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**24 SERIES STEREO MIXING CONSOLES  
I N S T A L L A T I O N   A N D  
S E R V I C I N G   M A N U A L**

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## INTRODUCTION

The MBI 24 Series is designed for full stereo operation throughout, using completely modular, plug-in units. It is supplied with the compliment of units and particular operational configuration initially specified by the customer. However, inbuilt features of the console, in conjunction with the modular construction of its functional units, enable different configurations to be easily achieved on site. Also, if the console is not initially fitted with a full compliment of available unit modules, or additional facilities are required later, extra modules may be added either in the existing frame or in an additional add-on frame.

This manual therefore describes the full range of different plug-in modules available. This, in conjunction with the detailed description of the basic console main frame and extension units, will provide all the information necessary for the correct installation and maintenance of the equipment.

The 24 Series plug-in modules are so designed that they can be plugged directly into a Series 24A console without any mainframe re-wiring. This is to allow updating of Series 24A modules to 24 Series modules in the future if required. However, it must be noted that 24A modules cannot be mixed with 24B/P type modules and function correctly.

### 24P -Type Modules

The 24 Series 'P' type modules are designed to form a console with up to four stereo groups and four mono (or two mono and one stereo) auxilliary outputs. Its main function is for use in production studios for the making of commercials or plays, etc. However, it can also be used as a main control desk for routing programmes through. This manual has been written specifically for this type of console.

### 24B - Type Modules

The 24 Series 'B' type modules are designed for self-op studios. The pcb's are the same as those used in the 'P' type modules except that group routing switches, phase reverse and other controls not associated with a self-op console have not been fitted. The modules are fitted as standard with two mono and one stereo auxilliary outputs. For ease of description, only the 'P' version of the modules have been covered by this manual as they are the most sophisticated. Changes for 'B' type modules are listed with the 'P' version of the circuit diagrams.

**MBI Broadcast Systems Limited reserves the right to modify any specification or drawing in this manual without notice.**

C O N T E N T S  
&  
L I S T O F I L L U S T R A T I O N S

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**CHAPTER 1**  
**TECHNICAL SPECIFICATIONS**

## CHAPTER 1 TECHNICAL SPECIFICATIONS

### 1.1. ELECTRICAL SPECIFICATION

Frequency Response	From input through to stereo main output at any level below clipping.  20Hz - 20KHz: +0, -1dB
Normal Operating Level	0dBu (0.775 volts rms)
Input Impedance	Inputs are transformer balanced and fully floating. Minimum input impedance 10K ohms (line), 1k ohm (mic).
Input Sensitivity	For normal operating level  +20dBu min to -20dBu max (line) -20dBu min to -80dBu max (mic) extra 10dB option on input modules available, post fader.
Output Impedance	Outputs are transformer balanced and fully floating. Source impedance is approximately 75 ohms. Minimum recommended load on all outputs 600 ohms.
Output Level	+22dBm, 20Hz - 20KHz
System Headroom	+22dB
Total Harmonic Distortion	From input through to stereo main output +8dBu, +20dB gain  at 100Hz, less than 0.05% at 1KHz, less than 0.02% at 10KHz, less than 0.05%

Noise	RMS 20Hz - 20KHz  microphone E.I.N. 200 ohm source -127dBm  stereo main output, faders closed -100dBm  stereo main output, faders 0 dB -83dBm  one stereo input routed 0 dB, Eq in -80dBm
Crosstalk	Interchannel and stereo crosstalk performance meets IBA code of practice
Power requirements	AC 110 - 125 volts, 220 - 250 volts, +/- 10% 45 - 65Hz 700VA max  supplying +/- 16 volts, 3 amps, DC (electronics) +24 volts, 10 amps, DC (lamps and relays) +48 volts, 0.1 amps, DC (phantom power)

## 1.2. MECHANICAL SPECIFICATION

Chassis Size	24 module configuration  1166.5mm wide 484.0mm high 947.0mm deep
Standard Module Pitch	45.5mm
Approximate Weight	All modules fitted  120Kg

The console system is manufactured and tested to conform with the British Independent Broadcasting Authority's Technical Code of Practice.

**CHAPTER 2**  
**I N S T A L L A T I O N**

## CHAPTER 2    I N S T A L L A T I O N

The 24 Series mainframe is designed for inclusion within the furniture of the studio. Refer to diagrams for dimensions and support points. It is strongly recommended that access is provided beneath the console for removal of service covers to the socket tray. All electrical connections are made at the rear bay of the console and space is provided within the mainframe external dimensions for cable trunking to enter and leave via access holes in the rear structure. Full access must be allowed to the vertical rear surface for removal of the back panel. Within are housed the electrical connections for power (terminal blocks), audio circuits (all plug in type connectors), certain console status controls and module retaining hardware. Refer to diagrams of connector details. Module removal for service requires access at the rear bay for removal of connectors and retaining hardware and extraction of module from mainframe. All module assemblies include their own connection systems and transformers, the mainframe contains no active electronic parts. During the planning stage of the studio complex, it is recommended that a study is made of the full range of modules available for the 24 Series and that cabling to the console location contains spare capacity to permit expansion.

### CONNECTION DETAILS

All connections for interface of console with studio are inside the rear console bay. Release cover with eight quarter turn self-retaining screws.

**POWER:** The power system uses remote sensing of the bipolar 16 volt amplifier supply to control crosstalk and noise. This places a restriction on the cable type and length fitted to the power supply terminals. An eight wire network transfers the PSU terminals to the power connector block on the console frame. Sense line must be wired using twisted and screened twin core cable. These do not carry load current. The powerlines must be wired using substantial conductors not less than 0.75sq.mm section for bipolar and 4sq.mm for aux 24 volt section. The stability requirements of the bipolar sense lines place a restriction on cable length between supply unit and console which is five meters. Complete the connection of power unit cables at both ends before applying AC power.

**EARTHING:** The console audio common circuits and power supply 0v circuits join with the console frame electrical earth at the power connector earth star point marked 0v. This is the technical earth for the console and any earth wires to or from external equipment must terminate at this point. Console power supply unit frames are earthed by AC power ground for safety. The console audio system must be connected to AC power ground independently in accordance with good studio practice. There is no continuity between power supply frame and console frame. All audio connectors include an audio ground circuit. This is pin 1 of 3 pole XLR types and the case contact of jack types. To avoid hum loops when connecting audio circuits, do not join pin 1 of XLR connectors to the plug case terminal.

## AUDIO CONNECTIONS: SPECIFICATIONS

### AUDIO INPUTS TO CHANNEL MODULES:

MODULE (Type S01/2P, M01/2P, T01P ME01) 3 pin XLR types

In all cases the input circuit is balanced, earth free, across connector pin 2 and 3. Phase continuity between all balanced inputs and outputs is guaranteed by console design method. Either pin 2 or 3 may be standardised as 'IN - PHASE'. Absolute phase of inputs is pin 2 + phase. The input terminates at the primary of the input transformer and presents an input impedance of 10k ohms. Optimum matching is obtained with external equipment having output source impedance 600 ohms or less. To operate with unbalanced equipment the unused phase (normally pin 3) should be connected to pin 1, signal to pin 2, screen to pin 1. When using channel module inputs with outside programme sources via cables rented from the telephone authority, suitable interfacing amplifiers approved by the authority must be added externally to the console.

**WARNING:** Type M01/2P input has provision for addition of balanced phantom power (+48v) at input terminals.

### AUDIO OUTPUTS FROM CONSOLE:

(MODULE TYPES MA01P, MA02P, T01P, MN01P, MN02P, G01/2P) 3 pin XLR types

In all cases the audio output is transformer balanced at line level, normally 0dBm 1kHz = PPM '4'. The output is on pins 2 and 3, phase information and operation with unbalanced external equipment is as described for audio inputs. The output impedance is approximately 75 ohms and optimum performance is obtained when bridging loads of 10k ohms or similar value are connected. Loads rated at 600 ohms will cause signal loss and high frequency losses due to mismatching. It is a condition of the tests for the console crosstalk specification that all outputs are loaded with 10k ohms, the quoted performance cannot be guaranteed with 600 ohm loads. Bridging loads are recommended for all outputs for these reasons. Consult telephone authority before connecting any output to rented cables.

### SPECIAL AUDIO INPUT CONNECTORS:

MODULE TYPES SL01/2P, MN02P

Monitor module MN02P provides inputs for five external stereo programme sources, e.g. taperecorder outputs, off-air receivers, station output, other studio outputs. These circuits connect into the rear of the module via the DIN spec 20 pin multiway connector which is wired to the table shown. The module loads the selected input circuit by 10k transformer balanced earth free connection. Unselected inputs are not loaded. Nominal sensitivity is 0dBm. Also available on the MN02P is one unbalanced input via ext I/P jack socket. This is for interpatch purposes, i.e. stereo aux O/P MHM01P O/P etc. and comes up on button number six.

Stereo source selector module SL01/2P provides inputs for 10 external programme sources and 10 outputs for Comm's use, associated with each input. Input and output details and connector descriptions are shown in figure 11.

MODULE INSERTION POINTS: (optional)

Each M01/2P, S01/2P, SL01/2P, G01/2P, MA02P channel has a circuit breakpoint between input preamplifier and fader circuits. When the option is fitted, the breakpoint is available at the back panel as a balanced earth free 0dB output with insert return input impedance of 10k. Connector is standard ring tip sleeve GPO B (small tip) type socket. In all cases +ve phase is present on tip circuit and -ve phase on the ring. Sleeve is audio ground. Stereo main group insertion points, if fitted, break the circuit before the main output faders and line amplifiers after the mixing and ducking amplifiers. Connections are the same as input channels, operating level is normally -6dB. The insertion point system is provided for local patching between sections of the console additionally to interface with the studio patch bay. Module MA01P has an option for unbalanced insert points on 4 auxes, they need to be balanced external to module.

INTERPATCH SYSTEM: (not to be used for connection with external equipment)

The 24 Series console is supplied in a variety of formats each having individual needs for talkback, monitoring, and metering. The interpatch system provides the means to adapt these features to specific requirements unique to each installation. The essential circuit functions for the interpatch system are presented at the rear of the module as jack sockets marked with a symbol (1). The circuits for all these are not balanced and are a combination of audio and DC control circuits. In order to prevent accidental damage by confusion with insertion sockets and circuits, the interpatch (1) symbol sockets are ring and sleeve large tip type sockets to suit standard audio 1/4 inch phone jacks.

<u>MODULE</u>	<u>SOCKET MARKED</u>	<u>FUNCTION</u>
MA02P	Mono O/P	Source of programme for clean feed derivation in T01 and SLO modules.
	Meter O/P	Selectable internally this O/P is either: Desk O/P Desk O/P interrupted by PFL PFL O/P.
MA01P	Meter O/P's	Two output sockets are provided for metering the auxes or for patching into MHM01P meterhood monitor. ODD = TIP EVEN = RING.
G01P	Meter O/P	Socket for metering group O/P or patching into MHM01P meterhood monitor.

MN02P	H/P O/P	Unbalanced stereo O/P for use via headphone amp to feed headphones.
	Meter O/P	Unbalanced stereo O/P for metering of pre-selected input to monitor module interrupted by PFL.
	T/B I/P	Input to receive audio and DC control from talkback send modules TB01 and TB02P.
	EXT I/P	Input for unbalanced audio send from MHM01P meterhood monitor, allocated to button number six.
MN01P	T/B I/P's	There are three T/B inputs, one for each monitor ring. They receive audio and DC controls from talkback send modules TB01 and TB02P.
	EXT I/P	Input for unbalanced audio from MHM01P meterhood monitor.
T01P	Mono I/P	Input to receive console mono output from MA02P module.
	TB I/P	Input to receive talkback audio from TB01 and TB02P module's SK7 which is continuous output.
SL01/2P	Mono I/P TB I/P	Identical purpose connection as T01P above. (Sockets are provided to allow for paralleling of I/P from module to module, i.e. daisy-chain)
ME01	Headphone I/P	Stereo input to internal headphone amplifier (tip left).
	Headphone O/P	Stereo output from headphone to local socket.
	Monitor meter I/P	Stereo input to monitor PPM.

## **2.1. UNPACKING**

The number of packages received will depend on the particular make-up of the equipment as there are a number of units which are optional. All the possible items are listed below with a brief description of each. Standard items, which include the main console, power supply unit, and ancilliary equipment such as power supply harness, spare interpatch connectors and tool kit, are all supplied inside one main shipping crate as described in the following:

### **MAIN CONSOLE**

This is a complete unit with the specified number of modules secured inside it and finished with mahogany trim surrounds. It is 24 units wide and is sent in the lower part of the main shipping crate, being separated from other items and protected by a wooden shelf inside the crate. This shelf can be removed by undoing one screw from each end of the shelf, accessible from the outside of the crate.

### **EXTENSION FRAME**

This is a metal frame, 8 units wide, containing its own modules, similar in construction to the metal mainframe of the main console. It is meant to be bolted on to the end of a console mainframe to make a longer unit. Two extension frames may be supplied, one for each end of the mainframe. An extension frame is supplied in its own separate packing case.

### **SMALL CONSOLE**

This consists of an extension frame fitted with its own modules having all necessary connections and complete with its own trim to make it a self-contained console. It is 8 units wide and supplied in its own separate packing case.

### **INTERPATCH CONNECTOR LEADS**

These are supplied with a standard console, some of which will already be fitted inside the equipment. Spare leads will be packaged in the 'upper' part of the shipping crate.

### **POWER SUPPLY**

This unit is an assembly housed in a 19" chassis. It is 3U high and has an overall front to back dimension of 500mm. It is supplied packed in the upper part of the main packing case.

## **POWER SUPPLY HARNESS**

This is also packaged in the upper part of the packing case. It is 5 metres long, fitted with connectors each end for interconnection between the main console and power supply.

## **TOOLS AND SPARES KIT**

An Installation and Servicing manual is included with these items. Two 'pozidriv' screwdrivers are supplied, one with a No. 1 point and one with a No. 2 point for use with GKN 'pozidriv' screws.

A Module Service Connector is included. This is a cable harness, terminated each end in a module edge connector, the use of which maintains all console frame connections into the module and allows access into the inside of the module for service.

## **2.2. INSTALLATION PROCEDURE**

### **2.2.1. SITING OF CONSOLE**

There are two main ways in which the console can be supported and positioned. It may be sited on its own as a separate free standing unit or alternatively, it can be integrated with other items of furniture as a flush-mounted mixing console. In either case, adequate provision must be made to allow access both to the underneath and rear of the unit. The means of access are shown and dimensioned in figure 1.

The underneath aperture, with cover, is provided to allow servicing of the 24 edge connectors and their busbar wiring located in that area, as shown in the side view of figure 2. The opening in the rear of the console allows access to the inside of the bay and so to the connectors on the modules and meterhood units, also power terminal block. In order to make connections and adjustments there, sufficient working space should be allowed behind the console. A minimum distance of one metre is recommended between the console and any obstruction behind it. Alternatively, provision could be made to move the console forward whenever rear access is required.

The underneath load-bearing surfaces, which are the same for both the main console and the extension frame, are indicated in figure 2. Tapped bushes are located on the inside of these surfaces. M6 metric bolts may be inserted into these as required to fasten the units in position. The dimensioned locations of bushes, 12 off for the main console and 6 off for the extension frame, are shown in figure 1. It is suggested that longitudinal bars can be used to support and fasten the units in position.

When the console is to be used as a free-standing unit, it should be supported at a suitable operating height on furniture which is capable of bearing the total weight of the equipment. A main console with modules weighs approximately 120kg and an extension unit weighs about 40kg.

When the console is to be integrated with the furniture of other equipment as a flush-mounted unit, its lower wooden end trims may be removed. This will facilitate satisfactory positioning with other units. The overall lengths of the main console and the extension frames, both with and without the wooden end trims, are shown in figure 1.

### **2.2.2. MODULES**

Modules are sent already positioned and secured inside the main console. Do not attempt to remove a module until the console has been properly sited and reference has been made to the following:

### **2.2.3. MODULE REMOVAL AND REPLACEMENT**

(refer to figure 2)

After the console has been properly positioned, remove the rear cover by turning each 'camlock' fastener a 1/4 turn counter-clockwise. Remove and discard the one M4 x 12 transit retaining screw located at the bottom rear of each module, using a No. 2 'pozidriv' screw-driver. To remove a module, disconnect all plugs and sockets from its rear panel and undo the two GKN 6AB x 1/2in. pan-head screws from its front panel (see figure 4). Grasp the module by the handle provided at its upper end and grip a control knob at its lower end. Using a rocking motion towards and away from the front of console, free the module from its connector socket. Withdraw it straight out from its position in the console.

To replace a module, first locate the edge of its printed circuit card in the guide fastened to the inside front of the console frame. Lower the module into position, keeping its card positioned in the front guide. Note that the lower part of the console frame is formed into a rear guide bar covered by a foam strip. Make sure that the rear panel of the module clears this by keeping the module well towards the front of the console when lowering it. The card will then locate into its connector socket. Exert a firm pressure on the module about a third of the way up its panel to bed it home and replace the two retaining screws. Since incorrect insertion of a module may cause the edge connectors to mis-mate and apply damaging voltages, it is recommended that power is switched off prior to module replacement until sufficient experience in correctly carrying out this procedure is gained.

#### 2.2.4. MODULE SITING WITHIN CONSOLE

The interpatch system used in the console permits the operation and function of any input module to be independent of its position. The two master output modules, types MA01P and MA02P, are normally fitted at the right-hand end of the mainframe. Apart from this, any other operating format required can be obtained by suitable arrangement of the modules and script space, if fitted.

With the exception of the position occupied by the master output module, type MA02P, on the extreme right of the console, all module positions are fully wired, with stereo fader module harness, to accept any module.

#### 2.2.5. ADDING AN EXTENSION FRAME

When an extension frame is to be added to the main console, support furniture must be supplied or modified to suit. Adequate longitudinal support under the complete assembly should be provided. One end support under an extension frame only is not satisfactory, nor should an extension frame be supported in cantilever form from the main frame. The addition of one extension frame will increase the overall length of the assembly by 408mm. The dimensioned locations of the six M6 mounting bushes incorporated in the underneath surfaces of the extension frame are shown in figure 1.

To fit an extension frame on to the end of a mainframe, first remove all mahogany end trims from the latter. These are held in position by 24-GKN 6AB x 1/2in pan head screws. Use a No. 2 'pozidriv' screwdriver to undo these. In order to reach the screws, remove the four or five modules which are positioned towards the relevant end of the main console, the screws being accessible from the inside of the console in the positions shown in figure 1. Four of the screws are behind the power input panel plate which will have to be temporarily removed for access using a No. 1 point screwdriver on its four M3 retaining screws, shown in figure 1. Also remove the two slotted-head woodscrews which are inserted through the lower trims into each end of the wooden armrest along the front of the console.

Position the extension frame against the console mainframe so that the two sets of holes, as indicated in figure 1, are in alignment. Bolt the two units together with the 9 M4 x 12 metric bolts and nuts supplied using a No. 2 point 'pozidriv' screwdriver.

Fasten the mahogany trim panels to the outside of the extension frame in the same way that they were fastened to the mainframe. An extension frame has no power terminal block. The modules receive their power supplies and are externally interfaced via their fixed edge connectors. The 'busbar' wiring of the connectors in the extension frame must, therefore, be commoned-up with the similar 'busbar' wiring of the connectors in the main console.

A wiring assembly is provided for this purpose, made up from insulated wires of two sizes. The thicker wires, size 30/0.25, are for interconnection of pins on the edge connectors where the existing 'busbar' wiring consists of 3 bare wires, and the smaller size of wire supplied, 16/0.2, is for connection where there is only one existing bare wire used between pins. Remove the cover underneath each set of connectors (see figure 2) using a No. 2 point 'pozidriv' screwdriver. There are 15 holes provided in the ends of the extension and mainframes. Use the wiring assembly with wires routed via these holes to connect one set of 'busbars' to the other. Wire a pin on the connector at the end of the mainframe to the corresponding pin on the connector at the end of the extension unit. Replace the covers underneath the connectors.

Note that the power unit type PSU1 supplied as standard with a main console will supply up to a total of 32 modules. This provides for a full complement of modules in a mainframe plus one extension frame. If the console system is to be extended beyond this capacity, then MBI should be consulted.

#### **2.2.6. SMALL CONSOLE**

This is a completely self-contained unit, similar in every respect to the main console except that it is 8 units wide instead of 24. Position and site this unit in the same way as described under the sub-heading 'Siting of Console' for the main console. Main dimensions for the small console, which utilises the same size metal frame as an extension unit, are given in figure 1. A separate power supply chassis, identical to that supplied with a main console, is supplied for this unit. Siting and connection details for this are described under the 'Power Supply Chassis' sub-heading.

#### **2.2.7. EXTERNAL ELECTRICAL INTERFACE**

All external cable connections are made in the rear bay of the console which is accessed by the removal of the rear cover as shown in figure 2. Audio cable connections are made on to the back panels of the modules and meterhood units by means of their male and female mating connectors. The main audio input/output connectors are 3-pin XLR type. The inputs are fixed female type (sockets) on the rear panels and the outputs are fixed connectors on the rear panels of the male (plug) pin version. The input/output studio cables carry the corresponding mating connectors. There are also 20-pin multiway audio connectors on the rear panels, which are the male (plug) version, for making on to the corresponding female connectors on the ends of studio cables. External DC control circuits are fed into and out of the modules by a miniature 9-way D-range male type connector on the rear of each module. Details of the types of connectors on each module with their pin configurations and numbering are given in figure 11.

The identification of individual wires connected to each pin are given on the circuit diagram for each different type of unit. To find which circuit diagram applies to any particular unit, refer to the 'List of Illustrations' in the manual. Using the data supplied, cables may be prepared in advance of receiving the equipment if so required.

Five 76mm diameter holes are provided across the bottom of the rear bay to accept the audio cable harness between the console and the studio equipment. Each module in the console carries its own audio interface connectors on the rear panel directly in line with the module front panel. The audio harness should be fanned-out to present individual connectors in the correct positions. This may be done in advance of installation.

Power supply connections to the console from the power unit are made via the power terminal block P1. This is located on the left end of the mainframe (viewed from the rear) in the position shown in figure 2. A power wiring harness is supplied for connection between console and power unit. One end of this is terminated in free wires, bare at the end, and with numbered sleeves for connection with the screw terminals of the console power terminal block P1. Refer to figures 8 and 10 for details of connection. The power unit must not be connected to the AC power supply until all connections have been made.

#### **2.2.8. POWER SUPPLY CHASSIS - SITING**

The power supply for the equipment is contained in a 19" rack chassis assembly. This unit comprises the three main power units and is illustrated in figure 9. A preferred housing for the assembly on site is one which is specifically designed to receive a 19" chassis. In any case, provision must be allowed for adequate vertical ventilation to dissipate heat generated within the unit. It should not, therefore, be laid flat to the floor nor close up against a ceiling which might prevent air circulating through it. The weight of the power unit is 27kg. With the above provisos, it may be placed in any convenient location which is within reach of the power cable harness supplied for its connection to the console. This harness is 5 metres long. Be careful not to locate the unit near to any hum-sensitive equipment and in particular it should not be placed underneath the mixing console.

### 2.2.9. POWER SUPPLY - ELECTRICAL CONNECTION

#### WARNING

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Dangerous high voltages are present. Connection should be carried out only by suitably qualified service personnel.

Make a visual check to ensure that the assembly is correctly set for the AC mains supply voltage available on site. The maximum power requirement for a console complete with 24 modules is 700VA. All three power units in the chassis are supplied for the mains voltage originally specified. The 48V phantom supply unit is not adjustable on site and must be one suitable for the available voltage within the range either of 110+-10 VAC or 240+-20 VAC. The other two units in the assembly are each adjustable for the ranges 210-245 VAC or 110-120 VAC by means of their split-primary windings. This means that the complete power unit chassis assembly is set either for a mains input voltage of 110-120 VAC or 220-245 VAC. If alteration is required, reference should be made to the two power supply handbooks included with this manual. The 'A Series' handbook refers to the power supply for the amplifiers (ATB 300-16/16) and the 'GPE Series' to the auxiliary supply (1000/24) for lamps and relays. The fuses specified in these handbooks can be replaced by removing the front panel of the chassis assembly.

Connect the power wiring harness to the two sets of terminals on the rear panel of the chassis. The two sets of fanning strips have numbered wires to identify which strip is connected to which group of terminals on the power unit, A or B. Connect the mains supply wires on to terminal group C according to the annotations on the rear panel of the unit, also shown in figure 10.

NOTE: Before switching on, check that all wiring connections, end to end, between the power unit and the console are good.

### 2.2.10. ELECTRICAL EARTHING

Salient points concerned with the earthing of the equipment are enumerated below. The points made must be adhered to and the procedures described should be properly carried out if trouble due to common impedance coupling, hum loops, and noise interference is to be avoided.

- i) The power supply chassis is earthed to AC power ground only by the earth wire in its 3-pin connector.
- ii) The zero volt output line of the power supply unit must not be connected to the rack of the power supply.

- iii) The console zero volt circuits and console chassis metalwork are common.
- iv) Console zero volt circuits and console chassis metalwork must be connected to the installation technical earth - which must be a CLEAN AC power earth. Terminal 13 on the console power terminal block is provided to accept the installation technical earth.
- v) Do not connect console audio ground terminals to earth via external equipment (e.g. not fortuitously, via connectors and cables to the common ground circuit of unbalanced earthed equipment). In particular, since all audio connectors of the console include an audio ground circuit, this being pin 1 of the 3 pole XLR types, do not join this pin to the plug case terminal.

**CHAPTER 3**  
**C O N S T R U C T I O N A L F E A T U R E S**

## CHAPTER 3    C O N S T R U C T I O N A L    F E A T U R E S

### 3.1. MAIN CONSOLE

The main console housing comprises a standard-sized metal mainframe constructed from a number of fabricated sub-frames as shown in figure 2. The shapes of the sub-frames provide for satisfactory positioning of the fader modules, channel modules, and meterhood modules in their three ergonomic planes of operation. It also permits their easy withdrawal and replacement for servicing. To obtain access to the inside of the console, free the rear cover by turning each of the eight 'camlock' fasteners a 1/4 turn counter-clockwise and remove it. The rear panels of all the modules with their external connectors are then exposed.

Apertures in the bottom rear tray provide for the entry of audio cables into the console. There are 24 fixed edge-connectors located in the mainframe whose purpose is to receive the printed circuit boards of the modules. These connectors can be individually replaced if damaged. To obtain access to them and their wiring, remove the cover underneath the console shown in figure 2 using a No. 2 'pozidriv' screwdriver.

Just underneath the units housed in the meterhood there is a tray which runs across the width of the mainframe, end to end. Clips fastened underneath this tray support the cables which make connection to the meterhood modules. To change the position of one of these modules, unclip the cable to it as appropriate for re-siting. A terminal block assembly is positioned inside the console (on left, viewed from rear). Connections from the power supply, edge connectors, and meterhood modules and earthing are made on to it. At each end of the mainframe, a 'power input panel' trimplate is mounted on pillars. Behind the one on the same side as the terminal block there are three capacitors. To obtain access to these, unscrew the four M3 screws holding the plate on to the pillars.

Figure 1 gives dimensions of the mainframe which provides for 24 units of module widths (24 x 45.5mm). Mahogany wooden trims are fastened to the outside of the framework by GKN 6AB x 1/2in screws inserted from the interior of the mainframe. To add extension frames (see following paragraph) remove the end trims from the holding screws indicated in figure 1.

### 3.2. EXTENSION FRAMES

An extension frame is constructed in the same way as a mainframe except that it provides for only 8 units of module width. It is meant to be bolted to the end of a mainframe (see chapter 2) to convert a standard sized mainframe into a larger unit. It, therefore, contains no power terminal block or capacitors. All module positions in an extension frame are wired to accept standard input modules.

### 3.3. SMALL CONSOLE

This is an 8-unit wide console. It is constructed using a basic extension frame to house the modules. It has similar connection and access facilities to the main console and, in general, the descriptions applying to the latter also apply to this smaller console. It is complete with power terminal block and wiring. The right-hand end module position is wired to accept the stereo master module MA02P and faders. All other positions are wired to accept standard input modules.

### 3.4. METERHOOD MODULES

The assembly details of a module housed in the meterhood are shown in figure 3. Most units in the meterhood part of the console are constructed in a similar fashion. The front and rear panels of the unit are fastened to flanges on its two side-plates by means of 10 GKN 6AB 'pozidriv' screws which are held in position by 'spire' captive nuts clipped on to the flanges. The main printed circuit board (pcb) is mounted on brackets screwed both to the side-plates and the rear panel. The pins of jack sockets, which are mounted on the rear panel, are also soldered to this pcb. To obtain free access to the main pcb, withdraw all screws holding the side-plates to the rear panels using a No. 1 'pozidriv' screwdriver. Also withdraw the screws holding the brackets which support the main pcb from the side-plates only. This will allow the front panel, still attached to the side-plates, to be moved. The main pcb will still be attached to the rear panel, both by its brackets and the soldered pins of the jack sockets. The front panel and side-plates are now free within the constraints of any wiring between components mounted on them (e.g. meters) and the main pcb. This wiring is sufficiently long to allow adequate access separation without the necessity of unsoldering.

All meterhood modules are the same height and depth, but vary in width. The Meter Modules are 8 units wide, Talkback Module 3 units wide, and Transmitter Interface 4 units wide. Printed circuit boards and rear-mounted connectors differ between units, but the same method of dismantling and reassembly applies to all of them. Each unit is held in the console through its front panel by four or more 6AB countersunk screws and 'spire' nuts as shown in figure 2.

### **3.5. CHANNEL MODULES**

Channel modules all occupy a width of 1 unit (1 x 45.5mm) in the console, except for the Stereo Line Select which takes up a width of 2 units (2 x 45.5mm). All modules are constructed in the same basic fashion from three main parts, as illustrated in figure 4. A U-shaped front panel, constructed from 16swg alloy, carries operating controls and indicators, also brackets by which the main printed circuit board (pcb) is mounted on to the front panel. Module front panel legend details are applied to the metal by double anodising and the result is permanent. Some of the components which are mounted on the front panel have their terminals soldered into the main pcb which provides additional anchoring between board and panel. A second L-shaped metal panel, constructed from 16swg steel, is hinged onto the front panel by two M3 bolts and self-locking nuts. This second metal panel normally forms the rear panel of the plugged-in unit and carries the status-setting switches and cable connectors for external electrical interfacing. It also carries transformers and other items of optional circuitry when these are called for. The rear panel is screen-printed with details of connector functions and module type. The two panels are kept in their normal right-angled configurations by an M3 countersunk screw inserted into a hankbush located on one of the flanges of the front panel.

When the unit is taken out of the console for servicing, the two metal panels can be opened-out into a straight-line configuration for better access to its electrical components. The method of doing this is illustrated in figure 4. Withdraw the M3 screw from the hankbush on the left front panel side flange and open the two panels outwards until they are in line. Lock them in this service configuration by inserting a GKN 6AB x 1/2in pan-head screw through the two panels as indicated in figure 4. Note that this screw is of the same type as those used through the front panel of the module to retain it in its place when in the console.

### **3.6. FADER MODULES**

All console channel module positions, including those covered by a script space, are wired to accept fader modules. Two types of fader are used in the console, mono and stereo. Stereo fader modules may be calibrated in one of two ways:

- a) 10dB overtravel as the highest setting.
- b) 0dB maximum setting.

All input modules have +10dB as their maximum setting as an option. Unless specified differently at the time of order all faders cut-off towards the operator. All units have a 15 pin Plessey '159 series' polarised connector on their rear panel. A multi-core cable makes connection from this to the console frame wiring. Unused connector cables are secured in the fader bay with clips to avoid damage in transit.

### **3.7. SCRIPT SPACES**

There are two versions of the shape of these units which are designed for inclusion in the console. They are both illustrated in figure 6 and either may be obtained in a width which occupies either six units (6 x 45.5mm), or eight units (8 x 45.5mm) or ten units (10 x 45.5mm). The sloping script space, type SS01, provides two areas of A4 space and the vertical type, SS02, has a deep well with a vertical rear panel. They are fabricated units and may be located alongside channel modules in any position in the console mainframe, each being retained in position by four GKN 6AB x 1/2in pan-head screws which are the same type of screw used for retaining the modules. The script space material is 16swg alloy, anodised black.

### **3.8. UTILITY MODULES**

Special facilities not covered by the standard range of modules are fitted in the meterhood space in two possible ways. The utility module, UT01 or TX01 are four units wide and are constructed with the normal side and rear panels. Their front panels can be pierced to carry the specified optional facilities. The rear panels carry connectors.

The front panel of both types is 14swg alloy which can be pierced to special order. Spare UT01/TX01 modules and single panels will be supplied on request for in-house special facilities. When ordering, please make available details of the system planned so as to avoid problems of cross-interference with the console systems.

**CHAPTER 4**  
**ELECTRICAL DESCRIPTION**

## CHAPTER 4 ELECTRICAL DESCRIPTION

### 4.1. INTRODUCTION

The 24 Series Stereo Mixer comprises a number of functionally different audio units all designed, both mechanically and electrically, on a fully modular basis.

A suitable selection of modules and their simple interconnection by interpatch connector leads, together with the status-setting of certain units by their included switching facilities, enables a required operational system to be established. The console is supplied with the compliment of units originally specified which are already connected and set to a particular configuration. The 'Original Operational Specification' enclosed with this manual lists the modules which are included and details how they are inter-connected to form the console mixing system. The information contained in this chapter gives an understanding of the functions and circuits of all the different modules which can be incorporated in the console. This will enable any particular configuration to be altered on site to suit changed external or studio requirements.

Wiring details of the mainframe and extension frame are described, also the production and distribution of power supplies to the console.

### 4.2. POWER SUPPLIES

Power supply unit Type PSU1

Three separate sources of power supply are housed in a common 19" chassis assembly as shown in figure 9. These are the audio power unit, the auxiliary power unit, and the +48V phantom power supply unit. A wiring diagram for the complete assembly is given in figure 8. The audio and auxiliary units each require a single phase, 45-65Hz AC input voltage. Each can be set for an input within the range 110-120 or 210-245 volts AC and the units are set, as specified, before despatch. This means that the AC mains supply to the complete power unit chassis must be within the range of 110-120 VAC or within 220-245 VAC. The total power consumption of the console is 700 VA maximum. The power supply chassis should be reserved for exclusive connection to the console power terminal block only. It should not be used to supply any other equipment as this may adversely affect the specified performance of the console. One power supply chassis is capable of supplying the requirements of 32 modules which would be housed in a 24 unit console mainframe with an 8 unit extension frame. A pre-fabricated power supply wiring harness is supplied for connection between the chassis and the console. Reference should be made to chapter 2, 'Installation', section 2.2.9. before attempting to switch on the supply for the first time.

The audio power unit is a Coutant type ATB300 which is a twin output model set to output voltages of +16V and -16V, each having a maximum current rating of 3A. The 0v line of each output is taken to the power terminal block P1 (chassis connector block P1 of figure 8) in the console where they are commoned on to the console chassis earth. The unit has a remote sensing load regulation capability for each output and these are also wired to sense the output voltages at block P1.

Circuit details of this power unit and its performance specification are given in the 'A Series' handbook which accompanies this manual.

The auxiliary power unit is a Coutant type GPE 1000/24 having an output voltage of 24 volts. The remote sensing leads of this unit are connected to its output terminals. The +24V line is taken to terminal 08 of P1 and its 0v line is taken to terminal 05 from which it is connected to chassis earth. The accompanying handbook entitled 'GPE Series - Power Supplies' gives circuit details and the specification of this unit.

The +48 volt unit is an MBI unit. The maximum rated output current is 100mA, but the unit will withstand substantial overloads for reasonable periods of time. Circuit is shown in Figure 3.2.

#### **4.3. POWER DISTRIBUTION AND MAINFRAME WIRING**

(refer to figure 8)

The three power units are connected from the power supply chassis to the console power terminal block P1 (chassis connector block) by the power cable harness, wired as shown in figure 8. From this terminal block, further power harness wiring in the end of the console takes the supplies to the appropriate terminals on the module edge connector sockets. Each of the meterhood modules is also wired from the block P1 by its own cable clipped to a tray running across the console underneath these modules. The general run and layout of power wiring in the console is shown in figure 2. The 24 module edge connector sockets are wired together in 'busbar' fashion with each similarly numbered terminal on each connector being joined together. The identification of wires shown on figure 8, therefore, holds good for all the module edge connectors. It will be noted that power supply connections occupy only a limited number of common terminal positions on each connector. Other terminals on each of them have different functions which can apply to any module chosen to occupy a particular position in the console. For example, from figure 8, pins 25 to 31 inclusive are used for the individual fader harnesses in the positions occupied by faders. In general, the edge connector 'busbar' wiring is also used for routing audio signals, within the console, between the various modular audio processing units.

The addition of an extension frame to a mainframe entails wiring between the two sets of edge connectors as described in chapter 2, section 2.2.5. A small console is supplied complete with its own wiring, similar to that of the main console and the same basic information is applicable to it.

#### **4.4. GENERAL OPERATIONAL SYSTEM**

An overall functional schematic of the console is given in figure 7/7A. This serves to illustrate the various facilities and functions available from the modules whose circuits and modes of operation are described in detail in this chapter.

##### **4.4.1. EXTERNAL AUDIO CONNECTIONS**

All audio inputs from the studio, external to the console, are made by XLR and multiway type connectors on to the rear panels of modules. They are routed into the units via input transformers and are balanced and fully floating. The input impedance is approximately 10k ohms over the audio bandwidth. Insertion points may be provided on the input modules as an optional feature. These inputs are made by GPO 'B' type (small tip) jack sockets and are also via transformers so as to be balanced and floating with an input impedance of approximately 10k ohms. Main external audio outputs are routed from the units via balanced transformers whose output impedance is approximately 75 ohms. XLR type connectors are used to make output audio connection on to studio cables. The outputs are compensated for optimum performance into bridging loads of medium impedance whose value lies between a few kilohms and some tens of kilohms. Although loads of 600 ohms can be satisfactorily driven, they will cause some mismatch with the output transformers. This would result in a loss of signal level of about 1dB across the whole of the audio band and would affect the high-frequency end to the extent of causing some 1/2dB of roll-off at 15 or 18kHz. Therefore, in order to maintain the guaranteed performance of the console, output bridging loads should be used throughout. The standard operating level for console inputs and outputs is 0dBm while the maximum output obtainable without significant increase of specified distortion is +22 dBm.

Note that external audio connections into the console should only be made by the panel connectors provided and identified as such on the rear panels of modules and never by the interpatch connectors.

#### 4.4.2. INTERNAL AUDIO CONNECTIONS

Audio interconnection between the units within the console, to set up a desired operational configuration, is achieved by means of the interpatch connector leads. An interpatch connector is a 2-core screened cable, terminated at each end in a 3-pole type A jack plug (large tip) as shown in figure 11. Provision is made, by a jack socket on the rear panel of each of the channel modules, to accept the connectors. As stated, these interpatch leads should not be used to make connections to or from any equipment external to the console. On the circuit diagrams and on the rear panels of the different units, the jack socket points which are specifically intended for use with the internal interpatch connectors are identified by the symbol (1). The pin configurations of all rear panel connectors are shown in figure 11.

A few basic rules apply to the use of the interpatch system as follows: The three types of circuits in use are mono audio lines, stereo audio lines, and mono audio lines combined with DC control. All interpatch audio lines are unbalanced and to prevent ground loops, the earths of some sockets are not connected. Reference should be made to circuit diagrams for this. All interpatch leads have the screen connected to the case of the plug at both ends. When making alterations to the interpatch system, the following points should be borne in mind:

- i) Never connect an input to another input.
- ii) Never connect an output to another output.
- iii) Never connect a DC control line to an input not intended to receive it. No damage will occur, but operational chaos will result.
- iv) Never use an interpatch lead in an insertion point socket. These latter use 'B-type' (small tip) jack plugs.
- v) Never use an interpatch jack socket to obtain a signal for studio use external to the console.

**NOTE:** 'Daisy-chaining' may be used in the interpatch routing of the outputs from modules type MA02P (mono output) and type TB01/2 (SK7 audio output) using parallel pairs of input sockets so that any amount of T01P or SL01/2P modules can be used in the console at any time.

#### 4.4.3. EXTERNAL DC CONTROL

Apart from audio amplification and mixing capabilities, the console modules contain circuits which also provide control functions that can be utilised for remote switching. Module type S01/2P, for example, incorporates a comprehensive remote control system which can interface with external studio equipment. It provides for remote switching of tape recorders, gramophone turntables, cartridge machines etc. The 'stereo line select' module, type SL01/2P, provides an interrupt talkback facility and the 'auxiliary master output', type MA01P, has provision for external muting of loudspeakers and illuminating 'on air' warning lamps. Loudspeaker muting and talkback facilities are also provided by the circuits of the monitor modules types MN01P and MN02P.

The switching functions of the above operate via high reliability reed relays under the control selection of the operator. The initiation of a remote function can either be directly manual or automatic. Their connections are made through the 9-way D-range plugs on the rear panels of the modules as shown in figure 11.

All the above functions are described more fully in the sections of this chapter which deal with the circuits of the different individual modules.

#### 4.4.4. FEATURES OF MODULES

The separate operational units which form the complete console system are in themselves electrically integral. The functions performed by each module can be wholly carried out by the circuitry within it and all necessary input and output connections are on the rear panel of each individual module. These features enable a module to be removed from the console and tested in all its operational aspects by simply supplying it with power via the service connector which is provided for this purpose. In the case of modules located in the meterhood part of the console, the power lead and audio connections can be disconnected from the rear panel. The module may then be removed and placed in an accessible position on top of the console or near it. The power lead and audio connections can then be reconnected to it for testing and servicing. Where, for example, remote external equipment is controlled from a type S01/2P module or clean feed outputs are generated by a type SL01/2P or type T01P module, all connections relevant to the particular function are found on the rear panel of the same module.

#### **4.5. COMMON FEATURES OF SYSTEM**

In this section, descriptive summaries of the various common signal processing and features of operation are given. These will provide an introduction to the more detailed circuit descriptions of the different modules which follow later in this chapter. The common features are conveniently considered under two functional headings: firstly, the audio path systems common to the whole range of modules; and secondly, DC control functions applying to relays and indicators which are incorporated in and are common to the whole console system.

##### **4.5.1. AUDIO PATH - STEREO OUTPUT**

The primary purpose of the 24 Series console is to produce a line-level output signal for transmission or recording. This signal consists of the combination of individual signal sources as selected by the setting of the various operating controls, in particular by the operation of the channel faders. There are three main constituent parts or elements of the console which function in the contribution to the stereo output. These are the input modules, the console mainframe chassis wiring, and the output module type MA02P.

The function of the output module is to receive a mix of signals from the various input modules, for both right and left channels, to amplify these signals to a suitable line level and feed them to the master output faders for suitable level adjustment. The signals are then fed to the fixed output XLR type connectors on their rear panels via balanced transformers and so out to the studio cables. The input signals to the master stereo output module are fed into it, via its incorporated male edge connector, from the 'busbar' wiring of the edge connectors located in the console mainframe chassis. These input signals to the master stereo are the outputs from the various input and group modules in the console. All the outputs from the input modules are fed on to 'busbars' in the console chassis, one for the right stereo channel and one for the left. These 'busbars' are shown, as one channel only, on the overall console schematic (figure 7) being annotated 'stereo mix'.

Summation of the signals reaching group and master output modules use virtual earth mixing techniques. The gain from input module to stereo output is, therefore, independent of the number of input modules used in the console system to contribute to the 'stereo mix'. The reason for the three output 'busbars' in the mainmix is to provide for appropriate routing of signals into the 'ducking' circuits in the stereo output module. These circuits can operate in one of three ways: 'active', 'neutral', or 'passive' as designated in figure 7. This feature is further explained under section 4.5.2, 'Audio Path-Ducking'. Each of the mix inputs to the master stereo output module is, therefore, directed into the appropriate amplifier and control circuit, according to the 'ducking' mode assigned to it, as shown to the right of the 'busbars' representation on figure 7. All signals which are allowed through the 'ducking' circuits are then combined in a common amplifier before being fed on to the master output fader.

#### 4.5.2. AUDIO PATH - 'DUCKING'

The stereo output of the console from module type MA02P consists of the left and right sums of the contributions from the channel and group modules.

The contribution to the stereo mix from each of the modules, both right and left channels, can be routed to the stereo output, MA02P, in one of three ways: using one pair of 'busbars' from the three pairs provided which are annotated 'active', 'neutral' (annotated '0' on module), and 'passive' for the two channels. The selection of the busbars used is made by the 'ducking' switch on each module and depends on the mode of ducking required for the contribution made by that particular input module. Thus, the source material from any input module can be made to take on one of three possible ducking modes which are described as 'active', 'passive', or 'neutral' (0). These modes are achieved by feeding the signals into three separate stereo circuits in the output module MA02P.

The ducking switch settings on the modules may be changed at any time, but it is advised that selections into and out of the 'active' mode should be made when the signal in that channel is absent or when the channel fader is closed. This will avoid unplanned ducking at the console main stereo output.

The actual ducking circuits are in the MA02P module. This module also carries switches affecting the behaviour of the ducking circuits themselves such that the characteristics of the 'ducked' signals can be adjusted as regards their depth, ducking attack, and release time.

When any input channel signal is directed into the 'active' mode, it activates the ducking circuit and will have the effect, when present, of ducking any and all the other circuits which have been put into the 'passive' mode. But an 'active' channel is not itself ducked and will contribute to the stereo output in the normal way. Any number of input channels can be selected to the active mode and each, when present, will have the effect described above without itself being affected. This means that if all inputs are selected to the 'active' mode, no ducking will take place. The 'active' channels are only effective in ducking the 'passive' circuits when their channel faders are opened. Because the activating signal is the rectified programme from the active channel, even if the faders are open, no ducking action takes place unless there is an active signal actually present.

When an input is directed into the 'passive' mode, it contributes to the stereo output in the normal way, except when there is any 'active' signal present, then the 'passive' channel, or channels, will be ducked by the 'active' signal from any source as described above.

When any input is made 'neutral' by a switch setting to '0', it will be routed to the main console output and contribute to it without either causing ducking or being ducked. The selection of the ducking mode by the switch on each of the input modules is shown as 'ducking select' on figure 7. Any ducking action takes place before the stereo output master faders and insertion points. It has effect only on the master stereo output, but will be in evidence wherever this output is in use, for instance, in the monitoring and metering facilities. However, the console 'mono' output for use with modules providing clean feed outputs does not include any ducking effects.

#### **4.5.3. AUDIO PATH - 'STEREO OUTPUT' AND 'STEREO MIX'**

The main stereo output, besides being fed out via the main rear panel XLR type connectors to the studio, is also fed to the edge connector 'busbar' annotated 'stereo O/P'. This allows the console's output to be distributed internally, within the console, for monitoring purposes.

#### **4.5.4. AUDIO PATH - 'AUXILIARY OUTPUT'**

As standard the mixer has four mono auxiliary outputs which may be used for any subsidiary recording or transmission process. However, by changing position of link plugs situated on input, group and aux output modules aux 3 and 4 become a stereo send where aux 3 = left and aux 4 = right, refer to figure 7.

These outputs are fed to the studio, via balanced transformers through the XLR connectors on the rear panel of the auxiliary master output module type MA01P. Situated on the front panel of the module are gain controls and 'AFL' switches associated with each auxiliary send. The 'AFL' switch routes the aux output to the 'PFL' bus as indicated on Figure 7. This is a post gain send which enables the auxiliary send level to be set via PFL metering and monitoring outputs.

The source material for all channel inputs and group modules can contribute to the auxiliary mix programme. Each channel's contribution to the auxiliary outputs is under control of the front panel rotary pots aux 1 to aux 4 located on the input and group channels. Provision is made for these pots to receive channel programme either before or after the channel fader selection is made by two switches situated on the front panel of the modules.

The auxes are switched in pairs 'pre' or 'post' fader. Aux 1 and 2 being one pair, and 3 and 4 being the other. The module outputs to the auxiliary mixes are via the module edge connector into the console frame common bus bar system and hence to MA01P circuits. Virtual earth summing techniques are used making gain to the aux outputs independent of the number of input channel modules fitted in the frame.

#### 4.5.5. AUDIO PATH - 'MONITORING'

In order to check on the performance of the console and any related external equipment, various stereo listening outputs are obtainable from the console. There are broadly two kinds of monitoring outputs: firstly, prefade listening (PFL) which consists of monitoring the individual programme sources from each of the channel input modules; and, secondly, the console stereo output monitoring. Programme material from external equipment, such as tape recorders, radio receivers and programmes from other studios are fed via an input connector on the rear panel of the module.

The modules which form the monitoring system are the 3-way monitor type MN01P, the multisource monitor type MN02P, the meterhood sub monitor MHM01P, together with the auxiliary master output module type MA01P (PFL amp) and the master output module type MA02P. The console edge connector busbars are used to route signals between the relevant modules and to provide a DC path for relay operation. The master output module, MA02P, has an output, annotated 'Meter Output' on figure 7, which is used for monitoring and metering purposes via MHM01P or ME01. The signal fed to this output is derived either from the 'Stereo PLF Mix' busbar or the 'Stereo Output' busbar or stereo output interrupted by PFL output when a PFL switch is latched in. A selector plug for these three options is located on the master output module MA02P.

The 3-way monitor module, type MN01P, can derive its output from either the 'Stereo O/P' busbar from MA02P or an 'ext' input socket located on the rear panel of the module. (Note the ext input is an unbalanced input and should only normally be used with interpatch system). If an external source is to be injected it should be unbalanced first. Refer to MN01P circuit description 4.6.6.) Each monitor output from this module can independently be selected to an 'Auto PFL' mode, so that whenever a 'PFL' switch on any module is operated the selected output will revert to 'PFL' output. As soon as the 'PFL' switch is released the output will revert back to its preselected input.

The multisource monitor type MN02P has a row of seven input selector push-buttons which can be used to monitor a signal either from the main console output via the 'Stereo O/P' busbar or six external sources. Five are balanced, floating inputs via a 20-way fixed socket on its rear panel. The sixth is an unbalanced input for use with interpatch system as described in 3-way monitor module MN01P. The two monitor outputs from this module (headphone and monitors) have independent 'Auto PFL' option as described in MN01P except that headphones may be manually switched to 'Split PFL' so that when a 'PFL' switch is operated the preselected output is heard in mono in one ear, and mono PFL is heard in the other ear. When the 'PFL' switch is detached headphone monitoring reverts back to stereo preselected output. Each type of monitor MN01P and MN02P have front panel rotary potentiometers for adjusting their amplifier outputs to a suitable listening level.

Meterhood sub monitor MHM01P has a row of ten input selector push buttons which can be used to monitor signals derived in the console, such as the four auxes, four groups and PFL. The ten inputs are unbalanced and should only be used with the interpatch system. Each input has a parallel output to enable the signal to be 'daisy chained' to another unit such as a meter. The unit also has two parallel outputs so that the selected input can be routed to the two monitor modules MNO1P and MNO2P external inputs. A loudspeaker is also located in the unit for sub monitoring, as well as a stereo PPM meter and signal/overload lamp. This is to allow for external metering of a group or aux, etc independently of the main console output.

#### **4.5.6. AUDIO PATH - 'METERING'**

The monitoring features described above are supplemented by visual indication of the levels of signals which are selected by and routed through the monitor modules. These signal levels are displayed on groups of meters which are mounted in units housed in the meterhood part of the console. The console stereo programme level can be monitored either by PPM or VU meter units. Circuitry to indicate when the peaks of signal exceed a predetermined threshold are available in some units, thus enabling a suitable control of level to be established.

Inputs to the meter modules are made by means of two types of connectors on their rear panels. These connectors are fixed female XLR type for inputs originating externally to the console or jack sockets for use with interpatch connectors. These latter being strictly reserved for interconnections between modules within the console. The metering system set up is at the discretion of the Station Operator and can easily be altered to different options to suit changing requirements.

Module type ME01 contains two twin movement meters identified as 'Stereo' and 'Monitor' and one single movement meter marked 'Mono'. The two input connectors for the meter marked 'Stereo' in this module are XLR type which may be used for signals from sources external to the console such as the transmitted programme from the radio station or any other dedicated function. The meter marked 'Monitor' is intended to display signals from a local switched source such as PFL output from the MA02P or from the MNO2P monitor module. Interpatch leads are used to make the connections to the meter module. When type MNO2P is in use, the programme monitored and metered can be that of any of the seven possible selections from this module as enumerated in section 4.5.5. The meter marked mono receives its input from the XLR type connector identified on the rear panel and may be used to display any mono programme. Alternatively, if the studio system requires it, the input to the mono meter may be selected internally to be the mono sum of the programme displayed on the stereo meter. The mono signal may be derived from a summing amplifier within the meter module or it may be fed to the 'Mono' meter from an external source which is generating the mono sum signal.

In the VU meter module type ME02, the left-hand and centre meters indicate the 'left' and 'right' signals respectively of a stereo programme. These VUs may be connected to a monitor module within the console or to an external source. The right-hand meter in this module displays the mono sum of the stereo programme. This also may be derived from a summing amplifier within the meter module or generated from an external source.

#### **4.5.7. AUDIO PATH - 'FADERS'**

Faders are wired into the 24 fixed edge connectors within the console by means of a separate wiring harness for each fader. The harness wired-in for use with every input module is normally that suitable for a stereo fader in the position corresponding to the module. The edge connector contacts used for fader connection are shown in figure 23. Each fader has a fixed 15-way connector mounted on its rear panel for mating with the connector on the end of the harness. The main stereo output of the console is normally controlled by a pair of mono faders and the console is wired to suit, but one stereo fader can be fitted to special order. The wiring applying to each type is shown on figure 23 while figure 5 gives a general view of a fader assembly. When no fader is required in the output position, a dummy shorting plug is supplied to complete the circuits between the fader wiring contacts as shown in figure 23.

Faders are fitted so as to fade down towards the operator unless specified to operate differently. Provision is made for a red warning LED to illuminate on the front panel of input modules when a fader is in the open condition.

#### **4.5.8. AUDIO PATH - 'INPUT SIGNALS'**

All the different types of modules which may contribute to the console stereo output and its various sub-systems are shown on the overall schematic, figure 7. A feature common to all modules is that their internal circuits are all unbalanced, including those fed by transformers which present balanced inputs to incoming signals.

Rotary type potentiometers on the front panels of all modules provide gain control. The 'pan' control for mono modules is situated on their front panels and the 'balance' control for stereo modules is also front-panel mounted. The 'L.R. Mono Source Select' facility, shown in figure 7, for stereo input modules types S01/2P and SL01/2P, permits either of these modules to function normally as a stereo unit or for either the left or the right signals of the individual unit to be routed into both its channels to be treated as a mono signal for that module with the rejection of the channel not chosen for this purpose. Or, with both switches operated, the stereo input is made mono and fed to the left and right outputs of that module.

Equalisation (mono and stereo) and insertion points may be fitted as options in the input path.

After this, the mono and stereo signals are processed as already partially described in sections 4.5.1. to 4.5.7. and as follows.

#### 4.5.9. AUDIO PATH - 'CLEAN FEED'

The action of the clean feed derivation circuits is to combine

- i) channel post fader stereo programme
- ii) talkback signal
- iii) desk mono sum pre ducking circuits

such that the resulting clean feed output signal contains desk mono sum minus channel post fader programme, but can include talkback.

In order to achieve clean feed outputs, two opposite phase mono sum signals are mixed together. One of these signals is annotated 'Desk Mono Sum Output' on figure 7 which shows schematically how the 'left' channel of the stereo programme is derived from the three separate amplifiers in MA02P and combined with the complete 'right' channel before being routed via a common amplifier to an interpatch output jack socket. This complete sum signal can be fed, via interpatch leads, to both the Stereo Source Select module, type SL01/2P, and the Telephone Input module, type T01P. This input, into each of these modules, is marked 'Mono Input' and is fed into a 'clean feed derivation' circuit within the module.

The signal to be eliminated is also fed into the clean feed derivation circuitry from within the module T01P or SL01/2P and is the programme source present in the channel post fader circuit when the fader is open.

Talkback signal from module TB01 or TB02P, via interpatch, is added to the module clean feed derivation circuitry output. In the case of T01P, this occurs whenever push-button COMM. is selected or talkback is pressed. In the case of SL01/2P, this occurs whenever the push-button Talkback pressed.

The clean feed, both for module T01P and SL01/2P, is fed out as a balanced output via a transformer to connector's on the rear panel.

The output from each of the modules T01P and SL01/2P is a 'true' clean feed in that the output from T01P contains the SL01/2P signal, but not the input to T01P and, similarly, the output from SL01/2P contains the T01P signal, but not its own input. In this way, individual clean feeds can be produced from each separate T01P or SL01/2P module and as many outputs as required for this purpose can be generated.

#### 4.5.10. AUDIO PATH - 'TALKBACK'

The talkback system provides for high priority voice communication between the operator of the console and people under his direction situated in studios or in the location of any programme source. Headphones or monitor loudspeakers can be used, there being facilities for muting the latter as appropriate. The system involves the use of Talkback module, TB01 or TB02P, in conjunction with the monitor modules types MN01P and MN02P.

Talkback module, TB01 is housed in the meterhood part of the console and has a capacitor microphone on its front panel. The voice signal from this, after amplification and limiting, is fed to the output connectors via selector switches 'TB Select'. One of these selected outputs is fed out from the module via a transformer and D-range plug to provide a balanced, floating output direct to an external location. The other five outputs are each from interpatch jack sockets selected one at a time by the push-buttons on the front panel of the unit. There is also a 'Break Point' B-type jack socket provided which allows for a voice input from the operator's M01/2P microphone channel instead of that from the Talkback module internal microphone.

Talkback module TB02P is a normal module that occupies one module space. It has provision for a plug in microphone on the module face which can be overplugged from the operations microphone channel if required, as described above. The voice signal after amplification and limiting is fed to output connectors and internal buses via switches 'TB Select'. A low frequency tone is also available for feeding to internal busses for 'Slating' purposes. This module also has a demuting function for 'Distant Mute' locations when in rehearse state. This is to enable talkback to be sent to a distant studio's monitor speakers without having to disturb microphone settings. In "Trans" mode this talkback option and the talkback to the consoles internal busses is 'Locked Out'.

A continuous audio output is available on both talkback units and is intended to be fed via interpatch leads to a Telephone Input module, T01P, or a Stereo Source Selector, SL01/2P, which provide talkback facilities with external sources. The jack socket outputs from the selector switches are for connection to monitor modules, either type MN01P or MN02P. When the appropriate selector switch is operated in the talkback module, the talkback relay in the monitor module, to which that selected output is connected, is energised via the connecting lead. This enables the voice output signals, which are fed into the monitor module by the same interpatch, to be fed out of that monitor module's 'Stereo Output' line (see section 4.5.5. 'Monitoring'). Additional circuitry assists voice communication by automatically muting or dimming loudspeakers in the operating area when a 'Talkback Selector' is pressed.

#### 4.5.11. 'RELAYS'

The various control functions required in the operation of the console, both internally and externally, are exercised through high-reliability reed relays. These functions may most conveniently be considered under four headings:

- i) Pre-fade listening
- ii) Muting/Dimming
- iii) External control, ancilliary to muting
- iv) External control, start/stop remote equipment

##### i) Pre-fade listening (PFL)

When a 'PFL' push-button, which is incorporated as a switching function on every input module, is operated, the input source material signals in that module are routed to the 'Stereo PFL Mix' busbars as indicated in figure 7. These signals are derived before the input channel module's fader and are then available as the input to the Auxiliary Master Output module MA01P. An output from MA01P, which will then be the pre-fade listening signal, is routed to the 'PFL O/P' busbars where it is available to the monitor modules MN01P and MN02P. These modules can also be preset by a switch on their front panels to automatically change over to receive the input from the 'PFL O/P' busbars whenever an input module's 'PFL' push-button is operated. The relays in these units, marked 'PFL' in figure 7, are operative for this purpose. Hence, for these preset conditions, the output from a monitor module will be the pre-fade listening signal from an input module each time the latter's 'PFL' button is pressed.

##### ii) Muting/Dimming

The silencing of loudspeakers, both local to the console and in distant locations, may be achieved through the muting of monitor modules. The relay annotated 'mute', in each type of monitor, is operative for the muting function in the appropriate monitor module. Control can be initiated from various modules according to requirement. These are: (a) the opening of a mono input module's fader; (b) the operation of the 'talkback selector' push-buttons in the talkback module TB01 or TB02P; (c) the selection of 'talkback' mode in the stereo line select module SL01/2P; (d) the operation of the 'COMM' push-button in a telephone input module T01P. In all talkback modes it is possible to dim speakers locally providing various link options are preselected.

Monitor modules can, themselves, be assigned for muting either to a 'local' or 'distant' ring. This choice is made by means of a plug-in selector on the circuit board of the 3-way and multisource monitor's. The subsequent occasions of muting then depend on the particular module from which control is initiated.

- (a) Muting from the fader on a type M01/2P input module can be operative via either the 'local' or 'distant' busbar at choice, so affecting those monitors which are already set to mute from the chosen busbar. Selection is made by a 'Mute Mode' status switch on the rear panel of each input module. Operation of the muting relay in a monitor module is accomplished by the changeover of the fader micro-switch acting in circuits within both the input module and the monitor module. Interconnection between the modules is by means of the 'local' and 'distant' busbars shown on figure 7 as a single line only, annotated 'Mute'. This line, in reality, represents two busbars. Another busbar enables the DC operation of PFL relays. Microphone inputs to the console are routed via an input module M01/2P hence the ability to mute both 'local' and 'distant' if required from these modules.

The other types of modules receive only external signals from non-microphone sources such as taperecorders, outside lines, telephone etc and, therefore, are not required to mute 'distant'. These modules do, however, mute or dimm monitors selected to local in order to prevent talkback howlround and also improve voice intelligibility when loudspeakers are in use.

#### iii) External Control, Ancilliary to Muting

It was stated above that the 'Mute' single busbar shown on figure 7 represents two busbars. The edge connector terminals connected to each busbar are enumerated on figure 8 together with their functions. Those busbars concerned with muting proper are the 'local' and 'distant' whose main functions have been described above. The 'local' and 'distant' busbars also serve to operate the 'local' and 'distant' relays, shown in figure 7, which are located in the Auxiliary Master Output module MA01P. These relays are a total of four in number, grouped as two pairs, two 'local' and two 'distant' with one normally open set of contacts to each individual relay. The contacts are connected to a multiway 'D-range' output connector on the rear panel. They are for use in various functions such as illuminating warning lamps and muting loudspeaker amplifiers etc.

#### iv) External Control, Start/Stop Remote Equipment

The two relays located in the stereo input module S01/2P, shown on figure 7 as 'Start' and 'Stop', each have a pair of contacts which can be used for control of external equipment. They are wired to a 9-way D-range output connector on the rear panel. The contacts are normally open and fully isolated. A number of options are available as to the operation of these relays.

A three-position switch on the front panel allows equipment either to be started at source (no remote control) or started by depressing a push-button below the selector switch, 'Start Mode', or started when the module's fader is opened, 'Fader Mode'. Indicators on the front panel show the option selected. In the 'Start Mode', the 'start' circuit closes for approximately 500 msec when the start button is pressed. The 'stop' circuit remains open. In the 'Fader Mode', the 'start' circuit closes for about 500 msec when the fader is opened. When the fader is closed back to infinity, the 'stop' circuit closes for approximately 500 msec.

#### **4.6. CIRCUIT DESCRIPTIONS OF MODULES**

In this section, the various parts of the complete circuitry comprised in each individual module are identified and their functions and mode of operation explained. Reference is made, where appropriate, to sections in the manual where some relevant description has already been given. The circuit diagram reference applying to any particular module is given at the beginning of each module description, but reference should also be made to the 'Amendments and Modifications' sheet to ensure that the circuit diagram used is up-to-date and that the module description in this manual has not been out-dated by any modifications noted on the modification sheet.

##### **4.6.1. COMMON CIRCUIT FEATURES**

###### **4.6.1.1. DC SUPPLIES**

The DC 'audio' supplies at  $\pm 16$  volts, the DC auxiliary supply at 24 volts, and the phantom +48 voltage are fed to the modules' edge connectors and meterhood cables as described in section 4.2. and 4.3. The terminal identification is given on figure 8. RC filter circuits are provided in each individual module as required with reduction of the  $\pm 16$  volts by additional zener stabilisation to  $\pm 15$  volts for the ducking control circuits in Master Module MA02P.

###### **4.6.1.2. MODULE CIRCUIT EARTHING**

To avoid common impedance coupling and cross-interference, four different types of earths are used for the connection of module circuitry into the console wiring. The general function of each is indicated, with the symbols used, in figure 8. For DC test measurements, the high and low current earths, with the auxiliary supply 0 volts, may be treated as identical. For AC measurements of signals within the unbalanced module circuitry, either the high or low current earths, or the module chassis, may be used as the measurement ground.

The 'clean' earth, which is AC ground, is reserved for sections of mixing circuits which require a clean ground through which no DC or AC currents flow. No measurement connection should be made to this earth.

To prevent switching interference from relays and lamps which are powered from the auxiliary 24 volts, this supply is given a separate earth.

All the earths are commoned at the power input terminal block P1 (chassis connector block on figure 8).

#### 4.6.1.3. GENERAL

Integrated circuit amplifiers, in an 8-pin dual-in-line package, perform all audio amplification. The IC types used are low noise, high speed amplifiers: TL072CP, NE5534 and NE5532 OP amps.

All active amplifiers are biased to centre rail 0 volts  $\pm 0.5$  volts with inputs and outputs blocked to DC by capacitors.

Volume controls act as potential dividers with one terminal earthed.

The bandwidth of all active sections of circuitry is restricted by RC filtering to the audio band.

Transformers are used at module inputs and outputs, as well as at insertion points, to change from internal unbalanced to external balanced circuits. They are all 1:1 ratio with the exception of the Mono Mic/Line input modules which have input transformers with a 1:6 step-up ratio.

#### Signal Phase:

All modules able to divide and route signals through the console system provide outputs which are in the same phase as the source material. At input and output connection points using XLR type connectors, the convention is that pin 2 is the terminal for +ve phase connection, pin 3 for -ve phase connection. Since the console system is phase coherent, this convention is arbitrary and so long as all connections are consistent any convention may be used. The signal phase detected at various points between the system input and output terminals will vary with individual circuit function.

There is one exception to the above rule of phase. The prefade listen output available at the rear of the module type MA02P, and under appropriate conditions at the rear of the three way monitor, is an inverted replica of the original source programme. Note that for all normal functional purposes, i.e. level alignment, cueing, and source identification, this phase inversion is of no consequence.

Refer to sections 4.4.1. and 4.4.2. for details of input and output impedance and level specifications.

#### 4.6.1.4. LAMP DRIVER CIRCUIT

A typical circuit is shown on the circuit diagram of the 3-way monitor (see figure 16). The lamp is illuminated when ext select switch S1 is latched in, by supplying volts to the base of Q1 via R1. C1 has the effect of Q1 turning on 'slowly' thus eliminating current surges and audible clicks. When S1 is detached a trickle current (approx. 5mA) is constantly passed through the lamp via R3, to keep the lamp 'warm'. This also helps to reduce surge current when the lamp is turned on and helps to extend lamp life. The lamp used is a 24 volt, 40mA, 10,000hr type T-1 1/2.

#### 4.6.1.5. RELAY OPERATING CIRCUIT

A typical circuit is shown on the circuit diagram of the 3-way monitor (see figure 16). The PFL relay RL101 is operated via Q101 when this transistor is switched on by transistor Q102 being turned off. This occurs when the base of Q102 is connected to earth via R124 (For the 3-way monitor module, R124 is earthed through the interpatch lead connected into SK1 when the talkback button is operated in the talkback module).

#### 4.6.1.6. 'LO FILTER'

This is provided on all input modules. It is a switchable filter for the elimination of low frequency, spurious signals. It attenuates to -3dB at 100Hz with a slope of 12dB per octave.

#### 4.6.1.7. EQUALISATION

Two optional equaliser circuits are available, one for use with a Mono Input module which then becomes type M02P (see MBD 200 Iss.1: PCB type MEQ Iss.1) and one for use with a Stereo Input module which then becomes a type S02P (see MBD 201 Iss.1: PCB type SEQ Iss.1). The components comprising the frequency equalisation circuits are mounted on printed circuit boards and are positioned in the modules as shown in the channel module assembly drawing, figure 4.

The circuits for each channel, both in the mono version and the stereo, are identical. Integrated circuit amplifiers are used with their gains controlled by their associated frequency response shaping circuitry. The response comprises a high end shelf operative at 10kHz, a low end shelf operative at 100Hz and a tunable peak/dip (reciprocal) mid-range operative between 400Hz and 6kHz.

The equaliser is controlled from the front panel of the module by four rotary potentiometers which alter the frequency responses in the high, low, and middle ranges. For the stereo version ganged controls are used for simultaneous adjustment of the two channels.

#### 4.6.1.8. INSERTION POINTS (see MBD 28 Iss.1)

These are available as an option on all input modules. An insertion point consists of two transformers with connections both to the module circuitry and to GPO 'B' type jack sockets mounted on the rear panel of the module. The transformers are positioned in the module as shown in figure 4. Both the outgoing 'Send' and the 'Return' are balanced circuits. Connections into the module are made at line signal level before the equalising option board e.g. as shown in the circuit diagram of the Mono Mic/Line module, figure 12.

#### 4.6.2. MONO MIC/LINE INPUT M01/2P

(figure 12 - MBD 194 Iss.1: PCB type Mic/Line Input AGO 145 Iss.3)

Low level input signals from a microphone are fed to the 1:6 ratio input transformer via phase reverse switch S3. Line signals are attenuated by operation of switch S2, which puts the attenuator formed by R1-R4 in circuit. Phantom power at +48 volts is fed to the microphone via on/off switch S1 located on the rear panel, provided S2 is set to 'mic'. The output is then routed to the pre-amplifier formed by IC1 which incorporates the front panel dual concentric 'coarse' and 'fine' gain controls RV1A and RV1B. The 'Lo' filter (see section 4.6.1.4.) may be switched in circuit by a push-button on the front panel. After the non-inverting amplifier IC2 provision is made for both insertion and equalising options (see sections 4.6.1.7. and 4.6.1.8.). Before the signal is routed into two separate paths under the control of 'Pan' potentiometer RV6. After the two 'Pan' amplifiers IC3A and IC3B. The two channels are then routed to a number of parallel circuits:-

- i) Terminals 26 and 28 of the edge connector for connection to the end of the fader.
- ii) To the 'PFL' switch S14 for routing to PFL mix bus, edge connector No's 38 and 39.
- iii) To IC5B where the signal is summed to make a mono 'pre-fader' send for the auxes.
- iv) To link plug P3 'pre-fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC5B.

The signal routed to terminals 26 and 28 of the edge connector (end of fader) are returned from the fader wipers on terminals 25 and 29 to the 'post fader' amplifiers IC4A and IC4B. The output from these amplifiers are also sent to a number of parallel circuits:-

- i) To main programme select switch S6 and then onto the 'ducking' switch S7. For routing directly to the ducking circuits in the master output module MA02P for processing as described in section 4.5.2.

- ii) To group select switches S8-S11 for routing to selected group modules G01/2P.
- iii) To IC5A where the signal is summed to make a mono 'post fader' send for the auxes.
- iv) To link plug P4. 'post fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC5A.

The signal to the 'PFL' switch S14 is routed through when the switch is latched in. This action also earth's terminal 14 via D2 enabling DC operation of the PFL relays in other modules as described in 4.5.1.1(1). If switch S2 is set to the 'mic' position S14 then also brings into operation the 'mute' circuits as described in 4.5.1.1(11) and (111) so that the monitor speakers are muted while the microphone level is set (if a mute is required in the line mode this can be achieved by link plug P1). The lamp is illuminated as described in section 4.6.1.2.

The auxiliary signals either 'pre' or 'post' fader, selectable in paris via front panel switches S12 and S13 are routed to the dual concentric aux send controls RV4A, RV4B, RV5A and RV5B to edge connector terminals 40 to 43 for routing to the auxiliary output master MA01P as described in section 4.5.4.

When the module's fader is opened, terminals 30 and 31 are shorted by the micro-switch in the fader unit so turning on transistor Q2. Transistor Q3 is thereby turned off so removing its shorting effect across the 'Fader Open' warning diode LD1, allowing it to illuminate. At the same time, the base of transistor Q4 is also taken to +24 volts via R62 which turns it on putting the pole of the local/distant switch to earth. Then, depending on its presetting either the 'Distant' or 'Local' line may become earthed. This means that either the 'Monitor Mute Local' or the 'Monitor Mute Distant' become earthed. This results in the energisation of mute relays in monitor modules to effect a pattern of muting as described in section 4.5.11.(ii) and (iii).

#### **4.6.3. STEREO LINE INPUT TYPE S01/2P**

(figure 13 - MBD 195 Iss.1: PCB type Stereo Input AGO 141 Iss.3)

The two channel inputs, via the XLR connectors SK1 and SK2, are converted from balanced to unbalanced circuits by the 1:1 transformers T1 and T2. A phase reverse switch S1 is situated in the right channel (B-LEG). A ganged gain control is provided by front panel potentiometers RV1A and RV1B. After pre-amplifiers IC1A and IC1B, channel balance is adjusted by RV2A and RV2B also a front panel control. The 'Lo' filter (see section 4.6.1.6) is switchable from the front panel and precedes line amplifiers IC2A and IC2B. The equaliser and insertion point options (see sections 4.6.1.7 and 4.6.1.8) are followed by the Source Select switches S4 and S5. These are two push-buttons mounted on the front panel marked 'left' and 'right' and provide four possible modes of operation as follows:-

- i) Both out: The stereo programme is unaffected.
- ii) Left in: The left signal is routed to both left and right outputs. i.e. it is treated as a mono signal and the right programme is rejected.
- iii) Right in: The right signal is routed to both left and right outputs. i.e. it is treated as a mono signal and the left programme is rejected.
- iv) Both in: The stereo programme is made mono in the module.

After the source select switches S4 and S5 the signal is fed to buffer amplifiers IC3A and IC3B which supply a number of parallel outputs:-

- i) Terminals 26 and 28 of the edge connector for connections to the end of the fader.
- ii) To the 'PFL' switch S16 for routing to PFL mix bus, edge connector No's 38 and 39.
- iii) To IC4B where the signal is summed to make a mono 'pre-fader' send for the auxes.
- iv) To link plug P2 'pre-fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC4B.

The signal routed to terminals 26 and 28 of the edge connector (end of fader) are returned from the fader wipers on terminals 25 and 29 to the 'post fader' amplifiers IC5A and IC5B. The output from these amplifiers are also sent to a number of parallel circuits:-

- i) To main programme select switch S6 and then onto the 'ducking' switch S13 for routing directly to the ducking circuits in the master output module MA02P for processing as described in section 4.5.2.
- ii) To group select switches S7-S10 for routing to selected group modules G01/2P.
- iii) To IC4A where the signal is summed to make a mono 'post fader' send for the auxes.
- iv) To link plug P3 'post fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC4A.

The signal to the 'PFL' switch S16 is routed through when the switch is latched in. This action also earth's terminal 14 enabling DC operation of the PFL relays in other modules as described in 4.5.11.(1).

The auxiliary signals either 'pre' or 'post' fader, selectable in pairs via front panel switches S12 and S13 are routed to the dual concentric aux send controls RV4A, RV4B, RV5A and RV5B to edge connector terminals 40 to 43 for routing to the auxiliary output master MA01P as described in section 4.5.4.

When the module's fader is opened, terminals 30 and 31 are shorted by the micro-switch in the fader unit so turning on transistor Q1. Transistor Q2 is thereby turned off so removing its shorting effect across the 'Fader Open' warning diode LD1, allowing it to illuminate.

#### **4.6.4. TELEPHONE LINE INPUT T01P**

(Figure 14 - MBD 203 Iss.1: PCB type Telephone Input AGO 178 Iss.2)

Input from an external source, via an external telephone balance unit (TBU), is routed into the module via the XLR connector SK1 located on the rear panel. It is converted to an unbalanced circuit by transformer T1 and fed via phase reverse switch S1 for gain adjustment by means of RV1, the signal is amplified by IC1A, after which the signal is routed into two channels with balance provided by 'pan' potentiometer RV2. Each channel is then fed to the pre-fader amplifier IC2A and IC2B. The output from these amplifiers are sent to a number of parallel circuits:-

- i) Terminals 26 and 28 of the edge connector for connection to the end of the fader.
- ii) To the PFL switch S11 and Comm switch S12 for routing to PFL mix bus, edge connector No.s 38 and 39.
- iii) To IC3B where the signal is summed to make a mono 'pre-fader' send for the auxes.
- iv) To link plug P1 'pre-fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 become right, instead of two mono sends from IC3B.

When the 'Comm' button is pressed, voice signals from a Talkback module TB01 or TB02P, which are fed into the Telephone module's 'Talkback Input' parallel sockets, are routed to the 'Comm Output Amp' circuit via relay RL2 and so to the module Comms output for connection with the TBU.

The 'PFL DC' line is earthed at the same time. This enables operation of relays in the monitor modules and in the auxiliary output module in exactly the same way as when a 'PFL' push-button is operated on any input module, as described in section 4.5.11.(i). This means that the 'distant' signals into the telephone modules SK1 can then be routed into a monitor module for console operator's listening. Hence two-way conversation is possible when the 'Comm' button is operated.

Operation of the 'PFL' push-button S11 also routes the telephone input module's output to the 'Stereo PFL Mix' busbars. This facility can, therefore, be used for local monitoring while still sending a 'clean feed' of console output to the TBU.

A talkback momentary pushbutton S13 is also available on the front panel. This enables talkback to be sent via the 'comm's' output without totally muting clean feed output, the output is dimmed by about 20dB under talkback voice when talkback is sent.

The signal routed to terminals 26 and 28 of the edge connector (end of fader) are returned from the fader wipers on terminals 25 and 29 to the 'post fader' amplifiers IC5A and IC5B. The output from these amplifiers are also sent to a number of parallel circuits:-

- i) To main programme select switch S5 and then onto the 'ducking' switch S7 for routing directly to the ducking circuits in the master output module MA02P for processing as described in section 4.5.2.
- ii) To group select switches S6-S9 for routing to selected group modules G01/2P.
- iii) To IC3A where the signal is summed to make a mono 'post fader' send for the auxes.
- iv) To link plug P2 'post fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC3A.
- v) To summing amplifier IC1B where a mono inverted sum of desk O/P is produced to use as a clean feed 'null' signal.

The output of IC1B is mixed with a non inverted mono console output by IC4A. This signal is then routed via talkback switch S13, and relay RL2 to the 'comm's' output amplifier IC4B. The 'mix minus' signal is then transformer balanced and routed to the 'comm's' O/P socket situated on the back panel of the module.

The auxiliary signals either 'pre' or 'post' fader, selectable in pairs via front panel switches S12 and S13, are routed to the dual concentric aux send controls RV4A, RV4B, RV5A and RV5B to edge connector terminals 40 to 43 for routing to the auxiliary output master MA01P as described in section 4.5.4.

When the module's fader is opened, terminals 30 and 31 are shorted by the micro-switch in the fader unit so turning on transistor Q4. Transistor Q5 is thereby turned off so removing its shorting effect across the 'Fader Open' warning diode LD1, allowing it to illuminate.

Also available on this module is an optional TBU remote switch S14. This enables the operator to divert the call from the phone to the console via the TBU. When the momentary switch is pressed a 'voltage free loop' is available on SK6 via RL1. Pressing the switch again will release the relay. Alternatively, a fader reset option is available by link plug P4. If it is set in the 'B' position opening the fader will not effect the state of RL1. However, if the relay is latched in, closing the fader will release the relay so that the TBU is automatically ready for the next call. With P4 in the 'A' position the fader will not affect the state of RL1 at all. The bulb in S14 is normally driven by Q3, however, if it is required to be driven externally by the TBU this can be achieved by link option P6. In the 'B' position the bulb is driven by Q3. However, when P6 is set in the 'A' position the bulb contacts are routed to SK6 located on the back panel so that the bulb can be driven externally.

There are three other link options available on this module P3, P7 and P8. P3 is a mute/dim option. This presets the condition of local monitor module MNO2P so that when comm or talkback switches are pressed the module either mutes or dims the local monitor speakers. P7 is usually set to select tip from the mono jack sockets for normal clean feed. Another option is available using aux outputs, refer to (5.3.3.). P8 can deselect the clean feed null so that a 'que' programme is available on the comm's O/P. This circuit can be wired to jack sockets on the rear panel of the module (via V15, V16 and V17) for external clean/que switching by MBI outside source switcher remote.

#### **4.6.5. STEREO LINE SELECT SLO1/2P**

(Figure 15 - MBD 205. Iss.1: PCB type SLS. AGO 183 Iss.1)

The three 20-way connectors on the rear panel of this module provide for a total of ten stereo inputs and ten comm's outputs. They are routed to the front panel selector switches S19 to S28 which are interlocked to allow only one push-button at a time to be operated. The selected stereo input is converted to unbalanced circuitry by the 1:1 transformers T1 and T2 and fed to a Stereo Input module S01/2P pcb (see figure 13 - MBD 195 Iss. 1). With reference to this latter circuit diagram, the signals are fed from the post-fade buffer amplifiers IC5A and IC5B to the 7-way connector P4 (type SLS interface mounted on PCB) and so, via C1 and C2 to the level adjustment potentiometers RV1 and RV2 shown on figure 15. The two stereo channels are combined and fed to one pole of the 'Comm Mode' switch S17. This is a switch, annotated 'Cue', 'Clean Feed'.

In the 'clean feed' mode shown on figure 15 with the push-button 'Talkback' switch S18 (located on the front panel) unoperated and link plug P3 in the 'B' position, the 'Mono Input' via interpatch sockets SK1 and SK2 is commoned with the new inverted mono signal. The 'Mono Input' is the 'Desk Mono Sum Output' from the Master Stereo Output module MA02P which is the desk output for deriving clean feed as described in section 4.5.9, which cancels out the selected signal into the Stereo Line Select module to give a balanced clean feed output via amplifiers IC1B and IC2A, 1:1 transformer and the Comm's output connector on the rear panel. Selection of S18 Talkback adds the voice signal from a talkback module to the Comm's output.

With S17 in the 'cue' position and S18 unoperated, the output consists only of the 'Mono Input' signals which then act as a 'cue' programme. If link plug P3 is set in the 'A' position, only voice talkback signals can be sent to the distant location. The talkback signals are fed into paralleled sockets SK4 and SK5 via an interpatch lead from a talkback module. (Socket SK7 is used on the talkback module for this purpose as it gives a continuous talkback output). From sockets SK4 and SK5 the signal is fed to the input of amplifier IC2 so that every time the 'talkback' push-button on the front panel of the SL01/2P module is pressed, the talkback signal is added to any mode that is preselected. i.e. 'cue' or 'clean feed' if these signals are present.

The operation of the lamp driver circuitry is described in section 4.6.1.4.

As standard, operation of S18 'Talkback' either grounds or adds 12 volts to the local mute busbar (32) and so mutes or dims monitor outputs selected to local mute mode. This mode is preselected by link plug P4, in the 'A' position the speakers are muted, in the 'B' position speakers are dimmed.

There are three other link options available on this module P1, P2 and P5. All these are to do with clean feed derivation. For normal operation P5 is set in the 'B' position, P2 in the 'B' position and P5 in the 'B' position. Another clean feed derivation option is available using aux outputs, refer to (5.3.3.).

When button ten on the ten-way input selector bank is latched in, remote stop/start functions are available as on S01/2P. If any other input is selected the remote stop/start function is disabled.

#### **4.6.6. 3-WAY MONITOR TYPE MNO1P**

(Figure 16 - MBD 202. Iss.1: PCB type 3-way Monitor AGO 169. Iss.1)

This module, in effect, comprises three similar stereo paths. Voltage supplies, stereo and PFL inputs, and input control functions to the module via its edge connector are common to all three paths although each path may have its own individual status settings. The following description applies for one path as shown on the circuit diagram. The other two paths function in an identical manner.

The input to each path is either the console stereo output from the left and right stereo busbars via the edge connection terminals 33 and 34 or an external input via SK4. The channels for the path are fed in, via the PFL relay RL101 contacts, IC101A or IC101B, and the talkback relay RL102 contacts, to output amplifiers IC102A and IC102B. Level control is provided by the front-panel-mounted potentiometers RV101A and RV101B. The outputs from the amplifiers are fed, via the mute relay RL103 contacts, to the two transformers T101 and T102, to provide balanced, floating outputs to the XLR type connectors on the rear panel of the module. Jack socket SK4 is available there, suitable for interpatch connection from MHM01P module.

There are two other possible stereo inputs to the monitor module, either of which may be selected as required, which then replace the normal stereo output. One is a talkback input connected by an interpatch lead from a talkback module into one of the jack sockets SK1 (SK2 and SK3). This input replaces or dims (depending on the setting of P102) the stereo input when RL102 is energised. This relay is energised through the transistors Q103 and Q104 which constitute a switch allowing current to energise RL102 when the junction of R129 and R130 is earthed. This occurs via the 'ring' contact of SK1 (SK2 and SK3) and the interpatch connection to the talkback module whenever the push-button which selects the monitor module is operated in the talkback module (see section 4.6.1.(iii)) so enabling voice talkback on both L and R channels.

The second alternative input to MN01P comes from the 'PFL O/P' busbars via its edge connector terminals 35 and 36 whenever PFL relay RL101 is energised. This relay is energised through the circuitry of transistors Q101 and Q102 which pass current to energise RL101 when the junction of R124 and R125 is earthed. The junction of R124 and R125 can be connected, via the latching push-button switch S101, mounted on the front panel, to terminal 14 of the module's edge connector. This terminal is connected to a busbar, 'PFL DC', which in turn is connected to a push-button switch located on the front panel of every input module, annotated 'PFL'. When any such push-button is operated on any input module, terminal 14 of the monitor module is earthed. If the 'Auto PFL' push-button in the monitor has been operated, the junction of R124 and R125 is thereby connected to earth. RL1 is then energised for the time that the 'PFL' push-button on an input module is held in. The signals into the monitor module will then be from the 'PFL O/P' busbars which will be the signals from the input module where the 'PFL' switch has been latched in (see section 4.5.5.). This is the provision for automatic prefade listening on the monitor, but the selection of talkback always takes precedence over both PFL and normal stereo programmes. The 'Auto PFL' push-button remains illuminated when operated.

Energisation of the mute relay RL103 results in R137 and R138 being earthed so muting the output of the monitor module. This relay can be chosen to operate, via transistors Q105 and Q106, via either terminal 32 of the edge connector termed 'Local' or terminal 37 termed 'Distant'. The 'mute mode selector' P101 used for selection is located on the printed circuit board of the module. Whenever the terminal connected to the junction of R137 and R138 is earthed, RL103 is operated. The 'local' terminal 32 forms part of the 'mute' busbar as shown schematically on figure 7. This busbar is wired to pins 01 and 02 of the chassis connector block P1 (see figure 8) and from there on to pin 4 of each meter bridge power lead. One of these leads connects into the rear of the talkback module TB01. When any selector button for talkback is operated in this TB01 module, its 'local mute' line is earthed (see figure 21 and section 4.5.11.(ii)) so earthing terminal 32 of the 3-way monitor, operating RL103, and muting the output. Thus, any local loudspeakers fed from any monitor module with its mute line connected to 'local' will be silenced by the TB01.

When the monitor module is set to 'local' it will also be muted for three other conditions. Firstly, if any fader connected into a mono mic/line input module type M01/2P is opened, the 'mute' busbar terminals 32 is earthed by a transistor switch, in M01/2P operated by the micro-switch in the opened fader module. This occurs providing the 'local-distant' selector status switch of MN01/2P is set to 'local'. Secondly, when the 'Talkback' switch in a stereo line select input module SL01/2P is operated, the 'mute' busbar pins 32 are earthed so muting any monitor module set to 'local'. Thirdly, when the 'Comm' switch on a telephone input module T01P is operated, local loudspeakers connected via a monitor module set to 'local' are muted. Note the MN01P has no auto dim facility so if it is used for local monitoring TB02P, T01P and SL01/2P link options should be set to 'mute'.

Terminal 37 of the 3-way monitor, which forms part of a separate mute busbar termed 'distant', is intended for use when a distant loudspeaker is required to be muted. This terminal is earthed and muting occurs when a fader feeding an input module type M01/2P is opened, providing the 'mute mode' switch in M01/2P is set to 'distant'.

When the MN01P is set to 'distant' mute, a de-mute facility is available from the talkback module TB02P - via SK1 (SK2, SK3) providing TB02P is in 'rehearse state'. This is achieved by sending DC volts down the ring of the talkback input socket SK1 (SK2, SK3). This has the effect of turning on transistor Q108, thus in effect grounding the junctions of R129 and R130 (talkback circuit) and also grounding the base of Q105, releasing mute relay RL103. This function is provided so that distant microphones do not have to be closed before talkback is sent to monitor's in a distant studio. This operation is automatically disabled when talkback module TB02P is in a transmission mode.

#### 4.6.7. MULTISOURCE MONITOR MODULE TYPE MNO2P

(Figure 17 - MBD 198. Iss.1: PCB type Multisource Monitor AGO 148 Iss.3)

The required inputs to 1:1 transformers T1 and T2 for left and right channels are selected through switches S10 to S16. Selection of the 'Main' input terminals 33 and 34 is made by operation of button 7 (S10), 'Desk'. This programme constitutes the console main stereo output as fed from module MA02P on to the busbar 'Stereo O/P', as shown on figure 7 and described in section 4.5.5. Inputs from balanced external sources are via the 20-way designated connector on the rear panel of the monitor. Provision is made for one unbalanced interpatch input (ext) also on the back panel, normally from MHM01P which comes up on button 6 (S11).

After the transformers, the selected inputs are routed to their respective amplifiers IC1A and IC1B monitor drive, IC4A and IC4B headphone drive, and IC3A mono sum.

#### MONITOR DRIVE

The signals to IC1A and IC1B are routed via contacts of PFL relay RL1. The operation of this relay, through the driver circuitry described in section 4.6.1.5, depends on the presetting of push-button S1. If this 'auto PFL' switch has been operated to latch in, then whenever 'PFL' push-button on an input module is operated, pin 14 of the multisource monitor is earthed via the busbar which connects it to pin 14 of the input module. Relay RL1 of the monitor module is thus energised and the input to the monitor drive then comes from terminals 35 and 36. This input is now from the busbar marked 'PFL O/P' on figure 7. This is the output from the module MA01P which, on operation of the input module's 'PFL' push-button, is derived from the busbar 'stereo PFL mix' as described in section 4.5.5. By this means, a signal from a selected input module can be fed into the monitor drive.

The gain of the amplifiers IC1A and IC1B are set by RV3 and RV4 which control the amount of negative feed-back supplied. The outputs from these are fed via the contacts of talkback/dim relay RL2 and the contacts of dim switch S2 to the front panel ganged potentiometers RV1A and RV1B for the adjustment of monitor level output. The push switch S2 marked 'dim', also on the front panel, allows the output to be temporarily reduced through the fixed potential dividers formed by R7, R8, R20 and R21. After the output amplifiers IC2A and IC2B, the signals are routed, via the 'mute relay' contacts to the 'XLR' type connectors identified on the rear panel. The mute relay RL6 may be assigned to operate either from terminal 32 'local' or terminal 37 'distant' by means of an internal link plug. The conditions which apply to the muting of the multisource monitor MNO2P are the same as those applying to the three-way monitor MNO1P and are described in section 4.6.6.

Front panel mounted 'Cut A' and 'Cut B' switches are situated after mute relay RL6 so that true mono can be checked when the mono switch S5 is latched in. Relay RL2 has a dual function:-

- i) When talkback is received the ring of J2 is grounded causing transistors Q6 and Q7 to energise RL2, RL4 and RL7 thus supplying talkback input from IC7A to override. Preselected input is dimmed by 20dB.
- ii) When DC voltage (approx 12 volts) is supplied to 'local' mute bus 32 transistors Q4 and Q5 are turned on thus dimming preselected input through fixed potential dividers R5, R6, R18 and R19 via RL2, and illuminating 'dim' lamp mounted in S2.

The 'local' mute bus is available on pins 01 and 02 of the chassis connector block P1 (see figure 8). If a 'door' dim facility is required this can easily be achieved by routing via a 2K2 resistor with 12V zenor diode the 24V rail to a micro-switch mounted in the door frame. The return of the micro-switch should then be connected to terminal 01 on the chassis connector block P1. This 'dim' function is only available when MN02P is selected to a local mute mode. The de-mute facility as described for MN01P (4.6.6.) is also available on this module providing it is in a 'distant' mute mode. DC volts applied to the ring of talkback input jack J2 from TB02P module turn on transistor Q11, thus grounding R106 and R107 causing RL2, RL4 and RL7 to energise via Q6 and Q7. At the same time voltage is removed from the base of transistors Q8 and Q10 causing RL6 to de-energise, and 'mute' lamp to extinguish, thus allowing talkback to be received.

A jack socket, J3, provides means of feeding the monitor signals to a meter module via an interpatch lead. This output is unbalanced and derived prior to module level and mute circuits. This output is preselected 'input' interrupted by PFL providing an 'auto PFL' switch is latched in.

#### HEADPHONE DRIVE

IC4A and IC4B are routed via contacts of PFL relay RL3. The operation of this relay, through driver circuitry described in section 4.6.1.5, depends on the presetting of push-button S4. If this 'auto PFL' switch has been operated to latch in, then whenever the 'PFL' push-button on an input module is operated, pin 14 of the multisource monitor is earthed as described previously in monitor drive circuits and PFL is now routed to the headphones.

RL5 is simultaneously operated with RL3. This relay 'RL5' routes PFL to the meter output socket J3 replacing the preselected programme source so that PFL level can be metered when either or both monitor outputs are in 'auto PFL' mode. The meter drive circuits for PFL are IC6A and IC6B. The gain of these amplifiers are set by RV5 and RV6 which control the amount of negative feedback supplied.

The outputs of IC4A and IC4B are fed via the contacts of talkback relay RL4 (for the operation see Monitor Drive section) then to the front panel ganged potentiometer RV2A and RV2B for the adjustment of headphone output level. The signal is then fed to the output amplifiers IC5A and IC5B. After the output amplifiers, the signals are fed directly to socket J1 to provide an unbalanced output to feed via an interpatch lead to a headphone amplifier located in the meterhood either ME01 or HP01.

### **MONO SUMMING AMPLIFIERS**

IC3A and IC3B are mono summing amplifiers. IC3A produces a mono sum of selected inputs (S10 - S16). IC3B provides a mono sum of PFL input. These mono signals are used in conjunction with 'split PFL' and 'split T/B' switches in the headphone drive circuits. With S9 'split PFL' and S4 'auto PFL' latched in, when PFL is preselected on an input module the mono PFL signal from IC3B is routed to the right headphone channel and the mono preselected input from IC3A is routed to the left headphone channel, thus allowing monitoring to be checked while in 'PFL' mode.

With split T/B switch 'S8' is latched in, as soon as talkback is received, mono preselected input from IC3A is routed to the left headphone channel and talkback to the right headphone channel only. If both split T/B and split PFL switches are latched in programme is always available in the left headphone channel. PFL is overridden when talkback is received.

### **MODULE MONO**

The multisource monitor outputs can be switched to mono if required by latching in switch S5. This causes R27, R28, R29 and R30 (monitor) and R71, R72, R79 and R80 (PFL) to become potential dividers. In all cases the mono signal is equal to half the sum of the left and right channels.

#### **4.6.8. AUXILIARY MASTER MODULE MA01P**

(Figure 18 - MBD 197. Iss.1: PCB type Aux Output AGO 144 Iss.3)

This module provides four mono auxiliary outputs as standard (or two mono outputs and one stereo output). The outputs are derived from the four aux mix busbars and is the mix of signals from group and input modules. These signals can be either 'pre' or 'post' the input and group modules' faders as described in section 4.5.4. The auxiliary signal inputs are amplified by IC2A for aux 1, IC2B for aux 2, IC1B for aux 3 and IC1A for aux 4. An unbalanced insert point option is available for all four 'auxes' after these amplifiers. The signal level of each is set by front panel mount potentiometers RV1, RV2, RV3 and RV4. After further amplification in IC4B, IC4A, IC5B and IC5A the signals are routed to 'AFL' switches (for monitoring on monitor modules MN01P and MN02P via 'PFL' bus) to two meter O/P jack sockets ODD=TIP, EVEN=RING, and via balancing transformers, to the four XLR type output sockets aux 1 to aux 4 on the rear panel of the module.

RV3 is a ganged potentiometer for use in 'Stereo Mode' and is associated with link plug P1 located on the module's pcb. When P1 is set to 'stereo' RV3 becomes a single control for aux 3 and aux 4 so that when a 'stereo' auxiliary send is received from an input or group module both left (aux 3) and right (aux 4) channels can be controlled by 'one' master send level control.

Similarly aux 3 'AFL' switch S3 can be used to send the stereo aux output to the 'PFL' bus. This is achieved by setting link plug P2 (also on the module's pcb) to the 'stereo' mode. When the stereo aux option is used RV4 and S4 (aux 4 level and 'AFL' controls) are redundant. Stereo 'PFL' mix circuits are also situated on this module they being IC3A and IC3B. The inputs to these amplifiers are from terminals 38 and 39 on the edge connector. The source for these amplifiers is any module whose 'PFL' button has been latched in. The outputs for IC3A and IC3B are on terminals 35 and 36. This output can then be picked up by any monitor module if required via the main console busbars.

#### **4.6.9. STEREO MASTER OUTPUT MA02P**

(Figure 19 - MBD 204. Iss.1: PCB Master Output AGO 150. Iss.2)

The way in which the right and left mix signals are derived and routed into this module, via edge connector terminals 1 to 6 shown on the circuit diagram, are described in section 4.5.1. The signals are routed into their respective amplifiers in the manner described in section 4.5.2. according to the processing selected for each programme from an input module. This determines the treatment for each individual mix programme - i.e. active, passive, or neutral - by its routing into the appropriate amplifier circuit, IC1 to IC6, in module MA02P. This output module contains the circuits which control the ducking of passive signals by active ones. The exact ducking characteristics produced by these circuits, as regards depth, attack, and release time, is adjustable by front panel switches S1, S2, and S3 which are in the ducking control circuits. The ducking control circuitry, which enables the active signals to duck the passive, is common to both right and left channels so that active signals in either channel are effective in ducking the passive signals in both channels at the same time. After passing through their respective active, passive, or neutral mix amplifiers IC1 to IC6, all the signals belonging to one channel, left or right, are commoned into one amplifier IC7 (left) or IC11 (right). The signals from the two active amplifiers, IC1 and IC4, are commoned as well into the ducking control circuitry via R82 and R81. This circuitry has the effect of attenuating the outputs of both passive amplifiers, IC3 and IC6, whenever an active signal is fed into it from either channel. This results in the passive inputs to IC7 and IC11 being ducked. The outputs from the neutral amplifiers, IC2 and IC5, are unaffected. The operation of the ducking control circuitry is as follows:

Resistors R81 and R82 connect the left and right active mix amp outputs to the audio sum point at the inverting input of IC13A pin 2 which has negative feedback on pin 2 which acts as a virtual earth summing point so preventing crosstalk between sources. IC13B raises signal level to 0dBm. IC13C inverts the signal and in conjunction with D1 and D2, forms a full wave rectifier so that the DC level at its output is proportional to the peak amplitude of AC signals at its input. Capacitor C52 is charged to the peak amplitude at the rectifier output and provides integration of the varying DC value with a time constant set by the combination C52 and R90 which, for discharge of the capacitor, has a value 100 mSec. The voltage on C52 is compared by IC13D with a fixed positive reference voltage set by RV12. When the DC voltage at pin 12 of IC13D exceeds the threshold, IC13D output swings hard positive. When the input falls below the threshold, IC13D output swings hard negative, D3 restricting negative excursion to 0.6V below ground. RC charging circuits are used to generate the switched characteristics under the control of S2 and S3. IC14A and IC14B are linear voltage followers used to charge capacitors C53 and C54. The DC voltage on C53 will rise to follow IC14A output positive, the charging current through S2 and the selected resistor value which sets the time for C53 to charge, so determining the attack time. When IC14A output falls, D4 conducts and IC14A sinks the excess charge on C53. The positive DC voltage on C53 is passed on to IC14B. The DC voltage on C54 will rise to follow IC14B output positive, the charging current flowing via D6. When IC14B output falls, D6 becomes reversed biased and blocks the discharge of C54 which, therefore, takes place via S3 and the selected resistor value which sets the time for C54 to discharge into the output of IC14B so determining the release time.

The voltage on C54 is the required control signal present only when programme in the active channel exceeds a predetermined threshold and whose time characteristics are under the control of panel selectors S2 and S3. D7, R98, and R99 limit the voltage excursion at the non-inverting input to IC14C.

The output of IC14C is connected, via R100, to the base of transistor Q1 whose emitter goes to the junction of R101 and R102 and also to the inverting input IC14C which provides negative feedback when there is a current through R102.

The collector of Q1 is connected to three LEDs in series LED1, LED2 and LED3 connected to +15 volts. Two of these act on light sensitive resistors, LDR2 and LDR3, which are respectively connected, as potential dividers, across the outputs of the left and right passive amplifiers. The current through Q1, which varies in relation to the active signals present in either channel, illuminates LEDs 2 and 3 accordingly. The resistances of LDR2 and 3 are thus reduced in the presence of active signals to result in the ducking of the passive by attenuation of the outputs of IC3 and IC6.

The amount of attenuation produced, which is the depth of ducking, is altered by switches S1A and S1B which select the value of resistance in series with each LDR so varying the ratio of the potential divider formed by R5 in series with an LDR plus a selected resistance. When there are no active signals, there is no current in Q1 and the LDRs' resistance is very high. For this condition, the attenuation is a minimum being determined by R5 in series with R10. The current through Q1 for a maximum voltage signal in the active path is about 4mA. The LED1 annotated 'System Indicator' is illuminated when there are active signals operating the ducking control circuit. Control circuit response and alignment is described in chapter 5, section 5.3.2.5. Controlled passive signals combine with active and neutral at the inputs of IC7 and IC11.

After the amplifiers IC7 and IC11, the signals in each channel are routed to their respective faders via the edge connector and fader harness. Signals are returned from the fader wipers and fed into the output amplifiers IC10 and IC12. The outputs from these are fed, via transformers, to the XLR type connectors on the rear panel as balanced outputs. Parallel outputs are also taken to pins 33 and 34 of the edge connector for feeding the 'stereo output' busbar for each channel for monitoring as described in section 4.5.5.

The DC supplies, +16 volts, -16 volts, and earth connections with the zener diodes used to stabilise the voltages down to +15 volts and -15 volts for the ducking control amplifiers are shown as from the edge connector terminals with the resistor-capacitor filtering provided.

Insert points at -6dB are an option on this module. A stereo unbalanced meter output signal is available on jack socket SK2. The output of this can be either:-

- i) Console main output
- ii) PFL output
- iii) Console main output interrupted by PFL.

Link plug P1 determines the output available on SK2. This is achieved by:-

- i) Leaving the junction of R131 and R132 'floating' so that RL1 is not energised by any external source on pin 14 (PFL DC). This then allows console main output to be present on SK2. For this P1 should be set in the 'B' position.
- ii) Tying the junction of R131 and R132 to ground so that RL1 is permanently energised. This then only allows 'PFL' output to be present on SK2. For this P1 should be set in the 'C' position.

- iii) Connecting the junction of R131 and R132 terminal 14 on the pcb edge connector. This then allows the relay to 'toggle' as soon as a 'PFL' switch is latched in. The output on SK2 is then console main output interrupted by PFL output. For this P1 should be set in the 'A' position.

A 'pre-ducking' mono output is available on SK1. This signal is used via the interpatch system for clean feed deviation on input modules T01P and SL01/2P as described in 4.5.9.

#### **4.6.10. PPM METER MODULE TYPE ME01**

(Figure 20 - MBD 13 Iss.1: PCB type ME01. Iss.4)

The general use and functions of this module are described in section 4.5.6. to which reference should be made. From the XLR connections on the rear panel, the 1:1 ratio transformers T1, T2, and T3 convert from balanced to unbalanced circuits for the Stereo and Mono inputs which are then fed directly into their respective driver circuits. A driver circuit diagram is given on figure 28.

The stereo channels of figure 20 are also fed into the summing amplifier IC1 whose output may be selected by the 'Mono Select' link located on the module's printed circuit board. This 'mono sum' signal can also be derived via the 'Mono Input' XLR connector. All three inputs, left, right (stereo) and mono are combined via amplifiers IC2A, IC2B; IC2C, IC2D and IC3A, IC3B and fed into another summing amplifier IC3C whose output is taken to the Overload Lamp Driver circuitry of IC3D. This circuit functions in a rather similar manner to other lamp driver circuits as described in section 4.6.1.4. The 'Threshold' control RV3 sets the level at the inverting input, pin 2, of IC3C so that the specified signal level at its non-inverting input, pin 3, produces a positive output from it sufficient at the input to IC3D to turn transistor Q1 on and illuminate the overload lamp. Excessive current, with large overload signals, is prevented by the negative feedback from the collector of Q1 to the inverting input, pin 6, of IC3D.

The module also houses stereo headphone amplifier circuits. A stereo signal can be fed into SK5 via an interpatch lead. The two channels are amplified by IC5 and IC4 whose outputs are then fed to the Headphone Output interpatch socket SK6 for connection to headphone outlets in the console furniture. These amplifiers have fixed gain and are intended for use in conjunction with console monitor module MNO2P.

#### 4.6.11. TALKBACK MODULES

##### 4.6.11.1. TALKBACK MODULE TYPE TB01 (Figure 21, MBD 12 Iss.1: PCB type TB01 Iss.2)

The voice pick-up microphone EM60 is located on the front panel of the module with a row of six push-button selection switches, S1 to S6, below it. The output jack sockets SK2 to SK7, input socket SK9, D-range connector SK1, and the 8-way 'cinch' power connector are all mounted on the rear panel.

The circuit is conveniently considered under three headings:-

- i) Pre-amplifier IC1A.
- ii) Limiter/Output amplifier IC2, Q1, and Q2.
- iii) Selector switch outputs S1-6 and output connectors.

Power is obtained from the console supply via the meterhood harness and SK8. The module requires connection with +16V -16V power, aux, 0v and the local mute bus for full operation.

##### i) Pre-amplifier

Electret-type microphone capsule EM60 is supplied with bias via R1 and R2 and provides a buffered low AC voltage output at V4. Operational amplifier IC1A is a non-inverting amplifier with high input impedance at pin 3 where the output of the microphone is connected. Feedback components R7, R6, C19, and RV1 provide DC and AC negative feedback to stabilise the amplifier and allow variation of gain. C19 produces L.F. roll off by increasing negative feedback into the inverting input of the amplifier at low frequencies. RV1 has a range of approximately 20dB allowing the pre-amp gain to be adjusted for the appropriate sensitivity in the operating conditions used. It is set at the factory for approximately 60dB of gain. The line level unbalanced output of IC1A passes via V4 to the switching contacts of SK9.

##### ii) Limiter/Output Amplifier

The primary of T2 is connected to the tip and ring contacts of SK9. As shown on the circuit, IC1A output is present on the back contacts of SK9 and flows across these to T2 primary. Alternatively, a GPO B type small tip jack plug may be used to inject the insertion point send signal from an M01/2 module into T2 via SK9. This enables the presenter microphone to be used as the talkback voice source when the console is used in 'self-op' situations if desired. When a jack plug is inserted into SK9, its back contacts are opened and the output of IC1A is unused.

Transformer T2 has a 1:1 ratio and provides for balanced to unbalanced input to the limiter circuitry. R27 and R28 form a potential divider to reduce the AC signal amplitude arriving at the active gain reduction elements R9 and Q1. Capacitors C6 and C7 DC isolate the active elements which are biased positively, with respect to ground, by RV2 via R11. Capacitor C8 provides a low impedance path to AC for signals on the source-drain channel of Q1. The action of the active gain reduction elements is as follows:-

Q1 is an in-channel depletion JFET. The source-drain channel is used as a variable resistance element whose value is modulated by the gate bias voltage. When the gate voltage with respect to ground is zero, the channel of the JFET is pinched off and has a high impedance (very much greater than R11). Potential divider R9 and R11 then has its minimum attenuation value. When the gate voltage rises to a positive value with respect to ground the channel is opened and its impedance falls increasing the attenuation across R9. In this way, the amplitude of AC signal arriving at IC2 input via R13 is under the control of a varying voltage applied to Q1 gate via R19. IC2 operational amplifier is of non-inverting type with high input impedance at pin 3 and gain fixed by the feedback network R15, R14, and C10. The gain of IC2 is 33dB and raises the signal from Q1 to line level and provides the circuit voice output for distribution. The output of IC2 is also fed to the base of Q2 via C13 and R22. Q2 and D1 rectify the AC signal whose DC value is stored on C14 which in conjunction with R20 provides the attack-release dynamic characteristics of the limiter. The gate of Q1 is modulated by the varying DC voltage on C14 via R19, hence the channel of Q1 has its resistance varied in response to the changing signal level at IC2 output. The voltage at C14 and JFET gate goes positive as the AC output of IC2 increases in amplitude. The effect of this is to provide a self-compensating system which progressively increases the signal attenuation before IC2 as the input signal amplitude increases. The result is that the gain of the system is non-linear, the output increasing linearly with input below threshold, but in the ratio 1:10 above threshold. RV2 allows the DC potential between the gate and channel of Q1 to be varied. This is necessary to accommodate the pinch-off bias requirements of individual JFETS. The DC voltage derived from the audio signal and applied to the gate, modulates the standing bias set by RV2. The threshold point at which the JFET channel starts to open can be adjusted to the desired maximum output from IC2. Once the threshold is exceeded, IC2 output increases with input in the ratio 1:10 approximately. Feedback components R18 and C12 reduce system distribution caused by non-linearities in Q1. The setting of RV2 determines the limiting characteristics of the circuit, the alignment of which is described in the following section, 4.6.11.1.

The output of IC2 is available at SK7 for interpatching to modules that require a constant (non-switched) source of talkback voice. Module SL01/2P and T01P have interpatch input connectors to receive this signal. A 'daisy-chain' can be created using the second parallel-connected input connector provided on every module designed to use constant talkback audio.

### iii) Selector Switch Outputs and Output Connections

The output of IC2 is connected to selector switch bank 'C' so that, with the operation of any selector switch, the voice signal is fed to its associated output connector. S1 is fed to D-range plug 'SK1' on the rear panel via the transformer T1. This provides a balanced, floating output suitable for routing into another remote console via its own monitor module's input. On operation of switches S2 to S6, the outputs from IC2 go to the 'tip' contact of jack sockets SK2 to SK6 from where connection is made to the inputs of chosen monitor modules by means of interpatch leads. Bank 'D' of the selector switches puts a short circuit across the 'sleeve' and 'case' of the selected jack socket. This results in the other end of the interpatch lead inserted into this socket putting the same short-circuit across the 'sleeve' and 'case' of the input jack socket of the monitor module receiving the patch-cord. The 'case' of the monitor's socket is earthed and its 'sleeve' is connected to the circuit operating the talkback relay in the monitor so that the short-circuit earths the relay circuit and causes the monitor relay to become energised. This enables talkback to replace the normal programme in the monitor module. Bank 'B' of the selector switches puts an earth on the 'local mute' line of the console. This results in the operation of the 'mute' relay in any monitor module which is preselected to respond to the 'local' line. Also the local control relays in the auxiliary module MA01 will be operated if they have been preselected to the 'mute' option.

#### 4.6.11.2. ALIGNMENT

The combined action of RV1 (gain) and RV2 (limiter threshold) enable the voice output of the TB01 module to be tailored for optimum use in the operating area. Each TB01 module is set up at the time of manufacture to provide the required voice output with normal speech at the operator position. The limiter threshold is set for 0dBm on sine wave.

Recalibration of the pre-amplifier gain may be made without alteration of the limiter stage. Subjectively, a heavily limited voice appears louder. Access to gain preset RV1 is obtained by removing the module from its operating position to the top of the meterhood. An instrument screwdriver is needed to adjust RV1.

Maximum gain is the full CW setting

Minimum gain is the full CCW setting

Listen to TB voice via headphones and one of the console monitor outputs. Adjust RV1 for the required sensitivity compared with normal programme at the same level control setting and with talkback not selected.

Adjustments to the limiter threshold RV2 are not necessary under normal operating conditions. If Q1 has been replaced, RV2 must be reset to the conditions shown on the circuit diagram using sine wave tone injected via SK9. When adjusting RV2, the circuit will require a few seconds for DC conditions to stabilise before correct operation is obtained.

Threshold minimum setting (limiting at low level) with RV2 max. CW

Threshold maximum setting (limiting at high level) with RV2 max. CCW

The setting recommended provides maximum protection against electronic overload distortion and the minimum limiter 'pumping' action.

#### 4.6.11.3. TALKBACK MODULE TYPE TB02P

(Figure 29 - MBD 199. Iss.1. Pcb type master talkback AGO 149. Iss.2)

A plug in goose neck microphone is located on the front of the module with two rows of push-button select or switches below it. The top row of six pushbuttons is for use for external connections to monitor modules MN01P and MN02P. The output connections for this are mounted on the rear panel SK1-SK6. SK7 is a continuous talkback output for use with input modules T01P and SL01/2P. The nine lower push-button selector switches are for internal use within the console and allow talkback to be injected directly to the mix buses of the four auxes, four groups and main console output. A low frequency slate tone is also available for use with these nine buttons so that tone bursts can be put on tape between 'takes' as a marker i.e. two bursts for 'take two', three bursts for 'take three', etc. Then when the tape is wound back at high speed high frequency blips are audible between takes. This makes location of 'takes' faster. The slate tone when selected by latching in S17 is mixed with voice talkback.

There are a number of link options available on this module which allow certain conditions to be pre-set. They are as follows:-

##### i) Mute/Dim

The two banks of switches can each be set to either mute or dim local monitor speakers via MN02P independently of each other i.e. one bank can mute while the other only dims. The link plugs for this are P8 (external talkback) and P9 (internal talkback). In the 'A' position the local speakers are muted when a talkback button is pressed, in the 'B' position the speakers are only dimmed.

##### ii) Stereo Aux Option (talkback to internal busses)

As described previously in the manual aux 3 and 4 can be a stereo aux send if required instead of two mono send's, where aux 3 becomes left and aux 4 becomes right. In this mode talkback can be sent to both busses simultaneously from one push-button (aux 3) by setting link plug P7 in the 'A' position. Aux 4 push-button is then redundant. With P7 in the 'B' position aux 3 and aux 4 push-buttons are in the normal mono mode.

### iii) Distant Monitor De-Mute Option

Each of the six external talkback push-buttons has a link plug associated with it P1-P6. This is to allow a 'de-mute' facility to be incorporated if required, from monitor outputs set to 'distant mute' on MN01P or MN02P. This is so that in rehearsal, speakers controlled by MN01P or MN02P can be demuted for talkback purposes without turning microphones off. Each talkback switch can be pre-set independently of each other using the six link plugs P1-P6. In the 'A' position demuting is available. The 'B' position is for normal use.

### Trans Switch

Internal talkback to desk busbars and the demute option can be 'safed' by latching in the trans switch situated at the bottom of the front panel. This is to stop talkback accidentally going out over 'the air'. This function is removable from a 'D' type connector mounted on the back panel of the module (SK8) a voltage free loop from a relay is required for this function and is connected between pins 1 and 2 on the 'D' connector.

Apart from an electronically balanced input from goose neck microphone (IC1A) the circuit function for talkback amplification, limiting and alignment is as described previously for TB01 (component ref numbers will vary). A line level microphone breakpoint is also available on the back panel. Oscillator level adjustment is available by RV3, the nominal level is 0dB.

### 4.6.12. FADER MODULES

(Figure 23 - MBD 27. Iss.2)

The fader modules are of Penny and Giles manufacture, utilising low noise plastic tracks and incorporating 'hop-off' pads (pins 7 and 14 of the 15-way connector) to ensure noise-free connection of the wipers to earth for the 'closed' condition of the faders. A micro-switch is incorporated in all stereo faders. It is operated on the opening of a fader to effect illumination of a 'fader open' warning LED as described for the Mono Mic/Line Input module M01/2P in section 4.6.2. and is also used to trigger muting and remote start circuits.

### .6.13. METERHOOD SUB MONITOR TYPE NHM01P

(Figure 30 - MBD 206. Iss.1. Pcb type meterhood sub monitor AGO 163. Iss.1)

The meterhood sub monitor has ten inputs and is for use as an extension of the consoles main monitors MN01P and MN02P. Its primary function is to monitor the consoles internal 'meter' outputs i.e. auxes, group, PFL, etc via the interpatch system. All inputs and outputs are stereo unbalanced signals. Each input (annotated 'A') has a parallel output (annotated 'B') associated with it to allow the input signal to be 'daisy chained' on to another unit if required.

The first four inputs SK1-SK4 are normally used as the auxiliary inputs. The signals from the auxiliary output module MA01P meter output jacks are in pairs odd=tip, even=ring. To overcome this problem two link plugs P1 and P2 are mounted internally on the pcb. These two link plugs route input signals from SK1-SK4 as follows. In the 'A' position all inputs SK1-SK4 are the same i.e. ten unbalanced stereo inputs.

In the 'B' position the tip and ring are routed separately to individual switches on the front panel. When aux 1 and 2 are to be connected to the MHM01P they should be connected via interpatch to SK1. Then with link plug P1 in the 'B' position aux 1 (tip) is routed to button number one and aux 2 (ring) is routed to button number two. In this mode SK2 is redundant. Similarly with SK3 and SK4 with P2 in the 'B' position aux 3 and 4 are patched into SK3. Aux 3 (tip) is routed to button number three and aux 4 (ring) is routed to button number four. SK4 is now also redundant.

The output's from the four groups meter output jacks can then be patched into SK5, SK6, SK7 and SK8. They in turn come up on switches five to eight. SK9 allows PFL to be brought up as a separate item if required, via meter output on MA02P. SK10 can be used for an external source if required, but the signal must be unbalanced first by transformers and as the input jacks sleeves are not grounded (to avoid hum loops internally to the console) one side of the transformers must be connected to console ground.

Two post selector stereo unbalanced outputs are available on the back panel SK11A and SK11B. These are connected via 'interpatch leads' to main monitor modules MN01P and MN02P external inputs so that the MHM01P selected input can be brought up on the main console monitoring system. SK12 and SK13 are two individual talkback inputs that only come up on the internal speaker in the MHM01P. These signals are not present on the sub monitors interpatch output.

#### Circuit Description

Input signals are routed to the ten way interlocking selector bank, the output of which is connected to a number of parallel circuits:-

- i) Monitor outputs SK11A and SK11B.
- ii) A flying lead connector plug for connection to meter mother board.
- iii) A summing amplifier IC1B for conversion to mono for monitoring purposes on internal speaker.

The output of IC1B is routed via front panel mount volume control VR1A to a talkback change over relay RL1, then via mute relay RL2 to a power amplifier IC2 for amplification to a suitable level to drive the internal loudspeaker.

The two talkback inputs from SK12 and SK13 are summed together by IC1A, the output of this amplifier is then connected to the normally open contacts of talkback relay RL1. When the ring of SK12 and/or SK13 is connected to ground RL1 is energised by the action of Q3 and Q4 as described in 4.5.11. When talkback is received it totally interrupts pre-selected input signal on the internal loudspeaker. As talkback input and pre-selected input have two separate volume controls it is possible to turn programme down yet still receive talkback if required. Mute relay RL2 totally mutes the internal monitor speaker when a local mute is operated on the console, it is energised by the action of Q1 and Q2 and is connected to the main console local mute bus by the 8 way cinch power connector situated on the back panel.

#### 4.6.13.1. THE METER MOTHER BOARD (Figure 31 - MBD 207. Iss.1)

This board incorporates an overload peak lamp drive circuit plus the two PPM drive IC's required to drive a stereo meter. (For PPM alignment refer to Figure 28.) The left and right input signals are rectified by IC1A and IC1B, the outputs of which are wire-ORed to pin 12 of IC1D. When the input on pin 12 of IC1D rises above the preset input on pin 13 of IC1D (set by RV2) IC1D gives an output on pin 14. This output turns on Q1 causing the lamp to illuminate. RV2 is set so that the lamp starts to glow at PPM 5 1/2. IC1C is not used in this application.

#### 4.6.14. GROUP OUTPUT TYPE G01/2P (Figure 27 - MBD 196. Iss.1. Pcb type group output AGO 143. Iss.3)

The channel inputs are pre-selected on pcb from edge connector terminal pins. All four groups are the same units apart from the fixed internal link settings. After pre-selection the input is routed to virtual earth mix amplifiers, IC1A and IC2A. Phase correction and level adjustment for each channel is achieved in the next stage of amplification by IC1B and IC2B. Insertion point and Eq options are available at this point if required. At the input to pre fader buffer amplifiers IC3A and IC3B is a mono switch S5. This allows for the monoing up of stereo signals if required. The outputs of IC3A and IC3B go to a number of parallel circuits:-

- i) Terminals 26 and 28 of the edge connector for connection to the end of the fader.
- ii) To the 'PFL' switch S1 for routing to PFL mix bus, edge connector numbers 38 and 39.
- iii) To IC4B where the signal is summed to make a mono 'pre fader' send for the auxes.
- iv) To link plug P3 'pre fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux 4 becomes right, instead of two mono sends from IC4B.

The signal routed to terminals 26 and 28 of the edge connector (end of fader) are returned from the fader wipers on terminals 25 and 29 to the 'post fader' amplifiers IC5A and IC5B. The output from these amplifiers are also sent to a number of parallel circuits:-

- i) To main programme select switch S3 and then onto the 'ducking' switch S2. For routing directly to the ducking circuits in the master output module MA02P for precessing as described in section 4.5.2.
- ii) To balancing transformers T1 and T2 so that a balance group output (regardless of 'PGM' selector switch mode) is available via XLR type connectors on the back of the module.
- iii) To meter output jack J1 for interpatch to MHM01P.
- iv) To IC4A where the signal is summed to make a mono 'post fader' send for the auxes.
- v) To link plug P2 'post fader' stereo option for aux 3 and 4 where aux 3 becomes left and aux becomes right, instead of two mono sends from IC4A.

PFL switch S1 and fader open LED drive circuits are as described in section 4.6.2. mono mic/line input.

**CHAPTER 5**  
**M A I N T E N A N C E**

## CHAPTER 5    M A I N T E N A N C E

### 5.1. GENERAL ATTENTION

The equipment should be kept clean and dust free to minimise any possibility of malfunction due to dirty electrical contacts. The edge connectors used have gold-plated mating contacts and so should not require any cleaning in normal use. Relays are of the enclosed reed type and so should prove reliable in operation over long periods without attention. The mahogany trim surrounding the main framework of the console will benefit from the occasional application of a good quality furniture polish. The front panel control knobs are of plastic material and care should be taken not to use chemical cleaners, such as carbon tetrachloride, which might damage either them or stain front panels themselves which are double-anodised aluminium with anodised annotations. A suitable cleaning agent for these parts is propyl alcohol.

### 5.2. ROUTINE SERVICING

The constructional features of the console, together with assembly details of both meterhood and channel modules, are described in chapter 3. Reference should be made to this chapter to become familiar with the general layout of the console before attempting to replace any component or service any module.

#### **5.2.1. REMOVAL AND REPLACEMENT OF MODULES**

(refer to figure 2)

To remove or replace a module in the console, undo the rear cover of the console by turning each of its 'camlock' fasteners a quarter turn counter-clockwise and remove the cover. Disconnect all plugs and sockets from the rear panel of the module and make sure its transit retaining screw, located at the bottom rear of each module, has been removed. If not, remove it. Release the panel fixing screw at each end of the front panel. Grasp the module from the front of the console by the handle provided at the upper end of its front panel and also grip a control knob at its lower end. Using a rocking motion towards and away from the front of the console, free the module from its edge connector socket. Withdraw it straight out from its position in the console.

To replace a module, first locate the edge of its printed circuit card in the guide fastened to the inside front of the console frame. Lower the module into position, keeping its card positioned in the front guide. Note that the lower part of the console frame is formed into a rear guide bar covered by a foam strip. Make sure that the rear panel of the module clears this by keeping the module well towards the front of the console when lowering it. The card will then locate into its connector socket. Exert a firm pressure on the module about a third of the way up its panel to bed it home and replace the two front panel retaining screws. Since incorrect insertion of a module may cause the edge connectors to mis-mate and apply damaging voltages, it is recommended that power is switched off prior to module replacement until sufficient confidence in correctly carrying out this procedure is gained.

### 5.2.2. ASSEMBLY DETAILS OF MODULES

The assembly details of a module housed in the meterhood are shown in figure 3. All units in the meterhood part of the console are constructed in a similar fashion. The front and rear panels of the unit are fastened to flanges on its two side-plates by means of ten GKN 6AB 'pozidriv' screws which are held in position by 'spire' captive nuts clipped on to the flanges. The main printed circuit board (pcb) is mounted on brackets screwed both to the side-plates and the rear panel. The pins of jack sockets which are mounted on the rear panel are also soldered to this pcb. To obtain free access to the main pcb, withdraw all screws holding the side-plates to the rear panels using a No.1 point 'pozidriv' screwdriver. Also withdraw the screws holding the brackets which support the main pcb from the side-plates only. This will allow the front panel, still attached to the side-plates, to be moved. The main pcb will still be attached to the rear panel both by its brackets and the soldered pins of the jack sockets. The front panel and side-plates are now free within the constraints of any wiring between components mounted on them (e.g. meters) and the main pcb. This wiring is sufficiently long to allow an adequate access separation without the necessity of unsoldering.

All channel modules are constructed in the same basic fashion from three main parts, as illustrated in figure 4. A U-shaped front panel, constructed from 16 swg alloy, carries operating controls and indicators also brackets by which the main printed circuit board is mounted on to the front panel. Module front panel legend details are applied to the metal by double anodising and the result is permanent. Some of the components which are mounted on the front panel have their terminals soldered into the main pcb which provides additional anchoring between board and panel. A second L-shaped metal panel, constructed from 16 swg steel, is hinged on to the front panel by two M3 bolts and self-locking nuts. This second metal panel normally forms the rear panel of the plugged-in unit and carries the status-setting switches and cable connectors for external electrical interfacing.

It also carries transformers and other items of optional circuitry when these are called for. The rear panel is screen-printed with details of connector functions and module type. The two panels are kept in their normal right-angled configuration by an M3 countersunk screw inserted into a hankbush located on one of the flanges of the front panel.

When the unit is taken out of the console for servicing, the two metal panels can be opened out into a straight line configuration for better access to its electrical components. The method of doing this is illustrated in figure 4. Withdraw the M3 screw from the hankbush on the left front panel side flange and open the two panels outwards until they are in line. Lock them in this service configuration by inserting a GKN 6AB x 1/2" pan head screw through the two panels as indicated in figure 4. Note that this screw is of the same type as those used through the front panel of the module to retain it in its place when in the console.

The terminals of potentiometers mounted on front panels are also soldered on to the pcbs and the pcb is also fastened to the front panel by brackets (see figure 4). To replace a potentiometer, first separate the pcb from the front panel. Release all those components from the front panel whose pin connections are soldered into the pcb. To release a potentiometer, take off the top cap on its control knob and undo the collet tightening screw until the knob is loose enough on the shaft to be removed. Removal of the knob exposes the potentiometer fixing nut. Undo and remove this, so releasing the potentiometer from the front panel. When all such components have been released, undo the bracket fixing screws and separate the pcb from the front panel with the components still soldered to it. A faulty potentiometer can now be unsoldered and replaced.

Switches and jack sockets are mounted in a way similar to potentiometers, fastened to panels and soldered to pcbs. The covers of push-buttons are removable from the front of the panel so allowing for easy replacement of the lamps contained in them. A piece of rubber sleeving, 3 to 4mm bore diameter maybe useful as an aid to their removal.

### 5.2.3. CALIBRATION CARD

The calibration card is used to facilitate the line-up of modules. It consists of a male-type pcb edge connector so that it can be plugged into a fixed edge connector in the console mainframe. Close tolerance value resistors are used on the calibration card so that a signal can be injected on to the audio mixing busbars.

**NOTE** IC amplifiers using the inverting terminal as the signal input results in a summing mode at the input terminal where signal levels can not reliably be detected as voltages.

### **5.3. OPERATIONAL SERVICING**

The mixing console will maintain its specified performance over long periods without the need of any adjustment or alignment unless some specific malfunction should develop due to a faulty component. In order to check its performance at any given time and to ensure that its individual modules are functioning correctly, a specified service procedure is described in this section. Alignment commences with ascertaining that the meter module ME01 is functioning correctly and calibrating it if necessary. It can then be used in further adjustments and checks of other modules proceeding with the alignment of the Stereo Master Output module MA02P and working back through the system to the input modules, Mono Mic/Line M01/2P, Stereo Line Input S01/2P and Group G01/2P.

#### **5.3.1. METER CALIBRATION - METER MODULE ME01** (Figure 20 - MBD 13. Iss.2: PCB type ME01. Iss.4)

In order to calibrate it, the meter module should be removed from its normal position in the meterhood and placed on the top of the console. This can be done by removing the cable connectors from its rear panel and undoing the screws retaining it in position in the meterhood. When positioned on the top of the console, the meter module is removed from the proximity of the steel tray running underneath the modules housed in the meterhood part of the console. In order to retain the calibration accuracy when the module is returned to its normal location within the meterhood, it is necessary to place a suitable 16 swg steel panel underneath the module when it is placed on top of the console. This simulates the effect of the meterhood tray while the module is being calibrated. This procedure is necessary for the highest accuracy, but may be omitted if errors in the region of 0.25dB are tolerable.

The locations of the five individual PPM amplifier driver circuits within the module are shown on figure 20. Each driver has potentiometer adjusters which are accessible from the top of the module. The positions of the adjusters within each driver and their locations in the driver circuit are shown on figure 28.

##### **5.3.1.1. STEREO METER PPM DRIVERS**

Follow the calibration procedures as described on figure 28. A 1kHz input signal at the various specified levels on this drawing should be applied to each channel in turn using the XLR input connectors on the rear panel of the module. Adjust the appropriate potentiometer as described to obtain the required meter reading.

##### **5.3.1.2. MONO METER PPM DRIVER**

Set the Mono/Sum link in the meter module to 'mono'. Calibrate the mono meter, following the procedure described, using inputs at the specified levels into the 'Mono' XLR input connector SK3.

In addition to calibration of the mono meter, the individual signal levels of the left and right channels need to be adjusted to ensure that there is equal contribution from each channel to the 'Mono Sum'.

When the mono meter has been calibrated, the mono sum compensation adjusters, RV1 and RV2 (shown on figure 20), should be preset. They are located on the main pcb of the meter module ME01 and accessible from beneath the rear of the module through holes in the pcb provided for the purpose.

Set the Mono/Sum link to 'Sum'. Inject a 1kHz signal at a level of 0dBm into the left channel input socket SK1. Adjust RV1 to give a mono meter indication of -6dBm. Clockwise rotation of RV1, viewed from above the module, increases the gain of the inverting mono sum amplifier IC1 to give a higher reading on the meter.

Disconnect the signal input from SK1 and transfer to the right channel input SK2 at the same level. Adjust RV2 for a reading of -6dBm on the meter.

Finally, set the Mono/Sum link to 'Mono'. Inject a 1kHz signal at a level of 0dBm into both of the stereo inputs at the same time. Check that all three meter movements, the two stereo and the one mono, indicate the same level of 0dBm.

#### 5.3.1.3. OVERLOAD INDICATOR

The signal level at which the overload lamp illuminates is preset by adjustment of RV3, shown on figure 20. This preset is located on the module's main pcb with access to it from beneath via a hole provided.

Inject 1kHz at a level of +9dBm into the XLR input connection SK1. Rotate RV3 from fully clockwise to counter-clockwise, viewed from above the module, until the overload lamp just illuminates. Check that the lamp extinguishes when the signal input level is reduced by about a 1/4 to 1/2 dB. A final setting of RV3 should be made with a music programme input. This allows for differences between the time-integration response circuits in the meter amplifiers and the overload sensor circuit. The recommended setting for users in the United Kingdom, where normal operating level is 0dBm (PPM 4), is for an overload indication at PPM 6 with normal programme material.

#### 5.3.1.4. MONITOR METER PPM DRIVER

Inject a 1kHz signal into the interpatch socket SK4 shown on figure 20. Set the signal level in turn to those specified and adjust the appropriate potentiometer in the driver amplifier to obtain the correct meter reading as shown on figure 28. Note that the left channel input at SK4 is between 'tip' and 'sleeve' and the right is between 'ring' and 'sleeve'. The positions of the left and right driver amplifiers for the monitor meter are shown in figure 20.

### 5.3.2. STEREO MASTER OUTPUT MODULE MA02P

There are eleven potentiometers in this module which are used to preset the gain of the audio stages. They are correctly set and locked before the module is despatched and should not require readjustment over a long period of time, unless some component failure (after the module has been put into service), should make it necessary. In this event, or after some alteration in resistor values due to ageing, realignment may be required.

Remove an input module from the console, plug the calibration card in the edge connector from which the module has been removed (see section 5.2.3.). The card permits simultaneous inputs to both left and right channels 'neutral' 'passive' or 'active' circuits. It incorporates close tolerance (less than 2%) resistors to which the input test signals should be applied. These resistors simulate the resistors in the output lines of the input modules hence, after setting-up as described in the following, the actual signal level as from each individual input module can differ only slightly due to a possible small difference in value between the actual resistors of the input modules and the resistors on the card used for calibration.

The following setting-up procedures apply whether or not Insertion Point options are included since these have unity gain and will not, therefore, affect test levels. If faders are fitted, they should be set to maximum gain in which condition they will not affect test readings.

#### 5.3.2.1. MAIN MIXER AMPLIFIERS (Module MA02P)

Each of these six amplifiers IC1 to IC6 needs checking for gain and readjustment if necessary. The test procedure is the same for each amplifier.

- i) Inject an AC signal of 1kHz at a level of 0dBm into the resistors on the calibration card that feed edge connector terminals one and four (active input).
- ii) Connect an AC volt meter to TP1 associated with right active amplifier and adjust RV7 'associated with IC1' for a reading of -6dBm  $\pm$ 0.1dB on the AC volt meter.
- iii) Connect ac volt meter to TP4 associated with left active amplifier and adjust RV3 'associated with IC4' for a reading of -6dBm  $\pm$ 0.1dB on the ac volt meter.

Repeat the above procedure for each pair of 'Neutral' and 'Passive' main mix amplifiers in turn as follows using the same reference levels:-

- iv) Inject signal on to the resistors that feed edge connector terminals two and five (neutral input).
- v) Probe TP2 and adjust RV8.
- vi) Probe TP5 and adjust RV2.
- vii) Inject signal on to the resistors that feed edge connector terminals three and six (passive input).
- viii) Probe TP3 and adjust RV9.
- ix) Probe TP6 and adjust RV1.

#### 5.3.2.2. PREFADER AMPLIFIERS

These are IC7 and IC11 on the circuit diagram figure 19. Proceed as follows:

- i) Ensure procedure 5.3.2.1 has been carried out.
- ii) Inject AC signal of 1kHz at a level of 0dBm into resistors that feed edge connector terminals two and five (neutral input).
- iii) Probe TP7 (left channel) and adjust RV4 for a level of -6dBm +-0.1dB.
- iv) Inject in turn on active inputs (pins 1 and 3) and passive inputs (pins 3 and 6) and observe any change in levels.
- v) Readjust RV4 to obtain minimum change of signal level at TP7 when signal is injected into the three different inputs 'Active', 'Passive', and 'Neutral'.
- vi) Transfer probe to TP8 (right channel) and repeat above now adjusting RV10.

On completion of above, the signal levels at TP7 and TP8 should be the same via any of the six source amplifiers.

### 5.3.2.3. OUTPUT AMPLIFIERS

These are IC10 and IC12 on figure 19. Each is adjusted for a gain of +6dB by presets RV5 and RV11 as follows:-

- i) Ensure preceding procedures 5.3.2.1 and 5.3.2.2 have been carried out.
- ii) Inject 1kHz signal at level of 0dBm into cc on a input, 'Active', 'Neutral' or 'Passive'.
- iii) Probe output at junction of R109 and V9.
- iv) Adjust RV5 for output signal level of 0dBm.
- v) Transfer probe to junction of R110 and V11.
- vi) Adjust RV11 for output signal level of 0dBm.

Check that overall gain from the input to the cc to the output at either channel output is 0dB  $\pm$  0.2dB. This completes the setting-up of the stereo path.

### 5.3.2.4. MONO AMPLIFIERS

These are IC8 and IC9. Their combined gain is set to 0dB by means of RV6. Their output at SK1 is the mono sum of the right and left channels and if, for any reason, there are signals in only one of the channels, their output will be 6dB lower. Note that a test signal via the cc injects the signals into both channels at the same time.

Proceed as follows:-

- i) Ensure preceding procedure 5.3.2.1 has been carried out.
- ii) Inject 1kHz signal at a level of 0dBm into cc at any input, 'Active', 'Neutral', or 'Passive'.
- iii) Probe TP9 and adjust RV6 for a level of 0dBm.

### 5.3.2.5. DUCKING CIRCUITS

These comprise the circuitry associated with IC13A to IC13D and IC14A to IC14C. They produce the effects described in sections 4.5.2 and 4.6.9, the precise characteristics of which are determined first by the presetting of RV12, 'Set Threshold' control, and then by the selected operational settings of rotary switches S1, S2, and S3. To preset RV12, proceed as follows:

- i) Ensure preceding procedure 5.3.2.1 has been carried out.
- ii) Inject 1kHz input at level of -4dBm into cc 'Active' input (giving level of -10dBm at TP1 or TP4 as shown on circuit diagram).
- iii) Set RV12 fully clockwise.
- iv) Connect a high-impedance DC voltmeter between the junction of R107 and D3 (pin 3 of IC14A) and signal earth.
- v) Lower the signal level at the cc input below -4dBm and then raise it to above this level, observing the voltage level at R107 and D3. This voltage will switch from approximately -0.6 volt to about +13 volts at some point.
- vi) Repeat procedure (v) and adjust RV12 until the voltage switching transition at R107 and D3 occurs when the input signal level to the cc is -4dBm.
- vii) After presetting RV12, check that the LED 1 (on figure 19) illuminates when the input to cc is above -4dBm. This corresponds to the control current passing through LED1 and LED3 which are in series with the indicating LED1.

### 5.3.3. IN-SERVICE TRIMMING

Over a period of time, due to ageing of components, temperature drift, and vibration, a small drift of alignment in the audio path may become discernible. Provided that performance remains satisfactory in respect of noise, distortion, and bandwidth, it is permissible to make a small correction of up to  $\pm 0.5$ dB in stereo output gain and balance by means of the adjuster in the MA02P module. If the console Monitor PPM meters are accurately calibrated (see section 5.3.1) then these can be used as a reference.

Checks can be made by feeding a 1kHz test signal into any input module whose 'Pan' and 'Balance' controls are set to their normal central positions. The output signal from this module is fed to MA02P. Switching the signal from the input module between 'Active', 'Neutral', and 'Passive' will reveal any error in the gain and left-right balance of the stages in MA02P. This will be shown on the monitor meters which should be set to show console stereo output. Any small error can then be corrected by the appropriate control in the output MA02P module.

For example, if comparison of gain between 'Active', 'Passive', and 'Neutral' is correct for each stereo channel, but one output is above the other for all three modes, then correction can be made by adjusting either RV5 or RV11.

If comparison of gain to stereo output reveals that left-right stereo balance is correct for both 'Active' and 'Neutral' modes, but the 'Passive' has a consistently low gain on one stereo channel, then RV1 or RV9 in MA02P can be adjusted to trim out the error.

Note that the presets available in the Output Module MA02P cannot be used to correct differences in the performance of individual input modules. Only small errors which are present with all input sources can be dealt with by the MA02P preset adjusters.

Now that the output module, MA02P, has been correctly set up, individual input modules can now be lined up as follows:-

#### AUX OUTPUT Figure 18

No alignment necessary.

#### STEREO INPUT S01/2P Figure 13 (No post fader gain)

Set gain and balance controls to their central position, fader to the top and if Eq fitted push Eq cut switch. Select programme output and set ducking to neutral. Inject 0dB 1kHz into both left and right inputs then adjust RV3 and RV4 until 0dB is at the output of the master output module.

#### GROUP OUTPUT G01/2P Figure 27 (No post fader gain)

Deselect PGM output on stereo input PCB. Route instead to group to be aligned. Select PGM on group module and set ducking to neutral, fader to the top and if Eq fitted push Eq cut switch. Adjust RV1 and RV2 for 0dB at output of master output module.

#### MIC LINE/INPUT M01/2P Figure 12 (No post fader gain)

Set gain and pan controls to their central position. Fader to the top and select line input, if Eq fitted push Eq cut switch, and inject 1kHz 0dB into the line input socket. Select PGM switch and set ducking to neutral then adjust RV1 and RV3 for 0dB at output of master output module.

#### TELEPHONE INPUT T01P Figure 14 (No post fader gain)

Set gain and pan controls to their central position, fader to the top, and inject 1kHz 0dB into input of module. Select PGM switch and set ducking to neutral then adjust RV5 and RV6 for 0dB at output of master output module.

#### 10dB POST FADER GAIN

In this case each input instead of being routed to main output should have its PFL button selected. Then by monitoring PFL output on the meter output socket of the master output module each modules presets should be adjusted for 0dB at this meter O/P point.

MONITOR MN01P Figure 16

No alignment necessary.

MONITOR MN02P Figure 17

This has four presets on it, two for PFL and two for desk output. Measuring on meter output of module select desk output (button 7) and with 0dB on desk output adjust RV3 and RV4 for 0dB. With input module sending 0dB down PFL buss select any auto PFL switch on monitor and then adjust RV5 and RV6 for 0dB on meter output.

CLEAN FEED

There are two methods of obtaining a clean feed on this desk:-

i) Clean feed mix minus

This is set up by injecting a 1kHz 0dB signal into the input of channel to be aligned (T01P or SL01/2P). The fader should be set to normal operation level and the modules output should be routed directly to master output module MA02P via 'PGM' switch. (Check interpatch has been connected from MA02P mono output to input channels mono input.)

On a T01P module P7 should be set in the 'A' position and P8 in the 'A' position. RV7 and RV8 are then adjusted for minimum output on the comm's O/P socket.

On the SL01/2P P3 should be set in the 'B' position and P2 in the 'B' position, P5 in the 'B' position and P1 in the 'B' position. RV1 and RV2 are then adjusted for minimum output on the comm's O/P socket.

**NOTE** - With this method if an input is routed via a group, a clean feed is only obtained when the group fader is up.

ii) Using auxes to set up clean feed

This is done by turning auxes up on group modules and input modules as required.

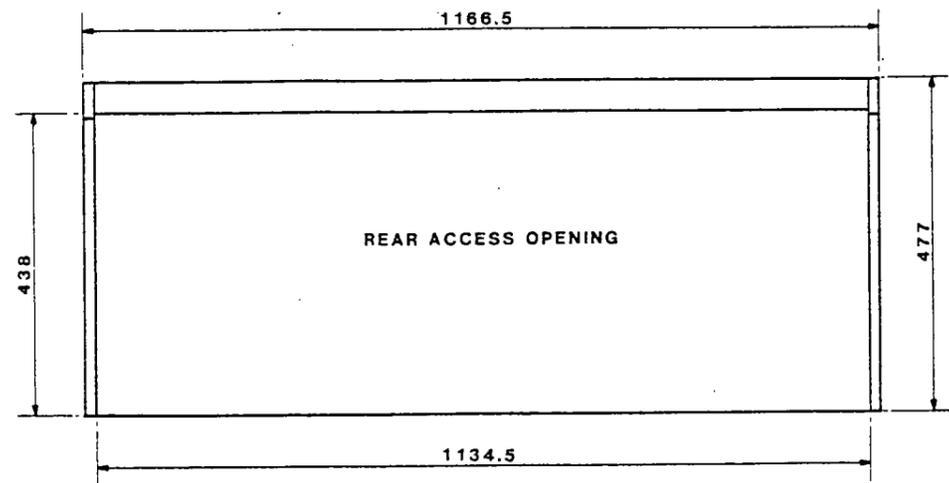
If for example two phones are routed to group 1 then aux 1 and 2 are turned up on the other three groups (post fader). On phone module 1 aux 1 is turned up and on phone module 2 aux 2 is turned up (both post fader).

The aux outputs (via their meter O/P) are then patched along to the phone modules 'Mono' inputs. On phone module 1 link plug P7 is set to 'B' and link plug 8 is set to 'B'. Then aux 2 output is used as a clean feed for phone module 1. On phone module 2 link plug P7 is set to 'A' and link plug P8 is set to 'B'. This time aux 1 is used as a clean feed for phone module 2.

**NOTE** - P7 selects either tip (aux 1) or ring (aux 2) on the mono input jack, the aux output has been patched into. P8 removes clean feed mix minus signal derived in module.

An SL01/2P module can be set up in the same fashion, refer to circuit diagram for link plug options.

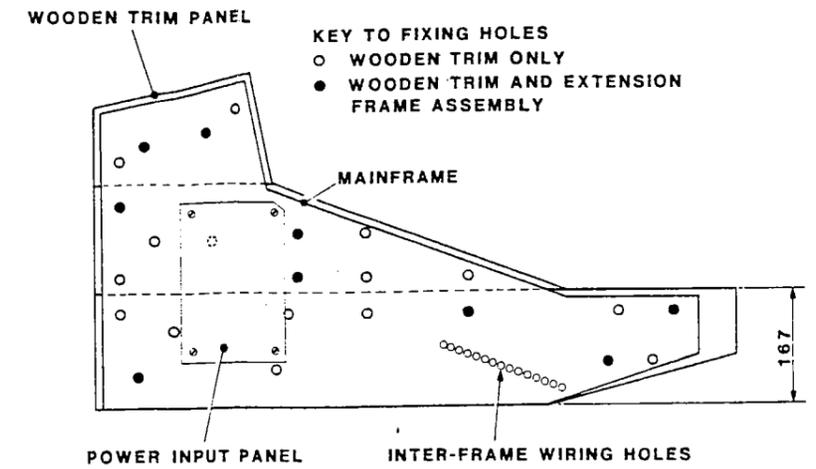




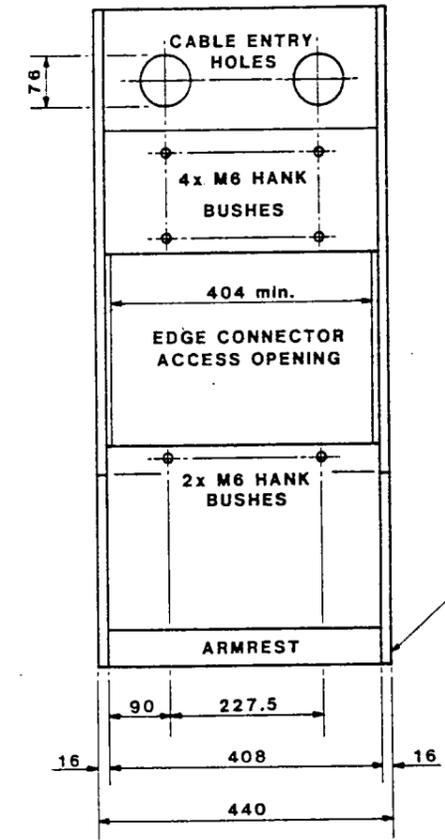
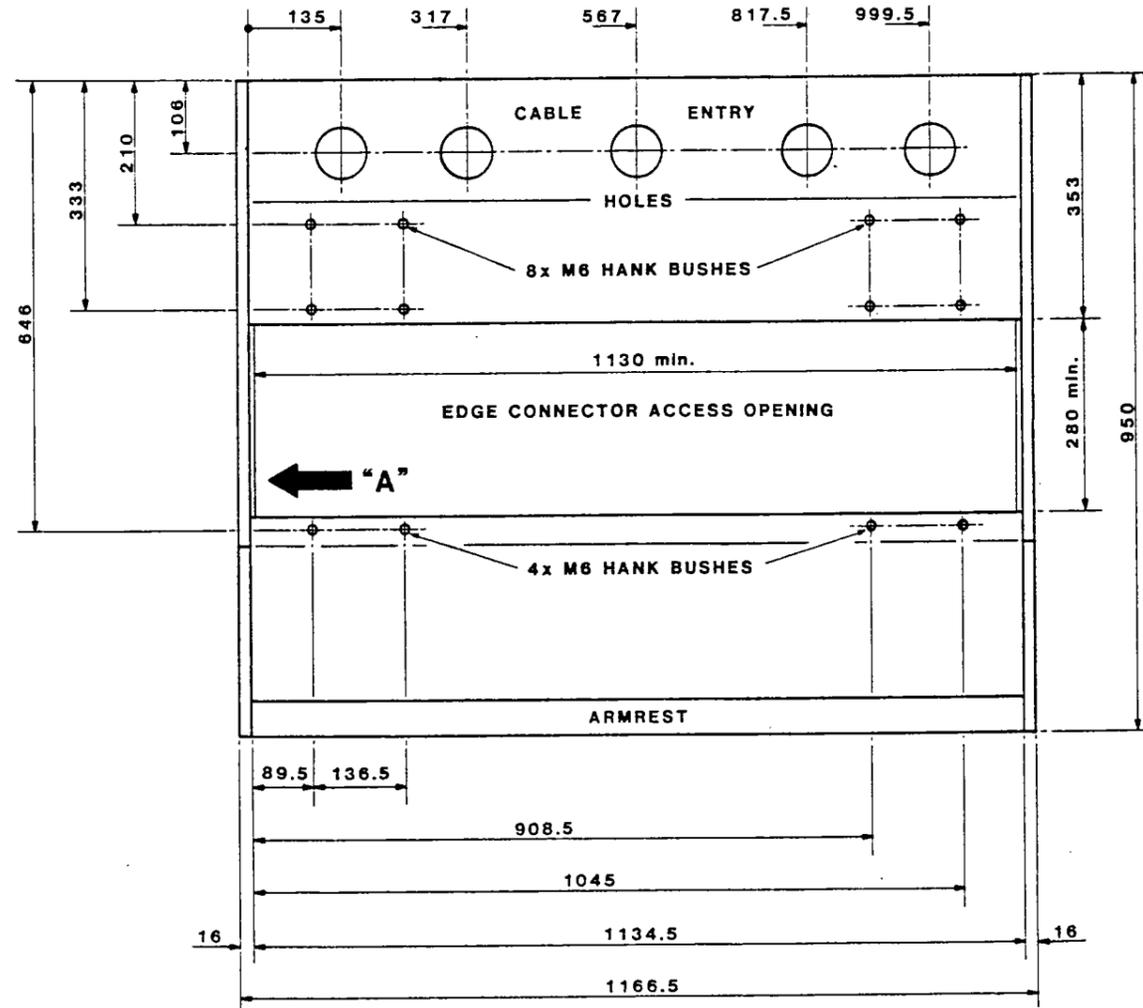
MAINFRAME



EXTENSION FRAME  
&  
SMALL CONSOLE



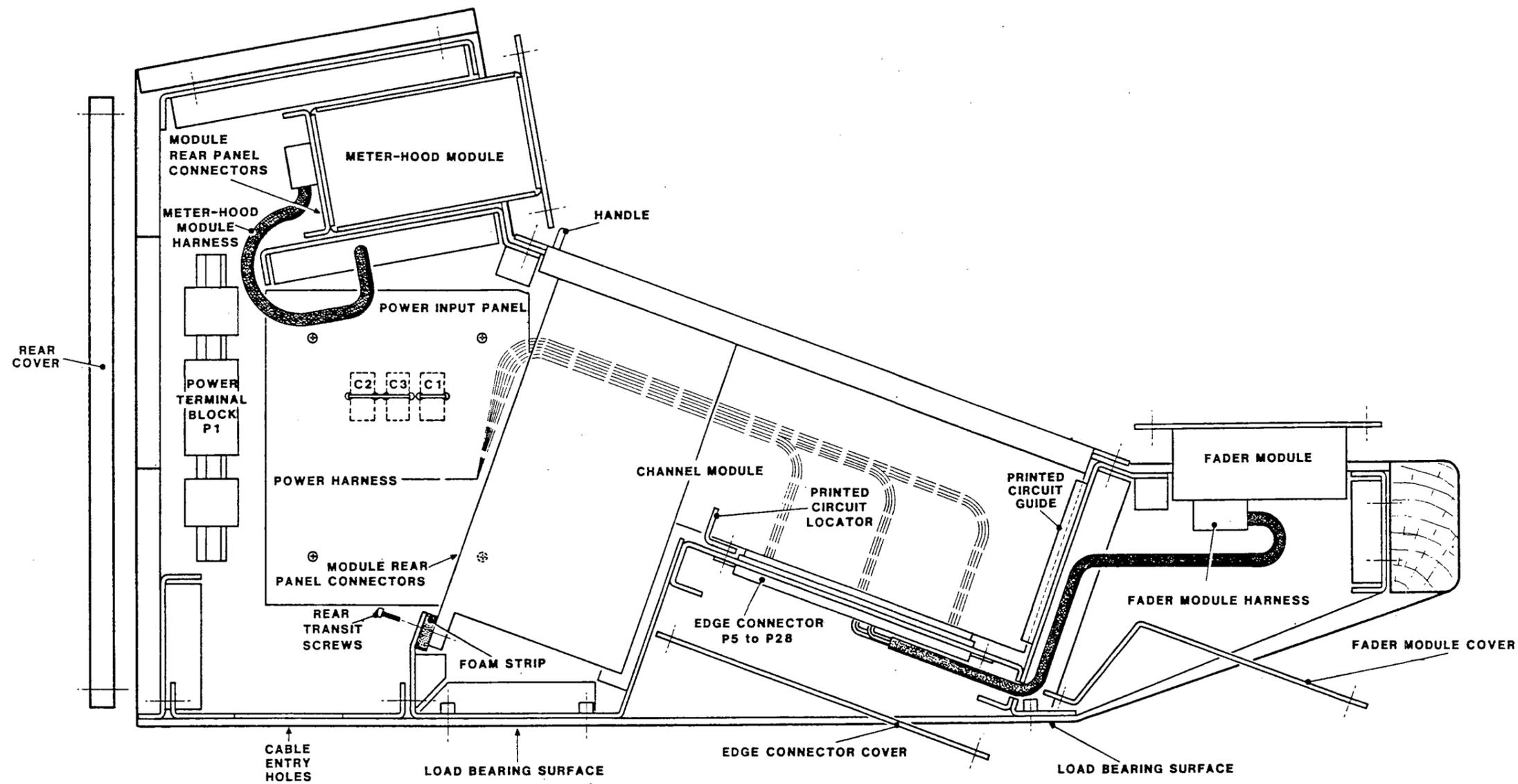
VIEW ON ARROW "A"



DIMENSIONS  
ARE IN  
MILLIMETRES

WOODEN TRIM PANEL

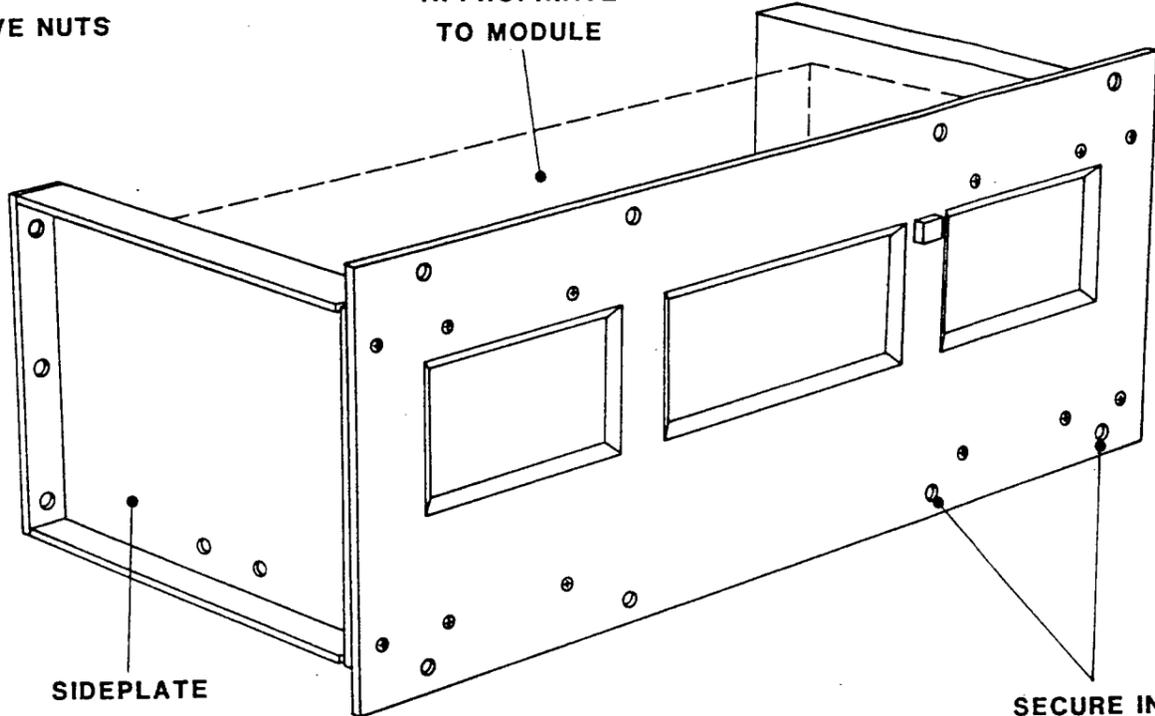
INSTALLATION OF CONSOLE
DRAWING No MBD 43 Iss.1
mbi
FIG 1



CONSOLE CONSTRUCTION	
DRAWING No MBD 44 Iss.1	
mbi	FIG 2

SPIRE CAPTIVE NUTS

CIRCUITRY  
APPROPRIATE  
TO MODULE

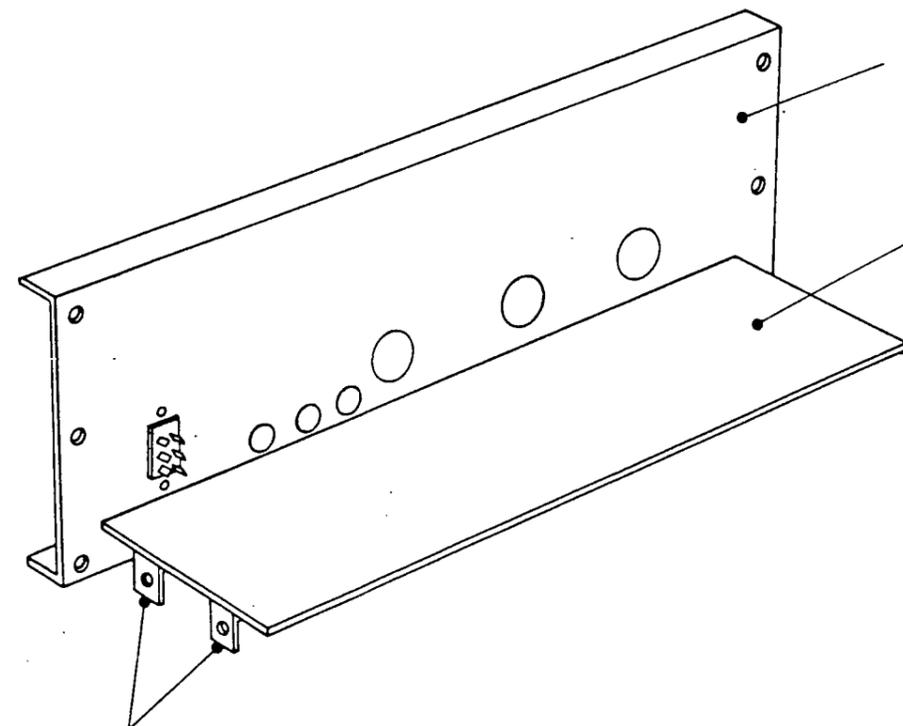


SIDEPLATE

SECURE IN CONSOLE

REAR PANEL

MAIN PRINTED  
CIRCUIT BOARD



FIXING BRACKETS  
TO SIDEPLATES

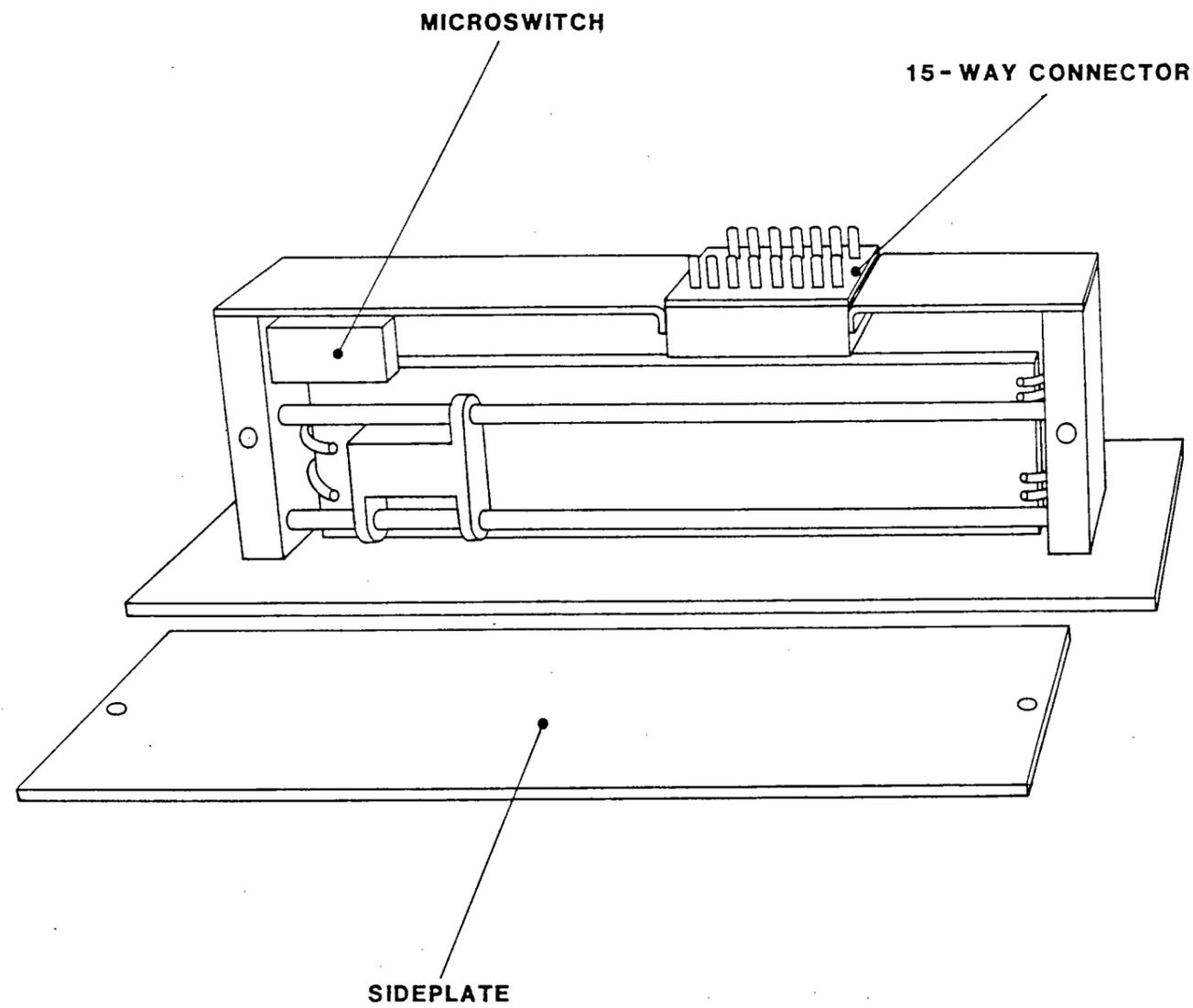
METERHOOD MODULE ASSEMBLY

DRAWING No MBD 45 Iss.1

**mbi**

FIG 3



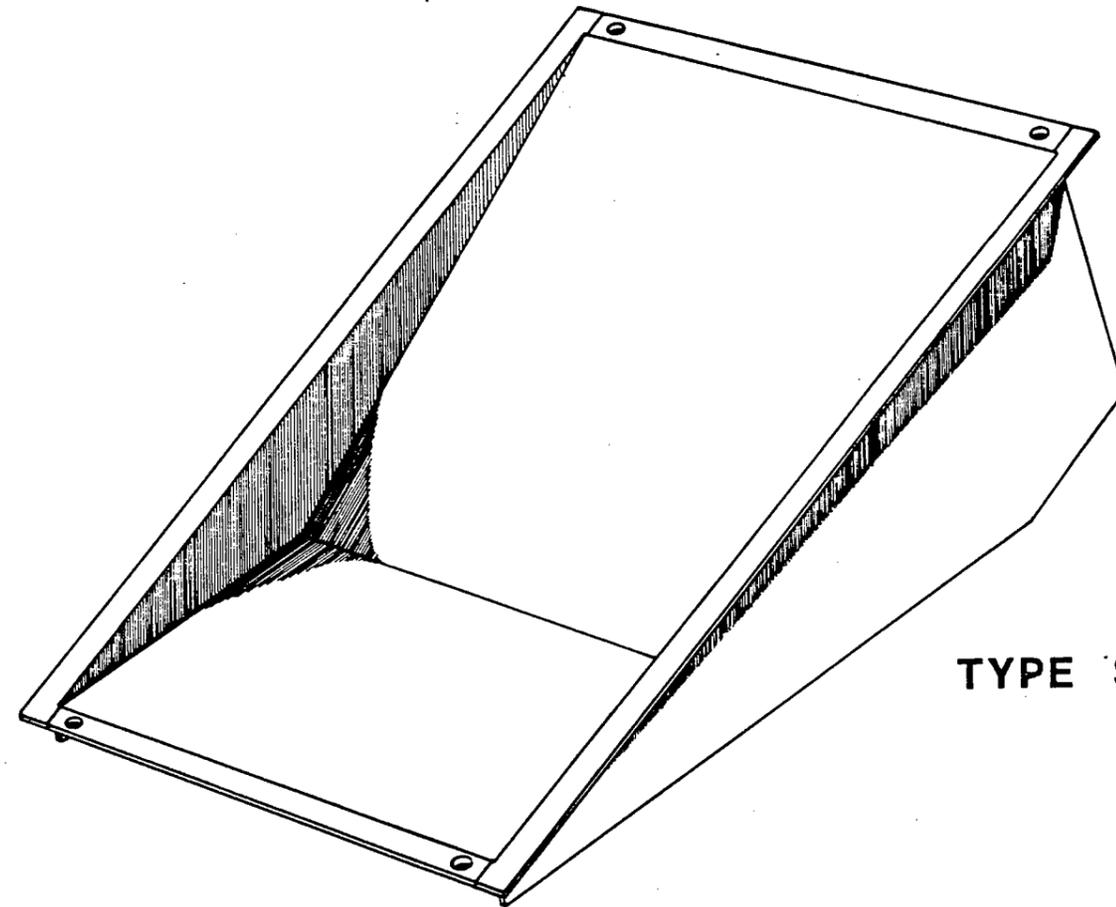


FADER MODULE ASSEMBLY

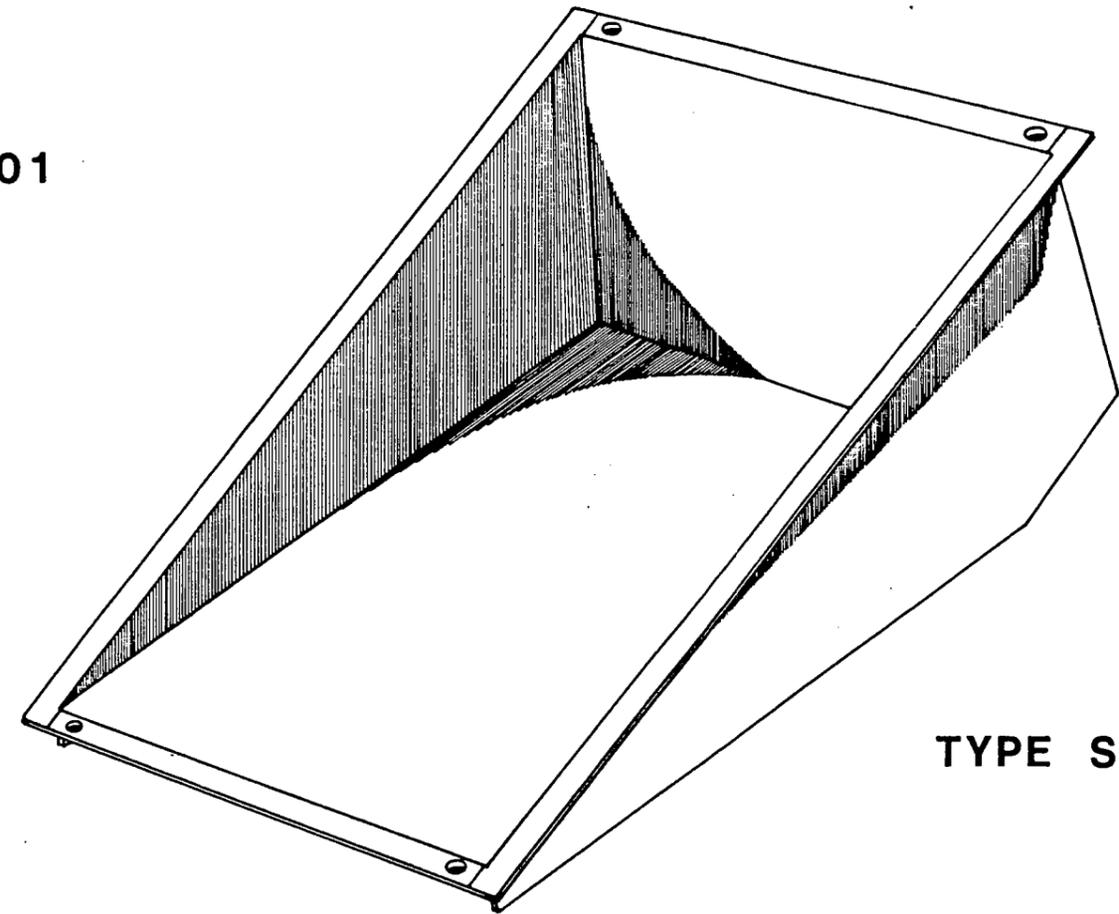
DRAWING No MBD 47 Iss.1

**mbi**

FIG 5



TYPE SS01



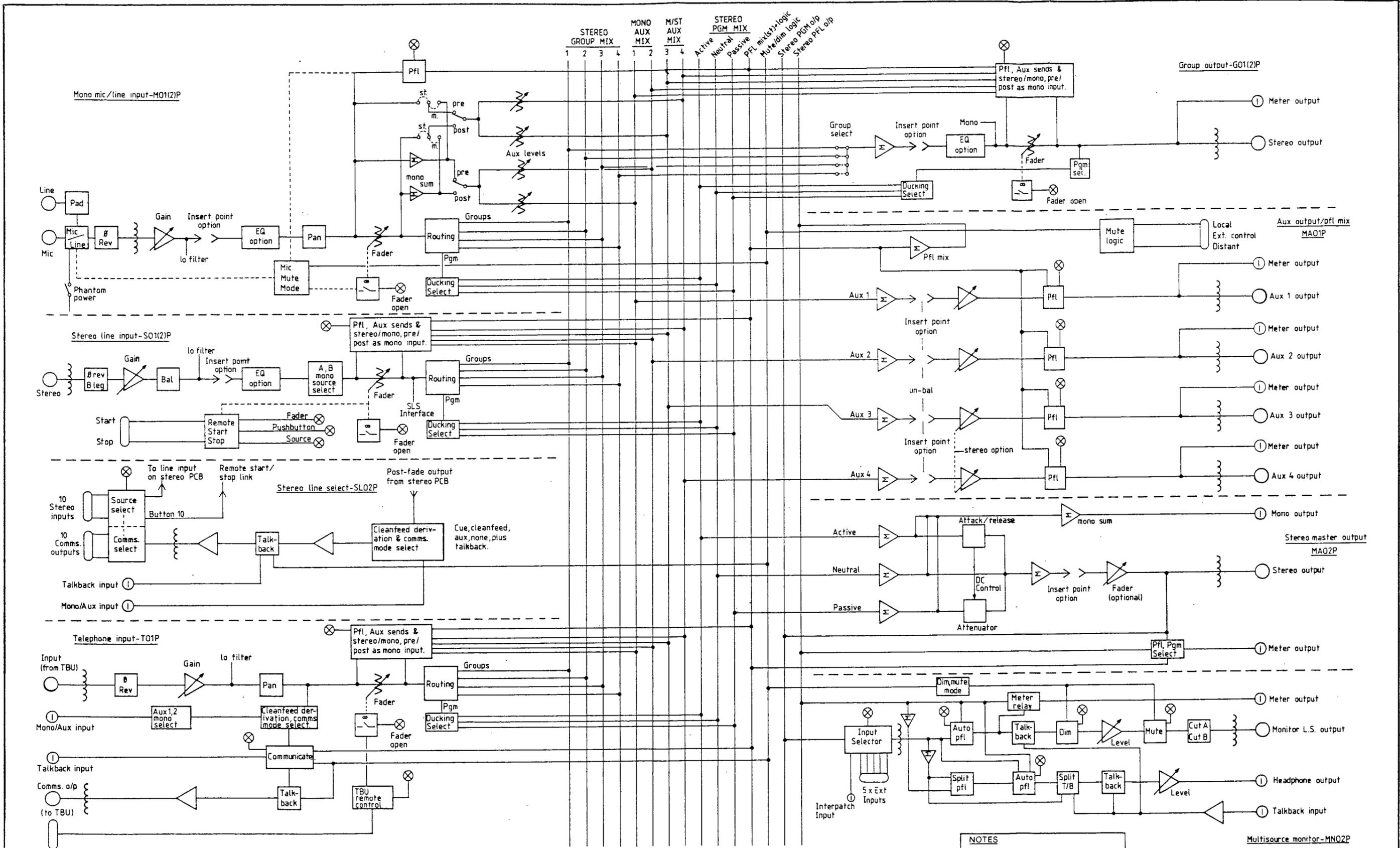
TYPE SS02

SCRIPT SPACES

DRAWING No MBD 48 Iss.1

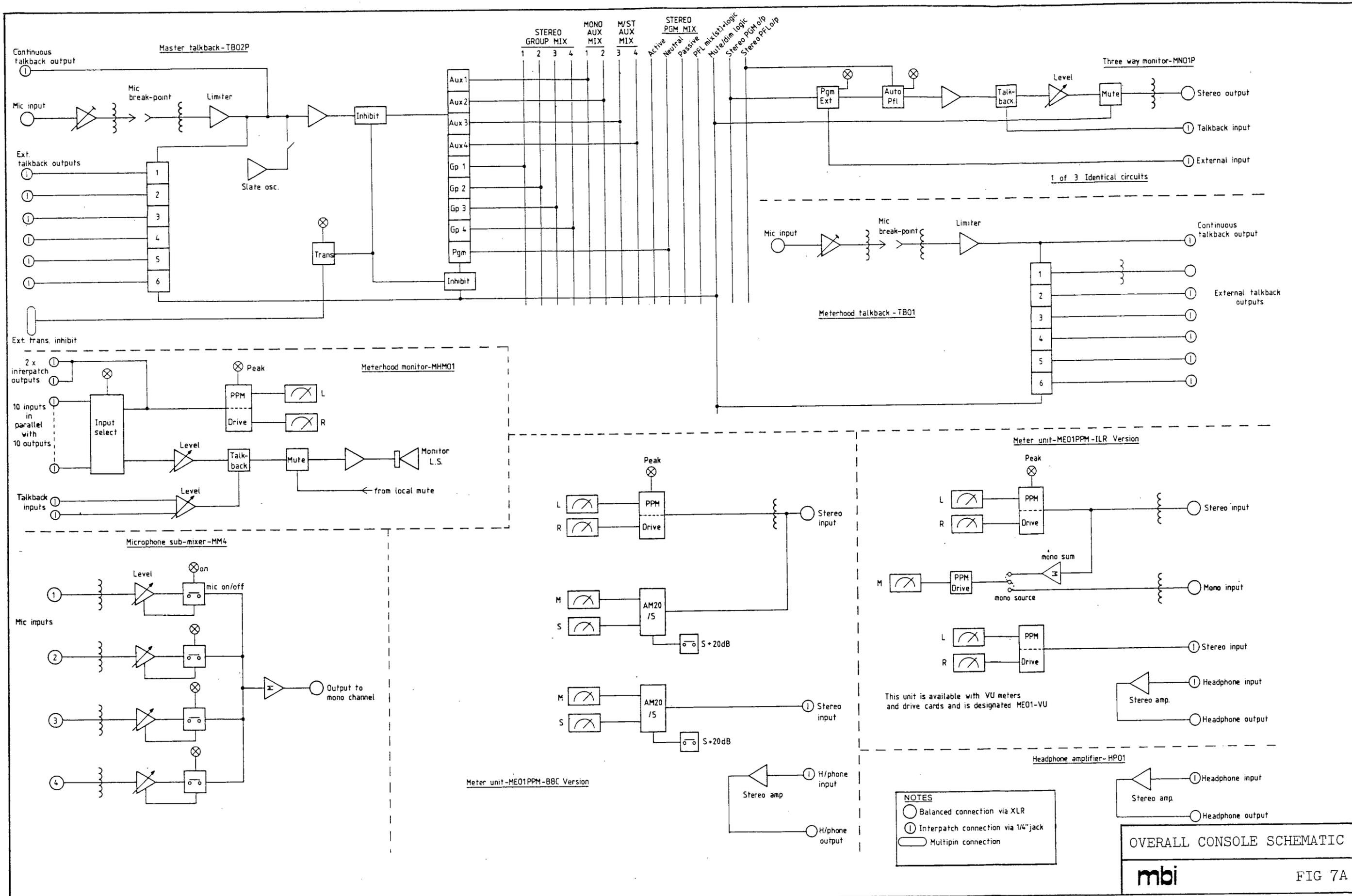
**mbi**

FIG 6

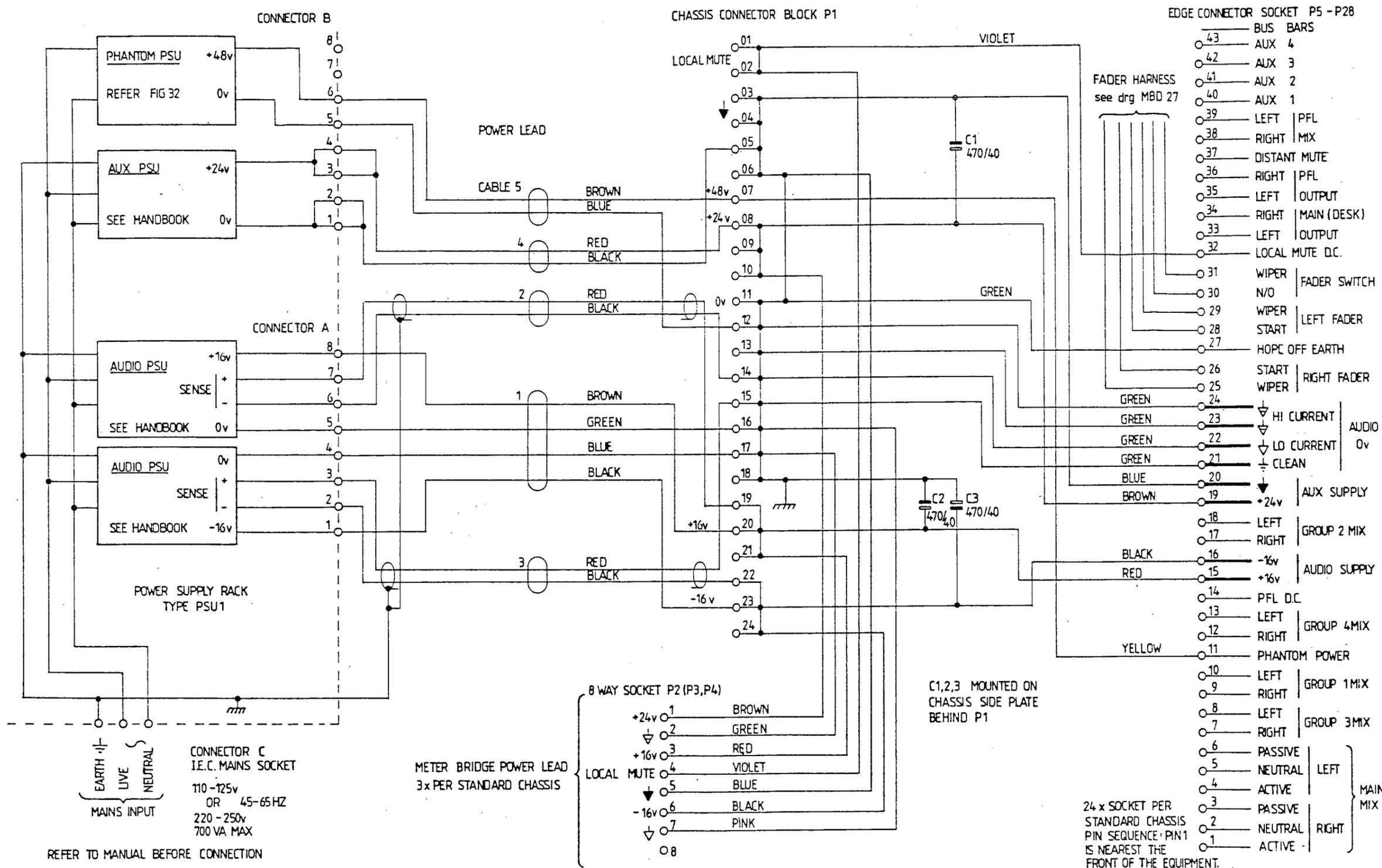


**NOTES**  
 ○ Connection via XLR  
 ⊙ Interpatch connection via 1/4" jack  
 ⊞ Multipin connection

**OVERALL CONSOLE SCHEMATIC**  
**mbi** FIG 7

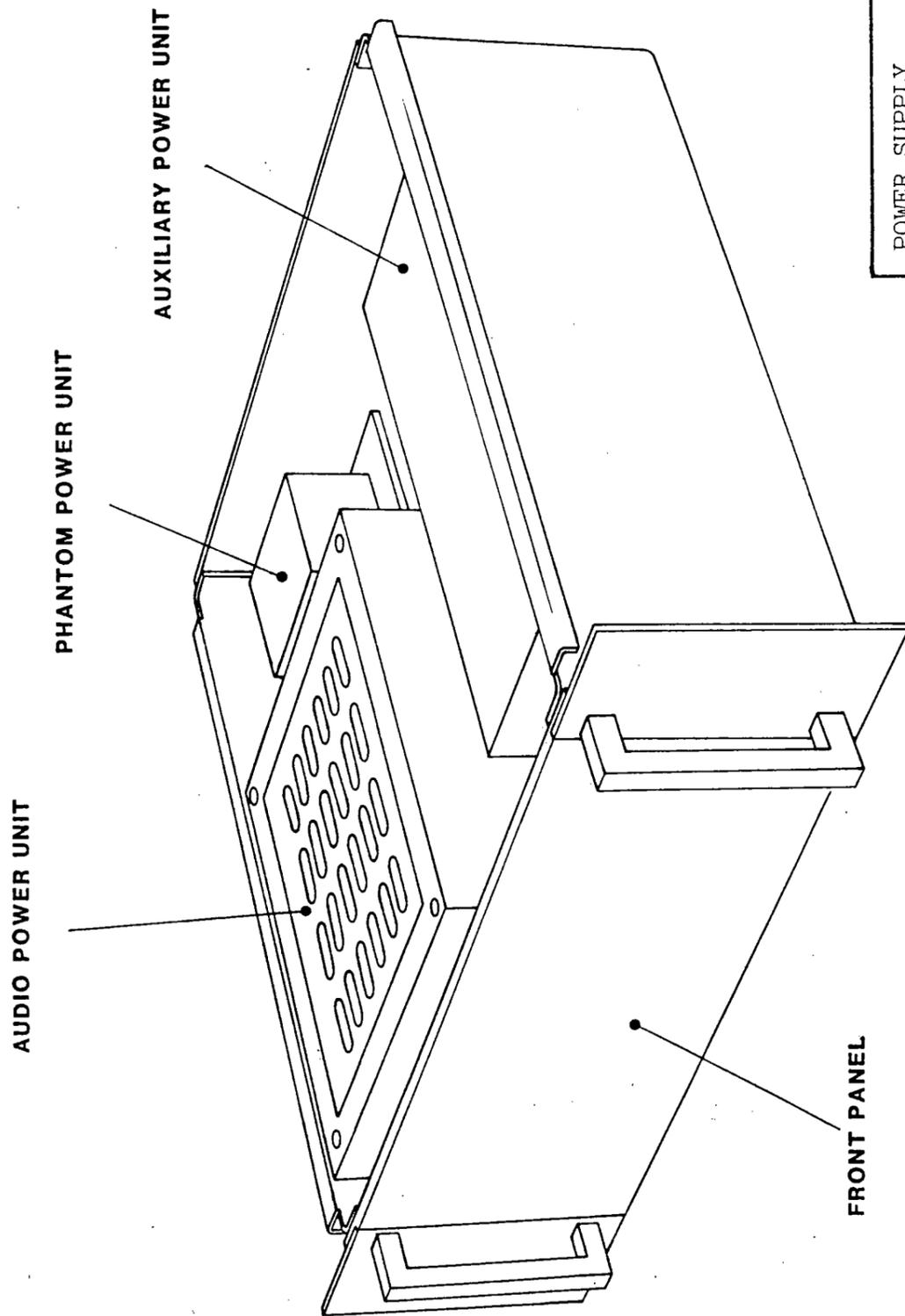


**NOTES**  
 ○ Balanced connection via XLR  
 ⊙ Interpatch connection via 1/4" jack  
 ⊔ Multipin connection



REFER TO MANUAL BEFORE CONNECTION

POWER SUPPLY & CONSOLE	
CHASSIS WIRING	
DRAWING No MBD 208 Iss.1	
<b>mbi</b>	FIG 8



POWER SUPPLY

CHASSIS ASSEMBLY

DRAWING No MBD 51 Iss.1

**mbi**

FIG 9

**POWER SUPPLY  
TYPE PSU 1**

SERIAL NUMBER [REDACTED]

Mains Input:  $\sim$  50/60Hz 700VA  
This unit is set for [REDACTED] Volt

AC operation

Refer to manual before

connecting to mains

Fuses: 48v unit 230v T250mA 20mm

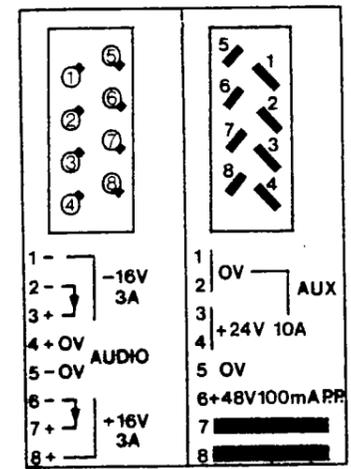
110v T500mA 1.25inch

24v and  $\pm$ 16v units internally fused

**CAUTION**  
**HIGH VOLTAGE HAZARD**  
REFER SERVICING TO  
QUALIFIED SERVICE  
PERSONNEL

ADEQUATE VENTILATION  
SPACE MUST BE PROVIDED  
ABOVE AND BELOW THIS UNIT

Made in England



**mbi** BROADCAST  
SYSTEMS Ltd.

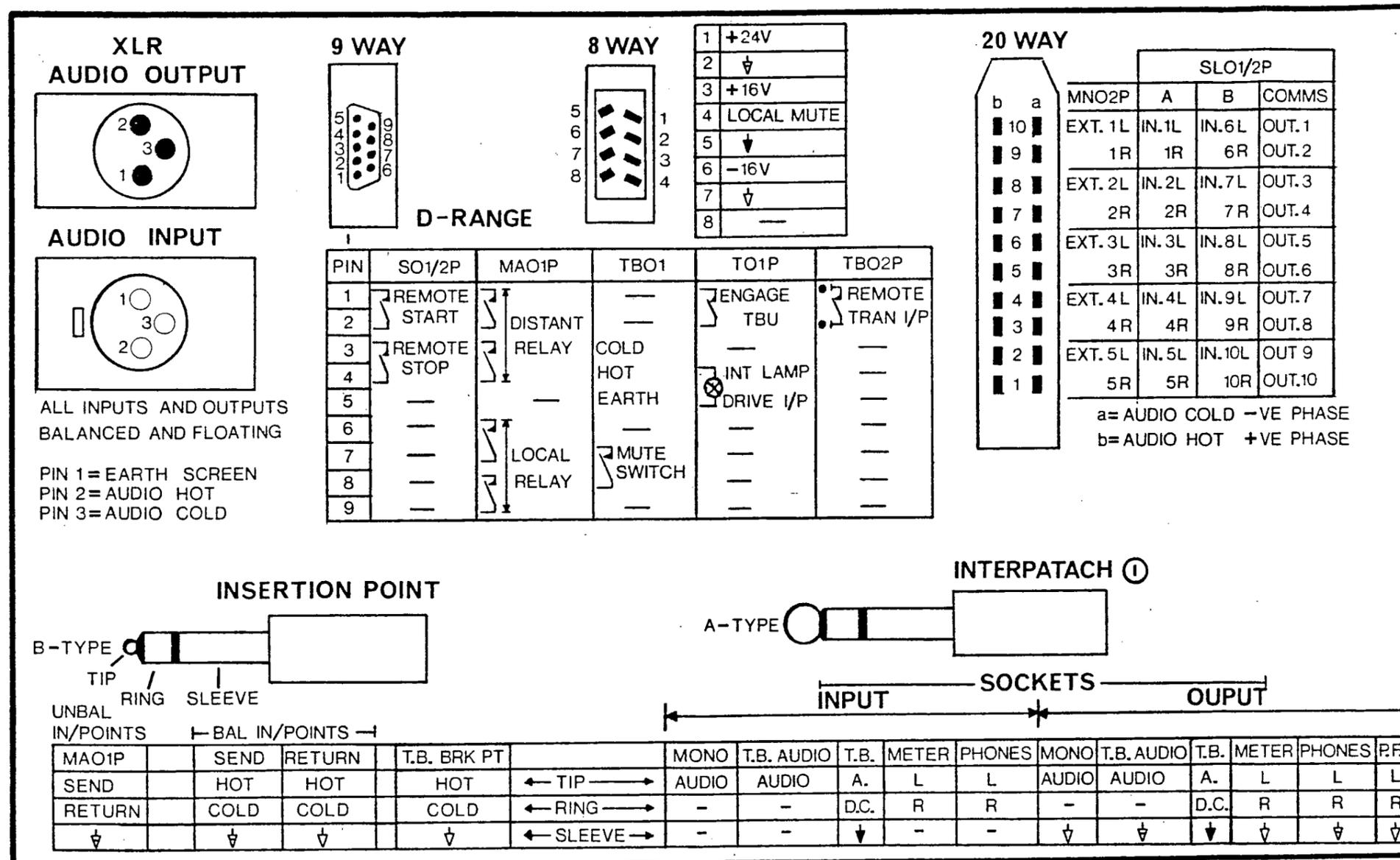
POWER SUPPLY

TERMINAL CONFIG.

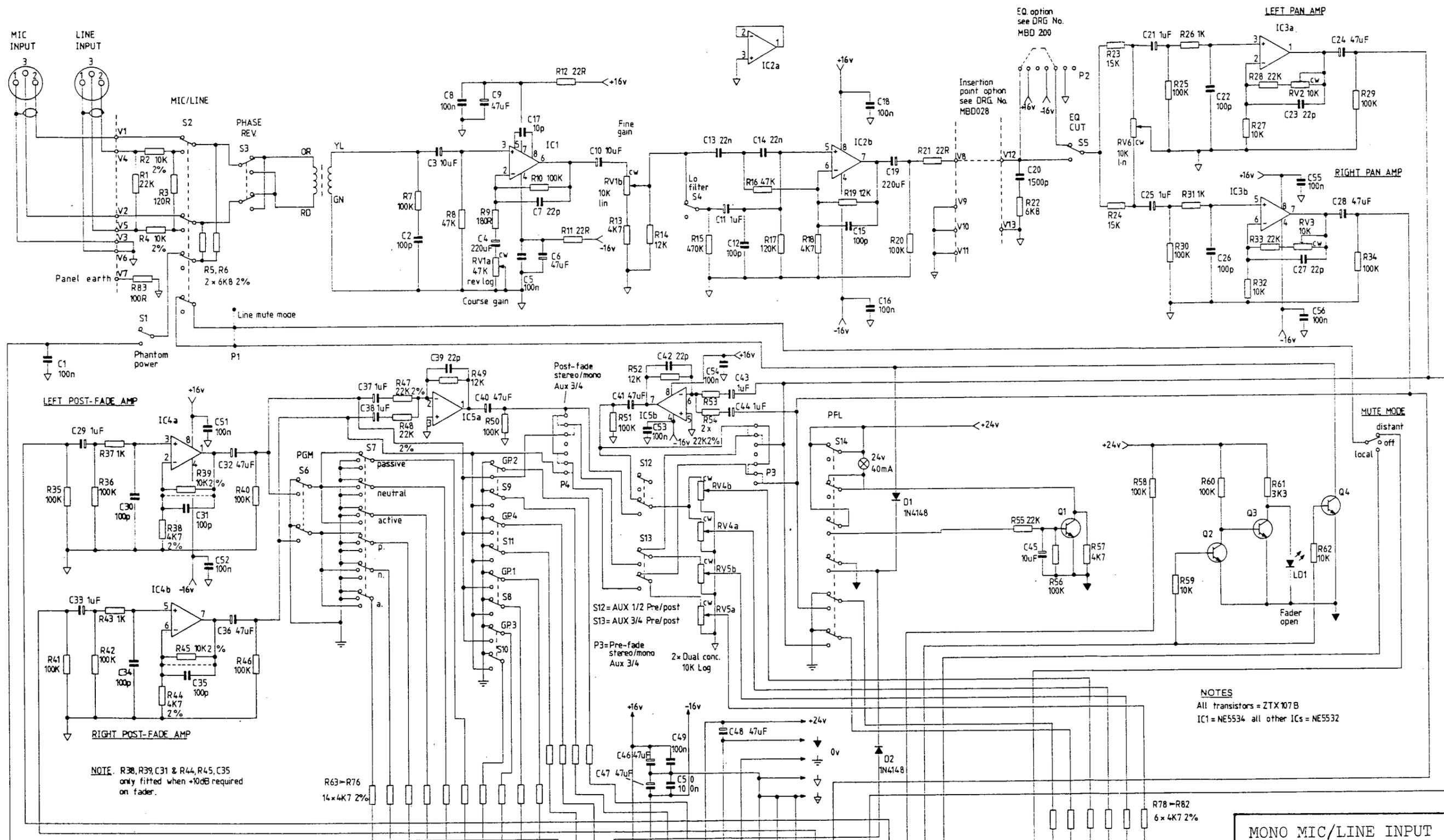
DRAWING No MBD 52 Iss.1

**mbi**

FIG 10



CONFIGURATION OF CONSOLE  
CONNECTORS  
DRAWING No AW 318 Iss.1  
**mbi** FIG 11



NOTE: R38, R39, C31 & R44, R45, C35 only fitted when +10dB required on fader.

NOTES  
All transistors = 2TX107B  
IC1 = NE5534 all other ICs = NE5532

'B' VERSION

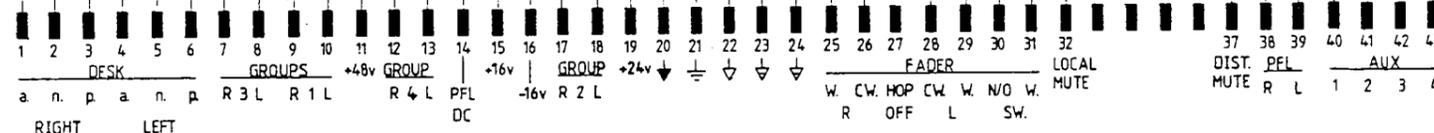
SWITCHES S3, S6, S8, S9, S10 & S11 NOT FITTED

S3 - LINKED IN DELATCHED POSITION

S6 - LINKED IN LATCHED POSITION

RESISTORS R69-76 NOT FITTED

RV5 - DUAL GANGED POTENTIOMETER P3 & P4 SET IN STEREO MODE



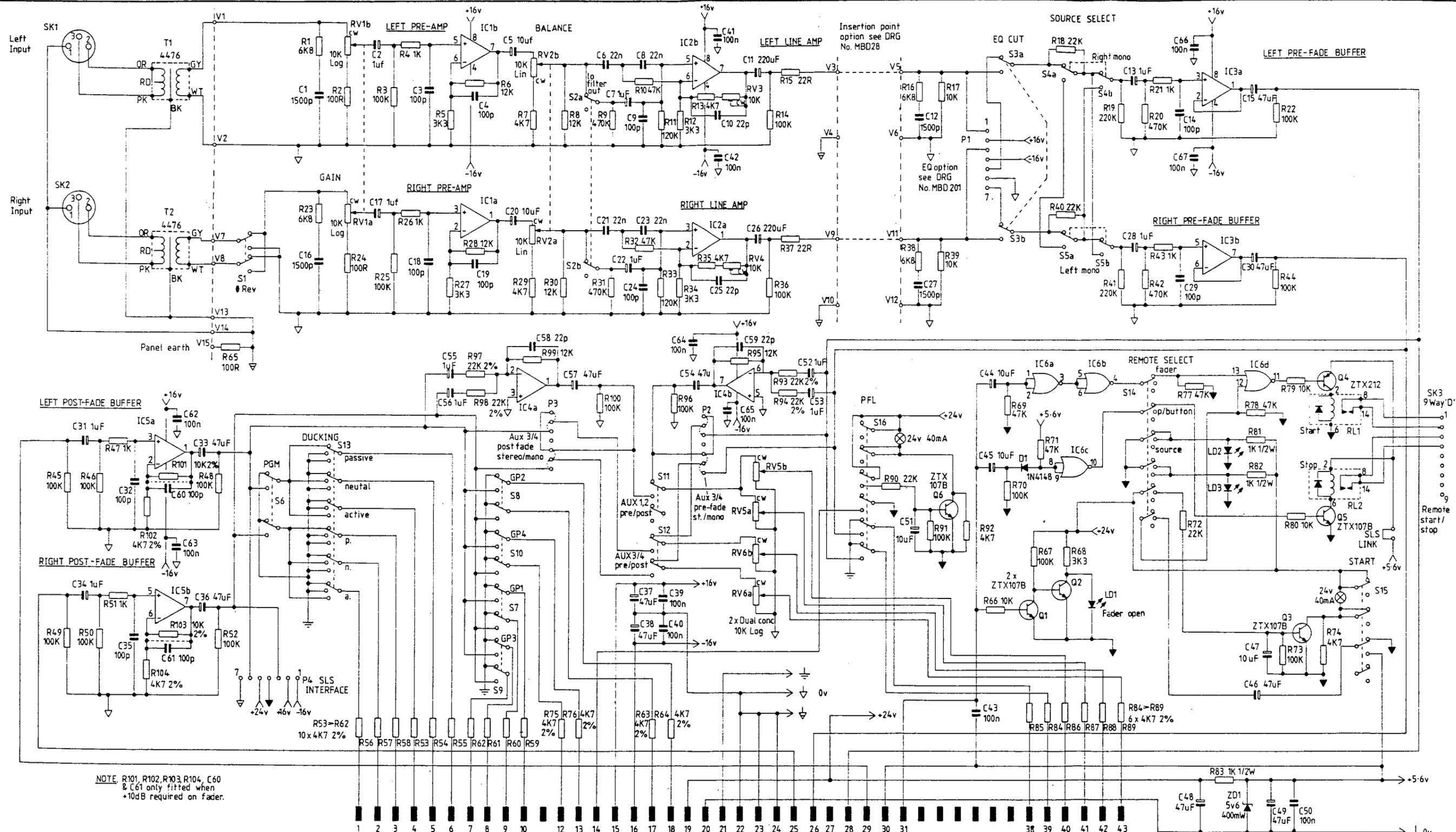
MONO MIC/LINE INPUT

DRAWING No MBD 194 Iss.1

PCB TYPE AG0145 Iss.3

mbi

FIG 12



NOTE: R101, R102, R103, R104, C60 & C61 only fitted when +10dB required on fader.

'B' VERSION

SWITCHES S1, S6, S7, S8, S9 & S10 NOT FITTED

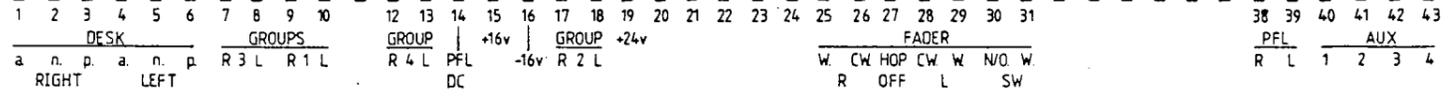
S1 - LINKED IN DELATCHED POSITION

S6 - LINKED IN LATCHED POSITION

RESISTORS R59, 60, 61, 62, 63, 64, 75 & 76 NOT FITTED

RV6 - DUAL GANGED POTENTIOMETER

P2 & P3 SET IN STEREO MODE



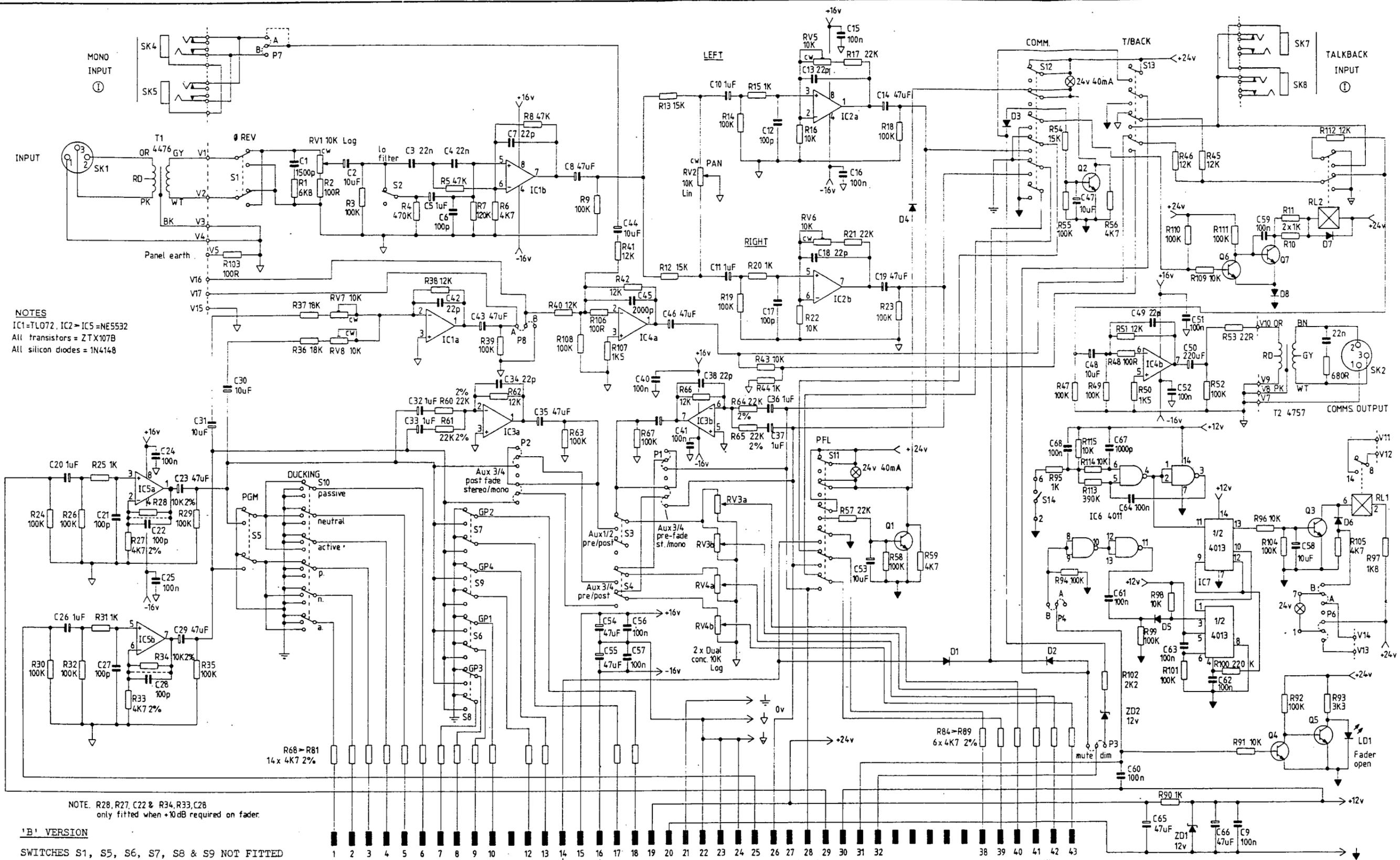
NOTES  
 IC1=TL072, IC2=IC5=NE5532  
 IC6=4001B  
 RL1, RL2=121-A4

STEREO LINE INPUT

DRAWING No MDB 195 Iss.1

PCB TYPE AGO141 Iss.3

**mbi** FIG 13

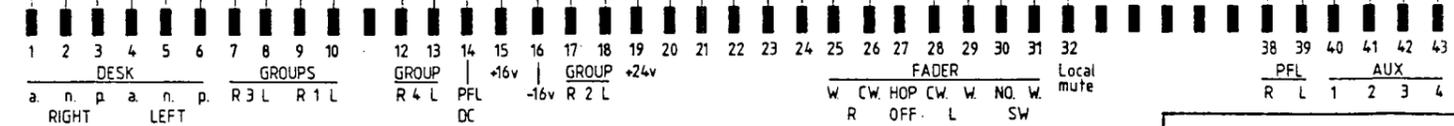


**NOTES**  
 IC1=TL072, IC2=IC5=NE5532  
 All transistors = ZTX107B  
 All silicon diodes = 1N4148

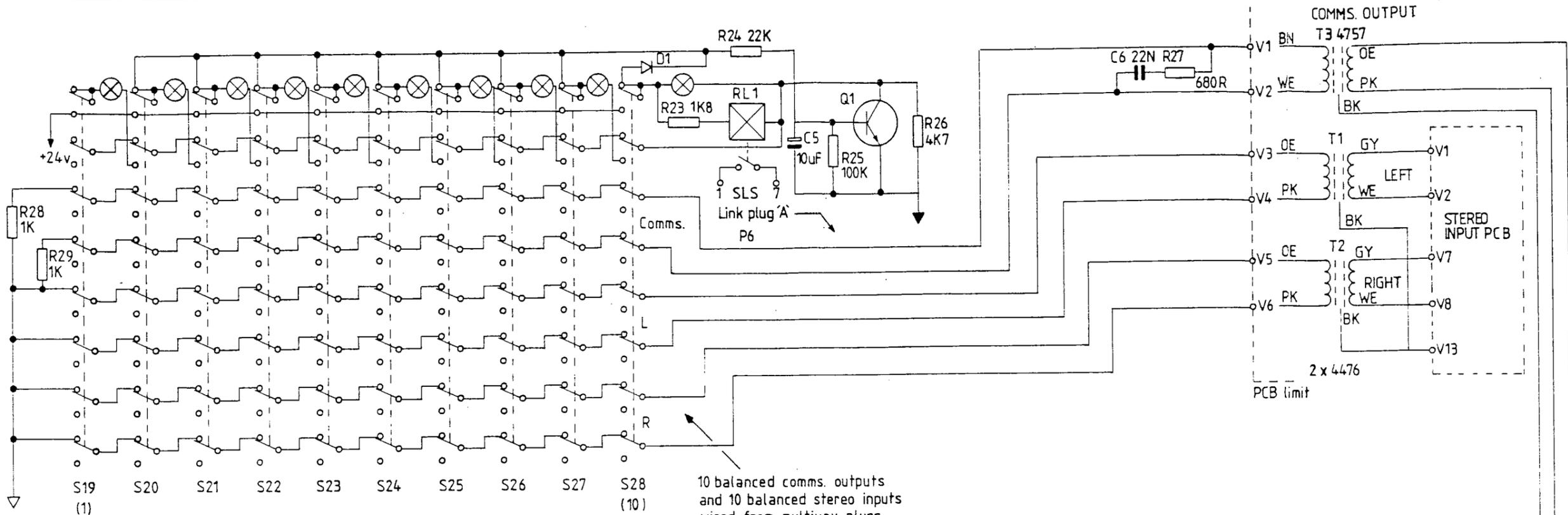
NOTE. R28, R27, C22 & R34, R33, C28 only fitted when +10dB required on fader.

**'B' VERSION**

- SWITCHES S1, S5, S6, S7, S8 & S9 NOT FITTED
- S1 - LINKED IN DELATCHED POSITION
- S5 - LINKED IN LATCHED POSITION
- RESISTORS R87-94 NOT FITTED
- RV4 - DUAL GANGED POTENTIOMETER
- P1 & P2 SET IN STEREO MODE

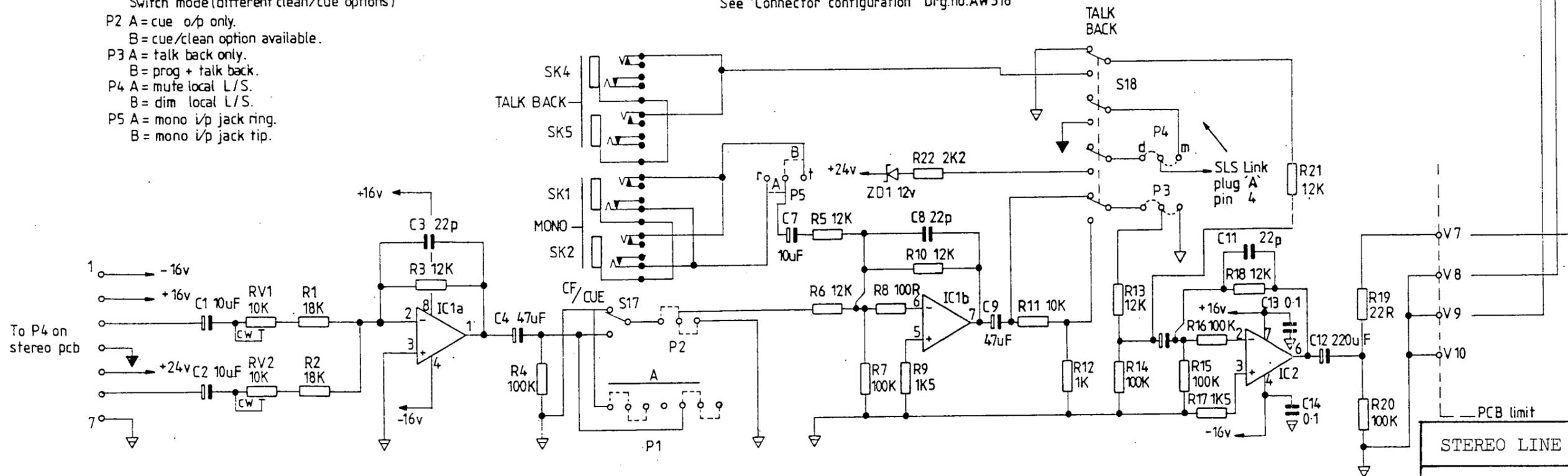


TELEPHONE LINE INPUT	PCB TYPE AGO178 Iss.2
DRAWING No MBD 203 Iss.1	mbi <span style="float: right;">FIG 14</span>

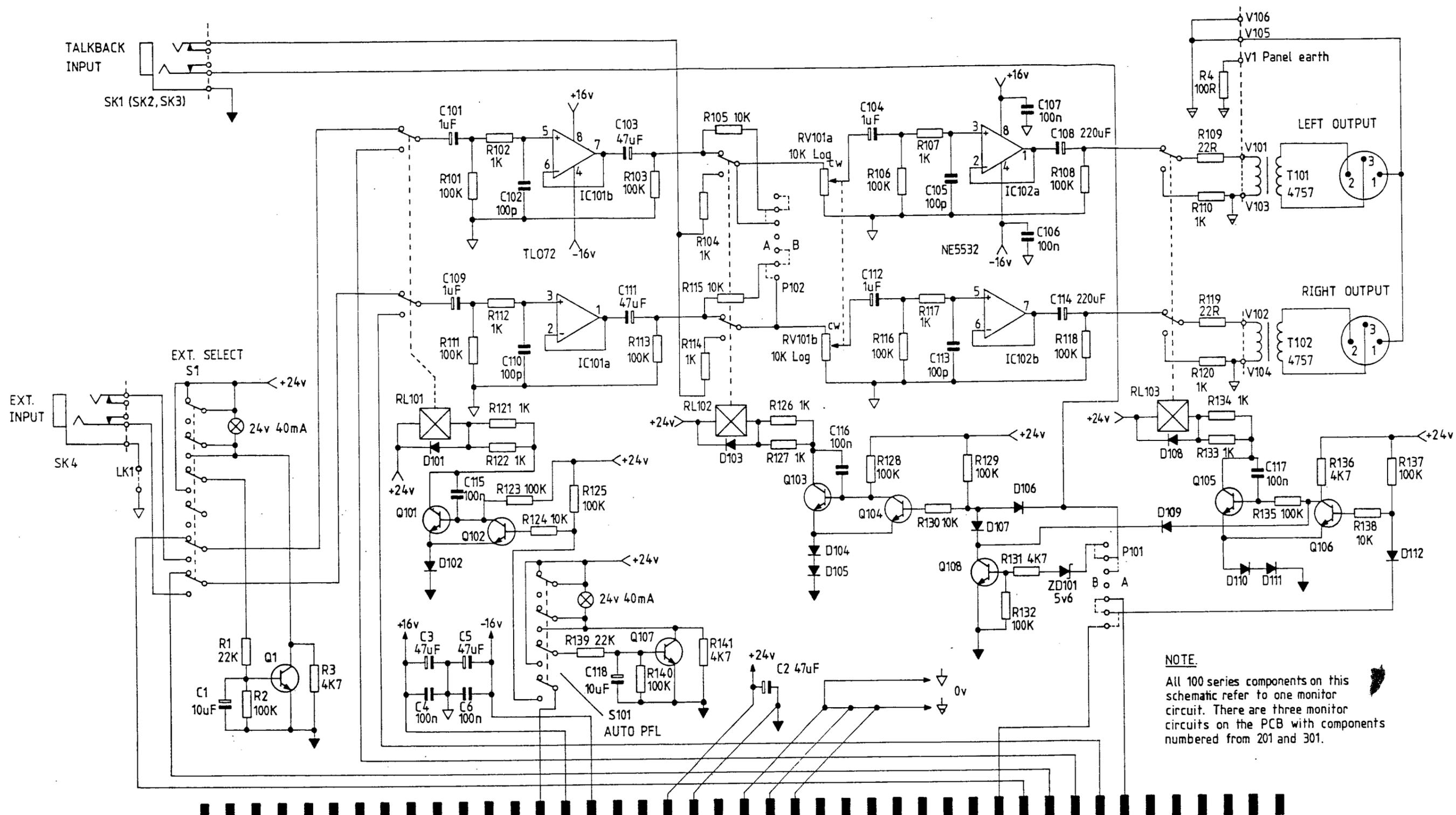


- P1 Reverse S17 (front panel)  
Switch mode (different clean/cue options)
- P2 A = cue o/p only.  
B = cue/clean option available.
- P3 A = talk back only.  
B = prog + talk back.
- P4 A = mute local L/S.  
B = dim local L/S.
- P5 A = mono i/p jack ring.  
B = mono i/p jack tip.

10 balanced comms. outputs  
and 10 balanced stereo inputs  
wired from multiway plugs  
direct to switch pins.  
See 'Connector configuration' Drg.no.AW318



STEREO LINE SELECT  
DRAWING No MBD 205 Iss.1  
PCB TYPE AG0183 Iss.1  
**mbi** FIG 15

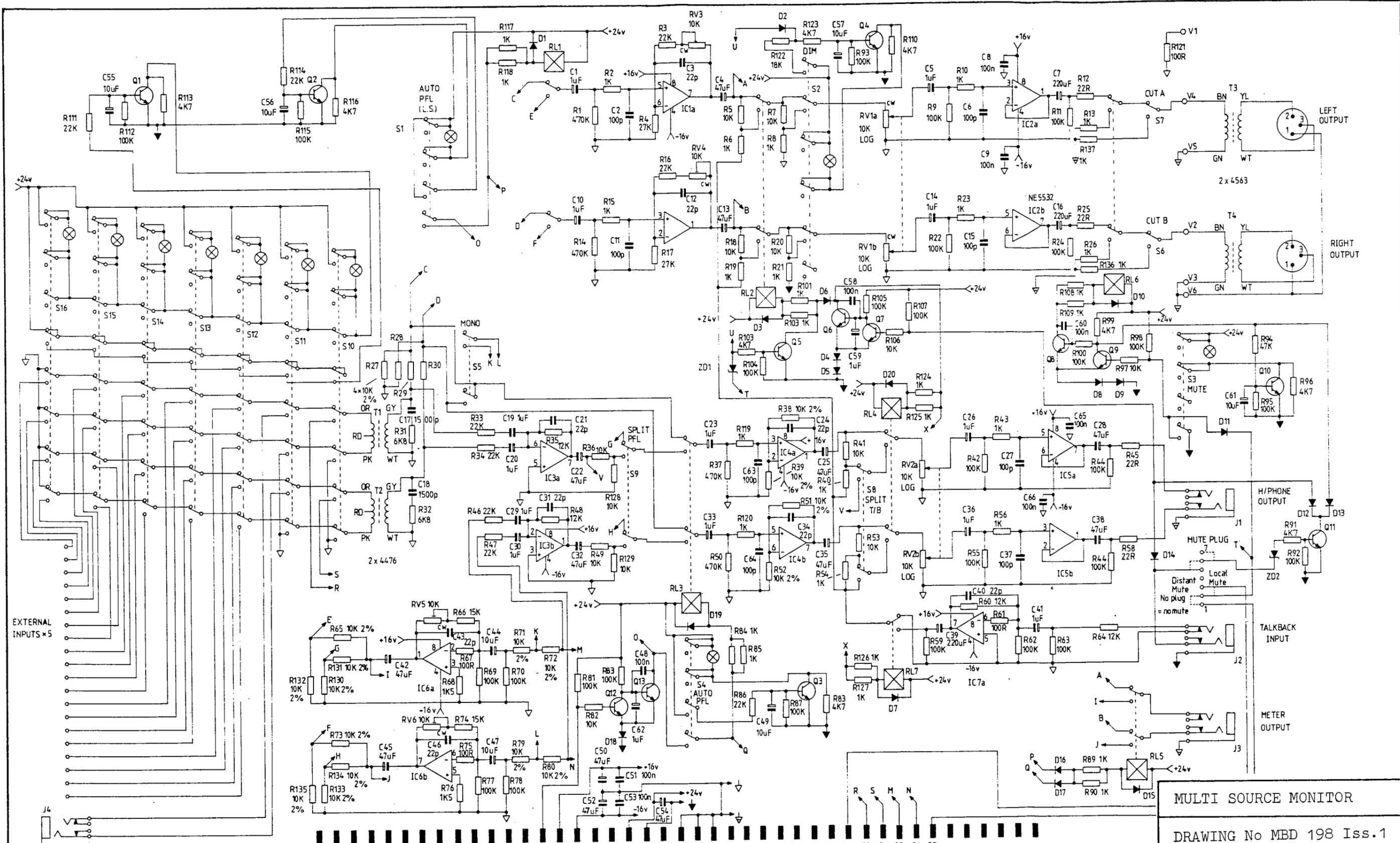


**NOTE**  
 All 100 series components on this schematic refer to one monitor circuit. There are three monitor circuits on the PCB with components numbered from 201 and 301.

**NOTES**  
 All transistors = ZTX107B  
 All silicon diodes = 1N4148



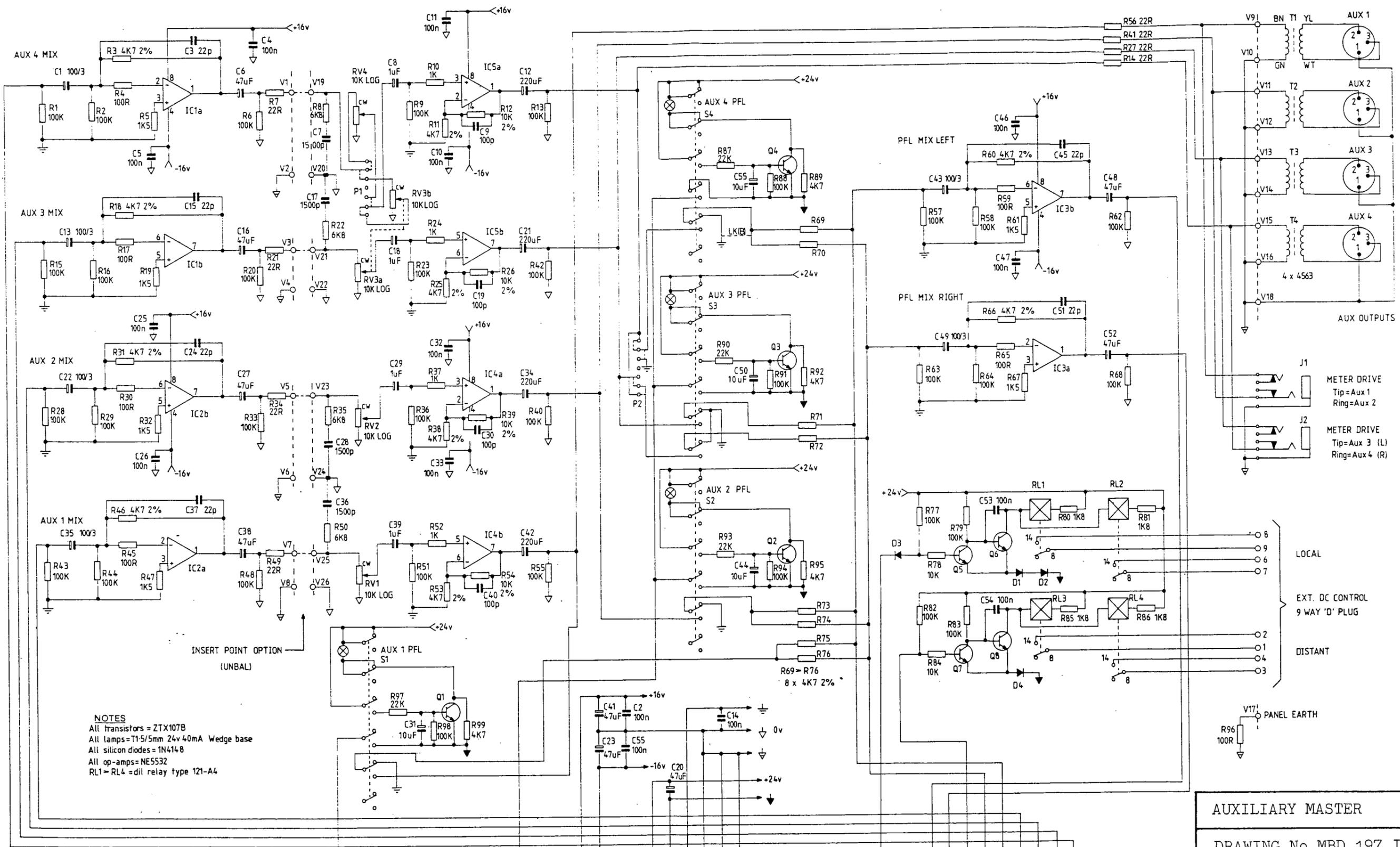
THREE WAY MONITOR	
DRAWING No MBD 202 Iss.1	
PCB TYPE AG0169 Iss.1	
<b>mbi</b>	FIG 16



**NOTES**  
 All transistors = ZTX 107B  
 All lamps = T1.5/5mm 24v 40mA  
 All silicon diodes = 1N4148  
 All op-amps = TLO 72 except IC2 = NE5532  
 Zener diodes = BZY88C5v6

**MULTI SOURCE MONITOR**  
 DRAWING No MBD 198 Iss.1  
 PCB TYPE AGO148 Iss.3

**mbi** FIG 17



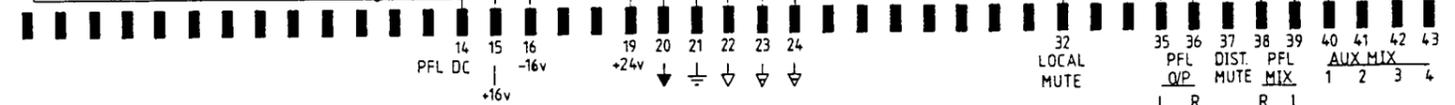
**NOTES**  
 All transistors = ZTX107B  
 All lamps = T1.5/5mm 24v 40mA Wedge base  
 All silicon diodes = 1N4148  
 All op-amps = NE5532  
 RL1-RL4 = diil relay type 121-A4

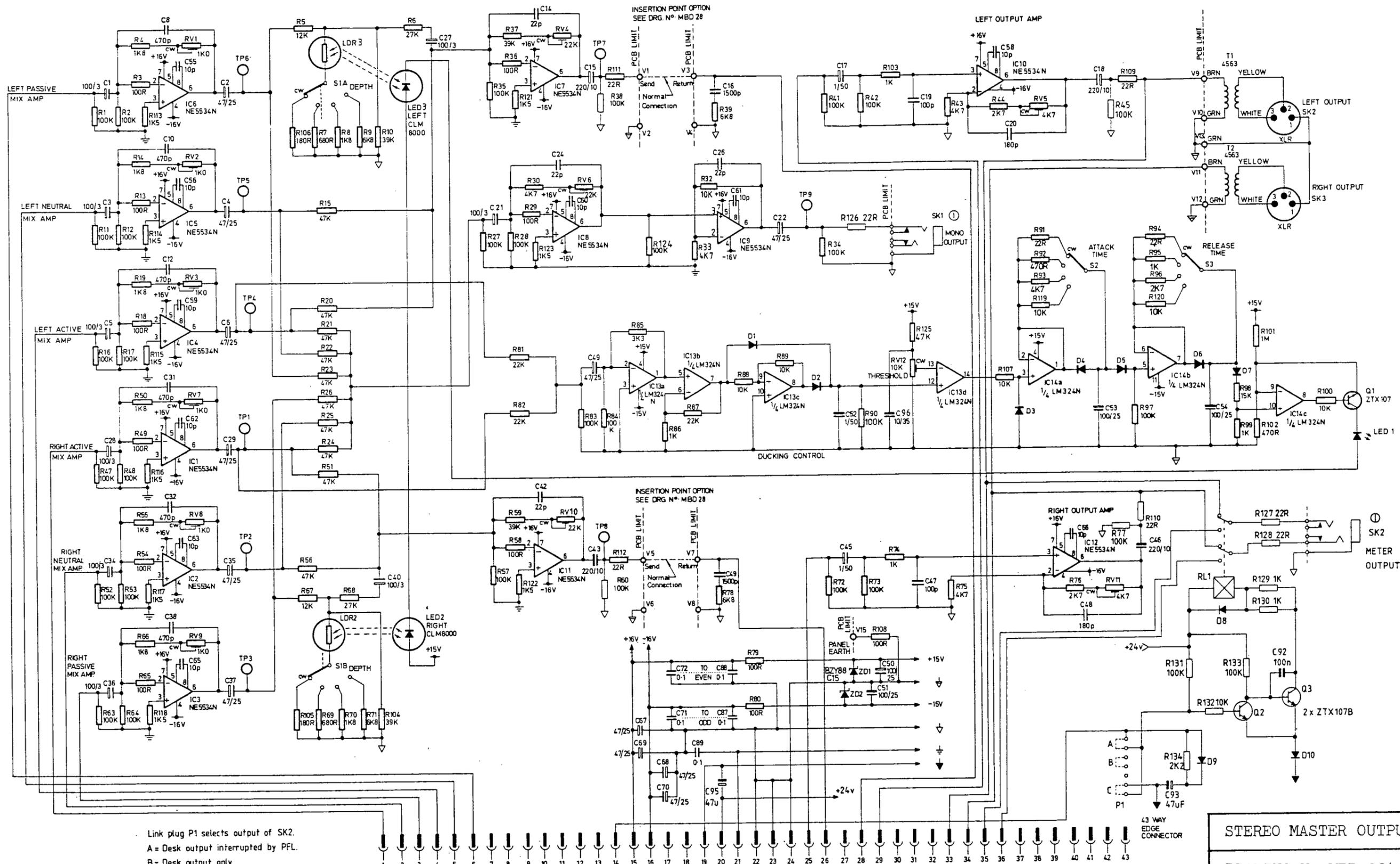
'B' VERSION  
 SWITCH S4 NOT FITTED  
 POTENTIOMETER RV4 NOT FITTED  
 P1 & P2 SET IN STEREO MODE

AUXILIARY MASTER  
 DRAWING No MBD 197 Iss.1

PCB TYPE AG0144 Iss.3

mbi FIG 18





Link plug P1 selects output of SK2.  
 A = Desk output interrupted by PFL.  
 B = Desk output only.  
 C = PFL output only.

All silicon diodes = 1N4148

RIGHT MIX  
 ACTIVE NEUTRAL PASSIVE  
 LEFT MIX  
 ACTIVE NEUTRAL PASSIVE

+16V -16V  
 AUDIO SUPPLY

AUDIO 0V

WIPER START WIPER  
 RIGHT FADER LEFT FADER  
 SEE FADER CIRCUITS - DRG. N° MBD 27

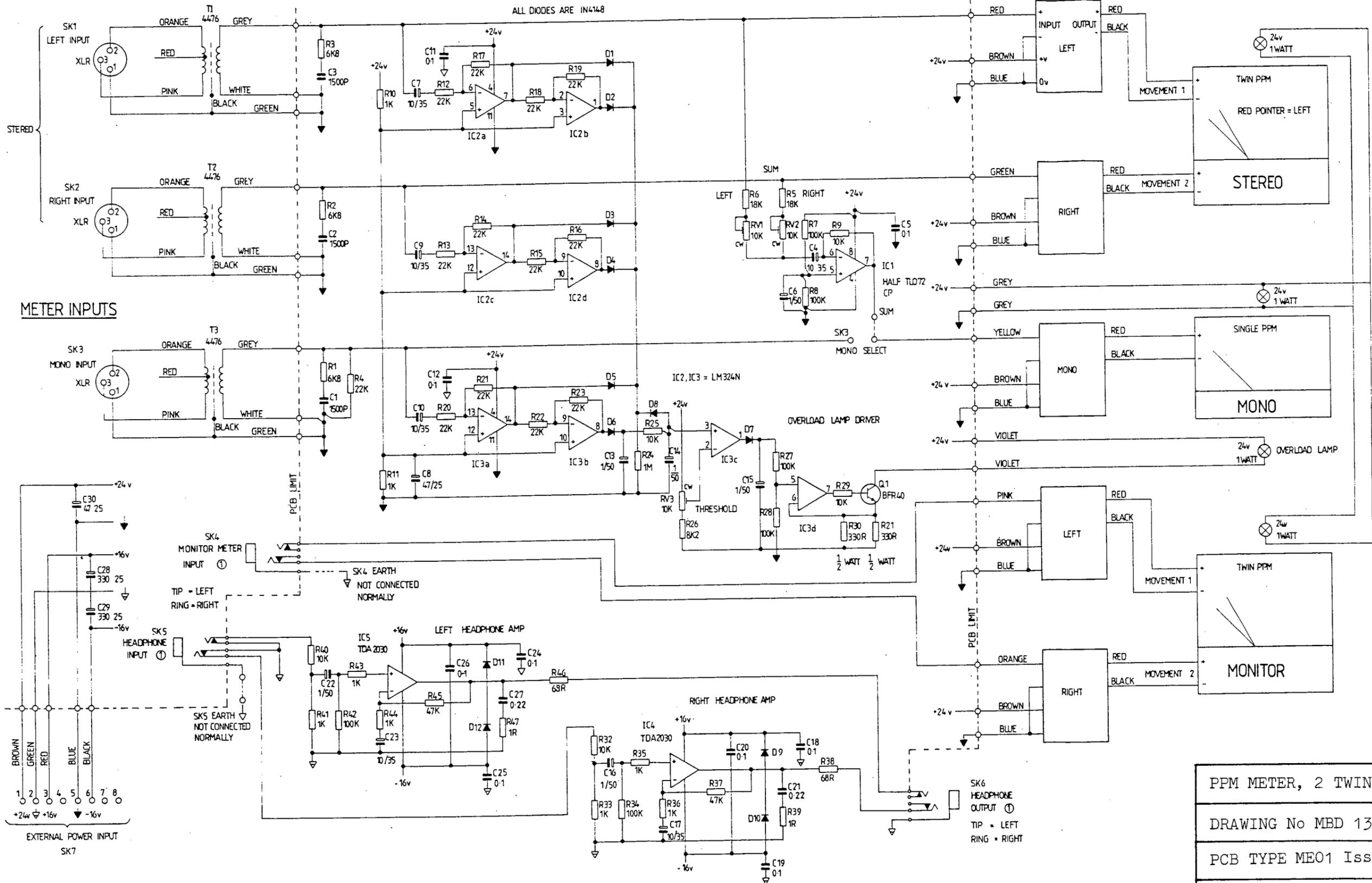
LEFT OUTPUT  
 RIGHT OUTPUT  
 PFL

STEREO MASTER OUTPUT  
 DRAWING No MBD 204 Iss.1  
 PCB TYPE AG0150 Iss.2

mbi FIG 19

5x PPM DRIVERS

ALL DIODES ARE IN4148



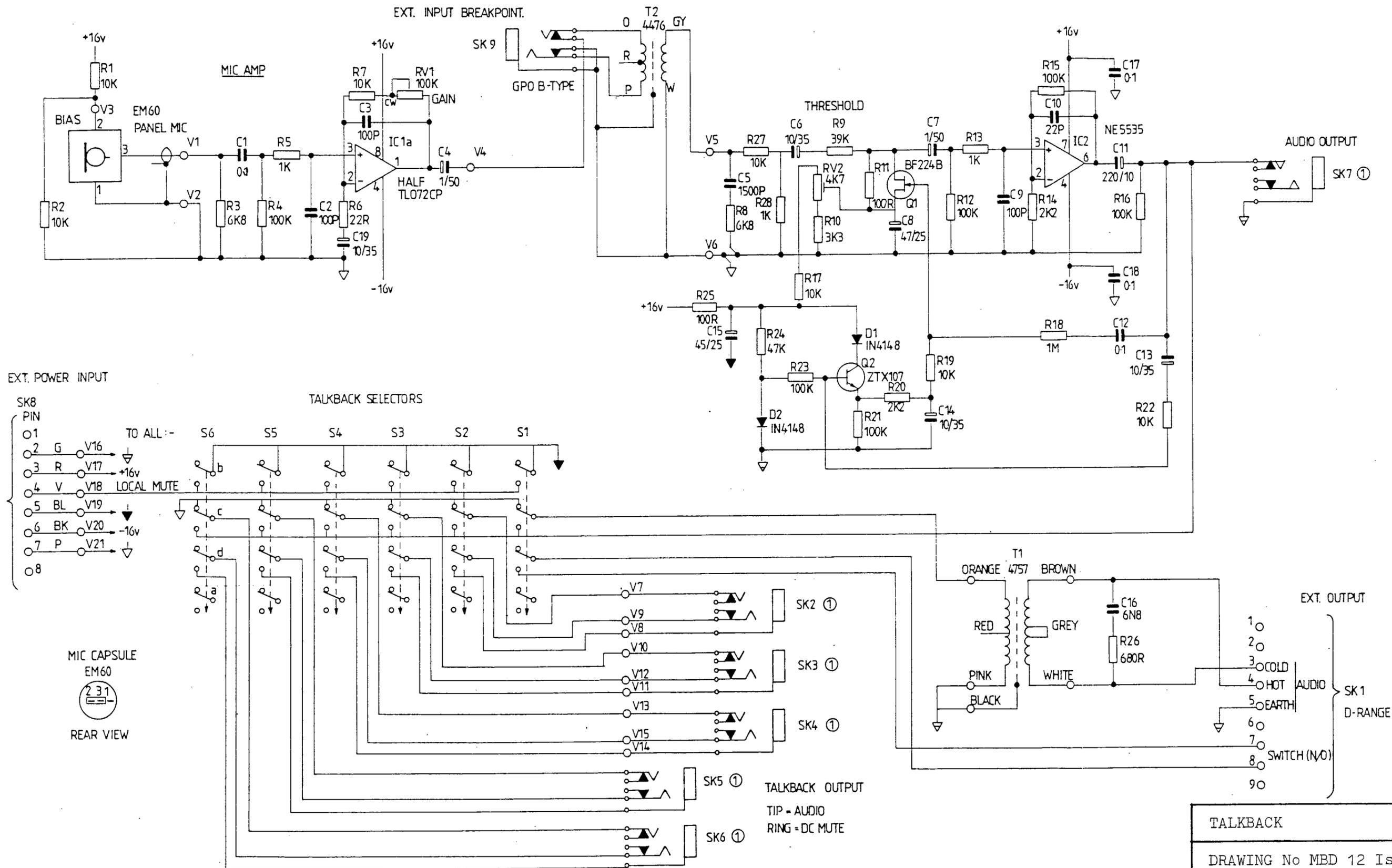
PPM METER, 2 TWIN 1 MONO

DRAWING No MBD 13 Iss.1

PCB TYPE ME01 Iss.3

mbi

FIG 20

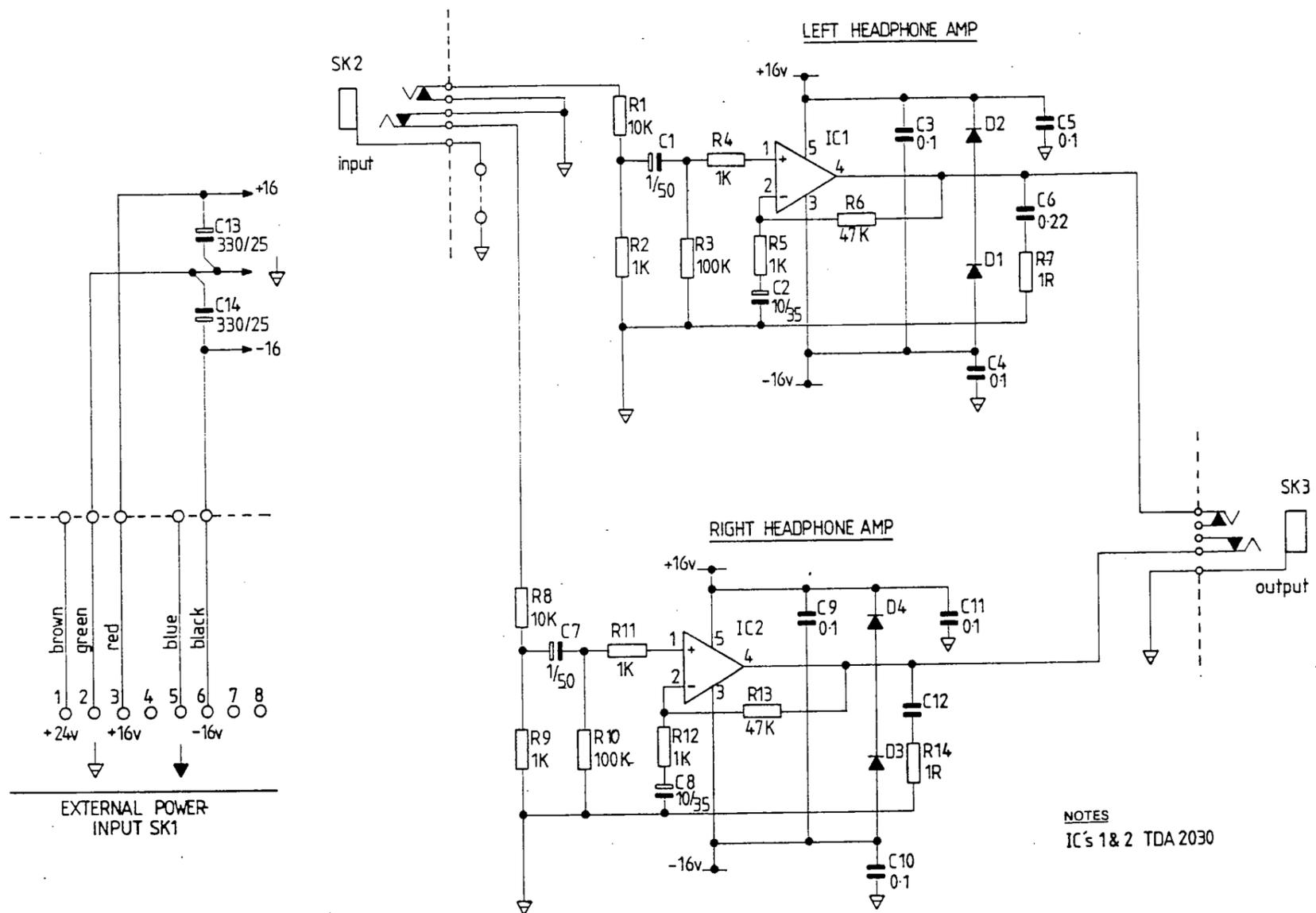


TALKBACK

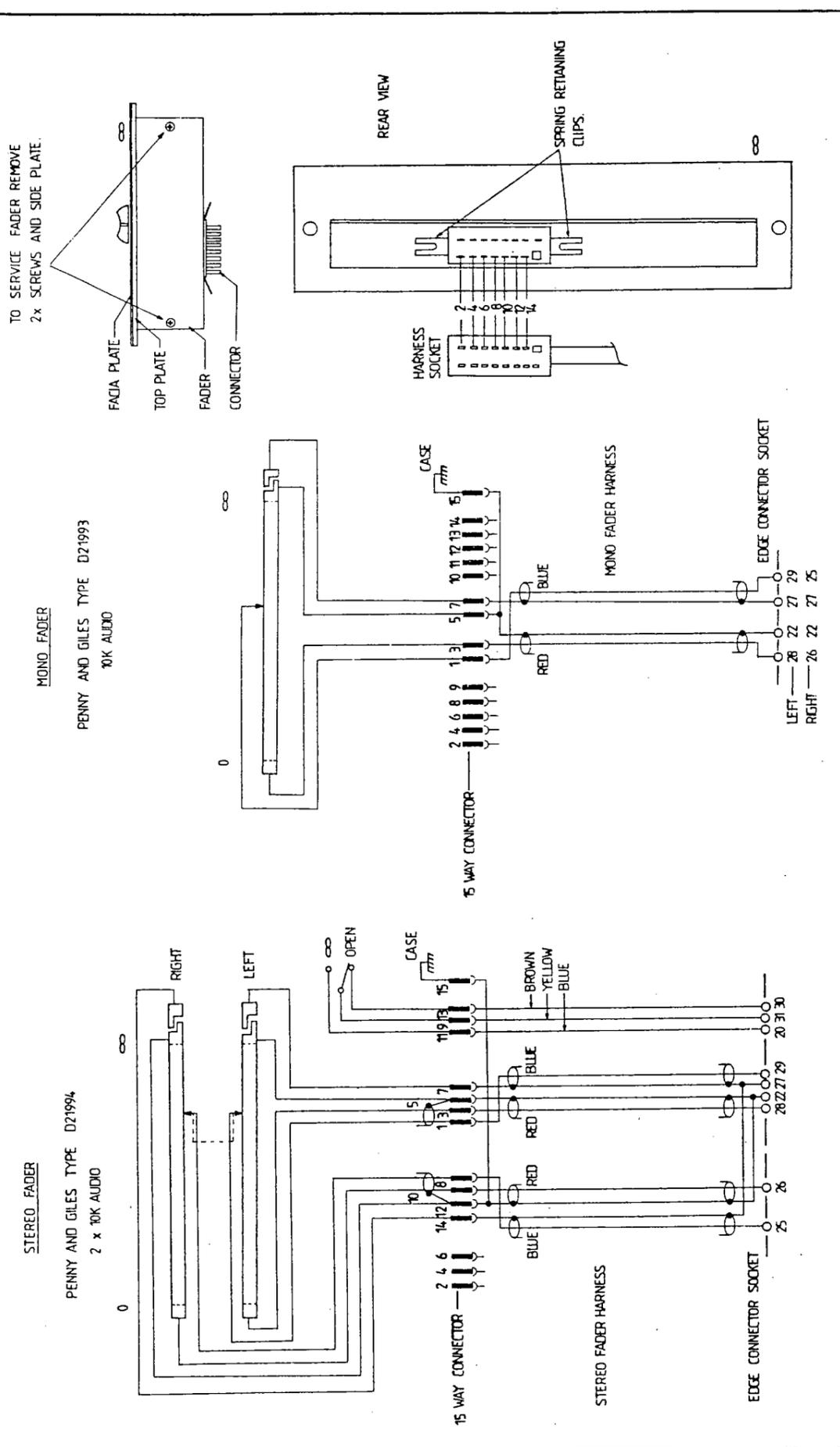
DRAWING No MBD 12 Iss.1

PCB TYPE TBO1 Iss.2

**mbi** FIG 21



HEADPHONE AMPLIFIER	
DRAWING No MBD 42 Iss.1	
PCB TYPE HPO1 Iss.1	
<b>mbi</b>	FIG 22

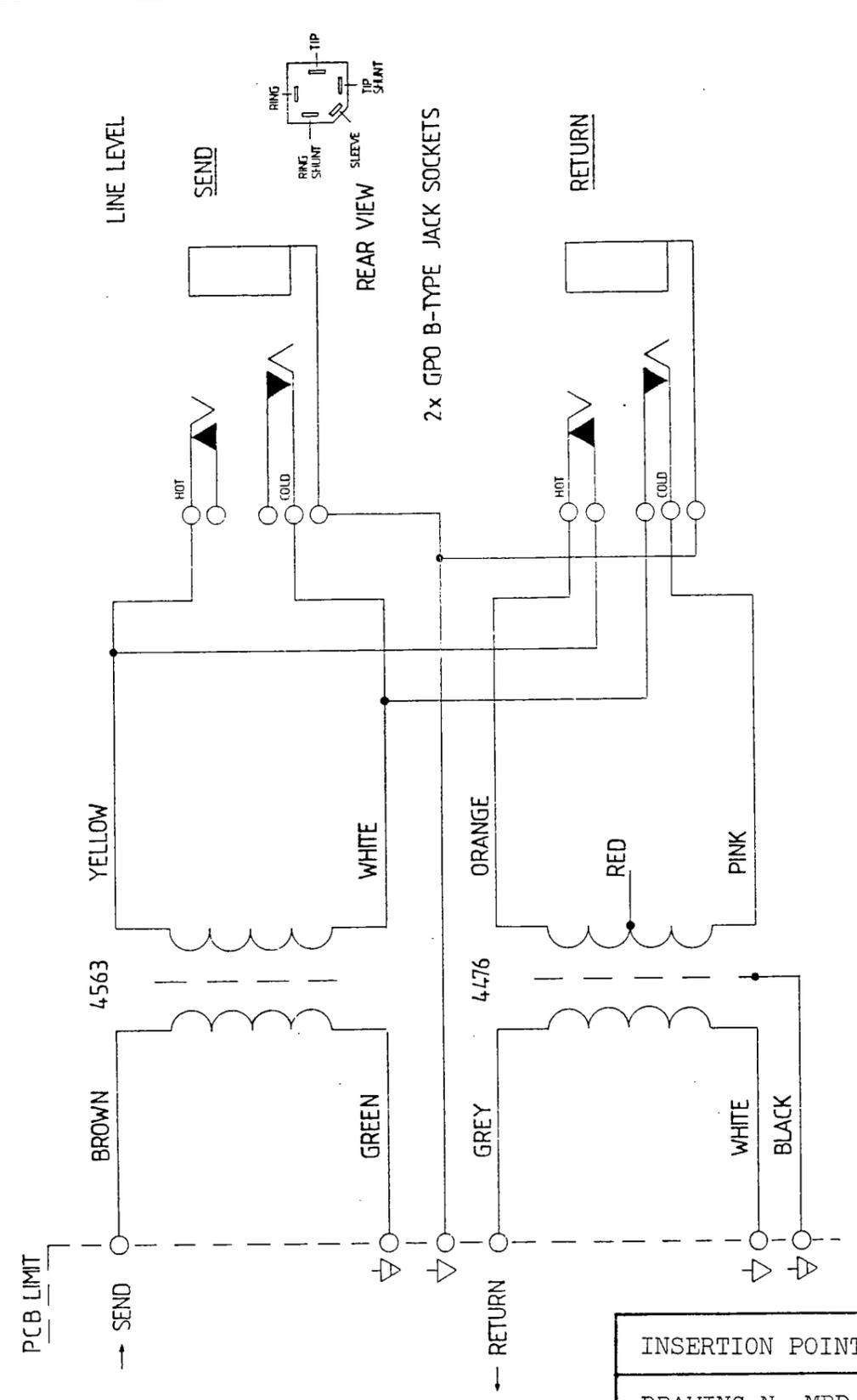
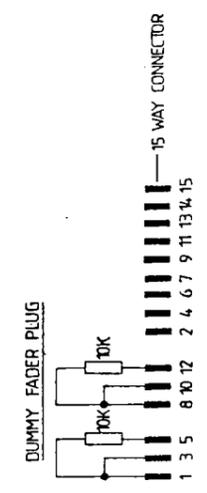


FADER

DRAWING No MBD 27 Iss.2

**mbi**

FIG 23

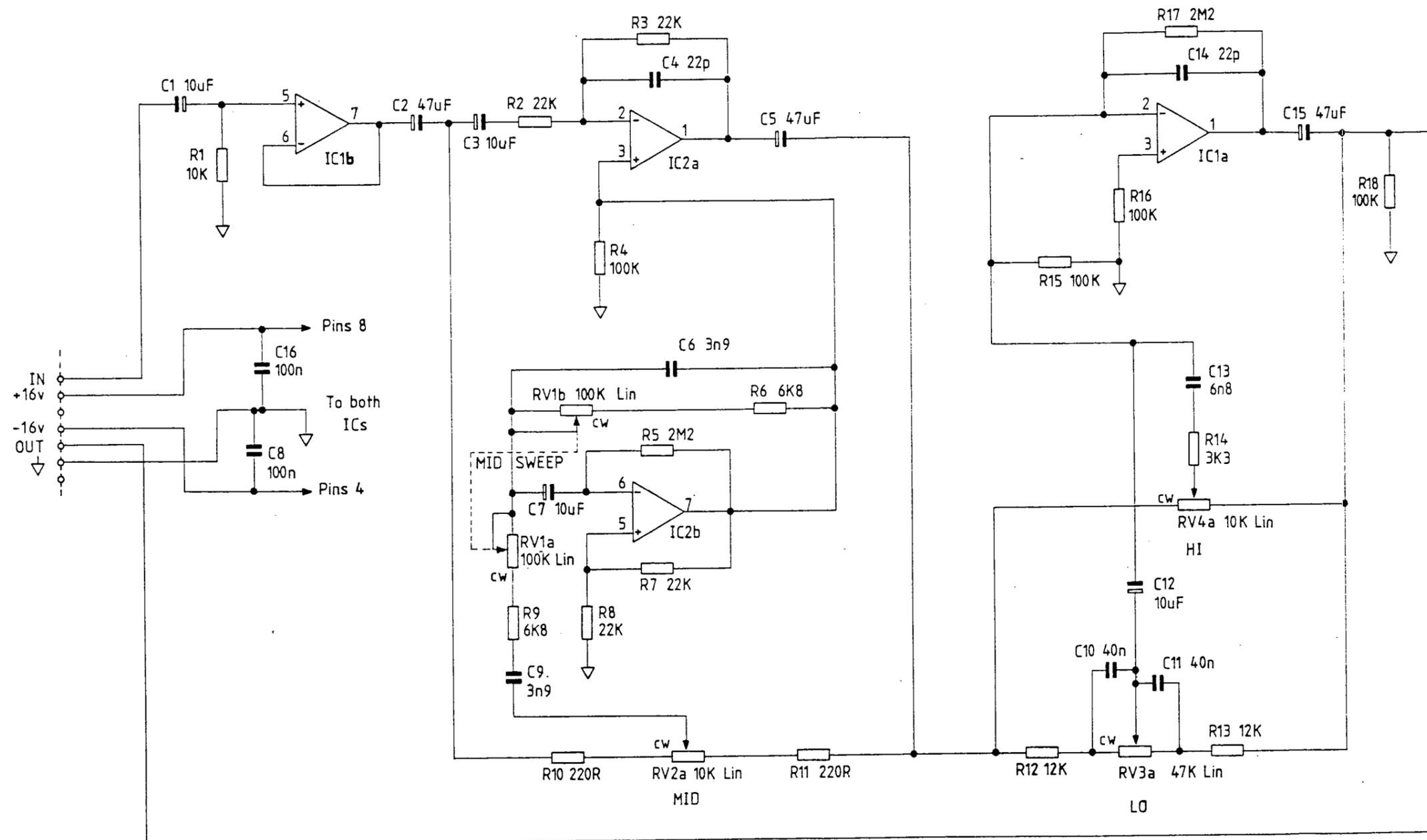


INSERTION POINT OPTION

DRAWING No MBD 28 Iss.1

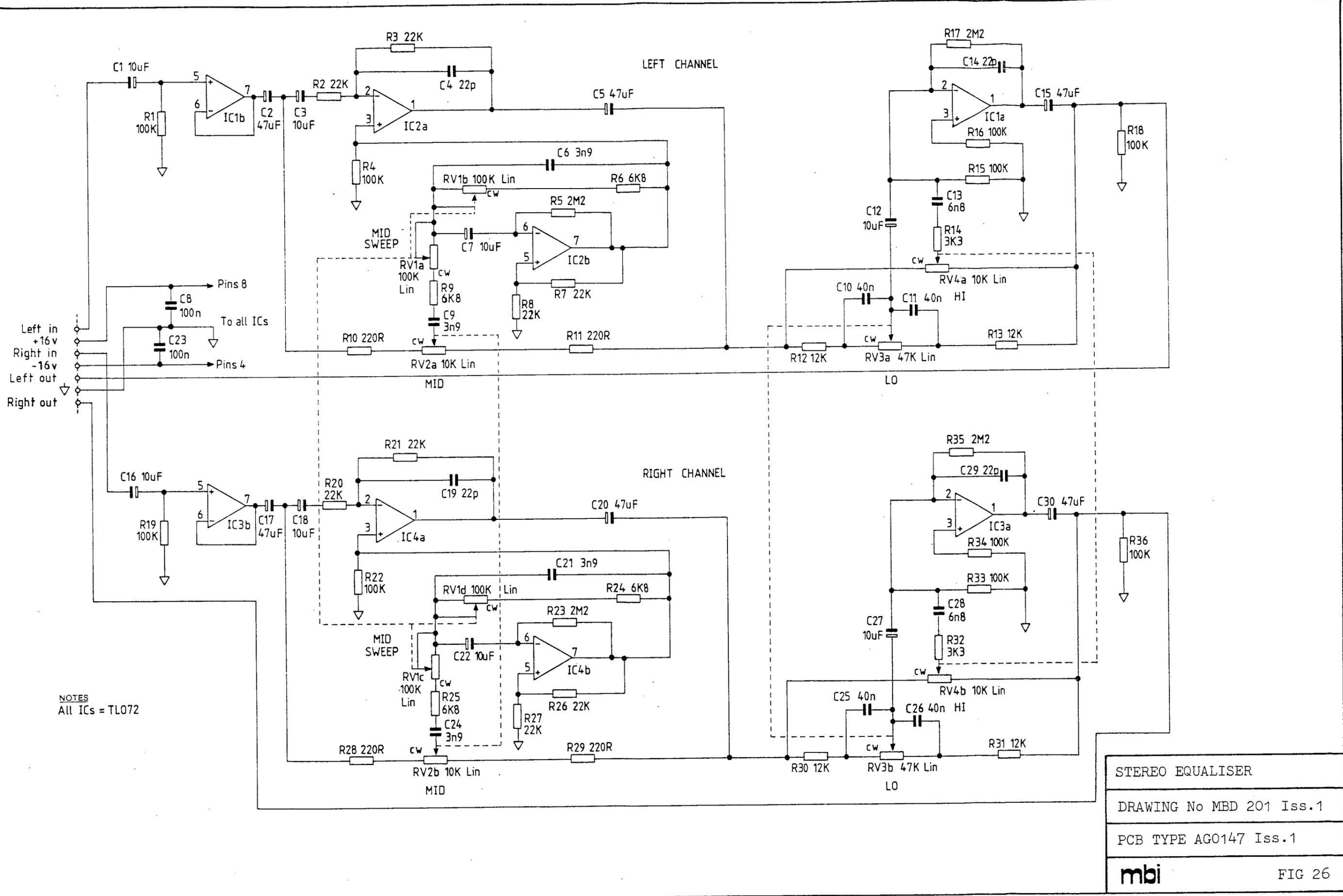
**mbi**

FIG 24



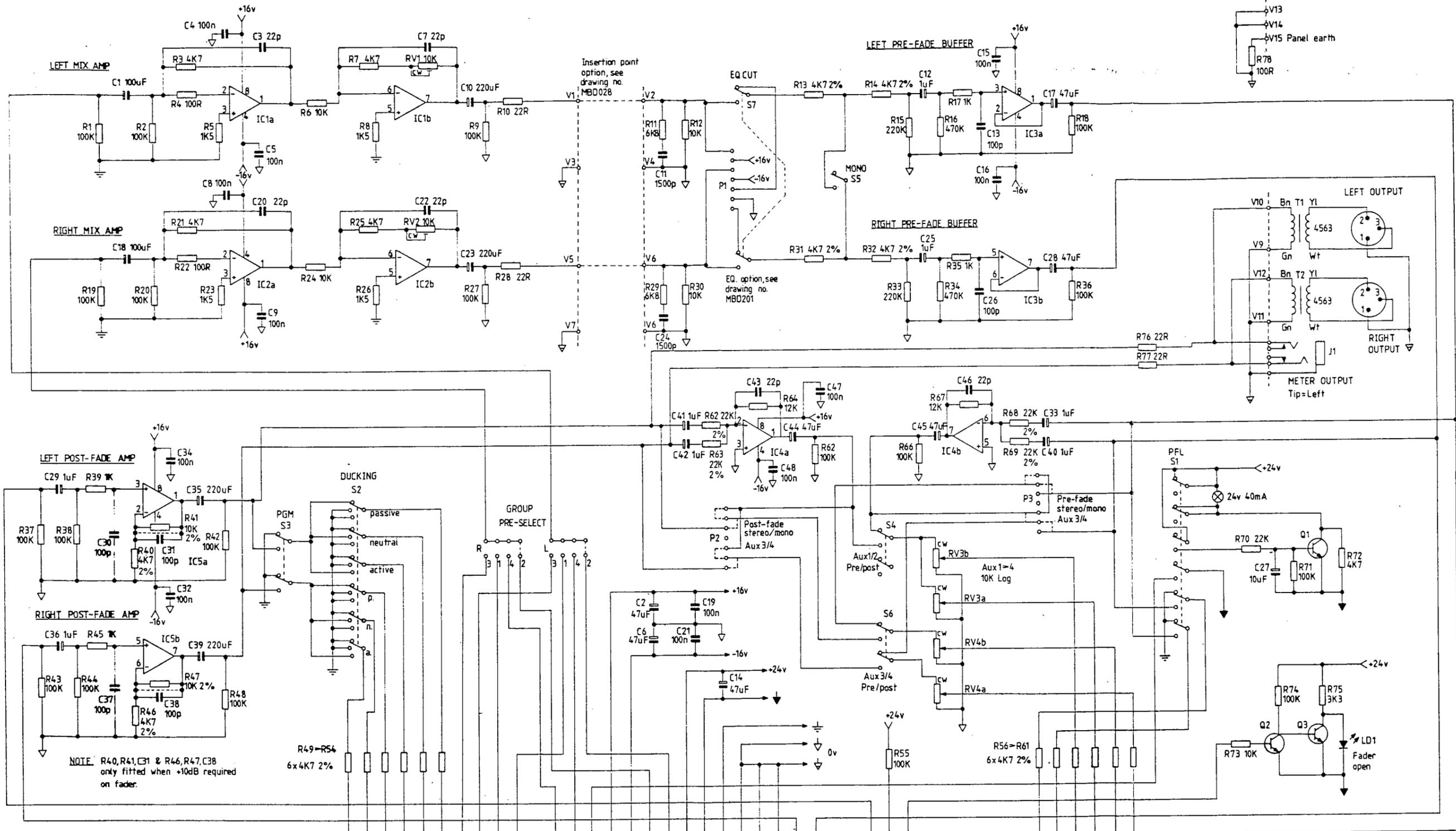
NOTES  
ICs=TL072

MONO EQUALISER
DRAWING No MBD 200 Iss.1
PCB TYPE AG0146 Iss.1
<b>mbi</b> FIG 25



NOTES  
All ICs = TL072

STEREO EQUALISER  
DRAWING No MBD 201 Iss.1  
PCB TYPE AG0147 Iss.1  
**mbi** FIG 26



NOTE: R40, R41, C31 & R46, R47, C38 only fitted when +10dB required on fader.

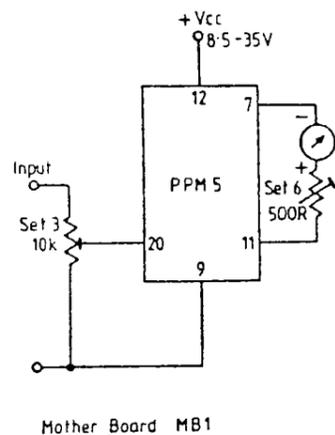
NOTES  
All transistors = ZTX107B  
All ICs = NE5532



GROUP OUTPUT  
DRAWING No MBD 196 Iss.1  
PCB TYPE AGO143 Iss.3  
**mbi** FIG 27

# SURREY ELECTRONICS

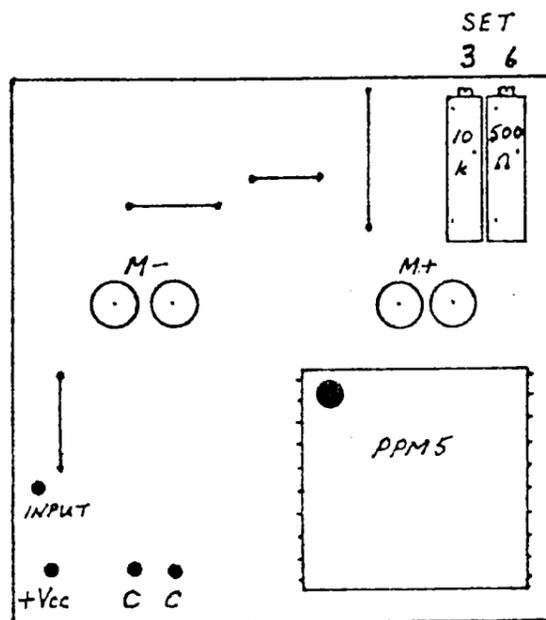
The Forge, Lucks Green, Cranleigh, Surrey,  
GU6 7BG, England. Tel. 0483 275997



PPM5 SPECIFICATION—Complies with IEC268-10A and BS5428-9 Type II. BS9450 and DEF-STAN 05-21 approved manufacture.

Input impedance	50k Ohms. Maximum permissible source impedance 2k5 Ohms
Input sensitivity for Mark 4	-13dBV.7, 170mV
Scale law	4dB increments between Mark 1 and Mark 7
Low level performance	Isolated 10ms burst of 5kHz at 30dB below Mark 6 reading gives a perceptible deflection
Calibration accuracy	Marks 2, 4, 6 $\pm 0.2$ dB; Marks 3, 5 $\pm 0.3$ dB; Marks 1, 7 $\pm 0.5$ dB
Frequency response at any Mark	31.5Hz - 16kHz $\pm 0.3$ dB 10Hz -2dB; 40kHz 0/-1dB
Rise time: response to isolated bursts of sine wave whose steady state amplitude deflects to Mk6	100ms of 5kHz 0 $\pm 0.5$ dB 10ms of 5kHz -2.5 $\pm 0.5$ dB 5ms of 5kHz -4.0 $\pm 0.75$ dB 1.5ms of 5kHz -9.0 $\pm 1.0$ dB 500 $\mu$ s of 10kHz -17.0 $\pm 2.0$ dB
Fall back time	Mark 7 to Mark 1 2.5 to 3s. Hybrids matched within 0.5% Suit use with TWIN movements without special pairing
Dynamic linearity and overload characteristic	When above 10 or 1.5ms burst of 5kHz is altered in level between -20dB and +10dB indications change in direct proportion $\pm 1$ dB +30dBV.7 input sustained indefinitely
Reversibility error	Bipolar rectification within 0.5dB at Mark 6 at 1kHz
Distortion introduced into 600 Ohms signal line	Sensitivity for Mark 4: 0dBV.7, supply on or off, MB1 circuit, 20Hz -20kHz at +20dBV.7. Less than -70dB, 0.03%
Temperature stability, drift between +10 and +50°C	Zero Mark 2 Mark 4 Mark 6 $\pm 2\%$ $\pm 0.8$ dB $\pm 0.4$ dB $\pm 0.2$ dB
Supply	+8.5V (2.5mA typ. 3mA max) to +35V (7mA typ. 8mA max)
Supply tolerance	8.5 to 35V variation: Zero $\pm 1\%$ , Mark 6 $\pm 0.2$ dB
Supply impedance permissible	Any. Protected against reversed supply polarity
Radio frequency immunity	No deflection in +120dB $\mu$ V/m, 84MHz, 100% AM by 1kHz sine wave
Meter movements	Left hand zero, 600 Ohms, 1mA f.s.d. special ballistics types suitable
20 pin DIL connections	Pitch 1 inch, 25.4mm: Pin 4 Rectifier output, 7 Meter -, 9 Common, 11 Meter +, 12 +Vcc, 20 Input

## MOTHER BOARD 1



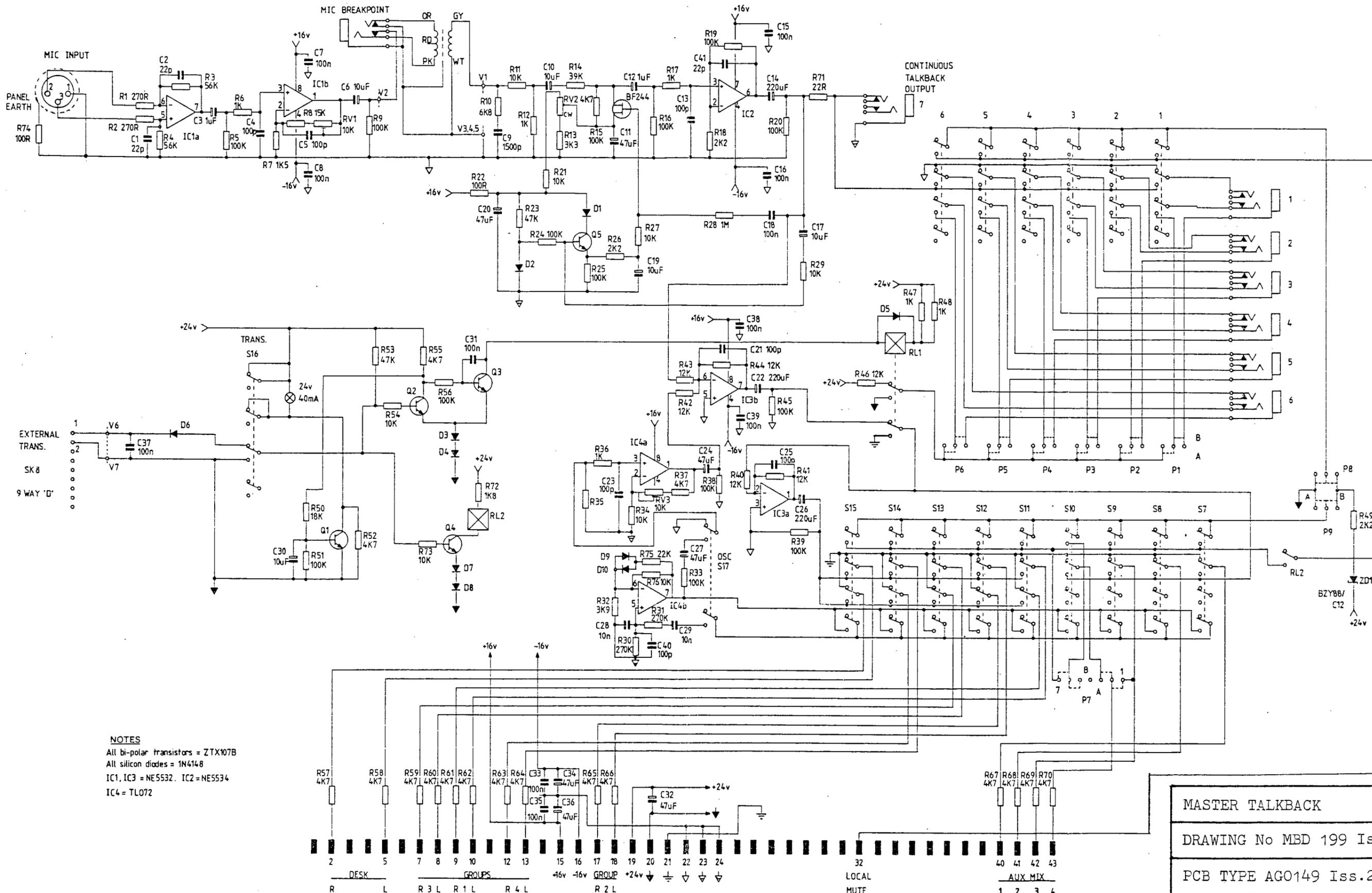
### Unbalanced

Input impedance 8k $\Omega$   
Sensitivity for PPM4: -13dBV.7, 180mV

### Alignment

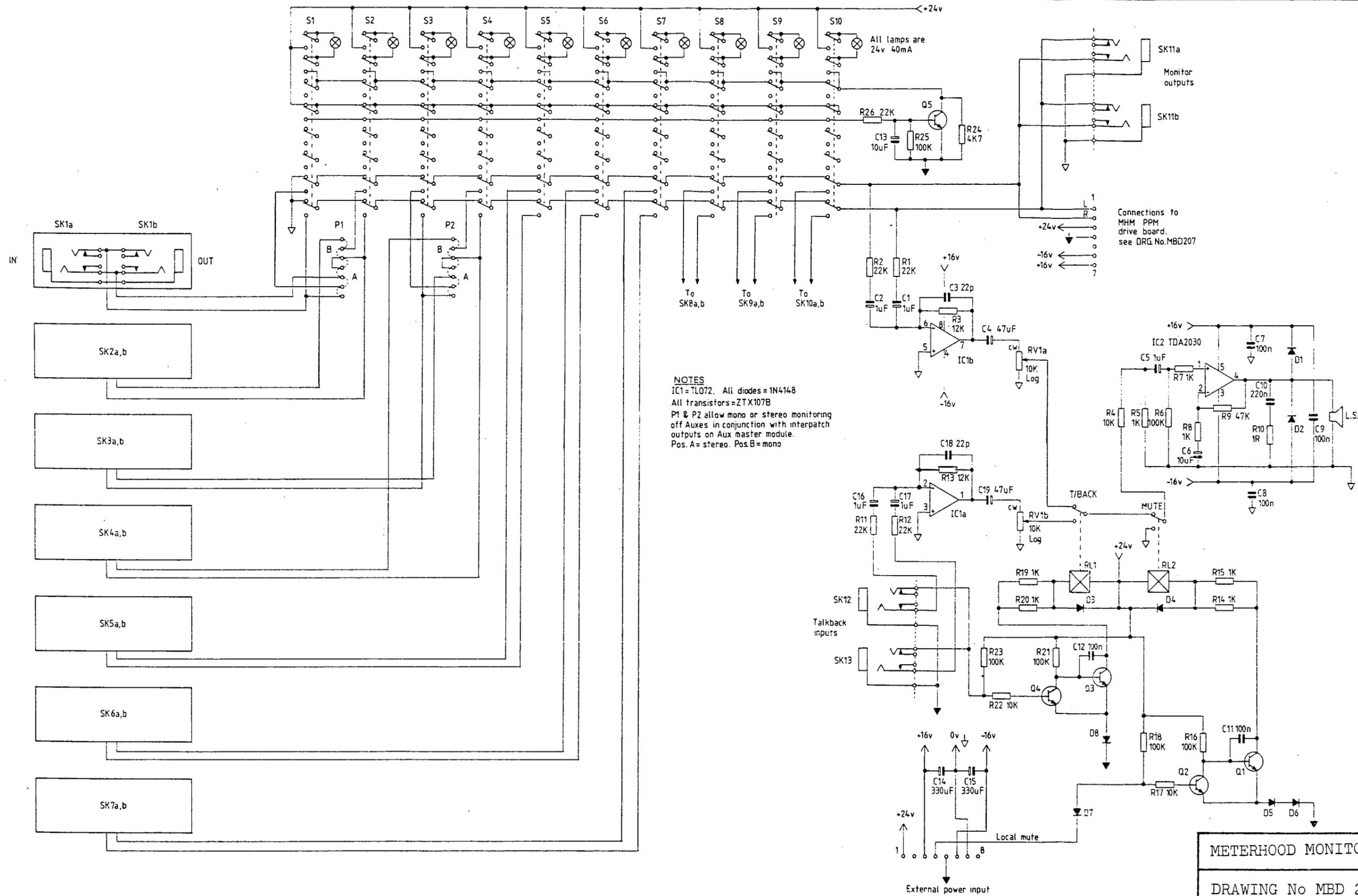
PPM Mark 6 is to be maximum level  
After the supply has been on for two minutes adjust the meter mechanical zero.  
Apply a 1kHz sine wave at 12dB below maximum and adjust SET 3 for a reading of Mark 3.  
Apply maximum level and adjust SET 6 for a reading of Mark 6.  
Repeat and then check that all divisions 1 to 7 are 4dB.

PPM DRIVER CARD, PPM 5
SURREY ELECTRONICS
mbi
FIG 28



**NOTES**  
 All bi-polar transistors = ZTX107B  
 All silicon diodes = 1N4148  
 IC1, IC3 = NE5532. IC2 = NE5534  
 IC4 = TL072

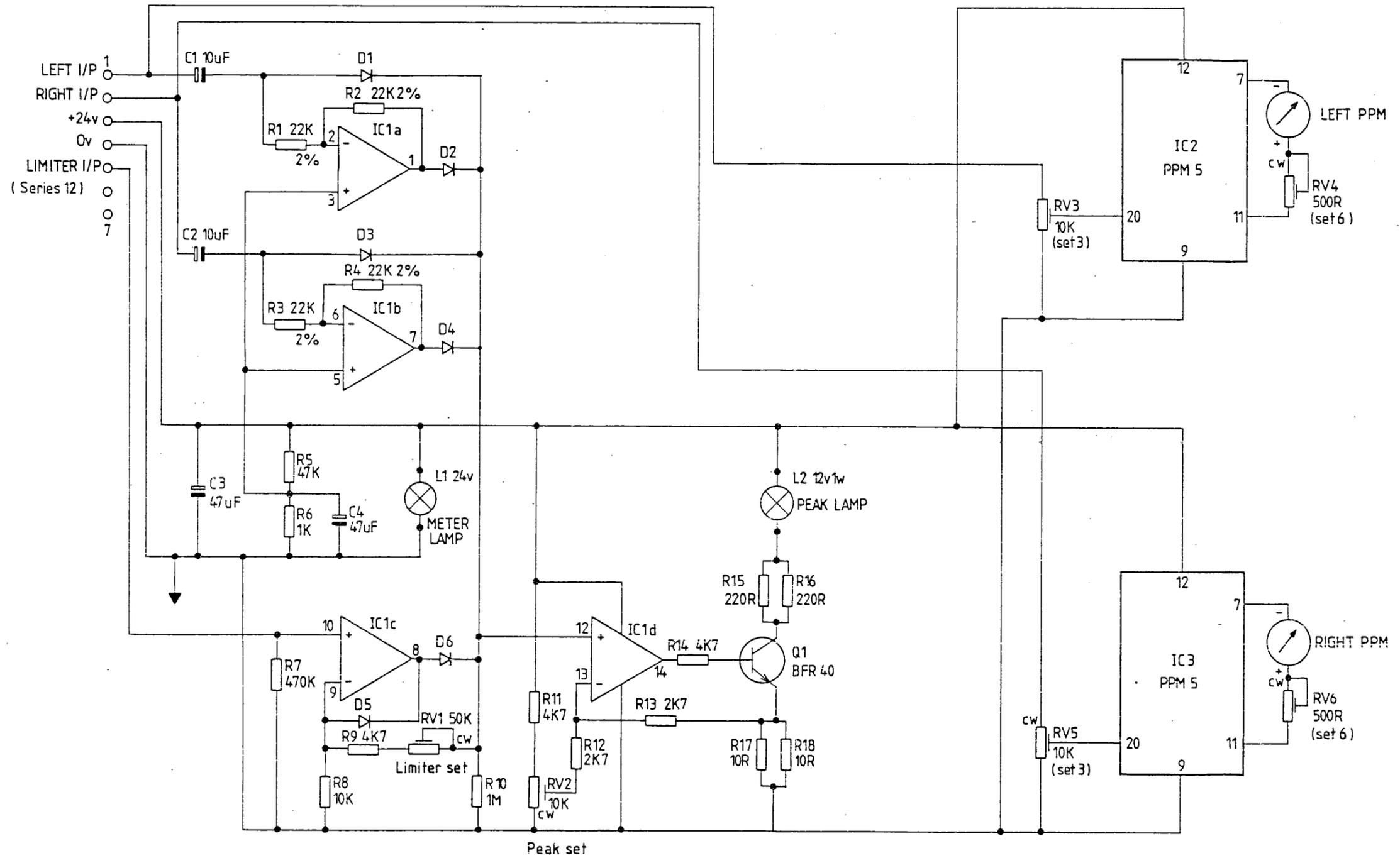
MASTER TALKBACK  
 DRAWING No MBD 199 Iss.1  
 PCB TYPE AGO149 Iss.2  
**mbi** FIG 29



**NOTES**  
 IC1 = TL072. All diodes = 1N4148  
 All transistors = ZTX107B  
 P1 & P2 allow mono or stereo monitoring  
 off Auxes in conjunction with interpatch  
 outputs on Aux master module.  
 Pos. A = stereo. Pos. B = mono

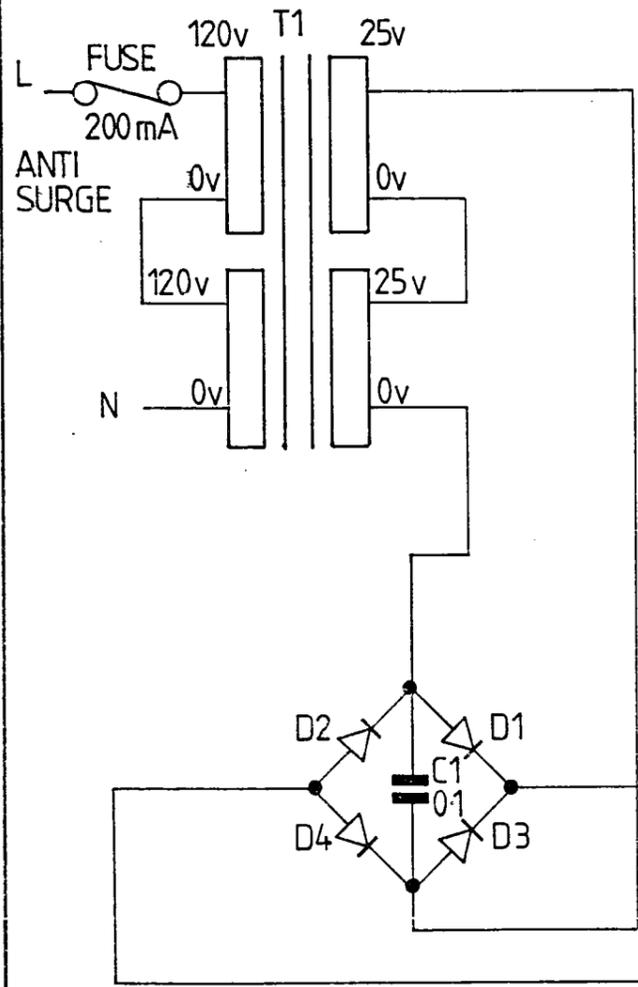
Connections to  
 MHM PPM  
 drive board.  
 see DRG No. MBD207

METERHEAD MONITOR	
DRAWING No MBD 206 Iss.1	
PCB TYPE AG0163 Iss.1	
mbi	FIG 30



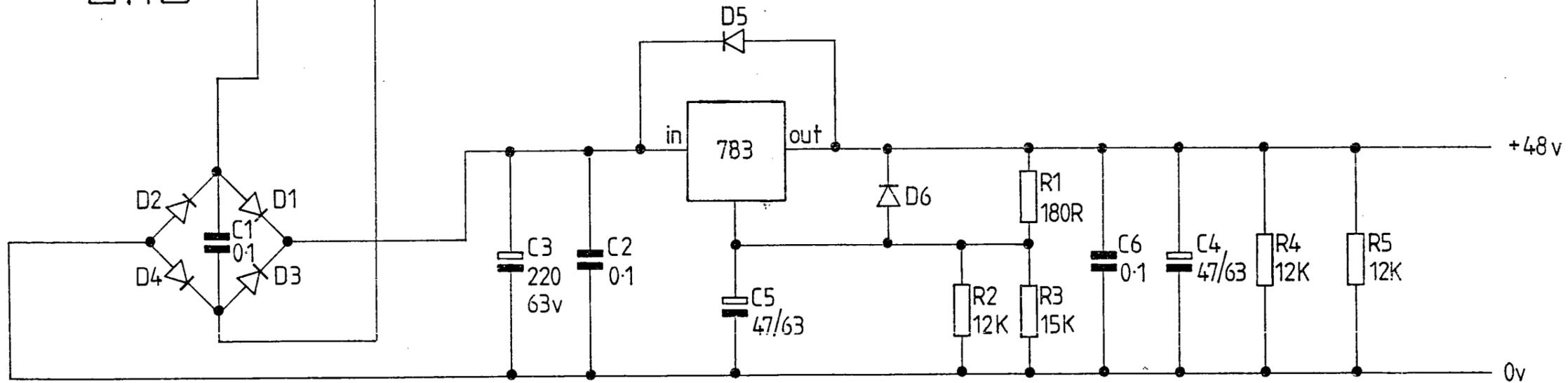
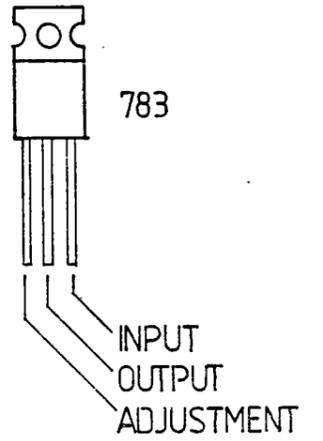
NOTES  
 IC1 = LM324  
 IC2 & 3 = Surrey PPM5  
 All diodes IN4148

PPM DRIVE BOARD	
DRAWING No MBD 207 Iss.1	
PCB TYPE AG0164 Iss.1	
<b>mbi</b>	FIG 31



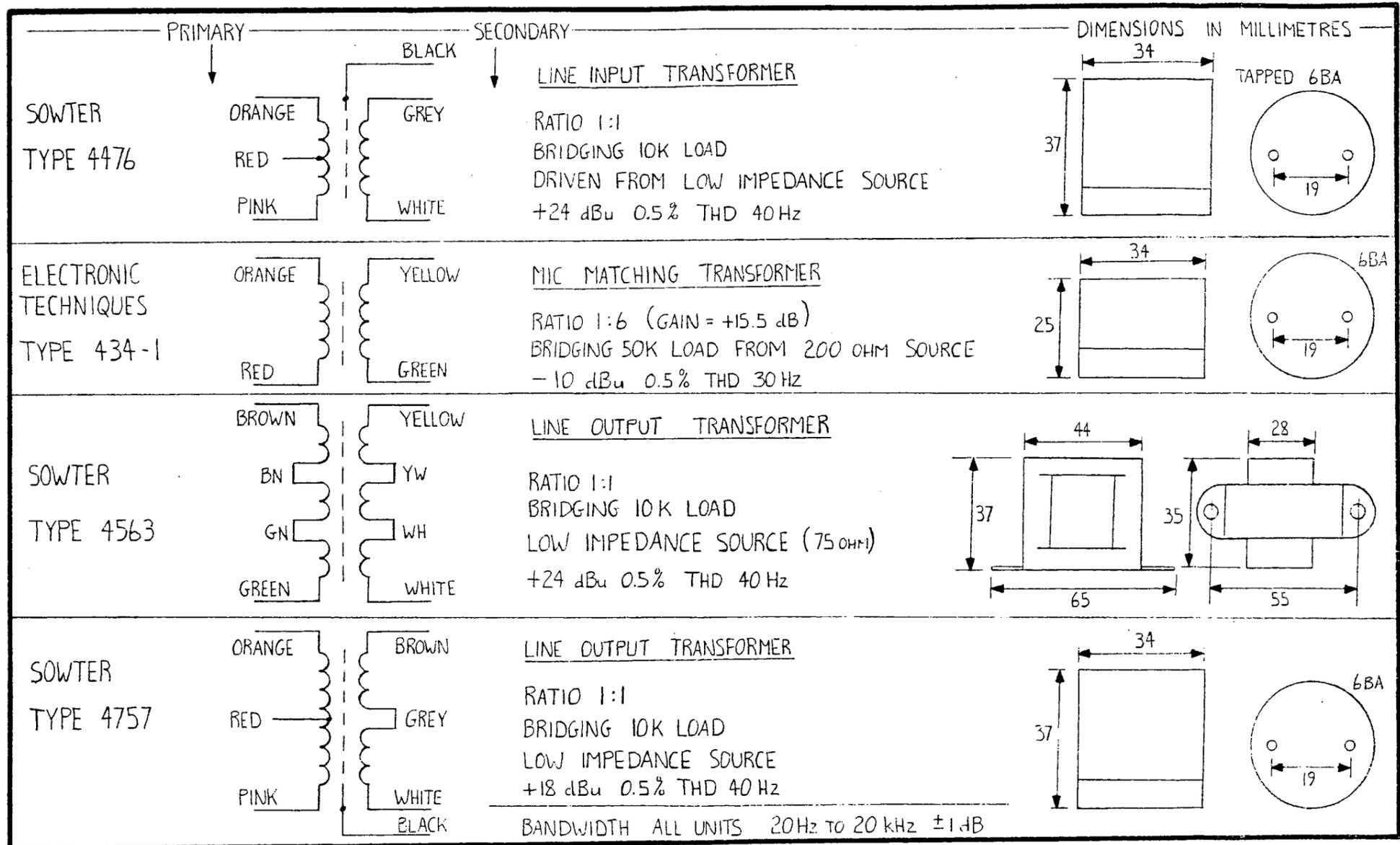
240v OPERATION AS SHOWN  
 120v OPERATION CONNECT PRIMARY WINDINGS IN PARALLEL  
 0v TO 0v AND 120 TO 120v

ALL DIODES IN4002



+48V PHANTOM PSU	
DRAWING No MBD 121 Iss.1	
PCB TYPE AG0116 Iss.1	
<b>mbi</b>	FIG 32





AUDIO TRANSFORMERS

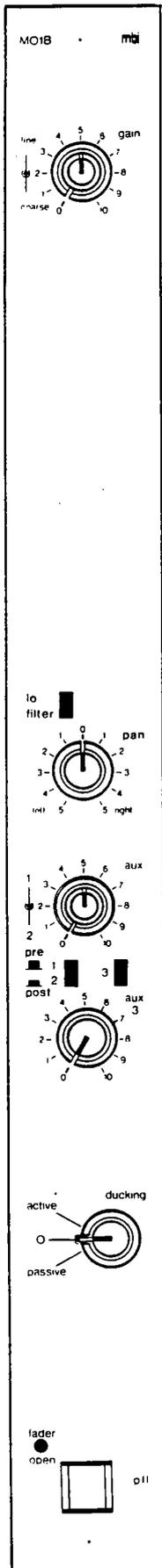
DRAWING No MBD 30 Iss.1

mbi

FIG 34

**S E R I E S   2 4 B   M O D U L E S**

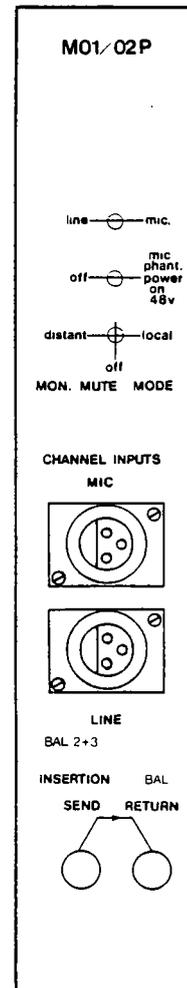
# MONO LINE INPUT MODULE WITHOUT EQUALISATION - M01B



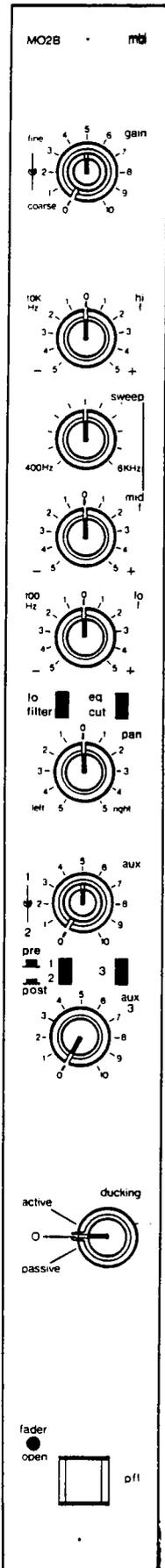
Mic/Line Input incorporating channel gain control to be used with pre-fade listen (pfl), bass roll-off, two mono and one stereo auxiliary sends (each switchable pre or post fader), pan control, ducking mode, fader open warning, pfl switch, mic/line selection, phantom power selection, and local-distant muting selection.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



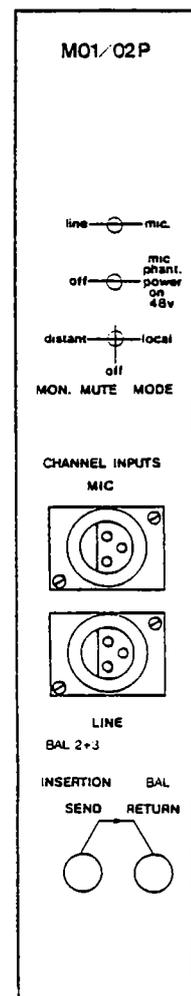
# MONO LINE INPUT MODULE WITH EQUALISATION - M02B



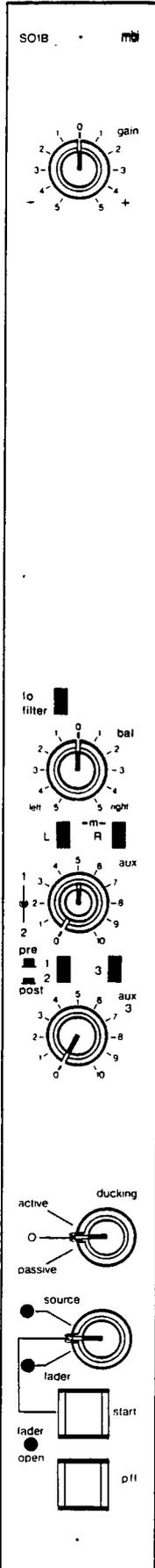
Mic/Line Input incorporating channel gain control to be used with pre-fade listen (pfl), three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, two mono and one stereo auxiliary sends (each switchable pre or post fader), pan control, ducking mode, fader open warning, pfl switch, mic/line selection, phantom power selection, and local-distant muting selection.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



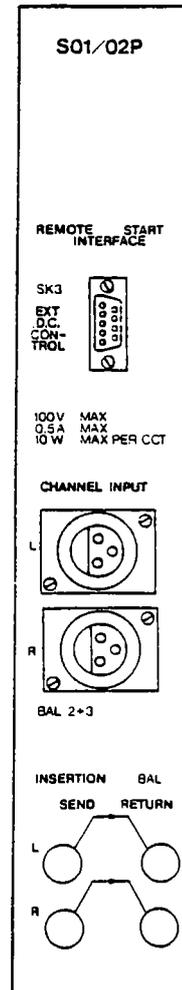
# STEREO LINE MODULE WITHOUT EQUALISATION - S01B



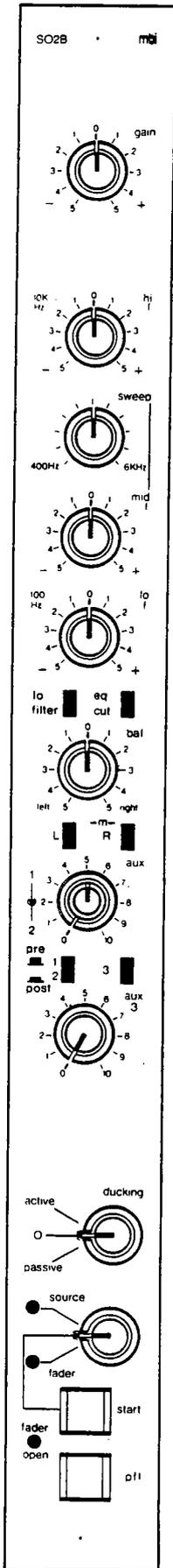
Stereo Line Input incorporating channel gain control to be used with pre-fade listen (pfl), bass roll-off, two mono and one stereo auxiliary sends (each switchable pre or post fader), balance control, stereo-left-right-mono select, ducking mode, fader start-stop/button start controls, fader open warning, pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



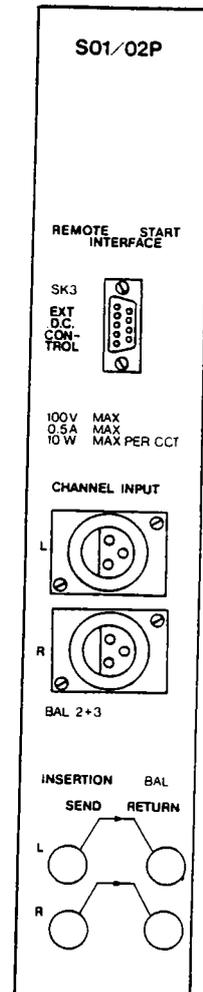
# STEREO LINE MODULE WITH EQUALISATION - S02B



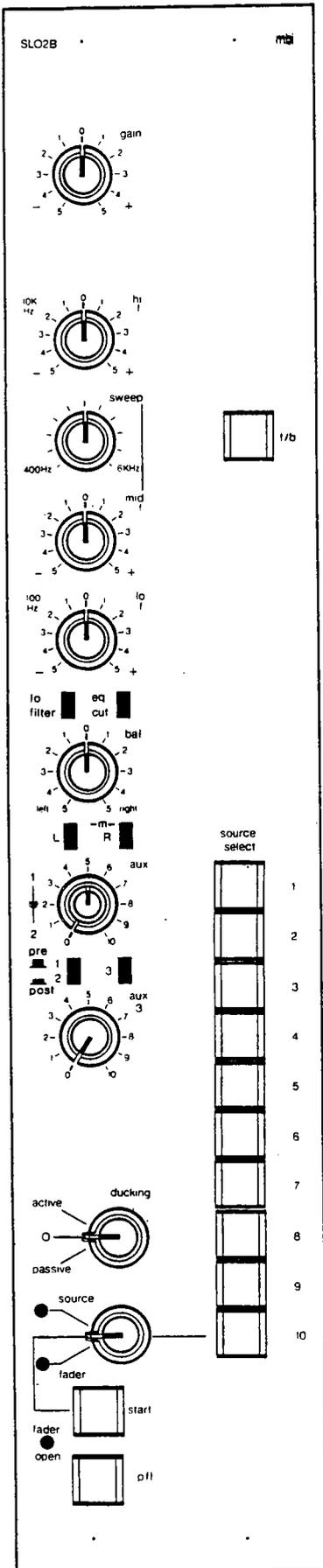
Stereo Line Input incorporating channel gain control to be used with pre-fade listen (pfl), three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, two mono and one stereo auxiliary sends (each switchable pre or post fader), balance control, stereo-left-right-mono select, ducking mode, fader start-stop/button start controls, fader open warning, pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



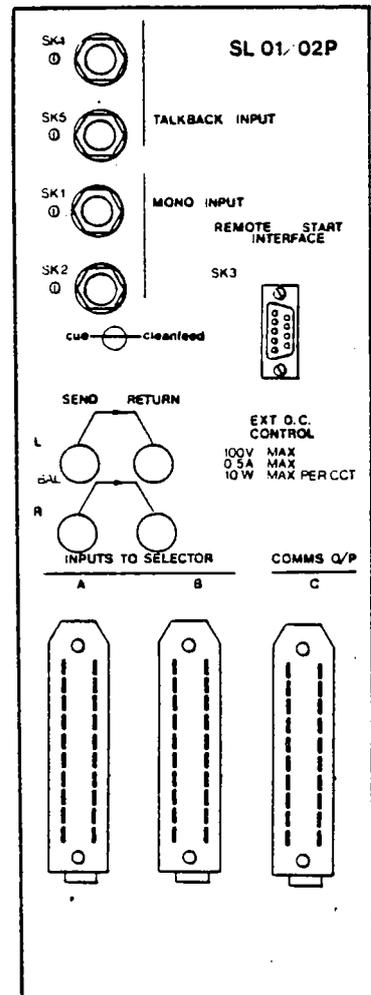
## STEREO LINE SELECTOR MODULE WITH EQUALISATION - SL02B



Stereo Line Input selectable between 10 stereo sources incorporating independent clean feed generation of desk output minus stereo line input selected (talkback switch on front panel interrupts), channel gain control to be used with pre-fade listen (pfl) three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, balanced input, two mono and one stereo auxiliary sends (switchable pre or post fader) balance control, stereo-left-right-mono select, ducking mode, fader start-stop/button start control operating on selector 10, fader open warning, pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

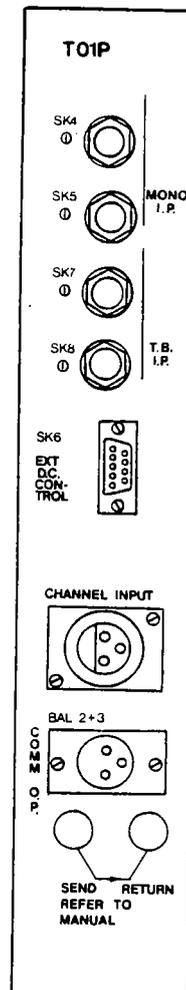
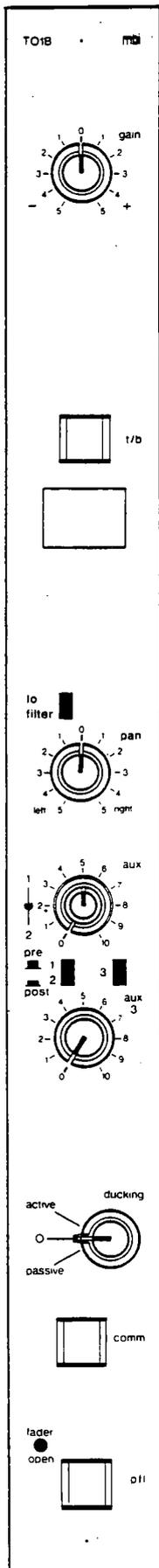


# TELEPHONE MODULE - T01B

Telephone Line Input incorporating independent clean feed generation of desk output minus telephone line input, channel gain control to be used with pre-fade listen (pfl), two mono and one stereo auxiliary sends (each switchable pre or post fader), pan control, ducking mode, communicate/to-air selector enabling call handling via talkback, an additional momentary talkback key is incorporated for use when the module is used for outside sources and a control line is in operation, fader open warning, pfl switch.

An optional tele-balance unit switch may be fitted and can be used in conjunction with a TBU to transfer calls to the module with or without use of a telephone handset. After the telephone call has been put to air, it is possible by closing the fader to cancel the call and clear the TBU for the next caller.

The module is also available with +10dB post fader gain.

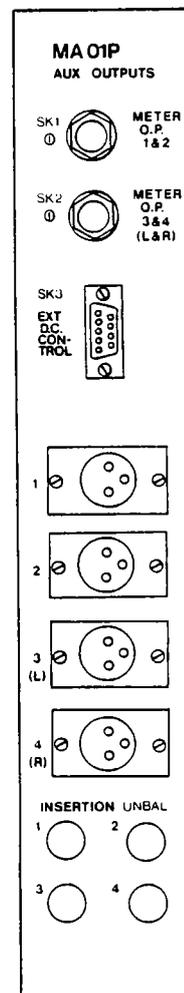
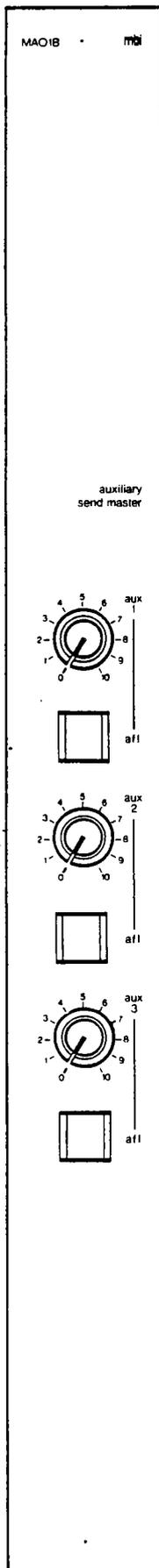


# AUXILIARY SEND MASTER MODULE - MA01B

Auxiliary master output with output controls for two mono and one stereo auxiliary sends including AFL.

This module is available with unbalanced insertion points.

Socket SK3 has two local mute control outputs and two distant mute control outputs (both voltage-free loops)



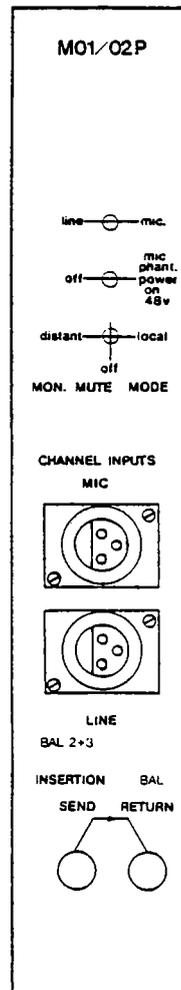
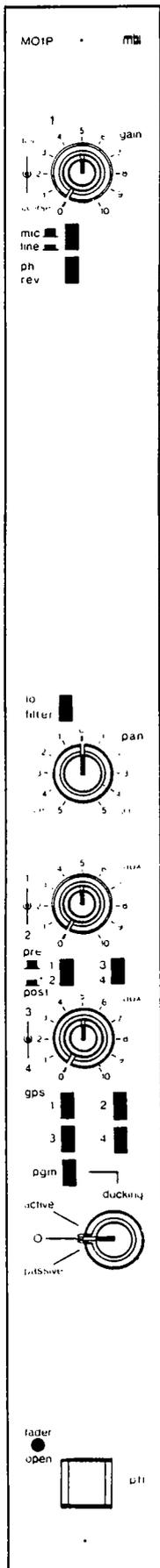
S E R I E S 2 4 P M O D U L E S

# MONO LINE INPUT WITHOUT EQUALISATION - M01P

Mic/Line Inputs incorporating channel gain control to be used with pre-fade listen (pfl), mic/line selector switch, phase reverse, bass roll-off, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), pan control, routing to 4 stereo sub-groups and main programme output, ducking mode when routed to main programme output, fader open warning, pfl switch, phantom power selection, local-distant muting selection.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

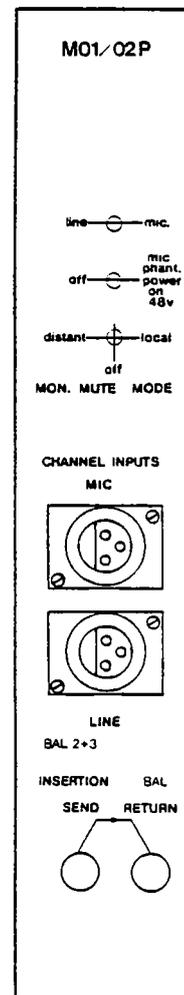
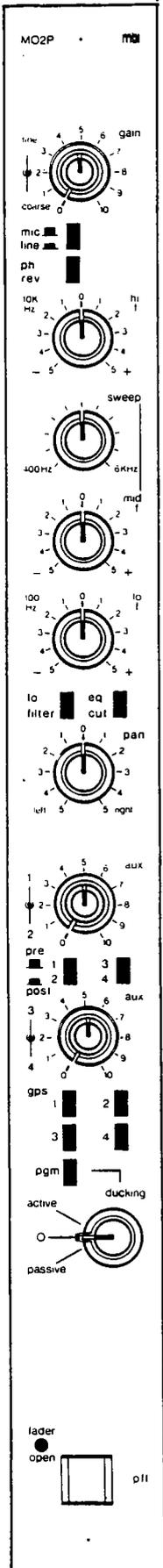


# MONO LINE INPUT WITH EQUALISATION - M02P

Mic/Line Inputs incorporating channel gain control to be used with pre-fade listen (pfl), mic/line selector switch, phase reverse, three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), pan control, routing to 4 stereo sub-groups and main programme output, ducking mode when routed to main programme output, fader open warning, pfl switch, phantom power selection, and local-distant muting selection.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

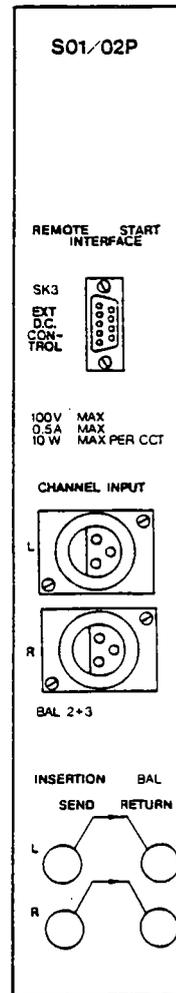
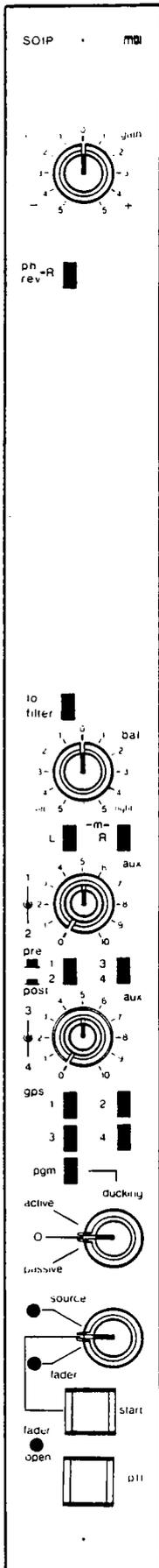


# STEREO LINE INPUT MODULE WITHOUT EQUALISATION - S01P

Stereo Line Input incorporating channel gain control to be used with pre-fade listen (pfl), bass roll-off, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), phase reverse on right balanced input, balance control, routing to 4 stereo sub-groups and main programme output, ducking mode when routed to main programme output, stereo-left-right-mono select, ducking mode, fader start-stop/button start controls, fader open warning, and pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

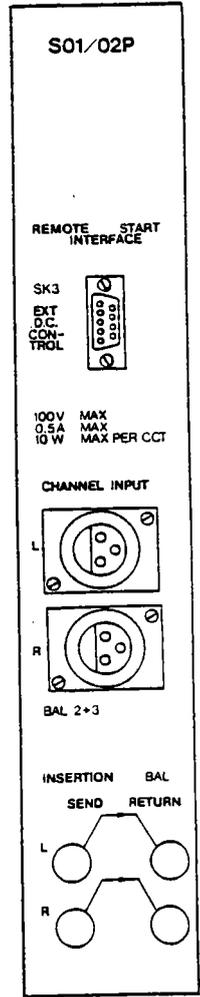
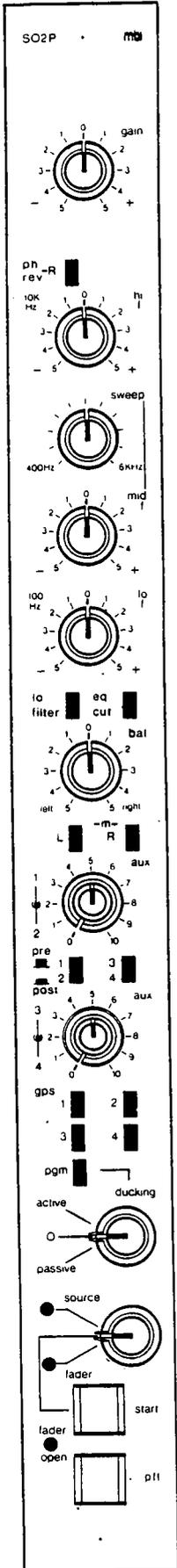


# STEREO LINE INPUT MODULE WITH EQUALISATION - S02P

Stereo Line Inputs incorporating channel gain control to be used with pre-fade listen (pfl), three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), phase reverse on right balanced input, balance control, routing to 4 stereo sub-groups and main programme output, ducking mode when routed to main programme output, stereo-left-right-mono select, ducking mode, fader start-stop/button start controls, fader open warning, pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

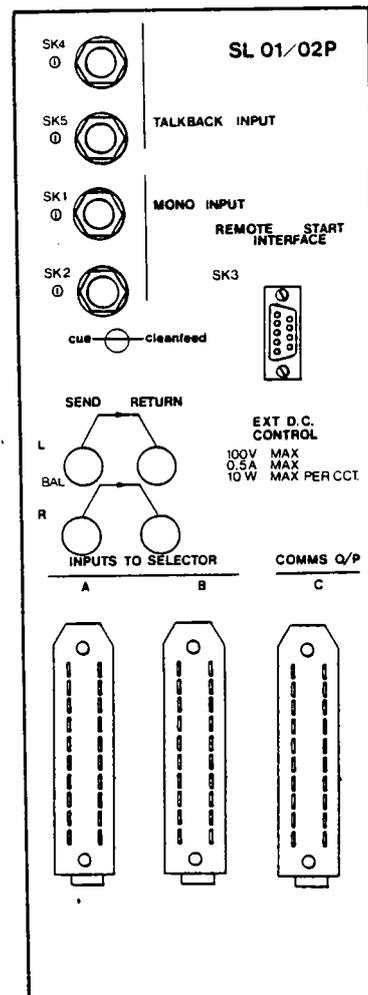
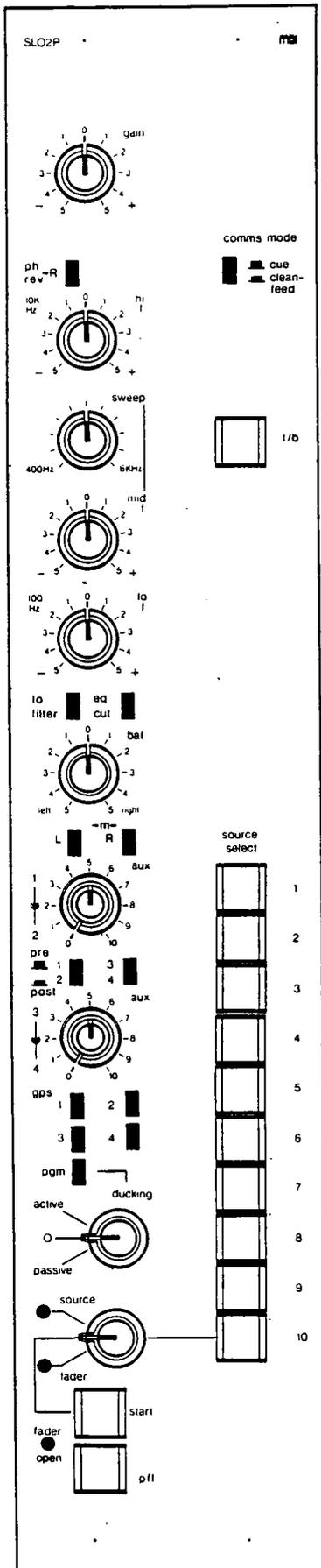


# STEREO LINE SELECTOR MODULE WITH EQUALISATION - SLO2P

Stereo Line Inputs selectable between 10 stereo sources incorporating independent clean feed generation of desk output minus stereo line input selected (talkback switch on front panel interrupts), channel gain control to be used with pre-fade listen (pfl), three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, bass roll-off, phase reverse on right balanced input, routing to 4 stereo sub-groups and main programme output, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), balance control, stereo-left-right-mono select, ducking mode, fader start-stop/button start control operating on button 10, fader open warning, pfl switch.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.

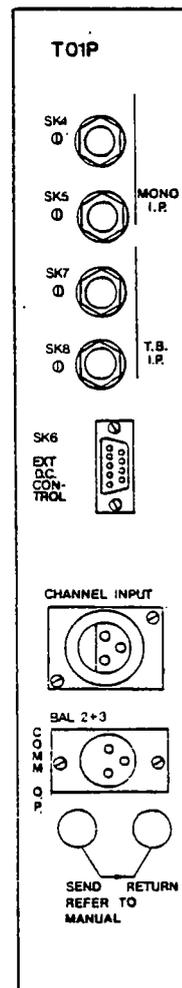
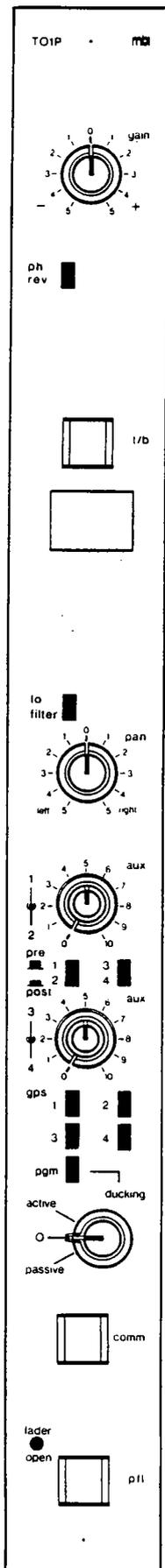


## TELEPHONE MODULE - T01P

Telephone Line Input incorporating independent clean feed generation of desk output minus telephone line input, channel gain control to be used with pre-fade listen (pfl), phase reverse, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), pan control, routing to 4 stereo sub-groups and main programme output, ducking mode when routed to main programme output, communicate/to-air selector enabling call handling via talkback, an additional momentary talkback key is incorporated for use when the module is used for outside sources and a control line is in operation, fader open warning, and pfl switch.

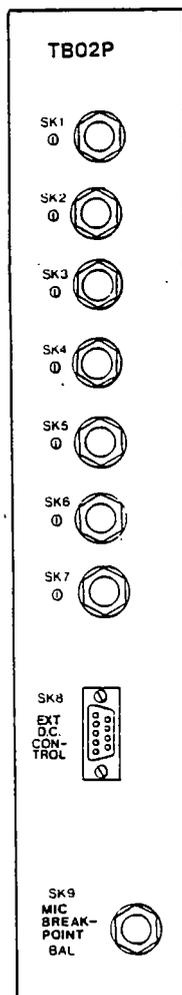
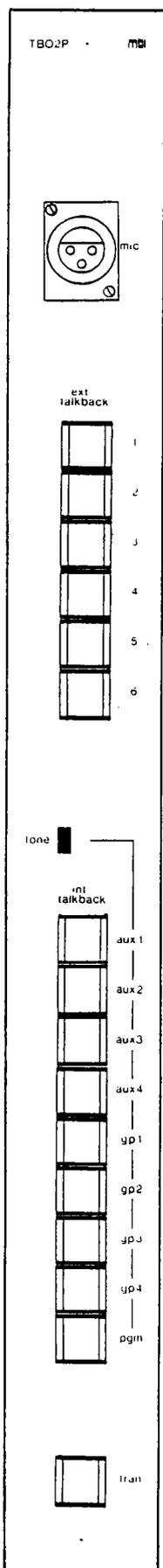
An optional tele-balance unit switch may be fitted and can be used in conjunction with a TBU to transfer calls to the module with or without use of a telephone handset. After the telephone call has been put to air, it is possible by closing the fader to cancel the call and clear the TBU for the next caller.

The module is also available with +10dB post fader gain.



# TALKBACK MODULE - TB02P

Talkback module incorporating talkback microphone on gooseneck, sends to six external destinations through headphones and loudspeakers via monitor modules, sends to nine internal destinations: 4 mono auxiliaries, up to 4 groups, and main programme output. The module also incorporates a low frequency slate tone which may be routed to any of the internal destinations and a 'rehearsal/transmission' control which disables sends to internal destinations. This facility is remoteable via socket SK8.



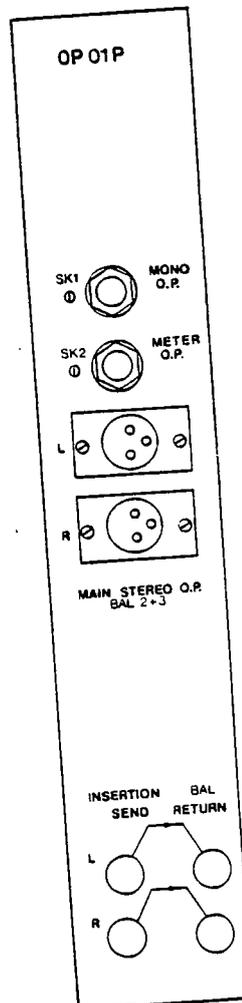
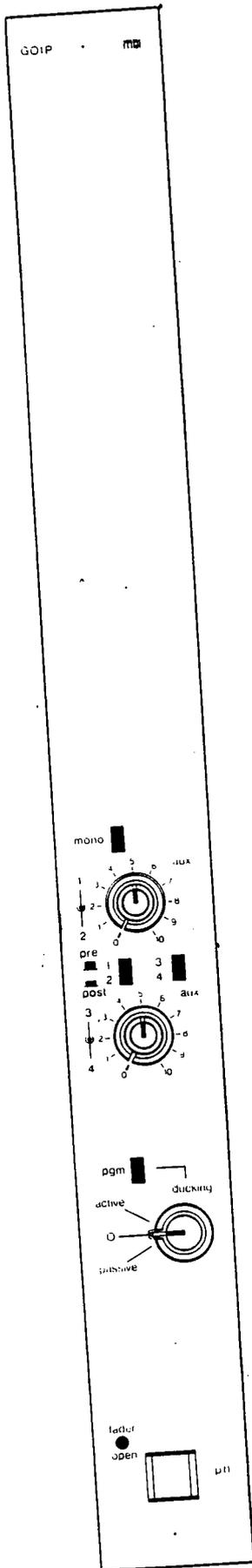
# GROUP OUTPUT MODULE WITHOUT EQUALISATION - G01P

Stereo Group Output incorporating mono switch, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), routing to main programme output, ducking mode when routed to main programme output, fader open warning, pfl switch, and meter output.

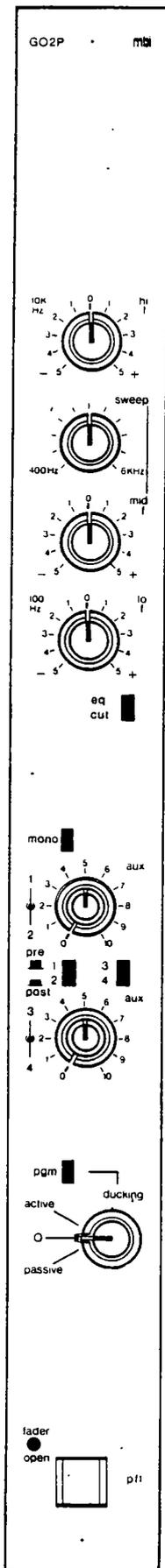
This unit has an individual group output provided a channel is routed to it. The output is after fader. In addition, when the programme switch is activated, group output is sent to the main stereo output of the desk.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



## GROUP OUTPUT MODULE WITH EQUALISATION - G02P

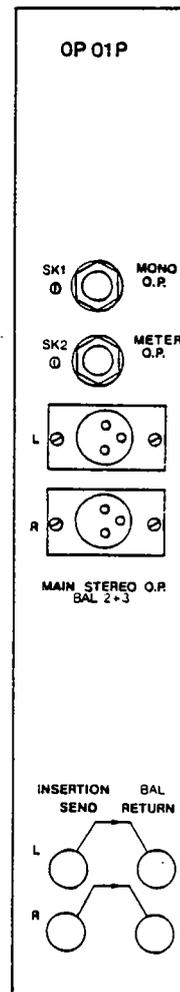


Stereo Group Output incorporating mono switch, four mono or two mono and one stereo auxiliary sends selectable internally (each switchable pre or post fader), three band equalisation at 10kHz +/-10dB, 400Hz to 6kHz sweepable +/-12dB, and 100Hz +/-10dB, eq in/out, routing to main programme output, ducking mode when routed to main programme output, fader open warning, pfl switch, and meter output.

This unit has an individual group output provided a channel is routed to it. The output is after fader. In addition, when the programme switch is activated, group output is sent to the main stereo output of the desk.

This module is available with balanced & floating insertion points and is denoted by adding I/P to the module suffix.

The module is also available with +10dB post fader gain.



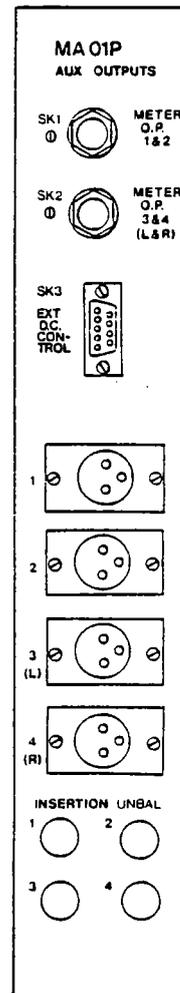
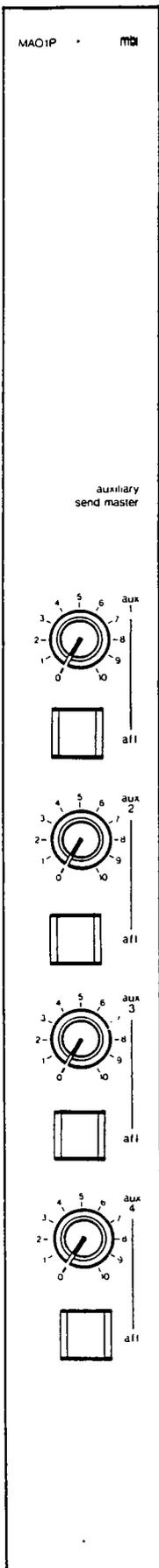
# AUXILIARY GROUP OUTPUT MODULE - MA01P

Master Auxiliary Output incorporating four master gain controls and AFL for each individual auxiliary output.

A link option provides a two mono and one stereo auxiliary buss system.

This module is available with unbalanced insertion points.

Socket SK3 has two local mute control outputs and two distant mute control outputs available (voltage-free loops)

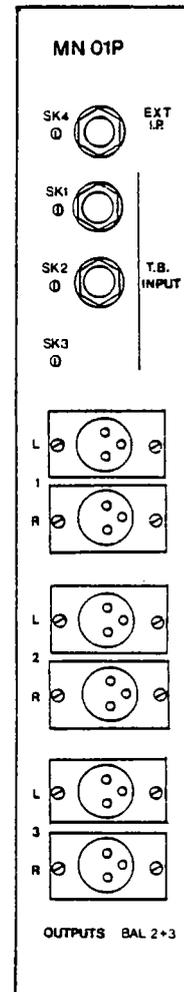
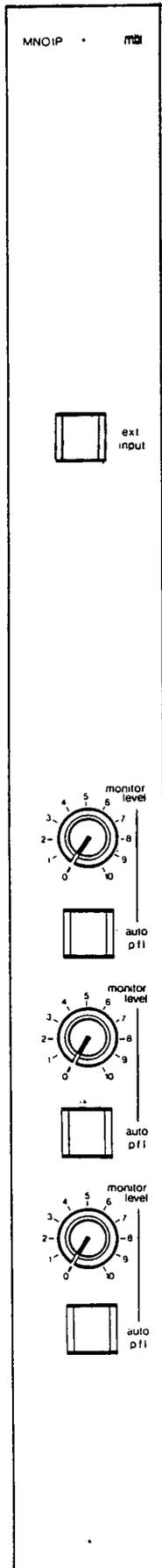


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SERIES 24B & SERIES 24P

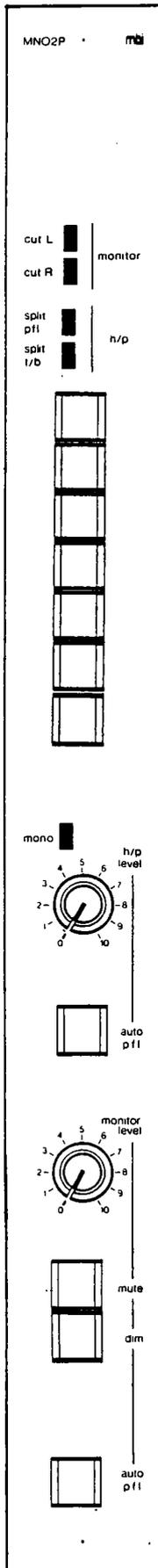
### THREE-WAY MONITOR MODULE - MN01B/P

Monitor module generating three independent stereo monitor feeds. Each monitor feed incorporates monitoring of desk output interrupted (when pre-programmed) by pre-fade listen in stereo when pfl is selected on an input module and by selective talkback. Each monitor feed may be directed to headphones, local loudspeakers, or distant loudspeakers; the loudspeakers will automatically mute when the corresponding local or distant microphone channel is activated. Alternatively, an external input selector is incorporated to switch the three outputs from desk to an external source monitoring. Separate gain controls are provided for each of the three feeds.

Demuting for distant loudspeakers available (via TB02) when in rehearsal state.



## FULL-WAY MONITOR MODULE - MNO2B/P



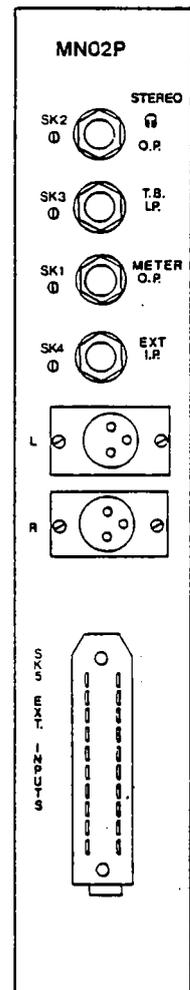
Monitor module generating one independent stereo monitor feed which is switchable between stereo desk output, and six stereo external sources such as off-air. The sixth input is unbalanced and is used in conjunction with the MHMO1 meter monitoring unit output. The monitor feed will be interrupted (when pre-programmed) by pre-fade listen in stereo when pfl is selected on an input module and by selective talkback. The feed may be switched to mono and may be manually muted or dimmed without affecting the setting of the gain control provided and may be directed to headphones, local loudspeakers, or distant loudspeakers; the loudspeakers will automatically mute when the corresponding local or distant microphone channel is activated.

A selector allows the operator talkback or programme, or in split mode talkback on one channel and programme on the other.

In addition, a split pre-fade selector allows a similar facility to that of the split talkback button.

De-muting for distant loudspeakers available (via TB02) when in rehearsal state.

"Door dim" facility available.



# MASTER OUTPUT MODULE - MA02B/P

Master Output with main stereo output and ducking attack release and depth controls.

Fader options:

- i) stereo output fader
- ii) left & right output faders
- iii) fader blank

This module is available with balanced and floating insertion points and is denoted by adding I/P to the module suffix.

