PROCESSING UNIT UN1/105

Introduction

Processing unit UN1/105 was designed as part of sound transmitter automatic monitor MN2M/7, each monitor containing two identical units UN1/105. The input to a unit is a programme signal and the output is a direct voltage which is related to certain parameters of the input, including level and frequency response.

At any given frequency, the unit operates as an amplifier-detector with three different gains corresponding to three different ranges of input level:

low:	below −30 dB
medium:	from −30 to 0 dB
high:	from 0 to +8 dB

At any given input level, the input sensitivity is a maximum at a frequency of 1 kHz, and falls off at higher and lower frequencies to conform to aural sensitivity.

The unit has a balanced input circuit with an impedance of more than 10 kilohms from 20 Hz to 15 kHz, and can accept a programme signal at up to zero volume, or a tone level of up to +8 dB relative to 0·775 volt r.m.s. An Input Volume attenuator is provided introducing a loss of 0 to 4 dB adjustable in 0·5-dB steps; this control may be used to check the sensitivity of the monitor.

The unit is constructed on two printed wiring boards mounted on a CH1/12A chassis designed for insertion into a nesting box PN3/23. Electrical connections to the unit are via a Painton 15-way in-line connector. Index pins are fitted in positions 21 and 42. The Input Volume control is on the front panel.

Circuit Description (Fig. 1)

The input to the unit is via a 1:1 transformer T1. The input impedance is about 25 kilohms at 1 kHz, but falls to about 10 kilohms at 15 kHz due to the presence of C1. R1 and C1 form a simple low-pass filter which shapes the high-frequency response before the signal is fed to a compression stage. TR1 and TR2 compose a simple two-stage amplifier with the attenuator forming part of the feedback network. The gain is about 8 dB with the attenuator on its 0-dB setting and falls in 0·5-dB steps to a minimum of 4 dB as the attenuator is switched in. C4 and bias resistors R17 and R18 form a simple high-pass filter which attenuates low-frequency signal components before they are passed to the compressor via emitter-follower TR3.

From TR3 the signal passes via R20 to amplitude-weighting networks. D1 and D2 are biased so that they do not conduct until the input to the unit exceeds about 0 dB; this provides high-level compression. Low-level compression is carried out by D3 and D4, which form part of the feedback circuit of amplifier TR4 to TR8. The feedback for this amplifier is taken from the emitters of complementary output stage TR7 and TR8 and is fed back to TR4 emitter. The low-level gain of this amplifier (for inputs below −30 dB) is about 40 dB, from C7 to C16. The diodes are biased to remain off until the input to the unit exceeds about −30 dB. When they begin to conduct they shunt feedback resistors R34 and R37, so limiting the output and hence the gain of the amplifier. Bias to the diodes is provided by R35 and R39 along with R36 and R38. The high-frequency response of the loop is curtailed by C10 to prevent instability. Diodes D5 and D6 provide bias to TR7 and TR8. C13 is a bootstrap capacitor provided to ensure that enough current is fed to TR8 at large positive excursions of the output signal.

The amplifier is followed by another frequency-shaping network. R46 and C17 provide an additional high-frequency roll-off and R46 together with the shunt inductance of T2 provides low-frequency shaping.

The output signal after processing as described is rectified full-wave by D7 and D8. C18 is a reservoir capacitor and the d.c. across it provides the final output from the unit.

In monitor MN2M/7, the outputs from two UN20/14 units are applied to the inputs of a differential detector UN20/14. The MN2M/7 and the UN20/14 are covered by separate instructions.

Test Procedure

Apparatus Required

Avometer Model 8
Oscilloscope and Probe
Tone Source TS/10
Attenuator: 0 to 50 dB
Digital Voltmeter
A.C. Test Meter ATM/1
600-ohm Resistor
0·33-μF Capacitor

General Performance Tests

1. Connect the tone source, with output −29 dB at 1 kHz, to PLA 13 and 14.
2. Set the Input Volume attenuator control on the front panel to 0 dB.
3. Connect the oscilloscope probe to the junction of C16 and R46 and observe the displayed waveform, which should be sinusoidal, with an amplitude of about 6.1 volts peak-to-peak. The oscilloscope earth should be taken to PLA 15 or chassis.
4. Increase the input level until just perceptible limiting occurs on the waveform display. The input level should then be −27.5 ±1 dB.
5. Increase the input level to −2 dB. The position of the limiting 'knee' in the waveform should remain constant, but the overall amplitude should increase.
6. Increase the input level again until a further stage of limiting is visible at each waveform peak. This should occur at an input level of +0·25 ±0·5 dB.

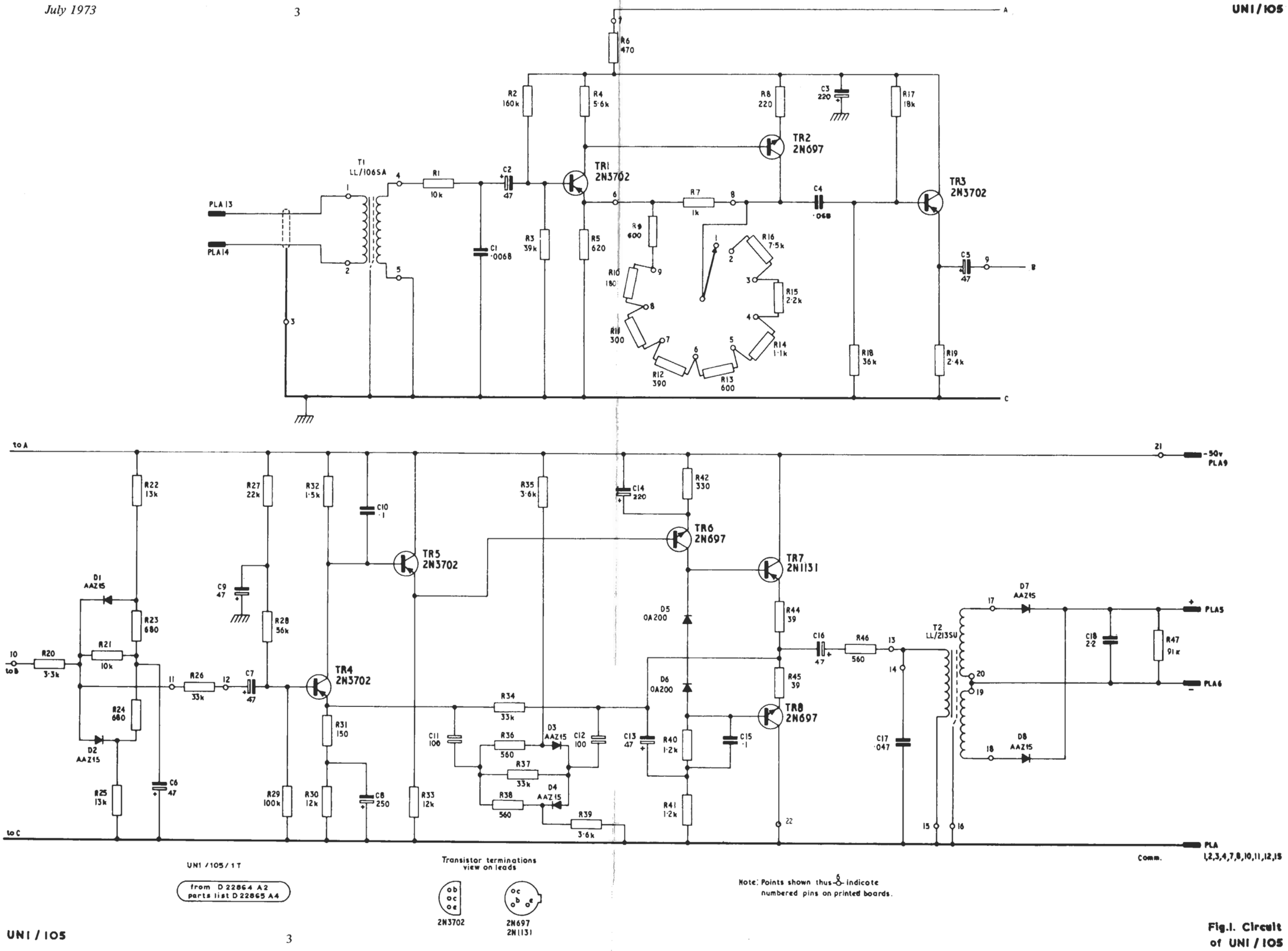

Fig.1. Circuit of UNI / 105

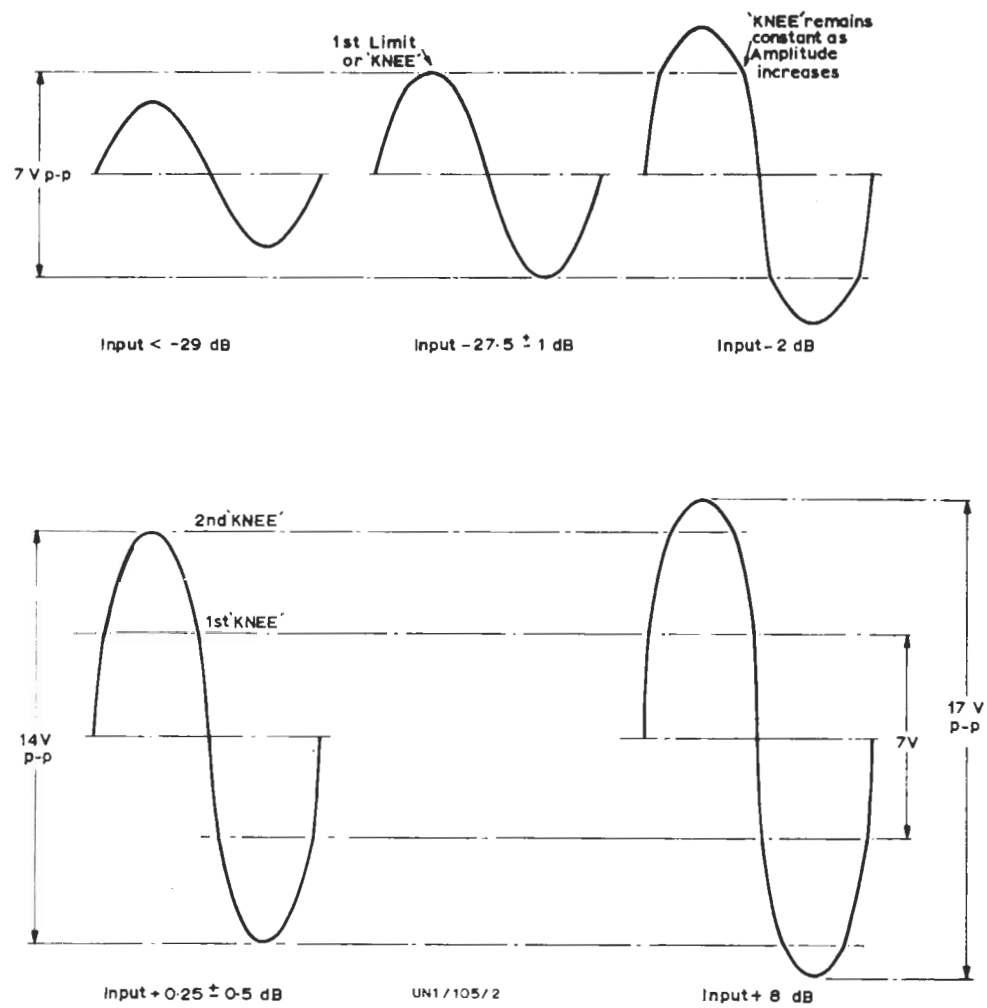

Fig. 2. UN1/105 Limiting Waveforms

The waveforms observed should approximate to those in Fig. 2.

Volume Weighting Response

1. Transfer the oscilloscope probe to pin 9 on the subassembly printed board. The oscilloscope earth should be taken to PLA 15 or chassis.
2. Feed the TS/10 output via the 0-to-50-dB attenuator to the input of the unit.
3. Set the input level to −20 dB.
4. Vary the input frequency and adjust the attenuator to keep the display amplitude constant, checking the response relative to 1 kHz against the limits below. (These limits show that the loss introduced by the attenuator at 60 Hz for example should be about 10 dB less than at 1 kHz.)

60 Hz	−10.0 ±0.5 dB
200 Hz	−2.25 ±0.5 dB
1 kHz	0 dB
3 kHz	−2.25 ±0.5 dB
15 kHz	−13.5 ±0.5 dB

Post Compression Weighting

1. Disconnect the positive end of C7 and feed tone via the attenuator and a repeating coil (terminated in 600 ohms) to the positive side of C7, and PLA 15 or chassis.
2. With the ATM/1 across the 600-ohm termination, set the level to −50 dB at 1 kHz.
3. Connect the digital voltmeter to PLA 5 and 6 and note the reading, which should be about 0·54 volt.
4. Vary the frequency and adjust the attenuator to maintain a constant reading on the digital voltmeter. At each frequency, note the level required across the 600-ohm termination, checking the response relative to 1 kHz against the figures below.

60 Hz	−11.0 ±1 dB
200 Hz	−3.0 ±0.5 dB
1 kHz	0 dB
6 kHz	−2.4 ±0.5 dB
10 kHz	−4.4 ±1 dB

Gain Adjustment

1. Feed 1-kHz tone at −1.0 dB to the input and measure with the digital voltmeter across PLA 5 and 6. Adjust R26 for a reading of 11.25 ±0.02 volts.
2. Check the readings at the following input levels.

−29 dB	4.66	±0.12 volts
−24 dB	6.20	±0.1 volts
+1 dB	11.25	±0.02 volts
+8 dB	14.74	±0.1 volts

Input Volume Attenuator

1. Set the input level to −20 dB at 1 kHz.
2. Measure the level between pin 9 on the sub-assembly printed board and PLA 15 or chassis with an ATM/1 (high-impedance input) in series with 0.33 μF. This level should be about −15.25 dB.
3. Adjust the tone source to give −15.0 dB and rotate the Input Volume attenuator switch in 0.5-dB steps, checking that the level at pin 9 is attenuated by a corresponding amount ±0.1 dB.

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