

**TECHNICAL INSTRUCTION**  
**P.9**

**Type-D Sound Control Equipment**  
**System Description**

*March 1971*

### AMENDMENT RECORD

| <i>Amendment Sheet No.</i> | <i>Initials</i> | <i>Date</i> | <i>Amendment Sheet No.</i> | <i>Initials</i> | <i>Date</i> |
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**CODED UNITS**

|        |         |         |         |         |
|--------|---------|---------|---------|---------|
| AM1/22 | ME12/8  | —       | PA8/300 | PA8/317 |
| AM1/33 | NE1/8   | PA8/284 | PA8/301 | PA8/318 |
| AM4/7  | PA8/260 | —       | PA8/302 | PA8/319 |
| AM4/8  | PA8/261 | PA8/286 | PA8/303 | PA8/320 |
| AM5/7  | PA8/262 | PA8/287 | PA8/304 | PA8/321 |
| AM5/8  | PA8/263 | PA8/288 | PA8/305 | PA8/322 |
| AM6/8  | PA8/264 | PA8/289 | PA8/306 | PA8/323 |
| AM9/8  | PA8/265 | PA8/290 | PA8/307 | TE1/13  |
| AM9/9  | PA8/266 | PA8/291 | PA8/308 | UN1/72  |
| AM9/10 | PA8/267 | PA8/292 | PA8/309 | UN1/88  |
| AM9/11 | PA8/268 | PA8/293 | PA8/310 | UN1/89  |
| AM22/1 | —       | PA8/294 | PA8/311 | UN1/111 |
| AM22/2 | PA8/273 | PA8/295 | PA8/312 | UN1/195 |
| AM22/3 | PA8/274 | PA8/296 | PA8/313 | UN8/14  |
| GE1/8  | PA8/275 | PA8/297 | PA8/314 | UN10/12 |
| IN5/3  | PA8/276 | PA8/298 | PA8/315 | UN14/8  |
| MA2/1  | PA8/277 | PA8/299 | PA8/316 | UN20/18 |

Instructions on these individual coded units of the Type-D equipment are not available unless shown in the List of Technical Publications or the corresponding alphabetical contents pages of ACO. Please do not apply to Technical Publications Section for copies of Instructions on units not so shown.

## SECTION 1

### INTRODUCTION

**General**

Type-D sound control equipment comprises a number of modular units which may be assembled in various combinations to make up sound desks to meet particular requirements. Typical examples of these assemblies are given later in this Instruction. The modules may be grouped into classes as indicated below according to their main function.

**Channel Modules**

|                                    |          |
|------------------------------------|----------|
| Channel desk panels .. .. .        | PA8/260A |
|                                    | PA8/260B |
|                                    | PA8/260C |
|                                    | PA8/260D |
| Audience mixer panels .. .. .      | PA8/268A |
|                                    | PA8/295  |
| Channel fader desk panels .. .. .  | PA8/297  |
|                                    | PA8/301  |
|                                    | PA8/315  |
| Microphone channel amplifier panel | AM9/11   |

**Group Modules**

|                                    |          |
|------------------------------------|----------|
| Group fader desk panels .. .. .    | PA8/262A |
|                                    | PA8/262B |
|                                    | PA8/262C |
| Group fader desk panel (stereo) .. | PA8/302  |
| Group output desk panel .. .. .    | PA8/312  |

**Main Modules**

|                                      |          |
|--------------------------------------|----------|
| Main fader desk panels .. .. .       | PA8/261A |
|                                      | PA8/261B |
| Main fader desk panels (mono/stereo) | PA8/261C |
|                                      | PA8/261D |
|                                      | PA8/323A |
|                                      | PA8/323B |

**Echo Modules**

|                                   |          |
|-----------------------------------|----------|
| Echo fader desk panels .. .. .    | PA8/263A |
|                                   | PA8/263B |
| Echo fader desk panel (stereo) .. | PA8/291  |
| Echo control desk panel .. .. .   | PA8/299  |
| Echo selection desk panel .. .. . | PA8/304  |
| Echo switching desk panel .. .. . | PA8/319  |

**Ancillary Programme Modules**

|                                  |        |
|----------------------------------|--------|
| Limiting amplifier .. .. .       | AM6/8  |
| Effects unit .. .. .             | AM22/1 |
| Response selection amplifiers .. | AM22/2 |
|                                  | AM22/3 |
| Compressor/limiter mounting ..   | UN1/88 |

**Monitoring Modules**

|                                      |          |
|--------------------------------------|----------|
| P.P.M. desk panel .. .. .            | ME12/8   |
| P.P.M. and L.S. control panels ..    | PA8/264A |
|                                      | PA8/264B |
|                                      | PA8/266A |
|                                      | PA8/266B |
| Miscellaneous monitoring desk panels | PA8/273  |
|                                      | PA8/321  |
| Dual-meter P.P.M. desk panels ..     | PA8/288A |
|                                      | PA8/288B |
| L.S. monitoring desk panel (stereo)  | PA8/289  |
| Ring-main desk panel (stereo) ..     | PA8/290  |
| Cubicle L.S. monitoring panel        |          |
| (mono/stereo) .. .. .                | PA8/303  |
| Ring-main desk panel (mono/stereo)   | PA8/307  |
| L.S. and P.P.M. monitoring desk      |          |
| panel .. .. .                        | PA8/318  |

**Telephone Modules**

|                                     |          |
|-------------------------------------|----------|
| Telephone and miscellaneous panel   | PA8/265A |
| Destination telephone desk panel .. | PA8/274  |
| Aux. destination telephone panel .. | PA8/275  |
| Source telephone desk panel .. ..   | PA8/276  |
| Aux. source telephone panel .. ..   | PA8/277  |
| Telephone desk panel .. .. .        | PA8/294  |
| Outside source telephone panel ..   | PA8/308  |
| S.B. telephone desk panel .. .. .   | PA8/309  |
| E.M.X. telephone desk panel .. ..   | PA8/310  |

Section 1

**Miscellaneous Units (Standard Modules)**

|   |          |
|---|----------|
| Group switching matrix .. ..                      | MA2/1    |
| Miscellaneous switching panel ..                  | PA8/267A |
| Talkback and equipment switching panel .. .. .    | PA8/284  |
| Studio L.S. select desk panel ..                  | PA8/286  |
| Miscellaneous desk panel .. ..                    | PA8/287  |
| Desk panel (stereo) .. .. .                       | PA8/296  |
| Signal divert desk panel .. ..                    | PA8/298  |
| S.T.B. and miscellaneous desk panel               | PA8/300  |
| Producer's prehear and talkback panel .. .. .     | PA8/305  |
| Source selection desk panel .. ..                 | PA8/306  |
| Intercom desk panel .. .. .                       | PA8/311  |
| Continuity output desk panel ..                   | PA8/313  |
| Tone selection desk panel .. ..                   | PA8/314  |
| Cue selection desk panel .. ..                    | PA8/316  |
| Miscellaneous desk panel (continuity)             | PA8/317  |
| Continuity interchange control desk panel .. .. . | PA8/320  |
| Miscellaneous continuity control panel .. .. .    | PA8/322  |
| Reverse talkback and intercom unit                | UN1/111  |
| Flexible module extender unit ..                  | UN1/195  |

**Miscellaneous Units (Various Chassis)**

|                                      |         |
|--------------------------------------|---------|
| Amplifier unit .. .. .               | AM1/33  |
| Desk panel (stereo) .. .. .          | PA8/292 |
| Echo switching panel (stereo) ..     | PA8/293 |
| Test unit for fader panels on CH1/35 | TE1/13  |
| Clean feed unit .. .. .              | UN1/72  |
| Programme switching unit .. ..       | UN1/89  |

**Subunits**

|                                       |         |
|---------------------------------------|---------|
| Cue programme amplifier .. ..         | AM1/22  |
| Cue programme distribution amplifiers | AM4/7   |
|                                       | AM4/8   |
|                                       | AM4/8A  |
| General purpose amplifiers .. ..      | AM5/7   |
|                                       | AM9/8   |
| Intercom amplifier .. .. .            | AM5/8   |
| Microphone amplifiers .. .. .         | AM9/9   |
|                                       | AM9/10  |
| Audible tone generators .. ..         | GE1/8A  |
|                                       | GE1/8B  |
| Selector hold alarm indicator ..      | IN5/3   |
| Stereo matrixing network .. ..        | NE1/8   |
| Source signalling unit .. .. .        | UN8/14  |
| Telephone unit .. .. .                | UN10/12 |
| Telephone throwback delay unit ..     | UN14/8  |
| 17-Hz detector unit .. .. .           | UN20/18 |

## SECTION 2

### DESIGN

#### Mechanical Design

Type-D equipment has a number of features which are not found in previous designs. Foremost among these are developments in the electrical circuits, but an important feature is the mechanical arrangement of the components which make up a circuit. Previously these components were grouped on panels according to their function, for example faders and amplifiers were mounted on separate panels and the interconnecting wiring was an integral part of the desk cabinet. In Type-D equipment, complete sections of the circuit are combined in one module.

Thus, a channel control unit carries all the controls associated with that channel together with amplifiers, fader and mixing network components. This panel unit is plugged into a nesting box which carries the linking wiring for the various circuits, and this can be mounted in a desk of any convenient shape or size. The system is designed to allow complete flexibility in function and size for the overall assembly.

The three basic module chassis are the CH1/35 which has a panel 16 inches long and  $2\frac{1}{4}$  inches wide, the CH1/37 which is 7 inches long and may be  $2\frac{1}{4}$ ,  $4\frac{1}{2}$ ,  $6\frac{3}{4}$ , 9 or  $11\frac{1}{4}$  inches wide, and the CH1/53 which is 9 inches long and  $2\frac{1}{4}$  inches wide. The nesting boxes are constructed from flat separator plates assembled on threaded rods with intervening spacers. The connection sockets are mounted on brackets also assembled on the threaded rods. Thus a nest to take any number of units can be assembled by selecting the required length of rods and number of plates and spacers.

#### Electrical Design

The most important electrical feature, the arrangement of the channel fader and preset gain control, is the subject of a BBC patent (British Patent No. 1,119,391). By the use of a special fader and amplifier, a control range of about 90 dB is obtained with a good signal-to-noise ratio, without the operator needing to have special knowledge of any optimum settings. This arrangement is described in detail in the Instruction on panel PA8/260. In addition to the fader, there is a switched 30-dB attenuator at the

input of the channel module which permits it to accept an input of 0 dB.

To enable a programme chain to be assembled easily with varying numbers of channels, groups and other circuits, the use of matching 600-ohm junctions has been abandoned. The mixing system is the constant-current type in which the sources are fed through high-value series resistors into a low-impedance busbar. The busbar impedance may be stepped up by a transformer to any desired value for connection to following amplifiers.

This mixing system enables a variable number of sources to be connected to a load busbar without much affecting the mixing loss, and makes the switching of dummy loads unnecessary. The mixing point is fed from an amplifier AM9/8 or AM5/7, which has an output impedance of about one ohm, through a series resistor of 1200 ohms and an LL/76 repeating-coil, giving a total series resistance of about 1300 ohms. The mixing-point impedance depends on the circuit requirements: in channel-to-group mixing an input of about 16 ohms is used, and in group-to-main mixing a 30-ohm busbar is used. The reason for this is that more channels may be connected to one group than the total of groups and independent channels into a main module, and the lower impedance minimises the loading effect of the connected channels. Thus if one channel were switched to a group module, the mixing loss would be 38 dB, whereas with 20 channels it would be 40 dB, a change which can be regarded as negligible. With fewer channels it would be possible to use a higher busbar impedance, thus reducing the mixing loss, provided that the succeeding circuits could accommodate the higher level. In coupling the busbar to succeeding circuits the mixer loss can be partially offset by using a step-up transformer to match to a higher succeeding-circuit impedance. In the group input circuit, for example, about 19 dB of loss is regained in this way.

The low busbar impedance does not cause this mixer system to be vulnerable to contact resistance in the channel-to-group selector switches, since these switches operate in a circuit loop having a resistance of nearly 1400 ohms.

SECTION 3

FACILITIES

**General**

Table 3.1 gives a summary of the main facilities available on the basic panel modules. Alternatives are indicated by the letters A to D suffixed to the panel codes. Switches are provided so that the outputs of the modules may be combined in a number of ways.

**Channel Module**

The output of a channel may be switched to one of three groups or destinations. The circuits switched are the direct and echo outputs, public address, and

the fader off-normal and cue key switching circuits. Coloured lamps on the fader indicate the group to which the channel is connected.

**Group Module**

The direct and echo chains of a group circuit can be simultaneously switched to either of two outputs.

**Echo and Main Modules**

Circuit switching details are given for typical assemblies in Section 4.

TABLE 3.1

| Facility  | Panel Module                  |                  |                 |                                |
|---|-------------------------------|------------------|-----------------|--------------------------------|
|   | Channel<br>PA8/260            | Group<br>PA8/262 | Echo<br>PA8/263 | Main<br>PA8/261                |
| Fader control<br>Preset gain control<br>Echo mixture control          | A B C D<br>A B C D<br>A B C D | A B C            | A B             | A B C D                        |
| P.A. control<br>Foldback control<br>Cue keys                          | A D<br>A B C<br>B             | A<br>A B C<br>B  |                 | A C<br>A B C D<br>B D          |
| Pre-hear<br>R.S.A. insertion<br>Prompt cut                            | A B C D<br>A B C D            | A B C<br>A B C   | A B             | A B C D<br>A B C D<br>A B(C D) |
| Circuit cut<br>Additional meter (P.P.M.)<br>Stereo use<br>Pan control | C<br><br>D<br>D               | C<br><br>PA8/302 | B<br>PA8/291    | C D                            |



SECTION 4

TYPICAL BASIC ASSEMBLIES

General

Examples of some of the ways in which the modules may be connected together are given below. In all cases the standard output circuit shown in Fig. 5.7 is used. The outside source and tape prehear and acoustic effects circuits shown in Fig. 4.1 may also be added to any of the other examples.

divided for stereo or divided-desk working. The channel module direct and echo outputs are paralleled so that accidental operation of the echo mixing controls has no effect. The channel outputs marked X and Y are the switched miscellaneous outputs and are connected to clean feed unit UN1/72 if fitted. This unit can mix up to six such sources with the

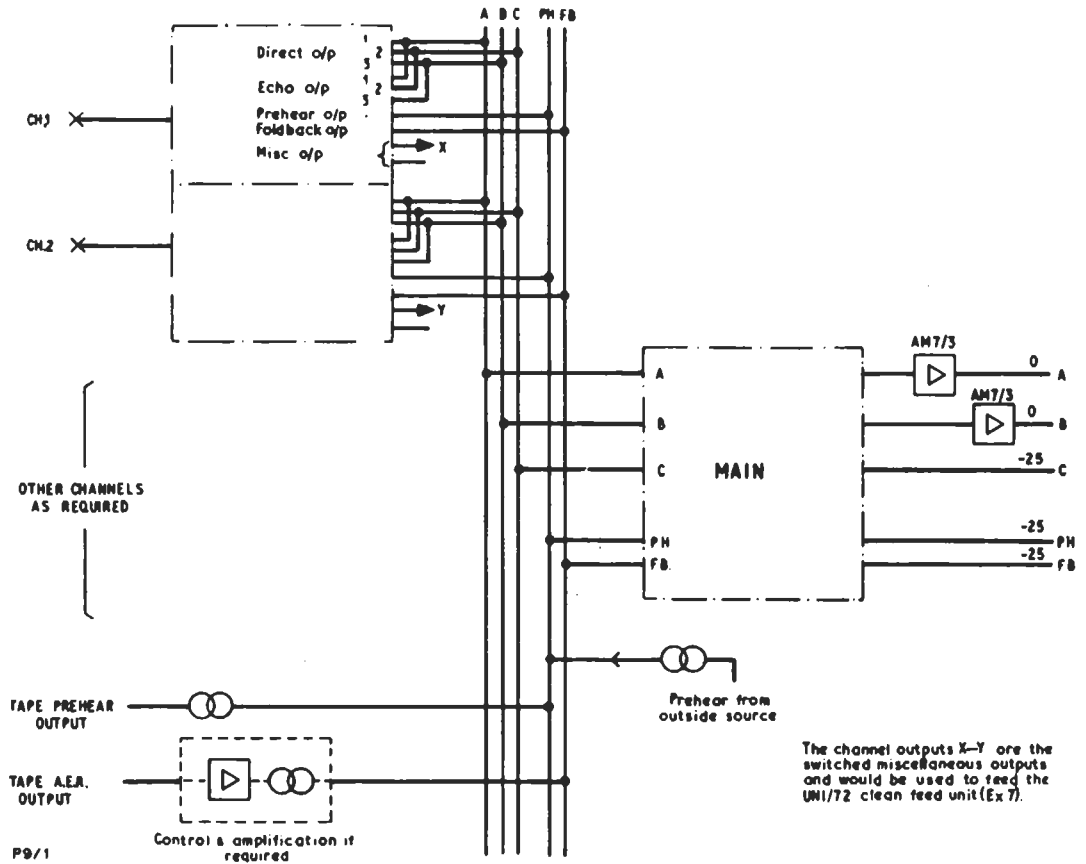


Fig. 4.1. Channel and Main Modules

Channel and Main Modules (Fig. 4.1)

The channel outputs are switched to the main module inputs A, B and C by the group switches on the channel modules. The C input is used for two-way working. The A and B inputs enable the desk to be

main clean feed from the main module, deriving a clean feed for each source.

Channel, Echo and Main Modules (Fig. 4.2)

The group switches of the channel module now

connect the direct and echo outputs to separate busbars. The echo *Go* input and *Return* output circuits are simultaneously switched by the echo module selector switch to either A or B busbars. The circuit selected is indicated by the fader lamps. (For stereo use it is necessary to use a different echo module with one input and two outputs.)

any other channel to form a subgroup.

**Channel, Group and Main Modules (Fig. 4.3)**

The direct and echo outputs of channels 1 to 5 are paralleled and each channel may be switched to either group A or group B or to the C input of the main module. The group inputs are paralleled and the

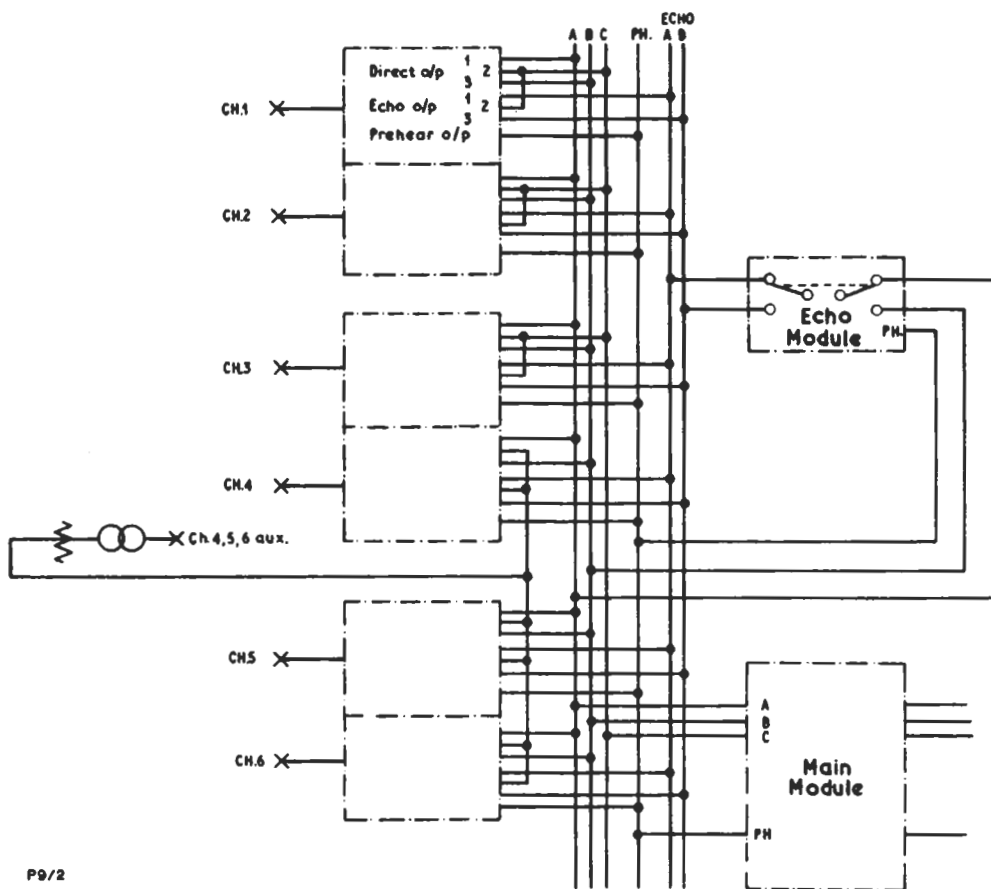


Fig. 4.2. Channel, Echo and Main Modules (showing method of subgrouping)

In this example the first three channels may be used for two-way working through the C input to the main module and for these channels the direct and echo outputs are paralleled.

Channels 4, 5 and 6 demonstrate the principles of subgrouping. One position of the group selector switches on these channels parallels the direct and echo outputs and connects them through a balancing transformer to a source jack which may be plugged to

group output switching connects one chain to the main module inputs A and B and the other to the separate group output. This arrangement provides an emergency changeover, and the separate outputs may be controlled by a 1-kilohm potentiometer and fed to output amplifiers. Channel 6 may be switched either to group A or to the two-way working busbar, or to inputs A and B of the main module as an independent channel.

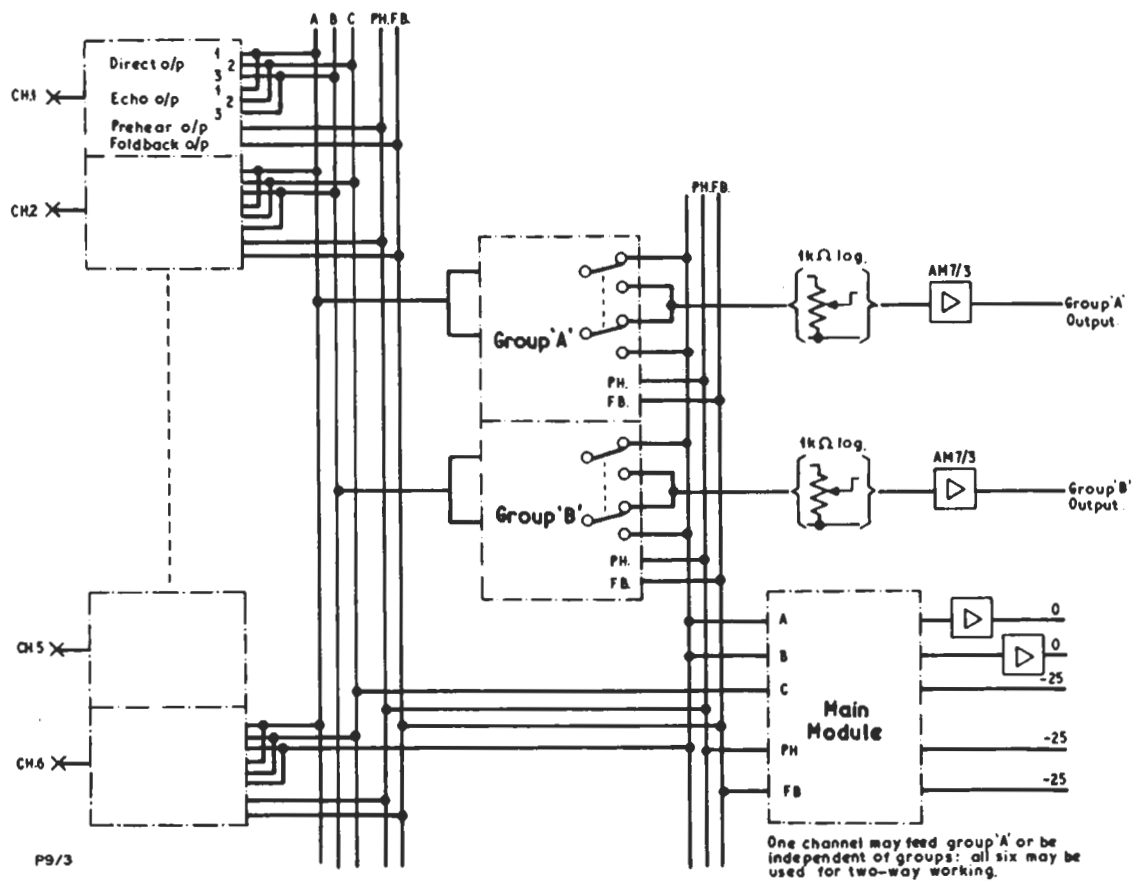


Fig. 4.3. Channel, Group and Main Modules

**Channel, Group, Echo and Main Modules (Fig. 4.4)**

The group modules have one chain of each group used for the direct programme circuit and the other for the echo circuit, to enable the echo circuit to be shared by both groups. The group switching is not

output or to the two-way working channel.

**Channel, Group Two Echo, and Main Modules  
Normal Arrangement (Fig. 4.5)**

The output switching on the group modules is

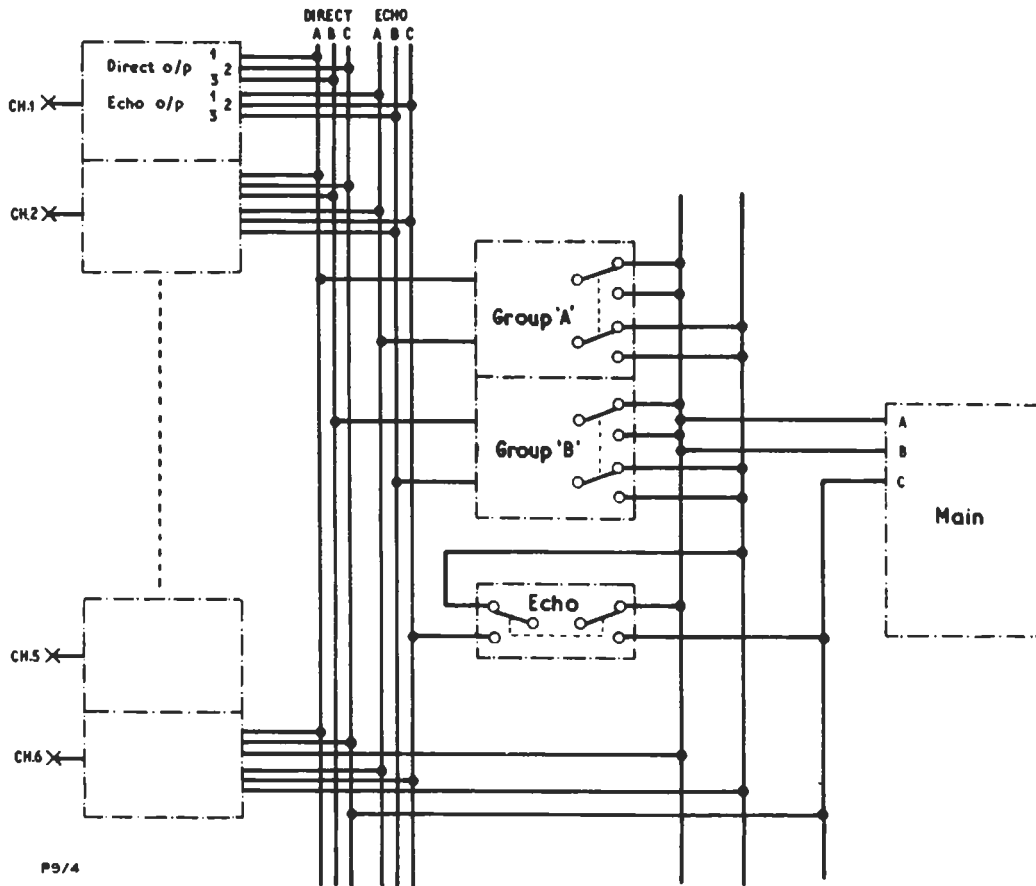


Fig. 4.4. Channel, Group, Echo and Main Modules

used. Channel 6 is connected as in the previous example as an optional independent channel, and its echo circuit is switched to correspond with the direct output routing. The echo circuit itself may be switched either to the group output and independent

used to select either of two echo circuits, and channel 6 output switching is used to connect the channel as an independent or as a two-way channel. Either echo circuit can be switched to become the echo circuit for the two-way working channels.

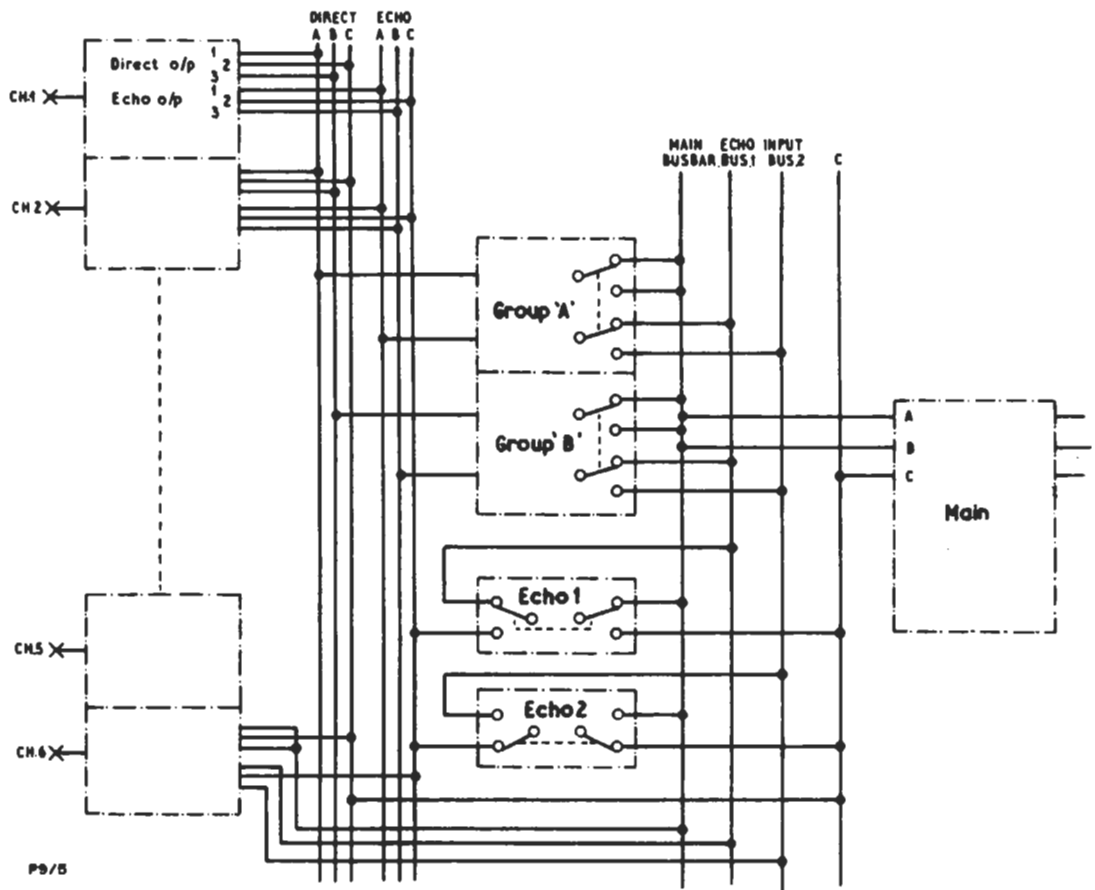


Fig. 4.5. Channel, Group, Two Echo, and Main Modules

*Echo-per-group and Split Working (Fig. 4.6)*

One echo input is connected to each channel echo output busbar and the echo outputs are fed to the corresponding group module inputs, where they are

of the above examples, connected as shown in Fig. 4.7. Any channel required for multiway working selects input C of the main module on the central position of its group selector switch, and has its

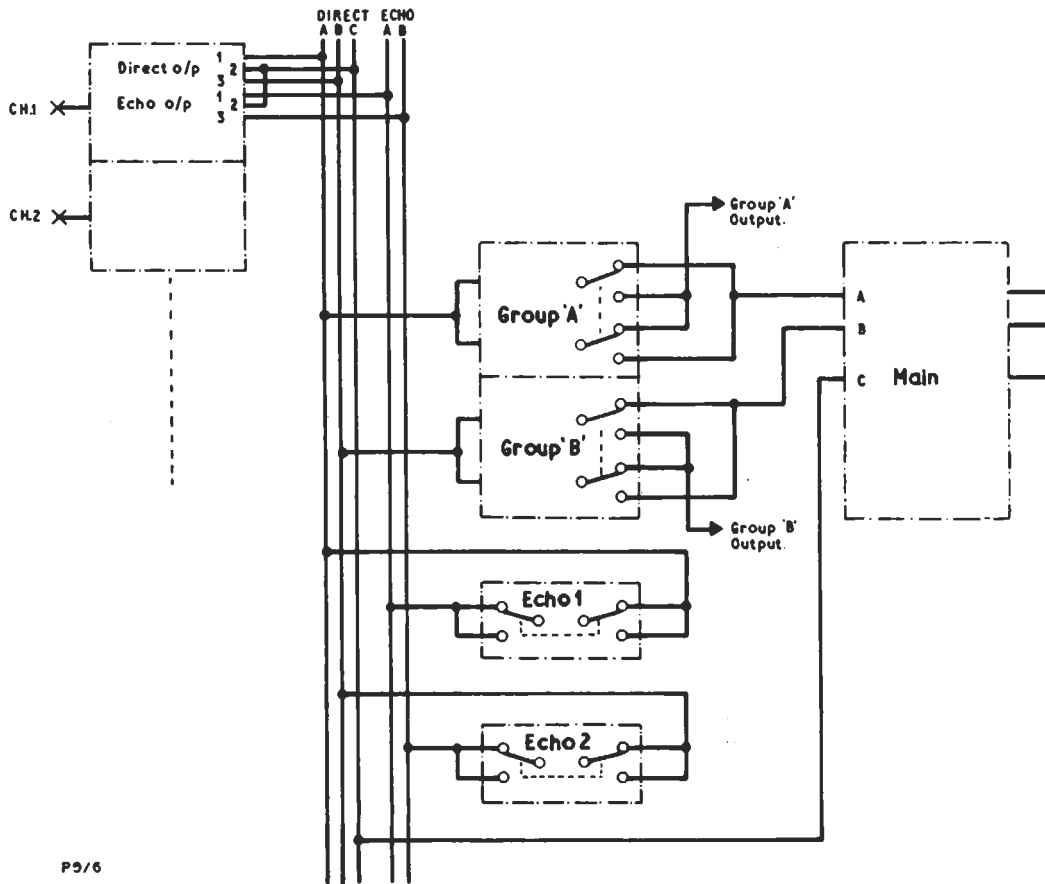


Fig. 4.6. Channel, Group, Two Echo, and Main Modules (echo-per-group and split working)

mixed with the direct outputs of the channels. Group A and Group B are fed to the A and B inputs respectively of the main modules, so that by operating the split-working key the desk can be divided into two distinct sections.

**Multiway Working (Figs. 4.7 and 4.8)**

The clean feed unit UN1/72 may be added to any

switched miscellaneous output connected to one of the inputs of the UN1/72. Relays within the UN1/72 enable each cue line to be fed with clean feed, talk-back or cue programme. External switching in d.c., circuits determines whether operation of the relevant keys sends talkback in place of clean feed or not. No amplifiers are required for isolation.

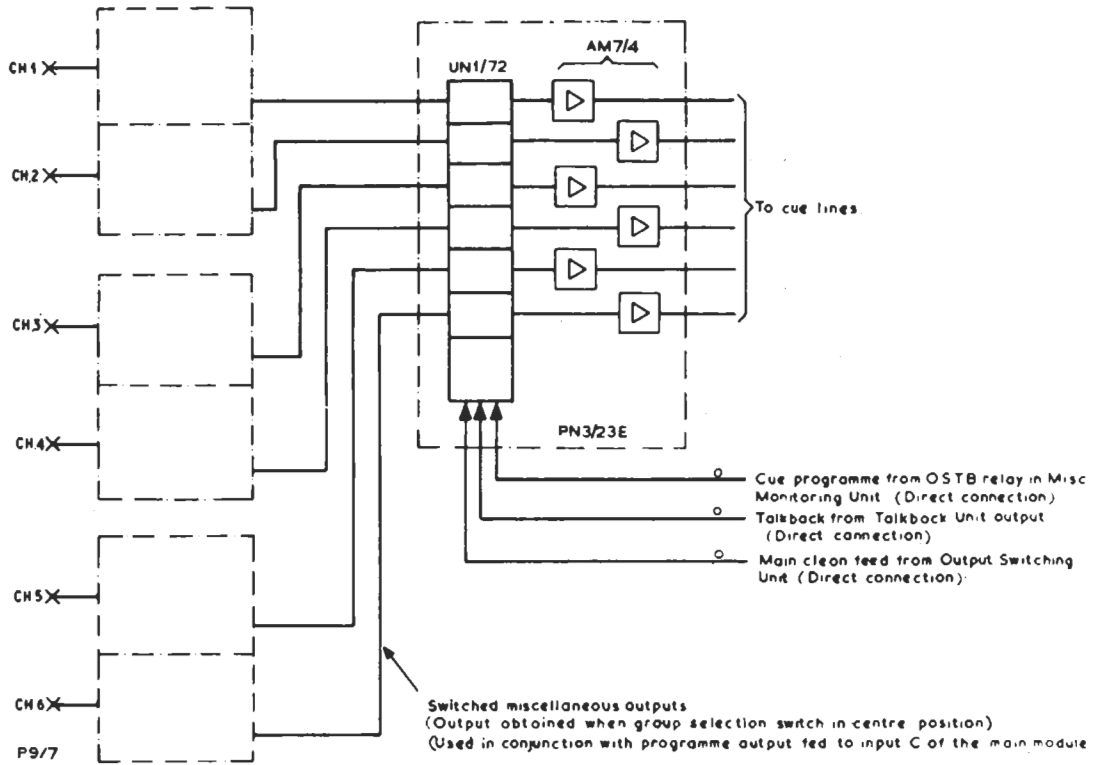


Fig. 4.7. Conversion for Multiway Working

Fig. 4.8 shows the connections required to link two UN1/72 clean feed units where more than six circuits are required. One input and the corresponding output of each UN1/72 are cross-connected, cue programme and talkback are fed to both units in

parallel, and the main clean feed from the main module is fed to one UN1/72 only. Unused inputs and outputs are short-circuited on the UN1/72 socket. In this example input G receives the combination of inputs A to E but does not allow these to be

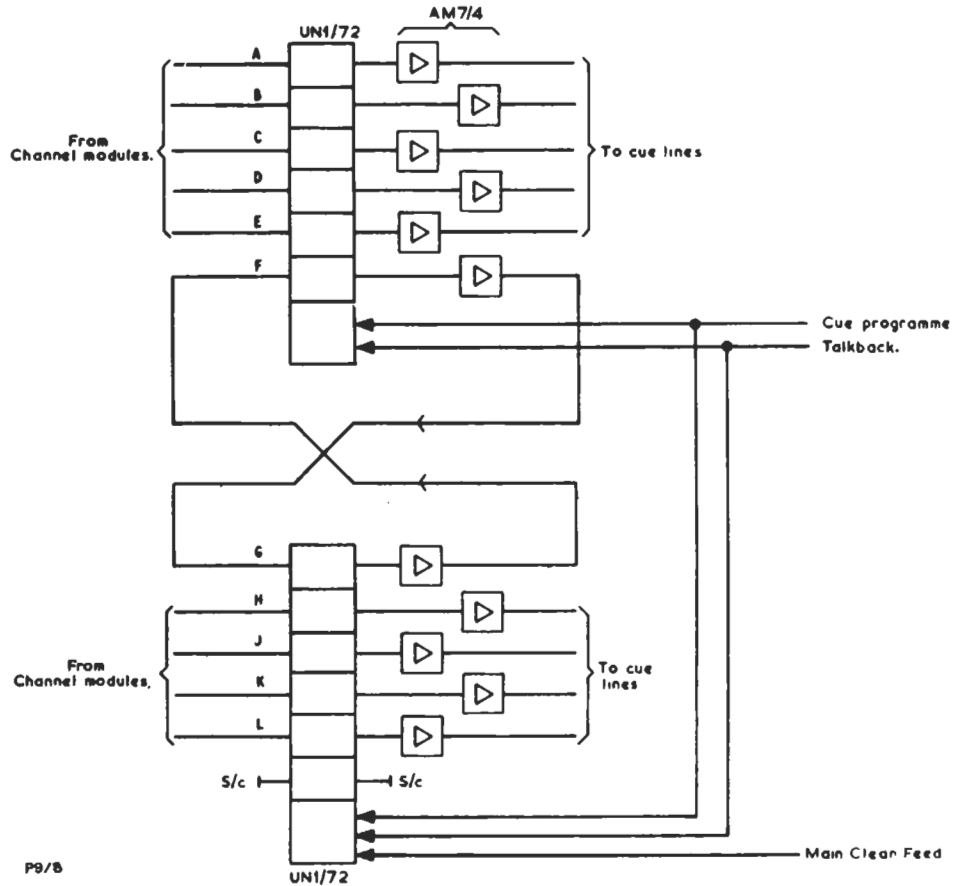


Fig. 4.8. Multiway Working (9-way)

parallel, and the main clean feed from the main module is fed to one UN1/72 only. Unused inputs and outputs are short-circuited on the UN1/72 socket. In this example input G receives the combination of inputs A to E but does not allow these to be

UN1/72. Talkback and cue programme are connected as in the simpler case, but operation of the talkback or cue programme relays for output F and G will send this material to the whole of the other UN1/72. Normally these relays would not be connected.



## SECTION 5 ANCILLARY CIRCUITS

### General

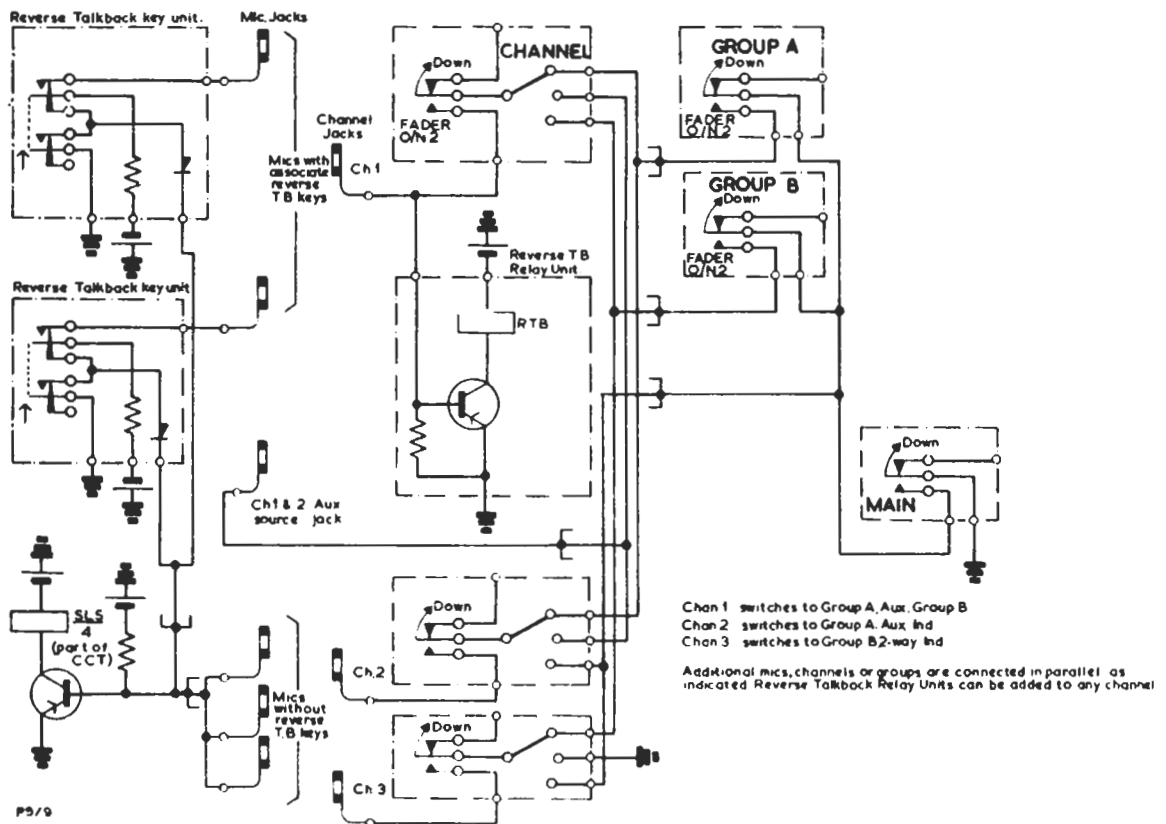
The use made of ancillary circuits and their interconnection with the programme circuits will vary with each installation and it is therefore not possible to give more than a general outline of these circuits.

### Studio Loudspeaker and Reverse Talkback (Fig.5.1)

One or more of the transmission microphones is used for reverse talkback, and to make the necessary connection, a relay RTB associated with the desired channel and a key with the microphone are required.

Connection is made over the sleeve circuit to which the microphone is plugged.

If the channel fader is down, operation of the reverse talkback key applies an earth to the SLS relay transistor base, releasing the relay and silencing the loudspeaker, and simultaneously sending a low-voltage d.c. over the sleeve circuit to operate RTB. Contacts of RTB connect the associated channel to a prehear busbar (operating in parallel with the channel prehear key). If the channel fader is up, no d.c. can appear on the sleeve circuit, and RTB remains unoperated.



*Fig. 5.1. Studio L.S. Cut-off and Reverse Talkback Circuit*

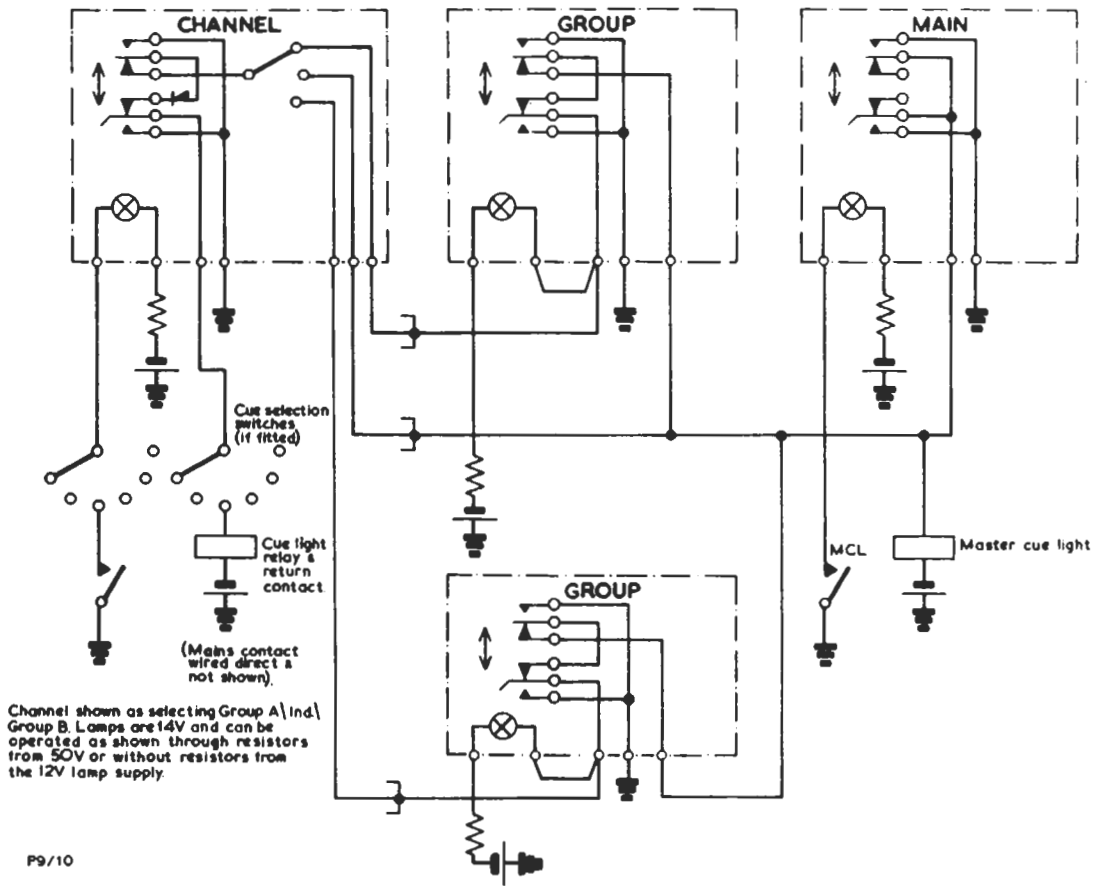


Fig. 5.2. Typical Cue-light Operating Circuit

**Cue Light Switching (Fig. 5.2)**

Fig. 5.2 shows the interconnection of cue keys and lamps on the modules. The cue selection switches

shown on the drawing, may, if required, be fitted on a separate 19-inch panel mounted in the source selection jackfield framework.

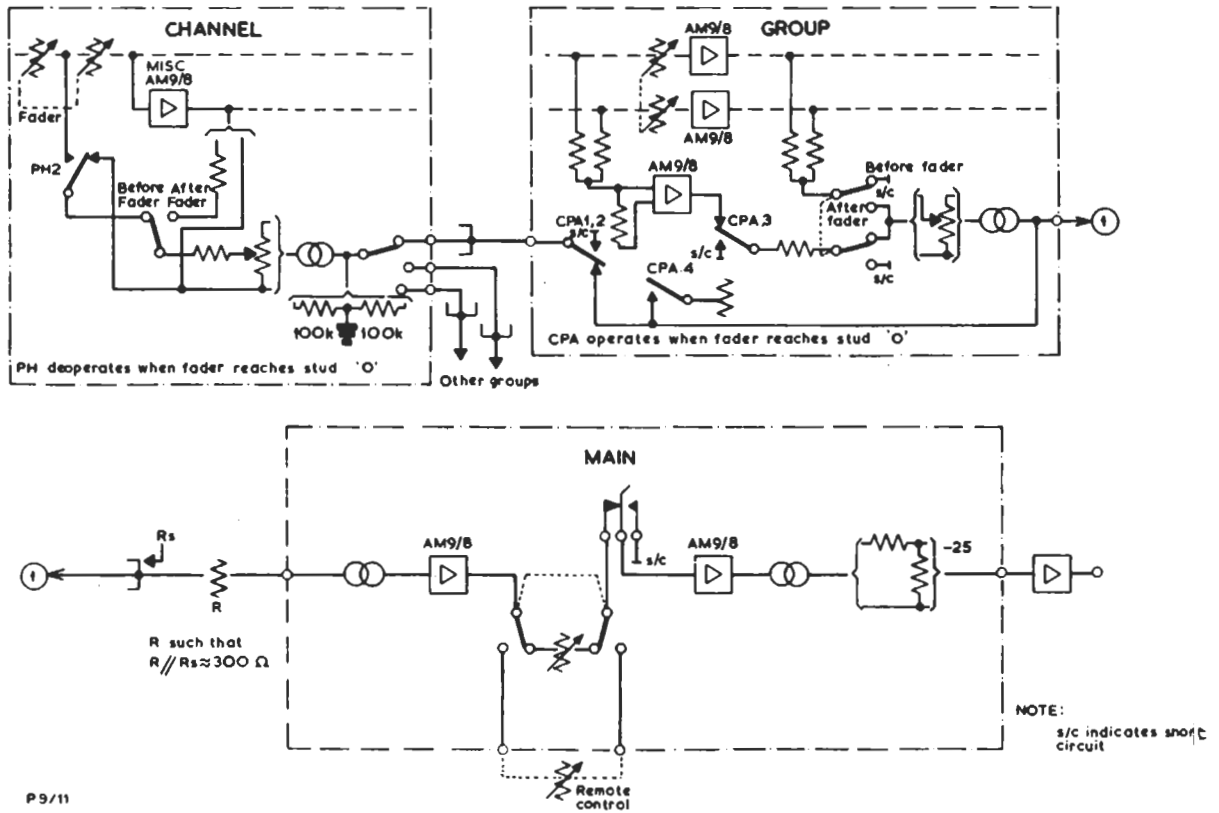


Fig. 5.3. Public Address

**Public Address (Fig. 5.3)**

Programme can be obtained from either before or after channel and group faders, and when a group fader is at *Off* the associated channel P.A. outputs are

cut.

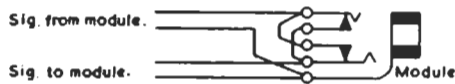
The main module carries master controls and amplifiers and an extension control may be switched in.

*Continued overleaf*

**R.S.A. Insertion Jackfield (Fig. 5.4)**

The output and input circuits of the response selection amplifiers or other signal processing devices are carried on one jack, thus simplifying the plugging operation. A tandem jack is provided so that two or more units can be inserted in series. For example two R.S.A.s could be used to give a *presence* lift greater than 6 dB, or an R.S.A. could be connected before a compressor/limiter to prevent it operating on heavy bass notes, followed by a second R.S.A. to restore the bass.

2. In the group module, after the fader, group amplifier and prompt cut point, and before the *Group Output Change-over* switch, on both main and separate output chains. A compressor/limiter inserted at this point has its input level controlled by the full range of the group fader.
3. In the echo *Go* circuit, and in the echo *Return* circuit after the echo cut key and before the echo fader.



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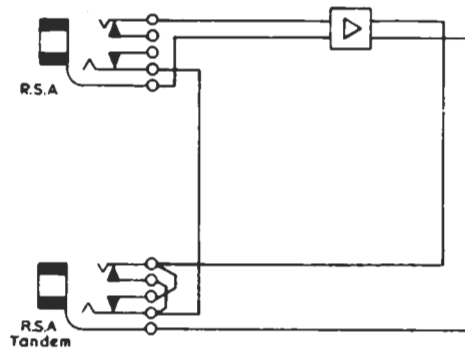


Fig. 5.4. R.S.A. Insertion Jackfield

The insertion points are located in the programme chain:

1. In the channel module, after the second pre-amplifier and before the *b* section of the fader. A compressor/limiter inserted at this point will be affected by the *a* section of the fader only. The remaining 21 dB of the *b* section will raise the level of the already compressed signal without increasing the degree of compression. Increased compression can be obtained by altering the chan-

4. In the output of the main module  
Connection between the insertion jackfield and other remote jackfields can be made by using intermediate tie-lines in which the input/output circuits are separated via repeating-coils and taken to pairs of jacks. For example the tie-line could be used to connect an R.S.A. into the foldback chain. Any apparatus connected in this way must have suitable terminal impedances.

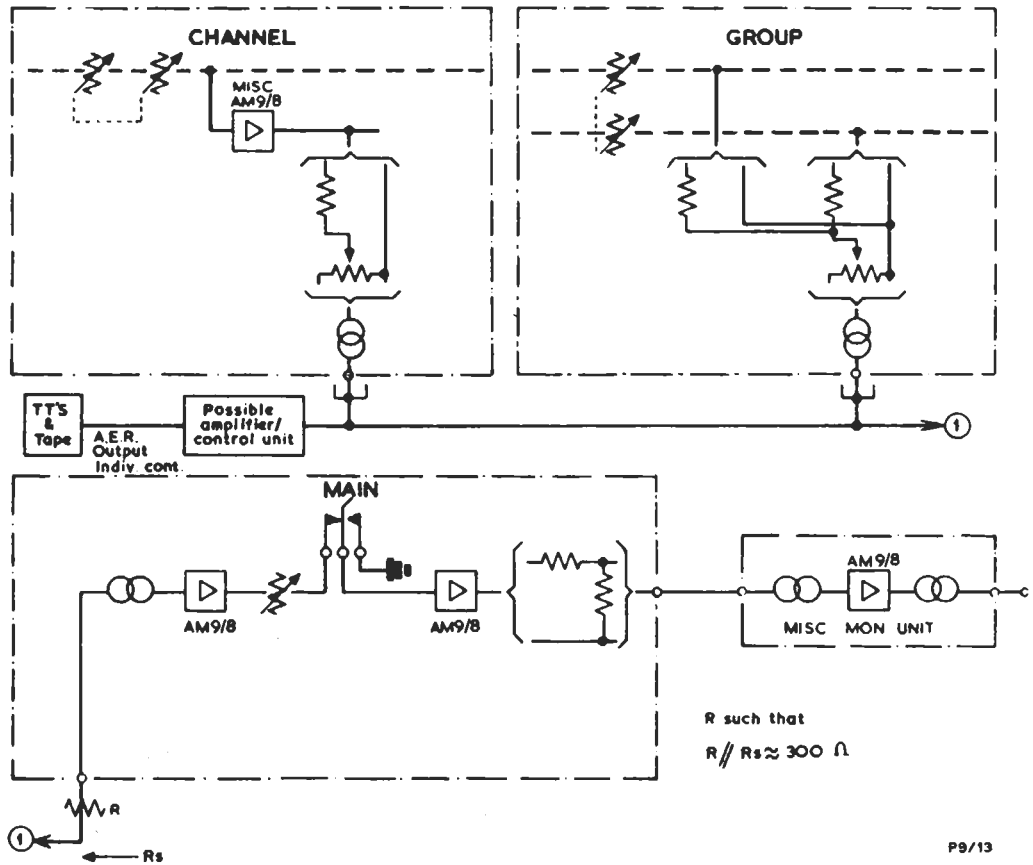


Fig. 5.5. Foldback: Basic Circuit

**Foldback (Fig. 5.5)**

Foldback feeds are available at all channel and group fader outputs after the R.S.A. insertion point. The master control and cut key are located in the main module. The foldback circuits are independent

of the channel switching and group back-stop switches. The A.E.R. circuit from tape and gramophone sources is coupled to the foldback circuit as shown in the diagram.

Continued overleaf

**Prehear (Fig. 5.6)**

Prehear is available on channel, group, main and clean-feed fader positions as well as on the echo return circuit. In addition outside source prehear can be selected in association with the talkback switching. Details of the distribution of prehear to the monitoring points are shown on Fig. 5.6.

low source impedance. This output may be switched to the outgoing line (over relay contacts OTB 1,2), the main clean-feed line (CFTB 1,2), the studio headphones and loudspeaker (STB 1, 2, 3, 4) and the outside source cue circuits (OSTB 1,2). Additionally individual outside source talkback can be provided. The same routing of talkback is used in the rehearsal

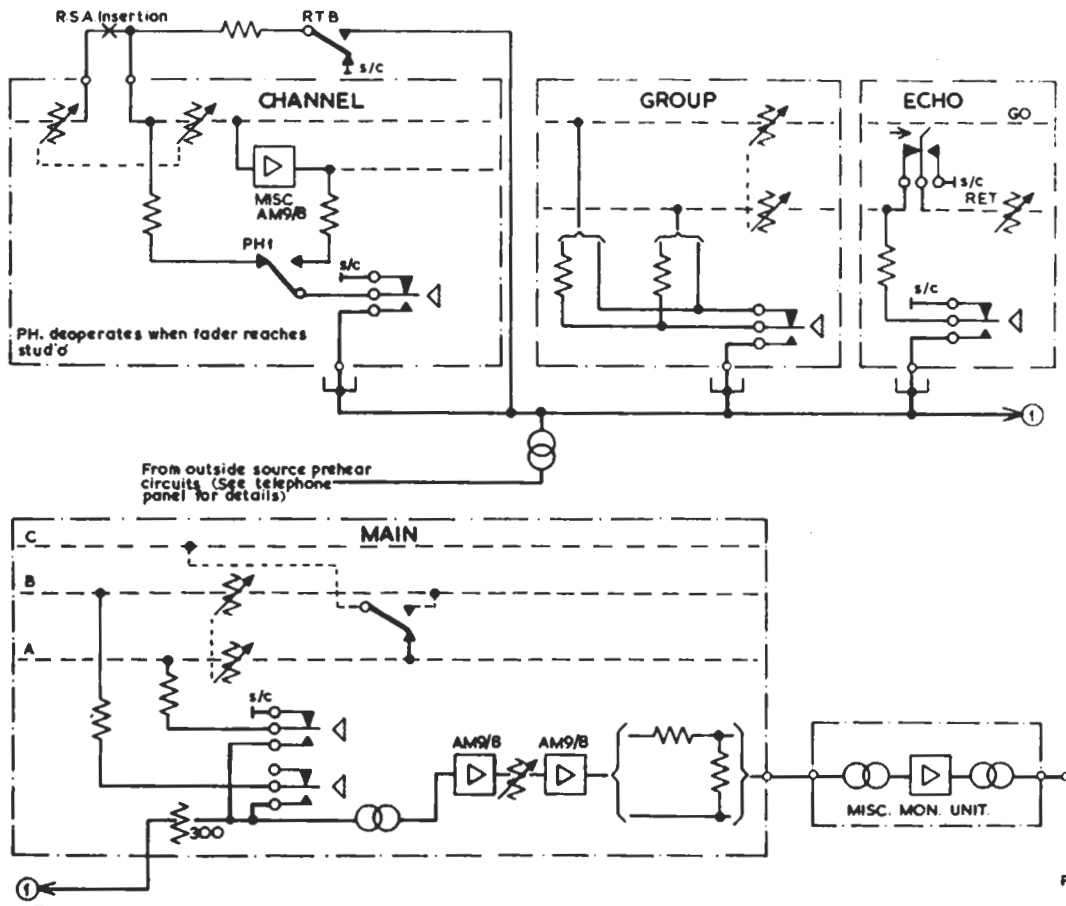


Fig. 5.6. Prehear: Basic Circuit  
(including application of reverse talkback relay contacts)

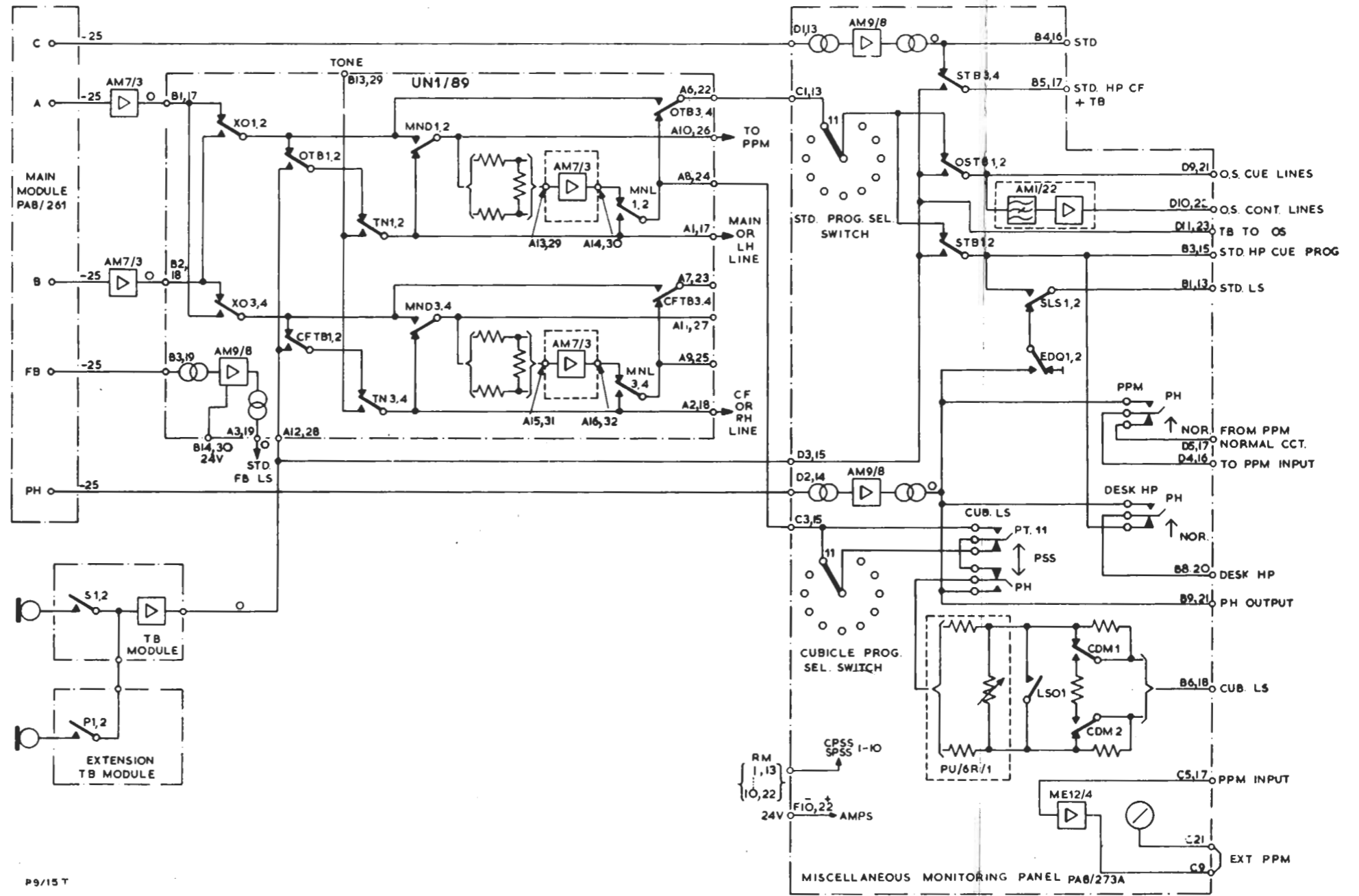
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**Talkback and Monitoring (Figs 5.7, 5.8 and 5.9)**

The programme switching unit, UN1/89, carries a duplicated circuit as standard, so that it may be used in a stereo desk. The miscellaneous monitoring panel, PA8/273, is suitable for mono only, and for stereo desks a monitoring panel PA8/289 should be used. The unit bearing the talkback microphone and keys houses an amplifier which delivers zero level from a

and transmission conditions. As shown in Fig. 5.7, a parallel talkback microphone and keys can be added using the same amplifier.

Switching the equipment to the transmission condition breaks the operating circuits of LSO/4, SLS/4 and the studio microphone muting circuits, so that loudspeaker talkback only occurs in the studio if the microphones are faded out. LSO/4 uses a switched



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Fig. 5.7. Control Desk: Programme Output and Miscellaneous Monitoring Circuit

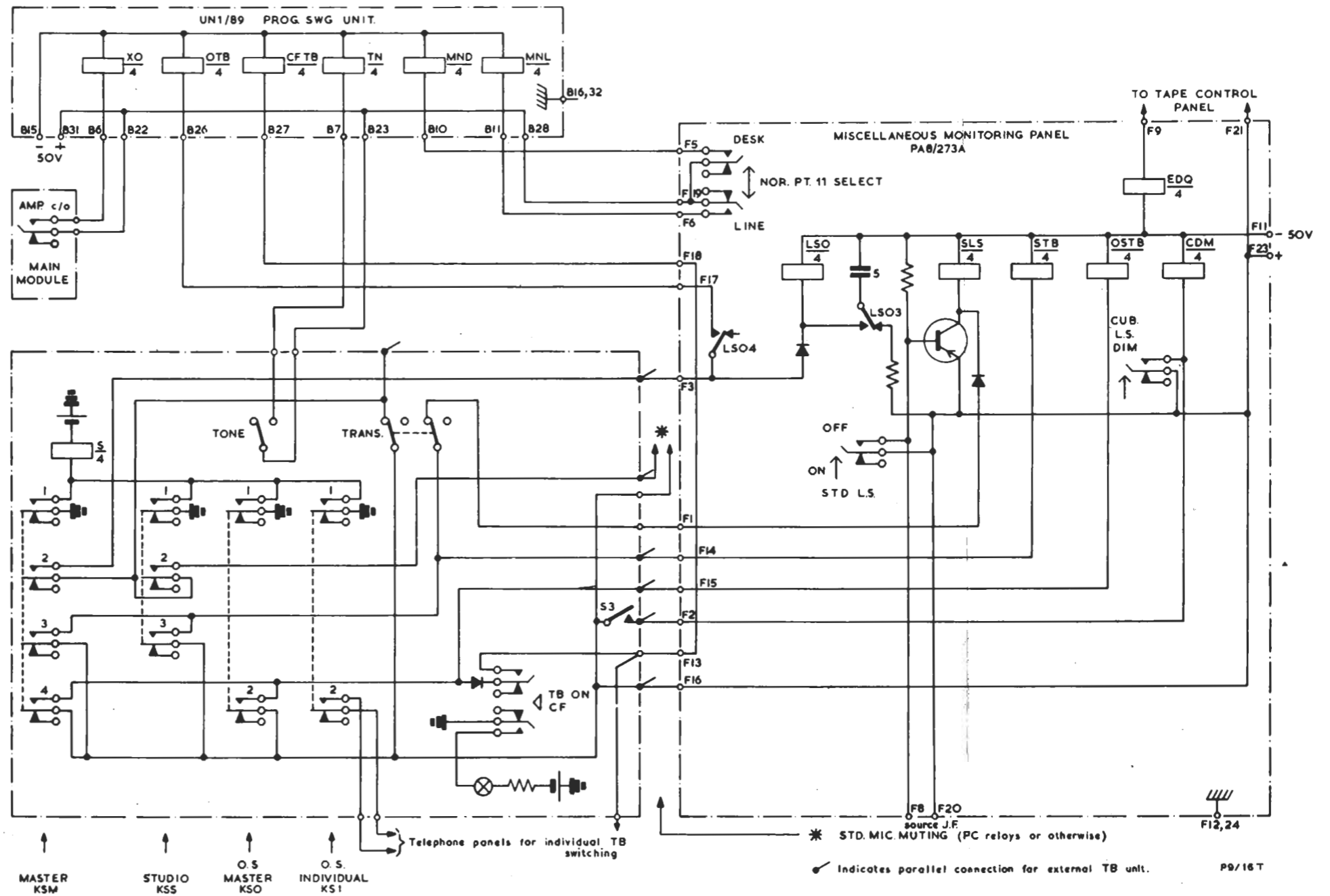


Fig. 5.8. Control Desk: Output and Miscellaneous Monitoring: Switching Circuit



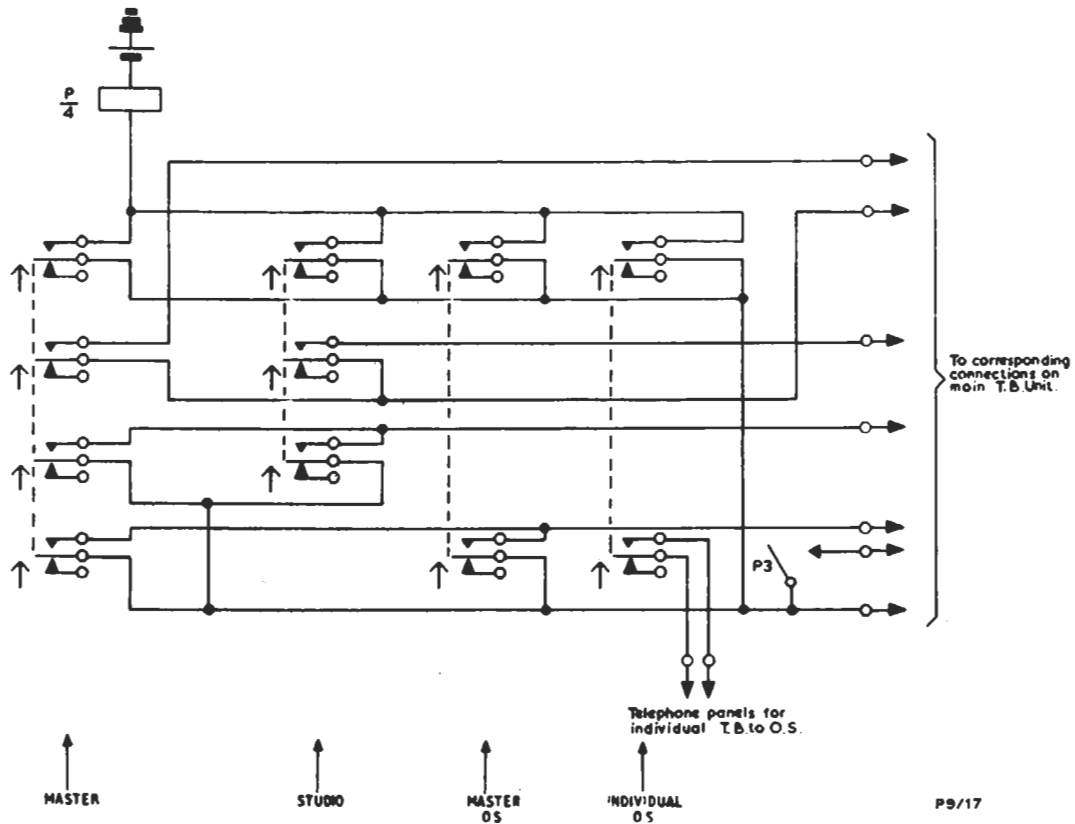


Fig. 5.9. Extension Talkback Unit  
(paralleled to the main unit)

delay circuit to obtain the correct sequence of operations with OTB/4 while using the standard four-changeover relay.

**Monitoring**  
*Cubicle Loudspeaker*

The three-position cubicle loudspeaker key provides a number of alternative connections for the loudspeaker.

1. Point 11, giving access to the main output line with or without a buffer amplifier, or the desk output with a buffer amplifier.
2. Programme selection switch, giving the programme ring-main.
3. The prehear output.

A continuously variable volume control and a dim key are provided.

*Studio Loudspeaker and Headphones*

The studio programme selection switch supplies ring-main programme to the studio loudspeaker and headphones. The loudspeaker may be cut by the loudspeaker *Off* key via relay contacts SLS 1,2.

The headphones may be plugged to a separate chain carrying clean-feed and clean-feed-with-talk-back.

*P.P.M.*

The P.P.M. input may be connected by a key across either the main output or the prehear output.

*Desk Headphones*

The desk headphones may be connected by a key to either the studio headphone output or the prehear output.

**Tape Editing**

The tape machine output should be connected to the prehear busbar, and programme can then be fed to the studio loudspeaker for editing purposes by relay EDQ through the break contacts of relay SLS.

## SECTION 6

## NESTING BOX WIRING

**General Principles**

The general principles to be followed for the inter-connecting wiring to and between the nesting boxes for Type-D modules are given in Designs Department Technical Memorandum No. 3.90(66). In particular:

1. For a desk containing three or more nesting boxes, the centre box would normally contain the Group and Main modules and the side boxes the Channel modules and miscellaneous units.
2. Two alternative methods of terminating the external cables may be used. They may either be wired directly to the nesting box connectors and tied to the main lacing bar, or terminated at a plug and socket interconnection clipped to a frame in the desk.

The first alternative has the advantage of simplicity and cheapness. In general sufficient length of cable should be left to enable the complete nesting box to be withdrawn to provide access to the rear wiring. Considerable space will be required for this, and care required in the lacing and disposition of the cables.

The second alternative removes this disadvantage and has other features to recommend it. Two free Painton 159 series connectors are used, one on the incoming cable and one on the nesting box cable, and the combination is clipped by the cable to a frame. The nesting boxes may therefore be pre-wired and installed by plugging in, and removed intact for maintenance. Individual pairs of connectors may be removed from the frame while still connected and circuit tests carried out by removing one cover. The connectors may be used as convenient points to divide power supplies and other circuits to simplify wiring and fault finding.

**Wiring Notes**

1. Programme wiring, including inter-module strapping, should be in individually screened pairs. Such straps on the nesting box should be as short as possible, subject to the requirements of access by a soldering iron.
2. Ancillary wiring such as P.A. or prehear should be in tightly twisted pairs between adjacent modules,

but in screened pairs in all other cases. The twisted pairs should be separated from adjacent wiring and not made into forms.

3. Where screened pairs are used for unbalanced circuits, the screen should be used for the earthy side. PSN2/4 with the pair bunched is suitable for this purpose.
4. Switching wiring should be carried out in PUN1/1 (25-S.W.G.) wire, and where the current involved exceeds 1 amp, a distribution point in the form of a tag-strip should be fitted.

**Earthing**

1. Separate nesting boxes must be solidly bonded together by a cable of low resistance.
2. The neutrals of unbalanced inter-module programme connections should be earthed at the main module, and additionally at the inputs to each group unless these are already earthed at the main module input earth, and in certain conditions at the input of an echo module.
3. Clean feed outputs taken from an independent channel to a UN1/72 should not be earthed at the module. Provision is made in the UN1/72 to earth the neutral of the clean feed network at the printed board.

**Power Supply**

The amplifiers and relays are supplied with 24 volts from the same power supplier. The supply lead is terminated on a terminal block in the desk and a separate feedback pair taken back from this block to the power supplier control amplifier, so that a constant potential is maintained at the block.

Separate pairs are run from the block to supply the amplifiers and relays in the modules. No wiring on the module side of the block must be common to both amplifiers and relay circuits. Similarly the feed for the amplifiers in the channel modules should be separate from that for the amplifiers in the other modules. The position of the block should be such that the lengths of all cables to the nesting boxes are as short as possible. The 24-volt desk power supply must not be used to feed any other equipment.

TABLE 6.1

| Module  | Maximum Current (mA)           |                            |                           |
|---------|--------------------------------|----------------------------|---------------------------|
|         | 24-volt<br>Amplifier<br>Supply | 24-volt<br>Relay<br>Supply | 12-volt<br>Lamp<br>Supply |
| Channel | 170                            | 24                         | 180                       |
| Group   | 75                             | 50                         | 270                       |
| Main    | 120                            | 20                         | 270                       |
| Echo    | 25                             | —                          | 90                        |

The normal maximum current consumption per module is given in Table 6.1.

**Miscellaneous Circuits**

1. At the rear of the main lacing bar on the nesting box there is a second bar to which tag-strips may be fixed. These may be used for miscellaneous wire-ended components and as distribution points for speech or power circuits.
2. The source selection jackfield should be wired in screened pairs in the normal manner, and straps wired across the inners of the channel input jacks to short-circuit the input when the channel is not in use.

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