ALESIS MicroVerb/ Microverb II (C1/C2) Service Manual

P/N: 8-31-0160-A

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Preface

This document is intended to assist the service technician in the operation, maintenance and repair of the Alesis device. Together with the User Reference Manual, this document provides a complete description of the functionality and serviceability of the Device. Any comments or suggestions you may have pertaining to the document are welcome and encouraged.

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Warnings

TO REDUCE THE RISK OF ELECTRIC SHOCK OR FIRE, DO NOT EXPOSE THIS PRODUCT TO WATER OR MOISTURE.

The arrowhead symbol on a lightning flash inside a triangle is intended to alert the user to the presence of un-insulated "dangerous voltage" within the enclosed product which may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point inside a triangle is intended to alert the user to the presence of important operating, maintenance and servicing instructions in the literature which accompanies the product.

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Regarding the Power Supply Fuse

CAUTION: The product under service may employ the use of a replaceable fuse. Danger of fire or electrocution if fuse is incorrectly replaced. Replace with only the same type or equivalent type recommended by the equipment manufacturer.

Regarding the Internal Battery

CAUTION: The product under service may employ the use of a internal battery. Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instruction.

Safety Instructions

Carefully read the applicable items of the operating instructions and these safety suggestions before using this product. Use extra care to follow the warnings written on the product itself and in the operating instructions. Keep the operating instructions and safety suggestions for reference in the future.

1. Power Source. The product should only be connected to a power supply which is described either in the operating instructions or in markings on the product.

2. Power Cord Protection. AC power supply cords should be placed such that no one is likely to step on the cords and such that nothing will be placed on or against them.

3. Periods of Non-use. If the product is not used for any significant period of time, the product's AC power supply cord should be unplugged from the AC outlet.

4. Foreign Objects and Liquids. Take care not to allow liquids to spill or objects to fall into any openings of the product.

5. Water or Moisture. The product should not be used near any water or in moisture.

6. Heat. Do not place the product near heat sources such as stoves, heat registers, radiators or other heat producing equipment.

7. Ventilation. When installing the product, make sure that the product has adequate ventilation. Improperly ventilating the product may cause overheating, which may damage the product.

8. Mounting. The product should only be used with a rack which the manufacturer recommends. The combination of the product and rack should be moved carefully. Quick movements, excessive force or uneven surfaces may overturn the combination which may damage the product and rack combination.

9. Cleaning. The product should only be cleaned as the manufacturer recommends.

10. Service. The user should only attempt the limited service or upkeep specifically described in the operating instructions for the user. For any other service required, the product should be taken to an authorized service center as described in the operating instructions.

11. Damage to the Product. Qualified service personnel should service the unit in certain situations including without limitation when:
    a. Liquid has spilled or objects have fallen into the product,
    b. The product is exposed to water or excessive moisture,
    c. The AC power supply plug or cord is damaged,
    d. The product shows an inappropriate change in performance or does not operate normally, or
    e. The enclosure of the product has been damaged.

1.0 General Description

The MicroVerb and MicroVerb II digital reverbs achieve their results by slicing analog signals into segments, and then converting them to a numeric value corresponding to the amplitude of the signal at that particular instant. These values are then mathematically manipulated and stored at various locations in a memory "loop" for eventual playback. By varying the placement and amplitude of incoming samples, discrete time delays are achieved. When mixed together, and converted back into analog, these delays simulate the reflections associated with natural reverb, as well as non natural effects such as reverse reverb, and gated reverbs. This service manual covers both the Alesis MicroVerb and MicroVerb II, since both units are virtually the same. The differences between these units are the algorithms programmed into the EPROM (U1), the digital clock rate, and the input filter values.

2.0 Power Supply

The power supply begins with the 9 Volt A.C., adapter (Alesis P2 type). Input from J6 is R.F. filtered by C1. From there it is split for the +12V, -12V, and +5V rails. The +12V rail consists of a voltage doubler (C5, C6, and D2, D4), a 7812 regulator (VR2), and filter capacitors (C10, C21). The -12V rail is a "mirror" of the +12V rail, consisting of voltage doubler (C4, C7, and D3, D5), a 7912 regulator (VR3), and filter capacitors (C11, and C22). The +5V rail consists of a rectifier diode (D1), filter capacitors (C2, C3, C9), a 7805 regulator (VR1), and a multitude of 0.1uF bypass capacitors.

3.0 Analog Signal Paths

The inputs (stereo) from J1 and J2 pass through the A.C. coupling capacitors (C35, C36) and have their impedances fixed at 1M by R5 and R7. While operating the unit monauraly (right input only), the input impedance is fixed at 500K (R5, and R7, in parallel). From there, the inputs are buffered by U16, and passed through the input potentiometers. The stereo signal is then sent to a low pass filter/buffer (U16 etc.) and on to the dry side of the mix potentiometer, as well as summed to mono (Via R12, R13, and defeat jack J5).

The summed stereo signal is sent to the anti-aliasing filter consisting of most of U15, and associated resistors and capacitors. There are several important features in the filter to be aware of. The first is the use of the LSTMSB (See section 4.1 for a description) signal from the ASIC. This signal is injected into the signal path at U15 pin 5. A signal diode/capacitor combination (D8, C32) at U10 pin 12 shunts any incoming signal exceeding 5V to the power supply of U9, preventing damage to the analog switch.

The input sample and hold circuit consists of 1/3 of the 4053 analog switch (U9B), the input sample capacitor (C20), a buffer amplifier (U10), and a comparator (U8).

The signal beyond this point is purely digital, until the DAC output cycle of the DASP 16. At the appropriate time, the DAC will output the processed left and right signals. This action is coordinated with the two output sample and hold circuits (U9 A&C, 2 op amps of U10, C18, C19), so that each receives the correct, separate signal for stereo output. After passing through low pass (anti aliasing) filters and buffering (2 op amps of U15, Misc. Resistors & Capacitors), the signals are sent through the wet side of the mix potentiometer. From here, they pass through R13, R14 to the output potentiometer, and finally on to the output jacks (J3, J4).

4.0 Digital Signal Paths

4.1 The DASP 16 ASIC

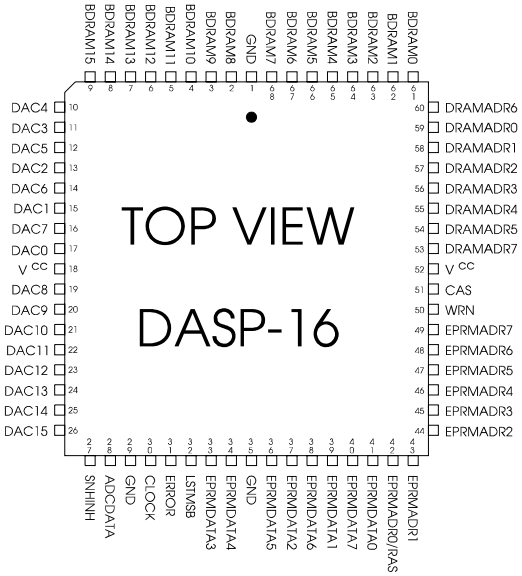


Diagram 1

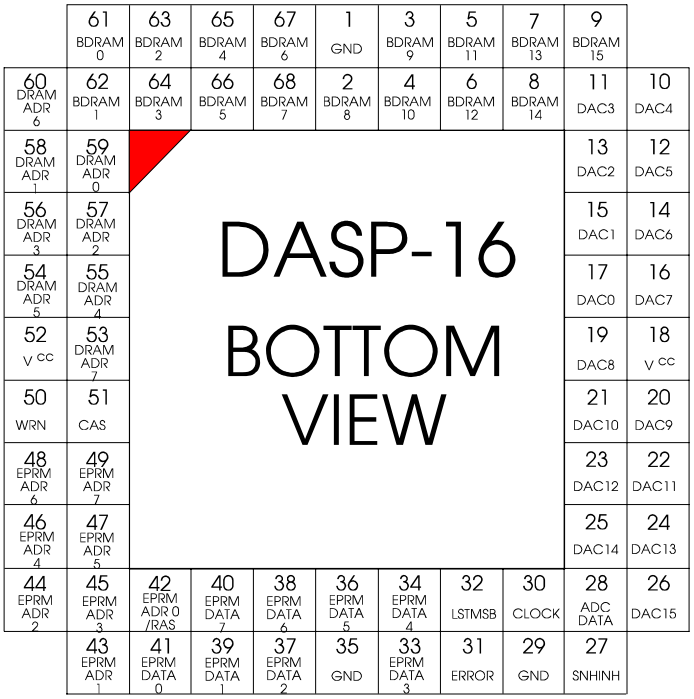


Diagram 2

Below is a description of the most important DASP-16 pins.

Pin #(s)	Name	Function
61-68, 2-11	BDRAM0-15	DRAM Data buss.
10-17, 19-26	DAC0-15	DAC Data outputs.
27	SNHINH	Controls sample and hold circuit timing.
28	ADCDATA	A/D comparison input.
30	CLOCK	ASIC Clock input (6MHz for MicroVerb or 8Mhz for MicroVerb II)
31	ERROR	This signal indicates a math overflow condition, and consequently turns on the clip LED circuit.
32	LSTMSB	This signal indicates the last state of the MSB (the sign bit in two's complement math). This signal, in conjunction with R27, R29, R44, and C17, is used to bias the incoming analog signal slightly positive, or negative, depending on the result of the last DAC cycle (i.e. if the last DAC cycle started off with a negative value, LSTMSB will be 1, causing the input to the sample and hold circuit to pull slightly positive. On the next cycle, the reverse will occur). This reduces any audio pop during the attack portion of the input signal, and allows for a faster response to small signals.
33-34, 36-41	EPRMDATA0-7	EPROM Data buss.
42-49	EPRMADR0-7	EPROM Address buss.
50	WRN	Write ENable line to DRAMs.
51	CAS	Column Address Strobe to DRAM.
53-60	DRAMADR0-7	DRAM Address buss.

4.2 The Shaft Encoder

At first the shaft encoder circuitry may appear more complex than is necessary to just switch programs. The reason for the extra circuitry is to ensure that noise isn't generated when switching programs. Diagram 3 shows the important signals present during preset switching (only 1 bit is shown for the encoder and latch, however, the principal applies to all 4 bits). Output from the shaft encoder is latched by U13 (note that the 4 outputs of latch that correspond to the outputs of the encoder are fed back to the other 4 data inputs of the latch). Any time that the shaft encoder changes, the upper 4 bits of the latch will be different from the lower 4 bits for exactly 1 clock cycle (on the next clock pulse, the lower 4 bits will change to the new value). 4 bit magnitude comparator U12 is used to detect these changes. Normally the **A=B** line of U12 (pin 6) stays high (the upper and lower 4 bits from U13 are equal) until the shaft encoder changes position. At this point, U12 **A=B** drops low, discharging C23. One U13 clock cycle later **A=B** again raises high allowing C23 to charge slowly through R39 (D7 provides protection for **A=B** during those times when **A=B** is high and C23 still has very little charge on it yet). Now note the line that travels from the junction of C23 and R39, via U11, to the **A12** line of the EPROM U1. This has the affect of temporarily forcing all use of the EPROM address buss to be limited to the lower half of the address space. The algorithms in this half of memory were written simply to clear the DRAMs of existing data during program changes, thus no data - no noise!

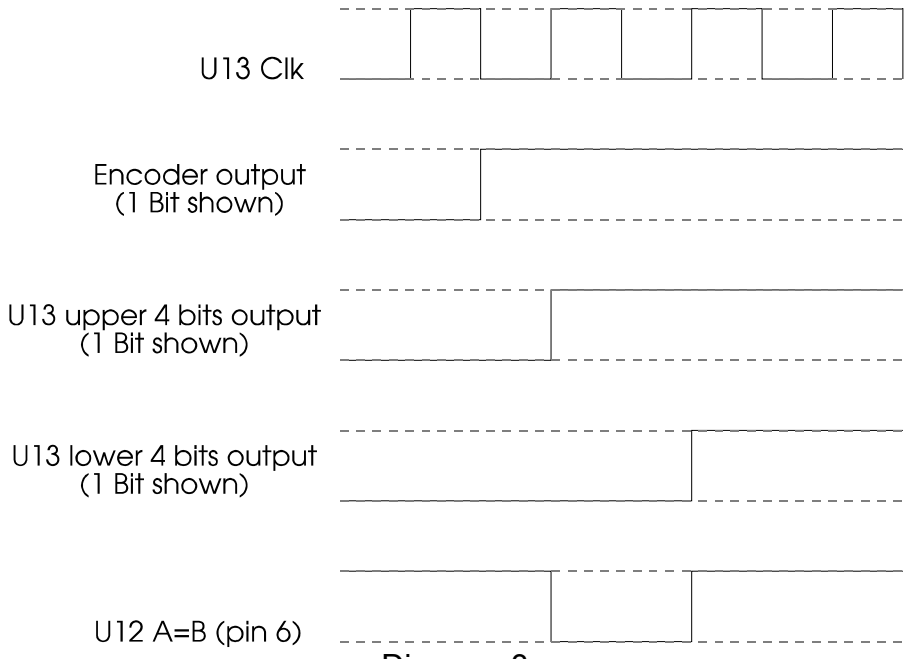


Diagram 3

4.3 Overflow Indicator

Due to the necessity of trying to convey several possible states with a single tricolor LED requires a small amount of logic (U14). The 3 states that need to be covered are:

- No signal input-LED is orange
- Signal is present-LED is green
- The ASIC is experiencing a math overflow-LED is red

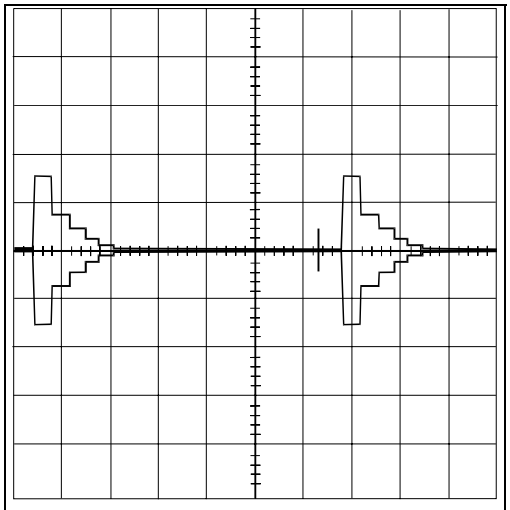
Whether or not a signal is present, it is input to the logic via Q1. Overflow conditions are sent to the logic from the ASIC. When no signal is present, the **EPRMADR7** line of the ASIC is used to switch between the red and green LED portions to simulate the appearance of orange.

5.0 Successive Approximation

Successive approximation is a "divide and conquer" approach to the process of analog to digital conversion. The idea here, is to divide the task into short, manageable sections. Each significant binary weight (starting with the Most Significant Bit) is taken in turn, thus requiring only 12 comparisons to achieve a final value.

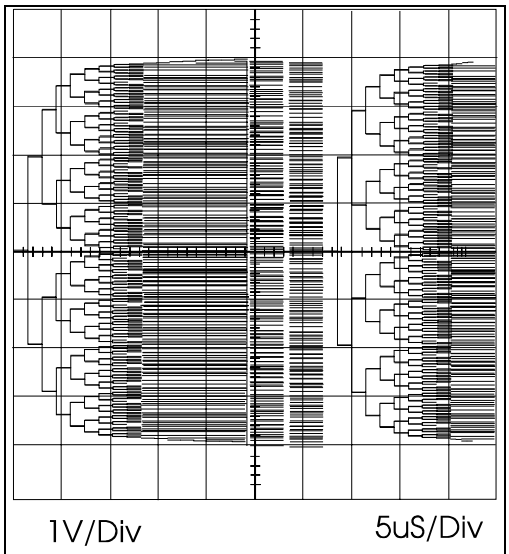
The process begins with the input "sample and hold circuit". 1 switch of U9 (4053) is turned on, allowing the input sample capacitor (C20) to charge (or discharge) to the level of the current input signal. When the switch is turned off, the capacitor will hold that level indefinitely

(barring internal leakage). At this point, the SAR (Successive Approximation Register) in the ASIC will take over. Starting with the MSB, the SAR will set the bit, and compare the output of the DAC to the level of the input sample capacitor (via comparator U8). The results of the comparison are stored, and the next most significant bit is tested. This process continues until a value is found for all 16 bits, and the data is ready for further processing by the ASIC. In order to see this signal properly on the scope, it will be necessary to use an external scope sync (Use U13 pin 11). Diagrams 4 and 5 show typical DAC output during successive approximation with no and high input levels respectively.



MicroVerb II Typical output w/ inactive SAR.

Diagram 4



MicroVerb II Typical output w/ fully active SAR.

Diagram 5

6.0 Updates and Corrections

6.1 C13

If a blue monoblock capacitor is found in this position, it must be replaced with a 0.1μF CerDisk or Film capacitor. The reason this is necessary is due to the fact that these capacitors were found to leak excessively for the circuit (these capacitors are fine for power supply filtering, but when used as a component in a voltage divider, the excess leakage will cause a significant enough of a voltage drop to trigger TTL logic). A faulty C13 will cause the LED to indicate an input signal is present (always green) regardless of input conditions.

6.2 C16

See Section 6.1 for details. A faulty C16 will cause the LED to indicate an overflow (always red) regardless of input conditions.

6.3 C20

Large Mylar capacitors in this position should be replaced with film capacitors. (again because of excessive leakage). A failure of this capacitor will cause distorted effects (wet signal).

6.4 C23

See Section 6.1 for details. If C23 is faulty, the unit will not have any effects out (no wet signal).

6.5 C32

See Section 6.1 for details. If C32 is faulty the +5V rail will not be solid at the 4053 (U9). This will manifest itself as a distorted wet signal.

6.6 Input/Mix/Output Potentiometers

Note that when replacing any of the 3 potentiometers due to "scratchiness", it's a good idea to replace all 3 if possible. This is due to the fact that disassembly and subsequent reassembly can cause the other potentiometers to fail in the same fashion. Also note that when replacing potentiometers, it's a good idea to reattach the front panel before soldering any new potentiometers in. This prevents damage to the potentiometers due to misalignment.

6.7 Goldstar 4053s (U9)

These devices have been found to be somewhat unreliable, and should be replaced. We are currently using Phillips CD4053s as replacements. The failure of this device usually causes extreme D.C. offset in the SAR output of the DAC.

6.8 Goldstar 7404s (U11)

These devices have been found to be somewhat unreliable, and should be replaced with TI 74HC14s. If this component fails it will cause small "Pops" to be heard when switching programs.

6.9 Beige Power Supply Jacks

These are older jacks and should be replaced with the newer black jacks (the older beige types have a tendency to break the center pin).

7.0 Test Procedures

Testing the MC or C2 is extremely simple.

- Use a clean audio source (CDs preferred) and set up the unit according to the user's manual.
- Listen to the wet (effects) output for any distortion.
- Be sure to move all of the potentiometers through the full range of their movement.
- Listen for any dropouts which would indicate a scratchy potentiometer.
- To ensure that the shaft encoders are functioning properly all programs should be listened to briefly.
- Turn the input level all the way down, and the output level all the up.
- Listen for excessive noise in the noise floor.
- As a final check it's a good idea to physically shake the unit so that no loose parts remain inside the unit.

8.0 Troubleshooting and Repair

Described Symptom	Possible Causes	Solution
Unit is completely dead. (No lights, no effects).	Faulty Power supply.	Replace supply and retest.
	Faulty P.S. jack.	Replace and retest.
	Faulty +5 volts.	Troubleshoot and repair as necessary.
Unit turns on, but no effects.	C23 is leaking.	Replace and retest.
	Faulty ASIC.	Troubleshoot and repair as necessary.
	Faulty DAC.	Troubleshoot and repair as necessary.
	Faulty 4053.	Troubleshoot and repair as necessary. (See also section 6.7).
LED stays green no matter what.	C13 is leaking.	Replace and retest.
LED stays red no matter what.	C16 is leaking.	Replace and retest.
	Faulty ASIC	Troubleshoot and repair as necessary.
	Problem with LSTMSB line. (This will usually be noticed as a DC offset in the signal at U14 pin 7).	Troubleshoot and repair as necessary. (See also section 4.1).
Distorted effects.	Failure in power supply section (+ or - 12V rail is bad).	Troubleshoot and repair as necessary.
	Faulty or wrong type 4053 (This can cause a DC offset at the input to the comparator [U8 pin 3]).	Troubleshoot and repair as necessary. (See also section 6.7).
	Faulty ASIC.	Troubleshoot and repair as necessary.
	Faulty DRAM(s).	Troubleshoot and repair as necessary.
	Faulty DAC	Troubleshoot and repair as necessary.
	Input sample capacitor is leaky.	Troubleshoot and repair as necessary.
Noise when switching effects.	Goldstar 7404s.	See section 6.8.
	Faulty shaft encoder.	Replace and retest.
Intermittent effects.	C23 leaking somewhat.	Replace and retest.
	Faulty shaft encoder	Replace and retest.
	Bypass jack normaling contact is dirty.	Troubleshoot and replace if necessary.

ALESIS MicroVerb/ Microverb II (C1/C2)

ECN HISTORY

○ Notice Only
● Implement Order
○ Waiver

ENGINEERING CHANGE ORDER

CM Release: BN

ALESIS STUDIO ELECTRONICS
3630 Holdrege Avenue, Los Angeles, CA. 90016
Voice-(310) 558-4530 ECO Fax-(310) 558-4907

E.C.O.#	S/N EFF.	EFF. DATE	PAGES
332701		11-19-93	1 OF 1

PART EFFECTED

USED ON : MICROVERB II
PRODUCT CODE : C2
ALESIS PART# : 0-03-0114 | ECO DATE : 11-19-93
PART NOMENCLATURE : RES 11K OHM 1/4W 5%
NEW REV -N/A PREV.REV -N/A
PREPARED BY : ADRIAN M. | PREPARED FOR : CONF. MNGTMNT.
NEW ALESIS PART# : 0-03-0113
NEW PART NOMENCLATURE : RES 11K OHM 1/4W 5%

CHANGE OUTLINE

DESCRIPTION OF CHANGE :
DELETE P/N 0-03-0114 FROM C2 BOM AND PART: MASTER FILE, AND REPLACE WITH P/N 0-03-0113 (EXISTING P/N)

REASON FOR CHANGE :
DUPLICATE ALESIS PART NUMBER (0-03-0114) IN AIMS PART MASTER CAN CAUSE PROBLEMS WITH THE MANUFACTURING OF THE PRODUCT.

NOTES / SPECIAL INSTRUCTIONS :
★ 0-03-0114 HAS NO INVENTORY RECORD IN AIMS.
★ 0-03-0113 HAS QTY OF 4830 IN STOCK
PM Ø
BOM Ø

VENDOR FURNISHED

VENDOR FURNISHED ? ○ YES ● NO

WAIVER INFORMATION

REASON FOR WAIVER : N/A

□ PERMANENT
□ TEMPORARY
START DATE
END DATE
WAIVERED BY:
S/N START
S/N STOP

APPROVALS

SIGNATURE OF...	SIGNATURE	DATE	DL
ENGINEERING MANAGER	N/A		
PROJECT ENGINEER	N/A		
MFG. ENG. MANAGER	William [illegible]		YES
PRODUCTION MANAGER	[signature]	11/23/93	YES
Q.E. MANAGER	[signature]	11/23/93	YES
PROD.CTRL. MANAGER	[signature] (for SM)		YES
BETA	N/A		
REGULATORY ENG.	N/A		
REPAIR MANAGER	[signature]	11/23/93	YES
PURCHASING MANAGER	[signature]	11/23/93	YES
INV. CTRL. MANAGER	SEE ABOVE		YES
SALES & MARKETING	N/A		
FAST FORWARD	N/A		
C.O.O.	N/A		

VENDOR FAX

VENDOR FAXED :				
BY :				

DRAWING

INCORPORATE CHANGE ? ○ YES ● NO N/A

DISPOSITION

	USE	RWK	OBS	QTY STOCK	QTY ON ORDER
PURCHASE ORDER - CURRENT					
INVENTORY STOCK				Ø	
KITS - PENDING		N/A			
KITS - WIP					
FINISHED GOODS					

CONFIG.MGMT.-REV.D-10/28/93-FS3:G:/USER/ADRIAN/CDR/ECO-D.CDR

ALESIS MicroVerb/ Microverb II (C1/C2)

BOM

9.0 Service Parts List

Note: This list reflects resistor and capacitor values for the MicroVerb II. Care should be taken when repairing the original MicroVerb to replace these components with the original value (not the one listed here for the MicroVerb II).

GROUP	DESCRIPTION	ALPARTNO	QTY	FROM	POSITION	PCB	MANUFACT	NOTES
CAP	0.01 MFD CERDISC	1-02-0103	3		C24,27,31	Main		C1/C2
CAP	0.01 MFD CERDISC 100V	1-02-0103	1		C1	Main		
CAP	0.033 MFD FILM 100V 5%	1-20-0333	2		C39,40	Main		
CAP	0.047 MFD 100V 5%	1-21-0473	1		C33	Main		
CAP	0.1 MFD 50V 5%	1-21-0104	3		C13,16,23	Main		
CAP	0.1 MFD 100V 5%	1-05-0104	5		C8,12,32,35,36	Main		
CAP	1000 PFD CERDISC	1-02-0105	3		C18-20	Main		
CAP	220 PF 100V 5%	1-21-0221	1		C34	Main		
CAP	30 PFD CERDISC 100V	1-02-0300	2		C14,15	Main		
CAP	330 MFD ELEC	1-09-0337	6		C2-7	Main		
CAP	330 PF 100V 5%	1-21-0331	1		C29	Main		
CAP	4.7 MFD ELEC	1-11-0475	8		C9-11,17,21,22,37,38	Main		
CAP	4700 PFD FILM 100V 5%	1-20-0472	4		C25,26,28,30	Main		
HDW	6-32x1/2 PF BLK	5-00-0001	2		FRONT PANEL SCREWS			
HDW	6-32x1/2 PP BLK	5-00-0002	2		REAR PANEL SCREWS			
IC	27C64 EPROM	2-19-0064	1		U1	Main		
IC	74HC00	2-14-7400	1		U14	Main		
IC	74HC04	2-14-7404	1		U11	Main		
IC	74HC374	2-14-0374	1		U13	Main		
IC	74HC85	2-14-7485	1		U12	Main		
IC	CD4053	2-23-4053	1		U9	Main		
IC	DASP-16 ASIC	2-27-0001	1		U2	Main		
IC	LM311	2-22-0311	1		U8	Main		
IC	PCM54HP	2-25-0054	1		U7	Main		
IC	TLO84 (LF347)	2-21-0084	3		U10,15,16	Main		
IC	TMS4416	2-16-4416	4		U3-6	Main		
JAC	1/4 CLIFF (MONO)	4-02-0001	5		J1-5	Main		
JAC	3.5mm JACK (P2)	4-16-0001	1		J6	Main		
ME	1N4002 POWER DIODE	2-01-4002	6		D1-6	Main		
ME	1N914	2-00-0914	1		D7,8	Main		
ME	2N4401	2-03-4401	1			Main		
ME	7805 +5V REG	2-11-7805	1		VR1	Main		
ME	7812 +12V REG	2-11-7812	1		VR2	Main		
ME	7912 -12V REG	2-11-7912	1		VR3	Main		
ME	8 MHz CER RES	7-01-0002	1		Z1	Main		
ME	LED (BI-COLOR)	3-03-0001	1		L1	Main		
ME	SHAFT ENCODER SWTCH	6-00-1001	1		S1	Main		
ME	XFORMER P2	7-40-0902	1					
POT	1 KB DUAL	0-09-1002	1		R2	Main		
POT	10 KB DUAL	0-09-1004	2		R1,3	Main		
RES	1.6K 1/4W 5%	0-03-0162	6		R16-19,21,22	Main		
RES	100 1/4W 5%	0-03-0101	1		R34	Main		
RES	10K 1/4W 5%	0-03-0103	1		R30	Main		
RES	11K 1/4W 5%	0-03-0114	2		R23,24	Main		
RES	150K 1/4W 5%	0-03-0154	1		R31	Main		
RES	1K 1/4W 5%	0-03-0102	8		R4,5,14,15,20,28,41,43	Main		
RES	1M 1/4W 5%	0-03-0105	5		R5,7,32,33,39	Main		
RES	220 1/4W 5%	0-03-0221	1		R42	Main		
RES	22K 1/4W 5%	0-03-0223	4		R35-38	Main		
RES	3K 1/4W 5%	0-03-0302	2		R25,26	Main		
RES	4.7K 1/4W 5%	0-03-0472	2		R9,11	Main		
RES	47K 1/4W 5%	0-03-0473	2		R8,10	Main		
RES	5.1M 1/4W 5%	0-03-0515	1		R44	Main		
RES	510K 1/4W 5%	0-03-0514	3		R27,29,40	Main		
RES	680 1/4W 5%	0-03-0681	4		R12,13,45,46	Main		
SOC	28 PIN DIP .6	4-06-0028	2		U1,7	Main		
SOC	68 PIN ASIC SOCKET	4-12-0068	1		U2	Main		
	CASE	9-02-1001	1					
	FRONT PANEL	9-01-1011	1					
	REAR PANEL	9-03-1013	1					
	RUBBER STRIP 5	9-23-1006	2					
	STANDARD KNOB	9-11-1001	4					