AUDIO DECODER UN17/508

Introduction

The UN17/508 as used in the Natlock slavelock system (described in Instruction V.1) converts a tone encoded error signal into three equivalent d.c. error signals which can be used to control a Drive Unit GE1/520.

The UN17/508 is constructed on a CH1/26B chassis with index peg positions 13 and 24.

Fig. 1 Simplified Block Diagram of the UN17/508

General Description

A simplified block diagram is shown in Fig. 1, and a detailed block diagram in Fig. 2. The input signal is passed through an a.g.c. amplifier which allows for a wide range of input levels and for variations in input level. The tones in the output of the a.g.c. amplifier are separated by means of three band-pass filters. The outputs of the filters are detected and the resulting d.c. signals are fed to output logic circuits.

Circuit Description

The circuit of the UN17/508 is given on page 3. The input signal is fed via transformer T1 and the input attenuator to the base of transistor TR2. Zener diode D9 provides some protection against gross overloads such as ringing-tone signal. The collector load of transistor TR2 is in two parts:

(a) a d.c. load is provided by a constant current source which includes transistor TR1.

(b) an a.c. load is formed by capacitor C4, resistor R10 and thermistor TH1. As the signal current through this load increases, the resistance of the thermistor decreases,

TABLE 1

Conditions	*Input tones*			*Detector outputs*			*Outputs of:*					
							NOR gate No. 1	*NOR gate No. 2*	*AND gate*	*OR gate No. 1*	*OR gate No. 2*	*OR gate No. 3*
	800Hz	*1200Hz*	*1600Hz*	*TR12c*	*TR9c*	*TR7c*	*TR18c*	*TR15c*	*D7/D8*	*pin 13*	*pin 8*	*pin 9*
	F	*R'*	*A'*	*F'*	*R*	*A*	*R'*	*A'*	*A'R'*	*F'+A'R'*	*R'+A*	*R+A'*
Fault	on	off	off	−ve	+ve	+ve	−ve	−ve	−ve	−ve	+ve	+ve
Fast retard	on	off	on	−ve	+ve	−ve	−ve	+ve	−ve	−ve	−ve	+ve
Fast advance	on	on	off	−ve	−ve	+ve	+ve	−ve	−ve	−ve	+ve	−ve
Fault	on	on	on	−ve	−ve	−ve	+ve	+ve	+ve	+ve	+ve	+ve
Fault	off	off	off	+ve	+ve	+ve	−ve	−ve	−ve	+ve	+ve	+ve
Retard	off	off	on	+ve	+ve	−ve	−ve	+ve	−ve	+ve	−ve	+ve
Advance	off	on	off	+ve	−ve	+ve	+ve	−ve	−ve	+ve	+ve	−ve
Normal	off	on	on	+ve	−ve	−ve	+ve	+ve	+ve	+ve	+ve	+ve

which tends to keep the signal voltage at the collector of transistor TR2 at a constant amplitude.

Thermistor TH2 is included to compensate for the effects of ambient temperature on thermistor TH1.

The band-pass filters at the input to each detector are of an impedance transforming type[1] (100 ohms to 10 kilohms) which give a voltage gain of 20 dB.

The behaviour of the output logic circuits is summarised in Table 1.

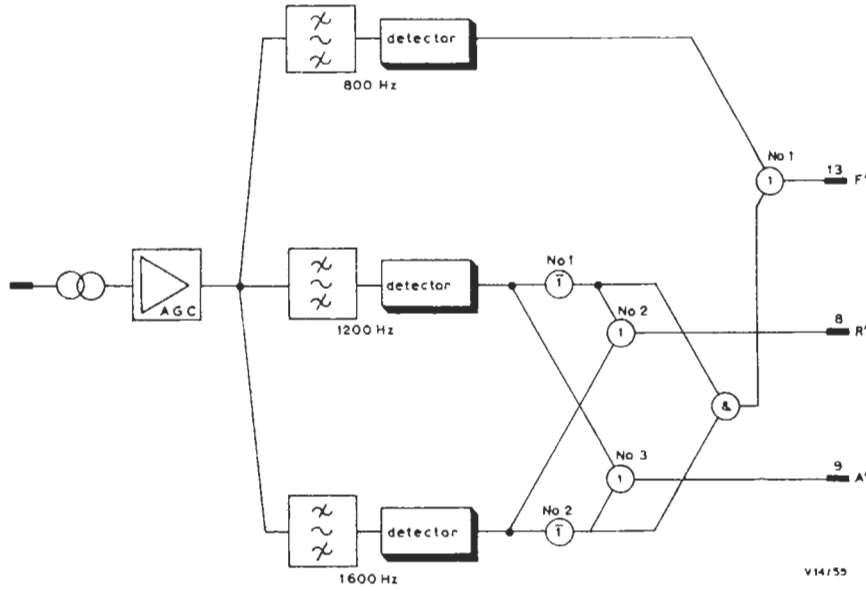

Fig. 2 Detailed Block Diagram of the UN17/508

Modifications

Some units, modified as shown in Fig. 4, have one green and two white indicator lamps instead of the usual one green, one white and one amber. The function of the green lamp in the modified UN17/508 is to indicate that the output control signals are not correcting the controlled Drive Unit GE1/520; that is, the output of the GE1/520 is synchronous at the mixing point. A relay provides external synchronous indication.

Test Schedule

Apparatus Required

Avometer Model 8.
Tektronix oscilloscope Type 515A.
Tone Sources TS/10 (two).
Power Supply: −12 volts at 110 mA.

Test Procedure

1. Connect the 12-volt supply as shown in Fig. 3.
   Connect the input of the oscilloscope (unterminated) to test point *TP*.
   Connect one Tone Source to the input of the Decoder. Set the frequency to 800 Hz and the output level to 0 dB.
   Switch the *Input Attenuator* to *−4 dB*.
   Observe the waveform at test point *TP*. Adjust the variable resistor R5 to give a waveform without signs of clipping. Its amplitude should be 4 to 5 volts p-p.
2. Reduce the input level in 4-dB steps, pausing before each observation.
   At an input level of −8 dB switch the attenuator to *−14 dB*.
   At an input level of −16 dB switch the attenuator to *−24 dB*.
   At each input level check that the waveform at test point *TP* has an amplitude of 4 to 5 volts p-p.
3. Connect the output of the second Tone Source in parallel with the output of the first and set both their output levels at +6 dB.
   Connect the oscilloscope to an output of the Decoder (first column in Table 2) and set the frequencies of the Tone Sources as shown in

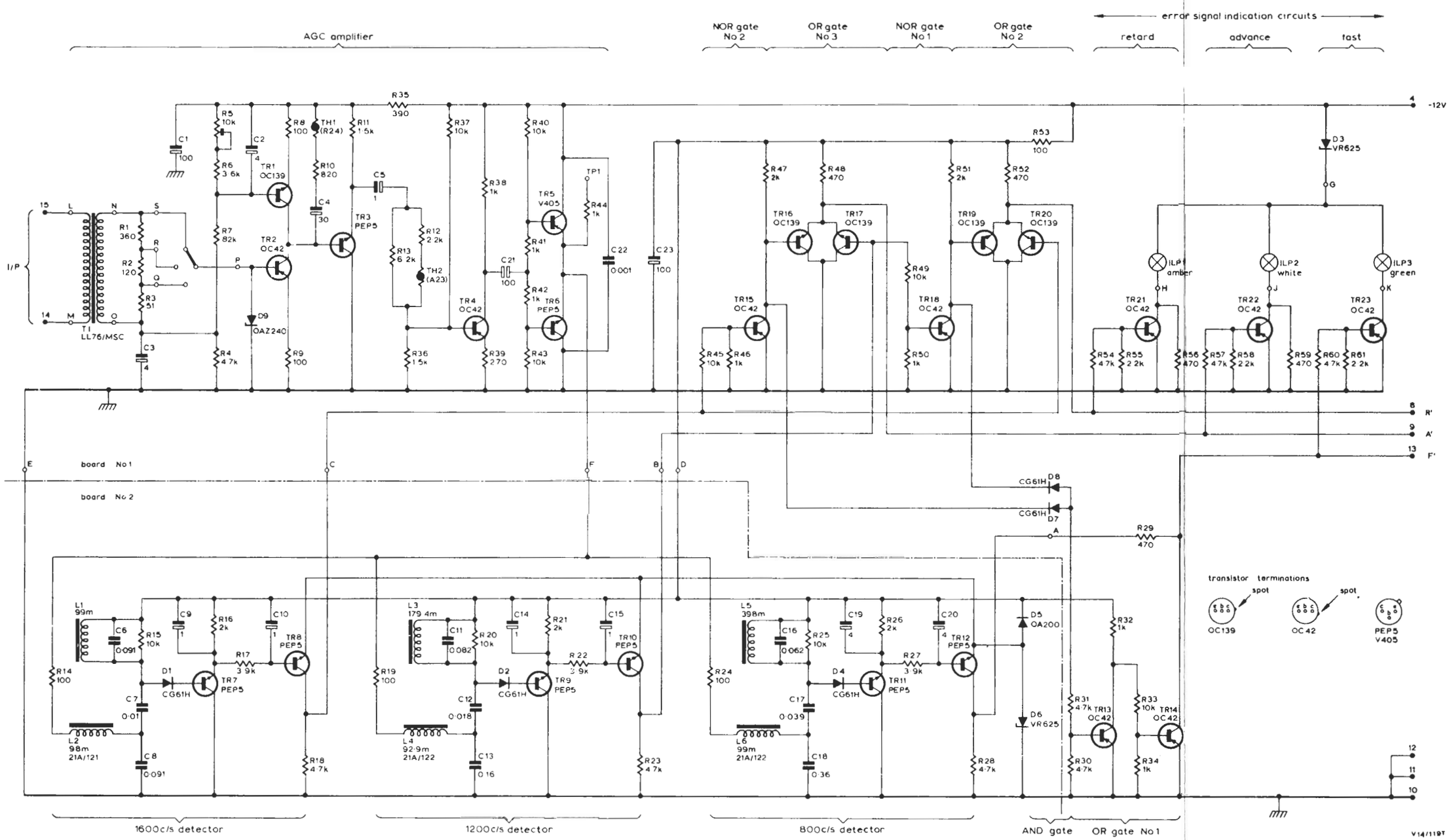

Fig. 3 Circuit of the UN17/508

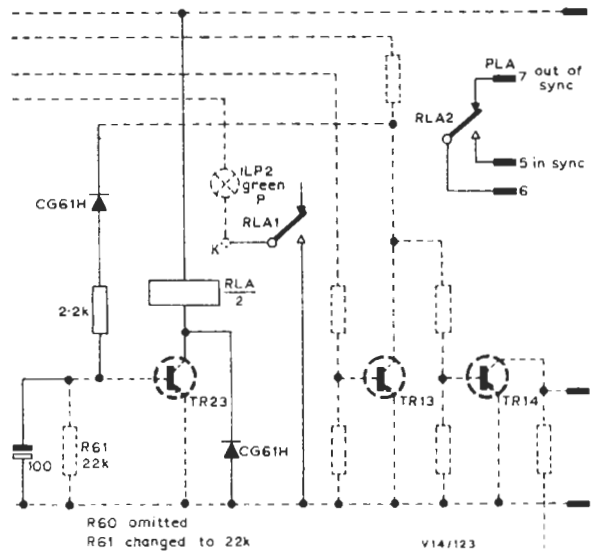

Fig. 4 Circuit Modifications for the UN17/508

the table. Measure the output voltage which should be between −4·5 volts and −6·5 volts. Check that the appropriate lamps are lit.
Vary the frequency of the second Tone Source and note the two frequencies at which the output drops to −4·0 volts. These frequencies should lie within the ranges given in Table 2.
Repeat test 3 for each output of the Decoder.

4. Set the Tone Source frequencies to 1200 Hz and 1600 Hz and measure the output voltages at pins 8, 9 and 13. They should be between −1·5 and 0 volts. Check that all the indicator lamps are extinguished.
5. Disconnect one of the Tone Sources and set the frequency of the other to 800 Hz.
Set the input attenuator to −4 dB.
Increase the output level of the Tone Source in 2-dB steps from zero level until the amber indicator lamp lights. This should be at an input level of either +14 dB or +16 dB.

Further Information

The Decoder can be checked in conjunction with an Encoder UN17/507. A 6-volt supply and three changeover switches are required to simulate the Encoder inputs. The behaviour of the Decoder

TABLE 2

Pin	*Frequency of Tone Source*		*Lamps lit*	*Frequency limits for Tone Source II when output voltage drops to −4·0 volts*	
	I	*II*		*lower*	*upper*
8	800 Hz	1600 Hz	Amber and White	1350—1500 Hz	1700—1850 Hz
9	800 Hz	1200 Hz	Green and White	950—1100 Hz	1300—1450 Hz
13	1200 Hz	800 Hz	Green and White	550— 700 Hz	900—1050 Hz

outputs as a function of the Encoder inputs is shown in Table 3:

Bibliography

1. Shea, T. E.; Transmission Networks and Wave Filters: D. Van Nostrand.

TABLE 3

Input condition	*Encoder input voltages*			*Transmitted tones*			*Decoder output lamps*			*Output condition*
	pin 6 F'	*pin 10 R'*	*pin 12 A'*	*800 H F*	*1200 H R'*	*1600 H A'*	*white F*	*amber R*	*green A*	
Fault	−ve	−ve	−ve	on	off	off	on	off	off	Fast advance*
Fast retard	−ve	−ve	+ve	on	off	on	on	on	off	Fast retard
Fast advance	−ve	+ve	−ve	on	on	off	on	off	on	Fast advance
Fault	−ve	+ve	+ve	on	on	on	off	off	off	Normal
Fault†	+ve	−ve	−ve	off	off	off	off	off	off	Normal
Retard	+ve	−ve	+ve	off	off	on	off	on	off	Retard
Advance	+ve	+ve	−ve	off	on	off	off	off	on	Advance
Normal	+ve	+ve	+ve	off	on	on	off	off	off	Normal

* This is not interpreted as a fast advance condition by the Decoder, but by a Variable Divider in a Drive Unit GE1/520.

† This is the most likely fault condition, brought about by a failure in the audio transmission circuit.

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