Issue 1
18/1/79

DESIGNS DEPT. MANUFACTURING INFORMATION

No. 6.335(78)

Automatic Polarity Corrector MN4/6

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GP

D.D.M.I. No. 6.335(78)
Title Sheet

BBC

DS/SPA4

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C O N T E N T S

D R A W I N G S

Circuit	D45380 A2
Parts List	D45381 A4
Assembly and Wiring	D45382 A2
Details	D45383 A2
Printed Board Wiring	D45384 A2
Printed Board Wiring (comp side)	D45385 A2
Printed Board Component Location	D45386 A3
Printed Board Drilling	D45387 A3

BBC

DS/SPA4

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1. Introduction

This unit, which forms parts of Audio Delay Equipment EP1M/23, will detect the presence of an Audio Frequency uni-directional pulse and ensure that it always has the same polarity at its output. Normal programme will not affect the polarity of the output but if a uni - directional pulse appears at the output in the wrong polarity the circuit will automatically detect this and reverse the polarity of the pulse within 15 seconds. A bistable relay is used to control the polarity of the signal and it will hold that polarity in the event of a power failure.

This unit is also used as an output interface for the FP1/23. It has a high impedance unbalanced input and a low impedance balanced output.

Pins 6 and 7 are connected via the make contacts of a relay which operates when the supply voltage is greater than 20 volts. By connecting pins 6 and 7 in series with a bypass relay the EP1M/23 will switch to bypass if the MN4/6 is removed or if the power supply drops to <20 volts.

2. Specification

Performance Data

Inputs:

Audio input	Unbalanced
Audio input impedance	>5k
Audio input level	zero programme volume
Power consumption	+ 25 ± 0.5 volts at 50mA ± 10mA + 12.5 ± 0.5 volts at 50mA ± 10mA

Outputs:

Audio output	Balanced
Audio output impedance	<50 Ω
Audio output level	zero programme volume
Frequency response	+0.1dB from 100Hz - 6.5kHz
Gain	0 + 0.2dB
Total harmonic separation	better than 70dB for an input signal of 1kHz at +8dBm into 600Ω
Signal to noise ratio	better than 70dB4w

3. Mechanical Data:

Chassis	CH1/65A
Indexing positions	1,12,15
Plug indexing position	A1
Weight	0.5kg

4. Installation Data:

Mount in PN3/55 and wire to pins as follows:-

Pin No.	Function
1	Chassis earth
2	Audio input (unbalanced live)
3	Audio input (earth)
4	Not used
5	Not used
6)	These pins are joined in the unit via a relay and they may be used to detect that the unit is in position and that the power supply is greater than 20V
8)	
7	Not used
9	Power supply earth (0V)
10	Not used
11	Power supply positive (+12.5V)
12	Not used
13	Not used
14	Audio output (balanced)
15	Audio output (balanced)
16	Not used
17	Power supply positive

BBC

DS/SPA4

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PRODUCTION TEST SCHEDULE

1. Description

This unit, which forms parts of Audio Delay Equipment EP1M/23, will detect the presence of an Audio Frequency uni-directional pulse and ensure that it always has the same polarity at its output. Normal programme will not affect the polarity of the output, but if a uni -directional pulse appears at the output in the wrong polarity the circuit will automatically detect this and reverse the polarity of the pulse within 15 seconds. A bistable relay is used to control the polarity of the signal and it will hold that polarity in the event of a power failure.

This unit is also used as an output interface for the EP1/23. It has a high impedance unbalanced input and a low impedance balanced output. Pins 6 and 8 are connected via the make contacts of a relay which operates when the supply voltage is greater than 20V. By connecting pin 6 and 8 in series with a bypass relay the EP1M/23 will switch to bypass if the MN4/6 is removed or if the power supply drops to <20V.

The polarity detector operates by slicing the audio signal and measuring its mean d.c. component over several seconds. The mean d.c level from the slicer will only rise significantly if a negative going pulse is applied to the input of the slicer. A second slicer is used to detect the mean d.c. voltage and, if it is high enough, it will toggle the bistable relay. A type D flip-flop is used to provide the necessary toggle action and a transistor is used to limit the duration of the energising pulse. A second transistor is used to inhibit the operation of the relay when the power supply voltage is less than about 20V, this prevents false operation when the power supply is switched on.

2. Information

a)	Design Section:	Transmission Section
b)	Designer:	M.T. Ellen
c)	Engineer responsible:	D.C. Savage
d)	Handbook:	Part of Handbook No. 6.163 (78) for Audio Delay Equipment EP1M/23
e)	Technical Instruction:	Not available on 1st July 1978
f)	Other information:	
g)	Pre-production batch:	This Production Test Schedule has been tested on a pre-production batch in D.D.

BBC
DS/SPA4

3. Manufacturing Performance Specification:

a) Input Requirements:

Low distortion sinewave 20Hz - 15kHz at +10dBm Max.
Switchable uni-directional pulse from D.D. test jig for MN4/6

b) Outputs:

Similar to input but polarity may be inverted.

c) Power Supply:

+25 ±0.5v at 50mA ± 10mA
+12.5V ± 0.5v at 50mA ± 10mA

d) Performance:

Gain:	0 ± 0.2dB at 1kHz
Frequency response:	±0.1dB from 100Hz to 6.5kHz
Total harmonic separation:	better than 70dB for an input signal of 1kHz at +8dBm into 600Ω
Signal to noise ratio:	Better than 70dB4w
Power supply detector operating point:	20 ± 2V
Polarity corrector response time:	<15 sec.

4. Warning

a) No voltages above 50V d.c. or 30V a.c. are connected to this unit.

b) This unit contains an MOS device (IC 6). Ensure that it is not subjected to an electrostatic discharge.

5. Test Apparatus Required:

2 0 - 30V variable power supplies up to 100mA, fitted with an ammeter and current limit control

1 oscilloscope, bandwidth 1MHz

2 oscilloscope probes

1 a.c. test equipment type EP14/1

1 D.D. test jig for MN4/6 (uni-directional pulse generator)

1 AVO

6. Inspection

a) Check that the slot positions of the coding comb are correct.

b) No mains voltages are connected to this unit. Check the wiring to the LED's on the front panel and to the output transformer T1.

c) Check that the following components are correctly inserted:-

a) Capacitors C1 - C12
b) Resistors R1 - R27, R29 - R41
c) Transistors TR1 - TR7
d) Integrated Circuits IC1 - IC6
e) Diodes D1 - D7
f) Transformer T1
g) Relays RLA, RLB
h) Plug

7. Test Procedure:

7.1 To check the current consumption:

a) Connect a power supply (set to 0V) to PLA9 (negative) and PLA11 (positive). Connect another power supply (set to 0V) to PLA8 (negative) and PLA17 (positive).

Gradually increase the voltage of the first power supply to 12.5V and monitor the current, then gradually increase the voltage of the second power supply to 25V while monitoring its current.

b) The current should be 50mA ± 10mA and 50 ± 10mA for the two power supplies respectively.

c) If the current drawn from the first power supply is incorrect check the circuit associated with the bistable relay and the type D flip-flop. If the current drawn from the second power supply is incorrect check the rest of the circuit.

7.2 To check the frequency response:

a) Connect the a.c. test set oscillator (75Ω source, internal 600Ω termination and 0dBm) to pins 2 and 3. Connect the a.c. test set detector (high impedance, mean indication) to pins 14 and 15. Measure the frequency response.

b) The gain should be constant within ±0.1dB from 100Hz to 6.5kHz.

c) If the frequency response is incorrect check the wiring to the output transformer T1. Then check the wiring in the rest of the amplifier section of the circuit.

7.3 To check the gain:

a) Set up the equipment as in section 7.2 and measure the gain at 1kHz.

b) The gain should be 0 ± 0.1dB.

c) If the gain is incorrect check the component values in the amplifier section of the circuit.

7.4 To check the distortion:

a) Leave the equipment set up as in section 7.3 but increase the output from the oscillator to +8dB and set it to 1kHz. Press the "mean" button and adjust the attenuator setting to obtain a centre reading on the meter. Then press the "1kHz harmonic" button and readjust the attenuator to obtain a centre reading. Note the difference between the two attenuator settings.

b) The difference should be greater than 70dB.

c) If this test is not passed check that the operational amplifiers are correctly biased and that the output transformer has been correctly manufactured.

7.5 To Check the Signal to Noise Ratio

a) Leave the equipment set up as in Section 7.4 but set the oscillator output level to 0dBm and press the TPM button. Check that the TPM reads 4 when the attenuator is at 0dB. Replace the oscillator with a 600Ω resistor, press the "weighted" button and readjust the attenuator to make the TPM peak to 4. Note the new attenuator setting.

b) The reading should be better than 70dB (i.e. 70dB4w).

c) If this figure cannot be obtained the operational amplifiers may be at fault. Also check the quality of the measurement equipment.

7.6 To check the Input Slicer

a) Short R37 to prevent a polarity reversal during initial testing. Connect the pulse output of the Designs Department Test Jig to pins 2 and 3 and connect an oscilloscope to pin 7 of IC3. Set the test jig output to positive then negative polarity and measure the mark/space ratio displayed on the oscilloscope for each condition.

b) The mark/space ratio should be within range 4:1 to 6:1.

c) If the mark/space ratio is incorrect check the circuit associated with IC3.

7.7 To check the Mean Level Detector

a) Connect 1 input of the oscilloscope to IC4 pin 6 and connect the other input to IC5 pin 1. Set the test jig polarity switch to make IC4 pin 6 drop to its lowest potential and wait 20 seconds. Then set the test jig polarity switch to the opposite position and observe the two waveforms on the oscilloscope.

b) The waveform on IC4 pin 6 should rise exponentially with a time constant of 2 - 3 seconds and after 2 seconds when it has a voltage of 15 ± 0.2 volts IC5 pin 1 should switch rapidly from 0 volts to ⩾20 volts.

c) If the time constant is wrong check R25, C11 and IC4.
If the switching level is wrong check the circuit associated with IC5.

7.8 To check the toggle action of the bistable relay

a) Remove the short on R31. Connect the oscilloscope to pins 14 and 15. Set the polarity switch on the test jig to each position in turn every 30 seconds and observe the waveform displayed on the oscilloscope. Also observe the polarity positive and polarity negative LED on the front panel.

b) The waveform should remain unchanged for up to 15 seconds after a polarity reversal. Also the LED indicators should remain unchanged for the same period. After this period the polarity of the pulse should revert to its original position and the polarity indications should change over.

c) If this test is not passed check the circuit associated with the bistable relay and the type D flip flop.

7.9 To check that spurious polarity reversal is not caused by power supply failure

a) Switch the power supply off then on again while observing the polarity indicators. Repeat this several times.

b) The same polarity LED should always be illuminated when the power supply is switched on.

c) If this test is not passed check the power supply detector circuit.

7.10 To check that spurious polarity reversal is not caused by programme

a) Connect pins 2 and 3 to a source of music (radio 1) for 5 minutes and then connect 2 and 3 to a source of speech (radio 4) for 5 minutes. Observe the polarity indicators during these periods.

b) The polarity indicators should not change under these conditions.

c) If this test is not passed repeat section 7.7.

7.11 To check the Power Supply Detector Circuit

a) Connect an AVO, set to the Ω range, between pins 6 and 8. Gradually reduce the 25 volt power supply until the AVO indicates an open circuit and note the power supply voltage at which this occurs.

b) The voltage should be 20 $\pm$ 2 volts.

c) If this test is not passed check D7, TR7 and RLB.

D45381 A4

SHEET 1 OF 8 SHEETS

ISS.	CHANGE
2	14-3-79

ITEM No.	No. OFF	DESCRIPTION		C'C'T REF.	BBC REF. OR DRG. No.
		DRAWING NUMBERS			
		CIRCUIT	D45380 A2		
		PARTS LIST	D45381 A4		
		ASSY & WIRING	D45382 A2		
		DETAILS	D45383 A2		
		P.B WIRING	D45384 A2		
		P.B WIRING (COMP SIDE)	D45385 A2		
		P.B COMP LOC	D45386 A3		
		P.B DRILLING	D45387 A3		
		FURTHER INFORMATION REQUIRED FOR MANUFACTURE :-			
		ASSY INFORMATION	E.A 10484		
		WIRING INFORMATION	E.A 10140		
1.	1	CHASSIS, CH1/65A TO BE MODIFIED BY CONTRACTOR AS FOLLOWS :			
		FRONT PANEL			D45383 A2 DET 1
		CODING PLATE			" DET 3
		HANDLE			" DET 4
2.	1	PRINTED BOARD			D45384 A2, D45385 A2 D45386 A3, D45387 A3
4					
5					
6					
7					
8					
9					
10					
		SCREWS	FOR FIXING ITEM		
11	6	M2.5 x 6LG PAN HD MS Zn P	2		
12	2	M2.5 x 8LG " " " " "	1S1		
13					
		NUTS			
14	2	M2.5 HEX, MS. Zn P	1S1		
15					
		WASHERS			
16	8	M2.5 PLAIN MS Zn P	2, 1S1		
17					
18					
19					
20					
21					
22					
23					

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DS/PLA4

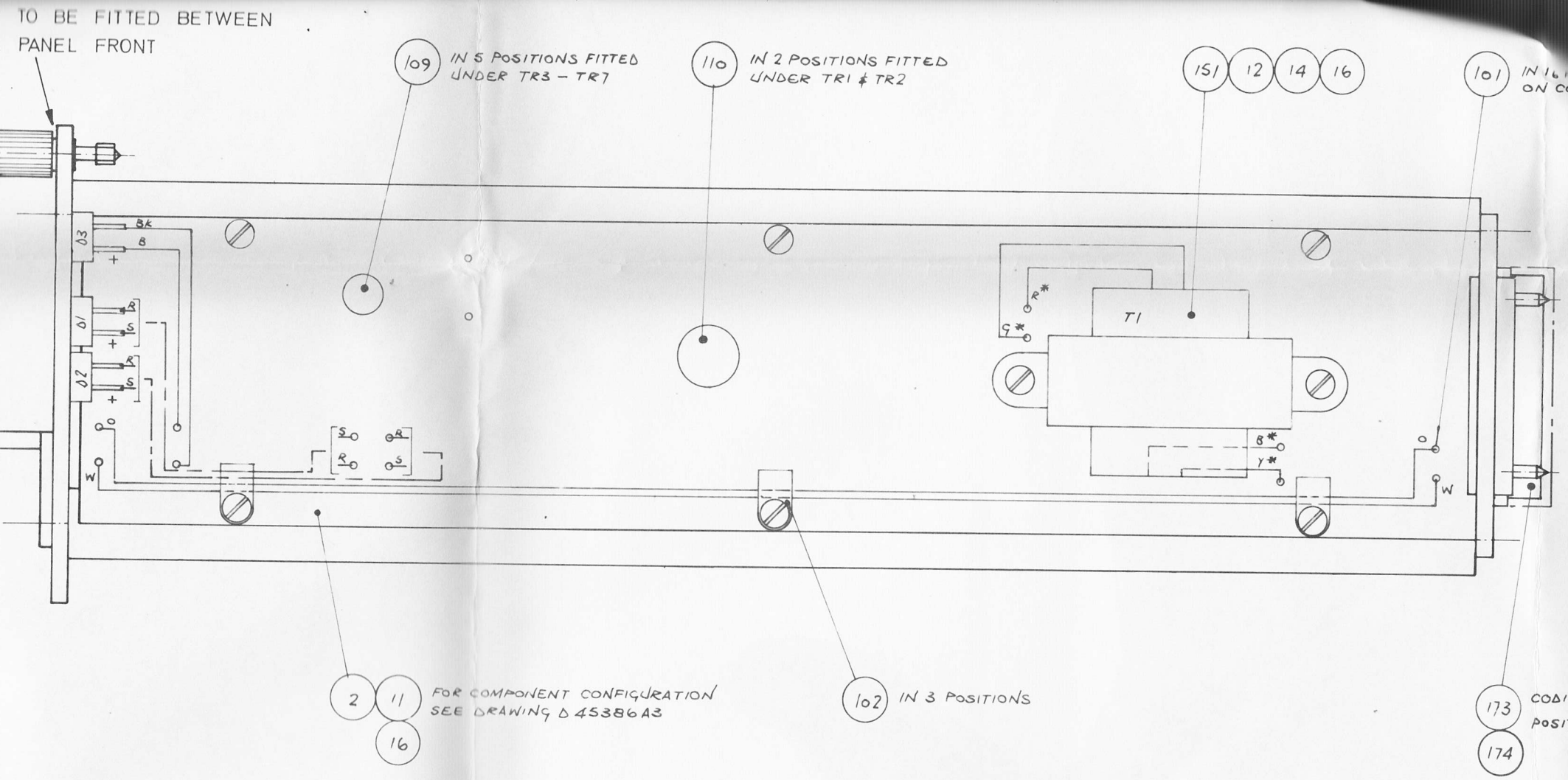
MN4/6 PARTS LIST
AUTO, POLARITY CORRECTOR UNIT

DRN.	K. TURNER	DESIGNS DEPARTMENT
TPD.		D45381 A4
CKD.		SHEET 1 OF 8 SHEETS.
APPD.	GS	

CIRCUIT REFERENCE INDEX

END OF CIRCUIT REFERENCE INDEX.

S & H LTD L 4321B


TO BE FITTED BETWEEN PANEL FRONT
109 IN 5 POSITIONS FITTED UNDER TR3 – TR7
110 IN 2 POSITIONS FITTED UNDER TR1 & TR2
151 12 14 16
101 IN 16 POSITIONS ON COMP SIDE
D3
D1
D2
BK
B
R
S
W
T1
R*
G*
B*
Y*
2 11 16 FOR COMPONENT CONFIGURATION SEE DRAWING D 45386 A3
102 IN 3 POSITIONS
173 174 CODING PINS IN POSITION A/1