

MONITORING-TONE DETECTORS AM3/3 AND AM3/4 SERIES

Introduction

These units are used to detect monitoring tone superimposed on programme material. They have high-impedance inputs, which are unbalanced and balanced for the AM3/3 and AM3/4 series respectively. The three versions in each series differ only in the frequency range of their input filters. The parent version has a wide-band filter to make it capable of detecting either of two monitoring tones, 19 kHz and 23 kHz, and each of the others accepts one of those frequencies. The summarised details are:

Unit	Input	Frequency (kHz)	Input	Unit
AM3/3	} Unbal.	19 to 23	} Bal.	AM3/4
AM3/3A		19		AM3/4A
AM3/3B		23		AM3/4B

When tone is present, and above a predetermined level, two relays are operated and lamps are lit. One relay is sensitive to short breaks in the incoming tone and the other is slugged to make it insensitive to such interruptions. Deliberate signals can therefore be accommodated without interrupting the normal monitoring facility.

Each unit has an integral mains-operated power supply. Provision is made so that the unit can be operated from an external source of 24 volts d.c.

The complete unit is built on a CH1/26A chassis with index peg positions 17 and 40.

General Specification

Input Impedance	12 kilohms.
Input Sensitivity	-18 dB to -40 dB w.r.t. 1 mW in 600 ohms.
Release Level	0.5 dB below the operate level.
Relay A operate and release times	Less than 100 milliseconds.
Relay B: operate time	200 milliseconds.
: release time	4 seconds.
Power Consumption	170 mA at 24 volts.

Circuit Description

Fig. 1 on page 3 is a circuit diagram showing the different versions. Wide-band detectors AM3/3 and AM3/4 include additional components which are necessary for the correct setting-up of the unit.

The detectors operate if the level of the incoming tone, either 19 kHz or 23 kHz, falls by more than the predetermined amount.

The tone detectors are normally used at the output of a rebroadcast receiver, where the level of the incoming 19-kHz tone is greater than that of the incoming 23-kHz tone by either 3.6 dB or 5.3 dB (depending upon the type of receiver in use). Hence an equalisation circuit to compensate for the different levels must be included in the input of the detector. The required equalisation is introduced by a parallel-tuned circuit comprising L5, C27, C28 and R38, shown at the top of Fig. 1. The circuit resonates at 19 kHz, and resistor R38 is selected to provide the required loss.

Resistor R43 is brought into circuit when the sensitivity of the unit is adjusted. The value of R43 is chosen so that, when push-button switch SA is pressed, the incoming signal is attenuated by an amount corresponding to the appropriate release margin, and the two relays should just release.

The remainder of the circuit diagram is common to all versions of the detector. Transistors TR1, TR2 and TR3 form what is often known as a ring-of-three amplifier¹. Negative feedback is applied between the collector of TR3 and TR1 emitter. Resistor R7 is a preset control, labelled *Sensitivity*, which is adjusted to set the working point of the unit. Transistors TR4, TR5 and TR6 form another ring-of-three circuit which works at a fixed gain.

Transistor TR7 is an emitter-follower which drives a diode-transistor pump^{2,3} comprising C21, C22, diode D1 and TR8. The diode-transistor arrangement ensures that the voltage developed across C22 is linearly related to the level of the incoming signal.

Transistors TR10 and TR11 form a Schmitt trigger³ which is driven by an emitter-follower TR9. Transistors TR9 and TR10 are complementary, their purpose being to stabilise the working point of the trigger circuit. When the input signal to the detector rises above the predetermined level, TR11 bottoms and operates a reed relay (RLA) in its collector circuit. Contact RLA-1 removes a short-circuit across lamp ILP1 and switches a negative 24-volts d.c. signal to pin PLA8 of a chassis-mounted plug. Transistor TR12

is driven by TR11 and operates reed relay RLB. Contact RLB-1 removes a short-circuit from lamp ILP2 and switches an earth to pin PLA7 of the plug.

Relay RLB is shunted by a high-value capacitor (C24) which delays its release by about four seconds. This allows the incoming signal to be interrupted for short periods, and RLA to release, without affecting circuits switched by RLB.

The 24-volt supply for the unit is derived from a full-wave rectifier which is supplied from a 225/24-volt transformer. If an external 24-volt supply is used, it is connected to pins PLA9 and PLA15.

Setting-up Procedure

Apparatus Required

- Audio-frequency signal generator
- 600-ohm variable attenuator

Method

1. Set the *Sensitivity* control, R7, fully clockwise and inject a signal of the appropriate frequency, given below, at point A or Z.

<i>Unit</i>	<i>Frequency</i>
AM3/3, AM3/4	21 kHz
AM3/3A, AM3/4A	19 kHz
AM3/3B, AM3/4B	23 kHz

2. Adjust the level of the input until lamp ILP1 lights. This level should be $-65 \text{ dB} \pm 2 \text{ dB}$.
3. Reduce the level until ILP1 is extinguished. This should occur with a reduction of 0.3 dB to 0.7 dB. ILP2 should extinguish approximately four seconds after ILP1.
4. Increase the level by 6 dB; ILP1 should now be lit. Lower the frequency of the input signal until lamp ILP1 extinguishes, and note the frequency. Increase the frequency continuously until the lamp relights and is again extinguished. Note the upper frequency of lamp extinction. The noted frequencies should be within the limits set out below:

<i>Unit</i>	<i>Frequency Range</i>
AM3/3, AM3/4	18 kHz $\pm 0.5 \text{ kHz}$ and 24.3 kHz $\pm 0.5 \text{ kHz}$

<i>Unit</i>	<i>Frequency Range</i>
AM3/3A, AM3/4A	18.5 kHz $\pm 0.2 \text{ kHz}$ and 19.5 kHz $\pm 0.2 \text{ kHz}$
AM3/3B, AM3/4B	22.4 kHz $\pm 0.3 \text{ kHz}$ and 23.5 kHz $\pm 0.3 \text{ kHz}$

5. Set the *Sensitivity* control, R7, fully counter-clockwise and repeat 2. The level of the input signal should be 43 dB $\pm 3 \text{ dB}$ above the level quoted in 2.
 6. Inject the input signal (23 kHz for the AM3/3 and AM3/4) at the normal input position and repeat 3. The level of the input should be $-41 \text{ dB} \pm 3 \text{ dB}$.
- Additionally when setting-up the wide-band units (AM3/3 and AM3/4):
7. Change the input frequency to 19 kHz and reduce the input level until lamp ILP1 is extinguished. The level should be 3.6 dB $\pm 0.3 \text{ dB}$ below that measured in 6 if the unit is to be connected across the output of a receiver that has no de-emphasis. The value for a unit to be used with a receiver having a de-emphasised output is 5.3 dB $\pm 0.3 \text{ dB}$. Select the value of R38 to meet the appropriate figure.
 8. If R38 is changed, repeat 6 and 7.
 9. Set the *Sensitivity* control, R7, to mid-position and press push-button switch SA. Keeping SA pressed, adjust the level of the input signal (23 kHz for the AM3/3 and AM3/4) until lamp ILP1 is extinguished. Release switch SA; lamp ILP1 should then relight. Reduce the level of the input until ILP1 is extinguished. This should occur with a reduction in level appropriate to the release margin specified for the particular installation. The value of R43 is chosen to meet this figure.

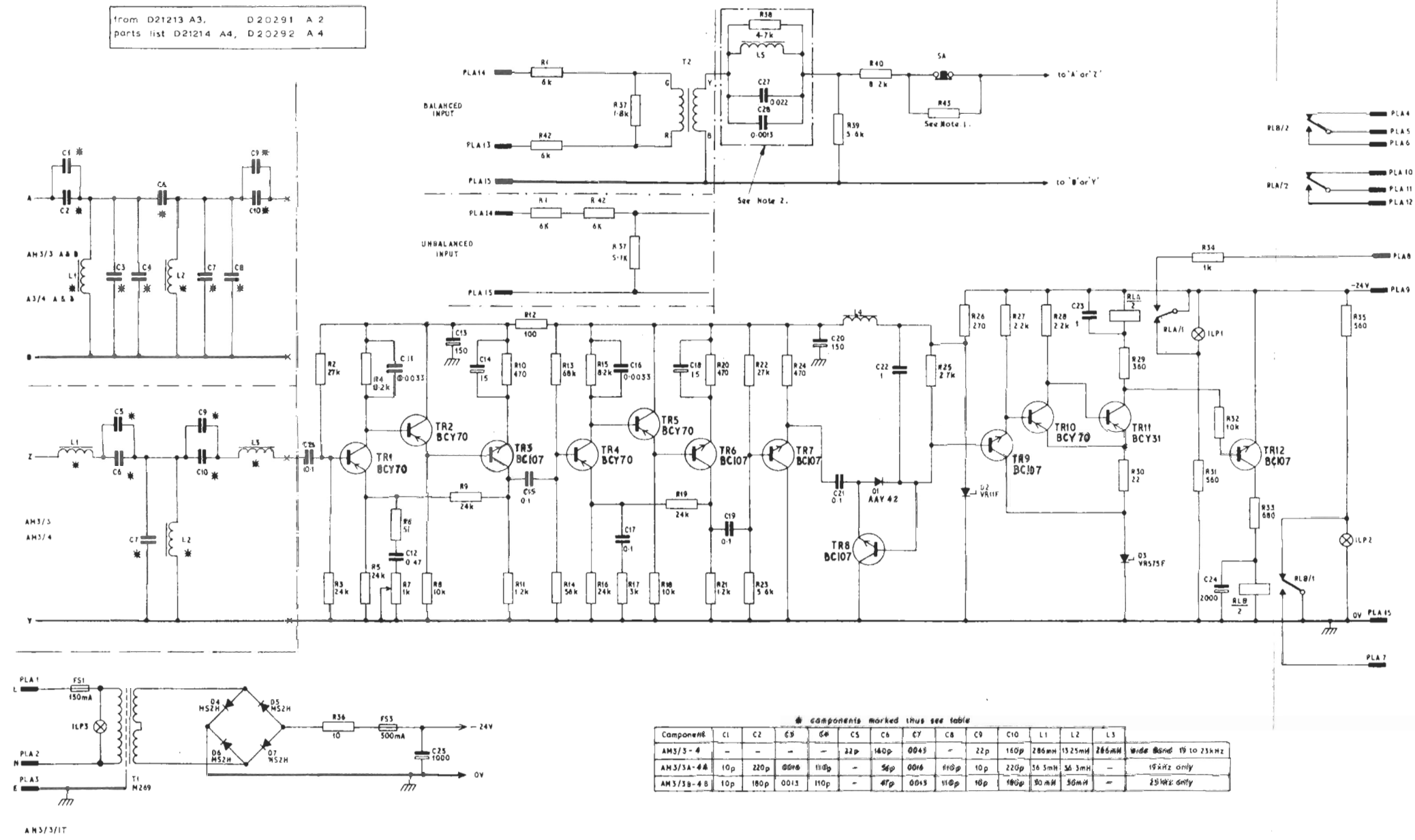
Note: Fig. 1 gives typical values for R38 and R43.

Bibliography

1. Garside, G.; Simplified Transistor Circuit Design: Wireless World, June 1967.
2. Waddington, D. E. O'N.; The Diode-transistor Pump: Wireless World, July, 1966.
3. Towers, T. D.; Pumps and Schmitts: Wireless World, August, 1966.

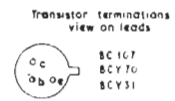
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from D21213 A3, D20291 A2
parts list D21214 A4, D20292 A4



* components marked thus see table

Component	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	L1	L2	L3	
AM3/3-4	-	-	-	-	22p	100p	0043	-	22p	100p	280mH	15.25mH	280mH	wide band 19 to 23kHz
AM3/3A-4A	10p	220p	0048	110p	-	56p	0046	110p	10p	220p	36.5mH	56.5mH	-	19kHz only
AM3/3B-4B	10p	180p	0013	110p	-	47p	0043	110p	10p	180p	30mH	50mH	-	25kHz only



- Notes:
- R43 25k for -10dB release. R34 3k for AM3/3 and AM3/4
12k for -4dB
25k for -6dB
 - Components enclosed within chain dotted line (R38, L5, C27 & C28) to be omitted for AM3/4A & B. Replace by shorting strap.

Fig. 1 Circuit Diagram of the AM3/3 and AM3/4 Series of Tone Detectors