LINE RECEIVING AMPLIFIERS AM7/4 AND AM7/4A

General Description

Amplifier AM7/4 is an audio-frequency transistor amplifier with a gain variable in half-dB steps from 20 to 60 dB. It has been designed primarily for use as a line receiving amplifier in place of the GPA/4A to make good the line and equaliser losses, and has an input impedance of 600 ohms and an output impedance of 55 ohms.

It is constructed on a CH1/18C chassis, with printed wiring, for plugging into bay-mounting panels of the PN3/23 series, in a similar manner to other amplifiers, such as the AM7/2 and AM7/3, constructed on the same type of chassis.

As with the AM7/3, the amplifier has been designed to feed into long cable runs giving high capacitance, and should not normally be terminated by a load of 600 ohms.

Circuit Description (Fig. 4)

The first two stages TR1 and TR2 of the amplifier are d.c.-coupled with series a.c. feedback between the emitter of TR2 and the base of TR1 by way of potential divider AT1 and the secondary circuit of the input transformer. The amount of feedback can be varied from a magnitude of 22 dB to 32 dB by AT1 which forms a fine gain control having half-dB steps over a range of 10 dB.

The stud switch SA controls the input to TR1 and enables the gain of the amplifier to be varied between 30 and 60 dB in 10-dB steps.

Since series feedback is used the impedance at the base of TR1 is high and the required input impedance is obtained from the resistive load across the secondary of the input transformer. Capacitors C1 and C2 correct the effect of the transformer leakage inductance by forming with this inductance an approximation to a low-pass filter section having a cut-off frequency of about 50 kc/s.

The use of series feedback only instead of combined series and shunt feedback (as in the AM9/5, Section 27) enables a more accurate input impedance to be obtained at the expense of a slightly worse noise factor. As the signal input is not normally less than −55 dB, however, the signal/noise ratio obtained is adequate.

The output of TR2 is fed to the phase-splitting stage TR3, which feeds the push-pull output stage. The latter is similar to that of amplifiers AM7/2 and AM7/3, and an output transformer is employed as in the AM7/3. Feedback of about 18 dB is taken from a tertiary winding on the transformer.

Further information relating to the design of this and other transistor amplifiers is given in *BBC Engineering Monograph* No. 26, August 1959: 'Transistor Amplifiers for Sound Broadcasting', by S. D. Berry.

General Data

Power Requirements

Supply voltage	24·5 V d.c.
Total current	45 mA

Impedances

Input impedance	600 ±15 Ω
Output impedance	55 ±2·5 Ω

Gain

Maximum voltage gain	60 ±1 dB at 1 kc/s measured with source resistance of 600 Ω, load resistance of not less than 15 kΩ and at 0 dB output voltage level.
Input gain control	3 steps of 10 ±0·3 dB each
Feedback gain control	Maximum gain change of 10 ±0·3 dB in steps of 0·5 dB approx.

Frequency Response

The output level under the conditions as above for measuring gain with constant input voltage level should be within the following limits relative to 1 kc/s :

Between 40 c/s and 10 kc/s : ±0·2 dB
At 15 kc/s : Within +0·2 and −0·3 dB

Non-linearity

At an output voltage level of +8 dB, with source and load impedances as for measuring gain, the total harmonic distortion should not exceed

at 60 c/s 0·4%
at 1 kc/s 0·3%

Similarly, at +12 dB voltage output level,

distortion should not exceed

at 60 c/s 0·5%
at 1 kc/s 0·5%

The onset of serious distortion at 1 kc/s, judged from an oscilloscope trace, should occur at a voltage output level of not less than +17 dB.

Noise

The total noise volume, indicated on a T.P.M. peaking to 6, should be not greater than −64 dB.

The noise reading should not fluctuate over a range greater than 1·5 dB.

Typical Voltages

The following typical voltages, measured with an Avometer 8 between emitter and common positive, are given to assist fault finding :

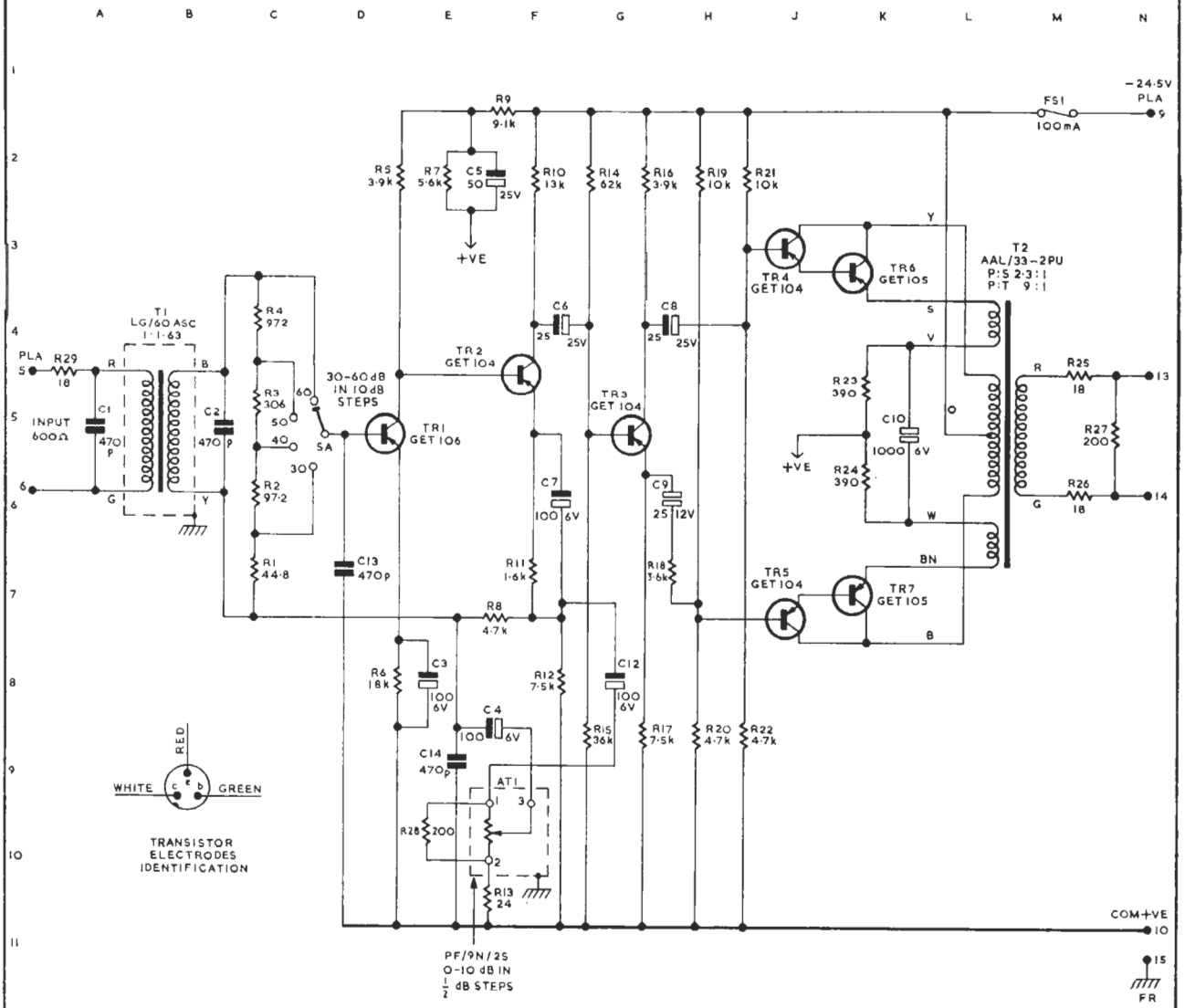
TR1	TR2	TR3	TR6	TR7
5·2 V	6·6 V	8·3 V	7·3 V	7·3 V

Amplifier AM7/4A (Fig. 4)

The AM7/4A is similar to the AM7/4 but without the variable attenuator AT1, and is intended for use in situations where an amplifier with a fine gain control is not required.

COMPONENT TABLE: FIG. 4

Comp.	Loc.	Type	Tolerance per cent
C1	A5	G.E.C. PF 125V	
C2	B5	G.E.C. PF 125V	
C3	E8	U.C.C. SC502/8LS	
C4	F9	U.C.C. SC541/8LS	
C5	E2	U.C.C. SC517/8LS	
C6	F4	U.C.C. SC502/8LS	
C7	F6	U.C.C. SC541/8LS	
C8	H4	U.C.C. SC502/8LS	
C9	H6	Plessey CE294 12V	
C10	K5	Plessey CE2087 6V	
C12	G8	U.C.C. SC541/8LS	
C13	D7	G.E.C. PF 125V	
C14	E9	G.E.C. PF 125V	
R1	C7	Erie NI 0·1W	2
R2	C6	Erie NI 0·1W	2
R3	C5	Erie NI 0·1W	2
R4	C4	Erie NI 0·1W	2
R5	D2	Erie NI 0·1W	2
R6	D8	Erie NI 0·1W	2
R7	E2	Erie NI 0·1W	2
R8	F7	Erie NI 0·1W	2
R9	F1	Erie NI 0·1W	2
R10	F2	Erie NI 0·1W	2
R11	F7	Erie NI 0·1W	2
R12	F8	Erie NI 0·1W	2
R13	F10	Erie NI 0·1W	2
R14	G2	Erie NI 0·1W	2
R15	G9	Erie NI 0·1W	2
R16	G2	Erie NI 0·1W	2
R17	G8	Erie NI 0·1W	2
R18	H7	Erie NI 0·1W	2
R19	H2	Erie NI 0·1W	2
R20	H9	Erie NI 0·1W	2
R21	H2	Erie NI 0·1W	2
R22	H8	Erie NI 0·1W	2
R23	K5	Erie 109 0·25W	2
R24	K6	Erie 109 0·25W	2
R25	M4	Erie NI 0·1W	2
R26	M6	Erie NI 0·1W	2
R27	N5	Erie NI 0·1W	2
R28	E10	Erie NI 0·1W	2
R29	A4	Erie NI 0·1W	2
T1	B5	LG/60 ASC	
T2	L5	AAL/33-2PU	



ALL RESISTORS $\frac{1}{10}$ WATT EXCEPT R23 AND R24 WHICH ARE $\frac{1}{4}$ WATT

NOTE:-
AM7/4 IS AS SHOWN.
IN AM7/4A, ATI IS OMITTED, C4 IS TAKEN TO JUNCTION OF R28/R13, & R28 IS 68 Ω

LINE RECEIVING AMPLIFIERS AM7/4 & AM7/4A: CIRCUIT

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