DD 500

User Manual

Klark Teknik Building
Walter Nash Road
Kidderminster
Worcestershire
DY11 7HJ

Tel: +44 (0) 1562 741515
Fax: +44 (0) 1562 745371

Email: info@uk.telex.com
Website: www.ddaconsoles.com

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1.1 Introduction

The DDA DD500 is a high quality Electronic Crossover, in which all the important filter parameters can be programmed by the use of various plug – in system programming modules.

The DD500 is switchable stereo 2 way, or 3/4 way mono.

Crossover frequency, slope, and roll – off characteristics can be tailored to suit the requirements of each system, and additionally, the output levels of each band can be precisely adjusted by front panel controls, which are mounted behind a tamper proof fascia.

Output polarity can also be reversed, in each band, to enable the system to be set up for optimum phase characteristics.

All inputs and outputs are electronically balanced, thereby eliminating unnecessary transformers from the signal chain, preserving phase integrity and ensuring low distortion at all output levels below clipping.

The limiters are located mid – band, the optimum electronic position to avoid distortion in the signal chain.

1.2 Warranty

This warranty applies to units purchased in the UK, and should form the basis of the warranty offered by the overseas Distributor of DDA products.

"DDA" means Dearden Davies Associates Limited

"End User" means the person who first puts the equipment into regular operation.

"Dealer" means the person other than DDA (if any) from whom the End User purchased the equipment provided such person is authorised for this purpose by DDA or its accredited Distributor.

"Equipment" means the equipment supplied with this manual.

If within the period of twelve months from the date of delivery of the Equipment to the End User it shall prove defective by reason only of faulty materials and/or workmanship (but not faulty design) to such an extent that the effectiveness and/or usability thereof is materially affected, the Equipment or the defective component shall be returned to the Dealer or to DDA and subject to the following conditions the Dealer or DDA will repair or at its option replace the defective components. Any component replaced will become the property of DDA.

Any Equipment or component returned will be at the risk of the End User whilst in transit (both to and from the Dealer or DDA) and postage must be prepaid.

This warranty shall only be valid if:–

i) The Equipment has been properly installed in accordance with the instructions contained in this manual; and
ii) The End User has notified DDA or the Dealer in writing within 14 days of the defect appearing; and
iii) No persons other than authorised representatives of DDA or the Dealer have effected any replacement of parts, maintenance, adjustments or repairs to the Equipment; and
iv) The End User has used the Equipment only for such purposes as DDA recommends with only such operating supplies as meet DDA's specifications and otherwise in all respects in accordance with DDA's recommendations.

v) Defects arising as a result of the following are not covered by this warranty : faulty or negligent handling, chemical or electrochemical or electrical influences, accidental damage, Acts of God, neglect, deficiency in electrical power, air – conditioning or humidity control.

vi) Benefit of this warranty may not be assigned by the End User.

vii) End Users who are consumers should note that their rights under this warranty are in addition to and do not affect any other rights to which they may be entitled against the seller of the Equipment.

Section 2.....Specifications

Input Impedance **Electronically Balanced**	**10k Ohms**
Input Level (nominal) (maximum)	+4dBv +20dBv
Output Impedance **Electronically Balanced**	**<75 ohms**
Output Level (nominal) (maximum balanced)	+4dBv +20dBv
Noise (at any output)	< −85dBv
Crosstalk	< −60dBv
Distortion (at any output, +4dBv)	<0.05%
Interface	Audio − XLR type AC Mains − IEC
Case	1U Rack Mount, Aluminium
Dimensions	Width 483 mm (19") Height 44.5 mm (1.75") Depth 205 mm (8.1")
Weight	3.8 Kg (8.5 lbs)
Power Requirements	100 − 120 Volts, 50/60 Hz 200 − 240 Volts, 50/60 Hz

3.1 Unpacking

Your DDA Crossover was carefully packed in a container designed to protect it from rough handling during transit. However, if damage is evident, do not destroy the packing material. Notify the carrier immediately. Claims for damage in transit must be made by the consignee.

3.2 Environmental Conditions

The unit itself produces very little heat. However, If installed in a rack containing other heat producing equipment, such as power amplifiers etc, adequate ventilation must be provided, to ensure prolonged component life. Avoid installation in close proximity to large power transformers, which could induce hum into the circuitry.

3.3 Power

The unit can be operated from either 100 – 120v or 200 – 240v mains supplies (50 or 60Hz).

Verify both the actual mains voltage and the setting of the mains voltage selector switch on the rear panel, before applying power to the unit.

Check also that the fuse rating is correct for the mains voltage. The fuse should be a 20mm Anti – surge type, of 250mA rating for 200 – 240v operation, and of 500mA for 100 – 120v operation.

Do not operate the unit with fuses of incorrect rating – this will invalidate the warranty.

Connect a suitable plug to the mains power cable. The colour coding of the cable will depend on the country in which the unit was purchased.

Europe	Brown – Live Blue – Neutral Green/Yellow – Earth
USA	Black – Live White – Neutral Green – Earth

Do not operate the system with the earth wire disconnected. It is required for safety and a potential hazzard situation could occur in the event of a malfunction.

3.4 Audio Connections

All audio connections are made by means of XLR type connectors, inputs being on female connectors, and outputs on males. Both inputs and outputs are electronically balanced to minimize earth loop problems.

Pin 1 – Screen

Pin 2 – Signal –ve (cold)

Pin 3 – Signal +ve (hot)

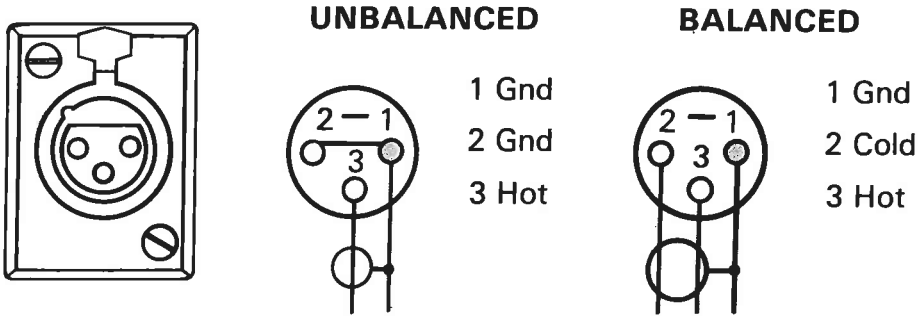

Fig 3.1 XLR Input Connections

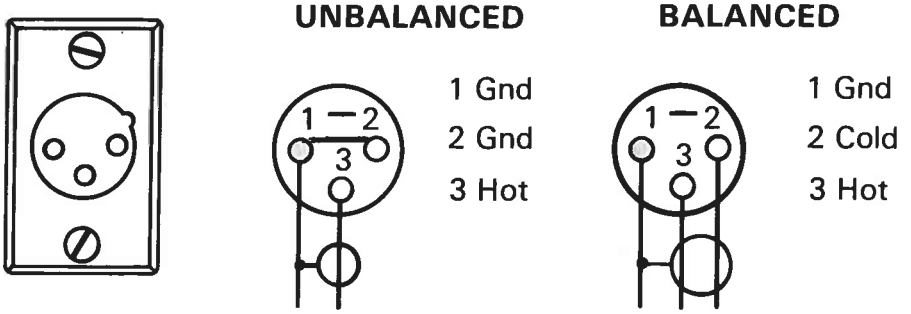

Fig 3.2 XLR Output Connections

The output stage of each band is a sophisticated electronically balanced circuit which can be operated in either balanced or unbalanced mode, without any change in output level, or readjustment. Either the signal –ve or the signal +ve can be grounded by linking directly to Pin 1 on the connector.

4.1 Mode

The DD500 is internally switchable for either Stereo 2 way, or Mono 4 way operation, indicated by front panel LED indicators. To change mode, it is necessary to remove the top cover panel of the unit, and set the alternate action push switch located immediately behinnd the mode LED's. In addition, correctly configured crossover cards must be plugged into the A and B positions for Stereo 2 way operation, and into the A, B and C positions for mono 4 way operation. The following table gives mode/card position data.

Mode v. Frequency card positions

Mode	B	C	A
2 way stereo	L	–	R
4 way mono	Lo/Lo – Mid	Lo/Mid – Hi/Mid	Mid/Hi
3 way mono	Lo/Mid	Mid/Hi	SPM3

If a mono 3 way configuration is required, a 3 way blanking card type SPM3 must be plugged into position A, to bypass the low – pass filter on the high – mid output. The high – mid band will now function as the HF (treble) output, and the HF output connector will be unused.

Output Connectors

Mode	Low	Low – Mid	High – Mid	High
4 way mono	L	L – M	H – M	H
3 way mono	L	M	H	–

4.2 Level Controls

The level in each band is controlled by a 41 position detented potentiometer. This allows levels to be accurately reset to previously determined positions, while at the same time providing essentially continuous control. The range of control is 16dB, ie +4dB of gain, or 12dB of attenuation.

4.3 Phase Reverse

The phase reverse switch inserts a 180 degree phase reversal into the selected band. This allows correction of the phase shift introduced by certain configurations of crossover slope. It is also useful to correct for miswired speaker systems. The above conditions will usually cause a notch to occur at the crossover frequency, which can be observed on a real time analyser.

Phase cancellation can also occur because of less than ideal placement of the various drive units in relation to each other. For instance, if the voice coils (ie the sound point sources) are not vertically aligned in the same plane, a time – delay is introduced which could mean the partial cancellation of a band of frquencies to which both upper and lower frequency drive units are responding, ie at the crossover frequency.

4.4 Mute

Each band can be separately muted, a facility which is very useful during set – up and alignment. When the switch is depressed and latched down, the band is muted, and indicated by an led.

4.5 Limiter

Each band contains a protection limiter which can be switched into circuit using the "Limiter On" switch. The limiter is connected mid filter, with the control chain derived from the filter output, thereby reducing any possibility of high level signals in one band causing limiting action in any other band. The attack and release time constants for the various bands are optimised for the band of frequencies being handled. In addition, the release time is program dependent, with a relatively fast release time for small amounts of limiting, but slower times for sustained overloads.

The limit threshold is adjustable separately for each band via a multi-turn preset accessible through the front panel, and will normally be set so that the limit threshold is approximately 2-3dB below the power amplifier clip-point.

For instance, assuming that the power amplifier will produce maximum output for an input signal of +8dBv, the threshold would be adjusted to give 1dB of gain reduction for an output level from the crossover of +6dBv, ie when the limiter is switched in, the output level will reduce to +5dBv. The set-up procedure is as follows:

1) Connect an oscillator to the crossover input and set the oscillator frequency to the centre of the frequency band being adjusted.

2) With the limiter switched out, set the output level of the crossover to the required threshold level, ie +6dBv.

3) Switch in the limiter and adjust the threshold preset level to give an output level of 1dB below the threshold level, ie +5dBv.

4) Repeat for the other bands, remembering to reset the oscillator frquency to the centre frequency of each band.

The red limit LED indicators will now light whenever the signal in a band exceeds the limit threshold.

The green signal present LED will light at a level of 8dB below the limit threshold. The limiters are intended to protect speaker systems from damage due to apparent volume by being continually overdriven.

5.1 SPM 2 Plug – in Filter Card

The SPM 2 card holds one IC (a TL074 quad op – amp) and all the associated components to create the filter. The values of components required to fix a given frequency are given in Tables 1 and 2 following. Refer to the block diagram below for component reference numbers.

The card holds both high pass and low pass filter circuits.

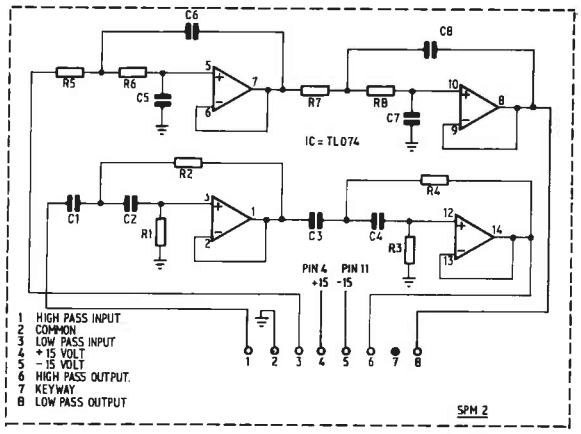

Fig 5.1 SPM 2 Filter Card Circuit Diagram

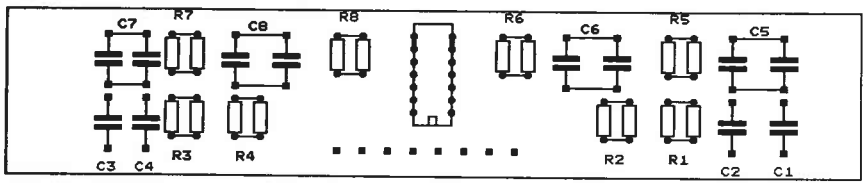

Fig 5.2 SPM 2 Filter Card PCB Layout

TABLE 1

DOUBLE BUTTERWORTH 24dB/OCTAVE FILTERS

	Low Pass	High Pass	
FREQ (Hz)	**R5 , R6 R7 , R8**	**R2 , R4**	**R1 , R3**
100	As R2, R4	270//39	68
125	"	150//33	270//68
150	"	150//27	1.2M//47
200	"	390//68	270//39
250	"	150//15	150//33
300	"	220//12	150//27
350	"	56//12	180//22
400	"	56//10	390//18
450	"	100//8.2	100//18
500	"	6.8//6.8	150//15
550	"	68//6.8	68//15
600	"	33//6.8	220//12
650	"	82//5.6	82//12
700	"	39//5.6	56//12
750	"	120//4.7	100//10
800	"	47//4.7	56//10
850	"	27//4.7	39//10
900	"	120//3.9	100//8.2
950	"	47//3.9	56//8.2

All Resistor values are in kOhms.

47//39 denotes 47kOhms in parallel with 39kOhms

	C1,2,3,4,5,7	C6,8
100 – 950 Hz	0.033uF	0.033uF//0.033uF
For freq x 10	0.003uF	0.0033uF//0.0033uF

For SPM1 (DD1000) R1 = R21, C1 = C21 etc.

TABLE 2

BESSEL 24 dB/OCTAVE FILTERS

	Low Pass				High Pass			
FREQ (Hz)	**R5**	**R6**	**R7**	**R8**	**R1**	**R2**	**R3**	**R4**
100	150//270	180//330	56//560	120//180	120//180	82//330	180//390	56//330
125	100//330	120//390	82//82	68//390	68//390	82//150	100	39
150	100//180	120//220	39//270	47	56//330	47//680	82	47//100
200	56//330	68//390	27//560	39//470	39//470	33	68//680	27//220
250	39	47	22//330	33//220	33//220	39//82	100//100	22//150
300	39//180	39	18//330	27//220	27//220	22	47//330	27//39
350	27	33	15//680	22//330	22//330	22//120	39//390	15//150
400	27//220	33//270	15//82	18	18	33//33	33//560	12
450	22//820	27//680	12//220	27//39	27//39	15//680	47//68	12//100
500	22//150	27//180	15//33	15//330	15//330	22//33	27//330	10//220
550	18//680	27//100	10//150	15//100	15//100	12	27//150	10//68
600	18//150	39//39	10//56	12	12	11	33//56	8.2//330
650	15	18	8.2//220	12//150	12//150	10	22//150	8.2//68
700	15//180	18//220	8.2//68	15//33	15//33	10//180	18	6.8
750	15//82	18//120	6.8	10//220	10//220	12//33	22//68	10//18
800	12	15//560	10//18	18//18	18//18	8.2	18//120	10//15
850	12//220	27//27	12//12	10//56	10//56	8.2//150	15	5.6
900	12//100	18//47	5.6	8.2//330	8.2//330	8.2//68	15//180	5.6//120
950	10	12	5.6	15//15	15//15	6.8	15//100	10//10

All resistor values in kOhms.
150//270 denotes 150kOhms in parallel with 270kOhms.

	C5	C6	C7	C8	C1	C2	C3	C4
100 – 950 Hz	.01	.01//.001	.01	.022//.0047	.033	.033	.033	.033
Freq x 10	.001	.001//.0001	.001	.0022//.00047	.0033	.0033	.0033	.0033

All capacitor values in uF.

For SPM 1 (DD1000) R1=R21 C1=C21 etc.

5.2 SPM 3 Blank Card

The SPM 3 card is only used when the DD500 is required as a 3 way mono system. It then contains only two links, with optional linking depending on how the HF output is needed to act.

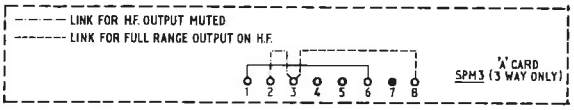

Fig 5.3 SPM 3 Blank Card PCB layout

Section 6.....Servicing

Although the DD500 crossover has been designed and constructed with high quality conservatively rated components, servicing may occasionally be required.

Fast and easy access to all parts of the circuitry can be obtained by removal of the top and bottom panels, which are retained by four posidrive screws for each panel on the side of the unit.

All major components are located on the main printed circuit board, into which are plugged the system programming modules. All components are clearly marked with their schematic reference number.

7.1 Input Section

The electronically balanced input stage is configured around IC1 (IC2 right channel). It has a loss of 6dB, and incorporates a low-pass filter with a slope of 6dB per octave, starting at 34kHz.

7.2 High Pass Filter

The high-pass filter is a 12dB per octave Sallen and Key network operating below 20Hz using the second section of IC1 (IC2).

7.3 Limiter

Each band of the crossover incorporates a loudspeaker protection limiter, consisting of a light-dependant resistor (LDR) forming the shunt arm of an input attenuator to the input of the gain stage, IC101. The LDR is controlled by a full wave rectifier, IC 102, which converts the audio signal in that band to a proportional DC voltage. This voltage is integrated into a smoothly changing DC voltage with optimised attack and decay characteristics for each band by the RC network (C104, C103, R116, R117). This is buffered by a unity gain stage, consisting of 1/2 of IC103 and fed to TR104 to provide asignal present indicator, and also to the light emitting diode in the LDR unit. The other half of IC103 forms a comparator to provide a limit indicator. Limiter threshold is adjusted using VR102 (and VR202). See setting up instructions for further details.

7.4 Gain Stage

The signal from the limiter attenuator is fed to a front panel operated gain stage, using 1/2 of IC101, providing a gain range of +4dB to -12dB, with unity gain at the centre detent.

7.5 Signal Inverter

After the gain stage, the signal can be fed to the unity gain inverter stage which uses the other half of IC101, to provide a phase reverse facility.

7.6 Output Stage

The output stage is an electronically balanced circuit, with cross-coupled feedback loops providing both positive and negative feedback paths. This arrangement allows either side of the output to be grounded without damage or loss of signal level. An output balance trim is provided which is factory set for optimum output symmetry.

7.7 Power Supply

The power supply is a conventional arrangement of 2 monolithic regulators providing a bi-polar 15 volt supply. Sufficient regulator headroom is maintained to enable the circuit to work efficiently over a wide range of mains voltage variations.

Fig 8.1 DD500 Block Schematic

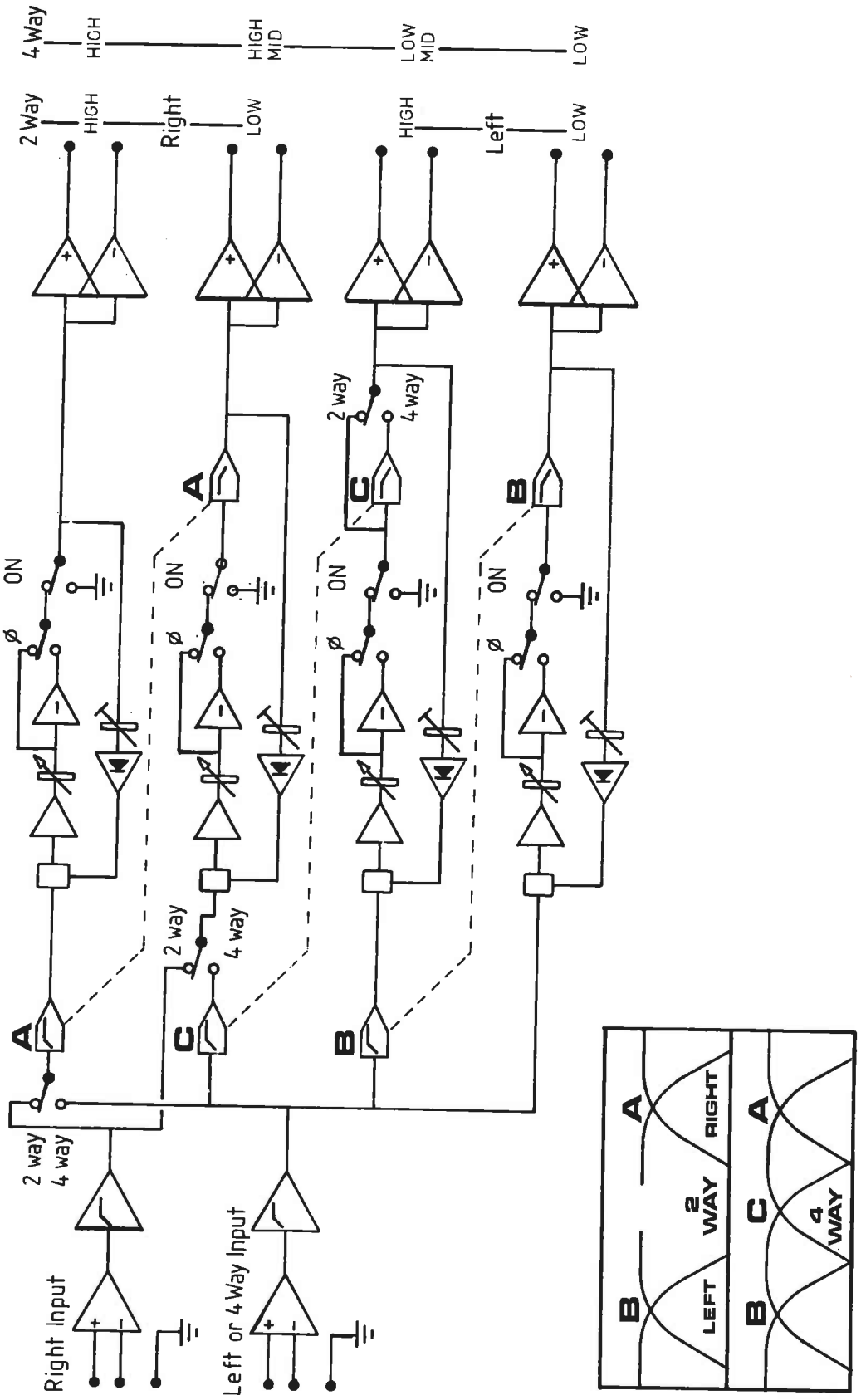

Fig 8.3 DD500 PCB Layout

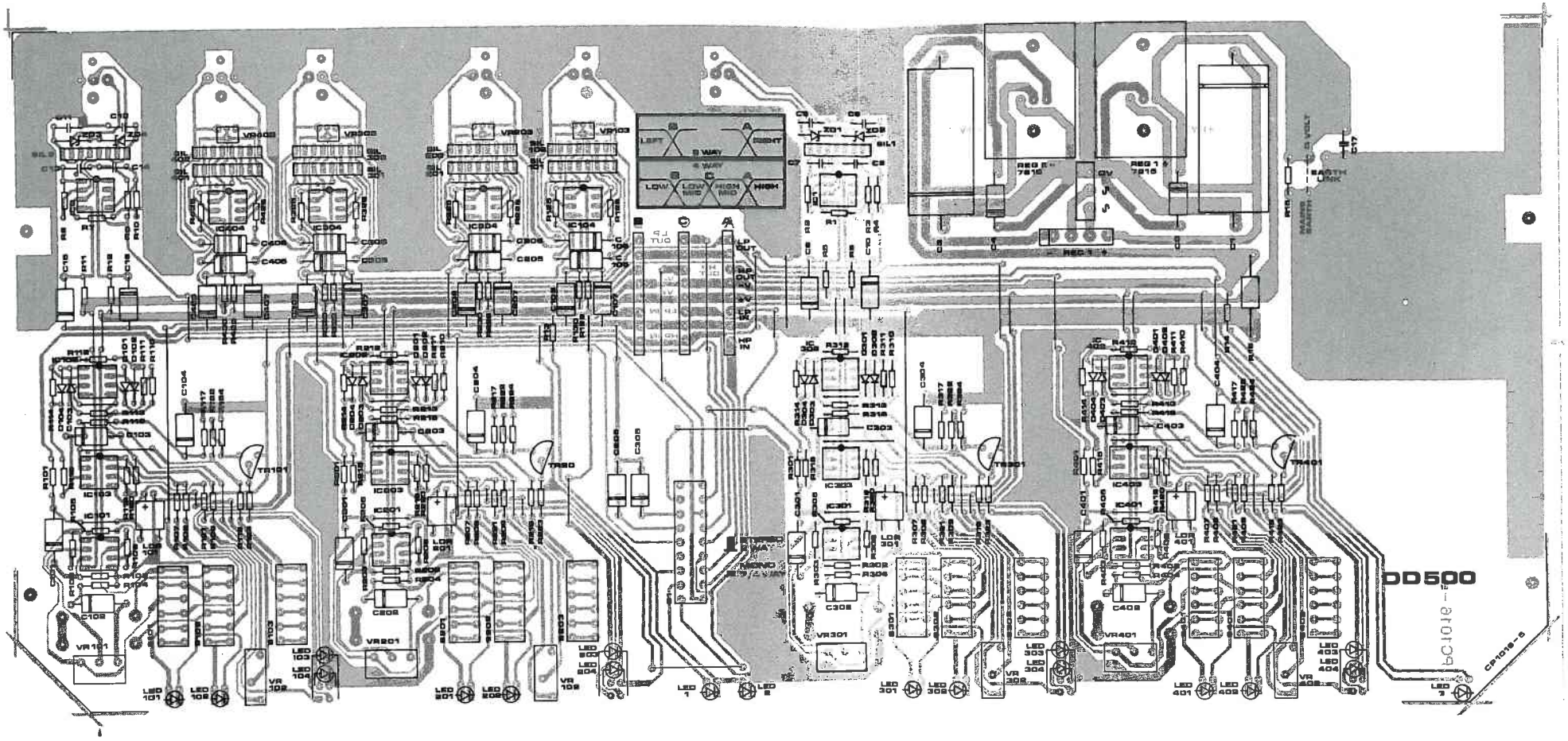

Fig 8.2 DD500 Circuit Diagram