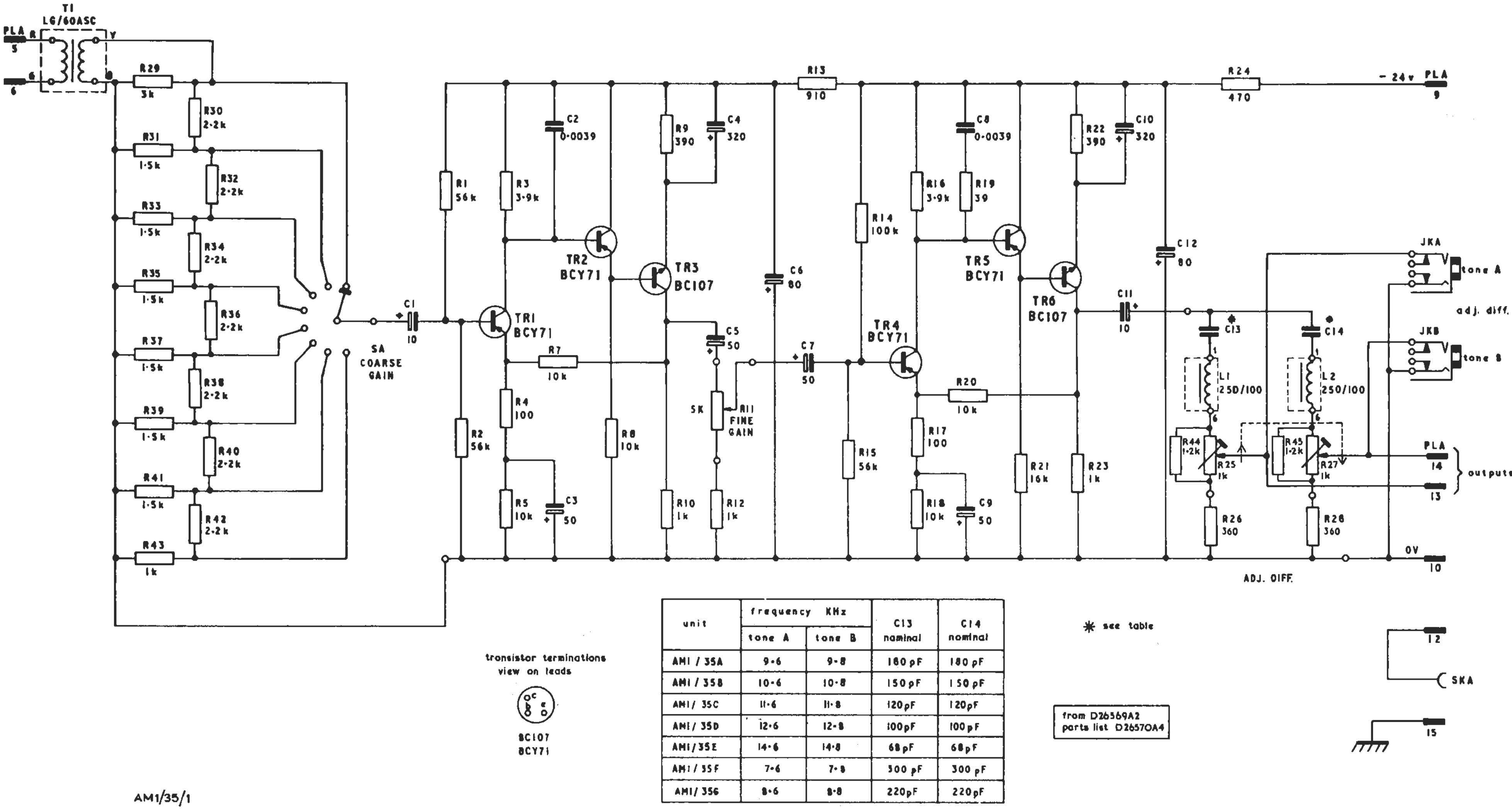
TONE AMPLIFIERS AM1/35A–G



unit	frequency KHz		C13 nominal	C14 nominal
	tone A	tone B		
AM1 / 35A	9·6	9·8	180 pF	180 pF
AM1 / 35B	10·6	10·8	150 pF	150 pF
AM1/ 35C	11·6	11·8	120pF	120pF
AM1/ 35D	12·6	12·8	100pF	100pF
AM1/ 35E	14·6	14·8	68pF	68pF
AM1/ 35F	7·6	7·8	300 pF	300 pF
AM1/ 35G	8·6	8·8	220pF	220pF

Fig. 1. Circuit of AM1/35A-G

Introduction

Each version of the AM1/35 accepts, at particular frequencies, a pair of tone signals applied to a single input. It amplifies the tones, together, by a preset amount and partially separates them at two outputs which are adjustable in relative level.

The A to G versions operate at the frequencies shown in Table 1 and were designed for use in sound automatic monitoring equipment MN2M/4A and MN2M/6A.

TABLE 1

AM1/35 Suffix	*Tone A kHz*	*Tone B kHz*
A	9·6	9·8
B	10·6	10·8
C	11·6	11·8
D	12·6	12·8
E	14·6	14·8
F	7·6	7·8
G	8·6	8·8

The amplifiers are each constructed on a CH1/18C chassis fitted with a 15-pin Painton plug and index pegs at positions 5 and 30.

General Specification

Input Impedance	600 ohms, balanced.
Overall Gain	About 73 dB maximum at each tone frequency, when the *Adj Diff* control (see below) is on zero.
Gain Controls, Range	
Coarse	70 dB in 10–dB steps.
Fine	15 dB, continuously variable.
Differential *(Adj Diff)*	About ±4 dB at each output. Simultaneous but opposite adjustment.
Outputs	About −20 dB maximum into 10 kilohms.
Discrimination	At each tone output the overall gain of the associated tone, 200 Hz off, is 10 ±2 dB below that of the intended tone.
Noise	Better than −60 dB at each tone output at maximum gain.
Power Requirement	15 mA at 24 volts d.c.

Circuit Description (Fig. 1)

Transformer T1 presents an input impedance of 600 ohms, balanced, at PLA5 and PLA6. Signals at T1 secondary reach TR1 via a 10–dB step attenuator which can be varied from 0 to 70 dB by SA, the *Coarse Gain* control.

TR1 and TR3 are in grounded-emitter stages coupled by emitter-follower TR2. Negative feedback is returned from TR3 to TR1 by R7. An adjustable amount of the TR3 collector output is taken off R11, the *Fine Gain* control, and fed to TR4 base. TR4, TR5 and TR6 form a second three-stage amplifier, similar to the TR1–TR3 circuit.

The signals from TR6 collector are fed to series circuit C13, L1, R25 and R26, and to series circuit C14, L2, R27 and R28. These two circuits are tuned to the tone A and B frequencies respectively.

Outputs are taken from the sliding contacts on R25 and R27. These are ganged so that increasing one tone output simultaneously decreases the other, allowing the introduction of a difference in the amplification of the two tones in the unit.

Adjustment and Testing

Apparatus

Tone source TS/10
Frequency counter
A.C. test meter ATM/1
600–ohm variable attenuator (e.g. PAT/3 or AT/30)
Two 600–ohm 1:1 shielded repeating coils
Avometer Model 7 or 8
Oscilloscope (if available)

Adjustment

1. Connect a 24-volt d.c. power supply to PLA9 (negative) and PLA10 (positive). Strap PLA10 to PLA15 (chassis). Check that the current from the supply is 13·5 ±1·5 mA. Using an Avometer Model 7 or 8, check that TR3 collector is at −5·0 ±0·5 volts and TR6 collector is at −5·5 ±0·5 volts with respect to PLA10.
2. Link the positive side of C11 (i.e. the side opposite that connected with TR6) to the junction of L1 with R25 and also to the junction of L2 with R27. Set the *Coarse Gain* and *Fine Gain* controls fully anticlockwise and set the *Adj Diff* control at mid-travel. Connect a TS/10 to PLA5 and PLA6 via a variable attenuator which has shielded repeating coils at its input and output.
3. Apply an input of −20 dB to the AM1/35 in steps from 100 Hz to 15 kHz and check by substitution or otherwise that over this range the input impedance of the AM1/35 is 600 ohms ±15 per cent.
4. Connect the high-impedance input of an ATM/1 to the positive side of C11 and to PLA10. Apply an input of −20 dB at 1 kHz to the AM1/35. Leaving the *Coarse Gain* at minimum, check the range of the *Fine Gain* control against the ATM/1 attenuators and meter. This range should be about 15 dB.

5. Reduce the input to –85 dB. With both *Gain* controls at maximum, a gain of 80 ±3 dB should be measured by the ATM/1 at C11 (i.e., the ATM/1 should indicate a level of –5±3 dB). Check that the waveform at C11 is sinusoidal on an oscilloscope (if available).
6. Decrease the *Coarse Gain* in steps from maximum and check, by increasing the input from the TS/10 and the external attenuator, and by observing the ATM/1, that each step is 10 ±1 dB.
7. Temporarily disconnect the TS/10, variable attenuator and repeating coils and substitute a simple 600-ohm termination at the input of the AM1/35. Turn both *Gain* controls to maximum. Measure the noise at C11 on the ATM/1, in the TPM mode and with the meter deflecting to '6' at peaks. The noise volume should be lower than –42 dB.
8. Reconnect the TS/10 to PLA5 and PLA6 via the variable attenuator and repeating coils as before. Remove the links from C11 to R25 and R27. Connect the high-impedance input of the ATM/1 to PLA13. Set the *Coarse Gain* to minimum and the *Fine Gain* and *Adj Diff* controls to mid-travel. Apply an input of –50 dB to the AM1/35 at the frequency of the tone A to be handled by the unit. Check the frequency on a counter. Select C13 and tune L1 so that these resonate, as shown by a maximum reading on the ATM/1. Check that clockwise rotation of the *Adj Diff* control increases the PLA13 output and that the total range of this control is about 8 dB.
9. Connect the ATM/1 to PLA14 and repeat the preceding adjustment with a tone B input, selecting C14 and tuning L2 to resonance. Check that clockwise rotation of the *Adj Diff* control decreases output at PLA14 and that the total range of this control is about 8 dB.
10. Work through the subsequent *Test Procedure.*

Test Procedure

1. Connect a tone source to the AM1/35 input via a variable attenuator which has shielded repeating coils at its input and output. Set the *Adj Diff* control at mid-travel.
2. Connect the high-impedance input of an ATM/1 to PLA13. Apply a tone A signal at –95 dB to the AM1/35 input. Turn the *Gain* controls to maximum (fully clockwise) and note the PLA13 output. Turn the *Coarse Gain* control anticlockwise two steps and measure the gain reduction by finding the increase of input required to make the PLA13 output the same as before. Note the loss of gain (which should be about 20 dB) and leave the *Coarse Gain* control at this setting. Restore the input to –95 dB, observe the PLA13 output level, and note the gain represented. This, added to the gain lost on the *Coarse Gain* control, should amount to 73 ±5 dB. Transfer the ATM/1 to PLA14 and apply a tone B signal at –95 dB to the AM1/35 input. Observe the PLA14 output and note the gain represented. This, added to the gain lost on the *Coarse Gain* control should also amount to 73 ±5 dB.

   Note: (i) The overall gain is found by this method so that input levels below –95 dB are not required and to avoid direct measurement of gain with outputs above –30 dB, where saturation effects may occur.

   (ii) It is preferable to check the tone A and B frequencies on a counter, but if it is assumed that the AM1/35 output circuits are correctly tuned, it may be satisfactory to trim the tone generator frequency for maximum output at PLA13 and PLA14 in turn when the two gains are checked.
3. Substitute a simple 600–ohm termination at the input of the AM1/35. Set the *Gain* controls at maximum (fully clockwise). Set the *Adj Diff* control fully clockwise. Check that the noise output at PLA13 is lower than –60 dB, measured on the ATM/1 in the TPM mode and with the meter deflecting to '6' at peaks.
4. Set the *Adj Diff* control at about mid-travel. Connect the high-impedance input of an ATM/1 to PLA13. Apply a tone A signal at –40 dB to the AM1/35 input. Check the tone A frequency on a counter. Adjust both *Gain* controls to obtain –30 dB output at PLA13. Transfer the ATM/1 to PLA14 and note the tone A output obtained there. Maintaining the level of the input, change its frequency to that of tone B. Check the tone B frequency on a counter. Using the ATM/1, measure the tone B levels at PLA14 and PLA13. Check from the measured levels that at PLA13 tone B is –10 ±2 dB relative to tone A (which was set at –30 dB), and that at PLA14 tone A is –10 ±2 dB relative to the level of tone B.

Final adjustment of the AM1/35 controls is made when it is installed as part of a system.

References

1. Designs Department Specification 11.117(71). Monitoring-tone Amplifier AM1/35A–G.
2. Sound automatic monitoring equipment MN2M/4A and MN2M/6A.

DPEB 8/72