FILTER AMPLIFIER AM1/28

General Description

This unit is intended for use in disk reproduction. It provides a rumble filter and a switchable top cut, plus a response selection amplifier (RSA) which may be switched into circuit and has bass and treble slope controls. The overall 'flat' gain of the unit is about 12 dB, the maximum input volume is about −17 dB and the maximum output volume about +3 dB. (See under heading *Nonlinearity*.)

The input impedance is 50 kilohms and the source impedance should not be more than 10 kilohms. There are two outputs, main and PFL. The main output has 5-kilohms impedance and is normally loaded by a 10-kilohm fader. The PFL output has 600-ohms impedance and requires a load of about 3 kilohms.

The amplifier draws about 25 mA at −24 volts d.c.

Components are mounted on a printed board of standard ISEP size (7 by 4·4 inches) which is fitted with a 25-way plug for use in a standard ISEP nest. The coding pins of the plug are at positions 3, 7 and 11. All controls are mounted externally.

Reference

Disk reproducer RP2/6*.

Circuit Description (Fig. 2)

The unit has eight transistors which separate the filters and provide the stipulated gain. There is about 18 dB of negative feedback from TR4 to TR1.

The rumble filter is a parallel-T *RC* network between TR1 and TR2 and is tuned just below 22 Hz. The filter is required to provide a fairly sharp attenuation curve below 40 Hz, without affecting the wanted low-frequency response down to 40 Hz and with minimum 'come-back', that is, minimum reduction of attenuation at very low frequencies, say below 20 Hz. This is obtained by putting the parallel-T network in the forward chain of an amplifier employing overall negative feedback. To secure the sharp cut-off and minimum come-back desired, the forward phase-shift through the amplifier and the amount of negative feedback are carefully controlled. TR1 feeds the parallel-T network C3, C4, C5, R5, R6, R7 which is terminated by a phase-shifting network C6, R8 and the emitter-follower TR2, which acts as a high-impedance termination and isolator for the next stage of amplification TR3. TR3 is coupled to TR4 which has the dual function of providing

(a) a low-impedance source from its emitter for the overall feedback network R18, R2, and
(b) the correct source impedance (R13) in its collector circuit for the following low-pass filter.

The switchable top-cut circuit, between TR4 and TR5, comprises an approximate half-section constant-*k* low-pass filter L1 and C11 with R13 and R20 as terminations. A loss of 3 dB at 5 kHz rising to 19 dB at 15 kHz is introduced with the top cut in.

The response selection amplifier is of the familiar type, and comprises TR6 and TR7 with the preceding *RC* networks incorporating bass-slope and treble-slope controls; these controls have a maximum range of ±10 dB at 100 Hz and ±13 dB at 10 kHz, both relative to 1 kHz. A switch between TR7 and the output transistor TR8 bypasses the RSA.

A 10-kilohm fader at the output, external to the AM1/28, provides the normal volume control.

General Specification

Impedances at 1 kHz

Source	maximum 10 kilohms
Input	about 50 kilohms
Main output	about 5 kilohms
Main output load	about 10 kilohms
PFL output	about 600 ohms
PFL output load	about 3·3 kilohms

Gain at 1 kHz

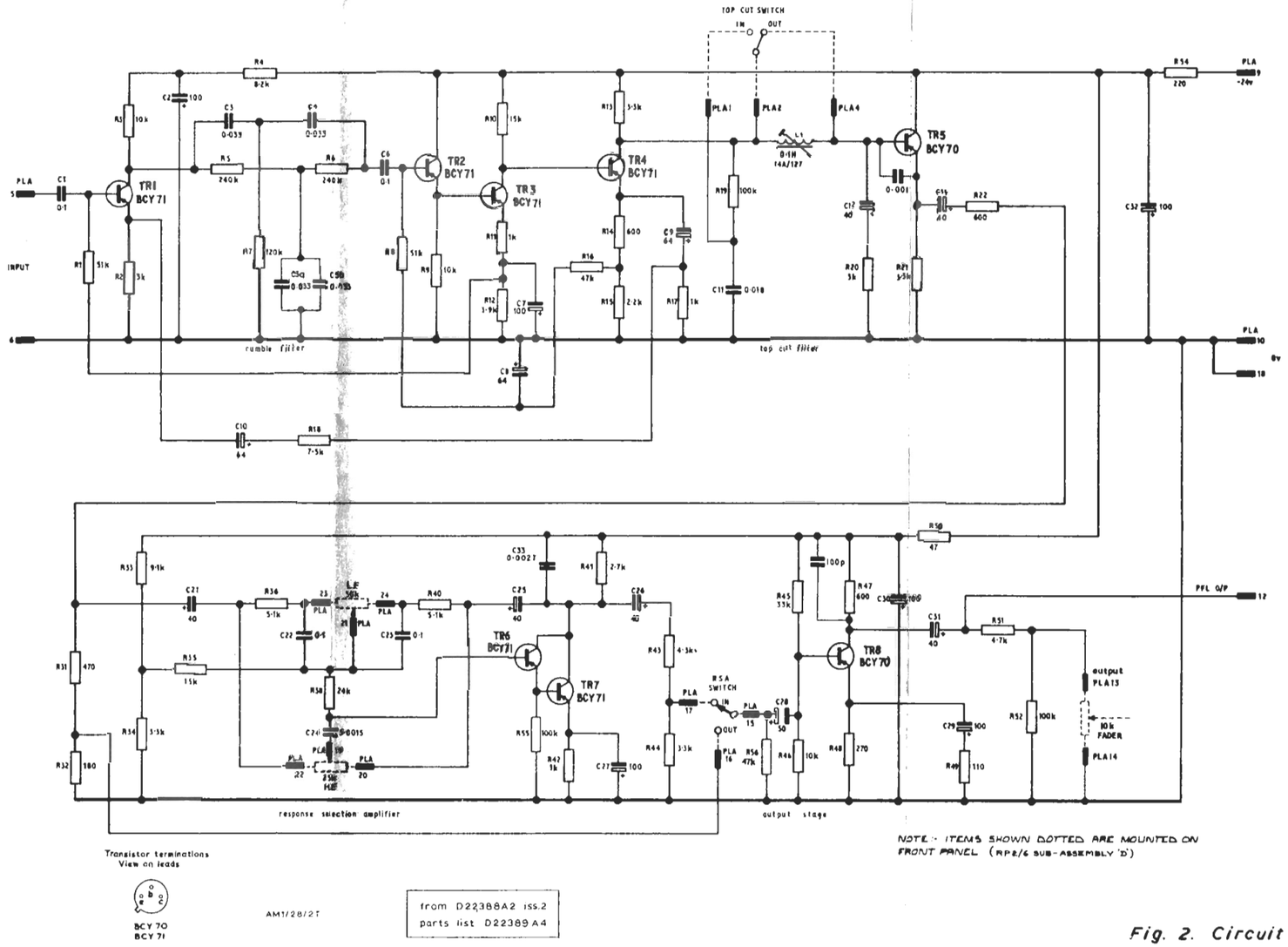
Measured with normal load impedances and either with RSA in circuit and controls 'flat' or with RSA out of circuit.

Gain at main output	12 ±1 dB
Gain at PFL output	15 ±1 dB

Maximum Programme Volumes

Maximum input programme volume	−17 dB
Maximum programme volume at main output	+3 dB

*Designs Department Technical Memorandum No. 151(70).



NOTE :- ITEMS SHOWN DOTTED ARE MOUNTED ON FRONT PANEL (RP2/6 SUB-ASSEMBLY 'D')

Transistor terminations
View on leads

BCY 70
BCY 71

AM1/28/2T

from D22388A2 iss.2
parts list D22389A4

Fig. 2. Circuit of AM1/28

Frequency Response

Rumble filter	loss 4 dB at 30 Hz increasing to 37 dB at 22 Hz
Top cut filter	loss 3 dB at 5 kHz increasing to 19 dB at 15 kHz
RSA slope controls	maximum ±10 dB at 100 Hz and ±13 dB at 10 kHz both relative to 1 kHz

A.C. Tests

A suitable test circuit is shown in Fig. 1. Measurements should preferably be made with an a.c. voltmeter with a resistance of not less than 1 megohm. It is possible to use the high-impedance circuit of a TPM/3 (or of an ATM/1 in the TPM mode), but with some loss of accuracy in measurements made at the main and PFL outputs. A TPM/3 or ATM/1 also does not provide low enough readings to allow the stipulated noise limit to be checked.

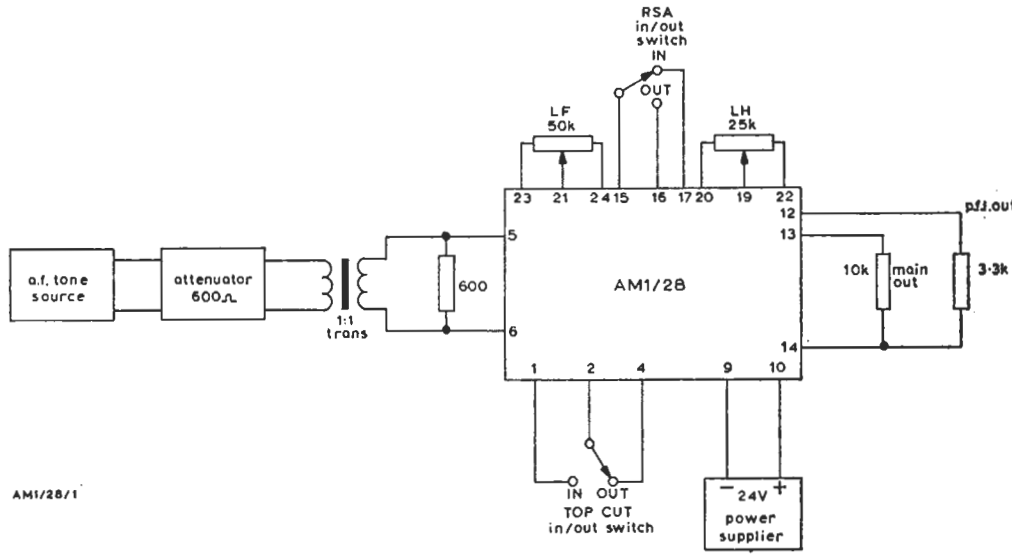


Fig. 1. Test Circuit for AM1/28

Maintenance

D.C. Tests

The following are typical voltage and current readings, measured with an Avometer Model 9 Mark 2 on the 0-30 volt or 0-100 mA range.

Supply voltage	—24 volts
Total current	25 mA
TR1 emitter	—2·2 volts
TR2 emitter	—4·3 volts
TR3 emitter	—3·6 volts
TR4 emitter	—6·4 volts
TR5 emitter	—10·3 volts
TR7 emitter	—3·5 volts
TR8 emitter	—3·2 volts

Gain at 1 kHz

From input to junction of R22/R31/C21	11 ±1 dB

See also General Specification.

Frequency Response

Apply an input level of —20 dB and measure the output at the junction of R22, R31 and C31. The response should be as shown in Table 1 relative to 1 kHz.

See also General Specification.

TABLE 1

Frequency	*Relative Response, dB*	
	Top Cut Out	*Top Cut In*
Hz		
5	−21·5	−21·5
10	−16·5	−16·5
15	−16·1	−16·1
20	−23·1	−23·1
30	−4·6	−4·6
40	−0·4	−0·4
60	+0·2	+0·2
100	+0·2	+0·2
200	+0·2	+0·2
500	+0·1	+0·1
kHz		
1	0	0
2	0	−0·2
4	0	−1·6
6	0	−5·0
8	0	−8·7
10	0	−12·2
15	0	−19·3

Nonlinearity

An input level above −9 dB overloads the rumble filter. The maximum level at the main output must not exceed +11 dB into a 10-kilohm load.

Noise Level

With input tags 5 and 6 short-circuited, main output tags 13 and 14 loaded with 10 kilohms and the RSA controls 'flat', the noise level should be not worse than −90 dB relative to 0·775 volt r.m.s. when measured with an a.c. voltmeter.

GH 9/70