel switch in, will cause the centre panel dial "Dimmer Position" to provide that information in respect of the channel dimmer concerned.

19. MASTER DIMMER (TELLVISION THEATRE ONLY)

When the tablet switch is put down the positive dimmer busbar at the control panel is decreased in voltage by an amount determined by the position of the master dimmer lever. The effect of this is to move any dimmers

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in circuit at the time by an amount in proportion to the movement of the master dimmer. The master dimmer is itself remotely controlled and is therefore subject to the speed pedal. In respect of individual dimmers at intermediate positions, the effect is to apply a proportional cut.

20. DIM

This toe piston will trip the Black and Red presets and move any dimmers whose channel switches are on. These dimmers will move right down to out, or intermediately if the toe piston is released early.

21. RAISE

This toe piston operates as I.20 above but in the reverse direction.

22. GENERAL MOVE

This toe piston, while depressed, cancels the normal restriction of dimmer movement to channels whose "Channel switches" are on. For example, if "Raise" and "General Move" are depressed together, all dimmers will come up, or if "Red Preset" and "General Move", then all dimmers will come to their preset positions.

23. OPERATION TECHNIQUE

Assuming the control has been switched on, as described in Part I.26 and 27, there are a few general points to observe in carrying out the operations below:-

(a) Use the very fast speeds 7 and 8, in conjunction with the preset dials. Switch off the appropriate preset immediately the dial has got home, or push the speed pedal back, otherwise some dimmers may tend to hunt slightly at this speed and rock the light. Speeds 6 or 5 (4.5 and 7 secs. respectively) are very convenient for general working.

(b) Take particular care when using the "Lamp Hold" at the same time as either Black or Red Preset Masters, or the Dim or Raise toe pistons. It is possible and at times it may be desirable to move a dimmer of a channel whose lamp contactor is locked "on". Thus a channel might be dimmed out although its contactor remains locked on.

A Complete lock of the studio lighting is only obtained while the green pilot lamp is steady and the

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timid are advised to make sure this condition exists. However, it will sometimes be helpful to use the flicking green lamp condition. For example, see I.46.

(c) When using the various controls, act deliberately particularly when working on the setting of the memory presets or when using the luminous pushes. Do not jab push buttons; give them time to work.

24. TV LIGHTING CONTROL TECHNIQUE.

Generally speaking, the main advantages that centralised control can bring are:

(a) Saving of time in bringing lighting in and out of use.

(b) Ease in which any lighting not required at the time can be killed. This saves current but above all, cuts down heat in the studio. It can also minimise interference caused by light from sets not in use.

(c) The balancing of lighting intensity by means of dimmers, i.e. a large lantern, can speak with a soft voice when necessary.

(d) The performance of lighting effect changes of the stage type, both on dimmers and by switching.

The above remarks apply to Tungsten Lighting only.

25. LIGHTING REHEARSAL TECHNIQUE.

There are three main necessities.

(a) Adequate time for plotting of changes, haste only provides a scribbled illegible plot which means delay later on.

(b) Opportunity to digest complicated bits of lighting so that the best use may be made of the control. The immediate run-through repeated ad nauseam solves nothing.

(c) Have a clear idea of the time available between one lighting change and the next. All too often it is possible to tie yourself in knots to set up for a complicated change only to find that you have plenty of time; whereas you can be floored by a simple change because it follows immediately on the tail of its predecessor.

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26. TO SET THE CONTROL FOR REHEARSAL

Assuming that all the B.B.C. isolators are already on in the dimmer room it is necessary only to press the "ON" push at the desk (or in the dimmer room) to bring everything to life. Press cancel push to ensure all channel switches are off.

Put all dimmer levers to the full on position, except for channels not required in this production which therefore should be put to off. It will be seldom, if ever, that all 166 channels will be needed and the setting of to-day's dimmer levers at full and the rest at off, gives a useful indication of the channels "in play" so to speak.

Set speed pedal at 6 and make sure "slow" switch is off. Trip D.B.O. (Dead Blackout) contactors by centering them. Centre all other master panel switches.

Switch on black preset to ensure that dimmers run to full on. There is no call to keep the preset on and in consequence the dimmer control potentiometers and bank motors running for the duration of the rehearsal, but it is advisable to make sure that dimmer levers are not moved without the preset being on. This will prevent false indication and lessen checking, by using the indicator dial; as will also the immediate plotting of each dimmer position when determined.

Studio lamps must have been connected by using the channel circuit selectors as described in Part II.

27. TO SET THE CONTROL FOR TRANSMISSION

Press Cancel push to ensure all channel switches are off.

Put all the dimmers required to the levels at which they make their first appearance using one colour of lever, either black or red, for the purpose. Set speed to 6, press "General Move" and the master for colour of preset used.

When the dimmers have reached their marks, switch off the preset and set both black and red levers to the next two changes (if any) but do not use either preset. The control is now in the position of having its dimmers at one position for instant use with two other positions stored in advance. The switching presets will have already been set at rehearsal and the lights may now be brought in when required.

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28. TO SWITCH ON LIGHTS INDIVIDUALLY

Any channel may be switched on by touching its luminous push, whereupon both push and studio lamp will light. Touched again the lamps are extinguished. If the DBO master switches, and/or the Lamp Hold, are down, then only the channel push will light. Similarly if the dimmers are down.

29. TO SWITCH A GROUP, OR GROUPS, OF LIGHTS

The channel switches required should be put on and the others put off, as described in I.28 above. The Setter toe piston is then held before any memory push is touched. After the latter is released, the setter is also released.

The particular group of lights is now captured by that memory push and can instantly be recalled by using it. Both the luminous pushes and studio lamps will light when recalled unless the DBO, Lamp Hold, or their dimmer positions rule otherwise.

Where there are several groups to memorise, the foot can hold the Setter piston all the time even though it is desired to use the Cancel push, as this latter is permanently connected. The lights in the studio will not be affected by Preset setting if Lamp Hold is put on.

30. TO SWITCH ON ONE GROUP AND EXTINGUISH ANOTHER

Normal working of a memory push automatically provides this, because while lighting up the chosen group it automatically cancels the remainder of the channels.

31. TO SWITCH OFF ALL LIGHTS

Use DBO switches or the cancel push. Using the first, the combination of lights last used will remain visible on the luminous pushes and may therefore be immediately recalled or modified before recall.

If the cancel push is used, then the luminous push lamps will be "saved" as well as the studio lamps.

32. TO ADD ONE GROUP TO ANOTHER

Assuming that some of the memory pushes have been preset, the combinations on each then can be used additively provided the foot is placed on "Preset Add" before pressing any memory push.

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"Preset Add" is not restricted to Presets, any combination arrived at by hand selection can have any Preset added to it, because while "Preset Add" is pressed, the cancelling action is removed from all channel reverser relays.

33. TO LOCK THE STUDIO LIGHTING TO BE INDEPENDENT OF THE CONTROL.

The green tablet "Lamp Hold" or the toe piston is used (the latter for short duration). This connects the series of relays which feed the lighting contactors to feed themselves and sustain. At the same time, the reverser relay outputs which form the channel switches are uncoupled. These reversers continue to operate and to feed their internal lamp and dimmer clutches.

Provided a steady green pilot lamp is exhibited, any switching of the luminous pushes will have no result. If however, the dimmer presets (see I.13 above) are on, then the green lamp flashes. This indicates that although the luminous pushes have no effect on the lamp contactor, nevertheless the dimmer may operate and change the light accordingly (see I.46 last half for deliberate use of this facility).

34. TO SET A GROUP FOR INSTANTANEOUS SWITCHOVER

Put down the green tablet Lamp Hold, and select the new combination by hand. The studio lighting will be locked to the combination in use at the time of putting the green tablet down. Immediately, the tablet is put off, the new lighting combination will replace the old.

35. TO CHECK THE CONTENT OF A MEMORY PRESET BEFORE USE

If it is required to make sure a memory preset really is correct before using on the lighting in the studio, then Lamp Hold can be put on and the push pressed for a rapid check. When the lighting is actually required, the Lamp Hold is released.

36. TO MODIFY A PRESET COMBINATION WHILE LIGHTING IS IN USE

Put down the green tablet Lamp Hold before using the particular memory push. Then the combination can be modified by touching the channel pushes in or out as required. It may be convenient to use the Lamp Hold toe piston instead of the green tablet if lighting changes are following each other quickly.

In a heavy production use of "Lamp Hold" in this way can save the memory presets for more vital work and a combination which returns with but slight variations can be appropriately modified.

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37. TO PRESET FURTHER GROUPS WHILE LIGHTING IS IN USE

Use Lamp Hold, make sure of a steady green then proceed, as already described in I.29 above.

38. SWITCHING FROM ONE STUDIO AREA TO ANOTHER

No masters for specific studio areas are fitted, because the areas required to be mastered will vary with the number of scenes, their size and the layout of the production in the studio. It is intended that the memory presets shall be used to capture the lighting for a particular scene area. Memory presets can be used in any order and for any number of repetitions. Using "Preset Add", they can give a lap change from scene to another without the need to preset the specific state where the two scenes are lit simultaneously.

A particular example which assumes three scene only will show this:-

Using Preset toe piston - Set scene 1 lighting on push 1

- Set scene 2 lighting on push 2

- Set scene 3 lighting on push 3

We can now change from one scene area to another using a lap change as follows:-

Scene 1 - press push 1 only
Preview scene 2 press Preset add plus push 2
Scene 2 - press push 2 only
Preview scene 3 press Preset Add plus push 3
Scene 3 - press push 3 only
Preview scene 1 press Preset Add plus push 1
and so on ad lib and ad infinitum.

39. DIMMER OPERATION

This control as pointed out earlier uses the mechanical P.R. system, consequently dimmers always remain at the position to which they were last called, whether the order to move is continued or not. Only a new instruction will move the dimmers. As the instruction to the servo-mechanism passes through the channel switch (in effect) it is necessary not only to select a dimmer preset but to see that the channel is switched on at its

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luminous push. When a general dimmer movement independent of the channel switches is required, then the General Move push should be depressed.

All dimmer movement is subject to the speed selected on the speed pedals and this is assumed for the instruction below in order to avoid repetition.

When deciding whether to choose the Black or Red preset, if a visual indication that the change has taken place is required, use the opposite preset to that last used, and which is therefore reading on the dial. If however, it is a matter of adding movement to further dimmers in a group already set up, then use the same preset as before.

40. TO RAISE OR DIM LIGHTS INDIVIDUALLY

Put Black or Red Preset on, set speed pedal and move dimmer appropriately.

In the unlikely event of the channel switch not being on (i.e. the channel has to be switched in at a dimmed position) it will be better to use individual Go. Put the switch down, hold the channel push and move "individual" dimmer appropriately. When "individual go" is used, the luminous push is frozen in respect of its lamp switching action, and a red pilot under the Black and Red preset shows these have been tripped and locked out.

41. TO RAISE A GROUP OF LIGHTS ALL TO FULL

Switch on the channels required, set speed (8 excluded) and depress the Raise Toe piston for as long as the dimmer speed requires.

42. TO DIM A GROUP OF LIGHTS ALL TO OFF

Switch on the channels required, set speed (8 excluded) and depress the dim toe piston for as long as the dimmer speed requires.

43. TO RAISE OR DIM A GROUP OF LIGHTS TO A VARIETY OF DIFFERING LEVELS

Either the Black or Red dimmer levers should be set as required and provided the channel switches are on, the Black or Red Master will actuate these dimmers, it is only necessary to set dimmer levers in respect of the channel switches that are on.

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If a large number of channel switches are on and the group of dimmers is comparatively small, it may be preferable to use the "Lamp Hold" and cancel the channels then pick out the ones on which dimmer movement is required. If the precaution has been taken of "memorising" the lighting group before cancelling, then recall after dimmer movement and before releasing "Lamp Hold" will only require a touch of a button.

44. TO CROSS FADE FROM ONE SET OF DIMMER LEVELS TO ANOTHER WITHIN THE SAME GROUP OR AREA

This will require the second preset if the two sets of levels are constantly used. The two sets of levers are set up as required and the Black preset will bring in one and the Red the other.

If however a set of levels once used is then discarded, then three sets of levels are possible to any group or area. The first being set as actual dimmer position in advance and merely switched in by the channel switches; the second and third being set on the dimmer levers and driven in by the Black or Red Master.

There is no reason why once a dimmer preset is discarded, its levers should not be reset.

45. TO GO FROM ONE SET OF DIMMER LEVELS IN ONE AREA TO ANOTHER SET IN ANOTHER AREA.

This is a switching cue, the dimmers remaining set at their levels. Set the dimmer levels as described in I.40 above then use the memory preset pushes to switch on the groups of channels as required. These channels will of course light at the intensity already determined by the dimmers.

46. TO DIM FROM ONE AREA OR GROUP TO ANOTHER AREA OR GROUP

It is not necessary to waste the second dimmer preset for this purpose, one only can be used.

Set each area to the required dimmer levels using say the Black preset. Make sure all dimmers are down. Switch on the channel switches for the first area and the Black Master. This latter can be captured on the same memory preset as the channel combination so the whole action requires the touch of one button. The dimmers then travel and the lights fade in.

To preview the next area, the next memory preset is invoked plus preset add. The second area then fades in.

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The lights in the first area can then be cut by pressing preset "two" without the add.

If however a dimming cut is required or a dimming return to area one is involved then "Lamp Hold" should be put down and preset "one" used with "Dim" toe piston. Preset "two" is then used without add and lamp hold knocked off. This is deliberate use of the flicker condition of Lamp Hold green pilot.

When setting memory presets for this kind of action the appropriate Black or Red Master should always be set "on" otherwise the preset switching will trip the master and another action will be involved. This kind of dimming change is unlikely to be of any visual value for Television because the cutting from scene to scene is done at the camera; however such changes might extend lamp life and from the artists point of view would be less drastic.

47. TO FIND OUT POSITION OF PARTICULAR DIMMERS

Put Indicator (INDIC) switch up, hold the channel push concerned and read on dial called "Dimmer Position". While Indic Switch is on, the luminous push is frozen in respect of its lamp switching action. The Black and Red Presets are tripped and held out (shown by Red pilot).

48. DIMMER SETTING

Whenever possible individual dimmer intensities should be set up in advance and be brought in by a group master switch, or by a master fader or by a preset, because the setting up of a large number of dimmer intensities in a hurry, is likely to lead to inaccuracies. When properly set, the board should rely on its presets and group masters aided by occasional movement of individual dimmer levers when absolutely necessary.

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PART II - CIRCUIT SELECTION.

1. INTRODUCTION - STRAND SYSTEM C/RP

Each control channel has its own 2Kw dimmer consequently no patching is necessary.

As the number of control channels is 166 and the number of studio circuits 348 each channel has a selector switch to allow it to serve 7 circuits. With minor wxceptions, no two channels serve exactly the same circuits.

Channels 139-146 and 151-166 are transformers and are connected directly to the studio outlets and channels Nos. 147-150 are 5Kw connected to special outlets in the studio.

2. B.B.C. RIV.I. STUDIO LAYOUT

There are three areas of hanging bars X, Y and Z and reference should be made to B.B.C. Plan P. & I.D. SK/5013/B for their location. Each bar has four circuits known as the Red A circuits, the White B circuits, the White C circuit and the Blue D circuit.. The circuits are identified by their bar number for exar le X1.A or if preferred Red X1, Red X2, etc. The colours indicate phasing and in any case circuit selection is restricted to circuits of the same colour in the same area of the studio. In fact to keep the selector relay numbers within bounds, the circuit selection is further restricted to half a studio area.

Thus in a hanging bar area which is one sixth of the studio the 14 red circuits, the 14 white circuits or the 14 blue circuits each have available 8 channels. As each channel can only take one circuit at a time, 8 circuits of each colour can be chosen and 6 discarded.

In an X area there are less circuits so the ratio is 7 channels to 12 circuits to each colour.

Each white channel can control the B. & C circuits together or separately provided the total of 2Kw is not exceeded. The channel selector moves B. & C simultaneously but a further two way and off switch allows B or C or B and C to be switched to the channel.

3. SELECTOR PANEL (SEE FIG.II.1)

The Selector Panel is arranged on the left to carry the Red Group (the A cir its) and the White group (the B and C circuits). On the right the Blue group (the D circuits). Under these are the White three way switches

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CHANNELS 1–7	CHANNELS 8–14	CHANNELS 93–99	CHANNELS 100–106
RED A CIRCUITS		BLUE D CIRCUITS	
BAR X1 – X12	BAR X13 – X24	BAR X1 – X12	BAR X13 – X24
CHANNELS 15–22	CHANNELS 23–30	CHANNELS 107–114	CHANNELS 115–122
RED A CIRCUITS		BLUE D CIRCUITS	
BAR Y1 – Y14	BAR Y15 – Y28	BAR Y1 – Y14	BAR Y15 – Y28.
CHANNELS 31–38	CHANNELS 39–46	CHANNELS 123–130	CHANNELS 131–138
RED A CIRCUITS		BLUE D CIRCUITS	
BAR Z1 – Z14	BAR Z15 – Z28.	BAR Z1 – Z14	BAR Z15 – Z28.
CHANNELS 47–53	CHANNELS 54–60	SWITCHES B AND OR C X1 ——— X12 BARS X13 ——— X24	
WHITE B & C CIRCUITS			
BAR X1 – X12.	BAR X13 – X24		
CHANNELS 61–68	CHANNELS 69–76	SWITCHES B AND OR C Y1 ——— Y14. BARS Y15 ——— Y28.	
WHITE B & C CIRCUITS			
BAR Y1 – Y14.	BAR Y15 – Y28		
CHANNELS 77–84	CHANNELS 85–92	SWITCHES B AND OR C. Z1 ——— Z14 BARS Z15 ——— Z28.	
WHITE B & C CIRCUITS			
BAR Z1 – Z14	BAR Z15 – Z26.		

LAYOUT OF CIRCUITS & CHANNELS – SELECTOR PANEL.

FIG II.1.

to switch the B & C circuits on each bar. The centre position gives B & C, the top - B, and the bottom - C. These switches are ranged in horizontal line with X, Y or Z selectors to which they correspond. The switches control specific pairs of bar circuits and are therefore labelled after the bars X1, Y24, Z7 etc.

Each colour is further subdivided into three rows, the X area of the studio, the Y area, and the Z area. Thus the X area of the studio is represented at the control by a Red row of levers, a white row and a blue row.

The X area has 14 channels to each 24 circuits, subdivided into two sets of 7 channels each serving 12 circuits.

The Y area has 16 channels to each 28 circuits subdivided into two sets of 8 channels each with 14 circuits.

The Z area is exactly similar in numbers to the Y area.

4. SELECTOR SWITCH

Each selector switch operates vertically and is notched to locate at six intermediate positions plus the top and bottom. The bottom position is off, the other seven positions are channel selections. The selector switch belongs to the particular channel whose number (1, 13, 67 etc.) appears on the tablet switch above.

The tablet switch is spring closed and is in series with the selector switch contact arm. Thus while this switch is held down, the selector can pass through stations without effect. <u>Always depress tablet switch before moving selector arm.</u>

The scale of the selector switch has a dash to each station on the side nearest the arm to which it refers. The bar numbers are engraved on the scale but to keep them bold, no reference to the circuit group is made there. The circuit type is given by the colour of the channel knob above the selector. Red being A circuits, White for B & C and Blue for D circuits.

5. SELECTOR SWITCH SETS

There are two types:- the X set with 7 channels and 12 circuits and the Y & Z with 8 channels and 14 circuits. As the latter is standard it is described first.

A specific example of a pair of 8 channel sets is shown in the lower part of fig. II.2. This covers circuits Red Y.1 - Red Y.14 or Y.1A - Y.14A. The lever

- continued -

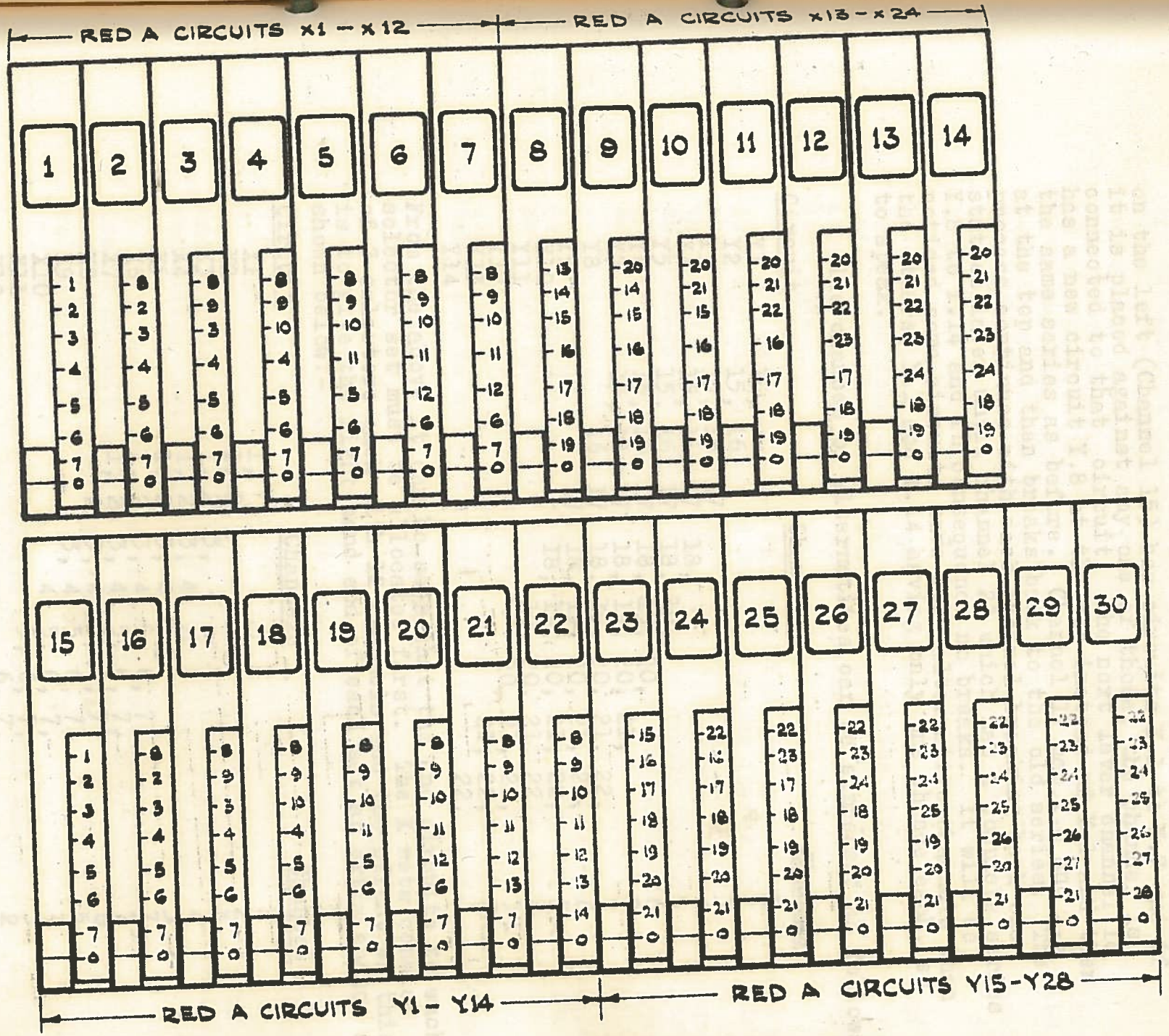

FIG II. 2. SPECIMEN OF SELECTOR SWITCH SETS.

on the left (Channel 15) has circuits Y.1 to Y.7 and if it is placed against any one of those, the channel is connected to that circuit. The next lever channel 16 has a new circuit Y.8 at the top instead of Y.1 and then the same series as before. Channel 17 has Y.8 and Y.9 at the top and then breaks back to the old series. The process continues with each channel breaking back one station later until channel 22 which has a complete series Y.8 to Y.14 and in consequence no breaks. It will be noticed some circuits have more alternative channels than the others, Y.1 and Y.14 having only one chance each, so to speak.

The chances or alternatives can be expressed as follows:

Circuit	Channels	Chances
Y1	15,	1
Y2	15, 16,	2
Y3	15, 16, 17,	3
Y4	15, 16, 17, 18,	4
Y5	15, 16, 17, 18, 19,	5
Y6	15, 16, 17, 18, 19, 20,	6
Y7	15, 16, 17, 18, 19, 20, 21,	7
Y8	16, 17, 18, 19, 20, 21, 22,	7
Y9	17, 18, 19, 20, 21, 22,	6
Y10	18, 19, 20, 21, 22,	5
Y11	19, 20, 21, 22,	4
Y12	20, 21, 22,	3
Y13	21, 22,	2
Y14	22,	1

From the above it can be seen that the end circuits to each selector set must be allocated first. The X sets consist of 7 selectors each with 12 channels and the effect of this is to give the right hand end of each set an extra chance as shown below:-

Circuit	Channels	Chances
X1	1,	1
X2	1, 2,	2
X3	1, 2, 3,	3
X4	1, 2, 3, 4,	4
X5	1, 2, 3, 4, 5,	5
X6	1, 2, 3, 4, 5, 6, 7,	7
X7	1, 2, 3, 4, 5, 6, 7,	7
X8	2, 3, 4, 5, 6, 7,	6
X9	3, 4, 5, 6, 7,	5
X10	4, 5, 6, 7,	4
X11	5, 6, 7,	3
X12	6, 7,	2

6. METHOD OF USE

In allocating channels to bar circuits the lighting supervisor may bear in mind that although all sixteen

- continued -

circuits on four adjacent bars can have channels, these are obtained at the expense of the other bars in that sixth of the studio. Four bars say Y1, Y2, Y3 and Y4 would take 12 channels (4 Red, 4 White and 4 Blue) and thus leave 12 only to be shared out among the remaining 10 bars with their 30 channel requiring circuits. As there is no patching, no jumping is possible except by extension leads from one bar to another in the studio. It may therefore be necessary to use a bar belonging to an adjacent area rather than the precise bar required geographically if there is a heavy demand for channels in a specific area.

When two lanterns are required on one channel without use of adaptors or splitter leads in the studio then a white channel should be used as these can be switched to control the B & C centre bars outlets in parallel - maximum load 2Kw.

The exigencies of the Selector system may sometimes, when severely taxed, lead to rather curious formations of control channels for related lighting. However, to ease the job at the lighting control desk, such formations could be captured on a memory preset and can thus be easily pulled out. The large number of 20 presets was allocated with this kind of thing in mind.

Although two circuits cannot be connected to one channel (except in the case of the specialised white circuits) it is a fact that two or more channels could be connected to one circuit. This would be inconvenient, though not electrically dangerous, and consequently care should be taken not to aline two channel levers on the same circuits.

7. HOW TO SET UP THE SELECTOR SWITCHES

If not already cleared, all selectors should be put down to the bottom Zero. If no channels are switched on then the selectors may be moved without further ado. If some channels are on, then the sprung on tablet over each selector must be held down while moving the arm.

Each group of selectors is split into two equal sets and this is indicated by a different filling to the tablet engraving. Each such set is an entirely separate entity.

The procedure in setting up involves putting the lowest circuit numbers on the low channels and the high numbers on the high. In other words, working from ends to centre.

ROUTINE FOR 8 CIRCUITS ON 8 CHANNEL SET: *

(a) Set the lowest circuit number on the extreme left on the lowest number channel in the set.

(b) Next set the highest circuit number on extreme right on the highest number channel in the set.

- continued -

(c) Take the next lowest number circuit and put on the lowest but one channel. Then the next highest number circuit and put on the highest channel but one.

(d) Proceed alternating between low and high numbers until complete.

ROUTINE FOR LESS THAN A FULL SET OF CIRCUITS ON CHANNELS:

Should there be two less circuits to connect up than there are channels, it is a good thing to leave the channels each end of the set vacant. Thus the setting up routine is as above but begins at (c).

The reason for this is that if we have to add circuits during rehearsal, these two end levers can cover the whole range between them. The particular anxiety is always the end circuits which of course only have one or two chances of channel.

When there are very few circuits, say four less than the number of channels, then two should be left either end.

It may be that additions to a production rig are unlikely, nevertheless it is wise to see that spare channels are left, to cover the largest range of circuits.

- o O o -

* The procedure is the same for 7 channel sets except that the high end is not so critical as they provide 2 chances (duplicate levers) for that end.

PART III - CIRCUITRY AND MECHANICAL ACTION

The object of this section is firstly to give a general description to aid lighting supervisors in the understanding of the instrument in order to get the best results; and secondly to aid Engineers in day to day and first aid maintenance. This section does not however aim to be a comprehensive treatise and it is recommended that regular maintenance should be undertaken by experts in this kind of work.

1. DRAWINGS

The following should be available in the dimmer room and some other approved localities, they are not issued as a matter of course with each instruction Book. For general reading of this section, the schematic diagrams in the text should be sufficient.

R & D 3830 - SYSTEM C ACTION WIRING DIAGRAM
R & D 3813 - REMOTE CIRCUIT SELECTION DIAGRAM
R & D 3852 - MEMORY RELAY AND CIRCUITRY
R & D 1004 - Schedule for Studio Switching
R & D 1763 - Studio Test Panel Diagram
C 2165 - Connections between Rectifier Contactor Box and Desk.
C 2141 - Low Voltage - Dimmer Terminal Blocks
B 2070 - Action Mains Connections in Dimmer Room

2. APPARATUS

This consists of two side wings with 166 dimmer channel controls, and a centre desk for the master controls. Adjacent is a selector switch panel for coupling channels to circuits.

From the above two multicore cables run to the dimmer room. One connects the control proper to the main relay and the other the selector switch panel to the corresponding circuit-channel contactor banks at the end of each dimmer bank. There are two dimmer banks, the left one deals with channels 1-92 and circuits X, Y, Z. Red and White. The right one has channels 93-166 and circuits X, Y, Z Blue. The colours also correspond to phasing.

The main relay is constructed mainly of mahogany and contains reverser relays for all control channels, couplers for dimmer preset and "lamp hold" and the memory relay mechanism.

The power supply for the action comes from three phase transformer and metal rectifier units giving D.C. outputs at 17 volt nominal, 24 volt nominal and 50 volt nominal respectively. The rectifiers etc., are mounted in one sheet steel case with door access to fuses. The main comes via a three pole contactor with automatic trip should serious excess current develop (Drawing C.2165).

- continued -

3. CIRCUITS AT LIGHTING VOLTAGE

The lighting voltage is 115 nominal phase to neutral. As the dimmer part of each bank does not lend itself to safety covers this section of the room has been caged off. Access involves removal of the Castel key in the main isolator and therefore the usual first aid measures such as pushing a dimmer up or down by hand, are tantalisingly out of reach.

DIMMERS: The majority are 100 contact element type 1/2Kw Type A resistances and the circuit is as fig.III.1 Each dimmer has an off contact at dim end of travel. These dimmers are not tied to one circuit and the seven alternative circuit contactors, any one of which may have to act as channel blackout, are shown. Each channel shares some of its alternative circuits with its neighbouring. channels. Consequently just as a channel will have several contactors, so approaching from each particular lamps point of view, there will be several, the number varying from 1-7. (See Part II - 5 for clues, and drawing R & D.3813)

There are 24-2Kw channels with fixed outlets and these are all transformers (fig.III.2). In addition, there are four 5Kw resistance dimmers made up of ganged plates (fig. III.3), an expedient adopted to avoid using the larger capacity dimmer Type D frames throughout the job.

The phasing of each dimmer is given by the colour of its mounting lugs.

TRANSFORMER DIMMER: This is a special unit designed to use the same drive and mount as a resistance dimmer. Contact is made by brush direct to the winding in such a way that 3 winding wires are in parallel at the top end, two in the middle and only one at the bottom. The brush is a very important feature therefore and must be replaced, as a precaution against distortion by wear, once a year. As there is only one lighting circuit to each transformer, the contactor is mounted on the back of, and feeds, the dimmer. This contactor is not only operated from the control panel but it is also tripped by a micro limit when the transformer arm is in the down (off) position. This removes the magnetising current.

Maintenance: Change transformer brushes once a year at least.

4. DIMMER DRIVE

All dimmers are driven by pairs of electro-magnetic clutches on a non-reversing shaft. Only the iron clutch wheel is one piece and cannot therefore be removed. The remainder of the clutch components are die castings in two halves. No graphite may be used for lubrication of any part of the clutches. A grease gun nipple looks after the

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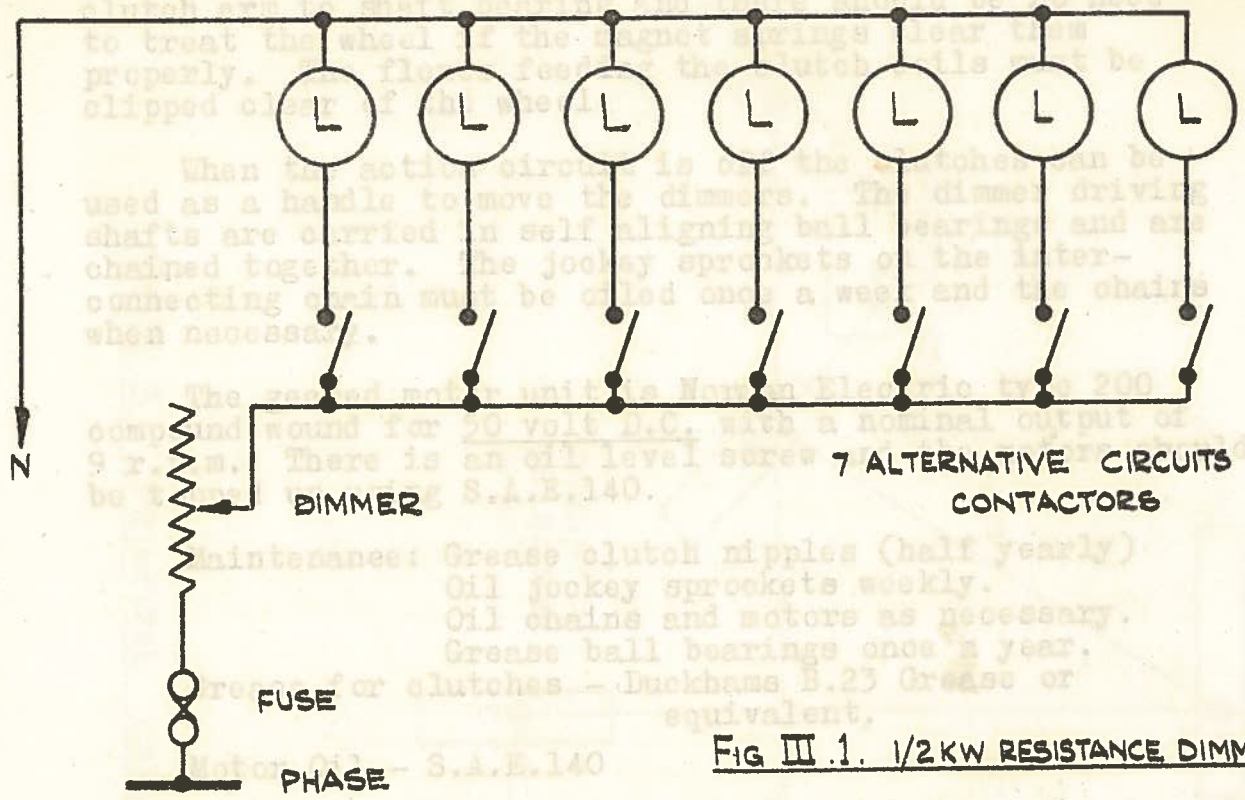

FIG III.1. 1/2KW RESISTANCE DIMMER

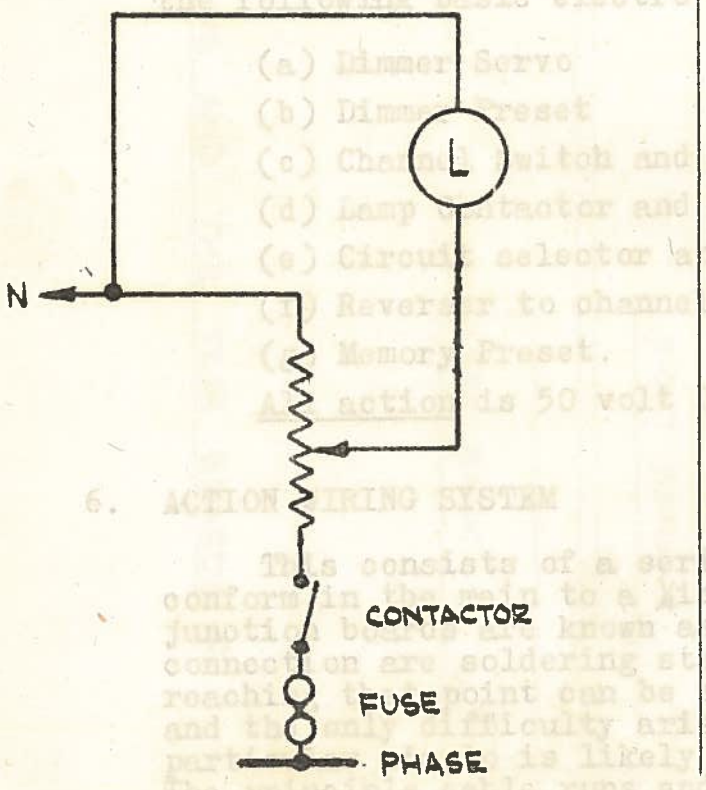

FIG III.2. TRANSFORMER DIMMER.

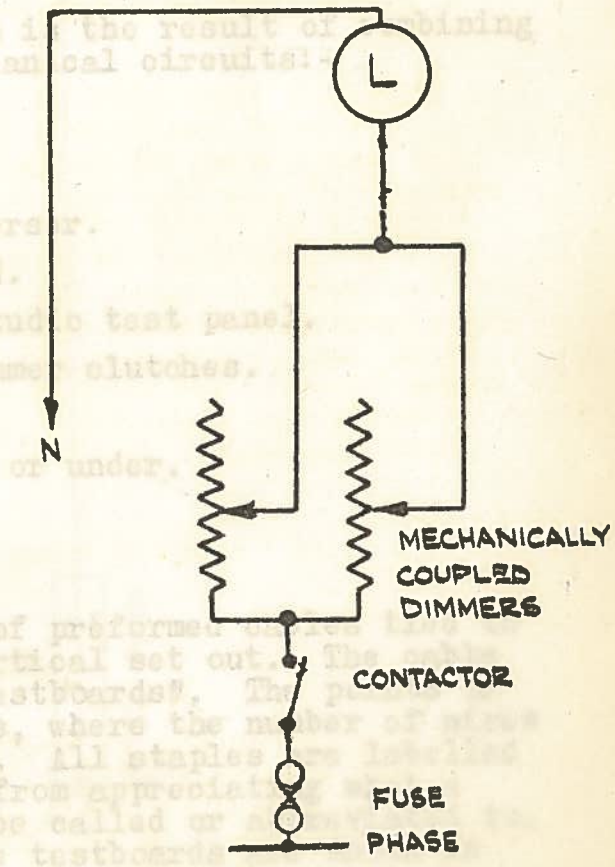

FIG III 2A. 5KW RESISTANCE.

clutch arm to shaft bearing and there should be no need to treat the wheel if the magnet springs clear them properly. The flexes feeding the clutch coils must be clipped clear of the wheel.

When the action circuit is off the clutches can be used as a handle to move the dimmers. The dimmer driving shafts are carried in self aligning ball bearings and are chained together. The jockey sprockets on the inter-connecting chain must be oiled once a week and the chains when necessary.

The geared motor unit is Norman Electric type 200 compound wound for 50 volt D.C. with a nominal output of 9 r.p.m. There is an oil level screw and the motors should be topped up using S.A.E.140.

Maintenance: Grease clutch nipples (half yearly)
Oil jockey sprockets weekly.
Oil chains and motors as necessary.
Grease ball bearings once a year.
Grease for clutches - Duckhams B.23 Grease or equivalent.

Motor Oil - S.A.E.140

5. BASIC ACTION CIRCUITS

The main bulk of the action is the result of combining the following basic electro mechanical circuits:-

(a) Dimmer Servo
(b) Dimmer Preset
(c) Channel Switch and Reverser.
(d) Lamp Contactor and Hold.
(e) Circuit selector and Studio test panel.
(f) Reverser to channel dimmer clutches.
(g) Memory Preset.

All action is 50 volt D.C. or under.

6. ACTION WIRING SYSTEM

This consists of a series of preformed cables tied to conform in the main to a ¼in vertical set out. The cable junction boards are known as "testboards". The points of connection are soldering staples, where the number of wires reaching that point can be seen. All staples are labelled and the only difficulty arises from appreciating what a particular staple is likely to be called or abbreviated to. The principle cable runs and the testboards are shown in fig.III.3.

- continued -

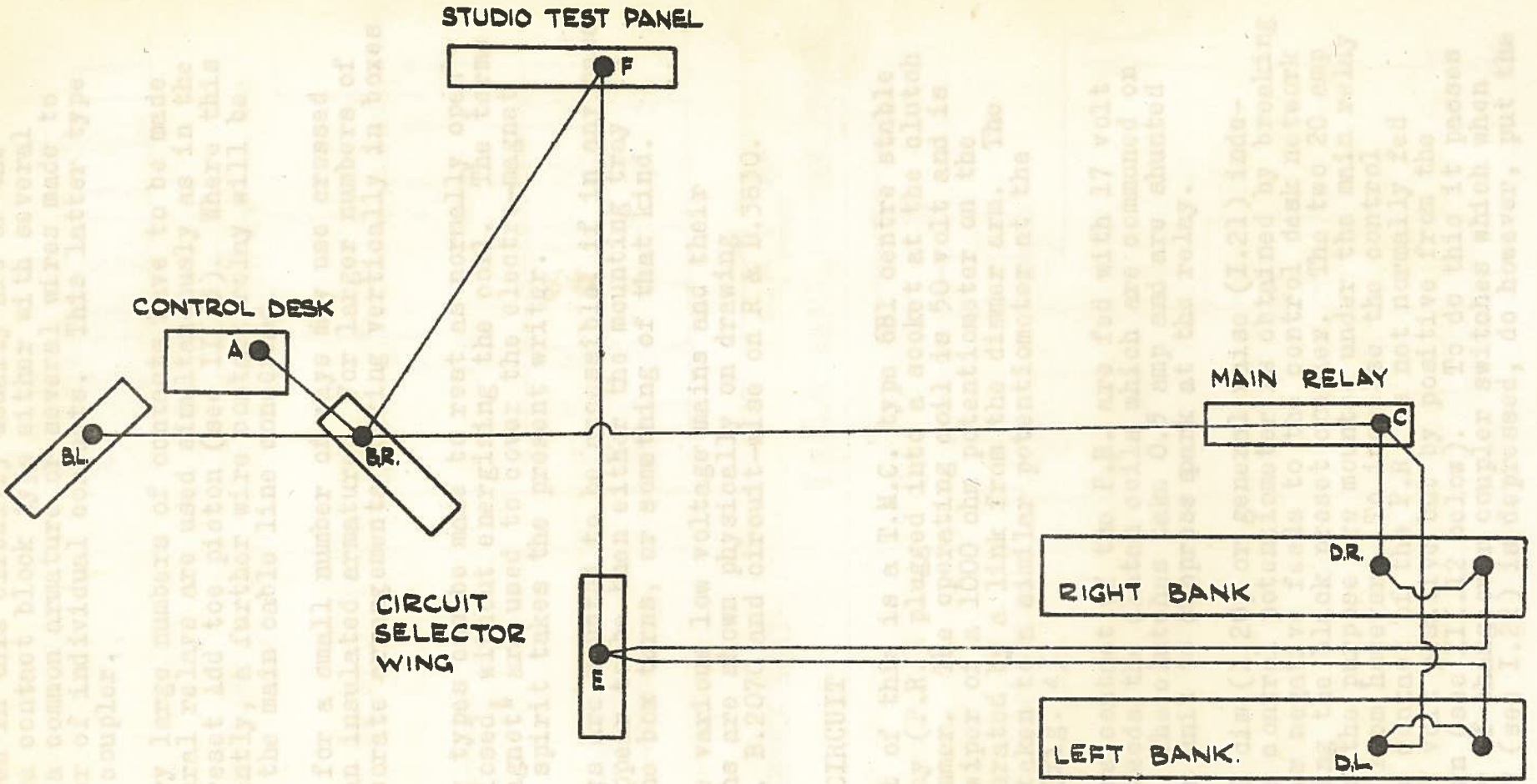

FIG III.3. PRINCIPAL CABLE RUNS AND THE TEST BOARDS ●.

Relays used in this circuitry usually are of the horizontal wire contact block type either with several wires made to a common armature or several wires made to the same number of individual contacts. This latter type is known as a coupler.

Where very large numbers of contacts have to be made together, several relays are used simultaneously as in the case of the Preset Add toe piston (see III.3). Where this is done frequently, a further wire contact relay will be interposed in the main cable line concerned.

Couplers for a small number of ways may use crossed contacts and an insulated armature. For larger numbers of ways more elaborate arrangements working vertically in boxes are used.

All relay types can be made to rest as normally open or normally closed, without energising the coil. The terms "coil" and "magnet" are used to cover the electro-magnet action as the spirit takes the present writer.

All relays are mounted to be accessible, if in any case they do not appear to be then either the mounting tray slides out, the box turns, or something of that kind.

Mains: the various low voltage mains and their runs are shown physically on drawing No. B.2070 and circuit-wise on R & D.3830.

7. DIMMER SERVO CIRCUIT

The heart of this is a T.M.C. type 6B1 centre stable polarised relay (P.R.) plugged into a socket at the clutch end of the dimmer. The operating coil is 50 volt and is taken to the wiper of a 1000 ohm potentiometer on the dimmer and operated by a link from the dimmer arm. The other end is taken to a similar potentiometer at the control desk (fig. 4).

The centre contact of the P.R. are fed with 17 volt positive and feeds the clutch coils which are commoned on the negative. The clutches take 0.5 amp and are shunted by a rectifier unit to suppress spark at the relay.

A general dim (I.20) or general raise (I.21) independent of the control potentiometer is obtained by breaking the positive or negative feeds to the control desk network and also closing the black preset coupler. The two 20 amp contactors for the purpose are mounted under the main relay in the dimmer room however. To increase the control facilities the contact of the P.R. is not normally fed direct with 17 volt positive but by positive from the reverser return (see III.12 below). To do this it passes through a pair of changeover coupler switches which when "General Move" (see I.22) is depressed, do however, put the

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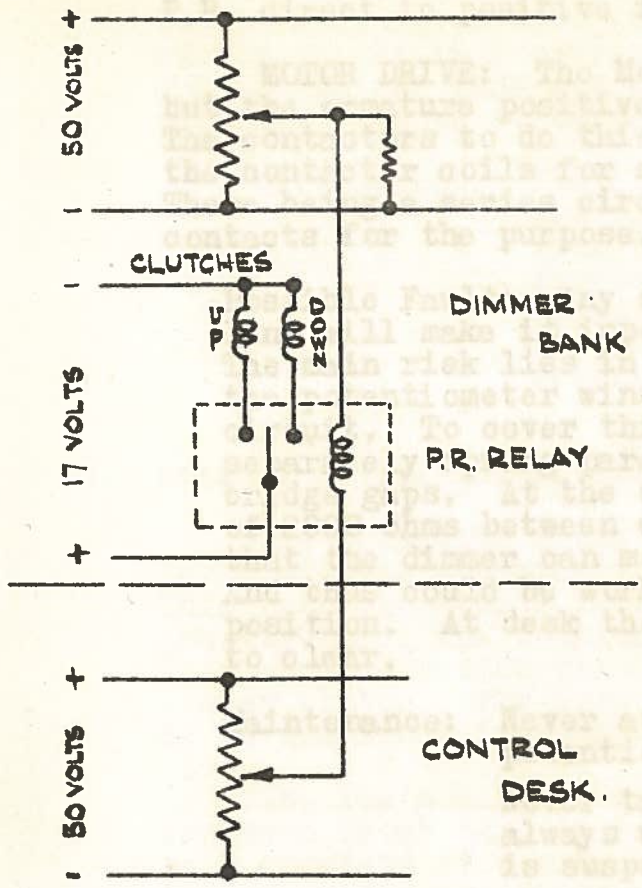

FIG III.4. BASIC DIMMER SERVO CIRCUIT.

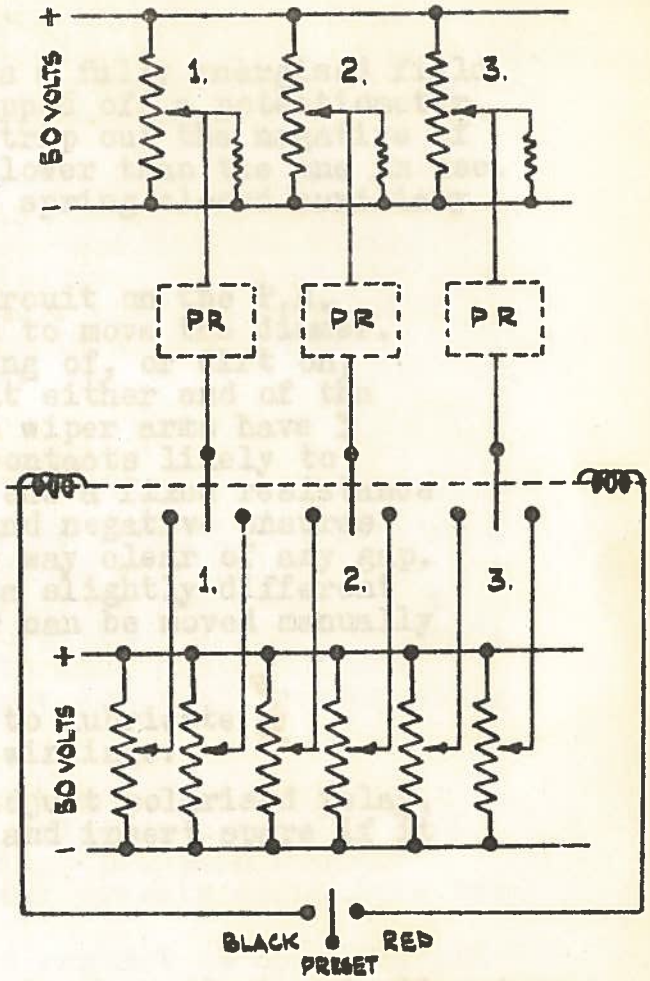

FIG III.5. BASIC DIMMER PRESET.

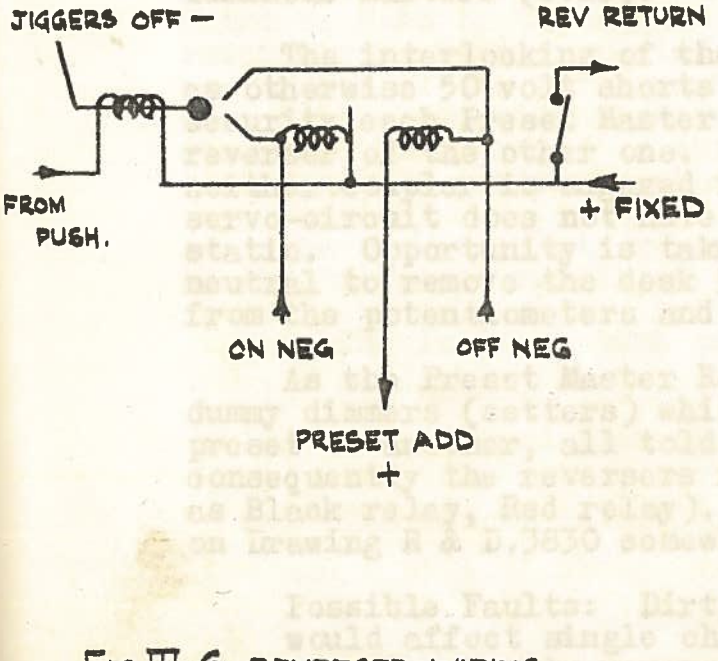

FIG III.6. REVERSER WIRING.

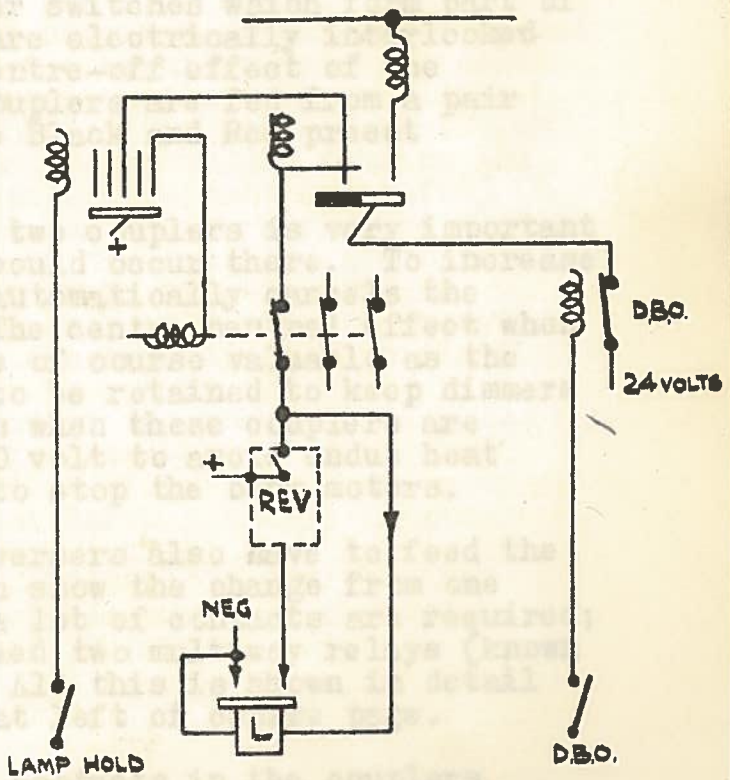

FIG III.7. LAMP HOLD CIRCUIT.

P.R. direct to positive instead.

MOTOR DRIVE: The Motor has a fully energised field but the armature positive is tapped off a potentiometer. The contactors to do this each trip out the negative of the contactor coils for speeds lower than the one in use. There being a series circuit of spring closed auxiliary contacts for the purpose.

Possible Faults: Any open circuit on the P.R. line will make it impossible to move the dimmer. The main risk lies in bunching of, or dirt on, the potentiometer windings at either end of the circuit. To cover this, the wiper arms have 3 separately sprung parallel contacts likely to bridge gaps. At the dimmer end a fixed resistance of 2000 ohms between wiper and negative ensures that the dimmer can move one way clear of any gap. And thus could be worked to a slightly different position. At desk the wiper can be moved manually to clear.

Maintenance: Never attempt to lubricate potentiometer windings.

Never try to adjust polarised relay, always unplug and insert spare if it is suspect.

8. DIMMER PRESET CIRCUIT

This is a simple duplication of the desk potentiometer (fig.III.5), the P.R. line comes to a common bar on two adjacent multi-contact coupler switches which form part of the main relay. The relays are electrically interlocked to give the changeover and centre-off effect of the diagram. The coils of the couplers are fed from a pair of reversers belonging to the Black and Red preset luminous masters (I.13).

The interlocking of the two couplers is very important as otherwise 50 volt shorts could occur there. To increase security each Preset Master automatically cancels the reverser of the other one. The centre neutral effect when neither coupler is engaged is of course valuable as the servo-circuit does not have to be retained to keep dimmers static. Opportunity is taken when these couplers are neutral to remove the desk 50 volt to avoid undue heat from the potentiometers and to stop the bank motors.

As the Preset Master Reversers also have to feed the dummy dimmers (setters) which show the change from one preset to another, all told a lot of contacts are required; consequently the reversers feed two multiway relays (known as Black relay, Red relay). All this is shown in detail on Drawing R & D.3830 somewhat left of centre page.

Possible Faults: Dirty contacts in the couplers would affect single channels on one or other preset. Faulty reverser action feeding preset

- continued -

coupler or bad contact via interlocks on the couplers, faults a whole preset. Traversing of Indicator dial without light in Preset push, shows lamp failure. Dimmers driving on one bank not the other would mean motor trouble, probably fuse or sticking speed contactor.

Maintenance: The dimmer lever units at the desk are plugged in and can be pulled out from the front once the two fixing screws are removed. The best way of cleaning coupler and other contacts of this nature is to work them several times.

9. CHANNEL SWITCH AND REVERSER CIRCUIT

The principle control for each channel consists of a luminous push internally illuminated by a pilot lamp. This push operates a reverser relay in the dimmer room, and together, the combination forms the "channel switch". This channel switch controls both lamp contactor and dimmer clutch. The action is most important consequently it is described in detail.

The luminous push can be relamped by removing the engraved front cap, it is stiff but does come off. The back consists of a single normally open push contact except on the black and red Master presets which have two.

The common feed to lamp and contact is negative and the return to the lamp is dropped via a fixed resistance on the unit (to improve lamp life).

The reverser relay in the dimmer room has three magnet coils. The first operated by the negative from the desk push operates a striker arm known as the "jigger". The striker feeds negative to either of two contact plates on a see-saw armature. This armature is pulled down in the front or back by two magnet coils (the "on" and "off") which are in turn connected to the armature contact plates. The effect of the arrangement is to cause the armature to move in the opposite direction every time the jigger strikes. Examination of a reverser will make its working clear and the wiring is shown diagrammatically in fig.6.

The back contact or output of the reverser is known as the "reverser return" and goes to:-

(a) The luminous push pilot lamp.

(b) The channel contactor switch (see III.10 below)

(c) The channel dimmer clutches via P.R. contact. (see III.12 below)

(d) The memory relay bars (see III.13 below)

- continued -

Alternatively, the reverser relay armature can be made to operate directly by energising the "off" and "on" coils with negative from the memory relay (see III.13 below). The preset is made to add only (See I.9) by depriving the "off" coils of common positive.

When the luminous push is used with Individual Move and Indicator (See I.17 and 18) the reverser must not operate and therefore the striker is deprived of the necessary negative by means of a multi contact normally closed relay known as "Jiggers Off".

Possible faults: Luminous head sticks in or back contact does not touch. Dud pilot lamp. Striker arm wedges under armature contact plate and does not return. Striker arm does not hit contact plate. Rev. return not making.

Maintenance: Patient adjustment of the reverser is the solution but great care to be used. The jigger striker can be pushed by hand or preferably a negative test lead taken to its coils. Even if the more refined adjustments are avoided the jigger must be pulled back if it sticks under the armature contact, otherwise a burnt out armature coil may result. If it persists in coming forward remove operating wire as temporary cure.

10. LAMP CONTACTOR AND HOLD

The reverser return feeds via a normally closed coupler switch the coil of the hold relay for the particular channel. This relay is on the end of the dimmer bank and is normally open. It has two circuits which make when closed; the first feeds the coil of the channel contactor, the second joins its own coil to positive via a normally open multi-contact relay known as Hold Sust. (Sustainer) and mounted of the relay row.

When lamp hold (I.6) is put down at the control desk the Hold Sust. closes and sustains any relays that are in. At the same time it also feeds and opens the hold coupler and the reverser return is disconnected.

The D.B.O. (I.5) is obtained by opening a normally closed contactor feeding positive via the hold relay armatures to the circuit contactors. Thus any set up (Held or otherwise) is not disturbed by D.B.O.

11. CIRCUIT SELECTOR AND STUDIO TEST PANEL

The majority of the channels do not have a single contactor but seven as shown in fig. III.1. This means

- continued -

that the outgoing wire goes from dimmer room to circuit selector panel in control room, passes via a sprung closed switch (II.4) to the wiper arm and thence to any one of seven contactors back in the dimmer room. This part of the circuit is detailed in Strand Drawing No. R & D.3813. Exceptions to the above are channels 139-166 which have only one circuit and in consequence the contactor is mounted on its dimmer.

The Studio lighting circuits can each be switched on from the Test panel on the gantry provided all dimmers are left in the up (full on) position (or at any rate a position to give light). Provided also all circuit selectors are at off, the circuit is shown on Strand Drawing No. R & D.1763. As a precaution against runnings and double operation, the master on the Test panel locks out the Hold coupler and disconnects the output of the channel reversers on the main desk. While the test panel is so doing, a red lamp is displayed on the main control desk. Should the Operator there require to trip the test panel, then he can do so by putting the Red switch above the lamp down.

12. REVERSER TO CHANNEL DIMMER CLUTCHES

The reverser return feeds the normally closed contact of a pair of interlocked couplers. The normally open contact is busbarred with its fellows to 17 volt positive. The bar contact common to both couplers is taken to the P.R. relay contact at each dimmer.

When General Move (I.22) is depressed the normally closed coupler opens and makes a contact to close the other coupler - the dimmer P.R.'s then operate subject only to dimmer preset and quite independent of the channel switch.

13. REVERSER TO MEMORY PRESET (See Drawing No. R&D.3852)

The reverser return is permanently connected to a magnet which operates a horizontal bar for the channel in the memory relay. The negative side of all the bar magnets is broken via a normally open multi contact relay. The bar consists of two notched silver strips insulated from one another and arranged that the notches come in adjacent pairs. The front strip and the back strip are fed by springs which serve to retain the bar in the normal off position, but which are electrically separate and are connected to the off and on coils of the channel reverser. (The front strip is the Off). The strips are fed by vertical rows of wire contacts in bakelite tracers. The number of tracers corresponds to the number of presets and there is one extra fixed strip at the right which is the cancel. The number of wires in each tracer corresponds to the number of channels.

- continued -

The tracers are pulled down by magnets and there is a pair of tracers to back and front of the relay.

The back one normally works every time the appropriate memory preset push feeds positive to the front and back magnets. This is because the back magnets get their negative via normally closed multi-contact relay contacts and the front via sprung open contacts.

The back contact strips are pulled down to make contact with negative each time their magnet is energised. This negative passes to the front via the notch in which the contact is captured and thence via the end spring to the On or Off magnet of the reverser in separate box below.

When the presetter toe piston is depressed the bar magnets and front tracer magnets receive their missing negative common while the back tracers are deprived of it. Consequently the horizontal bars of any channels whose reversers are on, are pulled one notch to the left. Any preset push now depressed and released will cause the front contacts to be captured in the "on" notches of any bars that are on. Once the presetter is released the horizontal bars return to the right but take any captured contacts with them.

Possible faults. Occasionally, through careless operation - the working of a preset push and presetter toe piston simultaneously - the front contact may balance and exactly bridge the front and back notches. The result is complete indecision on the part of the reverser.

The memory relay is also the only place where a pair of odd channel numbers or a pair of even can run together. A rare fault via the back plates of the bar magnets which are staggered in two columns and which therefore come out odds or evens together.

Maintenance: Except for the first of the two faults above, the memory relay boxes should never be opened or touched except by an expert. Once they have run in, they are, <u>if left alone</u>, a reliable piece of apparatus.

14. SCHEDULE OF FUSES

All fusing is single pole and in the dimmer room.

Master Action Contactor and valve voltmeter	H.R.C.	N.S.6
All Lighting channels (except 5Kw)	H.R.C.	S.S.20
5Kw Lighting Channels	H.R.C.	T.I.S.50

- continued -

Action Rectifier:-

50 volt	Left Bank	Circuit 1/1	H.R.C. T.I.A.30
	Left Motor	" 1/2	H.R.C. T.I.A.30
	Right Bank	" 1/3	H.R.C. T.I.A.30
	Right Motor	" 1/4	H.R.C. T.I.A.30
	Control Desk	" 1/5	H.R.C. S.S.20
24 volt	Left Bank Contactors	2/1	H.R.C. T.I.A.30
	Right "	" 2/2	H.R.C. T.I.A.30
15 volt	Left Bank	3/1	H.R.C. T.C.P.100
	Right Bank	3/2	H.R.C. T.C.P.100
	Desk	3/3	H.R.C. T.C.P.100

FUSIBLE LINKS: These are fitted locally on the dimmer rows and inside back of control desk wings one to each row for 50 volt small wiring protection. A pair is also fitted to the independent positive and negative for desk in D.B.O contactor box under main relay. These links are housed in locking type fuse bridges and 2 amp lead fuse wire should be used.

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