

TECHNICAL SERVICE MANUAL for

MAESTRO[®] PHASER



Model MP-1

2500 Walden Ave.
Buffalo, N.Y. 14225

Norlin
NORLIN MUSIC, INC.
(716) 681-7242

INTRODUCTION

This manual provides servicing and parts information for Maestro Model MP-1 Phaser, manufactured by Norlin Music, Inc., 2500 Walden Avenue, Buffalo, New York 14225. The Maestro Phaser generates standard phasing effects for guitar, bass and other electroacoustical music signals. Specifications for the Maestro Phaser include:

Input Impedance	1 megohm
Maximum Recommended	
Input Level	-10dBm
Output Impedance	5K ohms
Insertion Loss	0dB
Output Noise	-82dBm
Phasing Stages	6
Range of SPEED Control	0.10 Hz to 6.5 Hz
Power Requirements	9.0 VDC at 3.0 milliamperes nominal
Recommended Battery Type	NEDA 1604
Estimated Battery Life	100 hrs.

CIRCUIT DESCRIPTION

The Maestro Phaser produces phasing effects by movement of an active filter and consists of: (1) an input buffer and summing amplifier section which conditions the input signal from the signal source; (2) a six stage current controlled phase shifting chain which generates the phasing effect; (3) a low frequency triangle oscillator and exponential current source which drives the phase shift chain; and (4) a power supply section which powers the unit. Operating controls consist of a SPEED control which adjusts the phasing rate, a BALLS control which adjusts the phasing effect and an internal foot switch which selects either the output of the phase shift chain or the unaltered signal. Refer to Figure 4 for the schematic diagram.

Input Buffer and Summing Amplifier

In the phasing mode, the input signal from AXE jack J1 is coupled to input buffer IC1A converting the source's high input impedance to a low output impedance for driving summing amplifier IC1B. IC1B inverts the signal, adds a gain of 1.4 and sums the output signal from BALLS control R35 with the input signal. The output of summing amplifier IC1B drives the phase shift chain.

Six Stage Phase Shift Chain

The phase shift chain starts with IC2, an operational transconductance amplifier (OTA) with a Darlington output stage. The OTA has a current output with very high output impedance while the Darlington stage isolates the output of the OTA from the load. IC2 is used as a current controlled phase shift element and, with surrounding circuitry, can be substituted by the simple equivalent circuit illustrated in Figure 1.

The signal from IC1B is coupled through C5 and R_C in series with an inverter resulting in a network with a gain of one and a frequency dependent phase shift. With a dc input, C5 has no effect on phase resulting in a phase shift of 180 degrees. As the frequency increases, C5 comes into effect and the phase shift heads toward 360 degrees. At a frequency equal to $2\pi R_C C$, the phase shift is 270 degrees. The value of R_C is controlled by I_C into pin 5. As I_C increases, the effective value of R_C as well as the phase decreases but gain remains the same. Therefore, the phase shift is current controlled.

IC3 through IC6 operate in a manner identical to IC2. The phase shift of each stage adds to all previous stages and since they are driven by the same current from Q1B, they move together. The five moveable stages are followed by a stationary stage, IC7B. This phase shift stage is fixed and operates the same as the equivalent circuit with R_C replaced by

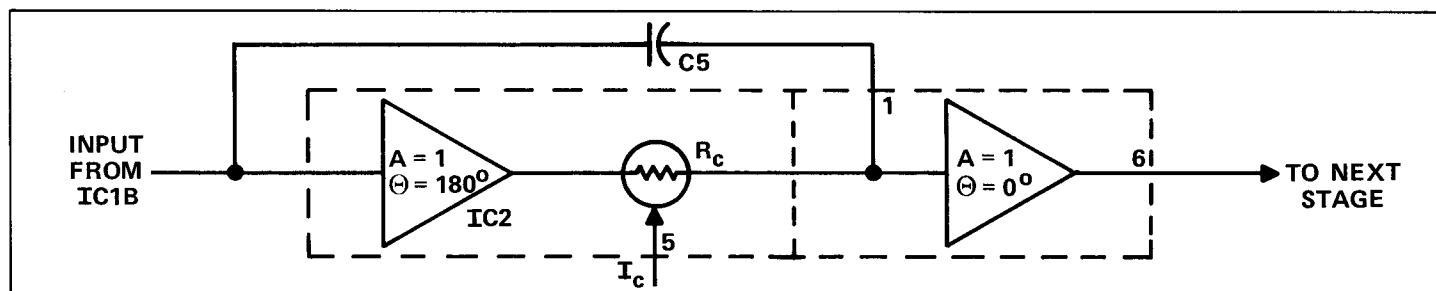


FIGURE 1 SIMPLE EQUIVALENT CIRCUIT

R33 adding a fixed phase shift to the chain. The output of IC7B drives BALLS control R35 and R36. R36 and R37 sum the outputs of IC7B and the original signal resulting in cancellation of the signal at frequencies where there are 180 degree phase shifts. With 100 microamperes of current through Q1B, these frequencies are 500 Hz, 2.25 KHz and 8 KHz. These notch frequencies move with the control current resulting in the phasing effect. BALLS control R35 applies positive feedback around the phase shift chain resulting in resonant peaking between notches. At our example current, these frequencies are 35 Hz, 1.2 KHz and 4.1 KHz.

Low Frequency Oscillator and Exponential Current Source

IC8A and IC8B form a dual slope integrating triangle oscillator of standard design and will not be discussed here. The triangle waveform from IC8A is applied to a lowpass shelf filter composed of R46, C17, R47 and R48. This filter reduces the amplitude of the triangle wave at higher frequencies to maintain smooth phasing. The filter output is applied to the input attenuator for exponential current source Q1 which reduces the signal level at the base of Q1B to a maximum of 120 mv. Exponential current source Q1 comprises a matched pair of NPN and PNP transistors and a constant current sink, Q3. When the voltage at the base of Q1A equals the 4.5 volt supply, collector current from Q1B equals the current through Q3 which is adjusted by center trimpot R50. This adjustment affects the center point of the phase shift chain. When the base of Q1B rises 18 mv above the 4.5 volt supply, current from Q1B doubles from its previous value. Another 18 mv rise results in another doubling and vice versa. This circuit changes the linearly varying triangle to an exponential varying current. The 120 mv drive from the filter to Q1B results in six octaves of current.

Power Supply

The main power supply for the Maestro Phaser is a 9 volt battery which is connected to the circuit when a standard phone plug is inserted in AXE jack J1. R39, R40 and IC7A provide a low impedance supply voltage at half the main supply voltage.

DISASSEMBLY

a) Pull out plungers on battery holder assembly (1, Figure 2) and remove battery holder assembly.

Disconnect battery (2) if present and remove.

b) Loosen setscrews (3) securing dial assemblies (4 and 5) by inserting a 1/16 inch Allen wrench through holes in dial assemblies and remove dial assemblies.

c) Remove nut (6) using a half inch nut driver, lock washer (7), three screws (8) and screw (9) from each end cap (10) and remove both end caps.

CAUTION

Do not set Maestro Phaser on its side when removing second end cap as damage to rotary pot shaft may result.

d) Position Maestro Phaser face down and carefully slide hinge assembly (11) out of housing assembly (24) making certain spring (12) around push switch assembly (15) does not fly off and remove spring.

e) Disconnect three pin connector on printed circuit board assembly (23) noting black wire on left side of connector.

f) Remove nuts (13) using a half inch nut driver and flat washers (14) from AXE and AMP jacks.

g) Remove hex nut (16), lock washer (17) and flat washer (18) and slide out push switch (20), lock washer and hex ring. Carefully remove printed circuit board assembly (23).

h) Slide foot pads out of their channels if replacement is required.

TEST, ADJUSTMENT AND TROUBLESHOOTING

The Maestro Phaser requires one adjustment to set the phase shift chain to the correct reference frequency assuring the unit will sweep over the correct frequency range. When troubleshooting, refer to the circuit description, schematic diagram and replacement part lists. Observe dc voltage levels and ac signal levels as shown on the schematic diagram using an oscilloscope. A high impedance voltmeter (1 megohm per volt or higher) may be used to measure dc voltage levels. Note that voltage levels and

waveforms displayed on the schematic diagram are not absolute values as readings may vary between units. Once the problem is localized, check the suspected part by direct substitution if possible. Otherwise use a voltmeter or oscilloscope to determine the malfunctioning part.

NOTE

All replacement parts may be obtained from Norlin Music, Inc. However, many standard electronic parts may be obtained locally in less time than is required to receive them from Norlin. When purchasing replacement parts locally, check the parts list for proper value, tolerance and rating.

a) Visually inspect unit for broken wires, damaged components, loose connections and other obvious defects.

b) Make certain unit is connected and operated according to Owners Manual or instruction label located on bottom of unit. If possible, check associated equipment such as cables, battery or amplifier used with the unit.

c) Turn BALLS and SPEED controls to "0" and variable resistor R50 full counterclockwise.

d) Connect a 9 volt power supply with a 0 to 10 ma meter connected in series to the battery clip and apply a 2.25 KHz, 100 mv peak-to-peak sine wave to AXE jack J1.

e) Connect an oscilloscope to output AMP jack J2 and a short clip lead across R49 (located near printed circuit board center, Figure 3).

f) Adjust R50 for an indication of 1.8 ma on the milliampere meter and adjust R50 back and forth for a null indication on oscilloscope. Milliampere meter should indicate 2 ± 0.25 ma.

g) Check for null indications at 550 ± 100 Hz and 8 ± 1 KHz. Adjust BALLS control to "9" and observe oscilloscope for a peak indication at 1.2 ± 0.1 KHz with a voltage level of 700 ± 50 mv peak to peak. Disconnect clip lead across R49 and 9 volt power supply from unit.

REASSEMBLY

a) Reassemble Maestro Phaser in reverse order of disassembly referring to the exploded view (Figure 2) and noting the following additions.

b) Finger tighten nuts (13) securing printed circuit board assembly (23) to housing assembly (24) to allow printed circuit board assembly to fit into slots of end caps (10). After both end caps are installed, tighten nuts (13).

c) Connect three pin connector (21) to printed circuit board assembly (23) making certain black wire (pin 1) is on left side of connector at bottom of printed circuit board.

d) Slip dial assemblies (4 and 5) on rotary pot shafts (left dial assembly (4) marked "L" between "9" and "0" and right dial assembly (5) marked "R" between "9" and "0") and turn each dial assembly full counterclockwise and then clockwise.

e) Turn right dial assembly full counterclockwise. Holding dial assembly steady at "0," insert small screwdriver in hole at center of dial assembly and turn pot shaft full counterclockwise, then approximately five degrees clockwise to relieve strain on pot shaft. Tighten setscrew (3).

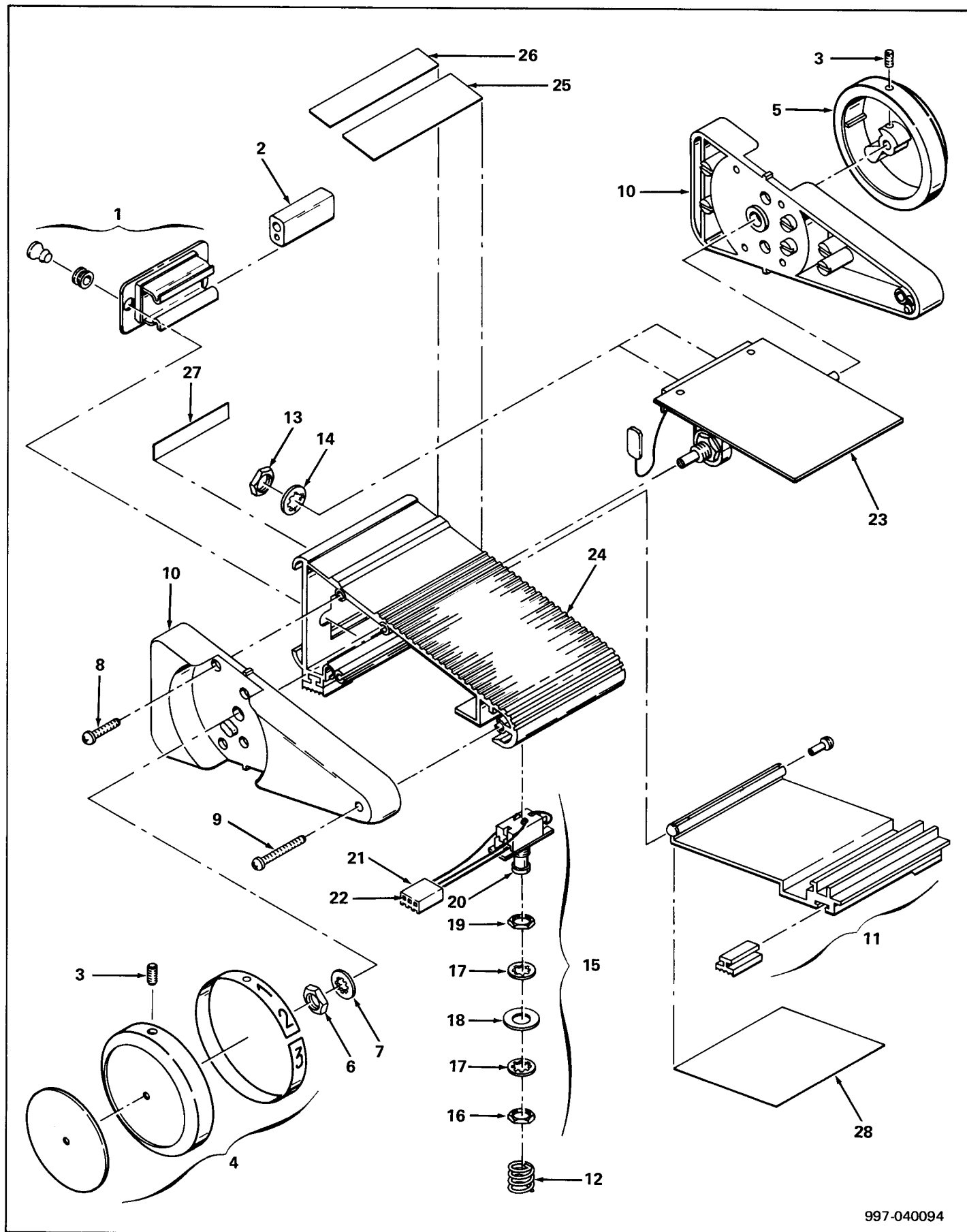
f) Turn left dial assembly full clockwise. Holding dial assembly steady at "0," insert small screwdriver in hole at center of dial assembly and turn pot shaft full clockwise, then five degrees counterclockwise to relieve strain on pot shaft. Tighten setscrew (3).

g) Rotate both dial assemblies making certain their range is from "0" to "9."

REPLACEMENT PART LISTS

ORDERING

The following lists specify parts available from Norlin Music, Inc., Customer Service Department, 2500 Walden Avenue, Buffalo, New York 14225, (716) 681-7242. Please specify the unit name, model, serial number, part description, electrical reference designator if applicable and part number when ordering.



997-040094

FIGURE 2 MAESTRO PHASER EXPLODED VIEW

MAESTRO PHASER REPLACEMENT PARTS LIST

INDEX NO.	PART NUMBER	DESCRIPTION	QTY
Figure 2	997-040094-001	Maestro Phaser	—
1	997-040040-001	Battery Holder Assembly, consisting of:	1
	964-040004-001	Battery Holder	1
	930-040044-001	Plunger	2
	930-040043-001	Grommet	2
2		Battery, 9 Volt, NEDA 1604	Ref
3	903-040486-061	Set screw, No. 6-32 x 5/16 lg, Cup Point (Clad Plate)	2
4	997-040041-001	Dial Assembly, Left Side, consisting of:	1
	964-040020-001	Dial	1
	913-040022-001	Decal, Dial, Left Side	1
	913-040046-001	Decal, Disc	1
5	997-040041-003	Dial Assembly, Right Side, consisting of:	1
	964-040020-001	Dial	1
	913-040022-003	Decal, Dial, Right Side	1
	913-040046-001	Decal, Disc	1
6	902-040504-007	Nut, 3/8-32	2
7	904-040495-014	Lock Washer, 3/8 Int.	2
8	811-040039-010	Screw, Self Tapping, No. 6A x 5/8 lg	6
9	811-040032-016	Screw, Self Tapping, No. 6A x 1 lg	2
10	968-040009-001	End Cap, Die Cast	2
11	997-040039-001	Hinge Assembly, consisting of:	1
	968-040014-001	Hinge Extrusion	1
	916-040021-001	Foot Pad	2
	905-040045-004	Rivet, Nylon	2
12	975-040128-001	Spring, Compression	1
13	902-040504-007	Nut, 3/8-32	2
14	904-042026-001	Flat Washer, 3/8	2
15	997-040124-001	Push Switch Assembly, consisting of:	1
16	902-040504-006	Hex Nut (15/32 Bushing)	1 Ref
17	904-040065-015	Lock Washer (15/32 Bushing) Int. Tooth	2
18	904-041495-006	Flat Washer (15/32 Bushing)	1
19	902-041442-007	Hex Ring (15/32 Bushing)	1 Ref
20	960-040127-001	Push Switch, SPDT	1
21	910-041714-003	Housing, Terminal, 3 Position	1
22	910-041720-001	Pin	3
23	996-040063-001	Printed Circuit Board Assembly (Refer to Figure 3)	1
24	997-040126-001	Housing Assembly, consisting of:	1
	968-040013-001	Housing Extrusion	1
	916-040021-001	Foot Pad	2
	997-040124-001	Push Switch Assembly (See 15, Figure 2)	Ref
	997-040039-001	Hinge Assembly (See 11, Figure 2)	Ref
	975-040128-001	Spring, Compression (See 12, Figure 2)	Ref
25	913-040089-001	Decal, BALLS-SPEED	1
26	913-040086-001	Decal, MAESTRO PHASER	1
27	913-040050-001	Decal, AXE-AMP.	1
28	913-040081-001	Instruction Label	1
	993-040396-001	Owners Manual	1

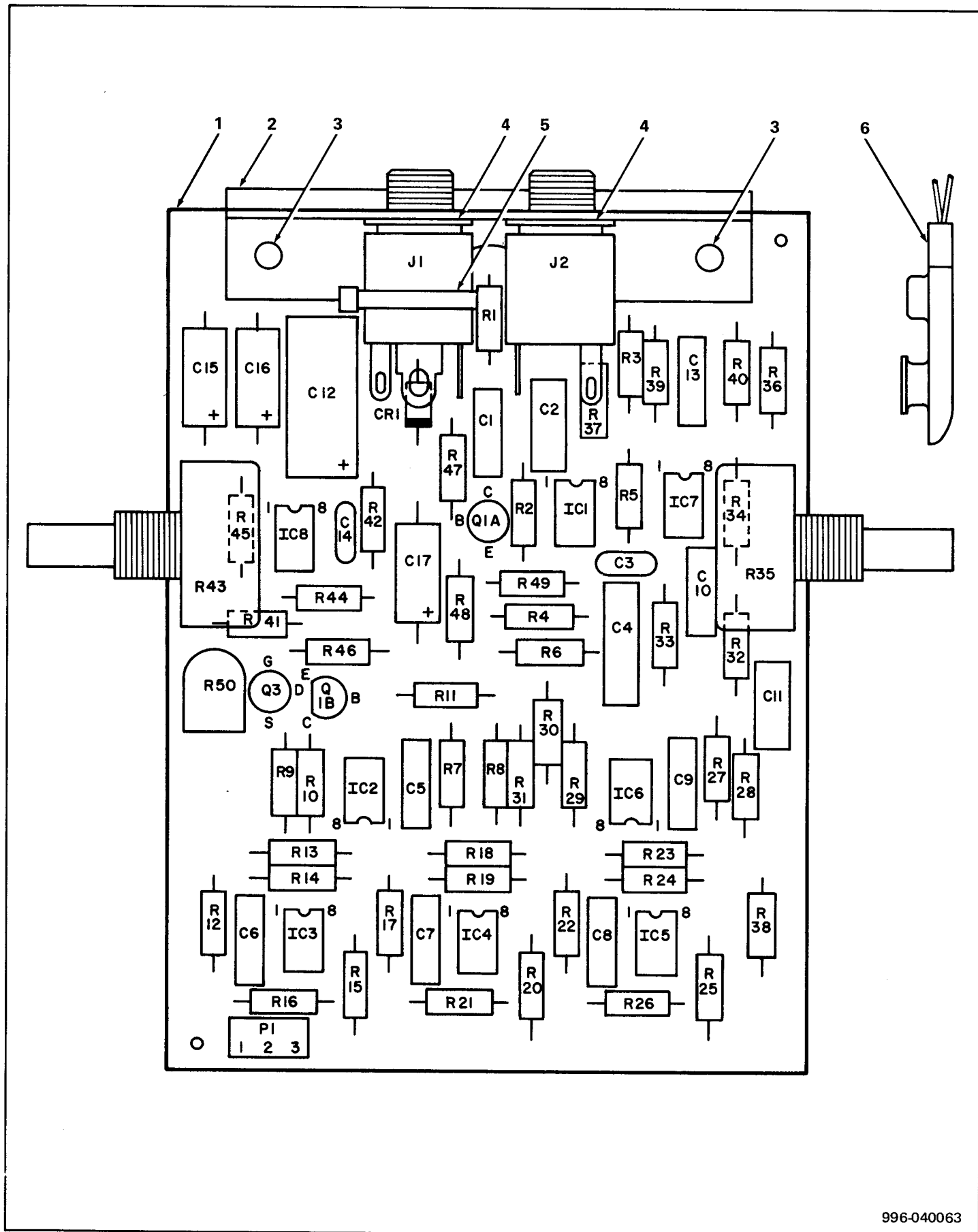
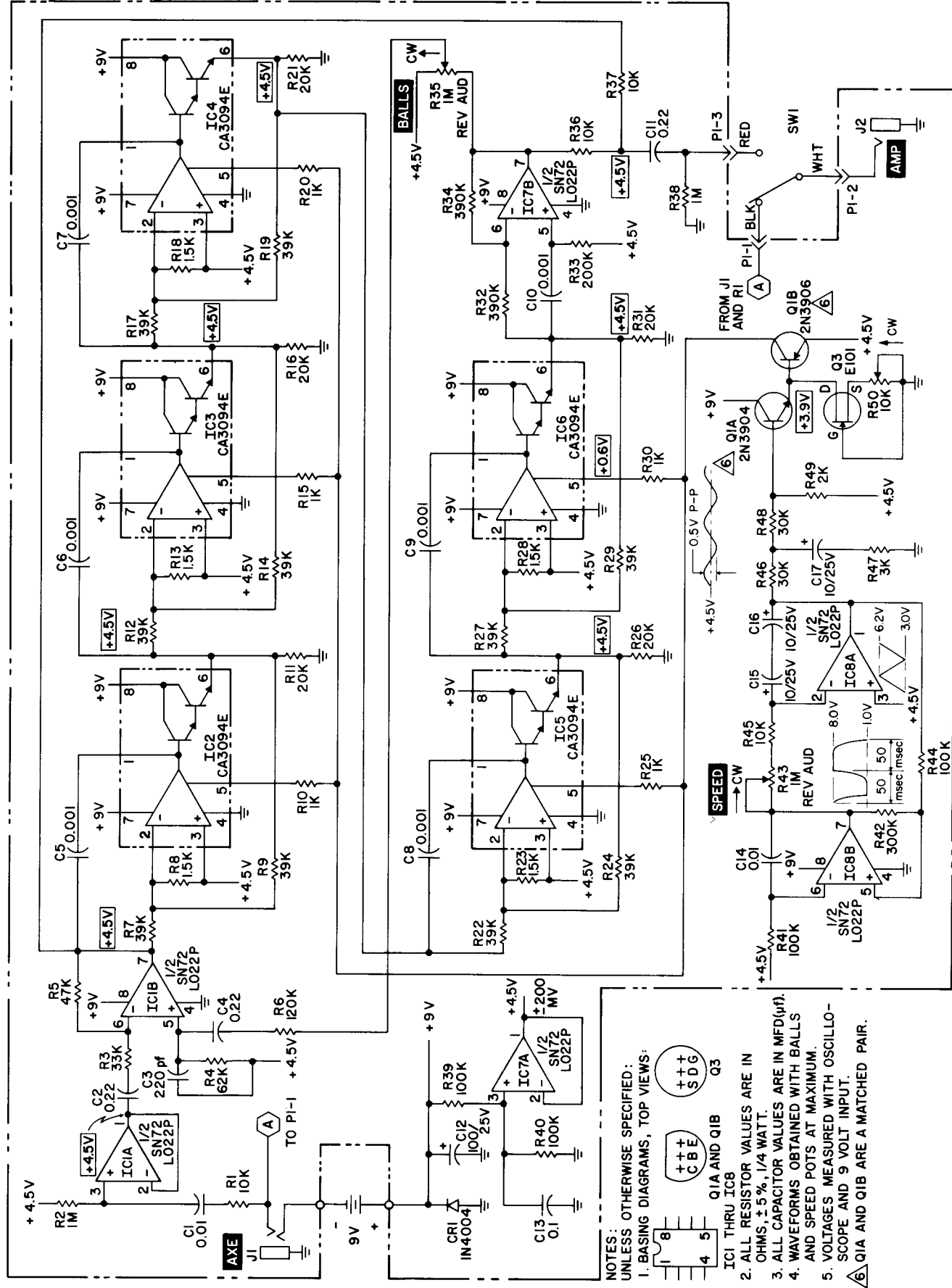


FIGURE 3 PRINTED CIRCUIT BOARD ASSEMBLY

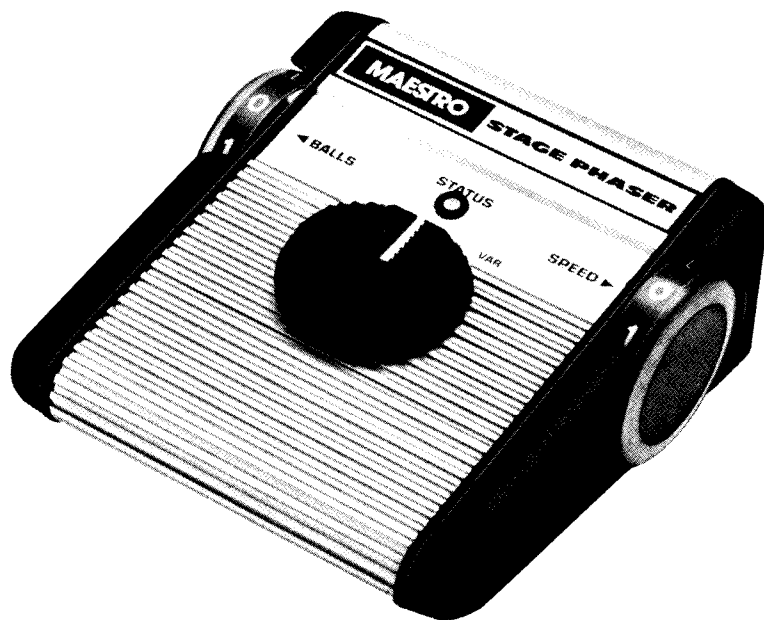
PRINTED CIRCUIT BOARD ASSEMBLY REPLACEMENT PARTS LIST

INDEX NO. OR REF DESIG	PART NUMBER	DESCRIPTION	QTY
Figure 3	996-040063-001	Printed Circuit Board Assembly, consisting of:	—
1	980-040062-001	Printed Circuit Board	1
2	967-040019-001	Angle Bracket	1
3	905-040498-001	Pop Rivet, 1/8 Dia.	2
4	904-040065-014	Lock Washer, 3/8 Int.	2
5	976-040791-002	Cable Tie, Small	1
6	935-041601-001	Battery Clip, 9 Volt	1
C1	946-041978-103	Capacitor, Polyester, 0.01 uf	1
C2, C11	946-041978-224	Capacitor, Polyester, 0.22 uf	2
C3	947-042020-221	Capacitor, Disc, 220 pf.	1
C4	946-040123-224	Capacitor, Polyester, 0.22 uf	1
C5 thru C10	946-041978-102	Capacitor, Polyester, 0.001 uf	6
C12	945-040209-009	Capacitor, Aluminum, Electrolytic, 100 uf, 25 V.	1
C13	946-041978-104	Capacitor, Polyester, 0.1 uf	1
C14	947-040200-103	Capacitor, Disc, 0.01 uf	1
C15 thru C17	945-040209-001	Capacitor, Aluminum, Electrolytic, 10 uf, 25 V.	3
CR1	919-042019-004	Diode, Rectifier, 1N4004	1
IC1, IC7, IC8	991-041209-001	Integrated Circuit, SN72LO22P	3
IC2 thru IC6	991-041210-001	Integrated Circuit, CA3094E	5
J1	910-041306-004	Jack, Phone, 2 Circuit, Switchcraft 112B	1
J2	910-041306-001	Jack, Phone, 1 Circuit, Switchcraft 111	1
P1	910-041803-003	Connector, Straight, 3 Position	1
Q1A	991-040672-001	Transistor, NPN, 2N3904, part of matched set.	1
Q1B		Transistor, PNP, 2N3906, part of matched set.	1
Q3	991-041275-001	Transistor, E101	1
R1,R36,R37,R45	852-312103-001	Resistor, 10K Ohms, $\pm 5\%$, 1/4 W	4
R2, R38	852-312105-001	Resistor, 1 Megohm, $\pm 5\%$, 1/4 W	2
R3	852-312333-001	Resistor, 33K Ohms, $\pm 5\%$, 1/4 W	1
R4	852-312623-001	Resistor, 62K Ohms, $\pm 5\%$, 1/4 W	1
R5	852-312473-001	Resistor, 47K Ohms, $\pm 5\%$, 1/4 W	1
R6	852-312124-001	Resistor, 120K Ohms, $\pm 5\%$, 1/4 W	1
R7,R9,R12,R14,R17, R19,R22,R24,R27,R29	852-312393-001	Resistor, 39K Ohms, $\pm 5\%$, 1/4 W	10
R8,R13,R18,R23,R28	852-312152-001	Resistor, 1.5K Ohms, $\pm 5\%$, 1/4 W	5
R10,R15,R20,R25,R30	852-312102-001	Resistor, 1K Ohms, $\pm 5\%$, 1/4 W	5
R11,R16,R21,R26,R31	852-312203-001	Resistor, 20K Ohms, $\pm 5\%$, 1/4 W	5
R32,R34	852-312394-001	Resistor, 390K Ohms, $\pm 5\%$, 1/4 W	2
R33	852-312204-001	Resistor, 200K Ohms, $\pm 5\%$, 1/4 W	1
R35	925-040078-001	Resistor, Rotary, Reverse, Audio, 1 Megohm, BALLS	1
R39,R40,R41,R44	852-312104-001	Resistor, 100K Ohms, $\pm 5\%$, 1/4 W	4
R42	852-312304-001	Resistor, 300K Ohms, $\pm 5\%$, 1/4 W	1
R43	925-040079-001	Resistor, Rotary, Reverse, Audio, 1 Megohm, SPEED	1
R46,R48	852-312303-001	Resistor, 30K Ohms, $\pm 5\%$, 1/4 W	2
R47	852-312302-001	Resistor, 3K Ohms, $\pm 5\%$, 1/4 W	1
R49	852-312202-001	Resistor, 2K Ohms, $\pm 5\%$, 1/4 W	1
R50	925-040275-004	Resistor, 10K Ohms, Trim, Carbon	1





MAESTRO FUZZ
MODEL MFZ-1
MANUAL NO. 993-040657



MAESTRO STAGE PHASER
MODEL MSP-1
MANUAL NO. 993-040660



MAESTRO FUZZTAIN
MODEL MFZT-1
MANUAL NO. 993-040659