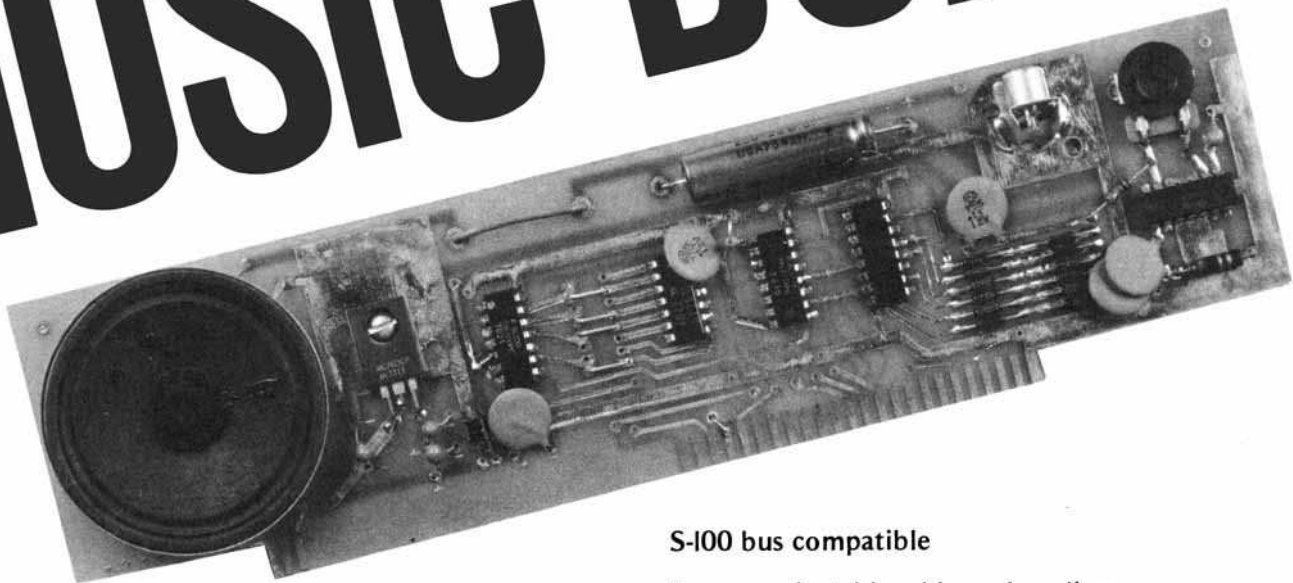


NEWTECH  
Model 6

# MUSIC BOARD



PRODUCES MELODIES, RHYTHMS,  
SOUND EFFECTS, MORSE CODE,  
TOUCH-TONE SYNTHESIS, AND  
MORE!

\$59.95 ASSEMBLED AND TESTED

AVAILABLE THROUGH YOUR  
LOCAL COMPUTER STORE

S-100 bus compatible

Jumper selectable address decoding

6-bit latching digital-to-analog converter

Glass epoxy printed circuit board with  
plated-through holes and gold-plated  
fingers

Audio amplifier

Speaker

Volume control

RCA phono jack for connection to  
external audio system

Complete users manual with BASIC  
program for writing musical scores  
and 8080 Assembly Language routine  
to play them

60-day parts and labor warranty

## NEWTECH COMPUTER SYSTEMS, INC.

131 JORALEMON STREET \* BROOKLYN, NEW YORK 11201 \* (212) 625-6220

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## I. GENERAL

Newtech Computer Systems' low-cost Model 6 Music Board enables anyone with an S-100 bus computer to produce music and sound effects. Applications include generating melodies, rhythms, sound effects, Morse code, touch-tone synthesis, and more.

The Model 6 is fully assembled and tested. Its features include selectable output port address decoding, a latched 6-bit digital-to-analog converter, audio amplifier, speaker, volume control, and RCA phono jack for convenient connection to your home audio system. It employs a glass epoxy printed circuit board with plated-through holes, gold-plated fingers and top quality components.

The Model 6 Users Manual provides complete documentation and includes a BASIC Language program for writing musical scores and an 8080 Assembly Language routine for playing them. Other software has been published which can easily be implemented on the Model 6. For example, Hal Chamberlain's "Computer Bits" articles in the September and October 1976 issues of Popular Electronics contain programs for tone, white noise, and "weird sound" generation, as well as a musical frequency table and tables for touch-tone frequency generation. Malcolm Wright's "Alphanumeric Music with Amplitude Control" (available from People's Computer Company) is another excellent resource for implementation of music on the Model 6 Music Board.

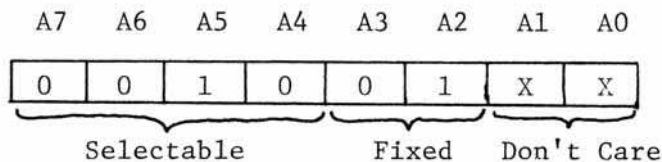
## II. THEORY OF OPERATION

### A. Address Decoding:

Address decoding is performed by the 8-input NAND gate IC1 and the Hex Buffer IC2. The output of IC1 (Pin 8) goes low only when all the inputs to IC1 are high. During any output instruction SOUT goes high. Signal  $\overline{PWR}$  is pulsed low during an output instruction and is therefore followed by inverter 2E to drive Pin 4 high.

When executing an output instruction the 8080 sends the output port address information out on the lower 8 address bus lines -- A0 thru A7 on S-100 busses. To uniquely decode an individual output instruction all 8 address bits would need to be decoded. The Model 6 Music Board decodes only the 6 most significant bits (A2 thru A7) and does not care about bits A0 and A1. This will result in the board responding equally well to any of four adjacent output addresses.

The 4 most significant output port address bits (A7 thru A4) are jumper selectable. Address bit A3 is hard-wired for a 0, bit A2 is hard-wired for a 1, and bits A1 and A0 are not decoded (they're "don't cares").



#### Output Port Address Selection

The Model 6 Music Board is supplied with address jumpers inserted for Port 24 Hex (044 Octal). Newtech Computer Systems software for the Model 6 Music Board uses this port as standard. Table 1 indicates the jumper positions to use for assigning other addresses to the Model 6. Your software must conform accordingly, of course.

CAUTION: CARE SHOULD BE TAKEN NOT TO JUMPER AN INDIVIDUAL BIT AS BOTH A 0 AND A 1 AT THE SAME TIME, AS THIS WILL SHORT OUT ONE OF THE HEX INVERTERS AND MAY DESTROY IC2.

NEWTECH COMPUTER SYSTEMS INC.

MODEL 6 MUSIC BOARD

Table 1.

OUTPUT PORT ADDRESS SELECTION

	<u>Ports selected (Hex)</u>	<u>J1</u>	<u>J2</u>	<u>J3</u>	<u>J4</u>	<u>J5</u>	<u>J6</u>	<u>J7</u>	<u>J8</u>
0	04,05,06,07		X		X		X		X
1	14,15,16,17		X		X		X	X	
2	* 24,25,26,27		X		X	X			X
3	34,35,36,37		X		X	X		X	
4	44,45,46,47		X	X			X		X
5	54,55,56,57		X	X			X	X	
6	64,65,66,67		X	X		X			X
7	74,75,76,77		X	X		X		X	
8	84,85,86,87	X			X		X		X
9	94,95,96,97	X			X		X	X	
A	A4,A5,A6,A7	X			X	X			X
B	B4,B5,B6,B7	X			X	X		X	
C	C4,C5,C6,C7	X		X			X		X
D	D4,D5,D6,D7	X		X			X	X	
E	E4,E5,E6,E7	X		X		X			X
F	F4,F5,F6,F7	X		X		X		X	

1	<u>J1</u>	16
2	<u>J2</u>	15
3	<u>J3</u>	14
4	<u>J4</u>	13
5	<u>J5</u>	12
6	<u>J6</u>	11
7	<u>J7</u>	10
8	<u>J8</u>	9

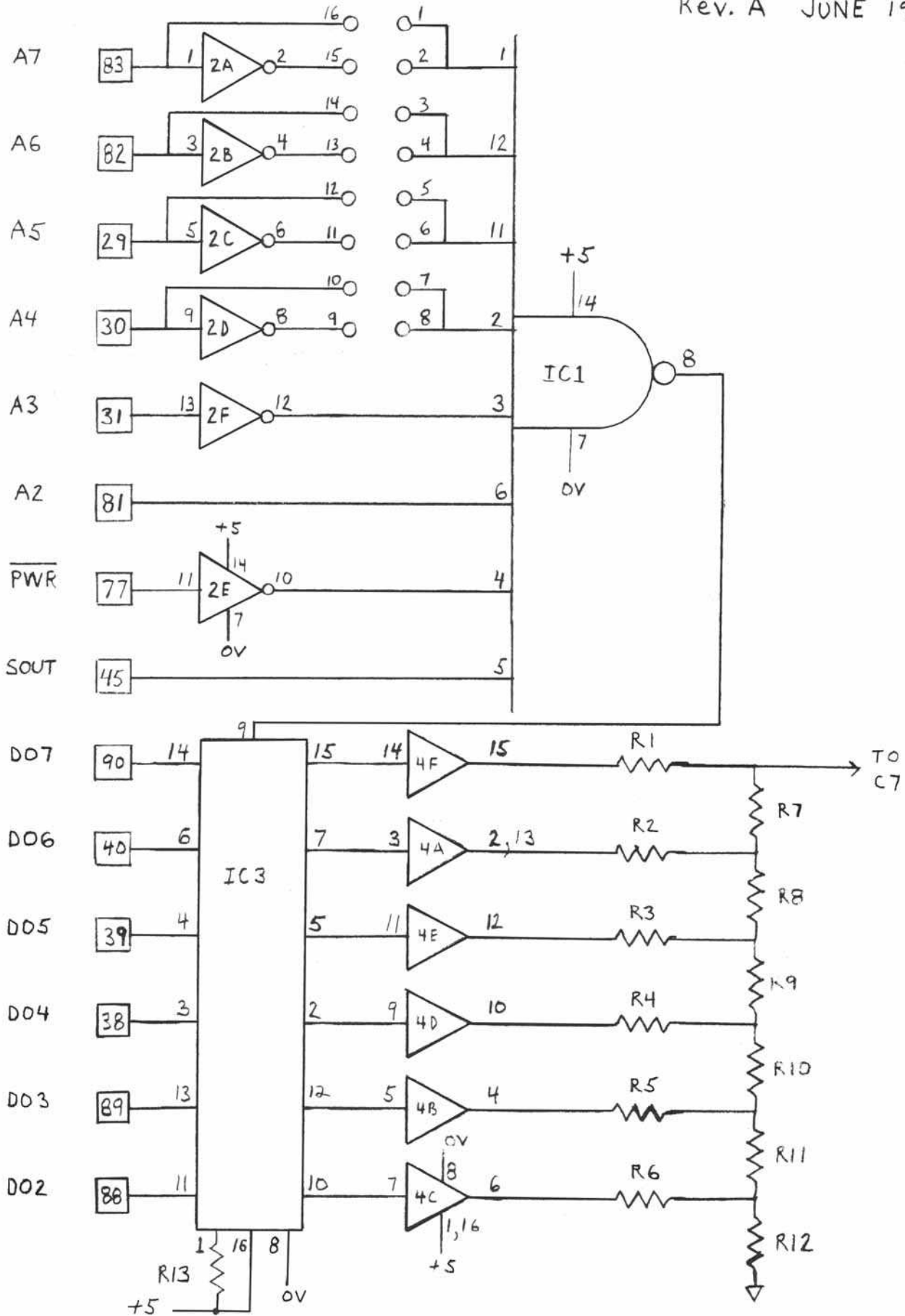
1		16
2	<u>J2</u>	15
3		14
4	<u>J4</u>	13
5	<u>J5</u>	12
6		11
7		10
8	<u>J8</u>	9

Address Jumper Positions

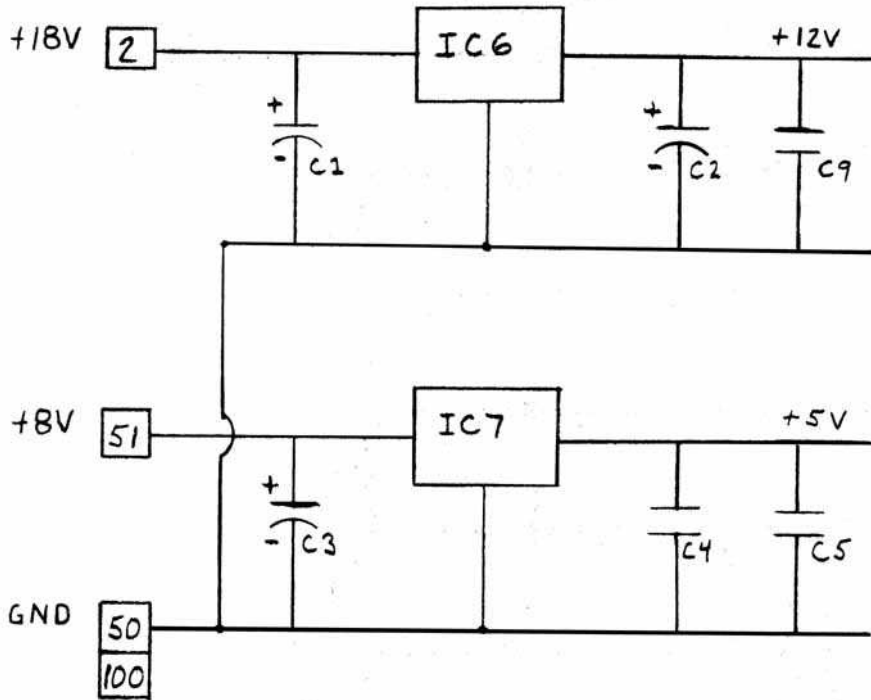
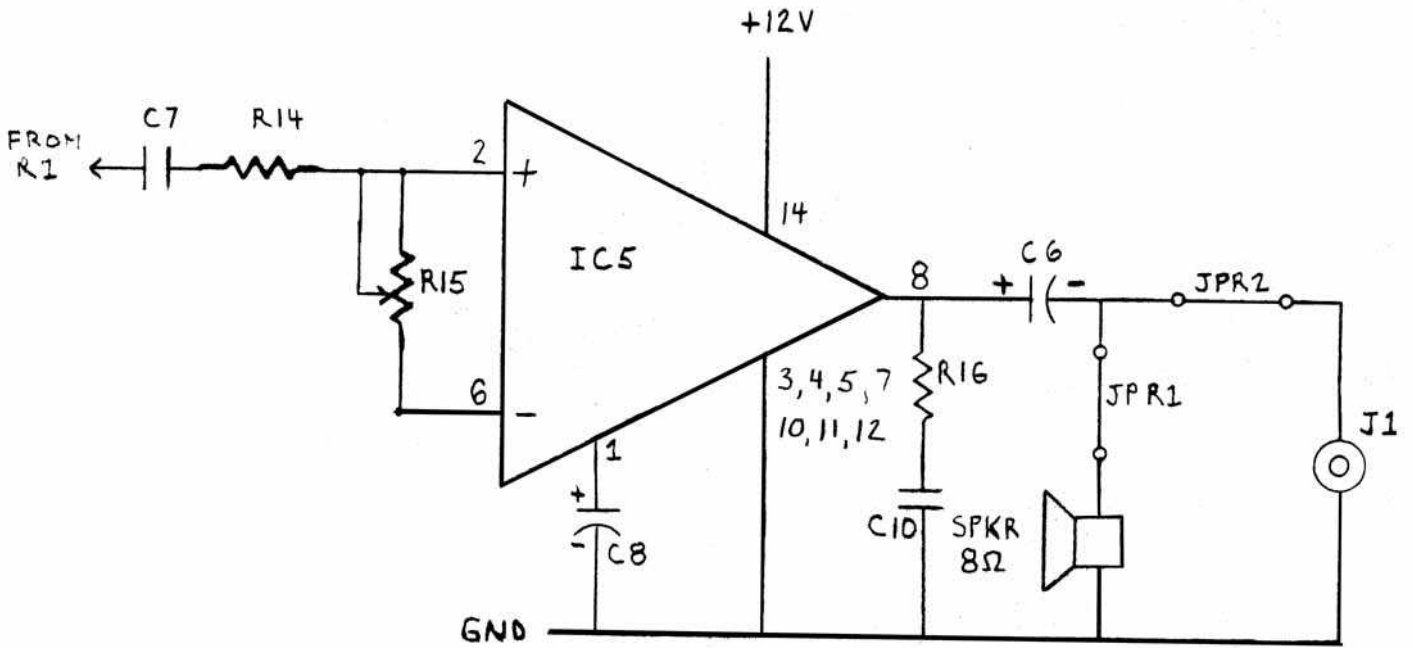
Jumpers for Standard Address Port 24Hex

\* Standard port assignment is for Port 24H

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Rev. A JUNE 1977



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#### B. Data Latching:

When an output instruction is performed to the Model 6 output port address the 8-bit contents of the accumulator appear on the data bus lines D00 thru D07. The most significant six bits of this data, D02 thru D07, are latched by the Hex latch IC3.

#### C. Digital to Analog Conversion (DAC):

The data latched in IC3 is buffered by CMOS buffers. These buffers drive an R/2R ladder network with voltages very close to 0 volts and the +5 volt supply. The ladder network employs 1% tolerance precision resistors and is minimally loaded by a high impedance voltage divider into the audio amplifier.

#### D. Audio Amplifier:

The analog output from the R/2R DAC ladder network is AC coupled through capacitor C7 and resistive divider network R14, R15 to an audio amplifier IC5. The output low pass filter R16 and C10, and capacitors C2 and C9 on the amplifier 12Volt supply, are required to maintain amplifier stability. The output of the R/2R ladder network can swing from 0 to 5 Volts. The input to IC5 can thus range from near zero to 5 Volts  $25K/(2M+25K) \approx .062$  Volts peak to peak. The gain of IC5 is about 50, so its output will swing about 3.08 Volts peak to peak. For a maximum amplitude square wave, output will thus be  $3.08/2 \approx 1.54$ VRMS. The maximum direct power output to an 8 Ohm speaker will thus be  $(1.54)^2/8 \approx .3$  Watt and peak speaker load current will be  $V/R = 1.54/8 = .19$  Ampere.

This rather detailed explanation of the audio amplifier section has been given for two reasons. The first is to make its operation easy to understand. The second is that it is important to understand the limitations of the Model 6 and what it will and will not do. It will drive the 2" speaker on the Model 6 Music Board or, alternatively, a small, external, efficient 8 Ohm speaker. Of course, the Model 6 can be used as well as an input to your audio system. One of the things the Model 6 will not do (nor for that matter will any other music board designed to run off a hobbyist computer power supply), is replace a home high fidelity system power amplifier to drive large inefficient speaker systems.

The Model 6 Music Board 12 Volt power supply, audio amplifier IC, and output capacitor C6 are conservatively rated to operate as supplied. But DO NOT ATTEMPT TO SOUP-UP THIS CIRCUIT TO PROVIDE HIGHER POWER OUTPUT. It would be dangerous, as the components are not rated for the increased stresses.



E. Power Supply:

IC6 inputs +18 Volts unregulated from the S-100 bus and provides 12 Volts regulated to the audio amplifier IC5. Capacitor C1 on the regulator input is required for regulator stability. Capacitors C2 and C9 are required for improved high frequency supply regulation and for stability of the audio amplifier IC5.

IC7 inputs +8 Volts unregulated from the S-100 bus and provides 5 Volts regulated for the logic and DAC circuitry. Capacitor C3 on the regulator input is required for regulator stability and capacitors C4 and C5 for improved high frequency regulation.

### III. USERS GUIDE

#### A. External Speakers:

Considerable improvement in sound quality can be readily achieved over the 2" speaker supplied with the Model 6 by using an external speaker.

When this is done, jumper JP1 should be removed (or cut) to disconnect the on-board speaker. The external speaker can be connected at J1. Excellent sound production has been achieved using very inexpensive 5" speakers.

#### B. Use with Home Audio System:

Best sound production is achieved when the Model 6 is connected to a high fidelity amplifier. An auxiliary input jack is likely your best choice.

CAUTION: The Model 6 is capable of producing a very wide range of frequencies extending from the subaudible, through the entire audio range and up to the ultrasonic. You should use the common sense you would use with any other signal source, such as a record turntable or radio. Play too loud, particularly on the bass drive, and you can damage your speakers.

Additionally, your software can cause subaudible or ultrasonic range outputs from the Model 6 which you can only see on an oscilloscope and yet may be driving your speaker system. So, a good rule of thumb would be to first set up your amplifier and Model 6 volume controls for the test program given herein, or for some other program known to be in the audio range, and then NEVER substantially exceed those amplifier settings.

#### IV. SOFTWARE

The two programs contained herein are named MICROSCORE and MICROPLAY. MICROSCORE is a BASIC program that uses alphanumeric notations of musical notes to produce a table of constants which, in turn, is used by the Assembly Language MICROPLAY program to "play" the music. The calculation of constants assumes use of an 8080 processor with no wait states. However, both MICROSCORE and MICROPLAY can easily be changed for use with a machine with wait states or with other S-100 bus processors.

MICROSCORE was written in North Star BASIC (Rev. 6), and may require modification for other BASIC's.

The music used in MICROSCORE is "The Entertainer" by Scott Joplin. Other music can be coded and inserted as DATA statements instead of those used for the Joplin piece.

Each note in the music is specified by a four- or five-character string appearing as a DATA statement in MICROSCORE. For example, the first note of the music, a sixteenth-note "D", is specified on line 830 as "D♭3S".

Pitch is specified by the first three characters:

First character: "A", "B", "C", "D", "E", "F", "G"

Indicates pitch within an octave.

Second character: "#"(sharp), "!"(flat), "♭"(blank character, or natural)

Indicates whether the pitch is raised or lowered (or neither) by a half-step.

Third character: "1", "2", "3"

Indicates the octave, with "1" being the lowest of the three octaves starting at A=220Hz, "2" being the second octave starting at A=440Hz, and "3" being the third octave starting at A=880Hz.

Duration is specified by the fourth and fifth characters:

Fourth character: "S"(sixteenth), "E"(eighth), "Q"(quarter), "H"(half), "W"(whole)

Indicates relative length of each pitch.

Fifth character (optional): "."

Indicates increasing by half the duration of the note specified by the fourth character.

Thus, for example, the first six notes of "The Entertainer" used in MICROSCORE:



are coded as:

```
830 DATA "D#3S","E#3S","C#3S","A#3E","B#3S","G#2E"
```

MICROSCORE has a special End-of-Score one-character string "X" which enters a zero pitch constant in the MICROPLAY score to indicate the end of the music.

Tempo can be increased or decreased by changing the constant K6. The speed is proportional to K6, so doubling K6 would double the speed of the music.

Illegal characters in a note specification string will produce an error message and terminate score compilation. The error message would be of the form:

```
ERROR IN NOTE #1  
DATA STRING "A#3P."  
CHARACTER #4
```

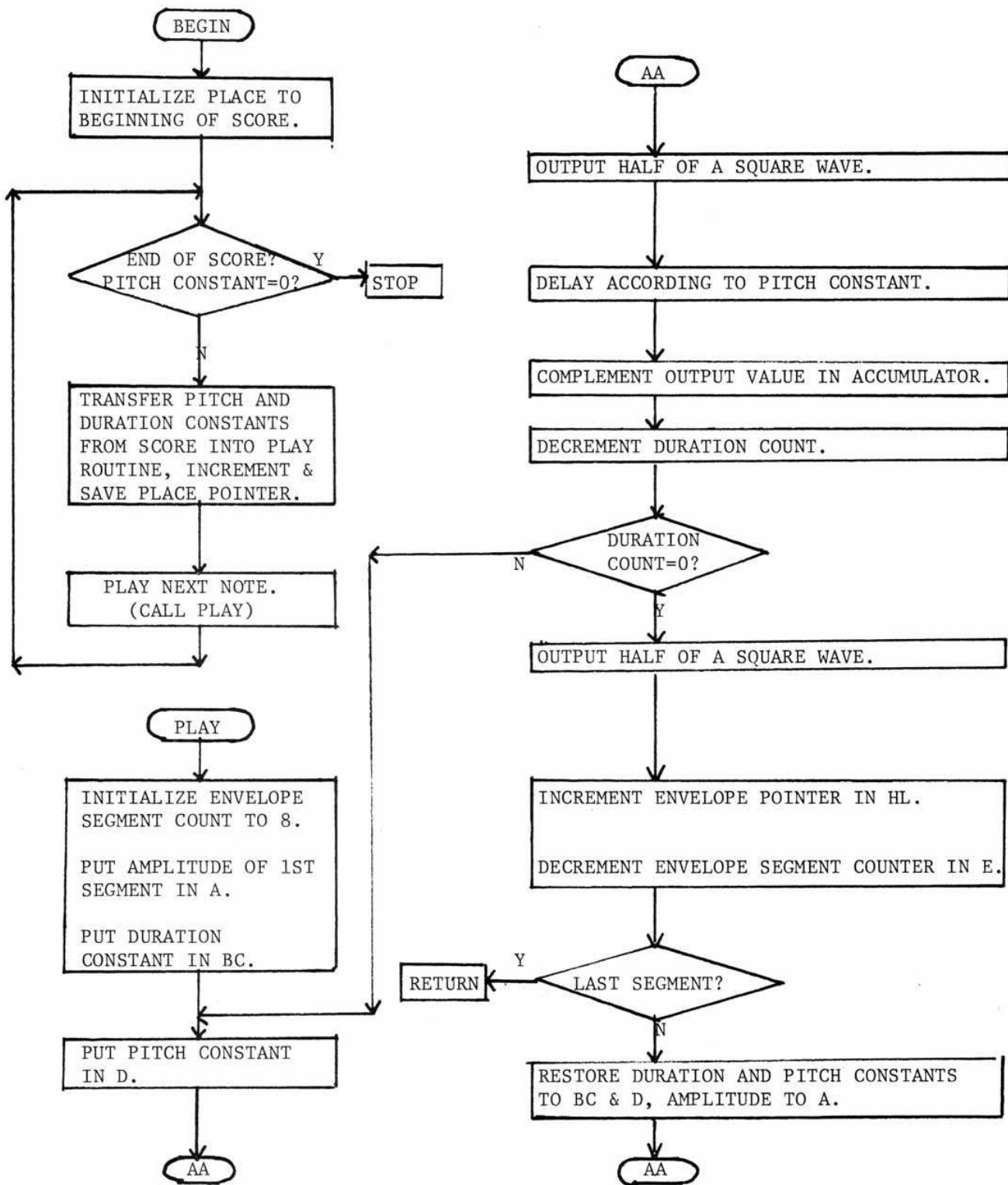
In this example the fourth character is illegal. When the score is completely compiled without error messages, "SCORE COMPILATION COMPLETE" will be indicated.

The starting location of the score produced is specified by the variable U. Standard location is 100H (specified as 256 in BASIC) but can be changed to any free memory location, provided the score location pointer in MICROPLAY is made to agree.

Program execution starts at the first statement -- requiring you to simply type "RUN".

Roughly eight to ten bytes of memory are required in the BASIC program for each note of music specified. MICROPLAY requires three bytes for each note of music.

FLOW CHART FOR MICROPLAY REV.A JUNE 1977



```

100 REM MICROSCORE REV.A JUNE 1977
110 REM NEWTECH COMPUTER SYSTEMS INC.
120 REM 131 JORALEMON STREET
130 REM BROOKLYN, N.Y. 11201
140 REM
150 LET U=256 \REM U DEFINES SCORE AREA IN MEMORY.
160 LET K1=2*(1/12)
170 LET K6=1.2 \REM TEMPO CONTROL
180 DIM Z$(5)
190 FOR V=1 TO 1000
200 LET C=1
210 READ Z$
220 LET N=100
230 IF Z$(1,1)="A" THEN N=1
240 IF Z$(1,1)="B" THEN N=3
250 IF Z$(1,1)="C" THEN N=4
260 IF Z$(1,1)="D" THEN N=6
270 IF Z$(1,1)="E" THEN N=8
280 IF Z$(1,1)="F" THEN N=9
290 IF Z$(1,1)="G" THEN N=11
300 IF Z$(1,1)="X" THEN GOTO 720
310 IF N=100 THEN GOTO 760
320 LET C=2
330 LET M=100
340 IF Z$(2,2)="!" THEN M=N-1
350 IF Z$(2,2)="#" THEN M=N+1
360 IF Z$(2,2)=" " THEN M=N
370 IF M=100 THEN GOTO 760
380 LET C=3
390 LET P=100
400 IF Z$(3,3)="1" THEN P=M
410 IF Z$(3,3)="2" THEN P=M+12
420 IF Z$(3,3)="3" THEN P=M+24
430 IF P=100 THEN GOTO 760
440 LET C=4
450 LET T=100
460 IF Z$(4,4)="S" THEN T=16
470 IF Z$(4,4)="E" THEN T=8
480 IF Z$(4,4)="Q" THEN T=4
490 IF Z$(4,4)="H" THEN T=2
500 IF Z$(4,4)="W" THEN T=1
510 IF T=100 THEN GOTO 760
520 IF LEN(Z$)=4 THEN GOTO 560
530 LET C=5
540 IF Z$(5,5)="." THEN T=2*T/3
550 REM CALCULATE CONSTANTS
560 LET F1=220*(K1*(P-1))
570 LET T1=10*6/(2*F1)
580 LET K3=(T1-56.5)/7.5
590 LET K4=F1/(K6*T)
600 LET D3=INT(K4) \REM MAKE DURATION EVEN#
610 LET D4=2*D3-2*INT(D3/2)
620 LET D5=INT(D4/256) \REM CALC. 2 BYTES
630 LET D6=D5+1 \REM D6=MSB
640 LET D7=D4-D5*256 \REM D7=LSB
650 REM TRANSFER CONSTANTS TO SCORE AREA.
660 FILL U+3*(V-1),INT(K3+.5)
670 FILL U+3*(V-1)+1,D7
680 FILL U+3*(V-1)+2,D6
690 PRINT V,
700 NEXT V

```

```

710 STOP
720 FILL U+3*(V-1),0
730 PRINT
740 PRINT "SCORE COMPILATION COMPLETE!"
750 STOP
760 PRINT "ERROR IN NOTE #",V
770 PRINT "DATA STRING ",Z$
780 PRINT "CHARACTER #",C
790 STOP
800 END
810 REM
820 REM "THE ENTERTAINER" BY SCOTT JOPLIN
830 DATA "D 3S","E 3S","C 3S","A 3E","B 3S","G 2E"
840 DATA "D 2S","E 2S","C 2S","A 2E","B 2S","A 2S","A!2S"
850 DATA "G 1Q","G 3E","D 1S","D#1S"
860 DATA "E 1S","C 2E","E 1S","C 2E","E 1S","C 2Q."
870 DATA "C 3S","D 3S","D#3S"
880 DATA "E 3S","C 3S","D 3S","E 3E"
890 DATA "B 3S","D 3E"
900 DATA "C 3Q.", "D 1S","D#1S"
910 DATA "E 1S","C 2E","E 1S","C 2E","E 1S","C 2Q."
920 DATA "C 2S","A 3S","G 2S"
930 DATA "F#2S","A 3S","C 3S","E 3E","D 3S","C 3S","A 3S"
940 DATA "D 3Q.", "D 1S","D#1S"
950 DATA "E 1S","C 2E","E 1S","C 2E","E 1S","C 2Q."
960 DATA "C 3S","D 3S","D#3S"
970 DATA "E 3S","C 3S","D 3S","E 3E","B 3S","D 3E"
980 DATA "C 3Q.", "C 3S","D 3S"
990 DATA "E 3S","C 3S","D 3S","E 3E","C 3S","D 3S","C 3S"
1000 DATA "E 3S","C 3S","D 3S","E 3E","C 3S","D 3S","C 3S"
1010 DATA "E 3S","C 3S","D 3S","E 3E","B 3S","D 3E"
1020 DATA "C 3Q","C 3S","E 2S","F 2S","F#2S"
1030 DATA "G 2E","A 3S","G 2E","E 2S","F 2S","F#2S"
1040 DATA "G 2E","A 3S","G 2E","E 2S","C 2S","G 1S"
1050 DATA "A 2S","B 2S","C 2S","D 2S","E 2S","D 2S","C 2S","D 2S"
1060 DATA "C 2E","G 1E","C 1E","X"

```

READY

RUN

```

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99
100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117
118 119 120

```

SCORE COMPILATION COMPLETE!

STOP IN LINE 760

READY

0000				0100 ; MICROPLAY REV.A JUNE 1977
0000				0110 ; NEWTECH COMPUTER SYSTEMS INC.
0000				0120 ; 131 JORALEMON STREET
0000				0130 ; BROOKLYN, N.Y. 11201
0000				0140 ;
0000				0150 ; MICROPLAY STARTS AT THE BEGINNING OF THE
0000				0160 ; MEMORY AREA DESIGNATED "SCORE" AND
0000				0170 ; TRANSFERS INTO THE PLAY ROUTINE A 1-BYTE
0000				0180 ; PITCH PARAMETER AND A 2-BYTE DURATION
0000				0190 ; PARAMETER. THE ROUTINE THEN CALLS THE
0000				0200 ; PLAY ROUTINE TO OUTPUT TO THE MODEL 6
0000				0210 ; THE MUSICAL NOTE SPECIFIED BY THESE NOTE
0000				0220 ; PARAMETERS. MICROPLAY CONTINUES TRANS-
0000				0230 ; FERING NOTE PARAMETERS AND CALLING THE
0000				0240 ; PLAY ROUTINE UNTIL A PITCH CONSTANT OF
0000				0250 ; ZERO IS ENCOUNTERED WHICH INDICATES THE
0000				0260 ; END OF THE MUSICAL SCORE.
0000				0270 ; THIS VERSION OF MICROPLAY WAS WRITTEN
0000				0280 ; FOR A 8080 HAVING 0 WAIT STATES BUT CAN
0000				0290 ; BE MODIFIED FOR 8080'S WITH WAIT STATES
0000				0300 ; OR FOR 280 PROCESSORS.
0000				0310 ;
0000	31	7F	00	0400 BEGIN LXI SP,STACK ;INIT. STACK POINTER.
0003	21	00	01	0410 INIT LXI H,SCORE ;INIT. SCORE POINTER.
0006	22	6D	00	0420 SHLD PLACE
0009	2A	6D	00	0430 NEXT LHLD PLACE ;IF END OF SCORE THEN
000C	3E	00		0440 MVI A,0 ;LOOP HERE.
000E	BE			0450 CMP M
000F	CA	0F	00	0460 HERE JZ HERE ;YOUR ENDING?
0012				0470 ; ;ELSE TRANSFER
0012				0475 ; ;PARAMETERS FOR NEXT
0012				0480 ; ;NOTE OF SCORE INTO
0012				0485 ; ;PLAY ROUTINE.
0012	7E			0490 MOV A,M ;LOAD PITCH.
0013	32	41	00	0500 STA XFER2+1
0016	32	60	00	0510 STA XFER4+1
0019	23			0520 INX H
001A	7E			0530 MOV A,M ;LOAD NOTE DURATION
001B	32	3A	00	0540 STA XFER1+1 ;LSD.
001E	32	5D	00	0550 STA XFER3+1
0021	23			0560 INX H
0022	7E			0570 MOV A,M ;LOAD NOTE DURATION
0023	32	3B	00	0580 STA XFER1+2 ;MSD.
0026	32	5E	00	0590 STA XFER3+2
0029	23			0600 INX H
002A	22	6D	00	0610 SHLD PLACE ;SAVE PLACE IN SCORE.
002D				0620 ;
002D	CD	33	00	0630 CALL PLAY ;PLAY ONE NOTE.
0030	C3	09	00	0640 JMP NEXT ;GO DO NEXT NOTE.
0033				0650 ;
0033				0660 ;
0033				0700 ;



```

0033 21 65 00      0800 PLAY LXI H,TBL1 ;INIT ENVELOPE POINTER
0036 1E 08      0810      MVI E,8 ;INIT. SEGMENT COUNT.
0038 7E      0820      MOV A,M ;GET STARTING
0039      0830 ; ;AMPLITUDE.
0039 01 00 00      U 0840 XFER1 LXI B,LENGTH ;INIT. DURATION COUNT.
003C 40      0850 LOOP2 MOV B,B ;WASTE TIME (WTZ)
003D C3 40 00      0860      JMP XFER2 ;(WT)
0040 16 00      U 0880 XFER2 MVI D,PITCH ;INIT. PITCH CONSTANT.
0042 D3 24      0890      OUT MODL6 ;OUTPUT HALF WAVE TO
0044      0900 ; ;MUSIC BOARD.
0044 34      0905      INR M ;WASTE MUCH TIME (WMT)
0045 35      0910      DCR M
0046 34      0920      INR M
0047 35      0930      DCR M
0048 34      0940      INR M
0049 35      0950      DCR M
004A 15      0960 LOOP3 DCR D ;DELAY ACCORDING TO
004B C2 4A 00      0970      JNZ LOOP3 ;PITCH CONSTANT.
004E AE      0980      XRA M ;COMPLEMENT A.
004F 0D      0990      DCR C ;COUNT DOWN DURATION #
0050 C2 3C 00      1000      JNZ LOOP2
0053 05      1010      DCR B
0054 C2 40 00      1020      JNZ XFER2
0057 D3 24      1030      OUT MODL6
0059 23      1040      INX H ;SET UP NEXT SEGMENT.
005A 1D      1050      DCR E ;DCR SEGMENT COUNT.
005B C8      1060      RZ ;RETURN IF ALL
005C      1070 ; ;SEGMENTS DONE.
005C 01 00 00      U 1080 XFER3 LXI B,LENGTH
005F 16 00      U 1090 XFER4 MVI D,PITCH
0061 7E      1110      MOV A,M ;SET NEW AMPLITUDE.
0062 C3 4A 00      1120      JMP LOOP3
0065      1130 ;
0065      1140 ;ENVELOPE SPECIFICATION:
0065      1141 ; MAXIMUM AMPLITUDE IS OUTPUT WHEN THE
0065      1142 ; ACCUMULATOR IS COMPLEMENTED FROM
0065      1143 ; 0FFH TO 000H AND BACK. MINIMUM
0065      1144 ; AMPLITUDE IS OUTPUT WHEN THE
0065      1145 ; ACCUMULATOR IS COMPLEMENTED FROM
0065      1146 ; 080H TO 07FH. THE 8 VALUES IN TBL1
0065      1147 ; SPECIFY THE ENVELOPE FOR EACH NOTE.
0065 95      1150 TBL1 DB 95H
0066 30      1160      DB 030H
0067 D0      1170      DB 0D0H
0068 FE      1180      DB 0FEH
0069 FF      1190      DB 0FFH
006A FF      1200      DB 0FFH
006B B0      1210      DB 030H
006C 85      1220      DB 085H
006D      1230 ;
006D      2000 SP EQU 6
006D 00 00      2010 PLACE DW 0 ;SCORE POINTER.
006F      2020 SCORE EQU 0100H ;YOUR SCORE LOCATION?
006F      2030 MODL6 EQU 24H ;YOUR OUTPUT PORT?
006F      2040 STACK EQU 5+10H

```

```

0000      0050 ; MODEL 6 MUSIC BOARD TEST ROUTINE
0000      0060 ;
0000      0070 ; THIS ROUTINE PRODUCES A TRIANGULAR
0000      0080 ; RAMP WAVEFORM OF 312.5 HZ FOR A
0000      0090 ; 2MHZ CLOCK 8080 SYSTEM WITH NO WAIT
0000      0100 ; STATES.
0000      0110 ;
0000 3C    0200 START INR A ;CALCULATE NEXT STEP.
0001 D3 24 0210 OUT 24H ;OUTPUT TO MODEL 6.
0003 C3 00 00 0220 JMP START ;LOOP

```

```

0000      0010 ; MODEL 6 MUSIC BOARD TEST ROUTINE
0000      0020 ;
0000      0030 ; THIS ROUTINE OUTPUTS A MAXIMUM
0000      0040 ; AMPLITUDE SQUAREWAVE FOR USE AS
0000      0050 ; A REFERENCE IN SETTING UP VOLUME
0000      0060 ; CONTROL LEVELS. FOR AN 8080 WITH
0000      0070 ; NO WAIT STATES, THE FREQUENCY WILL
0000      0080 ; BE 1005 HERTZ.
0000      0090 ;
0000 97    0100 START SUB A ;ZERO ACCUMULATOR
0001 06 40 0110 LOOP1 MVI B,64 ;INITIALIZE LOOP COUNTER
0003 05    0120 DCR B ;WASTE TIME
0004 C2 03 00 0130 JNZ $-4
0007 2F    0140 CMA ;COMPLEMENT & OUPUT A
0008 D3 24 0150 OUT 24H ;**CHANGE IF OTHER PORT*
000A C3 01 00 0160 JMP LOOP1 ;DO NEXT HALF WAVE

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NEWTECH COMPUTER SYSTEMS INC.

MODEL 6 MUSIC BOARD

Parts List

IC1        74LS30  
IC2        74LS04  
IC3        74LS174  
IC4        CD4050  
IC5        LM380  
IC6        7812 or 340T-12  
IC7        78L05

R1-R6      Resistor, 20K Ohm 1%  
R7-R12     Resistor, 10K Ohm 1%  
R13        Resistor, 4.7K Ohm 10%  
R14        Resistor, 2M Ohm 10%  
R15        Resistor, Potentiometer, 25K Ohm  
R16        Resistor, 1 Ohm 10% 1/2 Watt

C1,C2,C3   Capacitor, 1uF 35 Volt Tantalum  
C4,C5,C7   Capacitor, 0.1uF 12 Volt disc  
C9,C10  
C6        Capacitor, 220uF 25 Volt  
C8        Capacitor, 4.7uF 10 Volt Tantalum

SPKR      Speaker, 8 Ohm 0.2 Watt

J1        Phono Jack

1 ea.      Screw, 6-32x1/4"  
1 ea.      Hex Nut, 6-32x1/4"  
1 ea.      Lockwasher, #6

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### Sixty-Day Warranty

The Model 6 Music Board from Newtech Computer Systems is warranted to the original purchaser for a period of sixty days from the original purchase date under normal use and service against defective materials or workmanship.

Defective parts will be repaired, adjusted and/or replaced at no charge when the Model 6 Music Board is returned prepaid with Return Authorization Slip to Newtech Computer Systems Inc.

The warranty is void if the Model 6 Music Board has been damaged by accident or misuse, or if the Music Board has been serviced or modified by any person other than Newtech Computer Systems Inc.

This warranty contains the entire obligation of Newtech Computer Systems Inc. and no other warranties expressed, implied, or statutory are given.

This warranty is void unless the warranty registration card has been properly completed and mailed to Newtech Computer Systems within ten days of purchase.

Warranty Registration Form

To insure proper warranty coverage, complete and return this form within ten days of purchase to:

NEWTECH COMPUTER SYSTEMS INC.  
131 JORALEMON STREET  
BROOKLYN, NEW YORK 11201

NAME \_\_\_\_\_ STREET ADDRESS \_\_\_\_\_

SERIAL NUMBER \_\_\_\_\_ CITY, STATE, ZIP \_\_\_\_\_

DATE OF PURCHASE \_\_\_\_\_ PLACE OF PURCHASE \_\_\_\_\_

PROFESSION \_\_\_\_\_

WHAT COMPUTER SYSTEM DO YOU HAVE? \_\_\_\_\_

WHAT SOFTWARE WOULD YOU LIKE TO SEE FOR THE MODEL 6? \_\_\_\_\_

WHERE DID YOU FIRST FIND OUT ABOUT THE MODEL 6? \_\_\_\_\_