

Radio-Electronics

SPECIAL ISSUE—HI-FI & STEREO

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Radio-Electronics®

THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

BUILD WITH ONE IC
4-Channel Synthesizer

BOOKSHELF SPEAKERS
How To Buy A System

HI-FI
ACCESSORIES
That Are
Worth
Owning

R-E LAB HI-FI TESTS

★ **Pioneer CT-F9191**
Tape Deck

★ **Soundcraftsmen**
RP-2212 Equalizer



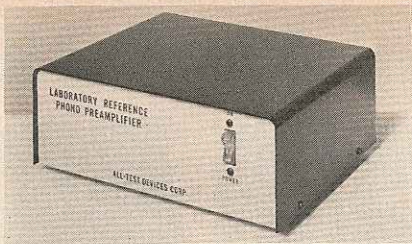
4-CHANNEL
SOUND
Where Is "QS" Going ?

PLUS

NEW HI-FI
TEST GEAR
For Precise Measurements

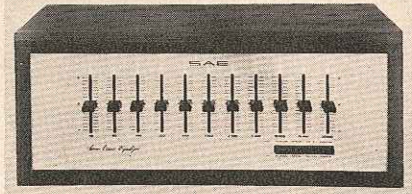
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Model ATD-25 "Laboratory Reference Phono-Preamplifier" priced at \$150. The add-on was designed to amplify magnetic phono cartridge signals to a level that will drive the high level inputs of any stereo preamplifier, integrated amplifier or receiver. The unit has less than 0.01 per cent IM distortion, thus giving you two similar sources for comparing magnetic cartridges. (NOTE: There is a caveat in this; All-Test claims that the input involving the ATD-25 will actually be superior to the existing magnetic input. The degree to which it will be superior will relate to the basic quality/price of the equipment; there will be more of a difference if the existing equipment is low priced.)



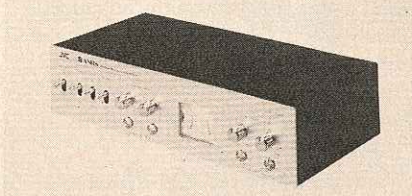
ALL-TEST DEVICES laboratory reference phono preamplifier.

If cartridge checkouts are not your bag, the ATD-25 will stand on its own original *raison d'être*—as a second, high quality magnetic phono facility that may be superior to an existing one.



SAE stereo octave equalizer.

Many stereo buffs are not convinced that four-channel sound is a viable entity yet. They are curious however, but not curious enough to make a grand investment in the growing medium. They have an "out" in the form of add-ons that will give them a taste of quadraphonics that may be sufficient to convince them they can live without quad sound, or to convince them they can't, and that they should make the grand investment. The add-ons are best described as "quad adaptors." They are low-priced passive devices that create a four-channel effect from stereo records, tapes or broadcasts in conjunction with a second pair of speaker systems. The instruments are priced as little as \$6.95 (Robins) and range up to \$40 in the Utah line. BSR markets a "package" of a quad adaptor and a pair of speaker systems for \$60.



JVC MODEL NR-1020 noise reduction unit.

(If you should succumb to the benefits of quad sound, you would be put in the position of evaluating your present equipment *vis-a-vis* the true-quad add-on equipment route, or starting off with a new quad receiver, amplifier or tape deck as your prime sound source. In either case, the subject is too involved to spell out within the scope of this article.)



BSR METROTEC sound level meter.

The Hi-Fi buffs using tape decks in their rigs have an excellent potential for expressing their creativity and expanding the capability of their equipment through add-on mixers. With such equipment they can produce special effects using multiple microphone and other sound sources, to mix and blend the sounds in a variety of ways to suit their fancy. The consumer type mixers generally have six channels of input and two channels of output for the mixed signal to be fed into the stereo tape recorder. However, if you have four-channel equipment, TEAC has a model with six channels in, four out, or if you wish, one, two or three out. Available from Sony, Pioneer and TEAC, the mixers range from \$59.95 for a passive model, up to \$250 for an amplified type. Two models are twin-powered, operating off house current and/or batteries.

built up with perfect synchronization on any two or three-head tape deck with the ability to record each channel independently.

Related to the mixers is a sound-on-sound and echo adaptor from Sony, Model SB-200. It is an inexpensive (\$39.95) way to add studio-type special effects in home recordings. Echo can be created, and its intensity regulated, on any three-head tape recorder. The sound-on-sound capability allows multiple source recordings to be

Another aid to tape recordists is a parabolic reflector from Sony, Model PBR-400, priced at \$79.95. The attachment was designed to pick up high quality sound from a distance. Depending on climatic conditions and surroundings, it has an effective recording range of several hundred yards. It can be used in a variety of ways, including field research recording such as capturing the sounds of birds, recording live concerts, speeches, sporting events, etc. The PBR-400 will improve the sound sensitivity of most omni-directional microphones by 10 to 20 dB over rated sensitivity, the company claims. The reflector is hand operable or can be mounted on a tripod.

A final aid to tape recordists—those into

tape in a big way—are multi-tape recorder switches. These enable the user to interconnect up to three different tape decks so that all or any can record or play at the same time in any combination, operating through a single preamp, amplifier, receiver or mixer. They are ideal for dubbing from one format to one or two others, or recording in all three basic formats simultaneously—as well as for other uses. Typical are models from Russound, the TMS-1W at \$22.95 and \$32.95, depending on finish, and Sony, Model SB-300 at \$44.95.

Audiophiles wanting to expand the playing capability of their rigs beyond just the listening room can do so with add-ons. While many amplifiers and receivers permit connection of an additional pair of speaker systems, you may want to operate speakers in three or four different locations. At your aid is Russound, with its MP-2 speaker amplifier control switch priced at \$69.95. The control does the following: Selects either of two amplifier sources and directs the output of either to any or all speakers. It distributes sound to any one, two, three or four pairs of stereo speakers from a central location. Changes the volume of one or turns on or off completely without affecting the sound level of the others. Connects any combination of high and low efficiency speakers with any mix of impedances. Maintains proper loading of your amplifier regardless of the number of speakers in use or their volume control settings. Other, less elaborate speaker or speaker/amplifier switching devices are also obtainable from Switchcraft, Audiotex, and Lafayette Radio, as well as Russound. They are priced from \$11 to \$82.50. Russound also has a "super-deluxe" switching center at \$250.00.

The speaker switching boxes also permit the HI-FI "nut" or sound perfectionist to play different kinds of music with different types of speakers—all at the touch of a switch.

Audio buffs experimenting or "playing around" with speaker systems have a handy widget in the form of sound level meters, available from BSR at \$60 and from Scott Instruments at \$98. The meters, with a range of 60 to 116 dB and 45 to 130 dB, respectively, permit checks of speaker systems to help balance their outputs, or, in conjunction with an equalizer, enable the user to obtain precise flat reproduction and accurately tune the speakers to a room setting. They also permit measurements of ambient and background noise, as well as other signals of interest. The BSR model also acts as a quality microphone.

A final add-on that can assure optimum performance of a HI-FI system is the "Turntable Foundation" by Discwasher. The foundation is just that—a solid base on which to place a turntable. Made of thick marble and mounted on eight damping feet, the device filters out vibrations and rumble that can affect the performance of the turntable. If your player is sensitive to feedback generated by subtle or overt vibrations in the listening room, the Discwasher foundation may be just what the doctor ordered. Price, \$40.

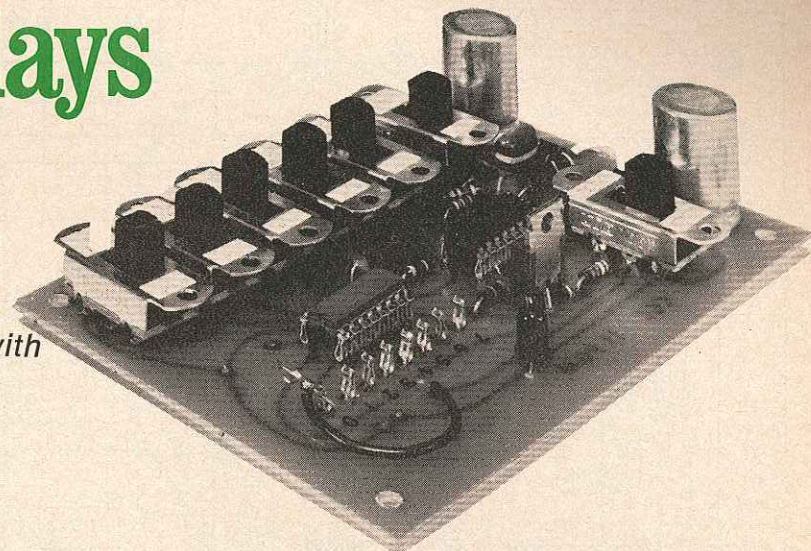
Maintenance and prevention

Radio-Electronics readers are familiar
(continued on page 78)

IC Doorbell Plays Your Song

You can program your own tune into this device and connect it to your doorbell. It features a PROM with a 32-note capacity.

by RALPH E. COUSINO



PART 1 OF THIS ARTICLE CONTAINED THE circuit description and construction details for this unusual doorbell.

This month, part 2 concludes this article with the circuit and programming details for the PROM.

Programming your melody

The electronic music box covers two octaves which provides the musical range to program most melodies. These two octaves begin at F below middle C or F3, when the master oscillator is set for 21560 HZ. Table I illustrates programming for the melody "Home Sweet Home." The notes of the melody are shown in the sequence in which they are played, beginning with program step one. The corresponding beats per note is also shown and designates the time the note will be held. The program word consists of eight bits B7 through B0. Refer to Tables II and III for the proper encoding of each note and beat. Since the melody requires only 28 steps, the remaining four steps are muted by making B3, B2, B1 and B0 all high. Where it is required to hold a note longer than four beats, step to the next word. Repeat the note and hold for the required additional beats. This is illustrated by steps #13 and #14, plus #27 and #28 where six beats are required.

The PROM can now be set up with your completed program. The address for each word should be noted as in Table I. Addressing all words of the PROM, blow the fuse to program each bit as shown for your melody. The program may be checked before programming the PROM. With the PROM IC6 and IC1 removed from their sockets, connect the poles of six SPDT switches to pins 1, 2, 3, 4, 5 and 6 of IC6. This corresponds to bit positions B0, B1, B2, B3, B4 and B5, respectively. One side of the switches should be tied to 5 volts—the other to ground. In the 5 volt

position, a "1" is programmed. In the ground position, a "0" is programmed. Set the switches for the note required which plays continuously. Using a tape recorder with pause control, record each note in the sequence it will be

memory that is programmed by means of built-in fuses. For each bit position, a "1" is programmed when the fuse is blown and "0" when not blown. The 8223 is supplied with all bit positions low or zero. The programming is ac-

Program Step	Program Steps Binary Address					Notes of Melody	Beats per Note	Binary Program for Note and Beat							
	14*	13*	12*	11*	10*			9*	7*	6*	5*	4*	3*	2*	1*
	A4	A3	A2	A1	A0			B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	F4	1	0	0	0	1	1	1	1	0
2	0	0	0	0	1	G4	1	0	0	0	1	0	1	1	1
3	0	0	0	1	0	A4	4	1	1	0	1	0	0	0	1
4	0	0	0	1	1	B4j	2	0	1	0	0	1	1	1	0
5	0	0	1	0	0	D5	2	0	1	0	0	0	1	0	1
6	0	0	1	0	1	C5	4	1	1	0	0	1	0	0	1
7	0	0	1	1	0	A4	2	0	1	0	1	0	0	0	1
8	0	0	1	1	1	C5	2	0	1	0	0	1	0	0	1
9	0	1	0	0	0	B4j	3	1	0	0	0	1	1	1	0
10	0	1	0	0	1	A4	1	0	0	0	1	0	0	0	1
11	0	1	0	1	0	B4j	3	1	0	0	0	1	1	1	0
12	0	1	0	1	1	G4	1	0	0	0	1	0	1	1	1
13	0	1	1	0	0	A4	4	1	1	0	1	0	0	0	1
14	0	1	1	0	1	A4	2	0	1	0	1	0	0	0	1
15	0	1	1	1	0	F4	1	0	0	0	1	1	1	1	0
16	0	1	1	1	1	G4	1	0	0	0	1	0	1	1	1
17	1	0	0	0	0	A4	4	1	1	0	1	0	0	0	1
18	1	0	0	0	1	B4j	2	0	1	0	0	1	1	1	0
19	1	0	0	1	0	D5	2	0	1	0	0	0	1	0	1
20	1	0	0	1	1	C5	4	1	1	0	0	1	0	0	1
21	1	0	1	0	0	A4	2	0	1	0	1	0	0	0	1
22	1	0	1	0	1	C5	2	0	1	0	0	1	0	0	1
23	1	0	1	1	0	B4j	3	1	0	0	0	1	1	1	0
24	1	0	1	1	1	A4	1	0	0	0	1	0	0	0	1
25	1	1	0	0	0	B4j	2	0	1	0	0	1	1	1	0
26	1	1	0	0	1	G4	2	0	1	0	1	0	1	1	1
27	1	1	0	1	0	F4	4	1	1	0	1	1	1	1	0
28	1	1	0	1	1	F4	2	0	1	0	1	1	1	1	0
29	1	1	1	0	0	mute	1	0	0	0	0	1	1	1	1
30	1	1	1	0	1	mute	1	0	0	0	0	1	1	1	1
31	1	1	1	1	0	mute	1	0	0	0	0	1	1	1	1
32	1	1	1	1	1	mute	1	0	0	0	0	1	1	1	1

*Number designates pin connection on IC-6.

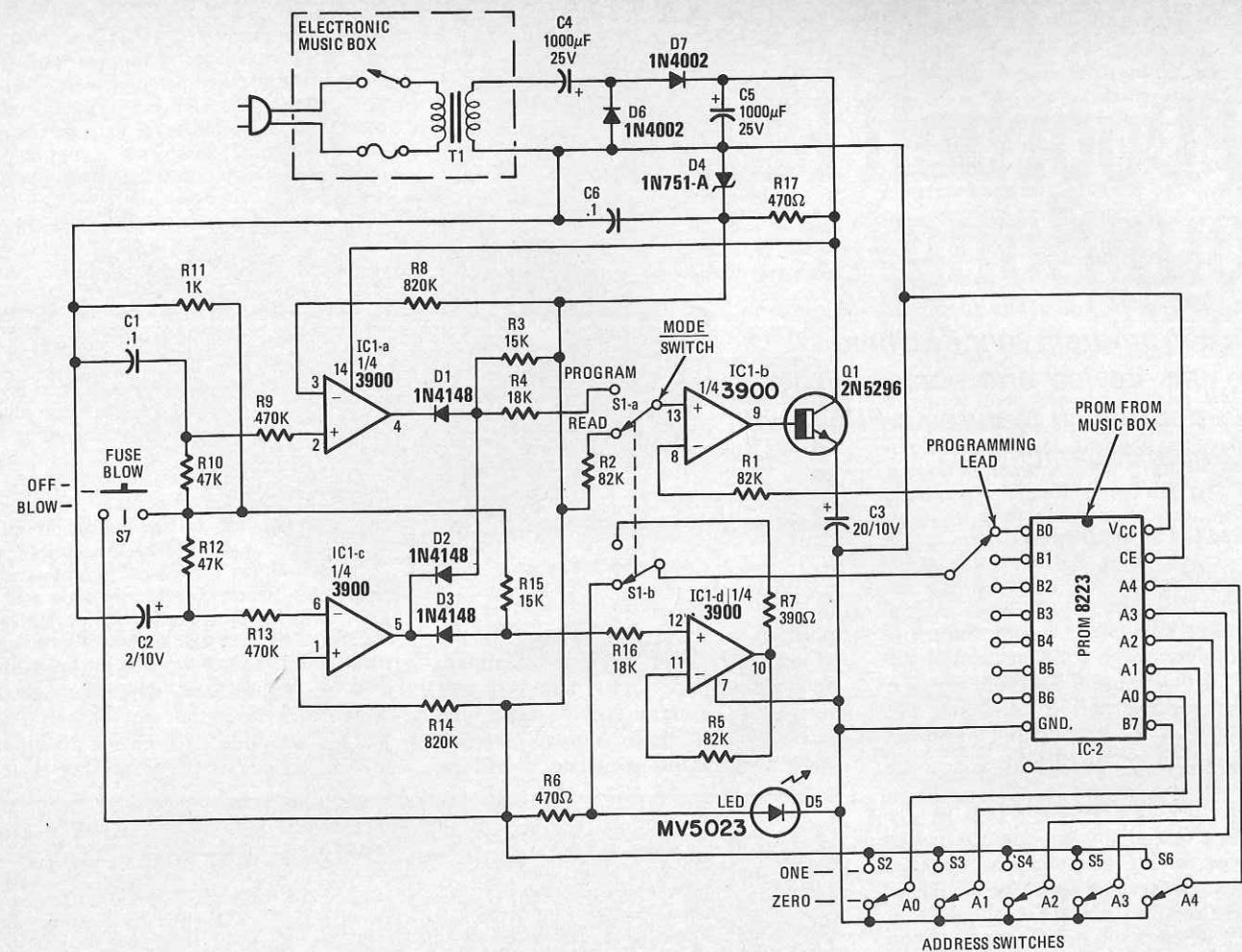
played for a period equal to the number of beats it is to be held. Playing back the tape you will hear the melody.

Programming the PROM

The PROM 8223 is a read-only

completed by addressing each word of eight bits and blowing those bit fuses that are required to be "1".

The circuit used for programming is shown in Fig. 4. The circuit operation consists of addressing each word by



PROM PROGRAMMER PARTS LIST

All resistors are 1/4-watt, 10%, unless noted
 R1, R2, R5—82,000 ohms, 5%
 R3, R15—15,000 ohms, 5%
 R4, R16—18,000 ohms, 5%
 R6, R17—470 ohms
 R7—390 ohms
 R8, R14—820,000 ohms
 R9, R13—470,000 ohms
 R10, R12—47,000 ohms
 R11—1,000 ohms
 C1, C6—.1 μF polyester film
 C2—2 μF, 10 volt electrolytic
 C3—20 μF, 10 volt electrolytic
 C4, C5—1,000 μF, 25 volt electrolytic
 IC1—3900 linear quad amplifier
 Q1—2N5296
 D1, D2, D3—1N4148
 D4—1N751A

D5—MV5023 LED
 D6, D7—1N4002
 S1—DPDT slide switch, PC board mount
 S2, S3, S4, S5, S6—SPDT slide switch, PC board mount
 S7—SPST normally open spring return slide switch, PC board mount
 T1—117 volt primary, 6.3 volt @ 0.6A secondary
 Misc.—Molex IC connectors, wire, solder, hardware.

The following parts may be ordered from Cousino Circuit Company, 3313 Brace Street, Burbank, CA 91504

#K11-EMB—Kit of all items in Electronic Music Box parts list, except miscellaneous items, fuse and transformer. In-

cludes PC board and un-programmed PROM. \$36.95 postpaid within USA.

#KHS11-EMB—Same as #K11-EMB except PROM is pre-programmed with "Home Sweet Home" melody. \$39.95 postpaid within USA.

#11-EMB—Drilled glass epoxy printed circuit board for Electronic Music Box. \$6.95 postpaid within USA.

#K11-PGM—Kit of all parts in parts list for PROM Programmer except miscellaneous items. Includes printed circuit board and programming data for several melodies. \$21.95 postpaid within USA.

#11-PGM—Drilled glass epoxy printed circuit board for PROM Programmer. \$5.95 postpaid within USA. California residents add sales tax.

setting switches S2, S3, S4, S5 and S6 to the binary address being programmed. This address is designated as A0, A1, A2, A3, A4 in the programming Table 1. The bit positions for each word B0, B1, B2, B3, B4, B5, B6 and B7 are programmed "1" as designated in Table 1 by connecting the programming lead to each bit position being programmed. The mode switch S1 placed in the READ position shows the bit status. The LED is on when a "1" is programmed. With the LED off, a "0" is programmed which should be the case of an unprogrammed bit.

Changing the mode switch S1 to the PROGRAM position prepares the circuit for blowing the bit fuse.

Depressing pushbutton switch S7 for one second or more blows the bit fuse, thereby programming a "1". When S7 is depressed, 5 volts is applied to the two R-C networks and voltage regulator IC1-d. The R10-C1 network switches comparator IC1-a after a brief delay. This unclamps voltage regulator IC1-b applying 12.5 volts to V_{cc} of the PROM. At the same time, 12.5 volts is applied immediately by voltage regulator IC1-d to the bit position being

programmed. After an elapsed time determined by R12-C2, comparator IC1-c clamps both voltage regulators to ground reducing both 12.5 volt outputs to 1.5 volts or less. At this time, the bit fuse should be blown. It is confirmed by switching the mode switch to the READ position. The LED should light, confirming a "1".

The programming circuit can be constructed on a PC board, with the circuit layout shown in Fig. 5 and component location detailed in Fig. 6. All components should be soldered in place using care to observe polarities

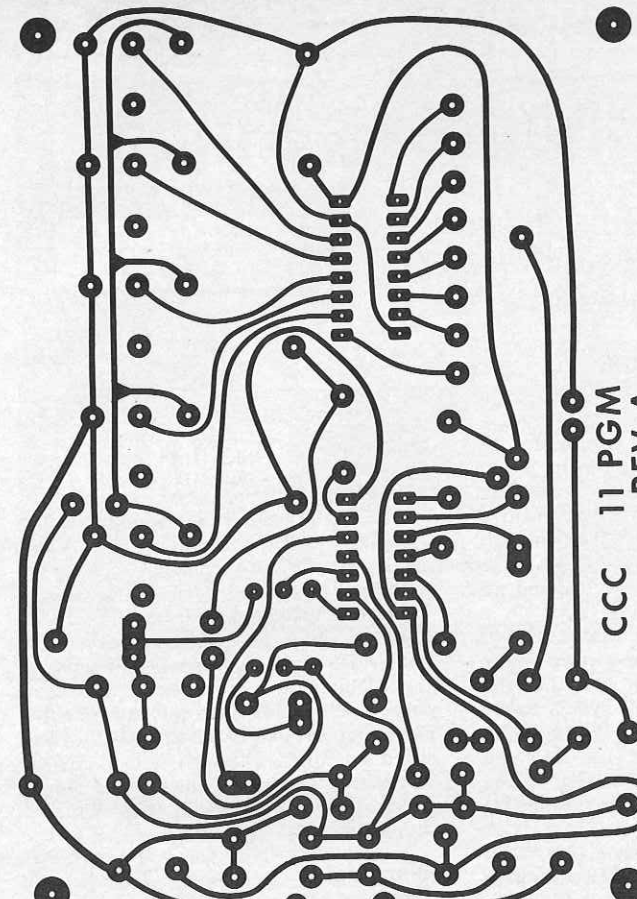


FIG. 4 (left)—PROM PROGRAMMER schematic diagram.

FIG. 5 (above)—FOIL PATTERN of printed circuit board for PROM Programmer.

FIG. 6 (right)—COMPONENT LAYOUT for the PROM programmer.

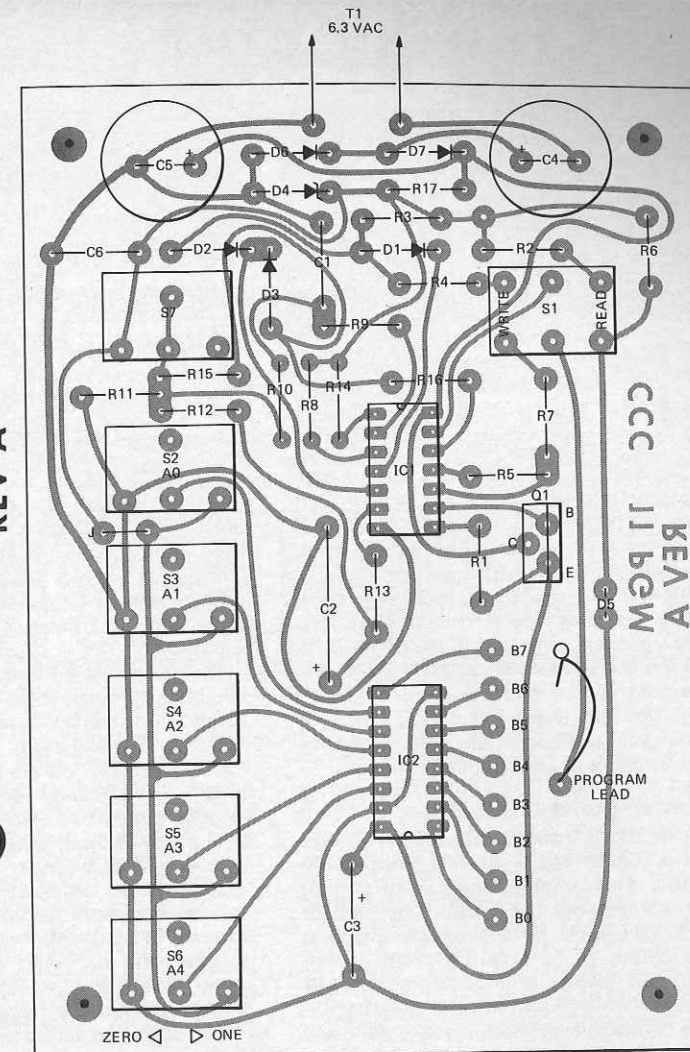


TABLE II
 BINARY CODING FOR MUSICAL SCALE COVERING TWO OCTAVES

Musical Note	Binary word for each note					
	6*	5*	4*	3*	2*	1*
	B5	B4	B3	B2	B1	B0
E5	0	0	0	0	0	1
E5 _♯	0	0	0	0	1	1
D5	0	0	0	1	0	1
C5 _♯	0	0	0	1	1	1
C5	0	0	1	0	0	1
B4	0	0	1	1	0	0
B4 _♯	0	0	1	1	1	0
A4	0	1	0	0	0	1
G4 _♯	0	1	0	1	0	0
G4	0	1	0	1	1	1
F4 _♯	0	1	1	0	1	1
F4	0	1	1	1	1	0
E4	1	0	0	0	0	1
E4 _♯	1	0	0	0	1	1
D4	1	0	0	1	0	1
D4 _♯	1	0	0	1	1	1
C4	1	0	1	0	0	1
B3	1	0	1	1	0	0
B3 _♯	1	0	1	1	1	0
A3	1	1	0	0	0	1
G3 _♯	1	1	0	1	0	0
G3	1	1	0	1	1	1
F3 _♯	1	1	1	0	1	1
F3	1	1	1	1	1	0
mute	0	0	1	1	1	1

of capacitors and diodes. The Molex IC terminals provide a socket for the integrated circuit and a connector for plugging in the programming lead to select the bit position. For simplicity, the slide switches and push button are soldered directly to the circuit board.

Before plugging in the PROM for programming, the circuit should be checked as follows. Confirm that the power supply voltage is 17-19 volts measured across C5. With the mode switch in the READ position, measure the voltage on the emitter of Q1 which should be 4.75 to 5.25 volts. Place the mode switch in the PROGRAM position, and connect a temporary short across

TABLE III
 PROGRAMMING THE BEATS PER NOTE

Beats Per Note	Bit Position	
	B7	B6
	9*	7*
1	0	0
2	0	1
3	1	0
4	1	1

*Number designates pin connection on IC6.

C2. Pressing the pushbutton switch S7, measure the voltage at emitter Q1 and the programming lead. Both should measure between 12 and 13 volts which then drops to 1.5 volts or less when the short is removed from C2.

To illustrate a typical programming procedure, refer to the Table I. Start at program step #1. Set address switches A0, A1, A2, A3 and A4 all to "0" (ground). Place mode switch on READ. Connect the programming lead to B0 (IC pin 1). The LED should be off confirming that the B0 fuse has not been blown. Throw mode switch to PROGRAM. Note the LED will always light when the mode switch is in PROGRAM position. Since Table I shows B0 as a "1", the fuse for this bit position should be blown. Pressing the pushbutton switch S7 blows the fuse programming a "1". Verify the "1" by switching to the READ mode. It may be necessary to repeat the procedure if the fuse does not blow the first time. It is also advisable to check the "0" bit positions to confirm that the fuse has not been blown. Use great care in programming since it is not possible to change a "1" to "0".