RESPONSE SELECTION AMPLIFIER AM22/3

General Description

The AM22/3 is one of the units designed for Type-D studio sound equipment. It is used to provide compensation for poor quality recorded material on disk, tape or film. It contains lowpass and hum filters with characteristics (Figs. 1 and 2) closely resembling those of amplifier AM1/9.

The assembly is based on a CH1/37A chassis and the unit is 7 inches long, 2¼ inches wide and 10¼ inches deep overall. The components, apart from coils L1-L3 and the keys, are fitted on two printed circuit boards mounted back-to-back. The interconnecting wires between the boards and external components are taken to numbered tagposts. The tagpost numbers appear on the circuit diagram

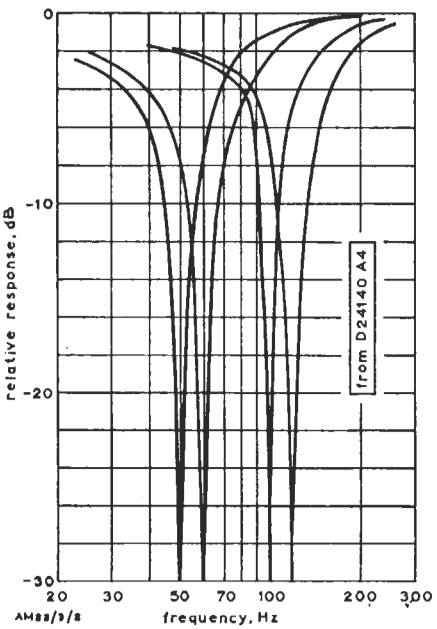

Fig. 1. AM22/3 Hum Filter Characteristics

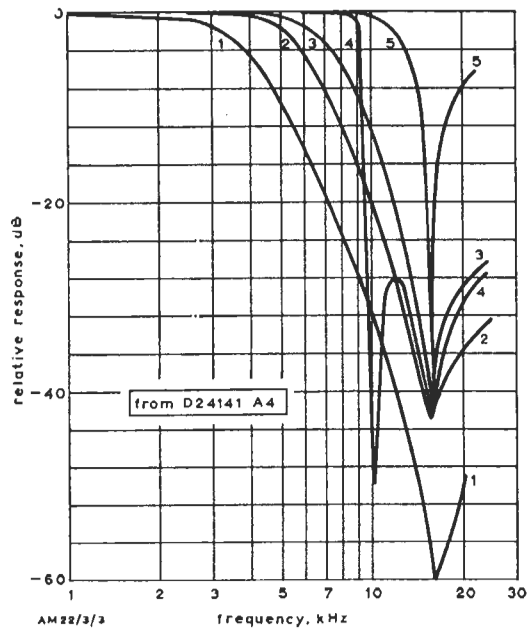

Fig. 2. AM22/3 Lowpass Filter Characteristics

For selecting the filters, there are six keys in two rows of three on the front panel. The upper keys select 3·5-kHz, 5-kHz and 7-kHz lowpass filters; the lower keys are double-throw and select 50/60-Hz and 100/120-Hz hum filters and 9/14-kHz lowpass filters. At the bottom of the panel is a bypass key which in the *Out* position connects the output directly to the input.

as the second digit of a reference of the form 1/2. The first digit indicates the board number, board 1 being the larger of the two.

The amplifier has 0 dB insertion loss when operated between the values of impedance to be found at the R.S.A. insertion points on studio equipment, and the normal input programme volume is −20 dB.

Circuit Description (Fig. 3)

The input and output are taken to the travellers of the bypass key so that, in the *Out* position, the input and output are connected directly together. With the key normal, the input is taken through the input transformer to passive networks in tandem comprising the hum and lowpass filters.

The first network is a hum filter tunable to either 50 or 60 Hz by switching either C4 or (C1 + C2) across C3. The selection key also brings a preset resistor R7 into circuit for the 50-Hz setting and R6 for the 60-Hz setting, and in its mid position applies a short to the tuned circuit. R6 and R7 are adjusted to give approximately equal maximum rejection ratios at the two frequencies. The second network is an identical circuit tunable to 100 or 120 Hz.

Following this, but separated by an isolating resistor R14, are five low-pass shunt-derived π filters in tandem, between 600-ohm terminations. Each filter may be selected by the operation of a key which shorts the series elements and open-circuits the shunt elements when the filter is not in use. The frequency of maximum attenuation is the mean of the 525-line and 625-line standard line frequencies in all cases. The 9-kHz filter has a second frequency of maximum attenuation for the 405-line standard. (See Table 1.)

TABLE 1: LOWPASS FILTER PARAMETERS

Filter No.	F_{co} *kHz*	$F\infty$ *kHz*	*Min. Loss at* $F\infty$ *(relative to 1 kHz) dB*
1	3·5	15·7	50
2	5	15·7	38
3	7	15·7	38
4	9	10·125 15·7	44 38
5	14	15·7	36

A three-stage transistor amplifier having a circuit similar to that of amplifier AM9/8 follows, to restore the loss at the passband frequencies in the preceding filters. The overall gain is adjusted to be 0 dB by selecting the feedback resistor R25 in the emitter circuit of TR1.

Test Specification

Power Supply

D.C. supply	24 volts
Current consumption	20 ±1 mA

Test Conditions

Source impedance	100 ohms
Load impedance	2·5 kilohms
Input level	−20 dB

Except where otherwise specified all filter keys should be set to normal, so that the filters are out of circuit.

Test Apparatus

Audio-frequency tone source
Test meter ATM/1
Oscilloscope
Distortion test set
24-volt power supply
Low-noise amplifier, e.g. AM9/5
Digital frequency meter

Insertion Gain

Gain at 1 kHz measured by operating bypass key	0 ±0·5 dB

Frequency Response

The response relative to 1 kHz when measured with a constant source e.m.f. should be within ±0·5 dB from 20 Hz to 20 kHz.

The response of the lowpass filters should be within ±2% of that shown in Fig. 2. For station maintenance tests it is sufficient that the filter response should lie within the limits given as nearly as can be judged.

Hum Filters

The hum filter circuits are adjusted by the following procedure.

1. Apply a tone of 50 Hz ±0·1 Hz to the input of the amplifier at a level of 0 dB.
2. Operate KB to the 50-Hz position and adjust L1 and R7 alternately to obtain minimum output.
3. Alter the input tone frequency to 60 Hz ±0·1 Hz.

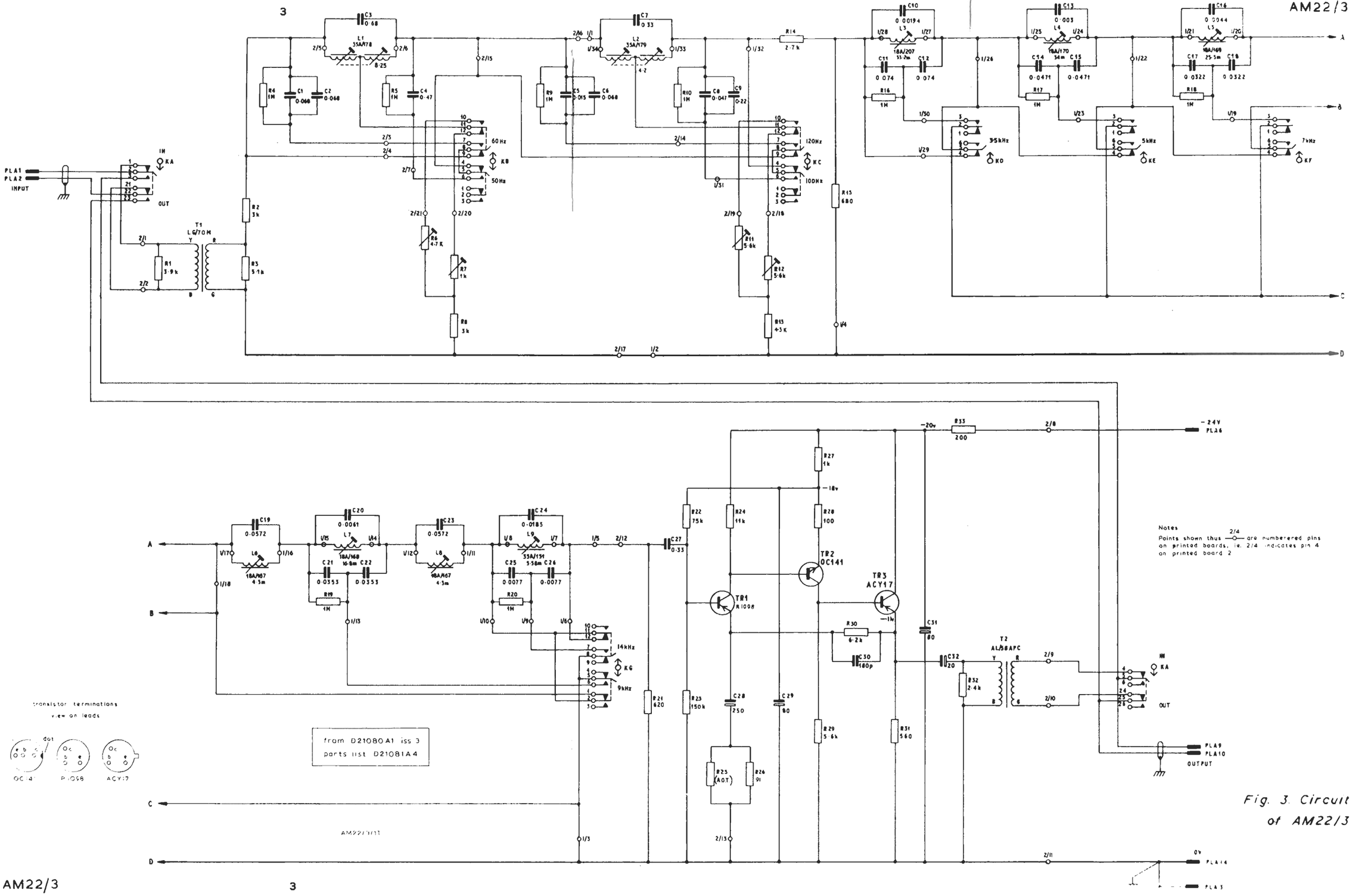

Fig. 3. Circuit of AM22/3

4. Operate KB to the 60-Hz position and adjust R6 to obtain minimum output.
5. If the output level is greater than −30 dB, readjust L1 to reduce it.
6. Check the level at 50 Hz and readjust R7 until the rejection ratios at 50 Hz and 60 Hz are approximately equal.
7. Restore KB to normal and operate KC to the 100-Hz position.
8. Apply a tone of 100 Hz ±0·2 Hz to the input and adjust L2 and R12 alternately to obtain minimum output.
9. Alter the input tone frequency to 120 Hz ±0·2 Hz.
10. Operate KC to the 120-Hz position and adjust R11 to obtain minimum output.
11. Make compromise adjustments as before to equalise the rejection ratios if necessary.

The response curves for the hum filters are shown in Fig. 1. At any selected hum frequency the rejection should be greater than 28 dB. At half and twice each selected frequency the response should be within ±0·5 dB of the values shown.

Input Impedance

At 20 Hz	2·2 kilohms ±10%
At 1 kHz	2·5 kilohms ±10%
At 20 kHz	2·5 kilohms ±10%

Output Impedance

At 20 Hz	165 ohms ±10%
At 1 kHz	89 ohms ±10%
At 20 kHz	171 ohms ±10%

Harmonic Distortion

Total distortion at output voltage level of +10 dB	⩾ 0·3% at 60 Hz ⩾ 0·2% at 1 kHz
Output voltage level for visual distortion on oscilloscope	⩽ +14 dB

Noise

With the input terminated in 100 ohms, and using a T.P.M. preceded by an amplifier (e.g. AM9/5) of known gain, the noise volume with the bypass key at *In* should not exceed −87 dB.

Phase

A signal applied to input terminal 1 should be in phase with the signal appearing at output terminal 9 in both positions of the bypass key.

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