

CHANNEL DESK PANELS PA8/260A-D

Introduction

Panel PA8/260 is one of the Type-D sound equipment modules. It contains two identical channels designed to accept and control a range of input signals from a microphone or other source at programme volumes varying from -80dB to 0dB without the use of auxiliary attenuators. It has been designed to have a reserve margin before overload of 28dB above normal line-up level, i.e. a margin of 20dB above normal programme volume. In addition to the programme output there are outputs for public address, foldback, prehear and echo. The direct and echo outputs may be switched to one of three groups or destinations, and other output switching arrangements are described later for individual panels. The programme circuit may be brought out to an insertion jackfield so that limiters, effects units or response selection amplifiers etc. may be connected into the circuit. The equipment is mounted in a CH1/35 chassis having overall dimensions of 16 by 2¼ by 9 inches and it weighs 10 lb.

General information on the use of the module in specimen installations can be found in Instruction P.9.

General Description

Facilities

The PA8/260 is made in four versions, coded PA8/260A to PA8/260D, and the facilities available on each version are given in Table 1. Block diagrams of the programme chains of the PA8/260A-C and the PA8/260D are shown in Figs. 1 and 2.

Controls

1. PA8/260A

The controls available on the front panel, from the top, are as follows:

- Eight-pole three-way group selection switch, which switches the direct and echo outputs, public address, studio loudspeaker relay circuit, group indication lamps and clean feed output.
- Preset gain control PNN/16N/1S giving an attenuation of 50 dB in 10 steps.
- Switch for a 30-dB input attenuator.
- Echo mixture control, a 7.5-kilohm twin-gang log/antilog carbon-track resistor.
- Foldback volume control, a 10-kilohm carbon-track logarithmic resistor.
- Switch to derive public address feed before or after the second section of the fader.
- Public address volume control, also a 10-kilohm carbon-track logarithmic resistor.
- Fader, Type PNN/17Q/1S.
- Non-locking pushbutton switch to connect the prehear circuit to the programme chain before or after the second section of the fader, according to whether the fader is down or up respectively.

2. PA8/260B

The public address volume control is replaced by a cue key and lamp. The cue circuit is routed by the group selection switch. The public address bank of the switch is used to provide a group-switched foldback output.

TABLE 1

<i>Facility</i>	<i>PA8/260A</i>	<i>PA8/260B</i>	<i>PA8/260C</i>	<i>PA8/260D</i>
Fader control	X	X	X	X
Preset gain control	X	X	X	X
Echo mixture control	X	X	X	**
P.A. control	X			X
Foldback control	X	X	X	
Prehear	X	X	X	X
R.S.A. insertion	X	X	X	X
Circuit cut key			X	
*Cue keys and lamps		X		
Pan Control				X

*See Fig. 4

**Limited

3. PA8/260C

The public address volume control is replaced by a programme cut key. The public address bank on the group selection switch is used to provide a group-switched foldback output.

4. PA8/260D

The twin-gang carbon-track control is used as a pan control to adjust the proportions of the left and right hand stereo signals derived from the mono input. It is used in conjunction with a separate auxiliary panel producing stereo echo feeds which return to the PA8/260D for routing via the group selection switch. A 10 kilohm carbon track logarithmic control is used as a simplified echo mixture control giving up to 50 per cent echo.

Internal Equipment

The equipment mounted inside the chassis is common to all four versions. Starting from the bottom there are the microphone amplifier AM9/9 (A1), the r.f. filter, two input transformers for the two sections of the AM9/9 mounted in a common monumental box with the coils at right-angles, T1 and T2 (LG/63A) and the miscellaneous output amplifier AM9/8 (A4). Next come the foldback and public address output transformers T6 and T7 (LL/76M). Finally there are the direct and echo amplifiers AM9/8 (A2 and A3), their output transformers in a common box, and the prehear relay.

Circuit Description (Figs. 1 to 5)

The Programme Chain

Figs. 1 and 4 give the programme chain and the full circuit of panels PA8/260A-C. Figs. 2 and 5 refer correspondingly to Panel PA8/260D, and Fig. 3 shows the attenuation characteristics of the channel fader and the input amplifier preset control fitted to all four panels.

The incoming programme is taken through an r.f. filter to remove longitudinal r.f. interference, and then via a switched 30-dB attenuator to the amplifier fader assembly. This comprises the two sections of the AM9/9 amplifier, a two-section fader PNN/17Q/1S with a useable range of 45 dB and a two-section attenuator PNN/16N/1S which controls the feedback on the two amplifier sections and has a range of 50 dB in 10 steps of 5 dB, distributed as shown in Fig. 3(b). The attenuation introduced by the two sections of the channel fader is split into three parts as shown on Fig. 3(a). This arrangement gives the necessary signal/noise ratio while at the same time avoiding the risk of overloading either section of the amplifier.

A connection for the prehear circuit is made immediately before the second section of the fader when this is faded down. The first fader section then provides an attenuation of 29.5 dB which is taken into account in determining the remaining attenuation between this point and the prehear busbar. When the fader is not fully faded down, the PH relay transfers the prehear tapping point to the output of the miscellaneous amplifier.

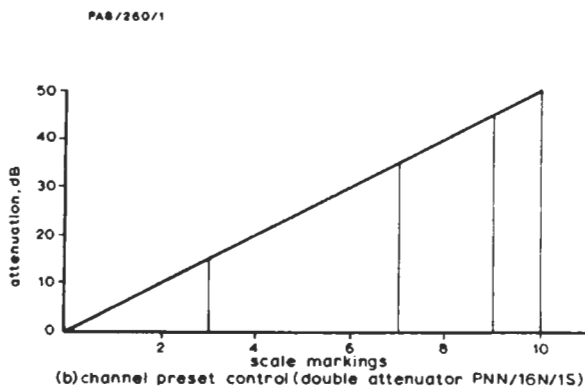
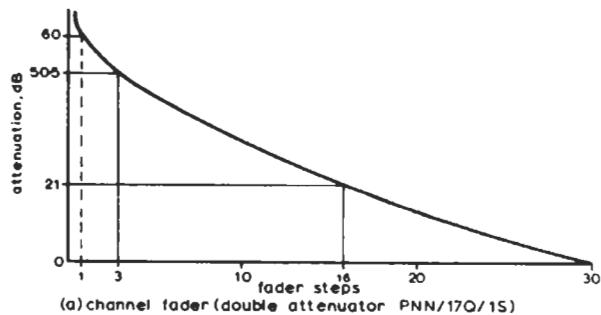


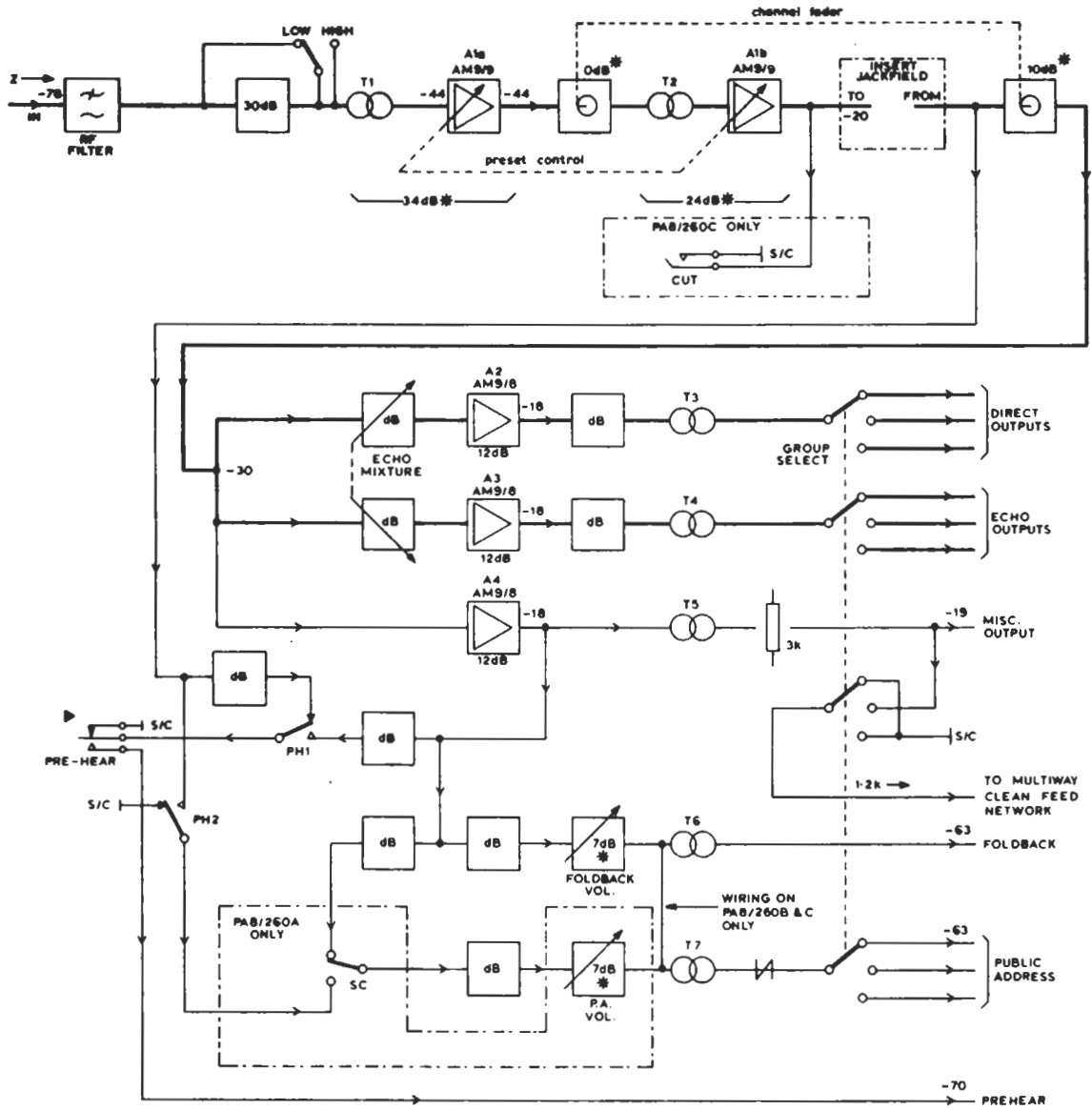
Fig. 3. Attenuation Characteristics

There is an access point between the second section of the AM9/9 and the fader for the insertion of response selection amplifiers and so on. Equipment inserted at this point should have a high input impedance and a low output impedance, it should accept unbalanced terminations, and it should operate satisfactorily at an input level of about -20 dB and be able to deliver a maximum output of $+12$ dB.

After the second fader section the programme chain divides into direct and echo chains. Echo mixture is continuously controlled by a ganged pair of controls having a law such that the mid-position loss in each chain is about 1 dB. In each circuit there is an isolating and level raising amplifier AM9/8 whose outputs are fed to the group selection switch through 1200-ohm mixing resistors and earth isolating transformers.

A feed is taken from the output of the second fader section to a level raising amplifier AM9/8 to supply the auxiliary outputs. The amplifier has an output impedance of a few ohms only and isolation of the circuits is provided by series resistors.

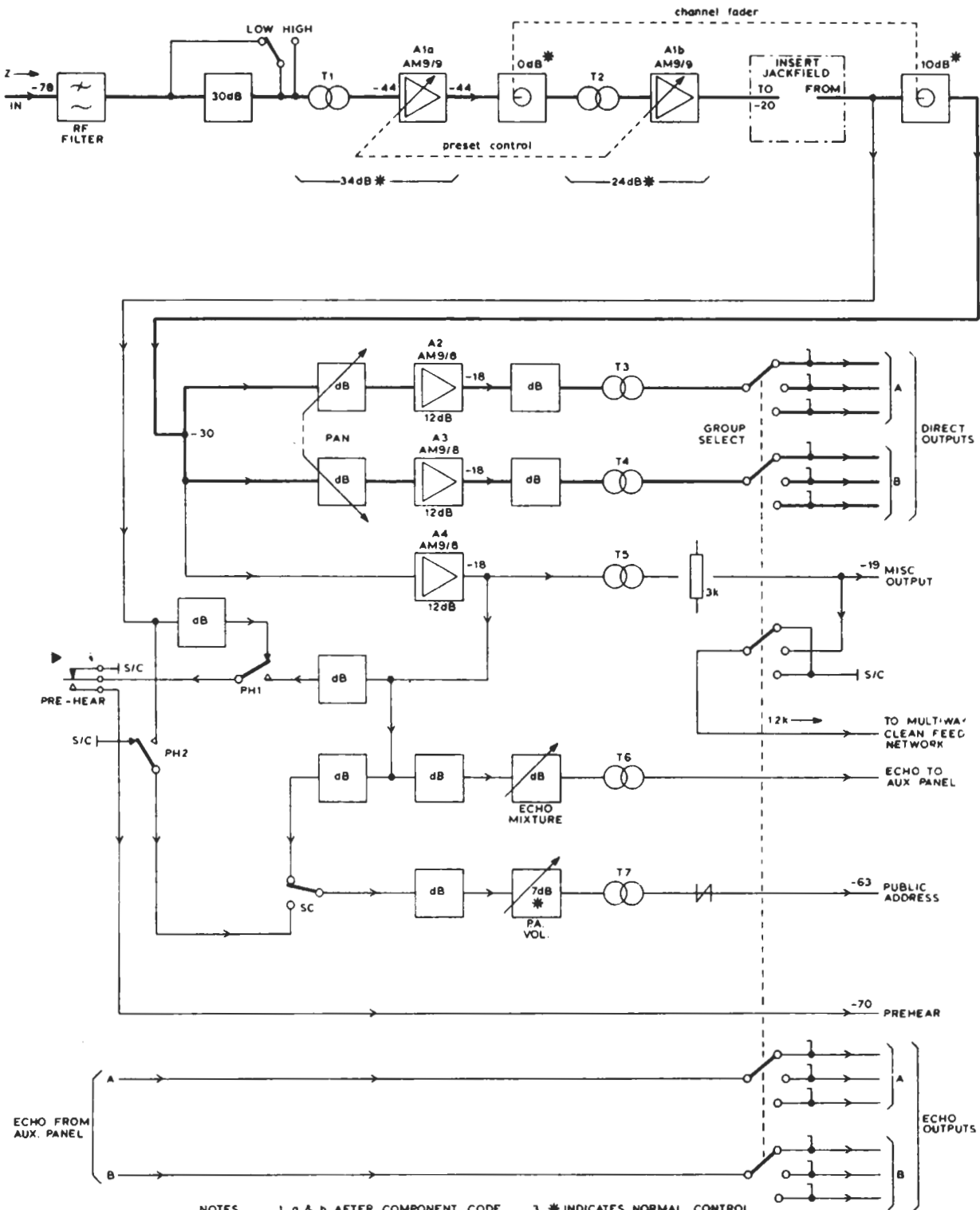
On the D version the echo circuit is simpler in form, and is derived from the miscellaneous amplifier through a volume control, which controls the echo contribution up to the level of the direct programme; that is, it provides up to a 50 per cent mixture. In place of the normal direct and echo outputs, 'A' and 'B' stereo outputs are derived from a mono input, the relative output volumes being controlled by a log/antilog panning control ('pan pot').



- NOTES
1. a & b AFTER COMPONENT CODE REFER TO THE TWO HALVES OF THE SAME COMPONENT
 2. Z INDICATES HIGH IMPEDANCE COMPARED TO CIRCUIT IMPEDANCE
 3. * INDICATES NORMAL CONTROL SETTING FOR INPUT LEVEL SHOWN
 4. INSERT JACKFIELD IS EXTERNAL TO MODULE
 5. GROUP SELECT SWITCH ALSO CONTROLS STUDIO LS. GROUP INDICATION AND CUE. SEE FIG. 4

PA8/260/2

Fig. 1. Programme Chain of PA8/260A-C (Two similar circuits)



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 4. INSERT JACKFIELD IS EXTERNAL TO MODULE

PA8/260/3

5. GROUP SELECT SWITCH ALSO CONTROLS STUDIO LS AND GROUP INDICATION. SEE FIG. 5

Fig. 2. Programme Chain of PA8/260D (Two similar circuits)

Foldback

The foldback output is taken from the output of the miscellaneous amplifier through a volume control and isolating transformer. On the B and C versions it is also routed by a wafer of the group selection switch. The foldback facility is not available on the D version.

Public Address

Public address outputs are provided on the A and D versions, the former having a switched output enabling the feed to be taken to the group panel, while the latter has a single unswitched feed which goes straight to the main module. By the operation of the switch SC, the public address feed may be taken from a point either immediately before or after the second fader section. When taken before, the signal volume remains constant while the fader is moved over the top 21 dB of its normal working range, and below this the volume is attenuated by a maximum of 29 dB before relay PH operates as the fader reaches its off position, and contact PH2 cuts the public address output. When the output is taken after the second fader section, the P.A. volume is controlled normally by the channel fader over the whole of its range. The relative level of the channel public address output to the P.A. busbar is controlled by a carbon-track volume control.

Clean Feed

When a channel is used for an incoming contribution to a multi-way programme, the group selector is set to its mid position, routing the direct output directly to the main module. A separate output, also switched by the group selection switch, is taken from the miscellaneous amplifier via a buffer resistor and transformer to the clean feed unit. This output is short-circuited in the other positions of the group selector switch.

Prehear

The prehear circuit may be used to check the source programme under faded-down or faded-up conditions.

(a) Faded Down

The prehear busbar is connected through the prehear switch SB, relay contact PH1 and isolating

resistor to the programme chain before the second fader section. The first fader section gives an attenuation of about 30 dB which is compensated for by the remainder of the prehear circuit.

(b) Faded Up

When the fader is moved from step 0, the prehear relay operates and contact PH1 transfers the prehear circuit to the output of the miscellaneous amplifier. This point is fully controlled and enables the operator to check the satisfactory working of a single microphone in a multi-microphone mix by listening to the prehear output.

Output Switching

The group selection switch connects the following circuits to up to three destinations.

Direct and echo programme.

Public Address (A).

Foldback (B and C).

Studio loudspeaker control circuit.

Group indication circuit.

Multiway clean feed network input.

Cue light circuit (B).

The impedances into which these circuits work will depend on the particular assembly used. Normally the direct and echo programme outputs will work into a low impedance of about 24 ohms, the miscellaneous output into 1200 ohms and the foldback, public address and prehear outputs into about 300 ohms. Other impedances may be used in special cases with consequent modifications of the programme levels.

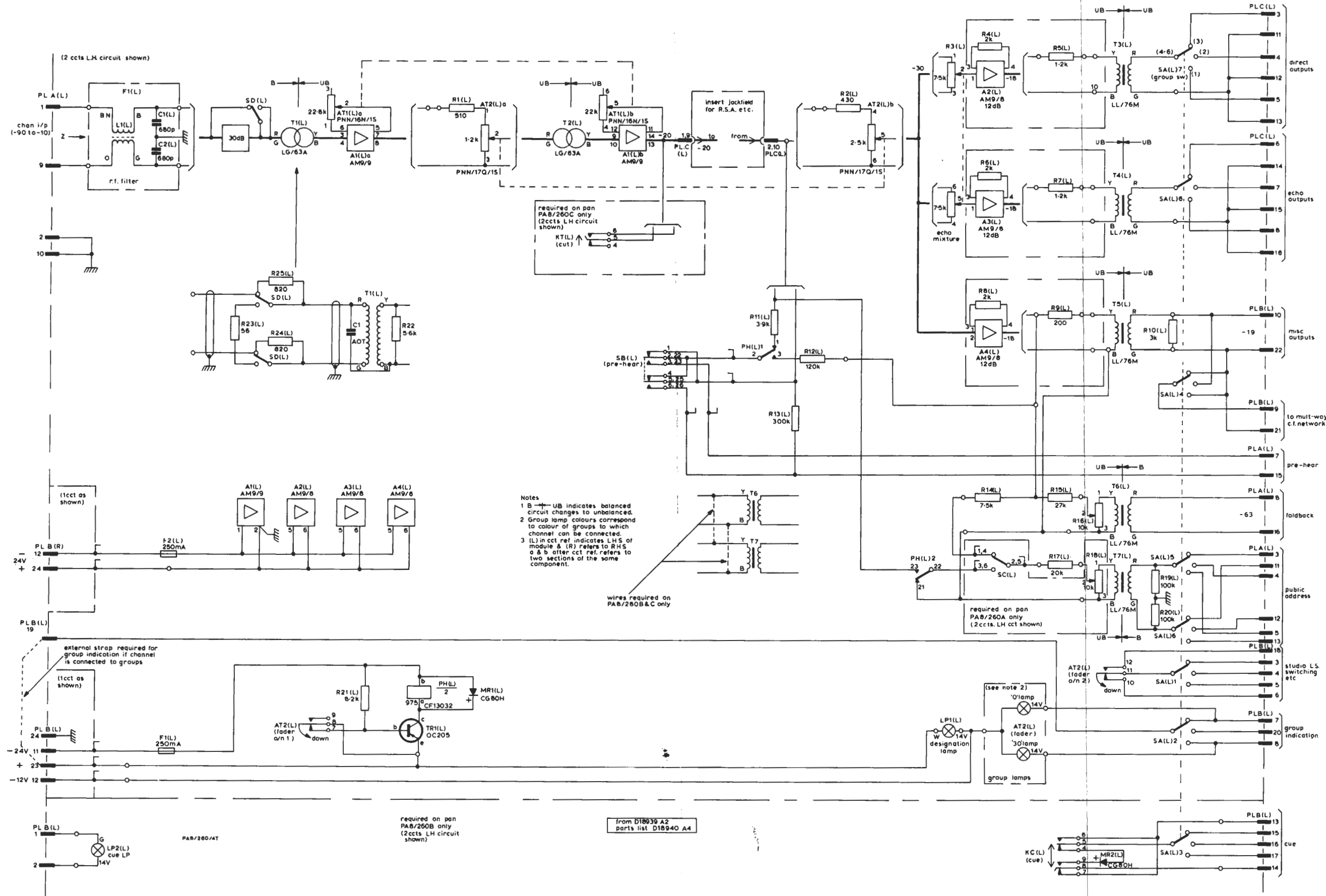
Tests

The levels obtained under normal conditions are shown on Figs. 1 and 2. Comprehensive tests on this unit can best be carried out by using the specially designed test panel TE1/13.

Modifications to PA8/260 (Alternative Amplifiers)

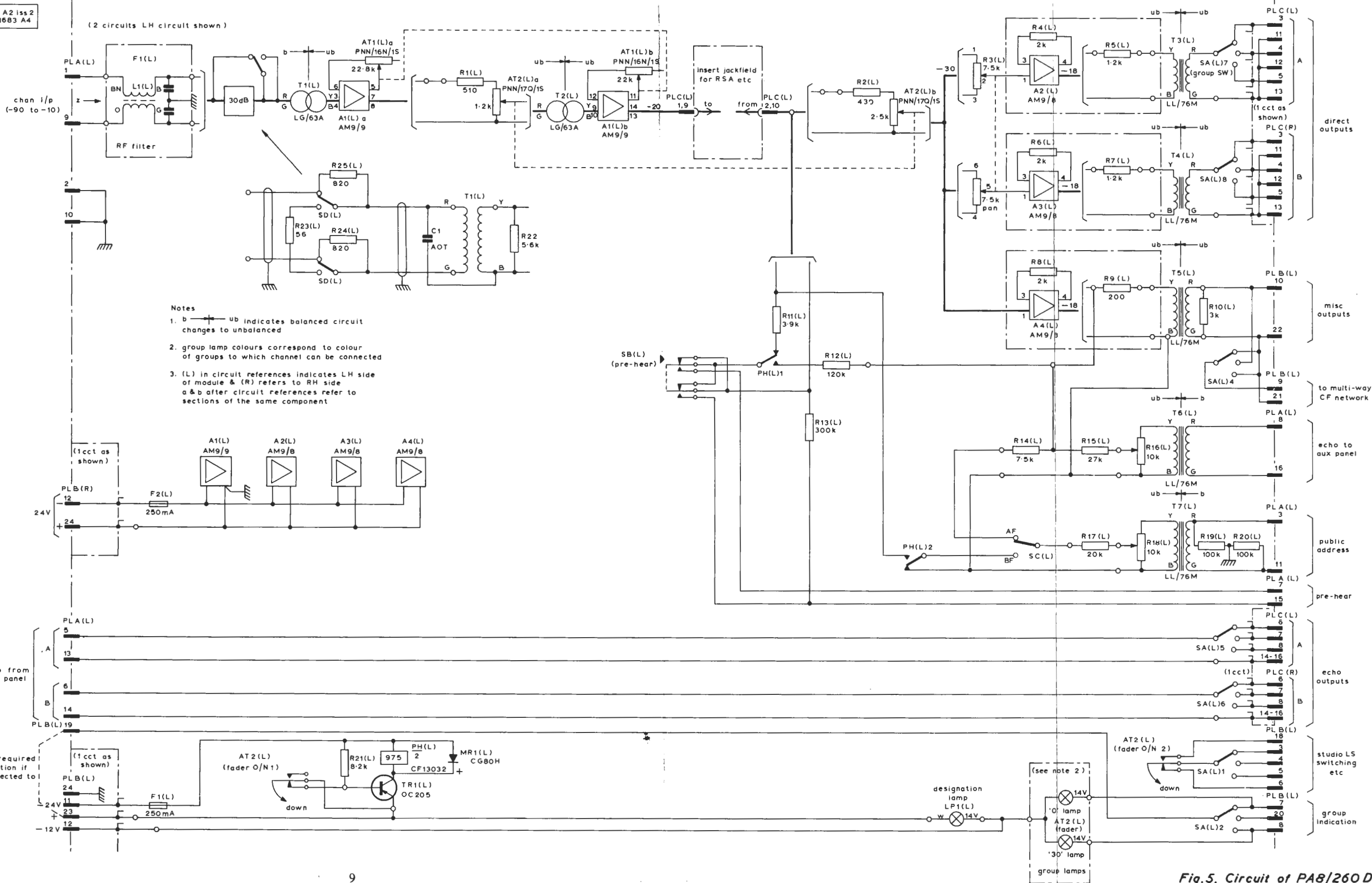
The amplifiers AM9/8 and AM9/9 have been superseded by the AM5/7 and AM9/10 respectively. Later models of the PA8/260 series may be fitted with the newer amplifiers.

WWM(X) 11/70



from D21682 A2 Iss 2
parts list D 21683 A4

(2 circuits LH circuit shown)



- Notes
1. b \rightarrow ub indicates balanced circuit changes to unbalanced
 2. group lamp colours correspond to colour of groups to which channel can be connected
 3. (L) in circuit references indicates LH side of module & (R) refers to RH side
a & b after circuit references refer to sections of the same component

external strap required for group indication if channel is connected to groups

Fig.5. Circuit of PA8/260 D

TEST PROCEDURE: PA8/260A-C

Apparatus Required

- Portable Routine Line Tester RLT/1P
- Tone Source TS/10
- Attenuator AT/30
- Repeating Coil
- A.C. Test Meter ATM/1
- Amplifier AM7/4
- Loudspeaker Unit LS5/1 or similar
- Desk Panel Tester TE1/13 including connector cables TE1A/2A-G
- Variable Air Capacitor, 10 to 50 pF
- Variable Air Capacitor, 50 to 1000 pF
- Selection of Polystyrene $\pm 2\%$ Capacitors in the range 20 to 250 pF
- 600-ohm Centre-tapped Resistor with each half matched to 0.01%
- Oscilloscope

General Notes

1. When the position of the Group Switch is referred to in what follows as A, X or B this signifies the extreme clockwise, mid or anti-clockwise position.
2. Each module comprises two independent and similar circuits, the left and right hand as viewed from the front panel. Although this test procedure refers mainly to one circuit, the tests apply to both except where a specific reference is made to one or the other.

D.C. Tests

General

Plug the module to tester TE1/13 and apply power. It is recommended that the module should be d.c. tested completely before a start is made on further tests.

D.C. Feeds

Remove the Meter Link from the tester and insert a milliammeter capable of reading up to about 200 mA. The total feed current, shown on the meter, should be about 180 mA with the fader up and about 160 mA with the fader down.

Lamps

The designation lamps should light when the tester is powered. To check the fader lamps, connect B.19 to B(L)23 and operate the Group Switch to A and B.

D.C. Test Schedule

Remove power from the tester TE1/13 and make resistance measurements on the module in accordance with the schedule given in Table 2. Resistances above 10 kilohms should be measured with the routine line tester RLT/1P in the A/E, B/E, and A/B Insulation modes; resistances below 10 kilohms should be measured in the E-A-E, E-B-E and loop R(A-B) modes.

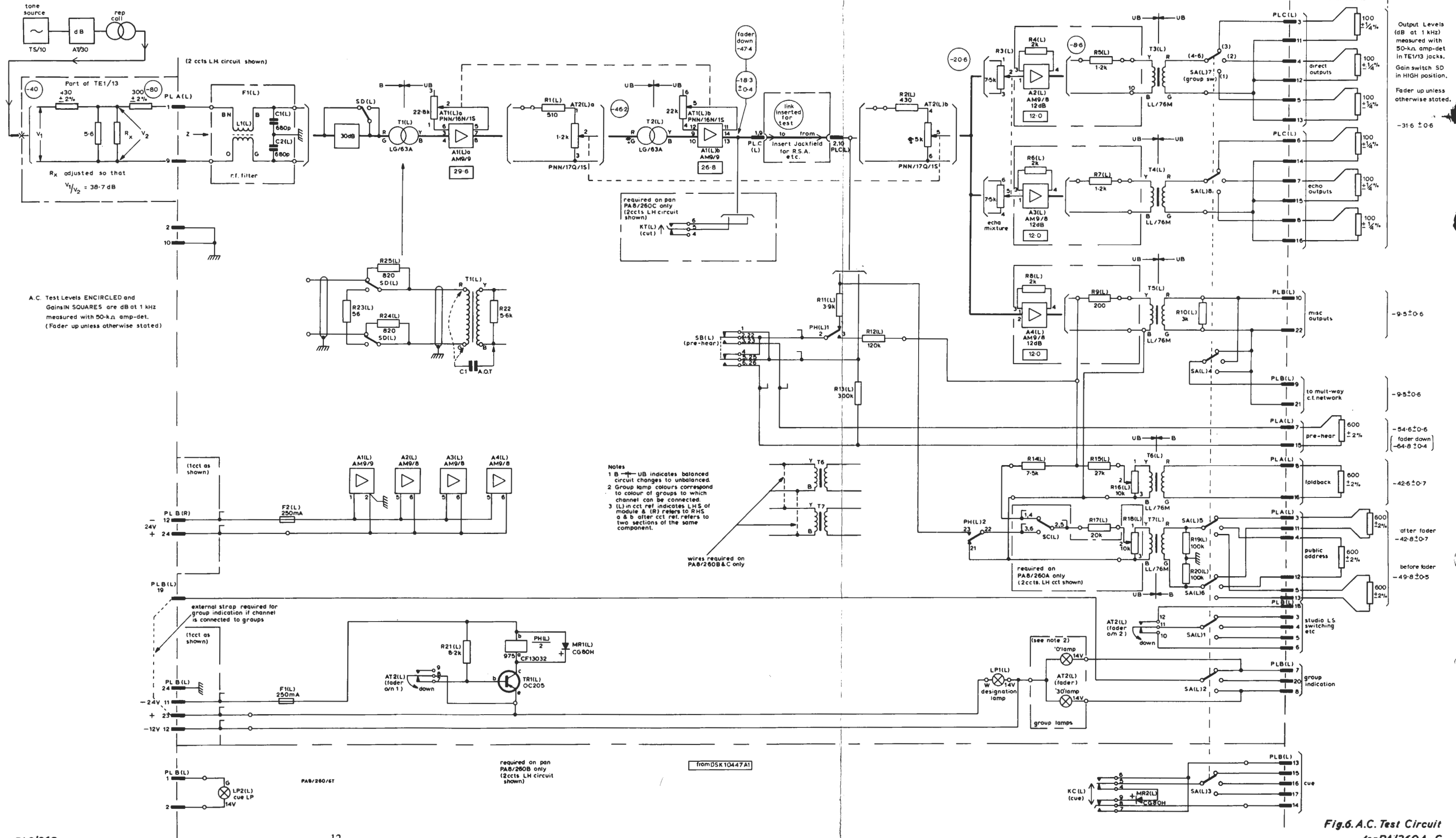
The connector cables, TE1A/2A-G, will be needed to gain access to the module for these checks and measurements.

TABLE 2

TE1/13 Jack Nos.	RLT/1P Mode			Relevant Module Control Settings
	E-A-E or A/E	E-B-E or B/E	Loop R or A/B	
A.1.9(L&R)	∞	∞	$\approx 40\Omega$	gain switch to high
A.2.10(L&R)	0	0	0	
A.3.11(L&R)	50k Ω / ∞	50k Ω / ∞	$\approx 60\Omega$ / ∞	group switch to A/group switch to X
A.4.12(L&R)	50k Ω / ∞	50k Ω / ∞	$\approx 60\Omega$ / ∞	group switch to X/group switch to B
A.5.13(L&R)	50k Ω / ∞	50k Ω / ∞	$\approx 60\Omega$ / ∞	group switch to B/group switch to X
A.7.15(L&R)	∞	300k Ω	∞	
A.8.16(L&R)	∞	∞	$\approx 60\Omega$	

TABLE 2 CONTINUED

TE1/13 Jack Nos.	RLT/1P Mode			Relevant Module Control Settings
	E-A-E or A/E	E-B-E or B/E	Loop R or A/B	
B.3.6(L&R)	∞ / ∞ / ∞	∞ / ∞ / ∞	0/ ∞ / ∞	1. group switch to A: fader down 2. group switch to A: fader up 3. group switch to X: fader both posns
B.4.6(L&R)	∞ / ∞ / ∞	∞ / ∞ / ∞	0/ ∞ / ∞	1. group switch to X: fader down 2. group switch to X: fader up 3. group switch to B: fader both posns
B.5.6.(L&R)	∞ / ∞ / ∞	∞ / ∞ / ∞	0/ ∞ / ∞	1. group switch to B: fader down 2. group switch to B: fader up 3. group switch to A: fader both posns
B.5.18(L&R)	∞ / ∞	∞ / ∞	∞ /0	1. group switch to B: fader down 2. group switch to B: fader up
B.7.19(L&R)	∞ / ∞	∞ / ∞	0/ ∞	group switch to A/group switch to X
B.19.20(L&R)	∞ / ∞	∞ / ∞	0/ ∞	group switch to X/group switch to B
B.8.19(L&R)	∞ / ∞	∞ / ∞	0/ ∞	group switch to B/group switch to X
B.7.12(L)	∞	∞	$\approx 50\Omega$	
B.8.12(L)	∞	∞	$\approx 50\Omega$	
B.9.21(L&R)	∞ / ∞ / ∞	∞ / ∞ / ∞	0/60/0	gp sw to A/gp sw to X/gp sw to B
B.10.22(L&R)	∞	∞	$\approx 60\Omega$	
B.24.-(L&R)	0	∞	∞	
C.3.11(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to A/group switch to X
C.4.12(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to X/group switch to B
C.5.13(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to B/group switch to X
C.6.14(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to A/group switch to X
C.7.15(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to X/group switch to B
C.8.16(L&R)	∞ / ∞	∞ / ∞	$\approx 60\Omega$ / ∞	group switch to B/group switch to X



A.C. Test Levels ENCIRCLED and Gains IN SQUARES are dB at 1 kHz measured with 50-k Ω amp-det. (Fader up unless otherwise stated)

- Notes
- 1 B — UB indicates balanced circuit changes to unbalanced.
 - 2 Group lamp colours correspond to colour of groups to which channel can be connected.
 - 3 (L) in cct ref indicates LHS of module & (R) refers to RHS a & b after cct ref. refers to two sections of the same component.

Test Terminations included in TE1/13

Output Levels (dB at 1 kHz) measured with 50-k Ω amp-det in TE1/13 jacks. Gain switch SD in HIGH position. Fader up unless otherwise stated.

-31.6 \pm 0.6

-9.5 \pm 0.6

-9.5 \pm 0.6

-54.6 \pm 0.6
fader down
-64.8 \pm 0.4

-42.6 \pm 0.7

after fader
-42.8 \pm 0.7

before fader
-49.8 \pm 0.5

Fig.6. A.C. Test Circuit for PA1260A-C

TABLE 2 CONTINUED

Tests on PA8/260B Only

TE1/13 Jack Nos.	RLT/IP Mode			Relevant Module Control Settings
	E-A-E or A/E	E-B-E or B/E	Loop R or A/B	
B.1.2(L&R)	∞	∞	≈50Ω	
B.13.14(L&R)	∞/∞/∞	∞/∞/∞	∞/0/25Ω	1. normal 2. cue key to locking position 3. cue key to non-locking position
B.14.15(L&R)	∞/∞	∞/∞	300kΩ/∞	1. group switch to A 2. group switch to A: cue key to non-locking position
B.14.16(L&R)	∞	∞	300kΩ	group switch to X
B.14.17(L&R)	∞	∞	300kΩ	group switch to B

Note that the lower tag number of a pair is designated as the A leg.

Circuit Transmission Tests (Fig. 6)

Fig. 6 gives the a.c. test circuit.

Restore power to the TE1/13 and apply 1-kHz test tone to a parallel. Connect a low-resistance double-ended jackplug lead TE1A/2A between the parallel and the Via 40-dB Att. jack on the TE1/13 which connects through a loss pad to the input of the

module on A.1.9. Connect the parallel to the input of the ATM/1 in the 50-kilohm amp-det condition. Using the ATM/1 as now connected, set the level at the loss pad input accurately to -40 dB; this provides an accurate -80 dB at the module input.

Use a further TE1A/2A lead to link C.1.9 jack to C.2.10. Set the Preset control to 10 and switch the gain to High. Using the ATM/1 in its 50-kilohm amp-det condition except where otherwise indicated, make the measurements given in Table 3.

TABLE 3

Test Conditions	Level (dB) at 1 kHz	Tolerances (dB w.r.t. 1 kHz)	
		20 Hz	20 kHz
<i>Insert Point for R.S.A.</i> Fader up. Measure with ATM/1 at C.1.9 listen jack.	-18.3 ±0.4	←-3.1	±0.2
As above, but with Gain switch on Low	about -49		
Fader down. Gain switch returned to High. Measure with ATM/1 at C.1.9 listen jack.	-47.4 ±0.4	←-3.1	±0.2
<i>Direct Outputs</i> Fader up and Echo Mixture control on 0.			
Check positions of Preset controls.	5 dB per stop		
Group switch on A. Measure at C.3.11 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
Group switch on X. Measure at C.4.12 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
Group switch on B. Measure at C.5.13 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
<i>Echo Mixture Control Law (Direct)</i> As for preceding test, but set Echo Mixture control to 4.	about -33		
<i>Echo Outputs</i> Fader up and Echo Mixture control on 8.			
Group switch on A. Measure at C.6.14 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
Group switch on X. Measure at C.6.14 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
Group switch on B. Measure at C.8.16 (100-ohm jack).	-31.6 ±0.6	←-3.5	±0.4
<i>Echo Mixture Control Law (Echo)</i> As for preceding test, but set Echo Mixture control to 4.	about -33		
<i>Multiway Clean Feed</i> Fader up. Group switch on X. Measure at B.9.21. Use TE1A/2C to connect B.9.21 to Test jack.	-9.5 ±0.6	←-3.5	±0.4

Test Conditions	Level (dB) at 1 kHz	Tolerance (dB w.r.t. 1 kHz)	
		20 Hz	20 kHz
(b) After Fader Repetition of tests (a) with public address outputs switched to After fader instead of to Before Fader.	-42.8 ±0.7		
P.A. Control Law As for preceding test, but with P.A. control on 4.	about -60		

Noise Tests

General

All noise measurements should be made on the T.P.M. section of the ATM/1 peaked to 6. The noise output should be monitored on an L.S. unit and should be white in character.

Input Amplifier Noise

1. Apply 1-kHz test tone to the channel input (A.1.9) as described for Transmission Tests.
2. Set the Group switch to A and the Echo Mixture control to 0. Bring the fader fully up and put the Preset controls to maximum gain.
3. Connect an amplifier AM7/4 to the Direct output (C.3.11 100-ohm jack) and adjust the amplifier gain to give an output level to 0 dB.
4. Remove the test tone from the input of the 40-dB pad, thus terminating the channel input with 300 ohms.
5. Measure the noise on an ATM/1 in the 50-kilohm T.P.M. condition at the AM7/4 output. The noise should not exceed -48 dB and any fluctuations should not exceed ±1 dB.

Direct Output Noise

Replace the AM7/4 by an AM9/5 set to 46 dB gain and select the 600-ohm input to the ATM/1. With the fader fully down, measure the noise output, which should not exceed -75 dB.

Echo Output Noise

Repeat the above test, measuring at the Echo output (C.6.14 100-ohm jack). The noise output should not exceed -75 dB.

Miscellaneous Output Noise

Repeat the above test, measuring at the Miscellaneous output (B.10.22). The noise output should not exceed -55 dB.

Impulsive Noise Due to Switching

General

For all the following noise tests, the module should be powered at least 15 minutes before tests are started.

Preset Control and Fader Off-normal Contacts

Set the channel for Direct noise measurement as above and check that operation of the Preset control, fader off-normal contacts and adjacent-channel fader off-normal contacts does not produce clicks or plops audible above the basic noise. This should be checked on a high grade monitoring loudspeaker such as an LS5/1 connected to the listen output of the ATM/1 and set for a reasonable listening level when the T.P.M. indicates normal volume range.

'Before/After Fader' Switch (PA8/260A Only)

Check for clicks or plops caused by operation of the Before/After switch with the monitoring loudspeaker and ATM/1 (see preceding paragraph) connected to the P.A. A output, A.3.11 600-ohm jack. The Group switch should be set to A and the P.A. control to 8.

Prehear Pushbutton

Check that clicks or plops caused by operation of the Prehear pushbutton are inaudible with the monitoring loudspeaker and ATM/1 connected to the Prehear output (A.7.15 600-ohm jack) with the ATM/1 set to 70 dB gain. This check should be made with the fader up and down.

Noise-free Operation of Fader Controls

Apply programme at about -40 dB via the 40-dB attenuator in the channel input and operate the Group switch to A. Using the monitoring loudspeaker and ATM/1, connect to the following output tags and check that the relevant controls operate in a noise-free manner.

C.3.11 (100-ohm jack)

1. Fader, with Echo Mixture on 0. Check that there is no breakthrough on the bottom stud.
2. Direct section of Echo Mixture control.
3. Preset control.

C.6.14 (100-ohm jack)

4. Echo section of Echo Mixture control.

A.8.16 (600-ohm jack)

5. Foldback control.

A.3.11 (600-ohm jack)

6. P.A. control. PA8/260A only.

Phasing

Using an asymmetric waveform, check with an oscilloscope connected to the listen output of the ATM/1 that all outputs are in phase with the input (A.1.9).

An asymmetric test waveform may conveniently be produced by shunting a tone source TS/10 set for +10 output with a suitable diode such as an AAY 32.

Balancing of Input Circuit at 10 kHz (Fig. 7)

1. Connect a 600-ohm balanced centre-tapped resistor across the channel input A.1.9 as shown in the circuit of Fig. 7. (Use a TE1A/2B lead.) Set the Preset control to 0, the Echo Mixture control to 0 and the group switch to A. Jacks C.1.9 and C.2.10 should be connected together with a TE1A/2A lead.

2. Apply 10-kHz tone to the channel input A.1.9 at the nominal level of 0 dB and with the 50-kilohm amp-det connected to the Direct UNTERMINATED output (C.3.11 jack). Set the relevant fader to produce an output level of 0 dB. A small adjustment of the tone source output level may be necessary to obtain this.
3. Transfer the 50-kilohm amp-det to the channel input A.1.9 and measure the exact input level.
4. Next apply the 10-kHz tone between centre-tap of the 600-ohm balanced resistor and the module chassis (earth), maintaining the output level of the now unterminated tone source constant.
5. Transfer the 50-kilohm amp-det (now set to the T.P.M. mode) to the Direct channel output (C.3.11 jack) and adjust the gain to produce a reading on the T.P.M.
6. Connect a variable air capacitor (either 10-to-50-pF or 50-to-1000-pF as suitable) between the red or green (primary) and blue (earthy end of secondary) of the channel input transformer T1 and adjust the capacitor for a minimum T.P.M. reading. (The T.P.M. output should be observed on an oscilloscope if a poor null due to hum is suspected.) Note the capacitance and the primary connection of T1 (red or green) required for balance and remove the variable air capacitor from circuit. The capacitance needed should not exceed 250 pF.
7. Select a polystyrene capacitor (125-volt working ± 2 per cent tolerance) of a value nearest to the

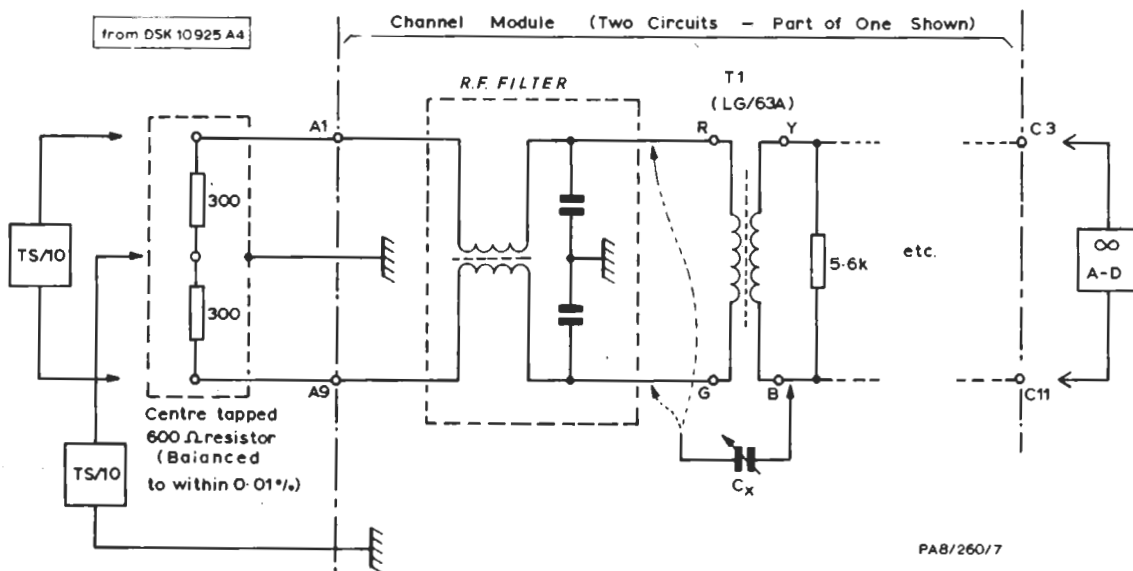


Fig. 7. Test Circuit for Balancing of PA8/260A-D Input Circuit at 10 kHz

one required for exact balance and solder this permanently between the appropriate primary and blue connections of T1.

- Again measure the 10-kHz output at C.3.11 jack with the 50-kilohm T.P.M. It should not exceed -78 dB.

TEST PROCEDURE: PA8/260D

Apparatus Required

As for panels PA8/260A-C.

General Notes

- Where the position of the Group Switch is referred to in what follows as X, Y or Z this signifies the extreme clockwise, mid or anti-clockwise position.
- Each module comprises two independent and similar circuits, the left and right as viewed from the front panel. Although this test procedure refers mainly to one circuit, the tests apply to both except where a specific reference is made to one or the other.

D.C. Tests

Plug the module to the tester TE1/13 and apply power. It is recommended that the module should be d.c. tested completely before a start is made on further tests.

D.C. Feeds

Remove the Meter Link from the tester and insert a milliammeter capable of measuring up to about 200 mA. The total feed current, shown on the meter, should be about 180 mA with the fader up and about 160 mA with the fader down.

Lamps

Connect, in turn, B(L)19 to B(L)23 and B(R)19 to B(L)23 to check that all lamps function satisfactorily. Operate the Group switch to X and Z to check the fader lamps.

D.C. Test Schedule

Remove power from the tester TE1/13 and make resistance measurements on the module in accordance with the schedule given in Table 4. Resistances above 10 kilohms should be measured with the routine line tester RLT/1P in the A/E, B/E and A/B insulation modes; resistances below 10 kilohms should be measured in the E-A-E, E-B-E and loop R(A-B) modes.

The connector cables, TE1A/2A-G, will be needed to gain access to the module for these checks and measurements.

Note that the lower tag number of a pair is designated as the A leg.

TABLE 4

TE1/13 Jack Nos.	RLT/1P Mode			Relevant Module Control Settings
	E-A-E or A/E	E-B-E or B/E	Loop R or A/B	
A.1.9(L&R)	∞	∞	≈40Ω	gain switch to high
A.2.10(L&R)	0	0	0	
A.3.11(L&R)	50kΩ	50kΩ	≈60Ω	
A.7.15(L&R)	∞	300kΩ	∞	
A.8.16(L&R)	∞	∞	≈60Ω	
B.3.6(L&R)	∞/∞/∞	∞/∞/∞	0/∞/∞	1. group switch to X: fader down 2. group switch to X: fader up 3. group switch to Y: fader both posns
B.4.6(L&R)	∞/∞/∞	∞/∞/∞	0/∞/∞	1. group switch to Y: fader down 2. group switch to Y: fader up 3. group switch to Z: fader both posns

TE1/13 Jack Nos.	RLT/1P Mode			Relevant Module Control Settings
	E-A-E or A/E	E-B-E or B/E	Loop R or A/B	
B.5.6(L&R)	∞/∞/∞	∞/∞/∞	0/∞/∞	1. group switch to Z: fader down 2. group switch to Z: fader up 3. group switch to X: fader both posns
B.5.18(L&R)	∞/∞	∞/∞	∞/0	1. group switch to Z: fader down 2. group switch to Z: fader up
B.7.19(L&R)	∞/∞	∞/∞	0/∞	group switch to X/group switch to Y
B.19.20(L&R)	∞/∞	∞/∞	0/∞	group switch to Y/group switch to Z
B.8.19(L&R)	∞/∞	∞/∞	0/∞	group switch to Z/group switch to Y
B.7.12(L)	∞	∞	≈50Ω	
B.8.12(L)	∞	∞	≈50Ω	
B.9.21(L&R)	∞/∞/∞	∞/∞/∞	0/≈60Ω/0	group switch to X/Y/Z
B.10.22(L&R)	∞	∞	≈60Ω	
B.24.-(L&R)	0	∞	∞	
C.3.11(L&R)	∞/∞	∞/∞	60Ω/∞	group switch to X/Y
C.4.11(L&R)	∞/∞	∞/∞	60Ω/∞	group switch to Y/Z
C.5.13(L&R)	∞/∞	∞/∞	60Ω/∞	group switch to Z/Y
C.6.14(L)	∞/∞	∞/∞	0/∞	group switch to X/Y
C.7.15(L)	∞/∞	∞/∞	0/∞	group switch to Y/Z
C.8.16(L)	∞/∞	∞/∞	0/∞	group switch to Z/Y
C.6.14(R)	∞/∞	∞/∞	0/∞	group switch to X/Y
C.7.15(R)	∞/∞	∞/∞	0/∞	group switch to Y/Z
C.8.16(R)	∞/∞	∞/∞	0/∞	group switch to Z/Y

left and right group switches should not be switched to same group

short A.6 to A.13

short A.6 to A.14

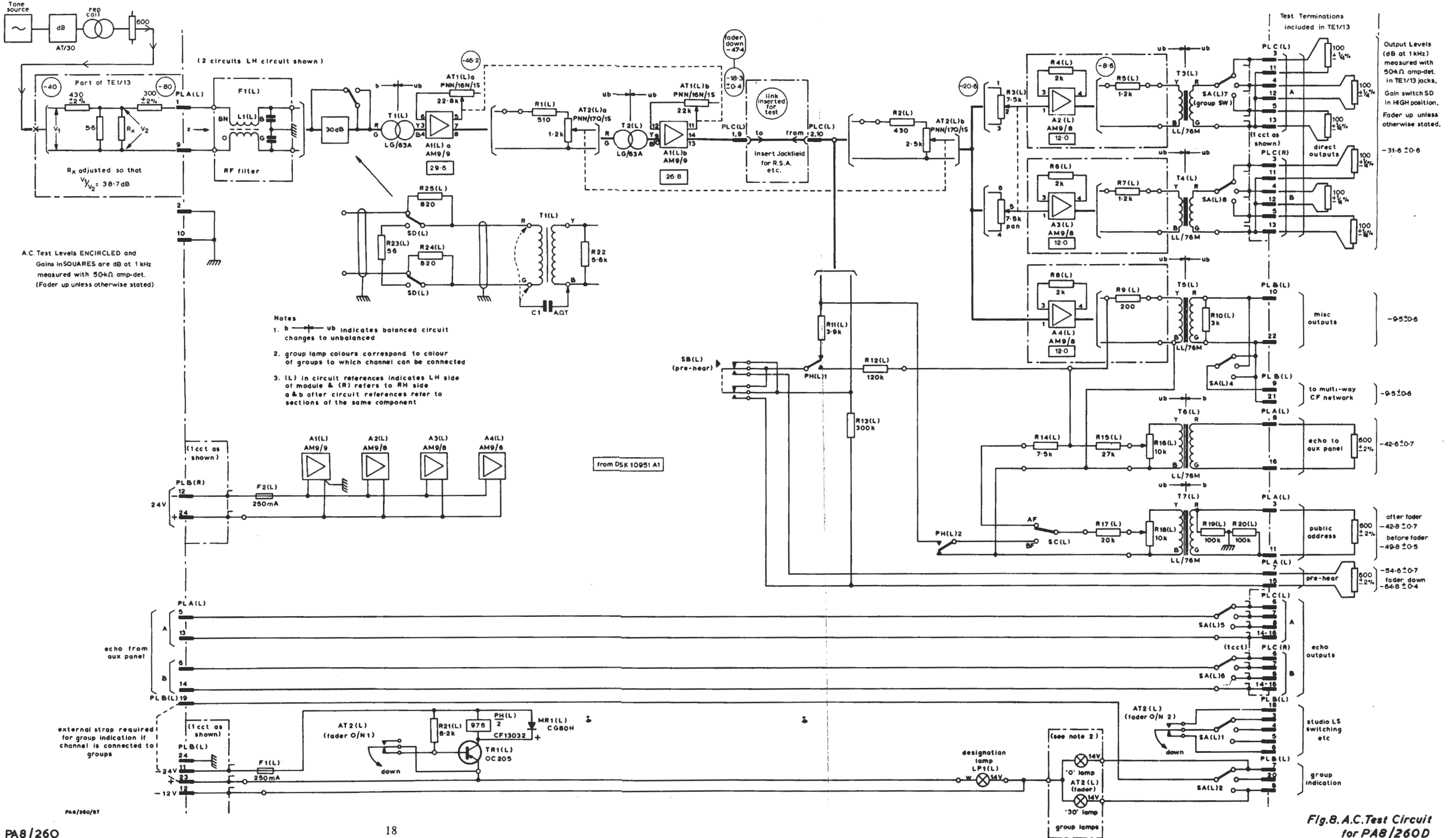


Fig.8. A.C. Test Circuit for PA8/260D

Circuit Transmission Tests (Fig. 8)

Fig. 8 gives the a.c. test circuit. Restore power to the TE1/13 and apply 1-kHz test tone to a parallel. Connect a low-resistance double-ended jackplug lead TE1A/2A between the parallel and the Via 40-dB Att. jack on the TE1/13 which connects through a loss-pad to the input of the module on A.1.9. Connect the parallel to the input of the ATM/1 in the 50-kilohm amp-det condition.

Using the ATM/1 as now connected, set the level at the loss-pad input accurately to -40 dB; this provides an accurate -80 dB at the module input.

Use a further TE1A/2A lead to link C.1.9 jack to C.2.10. Set the Preset control to 10 and switch the gain to High. Using the ATM/1 in its 50-kilohm amp-det condition except where otherwise stated, make the measurements given in Table 5.

TABLE 5

Test Conditions	Level (dB) at 1 kHz	Tolerances (dB w.r.t. 1 kHz)	
		20 Hz	20 kHz
<i>Insert Point for R.S.A.</i> Fader up. Measure with ATM/1 at C.1.9 listen jack.	-18.3 ±0.4	←-3.1	±0.2
As above, but with Gain switch on Low.	-49 about		
Fader down. Gain switch returned to High. Measure with ATM/1 at C.1.9 listen jack.	-47.4 ±0.4	←-3.1	±0.2
For the following tests, under the headings Direct Outputs (A), Pan Control Law (A), Direct Outputs (B), and Pan Control Law (B), the other channel group switch should not be switched to the same group as the channel under test.			
<i>Direct Outputs (A)</i> Fader up. Pan pot on 4 anticlockwise.			
Group switch on X. Measure at C.3.11 100-ohm jack (left).	-31.6 ±0.6	←-3.5	±0.4
Group switch on Y. Measure at C.4.12 100-ohm jack (left).	-31.6 ±0.6	←-3.5	±0.4
Group switch on Z. Measure at C.5.13 100-ohm jack (left)	-31.6 ±0.6	←-3.5	±0.4
<i>Pan Control Law (A)</i> As for above, but with Pan control on 0.	-33 about		

Test Conditions	Level (dB) at 1 kHz	Tolerances (dB w.r.t. 1 kHz)	
		20 Hz	20 kHz
<i>Direct Outputs (B)</i> Fader up. Pan pot on 4 clockwise.			
Group switch on X. Measure at C.3.11 100-ohm jack (right).	-31.6 ±0.6	←-3.5	±0.4
Group switch on Y. Measure at C.4.12 100-ohm jack (right).	-31.6 ±0.6	←-3.5	±0.4
Group switch on Z. Measure at C.5.13	-31.6 ±0.6	←-3.5	±0.4
<i>Pan Control Law (B)</i> As for above, but with Pan control on 0.	-33 about		
<i>Multiway Clean Feed</i> Fader up. Group switch on Y. Measure at B.9.21. Use TE1A/2C to connect B.9.21 to Test jack	-9.5 ±0.6	←-3.5	±0.4
<i>Miscellaneous Output</i> Fader up. Measure at B.10.22. Use TE1A/2C to connect B.10.22 to Test jack.	-9.5 ±0.6	←-3.5	±0.4
<i>Prehear Output</i> Fader down. Operate Prehear button and measure at A.7.15 (600-ohm jack).	-64.8 ±0.4		
As above, but with fader up.	-54.6 ±0.4		
<i>Echo to Auxiliary Panel</i> Fader up. Echo Mixture control on 8. Measure at A.8.16 (600-ohm jack).	-42.6 ±0.7		
<i>Echo Mixture Law</i> As for above, but with Echo Mixture control on 4.	-60 about		
<i>Public Address Output</i> (a) Before Fader P.A. control on 8. Measure at A.3.11 (600-ohm jack).	-49.8 ±0.5		
(b) After Fader P.A. control on 8. Measure at A.3.11 (600-ohm jack).	-42.8 ±0.7		

Noise Tests**General**

All noise measurements should be made on the T.P.M. section of the ATM/1 peaked to 6. The noise output should be monitored on a loudspeaker unit and should be white in character.

Input Amplifier Noise

1. Apply 1-kHz test tone to the channel input (A.1.9) as described for Transmission Tests.
2. Set the Group switch to X and the Pan control to 4 anticlockwise. Bring the fader fully up and put the Preset controls on maximum gain.
3. Connect an amplifier AM7/4 to the Direct (A) output (C.3.11(L) 100-ohm jack) and adjust the amplifier gain to give an output level of 0 dB.
4. Remove the test tone from the input of the 40-dB pad, thus terminating the channel input with 300 ohms.
5. Measure the noise at the AM7/4 output, using an ATM/1 in the 50-kilohm T.P.M. condition. The noise should not exceed -48 dB and any fluctuations should not exceed ± 1 dB.

Direct Output (A) Noise

Replace the AM7/4 by an AM9/5 set to 46 dB gain and select the 600-ohm input to the ATM/1. With the fader fully down, measure the noise output, which should not exceed -75 dB.

Direct Output (B) Noise

Repeat the above test, measuring on the Direct (B) output (C.3.11(R) 100-ohm jack) with the Pan control set to 4 clockwise. The noise output should not exceed -75 dB.

Miscellaneous Output Noise

Repeat the above test, measuring at the Miscellaneous output (B.10.22). The noise output should not exceed -55 dB.

Impulsive Noise Due to Switching**General**

For all the following noise tests, the module should be powered at least 15 minutes before tests are started.

Preset Control and Fader Off-normal Contacts

Set the channel for Direct noise measurement as above and check that operation of the Preset control, fader off-normal contacts and adjacent-channel fader off-normal contacts does not produce clicks or plops audible above the basic noise. This should be checked on a high grade monitoring loudspeaker such as an LS5/1 connected to the listen output of the ATM/1 and set for a reasonable listening level when the T.P.M. indicates normal volume range.

'Before/After Fader' Switch

Check for clicks or plops caused by operation of the Before/After Fader switch with the monitoring

loudspeaker and ATM/1 (see preceding paragraph) connected to the P.A. A output, A.3.11 600-ohm jack. The P.A. control should be set to 8.

Prehear Pushbutton

Check that clicks or plops caused by operation of the Prehear pushbutton are inaudible with the monitoring loudspeaker and ATM/1 connected to the Prehear output (A.7.15 600-ohm jack) with the ATM/1 set to 70 dB gain. This check should be made with the fader up and down.

Noise-free Operation of Fader Controls**General**

Apply programme at about -40 dB via the 40-dB attenuator to the channel input and operate the Group switch to X. Using the monitoring loudspeaker and ATM/1, connect to the following output tags and check that the relevant controls operate in a noise-free manner.

C(L) 3.11 (100-ohm jack)

1. Fader, with Pan control on 4 anticlockwise. Also check that there is no breakthrough on the bottom stud.
2. Direct (A) section of Pan control.
3. Preset control.

C(R) 3.11 (100-ohm jack)

4. Direct (B) section of Pan control.

A.8.16 (600-ohm jack)

5. Echo Mixture control.

A.3.11 (600-ohm jack)

6. P.A. control.

Phasing

Using an asymmetric test waveform, check with an oscilloscope connected to the listen output of the ATM/1 that all outputs are in phase with the input (A.1.9).

An asymmetric wave may be produced conveniently by shunting a tone source TS/10 set for +10 output with a suitable diode such as an AAY 32.

Balancing of Input Circuit at 10 kHz (Fig. 7)

NOTE:- For this test the other channel Group switch should not be switched to the same group as the channel under test.

1. Connect a 600-ohm balanced centre-tapped resistor across the channel input A.1.9 as shown in the circuit of Fig. 7. (Use a TE1A/2B lead.) Set the Preset control to 0, the Pan control to 4 anticlockwise and the group switch to X. Jacks C.1.9 and C.2.10 should be connected together with a TE1A/2A lead.
2. Apply 10-kHz tone to the channel input A.1.9 at the nominal level of 0 dB and with the 50-kilohm amp-det connected to the Direct UNTERMINATED output C(L)3.11. Set the relevant fader to produce an output level of

- 0 dB. A small adjustment of the tone source output level may be necessary to obtain this.
3. Transfer the 50-kilohm amp-det to the channel input A.1.9 and measure the exact input level.
 4. Next apply the 10-kHz tone between the centre-tap of the 600-ohm balanced resistor and the module chassis (earth), maintaining the output level of the now unterminated tone source constant.
 5. Transfer the 50-kilohm amp-det (now set to the T.P.M. mode) to the Direct (A)output (C(L)3.11 jack) and adjust the gain to produce a reading on the T.P.M.
 6. Connect a variable air capacitor (either 10-to-50-pF or 50-to-100-pF as suitable) between the red or green (primary) and blue (earthy end of secondary) of the channel input transformer T1 and adjust the capacitor for minimum T.P.M. reading. (The T.P.M. output should be observed on an oscilloscope if a poor null due to hum is suspected.) Note the capacitance and the primary connection of T1 (red or green) required for balance and remove the variable air capacitor from circuit. The capacitance required should not exceed 250 pF.
 7. Select a polystyrene capacitor (125-volt working ± 2 per cent tolerance) of a value nearest to the one required for exact balance and solder this permanently between the appropriate primary and blue connection of T1.
 8. Again measure the 10-kHz output at C(L)3.11 with the 50-kilohm T.P.M. It should not exceed -78 dB.

WWM(X) 6/72