No. 3.295(84)

AM 8/17 Loudspeaker Amplifier

1. INTRODUCTION

The AM8/17 is a high performance 50 watt power amplifier designed for use with the LS5/9 loudspeaker. It can also be used with other loudspeakers incorporating passive crossover units with the loudspeaker assembly.

It has been designed to operate in either the horizontal or the vertical plane, consequently it may be mounted either on the back of the loudspeaker as in the LS5/9Z or two may be mounted side by side in a 2U, 19 inch rack type PN1/41.

The unit is normally mains powered or may be operated from two 24 volt batteries at reduced maximum output power. Switching over to battery occurs automatically on loss of mains supply with no break in the output.

2. SPECIFICATION

Power Requirements		240 V AC ±10% 120 VA or ±24 V at 1 A emergency option
Size		350 mm x 210 mm x 85 mm
Ambient Temperature		0-40° C
Weight		4.5 kg
Fuse Requirements		Mains 1 x .5 A antisurge Output 2 x 2 A quick blow
Inputs	Mains	LNE
	Audio	PO Jack XLR Male - 3 pin
	Batts	XLR Male - 4 pin
Outputs	Spkr	XLR Female - 3 pin
Mains/Battery Switching		Diodes
Indicators		LEDs for fused supplies
Controls		Input Volume
Output Short Cct Protection		Fuses

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ELECTRICAL SPEC.

Power Output for 240 V AC	50 W continuous into 4 Ω or 8 Ω (Note 1)
Distortion at 1 kHz	<.004% all powers } 8 Ω load (typical)
Distortion at 40 Hz - 10 kHz	<.02% all powers }
Input Impedance	>10 k Ω balanced
Noise	-64 dB_4 (20 Hz - 20 kHz)
S/N Ratio	93 dB min relative to 50 W into 8Ω
Max Overall Voltage Gain	40 dB
Min Input Level for Full Output	-20 dBr programme -12 dBu tone
Max. Input for Rated Distortion	+20 dBu
Frequency Response	20 Hz - 20 kHz ±0.3 dB

(Note 1)

240 V AC supply power max 50 W
220 V AC supply power max 40 W
Battery operation power max 20w.

3. INSTALLATION

3.1 Bay Mount

The amplifier is designed to fit 2 units side by side, into the rack mounting panel PN1/41. This rack occupies 2U of bay height and is adequate for mobile use.

In studio areas where the bay is generally connected to a program use earth, the internal mains earth/chassis link will need to be broken. This link may be found underneath the top cover near the mains transformer on a terminal strip. The link to be removed is nearest the side of the amplifier.

3.2 Free Standing or Loudspeaker mounted

In this mode the mains earth will be connected to the chassis, therefore to prevent the possibility of programme and mains earth mixing via the input, the amplifier has an input/chassis earth link. This link should be removed if the incoming screen is connected to programme earth. In all other cases the link should be retained to prevent hum appearing at the output of the amplifier. The link can be found adjacent to the mains earth/chassis link.

Note: If amplifier is bay mounted, it will thus be connected to programme earth and the input/chassis link need not be removed.

3.3 Input/output connections

3.3.1 Input: The lead should be a twin screened cable if performance of the amplifier is not to be compromised.

3.3.2 Output: If the unit is to be mounted greater than 1m from the loudspeaker care should be exercised in the choice of cable. Ideally the total impedance of the cable should not exceed 0.2Ω.

3.3.3 Mains: The amplifier should be fed from a minimum supply fuse rating of 3A to prevent the turn on surge rupturing the supply fuse.

3.4 Cooling - Ventilation Requirements

3.4.1 Horizontal Mounting: The rear heatsink must have a free airflow from below and above.

3.4.2 Vertical Mounting: The rear heatsink must be lowermost and there should be free airflow around the sides of the unit.

3.4.3 Maximum safe ambient temperature is 40°C.

3.5 General use

The amplifier may be used with all current medium and high powered BBC coded loudspeakers including LS3/5A's without any other special considerations.

For use with non BBC coded units the amplifier is unconditionally stable for all resistive and complex loads. The normal operating load is 8Ω though lower impedances can be accommodated with due consideration to the increased dissipation on the heatsinks. Hence a max ambient temperature of 25°C is recommended for loudspeakers of impedances of <6Ω. Impedances of less than 4Ω could cause the supply fuses to rupture at high volume levels and hence loudspeakers of this type should be avoided.

3.6 Microphony

A low microphony input transformer has been used to minimize the effects of transfer of vibration on the amplifier to the output of the unit. Hence it can be mounted on the rear of a loudspeaker without any audible degradation of the amplifier performance.

3.7 Protection

The output of the amplifier is protected by supply fuses only; thus eliminating the danger of premature clipping when driving difficult loads while maintaining complete protection against overload at all operating temperatures.

4. CIRCUIT DESCRIPTION

4.1 Theory of Operation

4.1.1 Input:

C101 & C102 provide input R.F.I.protection. T101 provides the input balance. R101 and C103 give damping and roll off for T101.

4.1.2 Input Amplifier:

IC 101 forms part of a non-inverting stage fed from the main volume control R102. R106,D101, R107 and D102 provide supply regulation for the op-amp. R104 and R105 set the first stage gain. R108 and C109 provide HFroll off.

4.1.3 Second Stage:

The second stage is part of the actual power amplifier within the feedback loop. TR101 and TR102 are the differential input pair with R110 as the current setting tail. This resistor also sets the bias current for the rest of the amplifier. R111 and R115 are the collector loads. R113 sets the offset on the output of the amplifier by effectively trimming the value of the collector loads. R112 and R114 limit the range and hence give greater offset stability.

4.1.4 Drive Stage:

R123 sets the drive stage current relative to the second stage. TR104 and TR105 are the second differential pair providing further gain, both inputs being connected to the two outputs of the previous stage. TR103 and TR108 provide a current mirror load hence increasing the open loop gain of this stage. R119 is used as power dissipation limiting for TR104 balancing the dissipation in the differential pair. R125 sets the bias for the next stage and R122 limits the range of the adjustment improving reliability. C116 is HF bypass for R119 to improve gain at high frequencies. R120 and R124 provide matching for current mirror transistors.

4.1.5 Output Stage

TR106 and TR107 are a source follower push pull output stage. Being an F.E.T. the input impedance is very high with only a small capacitive load. The output stage is voltage driven, providing no load to the drive stage for all but high frequencies. The devices also have positive temperature coefficients, removing the need for temperature compensation. R127 and R129 are gate stoppers to prevent parasitic oscillation within the output devices.

4.1.6 Feedback

R121, R117 and R116 provide overall feedback and gain setting for the power amplifier stage. C112 and C113 provide D.C. blocking and wide band A.C. bypass. R118 provides overvoltage protection for C112 and sets the DC gain at approximately 2. R109 provides d.c. current balance for the differential amplifier.

4.1.7 Compensation

R128 and C117 form a half Zobel network for the output stage C118 and C114 compensate the main amplifier stage with C111 improving phase margins at very high frequencies.

4.1.8 Power Supply

C110 and C115 provide smoothing for the drive supply. R126 and R134 limit the charge currents, hence reducing the fast rise components on the supply ripple. C4 and C5 provide energy storage for the main output supply.

4.1.9 Protection

R2 prevents fuse rupture under short circuit conditions with no signal applied. FS2 and FS3 give short circuit and overload protection. The design prevents large D.C. offsets in the event of a single fuse rupture. D3 and D4 give supply indication and are extinguished in the event of fuse failure.

4.1.10 Mains Input and Rectification

The primary of the mains transformer is protected by FS1. The screen of the transformer is permanently connected to mains earth. D5 gives indication of AC presence. D1 and D103 provide rectification of the low and high voltage supplies respectively. D2 and D104 provide isolation and reverse polarity protection for the battery input.

5. MAINTENANCE

Dismantling the unit for maintenance.

5.1 For test and adjustments only the top cover needs to be removed. To do this remove all 10 3mm coutersunk screws from the top cover. The cover can now be lifted away.

If components need to be removed from the board it will be necessary to remove the side cover adjacent to the printed circuit board. To do this remove 3 M4 and 2 M3 countersunk screws from side heat sink, 4 M3 countersunk screws from base and 2 M4 hex head screws from front panel.

If an output F.E.T. needs to be replaced the extension spindle should be removed from the volume control potentiometer on the board and the 2 M4 screws adjacent to the rear heat sink removed. Rotate the board 180° anticlockwise so that the output F.E.T. screws are now accessible.

Note: Experience has so far shown that the F.E.T.s are extremely robust and consequently the latter operation should seldom be necesssary.

5.2 Routine Maintenance Requirements

There are no requirements for regular maintenance of the unit. All presets have a restricted range and no catastrophic consequences will be encountered even under gross misalignment.

5.3 Supply failure

In the event of output overload or short circuit, the supply fuses will blow. Remove output connection and replace fuses. If supply indication is restored no further work is required on the unit and the loudspeaker or wiring should be tested.

If supply fuses immediately blow, check firstly that an antisurge fuse has been fitted, if so, then it may be assumed that a catastrophic failure has occurred within the amplifier.

If on removal of the top cover, R126 and/or R130 are burnt out, again a catastrophic failure has occured.

Note: R126 and R130 must be replaced with the correct type as these components affect reliability.

5.4 Readjustment

The unit requires adjustment if any one of these parameters are exceeded.

a) D.C. on output exceeds 10mV
b) Low level distortion is outside the specification
c) Hum on output is greater than specification
d) Heatsink temperature is over 10°C above ambient under quiescent conditions.

Set both presets to the centre of their travel.

Connect D.V.M. to output and adjust R113 for 0V± 1mV.

Connect ammeter across either FS2 or FS3 and remove fuse. Adjust R125 for 100mA reading on ammeter.

Terminate input and connect oscilloscope to output. Slightly loosen transformer screws and rotate for minimum hum component in noise. Re-tighten screws.

Note: This operation need only be done if the mains transformer has been changed or otherwise disturbed.

Verify performance specification.

5.5 Trouble shooting

If the amplifier fails to respond to the readjustment procedure check the following points.

5.5.1

Noise Performance not inside specification:

a) Check measuring environment.
b) Check R102 not open circuit.
c) Check D101 or D102 not noisy.
d) Check for H.F. oscillation (above 1MHz)
if this is found, check C11, C114, C118 and C117.
R128 may be charred.

5.5.2

Distortion outside specification:

a) Check measuring environment.
b) Check correct adjustment of R125.
c) Check for H.F. oscillation as before.

5.5.3

D.C. on output outside range of offset control:

a) Check C108 and C112 for low leakage
b) Check operation of all transistors

5.5.4

Maximum Power not achieved:

a) Check mains is 240v
b) Check adjustment of R125
c) Check dummy load 8Ω ± 1°%
d) TR106 or TR107 out of specification.
e) Check on load supply voltages on transformer.

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5.5.5

Hum on output, out of specification limit:

a) Check earth links within the amplifier.
b) Check connection of all screens and continuity of earths.
c) Check for external hum fields.
d) Check for mains transformer fault.
e) Check D103 for Open Circuit diode.

D55376A2

+42V
C104 470n
R106 1·8k
D101 12V
C105 4·7
0V
R110 68k
C110 1m
0V
R126 10 to D103
R120 100
R124 100
TR108 2SA 1085D
TR103 2SA1085D
C111 10p
R119 12k
C116 1n
R127 100
TR106 2SK226
+35V
FS2 2AA/S to D1+
R1 5·6k
D3 CMD54530
C4 4·7m
SKB
R2 47m
C3 2·2m
L/S out
R104 5·6k
IC101 NE5534A
C108 4·7
R108 4·7k
TR101 2SA1085D
TR102 2SA1085D
R117 22k
R121 22k
R116 2·2k
R128 6·8
R122 1k
R125 1k bias
C117 22n
C112 22
C113 47n
R118 47k
T101 L096ASC
R101 2·2k
C101 100p
C102 100p
C103 1in
R102 10k vol.
R103 100k
R105 620
R109 22k
C109 820p
PLA
signal in
JKA
strap
C1 100p
C2 100p
0V
D102 12V
C107 4·7
C106 470n
R107 2·2k
D4 CMD54530
C5 4·7m
R3 6·8k
FS3 2AA/S to D1−
R129 100
TR107 2ST2
−35V
C118 47p
C114 68p
TR104 2SC2547D
TR105 2SC2547D
R123 120
R111 4·7k
R112 22k
R114 22k
R115 4·7k
C115 1m
R113 50k offset
−42V
R130 10 to D104

D6
mains in
D5 IN4006 CMD5053
R4 6·8k
T1 M571
SKA
L
N
E
FS1 500mA A/S
AC in
BN
B
BK
R
Y
W
O
+35V to FS2
−35V to FS3
−42V to R130
+42V to R126
0V
D1 GDB80-4
D103 W02
D2 GDB80-4
D104 W02
strap
PLB
batt in
0V

SCALE:- 0

Parts list D55377A4

THIRD ANGLE PROJECTION

ORIGINAL FRAME SIZE 400mm x 574mm

BBC

DS/A2/1

CHANGE		
BS	1	12-85

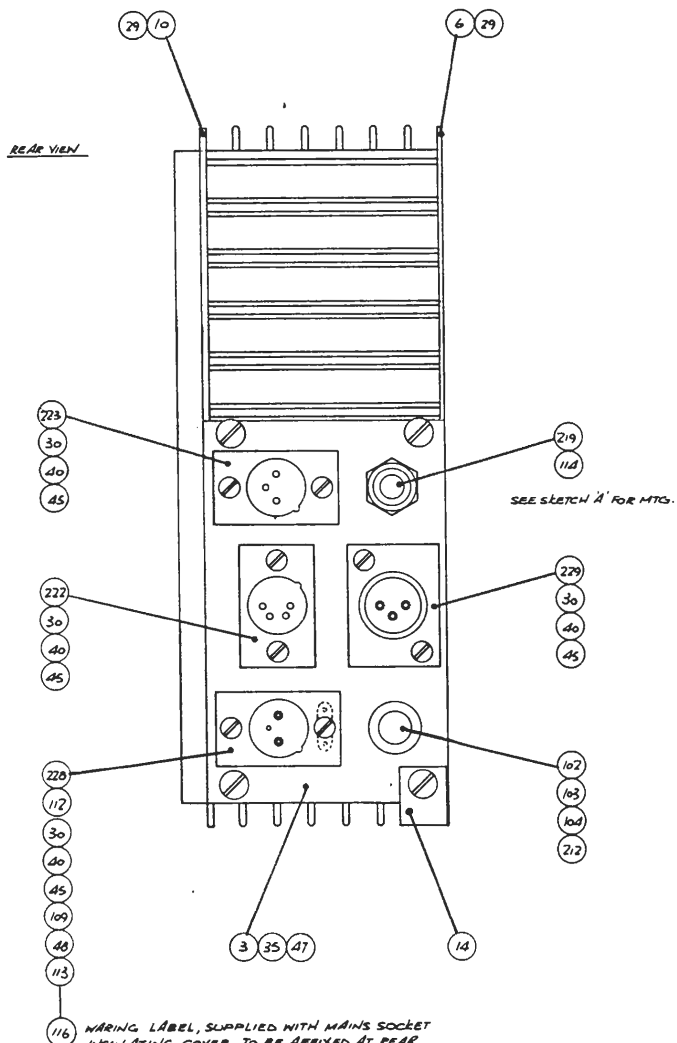
LOUDSPEAKER AMPLIFIER CIRCUIT

AM8/17 CIRCUIT

All dimensions in millimetres unless otherwise stated. Normal tolerances: no decimal place — ±1 mm unless; one decimal place — ±0·3 mm otherwise; two decimal places — ±0·1 mm stated

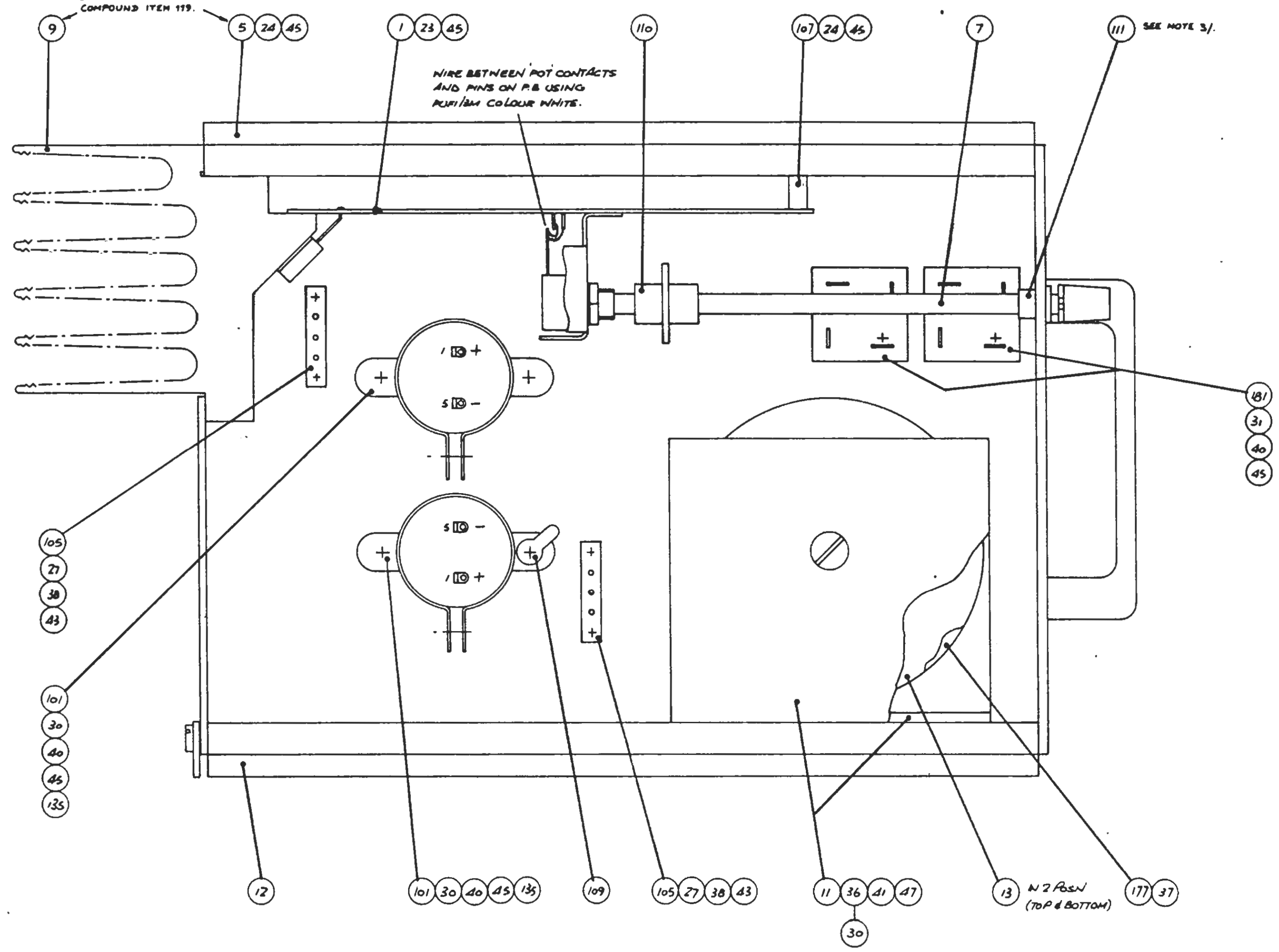
DRN	P.P.	DESIGNS DEPARTMENT
TCD		D55376A2
CKD		
APPD		

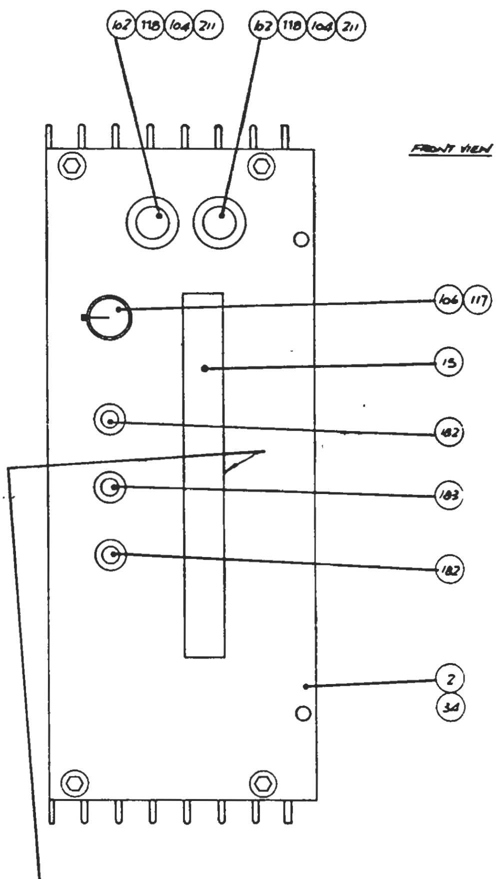
S & N LTD L8/10



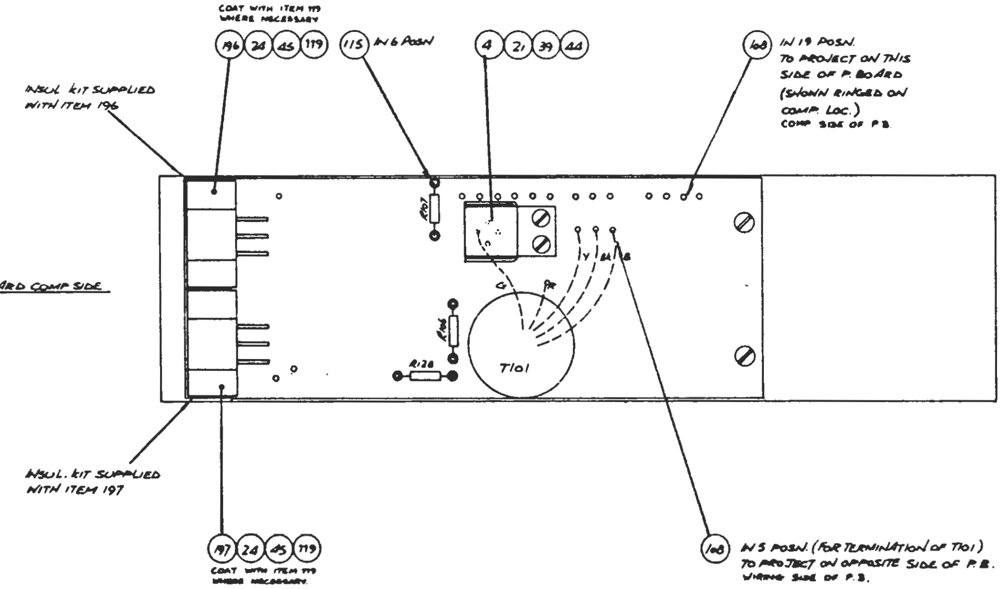
WARING LABEL, SUPPLIED WITH MAINS SOCKET INSULATING COVER, TO BE AFFIXED AT REAR END OF TOP COVER ABOVE MAINS SOCKET (ITEM 228). AFFIX 'LIVE TERMINALS' WARNING LABEL (ITEM 116) ADJACENT TO MAINS SOCKET WARNING LABEL. (116)

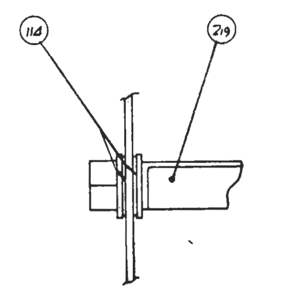
N.B. MATING FACES OF ITEMS 5 & 9 TO BE COATED WITH HEAT SINK COMPOUND ITEM 119.





SERIAL N° (SEE INDIVIDUAL ORDER) TO BE STAMPED IN 2.5 HIGH CHARACTERS, CENTRALLY DISPOSED ON UNDERSIDE OF HANDLE





SKETCH A

METHOD OF MOUNTING JACK (JK A) TO REAR PANEL

SCALE 1:1

OVERALL	DIMENSIONS
WIDTH	208 mm
HEIGHT	79 mm
LENGTH	352 mm

NOTES

1. THIS DRAWING TO BE IN ACCORDANCE WITH ASSEMBLY DRAWING EA 10484 NOTES 1, 4, 6 & 7
2. COMPONENTS TO BE WIRED IN ACCORDANCE WITH EA10140 NOTES 1, 4, 11, 16
3. ENSURE LOCATING LUGS DO NOT INTRUDE INTO APERTURE AS THIS WILL CAUSE FRICTION ON THE SHAFT. (CUT OFF SOME LUGS IF NECESSARY).

APPROX WEIGHT : 4.5kg

THIS DRAWING TO BE USED IN CONJUNCTION WITH WIRING DRAWING DSS384 A1

SCALE 1:1

SCALE - 0

THIRD ANGLE PROJECTION

ORIGINAL FRAME SIZE 574mm x 821mm

ISS	CHANGE
1	1-12-83
2	OVERALL DIMS. ADDED. UAQ 10 1 84
3	ITEM 119 ADDED. ITEM ... [illegible] J.K. 24-5-84

DS/A1/1

AM8/17 ASSEMBLY

All dimensions in millimetres unless otherwise stated. Normal tolerances: no decimal place — ±1 mm; one decimal place — ±0.3 mm; two decimal places — ±0.1 mm; unless otherwise stated

DRN. | TCD | CKD | APPD

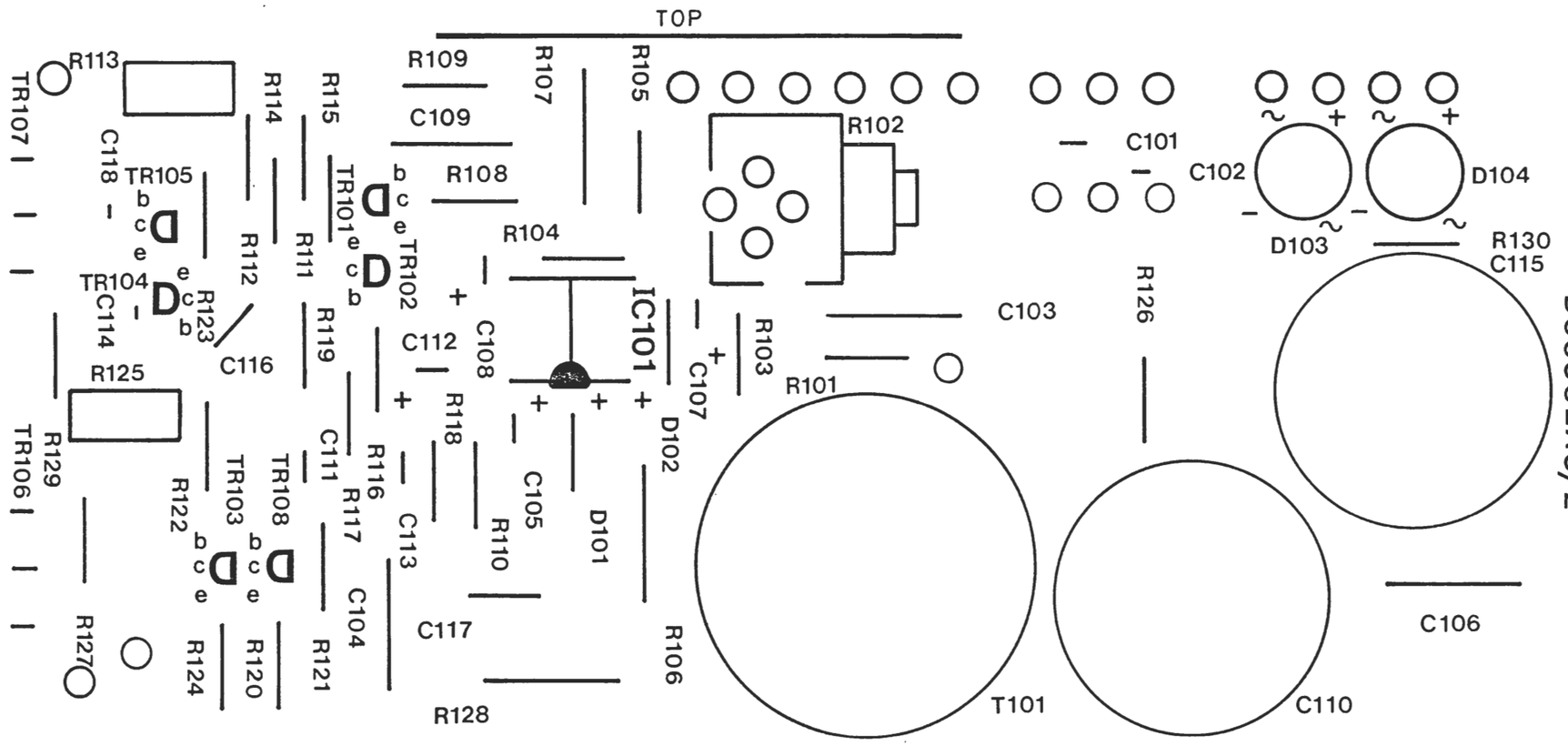
DESIGNS DEPARTMENT

DSS378 A1

S & H LTD LONDON

D55382A3

MINIMUM SIZE TO
CUT NEGATIVE



CHARACTERS AND LINES TO BE PRINTED BLACK
PRINTED BOARD WIRING IS D55381A2

SCALE 2 : 1

AM8/17
D55382A3/2

SCALE:- 0

THIRD ANGLE PROJECTION

ORIGINAL FRAME SIZE
277mm x 400mm

DS/A3/1

ISS	CHANGE
1	1-12-83
2	MODS TO DMS1140. DSE. J.H. 24-9-84

P.C.B. COMPONENT LOCATION

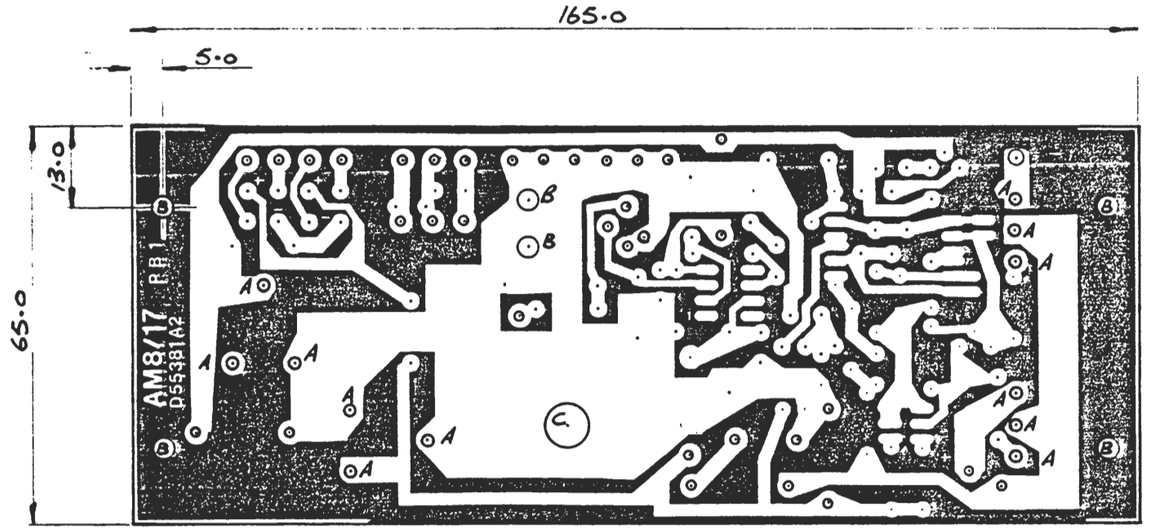
AM8/17
COMP. LOC.

All dimensions in millimetres unless otherwise stated. Normal tolerances:
no decimal place — ± 1 mm unless otherwise
one decimal place — ± 0·3 mm stated
two decimal places — ± 0·1 mm

DRN.	P.P.
TCD.	
CKD.	
APPD.	

DESIGNS DEPARTMENT

D55382A3



Approx. board area = 10,725 mm²

HOLE REF.	HOLE SIZE	APPROX. Nº HOLES
A	1·3 DIA	
B	3·4 DIA	
C	7·0 DIA	
D		
E		
F		
UNCODED & RINGED	1·0 DIA	
UNCODED	0·85 DIA	
●		

SCALE:- 1:1

MANUFACTURED TO: DSS381 A2 (2 SHEETS), DSS382 A2
AND IN ACCORDANCE WITH SPEC. ED139

MATERIAL: 1·6 THK. TO BS4584, +CL5·2, EP-GC-Cu-3,35/0, 1·60±0·14
(EPOXIDE WOVEN GLASS FABRIC, CLAD ON ONE SIDES WITH 35µm COPPER).

FINISH: TINNED.

APPROX. No. OF HOLES: - 147

COMP. LOC. LINES & CHARACTERS TO BE PRINTED IN BLACK

TRIMMING: BOARD TO BE FINISHED TO DIMENSIONS IF SHOWN, OTHERWISE TO OUTER EDGE OF COPPER

Original Frame Size: BMM 209 A3 — 277mm x 400mm

BBC

DS A3

CHANGE	ISS.
1-12-83	1
No. OF HOLES ADDED. CAB M.L. 20.12.83	2
MODS TO DMS1148 & INFO G.WHITEHEAD (LISTENING ROOM). DSI. J.H. 24-9-84	3

THIRD ANGLE PROJECTION

All dimensions in millimetres unless otherwise stated
Normal tolerances
no decimal place - ±1 mm
one decimal place - ±0·3mm
two decimal places - ±0·1mm
unless otherwise stated

AM8/17

P.B. DRILLING

DRN.	TCD.	CKD.	APPD.
K TURNER			

DESIGNS DEPARTMENT

DS5383 A3