# DIFFERENTIAL DETECTOR UNIT UN20/14

**Introduction**

The UN20/14 was designed as part of sound transmitter automatic monitor MN2M/7, in which it is used to compare the output voltages of two processing units UN1/105. A centre-zero meter on the front panel of the UN20/14 shows the degree of unbalance between these two outputs, and when they differ by more than about 1.5 volts d.c. a relay on the UN20/14 releases and a green light on the front panel goes out. The relay also releases on mains or power-supplier failure. A set of changeover contacts provided on the relay is available for switching 30-VA resistive loads.

The circuit of the unit is somewhat elaborated to ensure stability and so protect the alarm margin of the MN2M/7 from change.

The unit is constructed on a standard CH1/12A chassis, intended for mounting in a PN3/23 nesting box. Electrical connections are via a Painton 15-way in-line plug. Index pins are provided in positions 22 and 31.

**Circuit Description (Fig. 1)**

The unit is normally energised from a power supplier PS2/74D in the parent monitor unit MN2M/7. TR7, D2 and D3 form a simple series stabiliser which reduces the voltage in the unit to 24 volts. This circuit is also used to feed another unit (the UN1/99) in the monitor.

TR1 is part of a Colpitts LC oscillator which has a frequency of 25 kHz fixed by L1 and C3 and whose amplitude of oscillation is adjustable by altering C2. The oscillatory condition is produced by feedback from the tapped capacitors C2 and C3 to TR1 emitter. TR1 is effectively working in a common-base mode, C1 being a virtual short-circuit at the frequency of oscillation.

TR2, TR3 and TR4 consist of pairs of silicon transistors mounted in a small aluminium block which provides a common thermal environment and, because the transistors operate at equal temperatures, ensures low drift. These transistors have matched characteristics, and exhibit a very low differential temperature coefficient when operated under the conditions laid down by the maker.

TR4 is used as a differential amplifier and TR2 and TR3 are arranged to form part of the bias chain to TR4 bases. A differential voltage applied to TR2 bases causes unbalance in the collector currents of the transistors. As TR2 feeds TR3, TR3 becomes unbalanced also. The collector voltages of these transistors change, and because the collectors are connected to TR4 bases, this changes the gain applied to the 25-kHz signal fed to TR4.

The 25-kHz signal is fed from TR4 collector to TR5 via C6. The signal is rectified on its negative peaks by D1, the positive peaks turn TR5 on, C7 charges up and this in turn causes TR6 to pass current. When this happens RLA operates and the lamp lights via RLA contacts 2 and 3.

The relay is operated and the lamp is alight when the differential input voltage is less than 1.5 volts, the gain of the amplifier TR4 being at a maximum when the differential is zero. If the differential input exceeds 1.5 volts, the gain of TR4 is reduced sufficiently to turn off TR5 and hence TR6. The relay then de-operates and the lamp goes out.

The meter M1 connected across the collectors shows the degree of unbalance of the input voltage. The meter reading is about ±70 μA when the lamp goes out.

**Test Procedure**

*Apparatus Required*

Avometer Model 8
Oscilloscope with Probe
Test Circuit as shown in Fig. 2

*Tests*

1. Connect a 50-volt d.c. supply to PLA 1 (negative) and PLA 2 (positive). Check with the Avometer Model 8 that the voltage on the negative side of C9 is 24 ±1 volts relative to that on PLA 2.
2. Connect the oscilloscope probe to the junction of C2 and C3. Examine the resulting waveform, which should be sinusoidal, with a frequency of about 25 kHz (i.e., a period of 40 μs) and an amplitude of about 2 volts peak-to-peak.
3. Turn R4 fully anticlockwise. The green indicator lamp on the front panel should light.
4. Connect the test circuit shown in Fig. 2 to the input of the unit at PLA 11 and 14. Adjust the tapped 5-kilohm resistor VR1 in the test circuit until the Avometer reads zero on its 2.5-volt range. The centre-zero meter should read zero ±5 μA. Now adjust the 5-kilohm resistor VR1 until the Avometer Model 8 reads +1.5 volts. The centre-zero meter on the UN20/14 should deflect to one side and indicate about 70 μA. Note the exact reading obtained. Now reduce the Avometer reading through zero (pressing REV MC) to −1.5 volts. Check that the centre-zero meter deflects to the opposite side and gives the same reading as before ±5 μA (a quarter of a division on the scale).

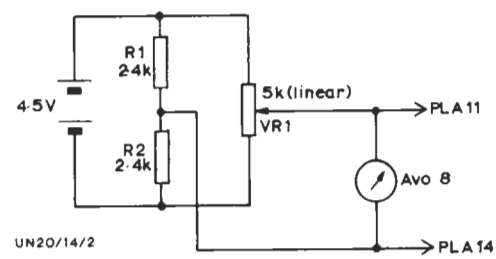
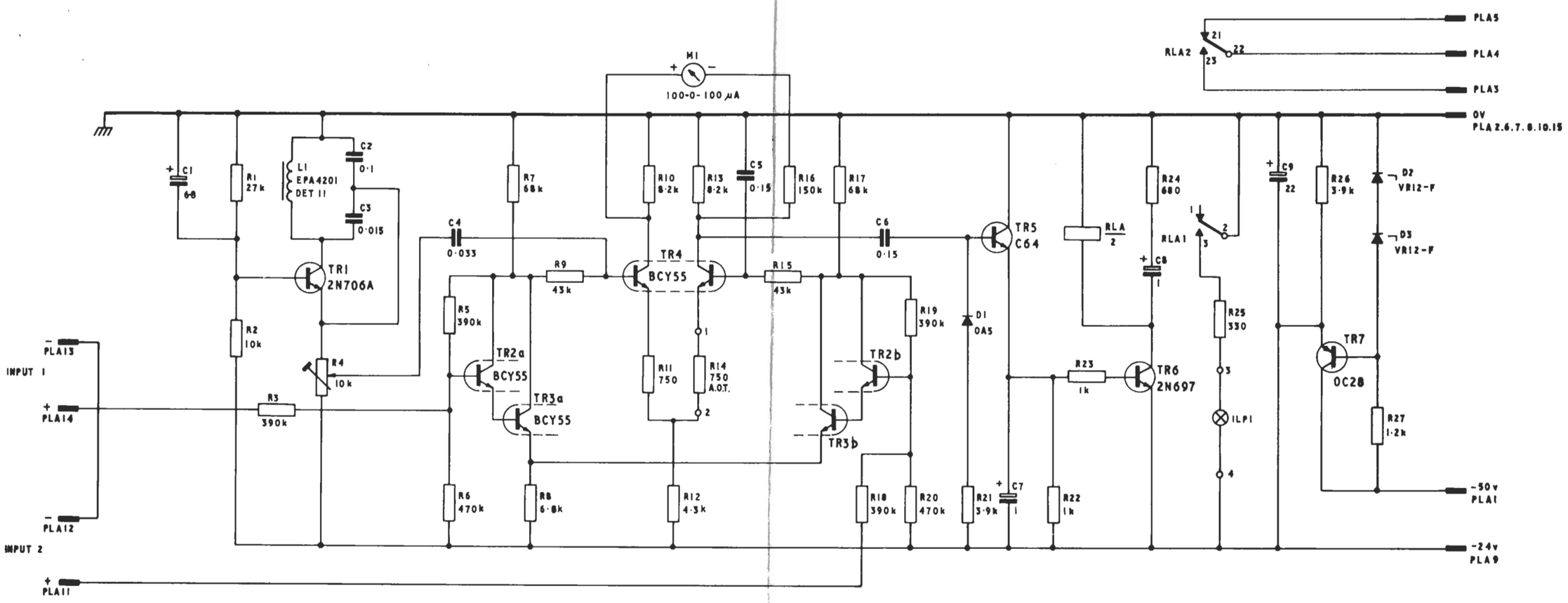



*Fig. 2. Test Circuit for the UN20/14*

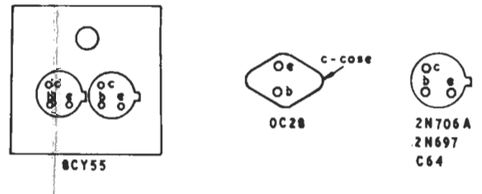
5. Set the reading on the Avometer to +1.5 volts again. Now adjust R4 until the green indicator lamp just goes out. Check that the lamp also goes out (when the voltage is reduced through zero) at −1.5 volts.
6. Connect the Avometer on its resistance range across PLA 3 and 4. Vary the voltage in a positive and negative direction and check that the relay contacts are closed when the lamp is on and open when it is off.
7. Remove the test circuit and all other connections to the unit.




UN20/14/1T

from D 22964A2
parts list D 22965A4

transistor terminations
view on leads




NOTE ○ 2 Numbers shown thus, refer to pins on printed board.



Fig.1. Circuit of UN20/14