



DESIGNS DEPARTMENT

DESIGNS DEPARTMENT HANDBOOK

No. 3.261(81)

MX3/5 Audio Mixer Card

**BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION**

DESIGNS DEPARTMENT HANDBOOK

No. 3.261(81)

MX3/5 Audio Mixer Card

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(W.T. Shelton)
for Head of Designs Department

Written by: M.B. Dubenski

D.D. Handbook No. 3.261(81)
Title Sheet

DESIGNS DEPARTMENT HANDBOOK

No. 3.261(81)

MX3/5 Audio Mixer Card

C O N T E N T S

1. INTRODUCTION
2. OPERATION
3. PERFORMANCE
4. CIRCUIT DESCRIPTION
5. MAINTENANCE AND ALIGNMENT

D R A W I N G S

Circuit	D 48606 A2
Parts List	D 48607 A4
P.B. Comp. Loc.	D 48612 A2

DESIGNS DEPARTMENT HANDBOOKNo. 3.261(81)MX3/5 Audio Mixer Card1. INTRODUCTION

The MX3/5 is a general purpose audio mixing card. It is supplied as a 4U BMM size P.C.B. fitted with an edge connector. It was originally used in the EP5M/15 chassis; part of the EP10/18 Radio Continuity Equipment. There are 12 inputs designated 'A' to 'M' (excluding I) and 5 output 'S', 'T', 'U', 'V' and 'Z'.

The various through paths are arranged as follows.

<u>Inputs</u>	<u>Outputs</u>
A)	
B)	S
C)	
D)	
E)	T
F)	
G)	
H)	U
J)	
K)	
L)	V
M)	

All inputs also appear on outputs 'Z'.

2. OPERATION

The MX3/5 has fixed gain and has no operational controls.

3. PERFORMANCE

Gain	0.0 dB \pm 0.1 dB
Frequency Response	40 Hz to 15 kHz \pm 0.1 dB w.r.t. response at 1 kHz.

Overload	>+18 dBu into high z in the frequency range 40 Hz to 15 kHz.
Output Noise	With the inputs terminated with 300 Ω , the output noise should be less than -80 dB ₄ .
Harmonic Distortion	In the frequency range of 40 Hz to 15 kHz at output levels of 0 dBu and +16 dBu the T.H.D. should be less than 0.1% (-60 dB) relative to output level.
Crosstalk	Crosstalk between 'channels' at 10 kHz should be better than 90 dB.
Input Impedance	>66 k Ω T.E.R.
Output Impedance	94 Ω T.E.R.
Power Requirement	\pm 12.5 V at 60 mA \pm 10 mA.

4. CIRCUIT DESCRIPTION

The MX3/5 is a general purpose audio mixing card. It is supplied as a 4U BMM size P.C.B. fitted with an edge connector.

There are four separate 'mixing paths' consisting of three inputs to one output, plus a main output (Z) which combines all the inputs. Further circuit description will be made in conjunction with the circuit diagram of the MX3/5, D 48606 A2. Input signals are applied via T.E.R. (Transmitted Earth Reference) network to a number of HA1-4741 quad integrated circuits. The T.E.R. circuit has been designed to minimise the effect of stray pick-up of interference signals in the input cables. Equal amplitude but of opposite phase signal currents flow in the cable under normal operating conditions. Hence any interference source which induces equal currents in the two input cables will have negligible effect due to cancellation.

Following the unity gain input stage there follows a phase-reversal IC (IC1a etc) and finally a virtual earth mixer (IC7, IC8 etc.). The output IC drives other equipment via T.E.R. terminations (2 x 47 Ω), 10 pF capacitors across the feedback resistors of the mixing stage increase the overall stability of the system. IC7 to 13 use operational amplifiers (LF356) requiring very low bias current (typically 30 pA). This makes it possible to connect the non-inverting input to 0 volt line without the usual bias resistor.

5. MAINTENANCE AND ALIGNMENT

The following readings are included to assist fault location.

D.C. Conditions

<u>Location</u>	<u>Reading</u>
IC1, 2, 3, 4, 5, 6 pin 4	+12.5 volts
IC1, 2, 3, 4, 5, 6 pin 11	-12.5 volts
IC1, 2, 3, 4, 5, 6 pins 1 7 8 14	0 volts ± 0.1 volts
IC7, 8, 9, 10, 11, 12, 13 pin 4	-12.5 volts
IC7, 8, 9, 10, 11, 12, 13 pin 7	+12.5 volts
IC7, 8, 9, 10, 11, 12, 13 pin 6	0 volts ± 0.1 volts

Signal Conditions

Input 0 dBu at 1 kHz

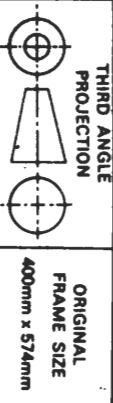
Signal to 6W, earthy connection to 5W (etc.)

<u>Location</u>	<u>Reading</u>
IC1, 2, 3, 4, 5, 6 pins 1 7 8 14	0 dB ± 0.1 dB
IC7, 8, 9, 10, 11, 12, 13 pin 6	0 dB ± 0.1 dB

Check signal output at the connector S, T, Z, U, V = all 0 dB ± 0.1 dB

There are no operational controls on the MX3/5.

BBC
 DS/A2/1
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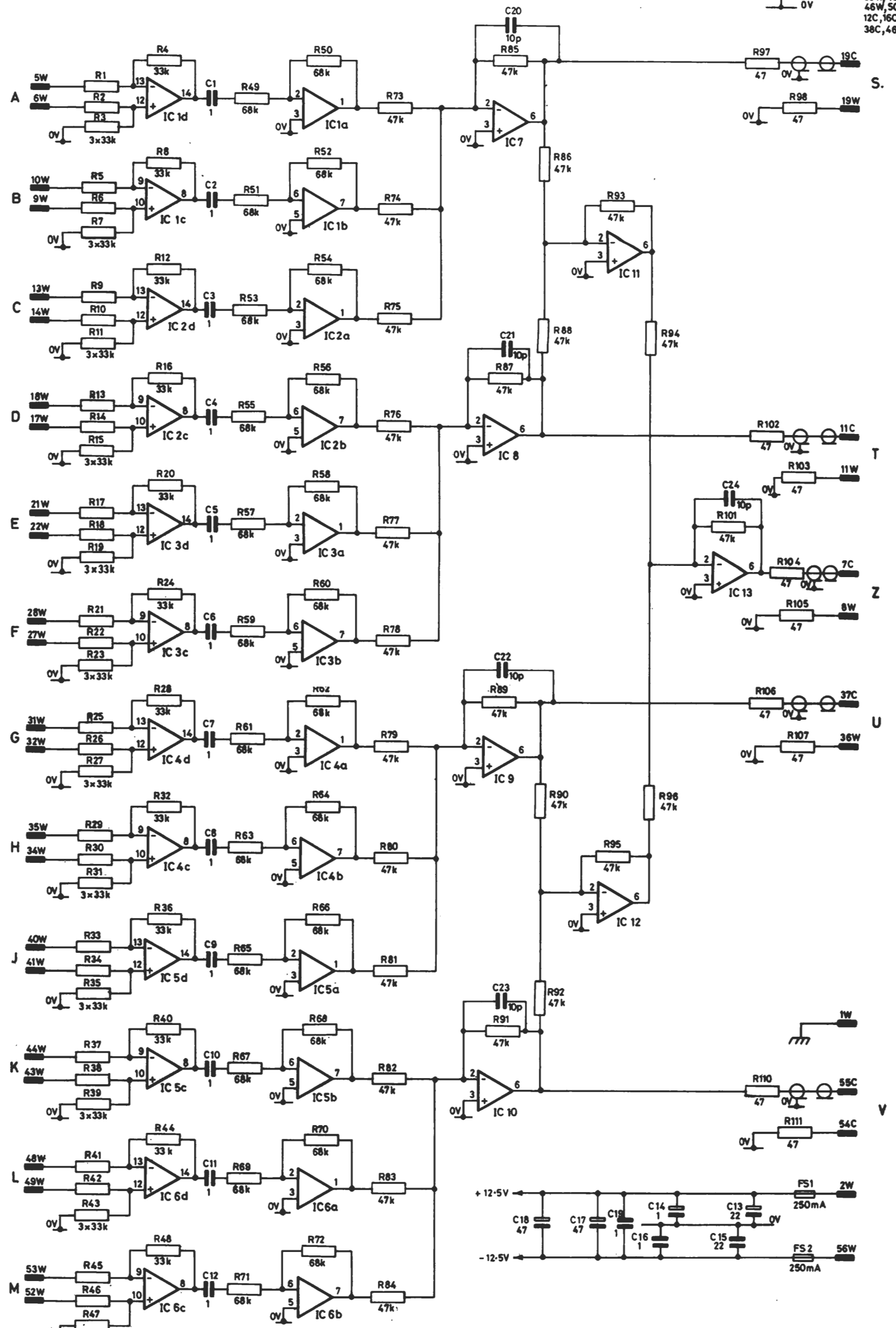
SCALE: 0

CHANGE
 26-2-81

1
 All dimensions in millimetres unless otherwise stated.
 Normal tolerances:
 0.1 mm unless otherwise stated
 0.2 mm unless otherwise stated
 0.5 mm unless otherwise stated
 1 mm unless otherwise stated
 2 mm unless otherwise stated
 5 mm unless otherwise stated
 10 mm unless otherwise stated
 20 mm unless otherwise stated
 50 mm unless otherwise stated
 100 mm unless otherwise stated
 200 mm unless otherwise stated
 500 mm unless otherwise stated
 1000 mm unless otherwise stated

DESIGNS DEPT.
D48606A2

Parts List: D48607A4



7W, 16W,
 20W, 25W,
 29W, 33W,
 39W, 42W,
 46W, 50W,
 12C, 16C, 20C,
 38C, 46C.

Cct. Ref.	Type	No of	Supply Conns.	
			+12.5V	-12.5V
IC 1, 2, 3, 4, 5, 6,	HA1-4741-5	4	4	11
IC 7, 8, 9, 10, 11, 12, 13,	LF 356N	1	7	4

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ISS	1
CHANGE	26-2-81
	1 H. 8/5/81
	2

ITEM No.	No OFF	DESCRIPTION	C'CT REF.	BBC REF OR DRG. No.
DRAWING NUMBERS				
		CIRCUIT	D48606A2	
		PARTS LIST	D48607A4	
		ASSEMBLY & WIRING	D48608A1	
		DETAILS	D48609A3	
		P.B. WIRING	D48610A2	
		P.B. COMP. SIDE WIRING	D48611A2	
		P.B. COMP. LOCATION	D48612A2	
		P.B. DRILLING	D48613A3	
FURTHER INFORMATION REQUIRED FOR MANUFACTURE				
UNIT ASSEMBLY INFORMATION EA104B4				
UNIT WIRING INFORMATION EA10139, EA10140				
1	1	* PRINTED BOARD MANUFACTURING TO TO SPEC ED/PA/MX3/5		0431799 D48610A2, D48611A2 D48612A2, D48613A3
2	1	* CODING PLATE, 4U SLOT POS ARE 1, 15, 47 MODIFIED :- BY B.B.C. W/S BEFORE ISS. TO CONTRACTOR		55223B - 0326593 D48609A3 DET.1
3	1	* SCREEN PLATE ASSY		552255 - 0367162
4	1	* HANDLE, NATURAL, VERO 21-1884E		553922 - 0388150
5	2	* SPACER, 5mm Ø/D X 5mm LG, TAPPED M2.5		558285 - 0207406
6	1	* SPACER, INSULATING, 5mm Ø/D X 5mm LG, TAPPED M2.5		558287 - 0325667
7				
8				
9	5	SCREEN		D48609A3 DET.2
10	6	SCREEN		D48609A3 DET.3
11				
12	2	* FUSEHOLDER, PRINTED WIRING		522252 - 0345142

BBC
DS/PLA4

MX 3/5
MIXER, AUDIO
PARTS LIST

DRN.	GRB
TPD.	
CKD.	
APPD.	JJR

DESIGNS DEPARTMENT
D48607A4

D 48607A4

SHEET 2 OF 6 SHEETS

CHANGE

26-2-81

I.H. 8/6/81

MX3/5 PARTS LIST

ITEM No	No OFF	DESCRIPTION	CCT REF.	BBC REF. OR DRG. No.
13	61	* TERMINAL PIN, SEAELECTRO A00136206/T		0239341
14				
15	NR	* WIRE, PUN1/1M, BLACK		0216568
16	1-1M	* CABLE, SINGLE-CORE, SCREENED, WHITE PSF 1/1M		043/129
17				
18	10	* SLEEVE, CABLE BINDING, HELLERMAN TH20 X 12.5mm LG		519768 - 0051969
19				
20				
21				
22				
23				
		<u>SCREWS</u>	<u>FOR FIXING ITEMS</u>	
24	2	M2.5 X 12 LG, CSK HD, M.S. Zn.P	2, 5	
25				
26	1	M2.5 X 6 LG, CSK HD, M.S. Zn.P	6	
27	6	M2.5 X 6 LG, PAN HD, M.S. Zn.P	3	
28				
29				
30				
		<u>NUTS</u>		
31	2	M2.5, HEX, FULL, M.S. Zn.P	2	
32				
33				
		<u>WASHERS</u>		
34	8	M2.5, PLAIN	2, 3	
35				
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BBC

DS/PLA4

MX3/5

PARTS LIST

DRN. GRB

TPD.

CKD.

APPD. DLS

DESIGNS DEPARTMENT

D48607A4

SHEET 2 OF 6 SHEETS

ITEM No.	Qty	DESCRIPTION AND CIRCUIT REFERENCE	BBC REF. or DRG.No.
101			
102			
103			
104			
CAPACITORS			
105	12	* 1.0uF, 20%, 100V dc, Capacitor, Ceramic Film C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12	S20648-0389813
106	2	* 22uF, -10+50%, 25V dc, Capacitor, Min. Elect. C13, C15	S20525-020491X
107	2	* 47uF, -20+100%, 35V dc, Capacitor, Plug-in Elect. C17, C18	S20814-0211281
108	2	* 1.0uF, 20%, 35V dc, Capacitor, Solid Tantalum. C14, C16	S21125-0085220
109	1	* 1.0uF 20% 50V dc Capacitor Ceramic Multilayer C19	S20648 - 0389813
110	5	* 10pF, 2%, 125V, dc, Capacitor, Tubular, C20, C21, C22, C23, C24,	S21004 - 0099397
111			
RESISTORS			
112	11	* 47 ohm, 2%, Resistor, Metal Film, 0.4W. R97, R98, R101, R102, R103, R104, R105, R106, R107, R110, R111	S26877-0099291
113	48	* 33kohm, 2%, Resistor, Metal Film, 0.4W. R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48	S26877-0099259
114	24	* 47kohm, 2%, Resistor, Metal Film, 0.4W. R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96	S26877-0099267
115	24	* 68kohm, 2%, Resistor, Metal Film, 0.4W. R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72	S26877-0099520

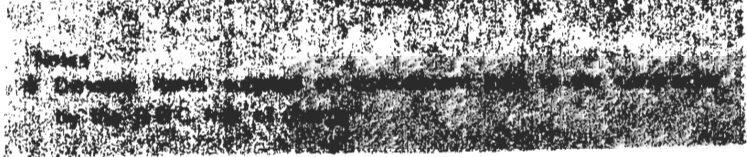
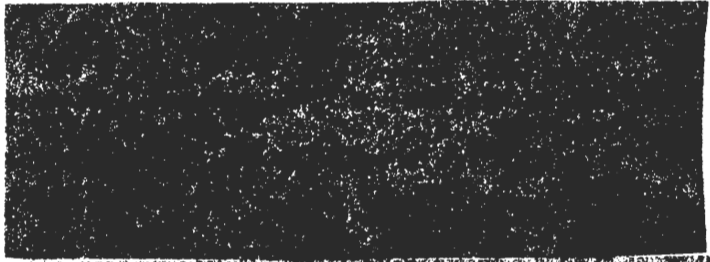
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BBC
VM423A4

AUDIO MIXER MX3/5
BBC: DESIGNS DEPARTMENT.

DD Ref: U590A-DS3/GRB
SHEET 3 OF PARTS LIST D48607 A4

ITEM No.	Qty	DESCRIPTION AND CIRCUIT REFERENCE	BBC REF. or DRG.No.
116			
117			
118			
INTEGRATED CIRCUITS			
119	6	* HA1-4741-5 IC1, IC2, IC3, IC4, IC5, IC6	0184061
120	7	* LF356N IC7, IC8, IC9, IC10, IC11, IC12, IC13	0194930
121	1	* BLICK LABEL NO. 8 GREEN	
122	1	CARD BOARD CARTON	
123			
FUSES			
124	2	* Fuse, Cartridge, Anti-Surge, Glass, 250mA FS1, FS2	S22425-0345327



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CIRCUIT REFERENCE INDEX

C1 105	R12 113	R42 113	R72 115	R102 112
C2 105	R13 113	R43 113	R73 114	R103 112
C3 105	R14 113	R44 113	R74 114	R104 112
C4 105	R15 113	R45 113	R75 114	R105 112
C5 105	R16 113	R46 113	R76 114	R106 112
C6 105	R17 113	R47 113	R77 114	R107 112
C7 105	R18 113	R48 113	R78 114	
C8 105	R19 113	R49 115	R79 114	
C9 105	R20 113	R50 115	R80 114	R110 112
C10 105	R21 113	R51 115	R81 114	R111 112
C11 105	R22 113	R52 115	R82 114	
C12 105	R23 113	R53 115	R83 114	IC1 119
C13 106	R24 113	R54 115	R84 114	IC2 119
C14 108	R25 113	R55 115	R85 114	IC3 119
C15 106	R26 113	R56 115	R86 114	IC4 119
C16 108	R27 113	R57 115	R87 114	IC5 119
C17 107	R28 113	R58 115	R88 114	IC6 119
C18 107	R29 113	R59 115	R89 114	IC7 120
	R30 113	R60 115	R90 114	IC8 120
R1 113	R31 113	R61 115	R91 114	IC9 120
R2 113	R32 113	R62 115	R92 114	IC10 120
R3 113	R33 113	R63 115	R93 114	IC11 120
R4 113	R34 113	R64 115	R94 114	IC12 120
R5 113	R35 113	R65 115	R95 114	IC13 120
R6 113	R36 113	R66 115	R96 114	
R7 113	R37 113	R67 115	R97 112	FS1 124
R8 113	R38 113	R68 115	R98 112	FS2 124
R9 113	R39 113	R69 115		
R10 113	R40 113	R70 115		
R11 113	R41 113	R71 115	R101 112	

END OF CIRCUIT REFERENCE INDEX.

CAPACITORS CONT

C19 109
C20 110
C21 110
C22 110
C23 110
C24 110

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ORIGINAL
FRAME SIZE
190mm x 277 mm

ALL DIMENSIONS IN MILLIMETRES UNLESS
OTHERWISE STATED

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SHT.	ISS.	DETAILS OF CHANGE	SHT.	ISS.	DETAILS OF CHANGE
3	2	ITEM 112 RESISTORS R99, 100, 108, 109 DELETED 29-7-80			
5	2	RESISTORS R99, 100, 108, 109 DELETED 29-7-80			
3	3	WAS SHT 2 ADD ITEMS 109 & 110			
4	2	WAS SHT 3			
5	3	WAS SHT 4 ADD C19-C24 25-2-81			
1	2	ITEM 1 SPEC ADDED ITEM 2 REVISED STARS ADDED			
2	2	STARS ADDED ITEM 16 WAS PSN 1/11.			
3	4	ITEM 106 BIN NO. WAS 20714 STARS ADDED			
4	3	ITEMS 121 AND 122 ADDED NOTES ADDED. I.H. 8/5/81			

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DESIGNS DEPARTMENT

CODE:- MX3/5

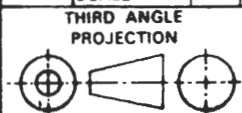
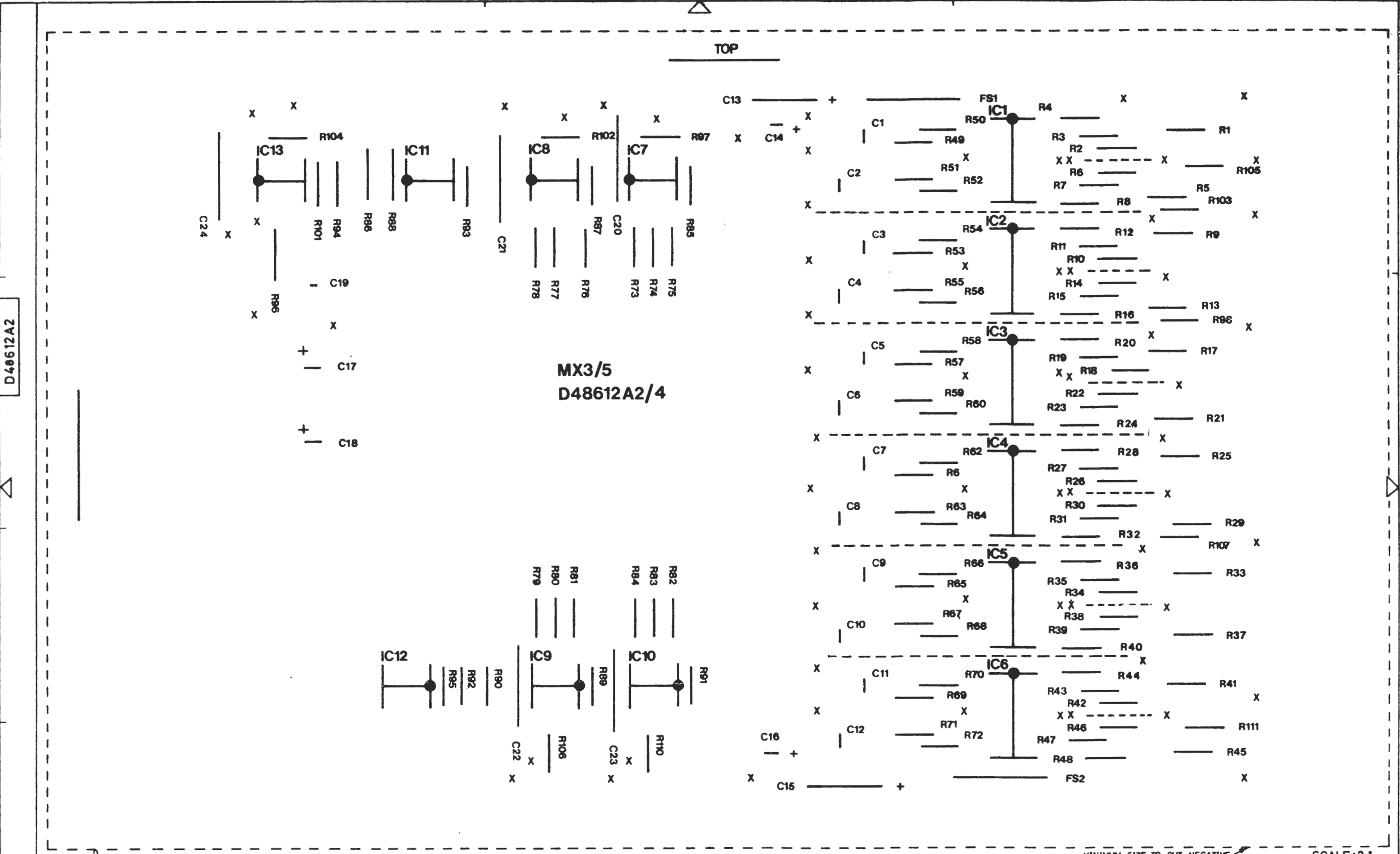
PARTS LIST CHANGE RECORD, ISSUE:- 4 8/5/81

D 48607 A4

SHEET 6

VM418/A4

D48612A2



THIRD ANGLE PROJECTION
ORIGINAL FRAME SIZE
400mm x 574mm

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DS/A2/1
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CHANGE	NO.	DATE	BY	REASON
1	1	10.10.80
2	1	08.11.80
3	1	07.12.80
4	1	01.01.81

Characters and lines to be printed in black.
Printed wiring on this side of board is D 48611A2
Printed wiring on reverse side of board is D48610A2

MX3/5
PRINTED BOARD COMPONENT LOCATION

All dimensions in millimetres unless otherwise stated Normal tolerances:		DRN	DESIGNS DEPT.
no decimal place	± 1 mm unless stated	TCD	D48612A2
one decimal place	± 0.3 mm unless stated	CKD	
two decimal places	± 0.1 mm unless stated	APPD	

