



Visible **M**usic **M**onitor

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A B Computers

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INTRODUCTION

Visible Music Monitor is an approach to entering, editing, and playing four part harmony music with your PET computer.

The program requires a PET/CBM computer with some sort of 8-bit Digital to Analog converter attached to the user (parallel) port. Recommended D to A converter with onboard amplifier is the KL-4M by K L Electronics, Montgomeryville, PA 18936. Other D to A converters should work, however. If your converter does not have an amplifier, or if you are bypassing your onboard amplifier, you will need an external amplifier, in addition to a speaker.

Visible Music Monitor is written primarily in 6502 machine language for speed of execution. The Monitor allows you to enter notes directly from the PET keyboard. VMM also helps you to edit your music (insert, delete, or move notes up or down on the staff). Other VMM features include "record changer" mode to load successive songs without intervention, user definable keyboard, complete tempo flexibility, transpose capability, and waveform modification capability. Music can be played either with note display, or with no display.

Visible Music Monitor is quite easy to use. Don't let the number of pages of documentation bother you. Once you go through the "Getting Started" section and spend a minimal amount of time playing with various VMM features, you will be entering and playing music with no problem.

GETTING STARTED

1. LOAD Visible Music Monitor, and type RUN. You should see a program option list, or "menu".
2. Press the 5 key to play the music selection included with Visible Music Monitor.
3. Listen to the music (a selection from a piano exercise book--composer unknown). At first, you will see nothing on the screen, but be patient. On the second pass through, the music will change tempo slightly, and the notes will be displayed while playing. You may allow the song to play to completion, or press STOP at any time. If you wish to play the song again, simply press the 5 key.

When you are through playing the precoded song and wish to see how the music was entered, press the 2 key to select SEGMENT mode from the menu. You will see the prompt TYPE SEG SYMBOL. Enter "B" (no quote marks, however). You should now see on the screen the staff and first part of the notes in segment B.

In Visible Music Monitor, a segment is a group of notes that you will probably want to play several times in the course of your song. Most songs repeat portions at least once.

You will see a large vertical bar in the center of the screen. This is the VMM cursor. Under the cursor, you should see an F in each clef signifying one flat. Press the CURSOR RIGHT key several times to begin moving through the song. Now press CURSOR DOWN. You should see the note to the immediate left of the vertical bar move down on the staff. If you depress CURSOR UP, you will see the same note move back up (it's easy to edit what you enter).

You will notice that multiple notes are not stacked on stems as in standard music notation. This was done for ease of editing. You should also notice small marks between groups of notes. These marks denote end of chord, so that all notes between two of these marks are played as a chord.

Now press INSERT about 12 times (remember to use the shift key). You should see empty music space opening up. Let's enter a few notes in that space, just as you might when editing or correcting your music.

Press the 2 key to indicate that you will be entering a half note (the 4 key selects a quarter note, the 8 an eighth note, etc.). Now touch "M" and you will see the note appear on the screen. Press the SPACE bar, and you should see the voice number at the bottom of the screen advance to 2 (each time you depress SPACE, the voice number increases by one until reaching four). Press "D", then SPACE, "K", SPACE, and "E". Now press RETURN to end the chord.

Enter 4 more notes in the same manner. To adjust the number of the voice you are about to enter, press SPACE. If you forget and wish to adjust the number of the voice you just entered, press SHIFT SPACE. After entering the notes, press "F" to end the measure.

Now press CLEAR to go back to the menu (CONTROL mode), then press 5 to play the song again. After the precoded song plays for a short time, you should hear the two chords you just inserted. They might be clinkers, but never-the-less, you entered some music.

After the song finishes (or you enter STOP), press 2 (SEGMENT), then B again to select the same segment B you were just editing. Use CURSOR RIGHT to go beyond the notes you entered. Now press DELETE a number of times to remove some of the notes you entered.

Let's look at another segment. Press the CLEAR key to go back to the menu, then 2 for SEGMENT, then A for segment A. You should now see the base and treble clef with four voices assigned to waveform tables. This section of music, or SEGMENT, does nothing other than assign the voices. While you can do this within any segment, it is convenient to do the assigning as in this example. In general, once the voices are assigned, you will rarely reassign them, so you might want to include this segment in all your songs.

Segments C and D are also assigned in the sample song. If you wish, you may look at either of these in the same manner (press CLEAR to go to the menu, then 2 for SEGMENT, then C or D).

To see how the segments were sequenced, go back to CONTROL mode (our menu display), then press 4 for MASTER. You should see the following display:

```
\[I]←FABCD\[O]←NBCD:
```

This set of control characters indicates the sequence in which segments are played. In the sample, \[I] sets tempo, ←F turns display off, A, B, C, and D are segments in play sequence, \[O] sets new tempo, ←N turns display on, segments B, C, and D are played again, and the colon (:) ends the playing.

If you wish to change the Master, use the normal cursor keys to insert, delete, type over, etc. For example, if you wish to play segment B twice in succession, move the cursor over the first B, press INSERT, then B.

In general, you can see that entering and editing music, along with specifying the sequence in which events are to occur has been made quite easy. To go into more detail, please read the expanded explanations in the remainder of the VMM documentation.

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CONTROL MODE

=====

When you RUN the program, you will automatically enter the Control Mode with this prompt:

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- 0.RETURN TO BASIC
- 1.CLEAR SEGMENT
- 2.SEGMENT
- 3.KEYBOARD
- 4.MASTER
- 5.PLAY
- 6.PLAY MUSIC & TAPE
- 7.SAVE MUSIC
- 8.SAVE PROGRAM
- 9.WAVEFORMS

Pressing the appropriate number key will call one the following modes:

"0" - RETURN TO BASIC

=====

This will exit the program and put you in the PET immediate mode.

"1" - CLEAR SEGMENT

=====

This will give you the following prompt:

TYPE SEG SYMBOL, CLR FOR ALL, OR RETURN.

If you wish to erase one segment of music, type the symbol of that segment. Symbols can be any number from 0 to 9 or any letter from A to Z.

If you wish to start a completely new composition, and you want to erase all segments, press "CLEAR".

If you entered the CLEAR SEGMENT mode by mistake, press RETURN to exit.

"2" - SEGMENT

=====

If you press a "2" when in the control mode, you will get the prompt:

TYPE SEG SYMBOL

Enter any number from 0 to 9 or any letter from A to Z. The bottom of your display will look something like this:

8-8TH NOTES/BAR 1=VOICE A=SEG SYMBOL

If at any time you wish to exit the SEGMENT mode, press "CLEAR".

"*" - NON-NOTE INSTRUCTIONS

You are now ready to write some music, but before you enter notes you must enter some other information. Press the "*" key and you will see the following prompt:

[T]EMPO [S]IGNATURE [D]ISPLAY [V]OICE [O]CTAVE

"T" - TEMPO

Let's set the tempo first. Press "T" and you will get this prompt:

ENTER TEMPO CODE: [Z], [A]-[Y] FOR TEMPOS

SLOW A-E, ACCEL 1-5, OR 0 FOR A TEMPO

The letters A-Y (shifted) are for setting the tempo at the beginning of the piece. [A] would be the fastest tempo. [Y] would be the slowest. [Z] is a special fast tempo key.

SHIFTED KEY:	1/4-NOTES PER MIN:	SHIFTED KEY:	1/4-NOTES PER MIN:
[A]	1090	[N]	80
[B]	545	[P]	68
[D]	273	[R]	60
[F]	181	[T]	54
[H]	136	[V]	50
[J]	109	[X]	45
[L]	91	[Y]	43

The letters A-E (unshifted) and numbers 1-5 are for making changes in tempo while the music is playing. This will be explained later (see RELATIVE TEMPO CHANGE).

"S" - SIGNATURE

After setting tempo, press "*", then "S" for signature prompt:

ENTER # OF SHARPS (0-7) or FLATS ([A]-[G])

To enter a key signature, press the number key that represents the number of sharps, or the shifted letter key for the number of flats (A=1, B=2):

PRESS THIS KEY:	FOR THIS SIGNATURE:	PRESS THIS KEY	FOR THIS SIGNATURE:
0	C (0 sharps)		
1	G (1 sharp)	[A]	F (1 flat)
2	D (2 sharps)	[B]	Bb (2 flats)
3	A (3 sharps)	[C]	Eb (3 flats)
4	E (4 sharps)	[D]	Ab (4 flats)
5	B (5 sharps)	[E]	Db (5 flats)
6	F# (6 sharps)	[F]	Gb (6 flats)
7	C# (7 sharps)	[G]	Cb (7 flats)

"D" - DISPLAY

The music can be played with the screen blank or with the sheet music displayed. In general, the music will sound better with the display off, but you may want the display on while editing. Press "*" then "D" to get the prompt:

TURN DISPLAY ON OR OFF

Enter "N" (unshifted) to have display on when the music is played, "F" to have it off.

"V" - VOICE

The program allows you to use up to four voices. You must define each voice you intend to use. If you are entering 2 part harmony, for example, define voices 1 and 2 only. Each voice can play a different instrument, or two or more voices can play the same instrument. Each instrument requires 256 bytes of memory (one page) to store its waveform table. Before you can write any music, you must tell each voice which waveform you will be using. You do this by giving it the address of the instrument's waveform. When in the SEGMENT mode, press "*" and then "V" for this prompt:

HIT 3 KEYS: VOICE#, PAGE (HI),(LO)

This program comes with four previously created waveform tables stored in pages \$19, \$1A, \$1B, and \$1C (\$ means hexadecimal notation). If, for example, you wanted to assign Voice #3 to the waveform table at page \$1B, you should press "3" (for Voice #3) then enter "1" (for the first digit in the hex number \$1B) then "B" (for the second hex digit). Entering your own waveform tables will be explained later.

OCTAVE

In the ENTERING NOTES section, you will see that it is possible to display five octaves on the screen. There may be times, however, when you wish a voice to sound higher or lower than this range. Press "*" then the letter "O" to get this prompt:

HIT 2 KEYS: VOICE#, OCTAVES UP (0-4) OR DOWN (A-D)

Pressing the "4" key and then the "1" key, for example, will cause Voice #4 to play one octave higher than the notes indicated on the screen. Pressing a "3" then a "B" would cause Voice #3 to play two octaves lower than normal. Entering the Voice Number, then "0" returns a voice to normal (as written).

"+" - TIME SIGNATURE

In order to make it easier for you to write music, this program performs calculations so that a minimum number of key strokes are required. The program tries to anticipate where you will be putting your end of chord markers, your bars, the duration of each note, and which voice you will be using for each note.

In order for some of these features to work, the program must know what time you will be using. When in SEGMENT mode, press "+" (not "*") to get this prompt:

OF 8TH NOTES/BAR (1-G) G=16

Note: Press letter key "A" for 10, "B" for 11, etc. Your entry will be recorded in the lower left hand corner of the screen. For example:

ENTER:	IF TIME IS:
"4"	4/8 or 2/4
"6"	6/8 or 3/4
"9"	9/8
"8"	8/8 or 4/4
"C"	12/8 or 6/8
"G"	16/8 or 8/4

ENTERING NOTES

At the very beginning of each piece of music, you should indicate which waveform table each voice will be using, as well as the key signature, the tempo, and the time signature. When this is done, press the "¶" (end of bar) key to start off the auto-bar feature (explained in the EDITING section).

In the sample music included with VMM, you will notice a row of numbers at the bottom of the screen beneath the notes. These indicate which voice plays the note. You should also notice that groups of notes are separated by end of chord marks. Notes within these marks are played simultaneously as one chord. In regular sheet music, these notes would be written one above the other. However, for editing, it is more convenient to have them side by side.

A note with an "♯" mark above it should be read as one octave lower than its position would indicate. A "↑" mark means the note is actually one octave higher than shown by its position.

Notes are created by entering first a duration value (as in the table below) and then the appropriate note key (see figure 2). Duration value is only required if the note has a different duration than the previous note.

KEYS FOR ENTERING NOTES

SPACE	Change next voice
shift space	change previous voice
1	Whole note
2	Half note
4	Quarter note
8	Eighth note
6	16th note
3	32nd note
5	64th note
.	Dotted note
-	Triplet
=	Natural
RETURN	End of chord
↑	End of bar
CURSOR UP	Raises previous note by 1/2 note
CURSOR DOWN	Lowers previous note by 1/2 note
A thru Z	Notes
0	Rest

"SPACE" - CHANGE NEXT VOICE

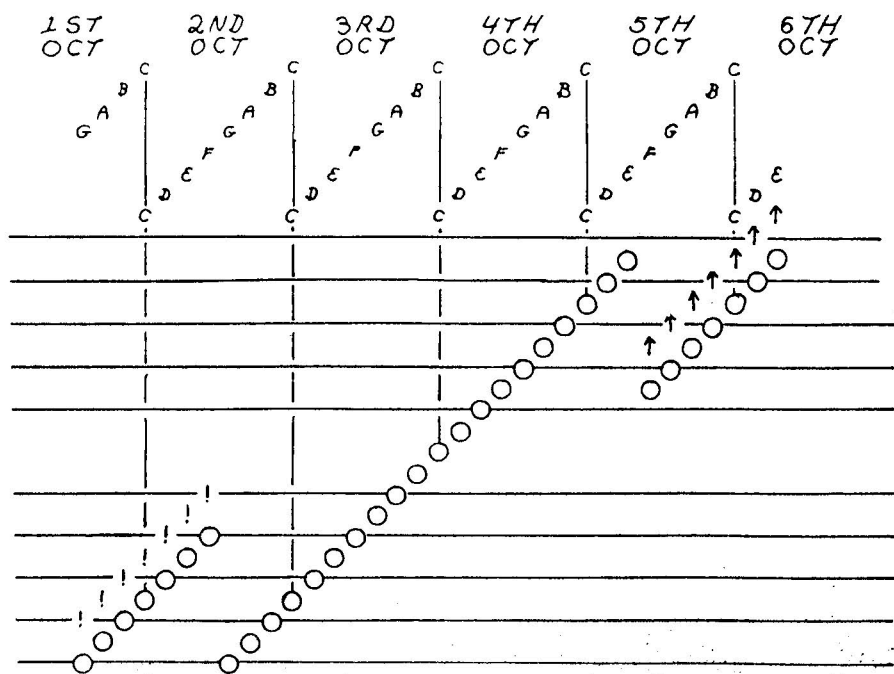
The voice number of the note to be entered will be displayed in the lower center of the CRT. If the program hasn't successfully guessed which voice to use, adjust to correct voice number with the SPACE bar before entering the note.

shifted "SPACE" - CHANGE PREVIOUS VOICE

Errors in voice entry can be corrected with the shifted SPACE key. This key changes the voice number of the note directly to the left of the cursor.

"1"- "8", ".", "-" - DURATION

If the note to be entered will have a different duration than the previous note, use the appropriate numeric key, and the "." and "-" keys to specify the new duration (see chart above). If entering a dotted note, first enter note duration, then "."; similarly, for triplets, enter note duration, then "-".



Five octaves can be represented on the screen.

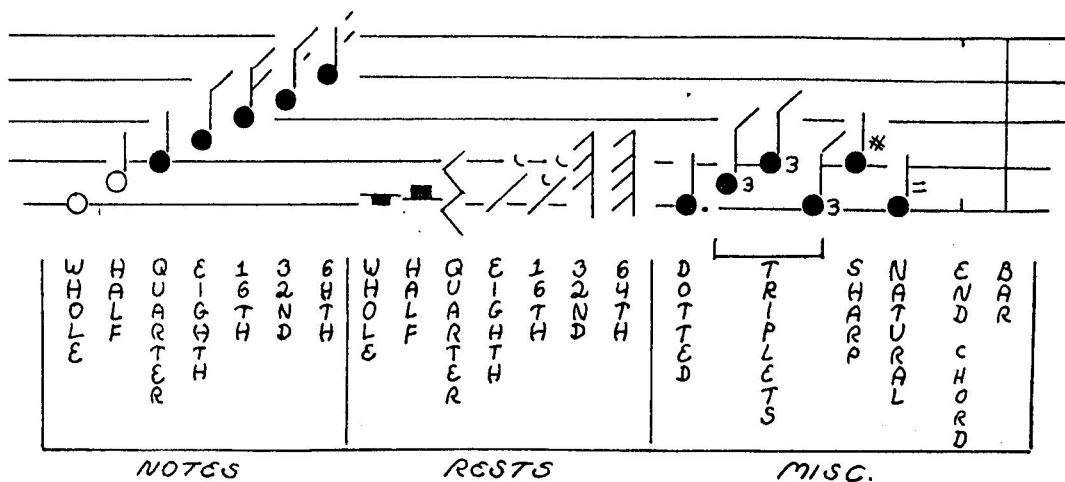


Figure 1

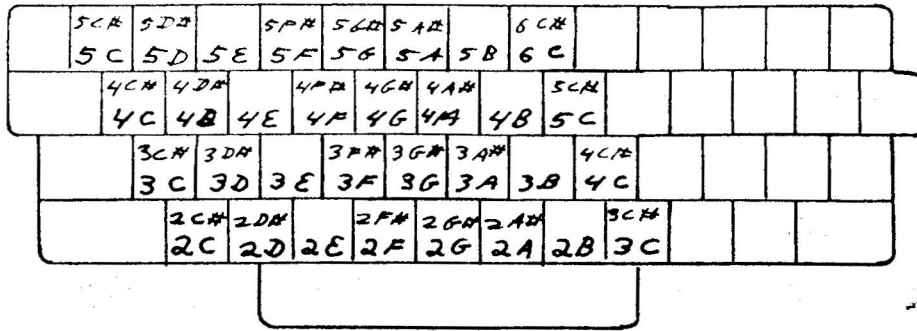


Figure 2a.
 Default Keyboard. Letter keys are used to enter notes.
 Shifted letter keys enter sharpened notes. For notes higher than 6C, or lower than 2C, use cursor up or down after entering a note.

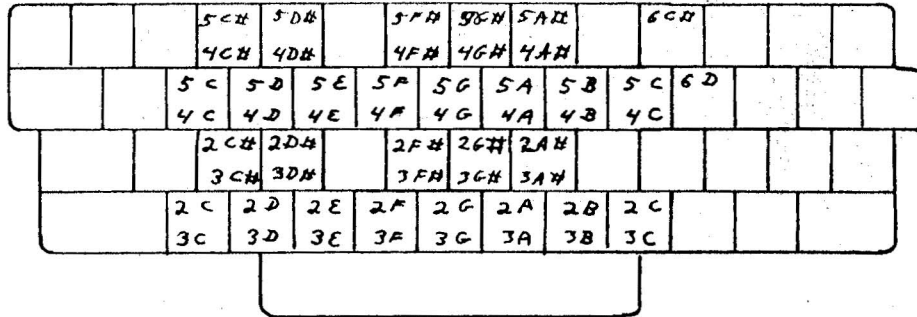


Figure 2b.
 Possible alternate way of representing notes with keys.

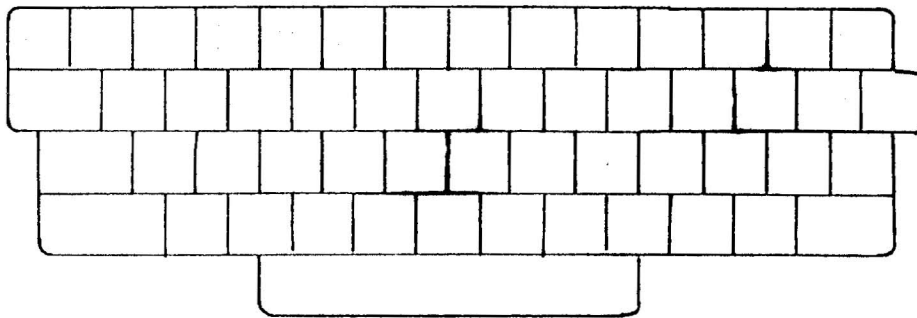


Figure 2c.
 You may wish to record your own method of key representation.

"A"- "Z" (and some punctuation keys) - NOTES

The letter keys are used to enter notes. The keyboard is initially defined as in figure 2a. You may also define the keys to represent whatever notes you want (see ENTER KEYBOARD).

CURSOR UP and CURSOR DOWN - CHANGE NOTE

If a note is entered incorrectly, it can be raised or lowered with the CURSOR UP and CURSOR DOWN keys. A sharp can be entered by first entering the un-sharped note and then hitting the CURSOR UP key. You can not enter flats with this program. B-flat, for example, would be entered as A-sharp. Moving a note off the scale will cause a slight disruption of the display, but will not affect the music.

"0" - REST

A rest is entered the same as if it were a note, except that "0" is pressed instead of a letter key. For example, if Voice 3 is to play a rest, hit SPACE if necessary to enter Voice 3, then enter Note Duration (as 4 for quarter rest), then "0".

"=" - NATURAL

The "=" key changes the note before the cursor to a natural. In standard sheet music, the effect of a natural lasts to the end of the bar. With this program, however, EVERY NOTE THAT IS TO BE A NATURAL MUST HAVE A NATURAL SIGN, AND EVERY NOTE THAT IS TO BE A SHARP MUST HAVE A SHARP SIGN.

"RETURN" - END OF CHORD

The RETURN key places an end of chord marker after the last note entered. Notice that the voice and duration must be entered before you enter the note. The sharp, natural, and end-of-chord must be entered after the note.

"¶" - END OF BAR

The "¶" key puts an end-of-bar marker after a note. The program should be able to automatically place bars in the correct locations for you as you write so that the "¶" key would be used only for corrections. The end of bar has the effect of an end of chord in addition to defining the end of the measure.

SYNTAX

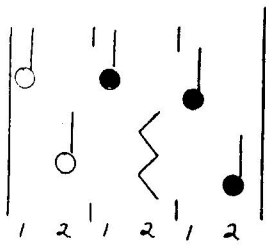
The voices within a chord should be entered in ascending order. That is 1,2,3; 1,3,4; etc.

Sometimes a rest can be left out. It will be "understood" by the program if this rule is followed: All rests for voice #1 must be entered. All other rests can be left out unless they are needed to establish the timing of a following note (see figure 3). Of course, when in doubt, you can always enter the rest.

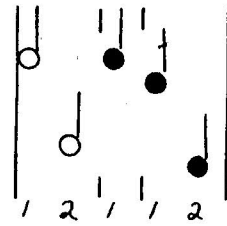
EDITING

Editing has been made very easy. The CURSOR LEFT, CURSOR RIGHT, INSERT, and DELETE keys function the way you would expect (the same as the PET screen editor).

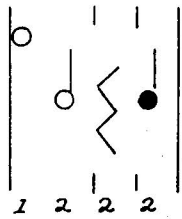
As soon as you use any of these keys, the program gives up its auto-bar feature, that is, its ability to place the bar in the correct position without being told. When you enter a bar by pressing "¶", the auto-bar will resume.



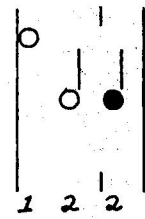
could be written as:



and the computer would understand , but



could not be written as:



because it would be interpreted as:

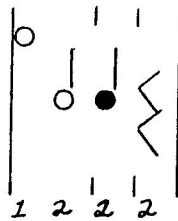


Figure 3.

NON-NOTE INSTRUCTIONS WITHIN MUSIC

Non-Note instructions are entries such as tempo, key signature, display, voice, or octave. They can be placed anywhere in the middle of the music provided they are at the beginning of a chord (i.e. they should be placed IMMEDIATELY AFTER an end of chord marker or a bar). The five NON-NOTE INSTRUCTION options are explained in the following section.

RELATIVE TEMPO CHANGE

You may wish to change tempo in the middle of a passage of music. You could change the existing tempo to a [J] tempo for example, by moving the cursor to the appropriate position in the segment, inserting a space with the "INSERT" key, pressing "*" then "T" then "J". Another way to do this is to change the RELATIVE tempo. Lets look again at the prompt we get when we press "*" then "T":

ENTER TEMPO CODE: [Z], [AJ]-[Y] FOR TEMPOS
SLOW A-E ACCEL 1-5 OR 0 FOR A TEMPO

We can tell the program to slow down or speed up at any point by pressing "1-5" or "A-E" (unshifted). Pressing "4" would give you a very slight increase in speed. Pressing "1" would give a very large increase. "A" to "E" would provide smaller and maller decreases in speed. The exact formula is:

$$NT=PT+(or-)OT*(1/2^{\uparrow}NK)$$

where NT is the new tempo, PT is the previous tempo, OT is the original tempo, and NK is the number of the key pressed. "Original tempo" refers to the last tempo defined with the shifted keys "A"- "Z". In other words, "A" decreases the present speed by an amount equal to one half the original tempo. "B" decreases by a factor of 1/4th. "C" by 1/8th. "D" by 1/16th, etc. Combinations of these changes can be used to get any middle values. For example: a "C" and a "D" would decrease present speed by a factor of 3/16th. Enter "0" at any time for "A tempo", that is to return the tempo to its original value.

PRESS KEY:	SLOW DOWN:	PRESS KEY:	SPEED UP:
A	50.0%	1	50.0%
B	25.0%	2	25.0%
C	12.5%	3	12.5%
D	6.3%	4	6.3%
E	3.1%	5	3.1%
F	1.6%	6	1.6%

The reason for allowing you to make relative tempo changes as well as absolute ones is that you may want to see how the entire piece sounds at a different over-all tempo. If the absolute tempo were set at the beginning and relative changes were made in the middle, you need only to change the absolute tempo.

KEY SIGNATURE

Key signature can be changed at the beginning of any chord. Rather than change signature in this manner, however, you might consider creating separate segments for changes in key, or use the TRANSPOSE feature in MASTER mode.

DISPLAY

Display can be turned on or off at the beginning of any chord. This may be helpful in editing your music.

VOICE

The assignment of a voice to a particular instrument can be changed at the beginning of any chord. This allows you to play more than four instruments during a composition. It also makes it possible for several voices to "drop" the instruments they are playing and help another voice play a chord on its instrument. Changes in volume are possible by having more than one waveform table for each instrument. A voice can be changed from quiet waveform to louder waveform of the same harmonic content.

OCTAVE

The octave-change feature can be used at the beginning of any chord. This allows a voice to go from very low notes to very high notes.

"3" - KEYBOARD

To get from the SEGMENT mode to the KEYBOARD mode, first press "CLEAR" to re-enter the CONTROL mode, then press "3".

When you first run Visible Music Monitor, keys will be assigned to notes as indicated in figure 2a. You can change these designations if you wish. When you select the KEYBOARD mode, a single note will be displayed on the screen. The program is asking you which key you want to represent this note. Press the key, and a new note will appear for definition. When you've defined all the notes, you will return to the CONTROL mode.

Figure 2b shows an alternate keyboard arrangement. Notice that on some arrangements, two different keys can refer to the same note. When the program asks you which key should represent each note, it will prompt you for some notes twice. These are the notes for which you will most likely want two keys. Press one key the first time the note is prompted. Press another key when the note is repeated.

If you don't want to change the key for a particular note, press "=". The key representing that particular note before KEYBOARD mode will continue to represent that note.

Notice also that not all the notes need be assigned to keys. It is not really necessary to assign the sharps to keys because they can always be entered using the unsharped note and then raised with the "CURSOR UP" key. When you are prompted for a note that you don't wish to define, press the "?" key.

"4" - MASTER

The MASTER allows you to specify the sequence of segments you wish to play. It also allows you to set or change tempo, turn the display on or off, or transpose.

When in MASTER mode, you will see a display that looks something like this:

```
\TEMP ← DISPLAY /SIG ↑TRANSPOSE  
+PLAY .END ;END TAPE
```

```
/4\[H]←NABCABD←FABCABD\4\3ABCABD\0↑AABCABD.
```

"\" TEMPO, "←" DISPLAY, "/" SIGNATURE

The two lines at the top of the screen are reminders of what the control symbols mean. The "\" symbol can be followed by any shifted letter A-Y, any letter A-E, or any number 1-5 (shifted keys will be in reverse field on the screen). These keys have the same meaning that they have when you define or change tempo in the SEGMENT mode. "←" can be followed by "N" or "F" for display on or off. "/" can be followed by 0-7 or shifted [A]-[G] to set the signature.

"↑" TRANSPOSE

"↑" stands for transpose and can be followed by any letter from A-Y, or any shifted letter [A]-[Y]. An unshifted "A" indicates that each note be played one half note higher than written. A shifted [B] would play each note two half notes lower than usual, etc. Transpose is reset to normal at the start of a new song.

```
↑A, ↑B, ... ↑Z   transpose up 1/2 steps  
↑[A]..... f[Z] transpose down 1/2 steps  
↑@             turn transpose off (transpose 0)
```

You may occasionally encounter a limitation in this feature. If the keys "↑" and "B" were used to play each note two half notes higher, for example, then the two highest notes that can be written on the screen (6C# and 6D) would not be played (they would be played as if they were rests). These notes could be obtained, however, if they were written an octave lower on the screen (5c# and 5d), and then raised an octave with the octave-change feature.

"+" - PLAY "." - END ":" - TAPE END

Pressing the "+" key plays the segments indicated by the master until reaching a "." or ":" symbol (returning control to the master). To stop playing, press the STOP key. The ":" symbol will be explained later (see PLAY MUSIC & TAPE).

The master in the above example does the following:

- 1)Sets up key of E (4 sharps) and tempo of 136 quarter notes per min. (/4\[H])
- 2)Turns the display on. (←N)
- 3)Plays segments A, B, C, then A and B again, and then D.
- 4)Turns the display off (←F) and plays all previous segments again.
- 5)Speeds the tempo by 3/16ths (\4\3).
- 6)Plays the sequence again.
- 7>Returns to "A Tempo" (\0).
- 8)Plays the sequence one half note higher (↑A).
- 9)Stops playing (at ".") and returns to MASTER mode.

Create your own master by entering the symbols from the keyboard. Use the CURSOR, INSERT, and DELETE keys to edit your master. CLEAR returns to control mode. Be sure to place "." or ":" at the end of the segments you wish to play.

"5" - PLAY

You can play the music when you are in the CONTROL mode by pressing the "5" key. This is the same as using the "+" key when in the MASTER mode, except the program returns to CONTROL mode when "." or ":" are encountered in the MASTER.

"6" - PLAY MUSIC & TAPE

This mode can be thought of as turning your PET into a turntable with an automatic record changer. You can put a number of compositions on a long playing cassette tape using the SAVE MUSIC mode (see next section). When you enter the PLAY MUSIC & TAPE mode, the current composition will be played. At the end of the piece, the program will load the next composition from tape and play it. The last composition on the tape should have the ":" symbol at the end of its master to shut off the cassette player.

"7" - SAVE MUSIC

This mode saves the sheet music (segments), the instrument waveform tables, and the master, to a cassette or disk. This program can be thought of as being in two major parts. The "Visible Music Monitor" is the part that writes, plays, and displays the music. The "Music" portion contains the sheet music (segments), the instrument waveform tables, and the master. You need not reload the monitor every time you want to change the music. The music can be saved separately by going into CONTROL mode and pressing "7". It can then be re-loaded by returning to basic (go to CONTROL mode and enter "0") and using the basic "LOAD" command to load the music the way you would load any basic program. Execute "RUN" to re-enter the monitor.

When you enter "7" you will see this prompt:

```
ENTER DEVICE# TITLE (RTN)
```

Here are two examples:

```
1TEA FOR TWO [RETURN]
80:WM TELL [RETURN]
```

The first saves "TEA FOR TWO" on cassette (device 1). The second saves "WM TELL" on disk (device 8 drive 0). As you spell out the title of your music, a row of graphic characters will appear at the bottom of the screen. These are used by the program to calculate the ASCII code of the title and can be ignored.

The delete key doesn't work, so if you make a mistake, press CLEAR and start over.

"8" - SAVE PROGRAM

This mode saves both the Visible Music Monitor and the music. It can be used to make a backup of the Monitor or to save the Monitor with a new keyboard arrangement. Saving is done the same way as with the SAVE MUSIC mode. CLEAR at any point returns to CONTROL mode.

"?" - WAVEFORMS

Unfortunately, an explanation of adding sine waves to approximate or create the sound of musical instruments is beyond the scope of this manual. You should be able to get interesting results, however, by experimentation. An excellent explanation of these methods appears in "The BYTE Book of Computer Music".

When you enter the WAVEFORMS mode, you will see the following prompt:

4 ADD CHA DEL

The number at the beginning of the prompt refers to the number of tables you already have.

"A" - ADD TABLE

If you press "A" for add, each table in the stack will be pushed up and the new table you create will be placed at \$19 (this means the PET "page" of 256 bytes starting at hexadecimal \$1900). The table previously at \$19 will be at \$1A, the table at \$1A will be at \$1B, etc. Your next prompt will be:

(PAGE 25) MAX?

The page number of the table you are changing will be written at the left side of the screen in DECIMAL notation (\$19 = decimal 25). MAX refers to maximum amplitude (loudness).

The maximum amplitude of all four voices added together cannot exceed 255. Generally, you would want each instrument to have an amplitude of 63. An exception would be if you were using less than four voices or if one voice was intended to be louder than another. If the combined maximum amplitudes of all four voices exceeds 255, a characteristic buzzing will be produced. Enter the maximum amplitude that you desire, then hit "RETURN". The next prompt will be:

PAIRS H,A THEN 0,0?

Enter two decimal numbers separated by a comma, and then press "RETURN". The first number is the harmonic and the second is the relative amplitude which will ultimately be scaled to be within the 0 to 255 range. If the first two numbers entered were "1, 1000" a sine wave would be created (see figure 5). The "1" generates one sine wave cycle in the waveform table. This is the "fundamental frequency" of the instrument. Because this is the first entry, the relative amplitude, 1000, does not yet affect the wave table. After the wave has been created, the "PAIRS H,A THEN 0,0?" prompt will be repeated. The characters at the bottom of the screen change as the program works on the waveform table.

If you were to enter "2, 500", a new wave would be created (see fig. 5). The harmonic is "2" so the wave consists of two consecutive sine waves. The relative amplitude, 500, is one half of 1000 so the maximum amplitude of this wave is 31.5 (one half of 63). The two waves are then added together and "normalized" so that the resulting wave has a maximum of 64 and a minimum of 0 (see fig 7).

The method used to generate music on the PET makes harmonics greater than about eight inaudible. If very high harmonic numbers are entered, you may hear extra tones in the music which are artifacts of the sampling process. If this happens, modify the waveforms to remove the highest harmonic. It is advised that relative amplitudes be expressed in amounts between 200 and 2000 to avoid errors due to rounding off.

After adding as many harmonics as you like, enter "0,0" to exit WAVEFORMS mode. CLEAR returns to CONTROL mode, but may leave partially updated waveforms.

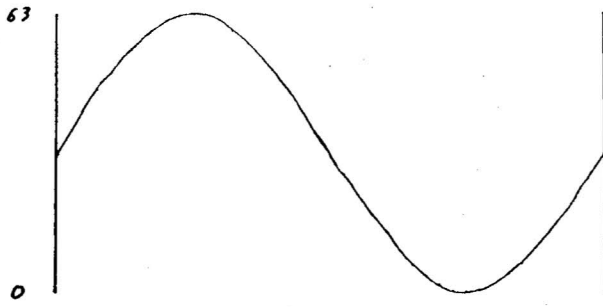


Figure 5.

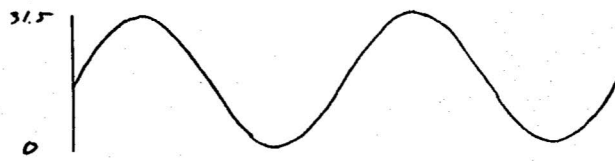


Figure 6.

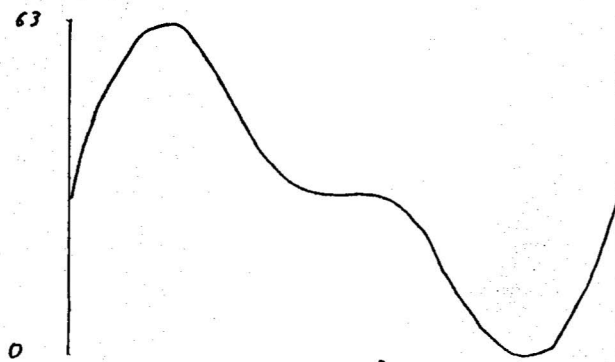


Figure 7.

"D" - DELETE TABLE

To delete a waveform table, press "D" when in WAVEFORMS mode. The waveform table at \$1A will be deleted and all other tables will be moved down one page. The table at \$1B will be moved to \$1A ,etc.

"C" - CHANGE TABLE

To change a table, press "C" in WAVEFORMS mode. You will get this prompt:

6 PAGE (HI),(LO)

The number at the beginning of the prompt is the number of tables that you now have. Enter the two hex digits of the address of the table you want to change. You will get this prompt:

(PAGE 25) MAX?

Complete the waveform table change as if you were adding a table (see previous section).

MEMORY MANAGEMENT IN AN 8K PET

If you use four waveform tables, you will leave only three pages free in an 8k PET in which to store your music. Each note and each command within the music, such as tempo change etc, requires two bytes. A page is 256 bytes, so you would have room for 384 notes. Every time you delete a wave table, you free another page of memory, and make room for another 128 notes.

It is possible to delete all four wave tables, giving you room for a total of 896 notes. A single table can be stored at \$18 using the CHANGE TABLE feature. \$18 is the address of that part of the program which creates the waveform tables. Once a table has been stored at page \$18, the program is no longer able to add or change waveforms.

If you should try to write more music than you have room for, you may not notice anything wrong until you leave a segment and then come back to it. The notes at the end of the segment will be changed to some arbitrary value.

HEXADECIMAL NOTATION

Useful hexadecimal equivalences for Visible Music Monitor:

PAGE NO.		ADDRESS	
HEX	DEC.	HEX	DEC.
\$18	24	\$1800	6144
\$19	25	\$1900	6400
\$1A	26	\$1A00	6656
\$1B	27	\$1B00	6912
\$1C	28	\$1C00	7168
\$1D	29	\$1D00	7424
\$1E	30	\$1E00	7680
\$1F	31	\$1F00	7936
\$20	32	\$2000	8192

READING SHEET MUSIC

For a refresher on reading music, try:

Learn to Read Music by Howard Shanet
Simon and Schuster
1230 Ave. of the Americas
New York, NY 10020
ISBN 0-671-21027-0 PBK
Cat. No. 55-11046

QUESTIONS

If you have questions about this program, or suggestions for improvement, please contact us:

A B Computers
115⁷E. Stump Road
Montgomeryville, PA 18936
(215) 699-5826

Chorale in C Major -- a step-by-step example

This selection was chosen because it uses only two part harmony (not too complex to enter), because it was short (the sheet music fits on one page), and because we were sure that J.S.Bach would not object. The sheet music is included immediately after this description.

The music is in two sections, the first of which ends with a repeat bar. We will make the first part Segment A, and the second part Segment B. We will also create Segments 1, 2, and 3 for the purpose of assigning voices to waveform tables (although these assignments could have been done within segments A and B, they were done in this manner for flexibility).

Begin by removing the tape from the cassette player (for safety). Get to the MENU with RUN and play the music to make sure that everything is in working order.

Key 1 to get to Clear Segment, then CLEAR to erase all existing music.

Key 4, then create a temporary MASTER: s[Y]1A.

Key 2 for SEGMENT mode, then 1 to create segment 1.

Key *V119 *V21B to assign (in segment 1) voices 1 & 2 to waveform tables at \$1900 & 1B00.

Press CLEAR, then enter SEGMENT mode and begin building segment A.

When you see the staff for segment A, enter *S0+6 for key of C and 3/4 (6/8) time.

ENTERING THE NOTES

The voice indicator should equal 1. If it does not, tap the space bar until it does. The first six notes are quarter notes, so key 4 to establish the duration. The monitor will not respond.

The first note is 5C (C - 5th octave), so enter the key for that note (if you entered the wrong note, use cursor up or cursor down to change). Now press the space bar once to rotate the voice indicator to 2. Enter the note for voice 2 (3C). The voice indicator will go back to 1. From now on, if you key notes without making mistakes that require the use of the space bar or INST/DEL, the voice indicator will flip back and forth between 1 and 2. Cursor up and down are OK (do not affect the voice entry synchronization).

Enter the key for the next note (4B). Notice that the monitor inserted the tic mark that delineates chords. The monitor will take care of this function so long as you do not use INST/DEL or the space bar. If an error is made, you will have to put in the tic marks (RETURN key) and rotate the voice indicator yourself until a new measure is begun.

If an error is made near the beginning of a measure, move the cursor back to the beginning of the measure and press [up arrow] to start a new measure. This is sometimes easier than completing the measure manually.

Continue entering notes until the end of the measure is reached. When the first note of the next measure is keyed (4A), VMM will insert a measure mark in place of the usual chord mark.

The next note is a half note, and so the duration must be changed. Key 2, then press the key for 3F. Change the duration back to 4 and key the next note (4B). Notice that the voice pointer (correctly) does not advance.

If you watch the voice indicator, and key the note for the indicated voice, the monitor will take care of the chord marks and save you a lot of work.

The third measure has quarter notes, a dotted quarter note, and sixteenth notes. Remember to change the duration.

Measure six has an accidental sharp (3F#). Remember to shift before keying this note.

The F# is returned to normal in measure eight. Key the note normally, then press the = key.

When you reach the repeat symbol at the end of the first section, press CLEAR to return to the menu. Press 5 to play the segment.

Create segment B from the second part of the music.

It is not necessary to give the key signature, but it looks nice.

Create segment 2: *V11A *V21C

Create segment 3: *V11B *V219

Make a new Master: .[Y] -N1AA2A3B. Play it.

When you are satisfied, make another master: .[H] -F1A2A3B -N1A2A3B.

Adjust the tempo until it pleases you, then save the music on tape.

Chorale in C Major

MODERATELY SLOW

J.S. BACH

Andante

5C 4B 5C 4A 4B 5C 4F 4G 4A 4G 4E 4D 4E 4C
mf
3C 3D 3E 3F 3E 3D 3G 2G 3C 2G 2C

4G 4A 4B 5C 5D 4B 4A 4A 4G
3C 2B 2A 2G 2F# 2G 3D 2D 2G 3G 3F 3E 3D

5C 5D 5E 4A 4B 5C 5D 5E 5F 5E 5D
mf
3G 3F 3E 3D 3C 3F 3E 2B 2G 3C 2G 3G 3A 3B 3G

5F 5A 5G 5F 5E 5D 5C 4A 4B 5C 5F 5D 5C
f
4C 3C 3E 3F 3E 3D 3E 3C 3A 3F 3G 3C

Reference Chart for Commands in the MASTER mode:

" ," - TEMPO

Absolute Tempo:

[A]-[Y]: fast to slow ([Z] special)

Relative Tempo:

A-F: decrease

1-6: increase

" -" - DISPLAY

N: on

F: off

" /" - SIGNATURE

0-7: number of sharps

A-G: number of flats

" !" - TRANSPOSE

A-Y: 1/2 note higher

[A]-[Y]: 1/2 note lower

- , END End of music.
- ; EOT End of tape.
- + Immediate play mode.